IEEE CCWC 2021 IoT Workshop

MacOS Getting Raspberry Pi Images

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SUMMARY

This document shows how to download a Raspberry Pi image. It also shows how to run a Raspberry Pi image using qemu-system-arm.

This is for MacOS.

DETAILS

Each step in Part 2 works to get images of Raspberry Pis working on your machine. These steps discuss some technical details of virtual Raspberry Pis using QEMU. These steps should be completed at least one day before the workshop.

All these installations and downloads are at your own risk.

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STEP 1: CREATE FOLDERS ON YOUR MAC

On MacOS these folders can be created using the **finder** or a **Terminal**.

Our objective is to build the following folders

Folder	Commands
/users/your-id/workshop	cd . ; mkdir workshop
~/workshop/RPi1	git clone https://github.com/wonder-phil/RPi
~/workshop/RPi2	After images are in RPi1 then duplicate RPi1 to RPi2
~/workshop/code	git clone

Assuming your-id is your login-id on your Mac, then here are the Terminal commands to create the folders:

MacOS> cd

MacOS> mkdir workshop

MacOS> cd workshop

MacOS> git clone https://github.com/wonder-phil/RPi

MacOS> ls -lh

 3.2M Jul 14 12:40 qemukernel
 7.9K Jul 14 12:39 versatile-pb.dtb

These two files are in your workshop/RPi folder

The qemukernel file is the Raspberrian operating system.

The versatile-pb.dtb is a mother board emulated by QEMU. Technically these are ARM Versatile/PB (ARM926EJ-S). Others are available as well.

https://www.raspberrypi.org/software/operating-systems/

Download Paspberry Pi OS Lite (438MB), 2-December-2020

Download **the Raspberry Pi OS Lite** image as shown below:

This comes down as a zip folder containing a single file. Unzip this folder getting the file:

2020-12-02-raspios-buster-armhf-lite.img

Place this file in ~/workshop/RPi

   MacOS> cd ~/workshop/RPi

   MacOS> ls -lh

1.7G Dec 2 07:56 2020-12-02-raspios-buster-armhf-lite.img
3.2M Jul 14 12:40 qemukernel
7.9K Jul 14 12:39 versatile-pb.dtb

STEP 3: RUN A RASPBERRY PI QEMU VIRTUAL MACHINE

   MacOS> cd ~/workshop/RPi

Check the IMG file:

   MacOS> qemu-img info 2020-12-02-raspios-buster-armhf-lite.img

image: 2020-12-02-raspios-buster-armhf-lite.img
file format: raw
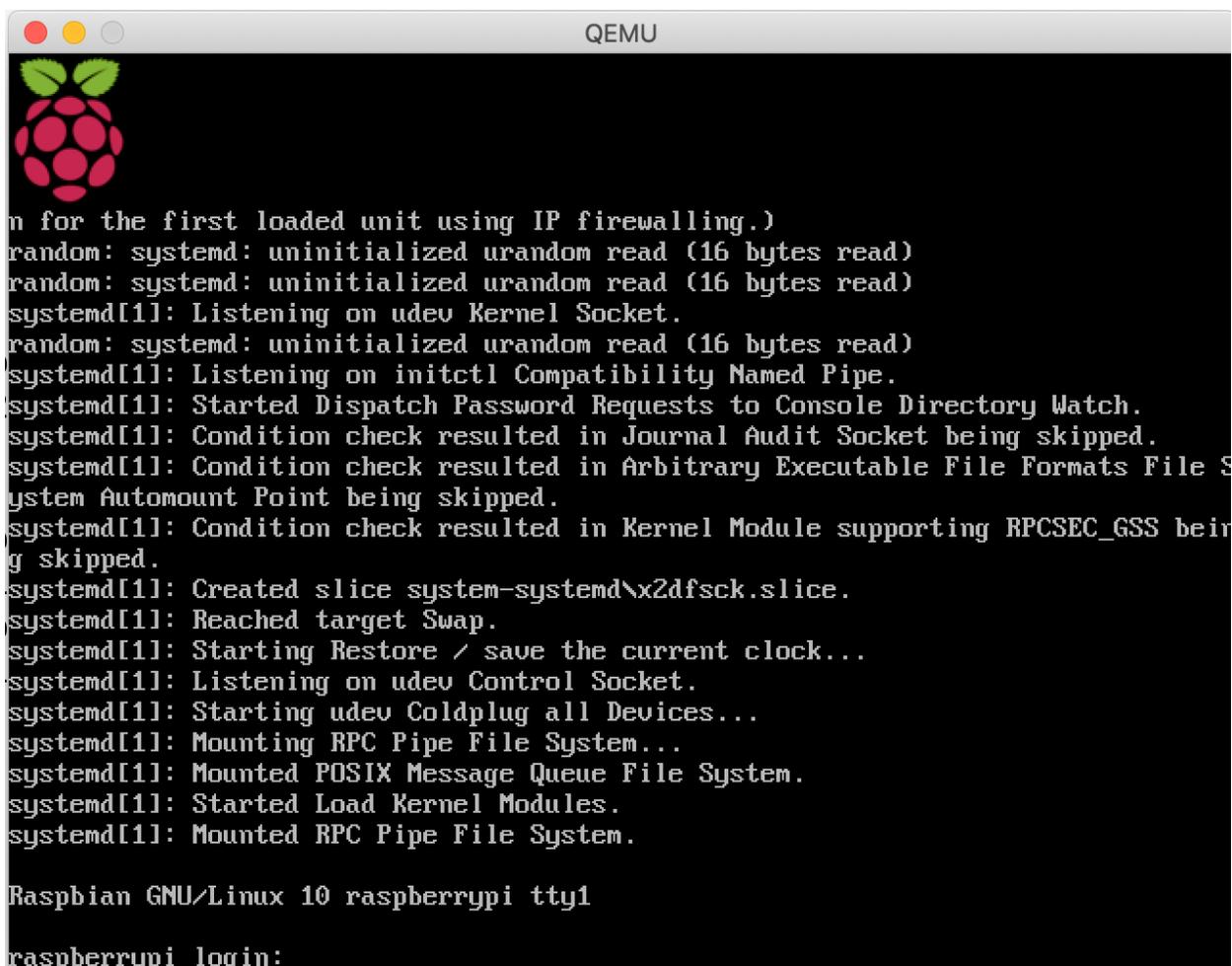virtual size: 1.73 GiB (1858076672 bytes)
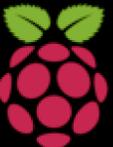disk size: 1.73 GiB

Now convert the IMG file to a QCOW2 file:

   MacOS> qemu-img convert -f raw -O qcow2 2020-12-02-raspios-buster-armhf-lite.img   2020-12.qcow2

   MacOS> qemu-img resize 2020-12.qcow2 +2G

MacOS> qemu-system-arm -M versatilepb \
        -cpu arm1176 \
        -m 256 -hda "./2020-12.qcow2" \
        -net nic -net user,hostfwd=tcp::5022-:22 \
        -dtb "./versatile-pb.dtb" \
        -kernel "./qemukernel" \
        -append "root=/dev/sda2 panic=1 rootfstype=ext4 rw" -no-reboot

Then a new screen should pop up showing the Raspberry Pi instance booting:

raspberrypi login: **pi**
raspberrypi password: **raspberry**

If your mouse cursor gets lost, then:

Control-Option-G to release the
mouse cursor

To shut down the Raspberry Pi gracefully, go to the Raspberry Pi's prompt and shut it down

RaspberryPi> sudo shutdown -h now

EXPLANATION OF THE QEMU-SYSTEM-ARM COMMAND

qemu-system-arm is the executable that we use from the QEMU binaries we downloaded earlier. This is what allows up to spin up the virtual machine.

-M versatilepb This names the machine type for QEMU.

-cpu arm1176   makes QEMU emulate the ARM1176 processor. This is the processor used by Raspberry Pis.

-m 256 sets QEMU to use 256MB memory for the emulated Raspberry Pi.

-hda "./2020-12.qcow2" sets QEMU to use the file image 2020-12.qcow2. Qcow2 is QEMU copy-on-wright format.

-net nic -net user,hostfwd=tcp::5022-:22 The -net nic indicates there is a network interface card. The "hostfwd=tcp::5022:22" maps the host port 5022 to the raspberry pi's port 22 on the virtual machine. This allows ssh access.

-dtb "./versatile-pb.dtb" just maps the file we have saved in our folder to the -M flag we specified earlier.

-kernel "./qemukernel" This points QEMU to the Raspberry Pi Raspberrian kernel.

-append "root=/dev/sda2 panic=1 rootfstype=ext4 rw" these specifics are appended on to the boot command.

-no-reboot This tells QEMU to stop when the Raspberry Pi shuts down rather than rebooting on shutdown.