OS Project 0
Build Linux Kernel

Advisor : Chien-Chung Ho

TA : Zong-Zhe Yang

Shih-Hao Chin

What is “Kernel”

- Kernel[1]
  - The kernel is a fundamental part of a modern computer‘s operating system
  - The kernel's primary function
    - Manage the computer's hardware and resources
    - Allow other programs to run and use these resources
  - Resources managed by the kernel consist of
    - Central Processing Unit (CPU)
    - Main memory
    - Input/Output (I/O) devices

Environment Setup (1)

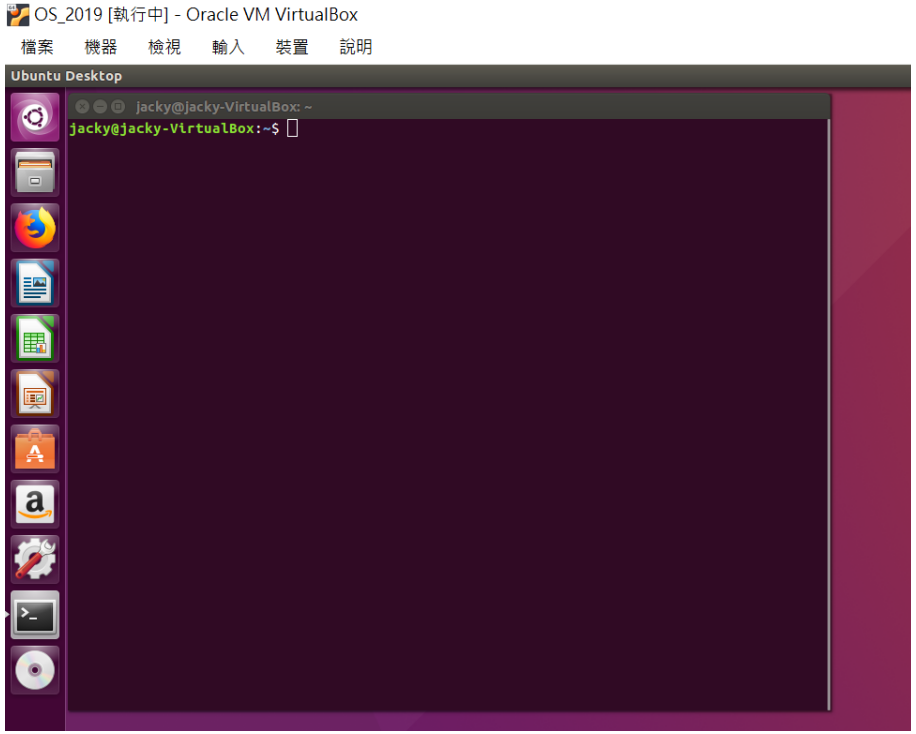
- In this course, you will be requested to do some implementations on the Linux kernel.
- To avoid some unexpected troubles due to the various hardware environment, we will use the virtual machine to implement the following projects.
- You should prepare a computer which installs the linux operating system, so as to implement the following projects

Environment Setup (2)

- Please download the following two programs, and both of them are free for use
- VirtualBox 6.0.12 platform packages[2]
  - Download link: https://www.virtualbox.org/wiki/Downloads
- Ubuntu 16.04.6 64bits LTS[3]
  - Download link(Desktop): https://www.ubuntu-tw.org/modules/tinyd0/
  - Make sure that your version is 64bits
- Install the Ubuntu 16.04.6 on the VitualBox

Building Linux Kernel(1)

- After the Linux installation, please login your Ubuntu and open a terminal to start your first experiment of building the Linux kernel



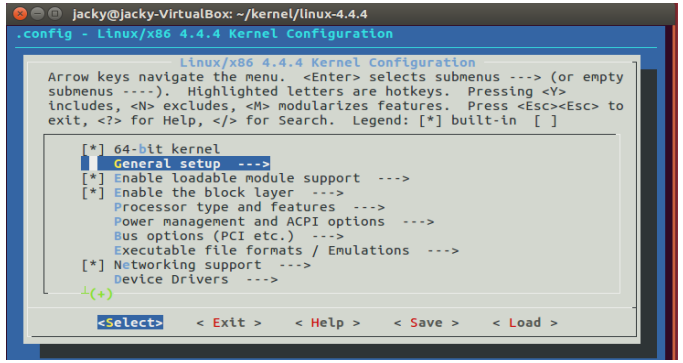
Building Linux Kernel(2)

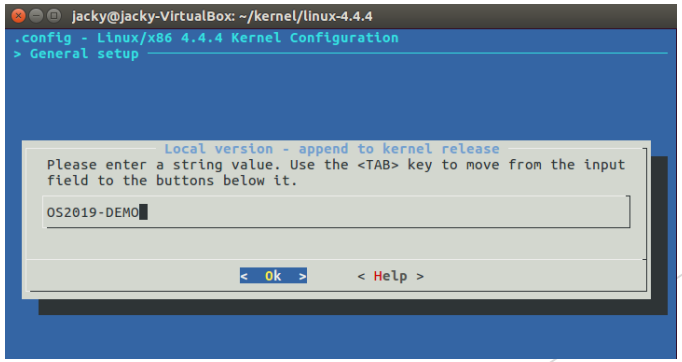
- Building Linux Kernel(2)
  1) mkdir kernels
  2) cd kernels
  3) wget https://mirrors.edge.kernel.org/pub/linux/kernel/v4.x/linux-4.4.4.tar.xz
  4) tar Jxvf linux-4.4.4.tar.xz
  5) cd linux-4.4.4
  6) Install build tools sudo apt-get install fakeroot kernel-package libncurses5 libncurses5-dev libc6-dev libssl-dev build-essential
  7) make mrproper

Building Linux Kernel(3)

8) make menuconfig

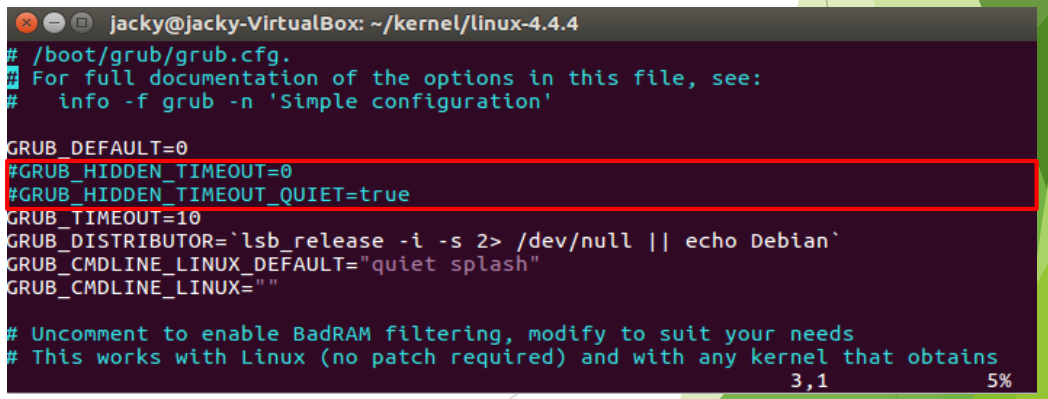
- Select (use “y”) the following options, the others use default setting
  - Device Drivers -->Fusion MPT device support -->Fusion MPT ScsiHost drivers for SPI
  - Device Drivers -->Generic Deriver Options --> Maintain a devtmpfs to mount at /dev
  - Device Drivers -->Generic Deriver Options --> Automount devtmpfs ar /dev, after the kernel mounted the rootfs
  - General setup → Local version → -StudentID1-StudentID2 (Do not use blank space)





Building Linux Kernel(5)

- Building Linux Kernel(2)
  9) make
     - You can use make –j # (# is the number of your physical cores) to create multiple threads to speed up the kernel building)
  10) make modules
  11) sudo make modules_install
  12) sudo make install
  13) sudo apt-get install vim-gtk
  14) sudo vim /etc/default/grub
     - Add "#" to comment the following 2 lines
       - #GRUB_HIDDEN_TIMEOUT=10
       - #GRUB_HIDDEN_TIMEOUT_QUIET=true



Building Linux Kernel(6)

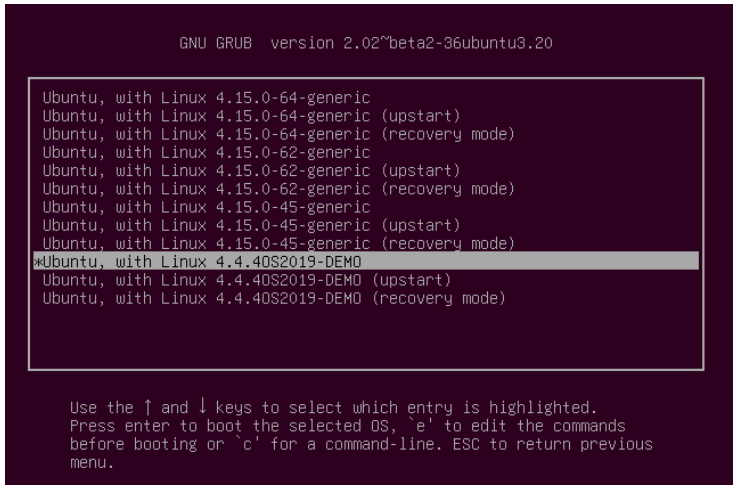
15) sudo update-grub2

16) sudo shutdown -r now

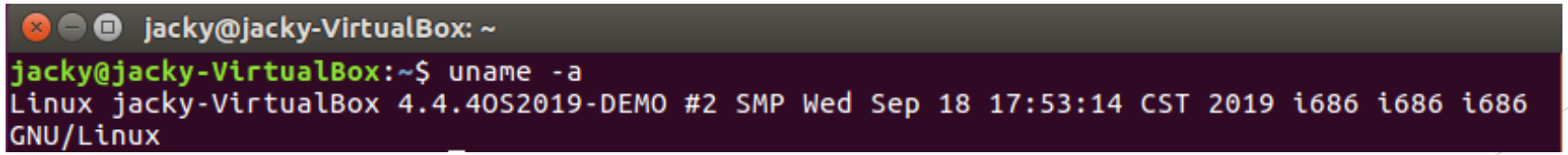
* Install tool : vboxadditions
  - Some people might have problems of failing on doing the "make menuconfig" due to the small resolution of window size. Please install the virtualbox tool to enable change the resolution of the window size.

Building Linux Kernel(7)

17) Now, you can select the version 4.4.4 kernel in the GNU grub to boot your Ubuntu.



18)Then, you can use terminal and type "uname –a" to check the kernel version.



Project Requirements

- Build your own kernel image. Pack the corresponding files and upload them into the FTP server : 140.123.105.185 ; user ID: OS2019 ; pass: 2019OS (50%)
- Bonus (30%)
  - In the step of "make menuconfig", you can enable/disable some functionalities as you want.
  - Please try to **minimize the size** of your built kernel image and **maintain its internet functionalities** as well.
- Write a project report (PDF format, within 2~4 pages) (40%)
  - What do you learn from this project
  - Is there any problem when you are implementing the project, state it
  - Which item is disabled by you in the bonus part, and what is its functionalities?

Project Notification

- In the following projects, you are requested to implement the requirement by groups.
- **2 members a team**
- Check your team number ## in the ecourse / ecourse2

Submit Requirement

- Project deadline: 2019/10/08 23:59
- **Delayed submissions yield 5 point deduction per day**
- The team project should
  - Contain your report (**PDF format, within 2~4 pages**)
  - Contain your built kernel image files, as follows
    - **/boot/vmlinuz-4.4.4**
    - **/boot/config-4.4.4**
    - **/boot/System.map-4.4.4**
    - **/boot/initrd.image-4.4.4**
    - **linux-image-4.4.4StudentID_10.00.Custom_amd64.deb**
      - **Building Debian package :** https://hackmd.io/@ULxjDFy0QLKSAQnD5DMKtQ/BkJW9iwvB
  - Be packed as one file named "OSPJ**0**_Team**##**.**ZIP**"
- **DO NOT COPY THE HOMEWORK**

Contact TAs

- If you have any problem about the projects or this course, you can contact TAs by the following ways.
- Facebook: CCU OS2019 Fall Group.
  - https://www.facebook.com/groups/1319131934920970/
  - E-mail: Shih-Hao Chin: ae8681239@gmail.com

    Zong-Zhe Yang : daankfust123@gmail.com

References

[1] Wikipedia http://en.wikipedia.org/wiki/Kernel_(computing)

[2] VirtualBox https://www.virtualbox.org/

[3] Ubuntu http://www.ubuntu.com/

[4] sudo wikipedia http://en.wikipedia.org/wiki/Sudo

[5] Kernel module http://en.wikipedia.org/wiki/Loadable_kernel_module

[6] 鳥哥的Linux私房菜 http://linux.vbird.org/linux_basic/0540kernel.php

[7] GRUB2 https://help.ubuntu.com/community/Grub2

References

[8] fakeroot:使用 remote server, 需要使用有 root 權限指令時可能無法取得, 因此使用 pseudo root

https://unix.stackexchange.com/questions/9714/what-is-the-need-for-fakeroot-command-in-linux

[9] build-essential : 可以安裝編譯需要的套件

https://www.virtualbox.org/

[10] kernel-package : 同樣也是安裝編譯需要的套件

https://packages.ubuntu.com/zh-tw/xenial/kernel-package

[11] libncurses5, libncurses5-dev : unix 圖形函式庫, 提供文字化圖形介面給如 ssh 連線使用