

# **Linux Kernel Compilation Assignment**

**Version: 6.11.1**

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## **Linux Kernel Compilation Assignment**

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# Linux Kernel Compilation Assignment

## 1. Introduction

This document provides a comprehensive, step-by-step account of compiling and installing Linux kernel version 6.11.1. The primary objective was to replace the default kernel with a custom-built version, incorporating specific tweaks for performance enhancements and functionality improvements. This assignment was completed as part of the Operating Systems Lab (OSLab) course.

## 2. Detailed Process

### 2.1. Downloading the Kernel Source

The first step involved downloading the Linux kernel source from the official repository at [kernel.org](https://kernel.org). For this assignment, version 6.11.1 was used.

The screenshot shows the homepage of The Linux Kernel Archives. At the top, there's a navigation bar with links for About, Contact us, FAQ, Releases, Signatures, and Site news. To the right of the navigation is a small Tux the Penguin icon. Below the navigation, there's a section for "Protocol" and "Location" with links for HTTP, GIT, and RSYNC. A prominent yellow button on the right says "Latest Release 6.11.1" with a downward arrow icon. Below this, there's a table of kernel releases with columns for name, date, and download links. At the bottom, there are two boxes: "Other resources" containing links to Git Trees, Patchwork, Mirrors, Documentation, Wikis, and Linux.com; and "Social" containing links to the Site Atom feed, Releases Atom Feed, and Kernel Planet.

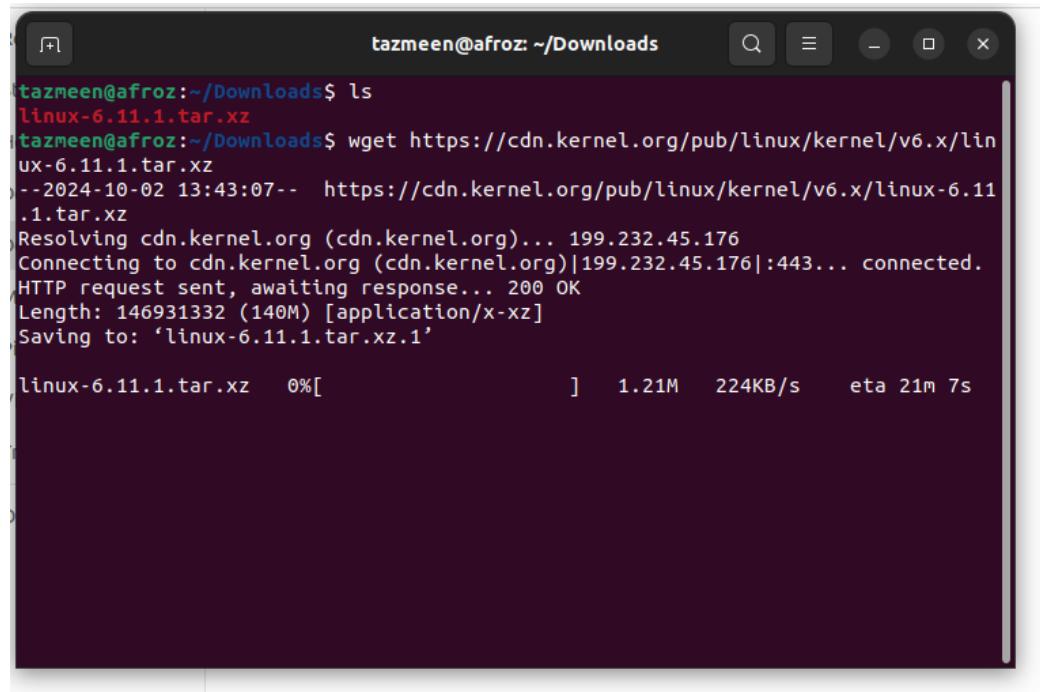
mainline:	6.12-rc1	2024-09-29	[tarball]	[patch]	[view diff]	[browse]			
stable:	6.11.1	2024-09-30	[tarball]	[pgp]	[patch]	[view diff]	[browse]	[changelog]	
stable:	6.10.12	2024-09-30	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff]	[browse]	[changelog]
longterm:	6.6.53	2024-09-30	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff]	[browse]	[changelog]
longterm:	6.1.12	2024-09-30	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff]	[browse]	[changelog]
longterm:	5.15.167	2024-09-12	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff]	[browse]	[changelog]
longterm:	5.10.226	2024-09-12	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff]	[browse]	[changelog]
longterm:	5.4.284	2024-09-12	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff]	[browse]	[changelog]
longterm:	4.19.322	2024-09-12	[tarball]	[pgp]	[patch]	[inc. patch]	[view diff]	[browse]	[changelog]
linux-next:	next-20241003	2024-10-03						[browse]	

## **Linux Kernel Compilation Assignment**

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Open the terminal and use the wget command to download the Linux kernel source code:

```
1 wget https://cdn.kernel.org/pub/linux/kernel/v6.x/linux  
-6.11.1.tar.xz  
2 tar xvf linux-6.11.1.tar.xz
```

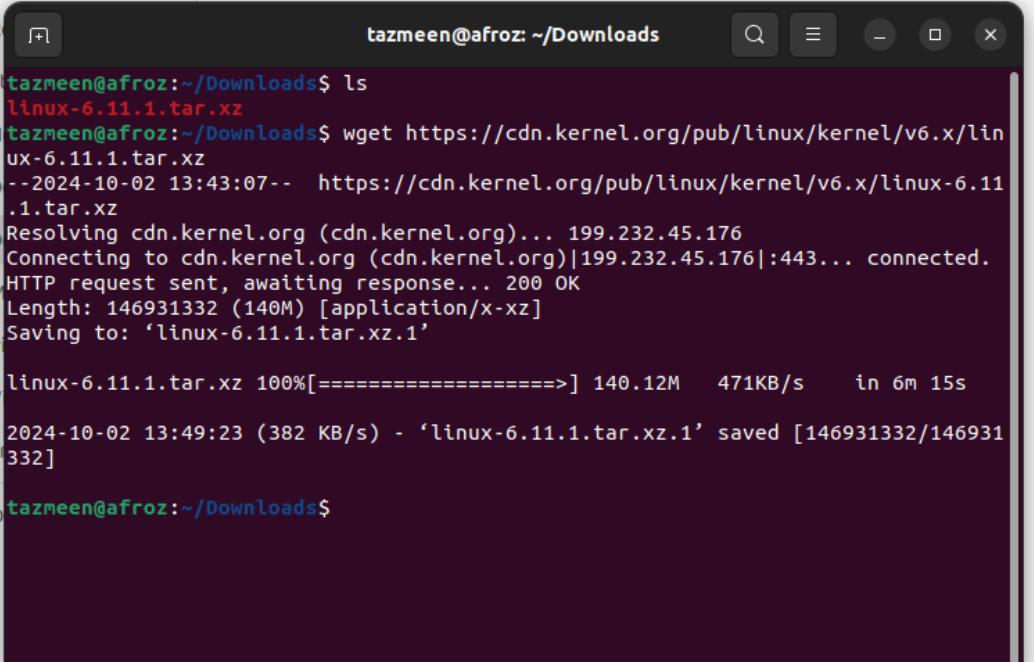


A screenshot of a terminal window titled "tazmeen@afroz: ~/Downloads". The terminal shows the following command and its execution:

```
tazmeen@afroz:~/Downloads$ ls  
linux-6.11.1.tar.xz  
tazmeen@afroz:~/Downloads$ wget https://cdn.kernel.org/pub/linux/kernel/v6.x/linux-6.11.1.tar.xz  
--2024-10-02 13:43:07-- https://cdn.kernel.org/pub/linux/kernel/v6.x/linux-6.11.1.tar.xz  
Resolving cdn.kernel.org (cdn.kernel.org)... 199.232.45.176  
Connecting to cdn.kernel.org (cdn.kernel.org)|199.232.45.176|:443... connected.  
HTTP request sent, awaiting response... 200 OK  
Length: 146931332 (140M) [application/x-xz]  
Saving to: 'linux-6.11.1.tar.xz.1'  
  
linux-6.11.1.tar.xz 0%[          ] 1.21M 224KB/s eta 21m 7s
```

## Linux Kernel Compilation Assignment

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A screenshot of a terminal window titled "tazmeen@afroz: ~/Downloads". The terminal shows the following command and its execution:

```
tazmeen@afroz:~/Downloads$ ls  
linux-6.11.1.tar.xz  
tazmeen@afroz:~/Downloads$ wget https://cdn.kernel.org/pub/linux/kernel/v6.x/lin  
ux-6.11.1.tar.xz  
--2024-10-02 13:43:07-- https://cdn.kernel.org/pub/linux/kernel/v6.x/linux-6.11  
.tar.xz  
Resolving cdn.kernel.org (cdn.kernel.org)... 199.232.45.176  
Connecting to cdn.kernel.org (cdn.kernel.org)|199.232.45.176|:443... connected.  
HTTP request sent, awaiting response... 200 OK  
Length: 146931332 (140M) [application/x-xz]  
Saving to: 'linux-6.11.1.tar.xz.1'  
  
linux-6.11.1.tar.xz 100%[=====] 140.12M 471KB/s in 6m 15s  
2024-10-02 13:49:23 (382 KB/s) - 'linux-6.11.1.tar.xz.1' saved [146931332/146931  
332]  
tazmeen@afroz:~/Downloads$
```

### 2.2. Extracting the Source Code

run the tar command to extract the source code:

Open the terminal and use the wget command to download the Linux kernel source code:

```
1 tar xvf linux-6.11.1.tar.xz
```

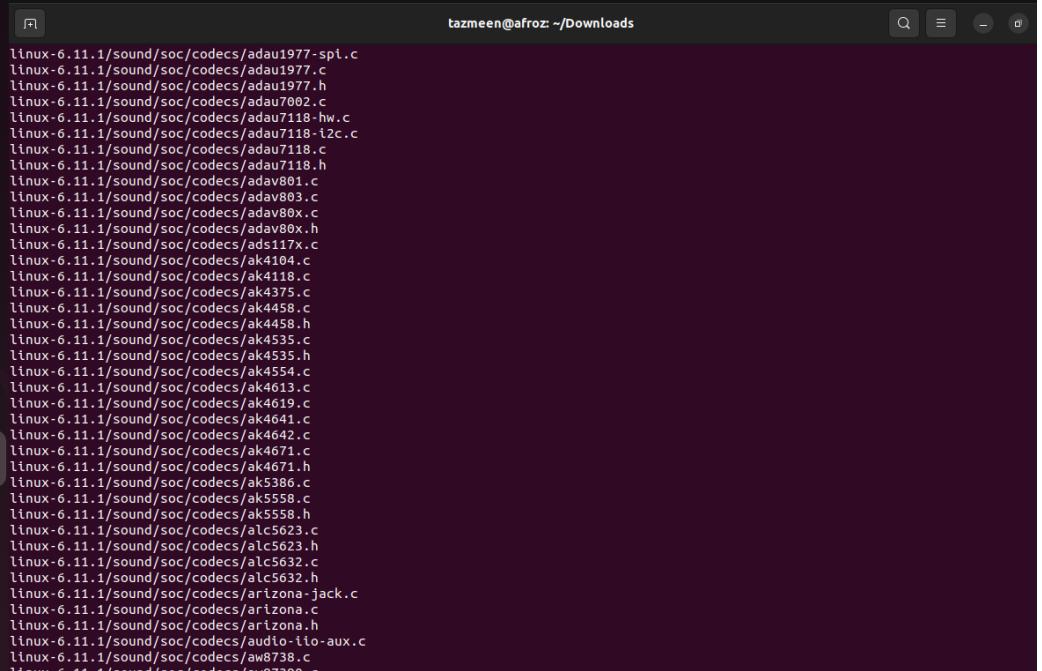


A screenshot of a terminal window showing the extraction of the tar file:

```
tazmeen@afroz:~/Downloads$ tar xvf linux-6.11.1.tar.xz
```

## Linux Kernel Compilation Assignment

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A screenshot of a terminal window titled "tazmeen@afroz: ~/Downloads". The window displays a list of file names from the "sound/soc/codecs" directory of the Linux kernel version 6.11.1. The files listed include various C and header files for audio codecs, such as adau1977-spi.c, adau1977.c, adau1977.h, adau7002.c, adau7118-hw.c, adau7118-12c.c, adau7118.c, adau7118.h, adav801.c, adav803.c, adav80x.c, adav80x.h, adv117x.c, ak4104.c, ak4118.c, ak4375.c, ak4458.c, ak4458.h, ak4535.c, ak4535.h, ak4554.c, ak4613.c, ak4619.c, ak4641.c, ak4642.c, ak4671.c, ak4671.h, ak5386.c, ak5558.c, ak5558.h, alc5623.c, alc5623.h, arizona-jack.c, arizona.c, arizona.h, audio-iio-aux.c, aw8738.c, and aw87390.c.

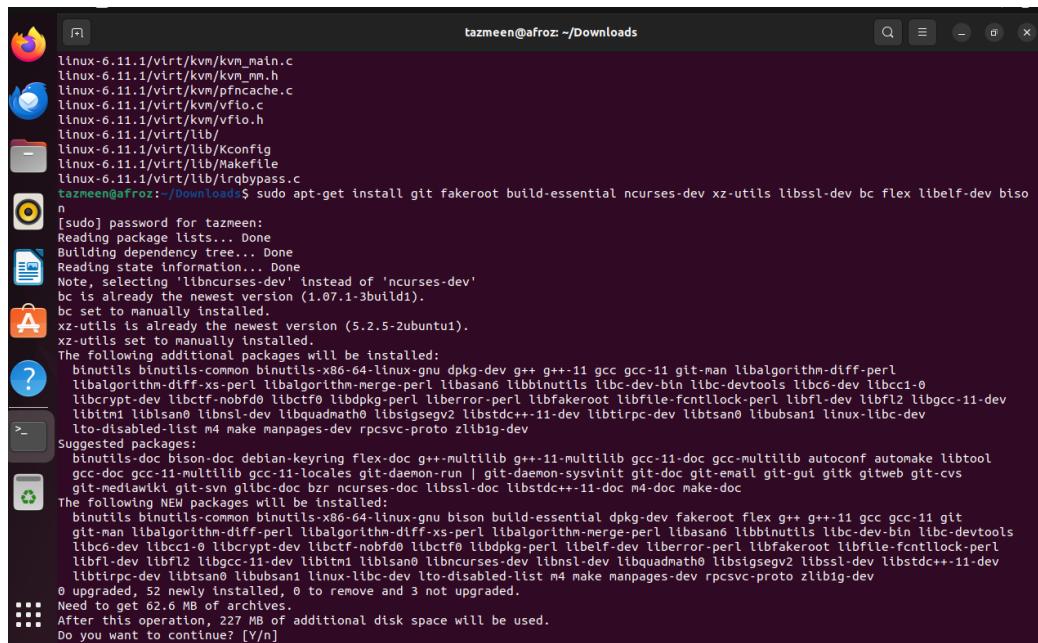
### 2.3. Installing Dependencies

Before proceeding with kernel compilation, the following dependencies were installed:

```
1 sudo apt-get install git fakeroot build-essential ncurses-dev xz-utils libssl-dev bc flex libelf-dev bison
```

This command ensures all necessary tools and libraries are available for the compilation process.

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```
tazmeen@afroz: ~/Downloads
tazmeen@afroz:~/Downloads$ sudo apt-get install git fakeroot build-essential ncurses-dev xz-utils libssl-dev bc flex libelf-dev bison
[sudo] password for tazmeen:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Note, selecting 'libncurses-dev' instead of 'ncurses-dev'
bc is already the newest version (1.07.1-3build1).
bc set to manually installed.
xz-utils is already the newest version (5.2.5-2ubuntu1).
xz-utils set to manually installed.
The following additional packages will be installed:
binutils binutils-common binutils-x86_64-linux-gnu bison build-essential dpkg-dev g++-4.8 gcc gcc-4.8 git-man libalgorithm-diff-perl
libalgorithm-diff-xs-perl libalgorithm-merge-perl libasan0 libbbnutils libc-dev-bin libc-devtools libc6-dev libbcc1-0
libcrypt-dev libctf-nobfd0 libctf0 libdpkg-perl liberror-perl libfakeroot libfile-fcntllock-perl libfl-dev libfl2 libgcc-11-dev
libitm1 liblsan0 libns1-dev libquadmath0 libsigsegv2 libstdc++-11-dev libtirpc-dev libtsan0 libubsan1 linux-libc-dev
lto-disabled-list m4 make manpages-dev rpcsvc-proto zlib1g-dev
Suggested packages:
binutils-doc bison-doc debian-keyring flex-doc g++-multilib gcc-11-doc gcc-multilib autoconf automake libtool
gcc-doc gcc-11-multilib gcc-11-locales git-daemon-run | git-daemon-sysvinit git-doc git-email git-gui gitk gitweb git-cvs
git-mediawiki git-svn glibc-doc bzip2 ncurses-doc libssl-doc libstdc++-11-doc m4-doc make-doc
The following NEW packages will be installed:
binutils binutils-common binutils-x86_64-linux-gnu bison build-essential dpkg-dev fakeroot flex g++-4.8-11 gcc gcc-11 git
git-man libalgorithm-diff-perl libalgorithm-diff-xs-perl libalgorithm-merge-perl libasan0 libbbnutils libc-dev-bin libc-dev-tools
libc6-dev libcc1-0 libcrypt-dev libctf-nobfd0 libctf0 libdpkg-perl libelf-dev liberror-perl libfakeroot libfile-fcntllock-perl
libfl-dev libfl2 libgcc-11-dev libitm1 liblsan0 libncurses-dev libns1-dev libquadmath0 libsigsegv2 libssl-dev libstdc++-11-dev
libtirpc-dev libtsan0 libubsan1 linux-libc-dev lto-disabled-list m4 make manpages-dev rpcsvc-proto zlib1g-dev
0 upgraded, 52 newly installed, 0 to remove and 3 not upgraded.
Need to get 62.6 MB of archives.
After this operation, 227 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

### 2.4. Configuring the Kernel

After installing dependencies, I navigated to the extracted kernel source directory and copied the existing system configuration:

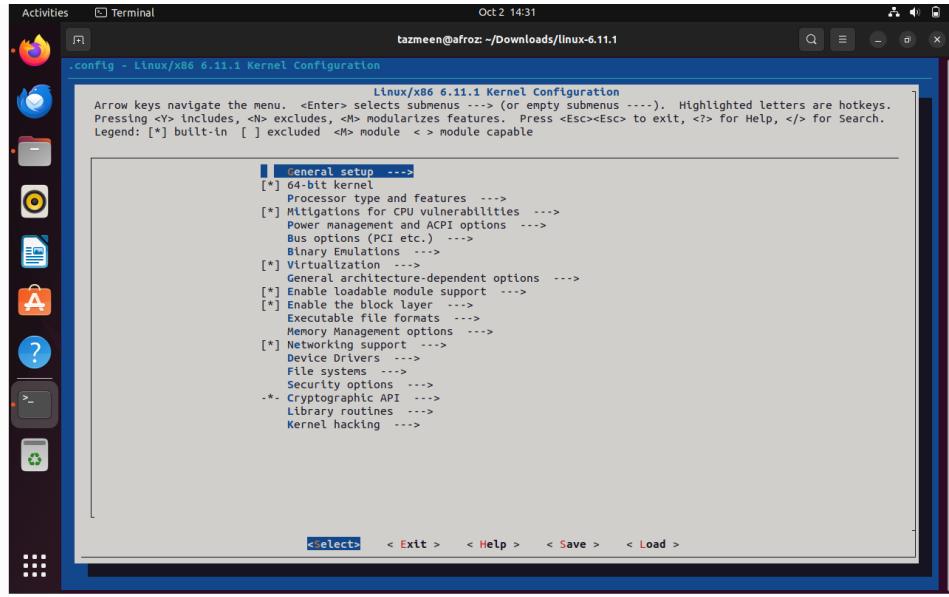
```
1 cd linux-6.11.1
2 cp -v /boot/config-$(uname -r) .config
```

```
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for install-info (6.8-4build1) ...
tazmeen@afroz:~/Downloads$ ls
linux-6.11.1 linux-6.11.1.tar.xz  linux-6.11.1.tar.xz.1
tazmeen@afroz:~/Downloads$ cd linux-6.11.1
tazmeen@afroz:~/Downloads/linux-6.11.1$ cp -v /boot/config-$(uname -r) .config
'/boot/config-6.8.0-40-generic' + '.config'
tazmeen@afroz:~/Downloads/linux-6.11.1$
```

To customize the kernel settings, I used the menuconfig interface:

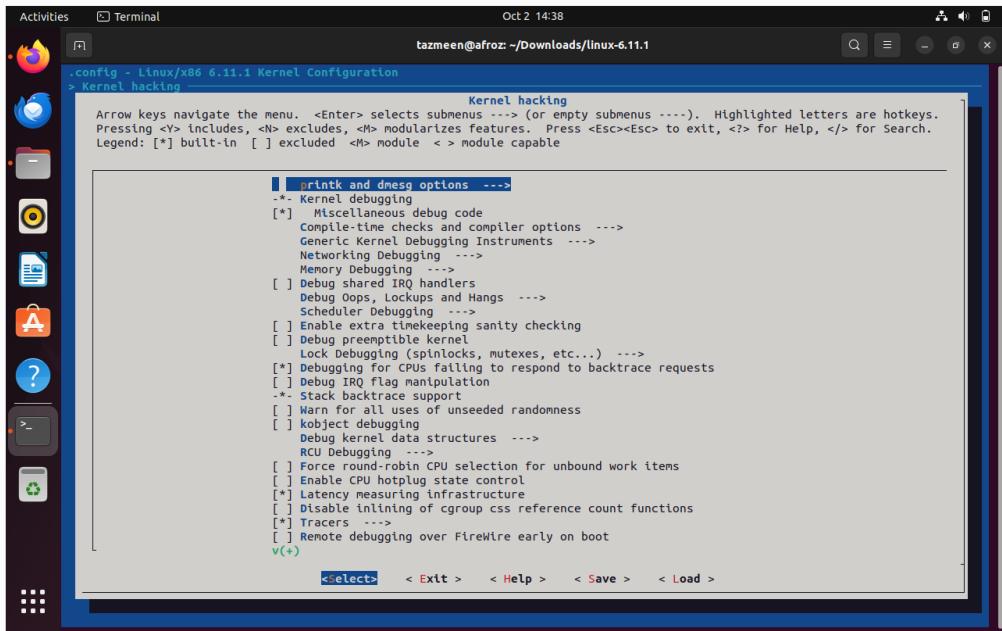
```
1 make menuconfig
```

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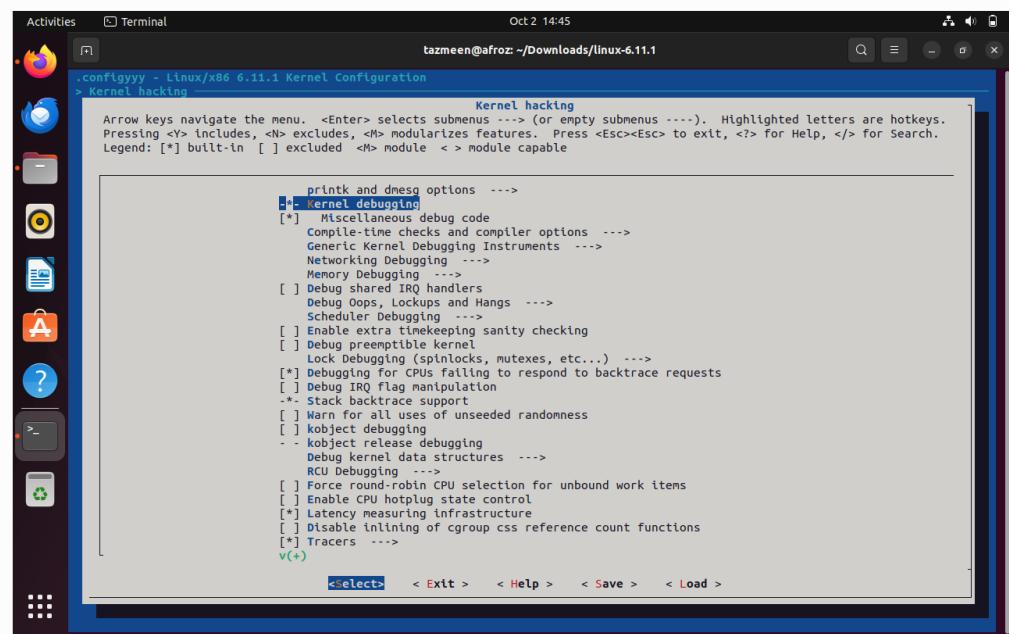
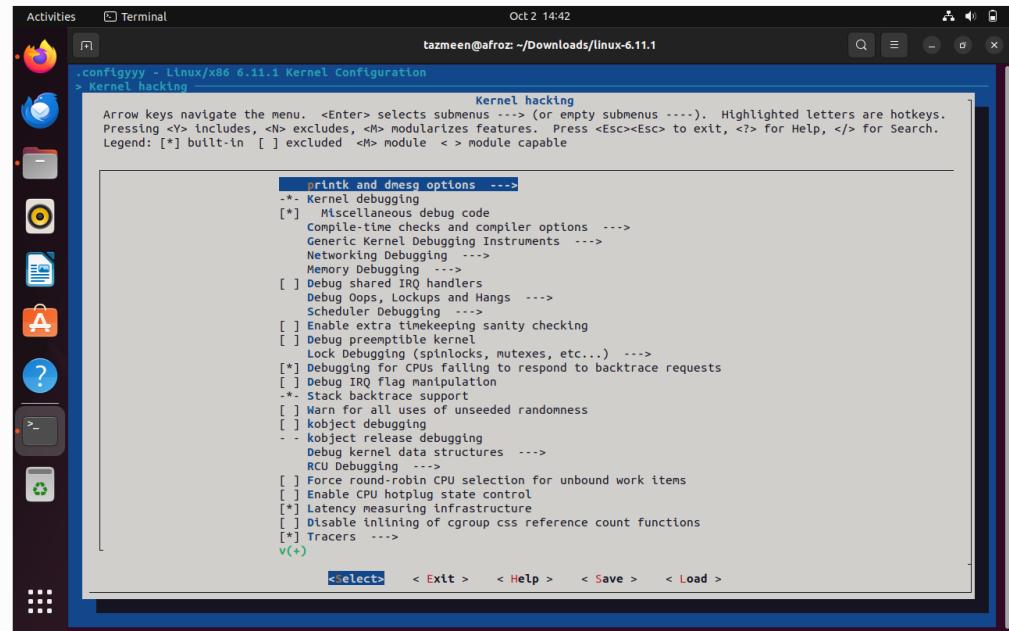


### 2.4.1. Bonus Tasks

In the configuration menu, I made the following custom adjustments:

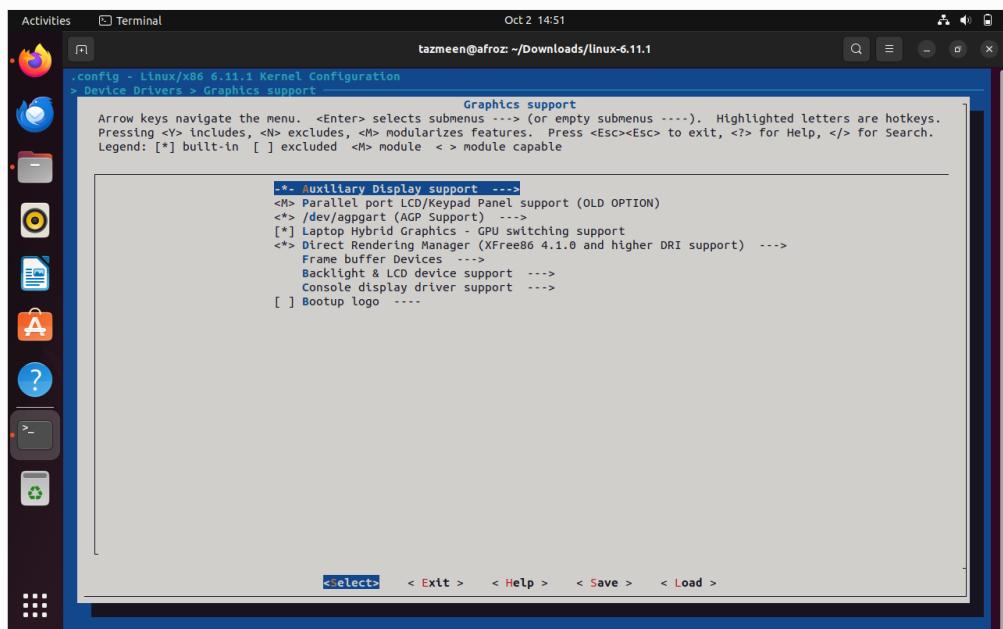
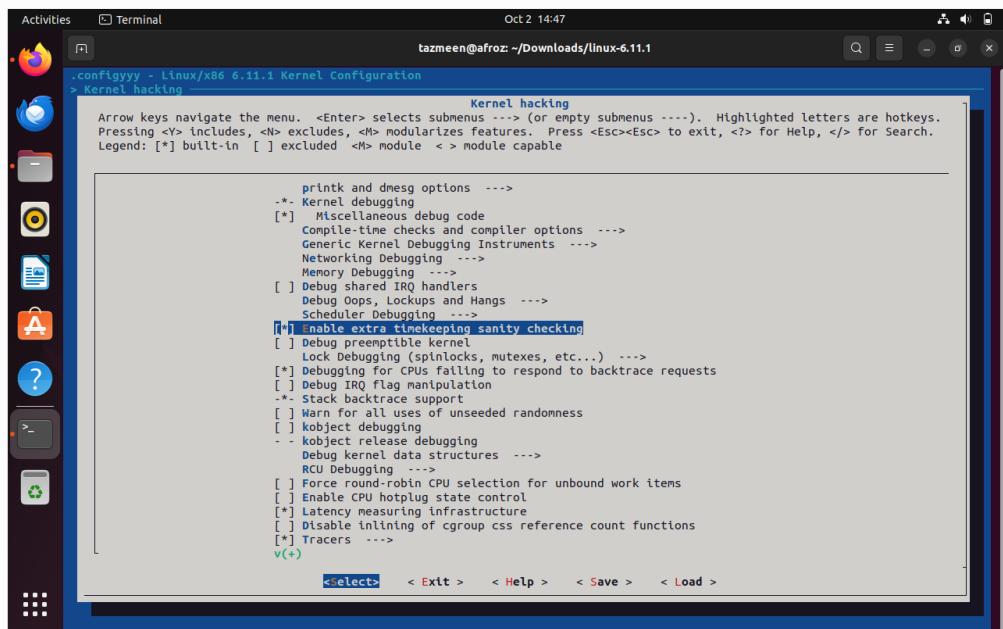


# Linux Kernel Compilation Assignment



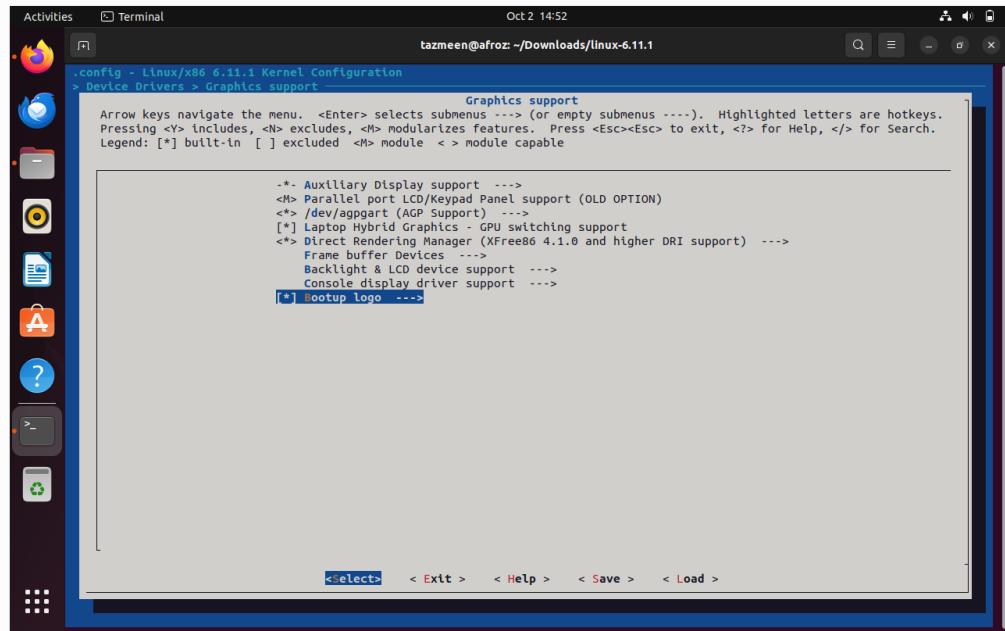
1. Enabled extra time keeping sanity check in kernel hacking

## Linux Kernel Compilation Assignment

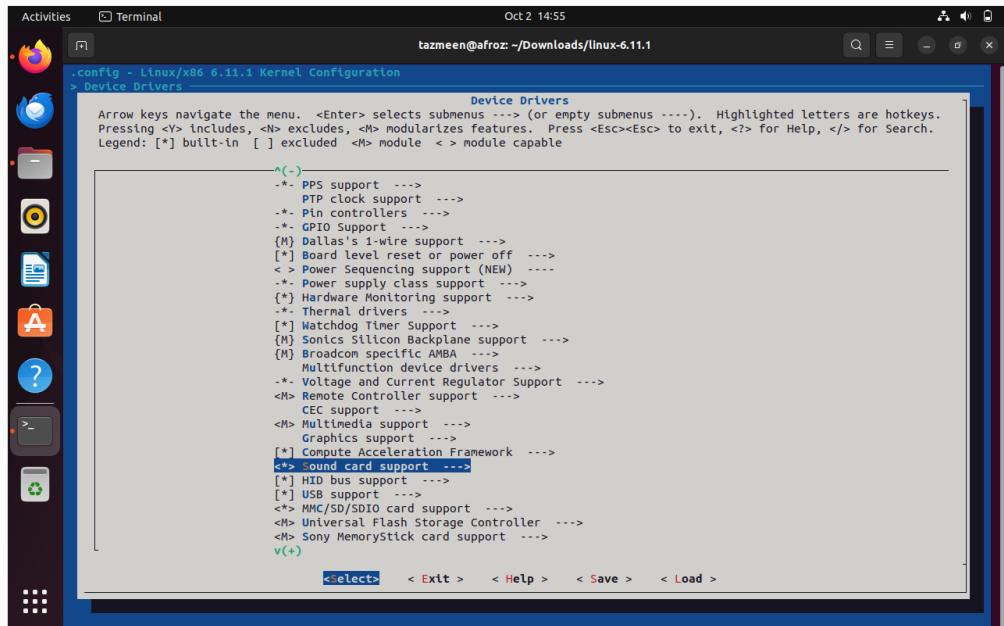


2. Enable bootup logo in graphics support

## Linux Kernel Compilation Assignment



### 3. Adjusted sound card settings for improved audio performance



The modified configuration was saved and applied.

## Linux Kernel Compilation Assignment

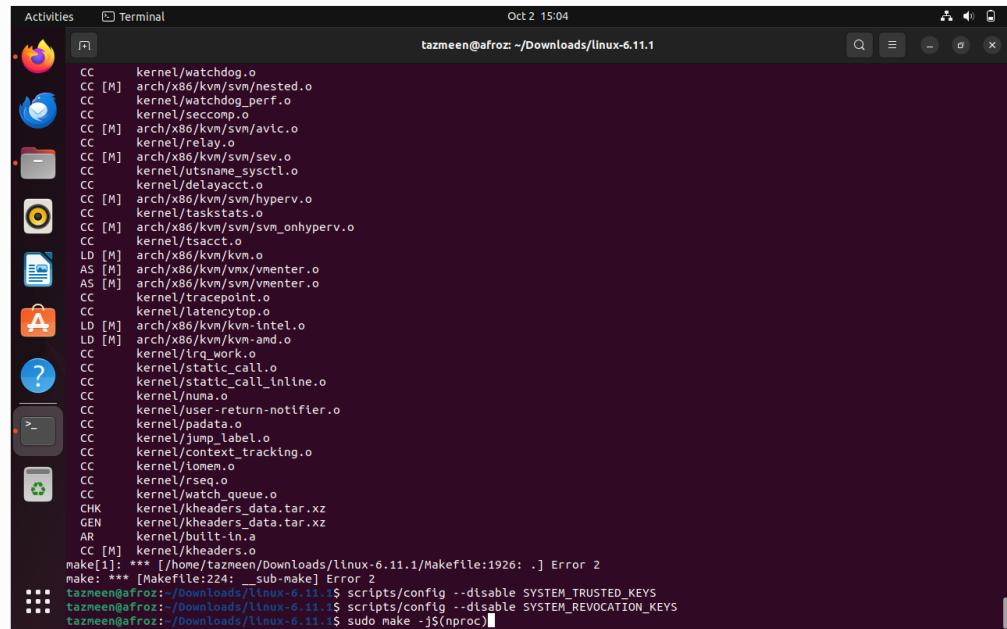
### 2.5. Compiling the Kernel

The kernel compilation process was initiated using the following command:

```
1 make -j$(nproc)
```

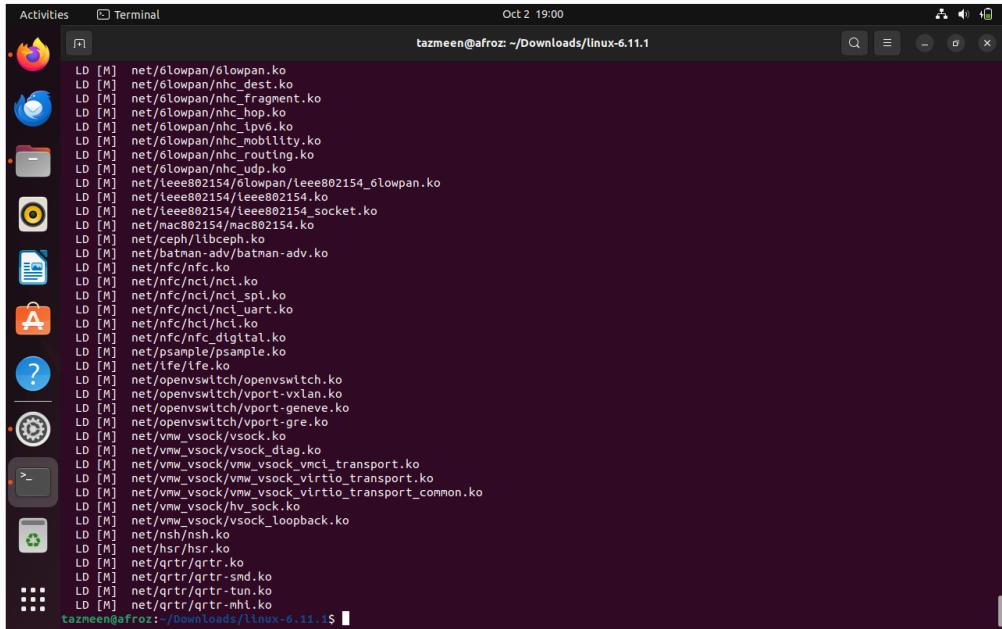
This command utilizes all available CPU cores for faster processing. The compilation process took approximately 3 hours and 30 minutes to complete.

In case of make error run following commands



```
Activities Terminal Oct 2 15:04 tazmeen@afroz: ~/Downloads/linux-6.11.1
CC kernel/watchdog.o
CC [M] arch/x86/kvm/svn/nested.o
CC kernel/watchdog_perf.o
CC kernel/seccomp.o
CC [M] arch/x86/kvm/svn/avic.o
CC kernel/el7ay.o
CC [M] arch/x86/kvm/svn/sev.o
CC kernel/utcnname_sysctl.o
CC kernel/delayacct.o
CC [M] arch/x86/kvm/svn/hyperv.o
CC kernel/taskstats.o
CC [M] arch/x86/kvm/svn/svn_ohhyperv.o
CC kernel/tsc.o
LD [M] arch/x86/kvm/kvm.o
AS [M] arch/x86/kvm/mx/vmenter.o
AS [M] arch/x86/kvm/svn/vmenter.o
CC kernel/tracepoint.o
CC kernel/encyclopedia.o
LD [M] arch/x86/kvm/kvm-intel.o
LD [M] arch/x86/kvm/kvm-amd.o
CC kernel/trq_work.o
CC kernel/static_call.o
CC kernel/static_call_online.o
CC kernel/numa.o
CC kernel/user-return-notifier.o
CC kernel/padata.o
CC kernel/jump_label.o
CC kernel/context_tracking.o
CC kernel/tomen.o
CC kernel/seq.o
CC kernel/watch_queue.o
CHK kernel/kheaders_data.tar.xz
GEN kernel/kheaders_data.tar.xz
AR kernel/built-in.a
CC [M] kernel/kheaders.o
make[1]: *** [/home/tazmeen/Downloads/linux-6.11.1/Makefile:1926: .] Error 2
make: *** [Makefile:224: __sub-make] Error 2
tazmeen@afroz:~/Downloads/linux-6.11.1$ scripts/config --disable SYSTEM_TRUSTED_KEYS
tazmeen@afroz:~/Downloads/linux-6.11.1$ scripts/config --disable SYSTEM_REVOCATION_KEYS
tazmeen@afroz:~/Downloads/linux-6.11.1$ sudo make -j$(nproc)
```

## Linux Kernel Compilation Assignment

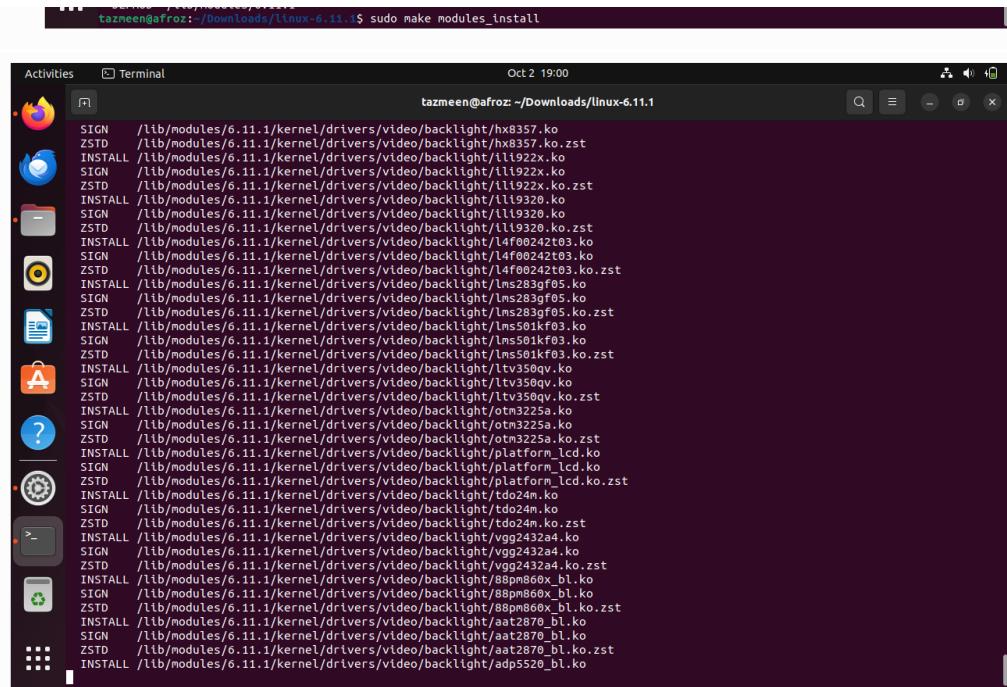


```
tazmeen@afroz: ~/Downloads/linux-6.11.1$ make -j8
```

```
[  1%] net/glowpan/glowpan.ko
[  1%] net/glowpan/nhc_dest.ko
[  1%] net/glowpan/nhc_fragment.ko
[  1%] net/glowpan/nhc_hop.ko
[  1%] net/glowpan/nhc_lpv6.ko
[  1%] net/glowpan/nhc_mobility.ko
[  1%] net/glowpan/nhc_routing.ko
[  1%] net/glowpan/nhc_udp.ko
[  1%] net/ieee802154/glowpan/Leee802154_glowpan.ko
[  1%] net/ieee802154/Leee802154.ko
[  1%] net/ieee802154/Leee802154_socket.ko
[  1%] net/mac802154/mac802154.ko
[  1%] net/ceph/libceph.ko
[  1%] net/batman-adv/batman-adv.ko
[  1%] net/nfc/nfc.ko
[  1%] net/nfc/nci/nci.ko
[  1%] net/nfc/nci/nci_spl.ko
[  1%] net/nfc/nci/nci_uart.ko
[  1%] net/nfc/hci/hci.ko
[  1%] net/nfc/nfc_digital.ko
[  1%] net/psample/psample.ko
[  1%] net/ife/ife.ko
[  1%] net/openvswitch/openvswitch.ko
[  1%] net/openvswitch/vport_vxlan.ko
[  1%] net/openvswitch/vport_geneve.ko
[  1%] net/openvswitch/vport_gre.ko
[  1%] net/vmw_vsock/vsock.ko
[  1%] net/vmw_vsock/vsock_diag.ko
[  1%] net/vmw_vsock/vmw_vsock_vmcn_transport.ko
[  1%] net/vmw_vsock/vmw_vsock_virtio_transport.ko
[  1%] net/vmw_vsock/vmw_vsock_virtio_transport_common.ko
[  1%] net/vmw_vsock/hv_sock.ko
[  1%] net/vmw_vsock/vsock_loopback.ko
[  1%] net/nsh/nsh.ko
[  1%] net/hsr/hsr.ko
[  1%] net/qtr/qtr.ko
[  1%] net/qtr/qtr_smd.ko
[  1%] net/qtr/qtr_tun.ko
[  1%] net/qtr/qtr_mhi.ko
```

After the main compilation, I installed the required modules:

```
1 sudo make modules_install
```



```
tazmeen@afroz: ~/Downloads/linux-6.11.1$ sudo make modules_install
```

```
SIGN /lib/modules/6.11.1/kernel/drivers/video/backlight/hx8357.ko
ZSTD /lib/modules/6.11.1/kernel/drivers/video/backlight/hx8357.ko.zst
INSTALL /lib/modules/6.11.1/kernel/drivers/video/backlight/l1l922x.ko
SIGN /lib/modules/6.11.1/kernel/drivers/video/backlight/l1l922x.ko
ZSTD /lib/modules/6.11.1/kernel/drivers/video/backlight/l1l922x.ko.zst
INSTALL /lib/modules/6.11.1/kernel/drivers/video/backlight/l1l9326.ko
SIGN /lib/modules/6.11.1/kernel/drivers/video/backlight/l1l9326.ko
ZSTD /lib/modules/6.11.1/kernel/drivers/video/backlight/l1l9326.ko.zst
INSTALL /lib/modules/6.11.1/kernel/drivers/video/backlight/l4f00242t03.ko
SIGN /lib/modules/6.11.1/kernel/drivers/video/backlight/l4f00242t03.ko
ZSTD /lib/modules/6.11.1/kernel/drivers/video/backlight/l4f00242t03.ko.zst
INSTALL /lib/modules/6.11.1/kernel/drivers/video/backlight/lms283gf05.ko
SIGN /lib/modules/6.11.1/kernel/drivers/video/backlight/lms283gf05.ko
ZSTD /lib/modules/6.11.1/kernel/drivers/video/backlight/lms283gf05.ko.zst
INSTALL /lib/modules/6.11.1/kernel/drivers/video/backlight/lms501kf03.ko
SIGN /lib/modules/6.11.1/kernel/drivers/video/backlight/lms501kf03.ko
ZSTD /lib/modules/6.11.1/kernel/drivers/video/backlight/lms501kf03.ko.zst
INSTALL /lib/modules/6.11.1/kernel/drivers/video/backlight/ltv350qv.ko
SIGN /lib/modules/6.11.1/kernel/drivers/video/backlight/ltv350qv.ko
ZSTD /lib/modules/6.11.1/kernel/drivers/video/backlight/ltv350qv.ko.zst
INSTALL /lib/modules/6.11.1/kernel/drivers/video/backlight/oth3225a.ko
SIGN /lib/modules/6.11.1/kernel/drivers/video/backlight/oth3225a.ko
ZSTD /lib/modules/6.11.1/kernel/drivers/video/backlight/oth3225a.ko.zst
INSTALL /lib/modules/6.11.1/kernel/drivers/video/backlight/platform_lcd.ko
SIGN /lib/modules/6.11.1/kernel/drivers/video/backlight/platform_lcd.ko
ZSTD /lib/modules/6.11.1/kernel/drivers/video/backlight/platform_lcd.ko.zst
INSTALL /lib/modules/6.11.1/kernel/drivers/video/backlight/tdo24m.ko
SIGN /lib/modules/6.11.1/kernel/drivers/video/backlight/tdo24m.ko
ZSTD /lib/modules/6.11.1/kernel/drivers/video/backlight/tdo24m.ko.zst
INSTALL /lib/modules/6.11.1/kernel/drivers/video/backlight/vgg2432a4.ko
SIGN /lib/modules/6.11.1/kernel/drivers/video/backlight/vgg2432a4.ko
ZSTD /lib/modules/6.11.1/kernel/drivers/video/backlight/vgg2432a4.ko.zst
INSTALL /lib/modules/6.11.1/kernel/drivers/video/backlight/88pm860x_bt.ko
SIGN /lib/modules/6.11.1/kernel/drivers/video/backlight/88pm860x_bt.ko
ZSTD /lib/modules/6.11.1/kernel/drivers/video/backlight/88pm860x_bt.ko.zst
INSTALL /lib/modules/6.11.1/kernel/drivers/video/backlight/aa2870_bt.ko
SIGN /lib/modules/6.11.1/kernel/drivers/video/backlight/aa2870_bt.ko
ZSTD /lib/modules/6.11.1/kernel/drivers/video/backlight/aa2870_bt.ko.zst
INSTALL /lib/modules/6.11.1/kernel/drivers/video/backlight/adp5520_bt.ko
```

# Linux Kernel Compilation Assignment

```
Activities Terminal Oct 2 19:06 tazmeen@afroz: ~/Downloads/linux-6.11.1
```

```
SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock_diag.ko
SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock_diag.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock_diag.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_vmc1_transport.ko
SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_vmc1_transport.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_vmc1_transport.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_virtio_transport.ko
SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_virtio_transport.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_virtio_transport.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_virtio_transport_common.ko
SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_virtio_transport_common.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_virtio_transport_common.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/vmw_vsock/hv_sock.ko
SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/hv_sock.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/hv_sock.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock_loopback.ko
SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock_loopback.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock_loopback.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/nsh/nsh.ko
SIGN /lib/modules/6.11.1/kernel/net/nsh/nsh.ko
ZSTD /lib/modules/6.11.1/kernel/net/nsh/nsh.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/hsr/hsr.ko
SIGN /lib/modules/6.11.1/kernel/net/hsr/hsr.ko
ZSTD /lib/modules/6.11.1/kernel/net/hsr/hsr.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/qtr/qtr.ko
SIGN /lib/modules/6.11.1/kernel/net/qtr/qtr.ko
ZSTD /lib/modules/6.11.1/kernel/net/qtr/qtr.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/qtr/qtr-smr.ko
SIGN /lib/modules/6.11.1/kernel/net/qtr/qtr-smr.ko
ZSTD /lib/modules/6.11.1/kernel/net/qtr/qtr-smr.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/qtr/qtr-tun.ko
SIGN /lib/modules/6.11.1/kernel/net/qtr/qtr-tun.ko
ZSTD /lib/modules/6.11.1/kernel/net/qtr/qtr-tun.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/qtr/qtr-mhi.ko
SIGN /lib/modules/6.11.1/kernel/net/qtr/qtr-mhi.ko
ZSTD /lib/modules/6.11.1/kernel/net/qtr/qtr-mhi.ko.zst
DEPMOD -l lib/modules/6.11.1
```

Finally, the kernel itself was installed:

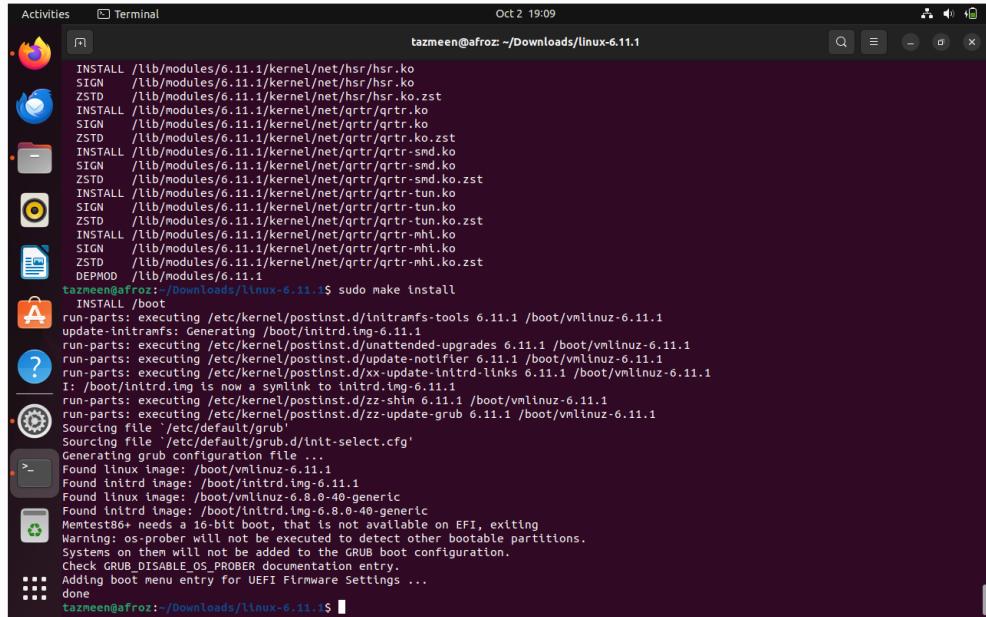
```
1 | sudo make install
```

```
Activities Terminal Oct 2 19:07
tazmeen@afroz: ~/Downloads/linux-6.11.1

SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock_diag.ko
SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock_diag.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock_diag.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_vmc1_transport.ko
SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_vmc1_transport.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_vmc1_transport.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_virtio_transport.ko
SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_virtio_transport.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_virtio_transport.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_virtio_transport_common.ko
SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_virtio_transport_common.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/vmw_vsock_virtio_transport_common.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/vmw_vsock/hv_sock.ko
SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/hv_sock.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/hv_sock.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock_loopback.ko
SIGN /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock_loopback.ko
ZSTD /lib/modules/6.11.1/kernel/net/vmw_vsock/vsock_loopback.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/nsh/nsh.ko
SIGN /lib/modules/6.11.1/kernel/net/nsh/nsh.ko
ZSTD /lib/modules/6.11.1/kernel/net/nsh/nsh.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/hsr/hsr.ko
SIGN /lib/modules/6.11.1/kernel/net/hsr/hsr.ko
ZSTD /lib/modules/6.11.1/kernel/net/hsr/hsr.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/qtr/qtr.ko
SIGN /lib/modules/6.11.1/kernel/net/qtr/qtr.ko
ZSTD /lib/modules/6.11.1/kernel/net/qtr/qtr.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/qtr/qtr_snd.ko
SIGN /lib/modules/6.11.1/kernel/net/qtr/qtr_snd.ko
ZSTD /lib/modules/6.11.1/kernel/net/qtr/qtr_snd.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/qtr/qtr_tun.ko
SIGN /lib/modules/6.11.1/kernel/net/qtr/qtr_tun.ko
ZSTD /lib/modules/6.11.1/kernel/net/qtr/qtr_tun.ko.zst
INSTALL /lib/modules/6.11.1/kernel/net/qtr/qtr_mhl.ko
SIGN /lib/modules/6.11.1/kernel/net/qtr/qtr_mhl.ko
ZSTD /lib/modules/6.11.1/kernel/net/qtr/qtr_mhl.ko.zst
DEPMOD /lib/modules/6.11.1

tazmeen@afroz: ~/Downloads/linux-6.11.1$ sudo make install
```

## Linux Kernel Compilation Assignment



A screenshot of a Linux desktop environment showing a terminal window titled "Terminal". The terminal window has a dark background and displays the command "tazmeen@afroz: ~/Downloads/linux-6.11.1\$ sudo make install" followed by a long list of kernel module installation commands. The desktop interface includes a dock with icons for file manager, terminal, browser, and others.

```
INSTALLED /lib/modules/6.11.1/kernel/net/hsr/hsr.ko
SIGN /lib/modules/6.11.1/kernel/net/hsr/hsr.ko.zst
ZSTD /lib/modules/6.11.1/kernel/net/hsr/hsr.ko.zstd
INSTALL /lib/modules/6.11.1/kernel/net/qtr/qtr.ko
SIGN /lib/modules/6.11.1/kernel/net/qtr/qtr.ko.zst
ZSTD /lib/modules/6.11.1/kernel/net/qtr/qtr.ko.zstd
INSTALL /lib/modules/6.11.1/kernel/net/qtr/qtr-snd.ko
SIGN /lib/modules/6.11.1/kernel/net/qtr/qtr-snd.ko.zst
ZSTD /lib/modules/6.11.1/kernel/net/qtr/qtr-snd.ko.zstd
INSTALL /lib/modules/6.11.1/kernel/net/qtr/qtr-tun.ko
SIGN /lib/modules/6.11.1/kernel/net/qtr/qtr-tun.ko.zst
ZSTD /lib/modules/6.11.1/kernel/net/qtr/qtr-tun.ko.zstd
INSTALL /lib/modules/6.11.1/kernel/net/qtr/qtr-mhl.ko
SIGN /lib/modules/6.11.1/kernel/net/qtr/qtr-mhl.ko.zst
ZSTD /lib/modules/6.11.1/kernel/net/qtr/qtr-mhl.ko.zstd
DEPMOD /lib/modules/6.11.1
tazmeen@afroz:~/Downloads/linux-6.11.1$ sudo make install
    INSTALL /boot
run-parts: executing /etc/kernel/postinst.d/initramfs-tools 6.11.1 /boot/vmlinuz-6.11.1
update-initramfs: Generating /boot/initrd.img-6.11.1
run-parts: executing /etc/kernel/postinst.d/unattended-upgrades 6.11.1 /boot/vmlinuz-6.11.1
run-parts: executing /etc/kernel/postinst.d/update-notifier 6.11.1 /boot/vmlinuz-6.11.1
run-parts: executing /etc/kernel/postinst.d/xx-update-initrd-links 6.11.1 /boot/vmlinuz-6.11.1
I: /boot/initrd.img is now a symlink to initrd.img-6.11.1
run-parts: executing /etc/kernel/postinst.d/zz-update-grub 6.11.1 /boot/vmlinuz-6.11.1
Sourcing file '/etc/default/grub'
Sourcing file '/etc/default/grub.d/lnlt-select.cfg'
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-6.11.1
Found initrd image: /boot/initrd.img-6.11.1
Found linux image: /boot/vmlinuz-6.8.0-40-generic
Found initrd image: /boot/initrd.img-6.8.0-40-generic
Memtest86+ needs a 16-bit boot, that is not available on UEFI, exiting
Warning: os-prober will not be executed to detect other bootable partitions.
Systems on them will not be added to the GRUB boot configuration.
Check GRUB_DISABLE_OS_PROBER documentation entry.
Adding boot menu entry for UEFI Firmware Settings ...
done
tazmeen@afroz:~/Downloads/linux-6.11.1$
```

### 2.6. Updating the Bootloader

Once the kernel was installed, I updated the bootloader configuration to include the newly installed kernel:

```
1 sudo update-initramfs -c -k 6.11.1
2 sudo update-grub
```

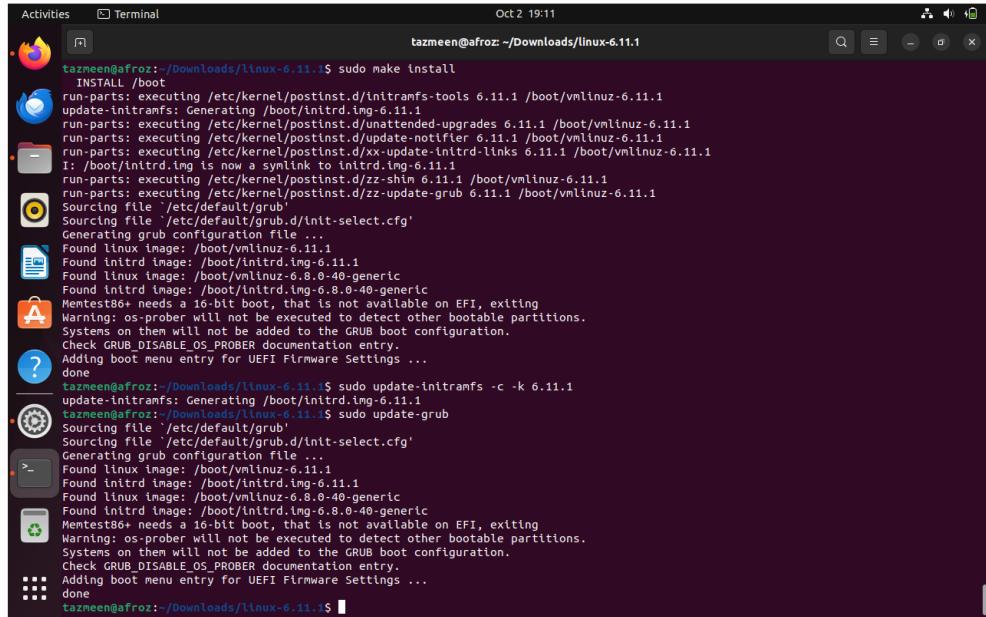
These commands create a new initial RAM disk for the new kernel and update the GRUB bootloader configuration.

## Linux Kernel Compilation Assignment

```
Activities Terminal Oct 2 19:09
tazmeen@afroz: ~/Downloads/linux-6.11.1$ sudo make install
  INSTALL /boot
  run-parts: executing /etc/kernel/postinst.d/initramfs-tools 6.11.1 /boot/vmlinuz-6.11.1
update-initramfs: Generating /boot/initrd.img-6.11.1
  run-parts: executing /etc/kernel/postinst.d/unattended-upgrades 6.11.1 /boot/vmlinuz-6.11.1
  run-parts: executing /etc/kernel/postinst.d/update-notifier 6.11.1 /boot/vmlinuz-6.11.1
  run-parts: executing /etc/kernel/postinst.d/xx-update-initrd-links 6.11.1 /boot/vmlinuz-6.11.1
I: /boot/initrd.img is now a sym link to initrd.img-6.11.1
  run-parts: executing /etc/kernel/postinst.d/zz-shim 6.11.1 /boot/vmlinuz-6.11.1
  run-parts: executing /etc/kernel/postinst.d/zz-update-grub 6.11.1 /boot/vmlinuz-6.11.1
  DEPMOD /lib/modules/6.11.1
Sourcing file '/etc/default/grub'
  Generating grub configuration file ...
  Found linux image: /boot/vmlinuz-6.11.1
  Found initrd image: /boot/initrd.img-6.11.1
  Found linux image: /boot/vmlinuz-6.8.0-40-generic
  Found initrd image: /boot/initrd.img-6.8.0-40-generic
Memtest86+ needs a 16-bit boot, that is not available on EFI, exiting
Warning: os-prober will not be executed to detect other bootable partitions.
Systems on them will not be added to the GRUB boot configuration.
Check GRUB_DISABLE_OS_PROBER documentation entry.
Adding boot menu entry for UEFI Firmware Settings ...
done
tazmeen@afroz: ~/Downloads/linux-6.11.1$ sudo update-initramfs -c -k 6.11.1
update-initramfs: Generating /boot/initrd.img-6.11.1
```

```
Activities Terminal Oct 2 19:10
tazneenda@afroz: ~/Downloads/linux-6.11.1$ sudo make install
  INSTALL /boot
  run-parts: executing /etc/kernel/postinst.d/initramfs-tools 6.11.1 /boot/vmlinuz-6.11.1
update-initramfs: Generating /boot/initrd.img-6.11.1
  run-parts: executing /etc/kernel/postinst.d/unattended-upgrades 6.11.1 /boot/vmlinuz-6.11.1
  run-parts: executing /etc/kernel/postinst.d/update-notifier 6.11.1 /boot/vmlinuz-6.11.1
  run-parts: executing /etc/kernel/postinst.d/xx-update-initrd-links 6.11.1 /boot/vmlinuz-6.11.1
I: /boot/initrd.img is now a sym link to initrd.img-6.11.1
  run-parts: executing /etc/kernel/postinst.d/zz-shim 6.11.1 /boot/vmlinuz-6.11.1
  run-parts: executing /etc/kernel/postinst.d/zz-update-grub 6.11.1 /boot/vmlinuz-6.11.1
  DEPMOD /lib/modules/6.11.1
Sourcing file '/etc/default/grub'
  Generating grub configuration file ...
  Found linux image: /boot/vmlinuz-6.11.1
  Found initrd image: /boot/initrd.img-6.11.1
  Found linux image: /boot/vmlinuz-6.8.0-40-generic
  Found initrd image: /boot/initrd.img-6.8.0-40-generic
Memtest86+ needs a 16-bit boot, that is not available on EFI, exiting
Warning: os-prober will not be executed to detect other bootable partitions.
Systems on them will not be added to the GRUB boot configuration.
Check GRUB_DISABLE_OS_PROBER documentation entry.
Adding boot menu entry for UEFI Firmware Settings ...
done
tazneenda@afroz: ~/Downloads/linux-6.11.1$ sudo update-initramfs -c -k 6.11.1
update-initramfs: Generating /boot/initrd.img-6.11.1
tazneenda@afroz: ~/Downloads/linux-6.11.1$
```

## Linux Kernel Compilation Assignment



A screenshot of a Linux desktop environment showing a terminal window titled "Activities Terminal". The terminal window has a dark background and displays the command-line interface of a user named "tazmeen@afroz". The user is in their home directory (~) and is running several commands related to kernel compilation and bootloader configuration. The commands include "sudo make install", "sudo update-initramfs -c -k 6.11.1", and "sudo update-grub". The terminal output shows various system paths, file names, and messages from the kernel and GRUB bootloaders. The desktop environment includes icons for the Dash, Home, and Applications menus, as well as icons for the terminal and file manager.

```
tazmeen@afroz:~/Downloads/linux-6.11.1$ sudo make install
INSTALL /boot
run-parts: executing /etc/kernel/postinst.d/initramfs-tools 6.11.1 /boot/vmlinuz-6.11.1
update-initramfs: Generating /boot/initrd.img-6.11.1
run-parts: executing /etc/kernel/postinst.d/unattended-upgrades 6.11.1 /boot/vmlinuz-6.11.1
run-parts: executing /etc/kernel/postinst.d/xx-update-initrd-links 6.11.1 /boot/vmlinuz-6.11.1
I: /boot/initrd.img is now a symlink to initrd.img-6.11.1
run-parts: executing /etc/kernel/postinst.d/zz-shim 6.11.1 /boot/vmlinuz-6.11.1
run-parts: executing /etc/kernel/postinst.d/zz-update-grub 6.11.1 /boot/vmlinuz-6.11.1
Sourcing file '/etc/default/grub'
Sourcing file '/etc/default/grub.d/10-select.cfg'
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-6.11.1
Found initrd image: /boot/initrd.img-6.11.1
Found linux image: /boot/vmlinuz-6.8.0-40-generic
Found initrd image: /boot/initrd.img-6.8.0-40-generic
Memtest86+ needs a 16-bit boot, that is not available on EFI, exiting
Warning: os-prober will not be executed to detect other bootable partitions.
Systems on them will not be added to the GRUB boot configuration.
Check GRUB_DISABLE_OS_PROBER documentation entry.
Adding boot menu entry for UEFI Firmware Settings ...
done
tazmeen@afroz:~/Downloads/linux-6.11.1$ sudo update-initramfs -c -k 6.11.1
update-initramfs: Generating /boot/initrd.img-6.11.1
tazmeen@afroz:~/Downloads/linux-6.11.1$ sudo update-grub
Sourcing file '/etc/default/grub'
Sourcing file '/etc/default/grub.d/10-select.cfg'
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-6.11.1
Found initrd image: /boot/initrd.img-6.11.1
Found linux image: /boot/vmlinuz-6.8.0-40-generic
Found initrd image: /boot/initrd.img-6.8.0-40-generic
Memtest86+ needs a 16-bit boot, that is not available on EFI, exiting
Warning: os-prober will not be executed to detect other bootable partitions.
Systems on them will not be added to the GRUB boot configuration.
Check GRUB_DISABLE_OS_PROBER documentation entry.
Adding boot menu entry for UEFI Firmware Settings ...
done
tazmeen@afroz:~/Downloads/linux-6.11.1$
```

### 2.7. Rebooting and Verification

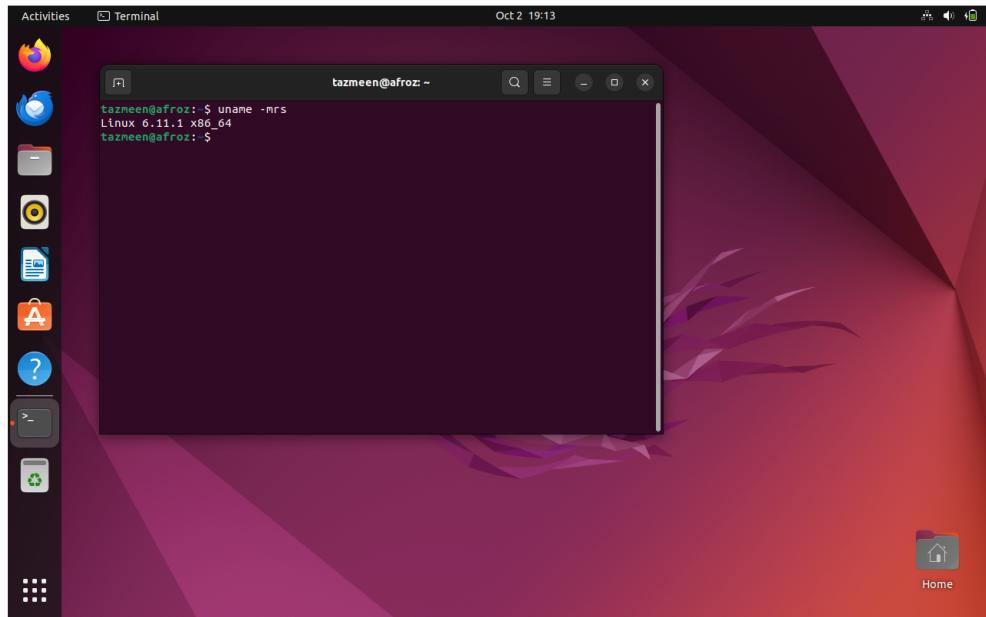
After completing the installation and bootloader update, I rebooted the system:

```
1 sudo reboot
```

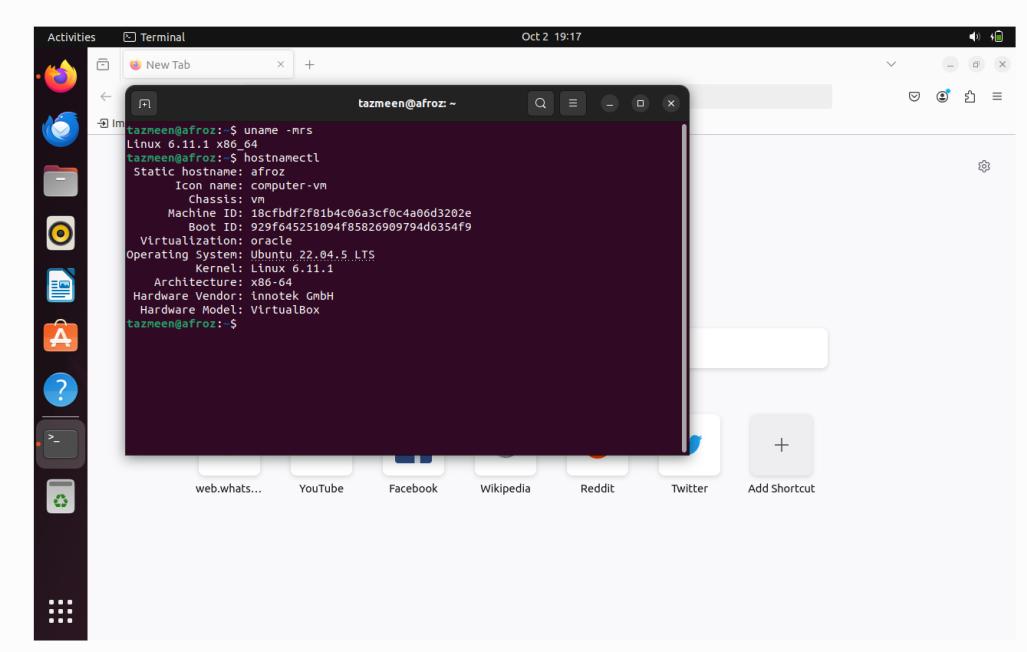
Upon rebooting, I confirmed that the new kernel was active by running:

```
1 uname -r
```

## Linux Kernel Compilation Assignment

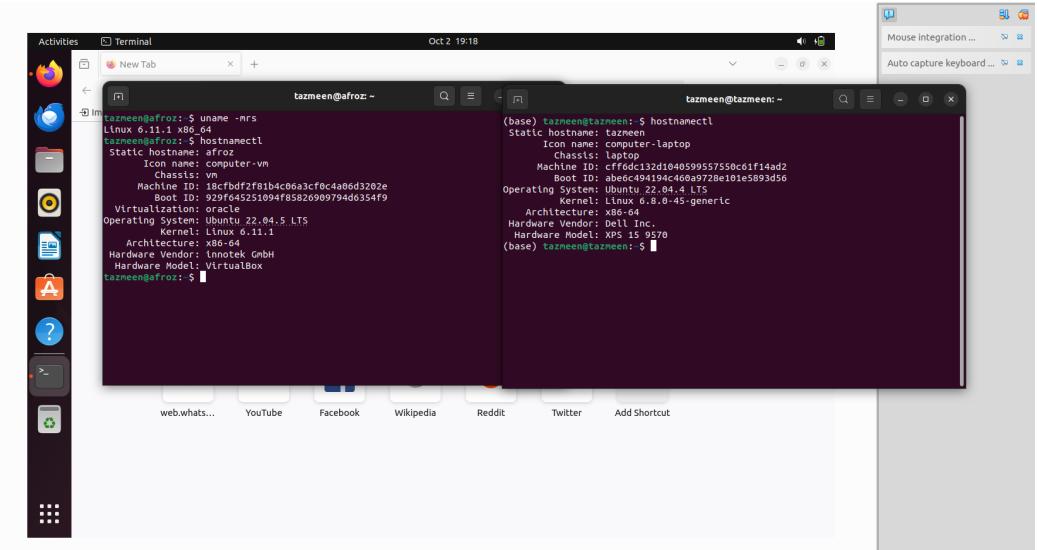


The output confirmed that kernel version 6.11.1 was successfully running.



## Linux Kernel Compilation Assignment

comparison



### 3. Compilation Time and Effort

The entire process, from initial setup to final verification, took 4 hours. This included:

- 15 minutes for setup and dependency installation
- 10 minutes for kernel configuration
- 3 hours for compilation and module installation
- 5 minutes for bootloader updates and final checks

The process required significant attention to detail and patience, especially during the lengthy compilation phase.