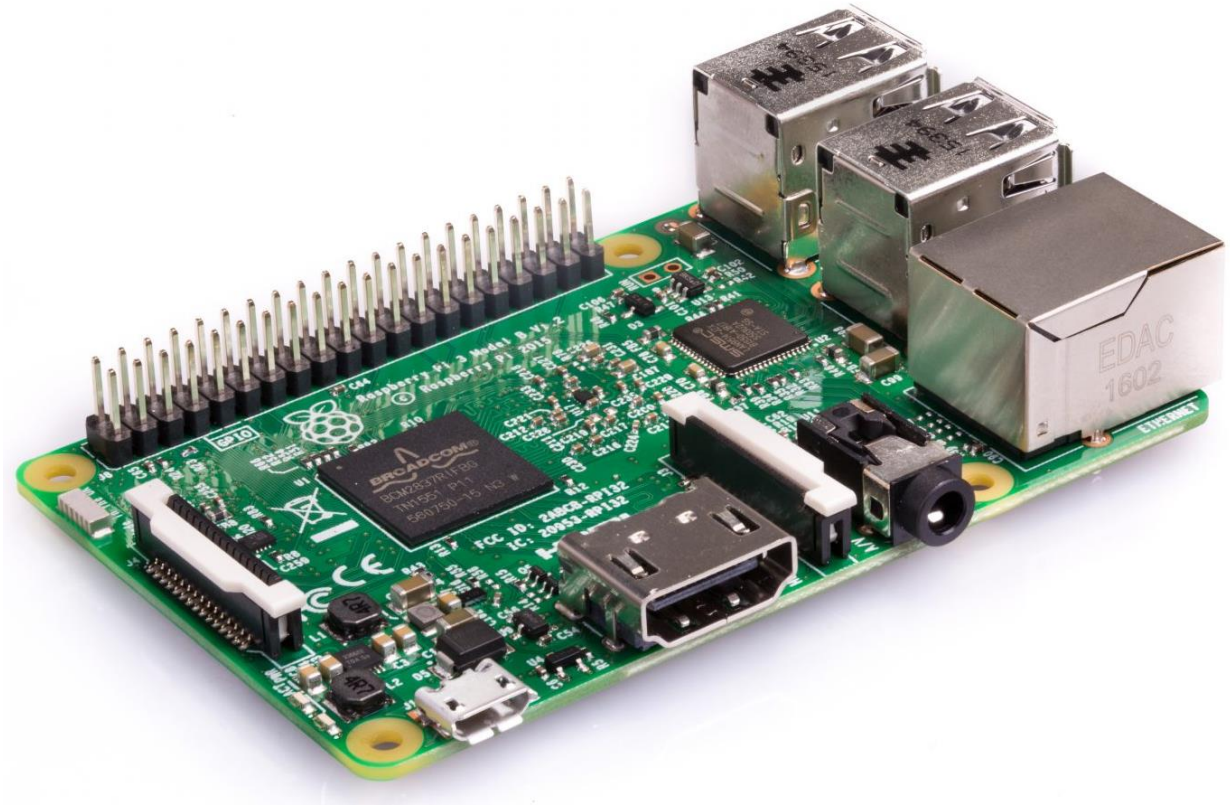
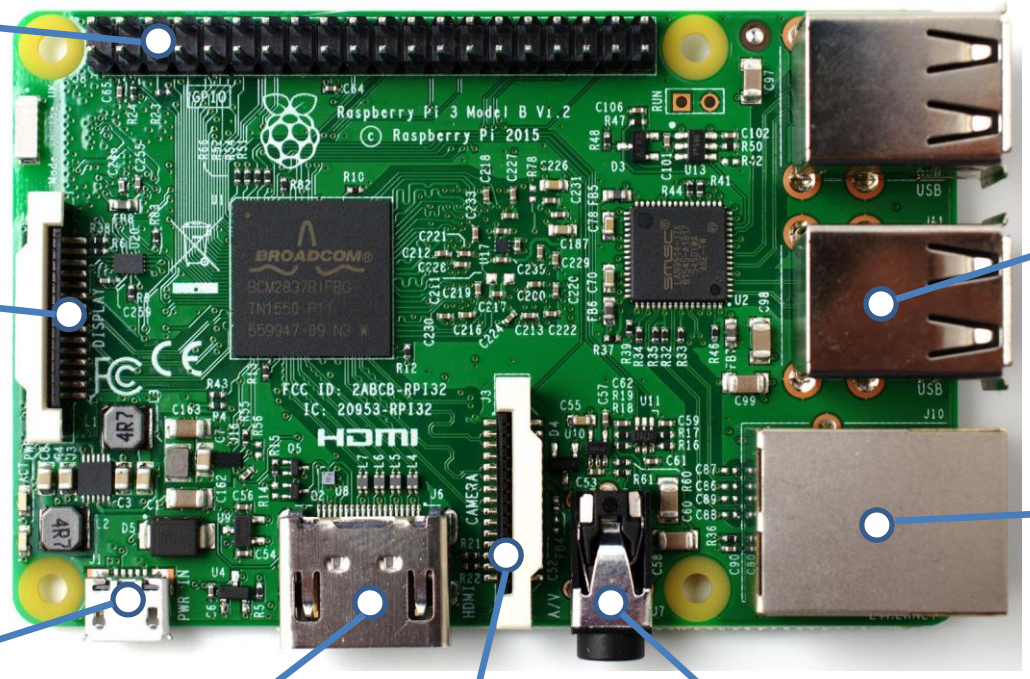
Raspberry PI



Raspberry PI 硬體週邊



40 GPIO pins

Display interface

Micro SD
(在下面)

Power supply

USB 2.0 *4

10M/100M
Ethernet port

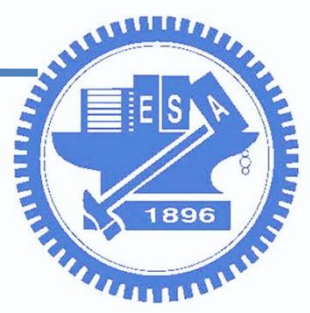
HDMI

Camera interface (CSI)

Combined 3.5mm audio jack
and composite video

Raspberry PI 3 Model B

- Raspberry PI 3 model B:
  - 主要有以下功能:
    - 1.) SD 卡: 當成內建的硬碟使用，一般來說最少需要有4GB 的容量，建議用比較穩定的牌子，這樣可以確保讀取資料正常
    - 2.) HDMI 輸出顯示
    - 3.) USB 的輸入端口: 如滑鼠與鍵盤
    - 4.) RJ45網路線端口
    - 5.) Micro USB 電源端口: 僅供電, 無資料傳輸用途
    - 6.) 內建802.11n Wi-Fi 與 藍牙4.1



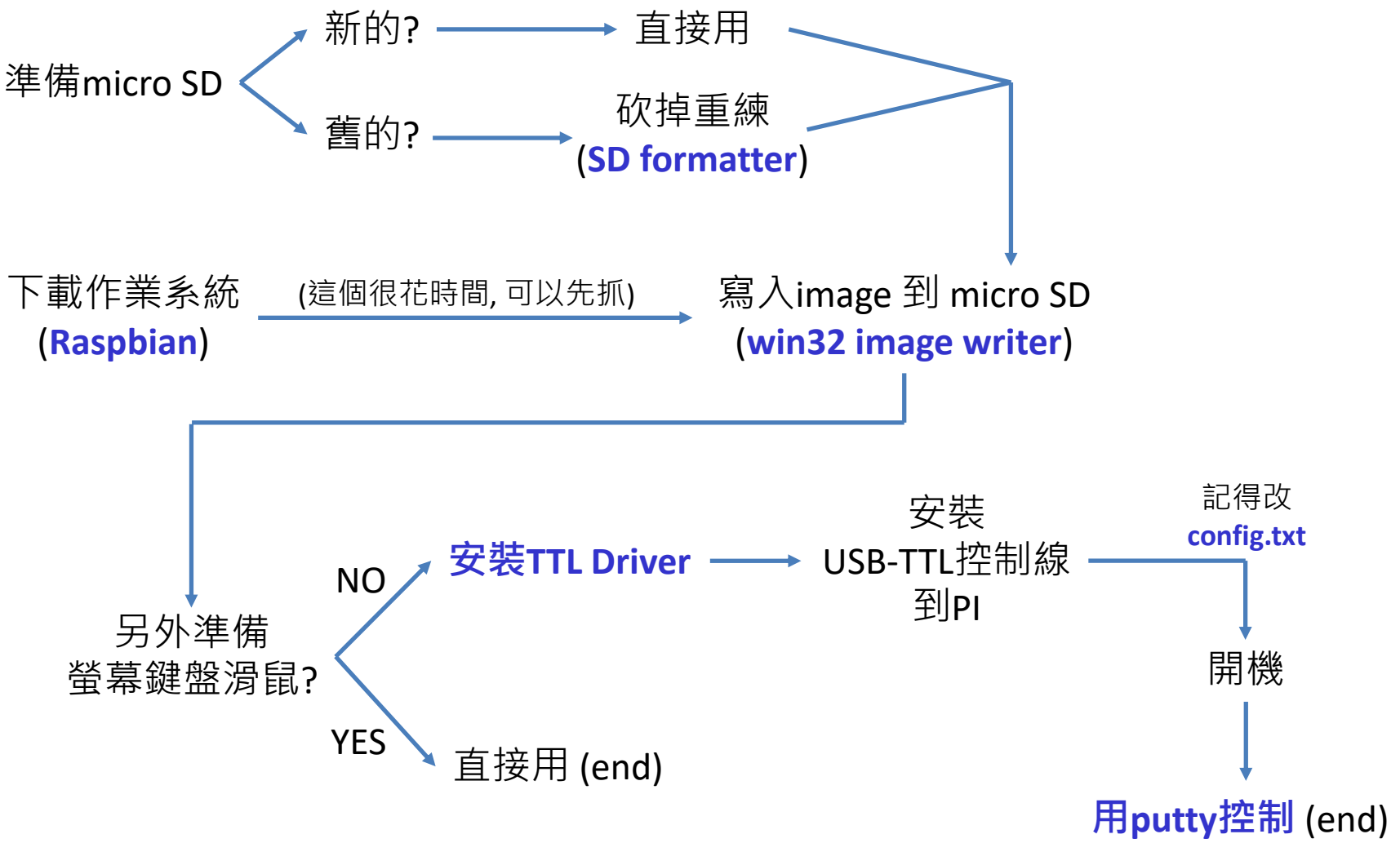
1. Raspberry PI Introduction Installation

National Chiao Tung University

Installation

- **1. 安裝OS (Raspbian)**
- **2. PI的環境設定**
  - 擴充SD卡空間
  - 用command line設定Wi-Fi
  - 使用apt-get安裝程式
- **3. 設定遠端桌面連線**
  - vnc
- **4. 與電腦互傳檔案**

準備流程


準備micro SD
新的?
直接用
舊的?
砍掉重練
(SD formatter)
下載作業系統
(Raspbian)
(這個很花時間, 可以先抓)
寫入image 到 micro SD
(win32 image writer)
另外準備
螢幕鍵盤滑鼠?
NO
安裝TTL Driver
安裝
USB-TTL控制線
到PI
記得改
config.txt
開機
YES
直接用 (end)
用putty控制 (end)

準備工具

- 下載作業系統(Raspbian)
  - 官方連結 (速度很慢)
    - https://downloads.raspberrypi.org/raspbian_latest
  - ubuntu-tw 分流下載 (2018-11-13-raspbian-stretch)
    - http://ftp.ubuntu-tw.org/mirror/raspbian-downloads/raspbian_full/images/raspbian_full-2018-11-15/2018-11-13-raspbian-stretch-full.zip
  - 交大實驗室分流 (2018-11-13-raspbian-stretch)
    - http://140.113.193.13:7788/raspbian.zip
    - http://140.113.144.127/raspbian.zip

準備工具

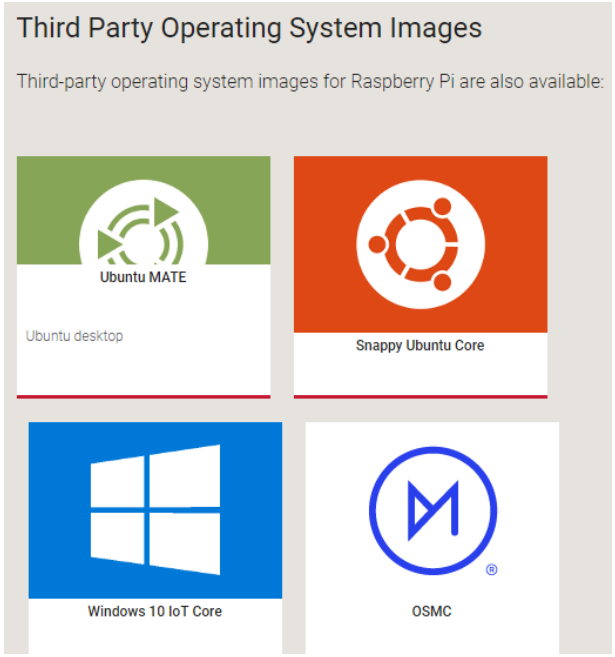
- SD Formatter (清除SD卡舊有的檔案系統)
  - https://www.sdcard.org/cht/downloads/formatter_4/
- Win32 image writer (寫入映像檔到SD卡)
  - https://sourceforge.net/projects/win32diskimager/
- Notepad ++ (編輯開機設定檔)
  - https://notepad-plus-plus.org/download/v7.3.2.html
- USB TTL driver (TTL控制線驅動程式)
  - http://www.prolific.com.tw/US/ShowProduct.aspx?p_id=225&pcid=41
- Putty (終端機程式)
  - https://the.earth.li/~sgtatham/putty/latest/x86/putty.exe

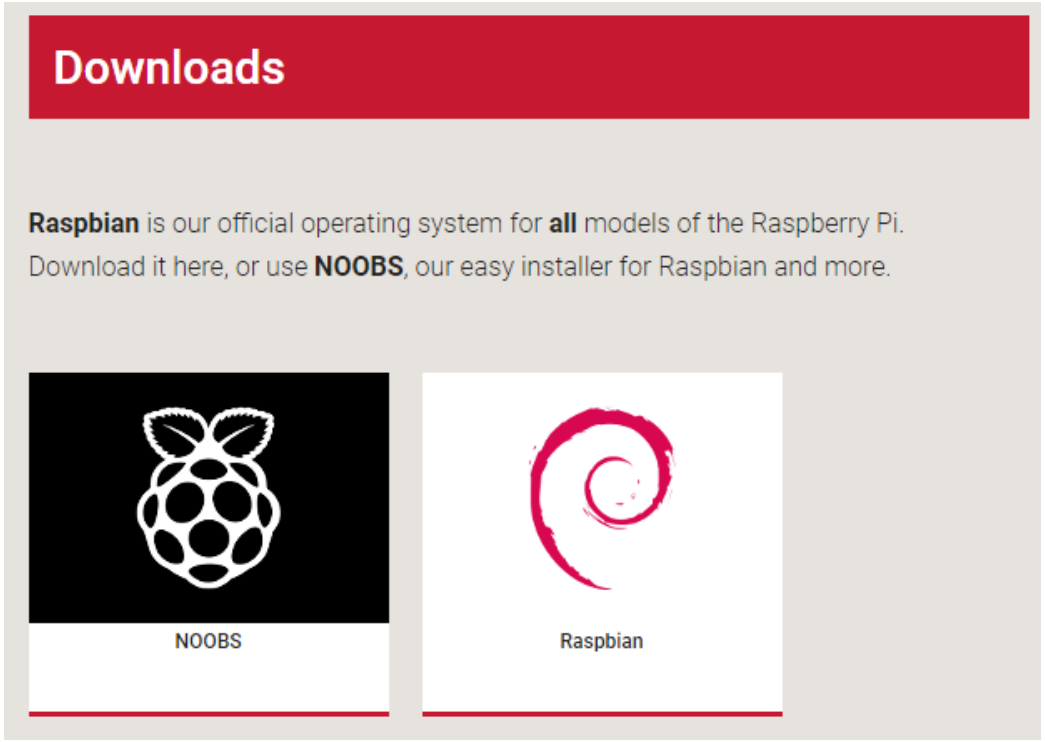
安裝Raspbian

- 步驟1：下載映像檔
  - Raspbian
- 步驟2：將映像檔燒錄至SD卡
  - SD formatter, win32 image writer
- 步驟3：調整開機設定檔
  - config.txt
- 步驟4：電腦端準備 USB 轉 TTL 序列傳輸線
  - 安裝TTL Driver
- 步驟5：將SD卡插到Raspberry PI並開機
  - 用putty控制 (by USB-TTL)

步驟1：下載映像檔

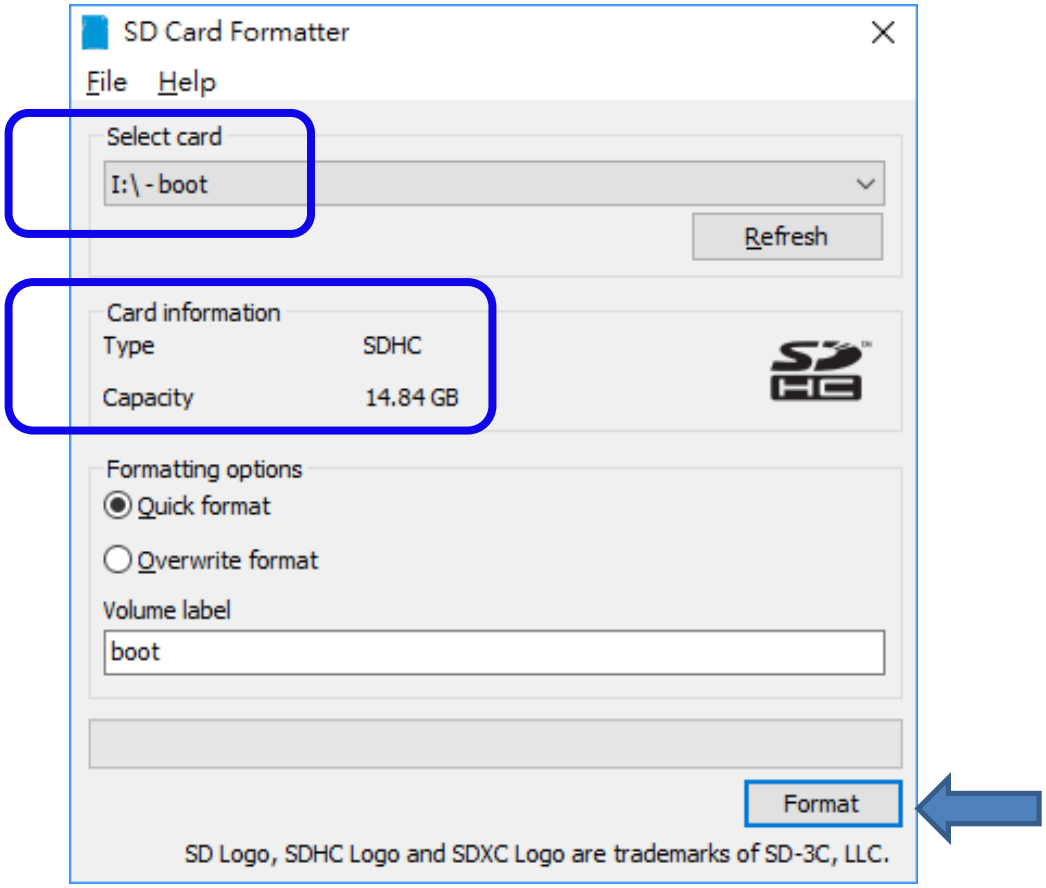
- 官方下載網頁
  - http://www.raspberrypi.org/downloads
- 選擇映像檔(image)
  - Raspbian(推薦)





步驟2：將映像檔燒錄至SD卡之前

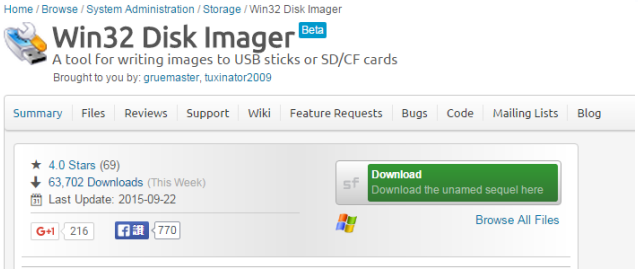
- If the micro SD is used before, use **SD Card Formatter** to erase it!!



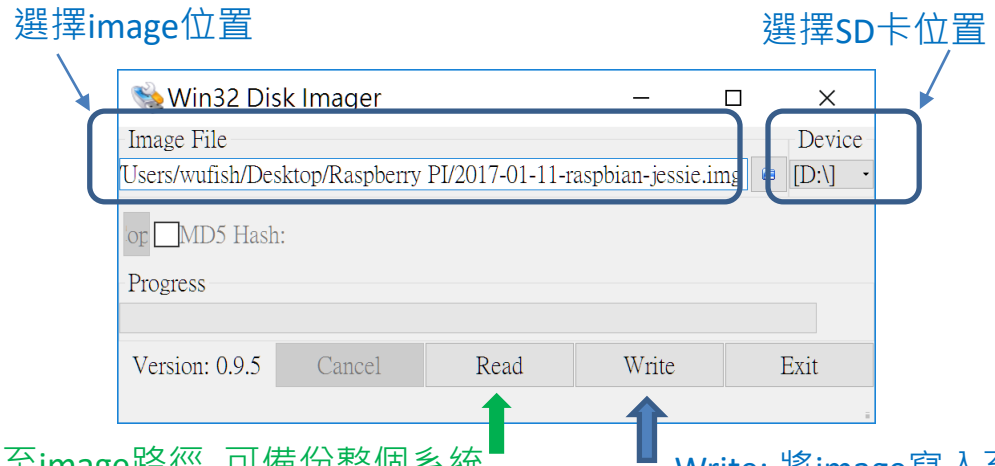
Check Device ID and capacity

步驟2：將映像檔燒錄至SD卡

- **下載燒錄軟體**
  - Win32 Disk Imager
    - http://sourceforge.net/projects/win32diskimager/



- **燒錄映像檔**
  - 開啟Win32DiskImager
  - 選取映像檔及欲燒入SD卡路徑並開始燒錄

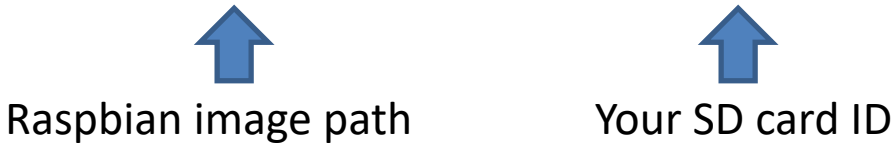


Read: 將SD卡儲存至image路徑, 可備份整個系統

Write: 將image寫入至SD卡

步驟2：將映像檔燒錄至SD卡 (MAC user)

- **For MAC OS**
  - Use “diskutil list” to check the device number of your SD card
    - Ex: /dev/disk2
  - After insert SD card, remember to unmount it
  - diskutil unmountDisk /dev/**diskX** (change **diskX** to above ID)
  - Write image to SD card
    - sudo dd bs=1m if=**2017-01-11-raspbian-jessie.img** of=/dev/**diskX**



  - You can use **Ctrl+T** to check the progress (It would take a long time)

步驟3：調整開機設定檔

- 拿到 PI 3, 想使用序列埠連線, 會發現出現亂碼, 該怎麼辦？(使用螢幕鍵盤滑鼠就可以忽略這問題)

因為原本 Pi 3 內建的硬體 UART 被 BCM2837 SoC 拿去給 Bluetooth 晶片組使用，而原本的 UART 輸出腳位(GPIOs 14 & 15)改成用 mini-uart port。意思是原本硬體 UART 有獨立的 clock divisor，因此 baud rate 可以維持在 115200，可是 mini-uart 使用系統核心時脈，實際只能跑到 72000 左右的 baud rate，因此當使用 115200 的 baud rate 連線就會出現亂碼

步驟3：調整開機設定檔

- 用notepad++修改**/boot/config.txt**,新增三行
  - dtoverlay=pi3-miniuart-bt
  - core_freq=250
  - enable_uart=1

新增

```
# Enable audio (loads snd_bcm2835)
dtparam=audio=on
dtoverlay=pi3-miniuart-bt
core_freq=250
enable_uart=1
```

- 修改/boot/cmdline.txt,將quiet splash的quiet移除

```
dwc_otg.lpm_enable=0 console=serial0,115200
console=tty1 root=PARTUUID=6b3a87b5-02 rootfstype=ext4
elevator=deadline fsck.repair=yes rootwait quiet
init=/usr/lib/raspi-config/init_resize.sh splash
plymouth.ignore-serial-consoles
```

SD卡插入windows電腦後, 會出現一個磁碟機. 修改磁碟機裡面的config.txt即可!

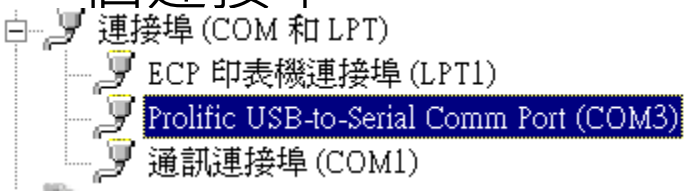
步驟4：電腦端準備 USB 轉 TTL 序列傳輸線

- 從序列埠登入到 Raspberry Pi
  - 透過 USB 轉 TTL 序列傳輸線，就可以在不需要螢幕和鍵盤滑鼠的情況下登入 Raspberry Pi

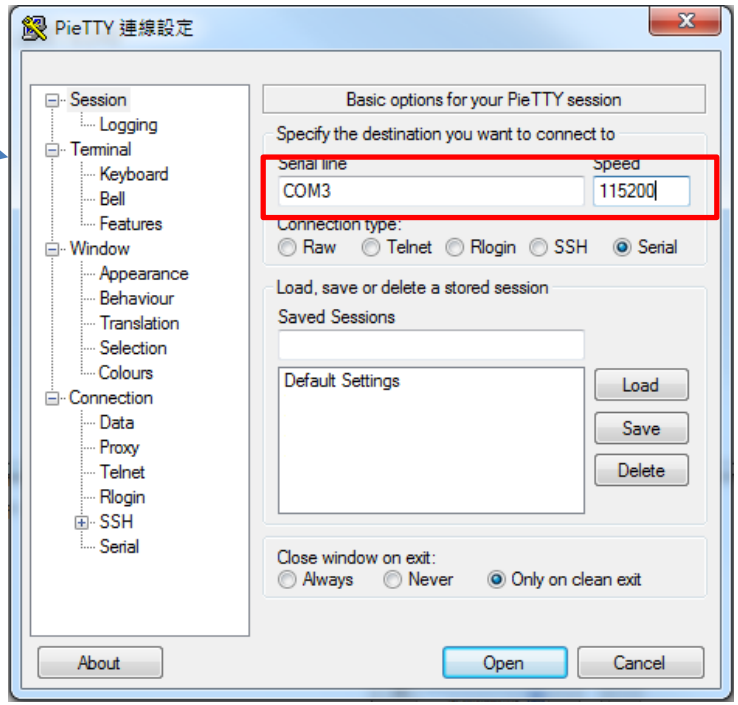
- 晶片組PL2303HXD:支援Windows 8/10, MAC
  - Windows Driver:
    - http://www.prolific.com.tw/US/ShowProduct.aspx?p_id=225&pcid=41
  - MAC driver:
    - http://www.prolific.com.tw/US/ShowProduct.aspx?p_id=229&pcid=41
    - https://www.ftdichip.com/Drivers/VCP.htm

步驟4：電腦端準備 USB 轉 TTL 序列傳輸線

- 安裝完驅動, 在裝置管理員可發現多一個連接阜 (下圖為 COM3)
  - 我的電腦 -> 右鍵-> 內容-> 裝置管理員



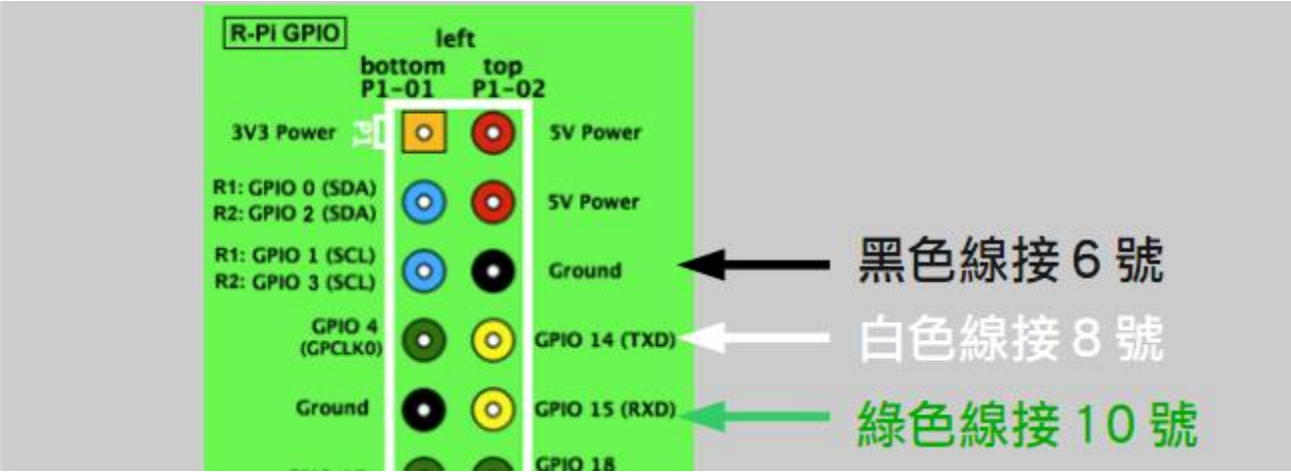
- 使用putty連線 (設定Serial port 與 Speed)



- For MAC OS
  - Use terminal, enter the command
  - **screen /dev/cu.usbserial 115200**

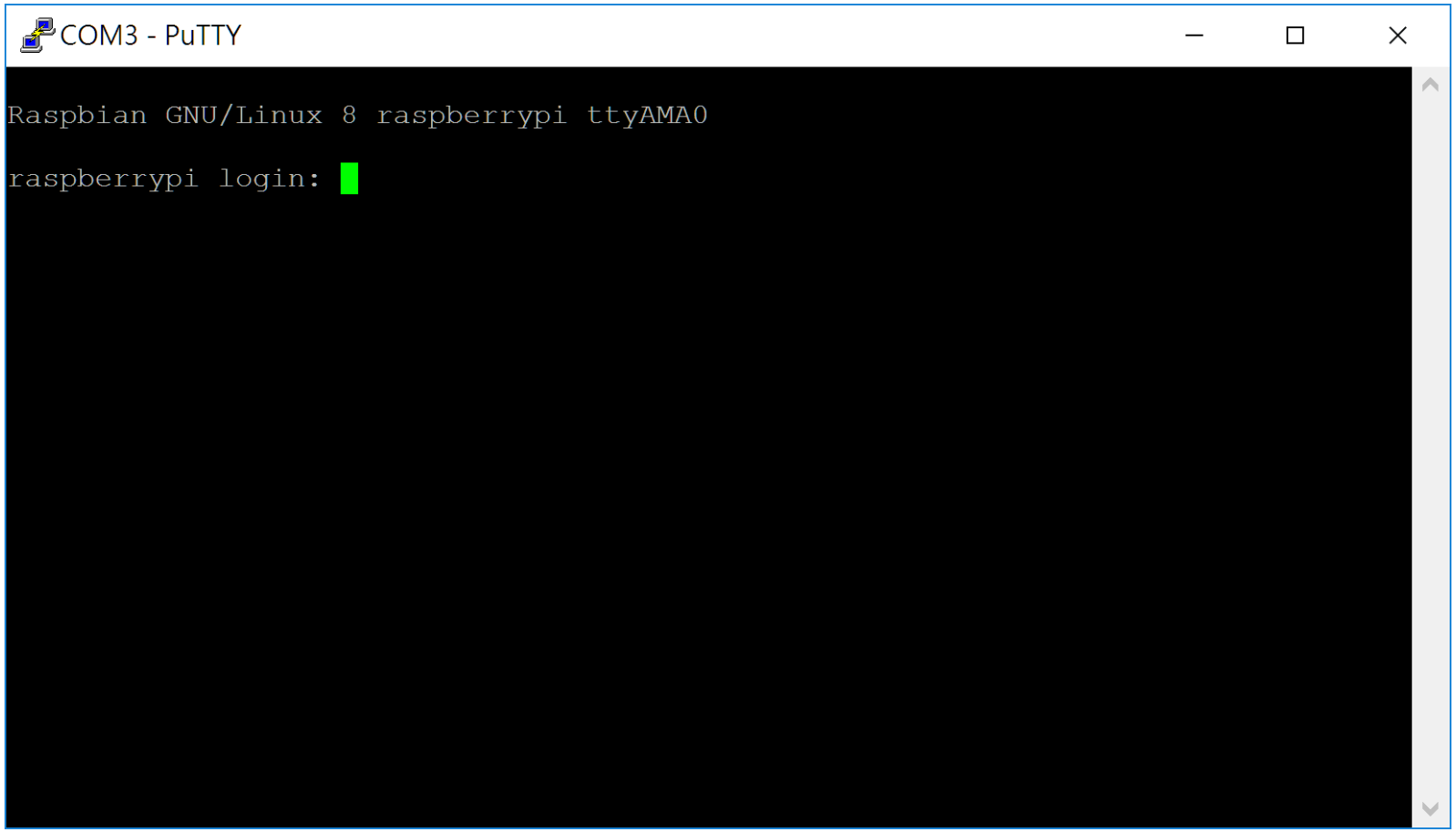
步驟5：將SD卡插到Raspberry PI並開機

- **從序列埠登入到 Raspberry Pi**
  - 透過 USB 轉 TTL 序列傳輸線，就可以在不需要螢幕和鍵盤滑鼠的情況下登入 Raspberry Pi
- **預設登入帳密**
  - ID: pi
  - PW: raspberry



https://www.raspberrypi.com.tw/tag/usb-to-ttl/

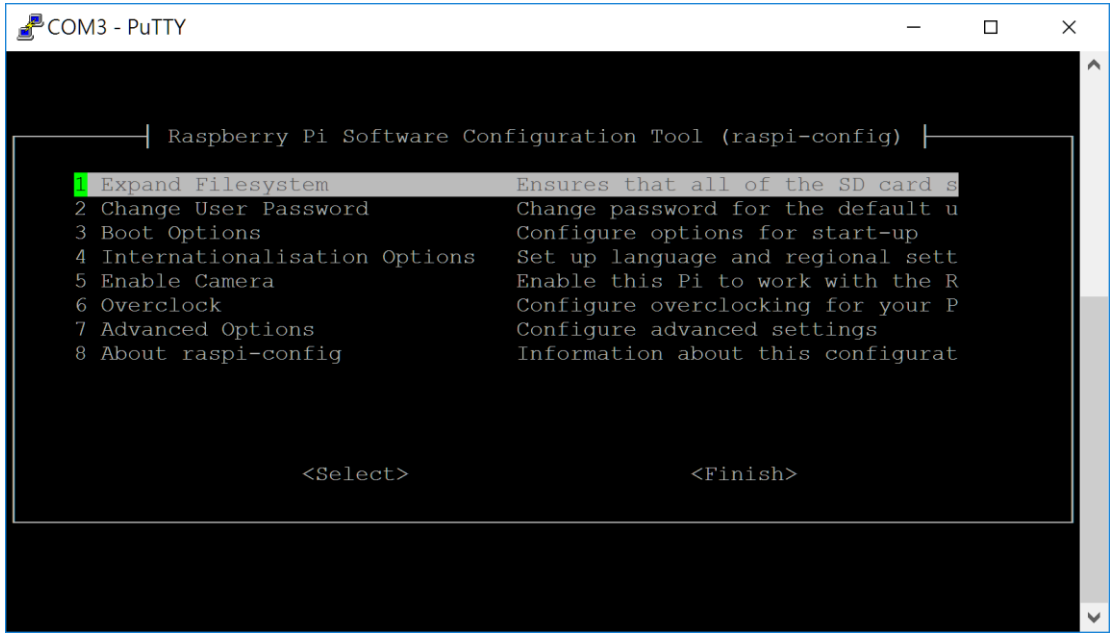
步驟5：將SD卡插到Raspberry PI並開機



還是沒有畫面? -> 按一下Enter鍵 or 電腦重開機試試

2. PI的環境設定

- 擴充SD卡空間
  - 預設只有使用約2G的空間 -> 可是SD卡有16G -> 浪費了10G的空間
  - 在terminal下輸入: **sudo raspi-config ->** 選擇「**Expand Filesystem** 」
  - Reboot後系統所能使用的空間就為SD卡所擁有的空間



2. PI的環境設定

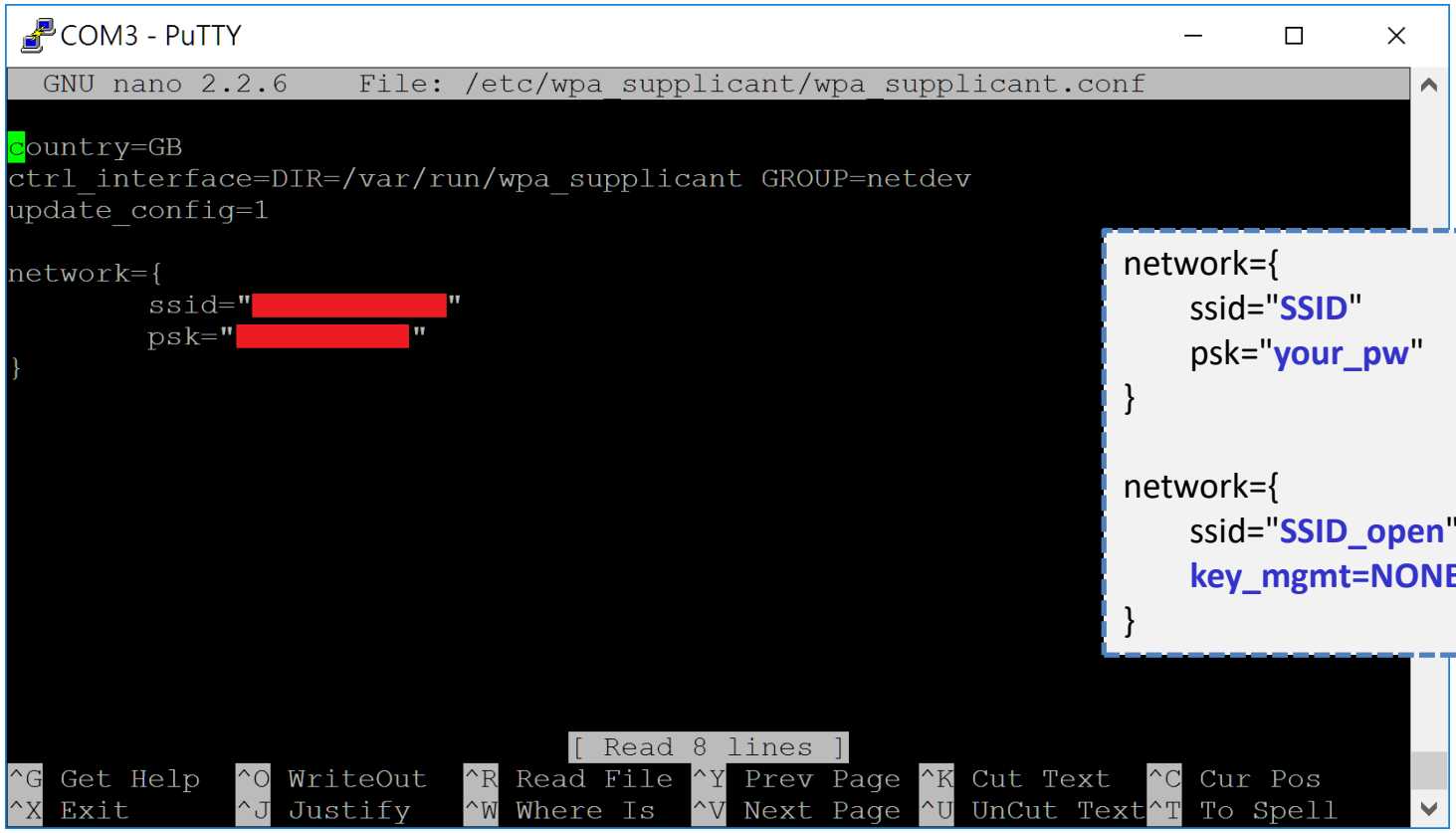
- 設定Wi-Fi
  - 使用螢幕鍵盤滑鼠, 可以直接點選Wi-Fi
    -> 在純文字介面要怎麼設定Wi-Fi?
- 用文字編輯器修改設定檔
  1. sudo nano /etc/wpa_supplicant/wpa_supplicant.conf (編輯設定檔)
  2. 填寫SSID與密碼
  3. 重開機
     - sudo reboot
  4. 使用 ifconfig 與 iwconfig 檢查連線狀態

```
network={
        ssid= "your_ap"
        key_mgmt=NONE
} // open system
```

```
network={
        ssid= "your_ap"
        psk= "your_passwd"
} // with password
```

2. PI的環境設定

- [設定Wi-Fi] 修改設定檔
  - sudo nano /etc/wpa_supplicant/wpa_supplicant.conf

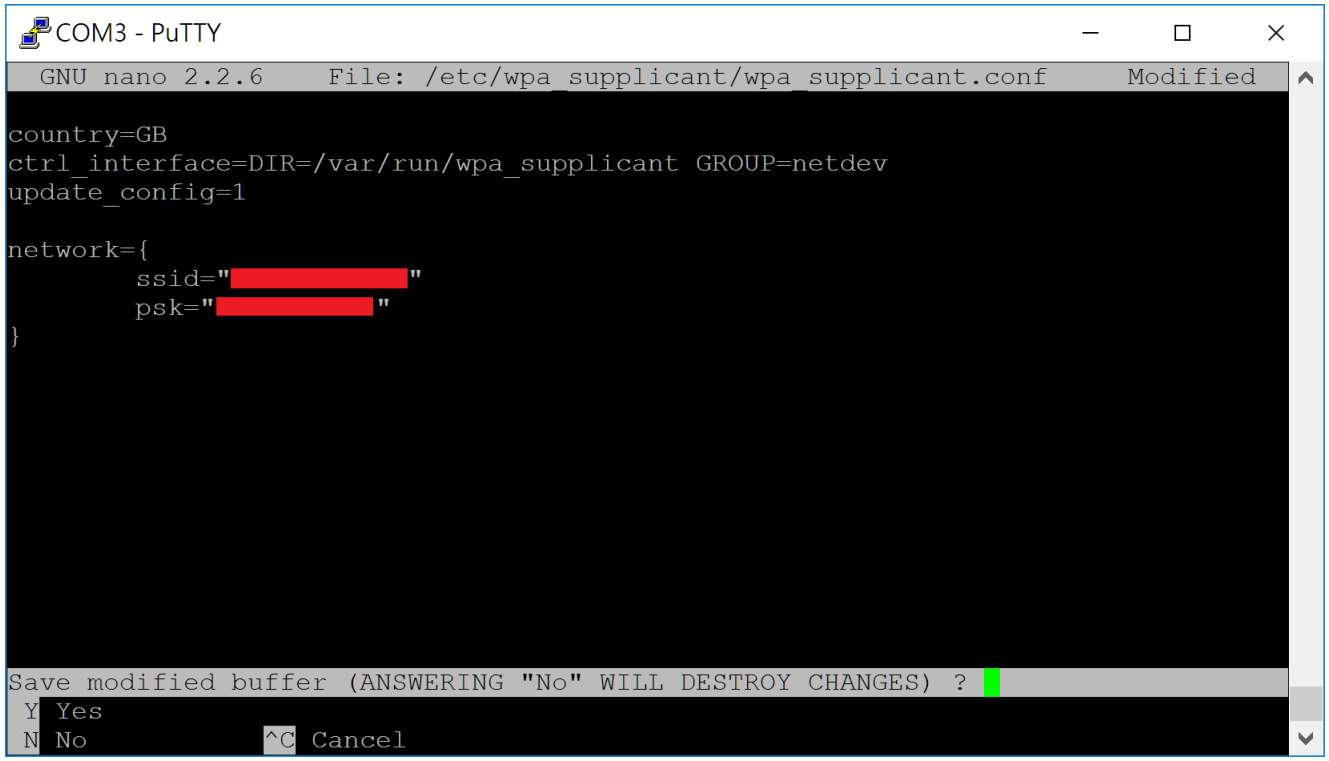



```
network={
        ssid="SSID"
        psk="your_pw"
}

network={
        ssid="SSID_open"
        key_mgmt=NONE
}
```

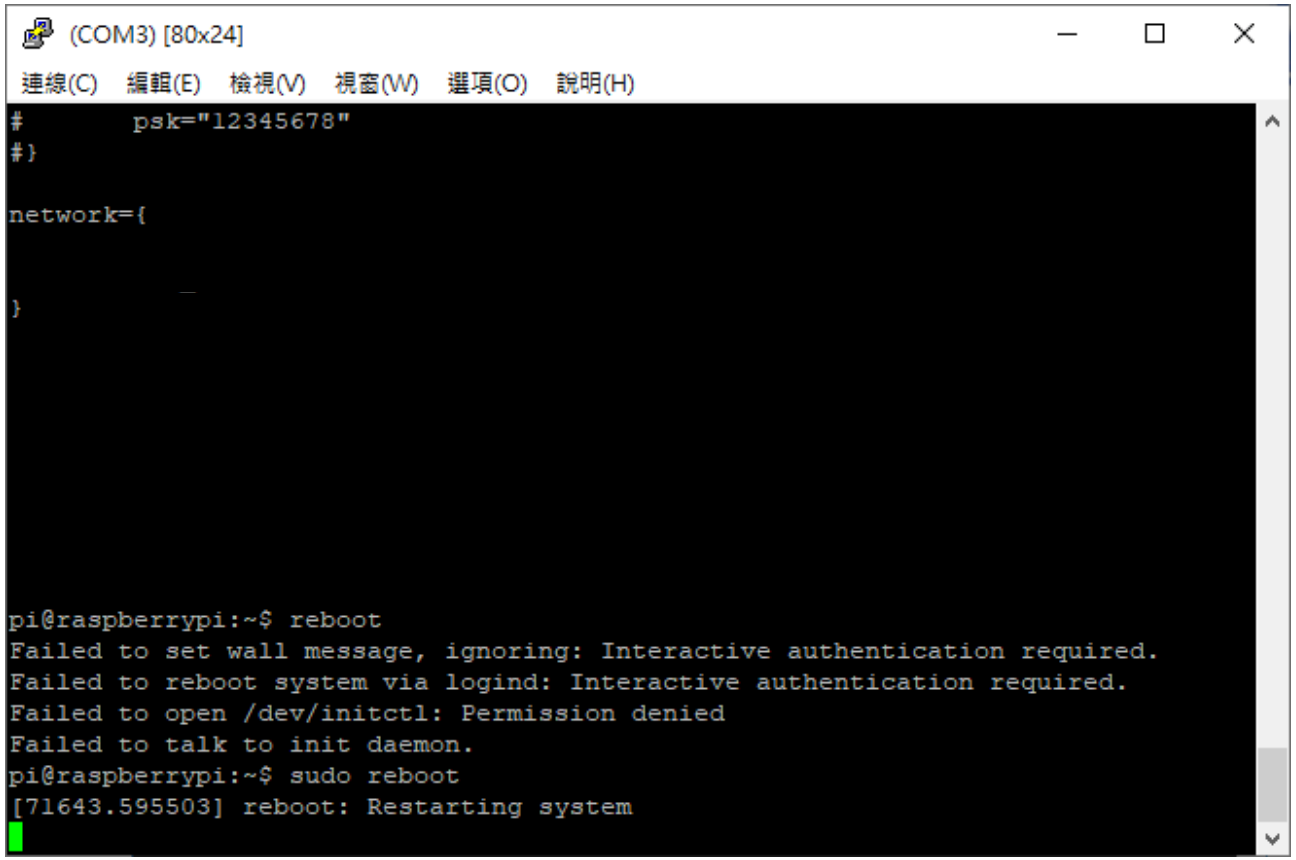
2. PI的環境設定

- [設定Wi-Fi] 文字編輯器 nano
  - 編輯結束按 **ctrl + x** 離開
    - 若有變動, 會問你是否存檔, 輸入 **Y** 即可



2. PI的環境設定

- [設定Wi-Fi] 重新啟動
  - 在終端機打 sudo reboot



2. PI的環境設定

- [設定Wi-Fi] 確認是否已連到網路
  - 指令: ifconfig 或 iwconfig
    - ifconfig 執行結果

```
wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.20  netmask 255.255.255.0  broadcast 192.168.1.255
        inet6 fe80::bdbe:cb97:93ed:4516  prefixlen 64  scopeid 0x20<link>
        ether b8:27:eb:ea:da:f8  txqueuelen 1000  (Ethernet)
        RX packets 10  bytes 1575 (1.5 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 34  bytes 5841 (5.7 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

    - iwconfig 執行結果

```
wlan0     IEEE 802.11  ESSID:"hscc_wu56"
          Mode:Managed  Frequency:2.437 GHz  Access Point: AC:9E:17:8E:9A:AC
          Bit Rate=65 Mb/s   Tx-Power=31 dBm
          Retry short limit:7   RTS thr:off   Fragment thr:off
          Power Management:on
          Link Quality=70/70  Signal level=-33 dBm
          Rx invalid nwid:0  Rx invalid crypt:0  Rx invalid frag:0
          Tx excessive retries:0  Invalid misc:0   Missed beacon:0
```

2. PI的環境設定

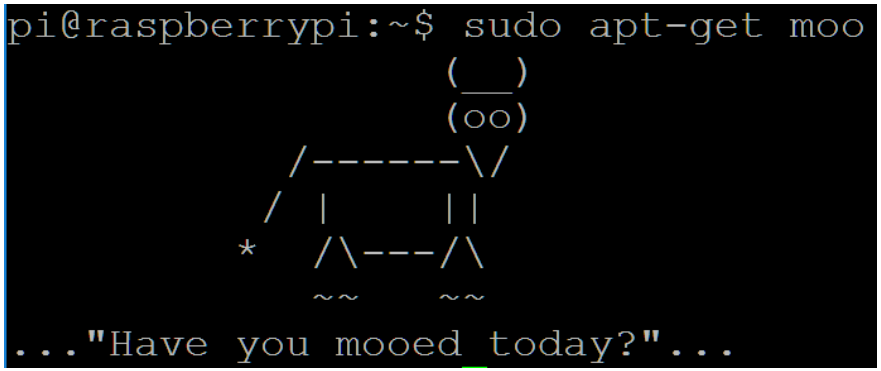
- 網路設定好之後, 可以開始建立想要的服務 or下載程式
- 建立服務: 使用apt-get安裝程式
  - APT = Advanced Packaging Tools
  - 連上網路自動下載程式來安裝
    - 已編譯好, 不須從source code重新編譯
    - 類似Appstore與Google play線上商店的概念
- Ex: sudo apt-get install xrdp -y
  - 安裝遠端桌面服務(xrdp)

使用apt-get安裝程式

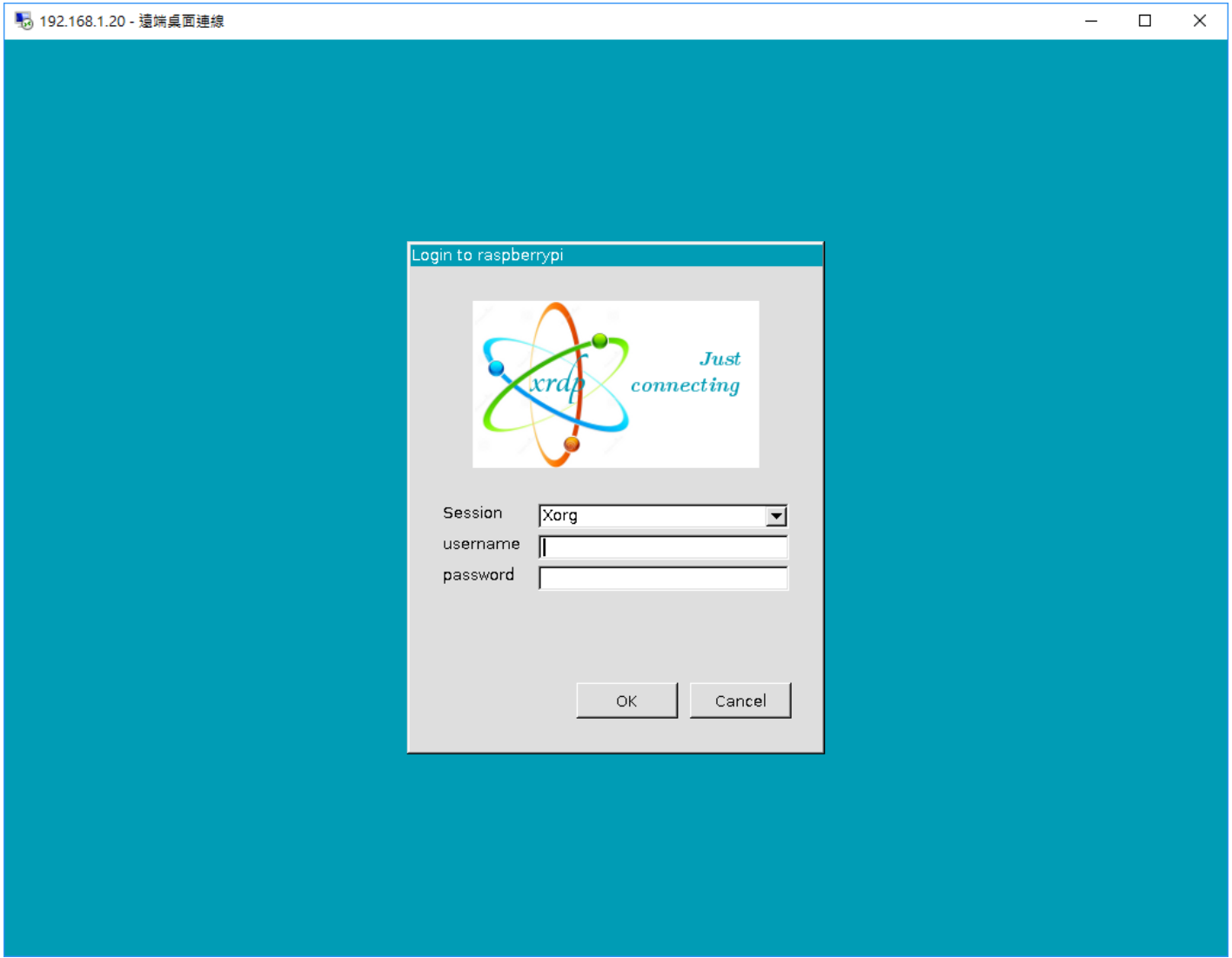
- 更新套件清單: sudo apt-get update
- 安裝套件: sudo apt-get install <pkg_name>

- 搜尋套件: sudo apt-cache search <keyword>
- 移除套件: sudo apt-get remove <pkg_name>
- 升級套件: sudo apt-get upgrade

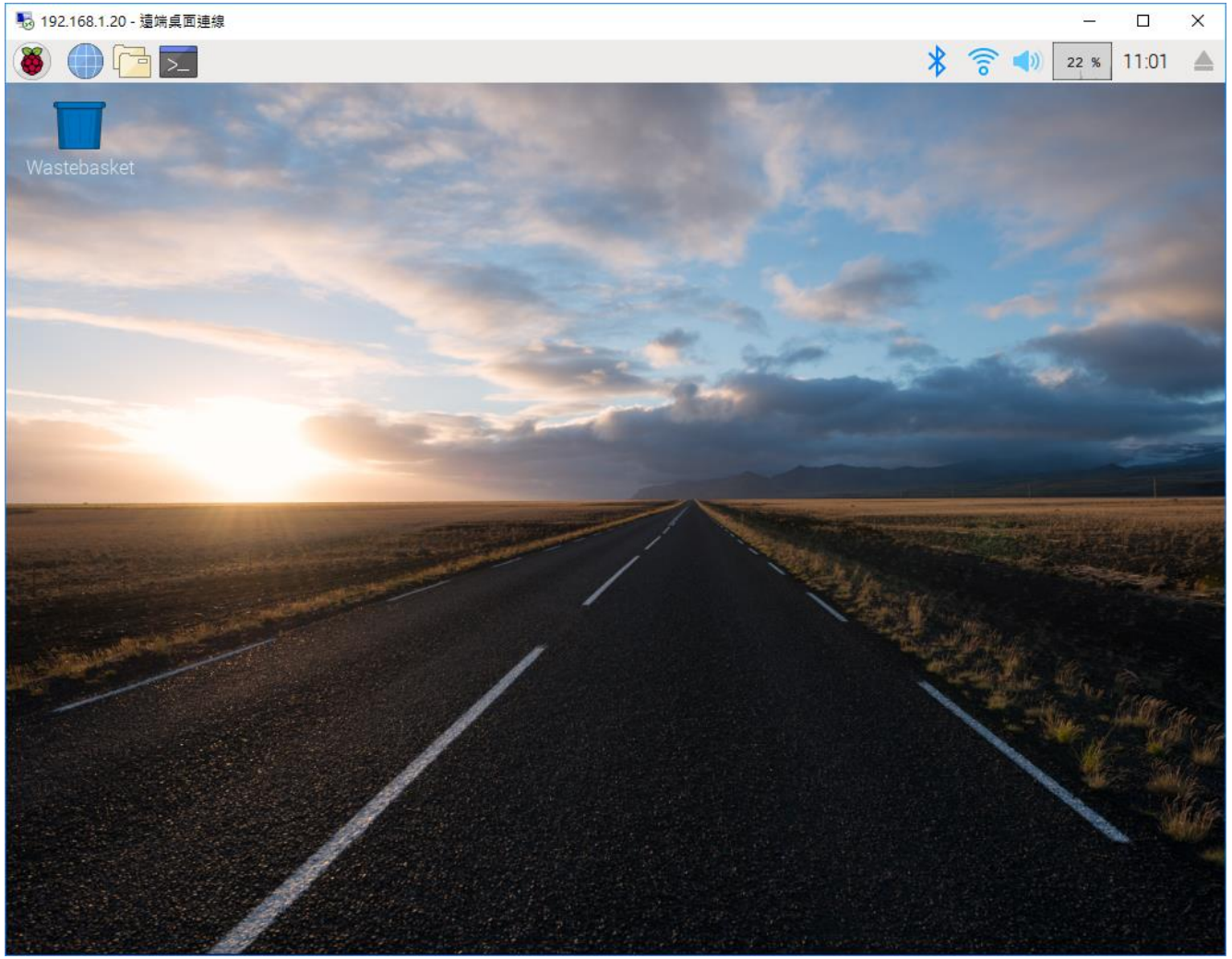
- 彩蛋: sudo apt-get moo



遠端桌面服務(xrdp)

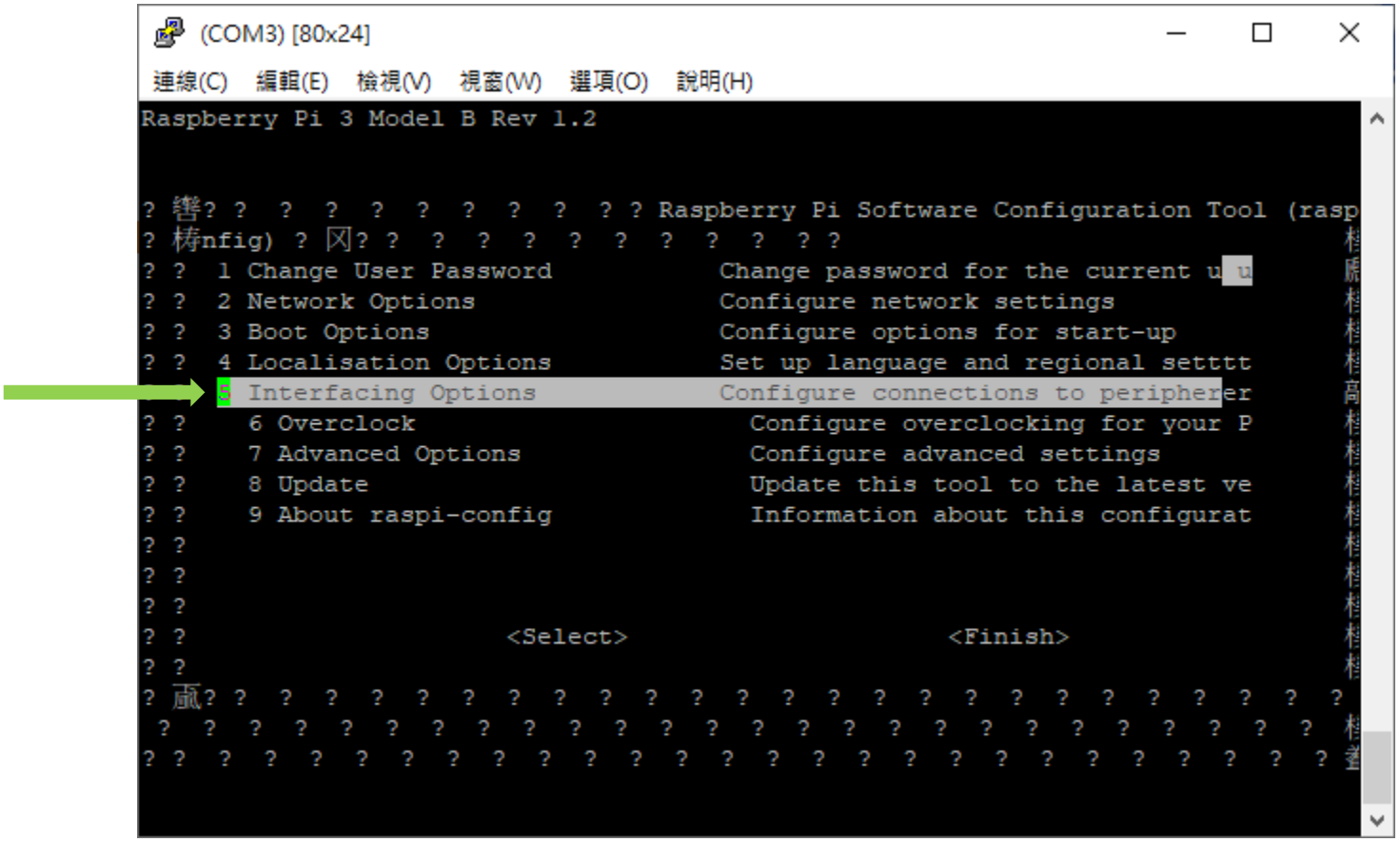

192.168.1.20 - 遠端桌面連線
Login to raspberrypi
xrdp
Just connecting
Session
Xorg
username
password
OK
Cancel

遠端桌面服務(xrdp)



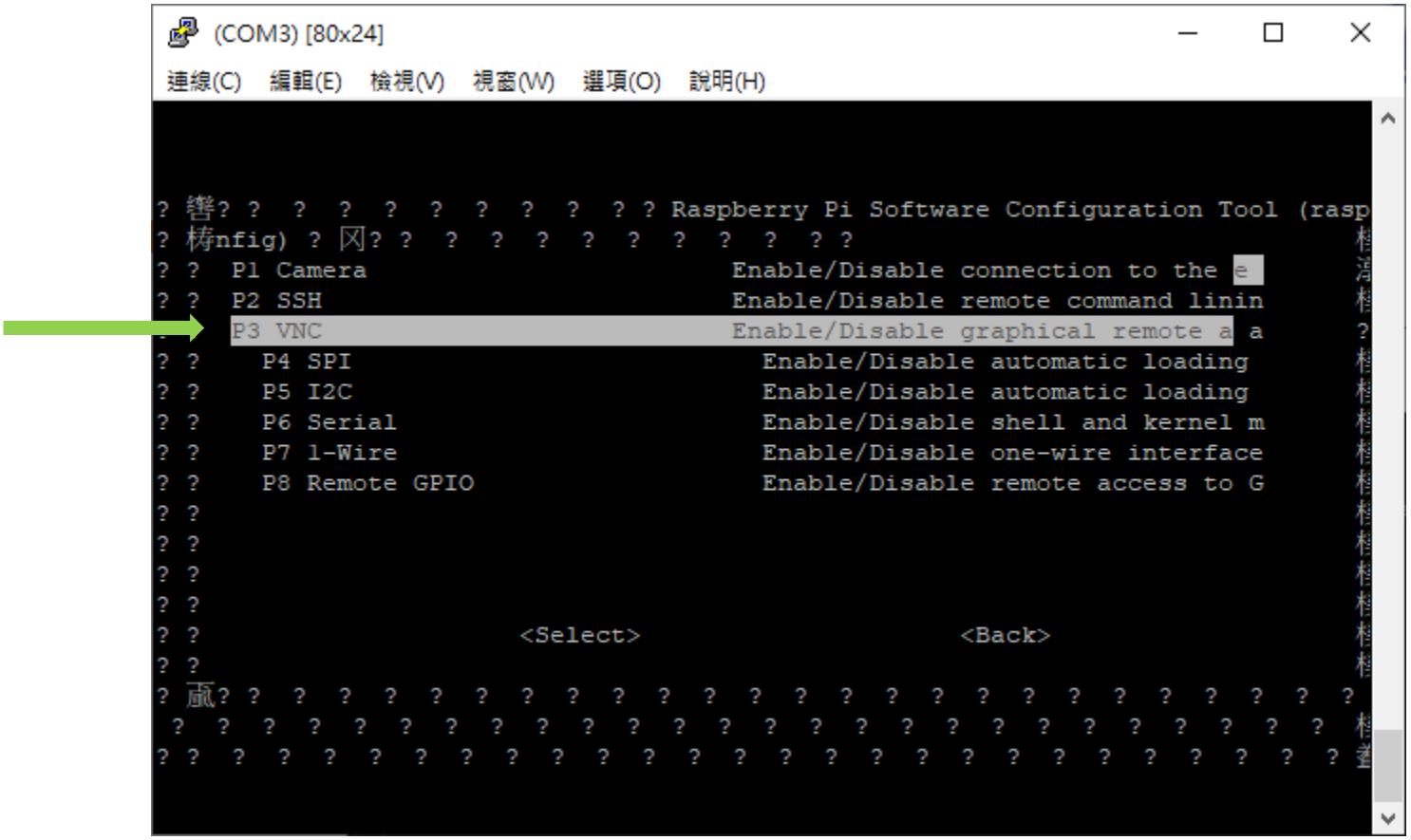
3. 設定遠端桌面連線(vnc)

- 執行指令: sudo raspi-config



3. 設定遠端桌面連線(vnc)

- 執行指令: sudo raspi-config

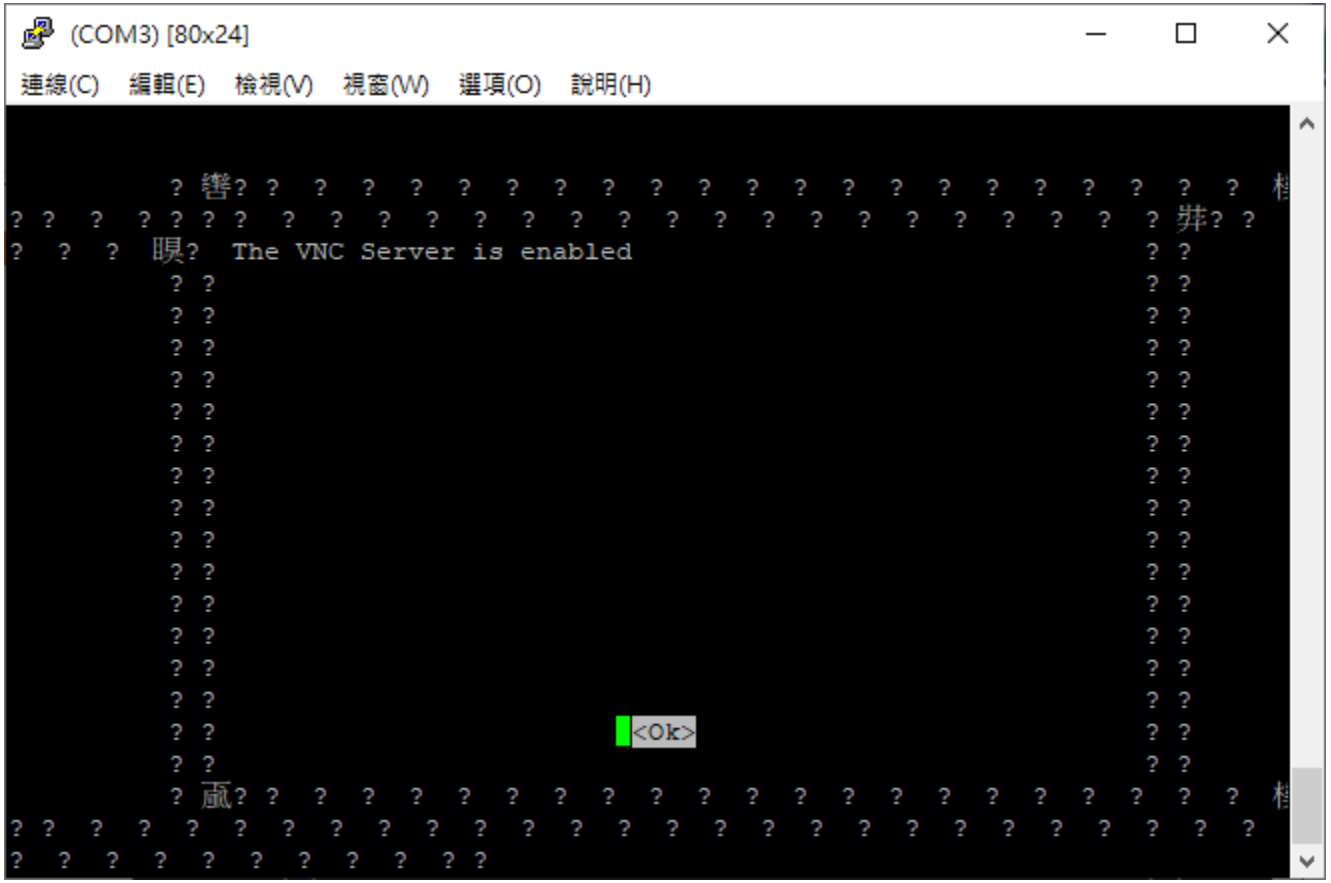


3. 設定遠端桌面連線(vnc)

- 執行指令: sudo raspi-config

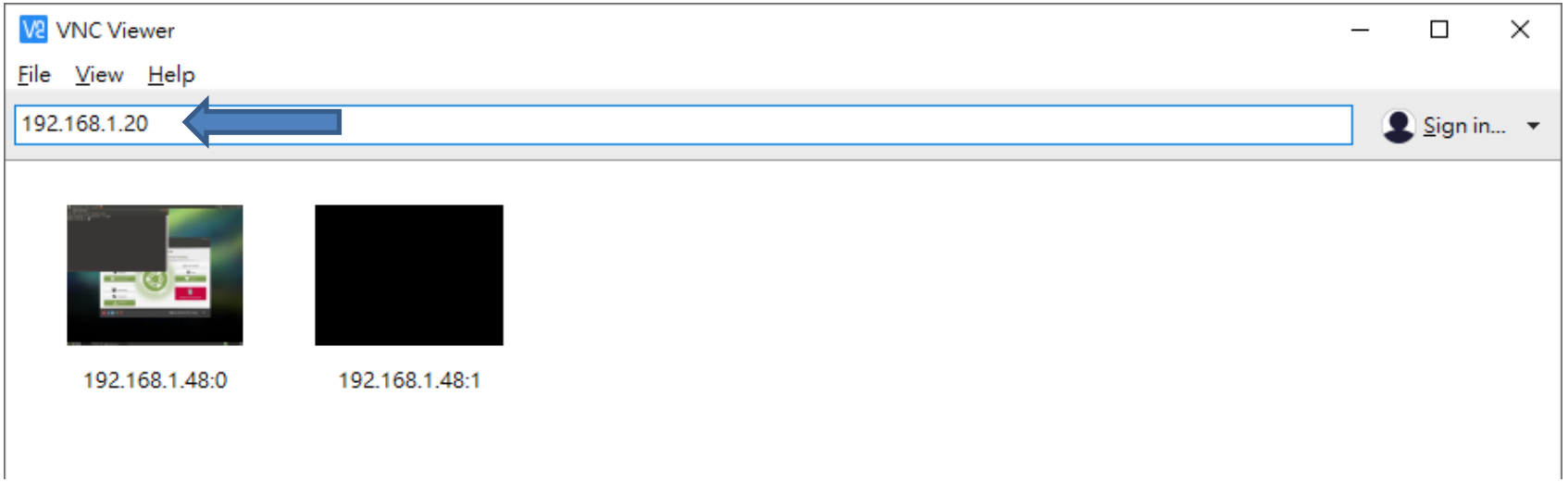
3. 設定遠端桌面連線(vnc)

- 執行指令: sudo raspi-config



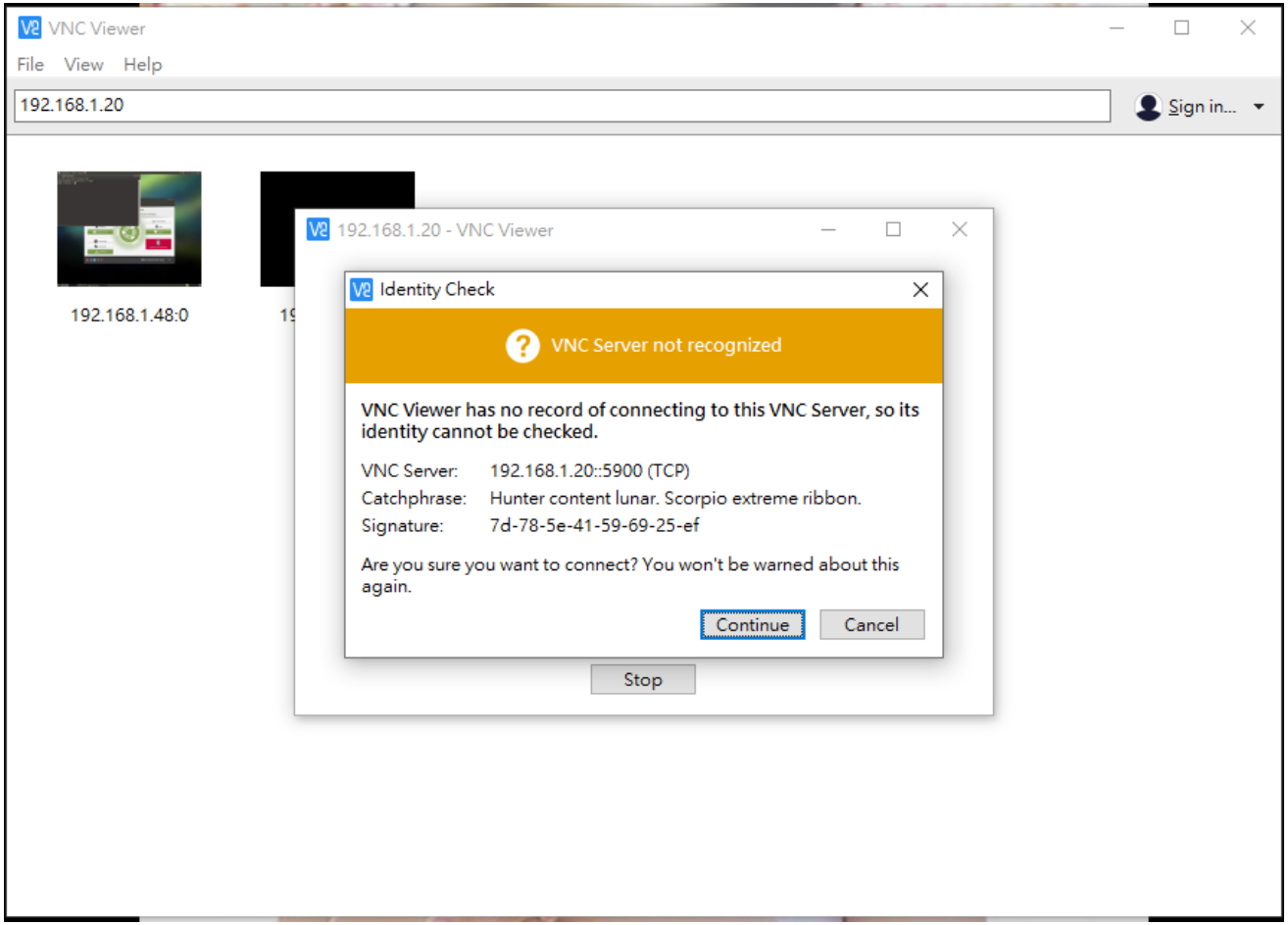
3. 設定遠端桌面連線(vnc)

- 電腦端執行vncviewer



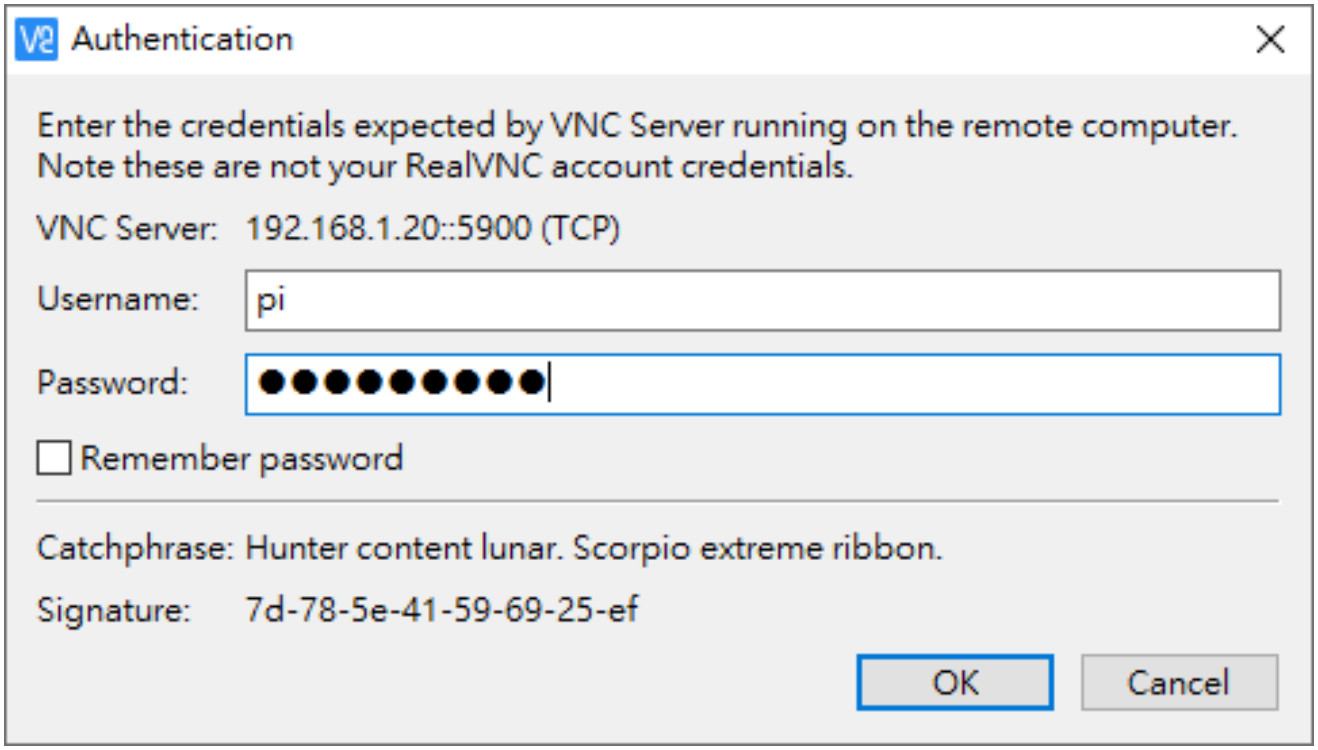
3. 設定遠端桌面連線(vnc)

- 電腦端執行vncviewer

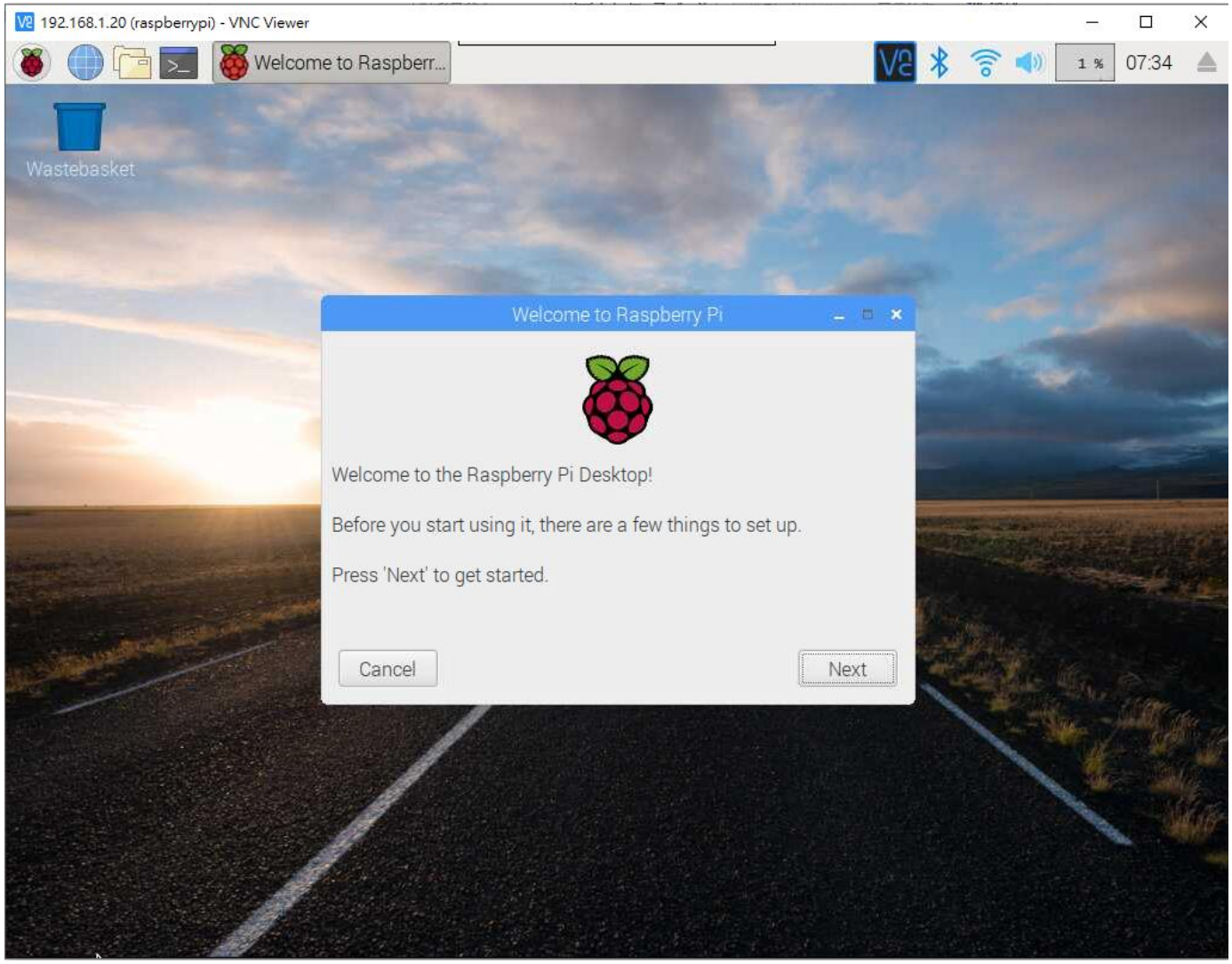


3. 設定遠端桌面連線(vnc)

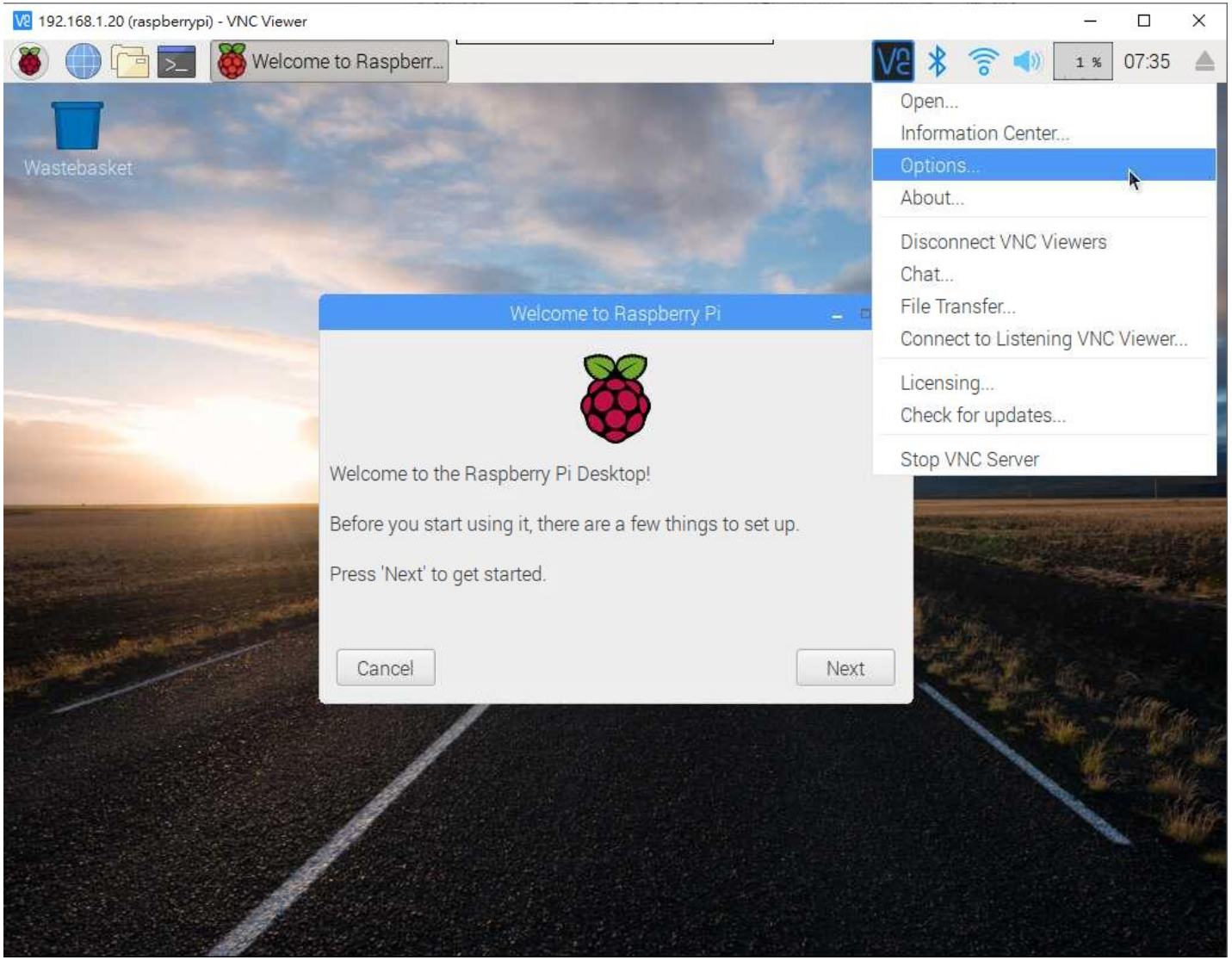
- 電腦端執行vncviewer



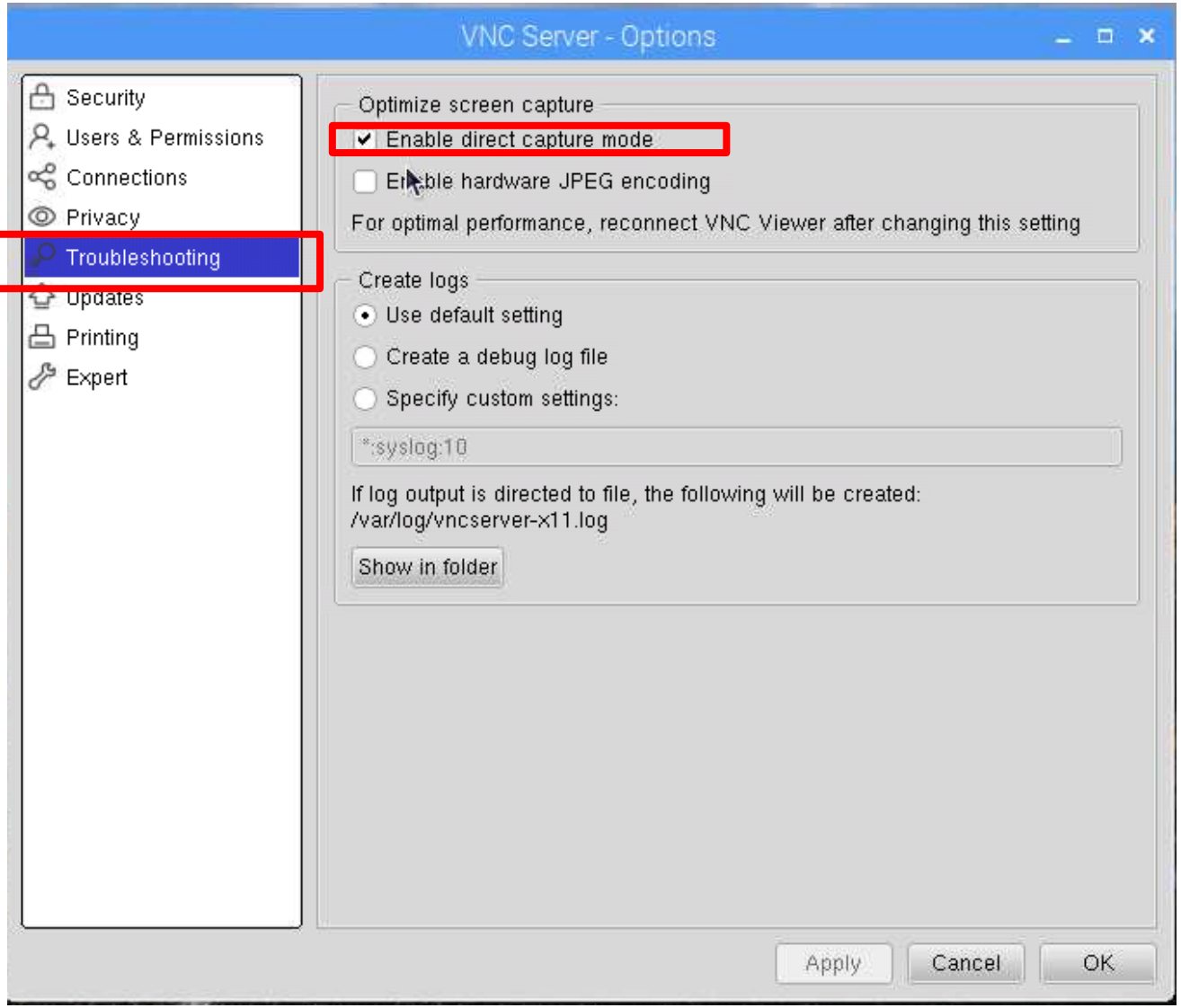
3. 設定遠端桌面連線(vnc)



3. VNC額外設定


192.168.1.20 (raspberrypi) - VNC Viewer
Welcome to Raspberr...
1 %
07:35
Wastebasket
Open...
Information Center...
Options...
About...
Disconnect VNC Viewers
Chat...
File Transfer...
Connect to Listening VNC Viewer...
Licensing...
Check for updates...
Stop VNC Server
Welcome to Raspberry Pi
Welcome to the Raspberry Pi Desktop!
Before you start using it, there are a few things to set up.
Press 'Next' to get started.
Cancel
Next

3. VNC額外設定

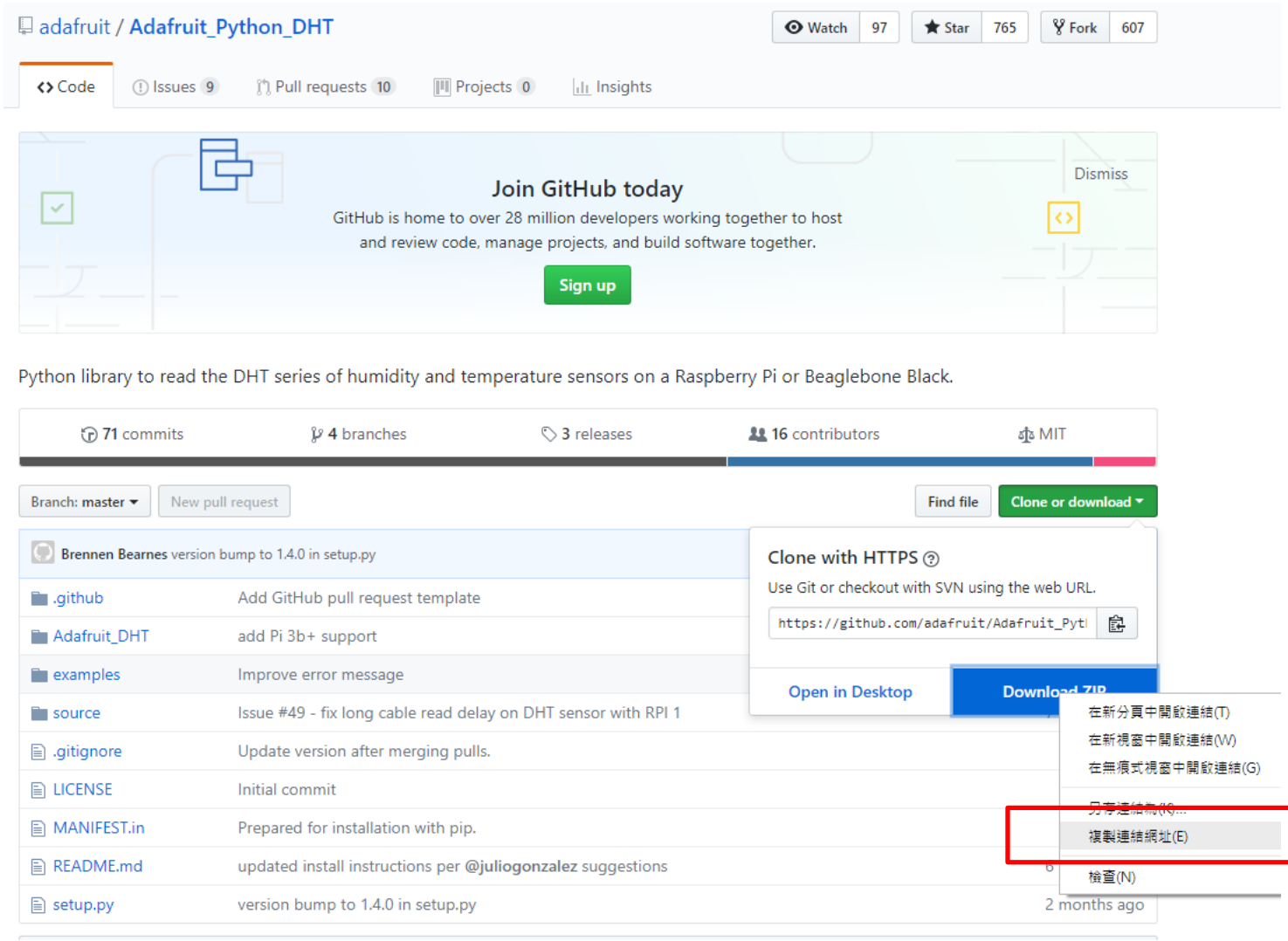

VNC Server - Options
Security
Users & Permissions
Connections
Privacy
Troubleshooting
Updates
Printing
Expert
Optimize screen capture
Enable direct capture mode
Enable hardware JPEG encoding
For optimal performance, reconnect VNC Viewer after changing this setting
Create logs
Use default setting
Create a debug log file
Specify custom settings:
*:syslog:10
If log output is directed to file, the following will be created:
/var/log/vncserver-x11.log
Show in folder
Apply
Cancel
OK

4. 與電腦互傳檔案

- Ex: 下載溫溼度library
  - https://github.com/adafruit/Adafruit_Python_DHT

- A. 直接用PI下載檔案
  - wget, git clone
- B.在電腦下載, 透過網路傳輸
  - python, winscp
- C. 在電腦下載, 用USB隨身碟複製過去
  - Linux操作指令, mount

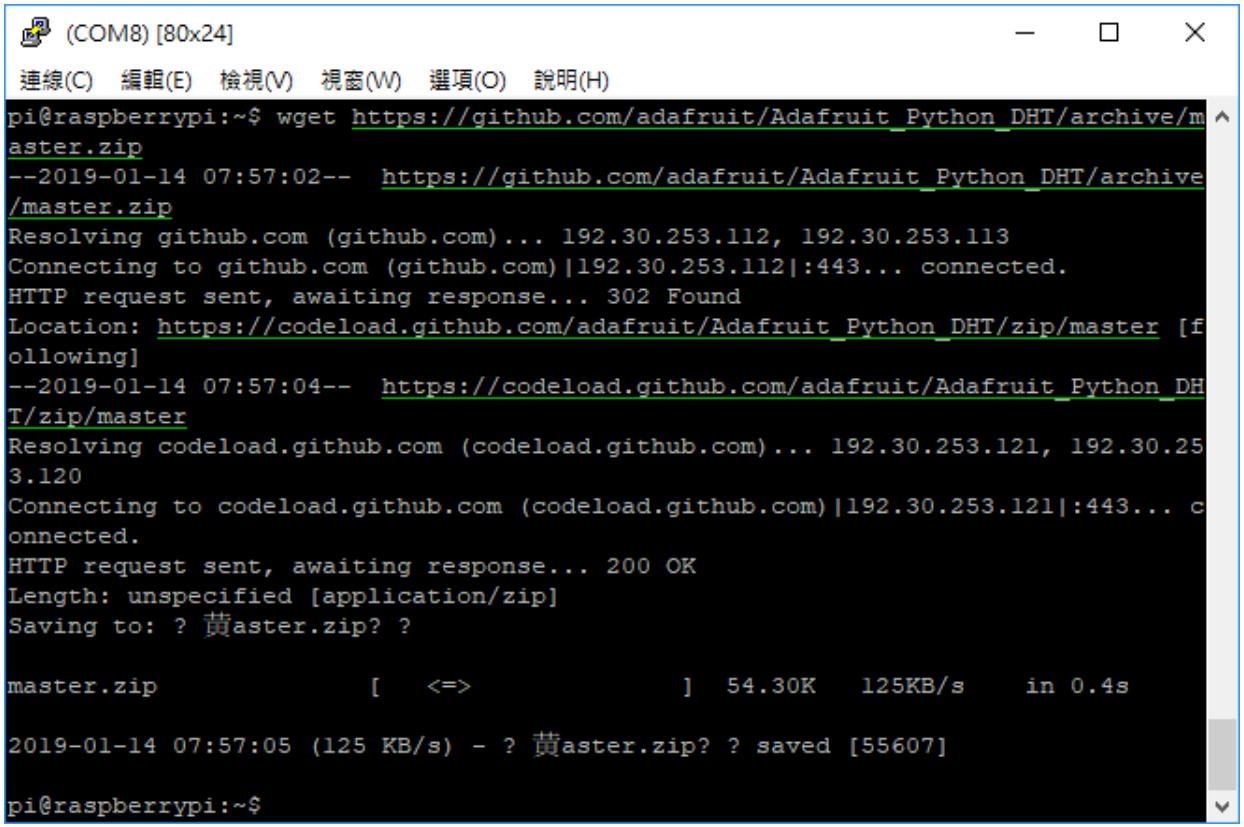
A. 直接用PI下載檔案



複製下載連結

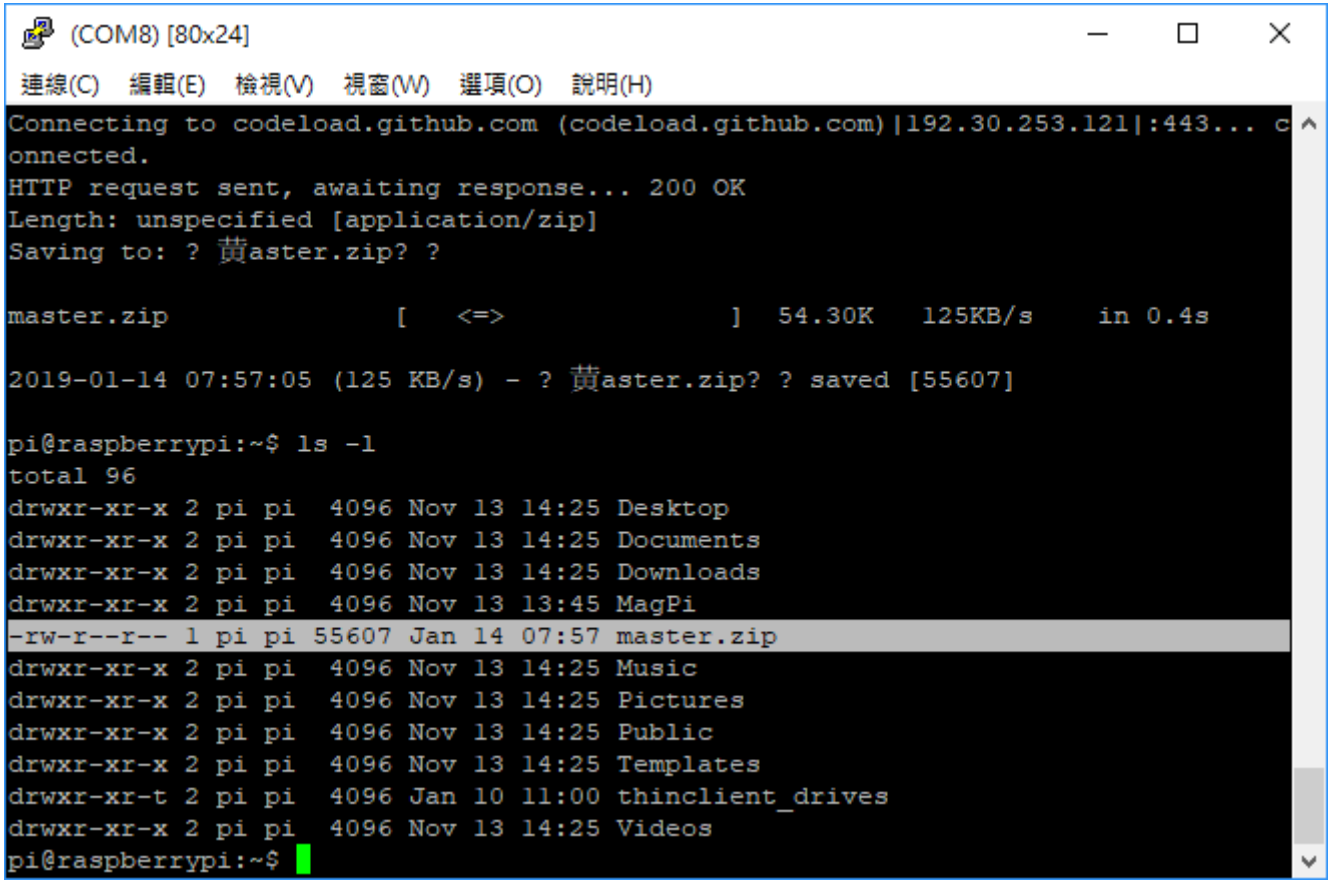
A. 直接用PI下載檔案

- 在終端機執行 wget 指令
  - Ex: wget https://github.com/adafruit/Adafruit_Python_DHT/archive/master.zip



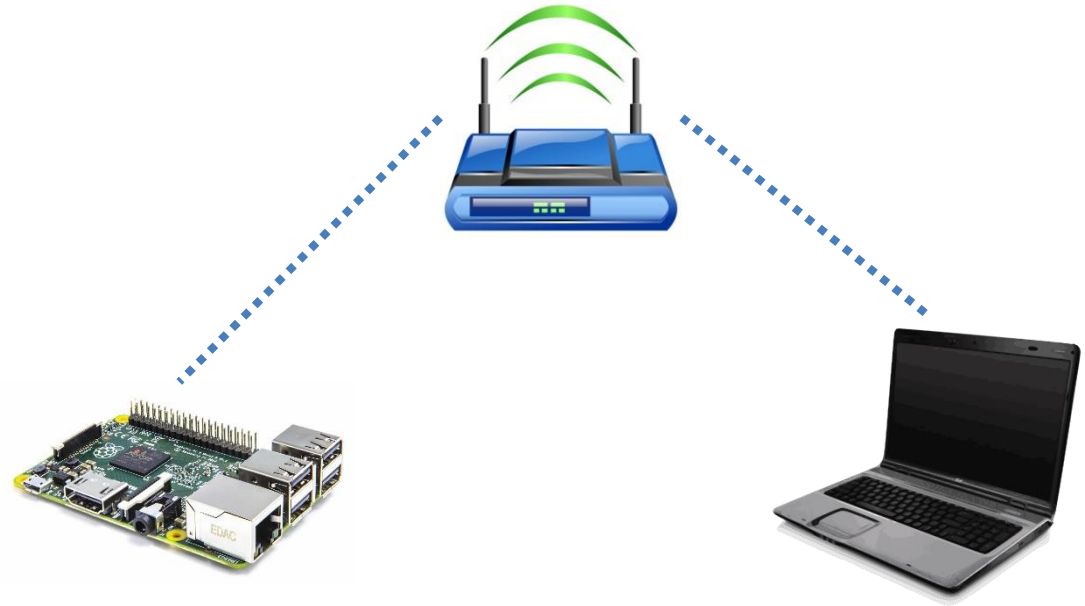
A. 直接用PI下載檔案

- 下載完畢



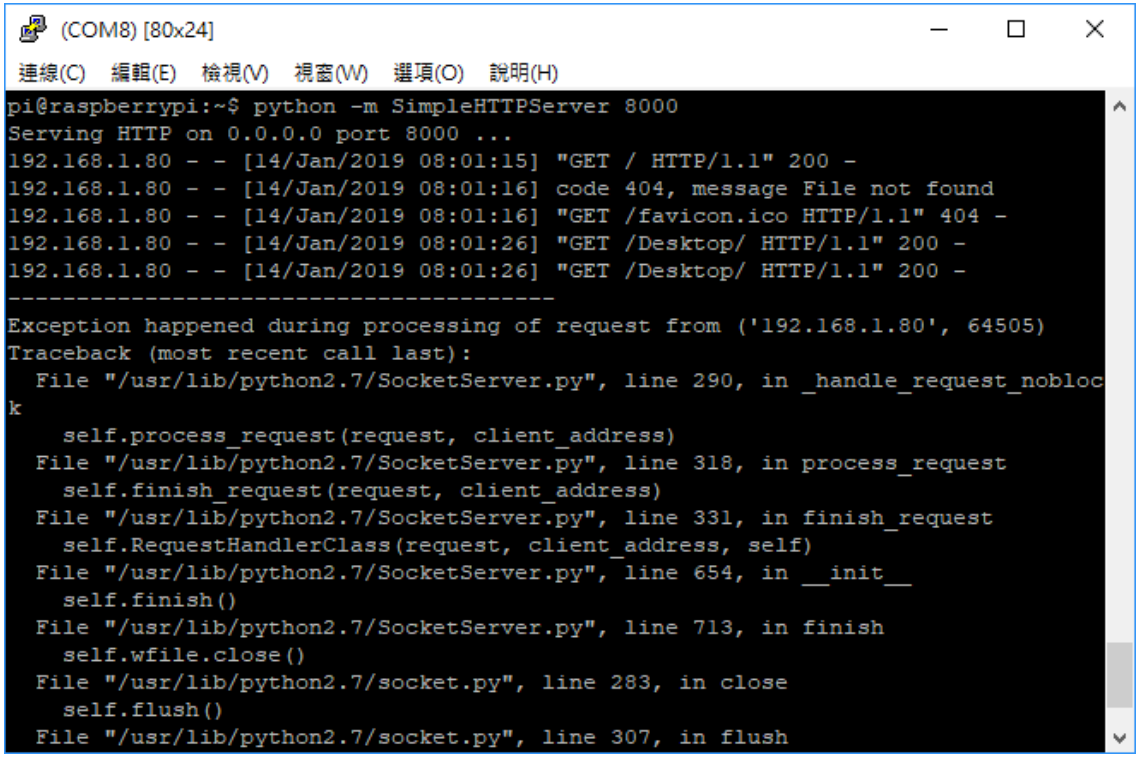
B. 在電腦下載, 透過網路傳輸

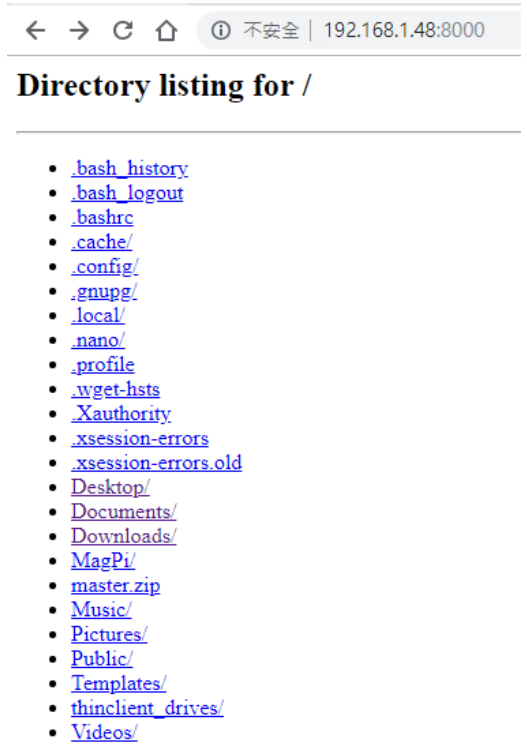
- 網路架構:
  - Case 1: PI 有 Public IP address (通常不可能)
  - Case 2: 電腦與PI在同一個子網路 (較常見)



B. 在電腦下載, 透過網路傳輸

- 1. python有內建simple http server
  - 指令: python -m SimpleHTTPServer 8000
  - 電腦端可以直接透過網頁下載PI裡面的檔案





B. 在電腦下載, 透過網路傳輸

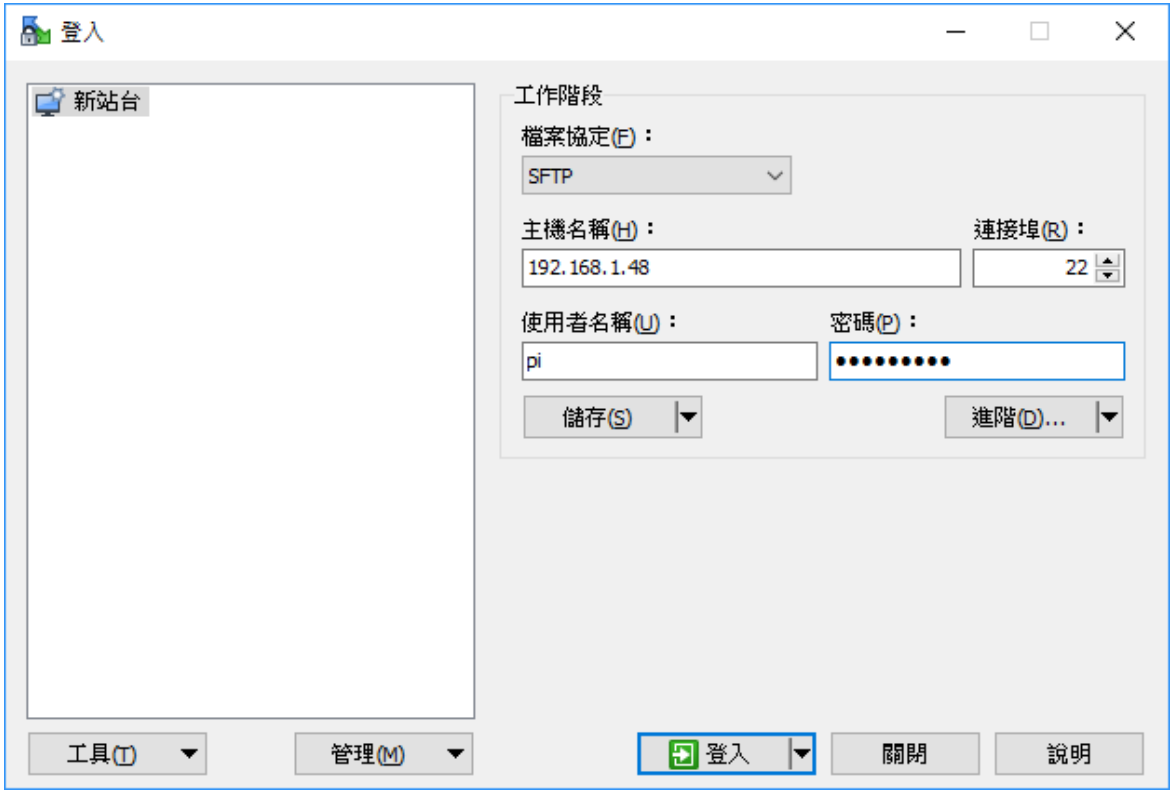
- 2. 在電腦上安裝winscp, 輸入IP的ip address與帳密, 即可連線傳輸資料 (如同ftp介面)
  - 需先啟用ssh login功能
    - 直接在 /boot/ 裡面新增空白檔案, 檔名為ssh
  - 設定指令: sudo touch /boot/ssh

For headless setup, SSH can be enabled by placing a file named ssh, without any extension, onto the boot partition of the SD card from another computer. When the Pi boots, it looks for the ssh file. If it is found, SSH is enabled and the file is deleted. The content of the file does not matter; it could contain text, or nothing at all.

https://www.raspberrypi.org/documentation/remote-access/ssh/

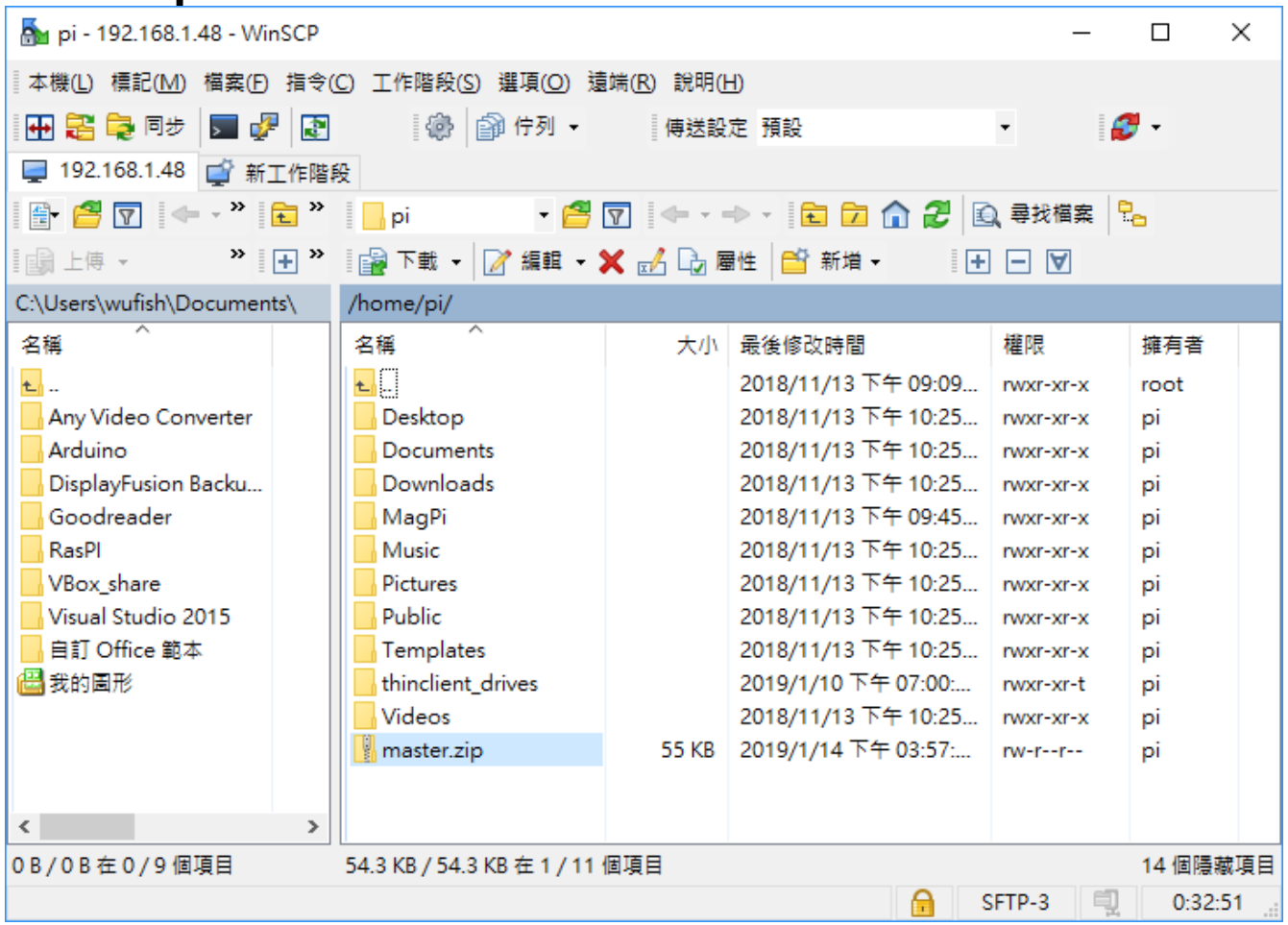
B. 在電腦下載, 透過網路傳輸

- 2. winscp: 輸入IP的ip address與帳密, 即可連線傳輸資料 (如同ftp介面)



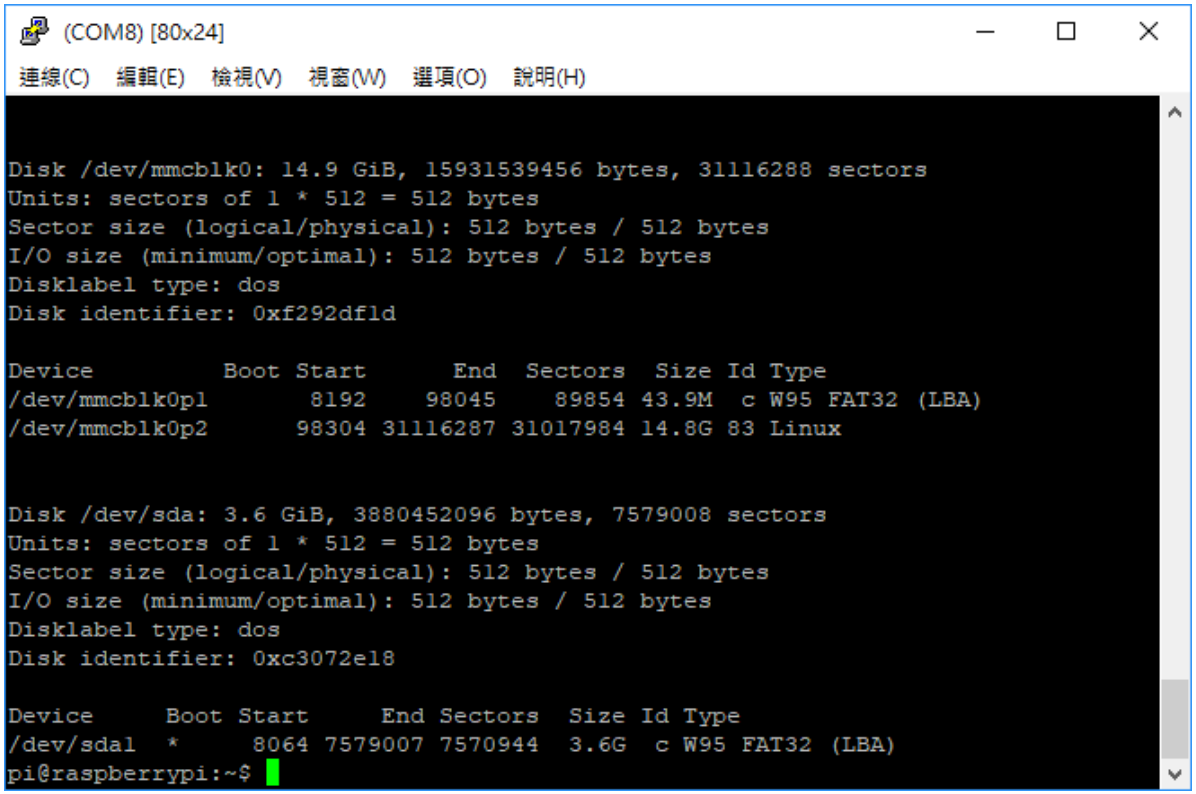
B. 在電腦下載, 透過網路傳輸

- 2. winscp 使用畫面



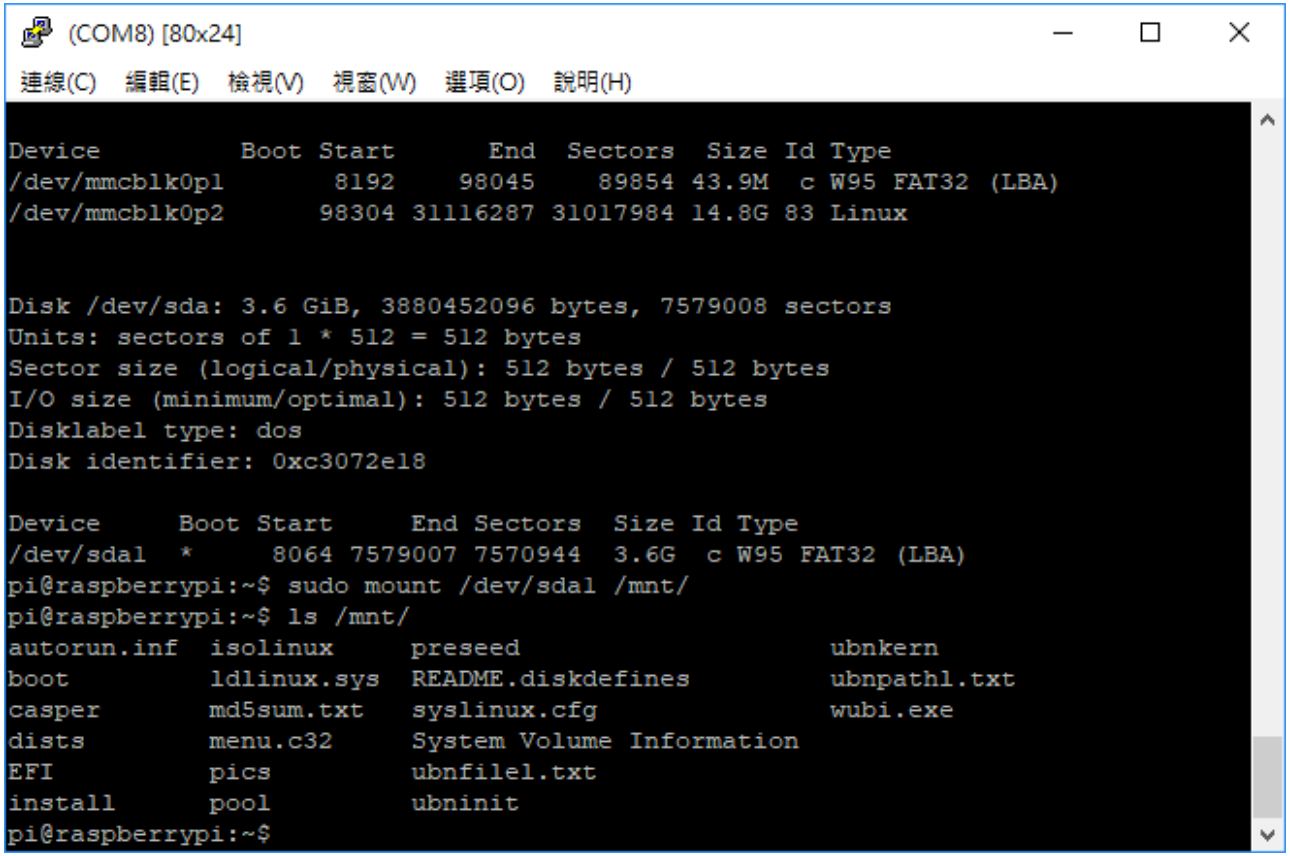
C. 在電腦下載, 用USB隨身碟複製

- 指令: mount
  - 較複雜, 適用於有linux操作經驗的使用者
  - 優點: 沒有網路也可複製



C. 在電腦下載, 用USB隨身碟複製

- 掛載: sudo mount /dev/sda1 /mnt
- 卸載: sudo umount /mnt

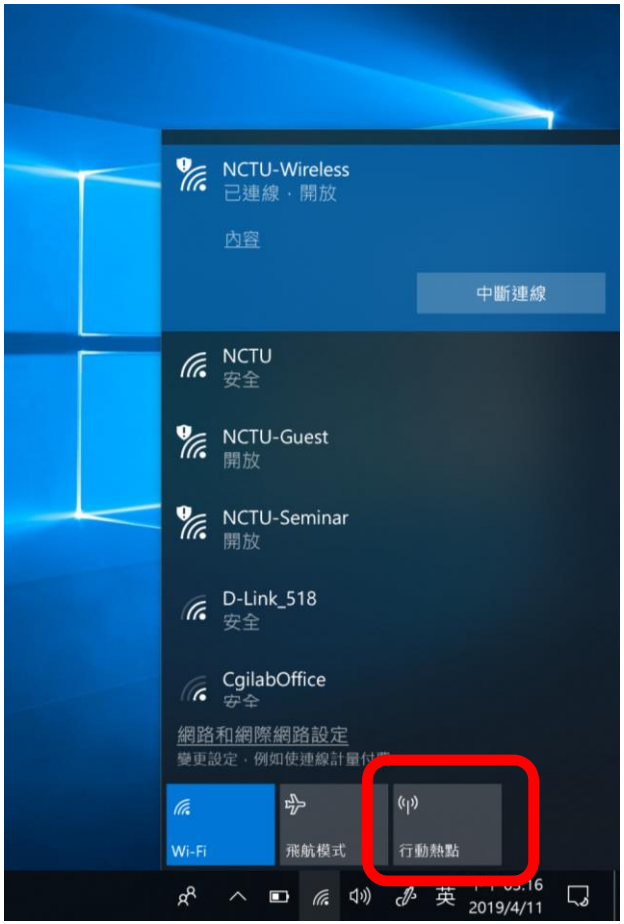


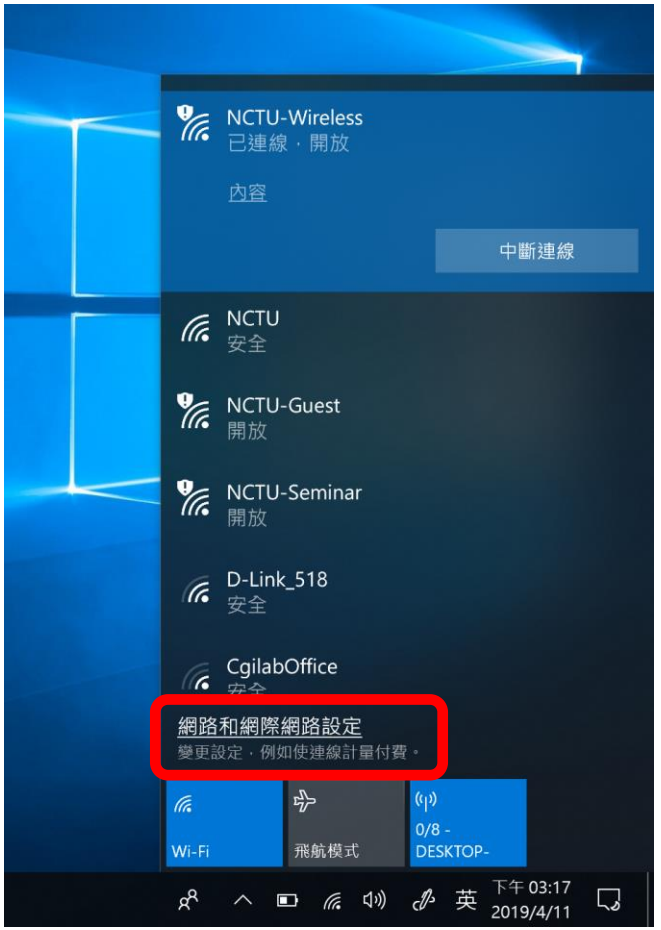
Summary

- 1. 根據安裝步驟, 使用TTL控制樹莓派
- 2. 建立VNC遠端桌面, 需開啟 “direct capture mode”
- 3. 練習wget、simpleHTTPserver與winscp傳輸檔案

Appendix 1

- Create your own Wi-Fi hotspot on windows 10





Appendix 1

- Create your own Wi-Fi hotspot on windows 10

https://github.com/raspberrypi-tw/sh/blob/master/dual_mode.sh

Appendix 2
Create Wi-Fi hotspot on PI

- wget https://raw.githubusercontent.com/raspberrypi-tw/sh/master/dual_mode.sh
- chmod +x dual_mode.sh
- sudo ./dual_mode.sh on # it will install related packages and reboot
- sudo ./dual_mode.sh off # it will reboot