



PicoMuon Detector

Setting up a

Raspberry Pi 4/5

Pico^μ

<https://ukraa.com/>

The UK Radio Astronomy Association

A charitable incorporated organisation

Registered charity in England and Wales No. 1123866



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Set-up instructions

These instructions cover setting up your Raspberry Pi4 or Raspberry Pi 5 with a suitable operating system and ability to be remotely access via VNC.

It is recommended that you use a Raspberry Pi 4/5 with at least 2GB memory.

When using the Raspberry Pi Imager, remember to write down the **hostname** you use – this is used to view the web page with the results from your UKRAA PicoMuon detector.

Please keep the username as **pi** when using OS customisation within the Raspberry Pi Imager.

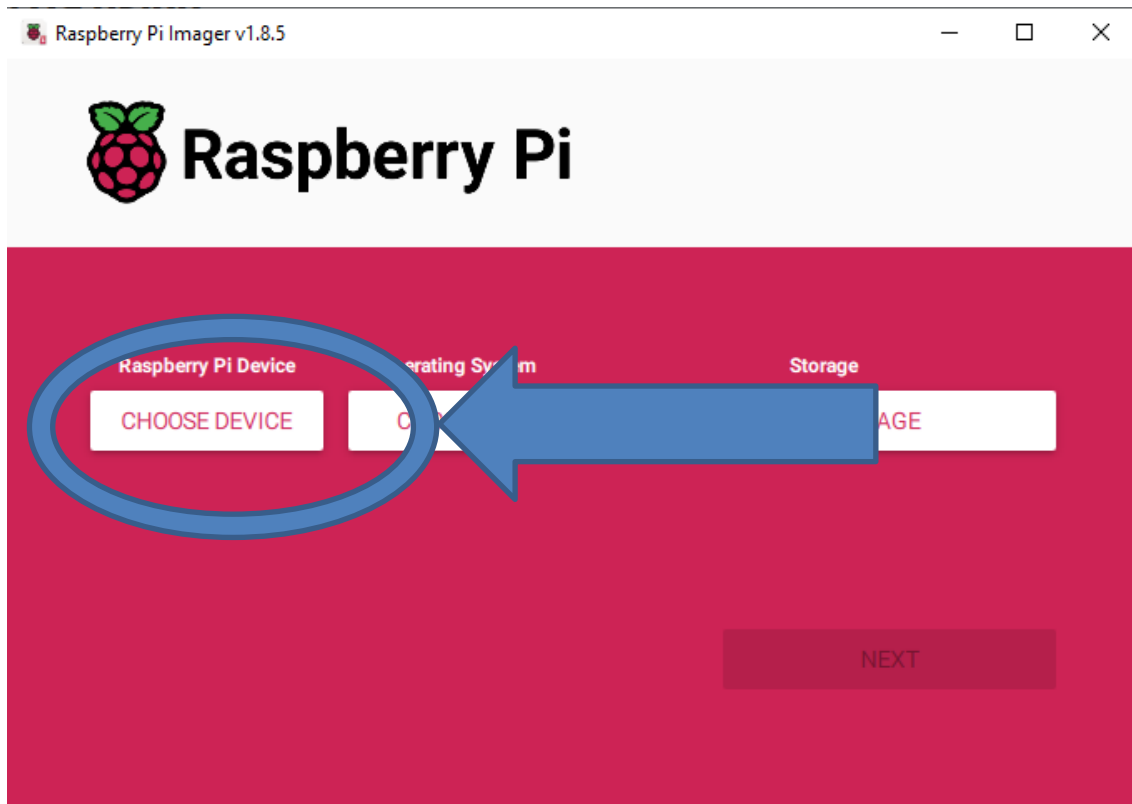
The instructions for accessing your Raspberry Pi heedlessly assume use of Windows PC and that the following two applications are preinstalled on that PC.

- PuTTY
- RealVNC Viewer

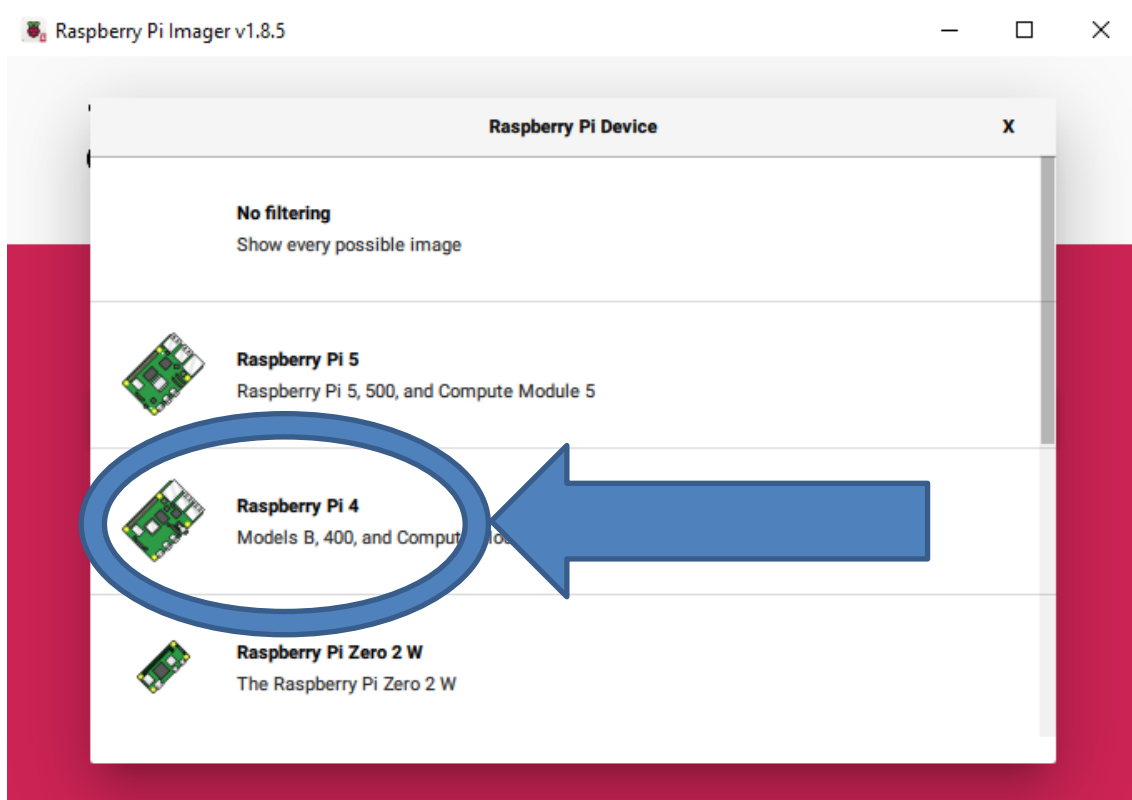
No information on installing these two applications is given in this text – there are numerous guides available on the internet.

Raspberry Pi OS

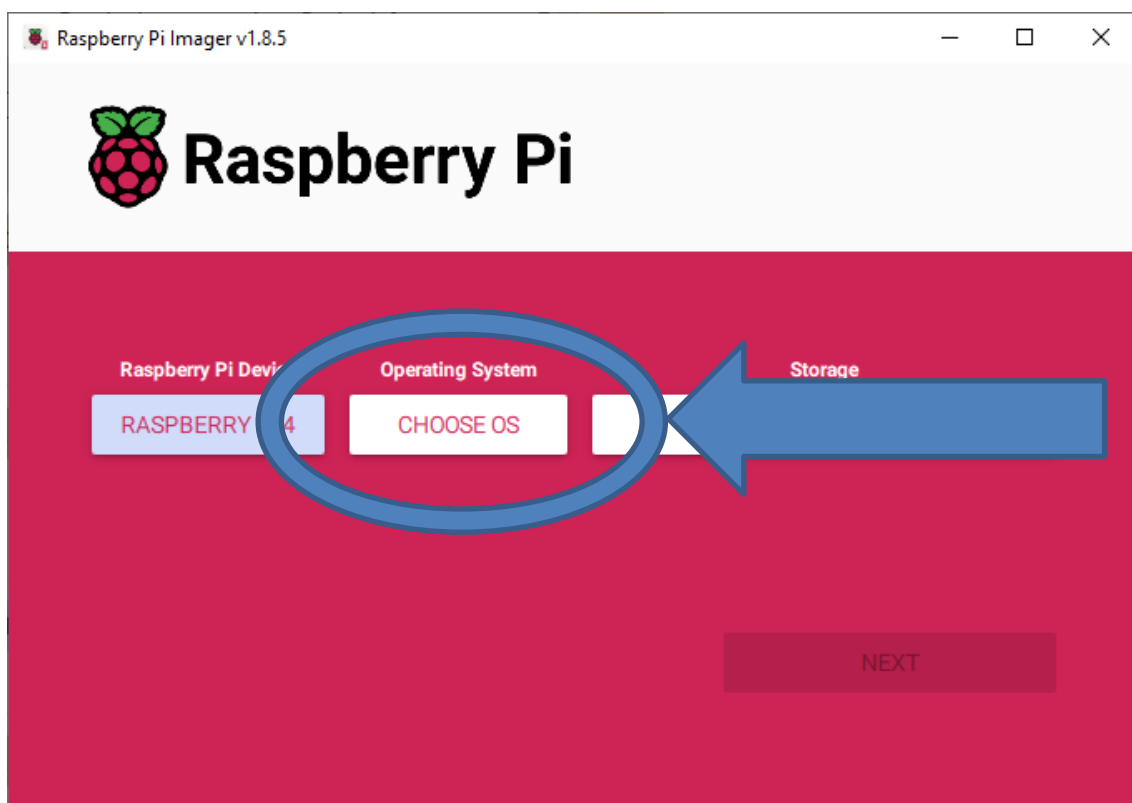
1. Download [Raspberry Pi Imager](#) for your operating system.
2. Run Raspberry Pi Imager.
3. Select **CHOOSE DEVICE**.



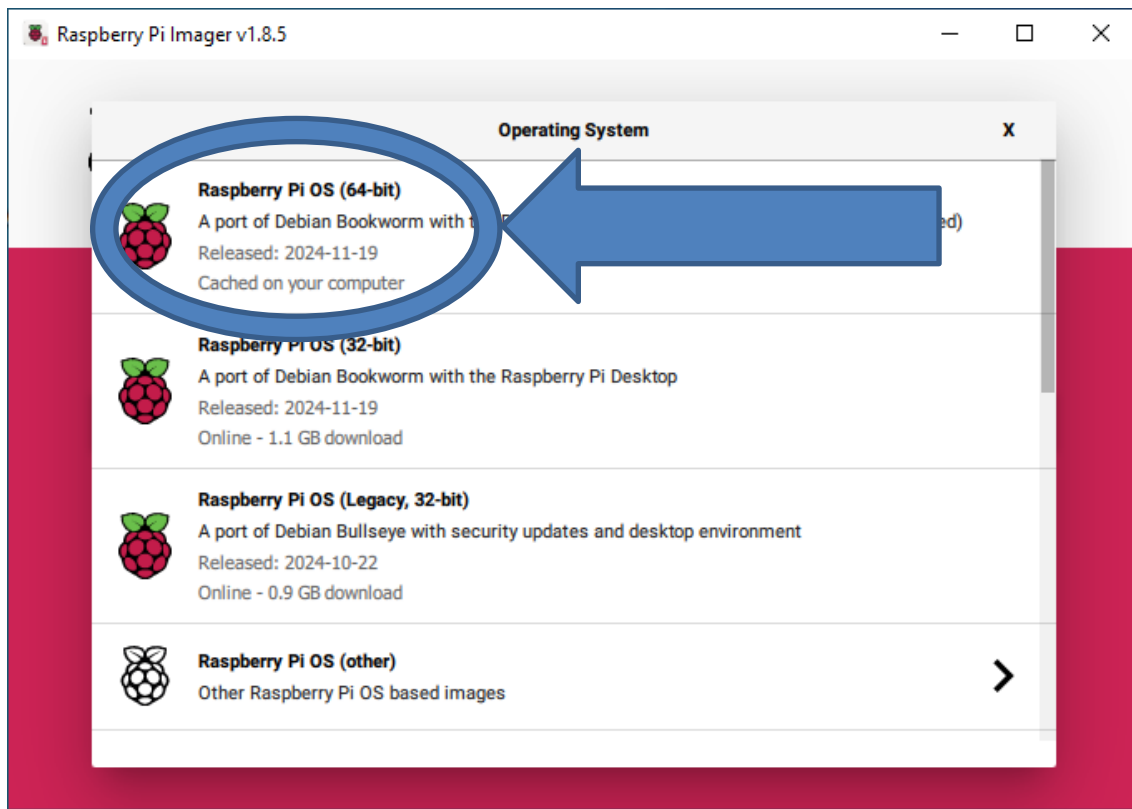
4. Select your **Raspberry Pi device** – in this case a RPi4.



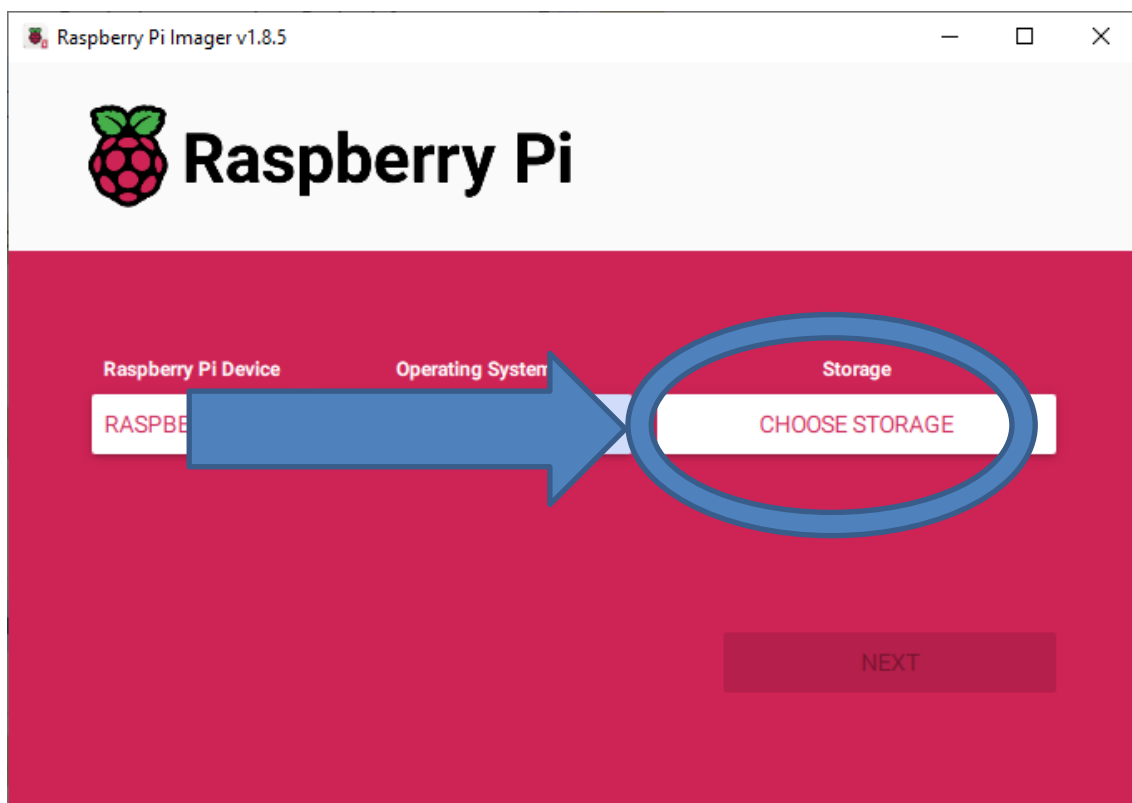
5. Select **CHOOSE OS**.



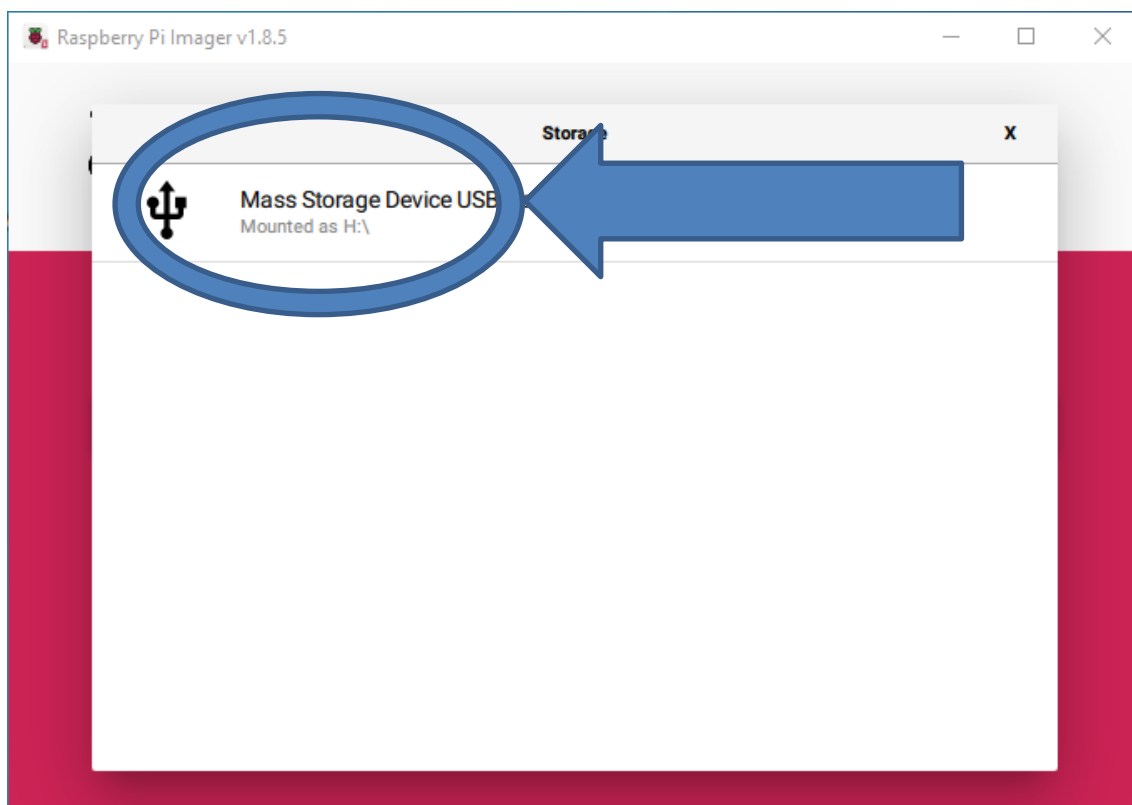
6. Select **Raspberry Pi OS (64bit)**.



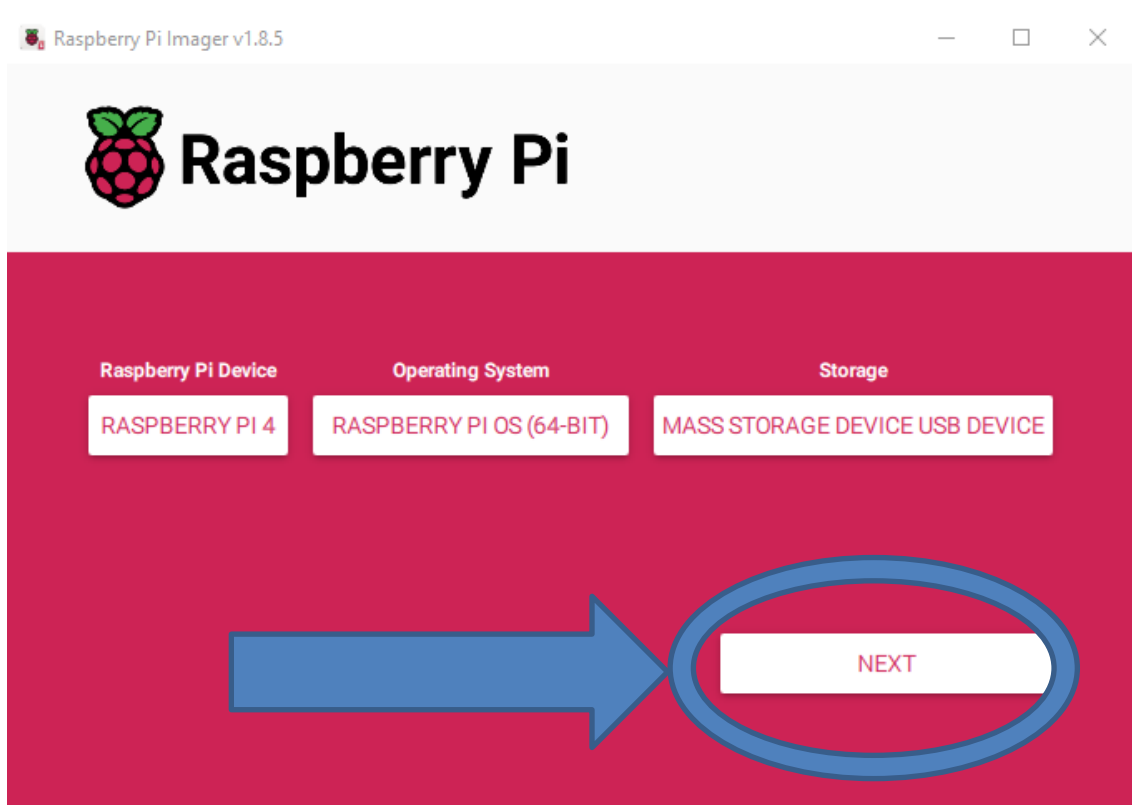
7. Select **CHOOSE STORAGE** and select your **microSD card** for your RPi.



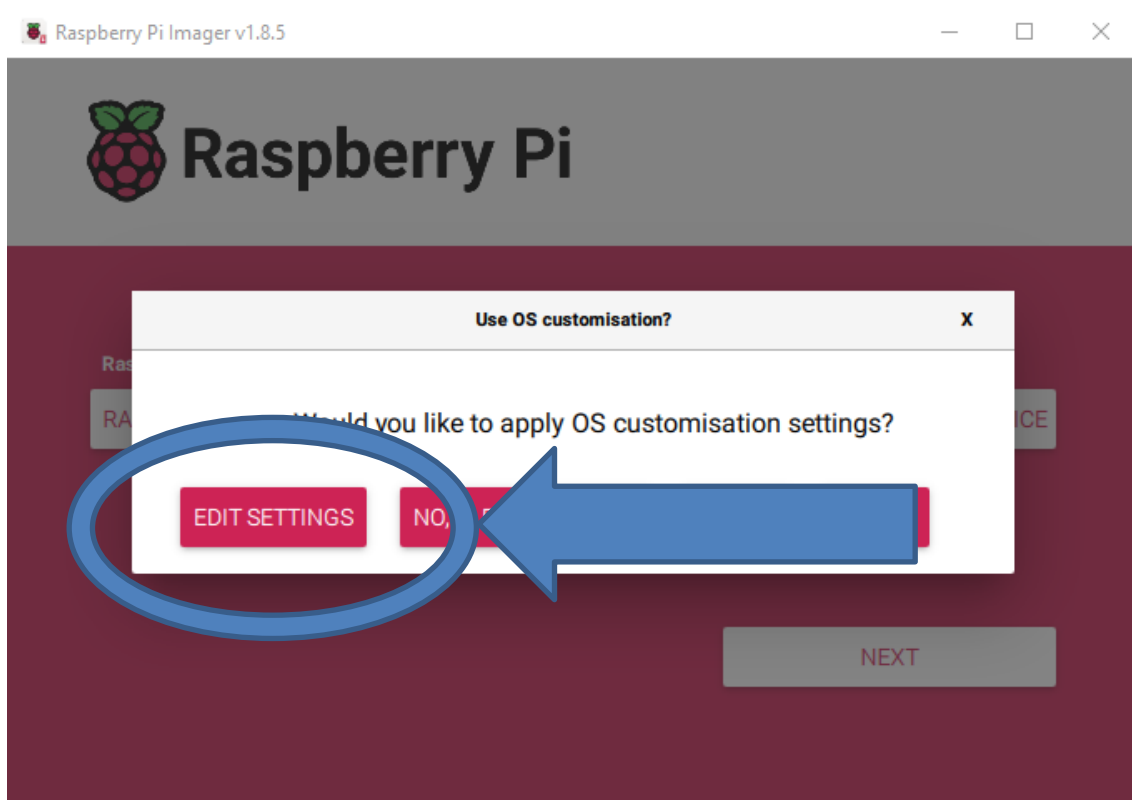
8. Select your **microSD** card for your RPi.



9. Select **NEXT**

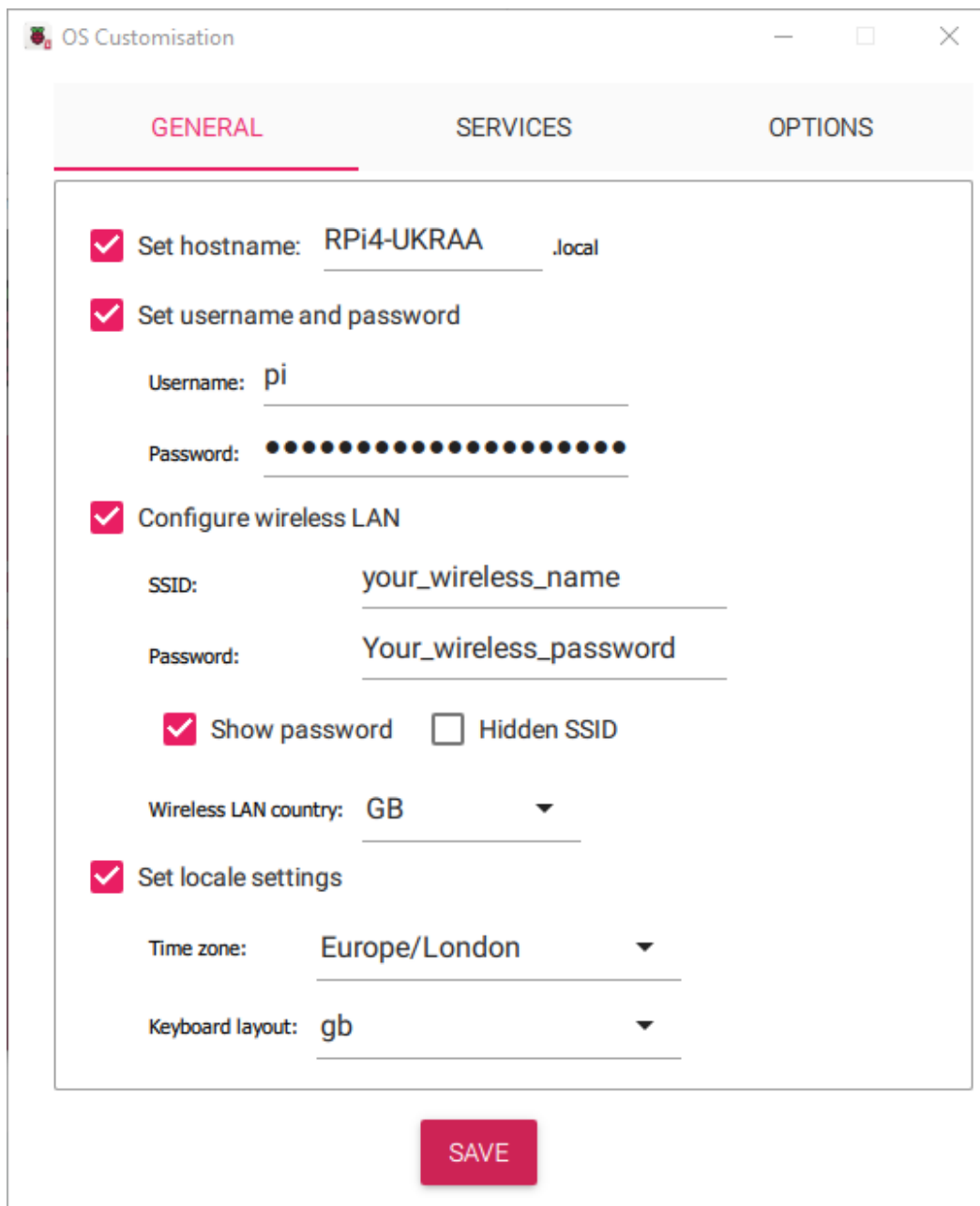


10. You are presented with a **Use OS customisation?** window, select **EDIT SETTINGS**.



11. On the **GENERAL** page...

1. **Set hostname** - set to whatever you want - but write it down, we will need it latter!
2. Set **Username:** and **Password:**
 1. Keep username as **pi**
 2. set your own password
3. Configure wireless LAN
 1. if you wish to use you RPi wirelessly
 2. Enter your wireless network's **SSID:**, **Password:** and **Wireless LAN country:**
4. Set locale settings
 1. set **Time zone:** and **Keyboard layout** to your preferences



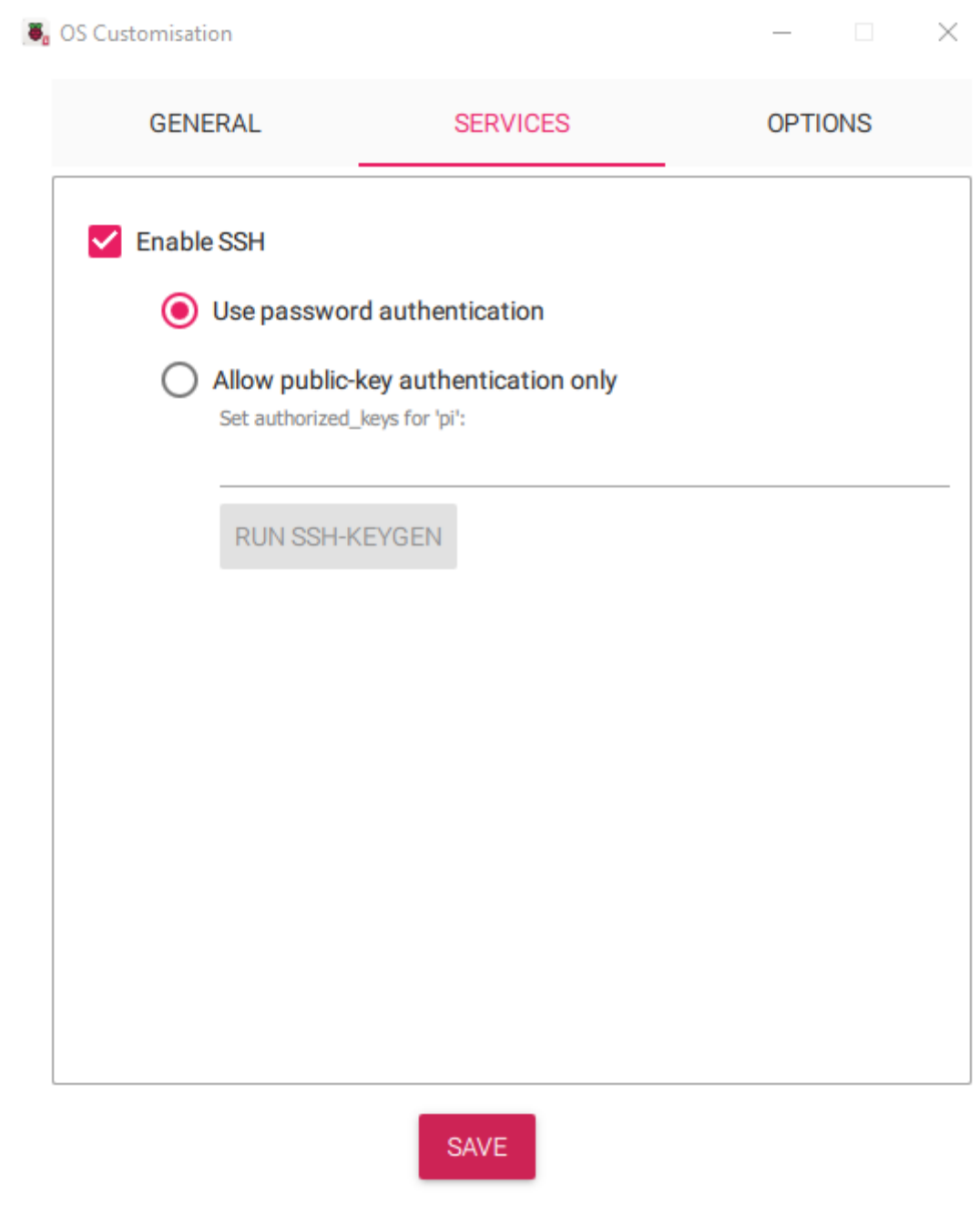
The screenshot shows the 'OS Customisation' window with the 'GENERAL' tab selected. The window has three tabs: 'GENERAL', 'SERVICES', and 'OPTIONS'. The 'GENERAL' tab contains several settings, each with a checked checkbox:

- Set hostname:** The text 'RPI4-UKRAA' is entered in the field, followed by '.local'.
- Set username and password:** The 'Username' field contains 'pi'. The 'Password' field is masked with 12 dots.
- Configure wireless LAN:** The 'SSID' field contains 'your_wireless_name'. The 'Password' field contains 'Your_wireless_password'. Below these, there are two checkboxes: 'Show password' (checked) and 'Hidden SSID' (unchecked).
- Wireless LAN country:** A dropdown menu shows 'GB' selected.
- Set locale settings:** The 'Time zone' dropdown shows 'Europe/London' selected. The 'Keyboard layout' dropdown shows 'gb' selected.

At the bottom of the window, there is a red 'SAVE' button.

12. Select **SERVICES**

- Keep as shown



The screenshot shows a window titled "OS Customisation" with three tabs: "GENERAL", "SERVICES", and "OPTIONS". The "SERVICES" tab is selected and highlighted with a red underline. Inside the "SERVICES" tab, there is a section for SSH configuration. It starts with a checked checkbox labeled "Enable SSH". Below this, there are two radio button options: "Use password authentication" (which is selected) and "Allow public-key authentication only". Under the second option, there is a text input field with the placeholder text "Set authorized_keys for 'pi':". Below the input field is a button labeled "RUN SSH-KEYGEN". At the bottom of the window, there is a large red button labeled "SAVE".

OS Customisation

GENERAL SERVICES OPTIONS

☒ Enable SSH

☒ Use password authentication

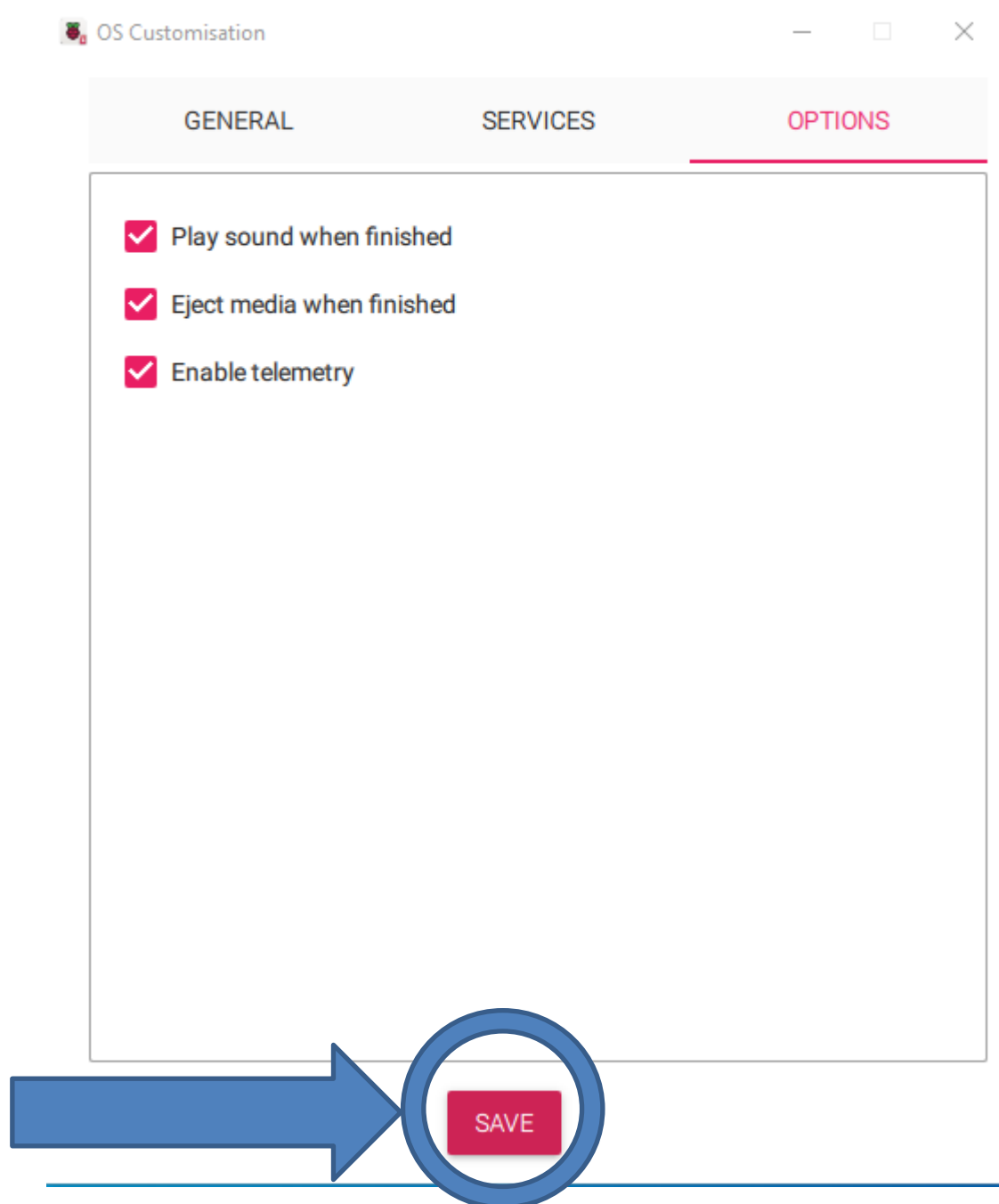
☐ Allow public-key authentication only
Set authorized_keys for 'pi':

RUN SSH-KEYGEN

SAVE

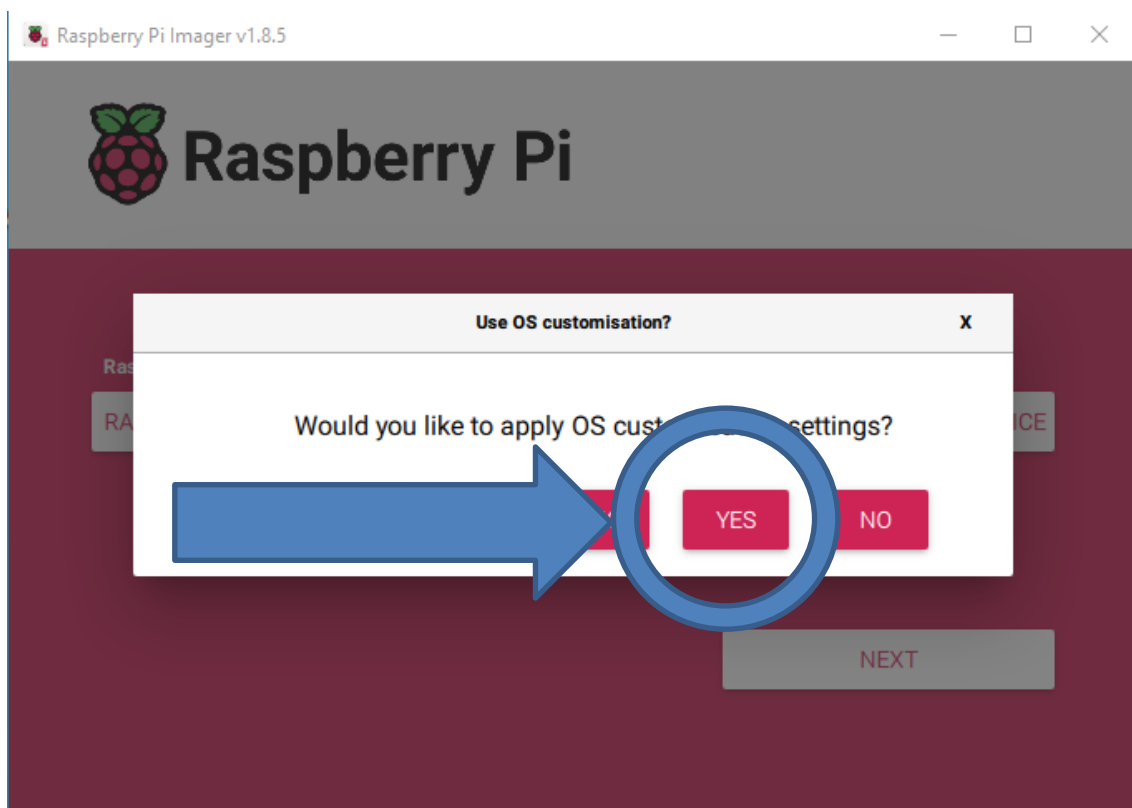
13. Select **OPTIONS**

- Keep as shown

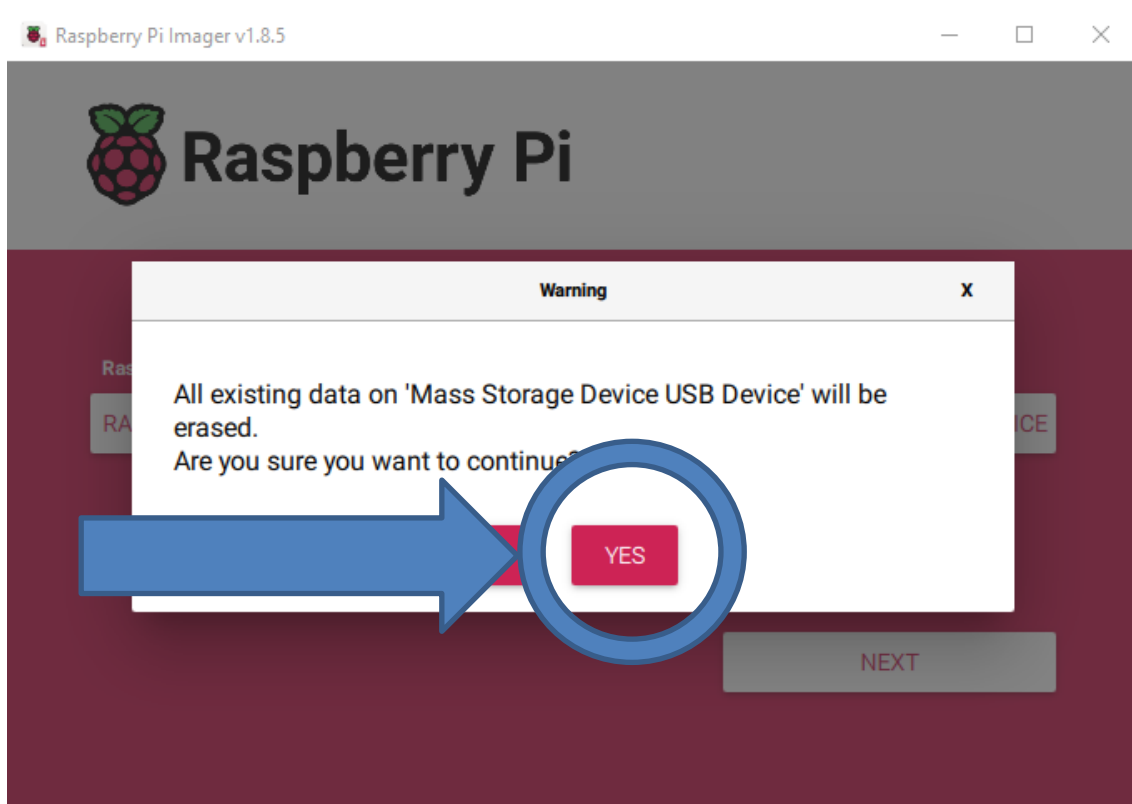


14. Select **SAVE** at bottom of window.

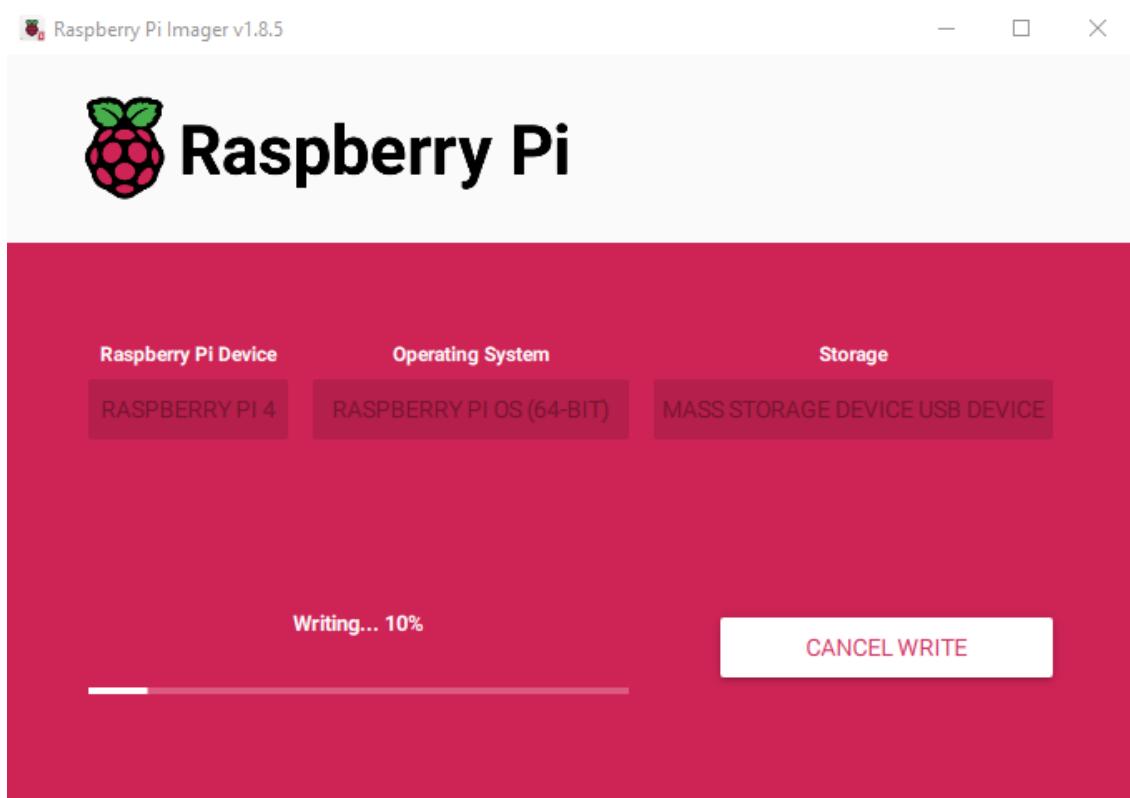
15. Now apply the customised OS settings by selecting **YES**.



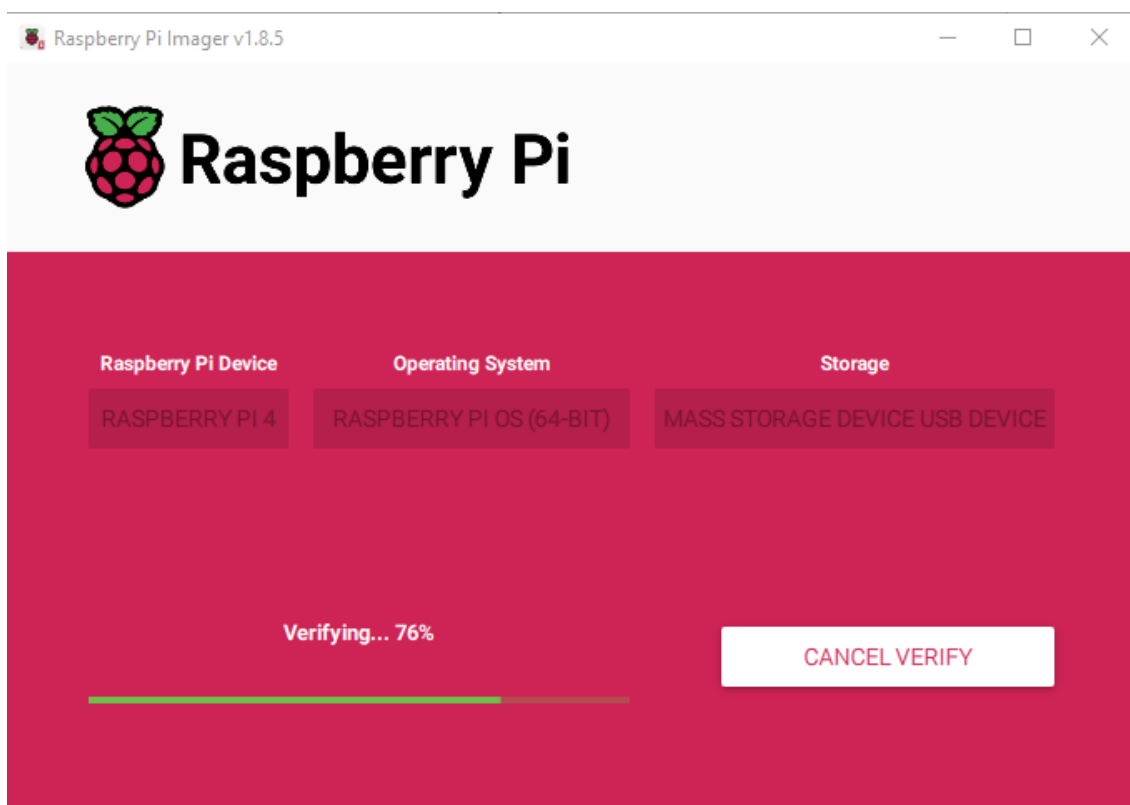
16. You will be asked if you wish to proceed, select **YES**.



17. The operating system will now be written to the microSD card



18. and then verified, this take a bit of time...



19. When finished, you can remove the microSD card and select **CONTINUE** and close the **Raspberry Pi Imager**.

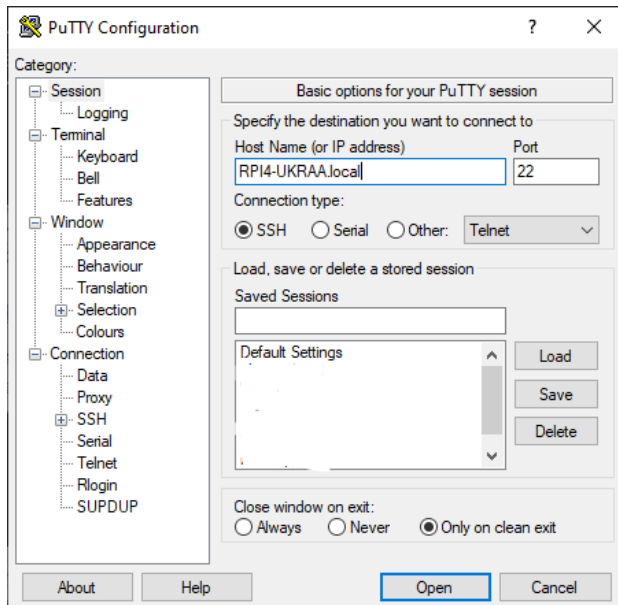


RPi4 first boot and initial configuration

Put the microSD card you have just created into your RPi4, connect the RPi to your LAN if necessary, insert the power cable and turn on.

Using PuTTY (<https://www.putty.org/>)

1. In **Host Name (or IP address)**, type the host name of your RPi that you wrote down earlier... and select **Open**

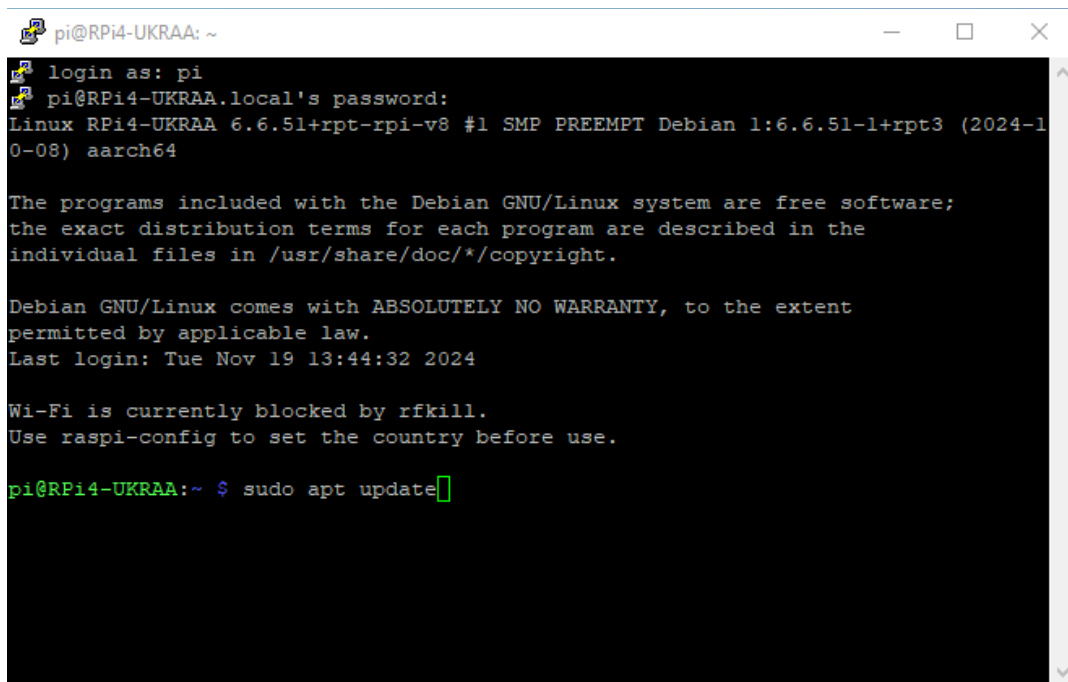


2. You will be presented with a PuTTY Security Alert - select **Accept**. You will now have a PuTTY terminal window.



3. Login as **pi** and enter your **password**
4. Now type the command below and press **enter**. This will update the RPi OS

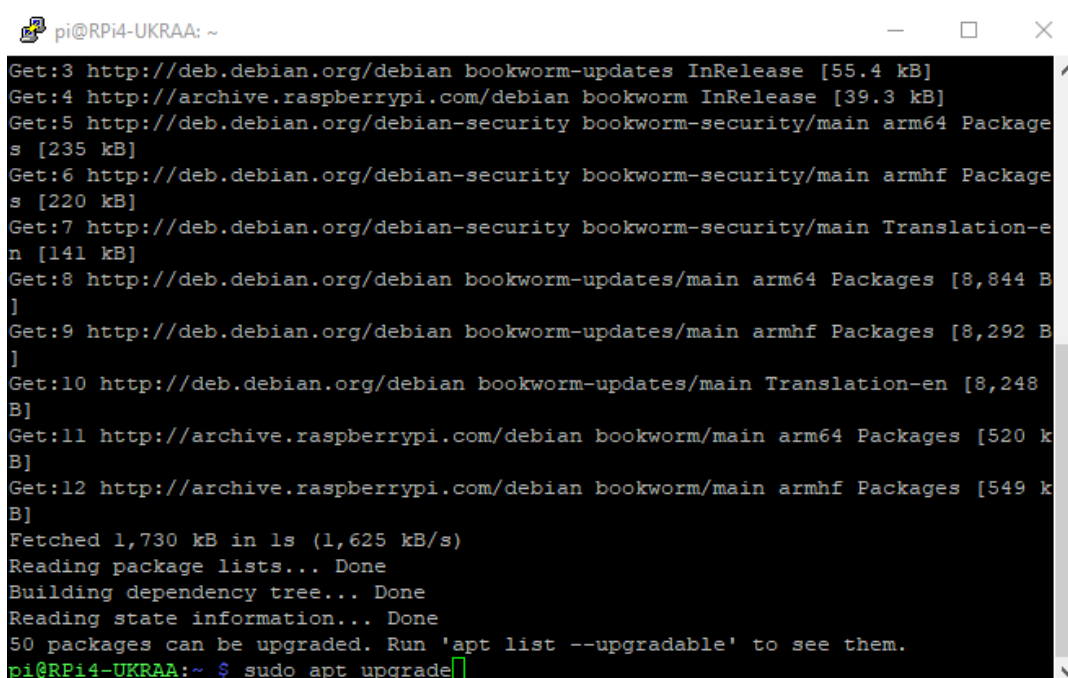
sudo apt update



```
pi@RPi4-UKRAA: ~  
login as: pi  
pi@RPi4-UKRAA.local's password:  
Linux RPi4-UKRAA 6.6.51+rpt-rpi-v8 #1 SMP PREEMPT Debian 1:6.6.51-1+rpt3 (2024-10-08) aarch64  
  
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: Tue Nov 19 13:44:32 2024  
  
Wi-Fi is currently blocked by rfkill.  
Use raspi-config to set the country before use.  
pi@RPi4-UKRAA:~ $ sudo apt update
```

5. Now type the command below and press **enter**. This will update any preinstalled software packages. You will be asked to type **y** and press **enter** to proceed.

sudo apt upgrade



```
pi@RPi4-UKRAA: ~  
Get:3 http://deb.debian.org/debian bookworm-updates InRelease [55.4 kB]  
Get:4 http://archive.raspberrypi.com/debian bookworm InRelease [39.3 kB]  
Get:5 http://deb.debian.org/debian-security bookworm-security/main arm64 Packages [235 kB]  
Get:6 http://deb.debian.org/debian-security bookworm-security/main armhf Packages [220 kB]  
Get:7 http://deb.debian.org/debian-security bookworm-security/main Translation-en [141 kB]  
Get:8 http://deb.debian.org/debian bookworm-updates/main arm64 Packages [8,844 B]  
Get:9 http://deb.debian.org/debian bookworm-updates/main armhf Packages [8,292 B]  
Get:10 http://deb.debian.org/debian bookworm-updates/main Translation-en [8,248 B]  
Get:11 http://archive.raspberrypi.com/debian bookworm/main arm64 Packages [520 kB]  
Get:12 http://archive.raspberrypi.com/debian bookworm/main armhf Packages [549 kB]  
Fetched 1,730 kB in 1s (1,625 kB/s)  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
50 packages can be upgraded. Run 'apt list --upgradable' to see them.  
pi@RPi4-UKRAA:~ $ sudo apt upgrade
```

- You may be advised that you can remove **no longer required** packages. You can type the command below and press **enter**. Again, you will be asked to type **y** and press **enter** to proceed.

sudo apt autoremove

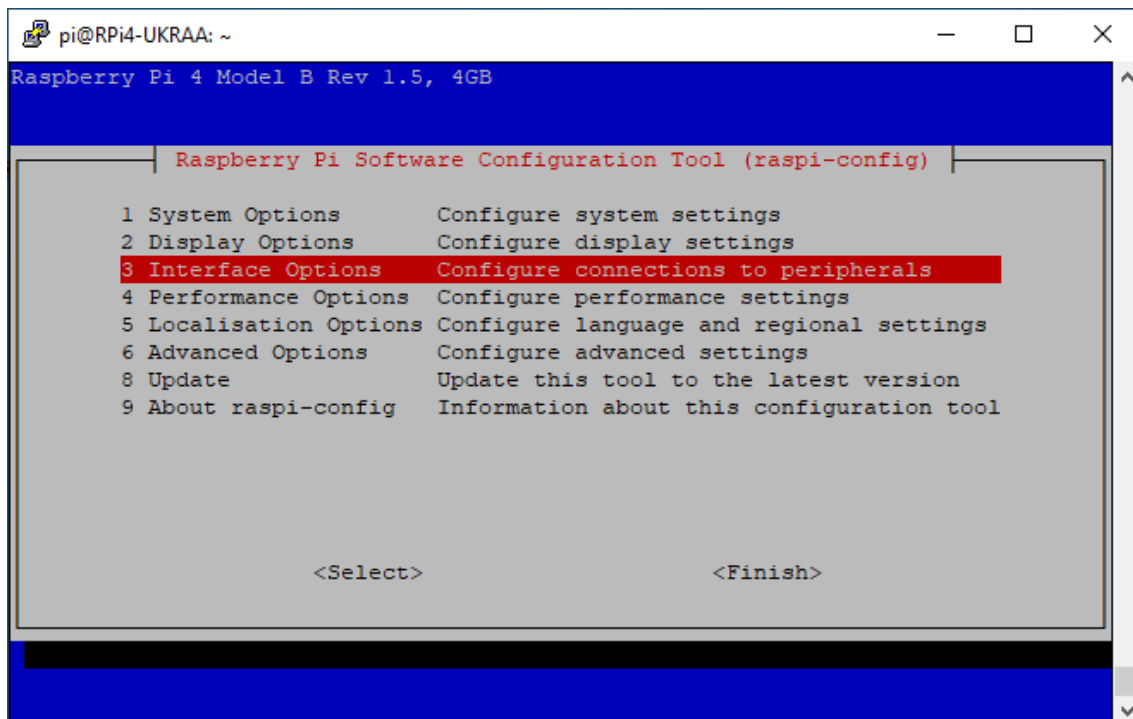
```
pi@RPi4-UKRAA: ~  
'/boot/initrd.img-6.6.62+rpt-rpi-v8' -> '/boot/firmware/initramfs8'  
update-initramfs: Generating /boot/initrd.img-6.6.62+rpt-rpi-2712  
'/boot/initrd.img-6.6.62+rpt-rpi-2712' -> '/boot/firmware/initramfs_2712'  
pi@RPi4-UKRAA:~$ sudo apt update  
Hit:1 http://deb.debian.org/debian bookworm InRelease  
Hit:2 http://deb.debian.org/debian-security bookworm-security InRelease  
Hit:3 http://deb.debian.org/debian bookworm-updates InRelease  
Hit:4 http://archive.raspberrypi.com/debian bookworm InRelease  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
1 package can be upgraded. Run 'apt list --upgradable' to see it.  
pi@RPi4-UKRAA:~$ sudo apt upgrade  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
Calculating upgrade... Done  
The following package was automatically installed and is no longer required:  
  libwlrroots12  
Use 'sudo apt autoremove' to remove it.  
The following packages have been kept back:  
  raspberrypi-ui-mods  
0 upgraded, 0 newly installed, 0 to remove and 1 not upgraded.  
pi@RPi4-UKRAA:~$ sudo apt autoremove
```

- We can now set up VNC to access the RPi from our desktop PC. Type the command below and press **enter**. We will be presented with the RPi configuration tool.

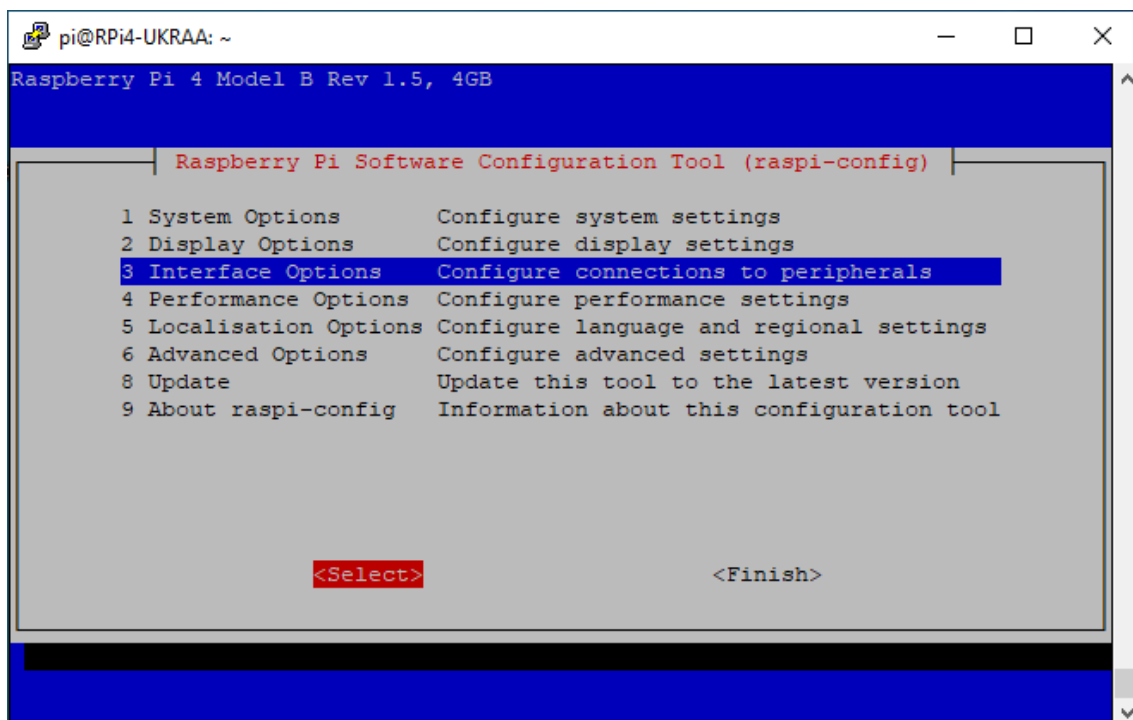
sudo raspi-config

```
pi@RPi4-PicoMuon: ~  
Wi-Fi is currently blocked by rfkill.  
Use raspi-config to set the country before use.  
pi@RPi4-PicoMuon:~$ sudo apt update  
Hit:1 http://archive.raspberrypi.com/debian bookworm InRelease  
Hit:2 http://deb.debian.org/debian bookworm InRelease  
Hit:3 http://deb.debian.org/debian-security bookworm-security InRelease  
Hit:4 http://deb.debian.org/debian bookworm-updates InRelease  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
All packages are up to date.  
pi@RPi4-PicoMuon:~$ sudo apt upgrade  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
Calculating upgrade... Done  
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.  
pi@RPi4-PicoMuon:~$ sudo apt autoremove  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.  
pi@RPi4-PicoMuon:~$ sudo raspi-config
```

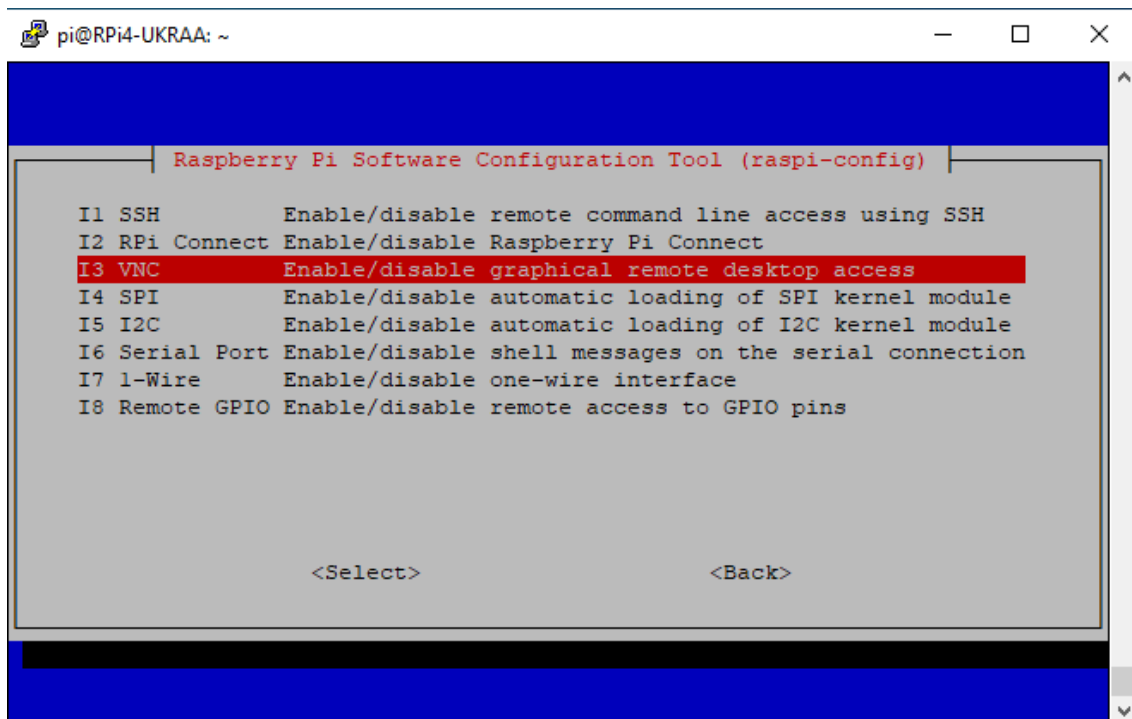
8. Select **3 Interface Options**



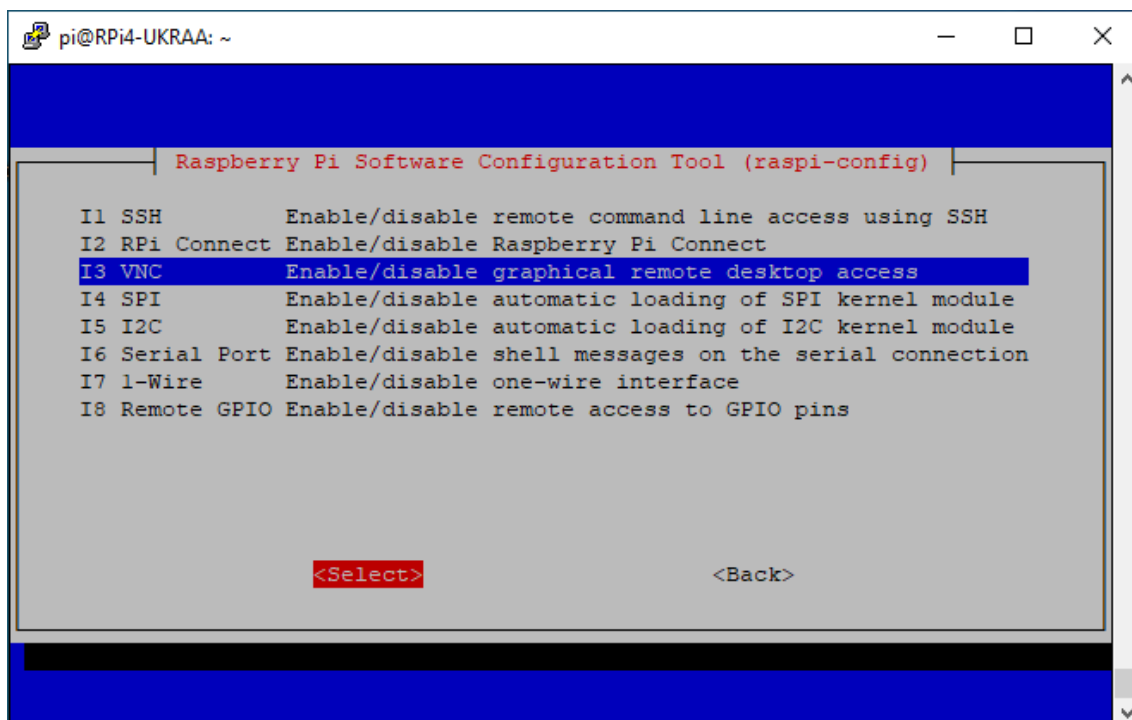
9. Navigate to **Select** and press **enter**.



10. Now navigate down to **I3 VNC** and selecting **Select** and press **enter**.



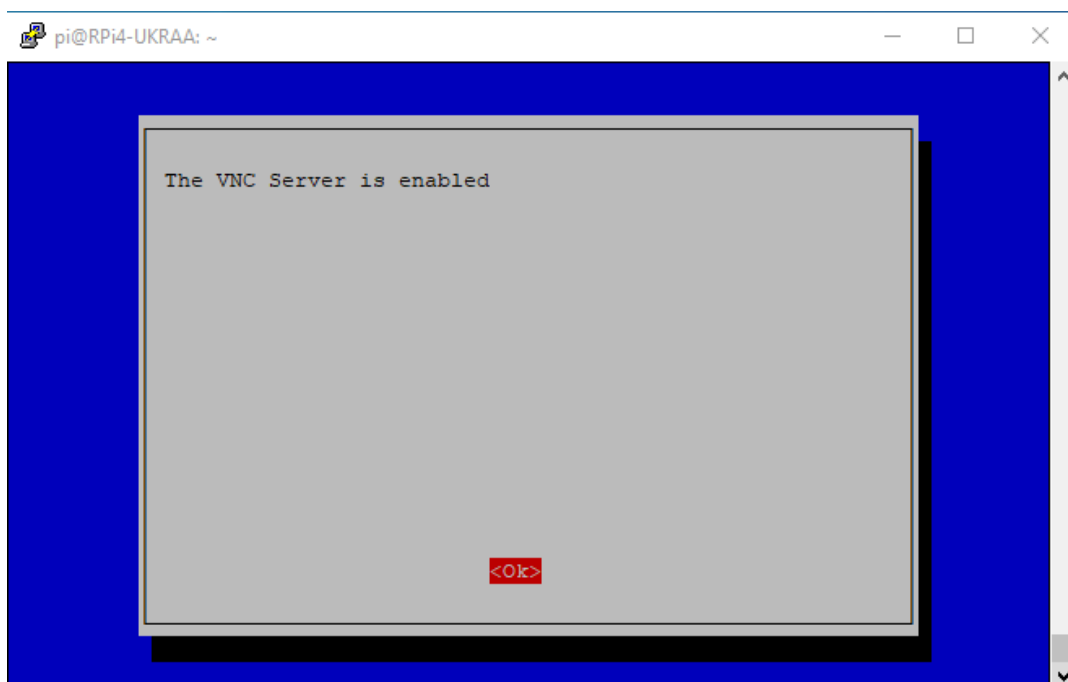
11. Navigate to **Select** and press **enter**.



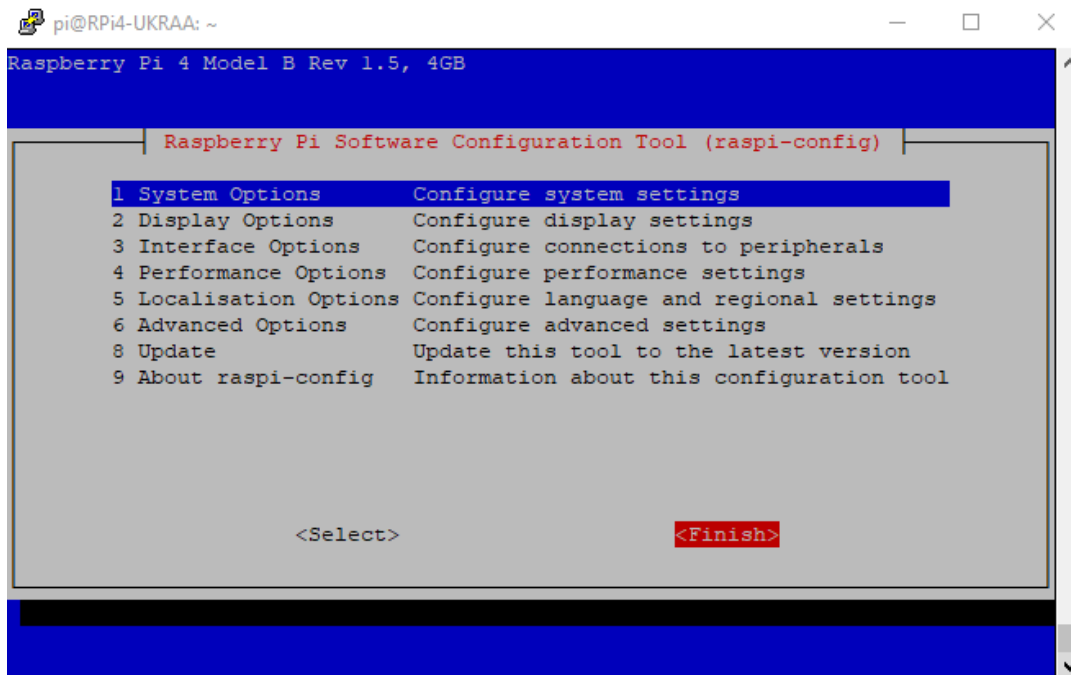
10. Select **Yes** and press **enter** to enable the VNC Server.



11. VNC server will now be enabled, press **enter**.



12. Finish with the Configuration Tool by selecting **Finish** and press **enter**.



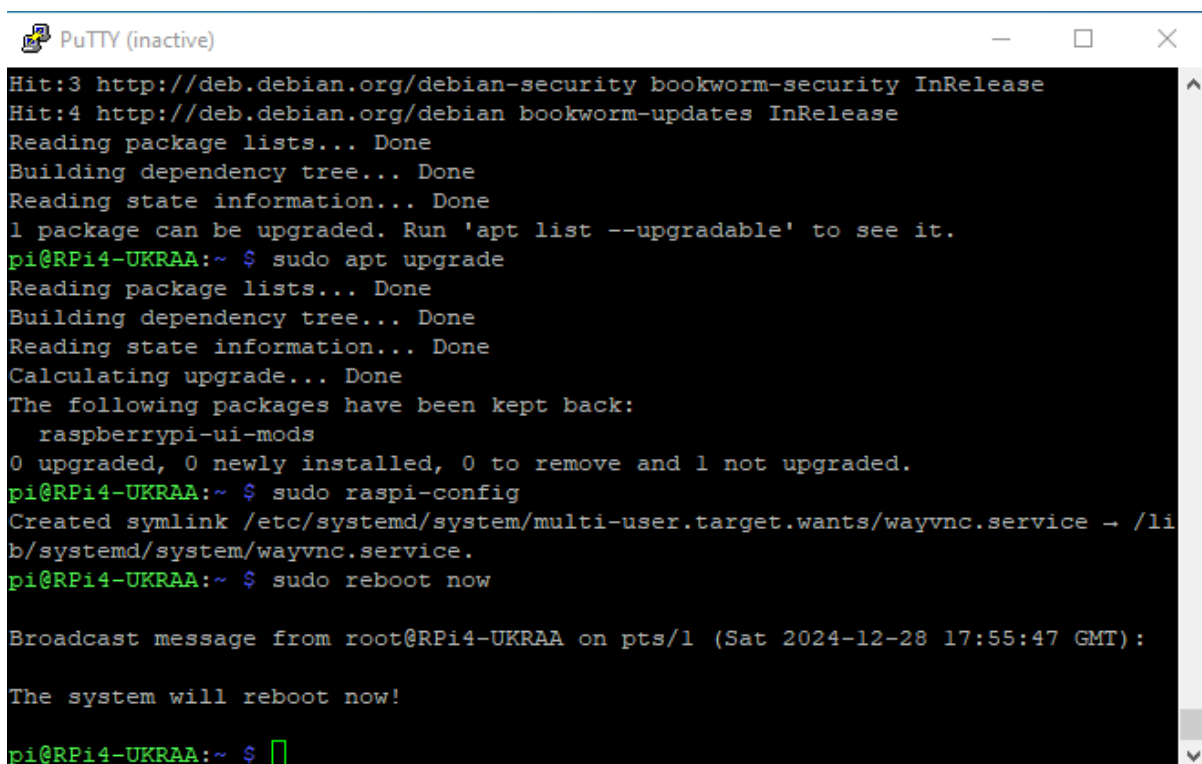
The screenshot shows the Raspberry Pi Software Configuration Tool (raspi-config) interface. The title bar indicates the user is 'pi@RPi4-UKRAA: ~'. The main window has a blue header with 'Raspberry Pi 4 Model B Rev 1.5, 4GB'. Below this, a red title bar reads 'Raspberry Pi Software Configuration Tool (raspi-config)'. The main area is a list of options:

1 System Options	Configure system settings
2 Display Options	Configure display settings
3 Interface Options	Configure connections to peripherals
4 Performance Options	Configure performance settings
5 Localisation Options	Configure language and regional settings
6 Advanced Options	Configure advanced settings
8 Update	Update this tool to the latest version
9 About raspi-config	Information about this configuration tool

At the bottom, there are two buttons: '<Select>' and '<Finish>'. The '<Finish>' button is highlighted in red.

13. Reboot the RPi, type the command below and press **enter**. This will close the PuTTY connection. You can close the Putty window.

sudo reboot



The screenshot shows a PuTTY terminal window titled 'PuTTY (inactive)'. The terminal output is as follows:

```
Hit:3 http://deb.debian.org/debian-security bookworm-security InRelease
Hit:4 http://deb.debian.org/debian bookworm-updates InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
1 package can be upgraded. Run 'apt list --upgradable' to see it.
pi@RPi4-UKRAA:~ $ sudo apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following packages have been kept back:
  raspberrypi-ui-mods
0 upgraded, 0 newly installed, 0 to remove and 1 not upgraded.
pi@RPi4-UKRAA:~ $ sudo raspi-config
Created symlink /etc/systemd/system/multi-user.target.wants/wayvnc.service → /lib/systemd/system/wayvnc.service.
pi@RPi4-UKRAA:~ $ sudo reboot now

Broadcast message from root@RPi4-UKRAA on pts/1 (Sat 2024-12-28 17:55:47 GMT):

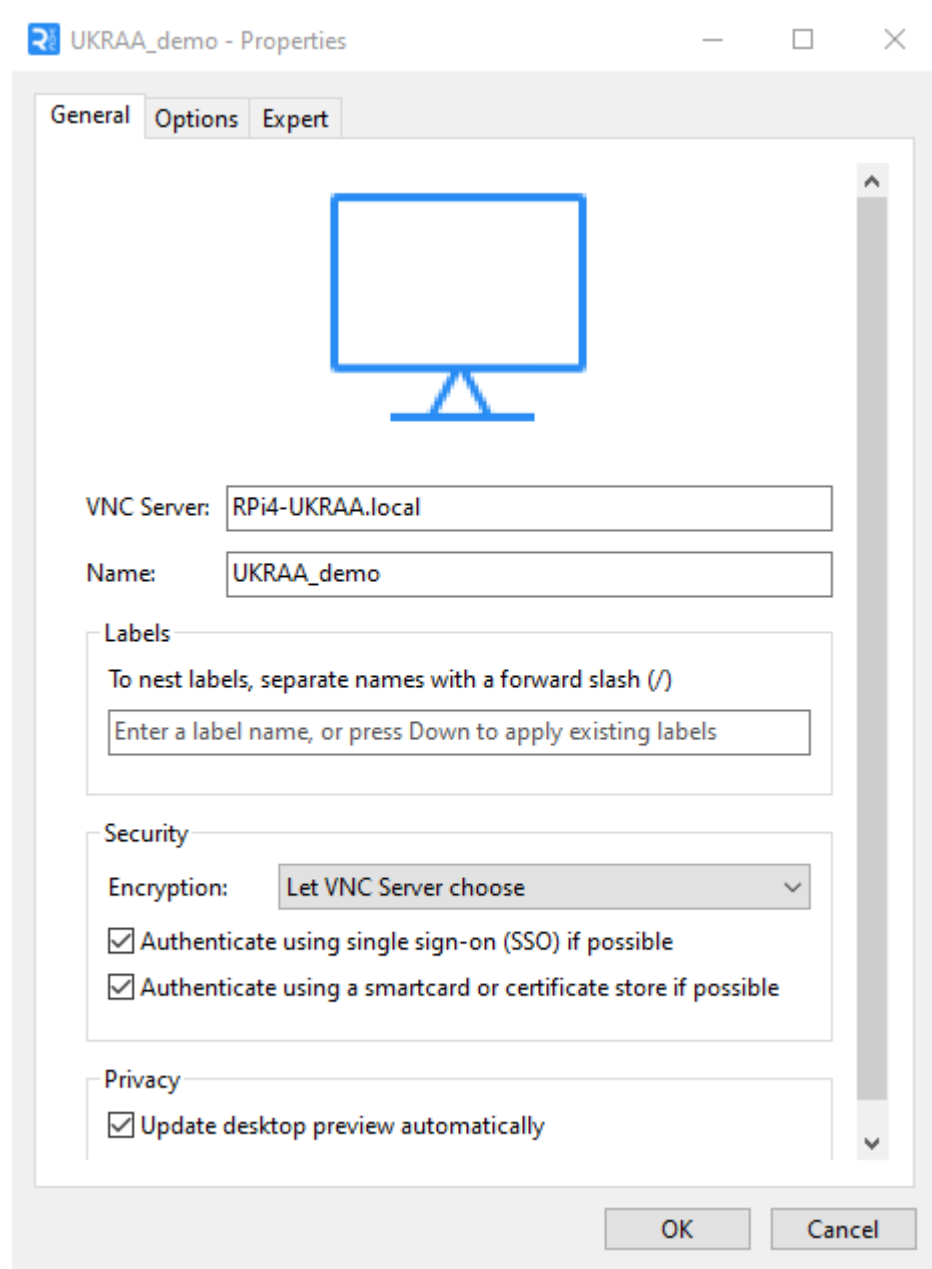
The system will reboot now!

pi@RPi4-UKRAA:~ $
```

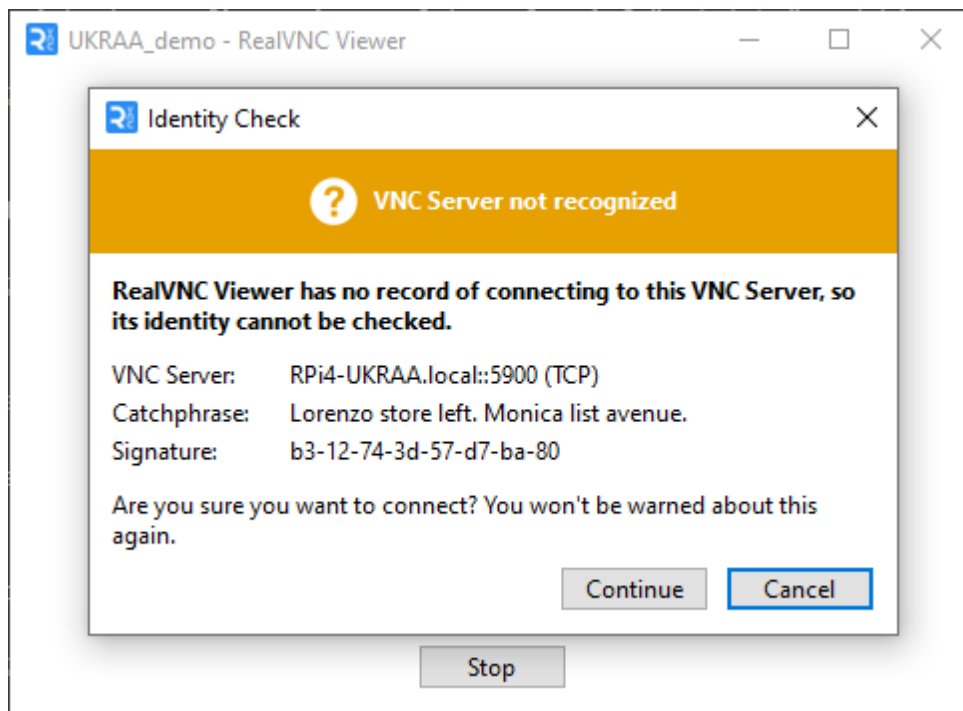
Headless access to RPi via VNC

Using a VNC program like RealVNC (<https://www.realvnc.com/en/>), connect to your RPi using your desktop PC...

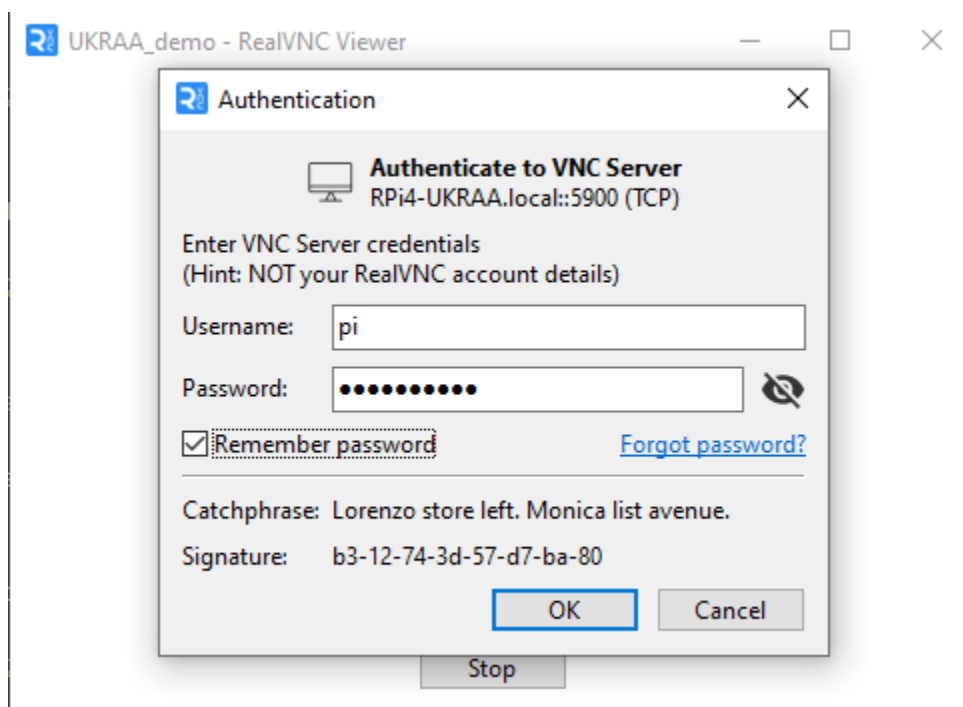
1. Create a **New connections** (CTRL-N) and enter the hostname into the **VNC Server:** box, add friendly name in the **Name** box and select **OK**.



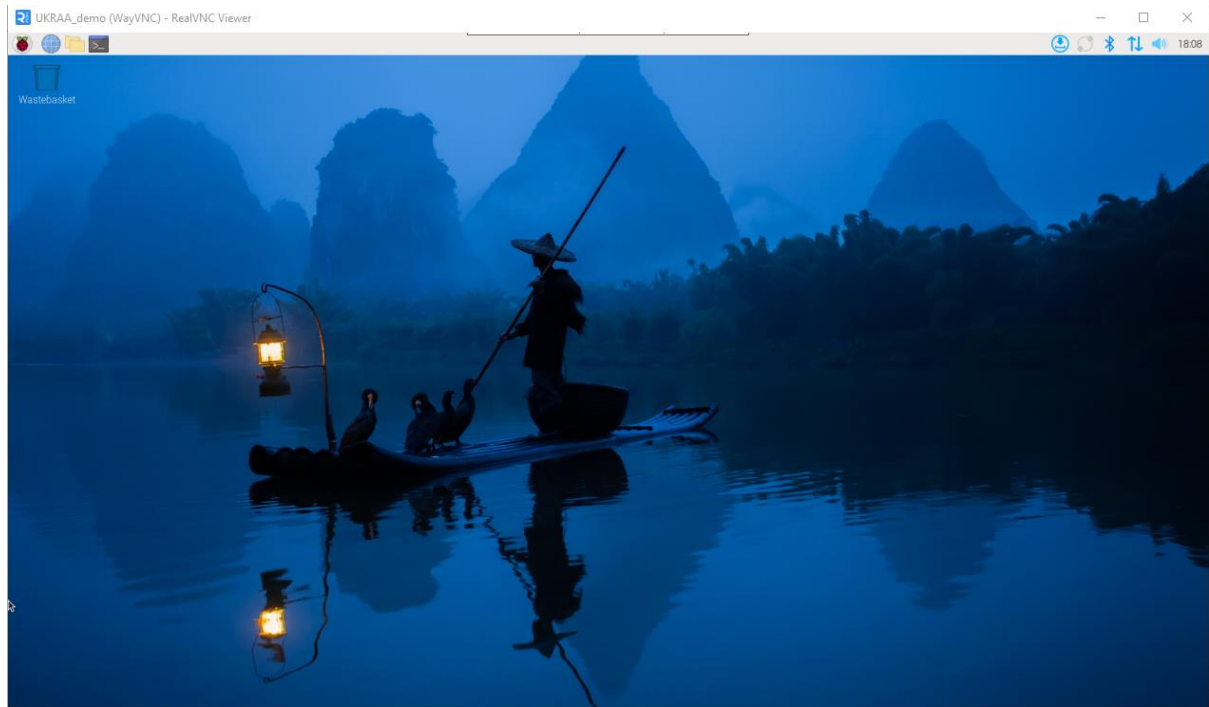
2. Open this VNC connection to your RPi; you will get a **VNC server not recognised** window from RealVNC. Select **Continue**



3. You will now get an **Authentication** window from RealVNC, enter your **Username** and **Password** details and select **Remember password** to make it easier to login in future.



4. You are now remotely accessing your RPi from your desktop PC...



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