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CS3003D: Operating Systems

ASSIGNMENT 1

Problem Statement: Download the latest stable Linux kernel from <u>kernel.org</u>, compile it, and dual boot it with your current Linux version. Your current version as well as the new version should be present in the grub-menu.

Methodology: I have Ubuntu 22.04 installed as a VM in VirtualBox running kernel version 5.15.0. In this assignment I downloaded the source code of kernel 5.19.9 and dual booted it with my existing kernel.

Procedure:
1. Download the tar archive file of kernel-5.19.9.
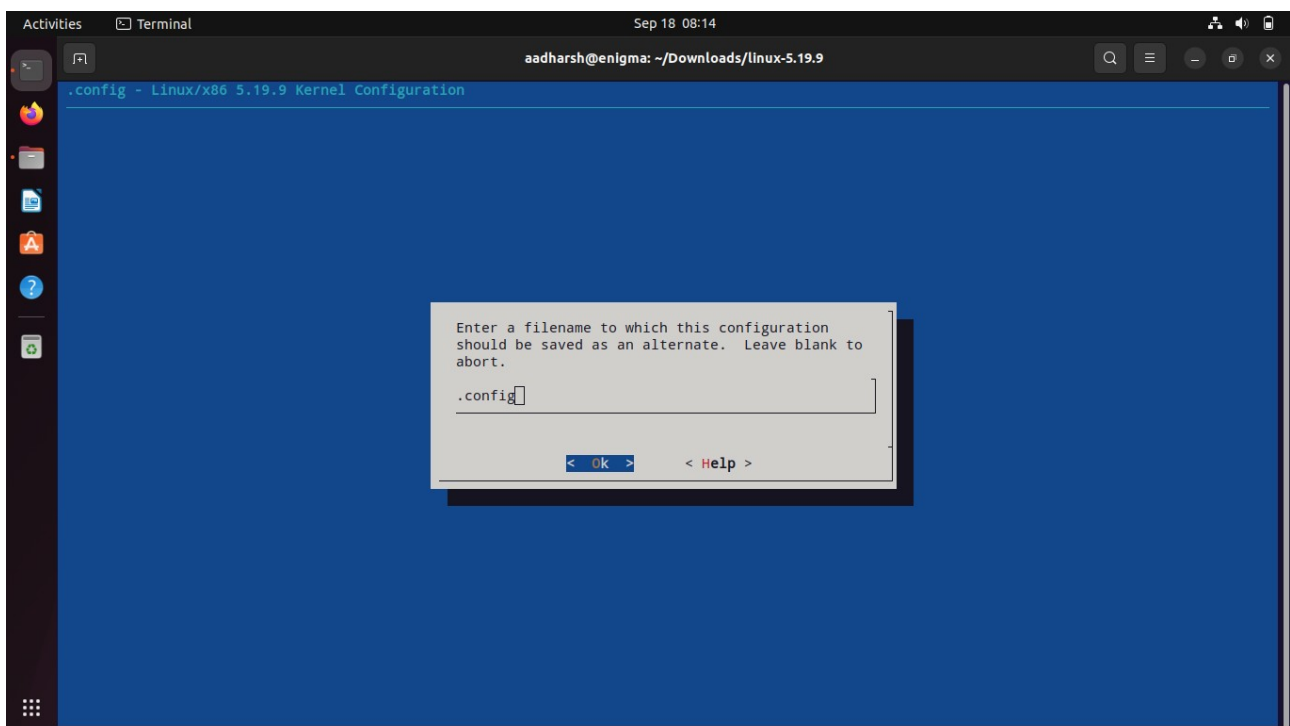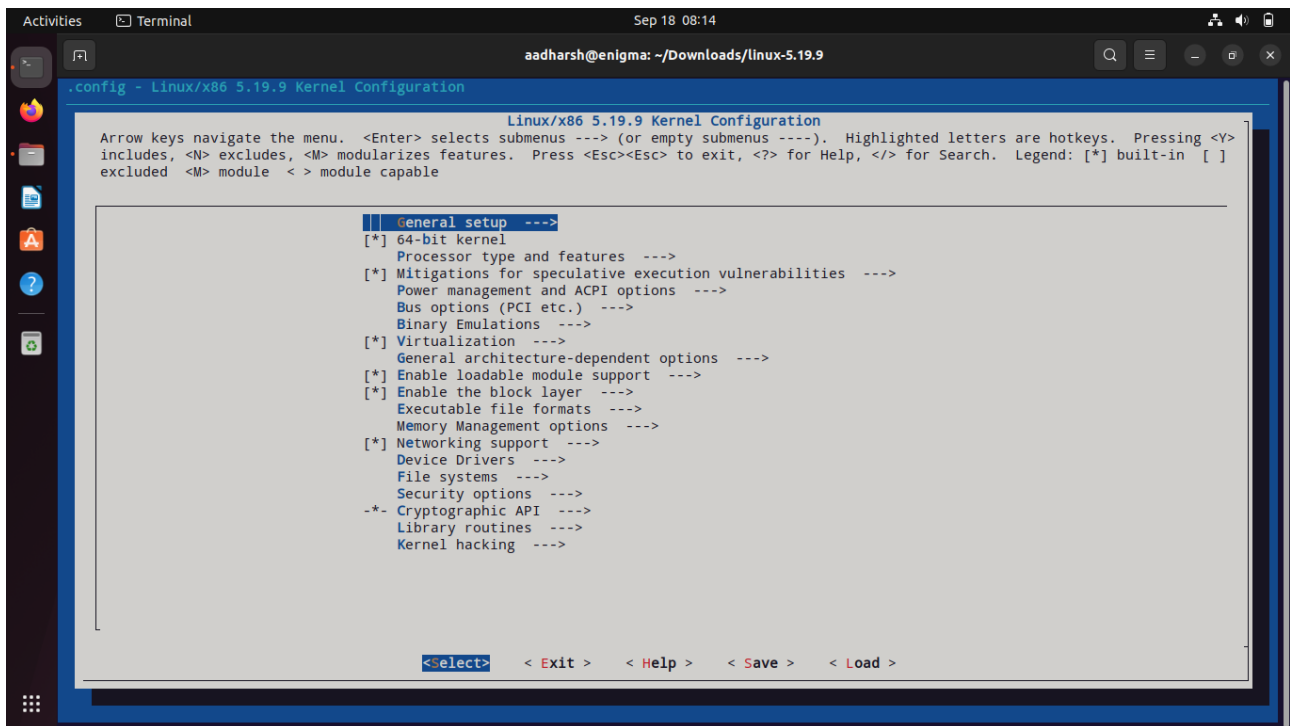2. Extract the tar archive.

```
tar xf linux-5.19.9.tar.xz
```
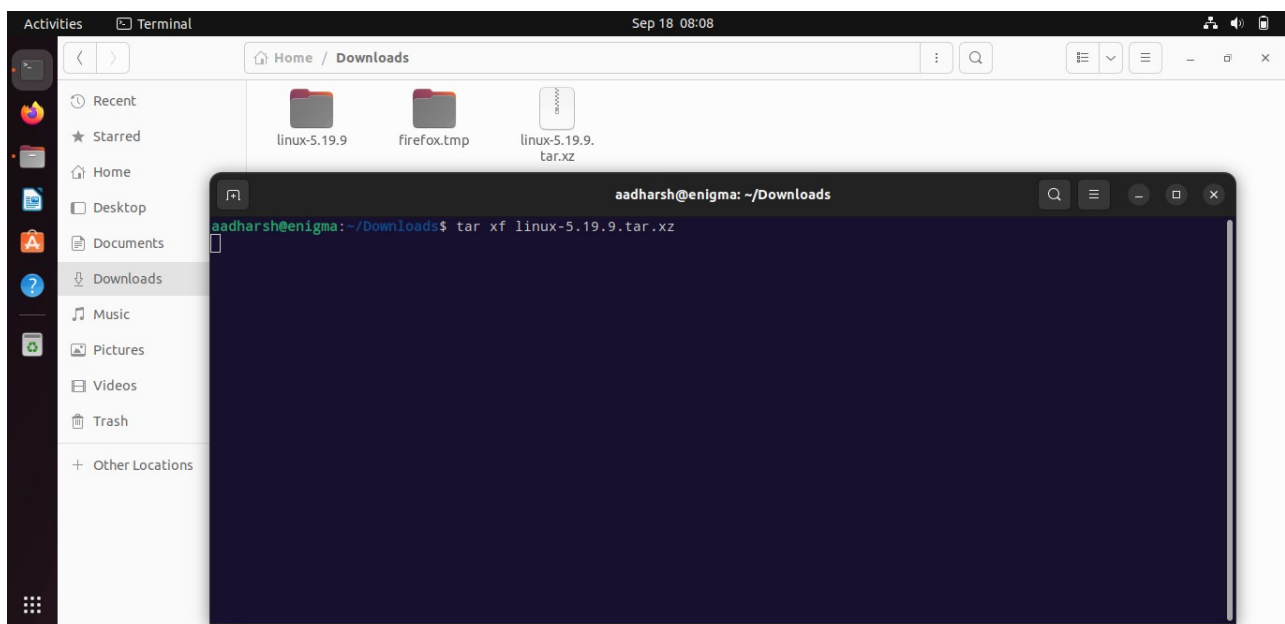

3. Navigate to the extracted directory.

```
cd linux-5.19.9
```

4. Copy existing kernel config file to the extracted directory and use *menuconfig* to make necessary changes. I have not made any changes to the .config file.

```
cp /boot/config-$(uname -r) .config
make menuconfig
```
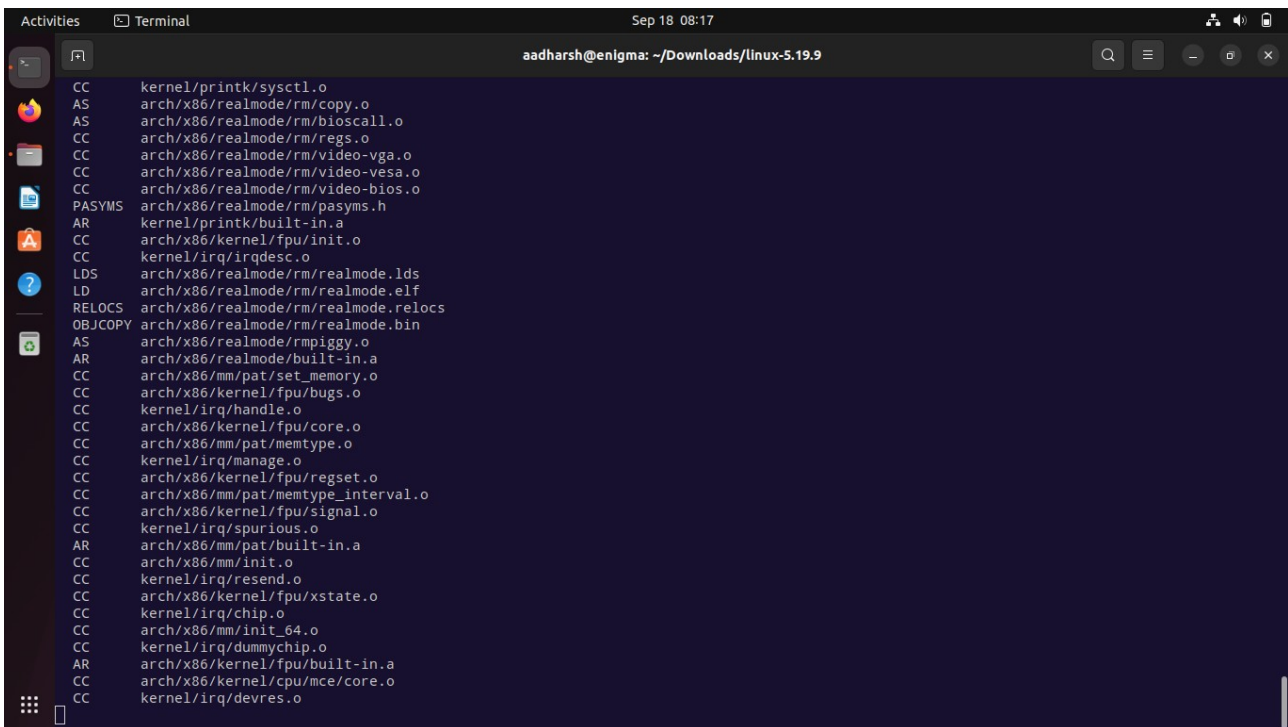
5. Now compile the kernel.

```
make
```

6. Install kernel modules.

```
make modules_install
```

7. Copy the kernel and .config file to the /boot folder and to generate the system.map file which stores the kernel symbol table.
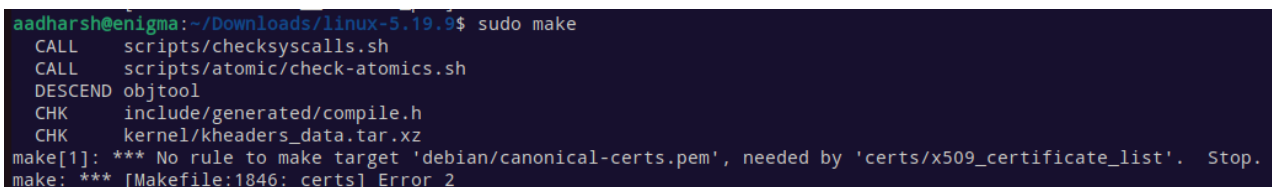
```
make install
```


8. While executing the *make* command, I encountered the following error.

fatal error: libelf.h: No such file or directory

It was solved by installing libelf package.

```
sudo apt install libelf-dev
```

9. When *make* command was executed again, I got the following error.

To solve this, I installed Ubuntu linux kernel sources and copied the certificates to */usr/local/src/debian/*.

```
sudo mkdir -p /usr/local/src/debian
sudo apt install linux-source
sudo cp -v /usr/src/linux-source-*/debian/canonical-*.pem /usr/local/src/debian/
sudo apt purge linux-source*
```

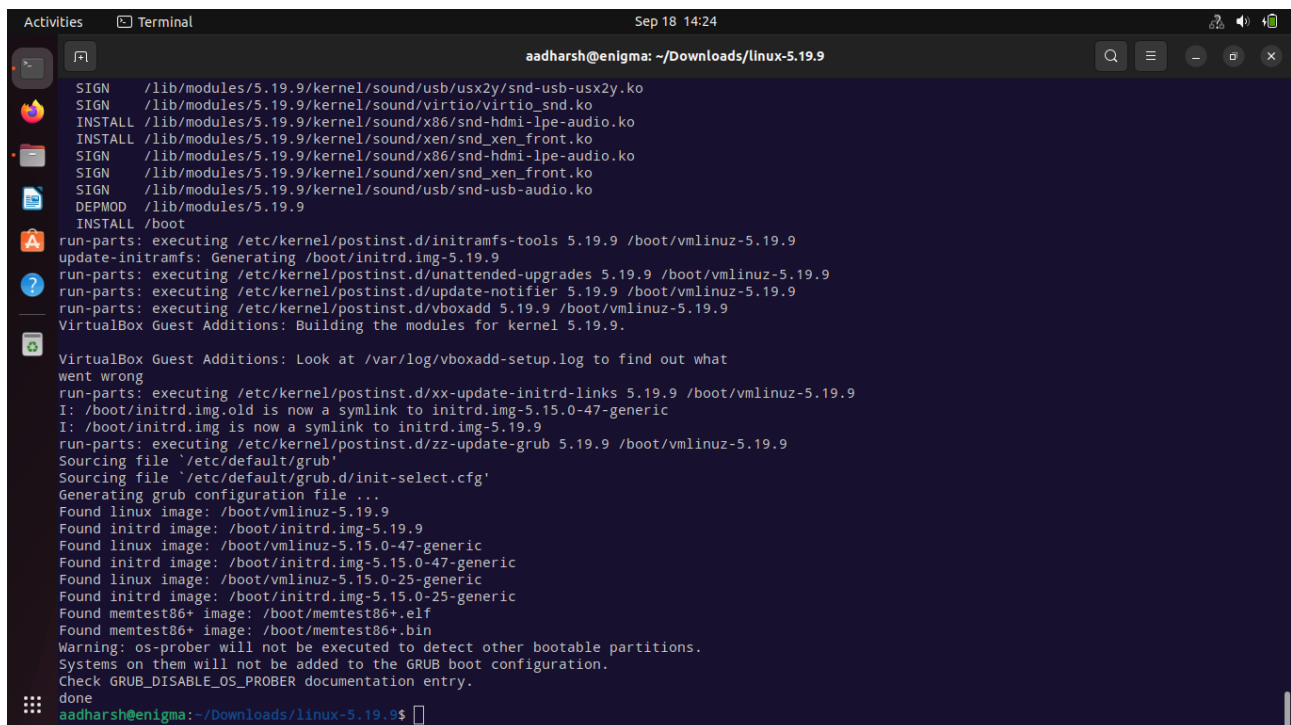Copy the certificates from *usr/local/src/debian/* to current folder.

```
cp -vrd /usr/local/src/debian .
```

10. After the successful execution of above commands, create a new initramfs image for the newly installed kernel 5.19.9.

```
update-initramfs -c -k 5.19.9
```

11. Then execute the update-grub command which looks up the /boot directory and adds a grub menu entry for the new kernel.

```
sudo update-grub
```


12. On rebooting, the grub menu didn't show up. This was because the GRUB_TIMEOUT was set to 0 in the grub config file and hence the grub menu doesn't show up when the OS boots up. To solve this make the following changes in the /etc/default/grub file.

GRUB_TIMEOUT=10
GRUB_TIMEOUT_STYLE=menu

and run

```
sudo update-grub
```

13. On rebooting, the grub menu shows up and the new kernel version 5.19.9 is present among the boot options.

```
                    GNU GRUB   version 2.06

 ┌──────────────────────────────────────────────────────────────────────┐
 │*Ubuntu, with Linux 5.19.9                                              │
 │ Ubuntu, with Linux 5.19.9 (recovery mode)                             │
 │ Ubuntu, with Linux 5.15.0-47-generic                                  │
 │ Ubuntu, with Linux 5.15.0-47-generic (recovery mode)                  │
 │ Ubuntu, with Linux 5.15.0-25-generic                                  │
 │ Ubuntu, with Linux 5.15.0-25-generic (recovery mode)                  │
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        Use the ↑ and ↓ keys to select which entry is highlighted.
        Press enter to boot the selected OS, `e' to edit the commands
        before booting or `c' for a command-line. ESC to return previous
        menu.
```