

# MODULE 1: PROVISIONING THE RASPBERRY PI FOR USE

RING & RUN STEM EVENT.



**ORION**  
OPEN ARCHITECTURE RESILIENT IOT  
FOR OPERATIONAL NETWORKS

# Module 1: Provisioning the Raspberry Pi for Use

- Write the operating system image: Raspberry Pi OS
  1. Configure services
    - [Secure Shell \(SSH\)](#)
      - raspi-config
        - [I2C](#)
        - [Virtual Network Computing \(VNC\)](#)
  2. Linux Primer
    - Short “Linux” command tutorial
      - Take some time to get familiar interacting with Raspberry Pi

# Install and Configure the Operating System (OS) and Services

## 1. Download and Install Raspberry Pi Imager on Laptop

- Select “Download for Windows”
  - <https://www.raspberrypi.com/software/>

Download for Windows

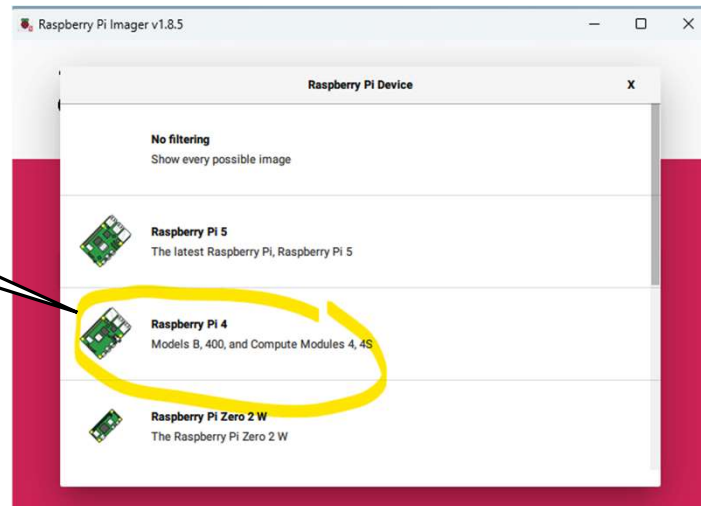
## 2. Insert micro-SD card into laptop USB card reader and run the imager tool. See screen shots below

**Note: the SD card will only one direction (don't force it)**

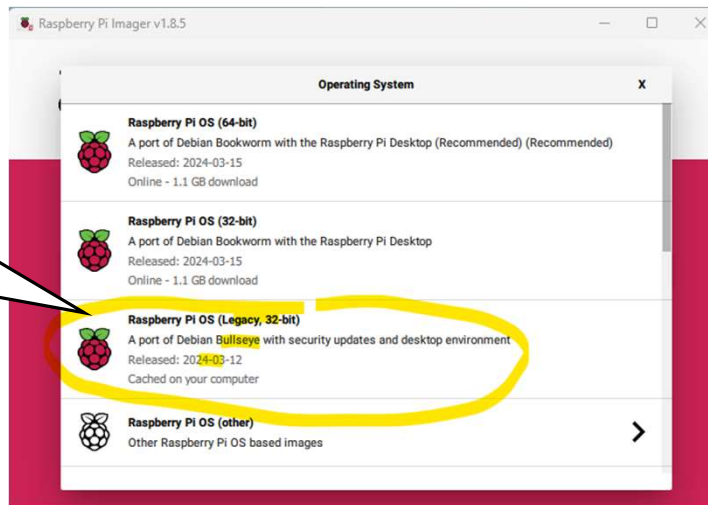


# Select and Write the Operating System (OS) Image to the SD card

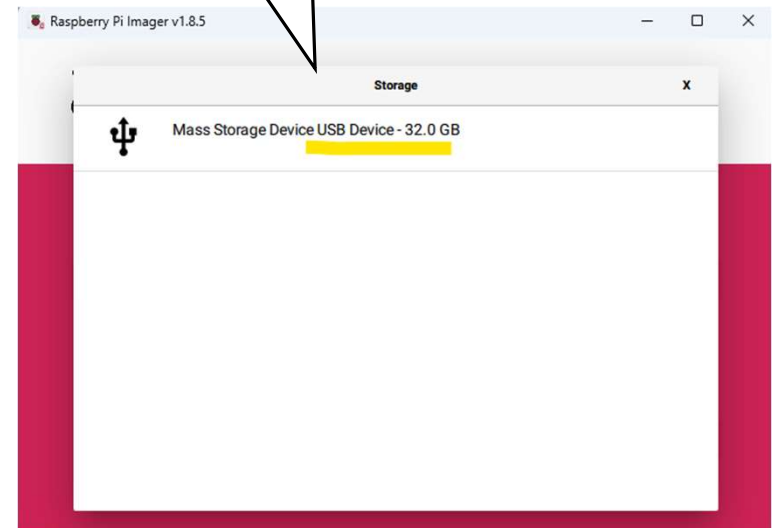
1. **Raspberry Pi device:** select your version (**Pi 4B**)



2. **Choose OS:** Select Pi OS (**32 bit (Bullseye)**) with desktop env.

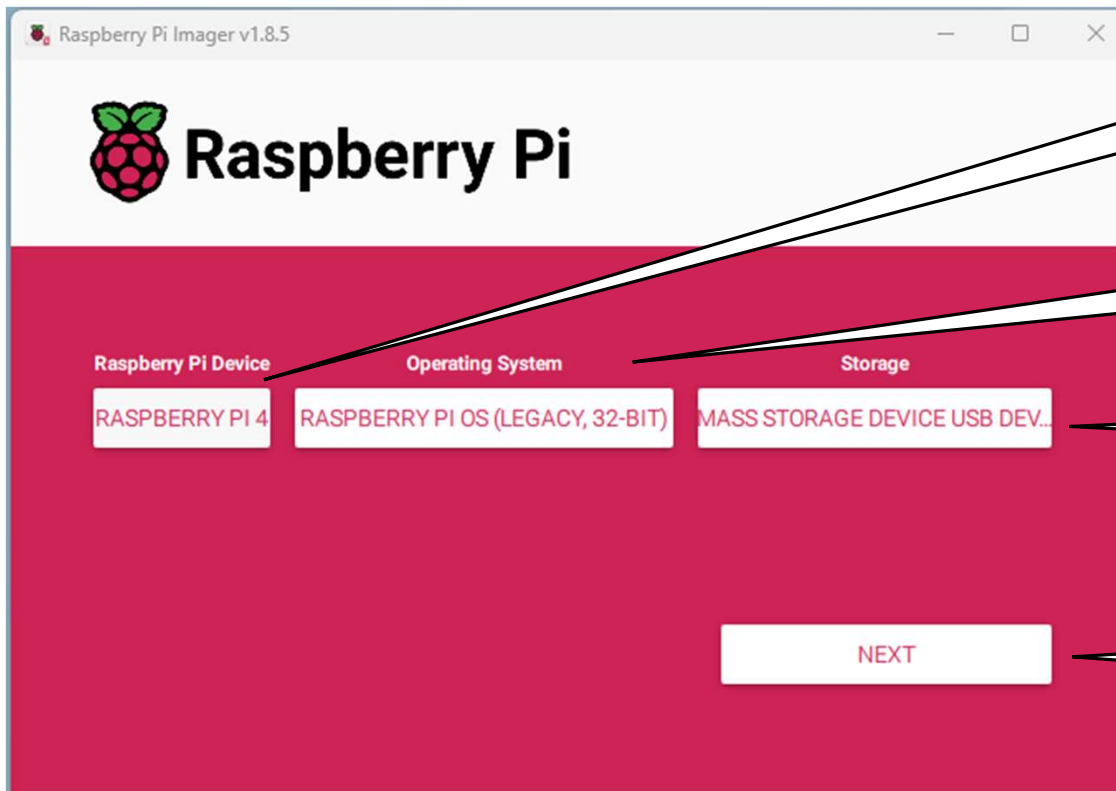


3. **Storage location:** Select the micro-SD card from USB reader





# Before you proceed, Make sure....



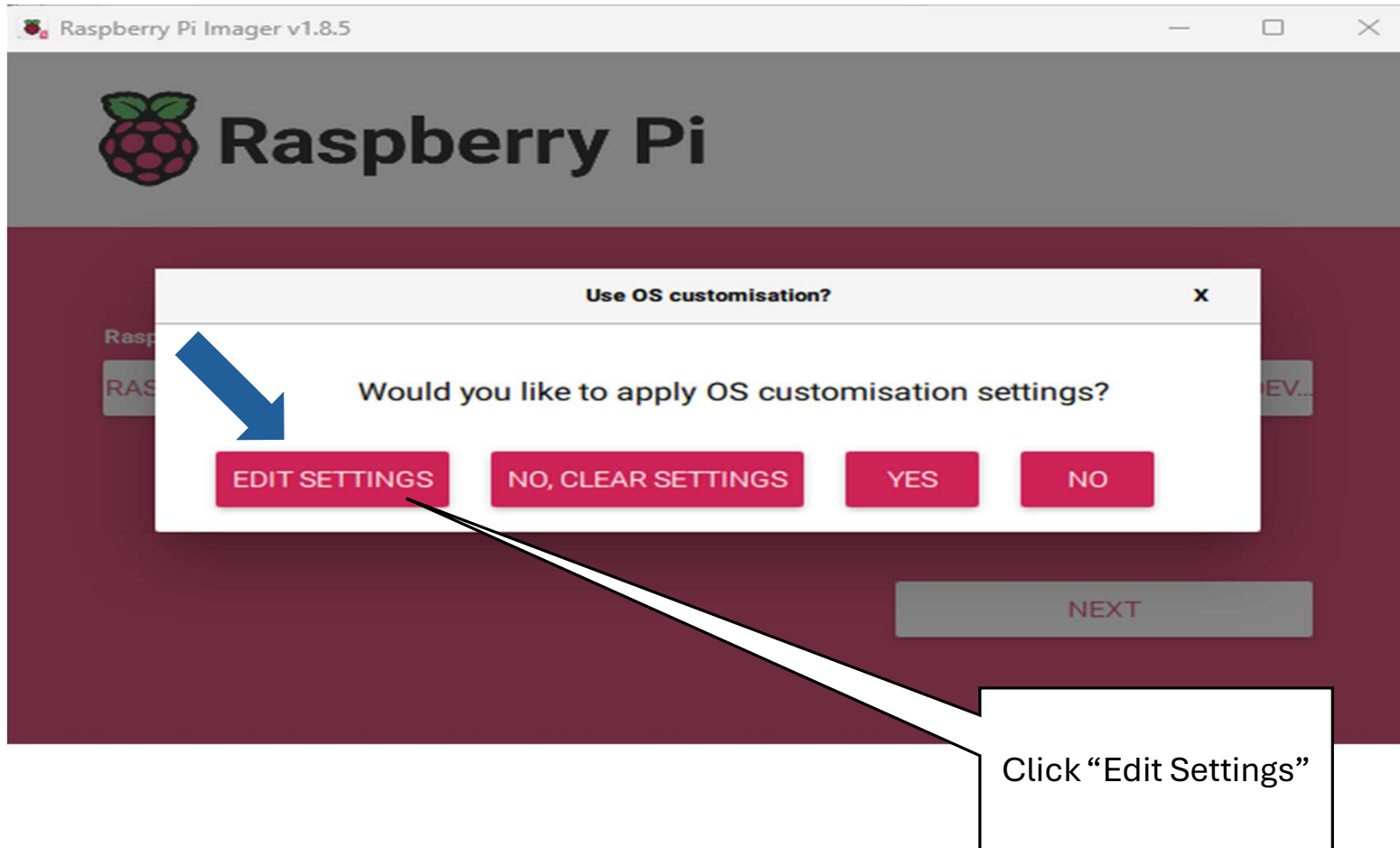
1. Raspberry Pi 4 is selected

2. 32-bit Legacy OS w/ desktop environment

3. Make sure the micro-SD card is selected as the storage

\* Only when 1,2, and 3 are verified, click "next"

# Customize the Settings:





These settings must be as specified, or your Pi will not be properly configured for the project

Click "Save"

OS Customisation

GENERAL SERVICES OPTIONS

☒ Set hostname: viper .local

☒ Set username and password

Username: pi

Password: ●●●●●●●●

☒ Configure wireless LAN

SSID: ringandrunk

Password: ●●●●●●●●●●

☐ Show password ☐ Hidden SSID

Wireless LAN country: US

☒ Set locale settings

Time zone: America/New\_York

Keyboard layout: US

SAVE

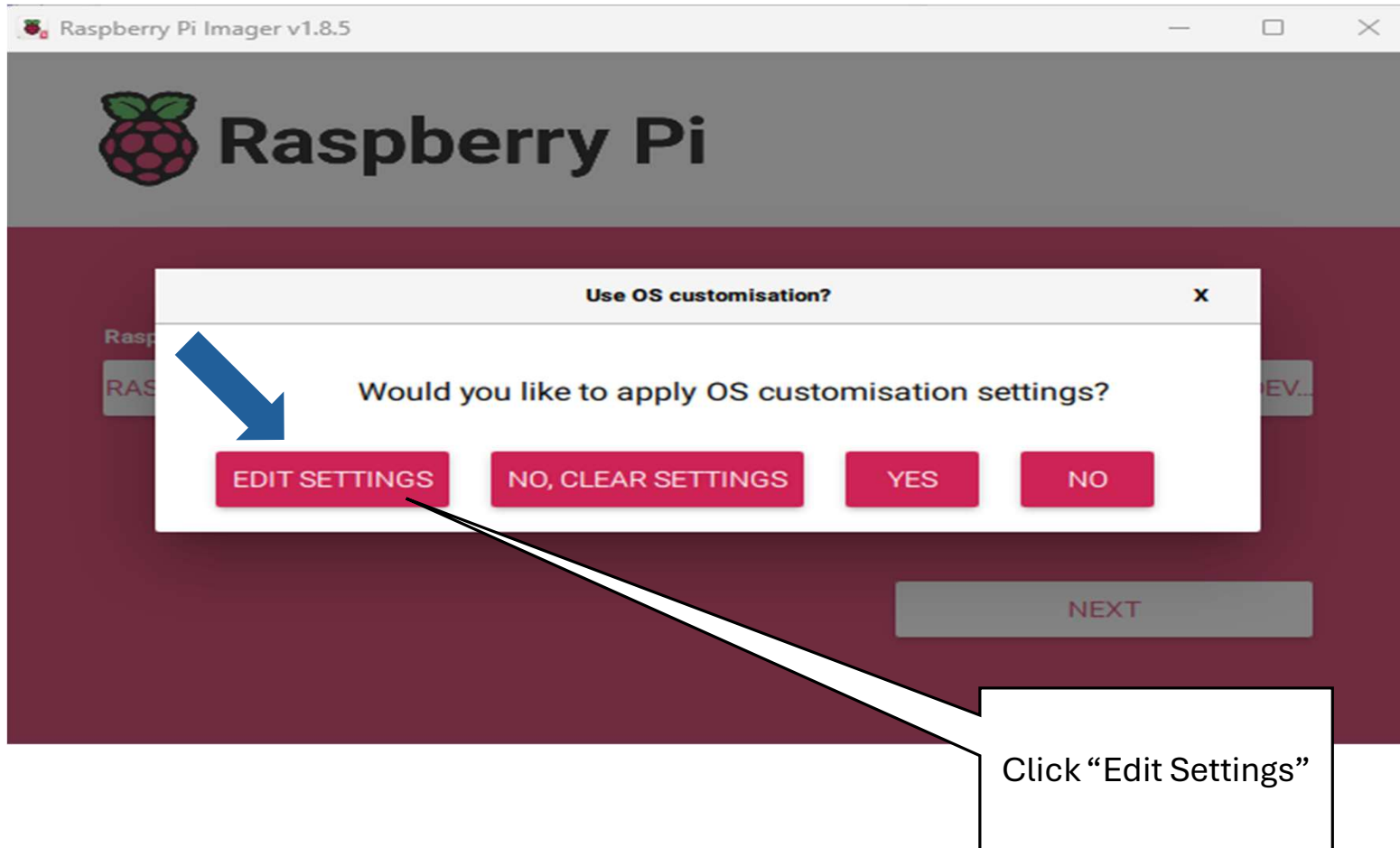
Specify the hostname. Use your Team name

Set the username to "pi" and the Password to "team chooses" (***make it simple to remember***)

Configure the WIFI settings to use the Guest network.

Select the country to 'US' and set the locale settings as illustrated

# Customize the Settings:





# Enable Secure Shell

1. Click “Services”  
Tab

2. Choose password  
authentication

3. Save settings

The screenshot shows the 'OS Customisation' window with three tabs: 'GENERAL', 'SERVICES', and 'OPTIONS'. The 'SERVICES' tab is active. Under the 'Enable SSH' section, the 'Use password authentication' radio button is selected. Below it, the 'Allow public-key authentication only' option is unselected, with a sub-label 'Set authorized\_keys for 'pi':' and a text input field. A 'RUN SSH-KEYGEN' button is located below the input field. At the bottom right of the window is a red 'SAVE' button. Arrows from the numbered instructions point to the 'SERVICES' tab, the 'Use password authentication' radio button, and the 'SAVE' button respectively.

OS Customisation

GENERAL SERVICES OPTIONS

☒ Enable SSH

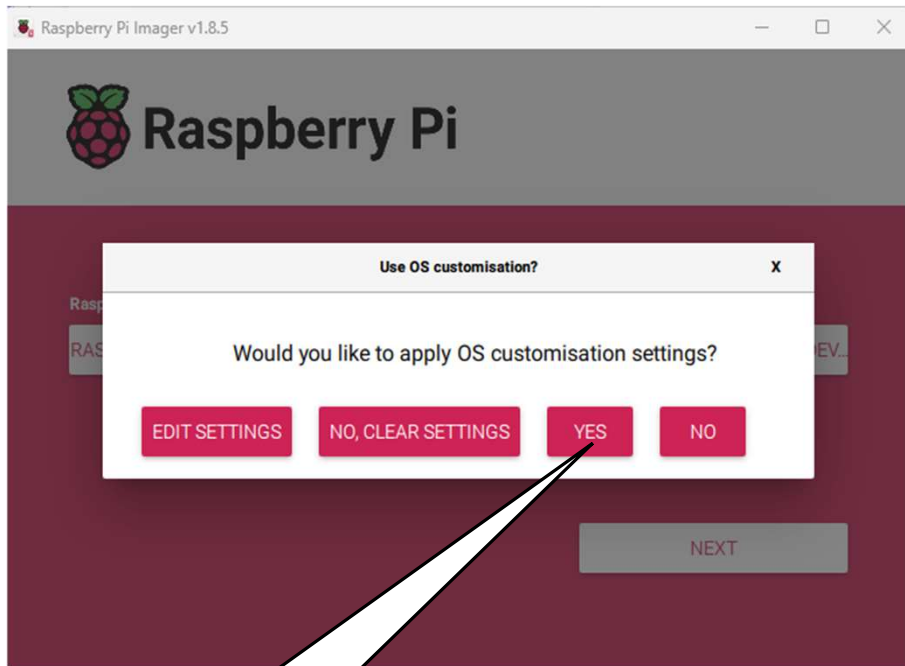
☒ Use password authentication

☐ Allow public-key authentication only  
Set authorized\_keys for 'pi':

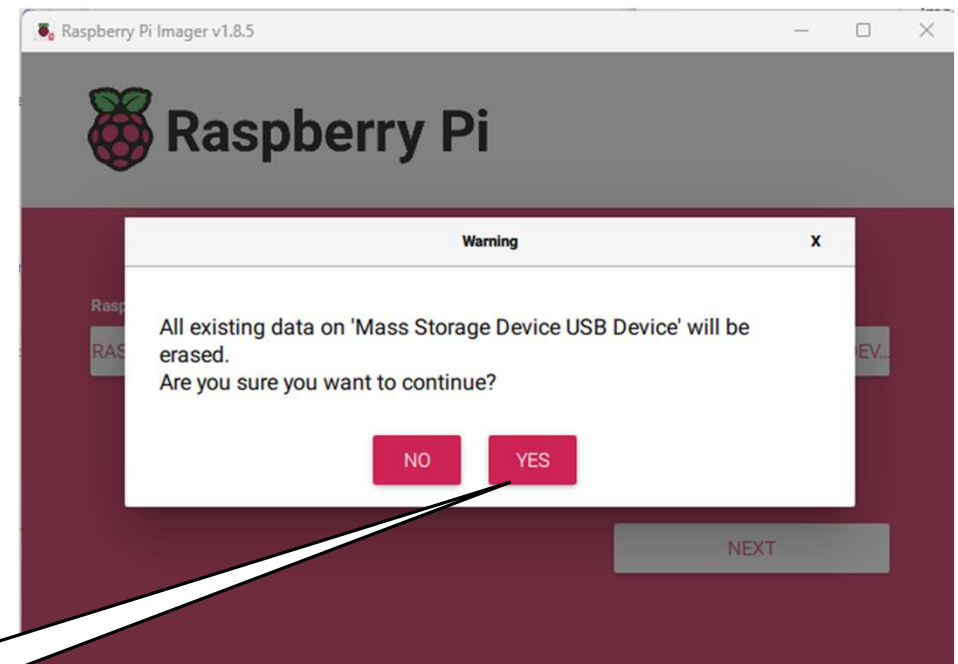
RUN SSH-KEYGEN

SAVE

# Write the System Image

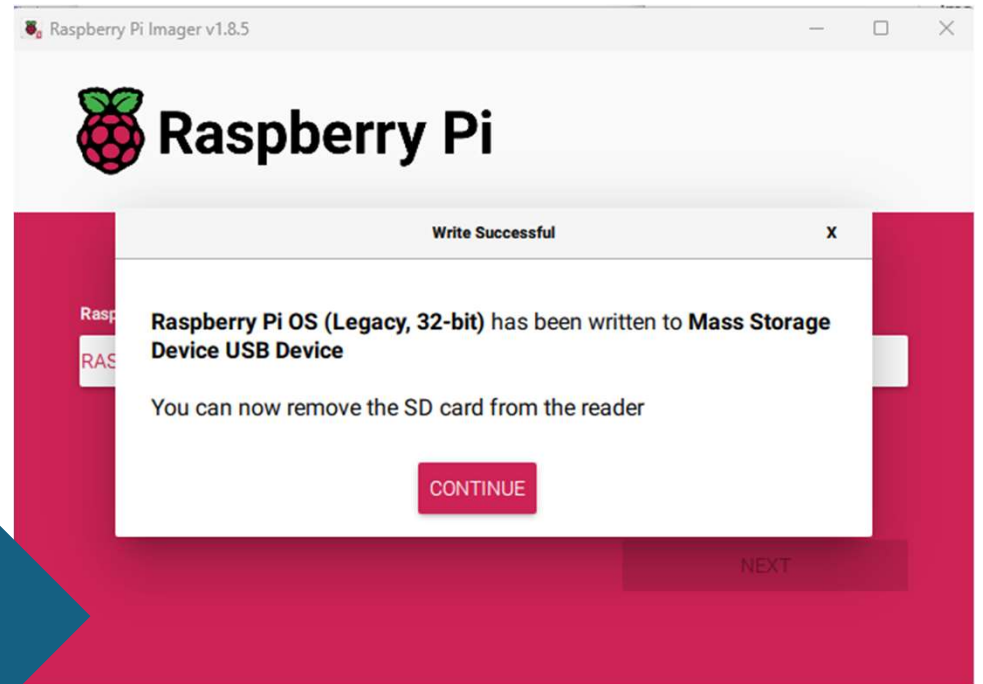
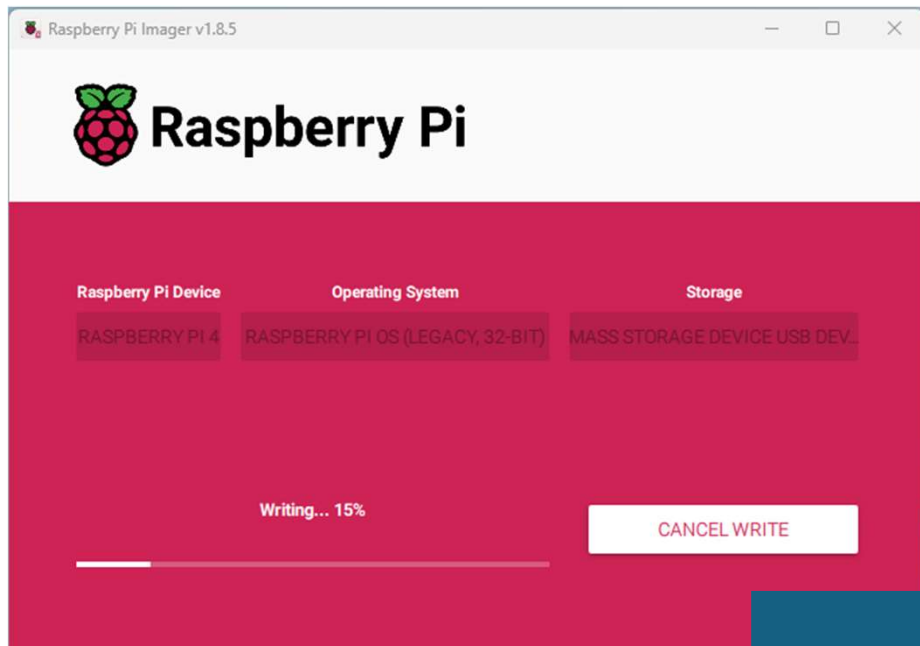


1. Click "Yes"



2. Click "Yes" to  
write the operating  
system image

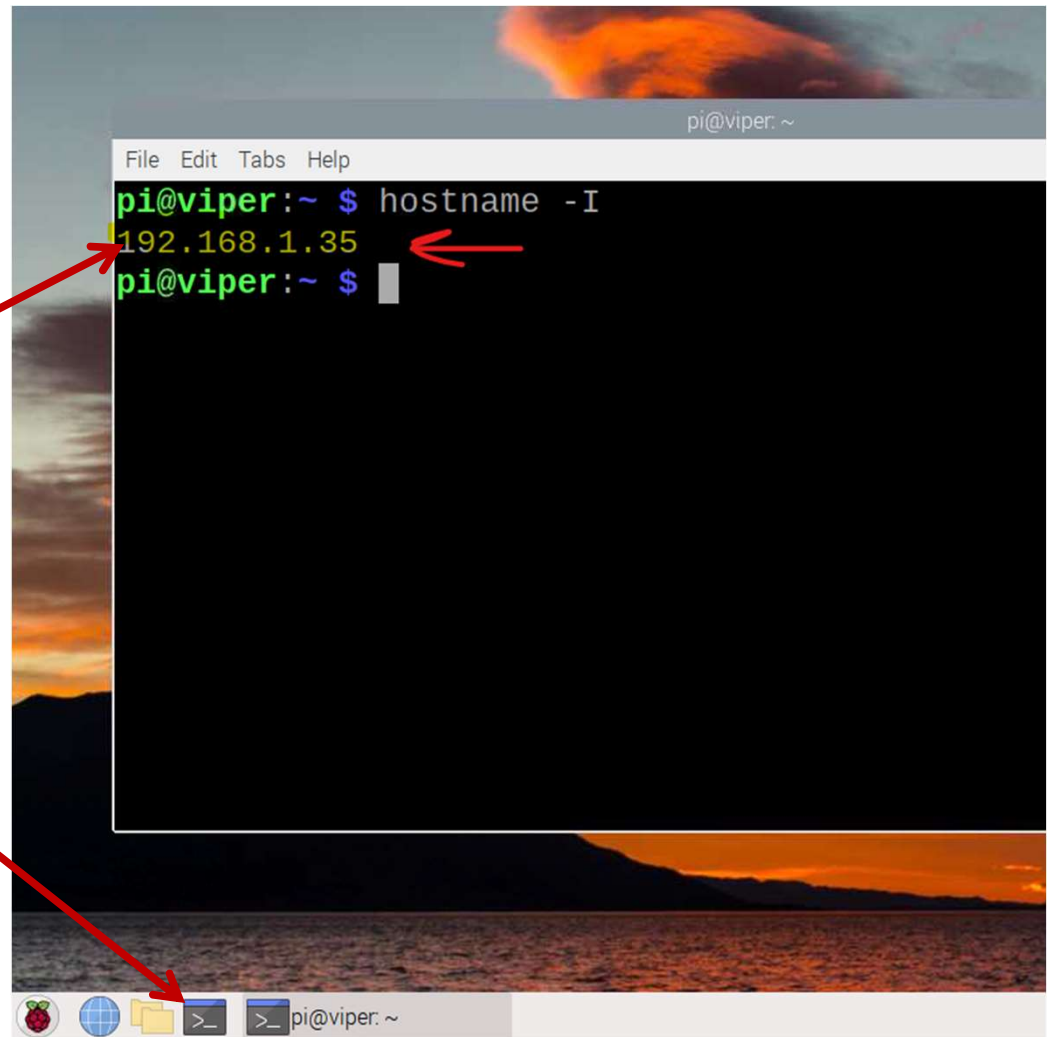
# Wait for the OS image to be written to the SD-card



1. Insert SD card into Raspberry Pi
2. Power on the Raspberry Pi

# Boot the Raspberry Pi

- With the keyboard and 7" LCD display plugged in
  - Insert the SD-card into the Raspberry Pi (**do not force it**) and power it on.
    - Open a terminal console and enter the command:  
*hostname -I*
- Record the IP-Address for use throughout the project



# Start an SSH session with the Raspberry Pi

1. Open a new terminal window
2. Type command: `ssh pi@ip-address`

Type command: `yes`

Congratulations. You have a new (remote) connection to the Raspberry Pi

```
pi@viper: ~
Microsoft Windows [Version 10.0.22631.3810]
(c) Microsoft Corporation. All rights reserved.

C:\Users\mmwcor>ssh pi@viper.local
The authenticity of host 'viper.local (fe80::951e:af60:78c9:e651%6)' can't be established.
ED25519 key fingerprint is SHA256:BDPrDW/SZGDhL7Qy809yFYS9HZ8Uu0/KjsyoCpstD1g.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'viper.local' (ED25519) to the list of known hosts.
Linux viper 6.1.21-v8+ #1642 SMP PREEMPT Mon Apr 3 17:24:16 BST 2023 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: Mon Mar 11 21:17:30 2024
pi@viper:~$ pwd
/home/pi
pi@viper:~$ ls
Bookshelf Desktop Documents Downloads Music Pictures Public Templates Videos
pi@viper:~$ |
```

# Run the Raspberry Pi configuration tool to configure the services

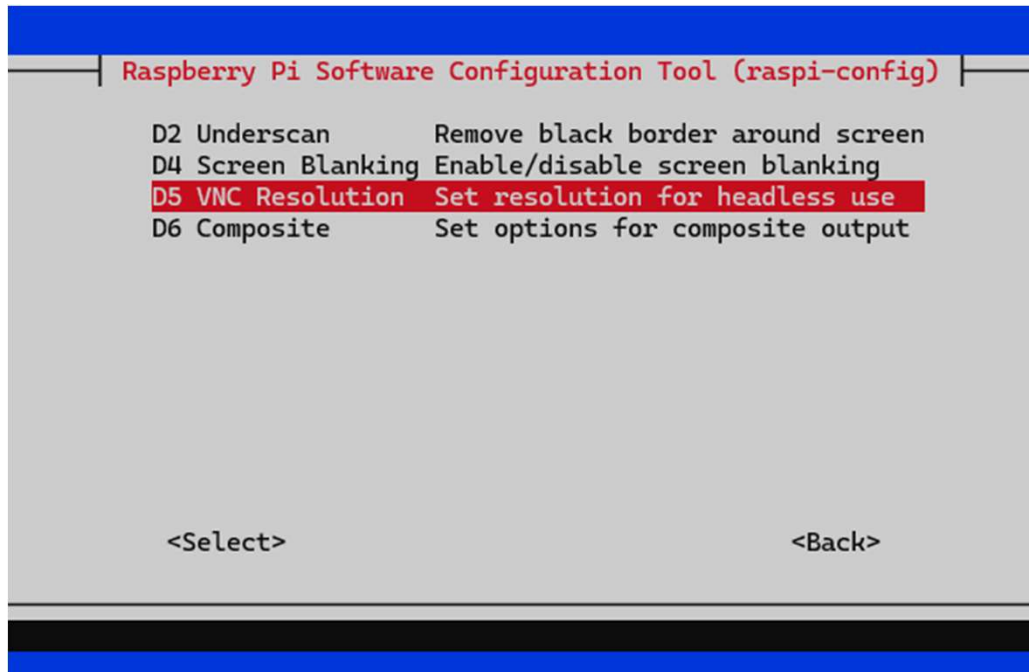
```
pi@viperpi: ~  
pi@viperpi:~ $ sudo raspi-config
```

Type command: *sudo raspi-config*

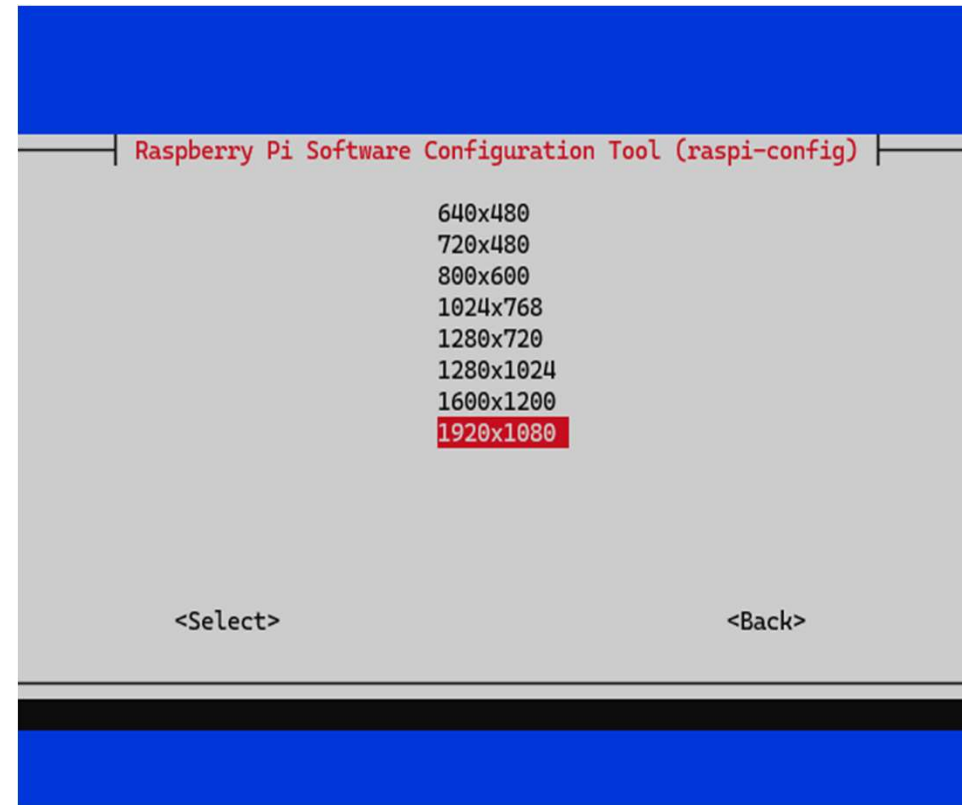
Choose *Display Options*

```
Raspberry Pi 4 Model B Rev 1.4  
  
Raspberry Pi Software Configuration Tool (raspi-config)  
  
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  
  
<Select>              <Finish>
```

# Run the Raspberry Pi configuration tool to configure the services

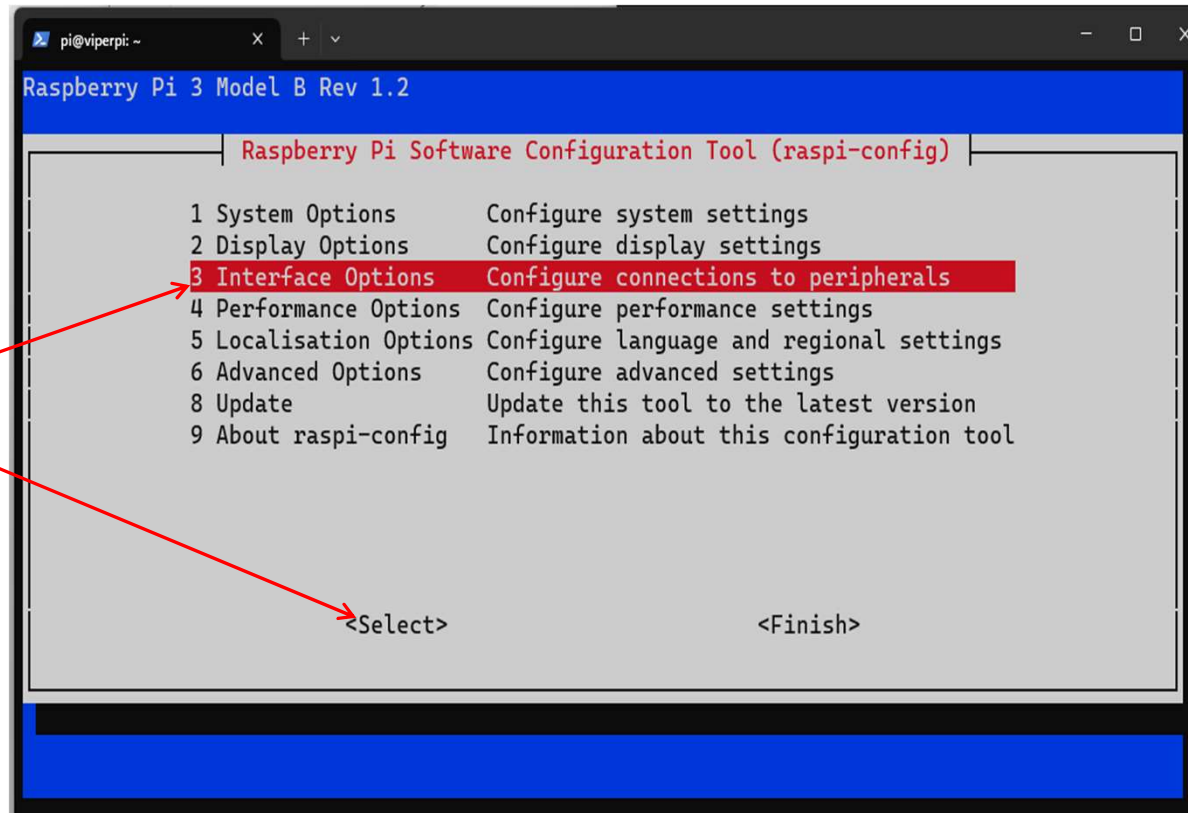


1. Choose VNC resolution for Headless use
2. Chose a high-resolution as shown



# Select “Interface Options”

Select menu item 3:



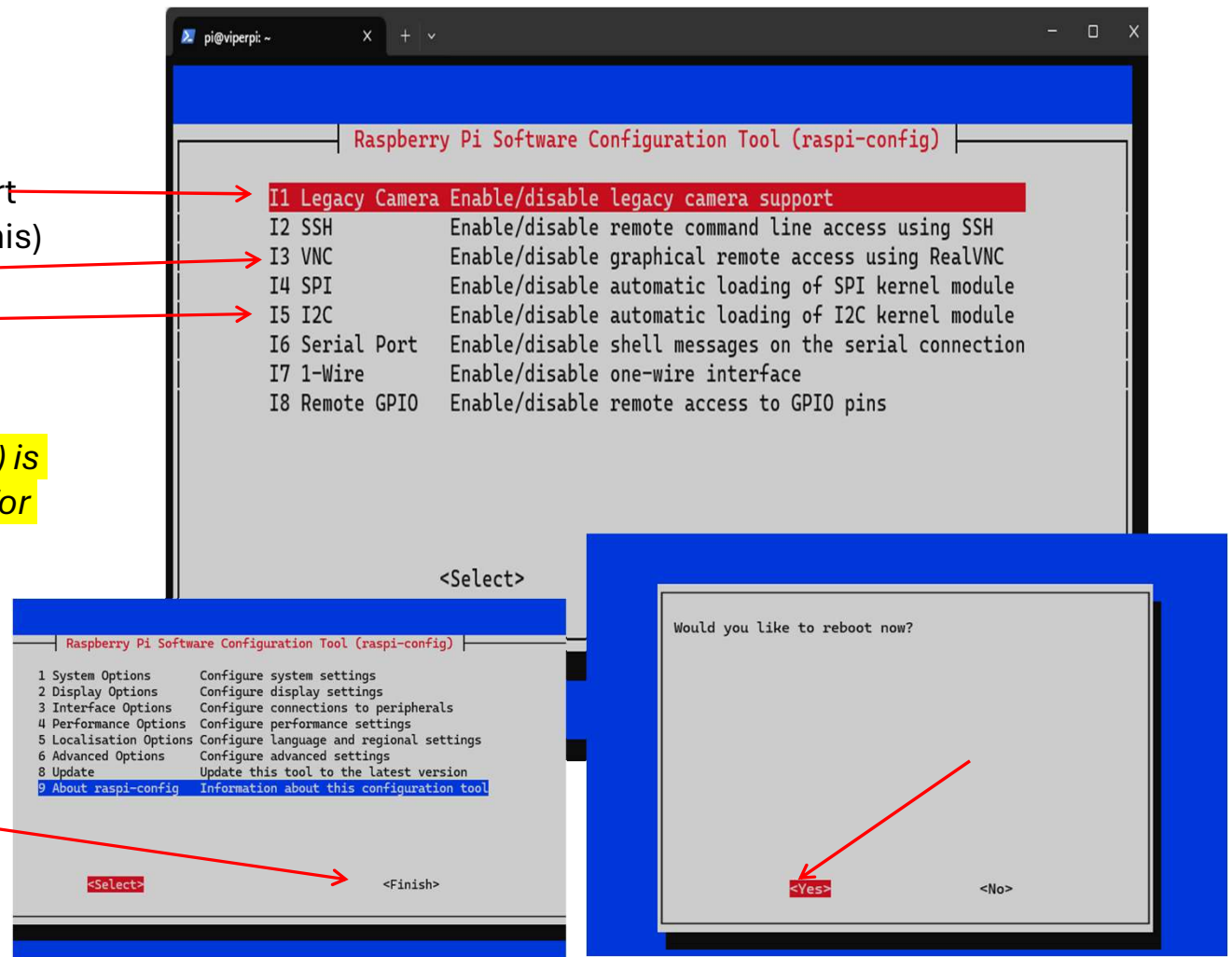


# Enable Required Services...

1. Enable Legacy Camera Support
2. SSH is already enabled (skip this)
3. Enable both VNC
4. Enable I2C

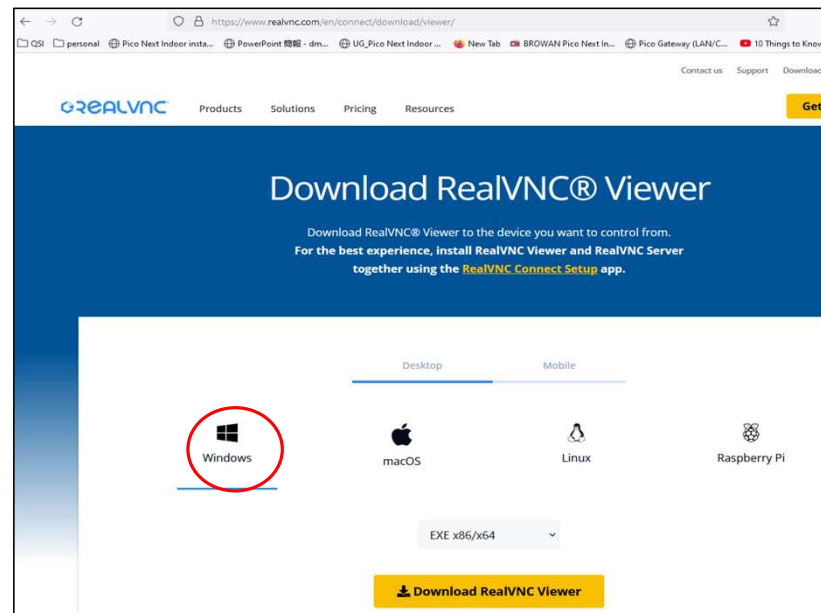
**Note:** *I2C (Inter-Integrated Circuit) is widely used a serial bus protocol for establish serial communication integrated circuits (ICs)*

When 1-4 are complete,  
Select Finish to exit and Reboot



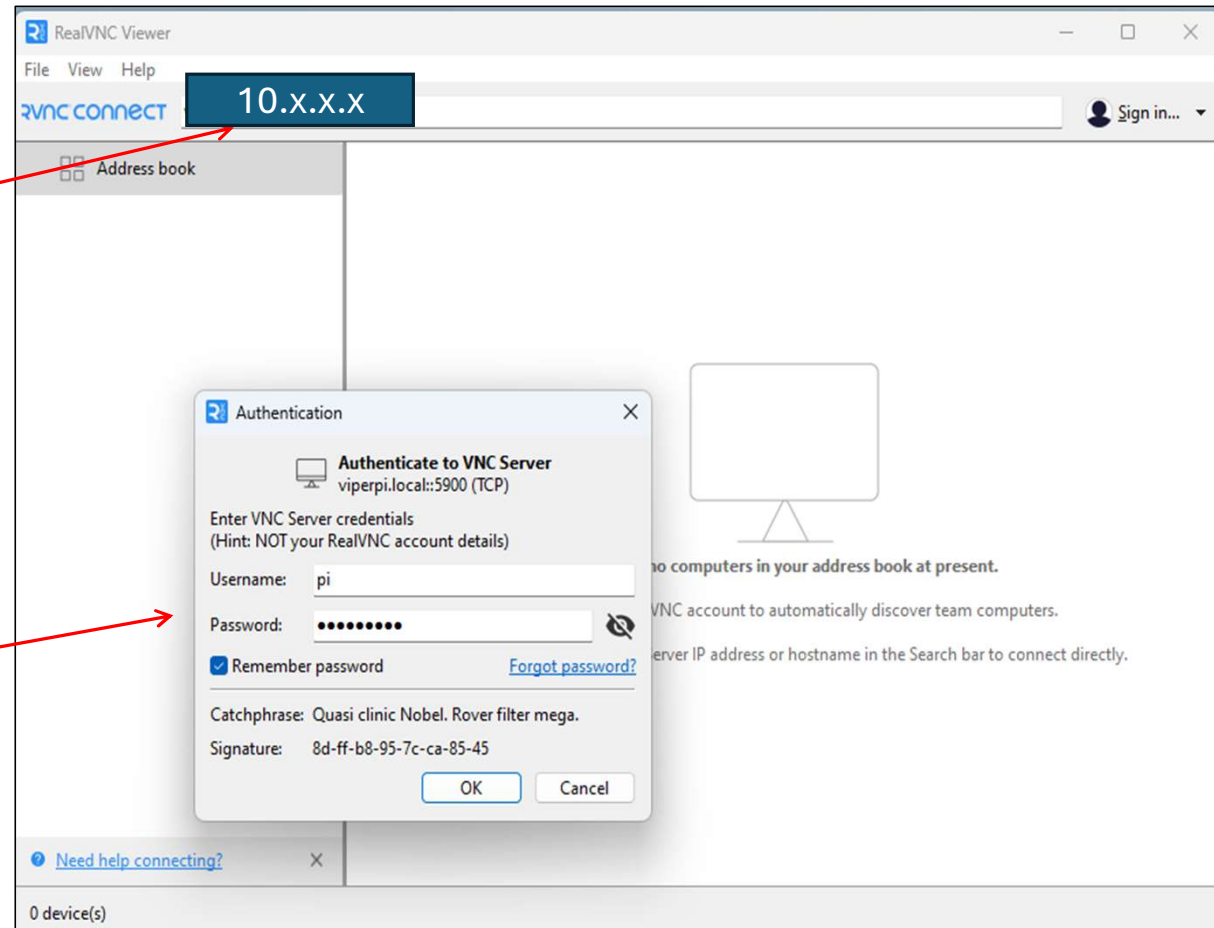
# Setup VNC viewer laptop PC

- VNC stands for ***Virtual Network Computing***. It is a cross-platform screen sharing system that was created to **remotely control/view another computer**
  - Download the VNC viewer application to Windows (host) computer:  
<https://www.realvnc.com/en/connect/download/viewer/>

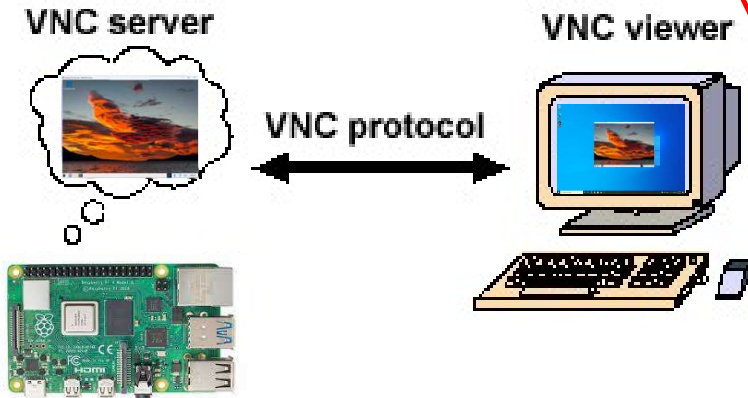


# Establish a VNC session with Raspberry Pi

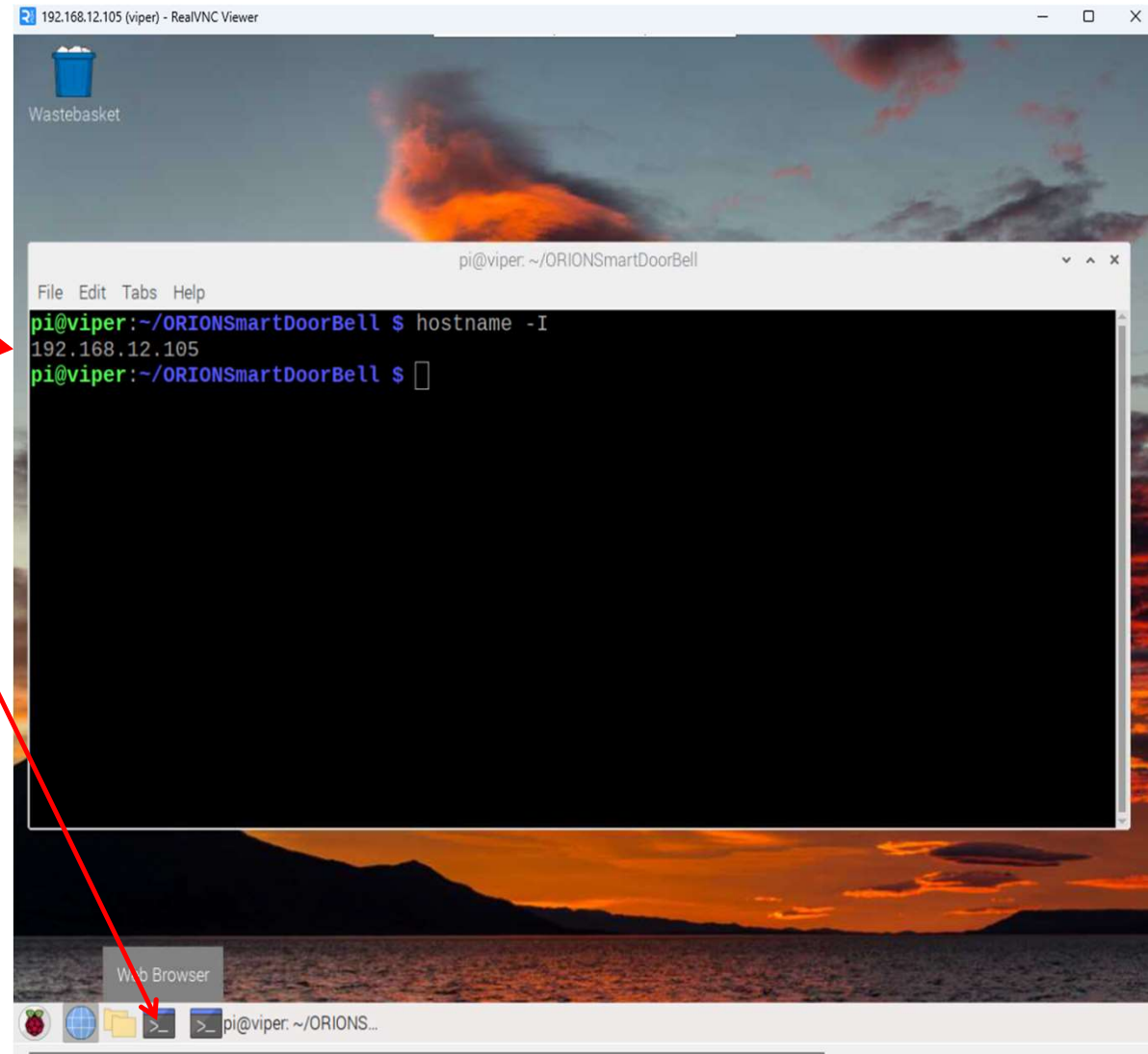
- Open the Real VNC viewer and enter the Raspberry Pi hostname or IP address in the connect box.
  - Enter the IP address (10.x.x.x) for your team's Pi in the Real VNC viewer connect box as shown and press enter
- Supply the username **“pi”**, and the **password your team specified.**



- Remote desktop experience, without the need for a physical monitor and peripherals
  - Open terminal and type command:  
*hostname -I*
- Record (write down) your IP address



Source: <http://web.mit.edu/cdsdev/src/howitworks.html>

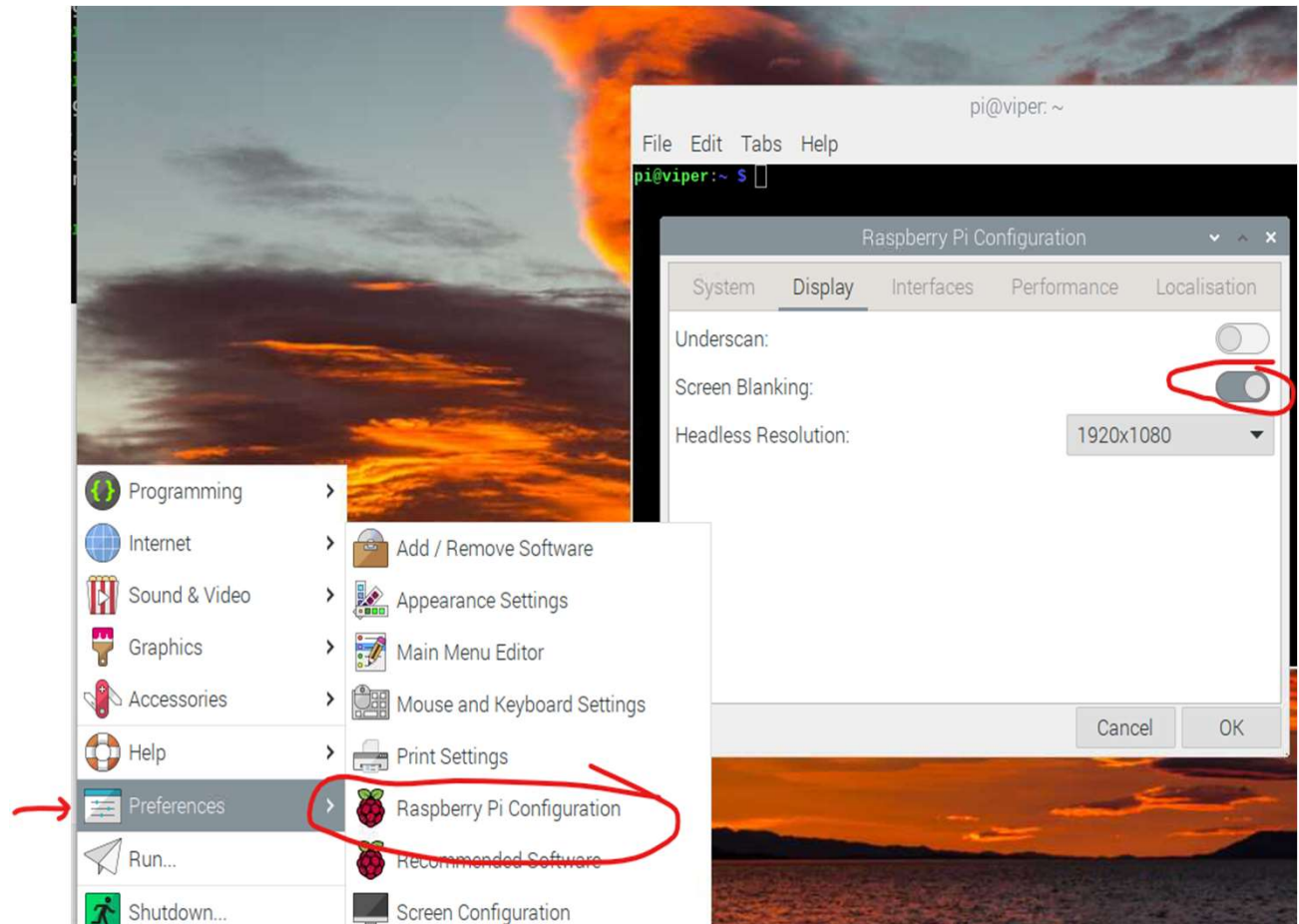


# Complete Configuration...

- **Preferences-> Raspberry Pi Configuration**

- This alternate way (besides raspi-config) to configure your Raspberry Pi

1. Turn off “Screen Blanking”
2. Pair the Bluetooth Speaker



# Interlude: Short Linux Primer

- Wait! Isn't this camp about building devices with Raspberry Pi?

Why are we pausing to talk about Linux?

- Ans: Linux is an operating system that runs almost everywhere! In almost all IT technical careers, you will be required to know and use Linux with proficiency.
  - Linux runs in more environments than you may realize:
    - Big enterprise datacenters, Cloud service backends, your Android phone, smart TVs, cameras, wearables (smart watches), etc.
    - And yes... it is the default OS that runs on your Raspberry Pi.
      - Called Raspberry Pi OS (based on the Debian GNU/Linux distribution )
        - [https://en.wikipedia.org/wiki/Raspberry\\_Pi\\_OS](https://en.wikipedia.org/wiki/Raspberry_Pi_OS)
- Reasonable (Funny) Video Intro to Linux
  - <https://www.youtube.com/watch?v=zA3vmx0GaO8>

# What is Linux ?

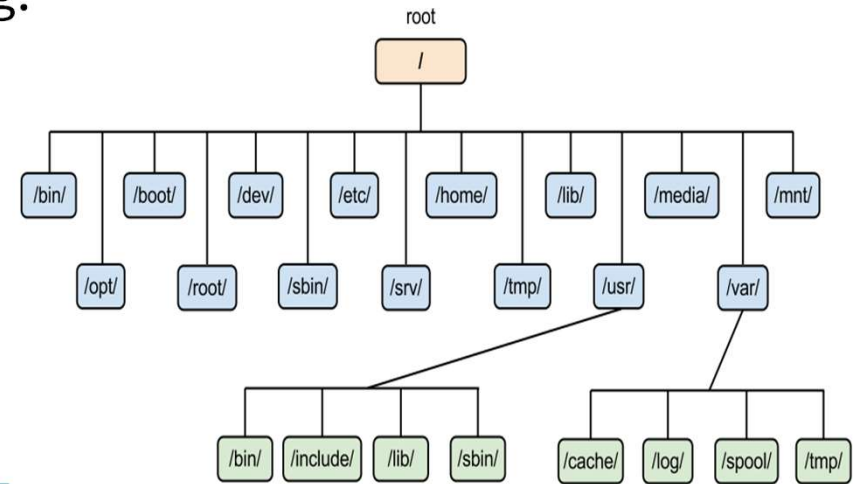
- <https://www.linux.com/what-is-linux/>
  - Video (Linux 100s) : <https://www.youtube.com/watch?v=rrB13utjYV4>
  - [https://www.tutorialspoint.com/operating\\_system/os\\_linux.htm](https://www.tutorialspoint.com/operating_system/os_linux.htm)
- Distributions: [https://www.youtube.com/watch?v=tjx\\_aSOPjls](https://www.youtube.com/watch?v=tjx_aSOPjls)
  - (For laptops): <https://www.youtube.com/watch?v=Z1LKHWY-Pvo>
    - For Raspberry PI: [https://en.wikipedia.org/wiki/Raspberry\\_Pi\\_OS](https://en.wikipedia.org/wiki/Raspberry_Pi_OS)
- Command cheat sheet:
  - <https://www.geeksforgeeks.org/linux-commands-cheat-sheet/#>

# Linux Command Line

- Shell - CLI - primer user interface to operating. It's essentially a program that interprets user commands, and runs other programs
- Understanding the Filesystems
  - Files and folders (called directories) are organized hierarchically (in a tree structure)
- Basic Linux Commands (video)
  - [https://www.youtube.com/watch?v=bb\\_ApuH15YE](https://www.youtube.com/watch?v=bb_ApuH15YE)
- Further study reference: “The Linux Command line” eBook
  - <https://linuxcommand.org/tlcl.php>

Short BASH Video

[https://www.youtube.com/watch?v=zsl\\_nafq\\_sA](https://www.youtube.com/watch?v=zsl_nafq_sA)



ls – list contents of folder

~ refers to home folder

cd – change to new directory (folder)



## Take 10-15 mins to get familiar with your Raspberry Pi



```
pi@viper:~/ORIONSmartDoorBell/certs $ ls -l
total 28
-rw-r--r-- 1 pi pi 1424 Jul 10 09:47 orion_ca.crt
-rw----- 1 pi pi 1751 Jul 10 09:44 orion_ca.key
-rw-r--r-- 1 pi pi  41 Jul 10 14:14 orion_ca.srl
-rw-r--r-- 1 pi pi 1298 Jul 10 14:14 ring_server.crt
-rw-r--r-- 1 pi pi 1054 Jul 10 10:26 ring_server.csr
-rw----- 1 pi pi 1679 Jul 10 09:57 ring_server.key
-rw-r--r-- 1 pi pi  319 Jul 10 10:24 san.cnf
```

**Challenge Questions:** Understanding file permissions is one of the most important aspects of using Linux effectively (and securely!!)

1. Review the command out below, describe generally what the output specifies.
2. (Write down) the access permissions for the files: *orion\_ca.crt*, and *orion\_ca.key*. Specially state the access control “details” for these two files.
3. What is the Unix command for managing file access permissions?



End of Module 1