

Operating Systems and System Programming

**LAND
OF THE
CURIOUS**

Experiment 2—System Call

- Prerequisite
 - `sudo apt-get install libncurses5-dev libncursesw5-dev`
 - `sudo apt-get install bison flex`
 - `sudo apt-get install libelf-dev libssl-dev`
- Download kernel
 - <https://www.kernel.org/>
 - `cp /mnt/d/linux-5.10.164.tar.xz ./`
 - `xz -d linux-5.10.16.tar.xz`
 - `tar -xf linux-5.10.16.tar`

Experiment 2—System Call

- Edit kernel
 - Edit kernel/sys.c to add a system call
 - SYSCALL_DEFINE0(hellozsh){
 - printk("Hello Shouhua * _*");
 - return 1;
 - }
 - Edit include/linux/syscall.h to add the declaration for the system call
 - asmlinkage long sys_hellozsh(void);
 - Edit arch/x86/entry/syscalls/syscall_64.tbl to add the system call number
 - 441 64 hellozsh sys_hellozsh

Experiment 2—System Call

- Compile kernel with configuration file
 - `sudo make KCONFIG_CONFIG=Microsoft/config-wsl -j4`
- Compile kernel without configuration file
 - `make menuconfig`
 - `sudo make -j4` (4 is number of logical processors)
 - `sudo make modules_install`
 - `sudo make install`

Experiment 2—System Call

- Errors
 - libncurses5-dev and libncursesw5-dev
 - `sudo apt-get install libncurses5-dev libncursesw5-dev`
 - `/bin/sh: 1: flex: not found`
 - `sudo apt-get install bison`
 - `sudo apt-get install flex`
 - “CANNOT GENERATE ORC METADATA FOR CONFIG_UNWINDER_ORC=Y, PLEASE INSTALL LIBELF-DEV, LIBELF-DEVEL OR ELFUTILS-LIBELF-DEVEL”. STOP.
 - `sudo apt install libelf-dev`
 - `sudo apt install libssl-dev`

Experiment 2—System Call

- Errors
 - /bin/sh: 1: bc: not found
 - sudo apt-get install bc
 - scripts/kconfig/Makefile:71: recipe for target 'synconfig' failedmake[2]: *** [synconfig] Error 1Makefile:588: recipe for target 'synconfig' failedmake[1]: *** [synconfig] Error 2Makefile:695: recipe for target 'include/config/auto.conf.cmd' failedmake: *** [include/config/auto.conf.cmd] Error 2
 - sudo make KCONFIG_CONFIG=Microsoft/config-wsl

Experiment 2—System Call

- Change kernel
 - ~/linux-5.10.164/arch/x86/boot/bzImage
 - wsl –shutdown (Power Shell)
 - Move or rename C:\Windows\System32\lxss\tools\kernel
 - Copy bzImage to C:\Windows\System32\lxss\tools
 - rename bzImage to kernel

Experiment 2—System Call

- Test system call
 - #include <unistd.h>
 - #include <linux/kernel.h>
 - #include <sys/syscall.h>
 - #include <stdio.h>
 - int main() {
 - long re =syscall(441);
 - printf("System call sys_hellozsh reutrn:%ld\n", re);
 - return 0;
 - }

Experiment 2—System Call

- Execute the test program
- View the log with dmesg
 - dmesg

```
[ 61.163719] FS-Cache: N-key=[10] '34323934393433343033'
[ 61.166355] FS-Cache: Duplicate cookie detected
[ 61.166358] FS-Cache: O-cookie c=00000000ab1f0145 [p=000000009542d952 fl=222 nc=0 na=1]
[ 61.166359] FS-Cache: O-cookie d=00000000f6186cb9 n=00000000bc2d7bde
[ 61.166360] FS-Cache: O-key=[10] '34323934393433343033'
[ 61.166366] FS-Cache: N-cookie c=0000000018ca888b [p=000000009542d952 fl=2 nc=0 na=1]
[ 61.166367] FS-Cache: N-cookie d=00000000f6186cb9 n=00000000e488a95c
[ 61.166367] FS-Cache: N-key=[10] '34323934393433343033'
[ 86.423155] Hello Shouhua *_*
[ 121.619937] WSL2: Performing memory compaction.
```