

# CS307 Project1: Introduction To Linux Kernel Module

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## 1 Programming Thoughts

### 1.1 Part 1

In the first part, first we have to create an initialization function and exiting function for our kernel module. Then we need to include necessary header files(e.g. `linux/jiffies.h` `linux/gcd.h`) to use the global variables and functions which are only available in kernel space. Another thing worth attention is the different types for these variables.

### 1.2 Part 2

In the second part, we need to interact with the `/proc` pseudo file system. First we need to print out the value of `jiffies` variable in `proc_read()` function and then we need to use this equation to get the time interval.

$$t = \frac{jiffies_t - jiffies_0}{HZ}$$

## 2 Execution Results And Snapshots

The execution results are shown in 1 and 2.

```

dreamboy@Elon_Mask:~/OSProjects/project1$ dmesg
[ 3047.326216] Loading module...
[ 3047.326217] Hello, JunjieWang
[ 3047.326218] The GOLDEN_RATIO_PRIME value is:7046029254386353131
[ 3047.326218] The HZ value: 250
[ 3047.326219] Current jiffies value: 4295654041
[ 3047.332916] The gcd result: 12
[ 3047.332917] Current jiffies value: 4295654042
[ 3047.332918] 0s time has elapsed since the insertion.
[ 3047.332918] Removing module...
[ 3047.332918] Goodbye, JunjieWang
[ 3072.310650] Loading module...
[ 3072.310653] Hello, JunjieWang
[ 3072.310655] The GOLDEN_RATIO_PRIME value is:7046029254386353131
[ 3072.310657] The HZ value: 250
[ 3072.310658] Current jiffies value: 4295660287
[ 3077.327961] The gcd result: 12
[ 3077.327964] Current jiffies value: 4295661541
[ 3077.327966] 5s time has elapsed since the insertion.
[ 3077.327967] Removing module...
[ 3077.327968] Goodbye, JunjieWang

```

Figure 1: part 1

```

dreamboy@Elon_Mask:~/OSProjects/project1$ make
make -C /lib/modules/4.18.1-041801-generic/build M=/home/dreamboy/OSProjects/project1 modules
make[1]: Entering directory '/usr/src/linux-headers-4.18.1-041801-generic'
^Cmake: *** wait: 没有子进程。 停止。
make: *** 正在等待未完成的任务....
make: *** wait: 没有子进程。 停止。
dreamboy@Elon_Mask:~/OSProjects/project1$ make clean
make -C /lib/modules/4.18.1-041801-generic/build M=/home/dreamboy/OSProjects/project1 clean
make[1]: Entering directory '/usr/src/linux-headers-4.18.1-041801-generic'
CLEAN /home/dreamboy/OSProjects/project1/.tmp_versions
CLEAN /home/dreamboy/OSProjects/project1/Module.symvers
make[1]: Leaving directory '/usr/src/linux-headers-4.18.1-041801-generic'
dreamboy@Elon_Mask:~/OSProjects/project1$ make
make -C /lib/modules/4.18.1-041801-generic/build M=/home/dreamboy/OSProjects/project1 modules
make[1]: Entering directory '/usr/src/linux-headers-4.18.1-041801-generic'
CC [M] /home/dreamboy/OSProjects/project1/seconds.o
CC [M] /home/dreamboy/OSProjects/project1/simple.o
CC [M] /home/dreamboy/OSProjects/project1/jiffies.o
Building modules, stage 2.
MODPOST 3 modules
CC /home/dreamboy/OSProjects/project1/jiffies.mod.o
LD [M] /home/dreamboy/OSProjects/project1/jiffies.ko
CC /home/dreamboy/OSProjects/project1/seconds.mod.o
LD [M] /home/dreamboy/OSProjects/project1/seconds.ko
CC /home/dreamboy/OSProjects/project1/simple.mod.o
LD [M] /home/dreamboy/OSProjects/project1/simple.ko
make[1]: Leaving directory '/usr/src/linux-headers-4.18.1-041801-generic'
dreamboy@Elon_Mask:~/OSProjects/project1$ sudo insmod jiffies.ko
sudo: 无法解析主机: Elon_Mask
dreamboy@Elon_Mask:~/OSProjects/project1$ sudo insmod seconds.ko
sudo: 无法解析主机: Elon_Mask
dreamboy@Elon_Mask:~/OSProjects/project1$ cat /proc/jiffies
Currently jiffies value is:4296033624
dreamboy@Elon_Mask:~/OSProjects/project1$ cat /proc/seconds
8s has elapsed since creation.
dreamboy@Elon_Mask:~/OSProjects/project1$

```

Figure 2: part 2

### 3 Code Explanation

The *proc\_init()* and *proc\_read()* are shown as belows. We first use a global variable **start** to record the value of jiffies at the beginning. And then use the formula to get the time interval

when the *proc\_read()* function is invoked.

---

```
static int proc_init(void)
{
    proc_create(PROC_NAME, 0666, NULL, &proc_ops);
    printk(KERN_INFO "/proc/%s created\n", PROC_NAME);
    start = jiffies;

    return 0;
}
...
static ssize_t proc_read(struct file *file, char __user *usr_buf, size_t
    count, loff_t *pos)
{
    int rv = 0;
    static int completed = 0;
    char buffer[BUFFER_SIZE];

    if(completed){
        completed = 0;
        return 0;
    }

    completed = 1;

    rv = sprintf(buffer, "%lus has eplased since creation.\n",
        (jiffies-start)/HZ);

    copy_to_user(usr_buf, buffer, rv);
    return rv;
}
```

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