System Call To Linux Kernel
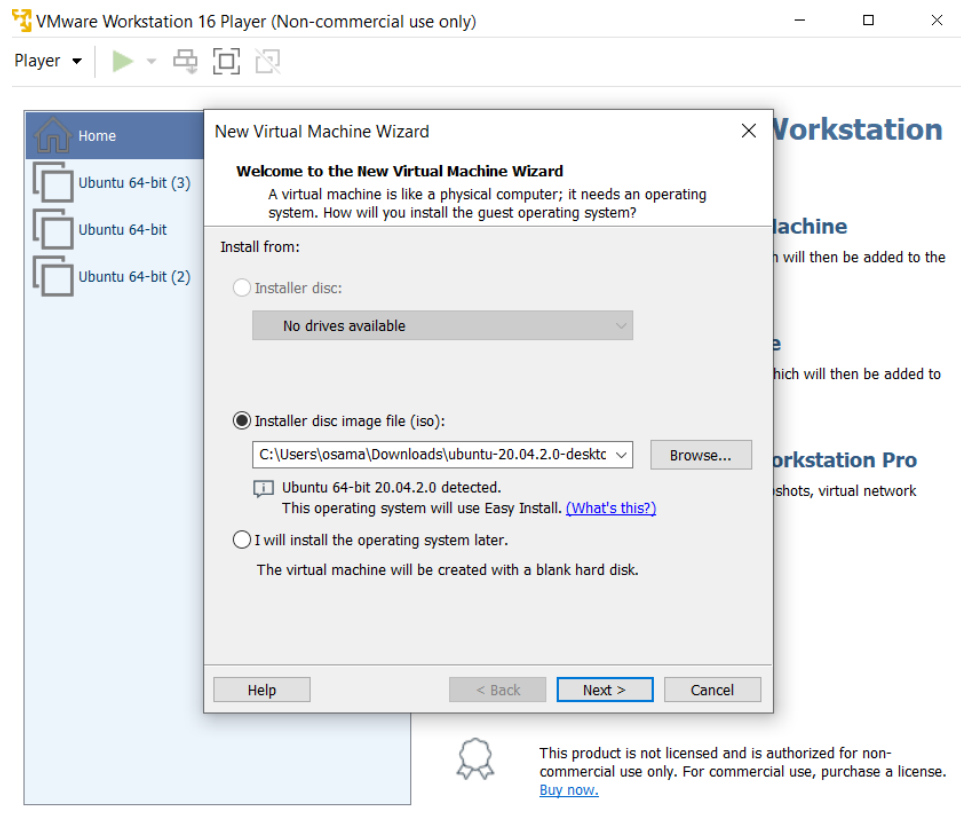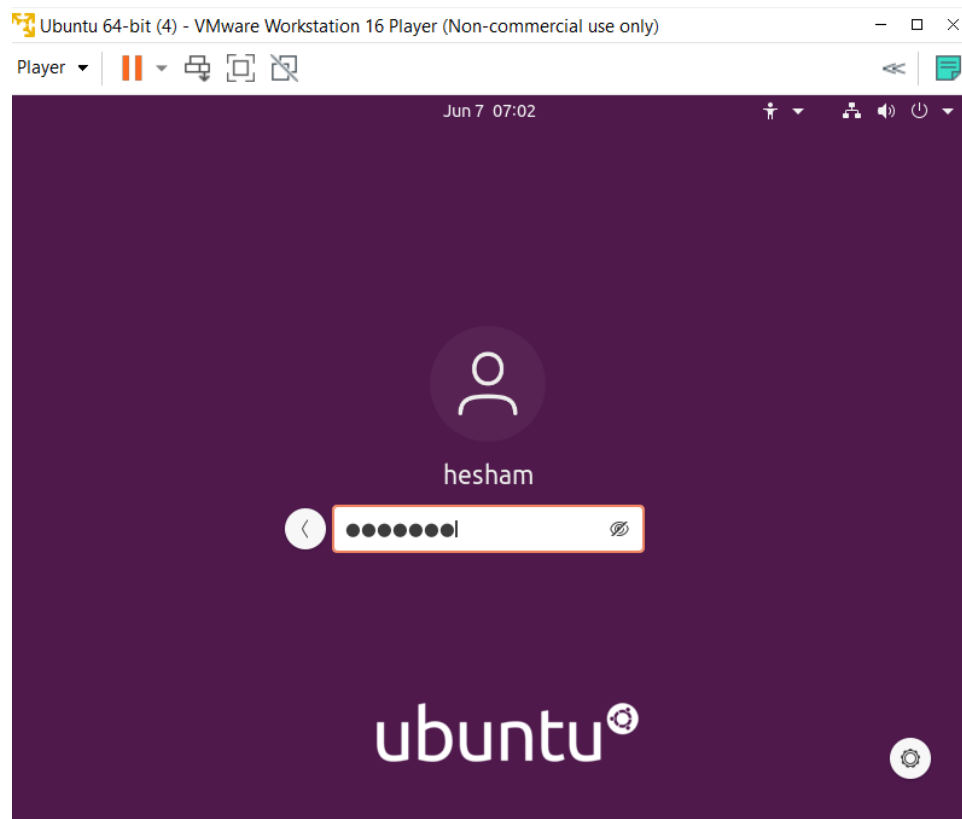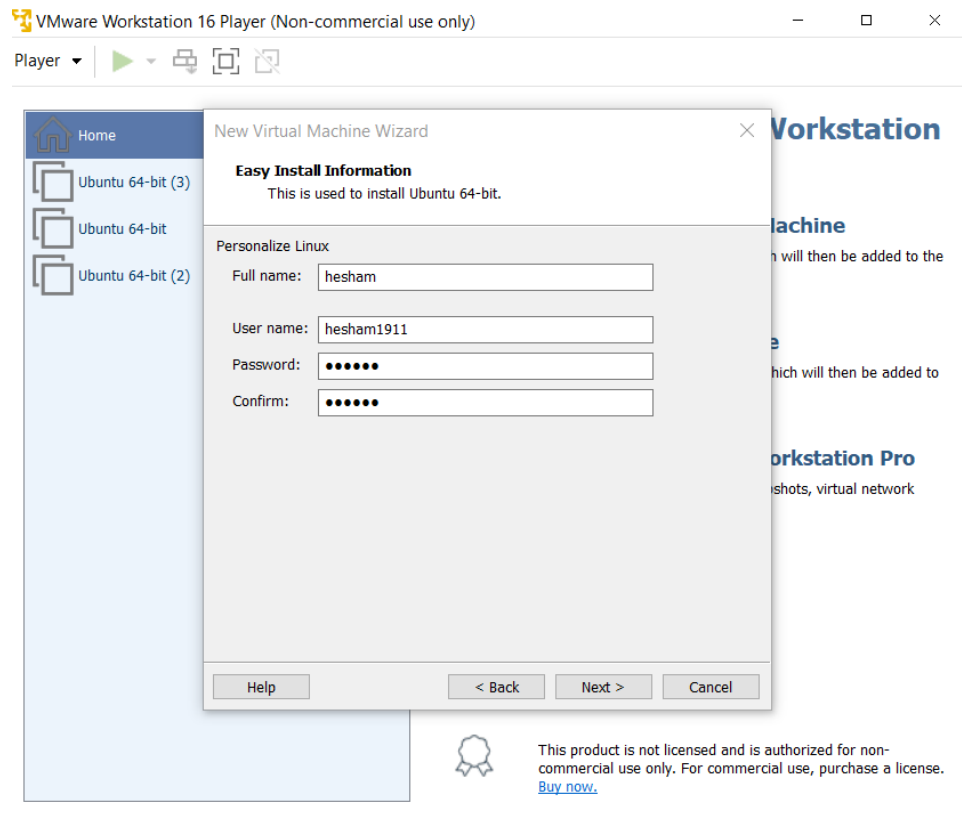
هشام سعيد عطيه

مصطفي محمد المهدي

عمر ايهاب مصطفي
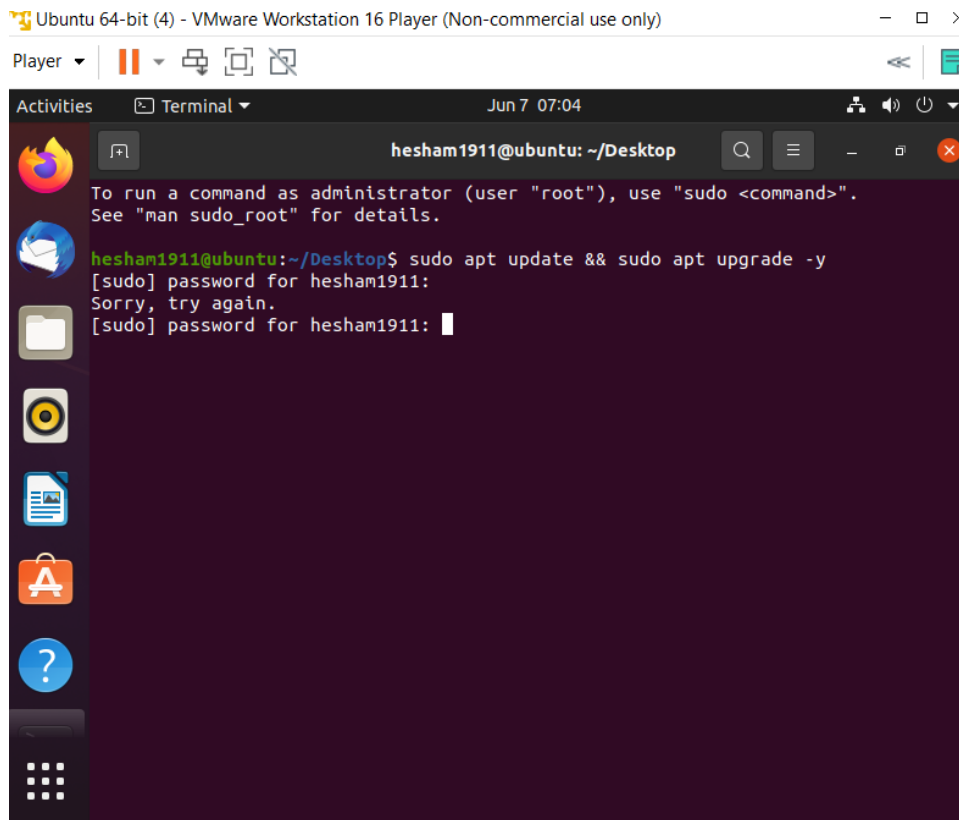
#-Install and setup lunix

VMware Workstation 16 Player (Non-commercial use only)

Player

Home

Ubuntu 64-bit (3)

Ubuntu 64-bit

Ubuntu 64-bit (2)

New Virtual Machine Wizard

Easy Install Information
This is used to install Ubuntu 64-bit.

Personalize Linux

Full name: hesham

User name: hesham1911

Password: ••••••

Confirm: ••••••

Help   < Back   Next >   Cancel

Workstation

...achine
... will then be added to the

...e
...hich will then be added to

...orkstation Pro
...shots, virtual network

This product is not licensed and is authorized for non-commercial use only. For commercial use, purchase a license.
Buy now.

Ubuntu 64-bit (4) - VMware Workstation 16 Player (Non-commercial use only)
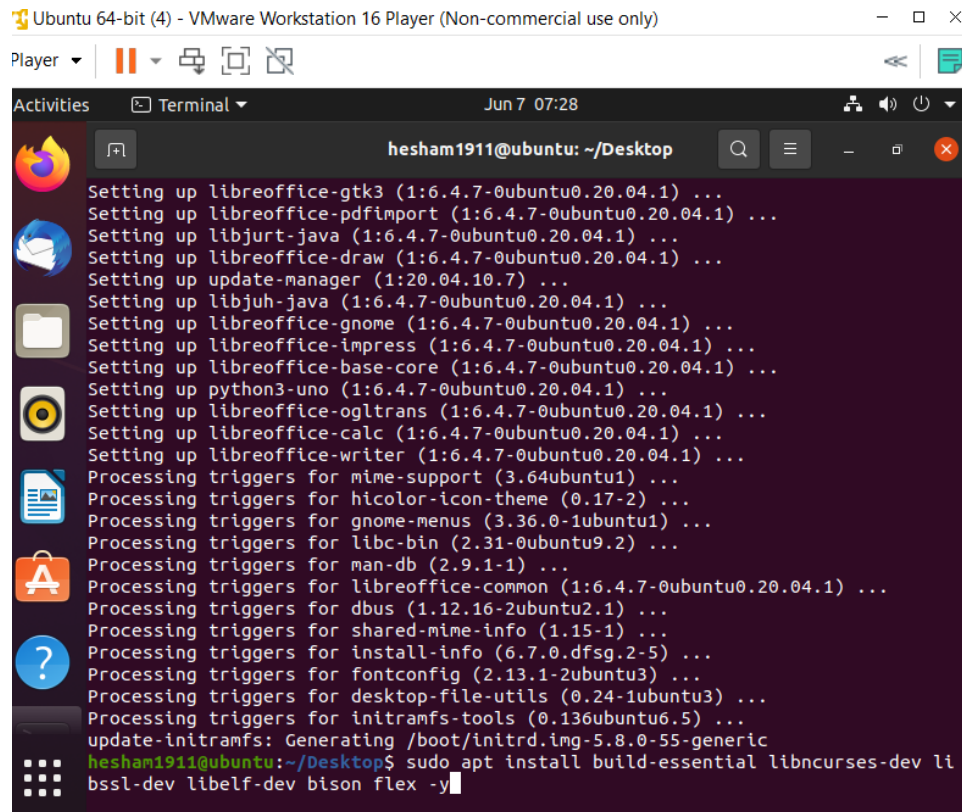
Player

Jun 7 07:02

hesham

••••••••

ubuntu

partation*In this section, you will download all necessary tools to add a basic system call to the Linux kernel and run it. This is the only part of the entire process where network connectivity is necessary.*

update your operating system.

Download and install the essential packages to compile kernels.

Clean up your installed packages. And I will Download the source code of the latest stable version of the Linux kernel.

Partation 2 *In this section, you will write a basic system call in C and integrate it into the new kernel.*Check the version of your current kernel.
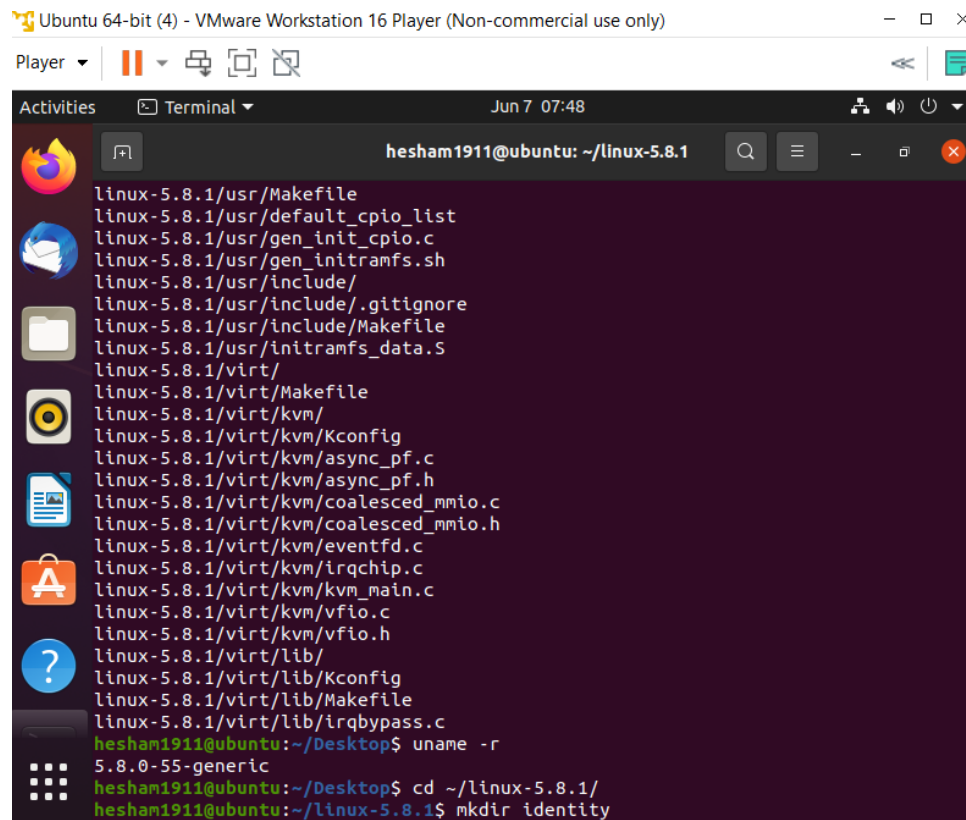
```
linux-5.8.1/usr/
linux-5.8.1/usr/.gitignore
linux-5.8.1/usr/Kconfig
linux-5.8.1/usr/Makefile
linux-5.8.1/usr/default_cpio_list
linux-5.8.1/usr/gen_init_cpio.c
linux-5.8.1/usr/gen_initramfs.sh
linux-5.8.1/usr/include/
linux-5.8.1/usr/include/.gitignore
linux-5.8.1/usr/include/Makefile
linux-5.8.1/usr/initramfs_data.S
linux-5.8.1/virt/
linux-5.8.1/virt/Makefile
linux-5.8.1/virt/kvm/
linux-5.8.1/virt/kvm/Kconfig
linux-5.8.1/virt/kvm/async_pf.c
linux-5.8.1/virt/kvm/async_pf.h
linux-5.8.1/virt/kvm/coalesced_mmio.c
linux-5.8.1/virt/kvm/coalesced_mmio.h
linux-5.8.1/virt/kvm/eventfd.c
linux-5.8.1/virt/kvm/irqchip.c
linux-5.8.1/virt/kvm/kvm_main.c
linux-5.8.1/virt/kvm/vfio.c
linux-5.8.1/virt/kvm/vfio.h
linux-5.8.1/virt/lib/
linux-5.8.1/virt/lib/Kconfig
linux-5.8.1/virt/lib/Makefile
linux-5.8.1/virt/lib/irqbypass.c
hesham1911@ubuntu:~/Desktop$ uname -r
```

Change your working directory to the root directory of the recently unpacked source code.
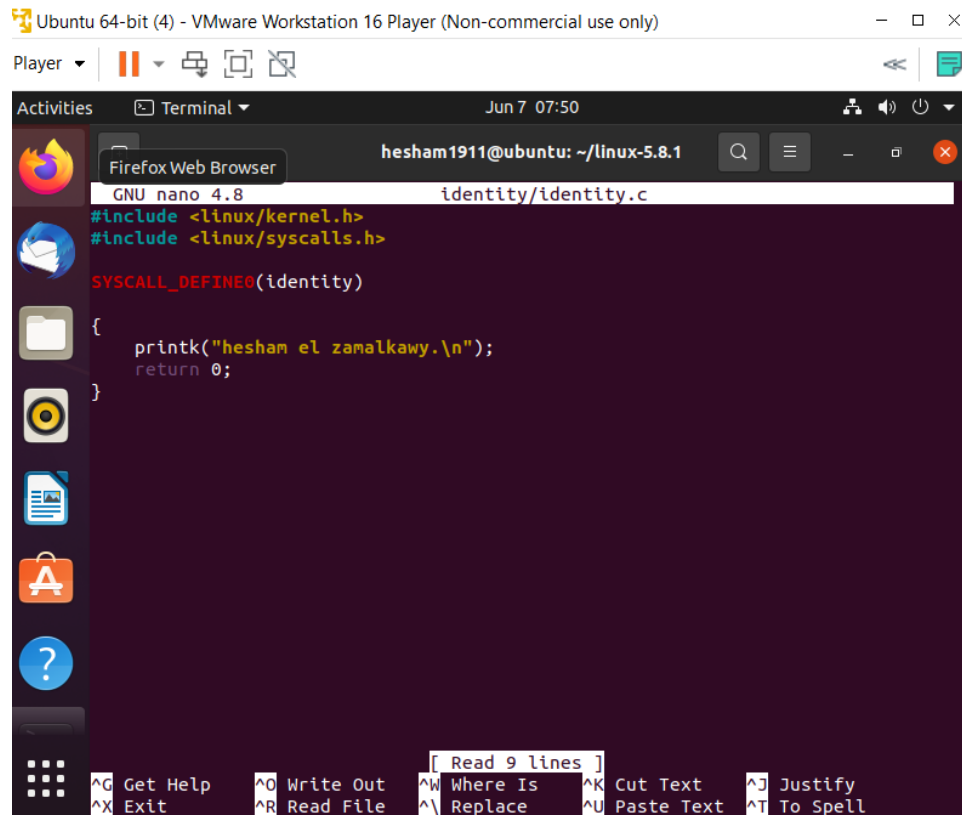
Create the home directory of your system call. Decide a name for your system call, and keep it consistent from this point onwards. I have chosen `identity`

```
linux-5.8.1/usr/Makefile
linux-5.8.1/usr/default_cpio_list
linux-5.8.1/usr/gen_init_cpio.c
linux-5.8.1/usr/gen_initramfs.sh
linux-5.8.1/usr/include/
linux-5.8.1/usr/include/.gitignore
linux-5.8.1/usr/include/Makefile
linux-5.8.1/usr/initramfs_data.S
linux-5.8.1/virt/
linux-5.8.1/virt/Makefile
linux-5.8.1/virt/kvm/
linux-5.8.1/virt/kvm/Kconfig
linux-5.8.1/virt/kvm/async_pf.c
linux-5.8.1/virt/kvm/async_pf.h
linux-5.8.1/virt/kvm/coalesced_mmio.c
linux-5.8.1/virt/kvm/coalesced_mmio.h
linux-5.8.1/virt/kvm/eventfd.c
linux-5.8.1/virt/kvm/irqchip.c
linux-5.8.1/virt/kvm/kvm_main.c
linux-5.8.1/virt/kvm/vfio.c
linux-5.8.1/virt/kvm/vfio.h
linux-5.8.1/virt/lib/
linux-5.8.1/virt/lib/Kconfig
linux-5.8.1/virt/lib/Makefile
linux-5.8.1/virt/lib/irqbypass.c
hesham1911@ubuntu:~/Desktop$ uname -r
5.8.0-55-generic
hesham1911@ubuntu:~/Desktop$ cd ~/linux-5.8.1/
hesham1911@ubuntu:~/linux-5.8.1$ mkdir identity
```

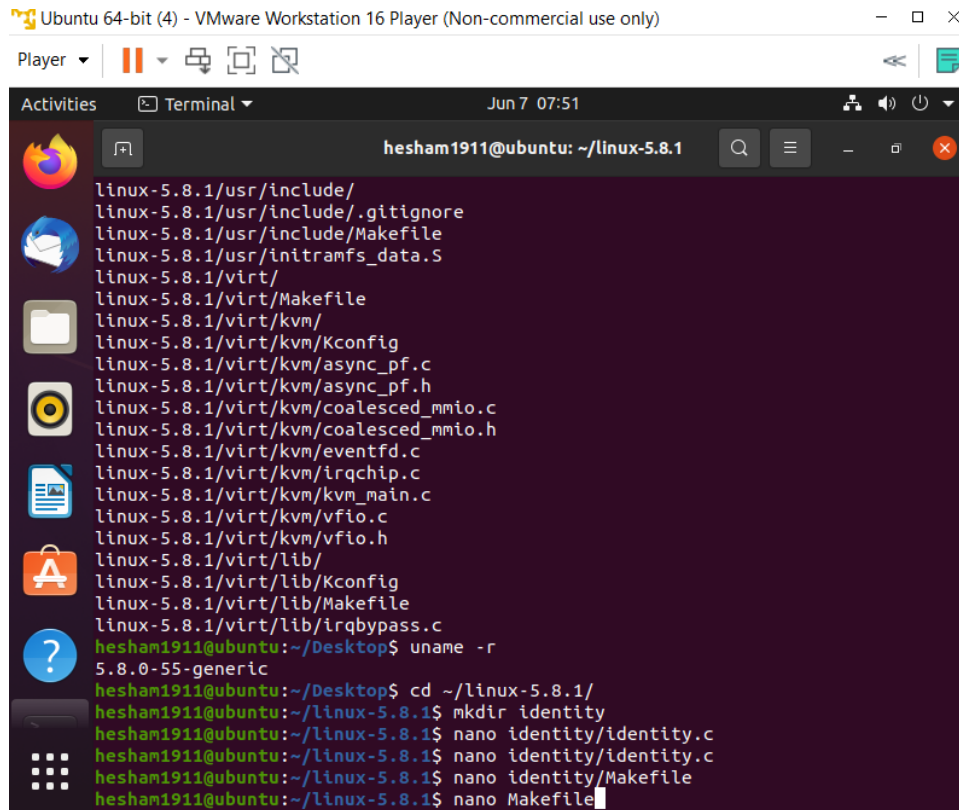Create a C file for your system call.

Create the C file Write the following code in it.

Add the home directory of your system call to the main Makefile of the kernel.

Open the Makefile with the following command.

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

Open the header file with the following command.

```
nano include/linux/syscalls.h
```

Add your system call to the kernel's system call table.

Open the table with the following command.

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

Activities   🖵 Terminal ▾   Jun 7 07:59   🖧 🔊 ⏻ ▾
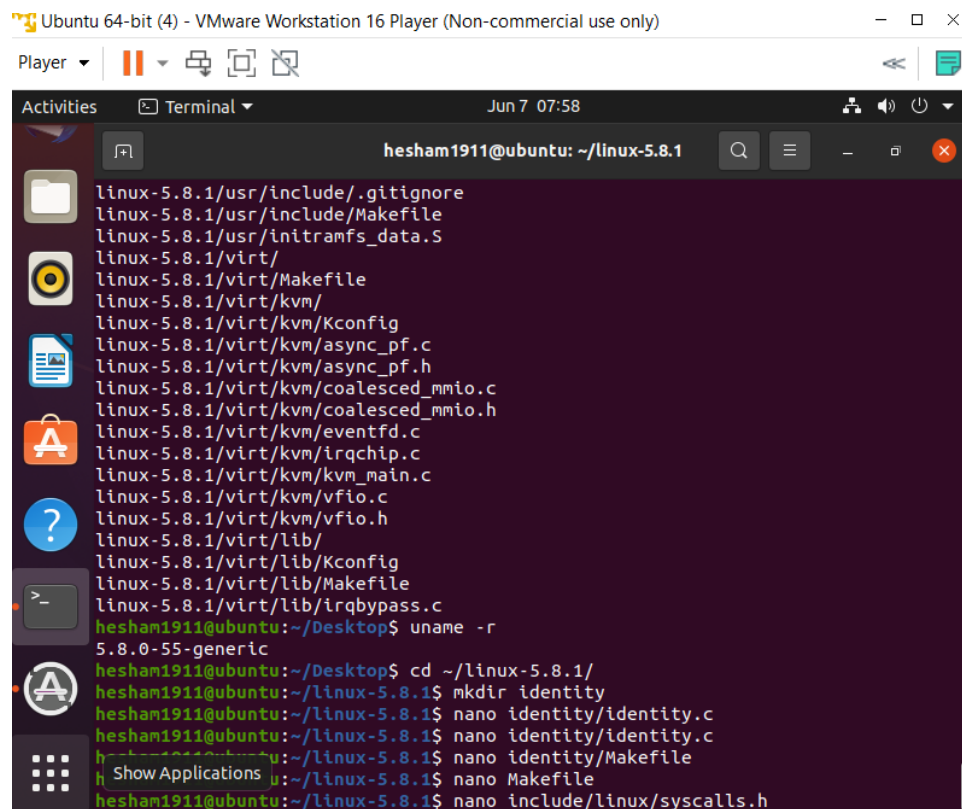
⊞   hesham1911@ubuntu: ~/linux-5.8.1   🔍 ☰   — ▢ ✕

```
linux-5.8.1/usr/include/Makefile
linux-5.8.1/usr/initramfs_data.S
linux-5.8.1/virt/
linux-5.8.1/virt/Makefile
linux-5.8.1/virt/kvm/
linux-5.8.1/virt/kvm/Kconfig
linux-5.8.1/virt/kvm/async_pf.c
linux-5.8.1/virt/kvm/async_pf.h
linux-5.8.1/virt/kvm/coalesced_mmio.c
linux-5.8.1/virt/kvm/coalesced_mmio.h
linux-5.8.1/virt/kvm/eventfd.c
linux-5.8.1/virt/kvm/irqchip.c
linux-5.8.1/virt/kvm/kvm_main.c
linux-5.8.1/virt/kvm/vfio.c
linux-5.8.1/virt/kvm/vfio.h
linux-5.8.1/virt/lib/
linux-5.8.1/virt/lib/Kconfig
linux-5.8.1/virt/lib/Makefile
linux-5.8.1/virt/lib/irqbypass.c
hesham1911@ubuntu:~/Desktop$ uname -r
5.8.0-55-generic
hesham1911@ubuntu:~/Desktop$ cd ~/linux-5.8.1/
hesham1911@ubuntu:~/linux-5.8.1$ mkdir identity
hesham1911@ubuntu:~/linux-5.8.1$ nano identity/identity.c
hesham1911@ubuntu:~/linux-5.8.1$ nano identity/identity.c
hesham1911@ubuntu:~/linux-5.8.1$ nano identity/Makefile
hesham1911@ubuntu:~/linux-5.8.1$ nano Makefile
hesham1911@ubuntu:~/linux-5.8.1$ nano include/linux/syscalls.h
hesham1911@ubuntu:~/linux-5.8.1$ nano arch/x86/entry/syscalls/syscall_64.tbl
```

Activities   🖵 Terminal ▾   Jun 7 08:00   🖧 🔊 ⏻ ▾

⊞   hesham1911@ubuntu: ~/linux-5.8.1   🔍 ☰   — ▢ ✕

```
  GNU nano 4.8        arch/x86/entry/syscalls/syscall_64.tbl        Modified
330     common  pkey_alloc              sys_pkey_alloc
331     common  pkey_free               sys_pkey_free
332     common  statx                   sys_statx
333     common  io_pgetevents           sys_io_pgetevents
334     common  rseq                    sys_rseq
# don't use numbers 387 through 423, add new calls after the last
# 'common' entry
424     common  pidfd_send_signal       sys_pidfd_send_signal
425     common  io_uring_setup          sys_io_uring_setup
426     common  io_uring_enter          sys_io_uring_enter
427     common  io_uring_register       sys_io_uring_register
428     common  open_tree               sys_open_tree
429     common  move_mount              sys_move_mount
430     common  fsopen                  sys_fsopen
431     common  fsconfig                sys_fsconfig
432     common  fsmount                 sys_fsmount
433     common  fspick                  sys_fspick
434     common  pidfd_open              sys_pidfd_open
435     common  clone3                  sys_clone3
437     common  openat2                 sys_openat2
438     common  pidfd_getfd             sys_pidfd_getfd
439     common  faccessat2              sys_faccessat2
440     common  identity                sys_identity
#
# x32-specific system call numbers start at 512 to avoid cache impact

^G Get Help    ^O Write Out   ^W Where Is    ^K Cut Text    ^J Justify
^X Exit        ^R Read File   ^\ Replace     ^U Paste Text  ^T To Spell
```
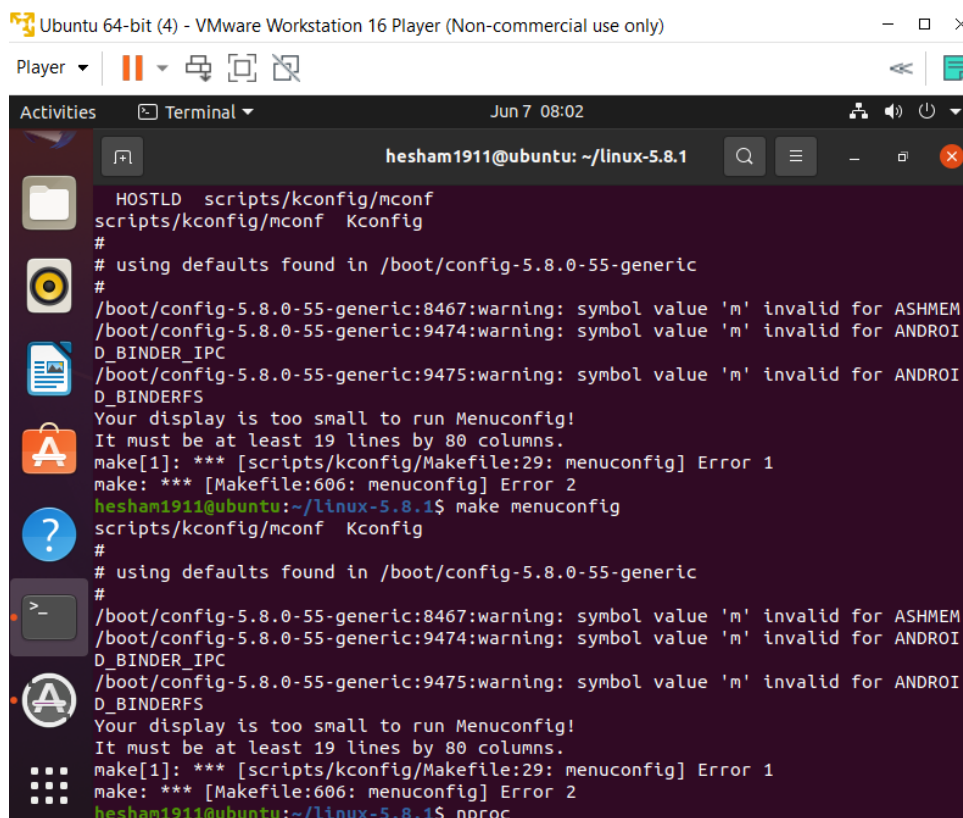
Partation 3

Configure the kernel.

Make sure the window of your terminal is maximized.

Open the configuration window with the following command.

`make menuconfig`

After some commend we have the system

```
  AR      fs/built-in.a
hesham1911@ubuntu:~/linux-5.8.1$ nproc
2
hesham1911@ubuntu:~/linux-5.8.1$ sudo make modules_install -j12
[sudo] password for hesham1911:
sed: can't read modules.order: No such file or directory
make: *** [Makefile:1390: _modinst_] Error 2
hesham1911@ubuntu:~/linux-5.8.1$ sudo update-grub
Sourcing file `/etc/default/grub'
Sourcing file `/etc/default/grub.d/init-select.cfg'
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-5.8.0-55-generic
Found initrd image: /boot/initrd.img-5.8.0-55-generic
Found linux image: /boot/vmlinuz-5.8.0-43-generic
Found initrd image: /boot/initrd.img-5.8.0-43-generic
Found memtest86+ image: /boot/memtest86+.elf
Found memtest86+ image: /boot/memtest86+.bin
done
hesham1911@ubuntu:~/linux-5.8.1$ uname -r
5.8.0-55-generic
hesham1911@ubuntu:~/linux-5.8.1$ cd ~
hesham1911@ubuntu:~$ nano report.c
hesham1911@ubuntu:~$ gcc -o report report.c
hesham1911@ubuntu:~$ ./report
Congratulations, hesham1911! Your system call is functional. Run the command dmesg in the terminal an
d find out!
hesham1911@ubuntu:~$
```