Fayoum unveracity

Operating System report

how to add your system call the Linux OS kernel.

Name Here
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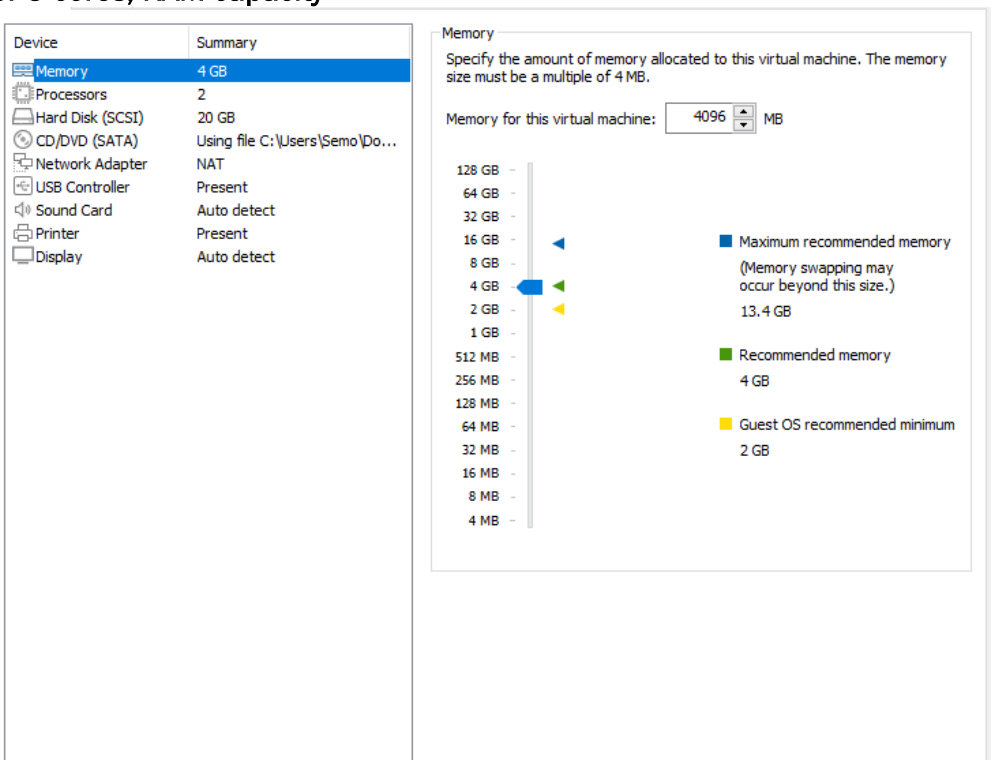
Description of my system

CPU cores, RAM capacity



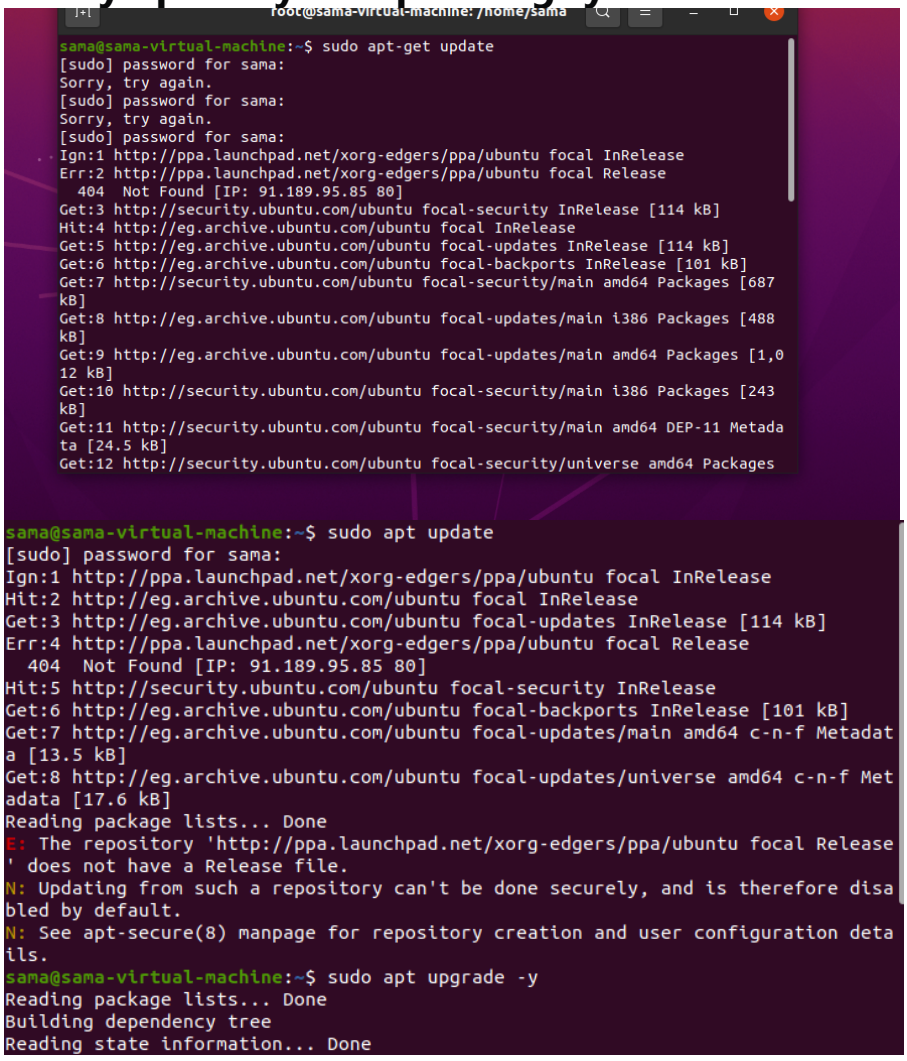
Kernel version
5.8.0.55-generic

```
sama@sama-virtual-machine:~$ uname -r
5.8.0-55-generic
sama@sama-virtual-machine:~$ cd ~
sama@sama-virtual-machine:~$ nano report.c
sama@sama-virtual-machine:~$
```

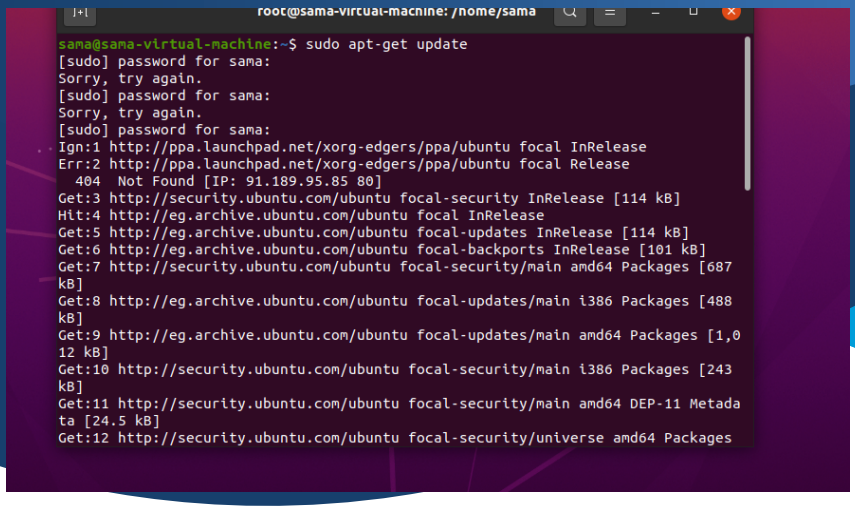
Steps of how adding the system call & Screenshots.

1 - Preparation

1.1 - Fully update your operating system



1.2 - Download and install the essential packages to compile kernels.



2 - Creation

2.1 **- Check the version of your current kernel.**

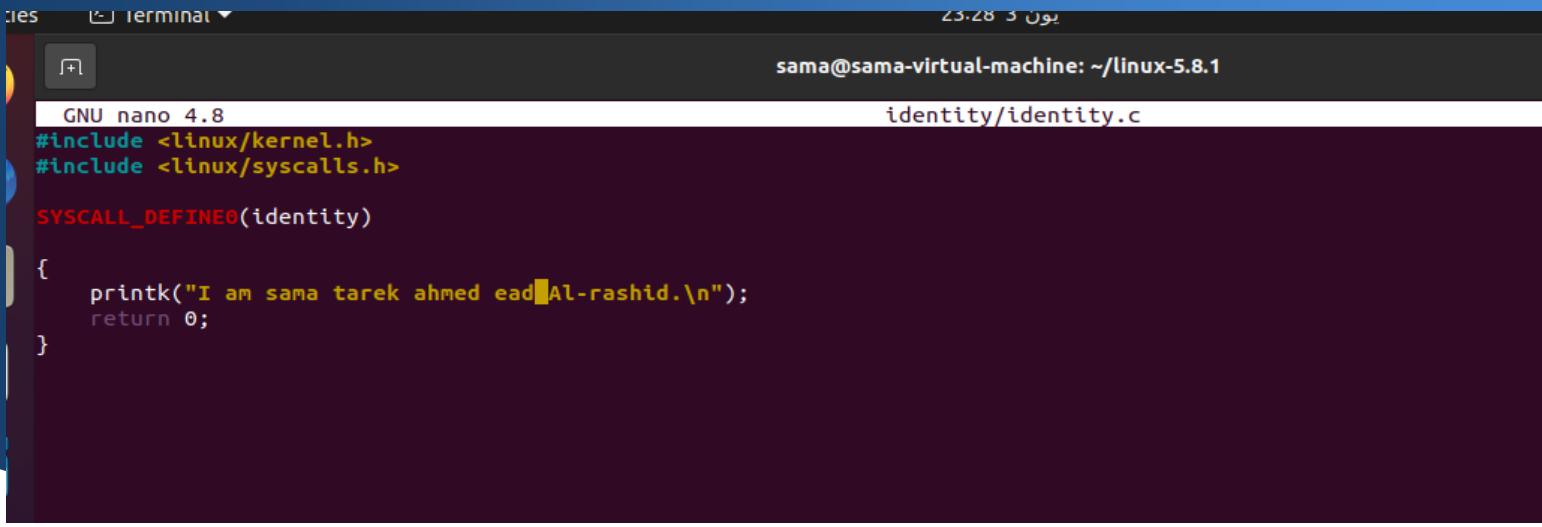
2.2 **- Change your working directory to the root directory of the recently unpacked source code.**
That is cd ~/linux-5.8.1/

2.3 - Create the home directory of your system call. Name is `identity`

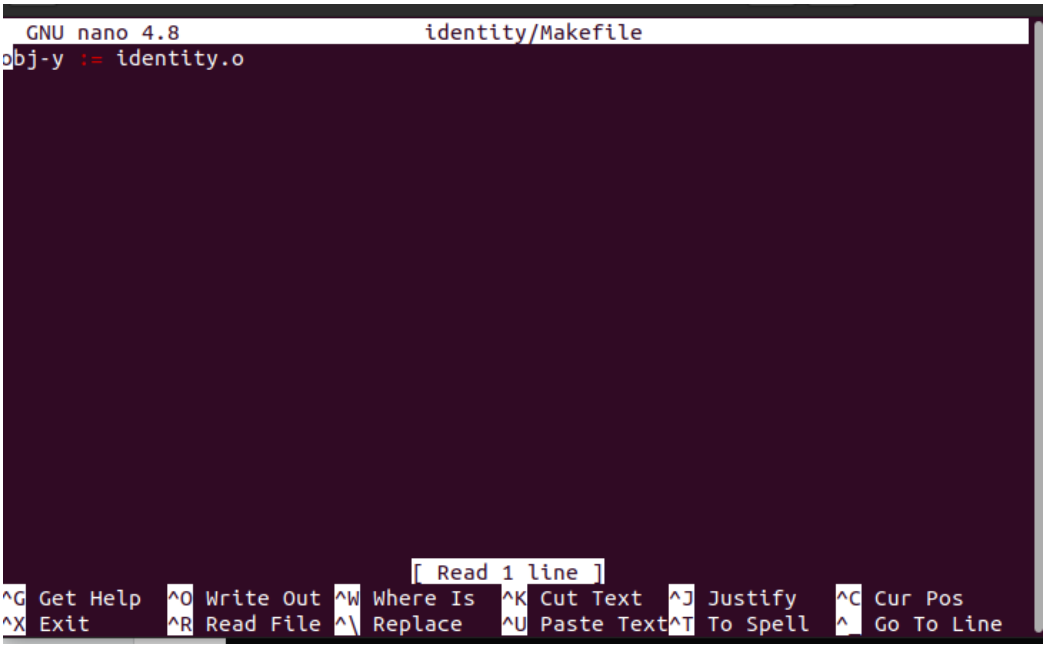
2.4 - Create a C file for your system call.

By nano identity/identity.c & Write the following code in it.

```
done
Removing linux-modules-5.8.0-43-generic (5.8.0-43.49~20.04.1) ...
Processing triggers for libc-bin (2.31-0ubuntu9.2) ...
sama@sama-virtual-machine:~$ sudo apt autoremove -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
sama@sama-virtual-machine:~$ wget -P ~/ https://cdn.kernel.org/pub/linux/kernel/v5.x/linux-5.8.1.tar.xz
--2021-06-03 23:18:51--  https://cdn.kernel.org/pub/linux/kernel/v5.x/linux-5.8.1.tar.xz
Resolving cdn.kernel.org (cdn.kernel.org)... 199.232.81.176, 2a04:4e42:54::432
Connecting to cdn.kernel.org (cdn.kernel.org)|199.232.81.176|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 114458544 (109M) [application/x-xz]
Saving to: '/home/sama/linux-5.8.1.tar.xz'

linux-5.8.1.tar.xz                100%[=================================================================>] 109.16M  1.57MB/s    in 67s

2021-06-03 23:19:58 (1.62 MB/s) - '/home/sama/linux-5.8.1.tar.xz' saved [114458544/114458544]

sama@sama-virtual-machine:~$ uname -r
5.8.0-53-generic
sama@sama-virtual-machine:~$ cd ~/linux-5.8.1/
bash: cd: /home/sama/linux-5.8.1/: No such file or directory
sama@sama-virtual-machine:~$ l
Desktop/  Documents/  Downloads/  linux-5.8.1.tar.xz  Music/  Pictures/  Public/  snap/  Templates/  Videos/
sama@sama-virtual-machine:~$ ls
Desktop  Documents  Downloads  linux-5.8.1.tar.xz  Music  Pictures  Public  snap  Templates  Videos
sama@sama-virtual-machine:~$ cd ~/linux-5.8.1/
sama@sama-virtual-machine:~/linux-5.8.1$ mkdir identity
sama@sama-virtual-machine:~/linux-5.8.1$ nano identity/identity.c
sama@sama-virtual-machine:~/linux-5.8.1$ nano identity/Makefile
```

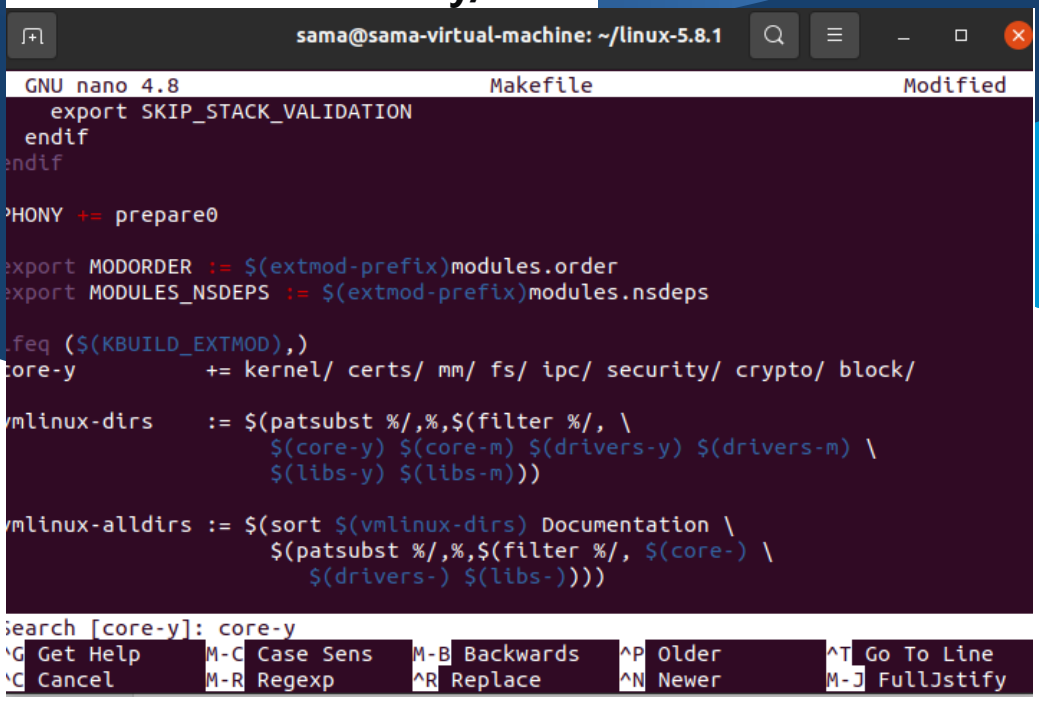


2.5 – Create a Makefile for your system call name identity Write the following code in it.



2.6 **- Add the home directory of your system call to the main Makefile of the kernel**

Search for core-y. In the second result, you will see a series of directories.Add "identity/" to it



2.7 - Add a corresponding function prototype for your system call to the header file of system calls.

By this command

nano include/linux/syscalls.h

following code just above #endif

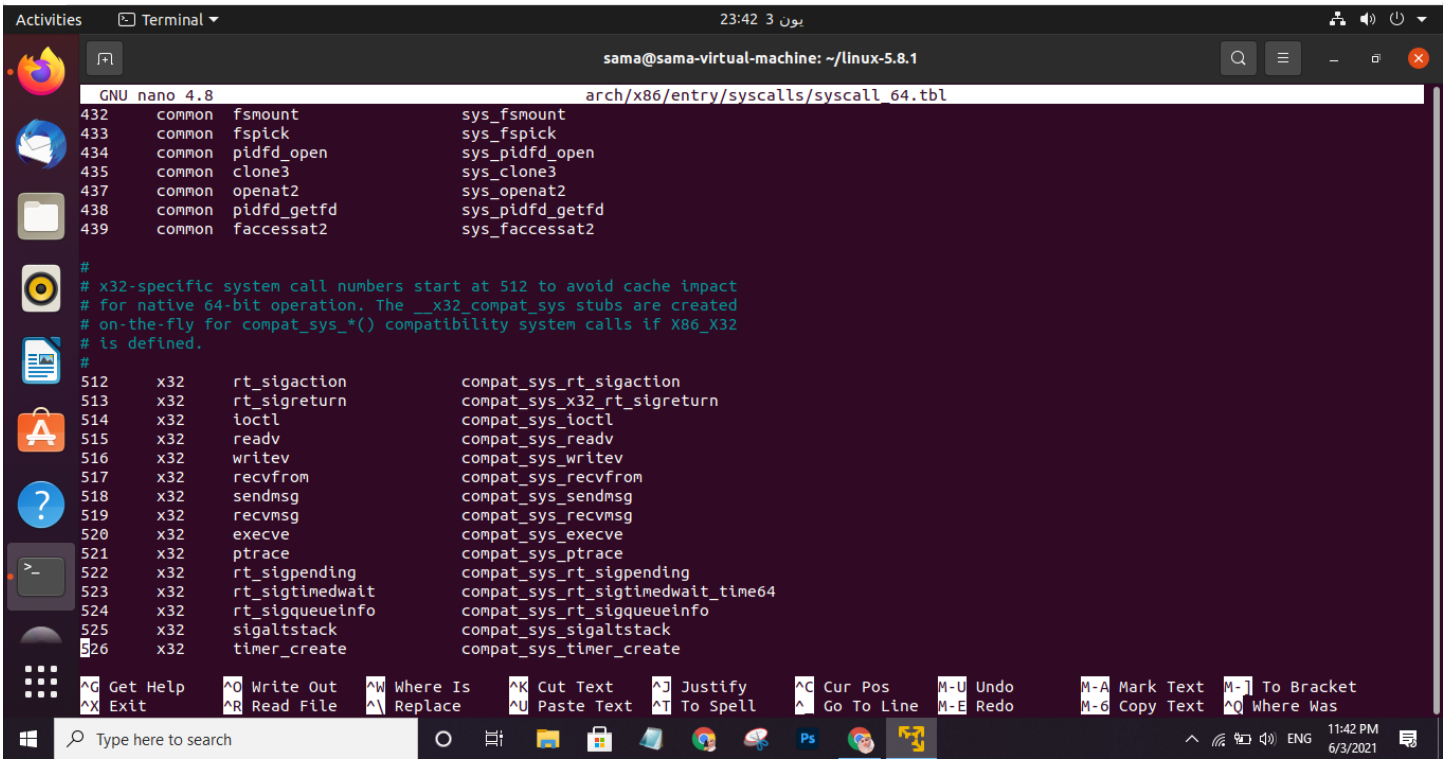
asmlinkage long sys_identity(void);

```
403 }
404
405 /* for __ARCH_WANT_SYS_IPC */
406 long ksys_semtimedop(int semid, struct sembuf __user *tsops,
407                      unsigned int nsops,
408                      const struct __kernel_timespec __user *timeout);
409 long ksys_semget(key_t key, int nsems, int semflg);
410 long ksys_old_semctl(int semid, int semnum, int cmd, unsigned long arg);
411 long ksys_msgget(key_t key, int msgflg);
412 long ksys_old_msgctl(int msqid, int cmd, struct msqid_ds __user *buf);
413 long ksys_msgrcv(int msqid, struct msgbuf __user *msgp, size_t msgsz,
414                  long msgtyp, int msgflg);
415 long ksys_msgsnd(int msqid, struct msgbuf __user *msgp, size_t msgsz,
416                  int msgflg);
417 long ksys_shmget(key_t key, size_t size, int shmflg);
418 long ksys_shmdt(char __user *shmaddr);
419 long ksys_old_shmctl(int shmid, int cmd, struct shmid_ds __user *buf);
420 long compat_ksys_semtimedop(int semid, struct sembuf __user *tsems,
421                             unsigned int nsops,
422                             const struct old_timespec32 __user *timeout);
423
424
425 asmlinkage long sys_h
```

2.8 - **Add your system call to the kernel's system call table.**
By this command

nano arch/x86/entry/syscalls/syscall_64.tbl

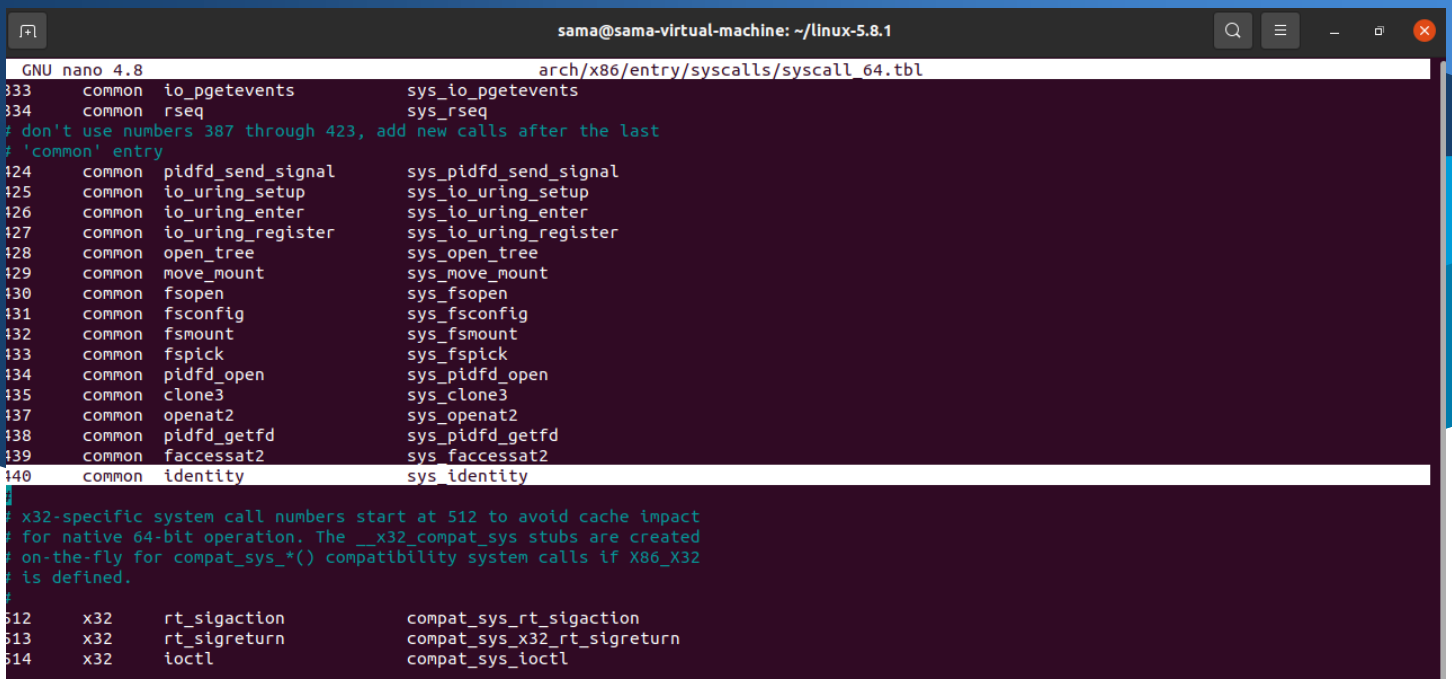
```
sama@sama-virtual-machine:~/linux-5.8.1$ nano arch/x86/entry/syscalls/syscall_64.tbl
sama@sama-virtual-machine:~/linux-5.8.1$
```



You will find a series of x32 system calls. Scroll to this section

440 common identity sys_identity

above it.

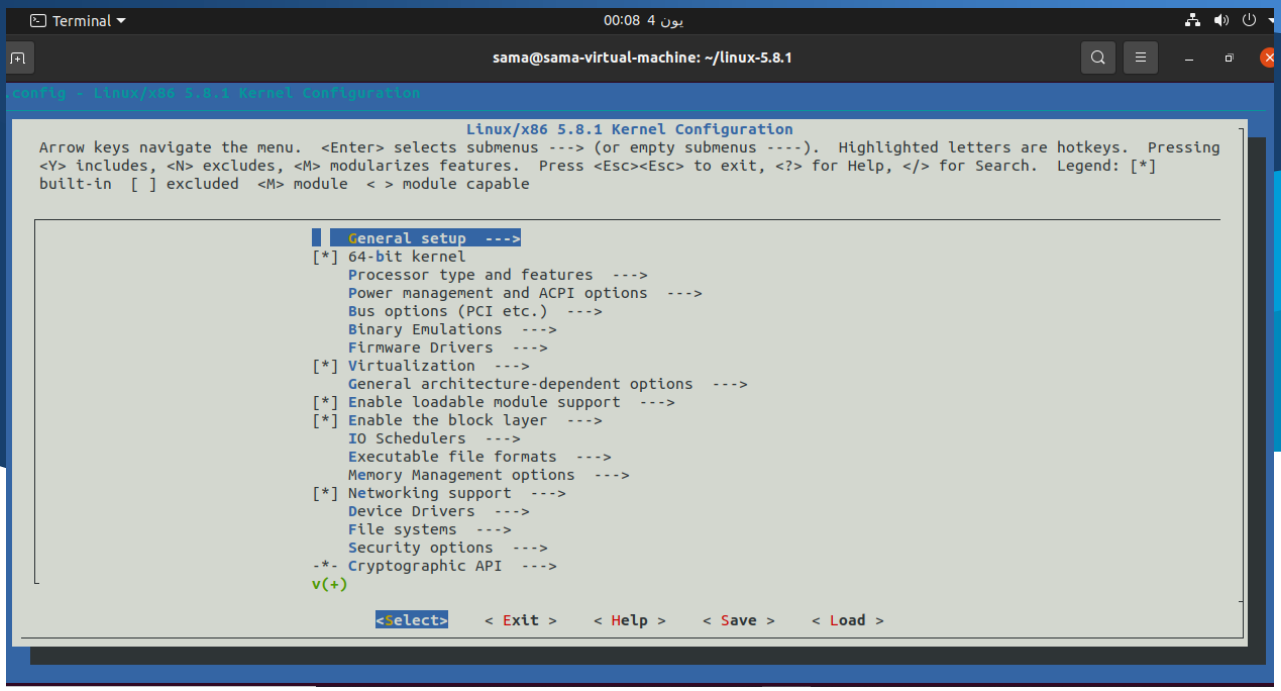


3 - Installation

3.1 - Configure the kernel.
configuration window with the following command.

make menuconfig

```
sama@sama-virtual-machine:~/linux-5.8.1$ make menuconfig
  HOSTCC  scripts/basic/fixdep
  UPD     scripts/kconfig/mconf-cfg
  HOSTCC  scripts/kconfig/mconf.o
  HOSTCC  scripts/kconfig/lxdialog/checklist.o
  HOSTCC  scripts/kconfig/lxdialog/inputbox.o
  HOSTCC  scripts/kconfig/lxdialog/menubox.o
  HOSTCC  scripts/kconfig/lxdialog/textbox.o
  HOSTCC  scripts/kconfig/lxdialog/util.o
  HOSTCC  scripts/kconfig/lxdialog/yesno.o
  HOSTCC  scripts/kconfig/confdata.o
  HOSTCC  scripts/kconfig/expr.o
  LEX     scripts/kconfig/lexer.lex.c
  YACC    scripts/kconfig/parser.tab.[ch]
  HOSTCC  scripts/kconfig/lexer.lex.o
  HOSTCC  scripts/kconfig/parser.tab.o
  HOSTCC  scripts/kconfig/preprocess.o
  HOSTCC  scripts/kconfig/symbol.o
  HOSTCC  scripts/kconfig/util.o
  HOSTLD  scripts/kconfig/mconf
scripts/kconfig/mconf  Kconfig
#
# using defaults found in /boot/config-5.8.0-53-generic
#
/boot/config-5.8.0-53-generic:8468:warning: symbol value 'm' invalid for ASHMEM
/boot/config-5.8.0-53-generic:9477:warning: symbol value 'm' invalid for ANDROID_BINDER_IPC
/boot/config-5.8.0-53-generic:9478:warning: symbol value 'm' invalid for ANDROID_BINDERFS


*** End of the configuration.
*** Execute 'make' to start the build or try 'make help'.
```



3.2 - Find out how many logical cores you have by nproc

3.2 - Find out how many logical cores you have by make -j12

```
sama@sama-virtual-machine:~/linux-5.8.1$ nproc
2
sama@sama-virtual-machine:~/linux-5.8.1$ make -j12
  DESCEND  objtool
  CALL     scripts/atomic/check-atomics.sh
  CALL     scripts/checksyscalls.sh
  CHK      include/generated/compile.h
make[1]: *** No rule to make target 'debian/canonical-certs.pem', needed by 'certs/x509_certificate_list'.  Stop.
make[1]: *** Waiting for unfinished jobs....
make: *** [Makefile:1756: certs] Error 2
make: *** Waiting for unfinished jobs....
  CHK      kernel/kheaders_data.tar.xz
```

3.5 - Install the kernel by sudo make install -j12

4 - Result

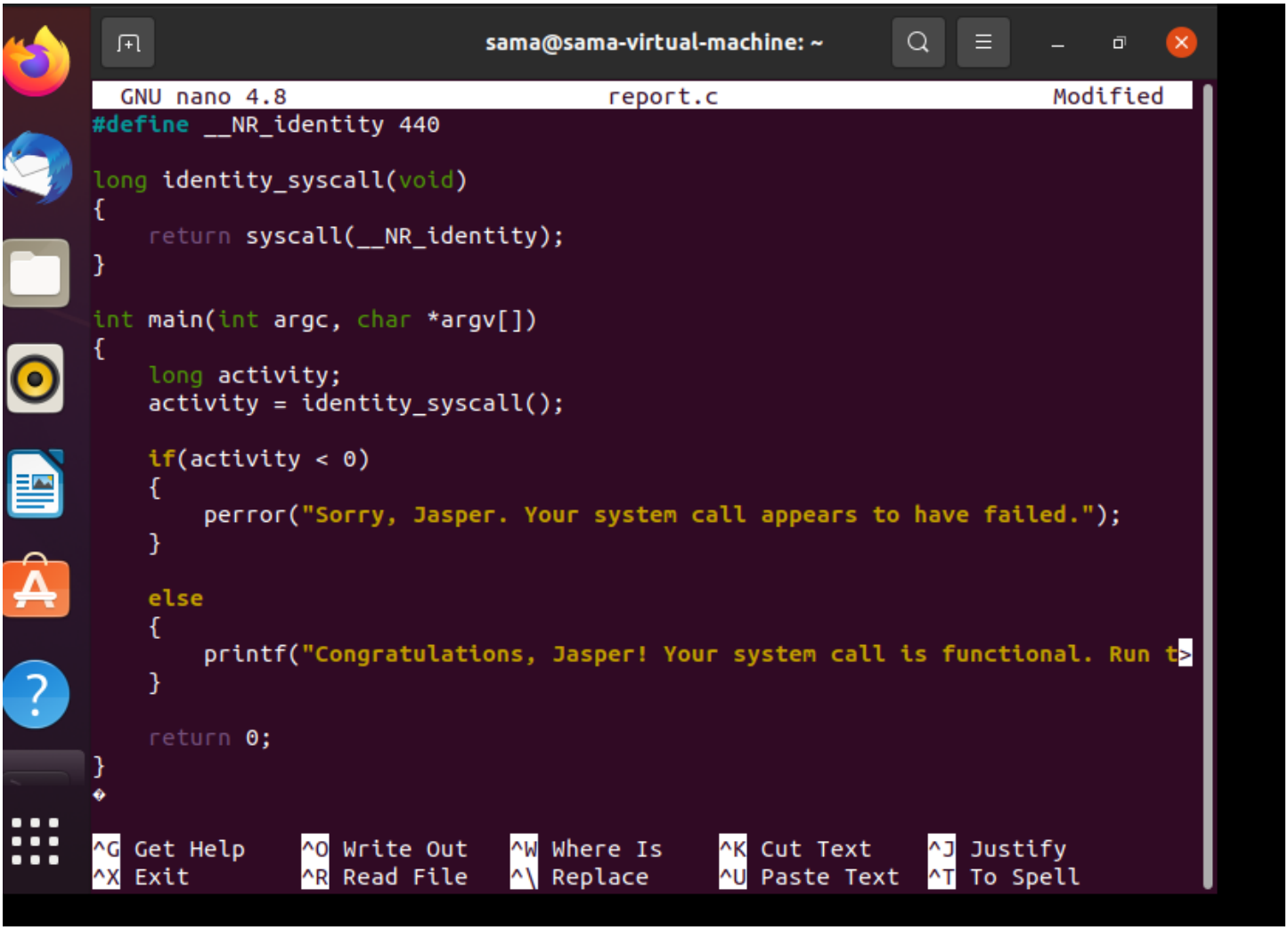
4.1 - Check the version of your current kernel.

4.2 - Change your working directory to your home directory.

4.3 - Create a C file to generate a report of the success or failure of your system call.

```
sama@sama-virtual-machine:~$ uname -r
5.8.0-55-generic
sama@sama-virtual-machine:~$ cd ~
sama@sama-virtual-machine:~$ nano report.c
sama@sama-virtual-machine:~$
```

Write the following code in it.



4.4 - Compile the C file you just created.

gcc -o report report.c

4.5 - Run the C file you just compiled. ./report

```
sama@sama-virtual-machine:~$ ./report
Congratulations, Jasper! Your system call is functional. Run the command dmesg
in the terminal and find out!
sama@sama-virtual-machine:~$
```

References

https://www.kernel.org/doc/html/latest/process/adding-syscalls.html

https://dev.to/jasper/adding-a-system-call-to-the-linux-kernel-5-8-1-in-ubuntu-20-04-lts-2ga8

https://medium.com/anubhav-shrimal/adding-a-hello-world-system-call-to-linux-kernel-dad32875872