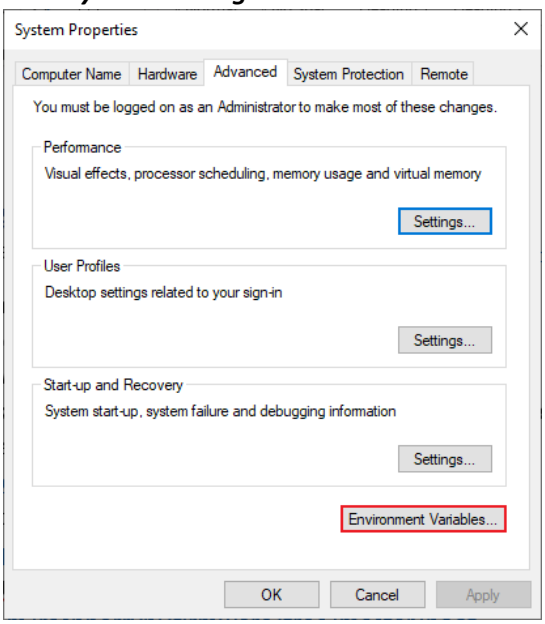
QEMU for Raspberry Pi Emulation (Windows Host)

Installing QEMU

(Loosely following tutorial at https://blog.agchapman.com/using-qemu-to-emulate-a-raspberry-pi/)

1. Install QEMU from https://www.qemu.org/download/ and note the installation location.
2. Add QEMU to the ***Path*** variable for ease of use. **You will need administrator privileges for this.**
    a. Go to ***Control Panel*** => ***System and Security*** => ***System.***
    b. Select ***Advanced System Settings*** => ***Environment Variables.***



Advanced System Settings *window with* ***Environment Variables*** *highlighted*

    c. **NOTE: BE VERY CAREFUL AT THIS STAGE TO AVOID DELETING ANY VARIABLES. DELETING VARIABLES MAY CAUSE PROGRAMS TO STOP WORKING.**
    d. In the ***System Variables*** section of the ***Environment Variables*** window, select the variable named "**Path**" and click ***Edit…***
    e. To add QEMU to the ***Path*** variable, select ***Browse…*** or ***New*** and input the location of the QEMU folder. By default, it will install to a location similar to ***C:\Program Files\qemu***.

Beginning Emulation

1. Acquire a Raspberry Pi OS kernel, such as those available at https://github.com/dhruvvyas90/qemu-rpi-kernel.
2. Download the latest Raspberry Pi OS image from https://www.raspberrypi.org/downloads/raspberry-pi-os/.
3. Download the .dtb file corresponding to the hardware you wish to emulate from https://github.com/raspberrypi/firmware/tree/master/boot.
4. Move the kernel, OS image and dtb file to the same folder.
5. Convert the Raspberry Pi OS image (.img file) to a qcow image.
    a. Open CMD or PowerShell and navigate to the folder the image is located in, then use the following command:
    qemu-img convert -f raw -O qcow2 [NAME OF .IMG FILE] [NAME OF NEW QCOW FILE].qcow

3. Create a batch file (i.e., a text document with the .bat file extension) containing the following command and arguments, substituting in file names for the files you have downloaded:

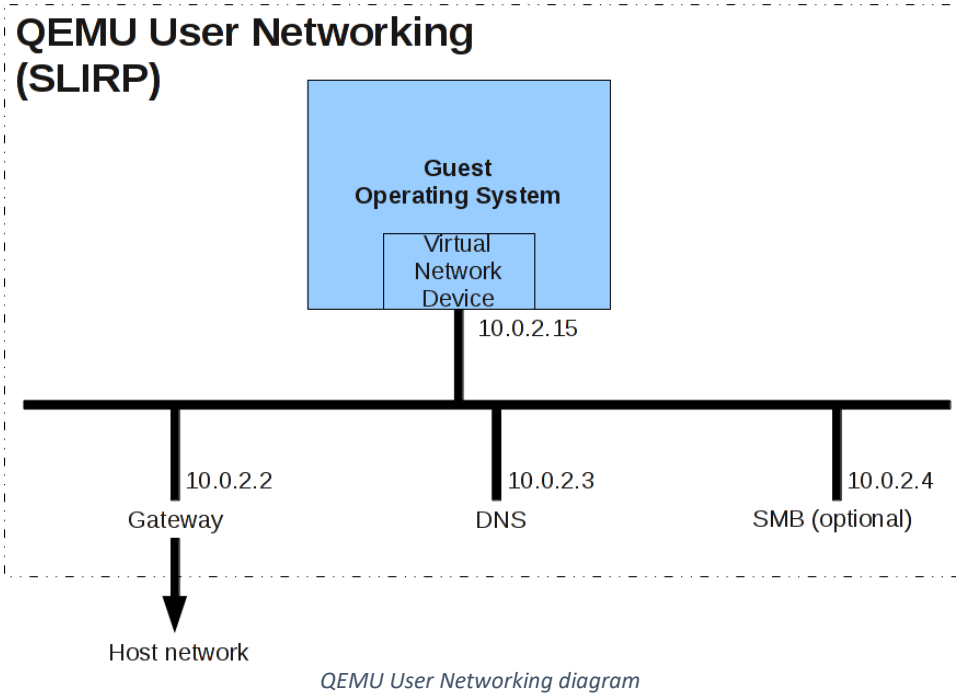
```
qemu-system-arm.exe ^
-kernel kernel-qemu-4.19.50-buster ^
-cpu arm1176 ^
-m 256 ^
-M versatilepb ^
-serial stdio ^
-append "root=/dev/sda2 rootfstype=ext4 rw" ^
-hda raspbian.qcow ^
-dtb versatile-pb-buster.dtb ^
-no-reboot
```

Script to begin emulation on Windows

   In-depth information about QEMU's commands can be found in the documentation: https://qemu.weilnetz.de/doc/qemu-doc.html.
4. Save the script as a .bat file.
5. Use CMD or PowerShell to run the .bat file.
6. If all goes well, this should begin the emulation of a Raspberry Pi.

Networking

As per the QEMU networking documentation (https://wiki.qemu.org/Documentation/Networking), if using the SLIRP networking backend (which is used by default), you may connect from the emulated guest to a port on the host at the IP address 10.0.2.2. The networking documentation provides the following diagram for the SLIRP network backend:



QEMU User Networking diagram

For example, if the host system is running a HTTP server on port 8091, the guest system may access this server by sending a GET command to http://10.0.2.2:8091.