

COMP 304 – ASSIGNMENT 1

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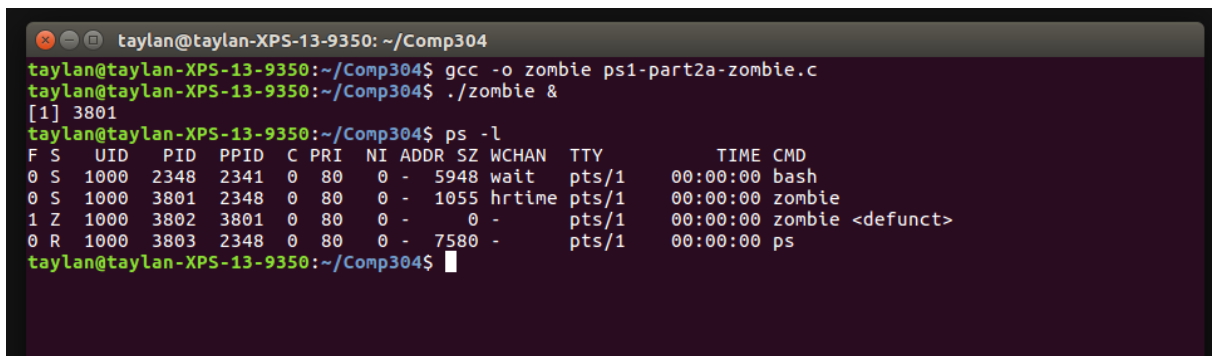
Problem 1

- a) System calls provide a way for programs to request services from OS. Kernel-level operations are critical, so programmers use API instead of directly invoking system calls to avoid corrupting the components of the system.
- b) In non-loadable kernel module systems, all functionality have to be loaded into the kernel even if they will not be used. This creates a waste of memory. Loadable kernel modules enable us adding and removing functionalities without needing to rebuild the kernel.
- c) - Advantages of a multiprogramming and time-sharing environment:
 - Programs run concurrently, even if number of CPU cores is less than the number of running programs.
 - CPU utilization is improved, cores are used more efficiently.- If several users share the system simultaneously, a user may read or corrupt the private data of another user. To avoid this, OS should fairly share the sources of the computer for programs and limit sharing of data between different programs. One-way pipes is an example of more secure communication. The processes must have a common parent process to be able to use pipes.

Snapshots of Sample Runs

Problem 2

a)



```
taylan@taylan-XPS-13-9350: ~/Comp304
taylan@taylan-XPS-13-9350:~/Comp304$ gcc -o zombie ps1-part2a-zombie.c
taylan@taylan-XPS-13-9350:~/Comp304$ ./zombie &
[1] 3801
taylan@taylan-XPS-13-9350:~/Comp304$ ps -l
 F S   UID     PID  PPID  C  PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
 0 S   1000    2348    2341  0   80   0  -  5948 wait  pts/1        00:00:00 bash
 0 S   1000    3801    2348  0   80   0  -  1055 hrtime pts/1        00:00:00 zombie
 1 Z   1000    3802    3801  0   80   0  -      0 -      pts/1        00:00:00 zombie <defunct>
 0 R   1000    3803    2348  0   80   0  -  7580 -      pts/1        00:00:00 ps
taylan@taylan-XPS-13-9350:~/Comp304$
```

b)

```
taylan@taylan-XPS-13-9350: ~/Comp304
taylan@taylan-XPS-13-9350:~/Comp304$ gcc -o orphan ps1-part2b-orphan.c
taylan@taylan-XPS-13-9350:~/Comp304$ ./orphan &
[1] 3844
taylan@taylan-XPS-13-9350:~/Comp304$ ps -l
F S    UID    PID    PPID    C  PRI   NI  ADDR  SZ  WCHAN  TTY          TIME CMD
0 S    1000    2348    2341    0   80    0   -    5948 wait  pts/1        00:00:00 bash
1 S    1000    3845    1174    0   80    0   -    1055 hrtim  pts/1        00:00:00 orphan
0 R    1000    3846    2348    0   80    0   -    7580 -      pts/1        00:00:00 ps
[1]+  Done                  ./orphan
taylan@taylan-XPS-13-9350:~/Comp304$
```

Problem 3

```
taylan@taylan-XPS-13-9350: ~/Comp304
taylan@taylan-XPS-13-9350:~/Comp304$ gcc ps1-part3.c -o 3 -lrt
ps1-part3.c: In function 'main':
ps1-part3.c:24:2: warning: implicit declaration of function 'pipe' [-Wimplicit-function-declaration]
  pipe(fdone);
  ^
ps1-part3.c:41:12: warning: implicit declaration of function 'fork' [-Wimplicit-function-declaration]
  childid = fork();
             ^
ps1-part3.c:44:3: warning: implicit declaration of function 'close' [-Wimplicit-function-declaration]
  close(fdone[1]);
  ^
ps1-part3.c:45:3: warning: implicit declaration of function 'read' [-Wimplicit-function-declaration]
  read(fdone[0], readBuff, sizeof(readBuff));
  ^
ps1-part3.c:49:3: warning: implicit declaration of function 'ftruncate' [-Wimplicit-function-declaration]
  ftruncate(shm_fd, 4096);
  ^
ps1-part3.c:55:3: warning: implicit declaration of function 'write' [-Wimplicit-function-declaration]
  write(fdone2[1], READY_MSG, strlen(READY_MSG) + 1);
  ^
taylan@taylan-XPS-13-9350:~/Comp304$ ./3 read.txt write.txt
taylan@taylan-XPS-13-9350:~/Comp304$
```

read.txt (~/.Comp304) - gedit

Open Save

Hello World

Plain Text Tab Width: 8 Ln 1, Col 12 INS

*write.txt (~/.Comp304) - gedit

Open Save

ps1-part3.c x *write.txt x
Hello World

Plain Text Tab Width: 8 Ln 1, Col 12 INS

Problem 4

a)

```
taylan@taylan-XPS-13-9350: ~/Comp304
taylan@taylan-XPS-13-9350:~/Comp304$ make
make -C /lib/modules/4.13.0-36-generic/build M=/home/taylan/Comp304 modules
make[1]: Entering directory '/usr/src/linux-headers-4.13.0-36-generic'
Building modules, stage 2.
MODPOST 1 modules
make[1]: Leaving directory '/usr/src/linux-headers-4.13.0-36-generic'
taylan@taylan-XPS-13-9350:~/Comp304$ sudo insmod ps1-part4a.ko
taylan@taylan-XPS-13-9350:~/Comp304$ dmesg
[13507.494025] Loading Module
[13507.494027] 5 8 1985
[13507.494028] 2 4 1994
[13507.494028] 12 7 1995
[13507.494029] 17 3 1994
[13507.494029] 23 1 1971
taylan@taylan-XPS-13-9350:~/Comp304$ sudo rmmod ps1-part4a
taylan@taylan-XPS-13-9350:~/Comp304$ dmesg
[13507.494025] Loading Module
[13507.494027] 5 8 1985
[13507.494028] 2 4 1994
[13507.494028] 12 7 1995
[13507.494029] 17 3 1994
[13507.494029] 23 1 1971
[13536.216093] Removing Module
taylan@taylan-XPS-13-9350:~/Comp304$
```

b)

```
taylan@taylan-XPS-13-9350: ~/Comp304
taylan@taylan-XPS-13-9350:~/Comp304$ make
make -C /lib/modules/4.13.0-36-generic/build M=/home/taylan/Comp304 modules
make[1]: Entering directory '/usr/src/linux-headers-4.13.0-36-generic'
CC [M] /home/taylan/Comp304/ps1-part4b.o
/home/taylan/Comp304/ps1-part4b.c: In function 'fileinfo304_init':
/home/taylan/Comp304/ps1-part4b.c:37:4: warning: ISO C90 forbids mixed declarations and code [-Wdeclaration-after-statement]
    struct list_head *list;
    ^
Building modules, stage 2.
MODPOST 1 modules
CC /home/taylan/Comp304/ps1-part4b.mod.o
LD [M] /home/taylan/Comp304/ps1-part4b.ko
make[1]: Leaving directory '/usr/src/linux-headers-4.13.0-36-generic'
taylan@taylan-XPS-13-9350:~/Comp304$ sudo insmod ps1-part4b.ko pid=1
taylan@taylan-XPS-13-9350:~/Comp304$ dmesg
[ 1485.667107] PID = 1
[ 1485.667109] Name = systemd
[ 1485.667110] Parent: PID = 0, Name = swapper/0
[ 1485.667111] 1. Child: PID = 246, Name = systemd-journal
[ 1485.667112] 2. Child: PID = 278, Name = systemd-udev
[ 1485.667113] 3. Child: PID = 586, Name = systemd-timesyn
[ 1485.667114] 4. Child: PID = 766, Name = ModemManager
[ 1485.667115] 5. Child: PID = 767, Name = rsyslogd
[ 1485.667116] 6. Child: PID = 771, Name = bluetoothd
[ 1485.667118] 7. Child: PID = 773, Name = accounts-daemon
[ 1485.667119] 8. Child: PID = 784, Name = cron
[ 1485.667120] 9. Child: PID = 789, Name = systemd-logind
[ 1485.667121] 10. Child: PID = 797, Name = acpid
[ 1485.667122] 11. Child: PID = 812, Name = dbus-daemon
[ 1485.667124] 12. Child: PID = 858, Name = NetworkManager
[ 1485.667125] 13. Child: PID = 861, Name = avahi-daemon
[ 1485.667126] 14. Child: PID = 862, Name = snapd
[ 1485.667127] 15. Child: PID = 863, Name = thermald
[ 1485.667128] 16. Child: PID = 910, Name = irqbalance
[ 1485.667129] 17. Child: PID = 933, Name = polkitd
[ 1485.667130] 18. Child: PID = 950, Name = lightdm
[ 1485.667131] 19. Child: PID = 989, Name = wpa_supplicant
[ 1485.667133] 20. Child: PID = 999, Name = whoopsie
[ 1485.667134] 21. Child: PID = 1004, Name = agetty
[ 1485.667135] 22. Child: PID = 1189, Name = rtkit-daemon
[ 1485.667136] 23. Child: PID = 1207, Name = upowerd
[ 1485.667137] 24. Child: PID = 1239, Name = colord
[ 1485.667139] 25. Child: PID = 1281, Name = systemd
[ 1485.667140] 26. Child: PID = 1288, Name = gnome-keyring-d
[ 1485.667141] 27. Child: PID = 1714, Name = udiskd
[ 1485.667142] 28. Child: PID = 1729, Name = fwupd
[ 1485.667143] 29. Child: PID = 3630, Name = cupsd
[ 1485.667144] 30. Child: PID = 3631, Name = cups-browsed
[ 1485.667146] 31. Child: PID = 6236, Name = mount.ntfs
taylan@taylan-XPS-13-9350:~/Comp304$
```