



ASSIGNMENT COMPLETION REPORT

- ❖ Compilation of the latest stable kernel and dual booting with the current version of Linux.

Synopsis

The kernel is a computer program at the core of an operating system (OS). It is the part of the OS that loads first and remains in the main memory. The kernel connects the system hardware to the application software. Linux kernel is a free, open-source, monolithic, modular, Unix-like operating system kernel. It is the main component of the Linux operating system (OS) and is the core interface between the computer's hardware and its processes.



→ Done using Virtualbox

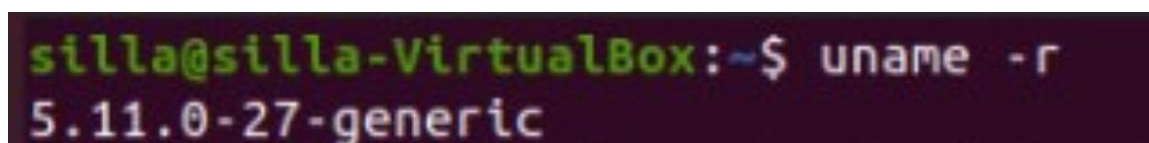


The procedure for compiling and installing the latest Linux kernel from source is as follows:

1. Run the

```
uname -r
```

command to see the current kernel version of linux distro.



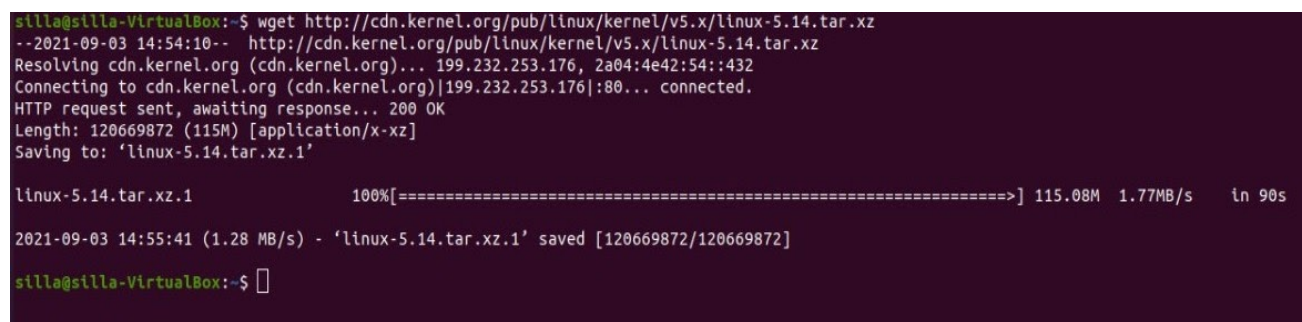
```
silla@silla-VirtualBox:~$ uname -r
5.11.0-27-generic
```

2. Download latest stable kernel: Go to the official site www.kernel.org . Then download the latest stable kernel tarball file. ([linux-5.14.tar.xz](#) in my case).

Use the command given below to download the source file corresponding to the tarball version.

```
wget
```

```
http://cdn.kernel.org/pub/linux/kernel/v5.x/linux-5.14.tar.xz
```



```
silla@silla-VirtualBox:~$ wget http://cdn.kernel.org/pub/linux/kernel/v5.x/linux-5.14.tar.xz
--2021-09-03 14:54:10-- http://cdn.kernel.org/pub/linux/kernel/v5.x/linux-5.14.tar.xz
Resolving cdn.kernel.org (cdn.kernel.org)... 199.232.253.176, 2a04:4e42:54::432
Connecting to cdn.kernel.org (cdn.kernel.org)|199.232.253.176|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 120669872 (115M) [application/x-xz]
Saving to: 'linux-5.14.tar.xz.1'

linux-5.14.tar.xz.1      100%[=====] 115.08M  1.77MB/s   in 90s

2021-09-03 14:55:41 (1.28 MB/s) - 'linux-5.14.tar.xz.1' saved [120669872/120669872]

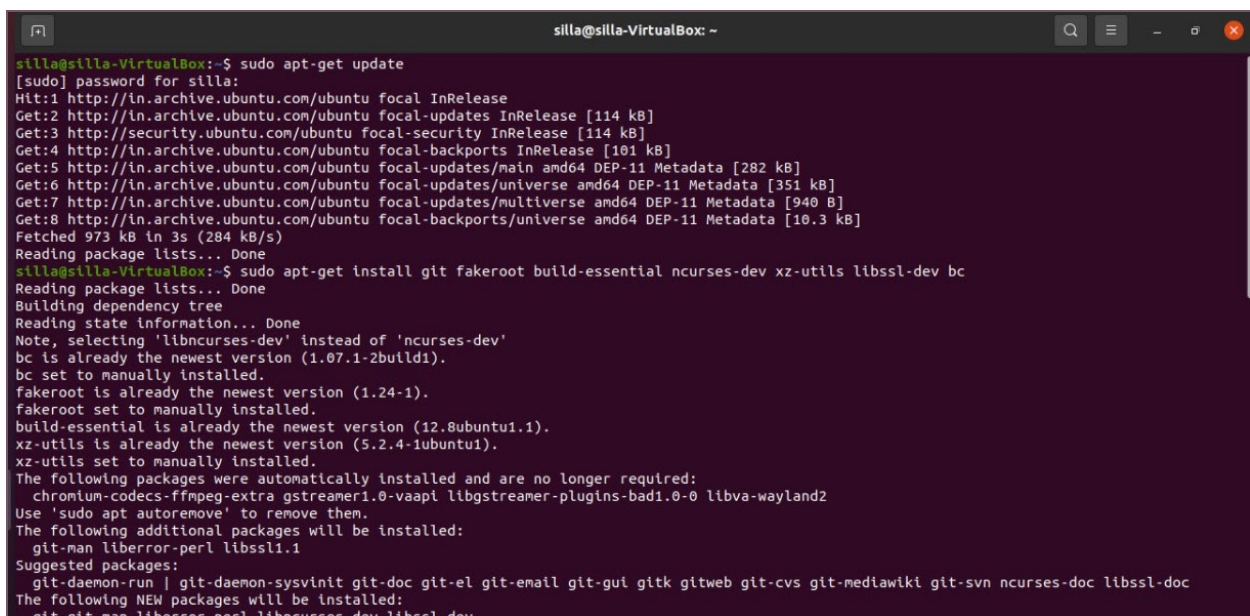
silla@silla-VirtualBox:~$
```

3.Packages for building kernel: Type the following apt-get

command to install the required packages for building the Linux kernel

```
sudo apt-get update
```

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



```
silla@silla-VirtualBox: ~  
silla@silla-VirtualBox:~$ sudo apt-get update  
[sudo] password for silla:  
Hit:1 http://in.archive.ubuntu.com/ubuntu focal InRelease  
Get:2 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]  
Get:3 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]  
Get:4 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease [101 kB]  
Get:5 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 DEP-11 Metadata [282 kB]  
Get:6 http://in.archive.ubuntu.com/ubuntu focal-updates/universe amd64 DEP-11 Metadata [351 kB]  
Get:7 http://in.archive.ubuntu.com/ubuntu focal-updates/multiverse amd64 DEP-11 Metadata [940 B]  
Get:8 http://in.archive.ubuntu.com/ubuntu focal-backports/universe amd64 DEP-11 Metadata [10.3 kB]  
Fetched 973 kB in 3s (284 kB/s)  
Reading package lists... Done  
silla@silla-VirtualBox:~$ sudo apt-get install git fakeroot build-essential ncurses-dev xz-utils libssl-dev bc  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
Note, selecting 'libncurses-dev' instead of 'ncurses-dev'  
bc is already the newest version (1.07.1-2build1).  
bc set to manually installed.  
fakeroot is already the newest version (1.24-1).  
fakeroot set to manually installed.  
build-essential is already the newest version (12.8ubuntu1.1).  
xz-utils is already the newest version (5.2.4-1ubuntu1).  
xz-utils set to manually installed.  
The following packages were automatically installed and are no longer required:  
chromium-codecs-ffmpeg-extra gstreamer1.0-vaapi libgstreamer-plugins-bad1.0-0 libva-wayland2  
Use 'sudo apt autoremove' to remove them.  
The following additional packages will be installed:  
git-man liberror-perl libssl1.1  
Suggested packages:  
git-daemon-run | git-daemon-sysvinit git-doc git-el git-email git-gui gitk gitweb git-cvs git-mediawiki git-svn ncurses-doc libssl-doc  
The following NEW packages will be installed:  
git git-man liberror-perl libncurses-dev libssl-dev
```

4.Extract tar.xz file: Extract the archive in any of the

directory using the following command:

```
tar xf linux-5.14.tar.xz
```

If you are done extracting,change the directory to the extracted folder .

```
cd linux-5.14
```

```
silla@silla-VirtualBox:~$ cd Desktop  
silla@silla-VirtualBox:~/Desktop$ tar -xf linux-5.14.tar.xz  
silla@silla-VirtualBox:~/Desktop$ cd linux-5.14
```

5.Configure Kernel features: Before we start compiling the kernel ,we should configure the kernel features ,to do so and to make it easier copy the existing file using

```
cp /boot/config-$(uname -r) .config
```

```
silla@silla-VirtualBox:~/Desktop$ cd linux-5.14
silla@silla-VirtualBox:~/Desktop/linux-5.14$ cp /boot/config-$(uname -r) .config
```

6.Install tools: In order to install gcc and more development tools we can use this command

```
sudo apt-get install libncurses-dev flex bison
openssl libssl-dev dkms libelf-dev libudev-dev
libpci-dev libiberty-dev autoconf
```

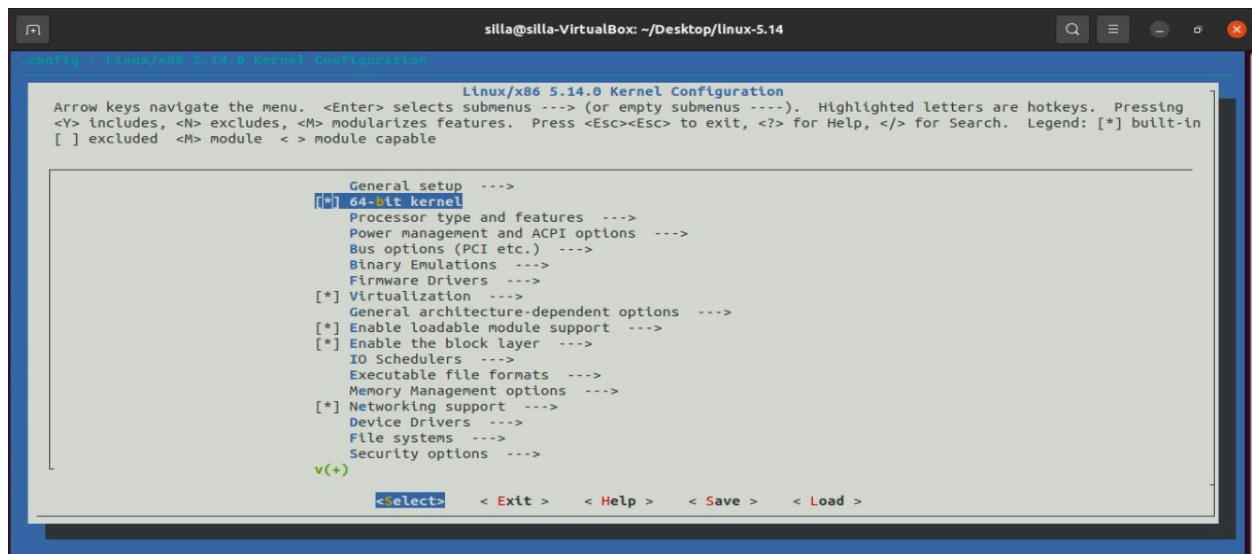
```
silla@silla-VirtualBox:~/Desktop/linux-5.14$ sudo apt-get install libncurses-dev flex bison openssl libssl-dev dkms libelf-dev libudev-dev libpci-dev libiberty-dev autoconf
Reading package lists... Done
Building dependency tree
Reading state information... Done
libncurses-dev is already the newest version (6.2-0ubuntu2).
dkms is already the newest version (2.8.1-5ubuntu2).
libssl-dev is already the newest version (1.1.1f-1ubuntu2.8).
The following packages were automatically installed and are no longer required:
  chromium-codecs-ffmpeg-extra gstreamer1.0-vaapi libgstreamer-plugins-bad1.0-0 libva-wayland2
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  automake autotools-dev libfl-dev libfl2 libsigsegv2 m4 zlib1g-dev
Suggested packages:
  autoconf-archive gnu-standards autoconf-doc libtool gettext bison-doc flex-doc m4-doc
The following NEW packages will be installed:
  autoconf automake autotools-dev bison flex libelf-dev libfl-dev libfl2 libiberty-dev libpci-dev libsigsegv2 libudev-dev m4 zlib1g-dev
The following packages will be upgraded:
  openssl
1 upgraded, 14 newly installed, 0 to remove and 19 not upgraded.
Need to get 2,508 kB/3,128 kB of archives.
After this operation, 9,346 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://in.archive.ubuntu.com/ubuntu focal/main amd64 libsigsegv2 amd64 2.12-2 [13.9 kB]
Get:2 http://in.archive.ubuntu.com/ubuntu focal/main amd64 m4 amd64 1.4.18-4 [199 kB]
Get:3 http://in.archive.ubuntu.com/ubuntu focal/main amd64 flex amd64 2.6.4-6.2 [317 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu focal/main amd64 autoconf all 2.69-11.1 [321 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu focal/main amd64 autotools-dev all 20180224.1 [39.6 kB]
Get:6 http://in.archive.ubuntu.com/ubuntu focal/main amd64 automake all 1:1.16.1-4ubuntu6 [522 kB]
Get:7 http://in.archive.ubuntu.com/ubuntu focal/main amd64 bison amd64 2:3.5.1+dfsg-1 [657 kB]
Get:8 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 zlib1g-dev amd64 1:1.2.11.dfsg-2ubuntu1.2 [155 kB]
Get:9 http://in.archive.ubuntu.com/ubuntu focal/main amd64 libelf-dev amd64 0.176-1.1build1 [57.0 kB]
Get:10 http://in.archive.ubuntu.com/ubuntu focal/main amd64 libfl2 amd64 2.6.4-6.2 [11.5 kB]
```

7.Configuring kernel: Use the command

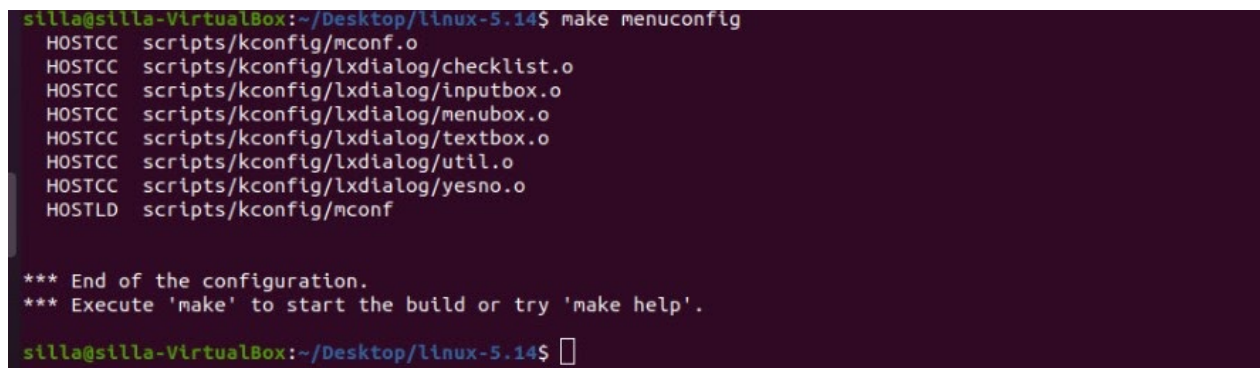
```
make menuconfig
```

To get text based color menus, radiolists & dialogs. This option is also useful on remote servers if you Want to compile the kernel remotely.

The menu configuration mentioned above is optional and you can use this option if you want to change some features or kernel driver or configuration.



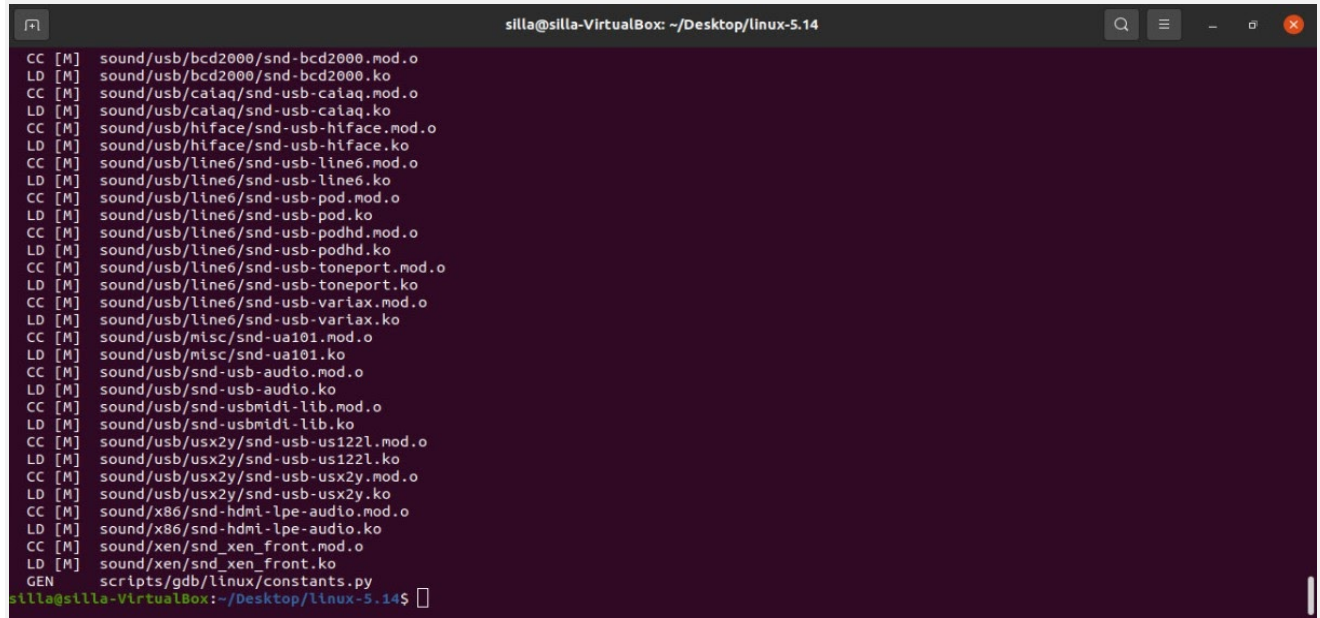
Save the configuration and exit, then the kernel configuration is complete. After that we will be given something like this.



8.Compilation of kernel:

1.Create a kernel image .

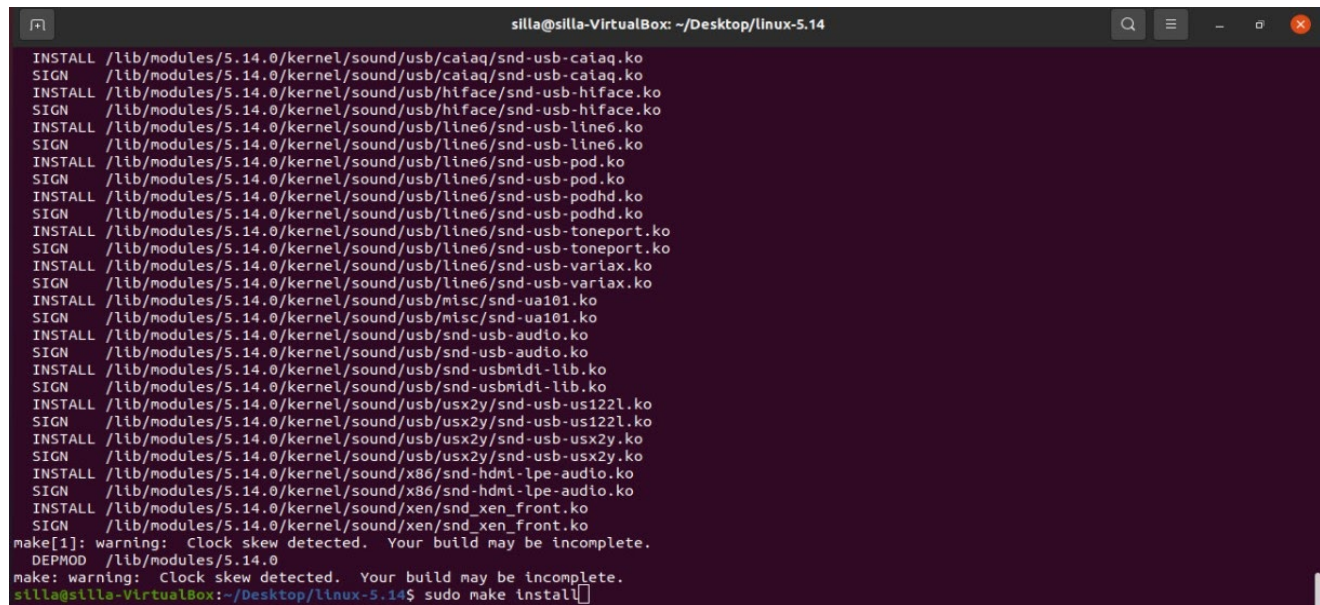
```
sudo make
```



```
silla@silla-VirtualBox: ~/Desktop/linux-5.14
CC [M] sound/usb/bcd2000/snd-bcd2000.mod.o
LD [M] sound/usb/bcd2000/snd-bcd2000.ko
CC [M] sound/usb/caiaq/snd-usb-caiaq.mod.o
LD [M] sound/usb/caiaq/snd-usb-caiaq.ko
CC [M] sound/usb/hiface/snd-usb-hiface.mod.o
LD [M] sound/usb/hiface/snd-usb-hiface.ko
CC [M] sound/usb/line6/snd-usb-line6.mod.o
LD [M] sound/usb/line6/snd-usb-line6.ko
CC [M] sound/usb/line6/snd-usb-pod.mod.o
LD [M] sound/usb/line6/snd-usb-pod.ko
CC [M] sound/usb/line6/snd-usb-podhd.mod.o
LD [M] sound/usb/line6/snd-usb-podhd.ko
CC [M] sound/usb/line6/snd-usb-toneport.mod.o
LD [M] sound/usb/line6/snd-usb-toneport.ko
CC [M] sound/usb/line6/snd-usb-variax.mod.o
LD [M] sound/usb/line6/snd-usb-variax.ko
CC [M] sound/usb/misc/snd-ua101.mod.o
LD [M] sound/usb/misc/snd-ua101.ko
CC [M] sound/usb/snd-usb-audio.mod.o
LD [M] sound/usb/snd-usb-audio.ko
CC [M] sound/usb/snd-usbmidi-lib.mod.o
LD [M] sound/usb/snd-usbmidi-lib.ko
CC [M] sound/usb/usx2y/snd-usb-us122l.mod.o
LD [M] sound/usb/usx2y/snd-usb-us122l.ko
CC [M] sound/usb/usx2y/snd-usb-usx2y.mod.o
LD [M] sound/usb/usx2y/snd-usb-usx2y.ko
CC [M] sound/x86/snd-hdmi-lpe-audio.mod.o
LD [M] sound/x86/snd-hdmi-lpe-audio.ko
CC [M] sound/xen/snd_xen_front.mod.o
LD [M] sound/xen/snd_xen_front.ko
GEN scripts/gdb/linux/constants.py
silla@silla-VirtualBox:~/Desktop/linux-5.14$
```

2.Install the kernel modules .

```
sudo make modules_install
```



```
silla@silla-VirtualBox: ~/Desktop/linux-5.14
INSTALL /lib/modules/5.14.0/kernel/sound/usb/caiaq/snd-usb-caiaq.ko
SIGN /lib/modules/5.14.0/kernel/sound/usb/caiaq/snd-usb-caiaq.ko
INSTALL /lib/modules/5.14.0/kernel/sound/usb/hiface/snd-usb-hiface.ko
SIGN /lib/modules/5.14.0/kernel/sound/usb/hiface/snd-usb-hiface.ko
INSTALL /lib/modules/5.14.0/kernel/sound/usb/line6/snd-usb-line6.ko
SIGN /lib/modules/5.14.0/kernel/sound/usb/line6/snd-usb-line6.ko
INSTALL /lib/modules/5.14.0/kernel/sound/usb/line6/snd-usb-pod.ko
SIGN /lib/modules/5.14.0/kernel/sound/usb/line6/snd-usb-pod.ko
INSTALL /lib/modules/5.14.0/kernel/sound/usb/line6/snd-usb-podhd.ko
SIGN /lib/modules/5.14.0/kernel/sound/usb/line6/snd-usb-podhd.ko
INSTALL /lib/modules/5.14.0/kernel/sound/usb/line6/snd-usb-toneport.ko
SIGN /lib/modules/5.14.0/kernel/sound/usb/line6/snd-usb-toneport.ko
INSTALL /lib/modules/5.14.0/kernel/sound/usb/line6/snd-usb-variax.ko
SIGN /lib/modules/5.14.0/kernel/sound/usb/line6/snd-usb-variax.ko
INSTALL /lib/modules/5.14.0/kernel/sound/usb/misc/snd-ua101.ko
SIGN /lib/modules/5.14.0/kernel/sound/usb/misc/snd-ua101.ko
INSTALL /lib/modules/5.14.0/kernel/sound/usb/snd-usb-audio.ko
SIGN /lib/modules/5.14.0/kernel/sound/usb/snd-usb-audio.ko
INSTALL /lib/modules/5.14.0/kernel/sound/usb/snd-usbmidi-lib.ko
SIGN /lib/modules/5.14.0/kernel/sound/usb/snd-usbmidi-lib.ko
INSTALL /lib/modules/5.14.0/kernel/sound/usb/usx2y/snd-usb-us122l.ko
SIGN /lib/modules/5.14.0/kernel/sound/usb/usx2y/snd-usb-us122l.ko
INSTALL /lib/modules/5.14.0/kernel/sound/usb/usx2y/snd-usb-usx2y.ko
SIGN /lib/modules/5.14.0/kernel/sound/usb/usx2y/snd-usb-usx2y.ko
INSTALL /lib/modules/5.14.0/kernel/sound/x86/snd-hdmi-lpe-audio.ko
SIGN /lib/modules/5.14.0/kernel/sound/x86/snd-hdmi-lpe-audio.ko
INSTALL /lib/modules/5.14.0/kernel/sound/xen/snd_xen_front.ko
SIGN /lib/modules/5.14.0/kernel/sound/xen/snd_xen_front.ko
make[1]: warning: Clock skew detected. Your build may be incomplete.
DEPMOD /lib/modules/5.14.0
make: warning: Clock skew detected. Your build may be incomplete.
silla@silla-VirtualBox:~/Desktop/linux-5.14$ sudo make install
```

3.Install the kernel.

```
sudo make install
```

This will copy the kernel and .config file to the /boot folder.

```
stilla@stilla-VirtualBox: ~/Desktop/linux-5.14$ sudo make install
arch/x86/Makefile:148: CONFIG_X86_X32 enabled but no binutils support
make: Warning: File 'vmlinuz.cmd' has modification time 4451 s in the future
make[1]: Warning: File 'arch/x86/boot/.zoffset.h.cmd' has modification time 4474 s in the future
sh ./arch/x86/boot/install.sh \
  5.14.0 arch/x86/boot/bzImage \
  System.map "/boot"
run-parts: executing /etc/kernel/postinst.d/apt-auto-removal 5.14.0 /boot/vmlinuz-5.14.0
run-parts: executing /etc/kernel/postinst.d/dkms 5.14.0 /boot/vmlinuz-5.14.0
* dkms: running auto installation service for kernel 5.14.0
run-parts: executing /etc/kernel/postinst.d/initramfs-tools 5.14.0 /boot/vmlinuz-5.14.0
update-initramfs: Generating /boot/initrd.img-5.14.0
run-parts: executing /etc/kernel/postinst.d/unattended-upgrades 5.14.0 /boot/vmlinuz-5.14.0
run-parts: executing /etc/kernel/postinst.d/update-notifier 5.14.0 /boot/vmlinuz-5.14.0
run-parts: executing /etc/kernel/postinst.d/vboxadd 5.14.0 /boot/vmlinuz-5.14.0
VirtualBox Guest Additions: Building the modules for kernel 5.14.0.
VirtualBox Guest Additions: Look at /var/log/vboxadd-setup.log to find out what
went wrong
run-parts: executing /etc/kernel/postinst.d/xx-update-initrd-links 5.14.0 /boot/vmlinuz-5.14.0
I: /boot/initrd.img is now a symlink to initrd.img-5.14.0
run-parts: executing /etc/kernel/postinst.d/zz-update-grub 5.14.0 /boot/vmlinuz-5.14.0
Sourcing file '/etc/default/grub'
Sourcing file '/etc/default/grub.d/init-select.cfg'
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-5.14.0
Found initrd image: /boot/initrd.img-5.14.0
Found linux image: /boot/vmlinuz-5.11.0-27-generic
Found initrd image: /boot/initrd.img-5.11.0-27-generic
Found memtest86+ image: /boot/memtest86+.elf
Found memtest86+ image: /boot/memtest86+.bin
done
make[1]: warning: Clock skew detected. Your build may be incomplete.
make: warning: Clock skew detected. Your build may be incomplete.
stilla@stilla-VirtualBox: ~/Desktop/linux-5.14$
```

Now the grub is also updated.

9.Rebooting and Grub-menu: Reboot the device and hold

down the *Shift*-Key while booting to retrieve the Grub menu.

Click on the 'Advanced option for Ubuntu', which will take you to the next menu with a list of kernels. Select the appropriate one and login.

GNU GRUB version 2.04

```
*Ubuntu
Advanced options for Ubuntu
Memory test (memtest86+)
Memory test (memtest86+, serial console 115200)
```

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.

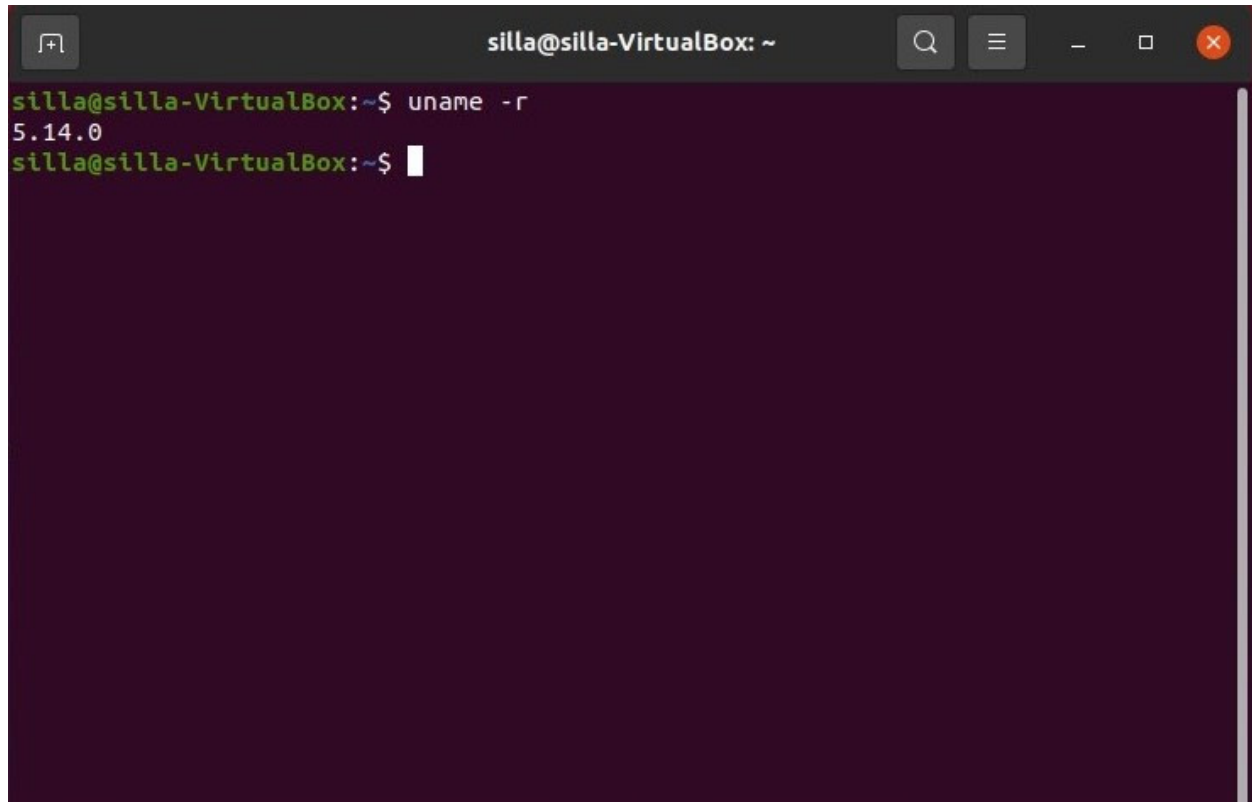
GNU GRUB version 2.04

```
*Ubuntu, with Linux 5.14.0
Ubuntu, with Linux 5.14.0 (recovery mode)
Ubuntu, with Linux 5.11.0-27-generic
Ubuntu, with Linux 5.11.0-27-generic (recovery mode)
```

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.

10.Verification: To view the kernel version (In my case:5.14.0),
go to terminal and write the command

```
uname -r
```

A screenshot of a terminal window titled 'silla@silla-VirtualBox: ~'. The terminal has a dark purple background. The prompt 'silla@silla-VirtualBox:~\$' is shown in green. The command 'uname -r' has been entered and executed, resulting in the output '5.14.0' displayed in green. A new prompt 'silla@silla-VirtualBox:~\$' is visible below the output, with a white cursor at the end.

```
silla@silla-VirtualBox:~$ uname -r
5.14.0
silla@silla-VirtualBox:~$
```

And Done!