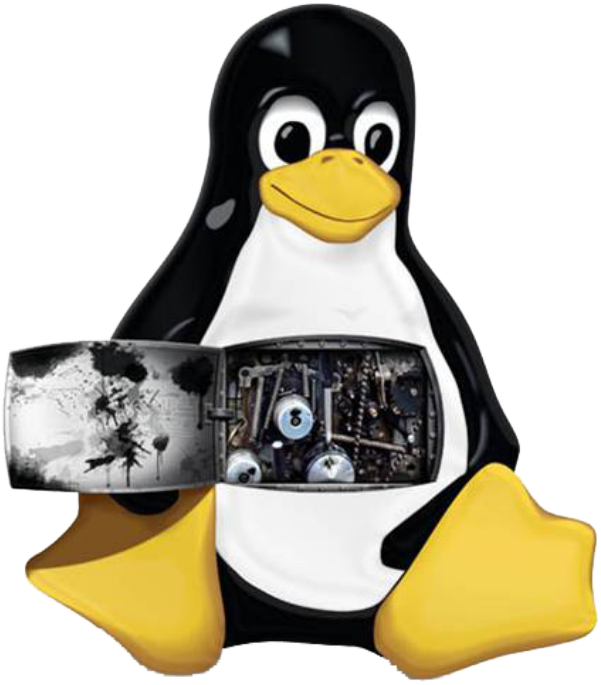
Linux Kernel Development (LKD)

Session 2



CISTER Framework: Laboratory 1

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INESCTEC

1 Tools and packages

In order to install the required tools and packages, open a terminal and type the following linux commands:

```
> sudo apt-get update
> sudo apt-get install libncurses5-dev
```

2 Showing grub menu

It is a good practice, to show the grub menu during the system boot. Because this allows us to choose the kernel version to boot.

1. Then, we must change the `/etc/default/grub` file to show the grub menu.

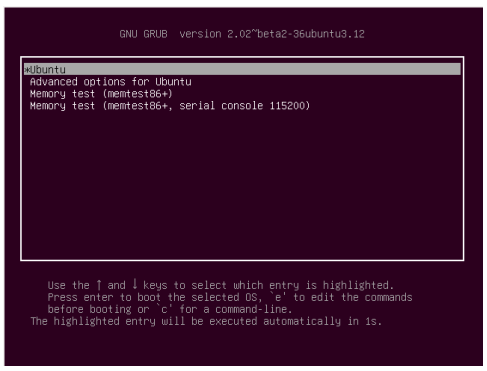
   So, for that type:
   `> sudo gedit /etc/default/grub`
   and comment the `GRUB_HIDDEN_TIMEOUT` option with a #:

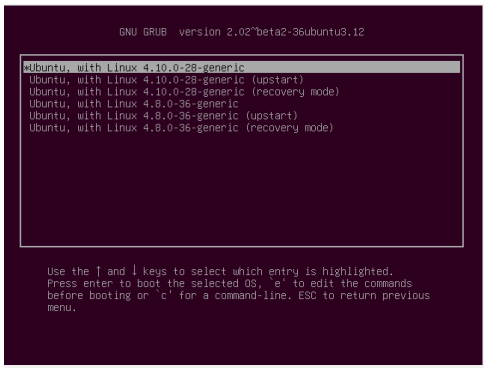
```
# If you change this file, run 'update-grub' afterwards to update
# /boot/grub/grub.cfg.
# For full documentation of the options in this file, see:
# info -f grub -n 'Simple configuration'

GRUB_DEFAULT=0
 # GRUB_HIDDEN_TIMEOUT=0
GRUB_HIDDEN_TIMEOUT_QUIET=true
GRUB_TIMEOUT=10
GRUB_DISTRIBUTOR=`lsb_release -i -s 2> /dev/null || echo Debian`
GRUB_CMDLINE_LINUX_DEFAULT="quiet splash"
GRUB_CMDLINE_LINUX=""
...
```

2. Save and close.

3. Next step is to update the grub. For that, type:
   `> sudo update-grub2`

4. Reboot the machine, typing:
   `> sudo reboot`





At boot process, the Grub menu is showed, use the "up" and "down" arrow keys and the "Enter" key to select the kernel version you want to boot.

3 Get Linux kernel source code

1. Create the `kernel_sc` directory:
   `> mkdir kernel_sc`
   and change to that directory:
   `> cd kernel_sc`

2. Next get the source code from `http://kernel.org/`. For that type:
   `> wget http://www.kernel.org/pub/linux/kernel/v4.x/linux-4.12.4.tar.xz`

3. Extract tar (.tar.xz) file:
   `> tar -xf linux-4.12.4.tar.xz`

4. Rename `linux-4.12.4` directory to `linux-4.12.4-cister` typing:
   `> mv linux-4.12.4 linux-4.12.4-cister`

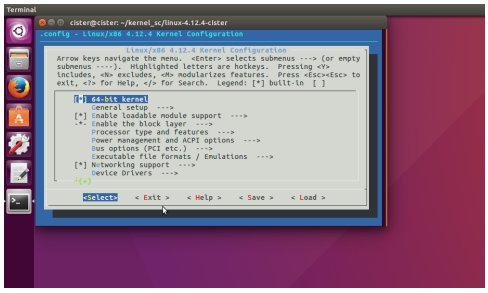
5. Download `config-4.12.4-cister` file from `http://www.cister.isep.ipp.pt/summer2017/w1/config-4.12.4-cister` by typing:
   `> wget http://www.cister.isep.ipp.pt/summer2017/w1/config-4.12.4-cister`

6. Copy the `config-4.12.4-cister` file to `linux-4.12.4-cister` directory changing the file name to `.config`:
   `> cp config-4.12.4-cister linux-4.12.4-cister/.config`

4 Configuring Linux kernel

1. Before compiling the Linux kernel type:
   `> cd linux-4.12.4-cister`

2. In order to customize the build and kernel options type:
   `> make menuconfig`



3. Using "Up", "Down", "Left" and "Right", "Space" and "Enter" keys you could select the appropriate compiling options. In this case, choose the "Exit".

4. Return to the `kernel_sc` directory, by typing:
   `> cd ..`

5 Customize Linux kernel version

1. In order to customize the Linux kernel version, edit `Makefile` file for adding `-cister` to `EXTRAVERSION` field. For that, type:
   `> gedit linux-4.12.4-cister/Makefile`

```
VERSION = 4
PATCHLEVEL = 12
SUBLEVEL = 4
EXTRAVERSION = -cister
NAME = Fearless Coyote

# *DOCUMENTATION*
# To see a list of typical targets execute "make help"
# More info can be located in ./README
# Comments in this file are targeted only to the developer, do not
# expect to learn how to build the kernel reading this file.
...
```

2. Save and close.

6 Compiling and installing Linux kernel

For compiling and installing the Linux kernel, it is necessary to execute the following comands:

```
> cd linux-4.12.4-cister
> make
> make modules
> sudo make modules_install
> sudo make install
> cd ..
> sudo update-grub2
> sudo reboot
```

1. So, in order to optimize this process you can download a script file from `http://www.cister.isep.ipp.pt/summer2017/w1/kcompile.sh`. Type:
   `> wget http://www.cister.isep.ipp.pt/summer2017/w1/kcompile.sh`

```
#!/bin/bash
start=$(date +'%s')
cd linux-4.12.4-cister
sudo make 2>../errors_4.12.4-cister
sudo make modules
sudo make modules_install
sudo make install
cd ..
sudo update-grub2
cat errors_4.12.4-cister
echo "Linux kernel compilation and installation took $(($(date +'%s') - $start)) seconds"
```

2. Assign execution permission to the `kcompile.sh` script file, by:
   `> sudo chmod 755 kcompile.sh`

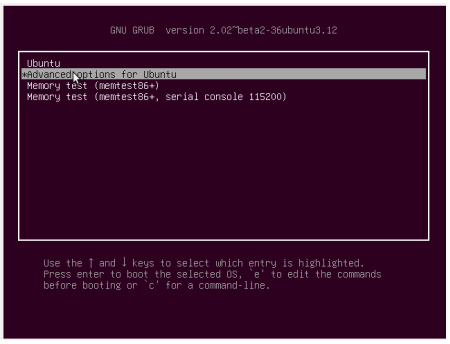
3. The next step, is to execute `kcompile.sh` script file:
   `> sudo ./kcompile.sh`
   This script creates a file called `errors_4.12.4-cister` where it outputs the compilation messages.

4. The last step is to reboot the machine.
   `> sudo reboot`

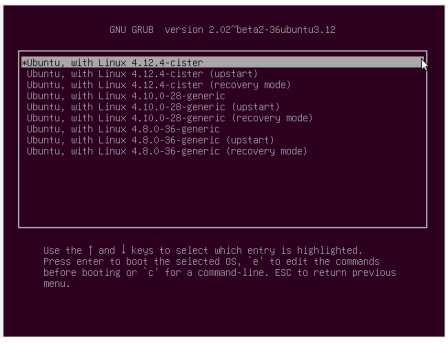
7 Booting Linux kernel 4.12.4-cister

1. During the system boot, when it presents the grub menu:

   (a) Select `Advanced options for Ubuntu` and press the "Enter" key;



   (b) Choose `Ubuntu, with Linux 4.12.4-cister` and press the "Enter" key.

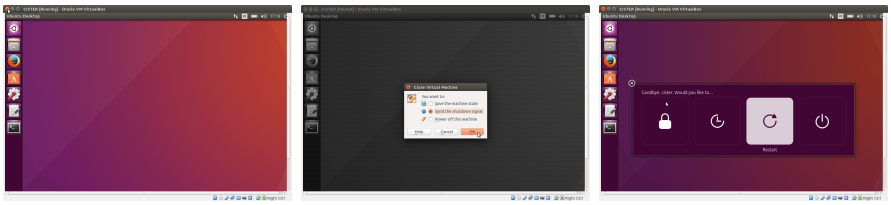


2. After booting and login, check the mouse pointer. There is no mouse!

8 Getting the mouse

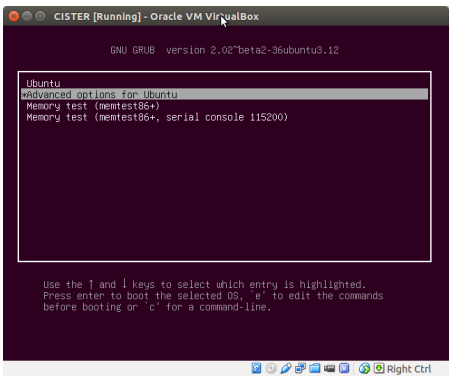
In order to get the mouse, you have to reboot the machine and boot it using a full functional kernel version.

1. Reboot the machine, by sending a shutdown signal.

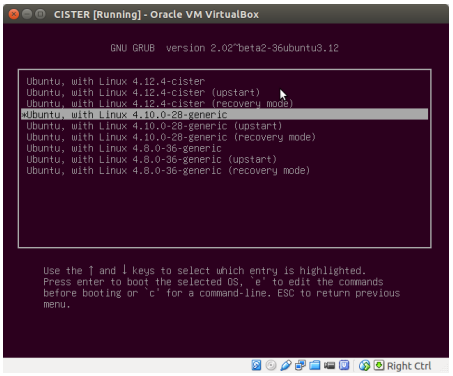


2. During the system boot, when it presents the grub menu:

   (a) Select `Advanced options for Ubuntu` and press the "Enter" key;



   (b) Choose `Ubuntu, with Linux 4.10.0-28-generic` and press the "Enter" key.

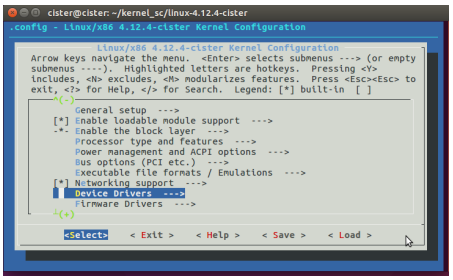


3. After booting and login, open a terminal and:
   `> cd kernel_sc/linux 4.12.4-cister`

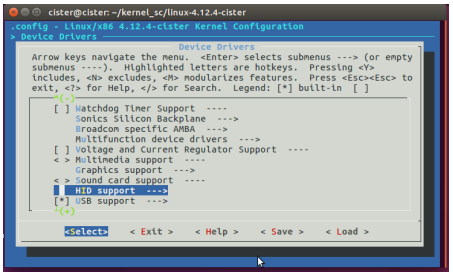
4. Then, type:
   `> make menuconfig`

5. Using Arrows keys, select:

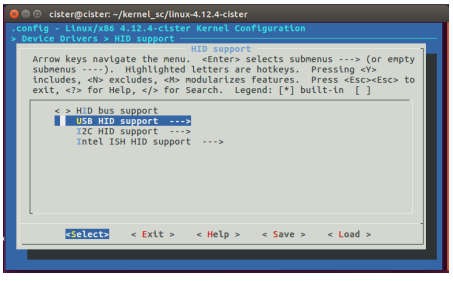
   (a) `Device Drivers`



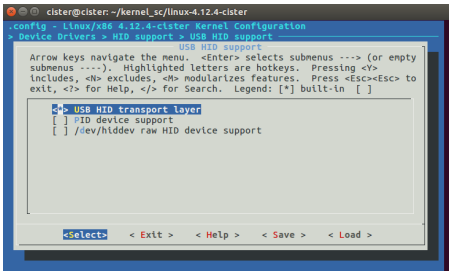
   (b) `HID support`



   (c) `USB HID support`

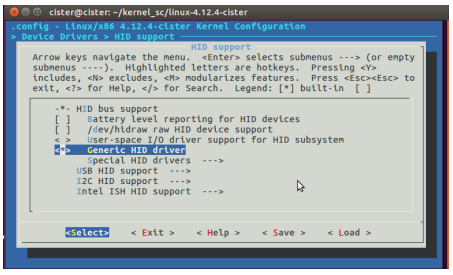


(d) `USB HID transport layer`



(e) Exit

(f) `Generic HID driver`



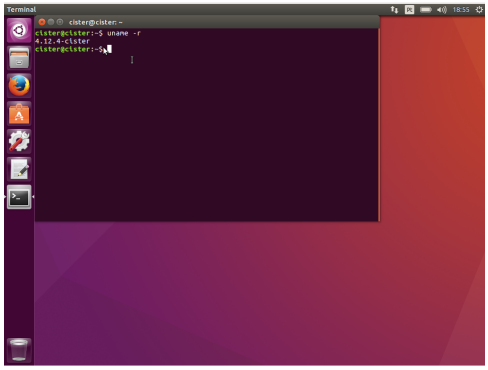
(g) Exit and save.

6. Move to `kernel_sc` directory:
   `> cd ..`

7. Then, compile and install the Linux kernel:
   `> sudo ./kcompile.sh`

8. Reboot
   `> sudo reboot`

9. After booting and login, open a terminal and type:
   `> uname -r`


Terminal
cister@cister: ~
cister@cister:~$ uname -r
4.12.4-clster
cister@cister:~$