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Assignment 6 - Device Driver

Description and How to Use Test Driver:

My sample test driver is a simple linux kernel module which functions as a
character device driver. It registers a device which can be written to or read from
by user programs, and can also receive specific commands via ioctl calls. The
driver encrypts user data (submitted via the command line) and prints it out,
then decrypts the data and also prints that out. To do this it utilizes a simple XOR
cipher.

Steps to build and use the driver and sample application:
- Call *make* using the terminal while in the **Module** folder
- Use command *bash installDev.sh*
- Move to the **Test** folder and call make run there
- The sample user application should interface with the driver and will ask
  you for input
- Enter input and watch it be encrypted!
- After using the user application and if you no longer wish to use the driver,
  unload it using *bash removeDev.sh* (calling this within the Module folder)

Issues and Resolutions:

I had major issues with getting the driver to open correctly on the user application side I
was stuck working on it for a very long time until I rewatched the lecture, I had
unfortunately forgot that mknod was required in order to create an interfaceable file
system node but once I got that working everything else was so much easier.

After I got the previous issue working, I ran into a similar problem again. I accidentally
changed my constant magic number for identifying the specific driver I was looking for
and it took me a long time to find out why I couldn't open the driver.

Compilation

Building the driver file

```
student@student-VirtualBox:~/Desktop/Spring23Assignments/csc415-device-driver-nl
rennacker/Module$ make
make -C /lib/modules/`uname -r`/build M=/home/student/Desktop/Spring23Assignment
s/csc415-device-driver-nlrennacker/Module modules
make[1]: Entering directory '/usr/src/linux-headers-5.4.0-148-generic'
  CC [M]  /home/student/Desktop/Spring23Assignments/csc415-device-driver-nlrenna
cker/Module/testDriver.o
  Building modules, stage 2.
  MODPOST 1 modules
  CC [M]  /home/student/Desktop/Spring23Assignments/csc415-device-driver-nlrenna
cker/Module/testDriver.mod.o
  LD [M]  /home/student/Desktop/Spring23Assignments/csc415-device-driver-nlrenna
cker/Module/testDriver.ko
make[1]: Leaving directory '/usr/src/linux-headers-5.4.0-148-generic'
student@student-VirtualBox:~/Desktop/Spring23Assignments/csc415-device-driver-nl
rennacker/Module$
```

Inserting the node into the kernel and creating a file system node

```
student@student-VirtualBox:~/Desktop/Spring23Assignments/csc415-device-driver-nl
rennacker/Module$ bash installDev.sh
student@student-VirtualBox:~/Desktop/Spring23Assignments/csc415-device-driver-nl
rennacker/Module$ ls -l /dev/test*
crw-rw-rw- 1 root root 250, 0 May 15 20:05 /dev/testDriver
student@student-VirtualBox:~/Desktop/Spring23Assignments/csc415-device-driver-nl
rennacker/Module$
```

Building the test application file

```
student@student-VirtualBox:~/Desktop/Spring23Assignments/csc415-device-driver-nl
rennacker/Test$ make
gcc -c -o Rennacker_Nathan_HW6_main.o Rennacker_Nathan_HW6_main.c -g -I.
gcc -o Rennacker_Nathan_HW6_main Rennacker_Nathan_HW6_main.o -g -I. -l pthread
student@student-VirtualBox:~/Desktop/Spring23Assignments/csc415-device-driver-nl
rennacker/Test$
```

Execution
Example text input

```
student@student-VirtualBox:~/Desktop/Spring23Assignments/csc415-device-driver-nl
rennacker/Test$ make run
./Rennacker_Nathan_HW6_main
Enter a message to encrypt: hello
Encrypted message: ◆◆◆◆◆
Decrypted message: hello
student@student-VirtualBox:~/Desktop/Spring23Assignments/csc415-device-driver-nl
rennacker/Test$
```

(this could easily be made into an infinite while loop to continuously encrypt messages but for the sake of brevity I just did one output)

Deleting the file system node and removing it from the kernel

```
student@student-VirtualBox:~/Desktop/Spring23Assignments/csc415-device-driver-nl
rennacker/Module$ bash removeDev.sh
[sudo] password for student:
Sorry, try again.
[sudo] password for student:
student@student-VirtualBox:~/Desktop/Spring23Assignments/csc415-device-driver-nl
rennacker/Module$ ls -l /dev/test*
ls: cannot access '/dev/test*': No such file or directory
student@student-VirtualBox:~/Desktop/Spring23Assignments/csc415-device-driver-nl
rennacker/Module$
```