NYCU Operation System Homework 1

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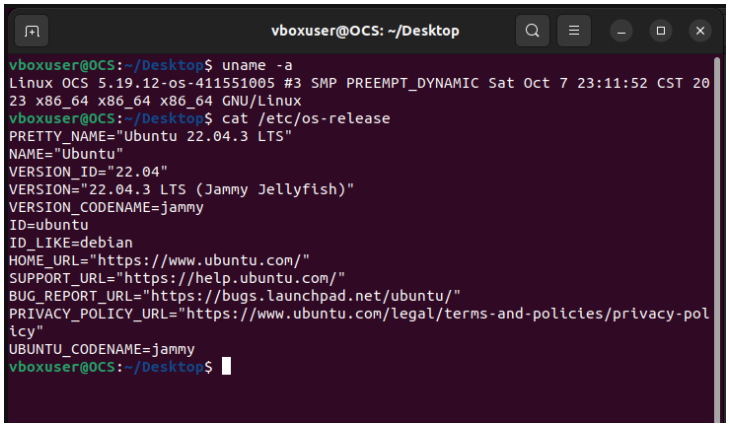
Part I: Kernel compilation.



Part II: System call.

- **For both System call**
  1. Creat “myFunction” folder.
  2. Creat three files named “hello.c”, “revstr.c”, and “Makefile”
  3. Add following line to “myFunction/Makefile”:

```
1 obj-y := hello.o revstr.o
```

  4. Add “/ myFunction” in “linux-5.19.12/Makefile” in line 1103:

```
1103 core-y                    += kernel/ certs/ mm/ fs/ ipc/ security/ crypto/ myFunction/
```

  5. Add the new system call to the system call table:
     cd arch/x86/entry/syscalls/
     add following line in syscall_64.tbl

```
548     common  hello                   sys_hello
549     common  revstr                  sys_revstr
```

  6. Add new system call to the system call header file:
     cd include/linux/
     add following line in syscalls.h

```
1388 asmlinkage long sys_hello(void);
1389 asmlinkage long sys_revstr(void);
```

  7. Compile the kernel:

```
>sudo make -j14
>sudo make modules_install install
>sudo
```

- **sys_hello**

```c
#include <linux/kernel.h>
#include <linux/syscalls.h>
SYSCALL_DEFINE0(hello)
{
    printk("Hello world.\n");
    printk("441551005\n");
    return 0;
}
```

```
[ 6177.856335] Hello world.
[ 6177.856337] 441551005
```

- **sys_revstr**

```c
#include <linux/kernel.h>
#include <linux/syscalls.h>
#include <linux/uaccess.h>  // for copy_from_user() and copy_to_us
er()

SYSCALL_DEFINE2(revstr, int, length, const char __user *, usr_str)
{
    char *kern_str;
    int i, j;
    kern_str = kmalloc(length + 1, GFP_KERNEL);
    if (!kern_str) {
        return -ENOMEM;
    }
    // Copy string from user space to kernel space
    if (copy_from_user(kern_str, usr_str, length)) {
        kfree(kern_str);
        return -EFAULT;
    }
    // Null-terminate the string
    kern_str[length] = '\0';
    printk(KERN_INFO "The origin string: %s\n", kern_str);
    // Reverse the string
    for (i = 0, j = length - 1; i < j; i++, j--) {
        char temp = kern_str[i];
        kern_str[i] = kern_str[j];
        kern_str[j] = temp;
    }
```

```
    printk(KERN_INFO "The reversed string: %s\n", kern_str);
    // Copy reversed string back to user space
    if (copy_to_user((void __user *)usr_str, kern_str, length)) {
        kfree(kern_str);
        return 0;
    }
    kfree(kern_str);
    return 0;
}
```

```
[   73.558261] The origin string: hello
[   73.558264] The reversed string: olleh
[   73.558269] The origin string: 5Y573M C411
[   73.558270] The reversed string: 114C M375Y5
```