Raspberry Pi

- Running Raspbian on Raspberry Pi and Installing related programs -

Aug. 2019

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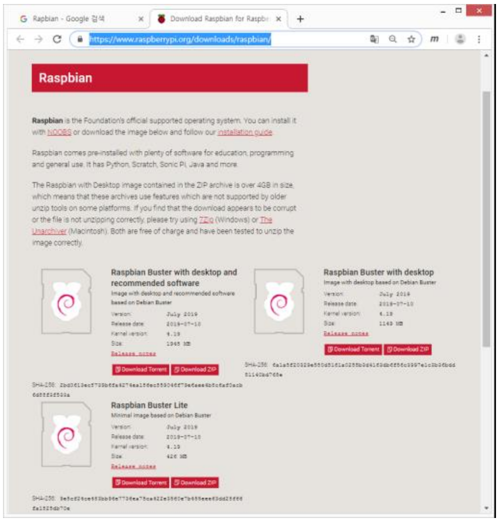
  - Raspberry Pi and Windows
- Backup Raspberry Pi image
- Clone Raspberry Pi image (Raspbian)
- Raspbian on VirtualBox
- ARM cross-compiler on Windows

Download Raspbian - Buster



Rapbian - Google 검색
Download Raspbian for Raspbe
https://www.raspberrypi.org/downloads/raspbian/

Raspbian

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

The Raspbian with Desktop 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 Buster with desktop and recommended software

Image with desktop and recommended software based on Debian Buster

Version:	July 2019
Release date:	2019-07-10
Kernel version:	4.19
Size:	1945 MB

Release notes

Download Torrent | Download ZIP

SHA-256: 2bd3613ecf739b6fa8274ea156ec559046f79e6aee4b5c6af3acb 6d8ff9f593a

Raspbian Buster with desktop

Image with desktop based on Debian Buster

Version:	July 2019
Release date:	2019-07-10
Kernel version:	4.19
Size:	1143 MB

Release notes

Download Torrent | Download ZIP

SHA-256: 6a1a5f20329e580d5161a0255b0d4163dbf8fc3997e1c3b36bdd 51140bd765e

Raspbian Buster Lite

Minimal image based on Debian Buster

Version:	July 2019
Release date:	2019-07-10
Kernel version:	4.19
Size:	426 MB

Release notes

Download Torrent | Download ZIP

SHA-256: 9e5cf24ce483bb96e7736ea75ca422e3560e7b455eee63dd28f66 fa1825db70e

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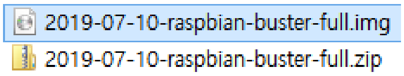
- Download
  - ▶ "Raspbian **Buster** with desktop and recommended software"
- Unzip the file



2019-07-10-raspbian-buster-full.img
2019-07-10-raspbian-buster-full.zip

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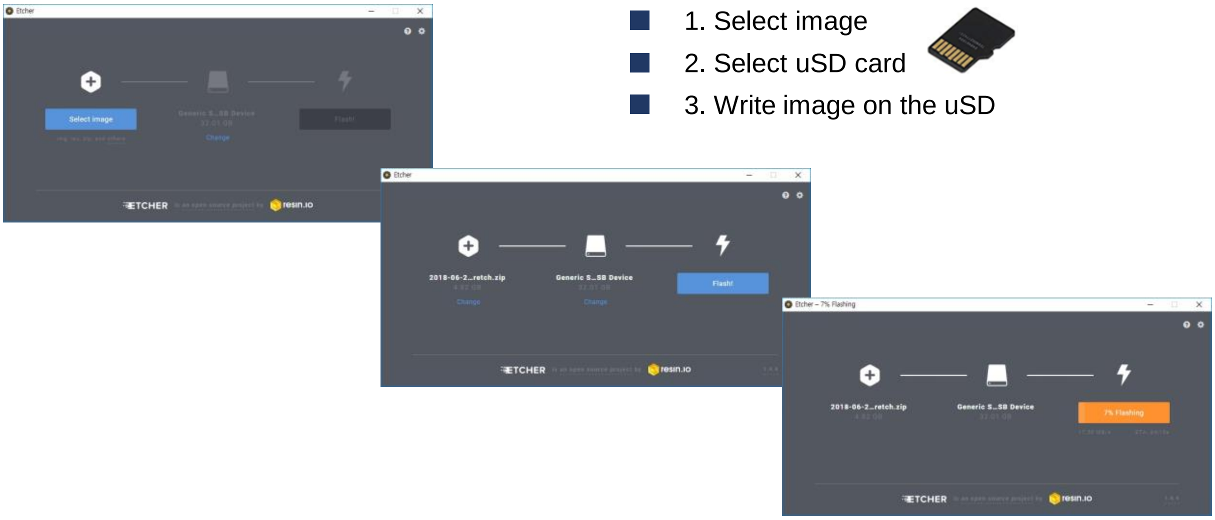
Writing image on the uSD using Etcher

- 1. Select image
- 2. Select uSD card
- 3. Write image on the uSD



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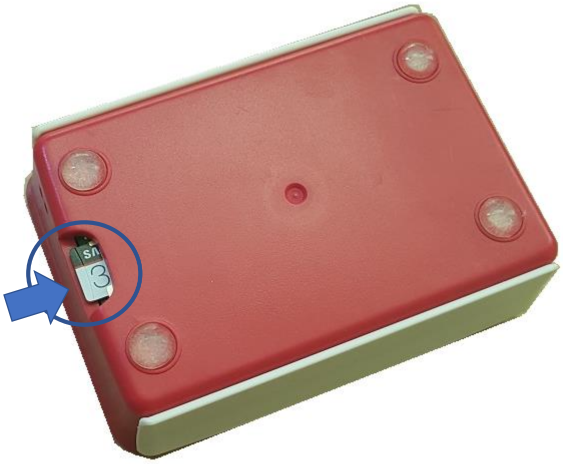
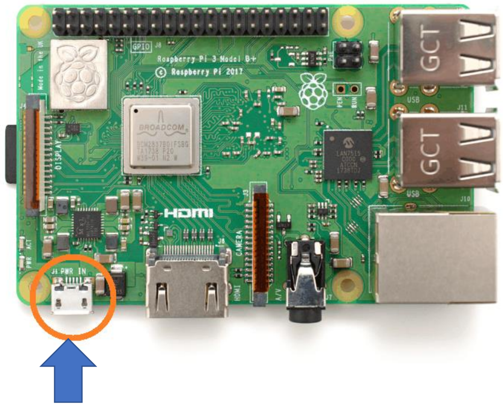
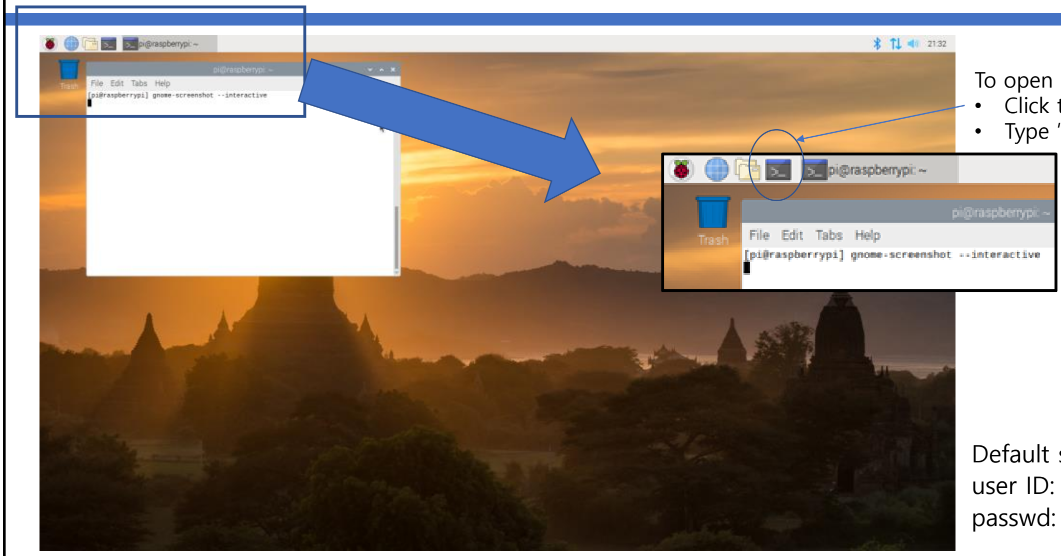




5V@2A through Micro-USB cable

Starting Raspbian



```
[pi@raspberrypi] gnome-screenshot --interactive
```

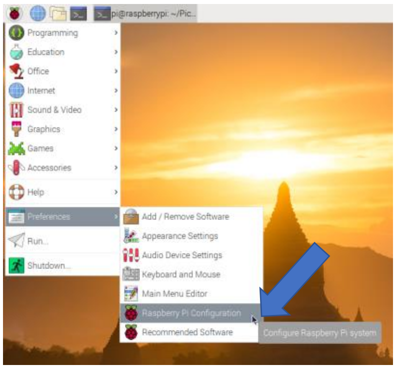
To open a command window

- Click this menu icon
- Type 'CTL-ALT t'

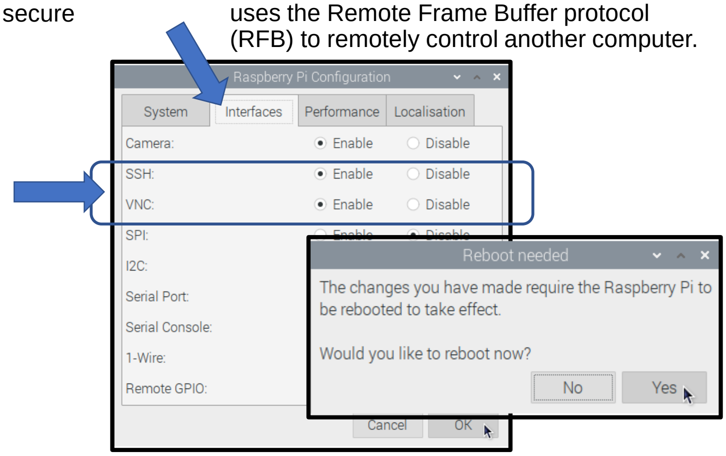
Default setting:
user ID: pi
passwd: raspberry

Enable SSH and VNC

- SSH: Secure Shell / Secure Socket Shell
  - a network protocol that gives users, particularly system administrators, a secure way to access a computer over an unsecured network.



- VNC: Virtual Network Computing
  - a graphical desktop-sharing system that uses the Remote Frame Buffer protocol (RFB) to remotely control another computer.



Camera: ● Enable ○ Disable

SSH: ● Enable ○ Disable

VNC: ● Enable ○ Disable

SPI: ○ Enable ● Disable

I2C:

Serial Port:

Serial Console:

1-Wire:

Remote GPIO:

Reboot needed

The changes you have made require the Raspberry Pi to be rebooted to take effect.

Would you like to reboot now?

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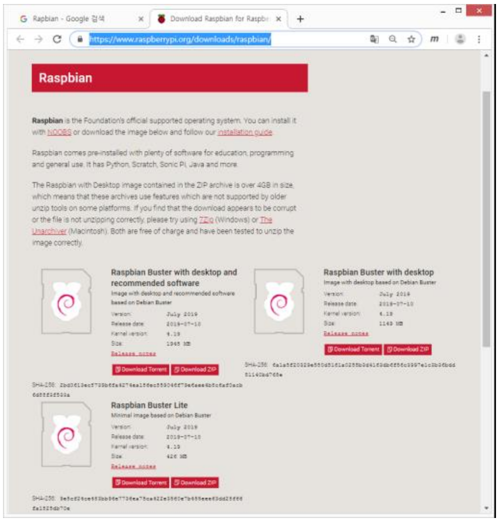
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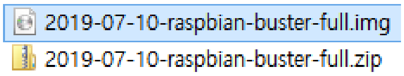

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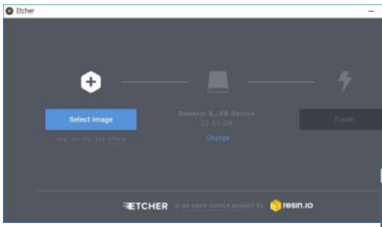
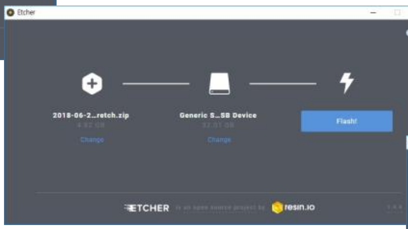
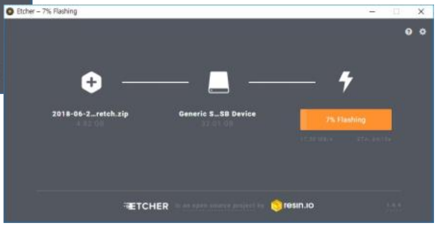

Etcher
Select image
img, iso, zip, and others
Generic S...SB Device
32.01 GB
Change
Flash!
ETCHER is an open source project by resin.io

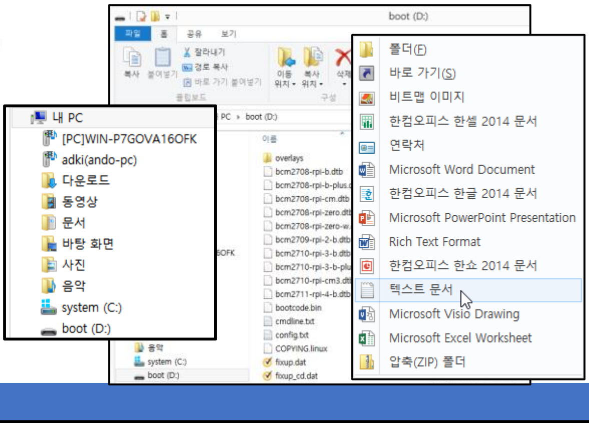


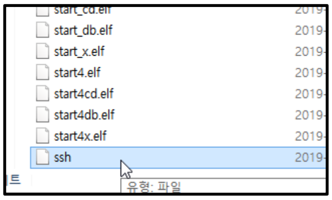


- 1. Select image
- 2. Select uSD card
- 3. Write image on the uSD

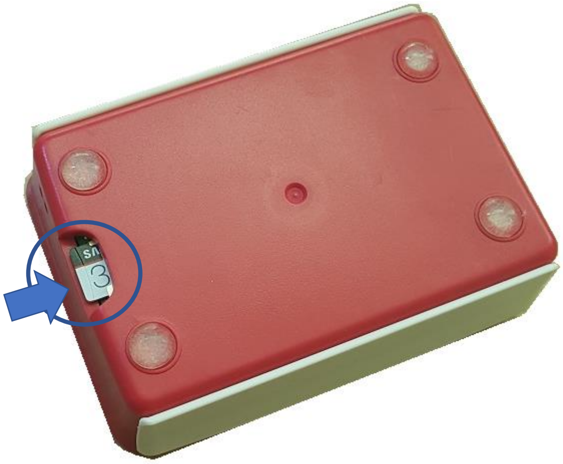
Create ‘ssh’ file at the uSD

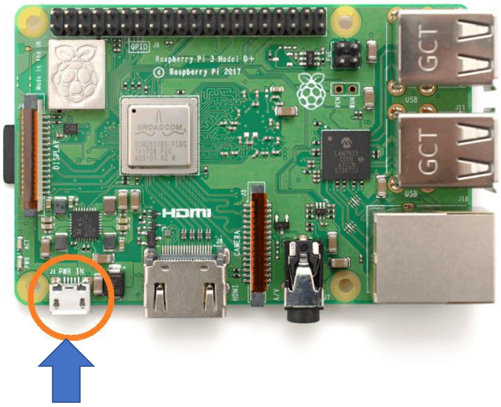
- 1. Open uSD card
- 2. Create ‘ssh’ file at the top directory(folder) of uSD using any text editor
  - an empty file with ‘**ssh**’ name





Insert uSD card and apply +5V power

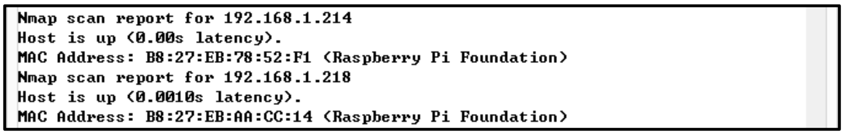




5V@2A through Micro-USB cable

IP scan on the host computer

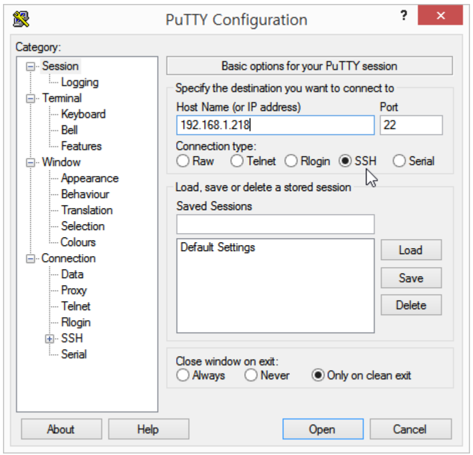
- Now find IP address of the Raspberry Pi
  - use ‘nmap’
    - $ nmap –sn 192.168.1.0/24
    - $ sudo nmap –sP –n 192.168.1.0/24
      - Note that Raspberry Pi uses “b8:27:eb:....” for its MAC HW address
  - use ‘arp’ (may not detect new IP)
    - Note ‘arp’ will not detect at the first time.
    - $ arp -a | grep -i b8:27:eb
      - Note that Raspberry Pi uses “b8:27:eb:....” for its MAC HW address
  - use ‘arp-scan’
    - $ sudo arp-scan --interface=***eth0*** 192.168.1.0/24
- arp-scan
  - $ sudo apt install arp-scan
- nmap
  - https://nmap.org/download.html
- ipscan
  - requires Java
  - Angry IP Scanner (https://angryip.org/)
- Advanced IP scanner
  - http://www.advanced-ip-scanner.com/



```
Nmap scan report for 192.168.1.214
Host is up (0.00s latency).
MAC Address: B8:27:EB:78:52:F1 (Raspberry Pi Foundation)
Nmap scan report for 192.168.1.218
Host is up (0.0010s latency).
MAC Address: B8:27:EB:AA:CC:14 (Raspberry Pi Foundation)
```

Enable SSH and VNC (1/3)

- Connect to the new Raspberry Pi through SSH.
- User name: pi
- Password: raspberry



PuTTY Configuration

Basic options for your PuTTY session

Specify the destination you want to connect to

Host Name (or IP address): 192.168.1.218

Port: 22

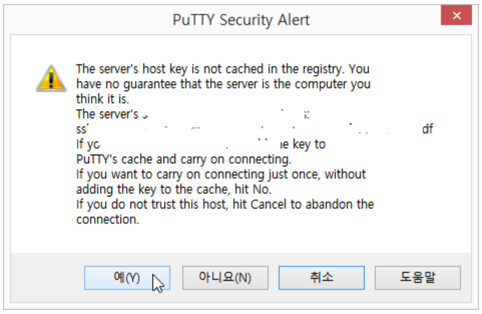
Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

Load, save or delete a stored session

Saved Sessions

Default Settings

Close window on exit: ○ Always ○ Never ● Only on clean exit

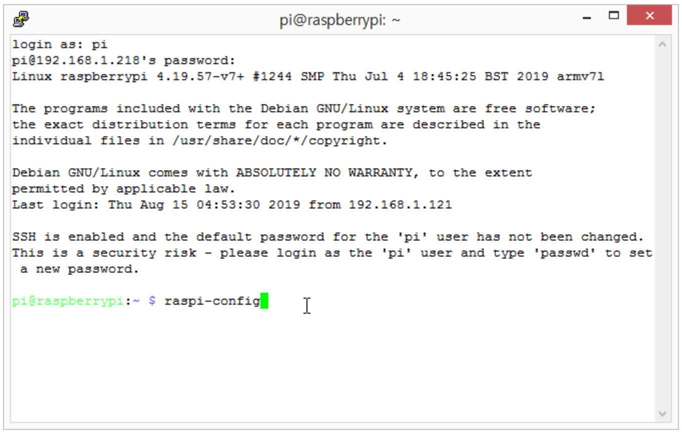


PuTTY Security Alert

The server's host key is not cached in the registry. You have no guarantee that the server is the computer you think it is.
The server's [redacted] df
If yc [redacted] ıe key to PuTTY's cache and carry on connecting.
If you want to carry on connecting just once, without adding the key to the cache, hit No.
If you do not trust this host, hit Cancel to abandon the connection.

Enable SSH and VNC (2/3)

- Login on and run ‘raspi-config’



```
login as: pi
pi@192.168.1.218's password:
Linux raspberrypi 4.19.57-v7+ #1244 SMP Thu Jul 4 18:45:25 BST 2019 armv7l

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.

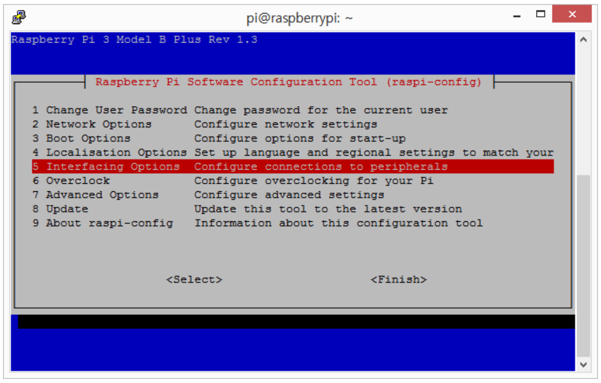
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Thu Aug 15 04:53:30 2019 from 192.168.1.121

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:~ $ raspi-config
```

- User name: pi
- Password: raspberry

Select ‘Interfacing options’



```
Raspberry Pi 3 Model B Plus Rev 1.3

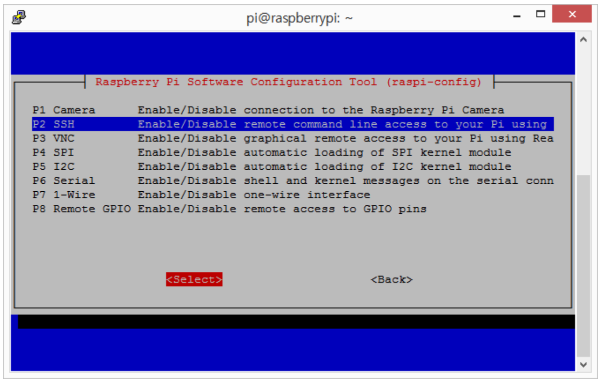
        Raspberry Pi Software Configuration Tool (raspi-config)

  1 Change User Password Change password for the current user
  2 Network Options      Configure network settings
  3 Boot Options         Configure options for start-up
  4 Localisation Options Set up language and regional settings to match your
  5 Interfacing Options  Configure connections to peripherals
  6 Overclock            Configure overclocking for your Pi
  7 Advanced Options     Configure advanced settings
  8 Update               Update this tool to the latest version
  9 About raspi-config   Information about this configuration tool


                 <Select>                     <Finish>
```

- Use arrow key to select menu.
- Use tab key to select <Select> or <Back>

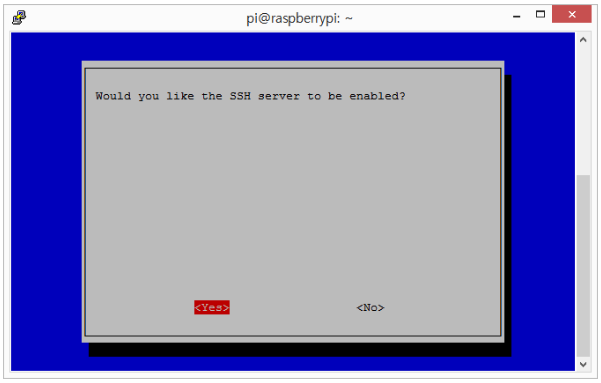
Enable SSH server



```
Raspberry Pi Software Configuration Tool (raspi-config)

P1 Camera      Enable/Disable connection to the Raspberry Pi Camera
P2 SSH         Enable/Disable remote command line access to your Pi using
P3 VNC         Enable/Disable graphical remote access to your Pi using Rea
P4 SPI         Enable/Disable automatic loading of SPI kernel module
P5 I2C         Enable/Disable automatic loading of I2C kernel module
P6 Serial      Enable/Disable shell and kernel messages on the serial conn
P7 1-Wire      Enable/Disable one-wire interface
P8 Remote GPIO Enable/Disable remote access to GPIO pins

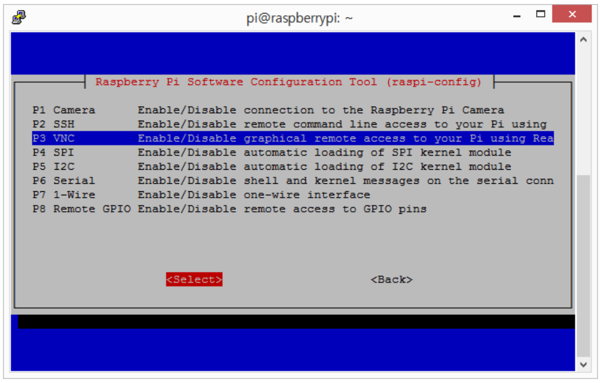

               <Select>                   <Back>
```



```
Would you like the SSH server to be enabled?


          <Yes>                <No>
```

Enable VNC server



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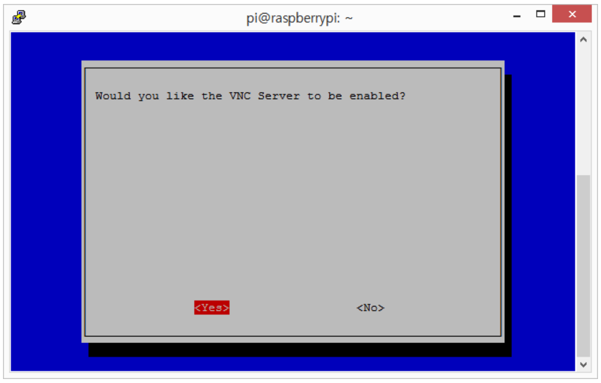

```
Would you like the VNC Server to be enabled?


          <Yes>                <No>
```

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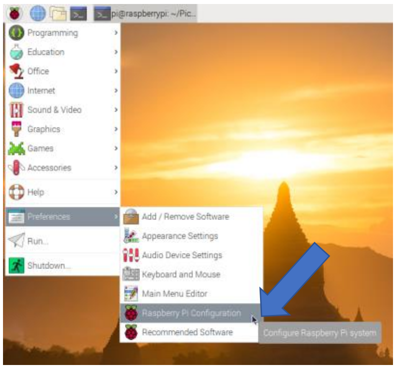

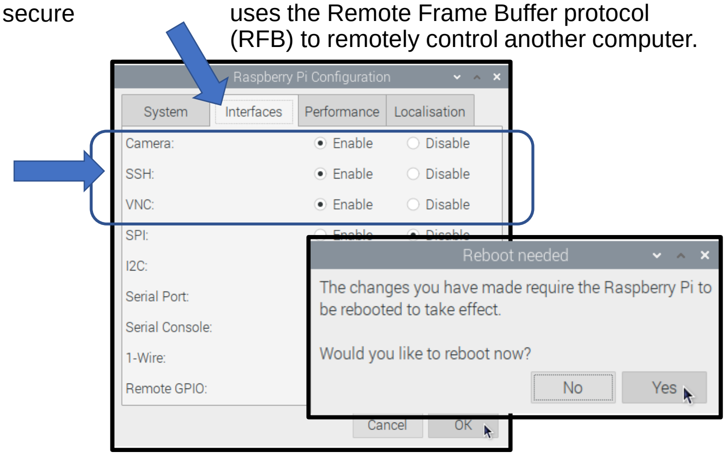

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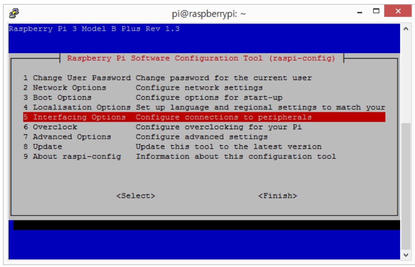
Reboot needed

The changes you have made require the Raspberry Pi to be rebooted to take effect.

Would you like to reboot now?

Enable SSH and VNC through network

- 1. Login on and run ‘raspi-config’
- 2. Run ‘$ sudo raspi-config’
- 3. Enable SSH server and VNC server



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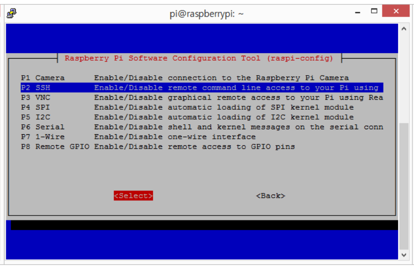

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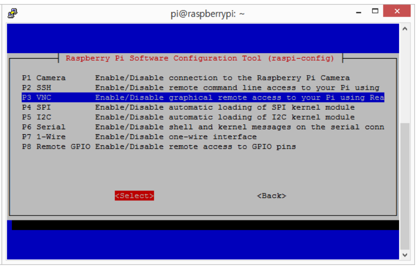
                   <Select>                    <Back>
```



```
pi@raspberrypi: ~

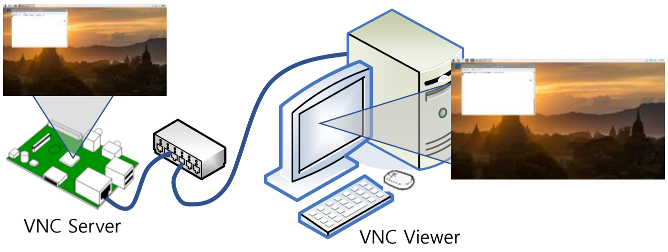
       Raspberry Pi Software Configuration Tool (raspi-config)

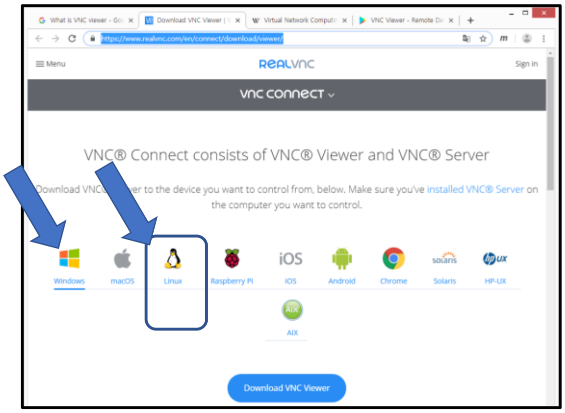
 P1 Camera      Enable/Disable connection to the Raspberry Pi Camera
 P2 SSH         Enable/Disable remote command line access to your Pi using
 P3 VNC         Enable/Disable graphical remote access to your Pi using Rea
 P4 SPI         Enable/Disable automatic loading of SPI kernel module
 P5 I2C         Enable/Disable automatic loading of I2C kernel module
 P6 Serial      Enable/Disable shell and kernel messages on the serial conn
 P7 1-Wire      Enable/Disable one-wire interface
 P8 Remote GPIO Enable/Disable remote access to GPIO pins

                   <Select>                    <Back>
```

Install VNC viewer

- VNC viewer
  - A client to control remote computer over the network
- Install VNC viewer
  - https://www.realvnc.com/en/connect/download/viewer/

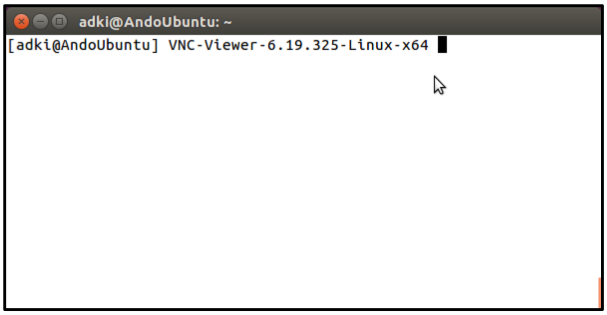




VNC® Connect consists of VNC® Viewer and VNC® Server

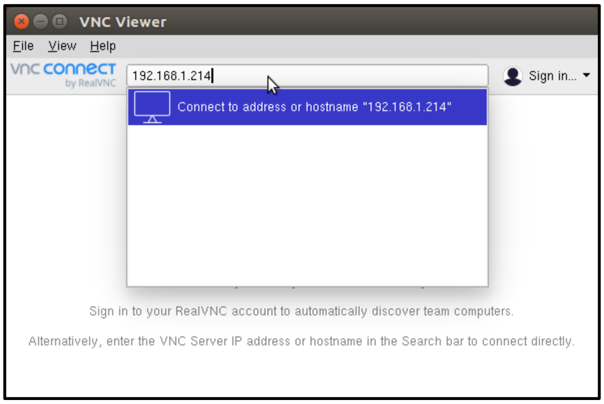
Download VNC[illegible]er to the device you want to control from, below. Make sure you've installed VNC® Server on the computer you want to control.

Running VNC viewer on Linux (1/3)



adki@AndoUbuntu: ~

```
[adki@AndoUbuntu] VNC-Viewer-6.19.325-Linux-x64 
```



VNC Viewer

192.168.1.214

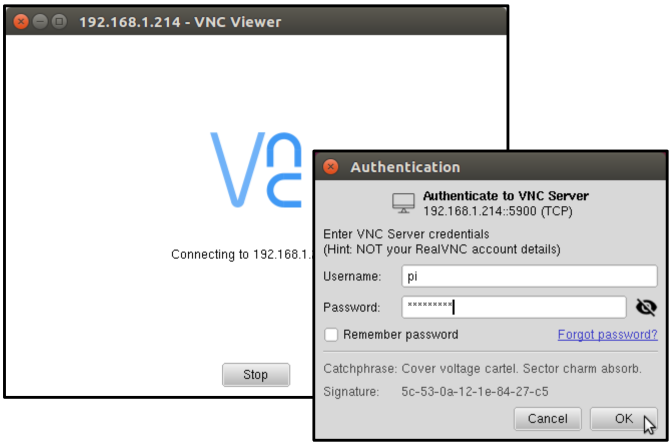
Connect to address or hostname "192.168.1.214"

Sign in to your RealVNC account to automatically discover team computers.

Alternatively, enter the VNC Server IP address or hostname in the Search bar to connect directly.

192.168.1.214::5900

Running VNC viewer on Linux (2/3)



192.168.1.214 - VNC Viewer

Connecting to 192.168.1.

Authentication

Authenticate to VNC Server
192.168.1.214::5900 (TCP)

Enter VNC Server credentials
(Hint: NOT your RealVNC account details)

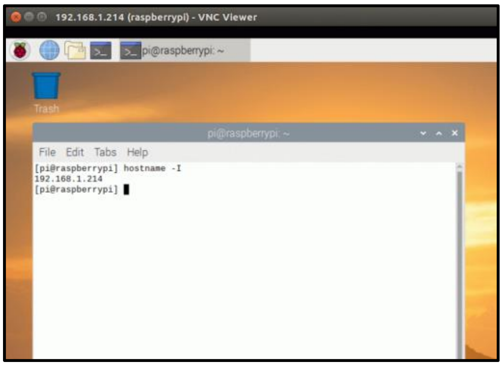
Username: pi

Password: *********

□ Remember password

Catchphrase: Cover voltage cartel. Sector charm absorb.

Signature: 5c-53-0a-12-1e-84-27-c5

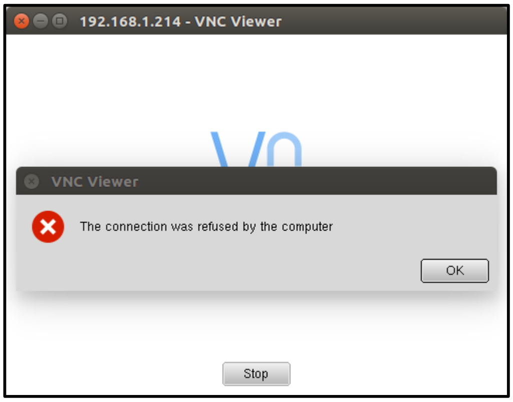


192.168.1.214 (raspberrypi) - VNC Viewer

```
[pi@raspberrypi] hostname -I
192.168.1.214
[pi@raspberrypi] 
```

Default setting:
user ID: pi
passwd: raspberry

Running VNC viewer on Linux (3/3)

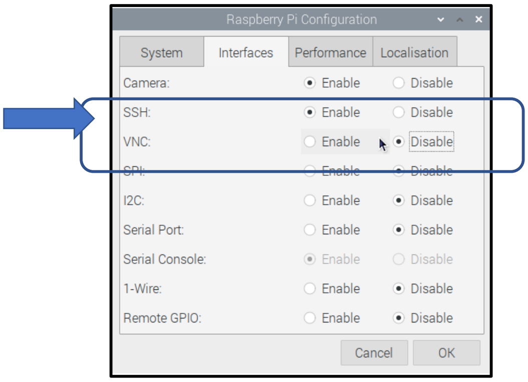


192.168.1.214 - VNC Viewer

VNC Viewer

The connection was refused by the computer

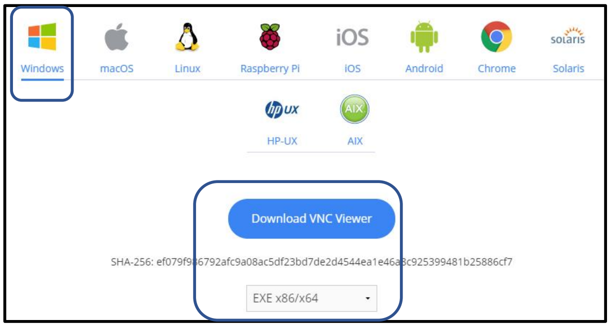
- Dealing with VNC error.
  - If you see error, check “Raspberry Pi Configuration’.
  - Set ‘Enable’ for VNC.



Raspberry Pi Configuration

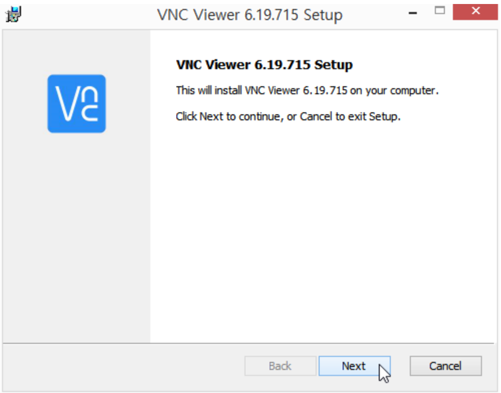
Camera:	● Enable	○ Disable
SSH:	● Enable	○ Disable
VNC:	○ Enable	● Disable
SPI:	○ Enable	● Disable
I2C:	○ Enable	● Disable
Serial Port:	○ Enable	● Disable
Serial Console:	● Enable	○ Disable
1-Wire:	○ Enable	● Disable
Remote GPIO:	○ Enable	● Disable

Install and running VNC on Windows (1/2)



SHA-256: ef079f986792afc9a08ac5df23bd7de2d4544ea1e46a8c925399481b25886cf7

EXE x86/x64



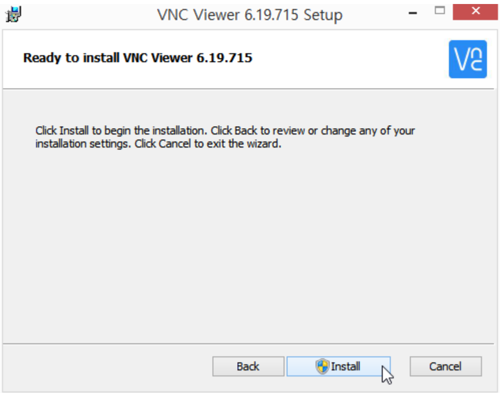
VNC Viewer 6.19.715 Setup

VNC Viewer 6.19.715 Setup

This will install VNC Viewer 6.19.715 on your computer.

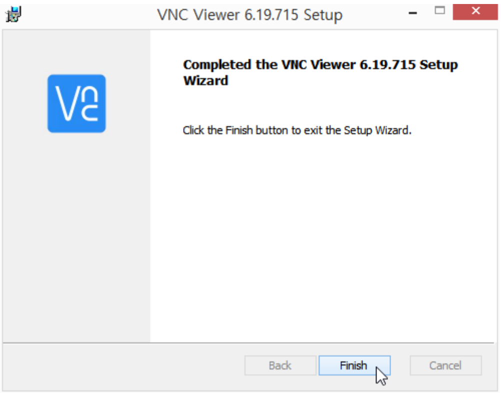
Click Next to continue, or Cancel to exit Setup.

Install and running VNC on Windows (2/2)


VNC Viewer 6.19.715 Setup

Ready to install VNC Viewer 6.19.715

Click Install to begin the installation. Click Back to review or change any of your installation settings. Click Cancel to exit the wizard.


VNC Viewer 6.19.715 Setup

Completed the VNC Viewer 6.19.715 Setup Wizard

Click the Finish button to exit the Setup Wizard.

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- Running Raspbian
  - Download Raspbian – Buster
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  - Insert uSD card and apply +5V power
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  - Download Raspbian – Buster
  - Writing image on the uSD using Etcher
  - Add ‘ssh’ file
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- **Change display resolution**
- **Enlarge swap-file size**
- **Enable Wireless Connection**
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- Install OpenMP
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  - Raspberry Pi and Windows
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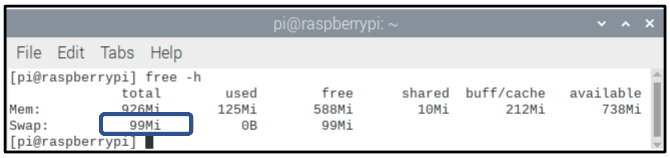
- Raspbian on VirtualBox
- ARM cross-compiler on Windows

Change display resolution

- Edit '/boot/config.txt' on the Raspberry Pi.
  - $ sudo vi /boot/config.txt
- Uncomment following two lines
  - framebuffer_width=1280
  - framebuffer_height=720
- Then reboot
  - $ reboot
- After that, reconnect

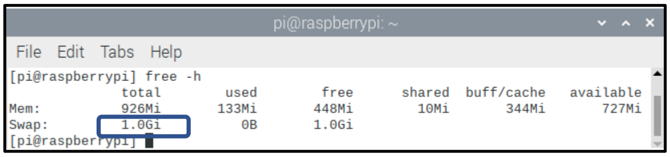
Enlarge swap-file size

- Check swap file size
  - $ free -h



```
[pi@raspberrypi] free -h
              total        used        free      shared  buff/cache   available
Mem:          926Mi       125Mi       588Mi        10Mi       212Mi       738Mi
Swap:          99Mi          0B        99Mi
[pi@raspberrypi] 
```

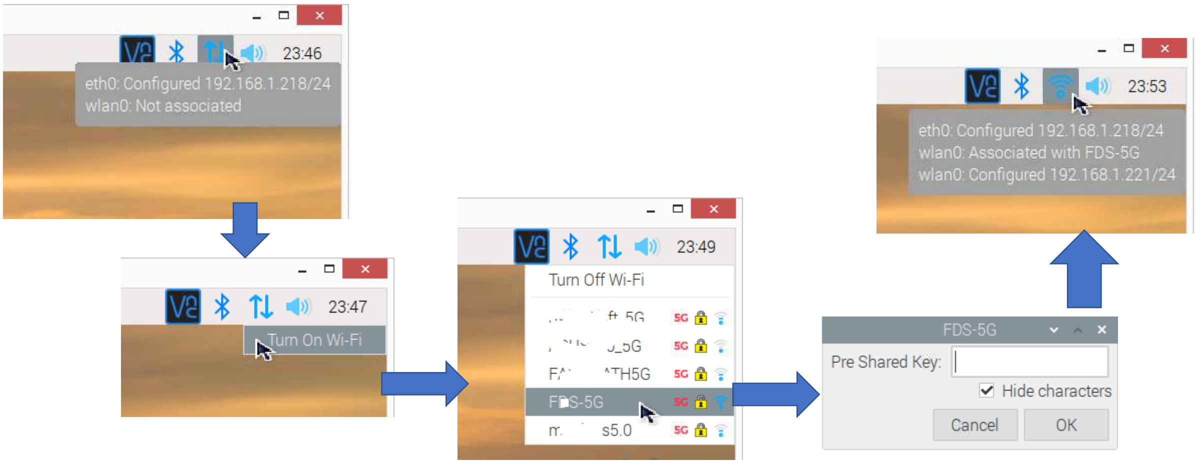
- Change value of 'CONF_SWAPSIZE' in '/etc/dphy-swapfile'
  - $ sudo vi /etc/dphy-swapfile
    - CONF_SWAPSIZE=100 ➔ CONF_SWAPSIZE=1024
      - It means 100Mbyte to 1Gbyte
- Do as follows
  - $ sudo /etc/init.d/dphys-swapfile stop
  - $ sudo /etc/init.d/dphys-swapfile start
  - $ free -h



```
[pi@raspberrypi] free -h
              total        used        free      shared  buff/cache   available
Mem:          926Mi       133Mi       448Mi        10Mi       344Mi       727Mi
Swap:         1.0Gi          0B       1.0Gi
[pi@raspberrypi] 
```

Enable Wireless Connection (1/2)

- Select network icon
- Type in passwd of Wifi



eth0: Configured 192.168.1.218/24
wlan0: Not associated

Turn On Wi-Fi

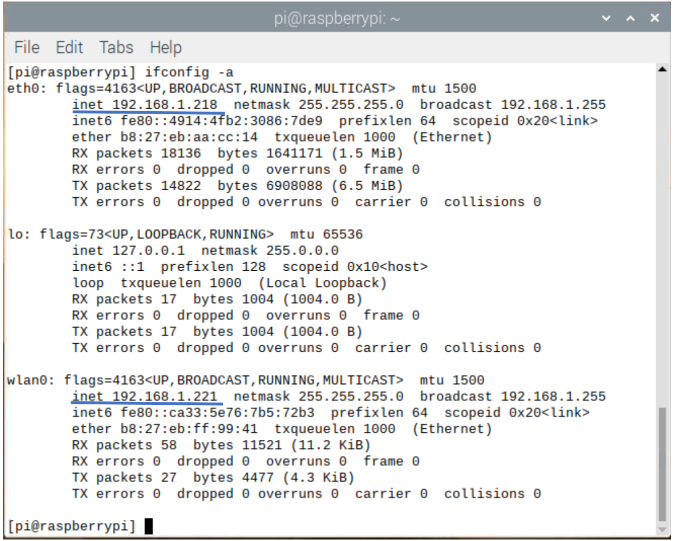
FDS-5G

Pre Shared Key:

☑ Hide characters

eth0: Configured 192.168.1.218/24
wlan0: Associated with FDS-5G
wlan0: Configured 192.168.1.221/24

Enable Wireless Connection (2/2)



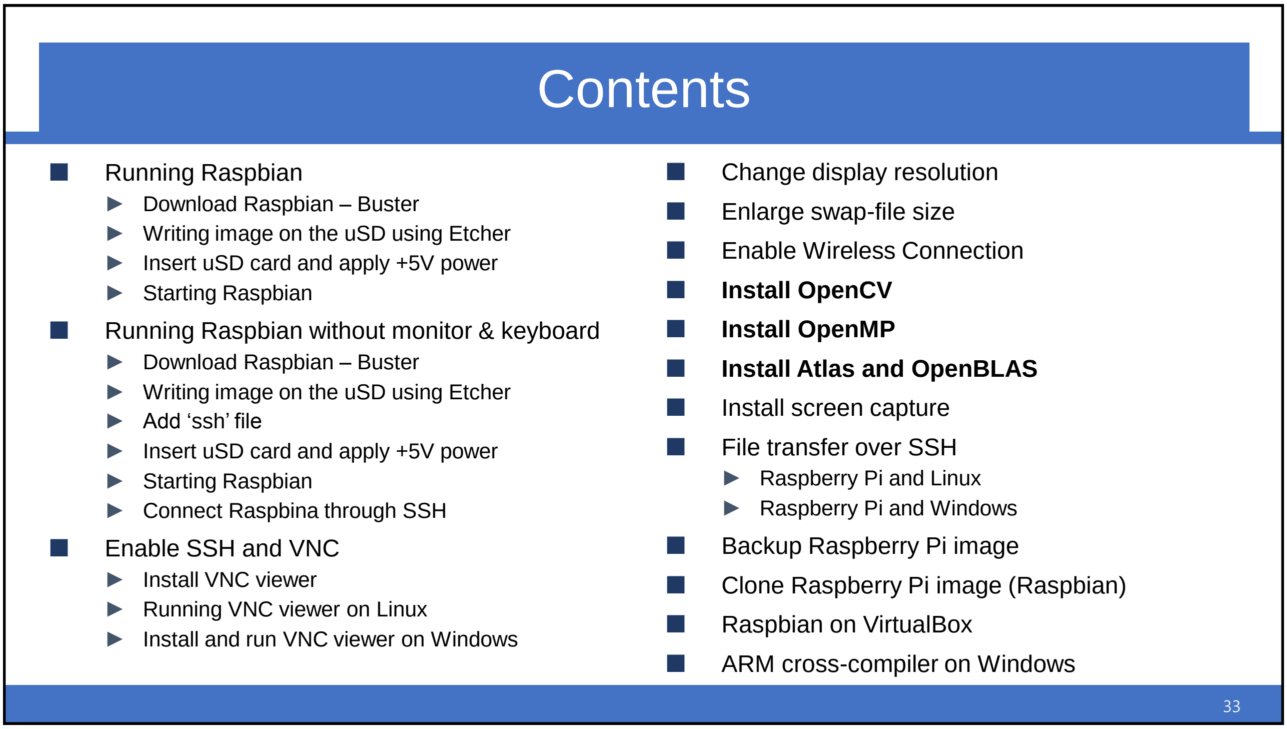
```
[pi@raspberrypi] ifconfig -a
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.218  netmask 255.255.255.0  broadcast 192.168.1.255
        inet6 fe80::4914:4fb2:3086:7de9  prefixlen 64  scopeid 0x20<link>
        ether b8:27:eb:aa:cc:14  txqueuelen 1000  (Ethernet)
        RX packets 18136  bytes 1641171 (1.5 MiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 14822  bytes 6908088 (6.5 MiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 17  bytes 1004 (1004.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 17  bytes 1004 (1004.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.221  netmask 255.255.255.0  broadcast 192.168.1.255
        inet6 fe80::ca33:5e76:7b5:72b3  prefixlen 64  scopeid 0x20<link>
        ether b8:27:eb:ff:99:41  txqueuelen 1000  (Ethernet)
        RX packets 58  bytes 11521 (11.2 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 27  bytes 4477 (4.3 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

[pi@raspberrypi] █
```

- Check IP addresses of ‘eth0’ and ‘wlan0’
  - ▶ $ ifconfig -a



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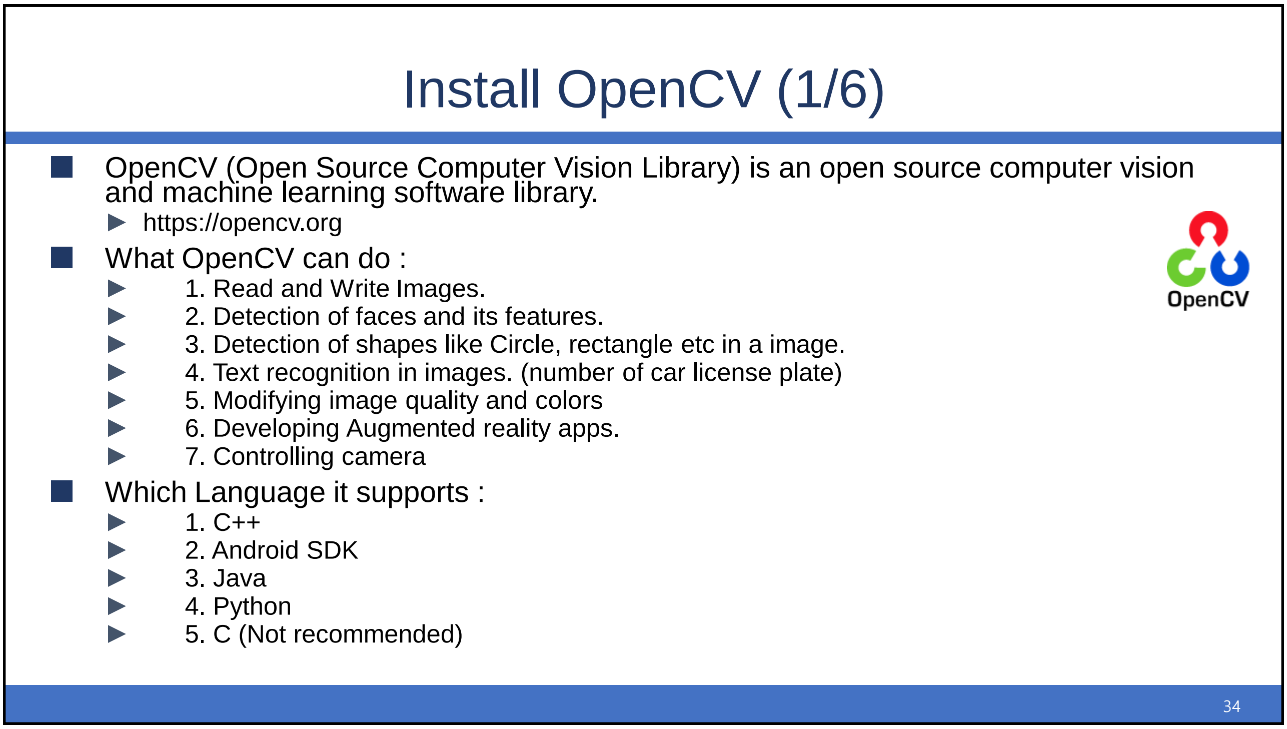
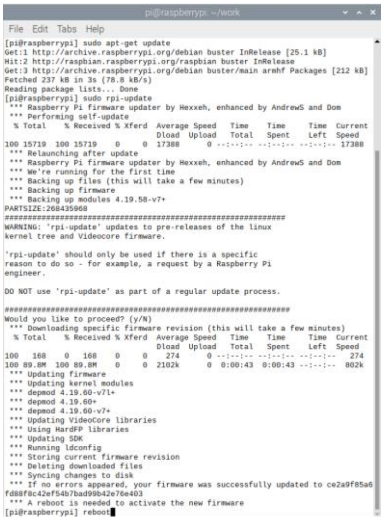


Install OpenCV (1/6)

- OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library.
  - https://opencv.org
- What OpenCV can do :
  - 1. Read and Write Images.
  - 2. Detection of faces and its features.
  - 3. Detection of shapes like Circle, rectangle etc in a image.
  - 4. Text recognition in images. (number of car license plate)
  - 5. Modifying image quality and colors
  - 6. Developing Augmented reality apps.
  - 7. Controlling camera
- Which Language it supports :
  - 1. C++
  - 2. Android SDK
  - 3. Java
  - 4. Python
  - 5. C (Not recommended)

Install OpenCV (2/6)

- $ sudo apt-get update
- $ sudo rpi-update
- $ reboot



```
[pi@raspberrypi] sudo apt-get update
Get:1 http://archive.raspberrypi.org/debian buster InRelease [25.1 kB]
Hit:2 http://raspbian.raspberrypi.org/raspbian buster InRelease
Get:3 http://archive.raspberrypi.org/debian buster/main armhf Packages [212 kB]
Fetched 237 kB in 3s (78.8 kB/s)
Reading package lists... Done
[pi@raspberrypi] sudo rpi-update
 *** Raspberry Pi firmware updater by Hexxeh, enhanced by AndrewS and Dom
 *** Performing self-update
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100 15719  100 15719    0     0  17388      0 --:--:-- --:--:-- --:--:-- 17388
 *** Relaunching after update
 *** Raspberry Pi firmware updater by Hexxeh, enhanced by AndrewS and Dom
 *** We're running for the first time
 *** Backing up files (this will take a few minutes)
 *** Backing up firmware
 *** Backing up modules 4.19.58-v7+
PARTSIZE:268435968
#############################################################
WARNING: 'rpi-update' updates to pre-releases of the linux
kernel tree and Videocore firmware.

'rpi-update' should only be used if there is a specific
reason to do so - for example, a request by a Raspberry Pi
engineer.

DO NOT use 'rpi-update' as part of a regular update process.

##############################################################
Would you like to proceed? (y/N)
 *** Downloading specific firmware revision (this will take a few minutes)
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   168    0   168    0     0    274      0 --:--:-- --:--:-- --:--:--   274
100 89.8M  100 89.8M    0     0  2102k      0  0:00:43  0:00:43 --:--:--  802k
 *** Updating firmware
 *** Updating kernel modules
 *** depmod 4.19.60-v7l+
 *** depmod 4.19.60+
 *** depmod 4.19.60-v7+
 *** Updating VideoCore libraries
 *** Using HardFP libraries
 *** Updating SDK
 *** Running ldconfig
 *** Storing current firmware revision
 *** Deleting downloaded files
 *** Syncing changes to disk
 *** If no errors appeared, your firmware was successfully updated to ce2a9f85a6
fd88f8c42ef54b7bad99b42e76e403
 *** A reboot is needed to activate the new firmware
[pi@raspberrypi] reboot
```

Install OpenCV (3/6)

- $ sudo apt-get update
- $ sudo apt-get cmake
- $ sudo apt-get install build-essential git cmake pkg-config
- $ sudo apt-get install libjpeg-dev libtiff5-dev libjasper-dev libpng12-dev
- $ sudo apt-get install libavcodec-dev libavformat-dev libswscale-dev
- $ sudo apt-get install libxvidcore-dev libx264-dev libeigen3-dev
- $ sudo apt-get install libgtk2.0-dev
- $ sudo apt-get -y install libv4l-dev v4l-utils
- $ sudo apt-get install libatlas-base-dev gfortran
- $ sudo apt-get install python2.7-dev python3-dev
- $ sudo apt-get install libgstreamer-plugins-base1.0-dev

Install OpenCV (4/6)

- $ cd ~/work
- $ wget -O opencv.zip https://github.com/Itseez/opencv/archive/3.3.0.zip
- $ unzip opencv.zip
- $ wget -O opencv_contrib.zip https://github.com/Itseez/opencv_contrib/archive/3.3.0.zip
- $ unzip opencv_contrib.zip
- $ cd opencv-3.3.0
- $ mkdir build && cd build
- $ cmake -D CMAKE_BUILD_TYPE=RELEASE   -D CMAKE_INSTALL_PREFIX=/usr/local \
-     -D BUILD_WITH_DEBUG_INFO=OFF -D BUILD_DOCS=OFF \
-     -D BUILD_EXAMPLES=OFF -D BUILD_TESTS=OFF \
-     -D BUILD_opencv_ts=OFF -D BUILD_PERF_TESTS=OFF \
-     -D INSTALL_C_EXAMPLES=OFF -D INSTALL_PYTHON_EXAMPLES=OFF \
-     -D OPENCV_EXTRA_MODULES_PATH=~/work/opencv_contrib-3.3.0/modules \
-     -D ENABLE_NEON=ON -D WITH_LIBV4L=ON \
-      ../

Install OpenCV (5/6)

- You are in the '~/work/opencv-3.3.0/build'
  - $ make
    - You may have some errors.
  - $ sudo make install
  - $ sudo ldconfig

- check installation
  - $ pkg-config --cflags opencv
    - -I/usr/local/include/opencv -I/usr/local/include
  - $ pkg-confg --libs opencv
    - -L/usr/local/lib -lopencv_stitching -lopencv_superres -lopencv_videostab -lopencv_photo -lopencv_aruco -lopencv_bgsegm -lopencv_bioinspired -lopencv_ccalib -lopencv_dnn_modern -lopencv_dpm -lopencv_face -lopencv_fuzzy -lopencv_hdf -lopencv_img_hash -lopencv_line_descriptor -lopencv_optflow -lopencv_reg -lopencv_rgbd -lopencv_saliency -lopencv_sfm -lopencv_stereo -lopencv_structured_light -lopencv_phase_unwrapping -lopencv_surface_matching -lopencv_tracking -lopencv_datasets -lopencv_text -lopencv_dnn -lopencv_plot -lopencv_ml -lopencv_xfeatures2d -lopencv_shape -lopencv_video -lopencv_ximgproc -lopencv_calib3d -lopencv_features2d -lopencv_highgui -lopencv_videoio -lopencv_flann -lopencv_xobjdetect -lopencv_imgcodecs -lopencv_objdetect -lopencv_xphoto -lopencv_imgproc -lopencv_core

- If 'cap_ffmpeg_impl.hpp' causes error due to 'CODEC_FLAG_GLOBAL_HEADER' not defined.
  - Add following at the top of "opencv-3.3.0/modules/videoio/src/cap_ffmpeg_impl.hpp"

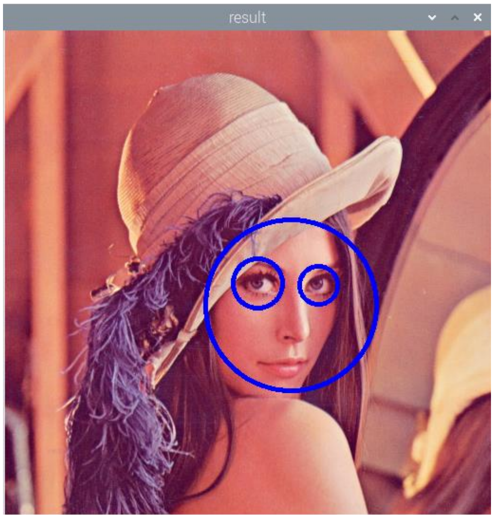
```
#define AV_CODEC_FLAG_GLOBAL_HEADER (1 << 22)
#define CODEC_FLAG_GLOBAL_HEADER AV_CODEC_FLAG_GLOBAL_HEADER
#define AVFMT_RAWPICTURE 0x0020
```

- If 'cv2.cpp' causes error due to 'invalid conversion from 'const char*' to 'char*'.
  - change as follows of 'opencv-3.3.0/modules/python/src2/cv2.cpp'

```
char* str = PyString_AsString(obj);
   ==> const char* str = PyString_AsString(obj);l
```

Install OpenCV (6/6) - testing

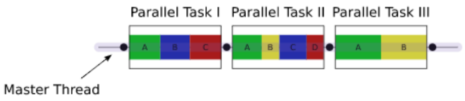
- $ cd ~/work/OpenCV/opencv-3.3.0/samples
- $ cmake .
- $ make
- $ cd cpp
- $ ./cpp-example-facedetect ../data/lena.jpg

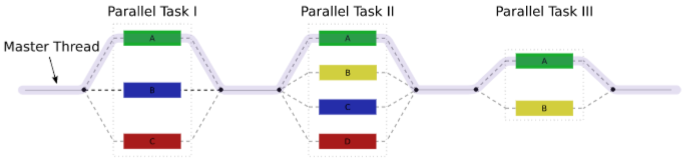


Install OpenMP

- OpenMP (Open Multi-Processing) is an application programming interface (API) that supports multi-platform shared memory multiprocessing programming in C, C++, and Fortran.

- $ sudo apt-get update
- $ sudo apt-get install libomp-dev

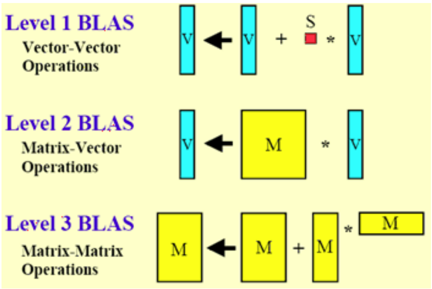




Install Atlas or OpenBLAS (1/3)

- OpenBLAS
  - Open Basic Linear Algebra Subprograms
    - https://github.com/xianyi/OpenBLAS
- ATLAS
  - Automatically Tuned Linear Algebra Software
    - https://github.com/math-atlas/math-atlas
- Intel MKL
  - Math Kernel Library

- BLAS
  - Level1: vector-vector operations
    - C= C + s x V
  - Level2: matrix-vector operations
    - C = C + A xV
  - Level3: matrix-matrix operations
    - C = C + A x B



Install Atlas or OpenBLAS (2/3)

- $ sudo apt install libatlas-base-dev

Install Atlas or OpenBLAS (3/3)

- From package repository
  - $ sudo apt-get install libopenblas-dev
- Check include files and libraries
  - $ pkg-config --cflags openblas
    - -I/usr/include/arm-linux-gnueabihf
  - $ pkg-config --libs openblas
    - -lopenblas
- From source
  - $ cd ~/work
  - $ git clone https://github.com/xianyi/OpenBLAS.git
  - $ cd OpenBLAS
  - $ make PREFIX=/opt/OpenBLAS
  - $ sudo mkdir /opt/OpenBLAS
  - $ sudo make install

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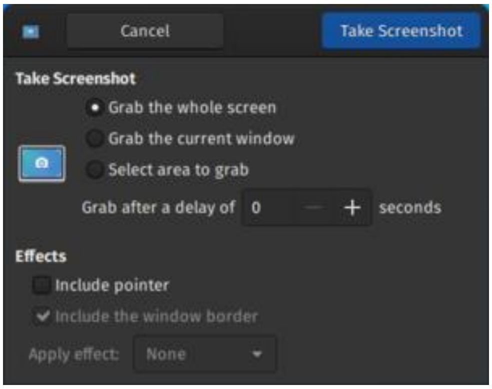
  - Running VNC viewer on Linux
  - Install and run VNC viewer on Windows
- Change display resolution
- Enlarge swap-file size
- Enable Wireless Connection
- Install OpenCV
- Install OpenMP
- Install Atlas and OpenBLAS
- **Install screen capture**
- **File transfer over SSH**
  - **Raspberry Pi and Linux**
  - **Raspberry Pi and Windows**
- **Backup Raspberry Pi image**
- **Clone Raspberry Pi image (Raspbian)**
- **Raspbian on VirtualBox**
- **ARM cross-compiler on Windows**

Install screen capture

- Install GNOME Screenshot
  - $ sudo apt update
  - $ sudo apt install gnome-screenshot
- $ gnome-screenshot --interactive



Take Screenshot

- ● Grab the whole screen
- ○ Grab the current window
- ○ Select area to grab
- Grab after a delay of 0 — + seconds

Effects

- □ Include pointer
- ✓ Include the window border
- Apply effect: None

File transfer over SSH

- Raspberry Pi and Linux
  - use ‘scp’
  - Linux to Raspberry Pi
    - $ scp file pi@192.168.1.214:/home/pi
    - $ scp pi@192.168.1.214:/home/pi/file .
  - Raspberry Pi to Linux
    - $ scp file user@192.168.1.100:/home/user
    - $ scp user@192.168.1.100:/home/user/file .
- Raspberry Pi and Windows
  - use ‘pscp’ - a command of PuTTY
  - Windows to Raspberry Pi
    - $ pscp file pi@192.168.1.214:/home/pi
    - $ pscp pi@192.168.1.214:/home/pi/file .
  - Or use WinSCP
    - https://winscp.net

Backup Raspberry Pi image (1/2)

- Linux
  - Say your uSD is inserted at /dev/sdx
  - Uncompressed way
    - $ dd if=/dev/sdx of=/path/rpi-backup.img bs=1M
    - $ dd if=/path/rpi-backup.img of=/dev/sdx bs=1M
  - Compressed way
    - $ dd if=/dev/sdx bs=1M | gzip > /path/rpi-backup.img.gz
    - $ gzip -dc /path/rpi-backup.img.gz | dd of=/dev/sdx bs=1M

Backup Raspberry Pi image (2/2)

- Windows
  - Use Win32DiskImager
    - https://sourceforge.net/projects/win32diskimager/

- Read
  - Insert uSD card to be read
  - Specify file to store
  - Then, 'Read'

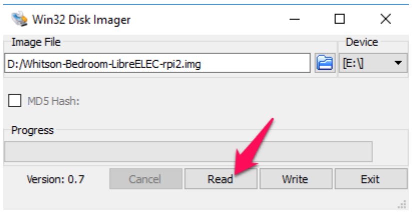


Image File: D:/Whitson-Bedroom-LibreELEC-rpi2.img

Device: [E:\]

Version: 0.7

- Write
  - Insert uSD card to save (backup)
  - Specify file to read
  - Then, 'Write'

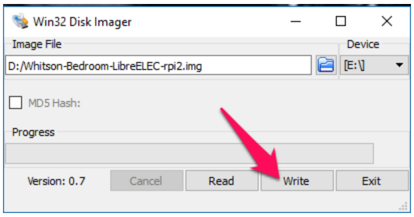


Image File: D:/Whitson-Bedroom-LibreELEC-rpi2.img

Device: [E:\]

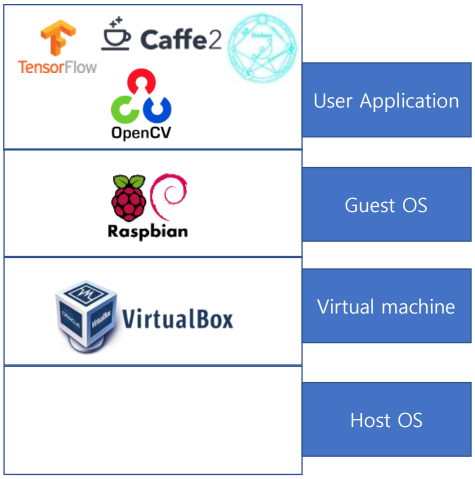
Version: 0.7

Clone Raspberry Pi image (Raspbian)

- Use rpi-clone/rpi-clone-setup on Raspberry Pi
  - $ cd ~work
  - $ git clone https://github.com/billw2/rpi-clone.git
  - $ cd rpi-clone
  - $ sudo cp rpi-clone rpi-clone-setup /usr/local/sbin

- Now insert new uSD or USB stick (say '/dev/sda' is the device for new disk)
  - If there exists file system on the uSD, umout all
    - $ sudo umount /media/pi/rootfs
    - $ sudo umount /media/pi/boot
  - $ sudo rpi-clone sda ← Backup case
  - or
  - $ sudo rpi-clone sda -s ***rpi2*** ← 'rpi2' is new host name 'raspberrypi' as a default.

Raspbian on VirtualBox (1/7)



User Application

Guest OS

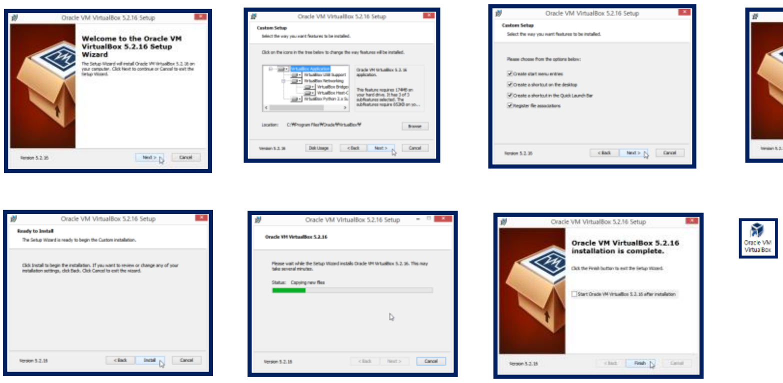
Virtual machine

Host OS

- 1) Windows에 VirtualBox를 설치
  - Installing VirtualBox on Windows host machine.
- 2) VirtualBox에 Raspbian를 설치
  - Installing Raspbian guest Operating System on VirtualBox.
- 3) 필요한 프로그램을 설치
  - Installing user programs and libraries on Raspbian.

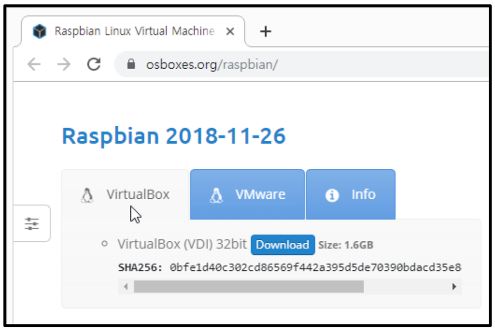
Raspbian on VirtualBox (2/7): Install VirtualBox

- Download VirtualBox install program from https://www.virtualbox.org/wiki/Downloads


Oracle VM VirtualBox 5.2.16 Setup
Welcome to the Oracle VM VirtualBox 5.2.16 Setup Wizard
Custom Setup
Warning: Network Interfaces
Ready to Install
Oracle VM VirtualBox 5.2.16
Oracle VM VirtualBox 5.2.16 installation is complete.
Next >
Install
Yes
Finish
Cancel
Oracle VM VirtualBox

Raspbian on VirtualBox (3/7): get VDI

- Get Raspbian VDI (Virtual desktop infrastructure) from https://www.osboxes.org/raspbian/



Raspbian 2018-11-26

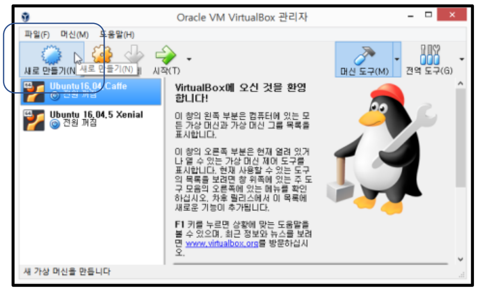
VirtualBox (VDI) 32bit Download Size: 1.6GB

SHA256: 0bfe1d40c302cd86569f442a395d5de70390bdacd35e8

- Uncompress
  - Have a look at ‘32bit/Raspbian 2018-11-26 (32bit).vdi”

Raspbian on VirtualBox (4/7)

- Specify name and others



Oracle VM VirtualBox 관리자

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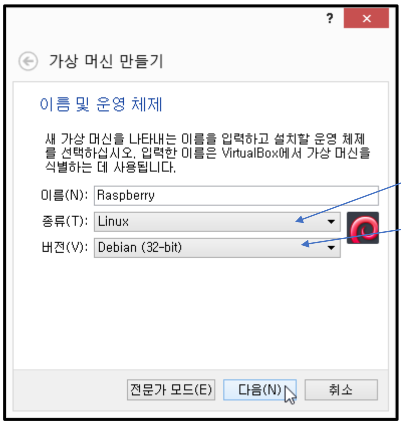
F1 키를 누르면 상황에 맞는 도움말을 볼 수 있으며, 최근 정보와 뉴스를 보려면 www.virtualbox.org를 방문하십시오.

새 가상 머신을 만듭니다



가상 머신 만들기

이름 및 운영 체제

새 가상 머신을 나타내는 이름을 입력하고 설치할 운영 체제를 선택하십시오. 입력한 이름은 VirtualBox에서 가상 머신을 식별하는 데 사용됩니다.

이름(N): Raspberry

종류(T): Linux

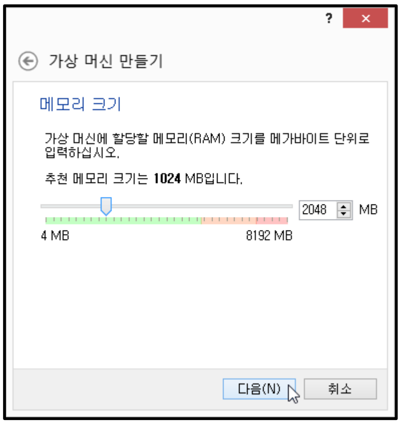
버전(V): Debian (32-bit)

Linux

Debian (32-bit)

Raspbian on VirtualBox (5/7)

- Set memory size and specify VDI



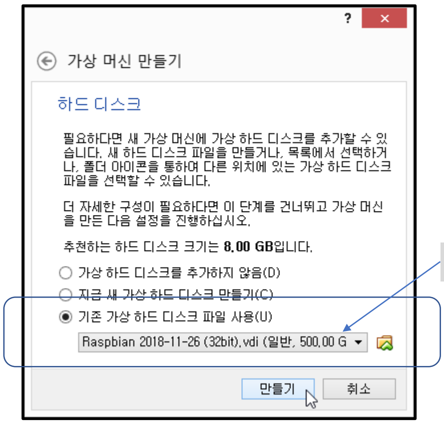
가상 머신 만들기

메모리 크기

가상 머신에 할당할 메모리(RAM) 크기를 메가바이트 단위로 입력하십시오.

추천 메모리 크기는 **1024** MB입니다.

2048 MB



가상 머신 만들기

하드 디스크

필요하다면 새 가상 머신에 가상 하드 디스크를 추가할 수 있습니다. 새 하드 디스크 파일을 만들거나, 목록에서 선택하거나, 폴더 아이콘을 통하여 다른 위치에 있는 가상 하드 디스크 파일을 선택할 수 있습니다.

더 자세한 구성이 필요하다면 이 단계를 건너뛰고 가상 머신을 만든 다음 설정을 진행하십시오.

추천하는 하드 디스크 크기는 **8.00 GB**입니다.

○ 가상 하드 디스크를 추가하지 않음(D)

○ 지금 새 가상 하드 디스크 만들기(C)

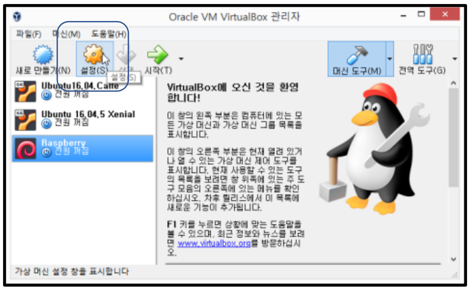
● 기존 가상 하드 디스크 파일 사용(U)

Raspbian 2018-11-26 (32bit).vdi (일반, 500.00 G

Raspbian VDI

Raspbian on VirtualBox (6/7)

- Set PAE



Oracle VM VirtualBox 관리자
파일(F) 머신(M) 도움말(H)
새로 만들기(N) 설정(S) 삭제 시작(T)
설정(S)
머신 도구(M) 전역 도구(G)
Ubuntu16.04.Caffe 전원 꺼짐
Ubuntu 16.04.5 Xenial 전원 꺼짐
Raspberry 전원 꺼짐

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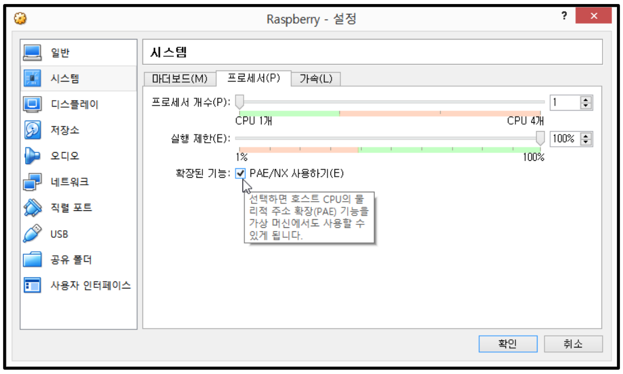
가상 머신 설정 창을 표시합니다



프로세서 개수(P): 1

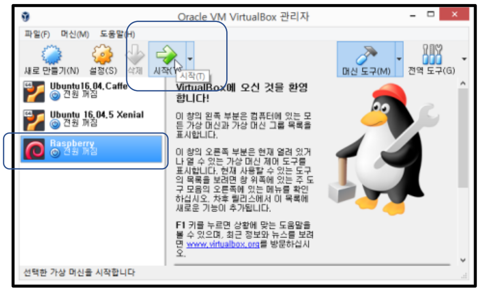
실행 제한(E): 100%

확장된 기능: ☑ PAE/NX 사용하기(E)

선택하면 호스트 CPU의 물리적 주소 확장(PAE) 기능을 가상 머신에서도 사용할 수 있게 됩니다.

Raspbian on VirtualBox (7/7)

- Select Raspbian



Oracle VM VirtualBox 관리자
파일(F) 머신(M) 도움말(H)
새로 만들기(N) 설정(S) 삭제 시작(T)
시작(T)
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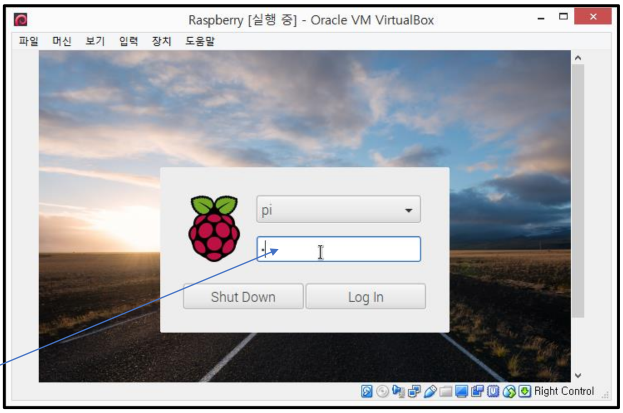
선택한 가상 머신을 시작합니다



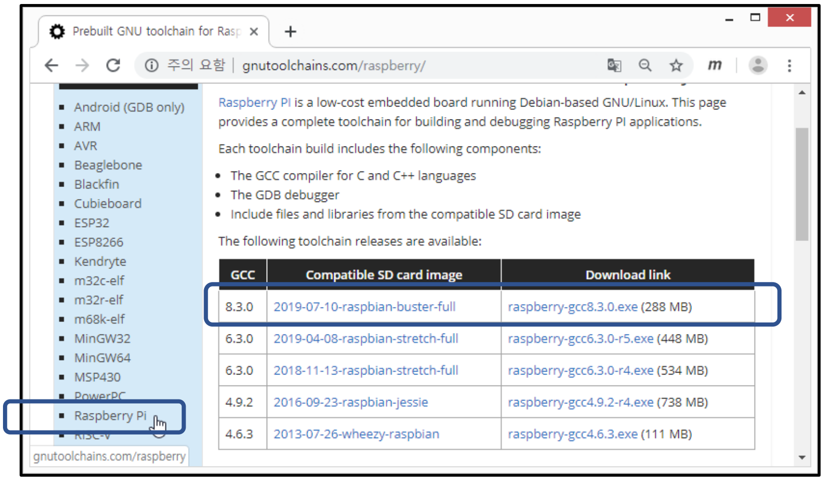
Raspberry [실행 중] - Oracle VM VirtualBox
파일 머신 보기 입력 장치 도움말
Shut Down
Log In
Right Control

pi

osboxes.org

ARM cross compiler on Windows (1/2)

- Get GCC package for Raspberry from http://gnutoolchains.com/raspberry/



Prebuilt GNU toolchain for Rasp ×

주의 요함 | gnutoolchains.com/raspberry/

- Android (GDB only)
- ARM
- AVR
- Beaglebone
- Blackfin
- Cubieboard
- ESP32
- ESP8266
- Kendryte
- m32c-elf
- m32r-elf
- m68k-elf
- MinGW32
- MinGW64
- MSP430
- PowerPC
- Raspberry Pi
- RISC-V

gnutoolchains.com/raspberry

Raspberry PI is a low-cost embedded board running Debian-based GNU/Linux. This page provides a complete toolchain for building and debugging Raspberry PI applications.

Each toolchain build includes the following components:

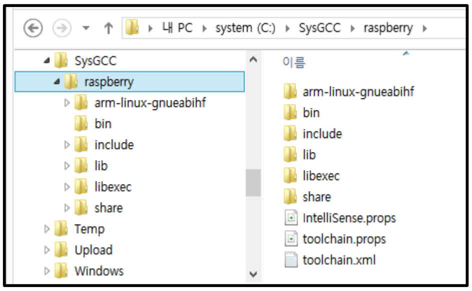
- The GCC compiler for C and C++ languages
- The GDB debugger
- Include files and libraries from the compatible SD card image

The following toolchain releases are available:

GCC	Compatible SD card image	Download link
8.3.0	2019-07-10-raspbian-buster-full	raspberry-gcc8.3.0.exe (288 MB)
6.3.0	2019-04-08-raspbian-stretch-full	raspberry-gcc6.3.0-r5.exe (448 MB)
6.3.0	2018-11-13-raspbian-stretch-full	raspberry-gcc6.3.0-r4.exe (534 MB)
4.9.2	2016-09-23-raspbian-jessie	raspberry-gcc4.9.2-r4.exe (738 MB)
4.6.3	2013-07-26-wheezy-raspbian	raspberry-gcc4.6.3.exe (111 MB)

ARM cross compiler on Windows (2/2)

- Un compress and run it to install



내 PC › system (C:) › SysGCC › raspberry ›

- SysGCC
  - raspberry
    - arm-linux-gnueabihf
    - bin
    - include
    - lib
    - libexec
    - share
- Temp
- Upload
- Windows

이름

- arm-linux-gnueabihf
- bin
- include
- lib
- libexec
- share
- IntelliSense.props
- toolchain.props
- toolchain.xml

- Use GCC in
  - C:/SysGCC/raspberry/bin
  - C:/SysGCC/raspberry/arm-linux-gnueabihf

㈜퓨쳐디자인시스템
34051 대전광역시 유성구 문지로 193, KAIST 문지캠퍼스, F723호
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