Lab 2

Members: Fangwen Liao (3439869) | Yijin Wang (3476217) | Moritz Pfeffer (3261671)

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.