

Ammar Meslmani - CBS-01

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the repo link to check the output of this assignment: [full report](#)

Lab 5:

- we need to update `int_stack.c` so that device creation will be linked to USB key insertion and that by replacing the following:

```
if (device_create(stack_class, NULL, dev_number, NULL, DEVICE_NAME) ==
    NULL) {
    class_destroy(stack_class);
    cdev_del(&stack_cdev);
    unregister_chrdev_region(dev_number, 1);
    return -1;
}
```

with

```
pr_info("int_stack: core initialized, waiting for USB key\n");
```

- let's check VID:PID of my little chinese wireless mouse

```
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ lsusb
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 001 Device 002: ID 04f2:b61e Chicony Electronics Co., Ltd Integrated Camera
Bus 001 Device 013: ID 248a:8367 Maxxter Telink Wireless Receiver
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 003 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 003 Device 002: ID 05e3:0608 Genesys Logic, Inc. Hub
Bus 003 Device 003: ID 0bda:b023 Realtek Semiconductor Corp. RTL8822BE Bluetooth 4.2 Adapter
Bus 003 Device 004: ID 27c6:55b4 Shenzhen Goodix Technology Co.,Ltd. Fingerprint Reader
Bus 004 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
```

- let's create `usb_gate.c` file:

```
#include <linux/module.h>
#include <linux/usb.h>
#include <linux/device.h>
#include <linux/cdev.h>

// imported from int_stack.ko
extern dev_t dev_number;
extern struct class *stack_class;

static struct usb_device_id pen_table[] = {
```

```
        { USB_DEVICE(0x248a, 0x8367) }, // my little chinese wireless
mouse's VID:PID
    {}
};
MODULE_DEVICE_TABLE(usb, pen_table);

static int pen_probe(struct usb_interface *interface, const struct
usb_device_id *id)
{
    printk(KERN_INFO "USB key (%04X:%04X) inserted\n", id->idVendor,
id->idProduct);

    if (stack_class) {
        device_create(stack_class, NULL, dev_number, NULL,
"int_stack");
        printk(KERN_INFO "int_stack: device created by USB key\n");
    }

    return 0;
}

static void pen_disconnect(struct usb_interface *interface)
{
    printk(KERN_INFO "USB key removed, removing /dev/int_stack\n");
    device_destroy(stack_class, dev_number);
}

static struct usb_driver pen_driver = {
    .name = "usb_stack_gate",
    .id_table = pen_table,
    .probe = pen_probe,
    .disconnect = pen_disconnect,
};

static int __init pen_init(void)
{
    return usb_register(&pen_driver);
}

static void __exit pen_exit(void)
{
    usb_deregister(&pen_driver);
}

module_init(pen_init);
module_exit(pen_exit);

MODULE_LICENSE("GPL");
MODULE_AUTHOR("Ammar Meslmani");
MODULE_DESCRIPTION("USB Gating Module for int_stack");
```

- and let's update `kernel_module.c` so that it displays the following error: `error: USB key not inserted` when the usb is not plugged in by updating the following part:

```
int fd = open(DEVICE_PATH, O_RDWR);
if (fd < 0) {
    if (errno == ENOENT || errno == ENODEV) {
        fprintf(stderr, "error: USB key not inserted\n");
    } else {
        perror("Failed to open device");
    }
    return EXIT_FAILURE;
}
```

- now let's update `Makefile`:

```
obj-m += int_stack.o
obj-m += usb_gate.o

KDIR := /lib/modules/$(shell uname -r)/build
PWD := $(shell pwd)

all:
    make -C $(KDIR) M=$(PWD) modules

clean:
    make -C $(KDIR) M=$(PWD) clean
```

- and let's build:

```
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ make
make -C /lib/modules/6.11.0-21-generic/build M=/home/ammar/Desktop/advanced_linux/lab5 modules
make[1]: Entering directory '/usr/src/linux-headers-6.11.0-21-generic'
warning: the compiler differs from the one used to build the kernel
The kernel was built by: x86_64-linux-gnu-gcc-14 (Ubuntu 14.2.0-4ubuntu2) 14.2.0
You are using: gcc-14 (Ubuntu 14.2.0-4ubuntu2) 14.2.0
CC [M] /home/ammar/Desktop/advanced_linux/lab5/int_stack.o
CC [M] /home/ammar/Desktop/advanced_linux/lab5/usb_gate.o
MODPOST /home/ammar/Desktop/advanced_linux/lab5/Module.symvers
CC [M] /home/ammar/Desktop/advanced_linux/lab5/int_stack.mod.o
LD [M] /home/ammar/Desktop/advanced_linux/lab5/int_stack.ko
BTF [M] /home/ammar/Desktop/advanced_linux/lab5/int_stack.ko
Skipping BTF generation for /home/ammar/Desktop/advanced_linux/lab5/int_stack.ko due to unavailability of vmlinux
CC [M] /home/ammar/Desktop/advanced_linux/lab5/usb_gate.mod.o
LD [M] /home/ammar/Desktop/advanced_linux/lab5/usb_gate.ko
BTF [M] /home/ammar/Desktop/advanced_linux/lab5/usb_gate.ko
Skipping BTF generation for /home/ammar/Desktop/advanced_linux/lab5/usb_gate.ko due to unavailability of vmlinux
make[1]: Leaving directory '/usr/src/linux-headers-6.11.0-21-generic'
```

- now let's keep the usb plugged in and compile `kernel_stack.c` and try running it

```

ammar@ubuntu:~/Desktop/advanced_linux/lab5$ sudo insmod int_stack.ko
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ sudo insmod usb_gate.ko
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ ls /dev/int_stack
/dev/int_stack
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ sudo chmod 666 /dev/int_stack
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ gcc kernel_stack.c -o kernel_stack
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ sudo chmod +x kernel_stack
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ lsusb
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 001 Device 002: ID 04f2:b61e Chicony Electronics Co., Ltd Integrated Camera
Bus 001 Device 013: ID 248a:8367 Maxxter Telink Wireless Receiver
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Bus 003 Device 004: ID 27c6:55b4 Shenzhen Goodix Technology Co.,Ltd. Fingerprint Reader
Bus 004 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ ./kernel_stack set-size 2
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ ./kernel_stack push 1
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ ./kernel_stack push 2
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ ./kernel_stack push 3
ERROR: stack is full
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ ./kernel_stack unwind
2
1

```

- now let's unplug the usb and try to run the program again

```

ammar@ubuntu:~/Desktop/advanced_linux/lab5$ ls /dev/int_stack
ls: cannot access '/dev/int_stack': No such file or directory
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ lsusb
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 001 Device 002: ID 04f2:b61e Chicony Electronics Co., Ltd Integrated Camera
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 003 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 003 Device 002: ID 05e3:0608 Genesys Logic, Inc. Hub
Bus 003 Device 003: ID 0bda:b023 Realtek Semiconductor Corp. RTL8822BE Bluetooth 4.2 Adapter
Bus 003 Device 004: ID 27c6:55b4 Shenzhen Goodix Technology Co.,Ltd. Fingerprint Reader
Bus 004 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
ammar@ubuntu:~/Desktop/advanced_linux/lab5$ ./kernel_stack set-size 5
error: USB key not inserted

```

- done!