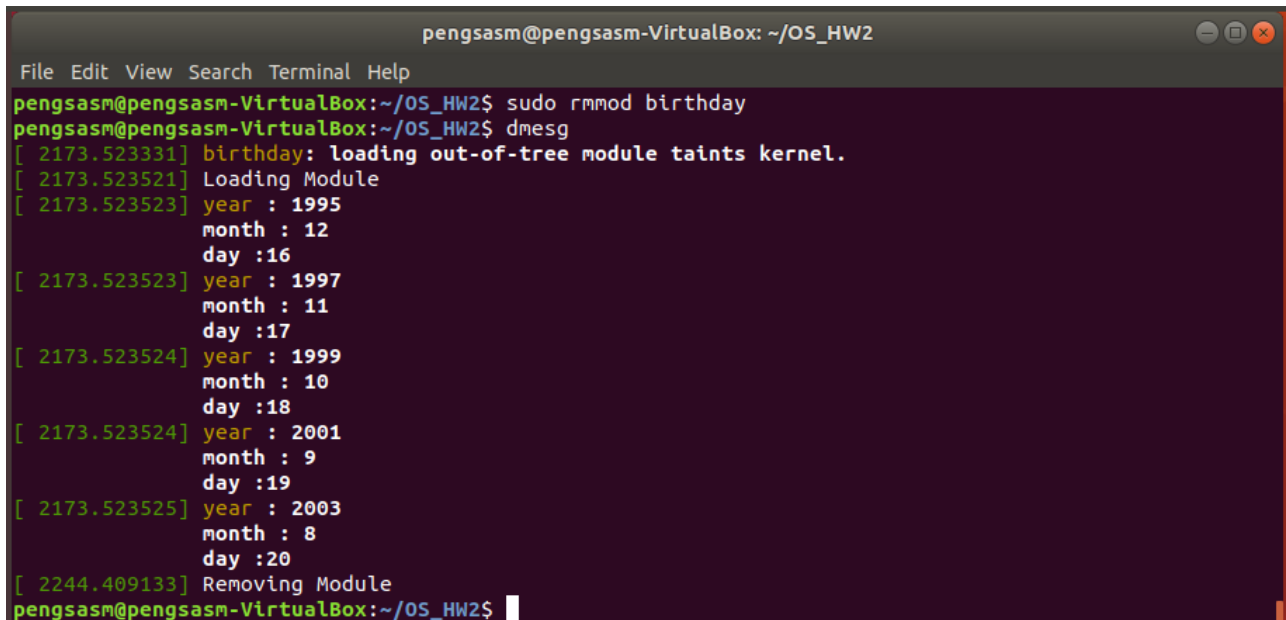


Operating Systems
Fall 2018
Hw No. 2

(Due on Oct. 11)

ID / NAME : 2014310407 / 이준혁(Lee JunHyuk)

1. Read the programming project in the textbook p. 94 – p. 98, Part II. Report the screen shot of the result of ‘dmesg’ of the two cases. (50)



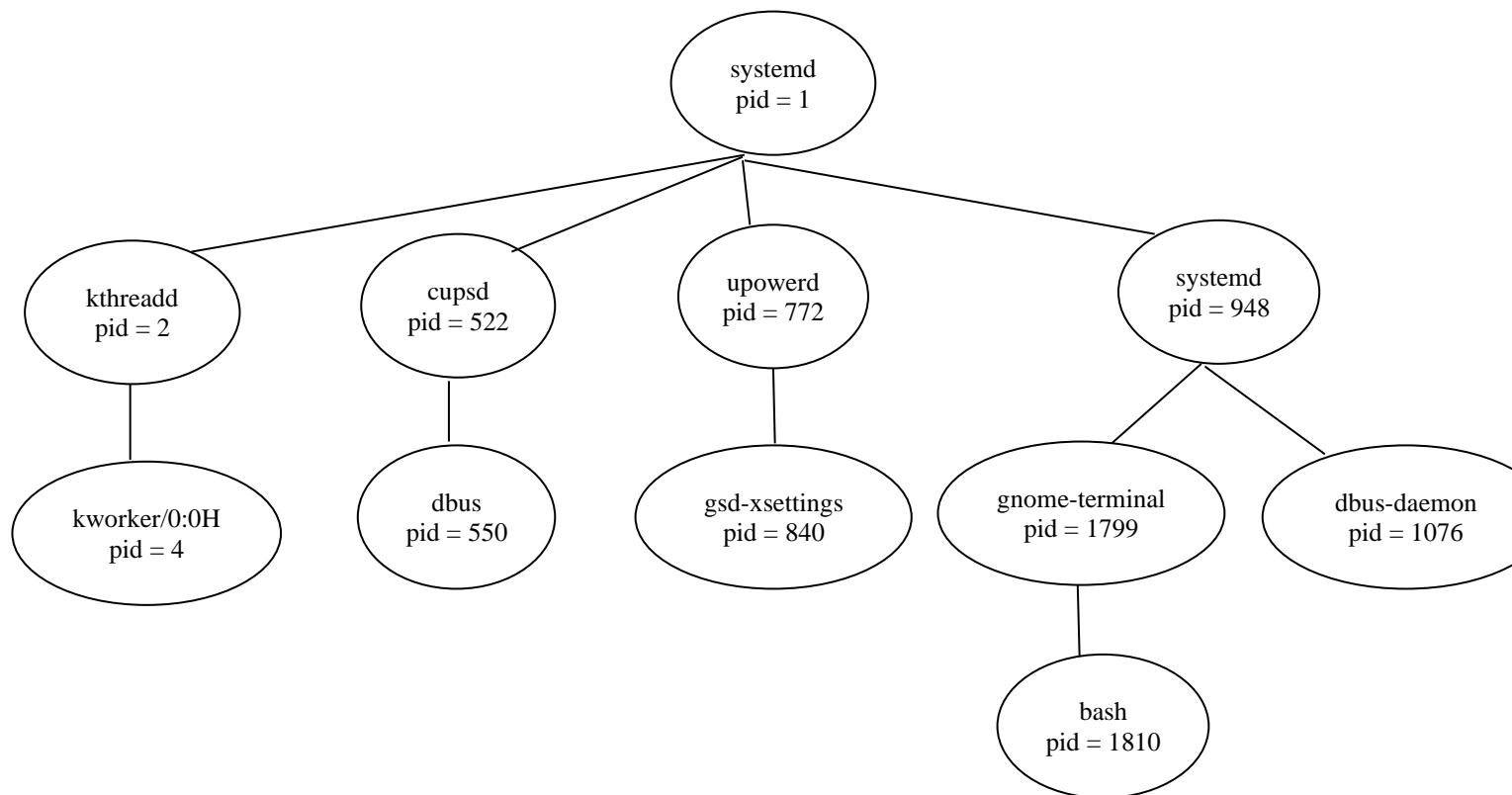
```
pengsasm@pengsasm-VirtualBox: ~/OS_HW2
File Edit View Search Terminal Help
pengsasm@pengsasm-VirtualBox:~/OS_HW2$ sudo rmmod birthday
pengsasm@pengsasm-VirtualBox:~/OS_HW2$ dmesg
[ 2173.523331] birthday: loading out-of-tree module taints kernel.
[ 2173.523521] Loading Module
[ 2173.523523] year : 1995
month : 12
day :16
[ 2173.523523] year : 1997
month : 11
day :17
[ 2173.523524] year : 1999
month : 10
day :18
[ 2173.523524] year : 2001
month : 9
day :19
[ 2173.523525] year : 2003
month : 8
day :20
[ 2244.409133] Removing Module
pengsasm@pengsasm-VirtualBox:~/OS_HW2$
```

- After inserting the module

```
pengsasm@pengsasm-VirtualBox: ~/OS_HW2
File Edit View Search Terminal Help
pengsasm@pengsasm-VirtualBox:~/OS_HW2$ sudo insmod birthday.ko
pengsasm@pengsasm-VirtualBox:~/OS_HW2$ dmesg
[ 2173.523331] birthday: loading out-of-tree module taints kernel.
[ 2173.523521] Loading Module
[ 2173.523523] year : 1995
                month : 12
                day : 16
[ 2173.523523] year : 1997
                month : 11
                day : 17
[ 2173.523524] year : 1999
                month : 10
                day : 18
[ 2173.523524] year : 2001
                month : 9
                day : 19
[ 2173.523525] year : 2003
                month : 8
                day : 20
pengsasm@pengsasm-VirtualBox:~/OS_HW2$
```

- After deleting the module

2. Textbook exercise 3.3 (p. 148). (15)



3. Textbook exercise 3.5 (p. 149). Answer the problem by executing the code of Figure 3.31. Use the command `ps -ael` to show the information of the process. (15)

```

pengasm@pengasm-VirtualBox: ~/OS_HW2
File Edit View Search Terminal Help
pengasm@pengasm-VirtualBox:~/OS_HW2$ gcc -o zombie HW2_zombie.c
pengasm@pengasm-VirtualBox:~/OS_HW2$ ./zombie
Killed
pengasm@pengasm-VirtualBox:~/OS_HW2$ vi HW2_fork.c
pengasm@pengasm-VirtualBox:~/OS_HW2$ gcc -o fork HW2_fork.c
pengasm@pengasm-VirtualBox:~/OS_HW2$ ./fork
pengasm@pengasm-VirtualBox:~/OS_HW2$

```

pid	ppid	uid	gid	size	rss	tm	cmd	time	state	priority	ni	name
0	S	1000	1489	976	0	80	- 148199 poll_s tty2	00:00:00	update-notif			
0	S	1000	1522	976	0	80	- 215657 poll_s tty2	00:00:00	deja-dup-mon			
1	I	0	1650	2	0	80	- 0 -	00:00:00	kworker/u2:1			
0	S	1000	1667	948	0	80	- 216905 poll_s ?	00:00:00	gnome-termi			
0	S	1000	1678	1667	0	80	- 7712 wait pts/0	00:00:00	bash			
0	S	1000	1695	1667	0	80	- 7712 wait pts/1	00:00:00	bash			
0	S	1000	1727	1695	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1728	1727	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1729	1727	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1730	1727	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1731	1727	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1732	1730	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1733	1729	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1734	1729	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1735	1728	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1736	1728	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1737	1728	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1738	1733	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1739	1736	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1740	1735	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1741	1735	0	80	- 1094 hrtim pts/1	00:00:00	fork			
1	S	1000	1742	1740	0	80	- 1094 hrtim pts/1	00:00:00	fork			
0	R	1000	1743	1678	0	80	- 9326 - pts/0	00:00:00	ps			

- 16 forks are invoked

If each fork function is invoked, then it creates the child process. That means the number of the processes are doubled. Since there are 4 fork function call, the total number of the processes are $2 * 2 * 2 * 2 = 16$

4. Textbook exercise 3.6 (p. 149). (20)

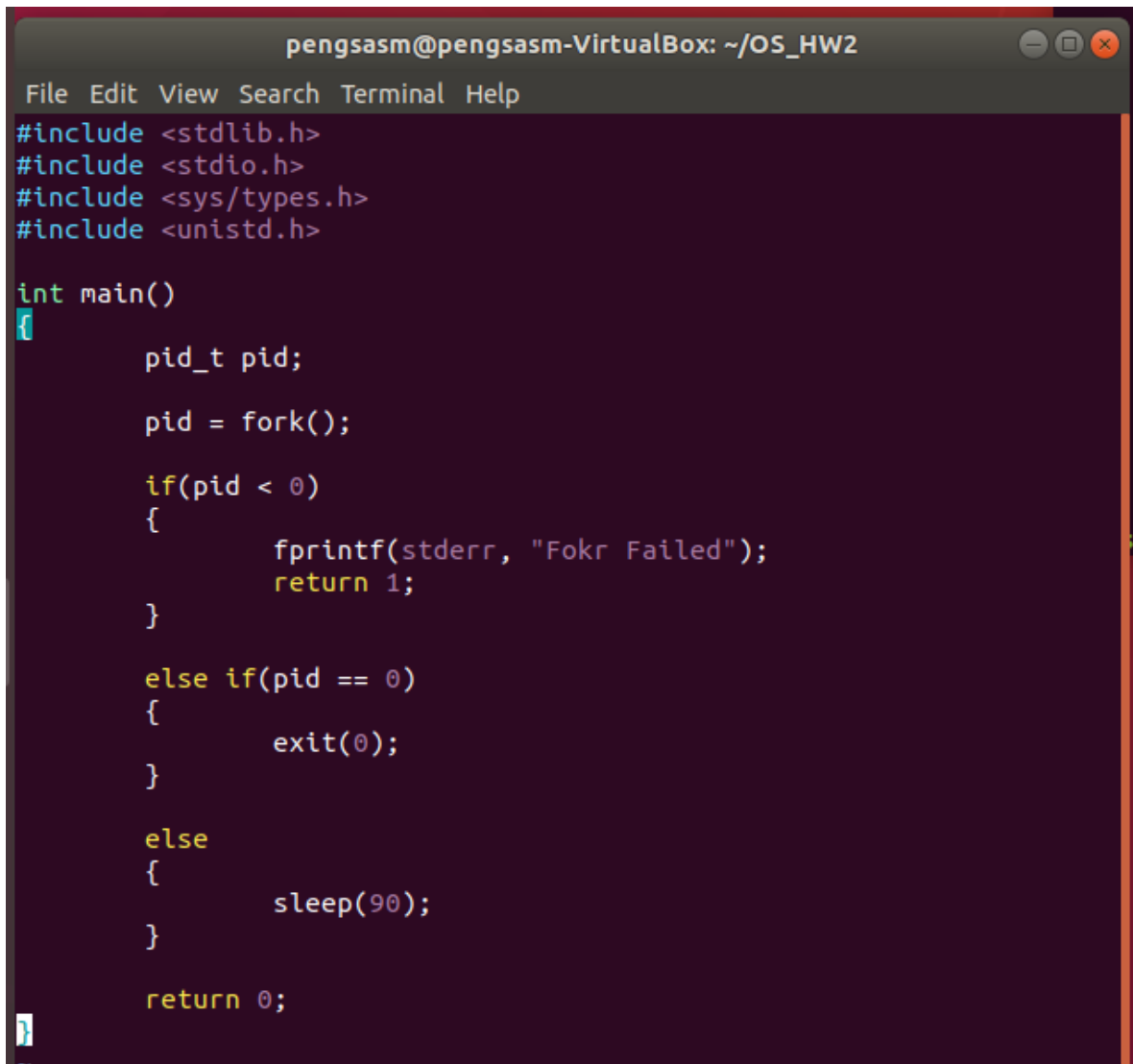
If the `execlp` is called, address space of the process is replaced by the parameter in `execlp`; in here, “PATH/bin/ls” will be the location. And this function does not return unless the errors are occurred. So, if child process is run normally, then “Line J” is never printed. It is only printed when the error occurs in child process; more explicitly, in `execlp`

5. Textbook exercise 3.7 (p. 149). (20)

- A: It is the return value of fork for child process; it is zero
 B: It is the pid number of child process
 C: It is the return value of fork for parent process; it is the pid of child process
 D: It is the pid number of parent process

- A: 0
 B: 2603
 C: 2603
 D: 2600

6. Textbook exercise 3.12 (p. 151). (30)



```
pengsasm@pengsasm-VirtualBox: ~/OS_HW2
File Edit View Search Terminal Help
#include <stdlib.h>
#include <stdio.h>
#include <sys/types.h>
#include <unistd.h>

int main()
{
    pid_t pid;

    pid = fork();

    if(pid < 0)
    {
        fprintf(stderr, "Fork Failed");
        return 1;
    }

    else if(pid == 0)
    {
        exit(0);
    }

    else
    {
        sleep(90);
    }

    return 0;
}
```

- Source code

```
pengsasm@pengsasm-VirtualBox: ~/OS_HW2
File Edit View Search Terminal Help

pengsasm@pengsasm-VirtualBox:~/OS_HW2$ gcc -o zombie HW2_zombie.c
pengsasm@pengsasm-VirtualBox:~/OS_HW2$ ./zombie

0 S 1000 1251 976 0 80 0 - 69861 poll_s tty2 00:00:00 gsd-mouse
0 S 1000 1267 1 0 80 0 - 127512 poll_s tty2 00:00:00 gsd-printer
0 S 1000 1297 976 0 80 0 - 286818 poll_s tty2 00:00:02 nautilus-des
0 S 1000 1299 976 0 80 0 - 67983 poll_s tty2 00:00:00 gsd-disk-uti
0 S 1000 1301 976 0 80 0 - 281702 poll_s tty2 00:00:03 gnome-softwa
0 S 1000 1317 1103 0 80 0 - 110781 poll_s ? 00:00:00 gvfsd-trash
0 S 1000 1333 948 0 80 0 - 223181 poll_s ? 00:00:00 evolution-ca
0 S 1000 1343 948 0 80 0 - 46976 poll_s ? 00:00:00 dconf-servic
0 S 1000 1350 1333 0 80 0 - 237030 poll_s ? 00:00:00 evolution-ca
0 S 1000 1360 948 0 80 0 - 183521 poll_s ? 00:00:00 evolution-ad
0 S 1000 1370 1360 0 80 0 - 221847 poll_s ? 00:00:00 evolution-ad
0 S 1000 1384 1128 0 80 0 - 51544 poll_s tty2 00:00:00 ibus-engine-
4 S 0 0 1394 1 0 80 0 - 139762 - ? 00:00:00 fwupd
0 S 1000 1445 948 0 80 0 - 248900 poll_s ? 00:00:02 nautilus
0 S 1000 1489 976 0 80 0 - 148199 poll_s tty2 00:00:00 update-notif
0 S 1000 1522 976 0 80 0 - 215657 poll_s tty2 00:00:00 deja-dup-mon
1 I 0 0 1650 2 0 80 0 - 0 - ? 00:00:00 kworker/u2:1
0 S 1000 1667 948 1 80 0 - 216728 poll_s ? 00:00:01 gnome-termin
0 S 1000 1678 1667 0 80 0 - 7712 wait pts/0 00:00:00 bash
0 S 1000 1695 1667 0 80 0 - 7712 wait pts/1 00:00:00 bash
0 S 1000 1709 1695 0 80 0 - 1094 hrtime pts/1 00:00:00 zombie
1 Z 1000 1710 1709 0 80 0 - 0 - pts/1 00:00:00 zo <defunct>
0 R 1000 1711 1678 0 80 0 - 9326 - pts/0 00:00:00 ps

pengsasm@pengsasm-VirtualBox:~/OS_HW2$
```

- Zombie process is made

```
pengsasm@pengsasm-VirtualBox: ~/OS_HW2
File Edit View Search Terminal Help
pengsasm@pengsasm-VirtualBox:~/OS_HW2$ gcc -o zombie HW2_zombie.c
pengsasm@pengsasm-VirtualBox:~/OS_HW2$ ./zombie
0 S 1000 1251 976 0 80 0 - 69861 poll_s tty2 00:00:00 gsd-mouse
0 S 1000 1267 1 0 80 0 - 127512 poll_s tty2 00:00:00 gsd-printer
0 S 1000 1297 976 0 80 0 - 206818 poll_s tty2 00:00:02 nautilus-des
0 S 1000 1299 976 0 80 0 - 67983 poll_s tty2 00:00:00 gsd-disk-uti
0 S 1000 1301 976 0 80 0 - 281702 poll_s tty2 00:00:03 gnome-softwa
0 S 1000 1317 1103 0 80 0 - 110781 poll_s ? 00:00:00 gvfsd-trash
0 S 1000 1333 948 0 80 0 - 223181 poll_s ? 00:00:00 evolution-ca
0 S 1000 1343 948 0 80 0 - 46976 poll_s ? 00:00:00 dconf-servic
0 S 1000 1350 1333 0 80 0 - 237030 poll_s ? 00:00:00 evolution-ca
0 S 1000 1360 948 0 80 0 - 183521 poll_s ? 00:00:00 evolution-ad
0 S 1000 1370 1360 0 80 0 - 221847 poll_s ? 00:00:00 evolution-ad
0 S 1000 1384 1128 0 80 0 - 51544 poll_s tty2 00:00:00 tbus-engine-
4 S 0 1394 1 0 80 0 - 139762 - ? 00:00:00 fwupd
0 S 1000 1445 948 0 80 0 - 248900 poll_s ? 00:00:02 nautilus
0 S 1000 1489 976 0 80 0 - 148199 poll_s tty2 00:00:00 update-notif
0 S 1000 1522 976 0 80 0 - 215657 poll_s tty2 00:00:00 deja-dup-mon
1 I 0 1650 2 0 80 0 - 0 - ? 00:00:00 kworker/u2:1
0 S 1000 1667 948 1 80 0 - 216728 poll_s ? 00:00:01 gnome-termin
0 S 1000 1678 1667 0 80 0 - 7712 wait pts/0 00:00:00 bash
0 S 1000 1695 1667 0 80 0 - 7712 wait pts/1 00:00:00 bash
0 S 1000 1709 1695 0 80 0 - 1094 hrtime pts/1 00:00:00 zombie
1 Z 1000 1710 1709 0 80 0 - 0 - pts/1 00:00:00 zo <defunct>
0 R 1000 1711 1678 0 80 0 - 9326 - pts/0 00:00:00 ps
pengsasm@pengsasm-VirtualBox:~$ kill -9 1709
```

- Kill the zombie process by terminating parent process

```
pengsasm@pengsasm-VirtualBox: ~/OS_HW2
File Edit View Search Terminal Help
pengsasm@pengsasm-VirtualBox:~/OS_HW2$ gcc -o zombie HW2_zombie.c
pengsasm@pengsasm-VirtualBox:~/OS_HW2$ ./zombie
Killed
pengsasm@pengsasm-VirtualBox:~/OS_HW2$ []
```

pengsasm@pengsasm-VirtualBox: ~			
File	Edit	View	Search Terminal Help
0 S	1000	1245	976 0 80 0 - 216926 poll_s tty2 00:00:00 gsd-media-ke
0 S	1000	1249	976 0 80 0 - 124804 poll_s tty2 00:00:00 gsd-keyboard
0 S	1000	1251	976 0 80 0 - 69861 poll_s tty2 00:00:00 gsd-mouse
0 S	1000	1267	1 0 80 0 - 127512 poll_s tty2 00:00:00 gsd-printer
0 S	1000	1297	976 0 80 0 - 206818 poll_s tty2 00:00:02 nautilus-des
0 S	1000	1299	976 0 80 0 - 67983 poll_s tty2 00:00:00 gsd-disk-uti
0 S	1000	1301	976 0 80 0 - 281702 poll_s tty2 00:00:03 gnome-softwa
0 S	1000	1317	1103 0 80 0 - 110781 poll_s ? 00:00:00 gvfsd-trash
0 S	1000	1333	948 0 80 0 - 223181 poll_s ? 00:00:00 evolution-ca
0 S	1000	1343	948 0 80 0 - 46976 poll_s ? 00:00:00 dconf-servic
0 S	1000	1350	1333 0 80 0 - 237030 poll_s ? 00:00:00 evolution-ca
0 S	1000	1360	948 0 80 0 - 183521 poll_s ? 00:00:00 evolution-ad
0 S	1000	1370	1360 0 80 0 - 221847 poll_s ? 00:00:00 evolution-ad
0 S	1000	1384	1128 0 80 0 - 51544 poll_s tty2 00:00:00 ibus-engine-
4 S	0	1394	1 0 80 0 - 139762 - ? 00:00:00 fwupd
0 S	1000	1445	948 0 80 0 - 248900 poll_s ? 00:00:02 nautilus
0 S	1000	1489	976 0 80 0 - 148199 poll_s tty2 00:00:00 update-notif
0 S	1000	1522	976 0 80 0 - 215657 poll_s tty2 00:00:00 deja-dup-mon
1 I	0	1650	2 0 80 0 - 0 - ? 00:00:00 kworker/u2:1
0 S	1000	1667	948 1 80 0 - 216857 poll_s ? 00:00:01 gnome-termin
0 S	1000	1678	1667 0 80 0 - 7712 wait pts/0 00:00:00 bash
0 S	1000	1695	1667 0 80 0 - 7712 poll_s pts/1 00:00:00 bash
0 R	1000	1712	1678 0 80 0 - 9326 - pts/0 00:00:00 ps

```
pengsasm@pengsasm-VirtualBox:~$
```

- After killing it