

Device Driver

The device driver that I built to accept user input as a string encrypts the user input and decrypts the input back to what the user entered initially. The assignment is a bit complex but I have been able to implement the required functions. Unfortunately, my test file could not open the device file for some reasons that I could not figure out.

- Steps
 - Head to the Module folder and do the following
 - Compile the device driver
 - ***make***
 - After successfully compiling the device driver, load the device using the following commands
 - ***sudo insmod ayelew_rob主_HW6_ddr.ko***
 - Create the node for the device file in the /dev directory
 - ***mknod /dev/ayelew_rob主_HW6_ddr***
 - After completing the above instructions, you can go ahead and test the device driver.
 - Test the device driver
 - Head to the Test directory where there is a file named ***ayelew_rob主_HW6_main.c*** and do the following.
 - ***make clean***
 - ***make***
 - ***make run***
 - If in case you want to unload the device driver, you can apply the commands under the **Module** directory
 - ***sudo rmmod ayelew_rob主_HW6_ddr***

Module Compilation screenshot

```
student@student-virtual-machine: ~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Mo...
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ make
make -C /lib/modules/`uname -r`/build M=/home/student/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module modules
make[1]: Entering directory '/usr/src/linux-headers-6.5.0-28-generic'
warning: the compiler differs from the one used to build the kernel
The kernel was built by: x86_64-linux-gnu-gcc-12 (Ubuntu 12.3.0-1ubuntu1~22.04) 12.3.0
You are using:          gcc-12 (Ubuntu 12.3.0-1ubuntu1~22.04) 12.3.0
CC [M] /home/student/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module/ayelew_robek_HW6_ddr.o
/home/student/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module/ayelew_robek_HW6_ddr.c: In function
'ny_device_write':
/home/student/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module/ayelew_robek_HW6_ddr.c:167:1: warning: the frame size of 2016 bytes is larger than 1024 bytes [-Wframe-larger-than=]
167 | }
    | ^
MODPOST /home/student/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module/Module.symvers
CC [M] /home/student/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module/ayelew_robek_HW6_ddr.mod.o
LD [M] /home/student/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module/ayelew_robek_HW6_ddr.ko
BTF [M] /home/student/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module/ayelew_robek_HW6_ddr.ko
make[1]: Leaving directory '/usr/src/linux-headers-6.5.0-28-generic'
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$
```

```
student@student-virtual-machine: ~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Mo...
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ ls
ayelew_robek_HW6_ddr.c  ayelew_robek_HW6_ddr.mod  ayelew_robek_HW6_ddr.mod.o  Makefile  Module.symvers
ayelew_robek_HW6_ddr.ko  ayelew_robek_HW6_ddr.mod.c  ayelew_robek_HW6_ddr.o  modules.order
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$
```

```
student@student-virtual-machine: ~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ sudo mknod /dev/ayelew_robel_HW6_ddr blk 415 0
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ ls /dev/ayelew_robel_HW6_ddr
/dev/ayelew_robel_HW6_ddr
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ |
```

```
student@student-virtual-machine: ~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ ls
ayelew_robel_HW6_ddr.c  ayelew_robel_HW6_ddr.mod  ayelew_robel_HW6_ddr.mod.o  Makefile  Module.symvers
ayelew_robel_HW6_ddr.ko  ayelew_robel_HW6_ddr.mod.c  ayelew_robel_HW6_ddr.o  modules.order
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ sudo insmod ayelew_robel_HW6_ddr.ko
[sudo] password for student:
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ lsmod
Module                Size  Used by
ayelew_robel_HW6_ddr  16384  0
bnep                   32768  2
intel_rapl_msr         20480  0
vmw_balloon           28672  0
ip6t_REJECT           12288  1
nf_reject_ipv6        24576  1 ip6t_REJECT
intel_rapl_common     40960  1 intel_rapl_msr
xt_hl                  12288  22
snd_ens1371            36864  2
ip6t_rt               16384  3
crc10dif_pclmul       12288  1
vsock_loopback        12288  0
vmw_vsock_virtio_transport_common 57344  1 vsock_loopback
snd_ac97_codec        196608 1 snd_ens1371
ipt_REJECT            12288  1
nf_reject_ipv4        16384  1 ipt_REJECT
polyval_clmulni       12288  0
```

```
student@student-virtual-machine: ~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ sudo rmmod ayelew_robels_HW6_ddr
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ lsmod
Module                Size  Used by
bnep                   32768  2
intel_rapl_msr         20480  0
vmw_balloon            28672  0
ip6t_REJECT            12288  1
nf_reject_ipv6         24576  1 ip6t_REJECT
intel_rapl_common      40960  1 intel_rapl_msr
xt_hl                  12288  22
snd_ens1371            36864  2
ip6t_rt                16384  3
crct10dif_pclmul       12288  1
vsock_loopback         12288  0
vmw_vsock_virtio_transport_common 57344  1 vsock_loopback
snd_ac97_codec         196608 1 snd_ens1371
ipt_REJECT             12288  1
nf_reject_ipv4         16384  1 ipt_REJECT
polyval_clmulni        12288  0
polyval_generic        12288  1 polyval_clmulni
xt_LOG                 16384  10
gameport               24576  1 snd_ens1371
ghash_clmulni_intel    16384  0
vmw_vsock_vmci_transport 45056  2
```

```
student@student-virtual-machine: ~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ ls /dev
autofs      dma_heap  input    loop3    net       pts       tty       tty2     tty31    tty43    tty55    ttyprintk  ttyS2     ttyS31    vcs       vcsa6    vmci
block       dmideidi  kmsg     loop4    ng0n1     random    tty0       tty20    tty32    tty44    tty56    ttyS0       ttyS20    ttyS4     vcs1      vcsu     vsock
bsg         dri       log      loop5    null      rfskill   tty1       tty21    tty33    tty45    tty57    ttyS1       ttyS21    ttyS5     vcs2      vcsu1    zero
btrfs-control  ecryptfs  loop0    loop6    nvme0     rtc       tty10      tty22    tty34    tty46    tty58    ttyS10      ttyS22    ttyS6     vcs3      vcsu2    zfs
bus         fb0       loop1    loop7    nvme0n1   rtc0      tty11      tty23    tty35    tty47    tty59    ttyS11      ttyS23    ttyS7     vcs4      vcsu3
cdrom       fd        loop10   loop8    nvme0n1p1 sg0       tty12      tty24    tty36    tty48    tty6     ttyS12      ttyS24    ttyS8     vcs5      vcsu4
char        full      loop11   loop9    nvme0n1p2 sha       tty13      tty25    tty37    tty49    tty60    ttyS13      ttyS25    ttyS9     vcs6      vcsu5
console     fuse      loop12   loop-control nvme0n1p3 snapshot  tty14      tty26    tty38    tty5   tty61    ttyS14      ttyS26    udmabuf   vcsa      vcsu6
core        hidraw0   loop13   mapper   nvram     snd       tty15      tty27    tty39    tty50    tty62    ttyS15      ttyS27    uhid      vcsa1     vfio
cpu         hpet      loop14   mcelog   port      sr0       tty16      tty28    tty4     tty51    tty63    ttyS16      ttyS28    uinput    vcsa2     vga_arbiter
cpu_dma_latency hugepages loop15   mem       ppp       stderr    tty17      tty29    tty40    tty52    tty7     ttyS17      ttyS29    urandom   vcsa3     vhci
cuse        hwrng     loop16   nidi     psaux     stdin     tty18      tty3     tty41    tty53    tty8     ttyS18      ttyS3     userfaultfd vcsa4     vhost-net
disk        initctl   loop2    queue    ptmx      stdout    tty19      tty30    tty42    tty54    tty9     ttyS19      ttyS30    userio    vcsa5     vhost-vsock
```

```
student@student-virtual-machine: ~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ sudo mknod /dev/ayelew_robel_HW6_ddr blk 415 0
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ ls /dev/ayelew_robel_HW6_ddr
/dev/ayelew_robel_HW6_ddr
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Module$ |
```

Testing screenshot

```
student@student-virtual-machine: ~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Test
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Test$ ls
ayelew_robel_HW6_main.c  Makefile
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Test$ |
```

```
student@student-virtual-machine: ~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Test
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Test$ ls
ayelew_rob主_HW6_main.c  Makefile
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Test$ make
gcc -c -o ayelew_rob主_HW6_main.o ayelew_rob主_HW6_main.c -g -I.
gcc -o ayelew_rob主_HW6_main ayelew_rob主_HW6_main.o -g -I. -l pthread
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Test$
```

```
student@student-virtual-machine: ~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Test
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Test$ make run
./ayelew_rob主_HW6_main
Could not open the device file.
: No such device or address
make: *** [Makefile:59: run] Error 1
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Test$ make
make: 'ayelew_rob主_HW6_main' is up to date.
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Test$ make run
./ayelew_rob主_HW6_main
Could not open the device file.
: No such device or address
make: *** [Makefile:59: run] Error 1
student@student-virtual-machine:~/Desktop/CSC-415-Assignments/csc415-device-driver-RobelKasahun/Test$
```