

Assignment 6 – Device Driver

Description:

This project focuses on implementing Linux device drivers that can be loaded and run within the kernel. The main focus is about taking input from a user-space application, where a text(string) is sent to the device driver and implementing encryption or decryption. The processed string then returns to the user-space application. The encryption technique that is used for this program is called Caesar cipher, which handles the ASCII values of characters in the string by predefined amount, which makes the encryption and decryption logic simple. The user-space program is a command line tool that interacts with device driver, passes input with the user's mode choice to clarify if the text should be encrypted or decrypted. This project demonstrates the integration of kernel programming with user-space applications.

Approach:

The development starts with making a character device driver using Linux Kernel. The driver became more comprehensible to handle encryption and decryption logic in a single struct. The 'ioctl' system call was for specifying operations such as 'e' for encryption and 'd' for decryption. A user-space command-line tool was developed to interact with drive and accept mode and input text. The program's functionality was checked by encrypting and decrypting sample texts to make sure every behavior is correct. It includes writing input string to device driver, running the matching encryption or decryption operation, then read output.

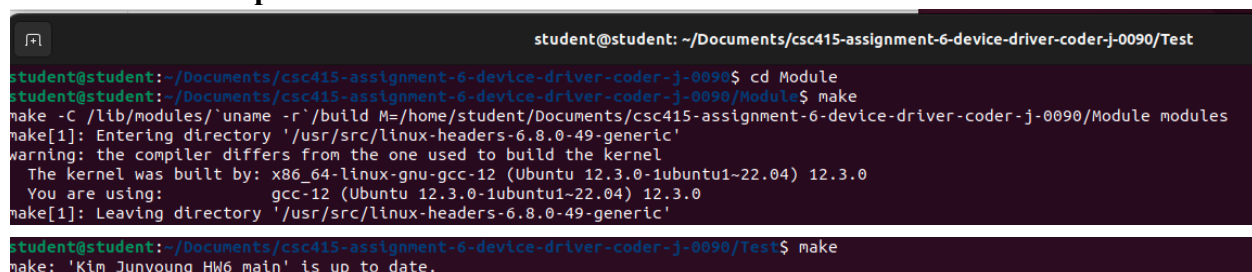
Issues and Resolutions:

I did face many issues while I was working on this. I faced errors such as permission denied, no rule to make target, syntax error, etc. I was sure the code itself wasn't wrong, so I tried multiple things such as redo updates in the git clone folder and 'Module' and 'Test', change the name of 'BASENAME' multiple times, etc. However, I couldn't really figure it out, so I re-downloaded the original version and re-wrote the whole code, then it worked. I still haven't figured out what was wrong in my previous code but I'm glad I could make the program I want.

Analysis:

N/A

Screenshot of compilation:



```
student@student: ~/Documents/csc415-assignment-6-device-driver-coder-j-0090/Test
student@student:~/Documents/csc415-assignment-6-device-driver-coder-j-0090$ cd Module
student@student:~/Documents/csc415-assignment-6-device-driver-coder-j-0090/Module$ make
make -C /lib/modules/`uname -r`/build M=/home/student/Documents/csc415-assignment-6-device-driver-coder-j-0090/Module modules
make[1]: Entering directory '/usr/src/linux-headers-6.8.0-49-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
make[1]: Leaving directory '/usr/src/linux-headers-6.8.0-49-generic'

student@student:~/Documents/csc415-assignment-6-device-driver-coder-j-0090/Test$ make
make: 'Kim_Junyoung_HW6_main' is up to date.
```

Screen shot(s) of the execution of the program:

```
student@student:~/Documents/csc415-assignment-6-device-driver-coder-j-0090$ cd Test
student@student:~/Documents/csc415-assignment-6-device-driver-coder-j-0090/Test$ make
make: 'Kim_Junyoung_HW6_main' is up to date.
student@student:~/Documents/csc415-assignment-6-device-driver-coder-j-0090/Test$ make run
./Kim_Junyoung_HW6_main
Enter 1 for Encryption or 0 for Decryption: 1
Enter the string: askd
Output: ;)1>
student@student:~/Documents/csc415-assignment-6-device-driver-coder-j-0090/Test$ make run
./Kim_Junyoung_HW6_main
Enter 1 for Encryption or 0 for Decryption: 0
Enter the string: ;)1>
Output: askd
```