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.

To include the UID I use the u option, and to print it numerically I use the n modifier. Both are documented in the man pages of ps.

> u Display user-oriented format.
> 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 -
l
```

(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.

I consult the man page of ps and find the **--user** switch.

> --user userlist
> Select by effective user ID (EUID) or name. Identical to -u and U.

Like in (a) I use **nu** and pipe the output into grep.

Here I filter out lines with closing brackets using the **-v** switch.

These correspond to kernel threads for the following reason:

A post on stackexchange tells me that ps prints the command in brackets when the process args are unavailable. Another page indicates that "these will be kernel threads implementing helper functions, specific subsystems, work queues, etc."

```
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/lvmetad -f
       0   242  0.0  0.1  16240  4100 ?        Ss   14:45   0:00
/lib/systemd/systemd-udevd
       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 -
l
```

Then i verify that this really yields the expected number of processes.

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

23 - 1 (header line) = 22. This matches the number indicated in the exercise description of (c).
Thus, my command appears to be correct.

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

Exercise 2

Exercise 3

Formatting Collection

Research the difference between systemd and init (System V init)
(a) describe in your own words the difference between these systems

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

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 recommend .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.