

Raspberry Pi

互動科技藝術與感測設計

劉士達

課程大綱

- 1 電子材料清單介紹、認識Raspberry Pi 3 硬體、安裝Raspbian系統、GPIO控制(LED元件、按鈕元件)
- 2 感測器模組與Raspberry Pi連接(繼電器、溫度、超音波距離感測器)
- 3 攝影機模組、SimpleCV影像處理
- 4 網路連線、伺服器架設、遠距馬達控制、距離感測器
- 5 物聯網、文字轉語音、Arduino應用開發
- 6 音樂版蘑菇總動員(1) 範例製作
- 7 語彙版蘑菇總動員(2) 範例製作

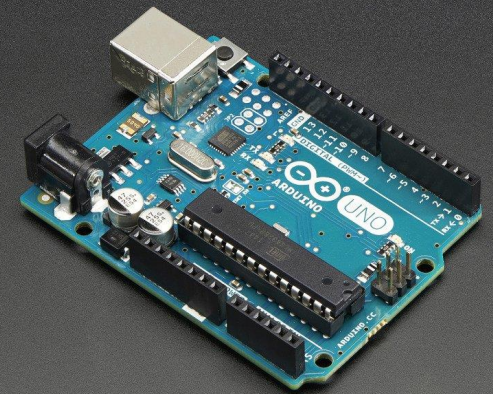
材料清點

- 請上google Drive
- <https://docs.google.com/document/d/1gmgK7umgoK2LUvMnI2CSYjb4y8dkCvYU4PlvTKcZw6s/edit?usp=sharing>

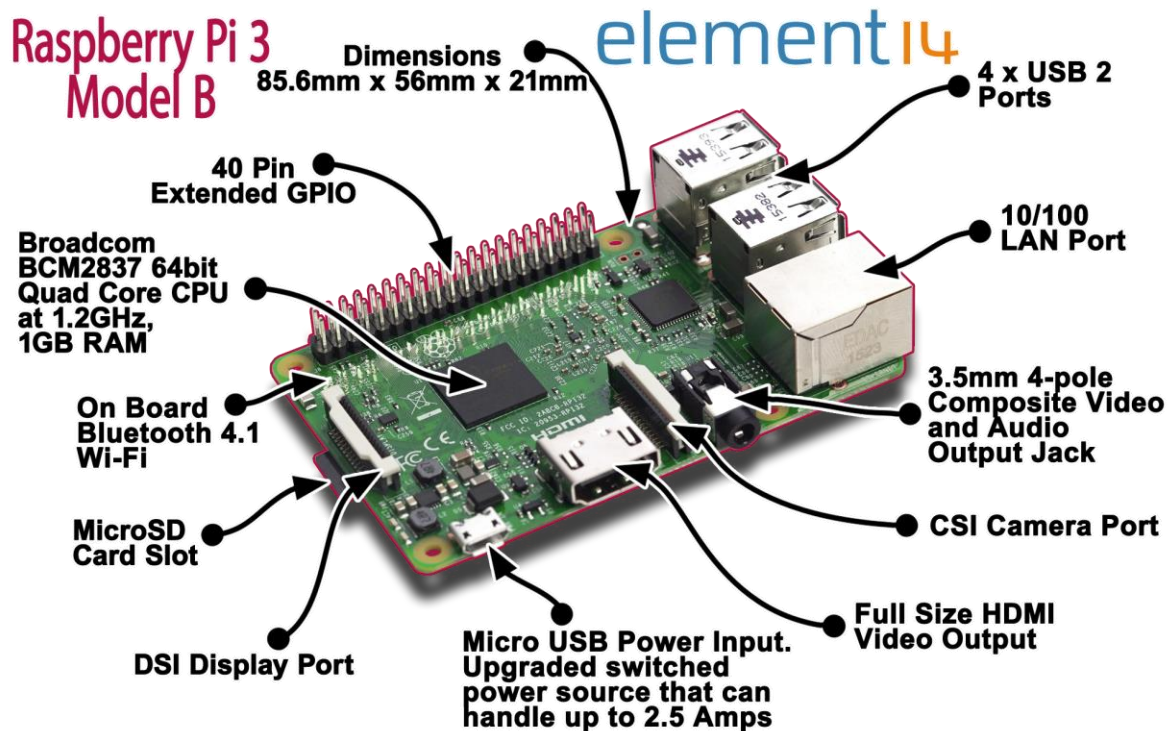




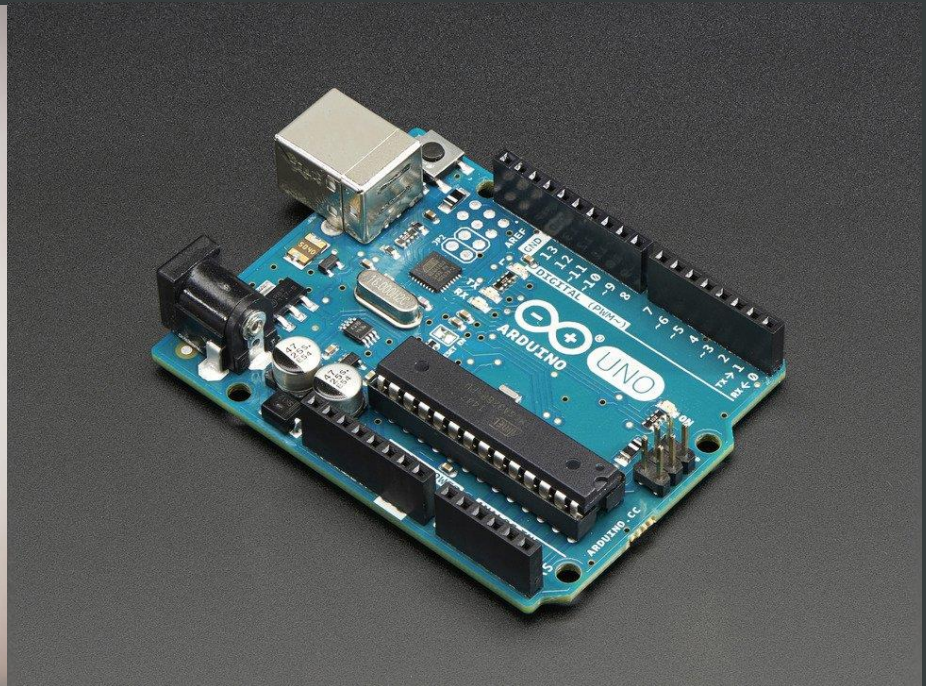
Raspberry pi (樹梅派) 是什麼？



微型電腦/單板電腦(Single-Board Computer)



Raspberry Pi VS Arduino



規格上

規格	Raspberry Pi	Arduino
CPU	32位元	8位元
速度	1.2GHz	16MHz
WiFi	有 802.11n	無
藍芽	有 Bluetooth 4.1	無
有線網路	10/100M	無
HDMI	有	無
音源輸出	有	無

規格上

規格	Raspberry Pi	Arduino
數位 I O	26組	14組
類比 I O	無	6組
相機 I O	有	無
螢幕介面	有	無
U S B	4組	無
影像處理器	內建	無
消耗電流	700~2500mA	20 ~ 40mA
工作電壓	3.3V	5V

使用方式

	Raspberry Pi	Arduino
程式語言	Python	C / Arduino
開發介面	內建的Python IDLE	Arduino IDE 1.6.10
外部連接能力	USB / GPIO	Digital In/Out / Analog In
範例	較為零散	內建

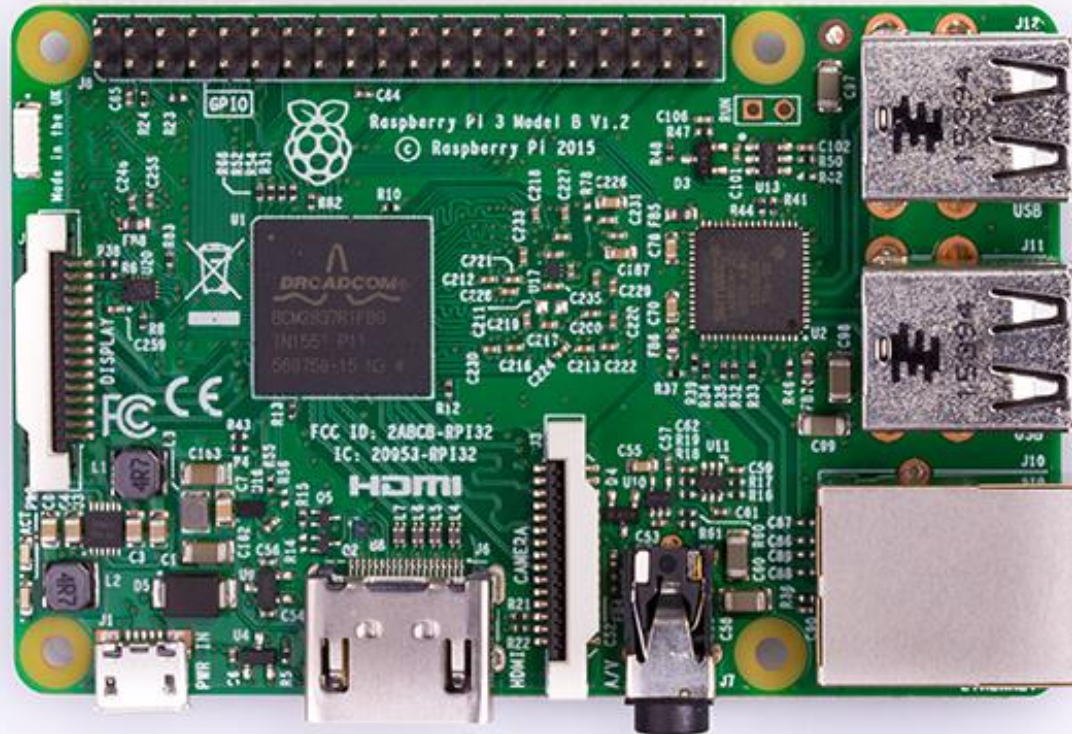
用途上差異

	Raspberry Pi	Arduino
連接網路處理感測資訊	可以透過WiFi / BT / 有線網路	無 (需要擴充)
處理多媒體影像能力	可外接攝影機/顯示器/麥克風/ 喇叭/具有3D顯示能力	無 (需要擴充
連接馬達/感測器/繼電器/ 可變電阻/WS2811燈帶	可以 相關程式庫比較少	非常適合 相關程式庫很多
攜帶性/可整合成裝置	適合 電量消耗稍微比較大	非常適合 電量消耗少

PC/MAC vs Raspberry Pi vs Arduino

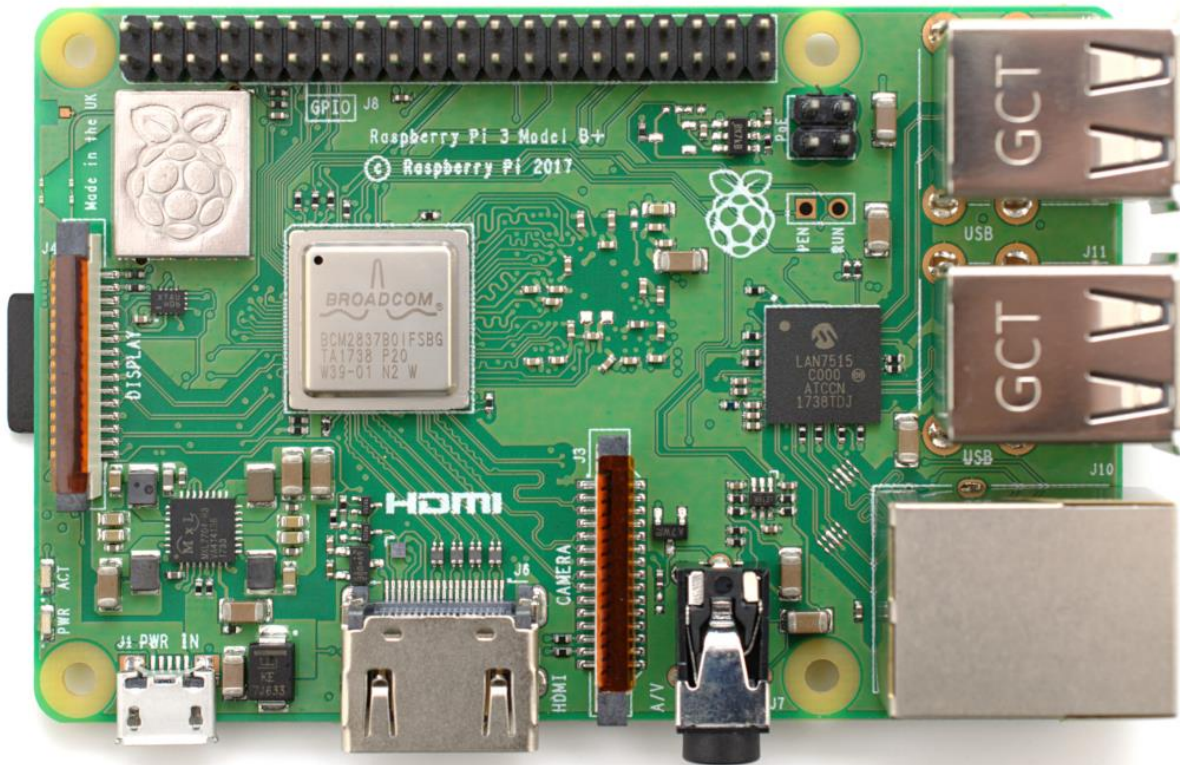
	PC/MAC	Raspberry Pi	Arduino
處理速度	最快/能處理多個事情	中等/處理單個應用程序	最慢/處理單一動作
系統	Windows/MacOS	Raspbian (Linux)	無
顯示畫面	可以	可以	無法
具有輸入輸出功能	有 USB/RS232/音效/SD卡	有 USB/音效	無 (需要額外擴充)
連接感測器	無法 (連接Arduino)	有 GPIO	有 Digital/Analog
儲存容量	1TB 以上	8 ~ 64GB	無 (需要額外擴充)
連線能力	WiFi / 藍芽	WiFi / 藍芽	無 (需要額外擴充)
價格	2萬 ~ 10萬	1000左右	300~800左右

Raspberry Pi 版本 – Raspberry Pi 3

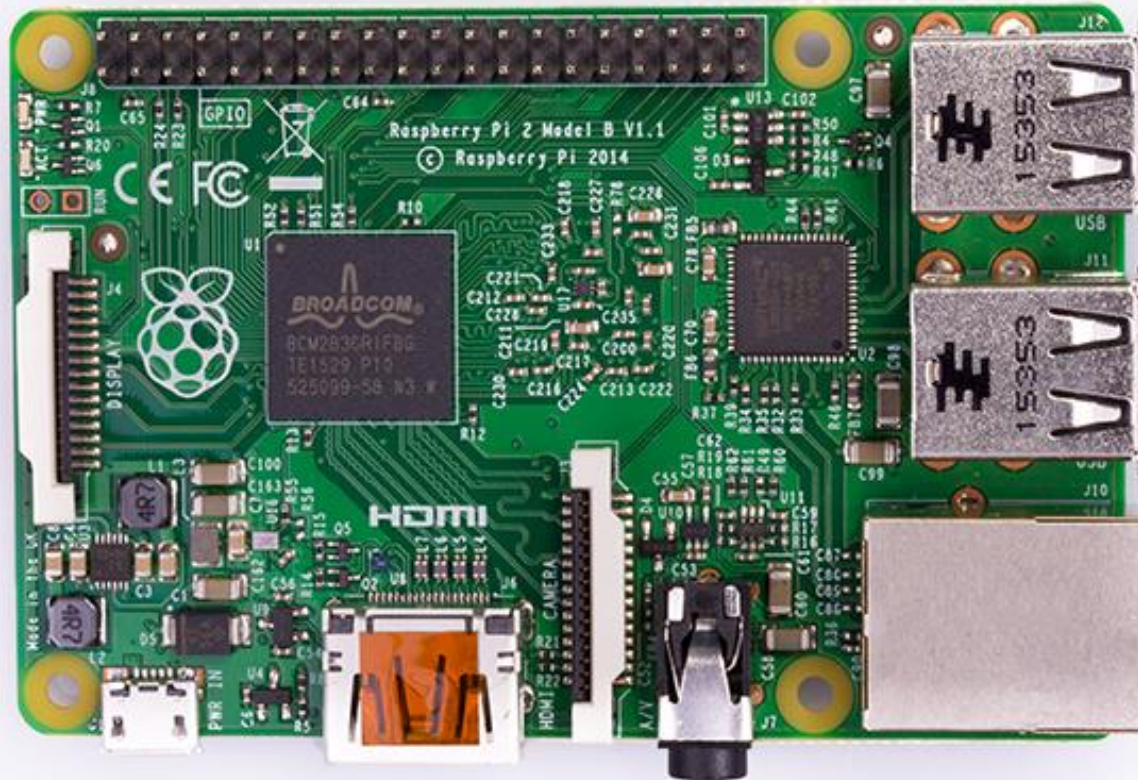


Raspberry Pi 版本 – Raspberry Pi 3 B+

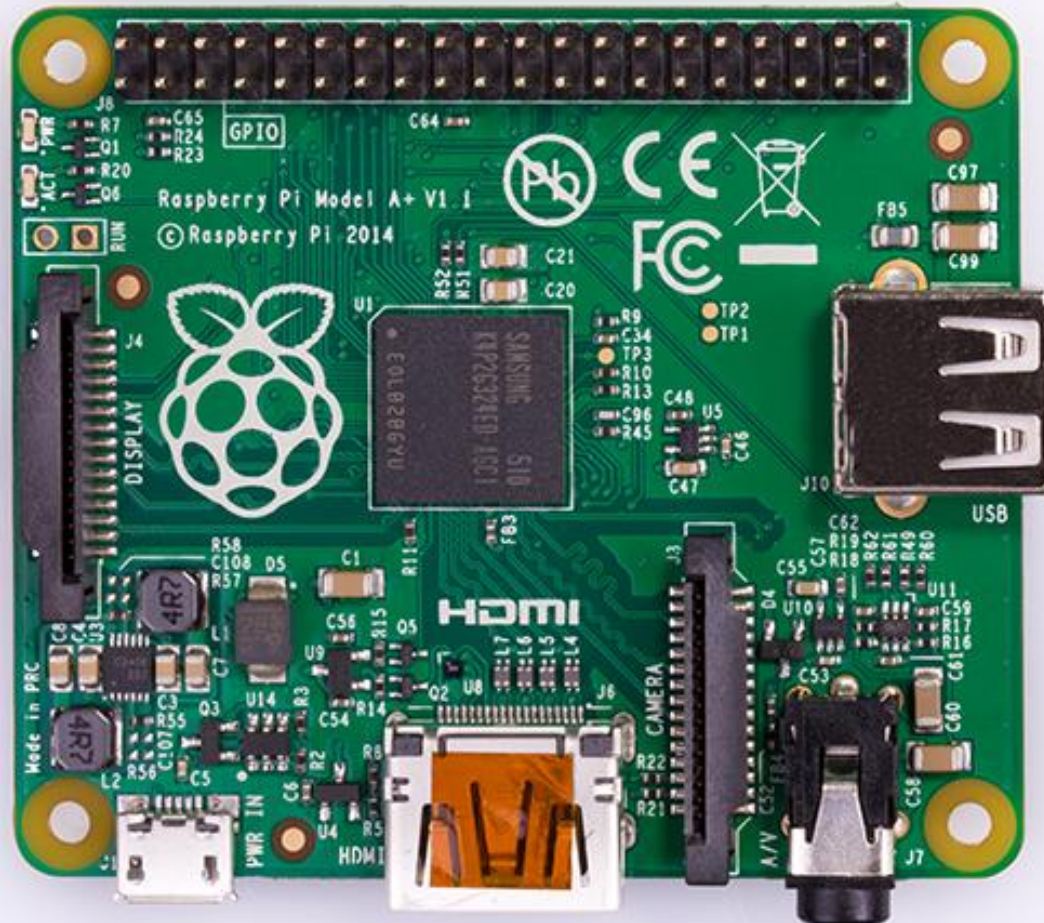
2018年3月14日發表



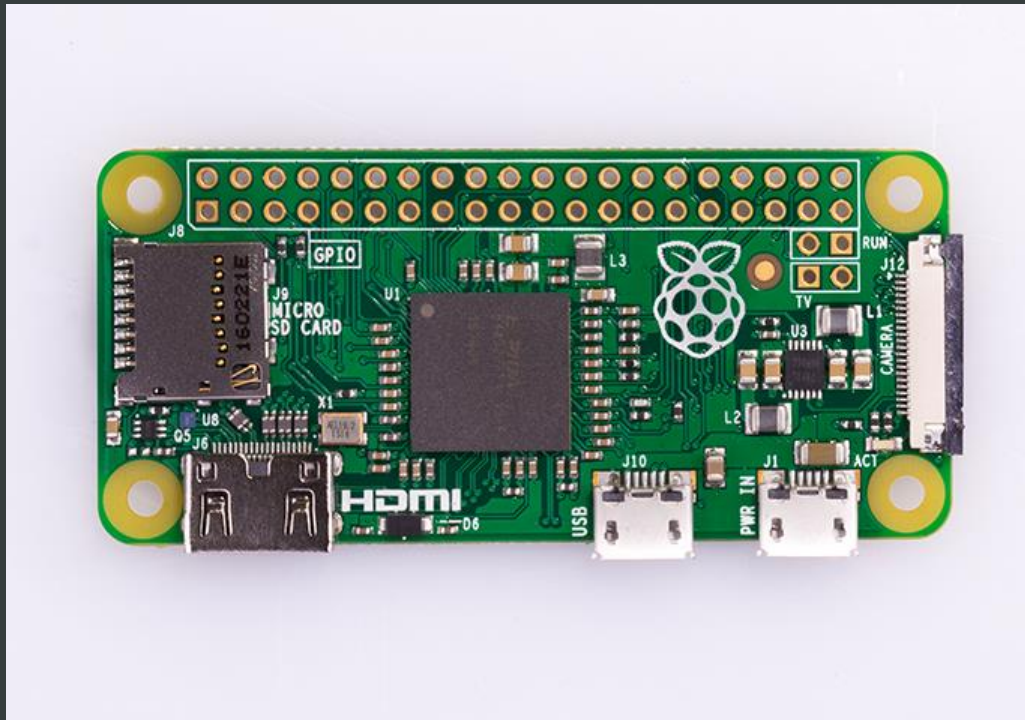
Raspberry Pi 版本 – Raspberry Pi 2 B+

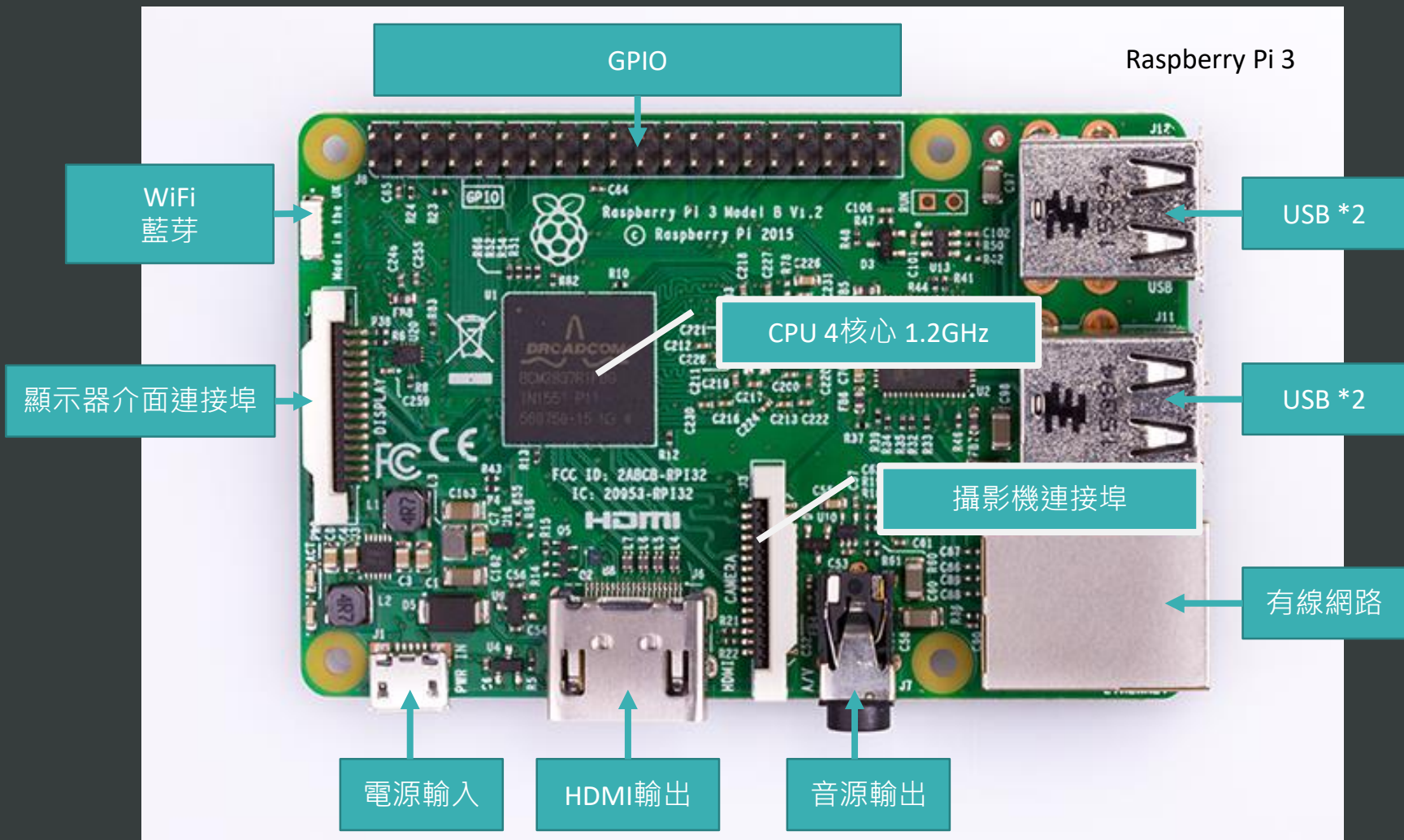


Raspberry Pi 版本 – Raspberry Pi A+



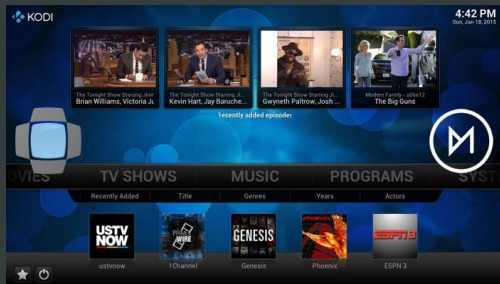
Raspberry Pi 版本 – Raspberry Pi zero







Raspberry Pi 的作業系統



ubuntu MATE

ubuntu

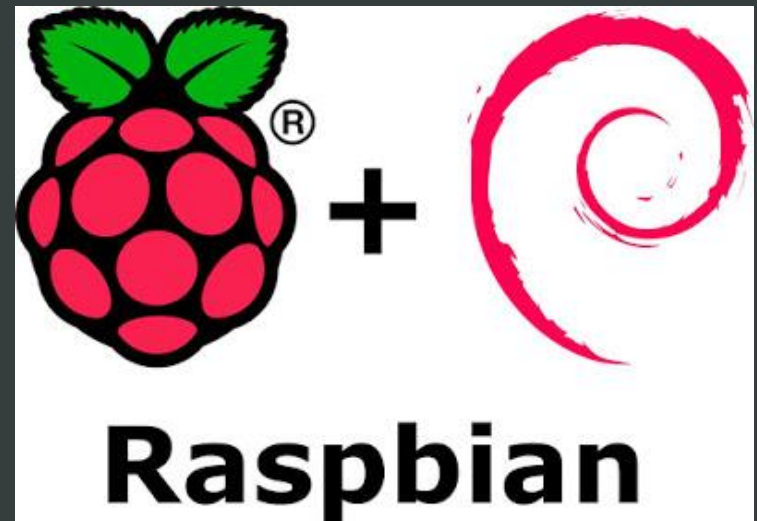


Linux



專用的Linux系統 - Raspbian

- Linux系統的其中一個版本Debian所修改而來的
- 最新的桌面U I - Pixel介面
- 內建Python程式開發工具(主要的程式語言可控制G P I O)
- 內建Chromium (Chrome瀏覽器的OpenSource版本)
- 內建LibreOffice (類似Word, Excel, Point)
- 內建Minecraft Pi遊戲
- 還有很多實用工具都已內建



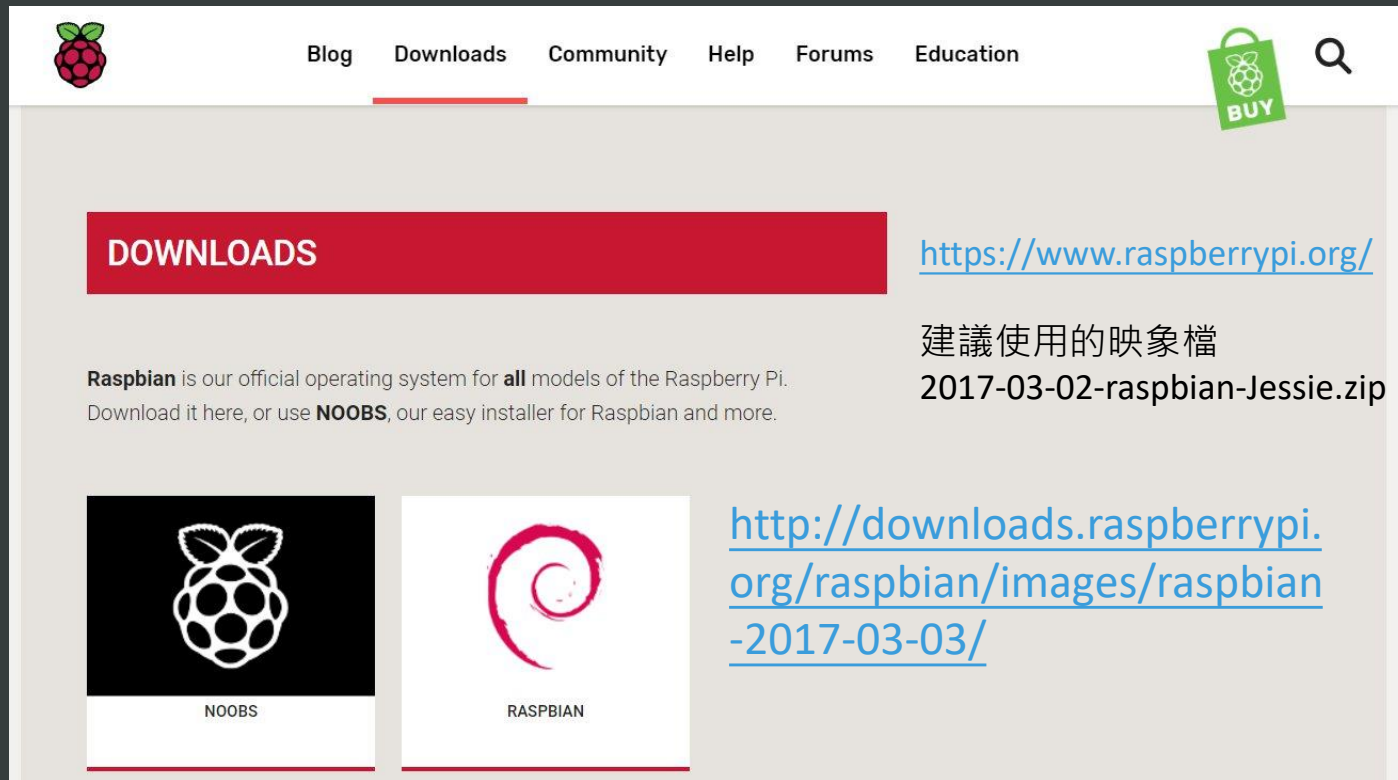
組裝Raspberry Pi

- 安裝透明壓克力殼
- 黏上散熱片



安裝Raspbian系統

Raspberry Pi的系統



The screenshot shows the Raspberry Pi website's 'Downloads' section. At the top, there is a navigation bar with links for Blog, Downloads (which is underlined), Community, Help, Forums, and Education. To the right of the navigation bar are a Raspberry Pi logo, a green 'BUY' button, and a search icon. Below the navigation bar, a red banner with the word 'DOWNLOADS' in white capital letters is displayed. To the right of this banner is a blue hyperlink: <https://www.raspberrypi.org/>. Below the banner, a paragraph states: 'Raspbian is our official operating system for **all** models of the Raspberry Pi. Download it here, or use **NOOBS**, our easy installer for Raspbian and more.' To the right of this paragraph is the text '建議使用的映象檔' followed by the filename '2017-03-02-raspbian-Jessie.zip'. Below the paragraph, there are two side-by-side boxes. The left box has a black background with a white Raspberry Pi logo and the word 'NOOBS' in white capital letters below it. The right box has a white background with a red spiral logo and the word 'RASPBIAN' in black capital letters below it. To the right of these boxes is a blue hyperlink: <http://downloads.raspberrypi.org/raspbian/images/raspbian-2017-03-03/>.

映像檔google drive下載

https://drive.google.com/open?id=1dXp6JVo0WS_1EPJP0t-4Wu8tm-q2EcA



Raspbian is the Foundation's official supported operating system. You can install it with [NOOBS](#) or download the image below and follow our [installation guide](#).

Raspbian comes pre-installed with plenty of software for education, programming and general use. It has Python, Scratch, Sonic Pi, Java, Mathematica and more.

The Raspbian with PIXEL image contained in the ZIP archive is over 4GB in size, which means that these archives use features which are not supported by older unzip tools on some platforms. If you find that the download appears to be corrupt or the file is not unzipping correctly, please try using [7Zip](#) (Windows) or [The Unarchiver](#) (Macintosh). Both are free of charge and have been tested to unzip the image correctly.



RASPBIAN JESSIE WITH PIXEL

Image with PIXEL desktop based on Debian Jessie

Version:	January 2017
Release date:	2017-01-11
Kernel version:	4.4
Release notes:	Link

[Download Torrent](#) [Download ZIP](#)

SHA-1: f987935e3e99366a6f1bf0d60a7a83fe3edb013c



RASPBIAN JESSIE LITE

Minimal image based on Debian Jessie

Version:	January 2017
Release date:	2017-01-11
Kernel version:	4.4
Release notes:	Link

[Download Torrent](#) [Download ZIP](#)

SHA-1: 0ed4dff4248c4c8b437a5d5feed4013197660c8a

大小約1.4GB

解壓縮成IMG檔

- RPI的系統檔是用映像檔(*img)所組成，只需用工具刷入到SD卡內即可
- 此動作只需第一次使用新的SD卡時做就好，若更換新的SD卡則要重新刷入
- 這個刷入的動作與一般安裝作業系統不一樣，刷入完成之後只需把SD卡放入RPI的SD卡內即可

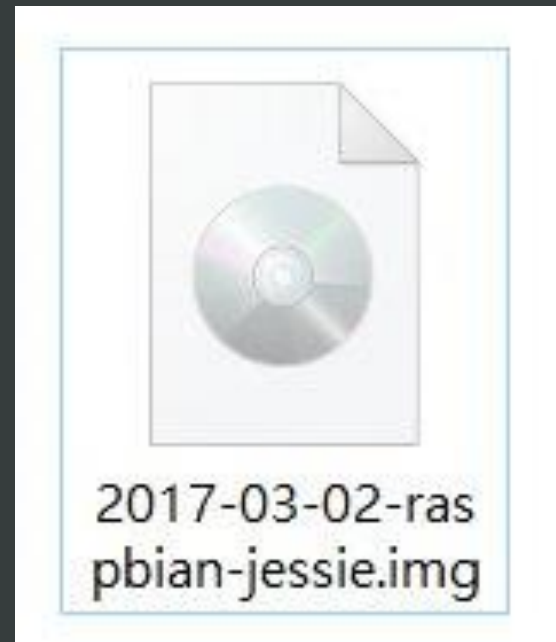
下載刷入img工具

- Windows
 - Etcher (推薦!!)
 - Win 32 Disk Imager
- MAC
 - Etcher (推薦!!)
 - Apple Pi Baker
- 完整清除sd卡內容工具：
 - SD Card Formatter



1.解壓縮 raspbian-jessie-img

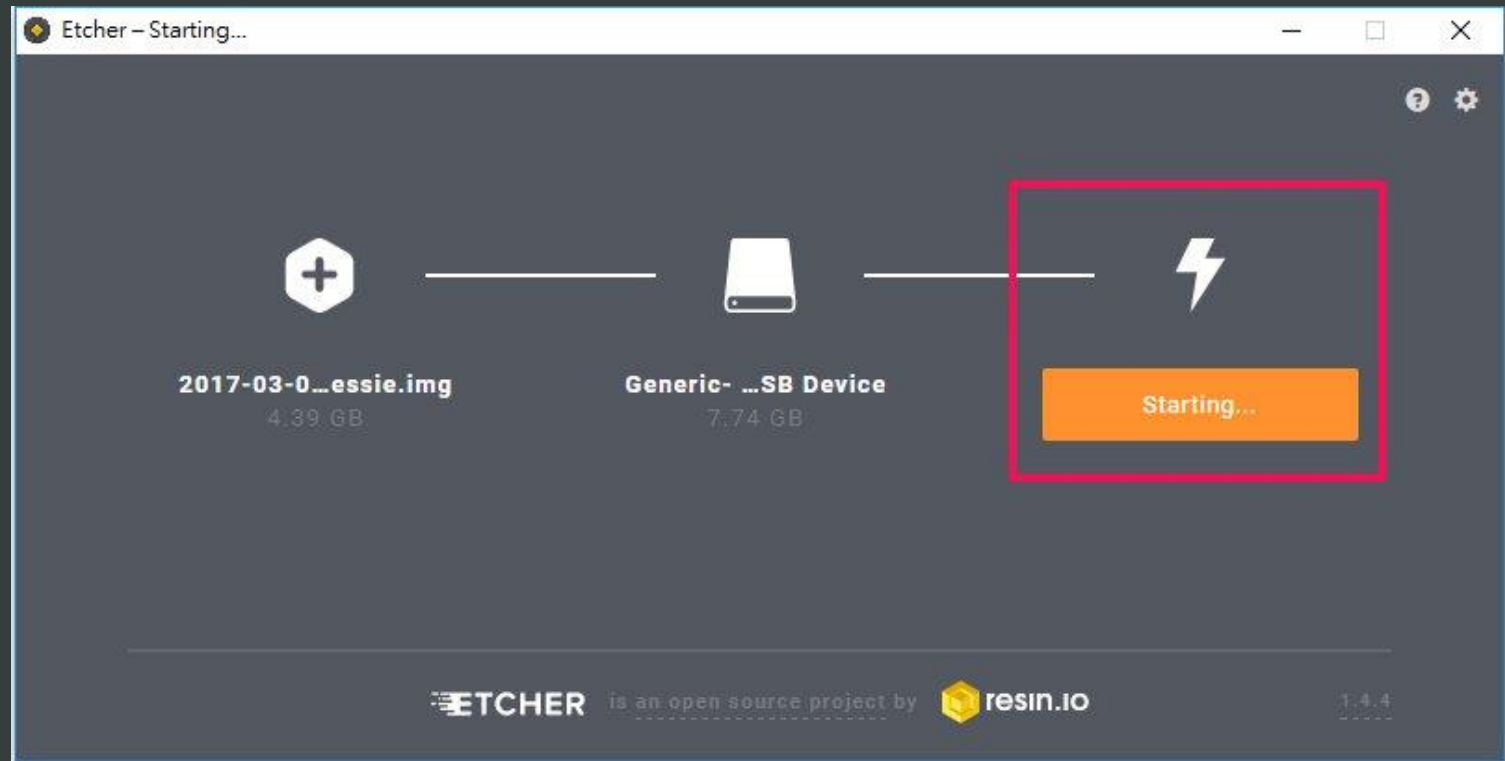
- 將下載的raspbian-jessie.zip解壓縮成raspbian-jessie.img



2.使用Etcher



3.確認SD卡讀卡機位置後按下Flash!



寫入完成->插入SD卡到Raspberry Pi

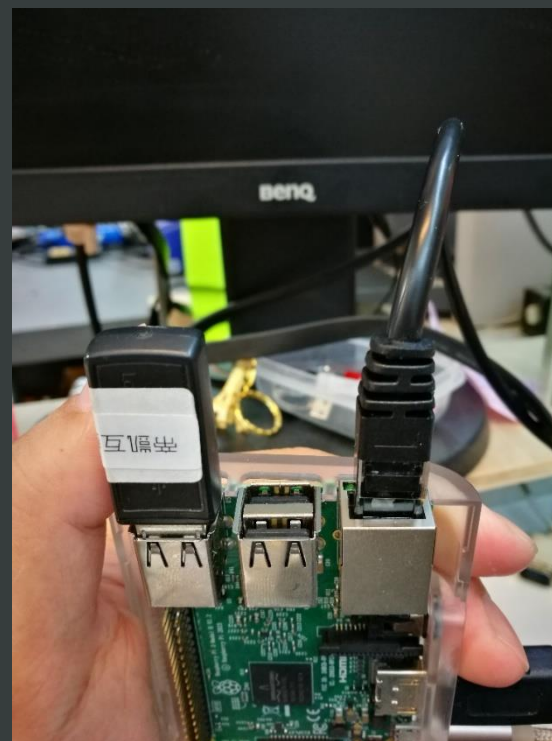
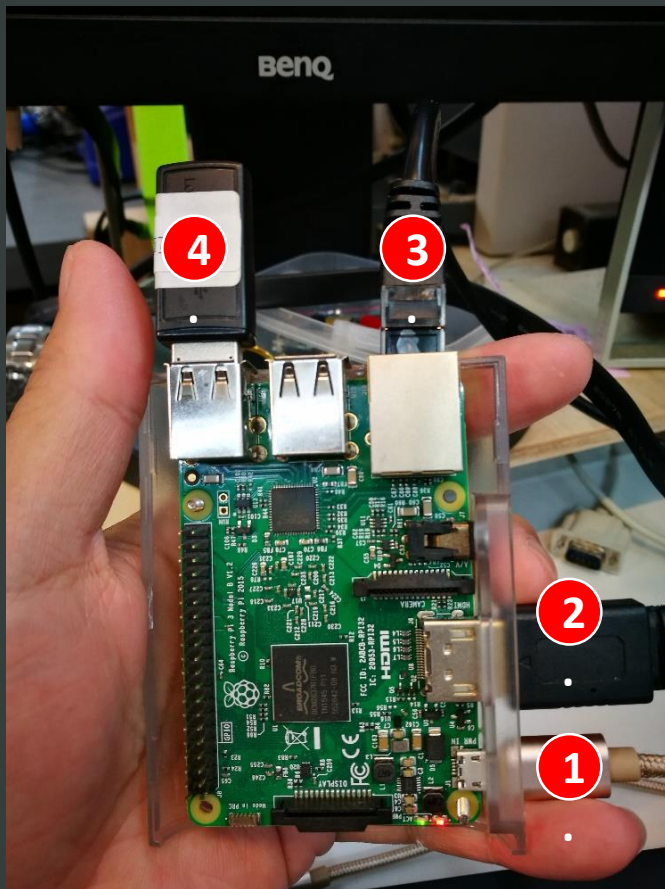


退出記憶卡



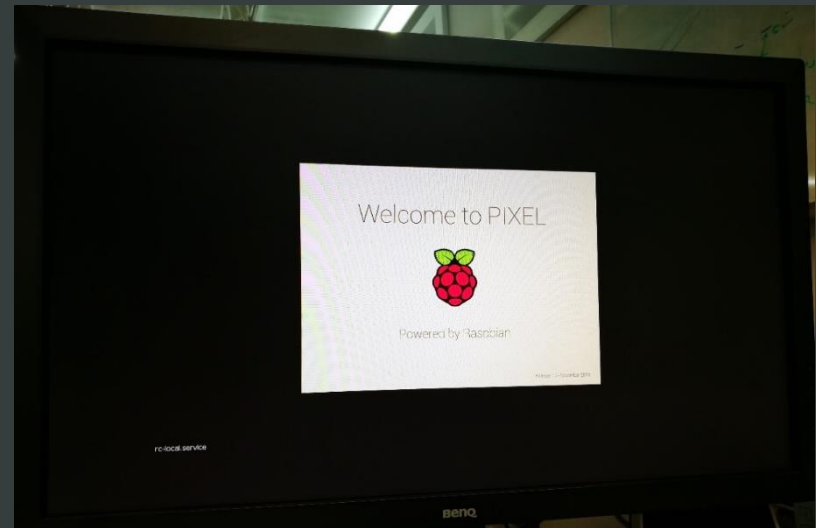
安裝記憶卡到樹梅派

接上週邊設備



- 1.USB電源線 5V2A
- 2.HDMI線
- 3.網路線
- 4.鍵盤滑鼠

首次開機



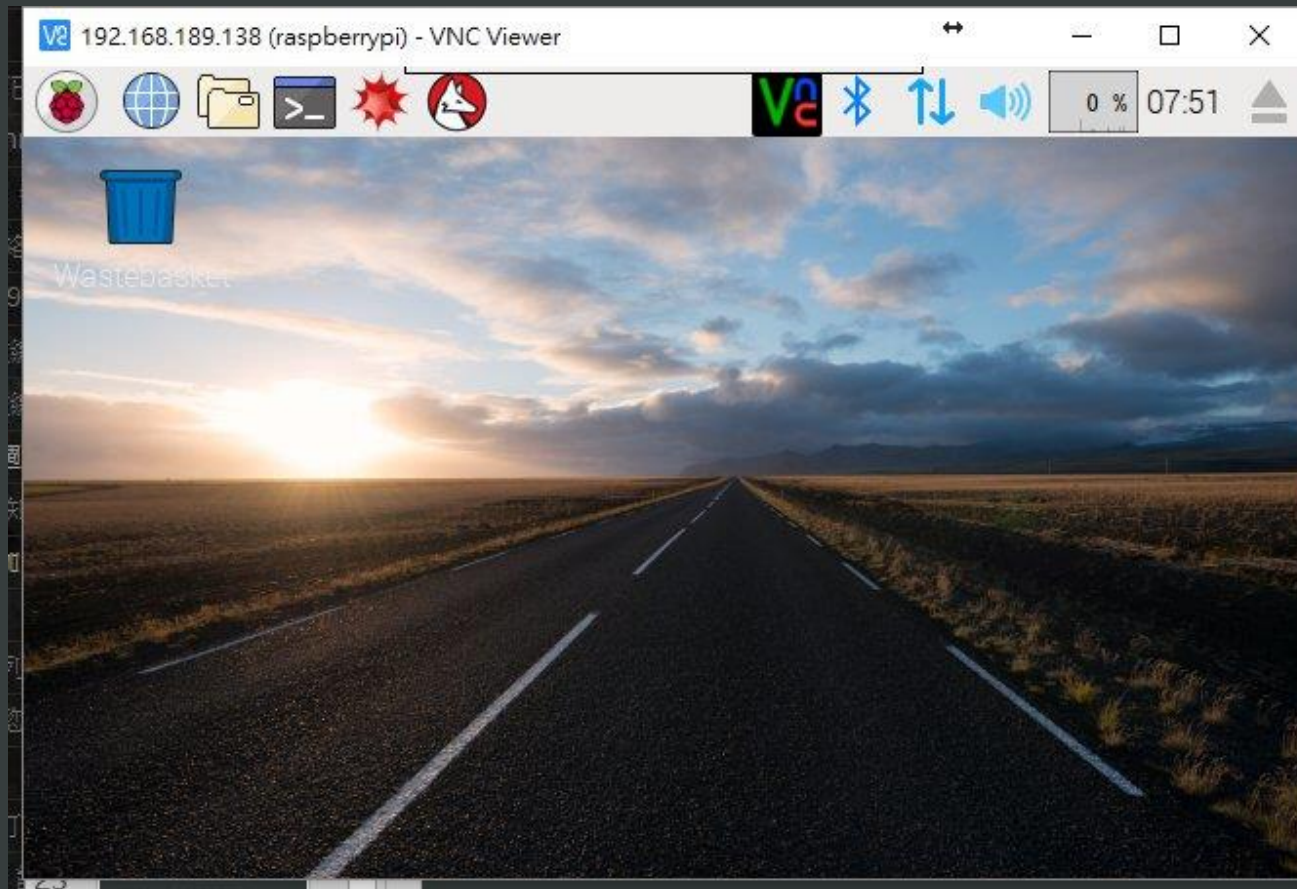
初次環境設定

初次設定環境參數

- 開啟VNC Server
- 開啟SSH
- 設定Raspberry Pi名稱
- 修改解析度
- WiFi或有線網路連接/記下自己樹梅派的IP
- 重開機/關機/登出
- 移除HDMI線、電源線、鍵盤
- 啟動連線VNC到raspberry pi
- 更改密碼
- 修改地區設定/鍵盤/wifi/中文語系
- 啟動連線SSH到raspberry pi

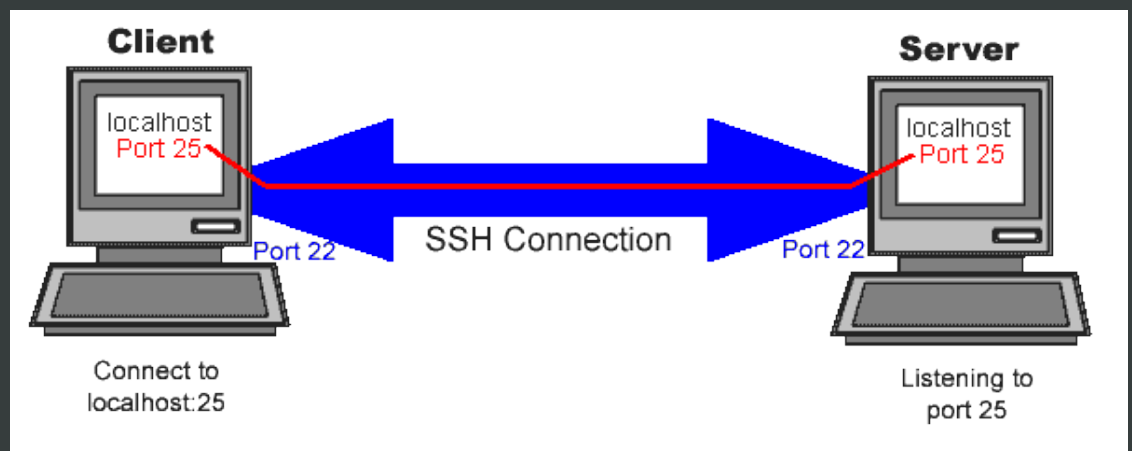
VNC Server (Virtual Network Computing)

- 遠端及時畫面網路控制
- 透過PC/MAC電腦的VNC Client軟體操控Raspberry Pi畫面



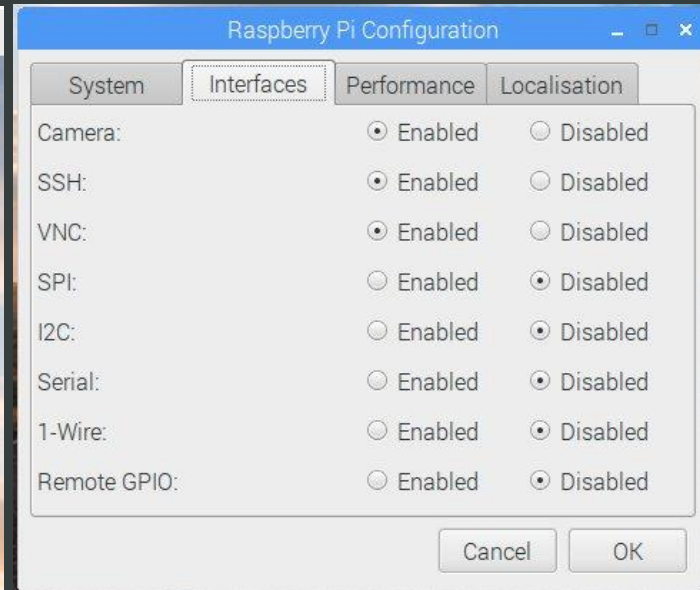
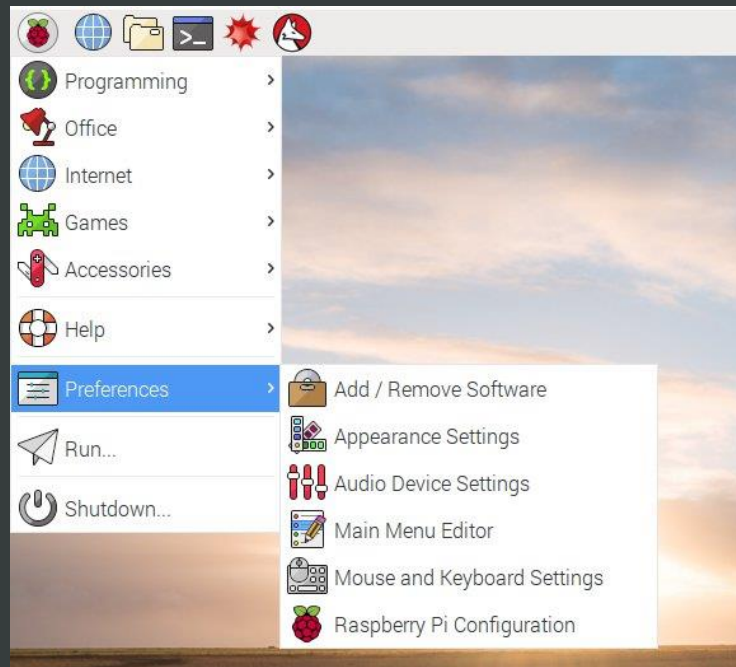
SSH (Secure Shell) 安全資料傳輸通道

- 遠端透過PC/MAC的指令列工具進行系統操作
- 遠端開機/關機樹梅派
- 遠端建立目錄/刪除檔案/複製檔案 ...等功能
- 遠端更新/安裝/下載軟體
- 遠端上傳下載檔案
- 遠端撰寫Python程式
- 遠端操控....很多很多功能



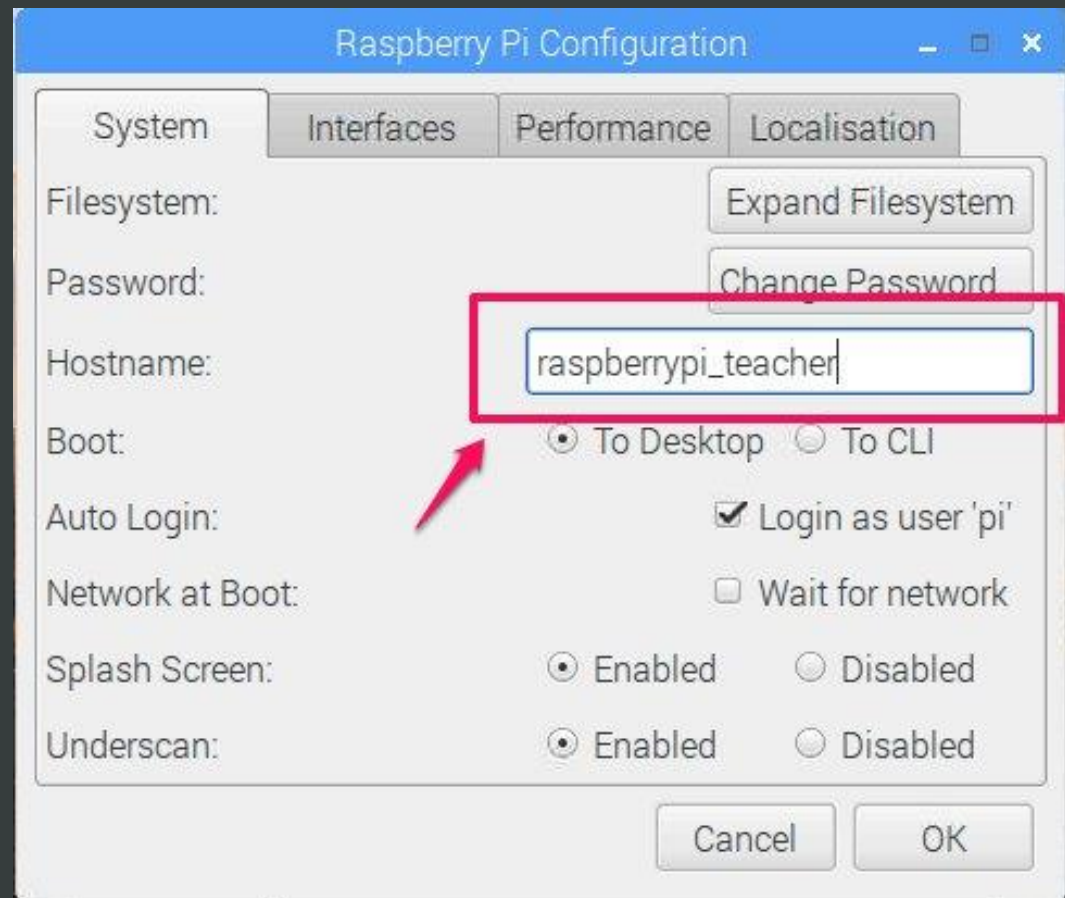
開啟SSH/VNC Server

- 點選左上角的樹梅派符號，選擇Preferences->Raspberry Pi Configuration
- 切換到interfaces頁面
- 勾選以下三個功能
 - Camera
 - SSH
 - VNC
- 重新開機

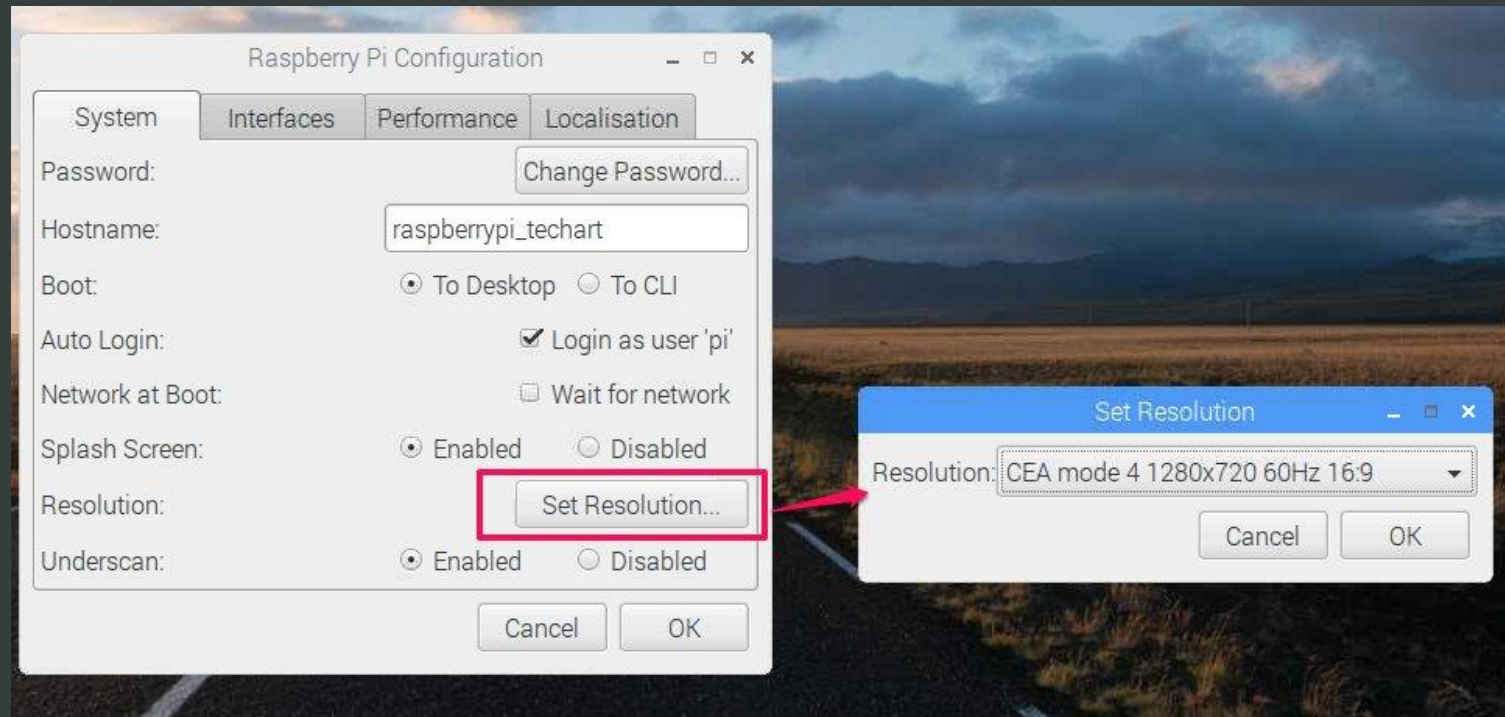


修改Raspberry Pi名稱，很重要!記得要改!

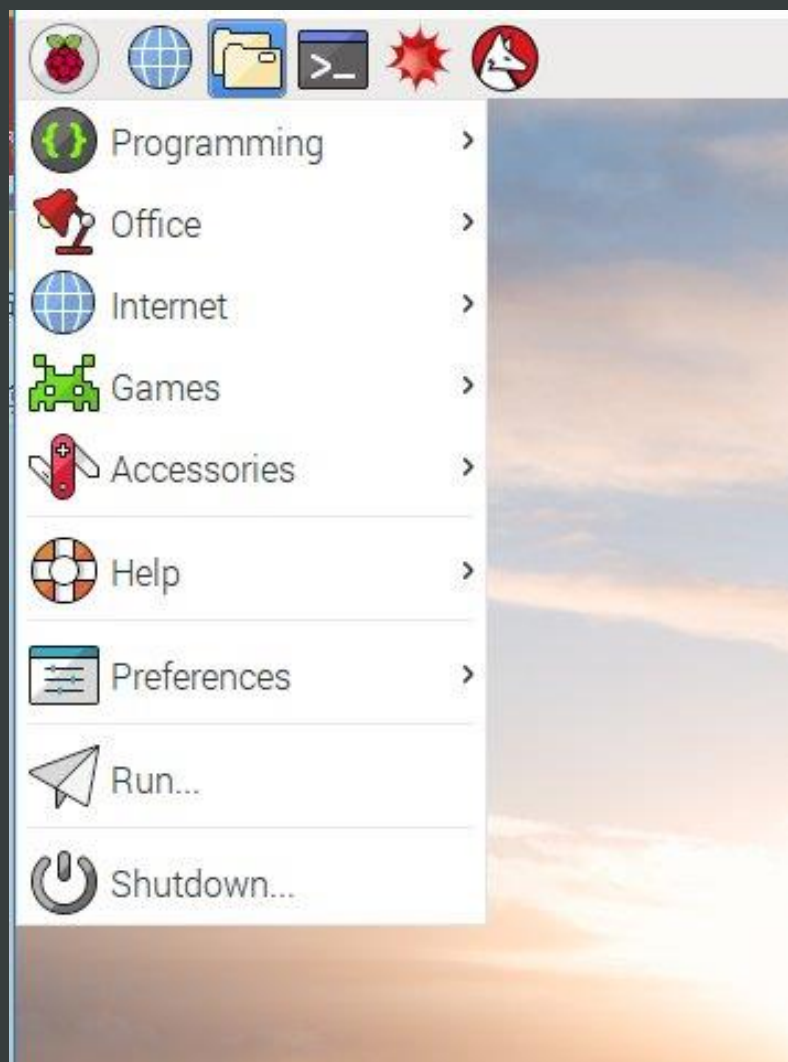
- 用VNC Viewer連入或直接用電腦螢幕觀看畫面
- 在Raspberry Pi Configuration內修改Hostname成自己希望的名稱
- 重新開機



設定預設解析度1280 x 720



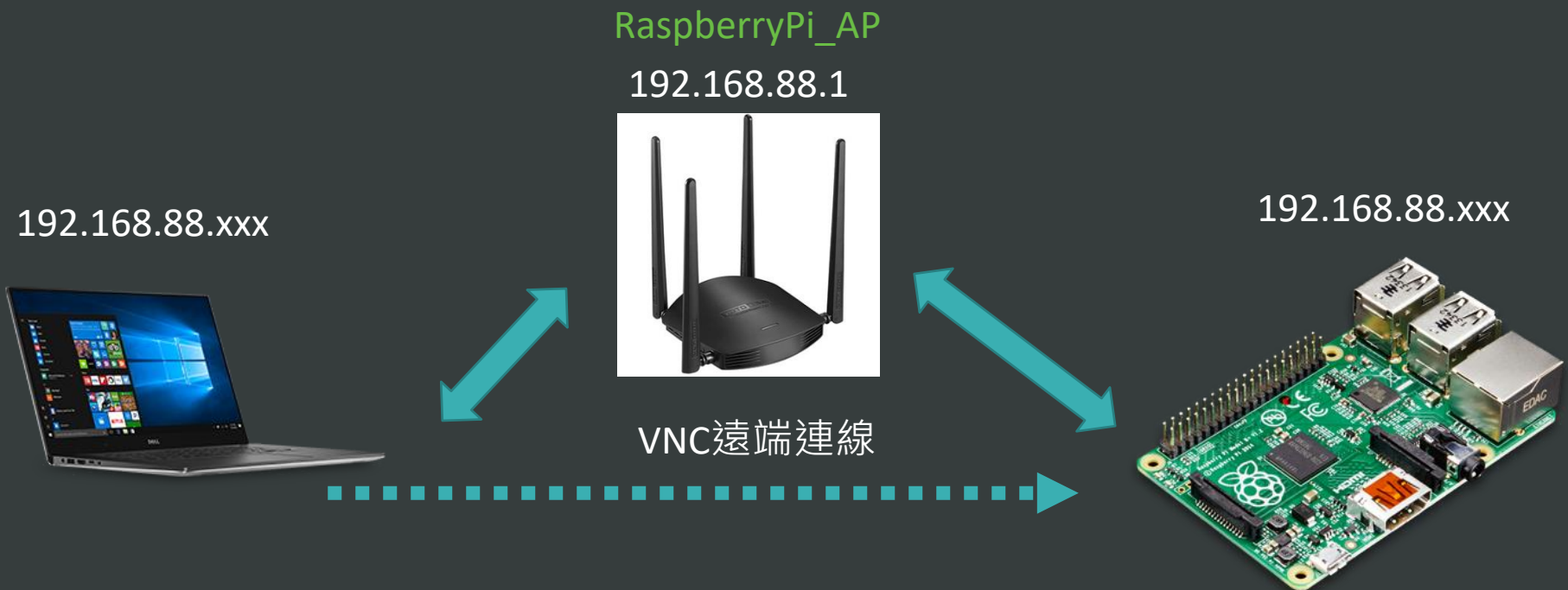
重新開機/關機/登出



遠端連線到Raspberry Pi

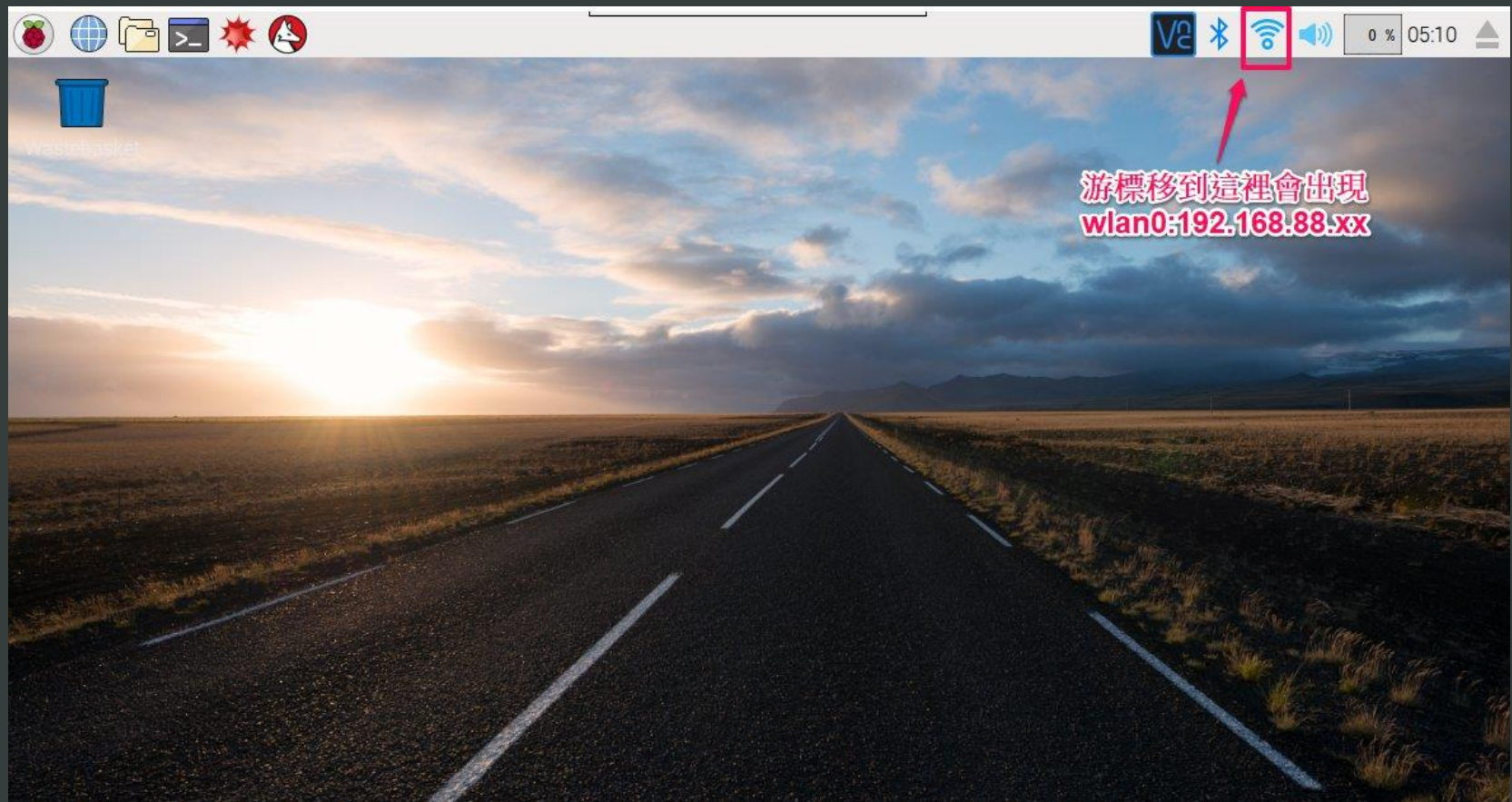
(一)連線到Raspberry Pi

- 連上WiFi 基地台(Android 手機, Mac, Windows, iphone ...等等都可以)
- SSID = **RaspberryPi_AP**
- 密碼 = **raspberrypi**
- 以上是上課時老師準備的無線AP，若自己家裡要連線或是自己準備AP請自行更改以上資訊



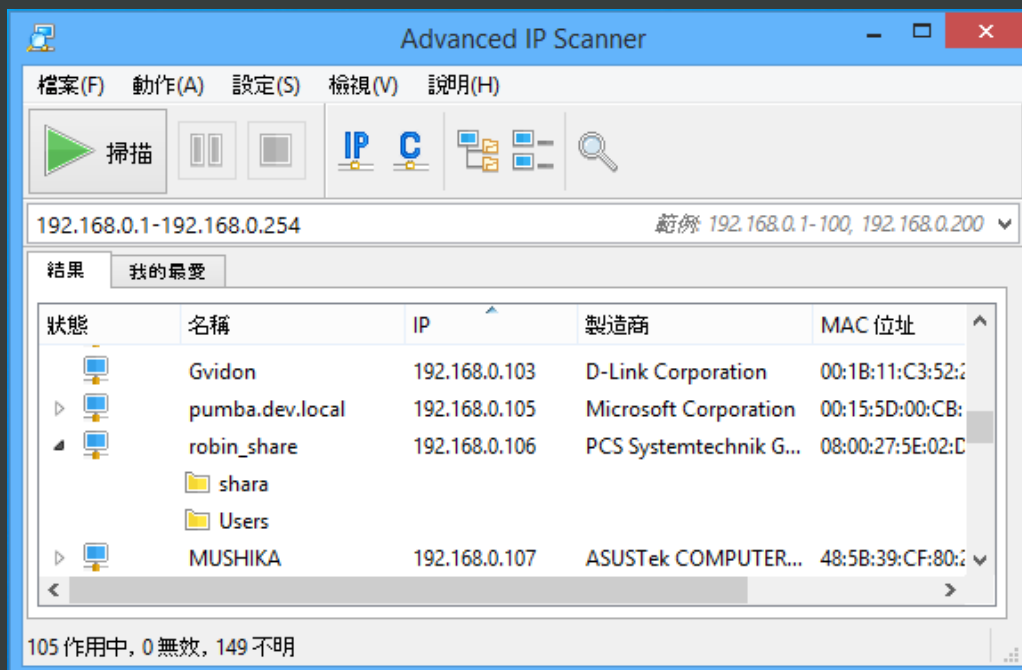
WiFi或有線網路連接/記下自己樹梅派的IP

- 這裡要讓Raspberry連線到無線路由器裝置，透過路由器配發IP位置給Raspberry，可透過無線或有線連接方式來連接。
- 在右上角的WiFi符號游標移到上方會顯示目前配置的IP



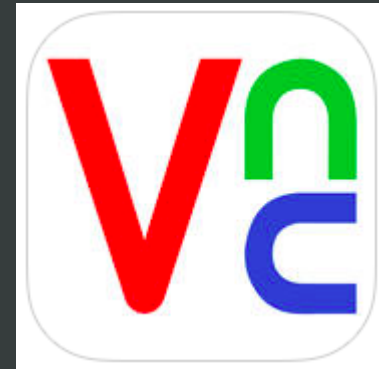
(二)查看自己的IP

- 一旦離開螢幕之後，透過VNC Viewer遠端登入功能必須先知道Pi的IP位置
- 使用專用工具掃描區域網路內的IP與pi的Hostname
- Windows:
 - Advanced IP Scanner
 - <http://www.advanced-ip-scanner.com/cn/>
- Mac OS:
 - Ip Scanner
 - 請在Apple Store內安裝



(三)使用VNC Viewer連入樹梅派

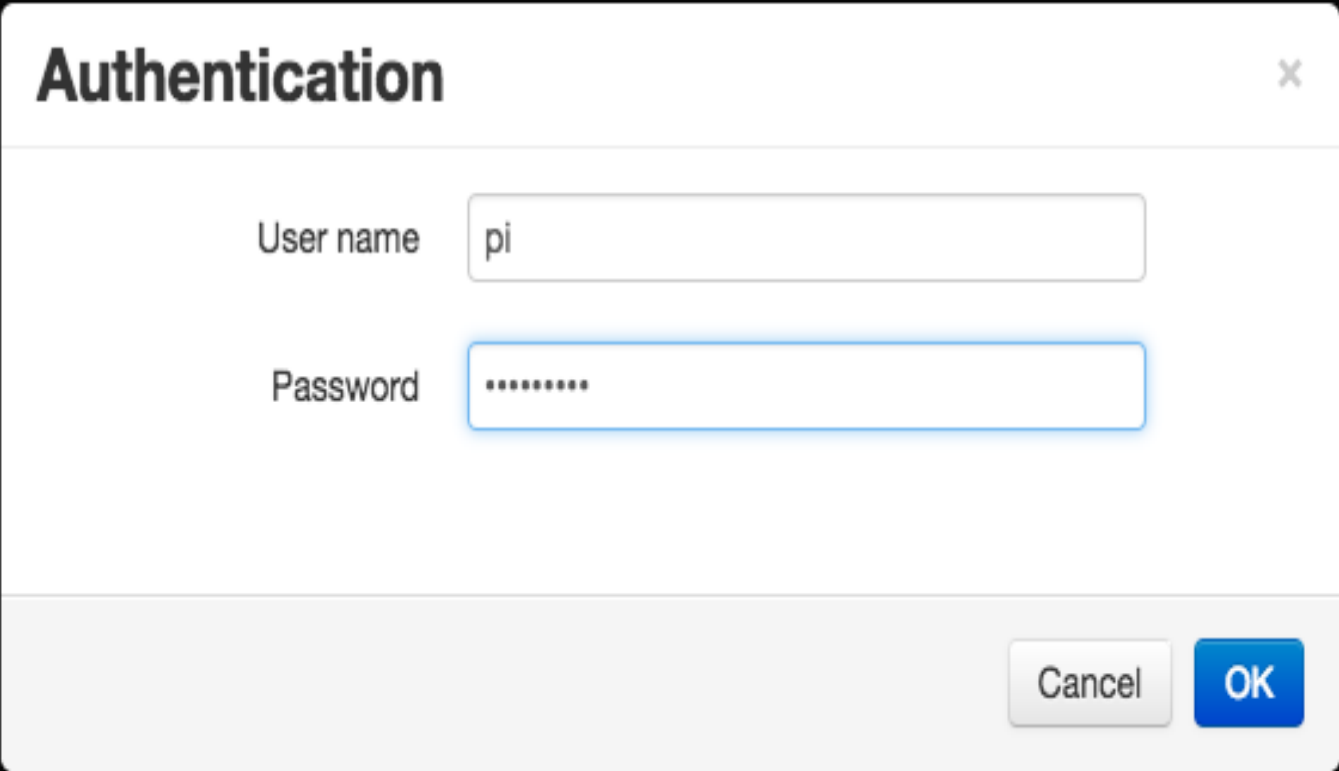
- 安裝VNC Viewer
 - Android手機
<https://play.google.com/store/apps/details?id=com.realvnc.viewer.android>
 - iOS
<https://itunes.apple.com/us/app/vnc-viewer/id352019548?mt=8>
 - Mac電腦
<https://www.realvnc.com/download/viewer/macosx/>
 - Windows電腦
<https://www.realvnc.com/download/viewer/windows/>
 - 打開Chrome瀏覽器也可以安裝 VNC Viewer addon
<https://chrome.google.com/webstore/detail/vnc%C2%AE-viewer-for-google-ch/iabmpiboiopbgfabjmgeedhcmjenhbla>
 - MAC的Safari瀏覽器也可以連 VNC
<http://osxdaily.com/2010/08/18/launch-mac-vnc-screen-sharing-client-from-safari-or-finder/>



(四)連入Raspberry Pi

- 打開VNC Viewer介面
- 輸入ip : 192.168.xxx.xxx [隨家裡的無線AP而改變, 要登入無線AP進去看IP]
- 按下Connect
- User name: pi
- Password: raspberry

Chrome的登入畫面



The image shows a standard Chrome authentication dialog box. It has a title bar with the word "Authentication" and a close button (X) in the top right corner. Below the title bar, there are two input fields. The first field is labeled "User name" and contains the text "pi". The second field is labeled "Password" and contains a series of dots, indicating a masked password. This second field is highlighted with a blue border. At the bottom right of the dialog, there are two buttons: a "Cancel" button and an "OK" button. The "OK" button is blue with white text, while the "Cancel" button is light gray with dark gray text.

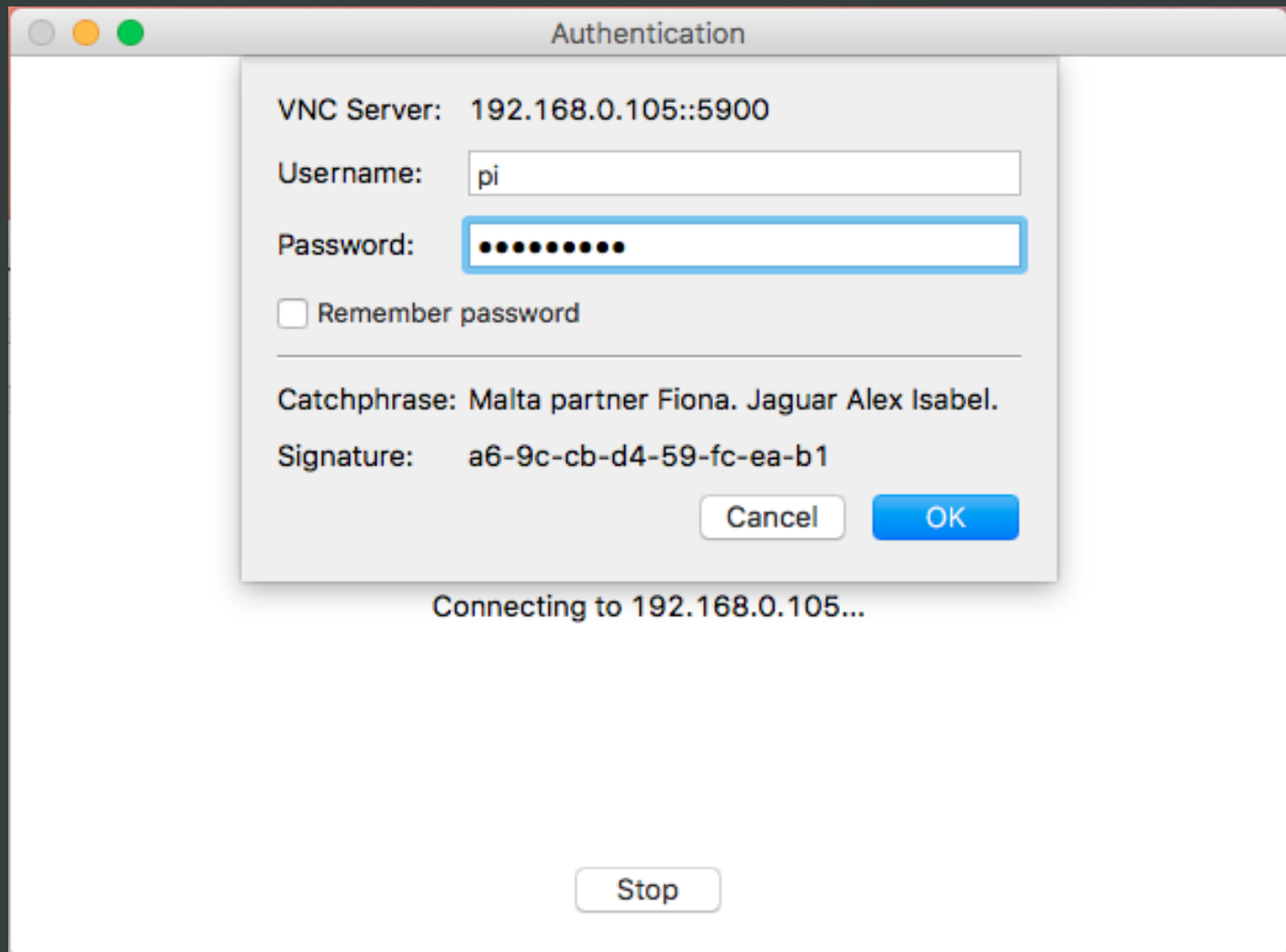
Authentication ×

User name

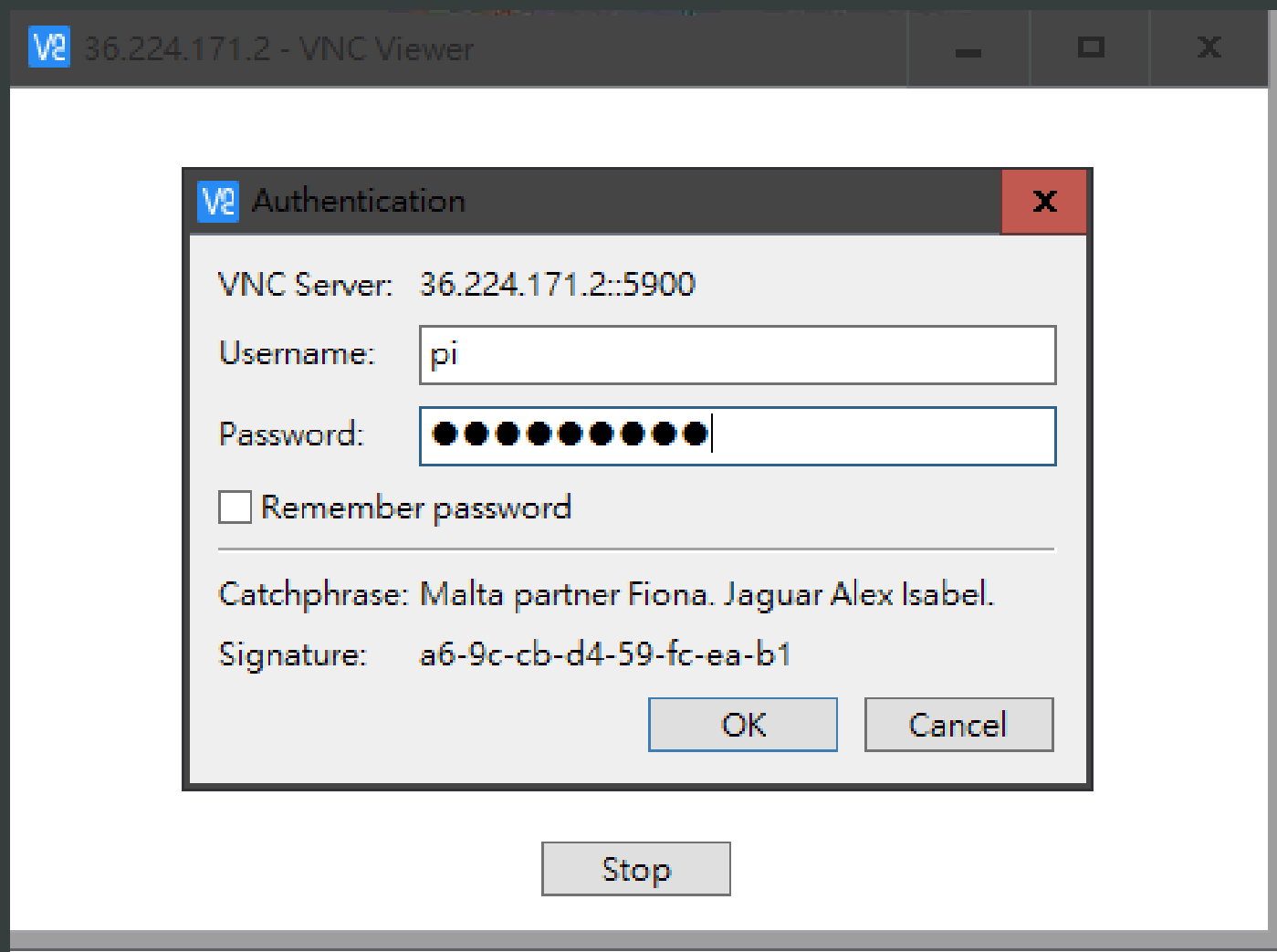
Password

Cancel OK

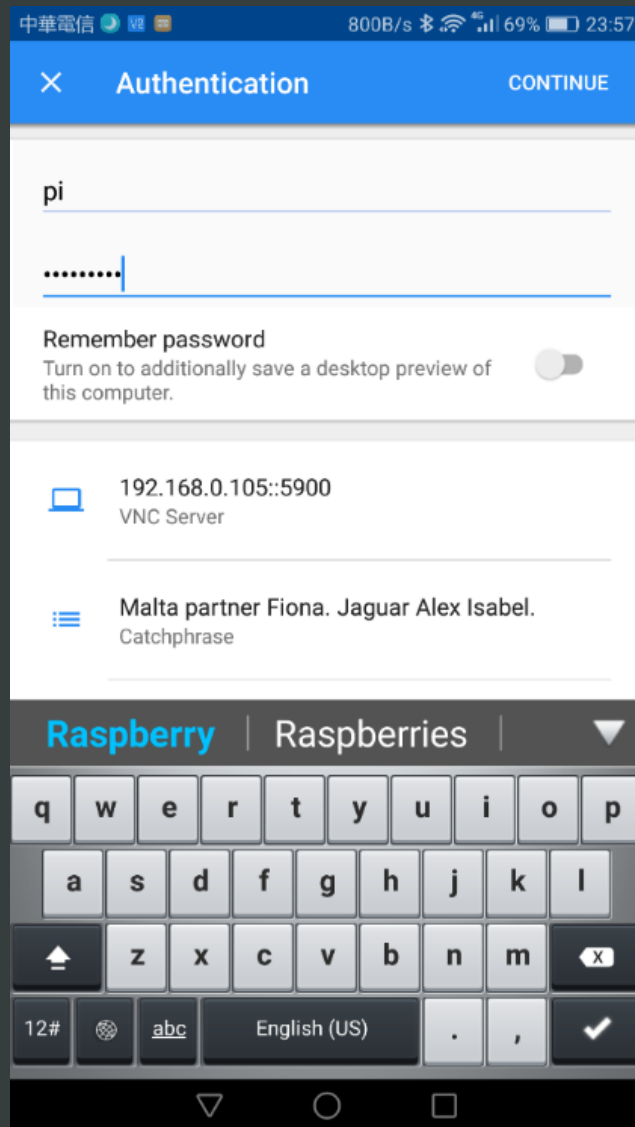
Mac系統下的認證畫面



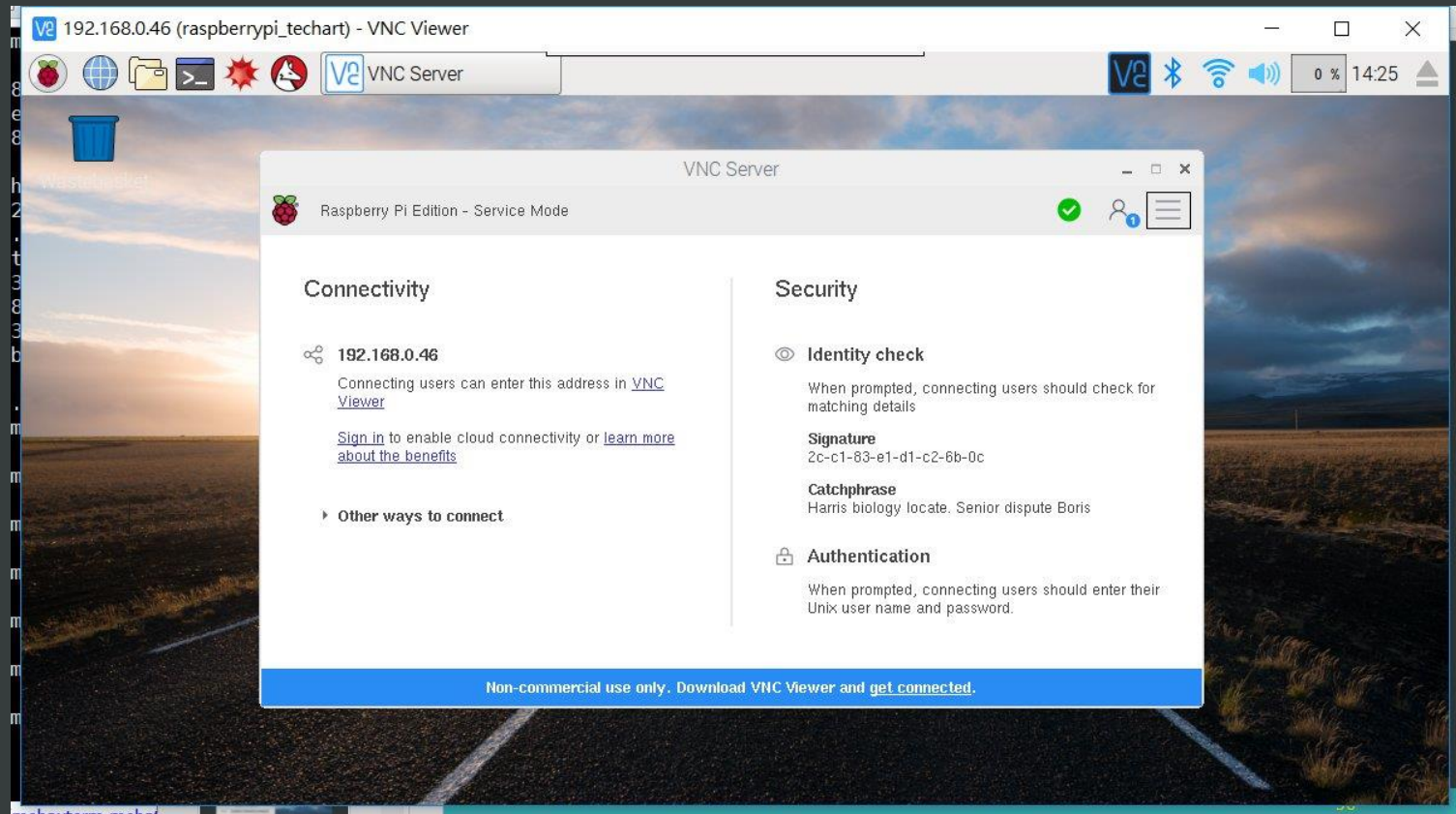
Windows 10系統下的登入畫面



Android手機上的認證畫面

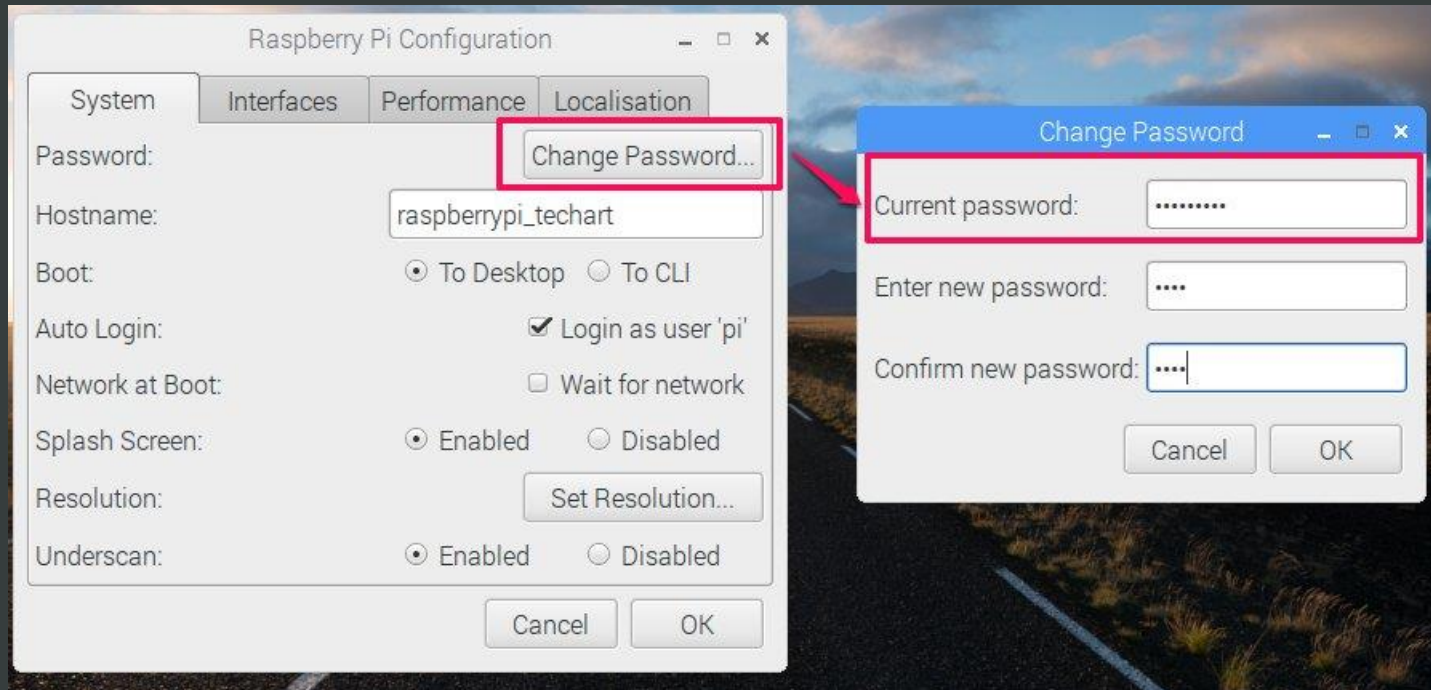


登入後看到的桌面



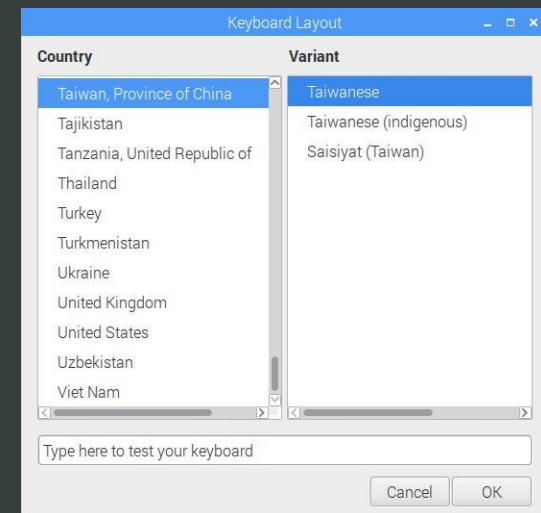
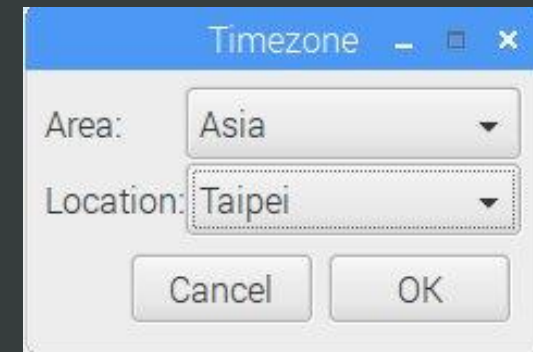
修改預設密碼

- 預設密碼為raspberry
- 修改過後的密碼請自己記好!!!忘記密碼只能重裝系統比較快



設定語系與鍵盤

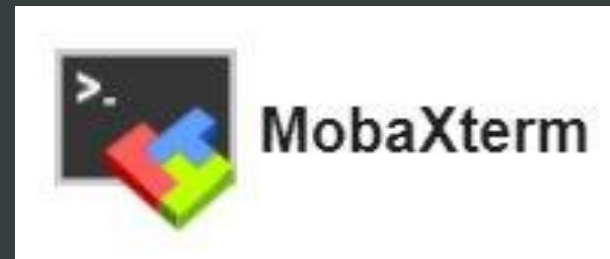
- Raspberry Pi Configuration->Localisation
- Set Locale
 - Zh (Chinese)
 - TW(Taiwan R.O.C.)
 - UTF-8
- Timezone
 - Asia
 - Taipei
- Keyboard
 - Taiwan
 - Taiwanese
- Country
 - TW (Taiwan)



用超級終端機連線到樹梅派

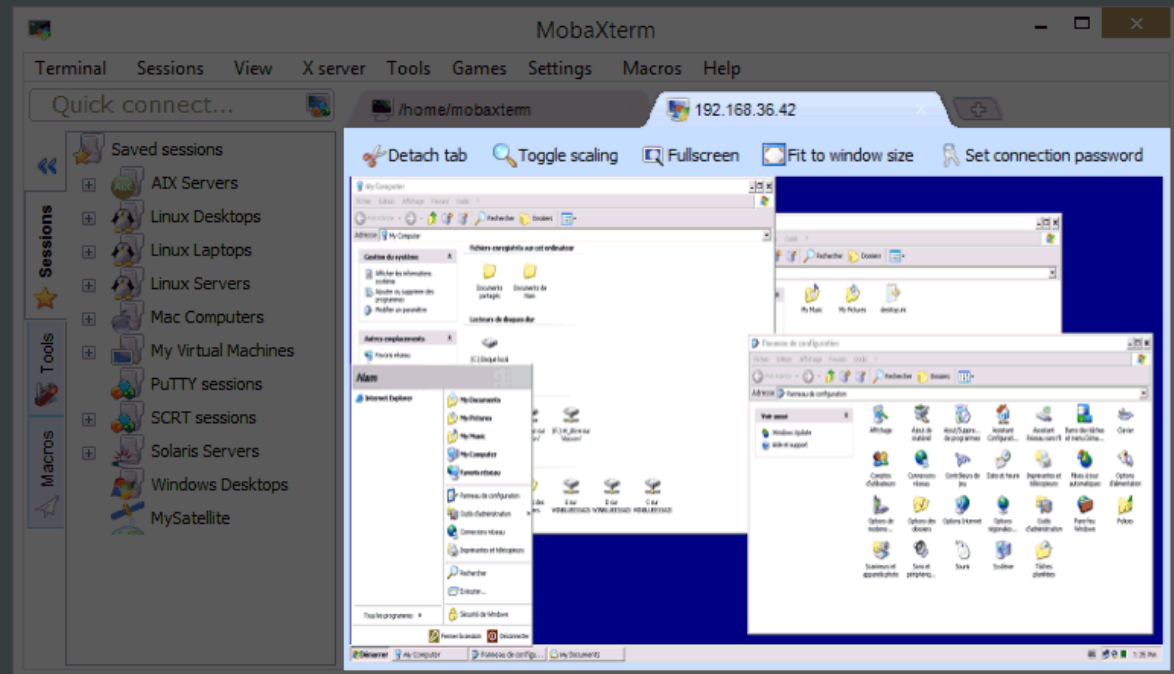
- Windows

- 推薦使用MobaXterm
<https://mobaxterm.mobatek.net/>
- 下載putty.exe
- <http://www.putty.org/>



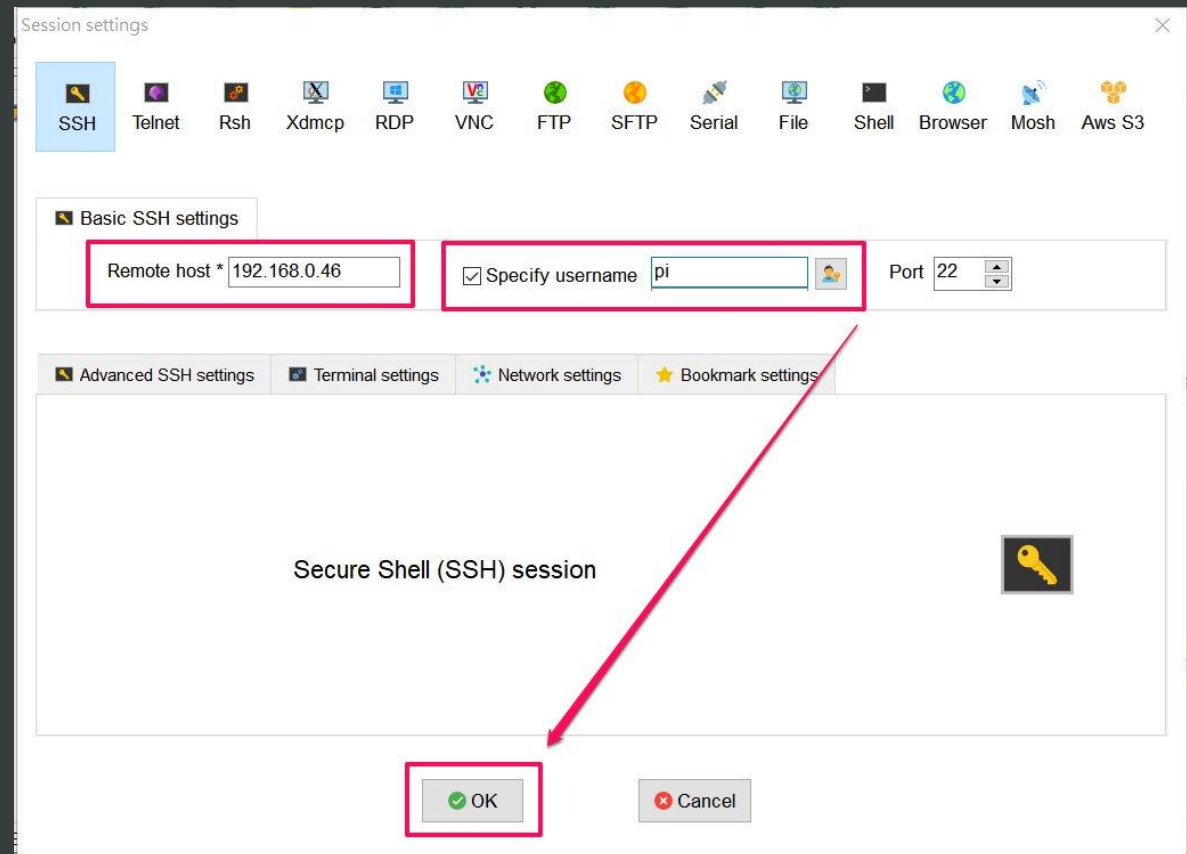
- Mac OS

- 開啟指令列 Terminal
- 應用程式->工具程式->終端機
- iterm2+zsh 是介面比較好看一些



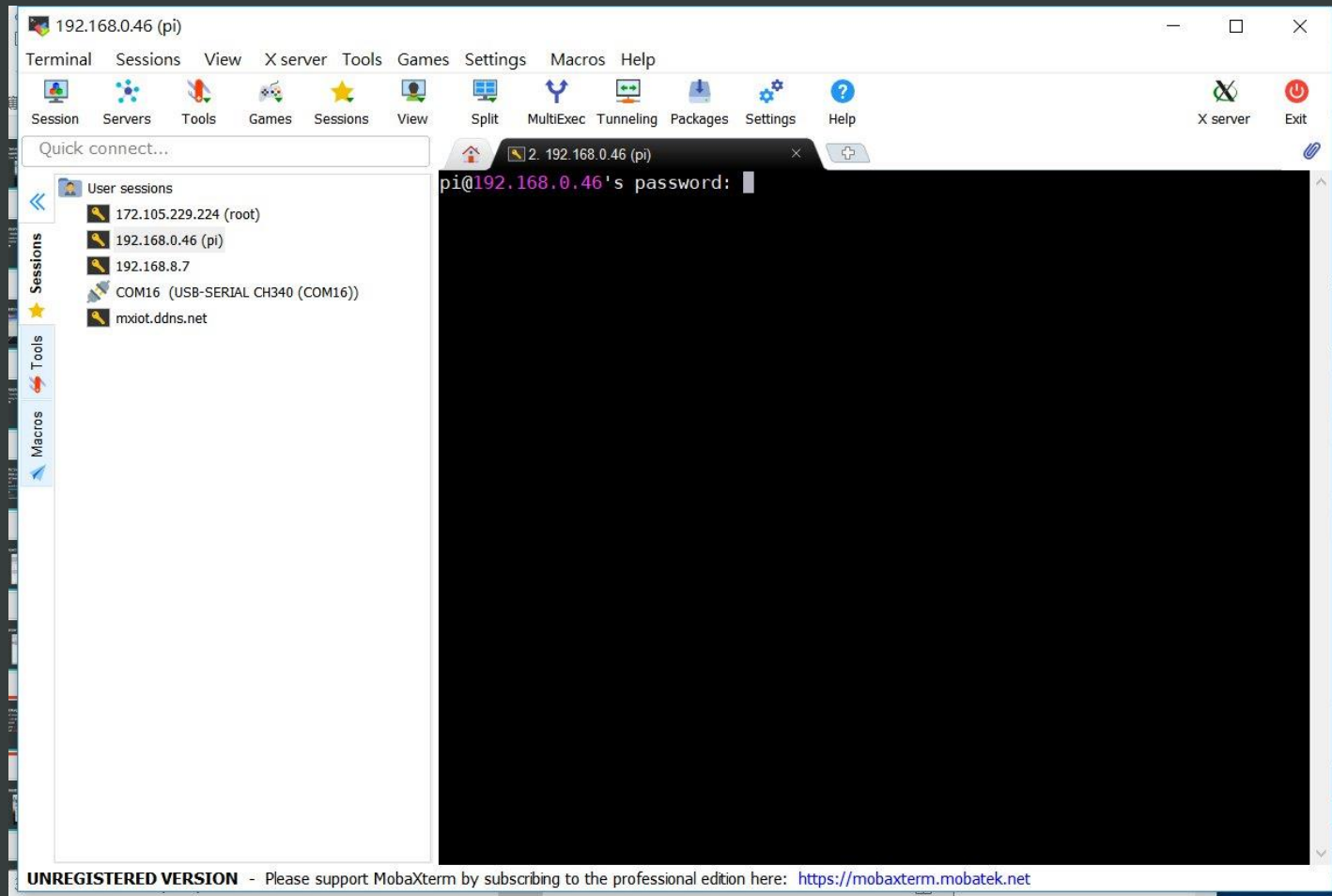
MobaXterm

- Session -> SSH
- Remote Host : 192.168.xxx.xxx [自己的樹梅派IP]
- Username: pi
- Port : 22

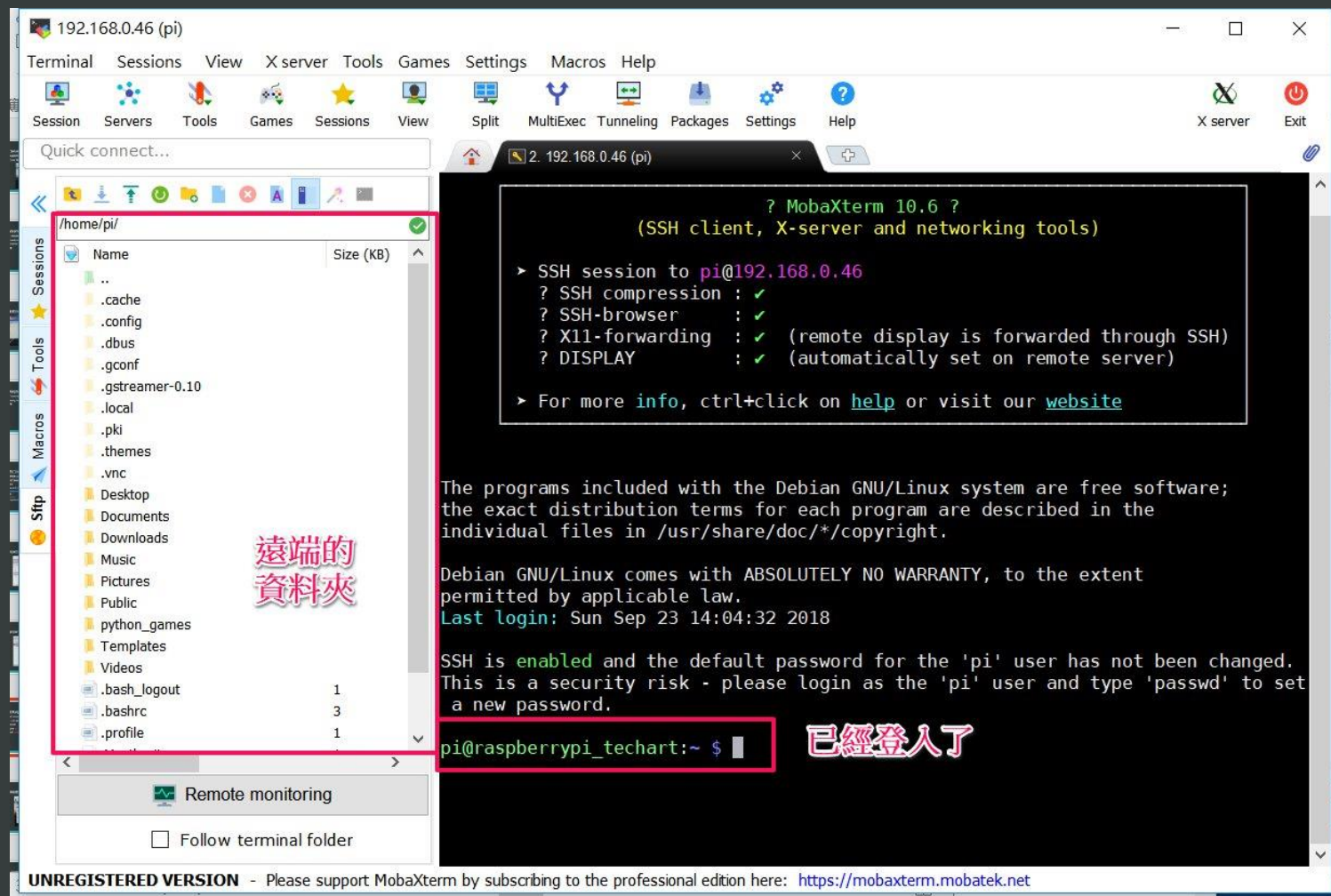


預設的帳密

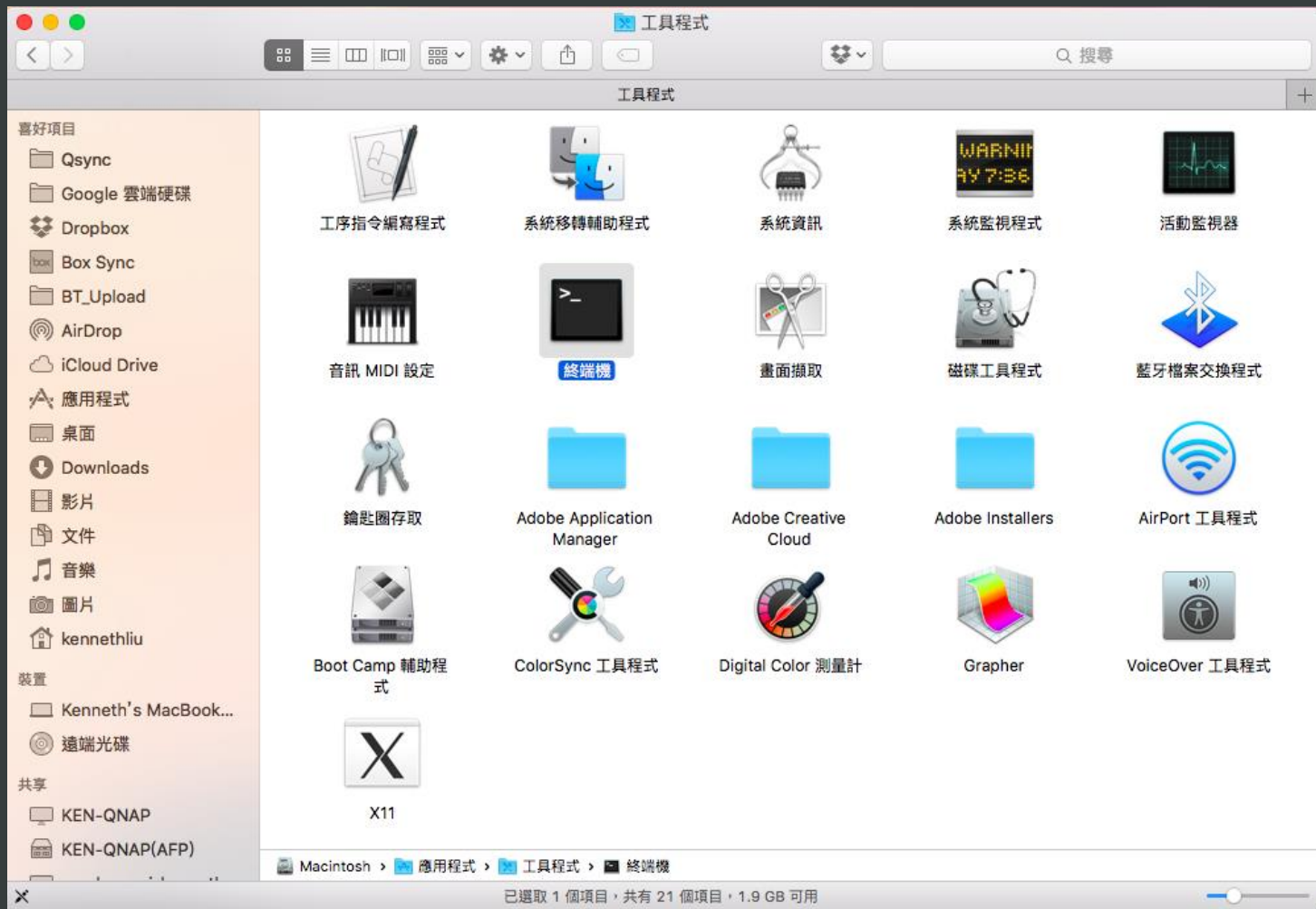
- pi@192.168.xxx.xxx [使用pi帳號登入]
- 密碼：raspberry



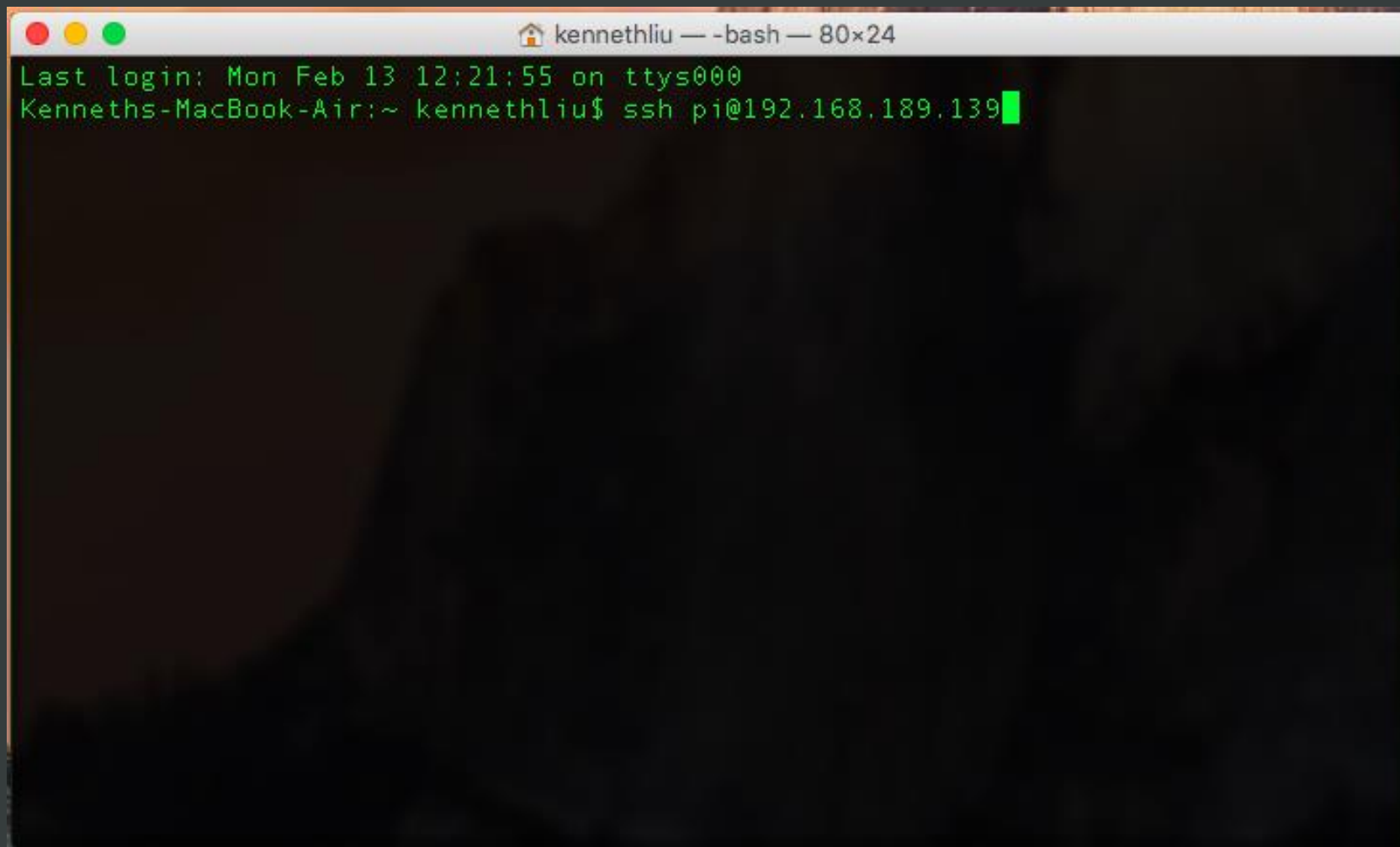
登入成功後



Mac終端機



Mac開啟終端機畫面



A screenshot of a Mac terminal window. The title bar at the top shows a home icon, the name 'kennethliu', and the command '-bash' followed by the window size '80x24'. The terminal text is as follows:

```
Last login: Mon Feb 13 12:21:55 on ttys000  
Kenneths-MacBook-Air:~ kennethliu$ ssh pi@192.168.189.139
```

The text is displayed in a light green color on a black background. A green cursor is visible at the end of the command line.

MAC登入Raspberry Pi使用ssh指令即可

- 輸入: `ssh pi@192.168.1.188`
ssh 空一格 pi @ ip位置
- Pi = 要登入的帳號

登入時密碼預設為raspberrypi

```
kennethliu — pi@raspberrypi_kenneth: ~ — ssh pi@192.168.189.139 — 80x24
Last login: Mon Feb 13 12:21:55 on ttys000
[Kenneths-MacBook-Air:~ kennethliu$ ssh pi@192.168.189.139
[pi@192.168.189.139's password:

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Mon Feb 13 12:27:40 2017 from 192.168.189.188

SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set
a new password.

pi@raspberrypi_kenneth:~ $
```

Linux系統與基本指令

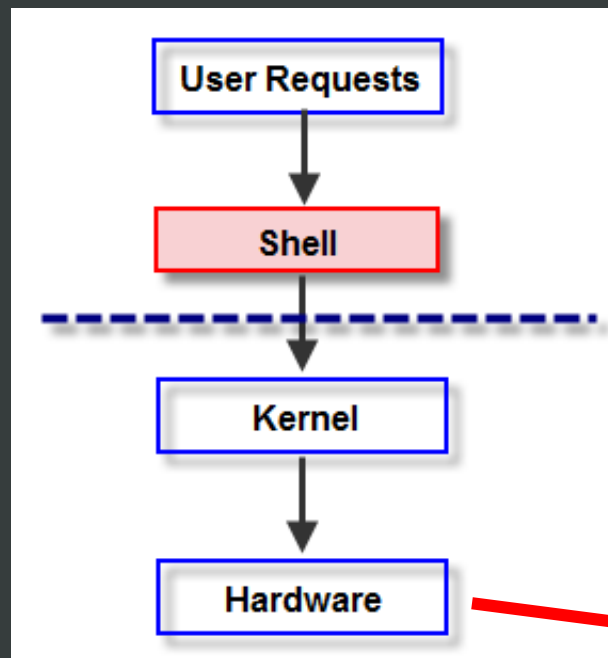
Linux系統

Linux 架構示意圖

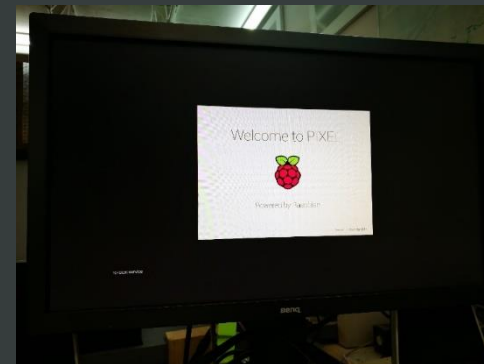


```
Irnick@dahbar:~$ ls -l
total 5.5M
drwxr-xr-x 2 Irnick Irnick 4.0K Jul 3 10:34 bin/
drwxr-xr-x 6 Irnick Irnick 4.0K Jul 3 09:55 Documents/
drwx----- 19 Irnick Irnick 12K Jul 3 09:55 Downloads/
-rw-r--r-- 1 Irnick Irnick 5.4M Jul 3 10:44 shell1.mp4
drwxr-xr-x 9 Irnick Irnick 4.0K Jul 3 10:16 Sources/
Irnick@dahbar:~$ cd Sources
Irnick@dahbar:~/Sources$ ls
arduino/ bazz/ geek/ hyve/ pyusb/ scrapytest/ temper1/
Irnick@dahbar:~/Sources$ mkdir foo
mkdir: created directory 'foo'
Irnick@dahbar:~/Sources$ cd foo
Irnick@dahbar:~/Sources/foo$ ls
Irnick@dahbar:~/Sources/foo$ ls ..
arduino/ bazz/ geek/ hyve/ pyusb/ scrapytest/ temper1/
Irnick@dahbar:~/Sources/foo$ touch bar
Irnick@dahbar:~/Sources/foo$ rm bar
Irnick@dahbar:~/Sources/foo$ ls
Irnick@dahbar:~/Sources/foo$ touch monkey touch panda touch butterfly
Irnick@dahbar:~/Sources/foo$ ls
butterfly monkey panda touch
Irnick@dahbar:~/Sources/foo$ cd ..
```

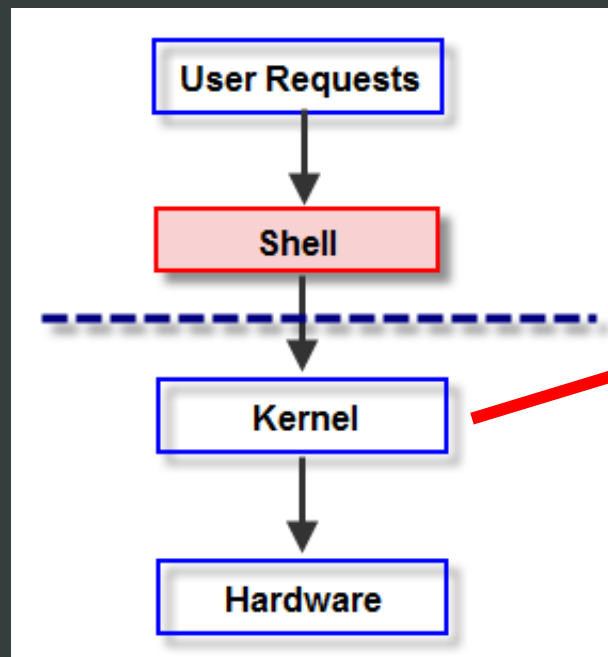
Linux Shell



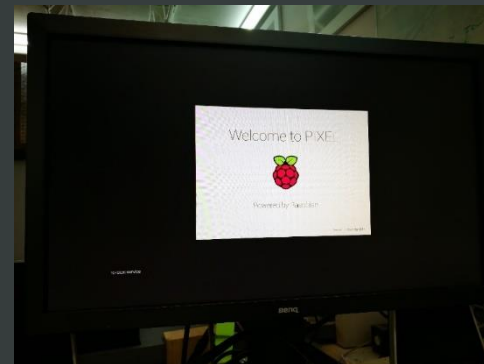
```
irvick@barbar: ~$ ls -l
total 5.9K
drwxr-xr-x 2 irvick irvick 4.0K Jul 3 10:34 .
drwxr-xr-x 6 irvick irvick 4.0K Jul 3 09:55 ..
drwxr-xr-x 15 irvick irvick 12K Jul 3 09:55 /usr/share/
-rw-r--r-- 1 irvick irvick 5.4K Jul 3 10:44 shell1.nod
drwxr-xr-x 3 irvick irvick 4.0K Jul 3 10:16 Sources/
irvick@barbar: ~$ cd Sources
irvick@barbar: ~/Sources$ ls
./  ../  .git/  .gitignore  .vscode/  README.md
irvick@barbar: ~/Sources$ mkdir foo
mkdir: created directory 'foo'
irvick@barbar: ~/Sources$ ls
./  ../  .git/  .gitignore  .vscode/  README.md  foo/
irvick@barbar: ~/Sources$ cd foo
irvick@barbar: ~/Sources/foo$ ls
..  .
irvick@barbar: ~/Sources/foo$ touch bar
touch: cannot touch 'bar': No such file or directory
irvick@barbar: ~/Sources/foo$ ls
..
irvick@barbar: ~/Sources/foo$ rm bar
rm: cannot remove 'bar': No such file or directory
irvick@barbar: ~/Sources/foo$ touch monkey touch panda touch butterfly
touch: cannot touch 'monkey': No such file or directory
touch: cannot touch 'panda': No such file or directory
touch: cannot touch 'butterfly': No such file or directory
irvick@barbar: ~/Sources/foo$ butterfly monkey panda touch
touch: cannot touch 'butterfly monkey panda touch': No such file or directory
irvick@barbar: ~/Sources/foo$ cd ..
irvick@barbar: ~/Sources$
```



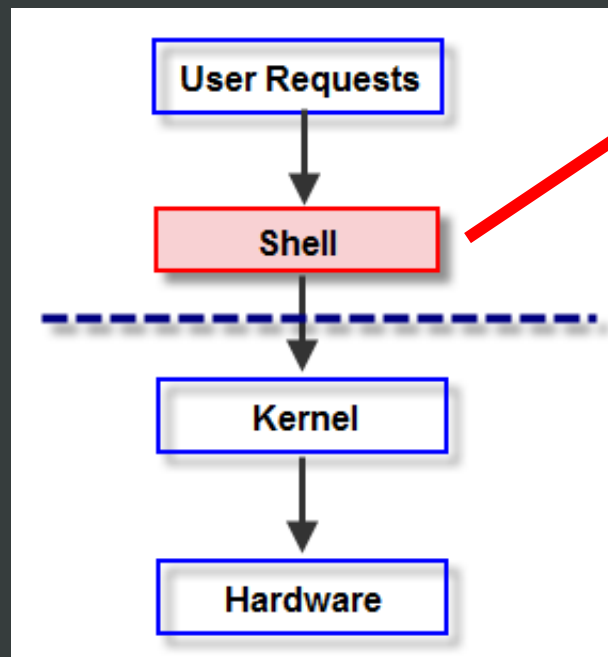
Linux Shell



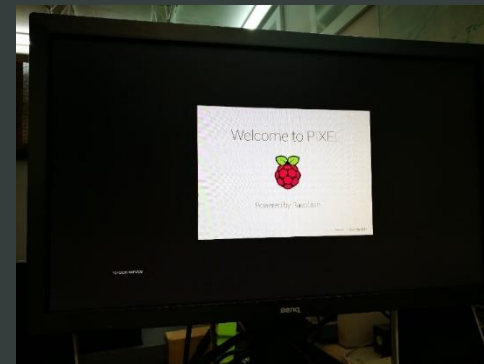
```
irick@bar:~$ ls -l
total 59K
drwxr-xr-x 2 irick irick 4.0K Jul 3 10:34 .
drwxr-xr-x 5 irick irick 4.0K Jul 3 09:55 ..
drwxr-xr-x 15 irick irick 12K Jul 3 09:55 /usr/share/
-rw-r--r-- 1 irick irick 5.4K Jul 3 10:44 shell1.nod
irick@bar:~$ cd Sources
irick@bar:~/Sources$ ls
./  ../  .git/  .gitignore  .vscode/  bar/  bar2/  Sources/
irick@bar:~/Sources$ mkdir foo
irick@bar:~/Sources$ mkdir created directory 'foo'
irick@bar:~/Sources$ ls
./  ../  .git/  .gitignore  .vscode/  bar/  bar2/  Sources/  foo/
irick@bar:~/Sources$ cd foo
irick@bar:~/Sources/foo$ ls
../  ../..  .git/  .gitignore  .vscode/  bar/  bar2/  Sources/
irick@bar:~/Sources/foo$ touch bar
irick@bar:~/Sources/foo$ ls
../  ../..  .git/  .gitignore  .vscode/  bar/  bar2/  Sources/  bar
irick@bar:~/Sources/foo$ rm bar
irick@bar:~/Sources/foo$ ls
../  ../..  .git/  .gitignore  .vscode/  bar/  bar2/  Sources/
irick@bar:~/Sources/foo$ touch monkey touch panda touch butterfly
irick@bar:~/Sources/foo$ ls
../  ../..  .git/  .gitignore  .vscode/  bar/  bar2/  Sources/  butterfly  monkey  panda  touch
irick@bar:~/Sources/foo$ cd ..
```



Linux Shell



```
irick@bar:~$ ls -l
total 5.9K
drwxr-xr-x 2 irick irick 4.0K Jul 3 10:34 .
drwxr-xr-x 5 irick irick 4.0K Jul 3 09:55 ..
drwxr-xr-x 15 irick irick 12K Jul 3 09:55 /usr/share/
-rw-r--r-- 1 irick irick 5.4K Jul 3 10:44 shell1.nod
irick@bar:~$ cd Sources
irick@bar:~/Sources$ ls
.  ..  /usr  /usr/share  /usr/share/doc  /usr/share/doc/ncurses
irick@bar:~/Sources$ mkdir foo
irick@bar:~/Sources$ ls
.  ..  /usr  /usr/share  /usr/share/doc  /usr/share/doc/ncurses  foo
irick@bar:~/Sources$ cd foo
irick@bar:~/Sources/foo$ ls
.  ..  /usr  /usr/share  /usr/share/doc  /usr/share/doc/ncurses
irick@bar:~/Sources/foo$ touch bar
irick@bar:~/Sources/foo$ ls
.  ..  /usr  /usr/share  /usr/share/doc  /usr/share/doc/ncurses  bar
irick@bar:~/Sources/foo$ rm bar
irick@bar:~/Sources/foo$ ls
.  ..  /usr  /usr/share  /usr/share/doc  /usr/share/doc/ncurses
irick@bar:~/Sources/foo$ touch monkey touch panda touch butterfly
irick@bar:~/Sources/foo$ ls
.  ..  /usr  /usr/share  /usr/share/doc  /usr/share/doc/ncurses  butterfly  monkey  panda  touch
irick@bar:~/Sources/foo$
```



Linux 系統指令

- 系統指令工具如同用檔案總管方式執行->新增資料夾->新增檔案->刪除檔案 等等的動作
- 透過SSH連線方式進入到Linux系統的Shell之中進行下達指令給電腦
- 除了透過SSH連線方式也可以直接在Pi裡面的終端機程式進行，操作的結果一樣

Linux系統介紹(使用者與Hostname)

- 當登入pi帳號到Raspberry Pi之後，預設的pi帳號會直接登入到你的hostname主機，所以當用SSH方式連入之後所顯示的訊息說明如下

```
pi@raspberrypi_teacher: ~  
login as: pi  
pi@192.168.3.5's password:  
  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*/copyright.  
  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
Last login: Wed Feb 15 14:04:40 2017  
  
@ is enabled. hostname: pi. The default password for the 'pi' user has not been changed.  
This is a security risk - please login as the 'pi' user and type 'passwd' to set  
a new password.  
pi@raspberrypi_teacher:~$
```

@ is enabled. **hostname**: pi. The default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set
a new password.
pi@**raspberrypi_teacher**:**~****\$**

pi = 帳號 **~** 所在目錄 **\$** 等待輸入的指令

pi@raspberrypi_teacher:~ \$

- Pi = 當時登入的使用者名稱
- @ = AT / 或是意思在xxx的主機
- Raspberrypi_teacher = 你的hostname
- ~ = 所在的目錄的路徑(“~” 是指正在home目錄)
- \$ = 等待要輸入的指令符號

ls 指令 (list directory contents)

- 在\$字符後面輸入 “ls” 然後按下enter

```
pi@raspberrypi_teacher: ~
login as: pi
pi@192.168.3.5's password:

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Feb 15 14:04:40 2017

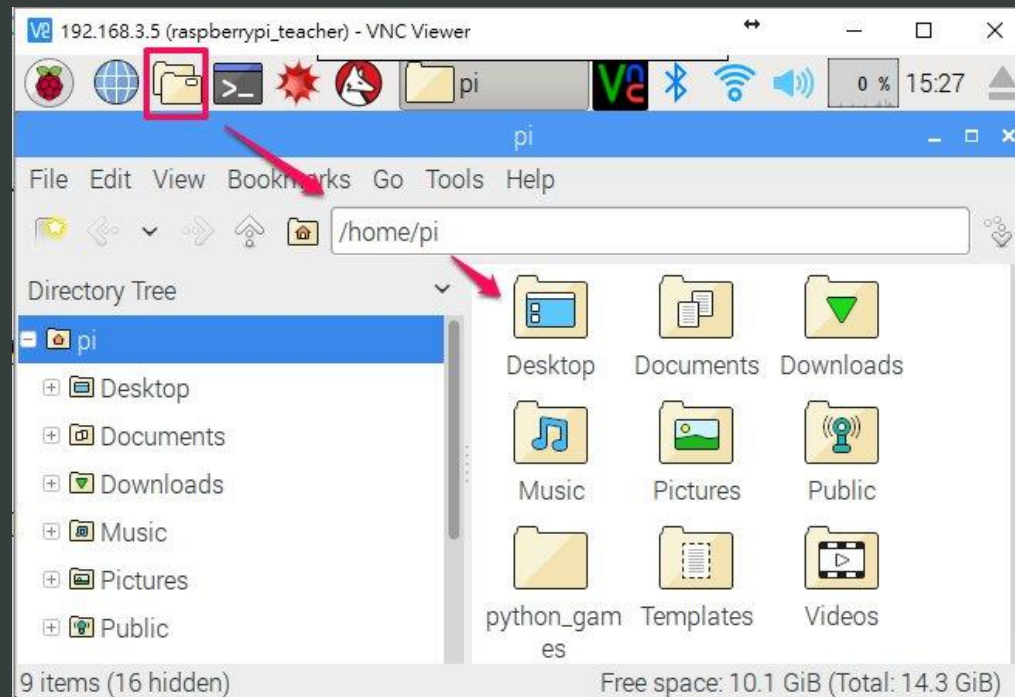
SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set
a new password.

pi@raspberrypi_teacher:~ $ ls
Desktop  Downloads  Pictures  python_games  Videos
Documents Music      Public    Templates
pi@raspberrypi_teacher:~ $
```

輸入 ls 指令

回饋的結果

看看pi裡面的資料夾是否一樣呢？



```
pi@raspberrypi_teacher:~ $ ls
Desktop      Downloads    Pictures     python_games  Videos
Documents    Music        Public       Templates
```

cd 指令(Change Directory)

- 現在來試試cd指令來切換到一個指定目錄
- 輸入 “cd Desktop ”
- 然後輸入“ ls ”
- 結果變成 ~/Desktop
- 但是裡面什麼都沒有

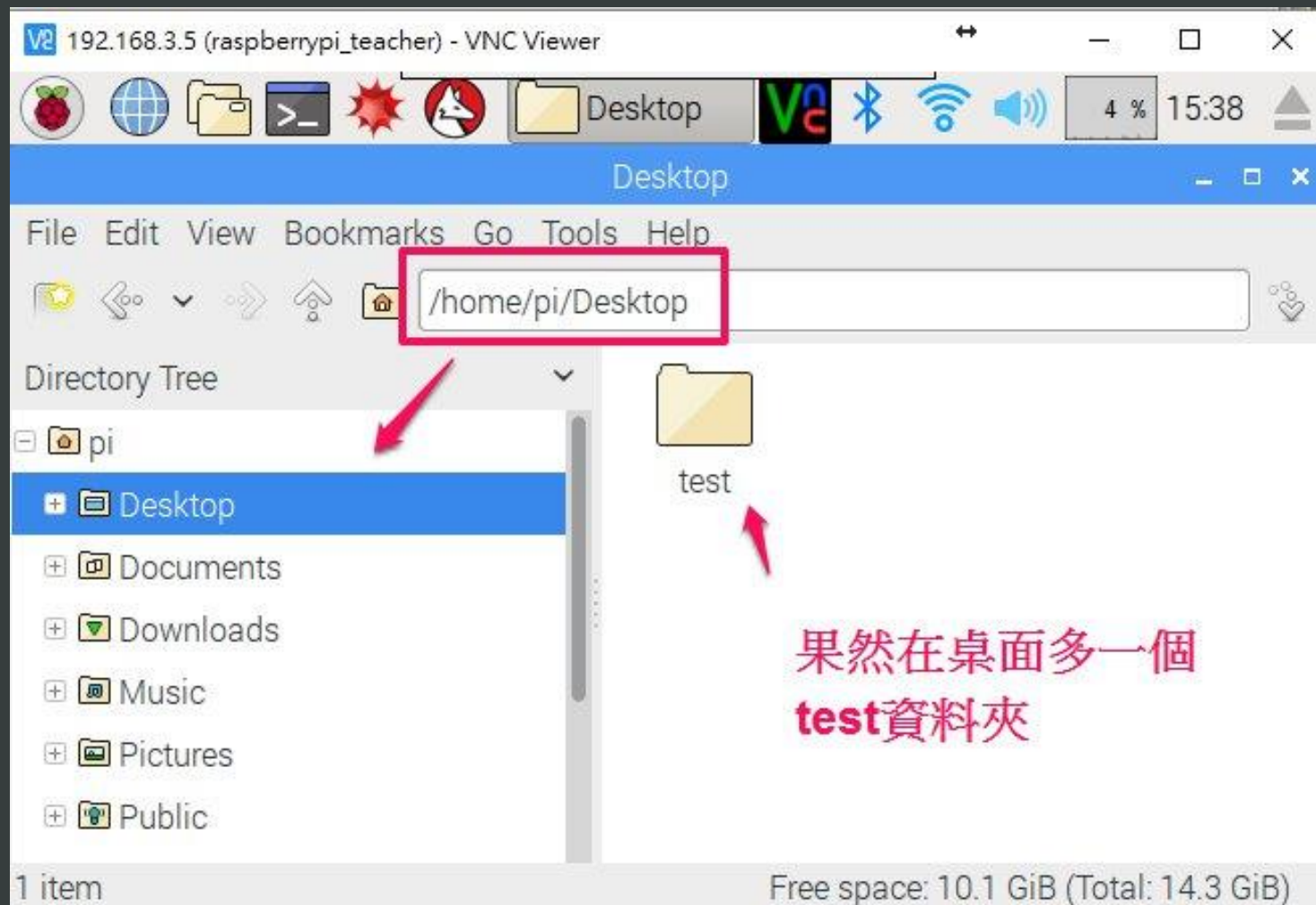
```
pi@raspberrypi_teacher:~ $ cd Desktop
pi@raspberrypi_teacher:~/Desktop $ ls
pi@raspberrypi_teacher:~/Desktop $
```

mkdir 指令(make directory)

- 既然沒有東西就來新建一個資料夾看看
- 在指令符後輸入 “`mkdir test`” 然後enter
- 再輸入 `ls` 指令看一看
- 是不是多出了一個test資料夾呢？

```
pi@raspberrypi_teacher:~/Desktop $ mkdir test
pi@raspberrypi_teacher:~/Desktop $ ls
test
pi@raspberrypi_teacher:~/Desktop $
```

檢查看看



sudo 指令(Super User Do) 安裝VIM

- Super user的用意是切換到超級使用者(root)執行系統級的工作
- 一般我們登入pi的帳號只能執行一些應用程式，但碰到安裝新的軟體或是更新一些系統檔案時，就必須要使用sudo指令來進行
- 試試 `"sudo apt-get install vim"`

```
pi@raspberrypi_teacher:~/Desktop $ sudo apt-get install vim
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
  vim-runtime
Suggested packages:
  ctags vim-doc vim-scripts
The following NEW packages will be installed:
  vim vim-runtime
0 upgraded, 2 newly installed, 0 to remove and 0 not upgraded.
Need to get 5845 kB of archives.
After this operation, 28.2 MB of additional disk space will be used.
Do you want to continue? [Y/n] 
```

← 按下Y繼續執行安裝

安裝vim發現無法下載該檔案

```
Err http://mirrordirector.raspbian.org/raspbian/ jessie/main vim-runtime all 2:7.4.488-7+deb8u1
404 Not Found [IP: 5.153.225.207 80]
Err http://mirrordirector.raspbian.org/raspbian/ jessie/main vim armhf 2:7.4.488-7+deb8u1
404 Not Found [IP: 5.153.225.207 80]
E: Failed to fetch http://mirrordirector.raspbian.org/raspbian/pool/main/v/vim/vim-runtime_7.4.488-7+deb8u1_all.deb 404 Not Found [IP: 5.153.225.207 80]

E: Failed to fetch http://mirrordirector.raspbian.org/raspbian/pool/main/v/vim/vim_7.4.488-7+deb8u1_armhf.deb 404 Not Found [IP: 5.153.225.207 80]

E: Unable to fetch some archives, maybe run apt-get update or try with --fix-missing?
pi@raspberrypi_teacher:~/Desktop $
```

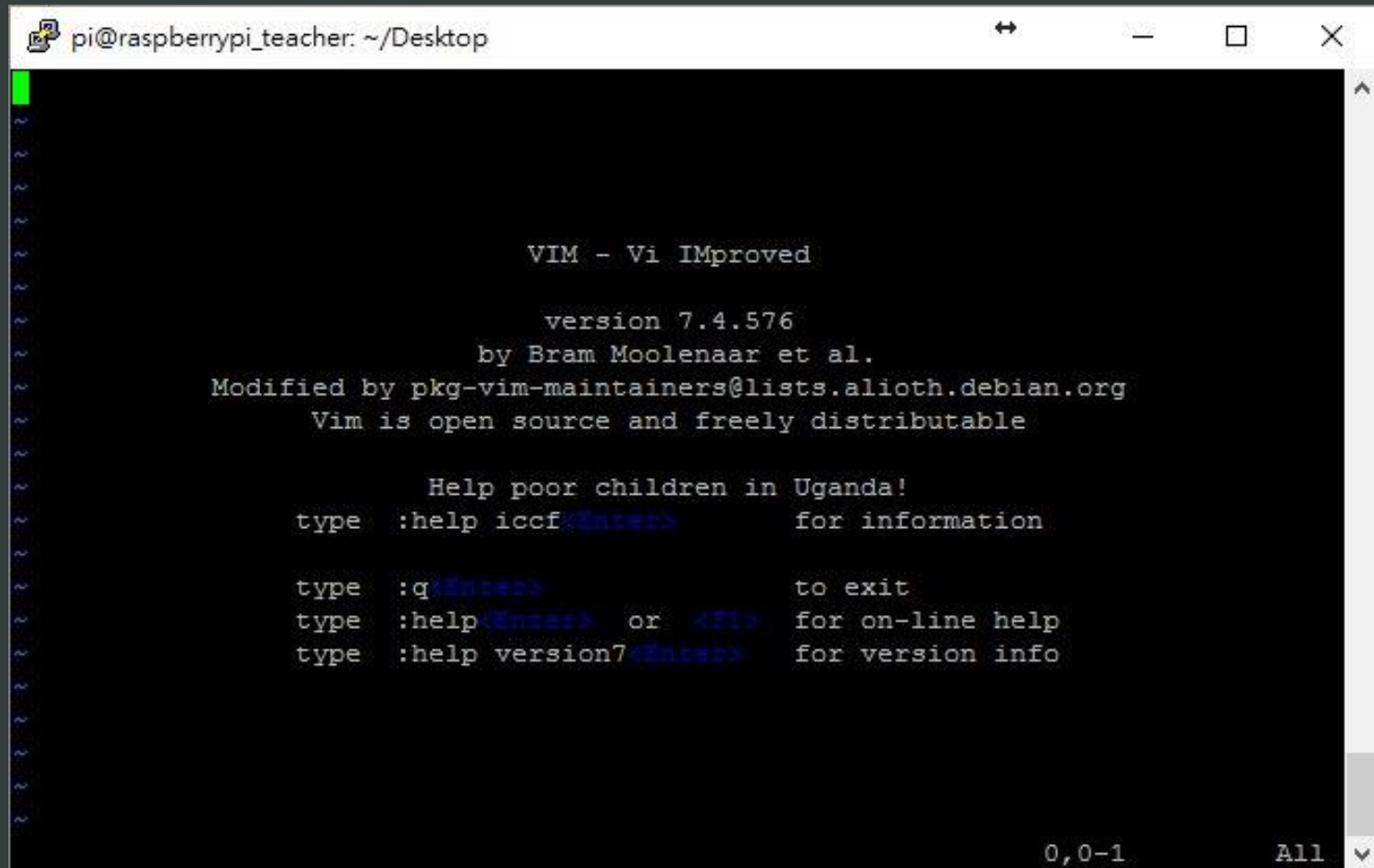
執行更新套件指令

- 有時候因Pi的系統去連接Server下載軟體發現版本太舊，或是有新的版本。此時就要執行更新套件的指令
- 輸入“ `sudo apt-get update`”

```
pi@raspberrypi_teacher:~/Desktop $ sudo apt-get update
Get:1 http://mirrordirector.raspbian.org jessie InRelease [14.9 kB]
Get:2 http://archive.raspberrypi.org jessie InRelease [22.9 kB]
Get:3 http://mirrordirector.raspbian.org jessie/main armhf Packages [8981 kB]
Get:4 http://archive.raspberrypi.org jessie/main armhf Packages [142 kB]
Get:5 http://archive.raspberrypi.org jessie/ui armhf Packages [53.6 kB]
Get:6 http://mirrordirector.raspbian.org jessie/contrib armhf Packages [37.5 kB]
Get:7 http://mirrordirector.raspbian.org jessie/non-free armhf Packages [70.3 kB]
Get:8 http://mirrordirector.raspbian.org jessie/rpi armhf Packages [1356 B]
Ign http://archive.raspberrypi.org jessie/main Translation-lzh_TW
Ign http://archive.raspberrypi.org jessie/main Translation-lzh
Ign http://archive.raspberrypi.org jessie/main Translation-en
Ign http://archive.raspberrypi.org jessie/ui Translation-lzh_TW
Ign http://archive.raspberrypi.org jessie/ui Translation-lzh
Ign http://archive.raspberrypi.org jessie/ui Translation-en
Ign http://mirrordirector.raspbian.org jessie/contrib Translation-lzh_TW
Ign http://mirrordirector.raspbian.org jessie/contrib Translation-lzh
Ign http://mirrordirector.raspbian.org jessie/contrib Translation-en
```

等待更新到完畢之後

- 再次安裝 “`sudo apt-get install vim`”
- 等安裝完畢之後輸入 “`vim`”



The screenshot shows a terminal window titled "pi@raspberrypi_teacher: ~/Desktop". The terminal displays the Vim help screen, which includes the following text:

```
VIM - Vi IMproved
      version 7.4.576
      by Bram Moolenaar et al.
Modified by pkg-vim-maintainers@lists.alioth.debian.org
Vim is open source and freely distributable

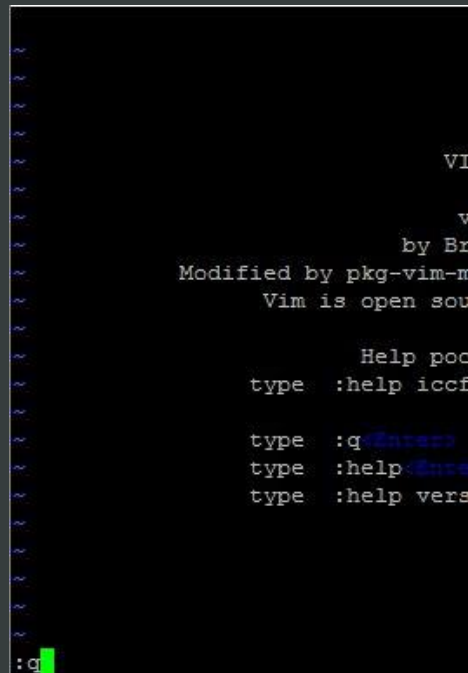
      Help poor children in Uganda!
type  :help iccf<Enter>      for information

type  :q<Enter>              to exit
type  :help<Enter> or <F1>   for on-line help
type  :help version7<Enter> for version info
```

At the bottom right of the terminal window, the status bar shows "0,0-1" and "All".

VIM (Vi Improved)文字編輯器

- Vim可以做為一般的純文字編輯器
- 因為在linux shell底下我們常常沒有一般的圖形介面軟體(word, office等等)來編輯一些大量文字，因此透過Vim軟體可以用一些指令進行編輯或修改檔案
- 進入Vim模式之後若要跳回剛剛的指令符畫面，只要輸入
 - “:” 然後輸入“ q ”
 - 即可跳回原來畫面



```
update-alternatives: using /usr/bin/vim.b
auto mode
update-alternatives: using /usr/bin/vim.b
in auto mode
update-alternatives: using /usr/bin/vim.b
o mode
update-alternatives: using /usr/bin/vim.b
auto mode
update-alternatives: using /usr/bin/vim.b
o mode
pi@raspberrypi_teacher:~/Desktop $ vim
pi@raspberrypi_teacher:~/Desktop $ vim
pi@raspberrypi_teacher:~/Desktop $
```

Linux指令補充說明 – CD指令

- cd 指令下，若要切換到想要的目錄去，需輸入“ `cd /path/to` ” “/” 是系統的根目錄，目錄底下有bin, boot, dev, etc, home ... 等等資料夾，而預設的pi帳號就是放在 /home/pi 目錄底下，pi目錄底下還存放了 desktop, Documents, Downloads, ...等等資料夾，大多數的檔案都會存放在 /home/pi/底下這些文件資料夾內。
- 試試切換到 Downloads資料夾去
- 若要切換到上一層目錄，可輸入 “`cd ..` ” 代表回到上一層目錄
- 若要快速切換到/home/pi目錄下，可輸入“ `cd ~` ”
- 切換到任何一個目錄時，指令列都會顯示目前的路徑位置，但是若要回到最頂層用 `cd ..` 指令太慢，這時可輸入 “ `cd /` ” 直接跳回系統的根目錄

Linux指令補充說明 – CD指令

- cd指令還可以一個重要的目錄概念，當直接到一個指定的目錄時，若下達

“`cd /home/pi`” 代表絕對路徑，若用 “`cd ~/Desktop`” 代表相對路徑，因為 “~” 符號已幫我們縮寫了 “/home/pi” 這個路徑，所以 “~/Desktop” 完整的路徑是指 “/home/pi/Desktop”

- 路徑的縮寫還有一個 “.” 代表當前目錄，例如 “`./lcd_show.sh`” 指當前目錄下的 “`lcd_show.sh`” 執行檔進行執行

```
? X11-forwarding : ✓ (remote display is forwarded through SSH)
? DISPLAY        : ✓ (automatically set on remote server)
```

```
> For more info, ctrl+click on help or visit our website
```

```
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
```

```
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
```

```
Last login: Sun Sep 23 22:39:13 2018
```

```
pi@raspberrypi_techart:~ $ ls
```

```
Desktop    Downloads  Pictures  python_games  Videos
Documents  Music      Public    Templates
```

```
pi@raspberrypi_techart:~ $ cd Downloads/
```

```
pi@raspberrypi_techart:~/Downloads $ ls
```

```
pi@raspberrypi_techart:~/Downloads $ █
```

Linux指令補充說明 – ls指令

- ls指令除了直接顯示目錄以外，還有很多參數可以一起使用，例如：
- “ls -l” 顯示全部檔案的說明
- “ls -a” 顯示全部檔案包括隱藏檔
- “ls -i” 顯示該目錄底下有多少資料

```
pi@raspberrypi_teacher: /  
pi@raspberrypi_teacher:/$ ll  
-bash: ll: command not found  
pi@raspberrypi_teacher:/$ ls -l  
total 71  
drwxr-xr-x  2 root root  4096 +- 26 01:33 bin  
drwxr-xr-x  5 root root  2560 -  1 1970 boot  
drwxr-xr-x 14 root root  3420 == 16 10:11 dev  
drwxr-xr-x 11 root root  4096 == 15 15:56 etc  
drwxr-xr-x  3 root root  4096 +- 26 01:24 home  
drwxr-xr-x 18 root root  4096 +- 26 01:33 lib  
drwx----- 2 root root 16384 +- 26 01:59 lost+found  
drwxr-xr-x  2 root root  4096 +- 26 01:19 media  
drwxr-xr-x  2 root root  4096 +- 26 01:19 mnt  
drwxr-xr-x  7 root root  4096 +- 26 01:49 opt  
dr-xr-xr-x 163 root root    0 -  1 1970 proc  
drwx----- 3 root root  4096 == 16 10:08 root  
drwxr-xr-x 22 root root   780 == 16 10:12 run  
drwxr-xr-x  2 root root  4096 +- 26 01:33/sbin  
drwxr-xr-x  2 root root  4096 +- 26 01:19 srv  
dr-xr-xr-x 12 root root    0 -  1 1970 sys  
drwxrwxrwt 15 root root  4096 == 16 10:17 tmp  
drwxr-xr-x 11 root root  4096 +- 26 01:46 usr  
drwxr-xr-x 11 root root  4096 +- 26 02:09 var  
pi@raspberrypi_teacher:/$
```

Linux系統寶典

- [鳥哥的Linux私房菜](#)
- http://linux.vbird.org/new_linux.php

鳥哥的Linux私房菜

新手的建議

繁體中文

基礎篇

伺服器

企業應用

桌面應用

安全管理

書籍點談

鳥哥我

33242344

since 2002-01-01

新手建議

開始閱讀之前

網站導覽

Linux 基礎文件

Linux 基礎訓練

Linux 架站文件

Linux 企業應用

Linux 安全管理

Linux 桌面應用

鳥哥彙整的資料

關於鳥哥

網友分享

特殊問題解決

網站資料搜尋

W3C CSS W3C XHTML 2.0

今日

昨日

本月

上月

Linux 的學習曲線，一個老人家的建議！

最近更新日期：2004/10/24

學習 Linux 的過程並不簡單！因為我們過去一直都是在某些特定軟體的支配之下，所以對於這個由一群素昧謀面的工程師因為『興趣』而發明出來的作業系統，其實開始時候的接受度並不是很好的。然而因為 Linux 的學習會使用到很多的基礎觀念，因此，對於想要更深入認識您所使用的作業系統的朋友來說，其實 Linux 真的是一套很棒很棒的作業系統囉！

這個網站的內容，是由鳥哥在剛剛接觸 linux 的時候就開始寫起的，簡單的來說，這個網站的內容基本上就是『鳥哥的 Linux 血淚史～』因為鳥哥在新手的時候遇到相當多的問題，雖然一步一步的找出問題，並且解決他，不過，剛開始時，並不是那麼容易就可以解決一個小問題的。因為很多的知識都是來自於 Internet 上面的，所以也就回饋這樣的一個網站給朋友們了。請大家看一看鳥哥是如何學習 Linux 的吧！

1. VBird 與 Linux

2. VBird 的 Linux 學習之路

3. 學習心態的分別

4. 基本的學習流程

5. 基本的架站流程表

6. 簡易的安全防護

1. VBird 與 Linux

在開始給 Linux 的新手建議前，得先讓您瞭解的是，為什麼鳥哥要這樣的建議新手學習呢？所以，先交代一下 VBird 學習 Linux 的心路歷程囉，好讓您瞭解到，為何 VBird 會比較熟悉 Linux 這門藝術！

數年前 VBird 因工作的需要，『被迫』得去學習 Unix 系統，那個時候我們使用的 Unix 系統是 Sun 這家公司的機器，當時的 Sun Unix 可不是一般人玩的起的，當然，VBird 也是一般人，所以當然也就玩不起 Sun Unix 囉！然而工作的案子還是需要進行的，那怎麼辦呢？這個時候就得要想一些替代方案啦！

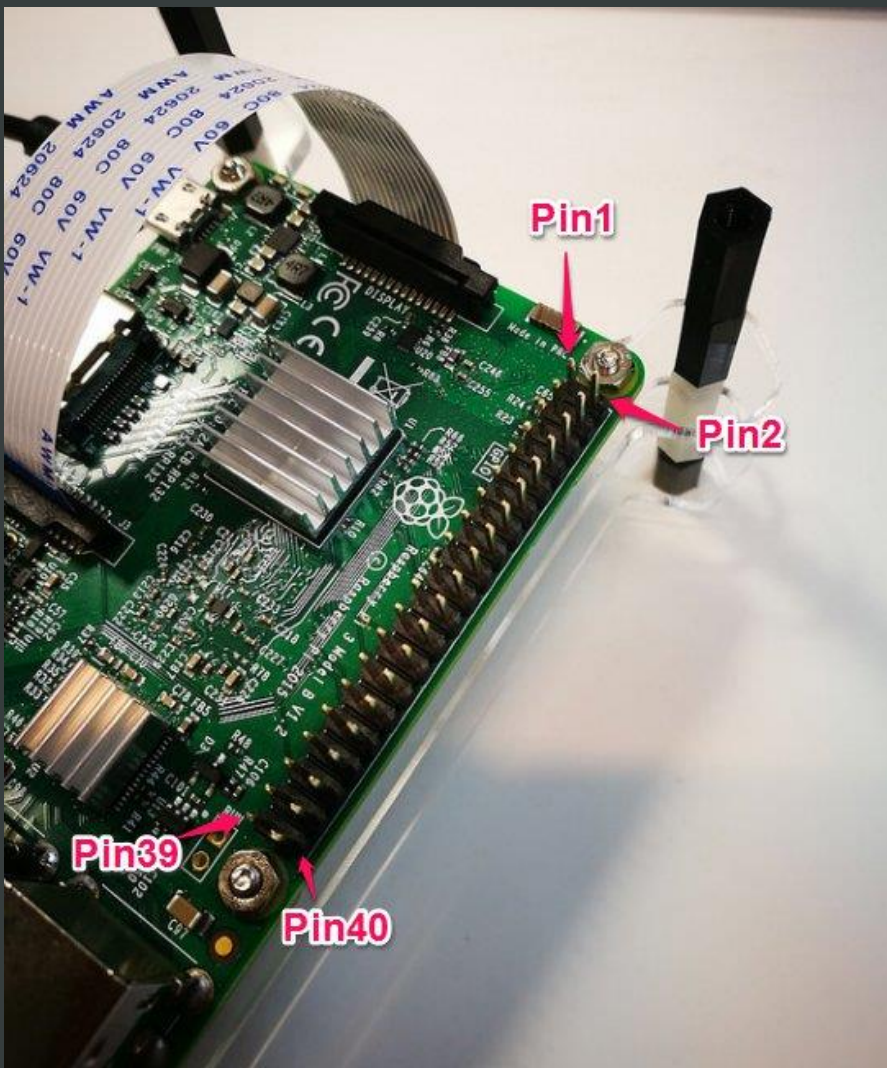
噢！聽說有另外一種可以在個人電腦 (Personal Computer, PC) 跑的 Unix-Like 系統，叫做 Linux 的，他的介面啦、功能啦、以及基本的檔案架構都跟 Unix 差不多，甚至連系統穩定性也可以說是一模一樣，而且對於硬體配備的要求並不高。嘿！既然玩不起幾十萬起跳的 Unix 系統，那麼使用一些即將廢棄的電腦配備來架設一部 Linux 主機吧！

在經過了一些時候的努力之後，呵呵！竟然真的給我架起來了(當時的版本是 Red Hat 6.1)！哇！好高興！那麼就趕快先來熟悉他，然後等到有了一定的經驗值『升級』成老手級之後，再來玩 Unix 吧，以免玩壞了幾十萬的大電腦！嘿！這似乎是不錯的方式，所以就開始了 VBird 的 Linux 學習之路啦！

Top

Raspberry Pi 的GPIO

GPIO(General Purpose Input & Output)



Raspberry Pi 3 GPIO Header

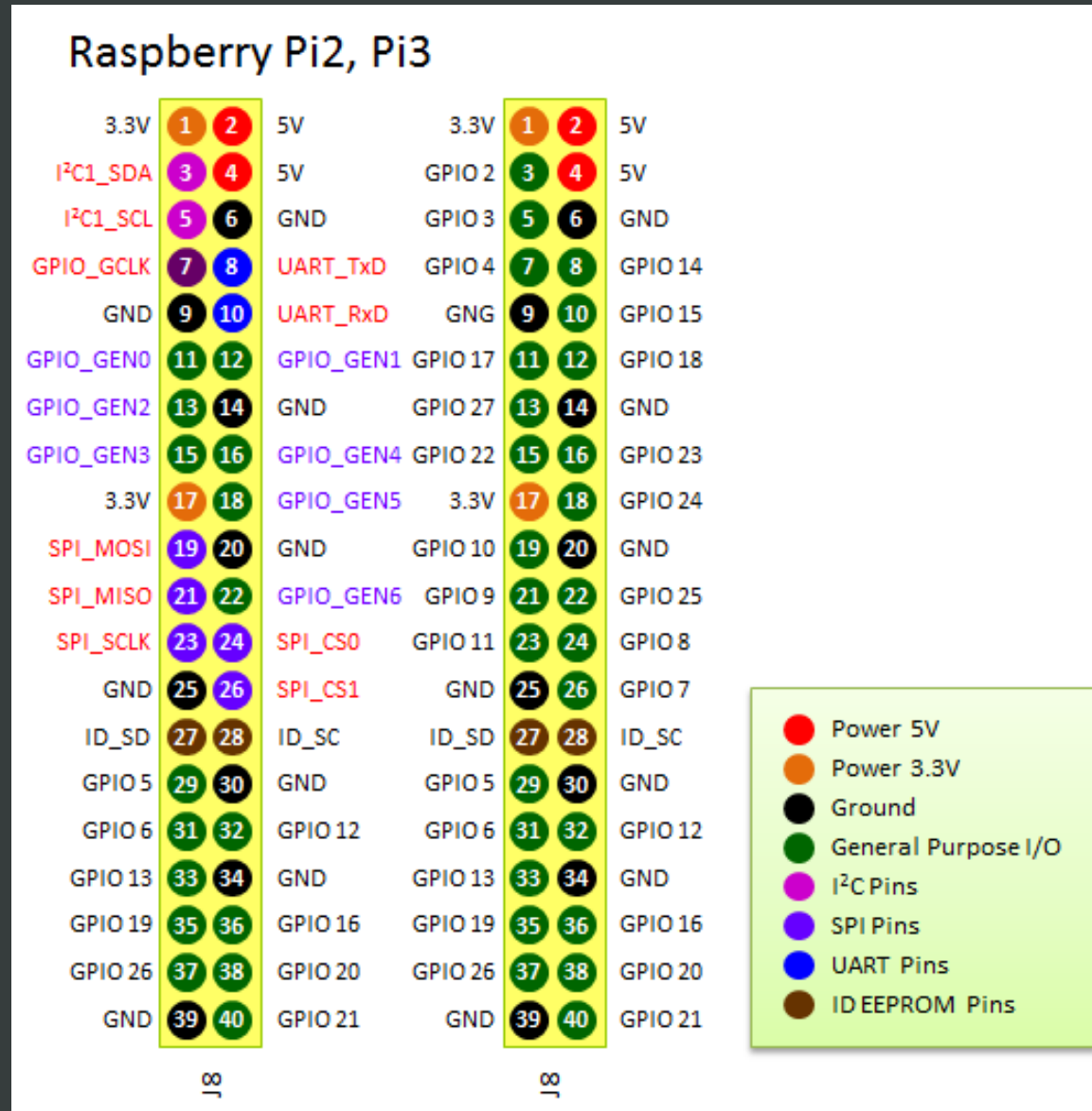
Pin#	NAME		NAME	Pin#
01	3.3v DC Power	⬤ ⬤	DC Power 5v	02
03	GPIO02 (SDA1 , I ² C)	⬢ ⬤	DC Power 5v	04
05	GPIO03 (SCL1 , I ² C)	⬢ ⬤	Ground	06
07	GPIO04 (GPIO_GCLK)	⬢ ⬢	(TXD0) GPIO14	08
09	Ground	⬤ ⬢	(RXD0) GPIO15	10
11	GPIO17 (GPIO_GEN0)	⬢ ⬢	(GPIO_GEN1) GPIO18	12
13	GPIO27 (GPIO_GEN2)	⬢ ⬤	Ground	14
15	GPIO22 (GPIO_GEN3)	⬢ ⬢	(GPIO_GEN4) GPIO23	16
17	3.3v DC Power	⬤ ⬢	(GPIO_GEN5) GPIO24	18
19	GPIO10 (SPI_MOSI)	⬢ ⬤	Ground	20
21	GPIO09 (SPI_MISO)	⬢ ⬢	(GPIO_GEN6) GPIO25	22
23	GPIO11 (SPI_CLK)	⬢ ⬢	(SPI_CE0_N) GPIO08	24
25	Ground	⬤ ⬢	(SPI_CE1_N) GPIO07	26
27	ID_SD (I ² C ID EEPROM)	⬢ ⬢	(I ² C ID EEPROM) ID_SC	28
29	GPIO05	⬢ ⬤	Ground	30
31	GPIO06	⬢ ⬢	GPIO12	32
33	GPIO13	⬢ ⬤	Ground	34
35	GPIO19	⬢ ⬢	GPIO16	36
37	GPIO26	⬢ ⬢	GPIO20	38
39	Ground	⬤ ⬢	GPIO21	40

Rev. 2
29/02/2016

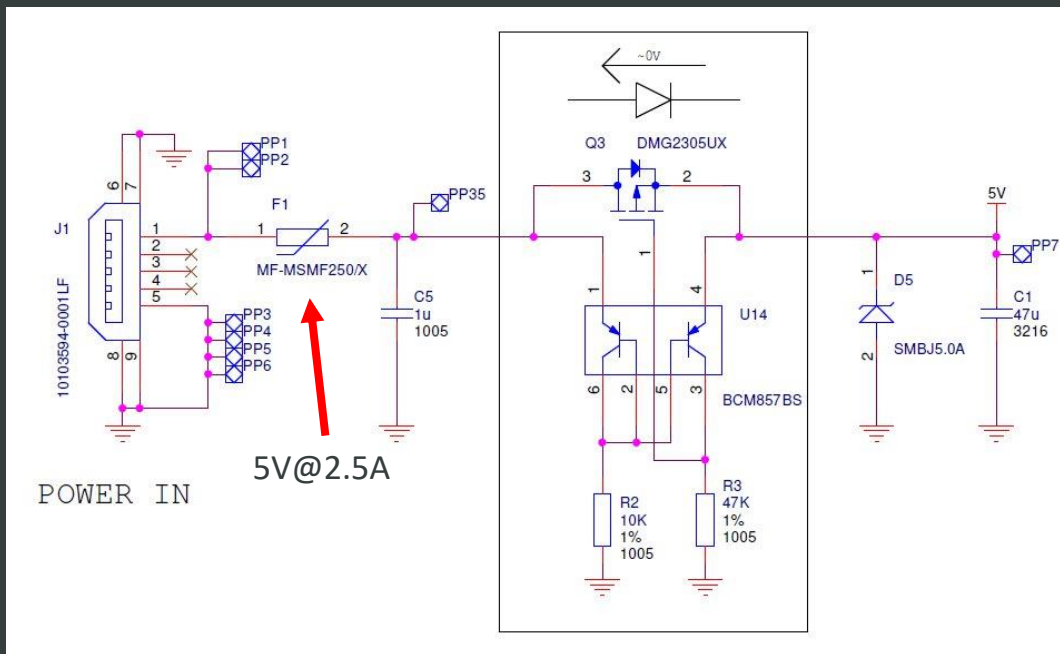
www.element14.com/RaspberryPi

各類IO數量

- 3.3V *2組
- 5V *2組
- GND *8組
- RX/TX *1組 (UART)
- GPIO *26組
- SPI *2組
- I2C *1組
- PWM *7組 (GENx)
 - GPIO17, 18, 27, 22, 23, 24, 25



Raspberry Pi的電源限制



BOURNS

Mouser 零件編號: 652-MF-MSMF250/16X-2
製造商零件編號: MF-MSMF250/16X-2
製造商: Bourns
說明: 可重疊保險絲 - PPTC 2.5A 16V 0.015ohm AEC-Q200 Xpansion

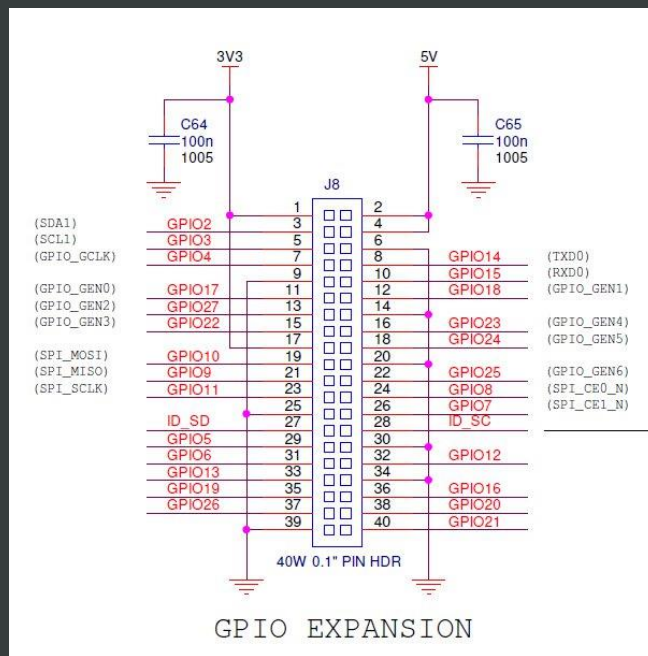
提供MultiSIM BLUE版

瞭解更多關於Bourns MF-MSMF250/16X-2的資訊

MF-MSMF250/16X-2 資料表

- 輸入電壓與電流最大5V 2.5A
- 當連接USB裝置越多時，消耗電流越高
- 若不連接USB裝置時，工作電流約350mA

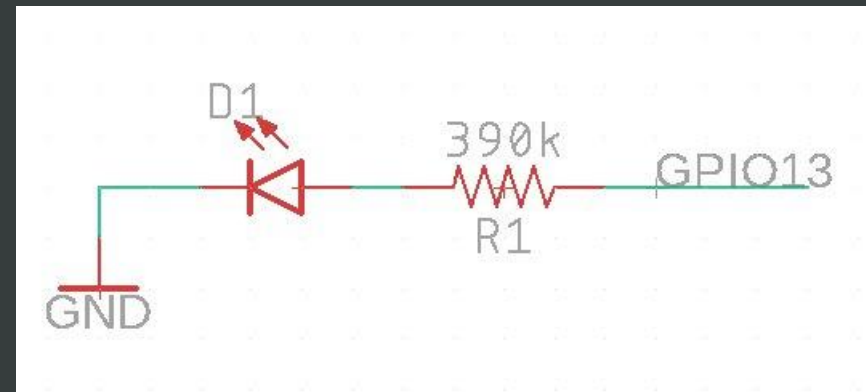
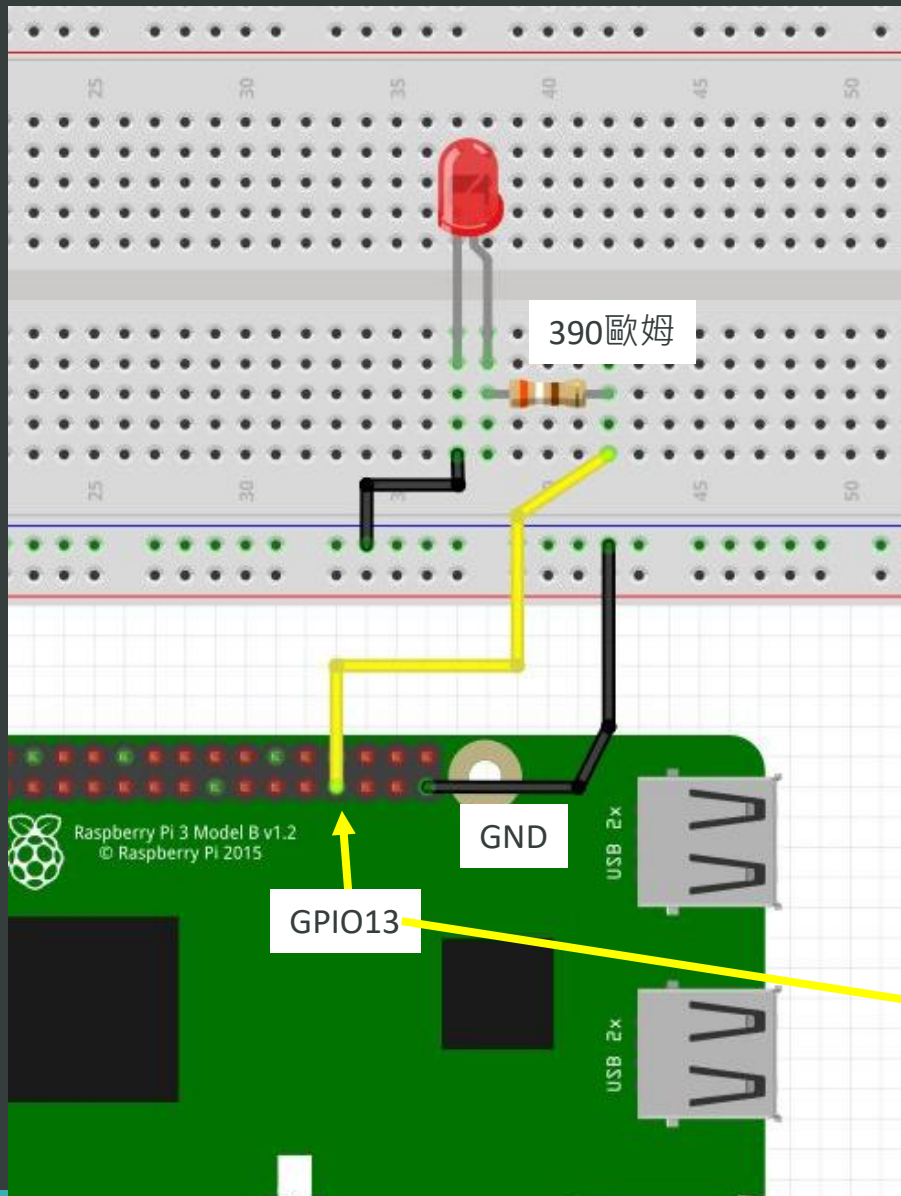
3.3V 50mA, 5V 300mA



- 全部的GPIO腳位只能輸出/輸入3.3V
- Pin1, Pin17 只能輸出3.3V 50mA
- Pin2, Pin4 輸出5V 300~500mA左右，視周邊USB裝置的耗電量而變動
- 其餘的GPIO腳位驅動電流僅有2mA~16mA
- 沒有額外的Vin輸入接口，僅有USB電源

實驗1 (LED控制)

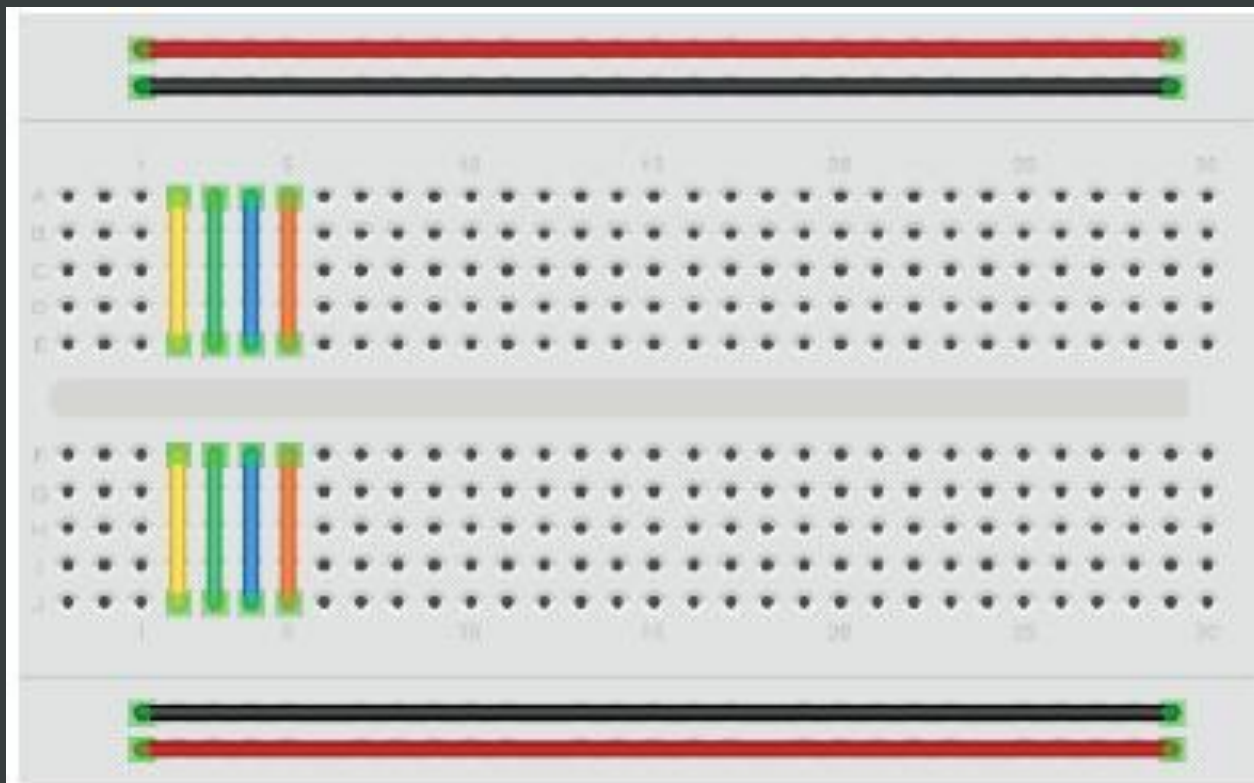
連接1個LED的電路



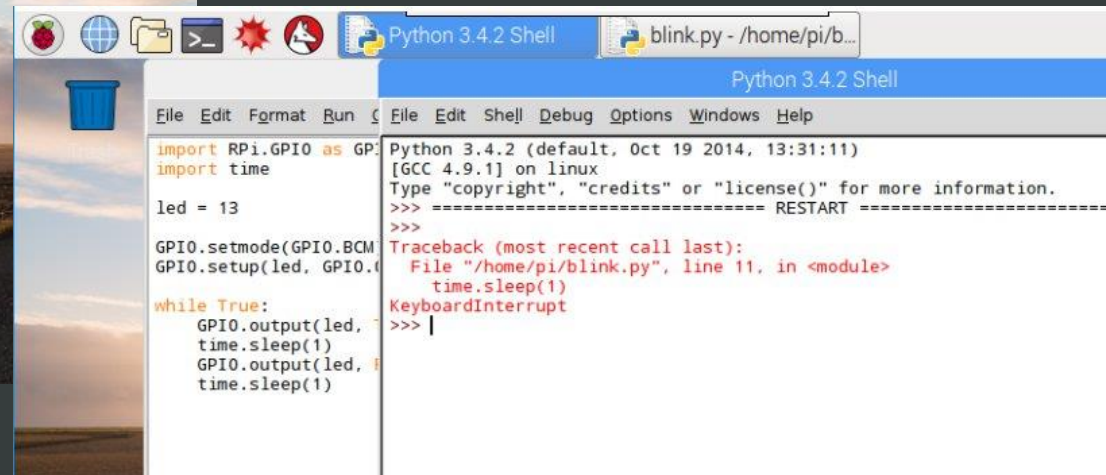
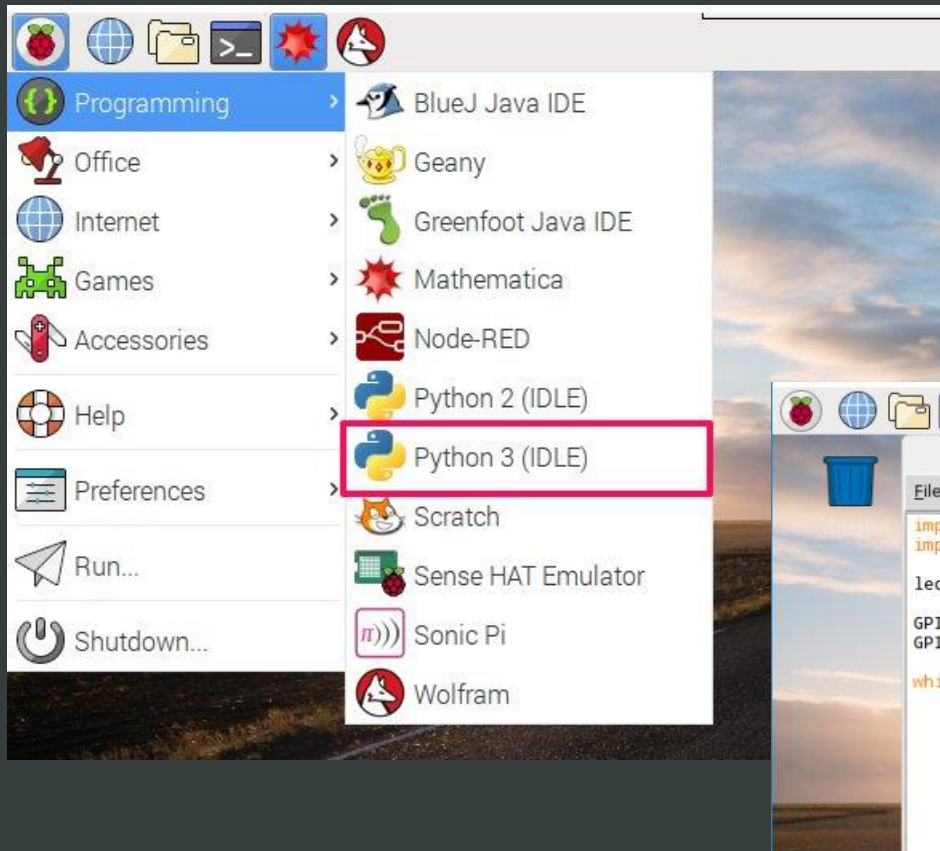
Pin No.	
1	2
3.3V	5V
GPIO2	5V
GPIO3	GND
GPIO4	GPIO14
GND	GPIO15
GPIO17	GPIO18
GPIO27	GND
GPIO22	GPIO23
3.3V	GPIO24
GPIO10	GND
GPIO9	GPIO25
GPIO11	GPIO8
GND	GPIO7
DNC	DNC
GPIO5	GND
GPIO6	GPIO12
GPIO13	GND
GPIO19	GPIO16
GPIO26	GPIO20
GND	GPIO21

補充：麵包板使用方式

- 紅色、黑色正負極直線都是連通
- A~E橫向連通
- F~J橫向連通



使用Python 3 (IDLE)



點亮GPIO13腳位的LED燈

```
import RPi.GPIO as GPIO
import time

led=13

GPIO.setmode(GPIO.BCM)
GPIO.setup(led, GPIO.OUT)

while True:
    GPIO.output(led, True)
    time.sleep(1)
    GPIO.output(led, False)
    time.sleep(1)
```

Blink.py

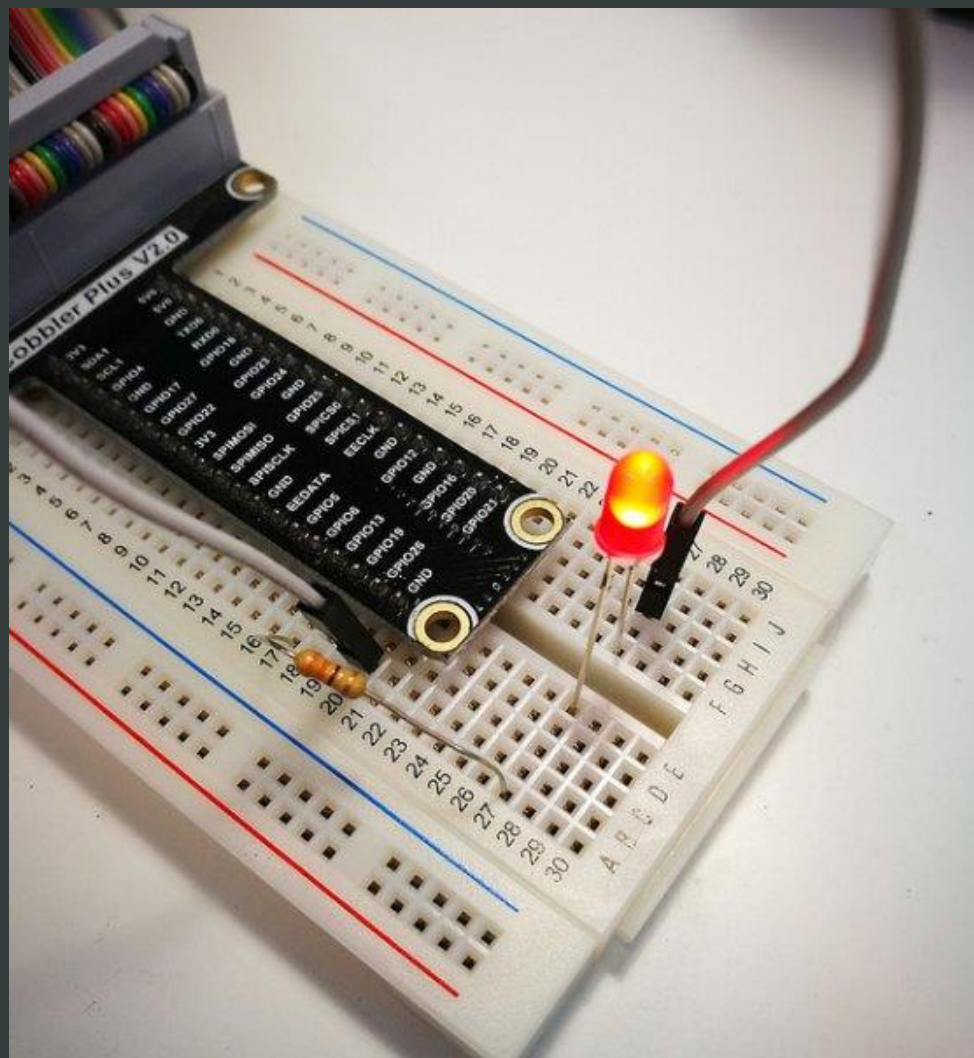
#匯入gpio套件，並重新自訂名稱為GPIO
#匯入time套件，後面使用sleep函數

#定義要點亮LED的腳位

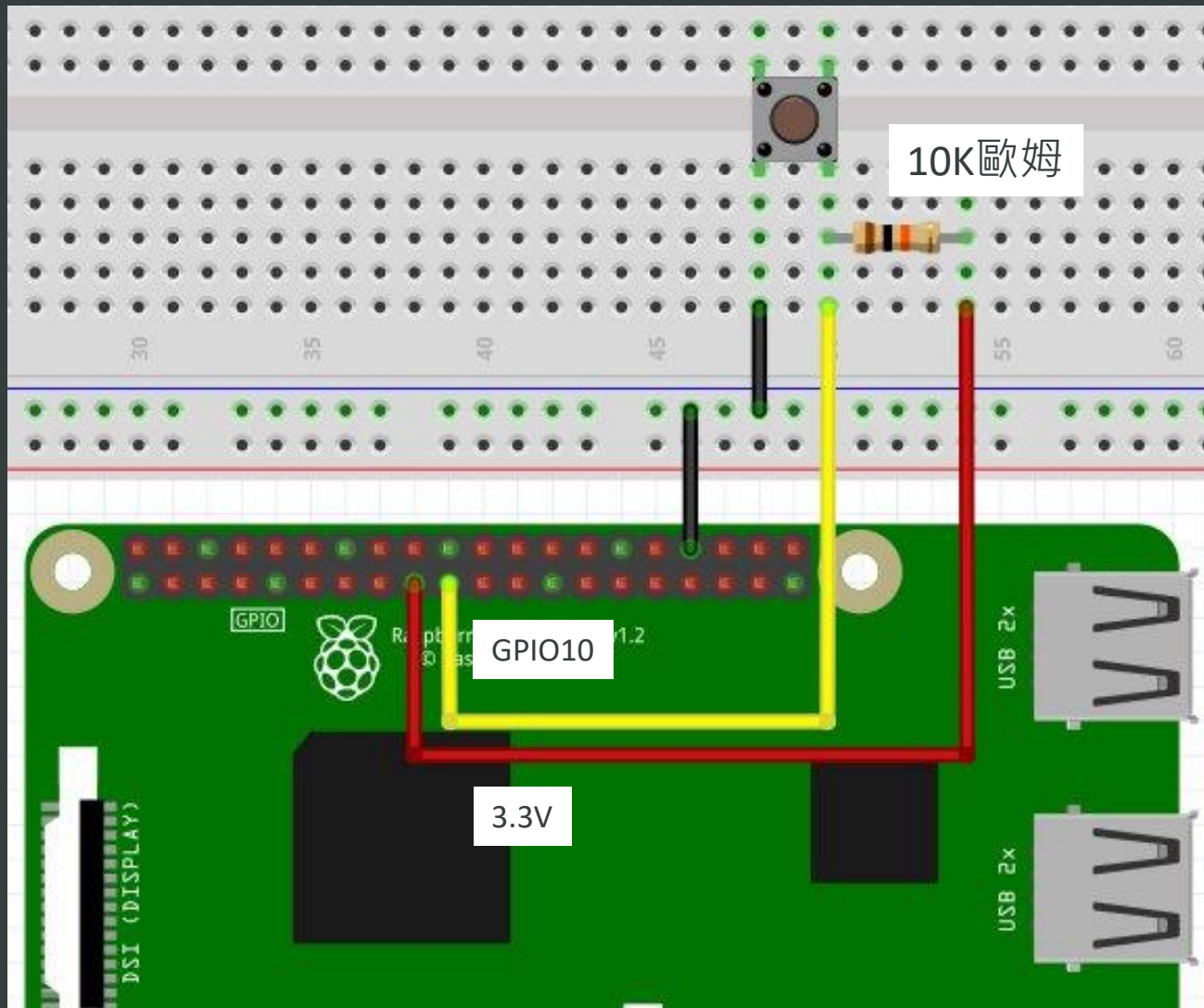
#設定模式，BCM模式為Broadcom GPIO模組
#設定GPIO腳位為輸出狀態

#當程式開啟時
#點亮LED燈
#delay 1秒
#關閉LED燈
#delay 1秒

執行結果

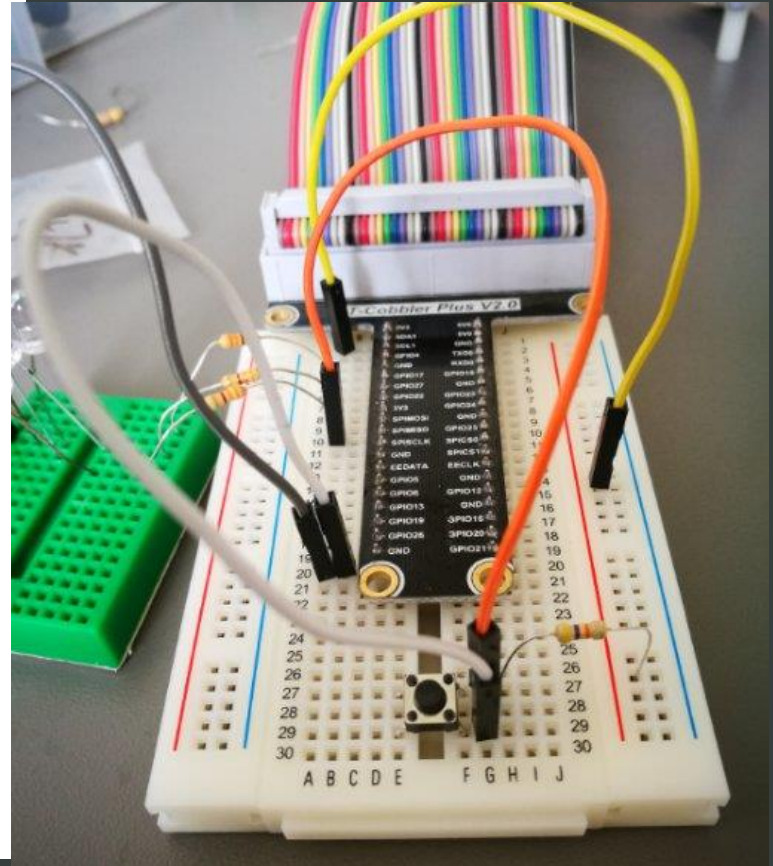
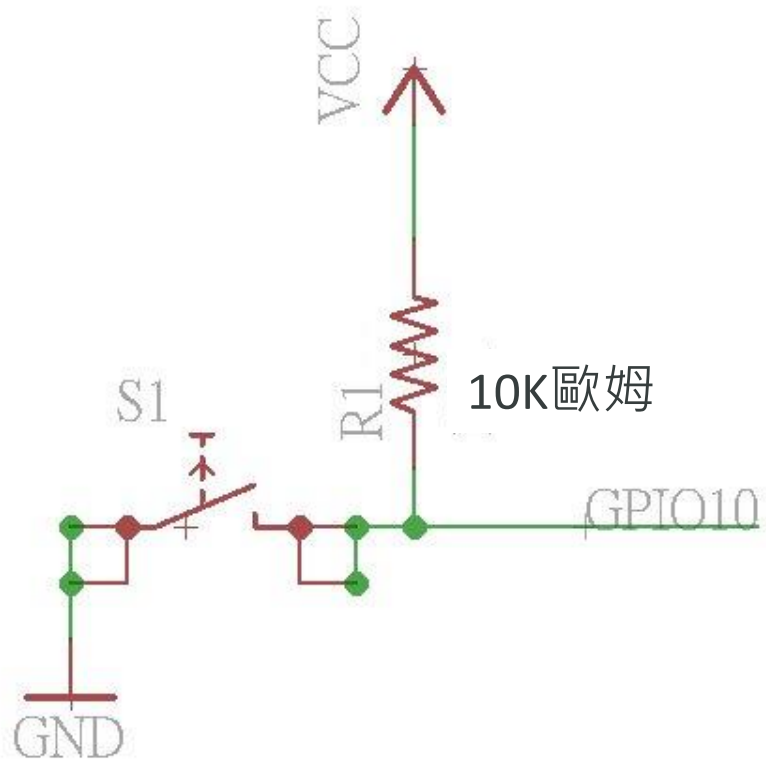


連接1個按鈕的電路



		Pin No.			
3.3V	1	2	5V	5V	
GPIO2	3	4	5V		
GPIO3	5	6	GND		
GPIO4	7	8	GPIO14		
GND	9	10	GPIO15		
GPIO17	11	12	GPIO18		
GPIO27	13	14	GND		
GPIO22	15	16	GPIO23		
3.3V	17	18	GPIO24		
GPIO10	19	20	GND		
GPIO9	21	22	GPIO25		
GPIO11	23	24	GPIO8		
GND	25	26	GPIO7		
DNC	27	28	DNC		
GPIO5	29	30	GND		
GPIO6	31	32	GPIO12		
GPIO13	33	34	GND		
GPIO19	35	36	GPIO16		
GPIO26	37	38	GPIO20		
GND	39	40	GPIO21		

電路原理圖



```
import RPi.GPIO as GPIO
```

```
inputButton=10  
counter=0
```

```
GPIO.setmode(GPIO.BCM)  
GPIO.setup(inputButton, GPIO.IN)
```

```
while True:  
    value = GPIO.input(inputButton)  
    if value == False:  
        print("You pressed button:" +  
              str(counter) + " Times.")  
        counter+=1  
        while value == False:  
            value = GPIO.input(inputButton)
```

```
#匯入gpio套件，  
#並重新自訂名稱為GPIO  
#設定輸入按鈕的pin腳為GPIO 10  
#定義一個counter變數
```

```
#設定GPIO模式為BCM  
#設定GPIO 10為輸入模式 GPIO.IN
```

```
#程式開始執行  
#讀取GPIO 10的按鈕數值到value變數內  
#當value為False時(預設還沒按下True)  
#印出按下的次數
```

```
#累加counter變數  
#當按鈕持續保持被按著時  
#強制給值到value，保持狀態，  
#否則會連續印出print
```

Button.py

回家作業

- 用一個按鈕按下時，控制LED燈亮起，當放掉按鈕時，LED燈熄滅。