

Operating System report

how to add your system call the Linux OS kernel

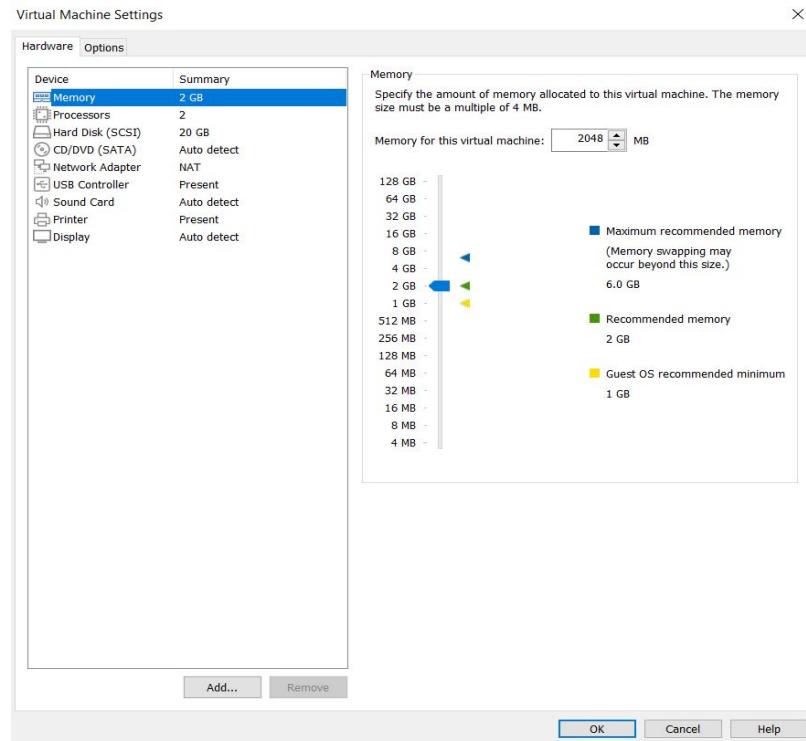
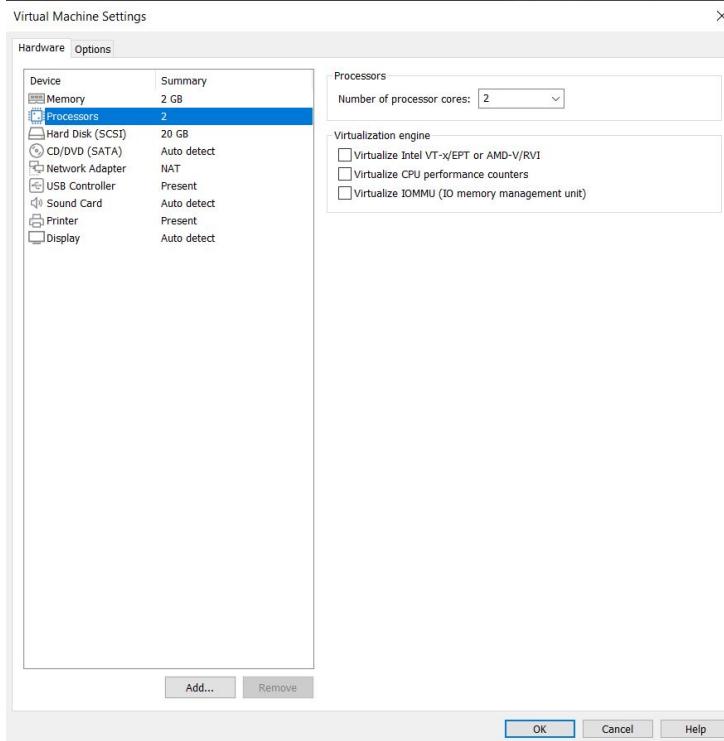
Name Member

1-Mohamed Atef Hussien

2-Mohamed Ahmed Abdullah

3-Abdelrhman Essam Youseif

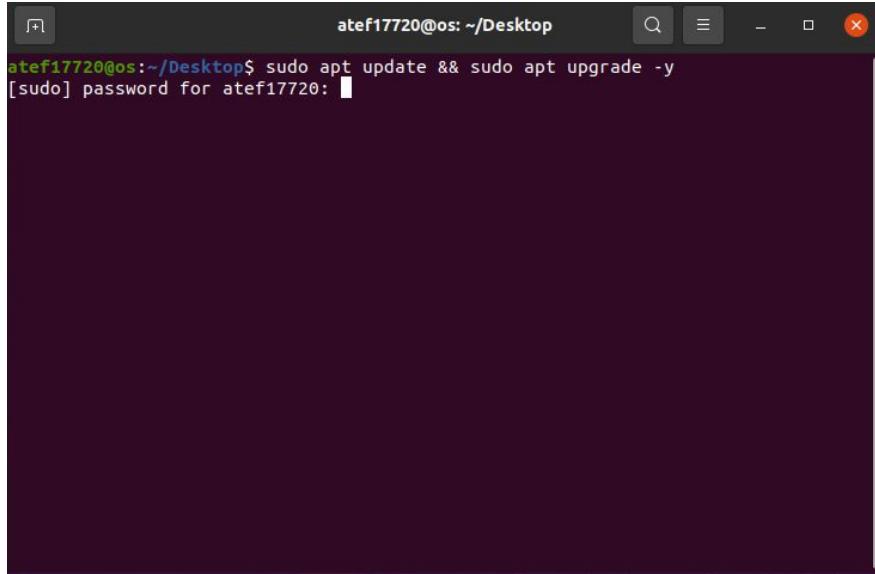
CPU cores, RAM capacity



1 - Preparation

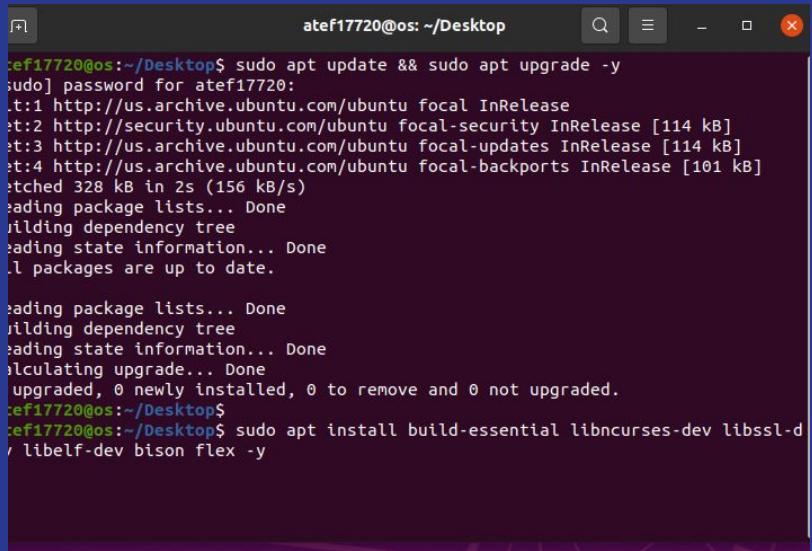
1.1 - Fully update your operating system

We downloaded all necessary tools to add a basic system call to the Linux kernel and run it



```
atef17720@os:~/Desktop$ sudo apt update && sudo apt upgrade -y
[sudo] password for atef17720:
```

1.2 - Download and install the essential packages to compile kernels



```
atef17720@os:~/Desktop$ sudo apt update && sudo apt upgrade -y
[sudo] password for atef17720:
Get:1 http://us.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:4 http://us.archive.ubuntu.com/ubuntu focal-backports InRelease [101 kB]
Fetched 328 kB in 2s (156 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
All packages are up to date.

Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
Upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
atef17720@os:~/Desktop$ 
atef17720@os:~/Desktop$ sudo apt install build-essential libncurses-dev libssl-dev libelf-dev bison flex -y
```

```
atef17720@os: ~/Desktop
Reading state information... Done
Calculating upgrade... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
atef17720@os:~/Desktop$ sudo apt install build-essential libncurses-dev libssl-dev libelf-dev bison flex -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
bison is already the newest version (2:3.5.1+dfsg-1).
flex is already the newest version (2.6.4-6.2).
libelf-dev is already the newest version (0.176-1.1build1).
libncurses-dev is already the newest version (6.2-0ubuntu2).
build-essential is already the newest version (12.8ubuntu1.1).
libssl-dev is already the newest version (1.1.1f-1ubuntu2.4).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
atef17720@os:~/Desktop$ sudo apt install vim -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
vim is already the newest version (2:8.1.2269-1ubuntu5).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
atef17720@os:~/Desktop$ sudo apt clean && sudo apt autoremove -y
```

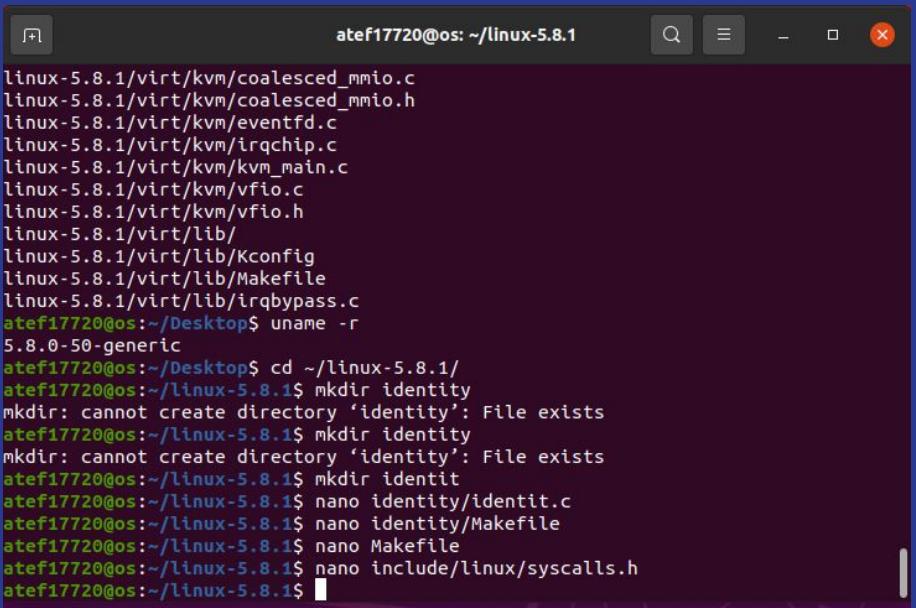
```
atef17720@os: ~/Desktop
libssl-dev is already the newest version (1.1.1f-1ubuntu2.4).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
atef17720@os:~/Desktop$ sudo apt install vim -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
vim is already the newest version (2:8.1.2269-1ubuntu5).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
atef17720@os:~/Desktop$ sudo apt clean && 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.
atef17720@os:~/Desktop$ wget -P ~/ https://cdn.kernel.org/pub/linux/kernel/v5.x/
linux-5.8.1.tar.xz
--2021-06-06 16:14:15-- 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/atef17720/linux-5.8.1.tar.xz.1'

linux-5.8.1.tar.xz. 9%[>] 10.29M 1.66MB/s eta 55s
```

2-Creation

we write a basic system call in C and integrate it into the new kernel.

- 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
- 2.3 - Create the home directory of your system call.
- 2.4 - Create a C file for your system call
- 2.5 - Create a Makefile for your system call.
- 2.7 - Add a corresponding function prototype for your system call to the
- 2.8 - Add your system call to the kernel's system call table.



A screenshot of a terminal window titled "atef17720@os: ~/linux-5.8.1". The terminal shows the user navigating through the Linux kernel source code directory. The user runs the command "uname -r" to check the kernel version, which returns "5.8.0-50-generic". The user then changes directory to the kernel source code with "cd ~/Desktop/linux-5.8.1". They attempt to create a directory named "identity" but receive an error message: "mkdir: cannot create directory 'identity': File exists". The user then creates a C file named "identit.c" using "nano identity/identit.c", followed by creating a Makefile with "nano identity/Makefile", and finally creating a syscalls.h header file with "nano include/linux/syscalls.h". The terminal window has a dark theme with light-colored text.

```
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
atef17720@os:~/Desktop$ uname -r
5.8.0-50-generic
atef17720@os:~/Desktop$ cd ~/linux-5.8.1/
atef17720@os:~/linux-5.8.1$ mkdir identity
mkdir: cannot create directory 'identity': File exists
atef17720@os:~/linux-5.8.1$ mkdir identity
mkdir: cannot create directory 'identity': File exists
atef17720@os:~/linux-5.8.1$ mkdir identit
atef17720@os:~/linux-5.8.1$ nano identity/identit.c
atef17720@os:~/linux-5.8.1$ nano identity/Makefile
atef17720@os:~/linux-5.8.1$ nano Makefile
atef17720@os:~/linux-5.8.1$ nano include/linux/syscalls.h
atef17720@os:~/linux-5.8.1$
```

```
atef17720@os: ~/linux-5.8.1
```

sy config - Linux/x86 5.8.1 Kernel Configuration

Linux/x86 5.8.1 Kernel Configuration

Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty submenus ----). Highlighted letters are hotkeys. Pressing <Y> includes, <N> excludes, <M> modularizes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search. Legend: [*] built-in []

General setup --->

- [*] 64-bit kernel
 - Processor type and features --->
 - Power management and ACPI options --->
 - Bus options (PCI etc.) --->
 - Binary Emulations --->
 - Firmware Drivers --->
- [*] Virtualization --->
- General architecture-dependent options --->
- [*] Enable loadable module support --->

v(+)

<Select> < Exit > < Help > < Save > < Load >

```
atef17720@os: ~/linux-5.8.1
```

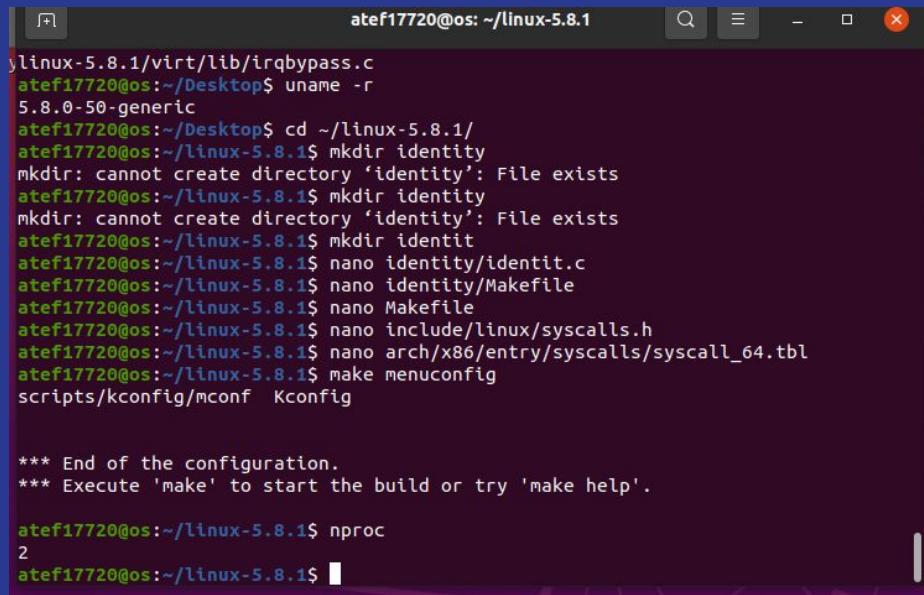
```
linux-5.8.1/virt/lib/Kconfig
linux-5.8.1/virt/lib/Makefile
linux-5.8.1/virt/lib/irqbypass.c
atef17720@os:~/Desktop$ uname -r
5.8.0-50-generic
atef17720@os:~/Desktop$ cd ~/linux-5.8.1/
atef17720@os:~/linux-5.8.1$ mkdir identity
mkdir: cannot create directory 'identity': File exists
atef17720@os:~/linux-5.8.1$ mkdir identity
mkdir: cannot create directory 'identity': File exists
atef17720@os:~/linux-5.8.1$ mkdir identit
atef17720@os:~/linux-5.8.1$ nano identity/identit.c
atef17720@os:~/linux-5.8.1$ nano identity/Makefile
atef17720@os:~/linux-5.8.1$ nano Makefile
atef17720@os:~/linux-5.8.1$ nano include/linux/syscalls.h
atef17720@os:~/linux-5.8.1$ nano arch/x86/entry/syscalls/syscall_64.tbl
atef17720@os:~/linux-5.8.1$ make menuconfig
scripts/kconfig/mconfig Kconfig

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

atef17720@os:~/linux-5.8.1$
```

3 - Installation

- 3.1 - Configure the kernel.
- 3.2 - Find out how many logical cores you have.
- 3.3 - Compile the kernel's source code.
- 3.4 - Prepare the installer of the kernel.
- 3.5 - Install the kernel.
- 3.6 - Update the bootloader of the operating system with the new kernel.
- 3.7 - Reboot your computer.



A screenshot of a terminal window titled "atef17720@os: ~/linux-5.8.1". The terminal is running a series of commands to configure a Linux kernel. The commands include navigating to the kernel source directory, creating a 'identity' directory, and using nano and makefile editors to modify files like 'identity/identit.c' and 'Makefile'. It also includes commands to edit 'include/linux/syscalls.h' and 'arch/x86/entry/syscalls/syscall_64.tbl', and to run 'menuconfig' and 'kconfig'. The session ends with instructions to execute 'make' and ends with a prompt for 'nproc'.

```
linux-5.8.1/virt/lib/irqbypass.c
atef17720@os:~/Desktop$ uname -r
5.8.0-50-generic
atef17720@os:~/Desktop$ cd ~/linux-5.8.1/
atef17720@os:~/linux-5.8.1$ mkdir identity
mkdir: cannot create directory 'identity': File exists
atef17720@os:~/linux-5.8.1$ mkdir identity
mkdir: cannot create directory 'identity': File exists
atef17720@os:~/linux-5.8.1$ mkdir identit
atef17720@os:~/linux-5.8.1$ nano identity/identit.c
atef17720@os:~/linux-5.8.1$ nano identity/Makefile
atef17720@os:~/linux-5.8.1$ nano Makefile
atef17720@os:~/linux-5.8.1$ nano include/linux/syscalls.h
atef17720@os:~/linux-5.8.1$ nano arch/x86/entry/syscalls/syscall_64.tbl
atef17720@os:~/linux-5.8.1$ make menuconfig
scripts/kconfig Kconfig

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

atef17720@os:~/linux-5.8.1$ nproc
2
atef17720@os:~/linux-5.8.1$
```

```
3.8.0-36-generic  
atef17720@os:~/linux-5.8.1$ cd  
atef17720@os:~$ nano report.c  
atef17720@os:~$ gcc -o report report.c  
atef17720@os:~$ ./report  
Congratulations, mohamed atef! Your system call is functional. Run the command d  
mesg in the terminal and find out!  
atef17720@os:~$ █
```

4 - 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-2
ga8](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-shrimai/adding-a-hello-world-system-call-to-linux-kernel-da
d32875872](https://medium.com/anubhav-shrimai/adding-a-hello-world-system-call-to-linux-kernel-da32875872)