Student ID: 1806235731

Name: Muhammad Tsaqif Al Bari

Class: B

Logbook W12 – Compile Kernel

Compile and install a new kernel (Generic Way)

Step-by-step on how to compile and install a new kernel

1. Get yourself a kernel

```
user@sysprog-ova:~/compile-kernel$ dir
linux-5.9.12.tar.xz
user@sysprog-ova:~/compile-kernel$ tar -xf linux-5.9.12.tar.xz
user@sysprog-ova:~/compile-kernel$ ls -a
.  ..  linux-5.9.12  linux-5.9.12.tar.xz
```

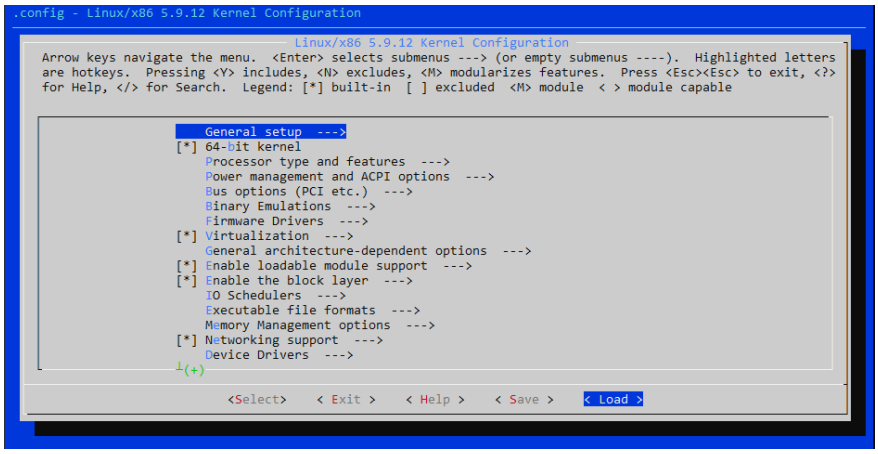
   The first thing we need to compile and install a kernel is well, a kernel. Kernel can be downloaded from many sources. For this worksheet, I am using linux 5.9.12 from https://www.kernel.org/. I will also be using a virtual box machine for this worksheet. So after downloading my kernel, I sftp it to my virtual box machine and extract it.

2. Make/Get a .config file

```
user@sysprog-ova:/boot$ dir
config-4.15.0-126-generic  initrd.img-4.15.0-126-generic  System.map-4.15.0-58-generic
config-4.15.0-58-generic   initrd.img-4.15.0-58-generic   vmlinuz-4.15.0-126-generic
grub                       System.map-4.15.0-126-generic  vmlinuz-4.15.0-58-generic
user@sysprog-ova:/boot$ cd $HOME/compile-kernel
user@sysprog-ova:~/compile-kernel$ cd linux-5.9.12/
user@sysprog-ova:~/compile-kernel/linux-5.9.12$ cp /boot/config-4.15.0-126-generic ./.config
user@sysprog-ova:~/compile-kernel/linux-5.9.12$ ls -a
.       .clang-format  crypto                .gitattributes  Kbuild    .mailmap     README    tools
..      .cocciconfig   Documentation         .gitignore      Kconfig   MAINTAINERS  samples   usr
arch    .config        drivers               include         kernel    Makefile     scripts   virt
block   COPYING        fs                    init            lib       mm           security
certs   CREDITS        .get_maintainer.ignore  ipc           LICENSES  net          sound
user@sysprog-ova:~/compile-kernel/linux-5.9.12$
```

   After downloading a kernel, we need a .config file. We can write our own .config file but it is best practice to copy a working .config file and modify it to our needs. A config file can be found on /boot directory under the name config-<version>.

3. Modify and save the .config file



   We can modify our config file in various ways, either writing it directly, or use an editor like menuconfig (make menuconfig), but it is best practice to use an editor than writing

over it directly. Since this tutorial does not require any modification, I would just go ahead load and save.

4. Set CONCURRENCY_LmakEVEL

```
root@sysprog-ova:/home/user/compile-kernel/linux-5.9.12# export CONCURRENCY_LmakeEVEL=5
root@sysprog-ova:/home/user/compile-kernel/linux-5.9.12#
```

Before compiling, we can set the number of CPU cores for compiling. For this worksheet I allocated 6 CPU cores to my virtual machine, so I would use 5 of those CPU for compiling, left one for other virtual machine needs. This step is optional though.

5. Clean up

```
root@sysprog-ova:/home/user/compile-kernel/linux-5.9.12# make-kpkg clean
exec make kpkg_version=13.018+nmu1 -f /usr/share/kernel-package/ruleset/minimal.mk clean
====== making target minimal_clean [new prereqs: ]======
This is kernel package version 13.018+nmu1.
test ! -f .config || cp -pf .config config.precious
test ! -e stamp-building || rm -f stamp-building
test ! -f Makefile || \
            make    ARCH=x86_64 distclean
make[1]: Entering directory '/home/user/compile-kernel/linux-5.9.12'
  CLEAN   scripts/basic
  CLEAN   scripts/kconfig
  CLEAN   include/config include/generated .config .config.old
make[1]: Leaving directory '/home/user/compile-kernel/linux-5.9.12'
test ! -f config.precious || mv -f config.precious .config
rm -f modules/modversions.h modules/ksyms.ver scripts/cramfs/cramfsck scripts/cramfs/mkcramfs
root@sysprog-ova:/home/user/compile-kernel/linux-5.9.12#
```

Another thing we could do is do run a clean up with make-kpkg clean. This is not necessarily a “must” step but I would recommend it since compiling is not a quick task and the last thing I want is after compiling for half an hour is an error message because of something I may not know.

6. Begin compiling

```
root@sysprog-ova:/home/user/compile-kernel/linux-5.9.12# make-kpkg -j 6 --initrd --append-to-version="-1806235731" ke
rnel_image kernel_headers
```

Begin compiling with the make-kpkg command. There some other parameters we fill such as:

a. -j : Number of CPU cores. My virtual machine have 6 CPU cores
b. –initrd : To create an initrd file
c. –append-to-version : Add an extra text after version number. For this worksheet it is required to put our Student ID.
d. kernel_image : Create a kernel image
e. kernel_headers : Create a kernel headers

7. Install the modules

```
root@sysprog-ova:/home/user/compile-kernel/linux-5.9.12# make modules_install
```

After we finish compiling our kernel, next is to install them. For installing, first we need to install all the modules to our machine with make modules_install on our extracted linux directory.

8. Install the kernel

```
root@sysprog-ova:/home/user/compile-kernel/linux-5.9.12# make install
```

After installing our modules, we could go ahead and install our kernel with make install on our extracted linux directory.

9. Update grub

```
root@sysprog-ova:/boot# ls -a
.                         config-5.9.12-1806235731       initrd.img-5.9.12-1806235731   vmlinuz-4.15.0-126-generic
..                        grub                           System.map-4.15.0-126-generic  vmlinuz-4.15.0-58-generic
config-4.15.0-126-generic initrd.img-4.15.0-126-generic  System.map-4.15.0-58-generic   vmlinuz-5.9.12-1806235731
config-4.15.0-58-generic  initrd.img-4.15.0-58-generic   System.map-5.9.12-1806235731
root@sysprog-ova:/boot#
```

```
root@sysprog-ova:/boot# update-grub
Sourcing file `/etc/default/grub'
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-5.9.12-1806235731
Found initrd image: /boot/initrd.img-5.9.12-1806235731
Found linux image: /boot/vmlinuz-4.15.0-126-generic
Found initrd image: /boot/initrd.img-4.15.0-126-generic
Found linux image: /boot/vmlinuz-4.15.0-58-generic
Found initrd image: /boot/initrd.img-4.15.0-58-generic
done
root@sysprog-ova:/boot#
```

After installing our kernel, we need to tell our machine to use that kernel on the next boot. With update-grub, we tell grub to update itself about the new compiled kernel we just made.

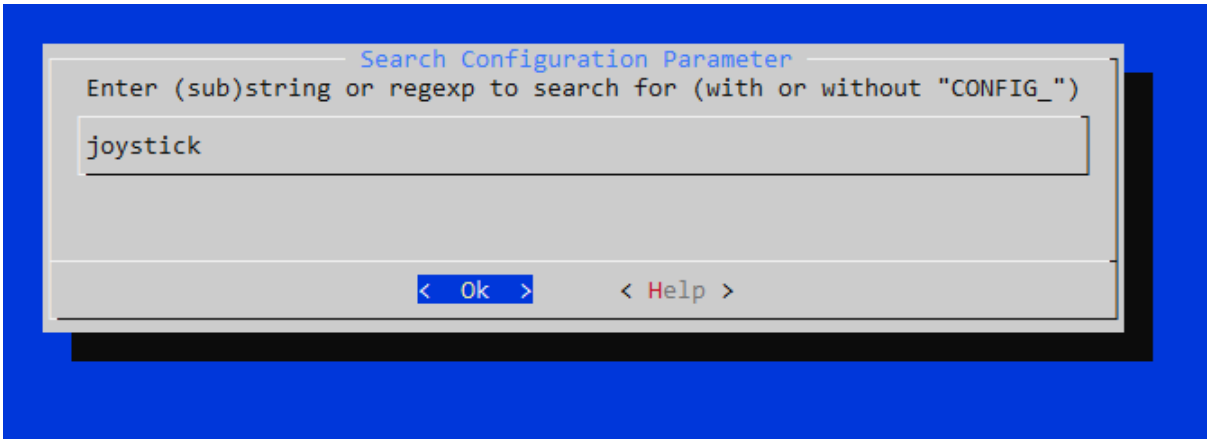
10. Done

```
user@sysprog-ova:~$ uname -a
Linux sysprog-ova 5.9.12-1806235731 #1 SMP Mon Dec 7 06:30:32 UTC 2020 x86_64 x86_64 x86_64 GNU/Linux
user@sysprog-ova:~$
```

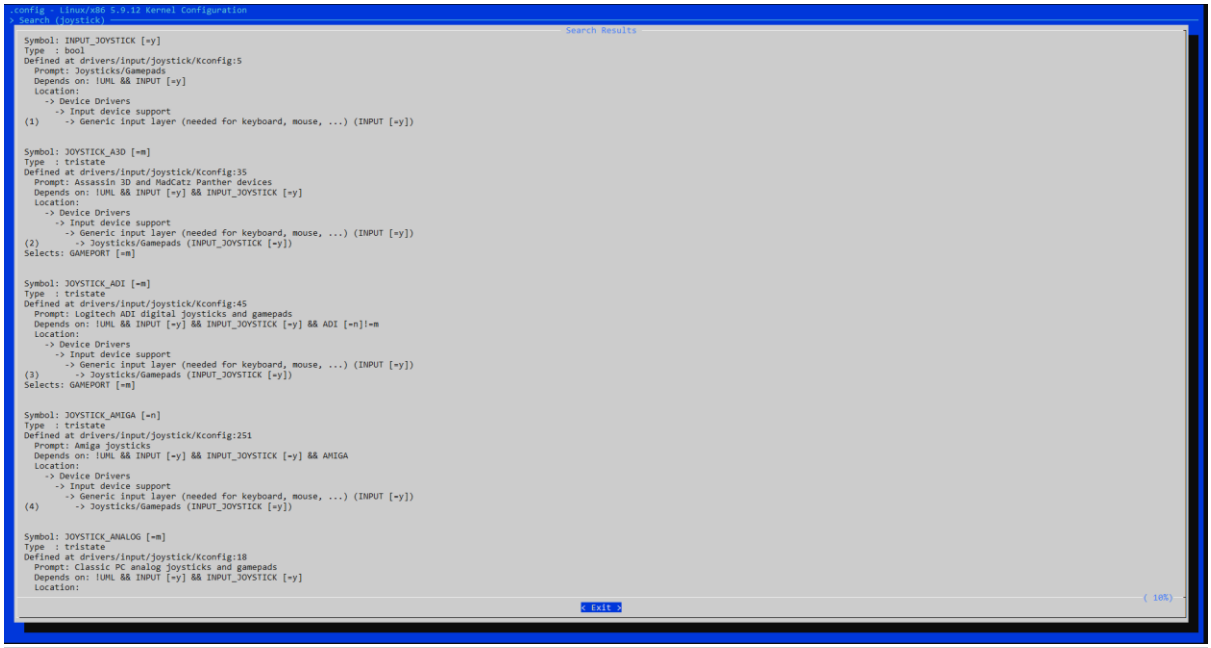
After a restart, hopefully we would get this result.

Removing Joystick Driver

1. Set Up
   This task is similar with the mandatory task with the only difference in this task we actually modify our kernel to remove joystick drivers from the kernel. First, download and extract a kernel and copy a working .config file to the extracted kernel directory. Open make menuconfig and load up our copied .config file.
2. Search for drivers



There’s a nice feature on menuconfig which is a configuration search, use <?> to open it. Search up joystick.




```
Symbol: INPUT_JOYSTICK [=y]
Type  : bool
Defined at drivers/input/joystick/Kconfig:5
  Prompt: Joysticks/Gamepads
  Depends on: !UML && INPUT [=y]
  Location:
    -> Device Drivers
      -> Input device support
(1)     -> Generic input layer (needed for keyboard, mouse, ...) (INPUT [=y])
```

From the search we get a list of driver's name and their path on menuconfig which relates to joystick. At the top of the search is a root path from where all of the other result. This is where all of the variations of joystick drivers is controlled.

3. Remove Joystick

```
[*]   Mice  --->
[ ]   Joysticks/Gamepads  ----
[*]   Tablets  --->
[*]   Touchscreens  --->
[*]   Miscellaneous devices  --->
```

From the result we go to Device Drivers → Input device support → Generic input layer. There we found Joysticks/Gamepads. Next we press <N> to remove Joysticks from our kernel.

4. Compile, install, update, and reset

Next we follow what we did on mandatory task, compile, install, update, and reset.

```
root@sysprog-ova:/home/user/compile-kernel/linux-5.9.12# export CONCURRENCY_LmakEVEL=5
root@sysprog-ova:/home/user/compile-kernel/linux-5.9.12#
root@sysprog-ova:/home/user/compile-kernel/linux-5.9.12# make-kpkg -j 6 --initrd --append-to-version="-1806235731-no-joy
stick" kernel_image kernel_headers
root@sysprog-ova:/home/user/compile-kernel/linux-5.9.12# make modules_install
```

```
root@sysprog-ova:/home/user/compile-kernel/linux-5.9.12# make install
```

```
root@sysprog-ova:/boot# update-grub
Sourcing file `/etc/default/grub'
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-5.9.12-1806235731-no-joystick
Found initrd image: /boot/initrd.img-5.9.12-1806235731-no-joystick
Found linux image: /boot/vmlinuz-5.9.12-1806235731
Found initrd image: /boot/initrd.img-5.9.12-1806235731
Found linux image: /boot/vmlinuz-4.15.0-126-generic
Found initrd image: /boot/initrd.img-4.15.0-126-generic
Found linux image: /boot/vmlinuz-4.15.0-58-generic
Found initrd image: /boot/initrd.img-4.15.0-58-generic
done
root@sysprog-ova:/boot#
```

```
user@sysprog-ova:~$ uname -a
Linux sysprog-ova 5.9.12-1806235731-no-joystick #1 SMP Tue Dec 8 03:36:54 UTC 2020 x86_64 x86_64 x86_64 GNU/Linux
user@sysprog-ova:~$
```

5. Confirmation

   Next we can check if our kernel have removed that module.

```
user@sysprog-ova:/lib/modules/5.9.12-1806235731/kernel/drivers/input$ ls -a
.   evbug.ko       gameport       input-polldev.ko  joystick  matrix-keymap.ko  mouse  serio            tablet
..  ff-memless.ko  input-leds.ko  joydev.ko        keyboard  misc              rmi4   sparse-keymap.ko  touchscreen
```

```
user@sysprog-ova:/lib/modules/5.9.12-1806235731-no-joystick/kernel/drivers/input$ ls -a
.   evbug.ko       gameport       input-polldev.ko  keyboard          misc   rmi4   sparse-keymap.ko  touchscreen
..  ff-memless.ko  input-leds.ko  joydev.ko        matrix-keymap.ko  mouse  serio  tablet
```

   On /lib/modules/<version>/kernel/drivers/input, we could see there's a difference between our previous kernel, 5.9.12-1806235731 and our new kernel 5.9.12-1806235731-no-joystick. Joystick modules does not exist in .9.12-1806235731-no-joystick.