

# Operating System Project 1

## 1. Edit the source code and Makefile

Add system calls to system call table

```
$ sudo vim /usr/src/linux-3.2.54/arch/x86/kernel/syscall_table_32.S
```

```
347 .long sys_sendmsg /* 341 */
348 .long sys_setres
349 .long sys_process_vm_readv
350 .long sys_process_vm_writev
351 .long sys_hello /* 349 hello system call */
352 .long sys_show /* 350 show */
353 .long sys_multiply /* 351 multiply */
354 .long sys_min /* 352 minimum */
```

Add macros

```
$ sudo vim /usr/src/linux-3.2.54/arch/x86/include/asm/unistd_32.h
```

```
355 #define __NR_process_vm_readv 347
356 #define __NR_process_vm_writev 348
357 #define __NR_hello 349
358 #define __NR_show 350
359 #define __NR_multiply 351
360 #define __NR_min 352
361
362 #ifdef __KERNEL__
363
364 #define NR_syscalls 353
```

Add system call functions declaration

```
$ sudo vim /usr/src/linux-3.2.54/arch/x86/include/asm/syscalls.h
```

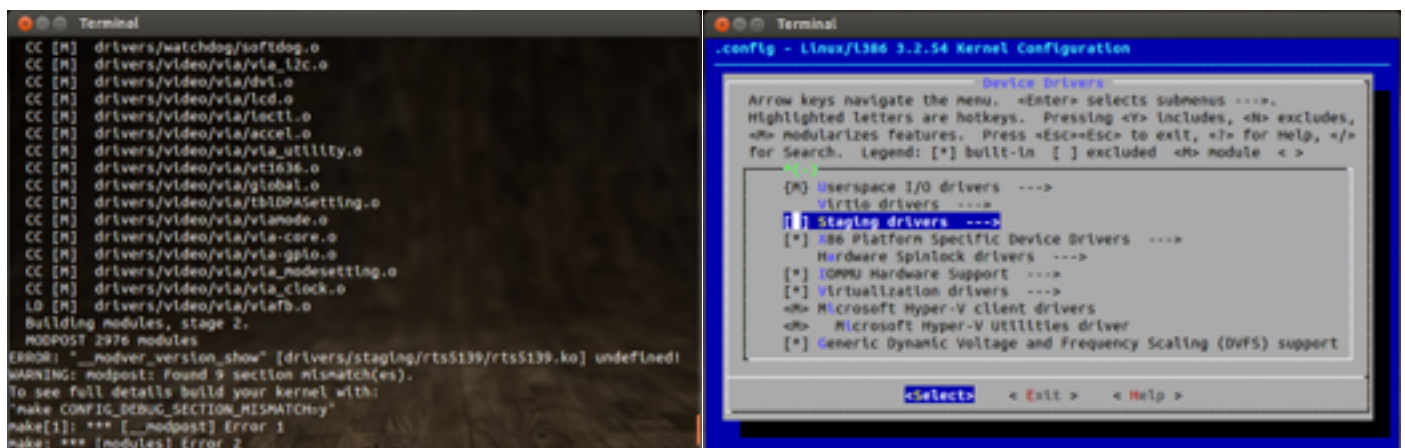
```
68 #endif /* LINUX_386_32 */
69 #endif /* _ASM_X86_SYSCALLS_H */
70
71 /* self-modified code */
72 asmlinkage int sys_hello(void);
73 asmlinkage int sys_show(void);
74 asmlinkage long sys_multiply(long, long);
75 asmlinkage long sys_min(long, long);
```

Add source code to making target

```
$ sudo vim /usr/src/linux-3.2.54/kernel/Makefile
```

```
3
4
5 obj-y += sched.o fork.o exec_domain.o panic.o printk.o \
6         cpu.o exit.o itimer.o time.o softirq.o resource.o \
7         syscall.o syscall_binary.o capability.o ptrace.o timer.o user.o \
8         signal.o sys.o knod.o workqueue.o pid.o \
9         rcupdate.o extable.o params.o posix-timers.o \
10        kthread.o wait.o kfifo.o sys_ni.o posix-cpu-timers.o mutex.o \
11        hrtimer.o rwsem.o nsproxy.o srcu.o semaphore.o \
12        notifier.o ksysfs.o sched_clock.o cred.o \
13        async.o range.o teamd.
14 obj-y += groups.o
```

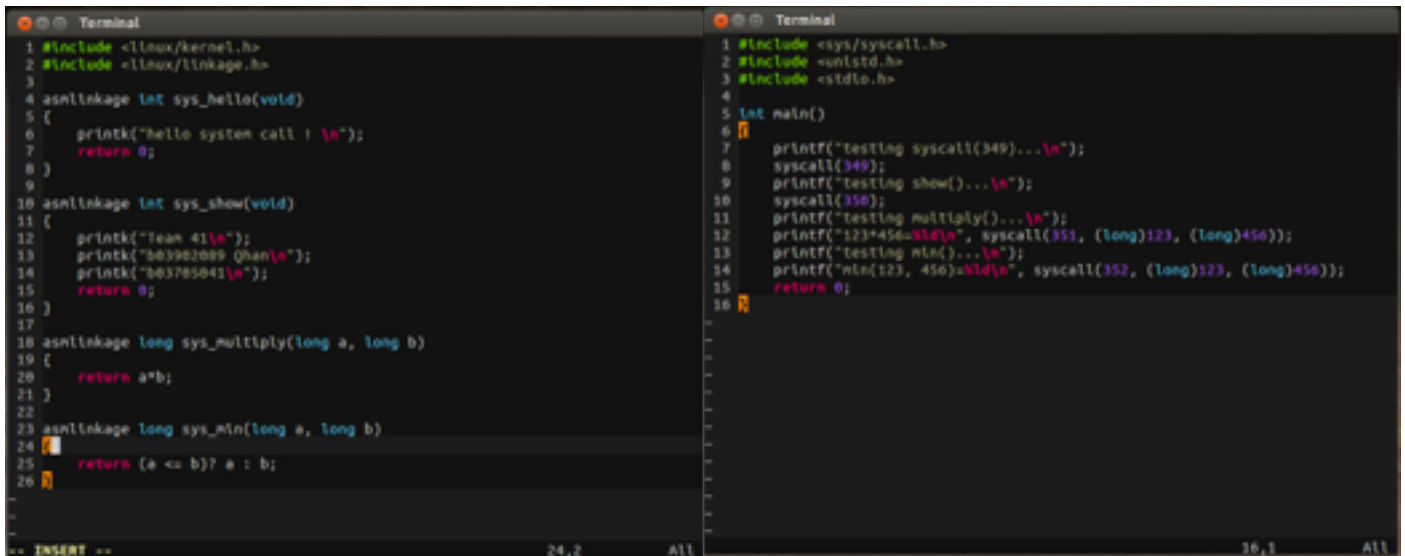
## 2. Problems during making modules



solutions : unable the to make the modules of staging during “sudo make menuconfig”

reference : <http://forum.ubuntu.org.cn/viewtopic.php?f=97&t=361214>

### 3. The source code we created : team41.c & The testing program : test.c



```

Terminal
1 #include <linux/kernel.h>
2 #include <linux/linkage.h>
3
4 asmlinkage int sys_hello(void)
5 {
6     printk("hello system call ! \n");
7     return 0;
8 }
9
10 asmlinkage int sys_show(void)
11 {
12     printk("Team 41\n");
13     printk("b03902009 Qhan\n");
14     printk("b03705041\n");
15     return 0;
16 }
17
18 asmlinkage long sys_multiply(long a, long b)
19 {
20     return a*b;
21 }
22
23 asmlinkage long sys_min(long a, long b)
24 {
25     return (a <= b)? a : b;
26 }
-- INSERT --
24,2 All

Terminal
1 #include <sys/syscall.h>
2 #include <unistd.h>
3 #include <stdio.h>
4
5 int main()
6 {
7     printf("testing syscall(349)...\n");
8     syscall(349);
9     printf("testing show()...\n");
10    syscall(350);
11    printf("testing multiply()...\n");
12    printf("123*456=lld\n", syscall(351, (long)123, (long)456));
13    printf("testing min()...\n");
14    printf("min(123, 456)=lld\n", syscall(352, (long)123, (long)456));
15    return 0;
16 }

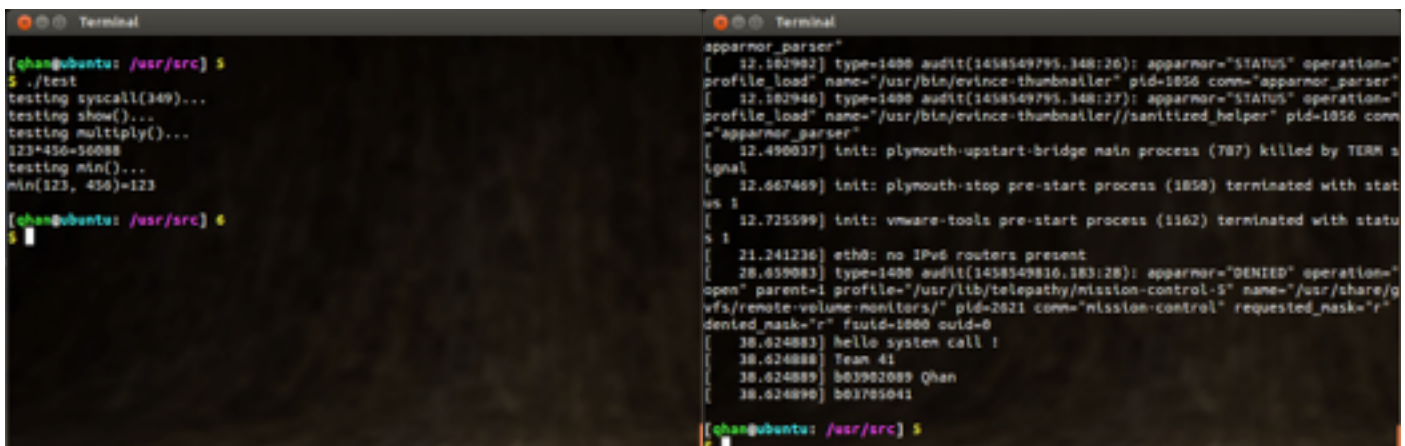
```

### 4. Testing result

```
$ sudo gcc /usr/src/test.c -o test
```

```
$ ./test
```

```
$ dmesg
```



```

[qhan@ubuntu: /usr/src] $
$ ./test
testing syscall(349)...\n
testing show()...\n
testing multiply()...\n
123*456=360888\n
testing min()...\n
min(123, 456)=123\n
[qhan@ubuntu: /usr/src] $

apparmor_parser [ 12.102902] type=1400 audit(1458549795.348:26): apparmor="STATUS" operation="profile_load" name="/usr/bin/evince-thumbnailer" pid=1056 conn="apparmor_parser" [ 12.102946] type=1400 audit(1458549795.348:27): apparmor="STATUS" operation="profile_load" name="/usr/bin/evince-thumbnailer/sanitized_helper" pid=1056 conn="apparmor_parser" [ 12.490037] init: plymouth-upstart-bridge main process (787) killed by TERM signal [ 12.667469] init: plymouth-stop pre-start process (1050) terminated with status 1 [ 12.725599] init: vmware-tools pre-start process (1162) terminated with status 1 [ 21.241236] eth0: no IPv6 routers present [ 20.059083] type=1400 audit(1458549810.183:28): apparmor="DENIED" operation="open" parent=1 profile="/usr/lib/telepathy/mission-control-5" name="/usr/share/gvfs/remote-volume-monitors/" pid=2021 conn="mission-control" requested_mask="r" denied_mask="r" fsuid=1000 ouid=0 [ 30.024083] hello system call ! [ 30.024088] Team 41 [ 30.024089] b03902009 Qhan [ 30.024090] b03705041
[qhan@ubuntu: /usr/src] $

```