VE482 Lab9

November 26, 2020

1 Read Write Return Value

The read operation should copy the desired data from kernel space to user space by functions like put_user. The write operation should copy the data from user space buffer to kernel space and do some operation. It's done through functions like get_user.

2 Major Number and Minor Number

The major number tells you which driver handles which device file. The minor number is used only by the driver itself to differentiate which device it's operating on, just in case the driver handles more than one device.

3 Add Char Device

```
// cdev variable
static struct cdev diceDev0;
// init cdev with customized file operation
cdev_init(&diceDev0, &fops0);
// add device with major number and minor number in MKDEV(majorNumber, minorNumber)
// (here minorNumber is 0)
cdev_add(&diceDev0, MKDEV(majorNumber, 0), 1);
```

4 Code Location

```
// module_init: /usr/src/linux-headers-5.4.0-53/include/linux/module.h
// module_exit: /usr/src/linux-headers-5.4.0-53/include/linux/module.h
// printk:      /usr/src/linux-headers-5.4.0-53/include/linux/printk.h
// container_of: /usr/src/linux-headers-5.4.0-53/include/linux/kernel.h
// dev_t:         /usr/src/linux-headers-5.4.0-53/include/linux/device.h

// MAJOR:     /usr/src/linux-headers-5.4.0-53/include/uapi/linux/kdev_t.h
// MINOR:     /usr/src/linux-headers-5.4.0-53/include/uapi/linux/kdev_t.h
// MKDEV:     /usr/src/linux-headers-5.4.0-53/include/linux/kdev_t.h
// alloc_chrdev_region:  /usr/src/linux-headers-5.4.0-53/include/linux/fs.h
// module_param:    /usr/src/linux-headers-5.4.0-53/include/linux/moduleparam.h
// cdev_init:        /usr/src/linux-headers-5.4.0-42/include/linux/cdev.h
// cdev_add:       /usr/src/linux-headers-5.4.0-42/include/linux/cdev.h
// cdev_del:       /usr/src/linux-headers-5.4.0-42/include/linux/cdev.h
// THIS_MODULE:   /usr/src/linux-headers-5.4.0-42/include/linux/export.h:
```

5 Generate Random Number

```
static struct timespec ts;

static int gen_rand(int mod) {
    int rd;
    getnstimeofday(&ts);
    rd = ts.tv_nsec % mod;
```

```
    return abs(rd);
}
```

6 Defind and Use Mudule Options

```
// in code, define and use gen_sides like common variable
static int gen_sides = 6;
module_param(gen_sides,int,S_IRUGO);
// when insmod, use:
// sudo insmod dice.ko gen_sides=20
```

7 Result

```
francis@ubuntu:~/code/lab9$ make
make -C /lib/modules/5.4.0-53-generic/build/ M=/home/francis/code/lab9 modules CFLAGS='-std=c11'
make[1]: Entering directory '/usr/src/linux-headers-5.4.0-53-generic'
    CC [M]  /home/francis/code/lab9/dice.o
    Building modules, stage 2.
    MODPOST 1 modules
    LD [M]  /home/francis/code/lab9/dice.ko
make[1]: Leaving directory '/usr/src/linux-headers-5.4.0-53-generic'
francis@ubuntu:~/code/lab9$ sudo insmod dice.ko gen_sides=20
[sudo] password for francis:
francis@ubuntu:~/code/lab9$ sudo -i
root@ubuntu:~# echo 1 > /dev/DiceDev0
root@ubuntu:~# cat /dev/DiceDev0
-------
| o o |
|  o  |
| o o |
-------
root@ubuntu:~# echo 2 > /dev/DiceDev1
root@ubuntu:~# cat /dev/DiceDev1
2 5
root@ubuntu:~# echo 3 > /dev/DiceDev2
root@ubuntu:~# cat /dev/DiceDev2
15 2 6
root@ubuntu:~# ls -l /dev/ | grep Dice
crw-------  1 root    root    507,   0 Nov 25 22:42 DiceDev0
crw-------  1 root    root    507,   1 Nov 25 22:42 DiceDev1
crw-------  1 root    root    507,   2 Nov 25 22:42 DiceDev2
```