Assignment 1: Compiling Linux Kernel and Adding Custom System Calls

311552067 劉承熙

1. results of executing *uname* -a and *cat /etc/os-release* commands

2. Which kernel sources did you modifiy? What do they do?

1. Add syscall function code and Makefile for each new syscalls
   - Makefile is to ensure that the c file is compiled and included in the kernel source code
2. Add new syscall folder in Makefile of Linux Kernel
   - This is to tell the compiler that the source files of new syscalls are in present in the new syscall directory
3. Add new syscall to syscall table_64
   - Define syscall number for syscall function and name
4. Add new syscall to syscall header file
   - Defines the prototype of the function of system call
5. Compile kernel code, install and update kernel

3. Each system call implemented (Source code)

Add syscall function code and Makefile for each new syscalls

```c
// linux-5.19.12/hello/hello.c
#include <linux/kernel.h>
#include <linux/syscalls.h>
SYSCALL_DEFINE0(hello){
    printk("Hello world!\n");
    printk("311552067\n");
    return 0;
}
```

```makefile
// linux-5.19.12/hello/Makefile
obj-y := hello.o
```

```c
// linux-5.19.12/linux-5.19.12/revstr/revstr.c
#include <linux/kernel.h>
#include <linux/syscalls.h>
#include <linux/string.h>
#include <linux/uaccess.h>
SYSCALL_DEFINE2(revstr, int, len, char __user *, src){
    char str_in[100];
    char reverse[100];
    if( copy_from_user(str_in, src, len)){
        return -EFAULT;
    }
    for(int i=0; i<len; i++){
        reverse[i] = str_in[(len-1) - i];
    }
    str_in[len] = '\0';
    reverse[len] = '\0';
    printk("The origin string: %s\n", str_in);
    printk("The reversed string: %s\n", reverse);
    return 0;
}
```

```
// linux-5.19.12/revstr/Makefile
obj-y := revstr.o
```

Add new syscall folder in Makefile of Linux Kernel

```
// linux-5.19.12/Makefile
core-y  += kernel/ certs/ mm/ fs/ ipc/ security/ crypto/

//add new syscalls folder(hello/ revstr/)

core-y  += kernel/ certs/ mm/ fs/ ipc/ security/ crypto/ hello/ revstr/
```

Add new syscall to syscall table_64

```
//  linux-5.19.12/arch/x86/entry/syscalls/syscall_64.tbl
548 64  hello           sys_hello
549 64  revstr          sys_revstr
```

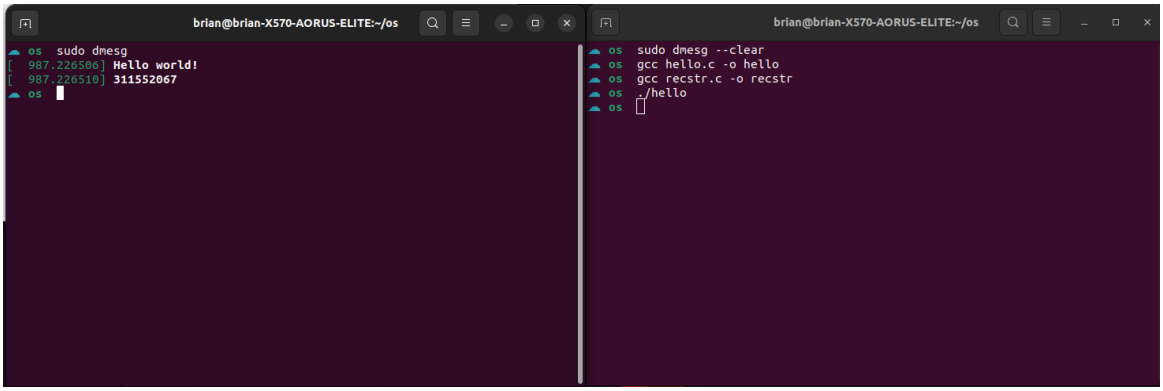
Add new syscall to syscall header file

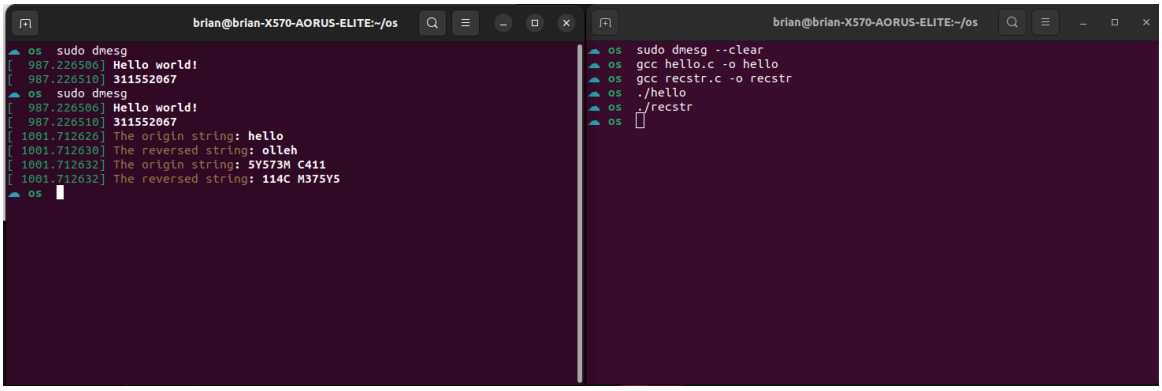
```
// linux-5.19.12/include/linux/syscalls.h
asmlinkage long sys_hello(void);
asmlinkage long sys_revstr(int len, char __user *src);
```

compile

```
sudo make
sudo make modules_install
sudo make install
```

4. Result


brian@brian-X570-AORUS-ELITE:~/os
os sudo dmesg
[987.226506] Hello world!
[987.226510] 311552067
os
brian@brian-X570-AORUS-ELITE:~/os
os sudo dmesg --clear
os gcc hello.c -o hello
os gcc recstr.c -o recstr
os ./hello
os


brian@brian-X570-AORUS-ELITE:~/os
os sudo dmesg
[987.226506] Hello world!
[987.226510] 311552067
os sudo dmesg
[987.226506] Hello world!
[987.226510] 311552067
[1001.712626] The origin string: hello
[1001.712630] The reversed string: olleh
[1001.712632] The origin string: 5Y573M C411
[1001.712632] The reversed string: 114C M375Y5
os
brian@brian-X570-AORUS-ELITE:~/os
os sudo dmesg --clear
os gcc hello.c -o hello
os gcc recstr.c -o recstr
os ./hello
os ./recstr
os