

Модули ядра линукс

При сборке ядра были использованы такие команды

make - сборка модуля ядра с помощью Makefile

sudo insmod test123.ko - загрузка модуля ядра

sudo dmesg | tail -n 10 - вывод сообщений ядра

```
qwerty@qwerty-To-Be-Filled-By-0-E-M:~/Desktop/last/task1$ make
make -C /lib/modules/6.8.0-45-generic/build M=/home/qwerty/Desktop/last/task1 modules
make[1]: Entering directory '/usr/src/linux-headers-6.8.0-45-generic'
warning: the compiler differs from the one used to build the kernel
The kernel was built by: x86_64-linux-gnu-gcc-13 (Ubuntu 13.2.0-23ubuntu4) 13.2.0
You are using: gcc-13 (Ubuntu 13.2.0-23ubuntu4) 13.2.0
cc [M] /home/qwerty/Desktop/last/task1/test123.o
/home/qwerty/Desktop/last/task1/test123.c:11:13: warning: no previous prototype for 'test_read' [-Wmissing-prototypes]
11 |     ssize_t test_read(struct file *fd, char __user *buff, size_t size, loff_t *off) {
    |
/home/qwerty/Desktop/last/task1/test123.c:21:13: warning: no previous prototype for 'test_write' [-Wmissing-prototypes]
21 |     ssize_t test_write(struct file *fd, const char __user *buff, size_t size, loff_t *off) {
    |
MODPOST /home/qwerty/Desktop/last/task1/Module.symvers
CC [M] /home/qwerty/Desktop/last/task1/test123.mod.o
LD [M] /home/qwerty/Desktop/last/task1/test123.ko
BTF [M] /home/qwerty/Desktop/last/task1/test123.ko
Skipping BTF generation for /home/qwerty/Desktop/last/task1/test123.ko due to unavailability of vmlinux
make[1]: Leaving directory '/usr/src/linux-headers-6.8.0-45-generic'
qwerty@qwerty-To-Be-Filled-By-0-E-M:~/Desktop/last/task1$ sudo insmod test.ko
[sudo] password for qwerty:
insmod: ERROR: could not load module test.ko: No such file or directory
qwerty@qwerty-To-Be-Filled-By-0-E-M:~/Desktop/last/task1$ sudo insmod test123.ko
qwerty@qwerty-To-Be-Filled-By-0-E-M:~/Desktop/last/task1$ sudo dmesg | tail -n 10
[17785.246480] audit: type=1400 audit(1728758195.025:230): apparmor="DENIED" operation="symlink" class="file" profile="snap.firefox.firefox" name="/dev/char/195:0" pid=4769 comm="glxtest"
[17785.246570] audit: type=1400 audit(1728758195.025:231): apparmor="DENIED" operation="symlink" class="file" profile="snap.firefox.firefox" name="/dev/char/195:0" pid=4769 comm="glxtest"
[17785.246704] audit: type=1400 audit(1728758195.025:232): apparmor="DENIED" operation="symlink" class="file" profile="snap.firefox.firefox" name="/dev/char/195:0" pid=4769 comm="glxtest"
[17785.246841] audit: type=1400 audit(1728758195.025:233): apparmor="DENIED" operation="symlink" class="file" profile="snap.firefox.firefox" name="/dev/char/195:0" pid=4769 comm="glxtest"
[17785.258326] audit: type=1400 audit(1728758195.029:234): apparmor="DENIED" operation="symlink" class="file" profile="snap.firefox.firefox" name="/dev/char/195:255" pid=4769 comm="glxtest"
[17785.251173] audit: type=1400 audit(1728758195.029:235): apparmor="DENIED" operation="symlink" class="file" profile="snap.firefox.firefox" name="/dev/char/195:254" pid=4769 comm="glxtest"
[17785.251177] audit: type=1400 audit(1728758195.029:236): apparmor="DENIED" operation="symlink" class="file" profile="snap.firefox.firefox" name="/dev/char/195:0" pid=4769 comm="glxtest"
[17730.116732] test123: module verification failed: signature and/or required key missing - tainting kernel
[17730.116936] test module is loaded.
[17730.116939] Major number is 234.
```

sudo mknod test123 c 234 0 - создание файла символического устройства с мажорным номером 511 и минорным 0

В лекциях была использована утилита cat, но в моём случае это выводило ошибку

```
qwerty@qwerty-To-Be-Filled-By-0-E-M:/dev$ sudo cat test123
cat: test123: Bad address
```

и мной была использована утилита strings

```
qwerty@qwerty-To-Be-Filled-By-0-E-M:/dev$ echo "VSEMPRIVET" > test123
qwerty@qwerty-To-Be-Filled-By-0-E-M:/dev$ sudo strings /dev/test123
VSEMPRIVET
```

echo "VSEMPRIVET" > test123 - запись содержимого в переменную

sudo rmmod test - выгрузка модуля ядра