Jetson Zoo

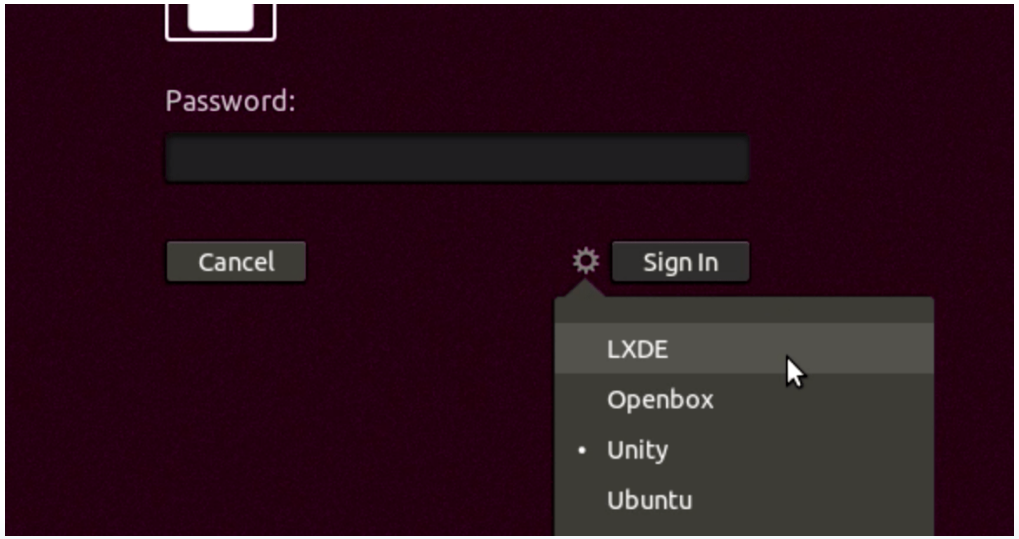
Real-time Inference on Jetson Nano

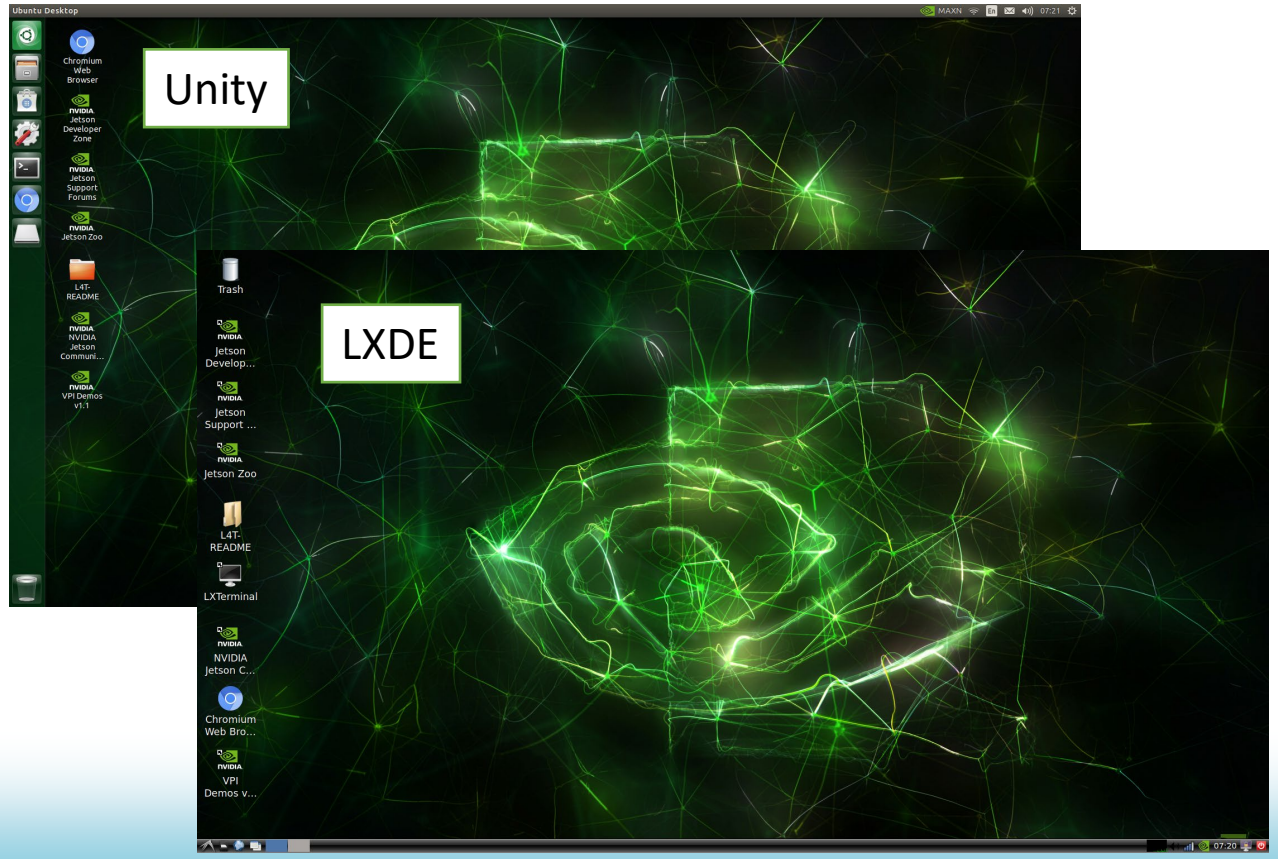
【110上】嵌入式系統技術實驗課程

TA: 陳翰群 hanz1211.ee09@nycu.edu.tw

Tips: Save Memory with LXDE

- If you need more RAM or do not work with GUI that much, you can switch to LXDE desktop environment.
- Logout, and below the password input section is a gear icon you can switch the desktop environment you want.
- Choose LXDE and Sign In.





Optional: Connect with SSH

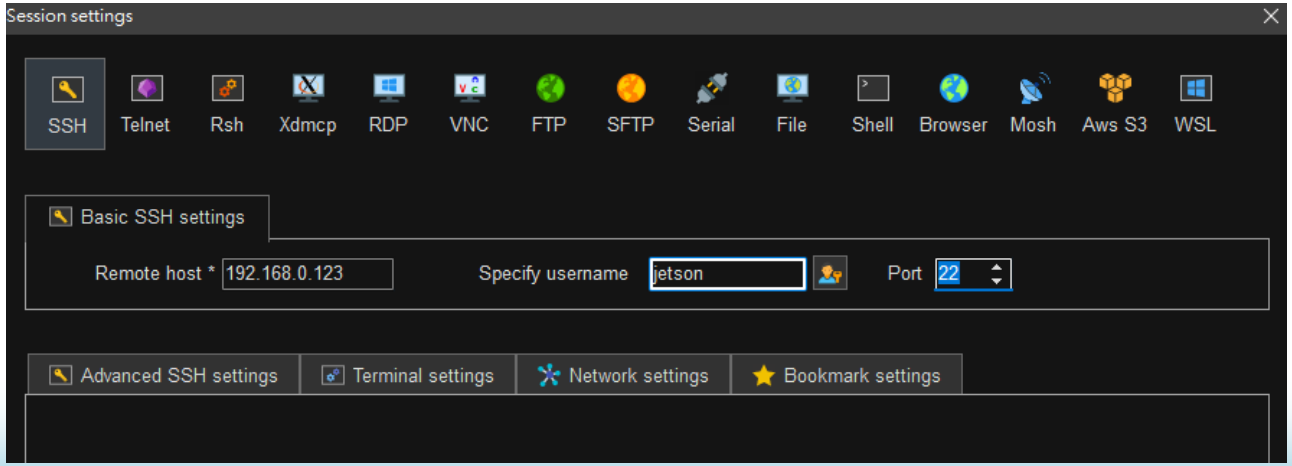
- After Nano connected to the Internet, we can control it with SSH
- Find the LAN IP address:

```
ifconfig | grep 192
```

  - You will see your LAN IP like this:

    inet 192.168.0.XXX netmask 255.255.255.0 broadcast 192.168.0.255

  - If you own a Wi-Fi router, you can check it in the admin window
- Use a computer that's in the same Wi-Fi/LAN, connect with SSH client



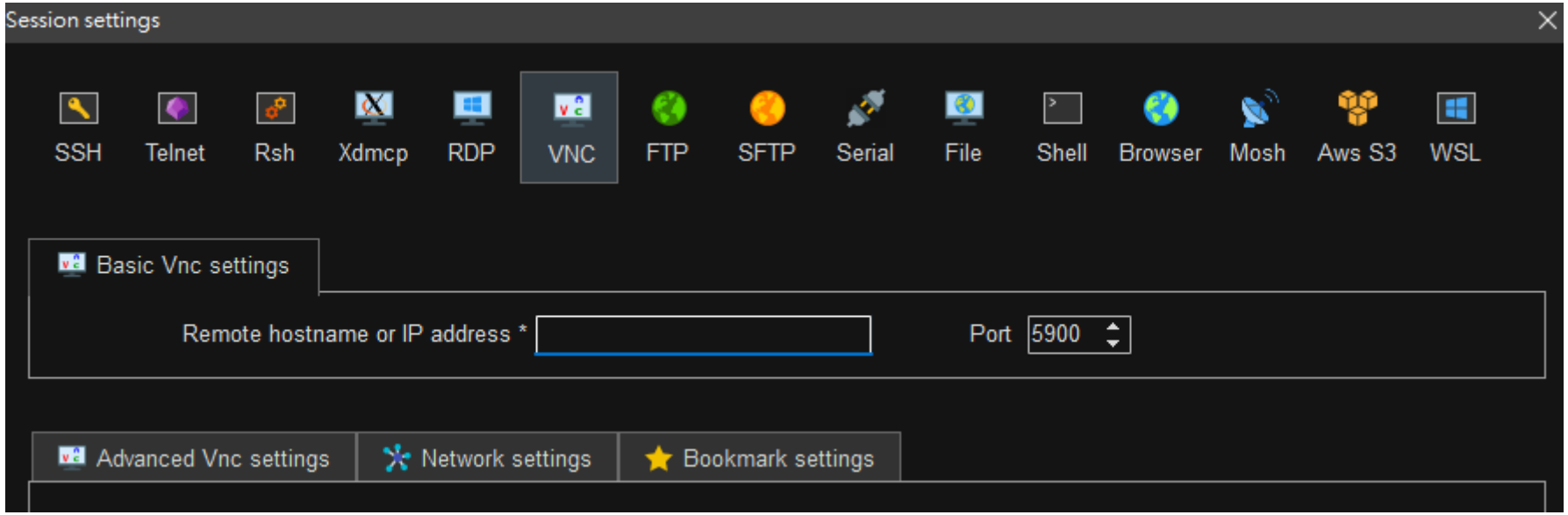
Optional: Remote Desktop

- You can refer this tutorial to setup Remote Desktop server, there are two options:
  - VNC: Setting Up VNC | NVIDIA Developer
  - XRDP: 【教學】Jetson Nano 遠端桌面設定(Windows, Mac OSX)
    - Jump to the section “在Jetson Nano上設定xrdp遠端桌面”
    - The XRDP setup takes more time but run faster than VNC
- Here is the summarized instruction for VNC setup

```
mkdir -p ~/.config/autostart
cp /usr/share/applications/vino-server.desktop ~/.config/autostart/.

gsettings set org.gnome.Vino prompt-enabled false
gsettings set org.gnome.Vino require-encryption false

gsettings set org.gnome.Vino authentication-methods "['vnc']"
gsettings set org.gnome.Vino vnc-password $(echo -n 'jetson'|base64)

sudo reboot
```

Optional: Remote Desktop

- The link provided some VNC viewer
- You can use MobaXterm provided VNC viewer as well:



Optional: Remote Desktop

- If you want to change the remote desktop resolution
- Edit configuration file:

```
sudo gedit /etc/X11/xorg.conf
```

- Add these lines at the end of file and save it, which will change the remote res to 1280x800 after reboot

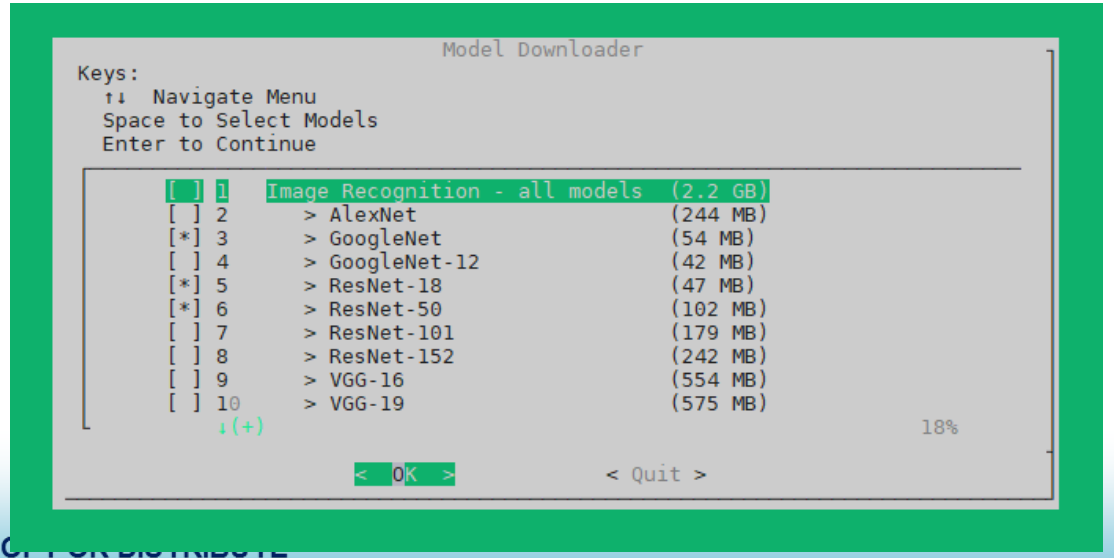
```
Section "Screen"
        Identifier "Default Screen"
        Monitor "Configured Monitor"
        Device "Default Device"
        SubSection "Display"
                Depth 24
                Virtual 1280 800
        EndSubSection
EndSection
```

Build Jetson Inference from Source

- Clone the official Git repo on your Nano and configuring with CMake:

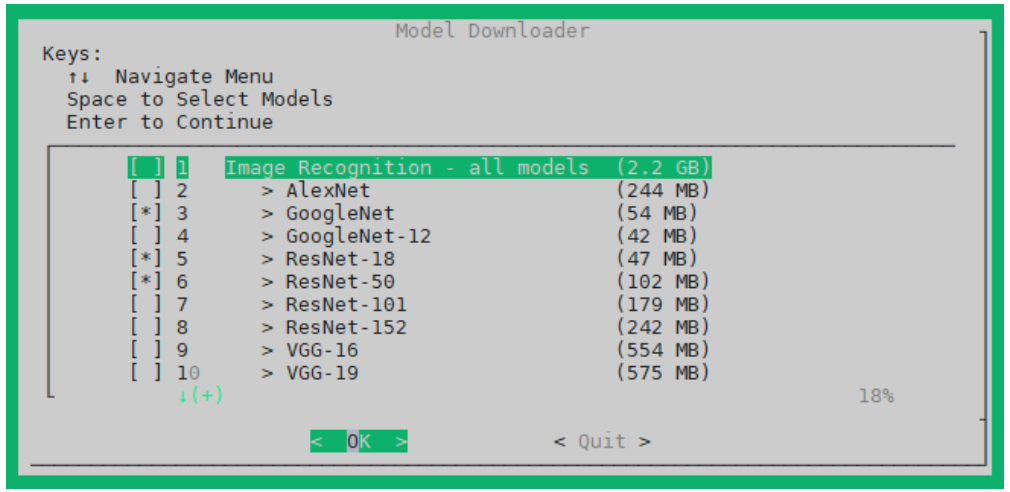
```
git clone --recursive https://github.com/dusty-nv/jetson-inference
cd jetson-inference
mkdir build
cd build
cmake ../
```

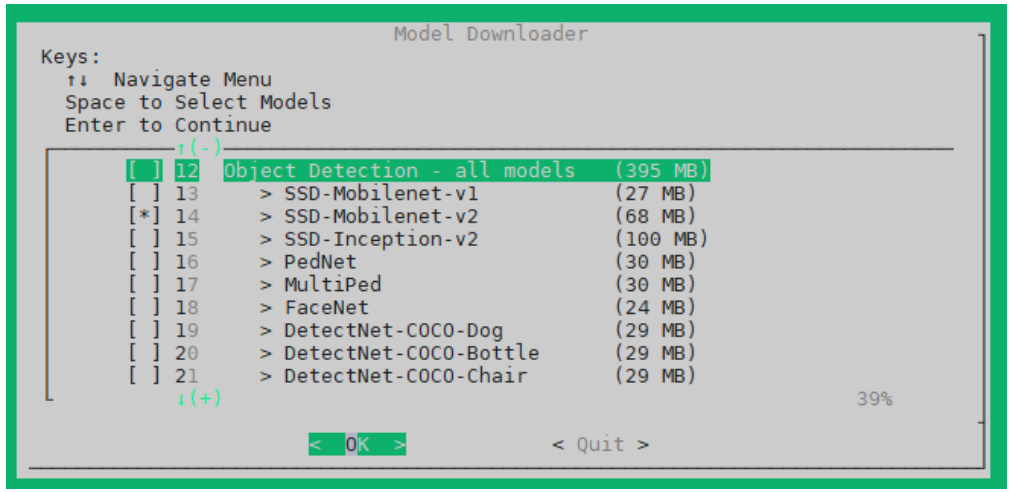
- You will see the Model Downloader like this, select or deselect by pressing Space:



Build Jetson Inference from Source

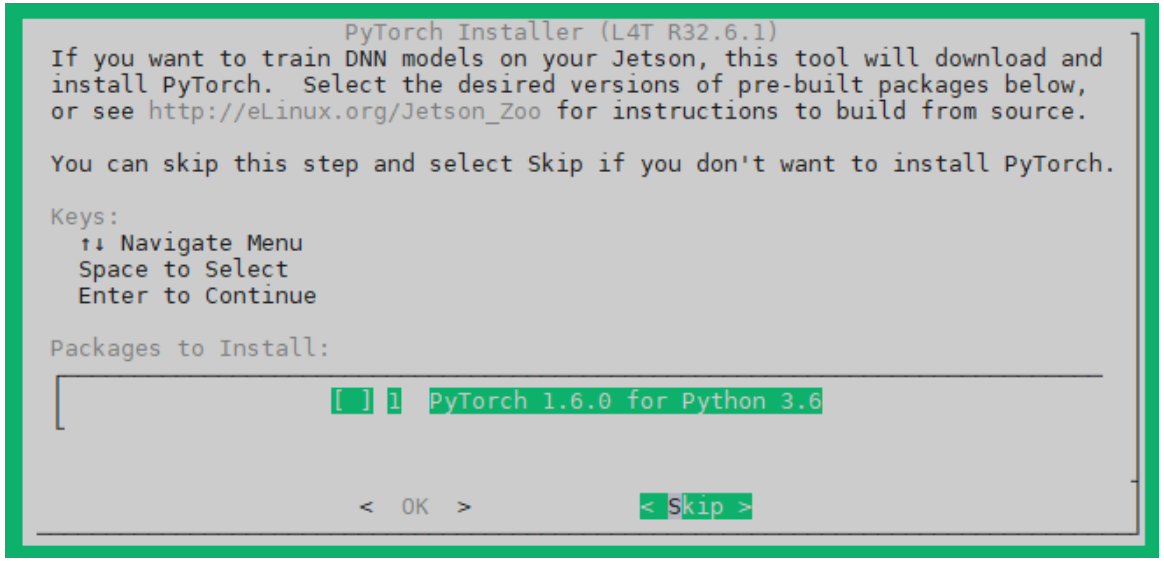
- The project comes with many pre-trained networks.
- You can select the models you want or run the tool again later to download more models another time by running the script ./tools/download-models.sh
- For this week's project, we need GoogleNet, ResNet-18, ResNet-50, SSD-Mobilenet-v2, you can deselect unused models or add models based on your need.





Build Jetson Inference from Source

- After downloading models, the PyTorch Installer will pop up, choose skip because there is already a newer version in the provided system image.



Build Jetson Inference from Source

- Make sure you are in jetson-inference/build directory (you can check the absolute path with pwd command, which means present working directory)
- Now compile the project with Makefile that generated by CMake:

```
make
sudo make install
sudo ldconfig
```

- This process takes less than 10 minutes, the C++ & Python dependency will be installed during sudo make install step.

Run Example Code

- You can not see the result via SSH, do these steps directly on Nano
- Go to the Python example directory:

```
cd ../python/examples
```

- Connect your webcam, then check if the system detects it

```
ls /dev/video*
```

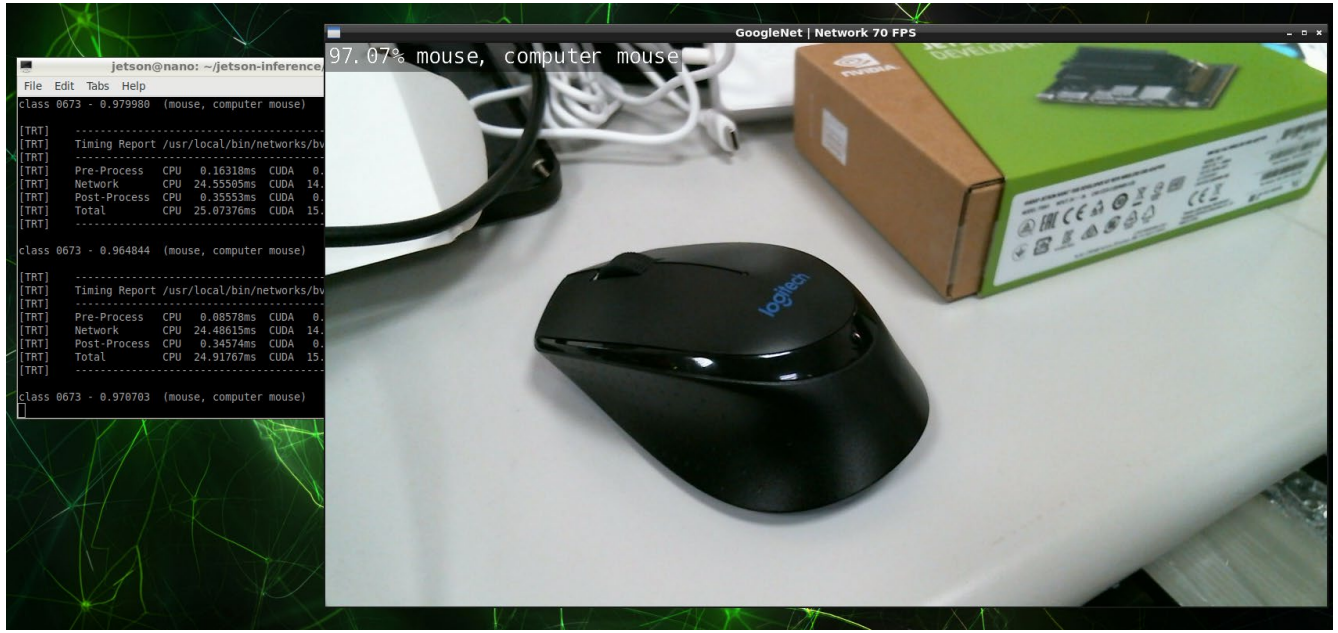
  - By default, you should see /dev/video0
  - In Linux, all physical devices are listed as files inside /dev.
  - the video* is a wildcard notation, which includes all item start with video.

- Run the inference on default camera with:

```
./imagenet.py /dev/video0
```

Run Example Code

- The default classification network is GoogleNet



To stop the program, you can click the X of image window,
or Ctrl+C inside terminal to force stop

- You can try other models we installed earlier, for example ResNet-18

```
./imagenet.py /dev/video0 --network=resnet-18
```

  - The CLI argument for different Pre-Trained Models are listed here

More Resources for Your Project

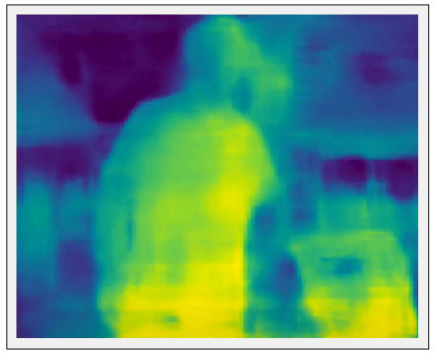
- The official Hello AI World GitHub
  - https://github.com/dusty-nv/jetson-inference
  - Which includes some common computer vision tasks

Image Classification

Object Detection

Semantic Segmentation

Pose Estimation



Mono Depth

Basic Linux Usage

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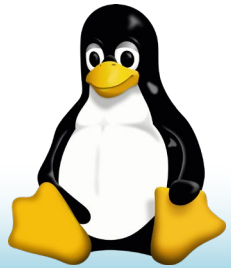
TA: 陳翰群 hanz1211.ee09@nycu.edu.tw

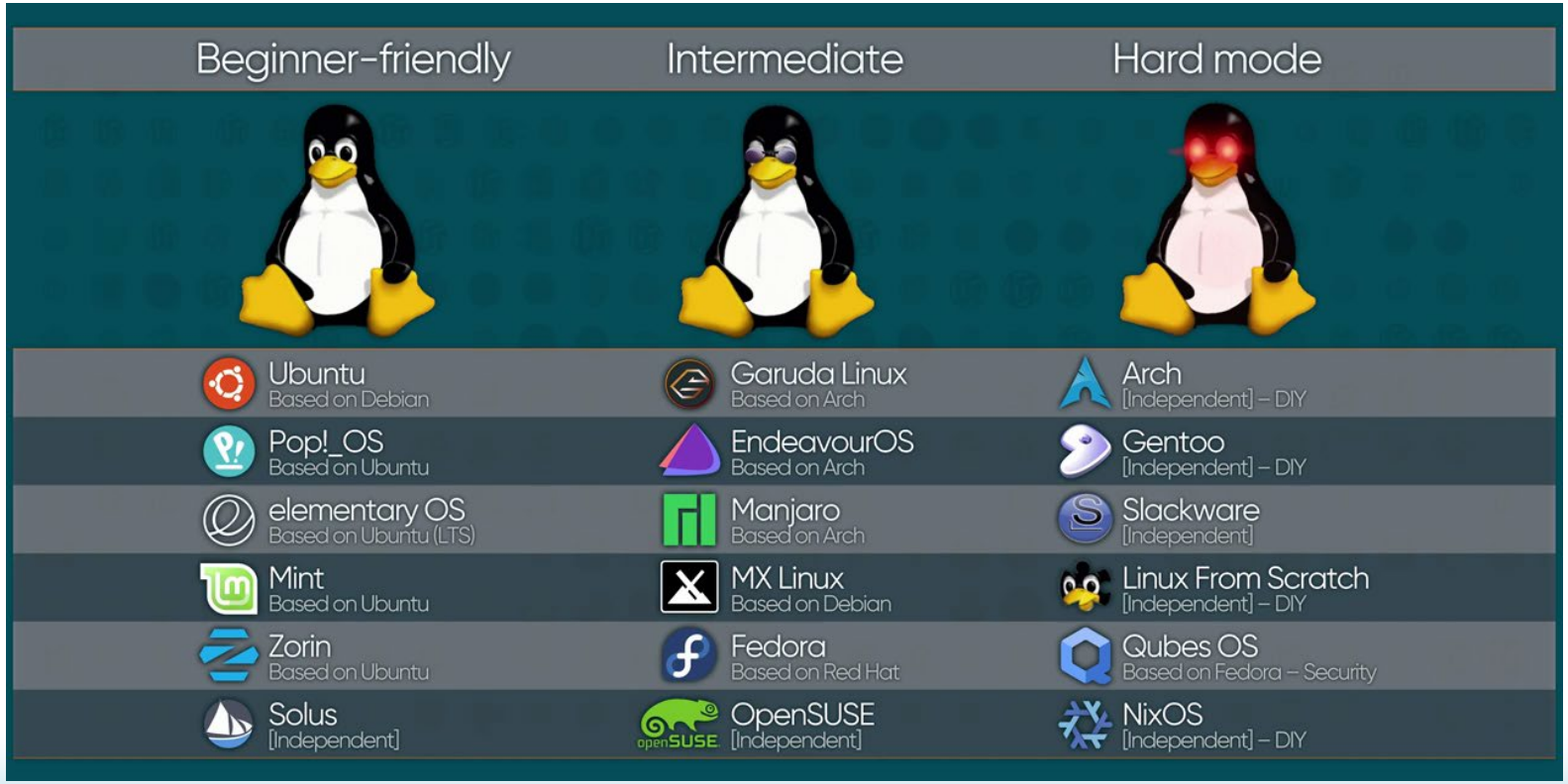
Linux介紹

- Unix
  - 源自於美國AT&T公司的貝爾實驗室開發的AT&T Unix，前身為1964年開始的Multics
  - 1973 年 Ken Thompson 與 Dennis Ritchie 以 C 語言改寫 Multice 命名 Unix，可攜性變成 Unix 的特色
  - AT&T公司以低廉甚至免費的許可將Unix原始碼授權給學術機構做研究或教學之用
    - 最著名的變種之一是由加州大學柏克萊分校開發的柏克萊軟體套件(BSD)產品
- Linux (Linus's Unix System)
  - 1991 年芬蘭大學生 Linus Torvalds改寫一套名為 Minix 的小型 Unix 以適合個人電腦 x86 使用，定名為 Linux
  - Linux系統內搭載許多GNU自由軟體計畫的組件和軟體，因此完整名稱應為GNU/Linux

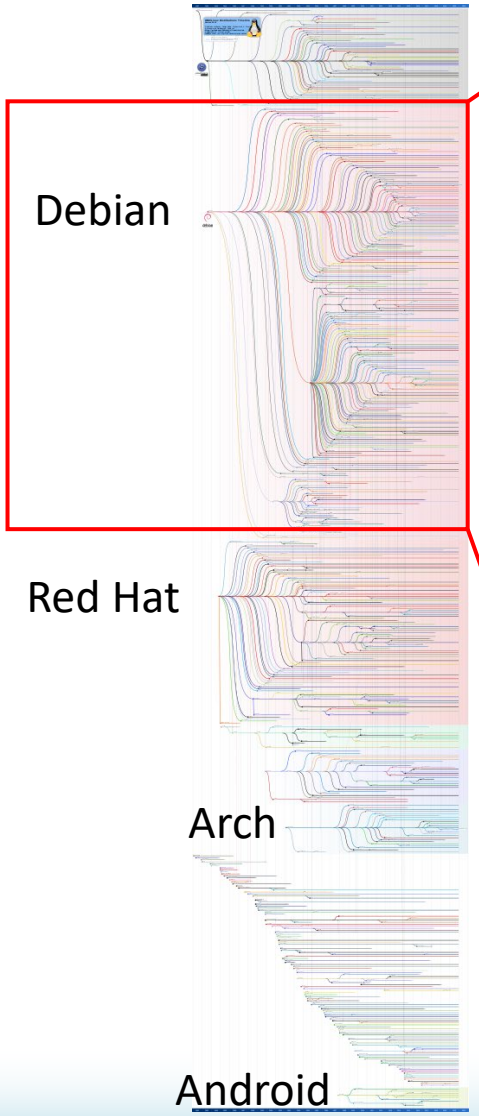


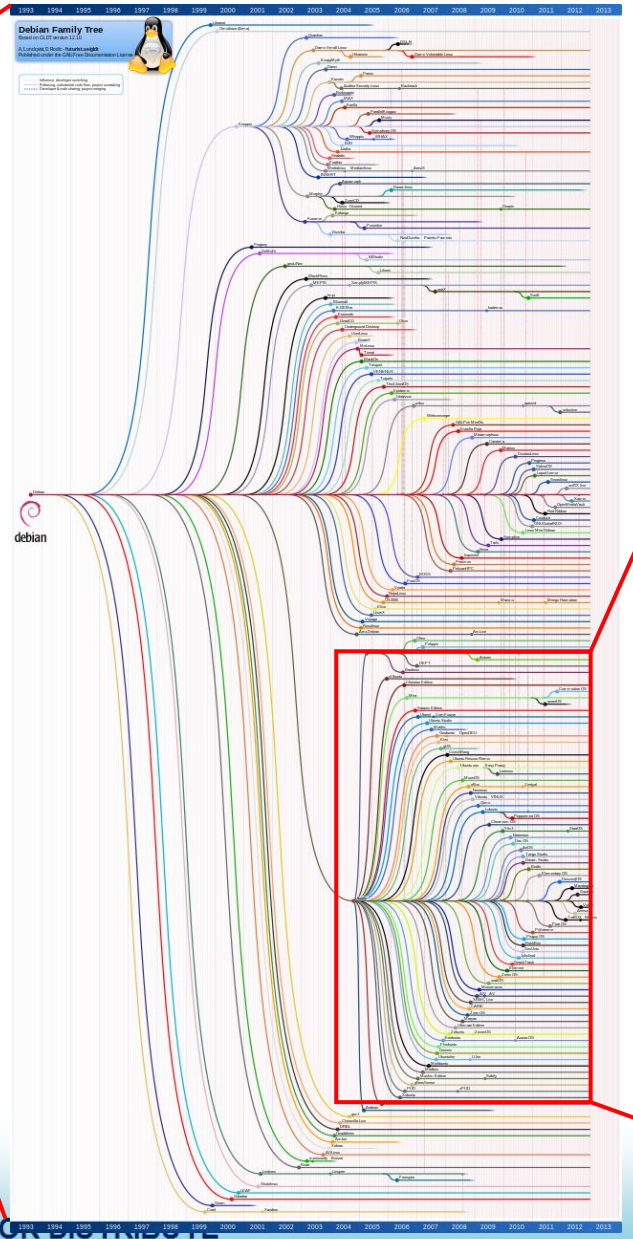
Linux 發行版

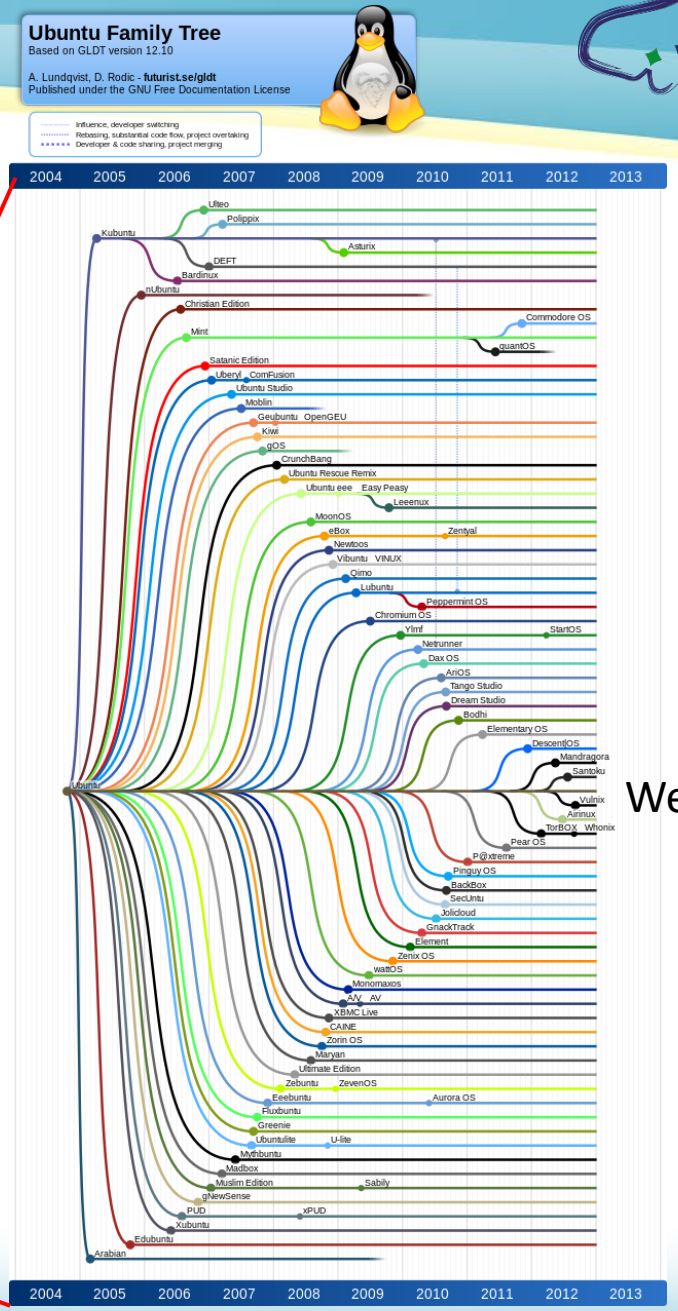
- Linux不算是一個系統，而是一個系統核心（Kernel），基於此核心衍生許多發行版（Linux Distro）
  - Debian
    - Ubuntu, Mint
  - Red Hat
    - Fedora, CentOS
  - Arch Linux
    - Manjaro, EndeavourOS
  - Android



Linux Distro Tree



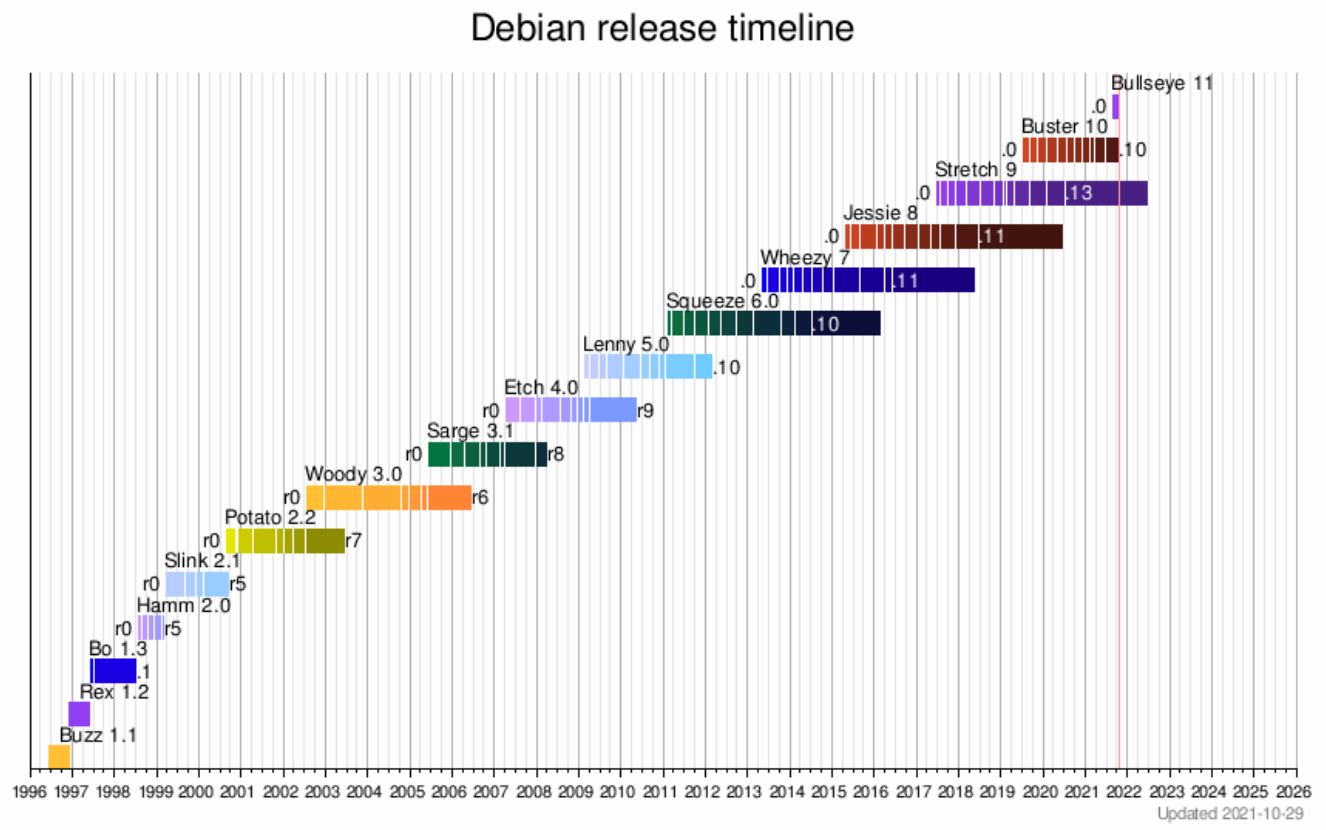




We are here!

Debian & Ubuntu

- Debian第一個穩定版本在1996年發布（代號Buzz）
- 穩定版通常每隔兩年發布一個版本
  - 衍生的Ubuntu也跟著每兩年發行一次長期支援



8.04 LTS	Hardy Heron	堅強的鷺	2008-04-24	2011-05-12	2013-05-09	2.6.24
8.10	Intrepid Ibex	無畏的羱羊	2008-10-30	2010-04-30		2.6.27
9.04	Jaunty Jackalope	活潑的鹿角兔	2009-04-23	2010-10-23		2.6.28
9.10	Karmic Koala	幸運的無尾熊	2009-10-29	2011-04-30		2.6.31
10.04 LTS	Lucid Lynx	清醒的山貓	2010-04-29	2013-05-09	2015-04-30	2.6.32
10.10	Maverick Meerkat	標新立異的狐獴	2010-10-10	2012-04-10		2.6.35
11.04	Natty Narwhal	敏捷的獨角鯨	2011-04-28	2012-10-28		2.6.38
11.10	Oneiric Ocelot	有夢的虎貓	2011-10-13	2013-05-09		3.0
12.04 LTS	Precise Pangolin	精準的穿山甲	2012-04-26[38]	2017-04-28[39]		3.2[40]
12.10	Quantal Quetzal	量子的格查爾鳥	2012-10-18	2014-05-16[41]		3.5[42]
13.04	Raring Ringtail	卯足了勁的環尾貓熊	2013-04-25	2014-01-27[43]		3.8[44]
13.10	Saucy Salamander	活潑的蠑螈	2013-10-17[45]	2014-07-17[46]		3.11
14.04 LTS	Trusty Tahr	可靠的塔爾羊	2014-04-17[47]	2019-04-25[48]		3.13
14.10	Utopic Unicorn	烏托邦的獨角獸	2014-10-23[49]	2015-07-23[50]		3.16[51]
15.04	Vivid Vervet	活潑的長尾黑顎猴（英語：Vervet monkey）	2015-04-23[52]	2016-02-04[53]		3.19[54]
15.10	Wily Werewolf	老謀深算的狼人	2015-10-22[55]	2016-07-28[56]		4.2[57]
16.04 LTS	Xenial Xerus	好客的非洲地松鼠	2016-04-21[58]	2021-04-30		4.4[59]
16.10	Yakkety Yak	喋喋不休的氂牛	2016-10-13[60]	2017-07-20		4.8
17.04	Zesty Zapus	熱情的美洲林跳鼠	2017-04-13[61]	2018-01-13		4.10[62]
17.10	Artful Aardvark	巧妙的土豚	2017-10-19[63]	2018-07-19		4.13[64]
18.04 LTS	Bionic Beaver[65][66]	仿生的海狸	2018-04-26[67]	2023-04		4.15
18.10	Cosmic Cuttlefish	宇宙的墨魚	2018-10-18[68]	2019-07-18		4.18[69]
19.04	Disco Dingo	迪斯可的澳洲野犬	2019-04-18[70]	2020-01-23		5.0[71]
19.10	Eoan Ermine	黎明的白鼬	2019-10-17[72]	2020-07-17		5.3[73]
20.04 LTS	Focal Fossa	焦點的馬島長尾狸貓	2020-04-23[74]	2025-04		5.4[75]
20.10	Groovy Gorilla	時髦的大猩猩	2020-10-22[76]	2021-07-22		5.8[77]
21.04	Hirsute Hippo	多毛的河馬	2021-04-22[78]	2022-01		5.11[79]
21.10	Impish Indri	頑皮的大狐猴	2021-10-14[80]	**2022-07**		5.13[81]
22.04 LTS	Jammy Jellyfish	適意的水母	2022-04-21[82]	2027-04		待定[83]

格式： 舊版本 舊版本，仍被支援 目前版本 最新的預覽版 未來版本

檔案管理指令集 (1/5)

- ls: 列出目錄下的檔案名稱
  - 格式: ls [參數] [檔案或目錄名]
  - 參數
    - -a: 列出全部檔案
    - -l: 列出檔案目錄的相關資訊
    - -g: 列出檔案所屬的group名稱
    - -F: 列出各種不同類型的檔案(/ 為目錄，* 為可執行檔)
    - -s: 在檔案前顯示其block大小，一般是以Kbyte為單位
    - -R: 遞迴列出檔案及子目錄及其下的所有子目錄和檔案
  - 範例
    - ls –l
    - ls –F
    - ls -al

檔案管理指令集 (2/5)

- pwd：顯示目前工作目錄
  - 範例：pwd
- cat, more, head, tail：列出檔案內容
  - 說明
    - cat filename: 可列出全部檔案內容
    - more filename: 可列出全部檔案內容，但會自動分頁，可按 “space bar” 繼續
    - head –n filename: 可列出前n行
    - tail –n filename: 可列出後n行
  - 範例: cat file

檔案管理指令集 (3/5)

- rm：刪除檔案
  - 語法：rm filename
  - 刪除整個資料夾：rm -rf ./dirname
  - 請小心使用，Terminal裡清掉的資料不會進資源回收筒
- cp：複製檔案
  - 語法：cp source-file target-file
- mv：改變檔案名稱或移動檔案
  - 語法：mv [-f] [-i] file1 [file2…] target

檔案管理指令集 (4/5)

- cd: 變換工作目錄
  - 語法: cd (aaa)　　進入aaa資料夾
  - 語法: cd..　　跳出現在資料夾
- mkdir: 建立目錄
  - 語法: mkdir aaa　　建立名為aaa資料夾
- rmdir: 刪除目錄
  - 語法: rmdir aaa　　刪除aaa資料夾

檔案管理指令集 (5/5)

- diff: 比較兩個檔案的不同處
- find: 在tree structure中尋找filename
- grep: 在某個file中找string

- 上傳
  - scp -r 本地資料夾路徑 使用者名稱@伺服器ip:目標路徑
- 下載
  - scp 使用者名稱@伺服器ip:檔案路徑 本地檔案路徑

壓縮指令 (1/2)

- 透過檔案的副檔名，可以知道是哪一種壓所程式壓縮的
  - .Z: compress, uncompress
  - .gz: gzip
  - .z: pack, upack
  - .tar: tar
  - .tar.gz: tar+gzip
  - .tgz: tar+gzip

壓縮指令 (2/2)

- tar
  - 語法
    - tar –c[vwfbL[#s]] device block files..
    - tar –r[vwfbL[#s]] device block files..
    - tar –f[vfL[#s]] device [files..]
    - tar –u[vwfbL[#s]] device block files..
    - tar –x[lmovwfL[#s]] device [files..]
  - 選項
    - -c: 建立新的保存檔
    - -r: 新增到保存檔的尾端，而不會重新建立保存檔
    - -t: 列出保存檔所包含的檔案名稱
    - -u: 更新檔案
    - -x: 將指定的檔案名稱從保存檔中取出
  - 範例
    - tar czvf aaa.tgz aaa/: 把aaa目錄壓成aaa.tgz檔
    - tar xzvf aaa.tgz: 將aaa.tgz解壓縮
    - tar cvf aaa.tgz aaa/: 建立aaa/目錄的保存檔aaa.tar
    - tar xvf aaa.tar: 將保存檔aaa.tar解開

其他

- !：呼叫所用過的指令
- cal：印出本月之月曆
- history：列出曾鍵入之命令
- clear：清理螢幕（Ctrl+L也可以）

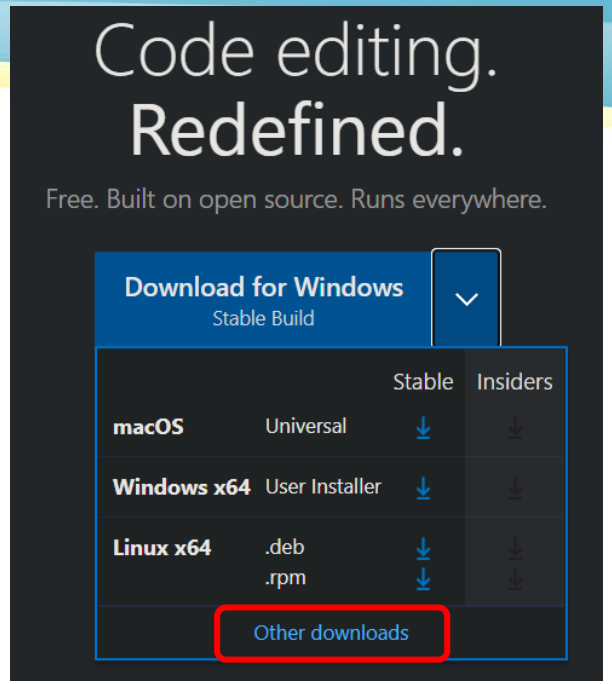
- Ctrl+C：強制停止程式
- jobs：列出當前Terminal的背景程式
- htop：效能監視器
- Ctrl+R：反向搜尋，打關鍵字會顯示最近用到的指令
- sudo !!：用sudo權限執行上一個指令

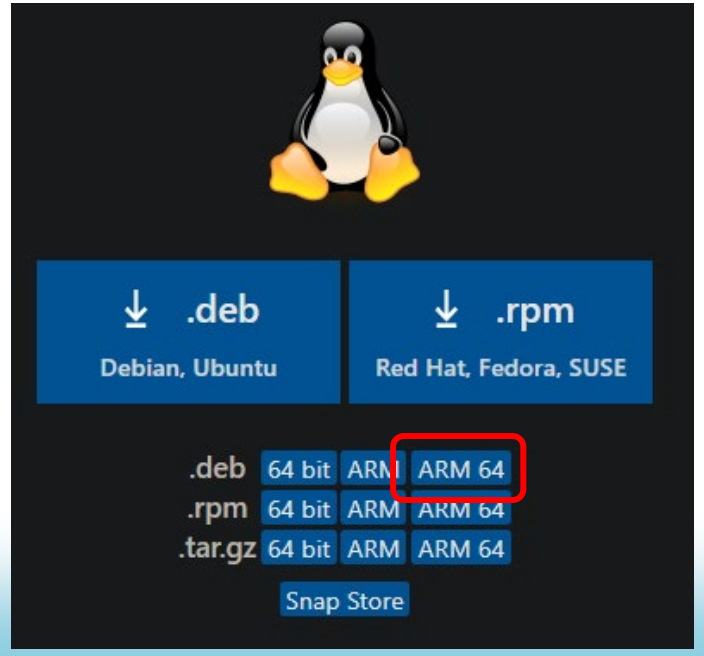
Ubuntu Text Editor

- gedit myfile.txt
  - gedit myfile.txt &
  - 加&會指定在背景運行，同個Terminal才不會卡住
- vim myfile.txt
- nano myfile.txt
- Visual Studio Code
  - https://code.visualstudio.com/
  - 下載ARM64用的.deb檔案

```
sudo apt install ./<file>.deb
```

  - 安裝好可以點圖示或在Terminal裡 `code .`
    - 後面加 . 代表在目前資料夾打開VSCode





Python

- Linux 預設有 Python2 跟 Python3
- 如果要運行Python程式

```
python3 main.py
```

- 也可以給.py檔執行權限，這樣可以直接跑

```
./main.py
```

  - 新增執行權限，用chmod

```
chmod +x main.py
```