# Welcome to the course

Welcome to *Getting Started With Your Raspberry Pi*. In this course you will learn how to get up and running with your Raspberry Pi, from when you first unbox your device to using your Raspberry Pi for doing everyday tasks and digital making, and even how to take control of it using the command line.

In week one, you'll install the Raspberry Pi Operating System, configure and personalize your device, and get to know your way around the desktop.
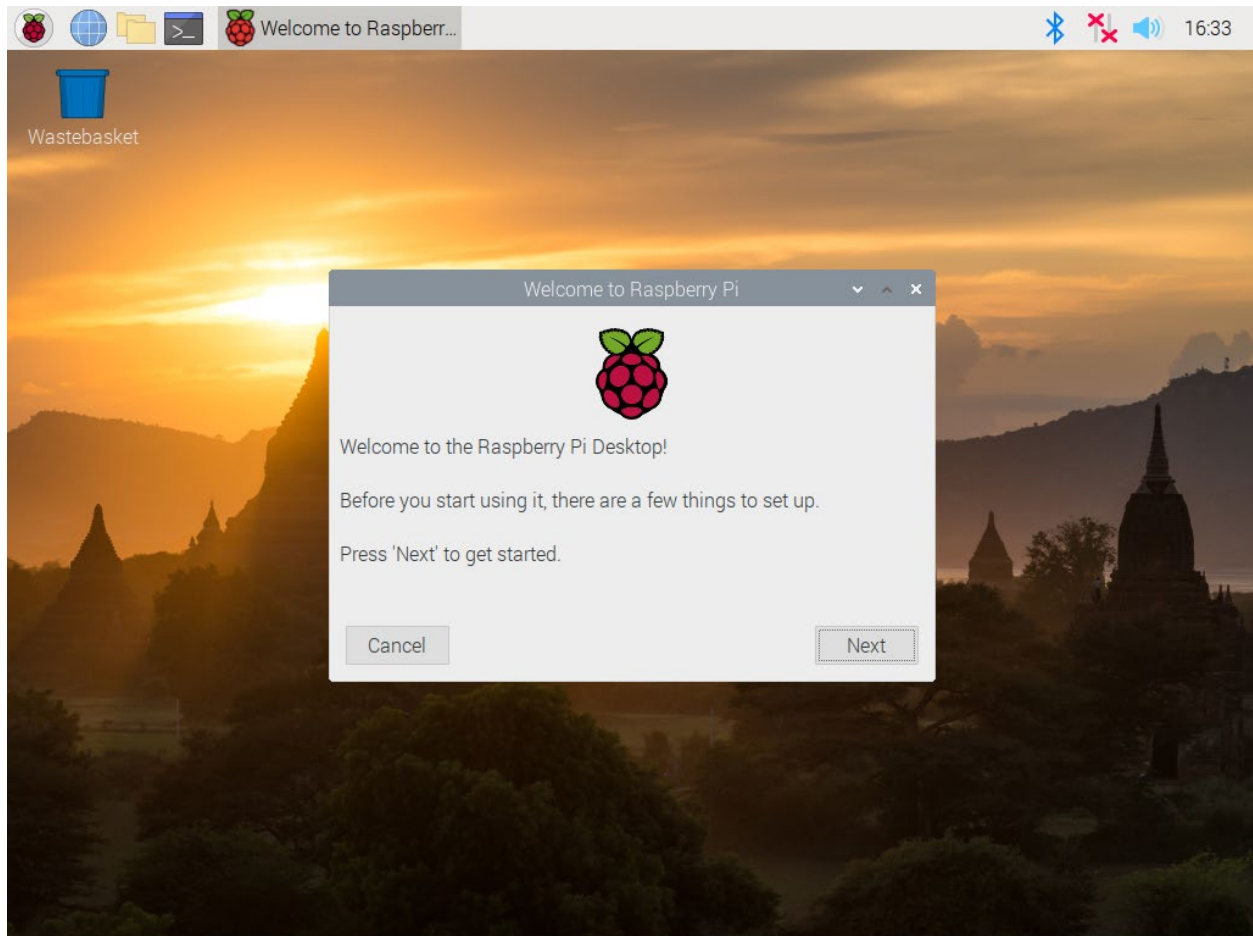

In week two, you'll learn how to launch and use a variety of applications that are preinstalled on your Raspberry Pi. You'll see how your Raspberry Pi can be used as a desktop computer for work, homework, and hobbies,

and how you can create your own digital making projects using coding, art, music, and electronics components.
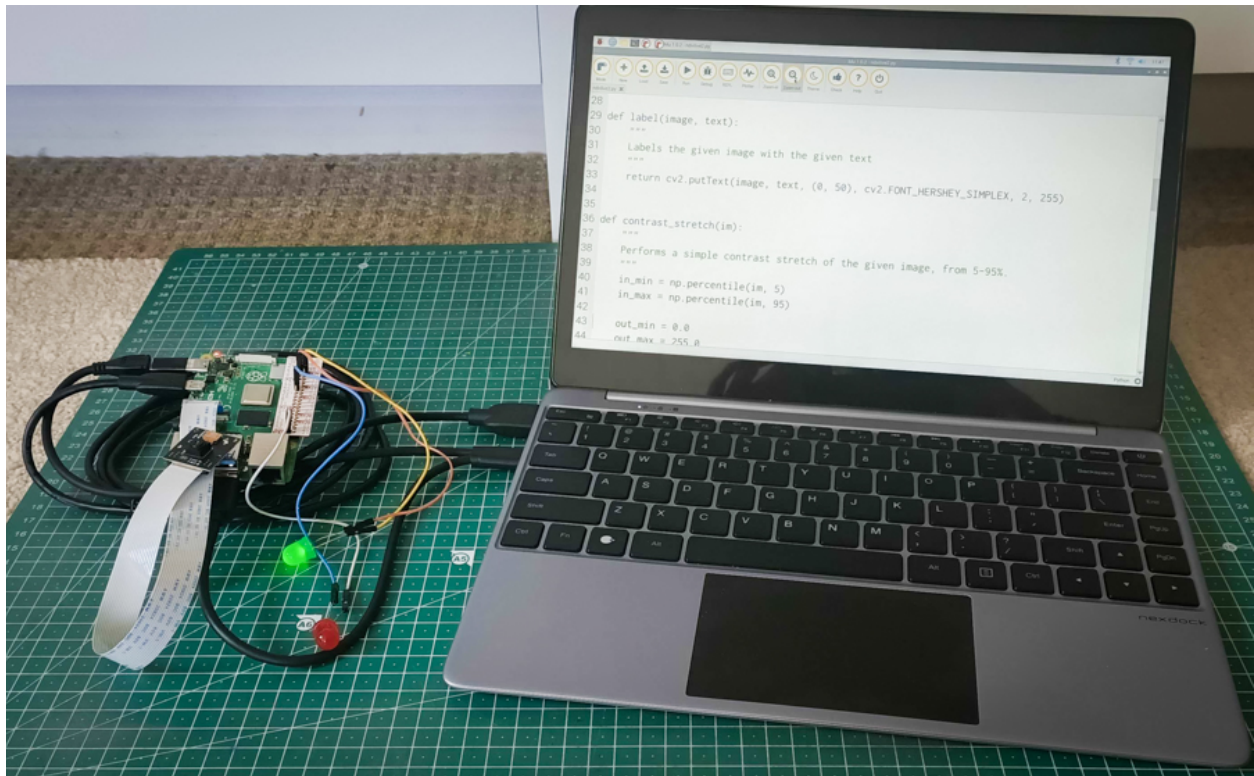

In the final week, you'll be learning systems administration skills so that you will be able to use the command line, automate tasks, keep your Raspberry Pi up to date and secure, and remotely access your Raspberry Pi from another computer.
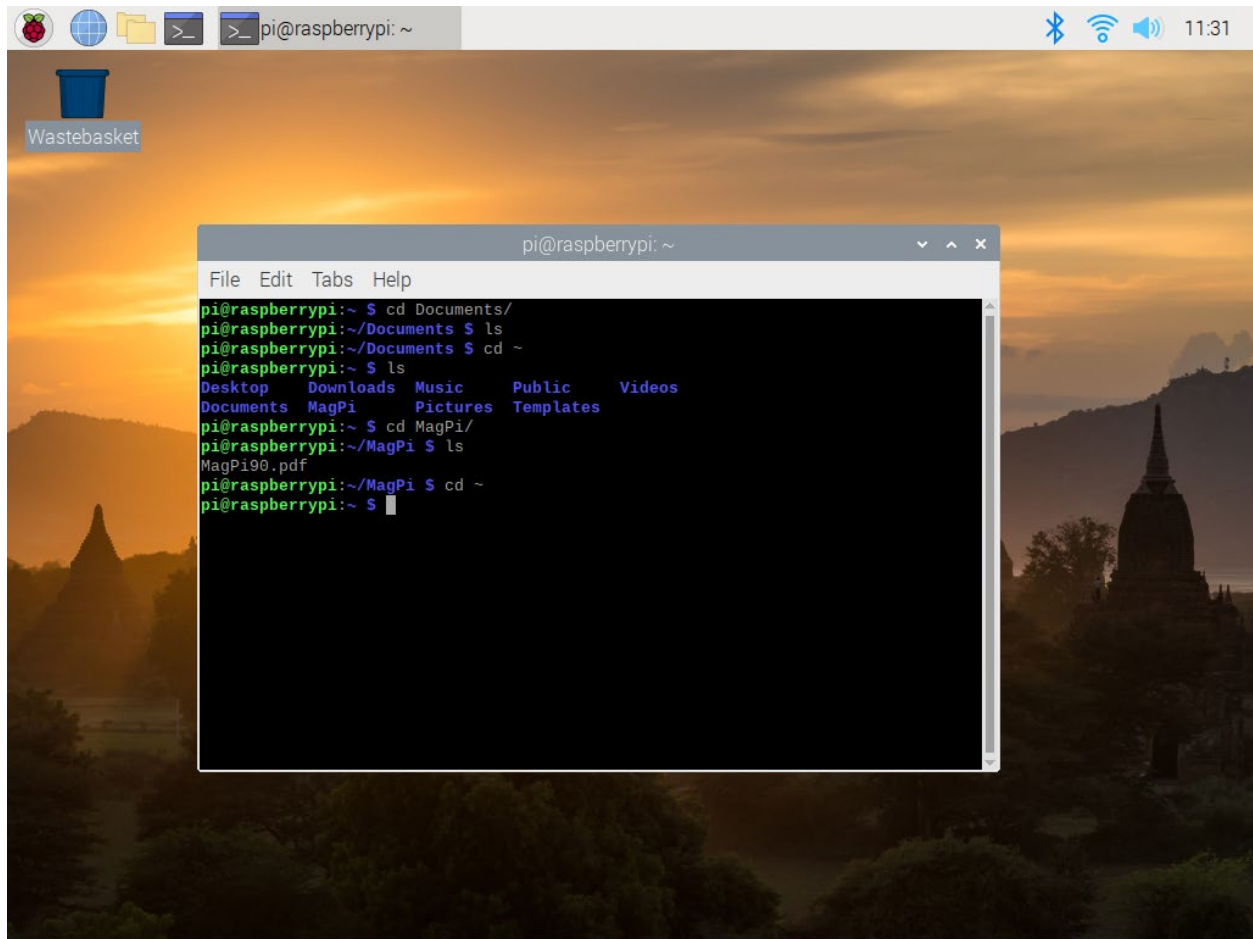
Raspberry Pi

Raspberry Pi is a single-board computer. What this means is that all the components that make up a computer, such as the processor, memory, and graphics chip, are all soldered to a single circuit board. There are also no integrated peripheral devices, as you might find with a notebook or some desktop computers, such as a screen, keyboard, speakers, or touchpad.
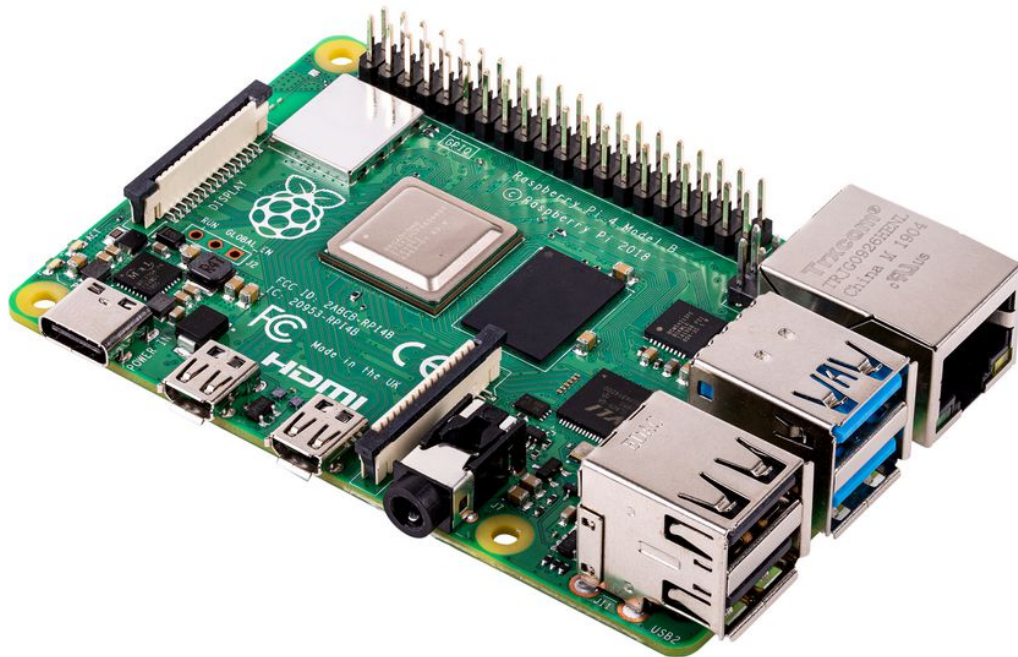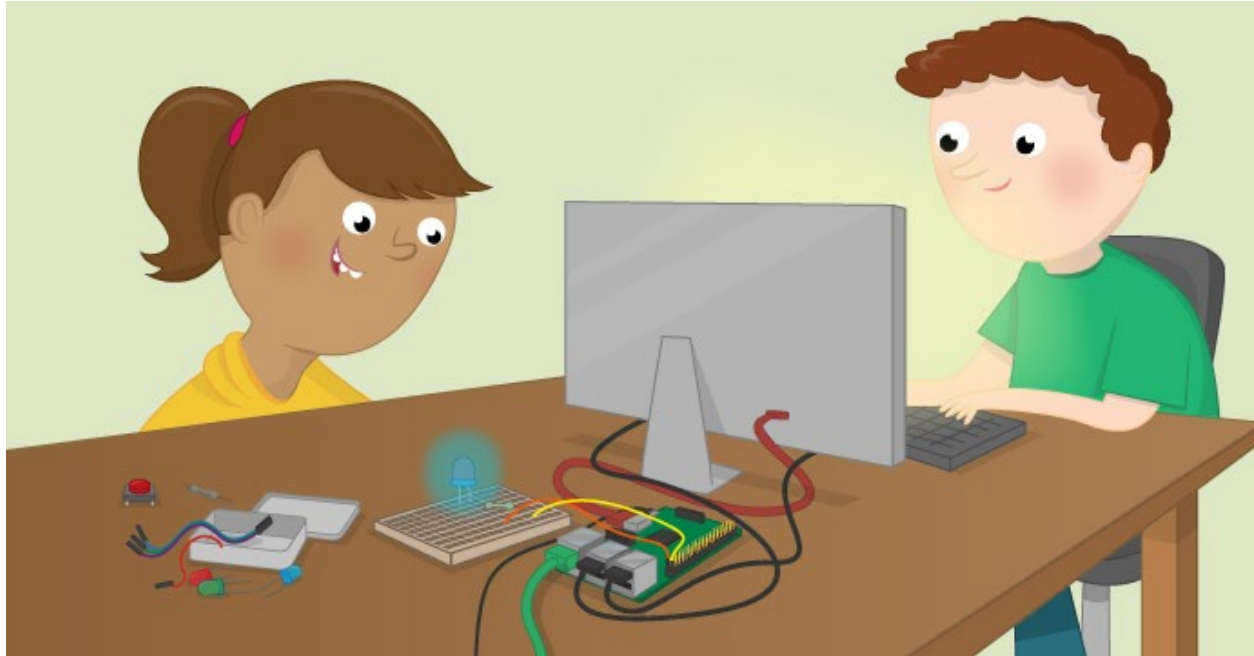
Why Raspberry Pi?

Raspberry Pi was first developed in response to a shortage of undergraduate students applying for university Computer Science courses who had sufficient experience in the technical aspects of computing. A few decades ago, home computers such as the BBC Micro and the Commodore 64 had resulted in a generation of hobbyists growing up with experience in tinkering with their computers and learning programming in languages such as BASIC. But the rise in popularity of home and mobile computing then led to computing platforms being developed that were more user-friendly. Users were less inclined to play around with their computers, and these computers could be used without any knowledge of programming. The aim of Raspberry Pi was to provide learners with a low-cost device that was designed to be tinkered with, in order to reignite the hobbyist culture and the associated development of key computer skills.

What can you do with it?

Raspberry Pi has almost unlimited uses, and it is this versatility that has led to its extraordinary success, far beyond the initial scope of the device. While at first it was designed to be used as an educational device, it has rapidly become one of the bestselling computers of all time. So what can you do with a Raspberry Pi? The answer is pretty much whatever you want. It can be used as a desktop PC, a media server, an ad-blocker for your

network, the brains of a robot, the monitoring system for a weather station… the list goes on and on.

This is an additional video, hosted on YouTube.

Raspberry Pi versus other computers

Before you get started learning how to use your Raspberry Pi, I'll talk you through how it compares to a more traditional computer.

Firstly, Raspberry Pi uses a smaller and slower processor and has less memory than you might find in a standard consumer computer. This means some software will run a little more slowly on Raspberry Pi, and it also means that fewer applications can be run simultaneously. However, the smaller chip requires less cooling and less power. This means you can run a Raspberry Pi using a phone charger, and there is no need to have bulky and noisy fans running constantly.
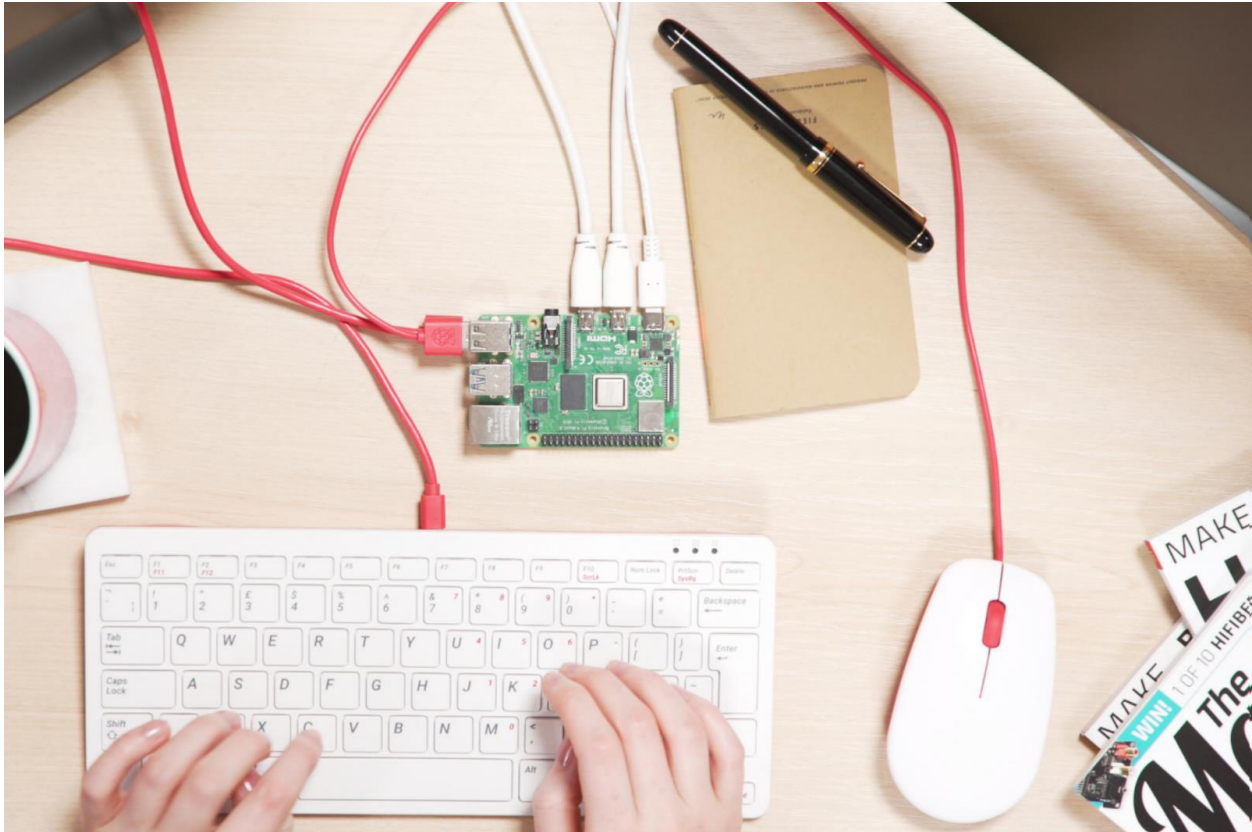
Just like a normal desktop computer, Raspberry Pi has ports for plugging in speakers, monitors, keyboards, mice, and any other USB devices. However, there are some additional ways of connecting hardware that you may not have seen before.

There's a special port for connecting cameras, and another for connecting LCD displays. On top of all this, there is the GPIO (General-Purpose Input/Output) header, which consists of 40 pins and allows you to connect electronic components such as light-emitting diodes (LEDs), buttons, sensors, and motors, as well as specialized devices known as HATs.

One other major difference between a Raspberry Pi and a traditional computer is how data is stored. Most desktops and notebooks have hard drives, which are often capable of storing hundreds of gigabytes of data, including the operating system. Raspberry Pi uses a microSD card to store the operating system and other files.

Lastly, the operating system for Raspberry Pi is different to other operating systems you may have used in the past, such as Windows and macOS. The recommended operating system for Raspberry Pi is called Raspberry Pi OS (formerly known as Raspbian). This is a version of a popular operating system known as Linux. While not many people use Linux on their home computers, it is the major operating system used on the servers that drive the internet and the World Wide Web. Linux is also the base operating system on all Android phones and Chromebooks and many smart devices you may use, such as televisions.

In the next step, you're going to learn how to install the Raspberry Pi Operating System onto your SD card.

Preparing your SD card

In order for your Raspberry Pi to run, you'll need to load the Raspberry Pi Operating System (formerly known as Raspbian) onto

an SD card. There are other operating systems you can use, but we'll be using the full version of the Raspberry Pi OS on this course.

If you bought a Raspberry Pi kit, it may have already come with a simple operating system installer called NOOBS, loaded onto an SD card. If you choose to use that card to install Raspberry Pi OS, you can skip the rest of this step; I'll explain how to install Raspberry Pi OS using NOOBS later.

We recommend using the Raspberry Pi Imager software on your desktop computer or laptop (Windows, macOS, or Ubuntu) to prepare your SD card. This step will take you through the process of preparing an SD card using the Raspberry Pi Imager.

You will need

You will need to have a way to connect this card to your desktop computer or laptop.

- Many laptops will have a microSD slot

- If your desktop or laptop only has a larger SD card slot, you will need an adapter for the microSD card to fit into; microSD cards are often sold with this adapter

- If your desktop or laptop doesn't have an SD card slot, you will need to buy a USB SD card adapter

Formatting your SD card
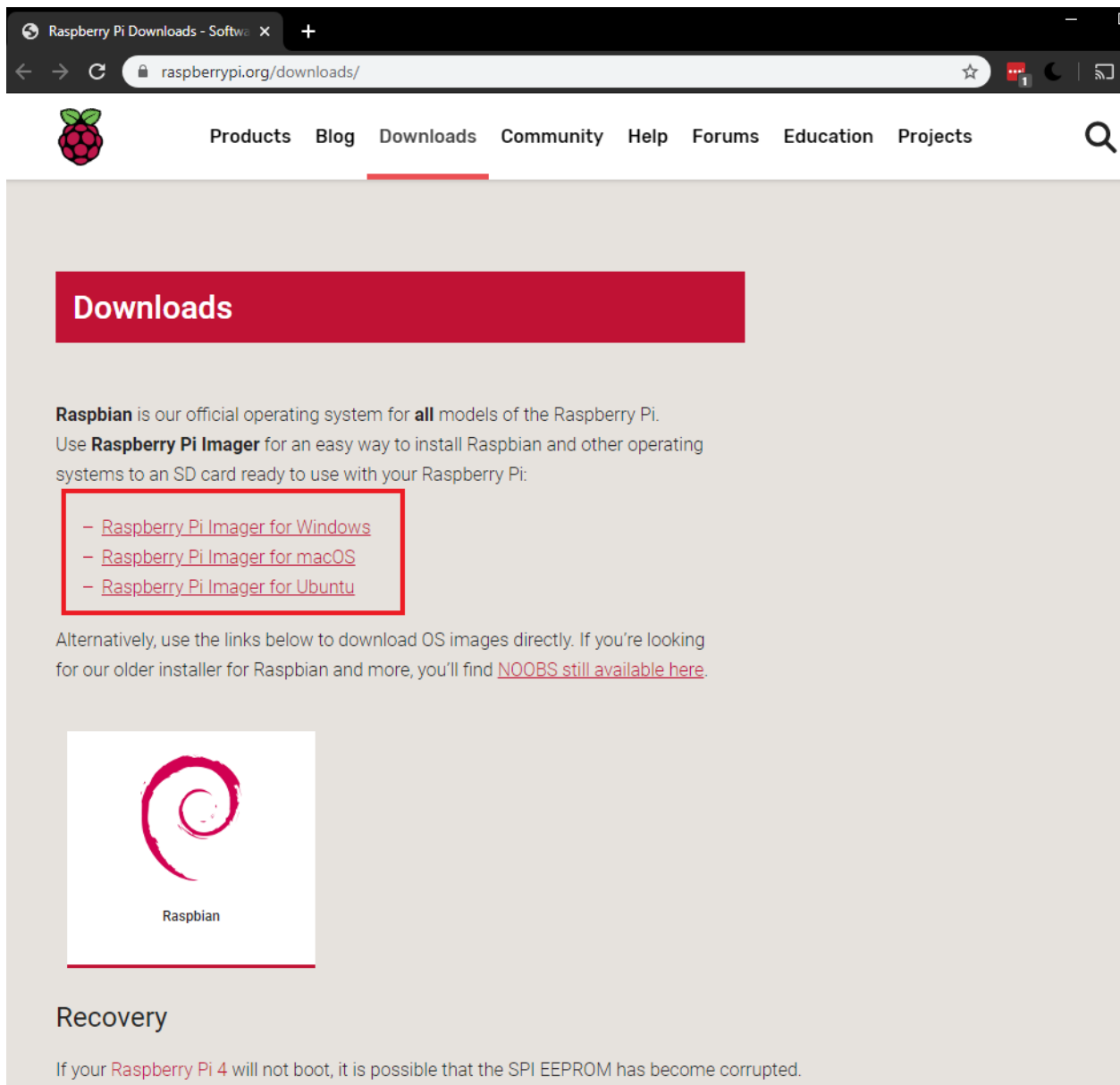
This process will overwrite all data on the SD card, so back up any important files first. Most operating systems have their own disk formatting tool, but we recommend using the SD Association's Formatter if you are using Windows or a Mac.

- Visit the SD Association's website and download [SD Formatter 5.0](#) for Windows or Mac

- Follow the instructions to install the software

- Insert your SD card into the computer's SD card reader and make a note of the drive letter allocated to it in Windows, e.g. F:/; in Mac OS X, the drive will be allocated a number, for example `disk6`; you can identify the disk and its allocated number by opening Disk Utility

- In SD Formatter, select the drive letter or number for your SD card, and format it

Downloading and launching the Raspberry Pi Imager

- Visit the [Raspberry Pi downloads page](#)

- Click on the link for the Raspberry Pi Imager that matches your operating system
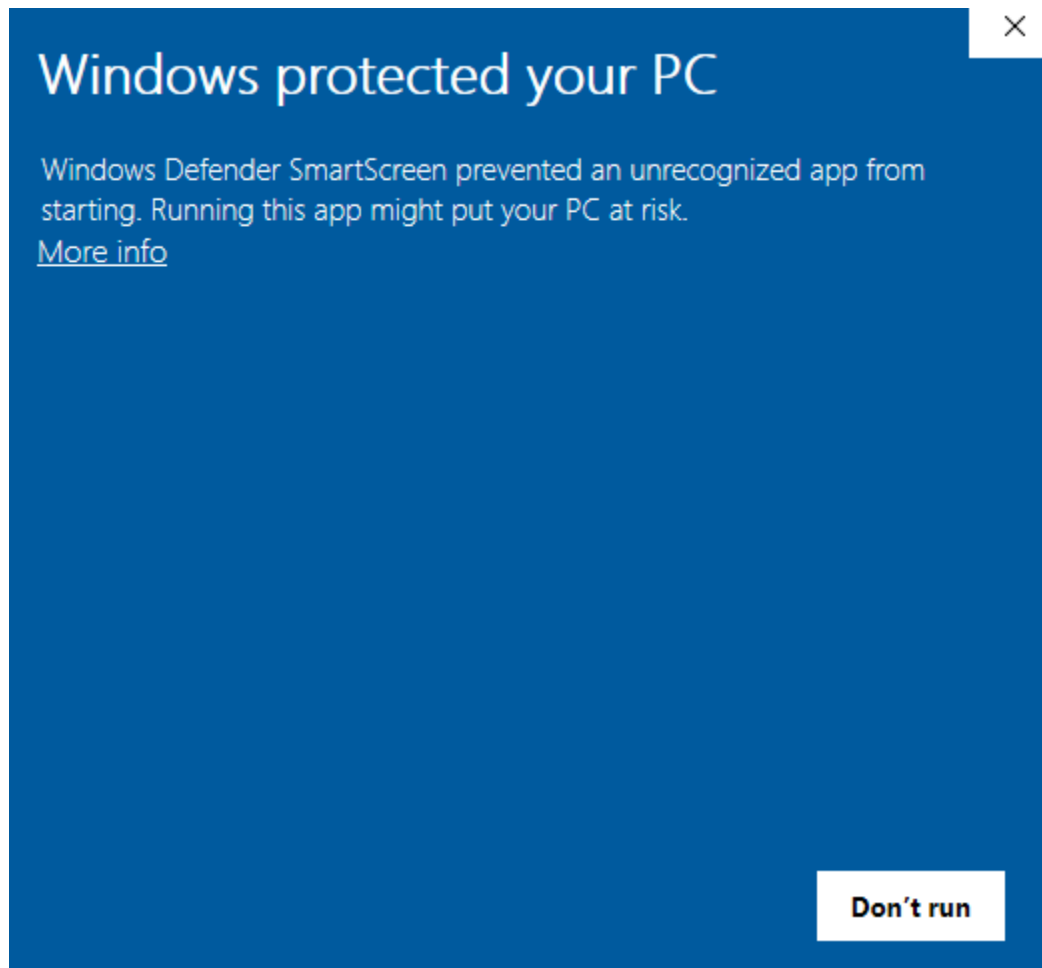
- When the download finishes, click on it to launch the installer

Using the Raspberry Pi Imager

When you launch the installer, your operating system may try to block you from running it. For example, Windows may give the following message:

Windows protected your PC

Windows Defender SmartScreen prevented an unrecognized app from starting. Running this app might put your PC at risk.

More info

Don't run

- If you get this, click on `More info` and then `Run anyway`

- Insert your SD card into the computer's SD card slot

Note: In this course, you will want to explore a wide range of software, so you will choose the full version of Raspberry Pi OS and not the recommended version that appears at the top of the list.

- In the Raspberry Pi Imager, click on Operating System and select **Raspberry Pi OS (Other)**

- In the next dialog box, pick **Raspberry Pi OS Full**

- Select the SD card you would like to install it on; different platforms will display the drives in different ways—Mac OS, for example, will show you all drives, including your main operating system

Note: Make sure you are selecting the correct drive. The drive's memory capacity can be a useful indicator of which drive you are selecting.
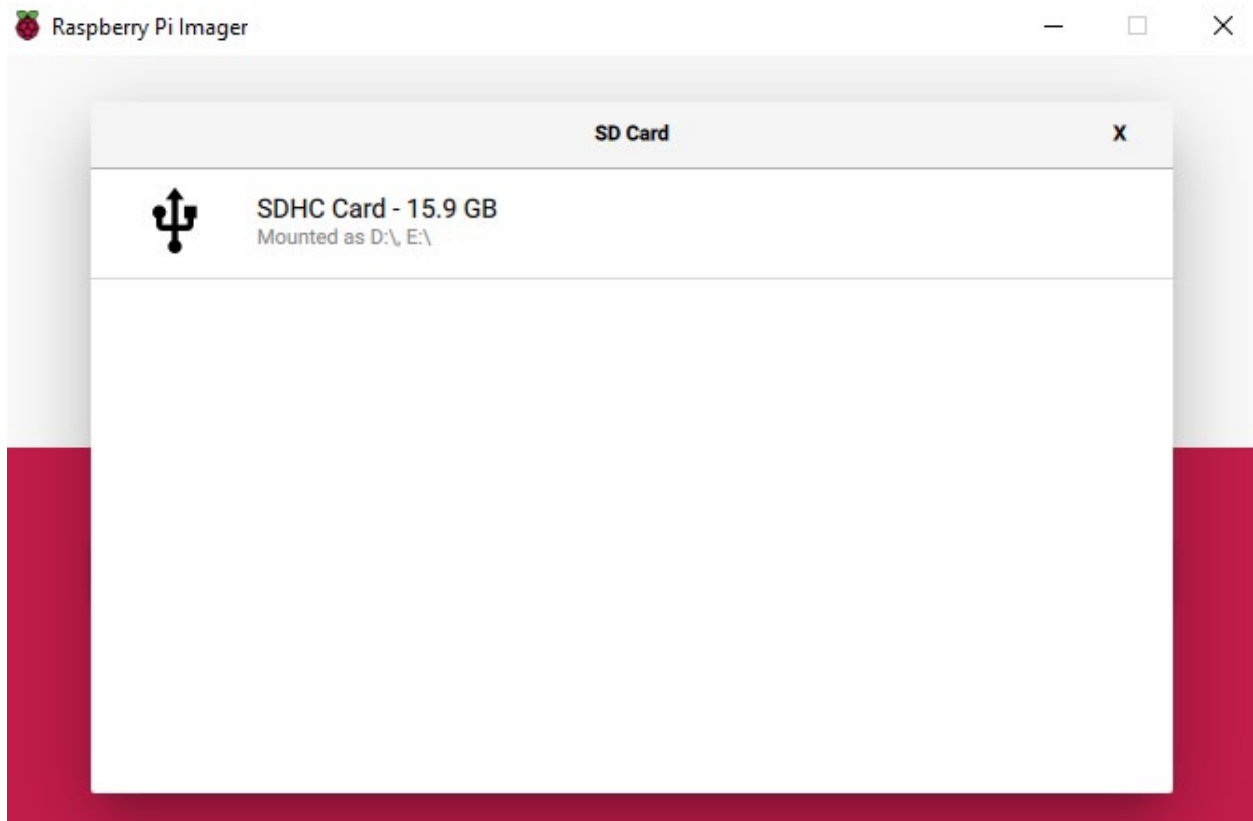
Once you have selected both the OS and the SD card, a new **WRITE** button will appear.
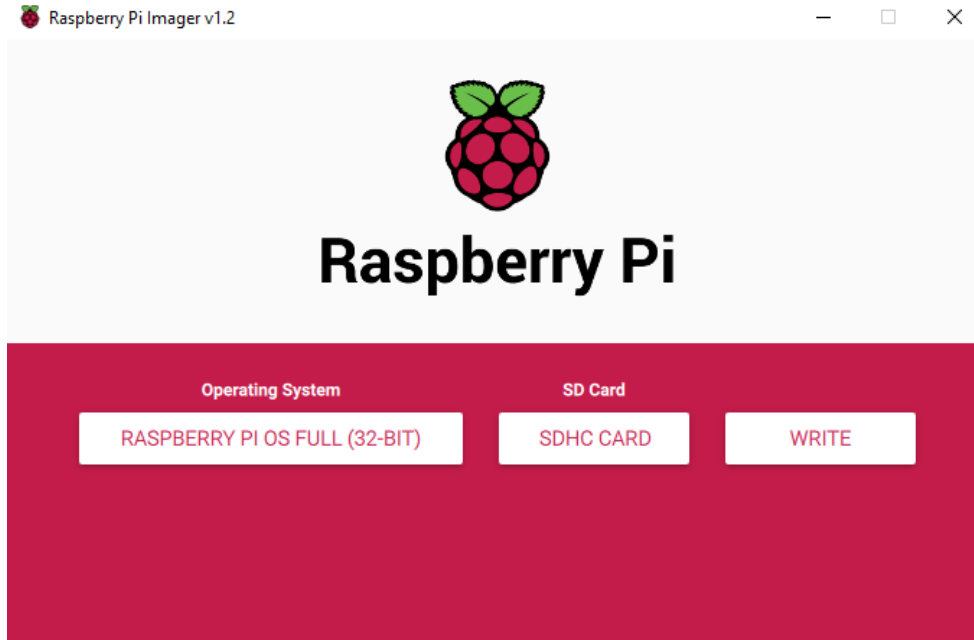
- Click the **WRITE** button

- Wait for the Raspberry Pi Imager to finish writing

- Once you get the following message, your SD card has been safely ejected and you can remove it from the computer

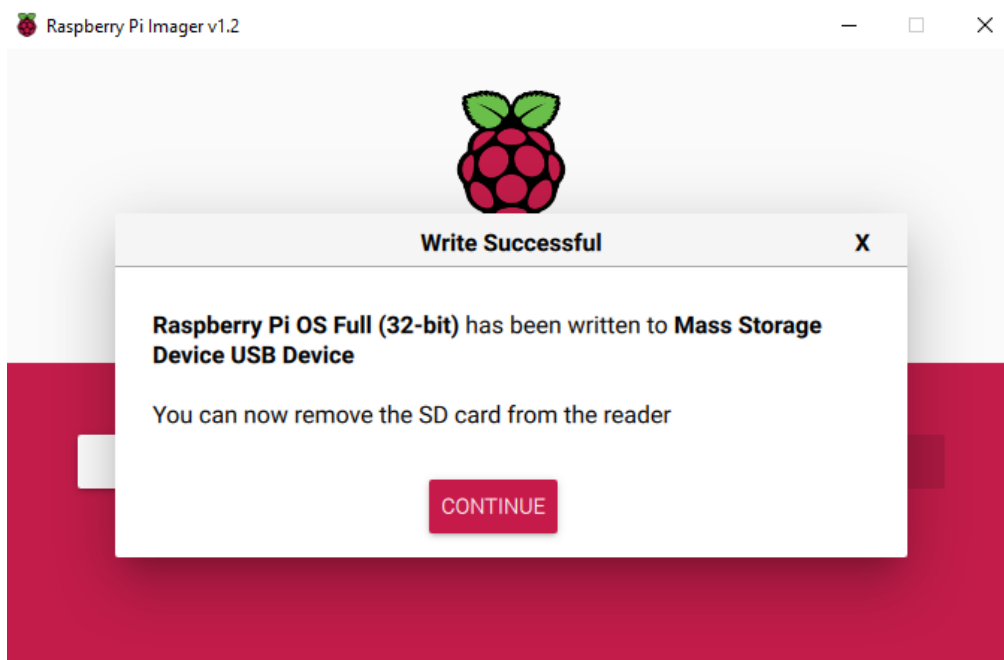Your SD card now has Raspberry Pi OS fully loaded and is ready to go into your Raspberry Pi's SD card slot.

Raspberry Pi hardware and set-up

Before you boot up your Raspberry Pi, I'd like to take you on a little tour of it. In this step you will learn about the main components on a Raspberry Pi computer.

This course uses the latest Raspberry Pi 4 model. If you are using an older model, you will see some differences, but most instructions will still work the same.

What's on the board?
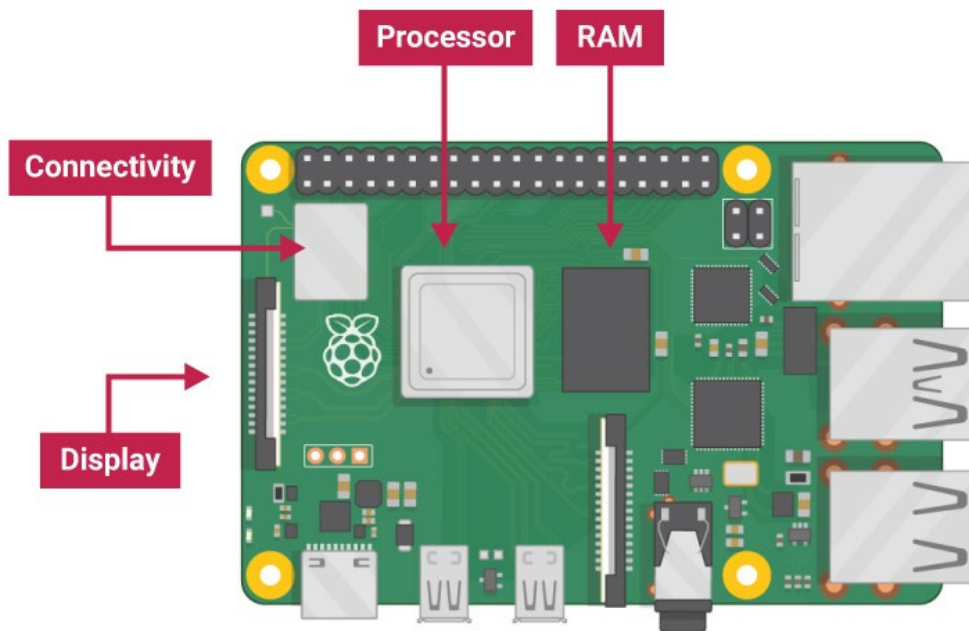
Get out your Raspberry Pi computer and take a look at it. Find the Raspberry logo and make sure it is the right way up, as shown on the diagram.

The green board is a printed circuit board. You'll see various large and small components on it. If you look closely, you'll see that the components are connected by conductive lines that are printed onto the board. You'll also see some helpful labels that identify some of the components you can see.

- **Processor:** The large silver square to the right of the Raspberry Pi logo is the processor or CPU; it's a 64-bit, quad-core ARM processor

- **RAM (memory):** To the right of the processor you'll see a large black rectangle, which is the RAM, the computer's working memory

Your Raspberry Pi 4 could have come with 2GB, 4GB, or 8GB of RAM, depending on the model. If you will be using your Raspberry Pi as a desktop computer, it is worth choosing the largest amount of RAM that you can afford.

- **Connectivity:** The shiny rectangular chip above the Raspberry Pi logo provides wireless networking and Bluetooth connectivity

There are also connectors on top of the board:

- **Display and camera:** There are also two connection ports on top of the board; if you look closely you'll see that one is labelled DISPLAY and can be used for connecting a display such as a touchscreen, and the other is labelled CAMERA and can be used to connect an official Raspberry Pi camera

Around the edge of the board you'll find lots more ports to connect additional components:
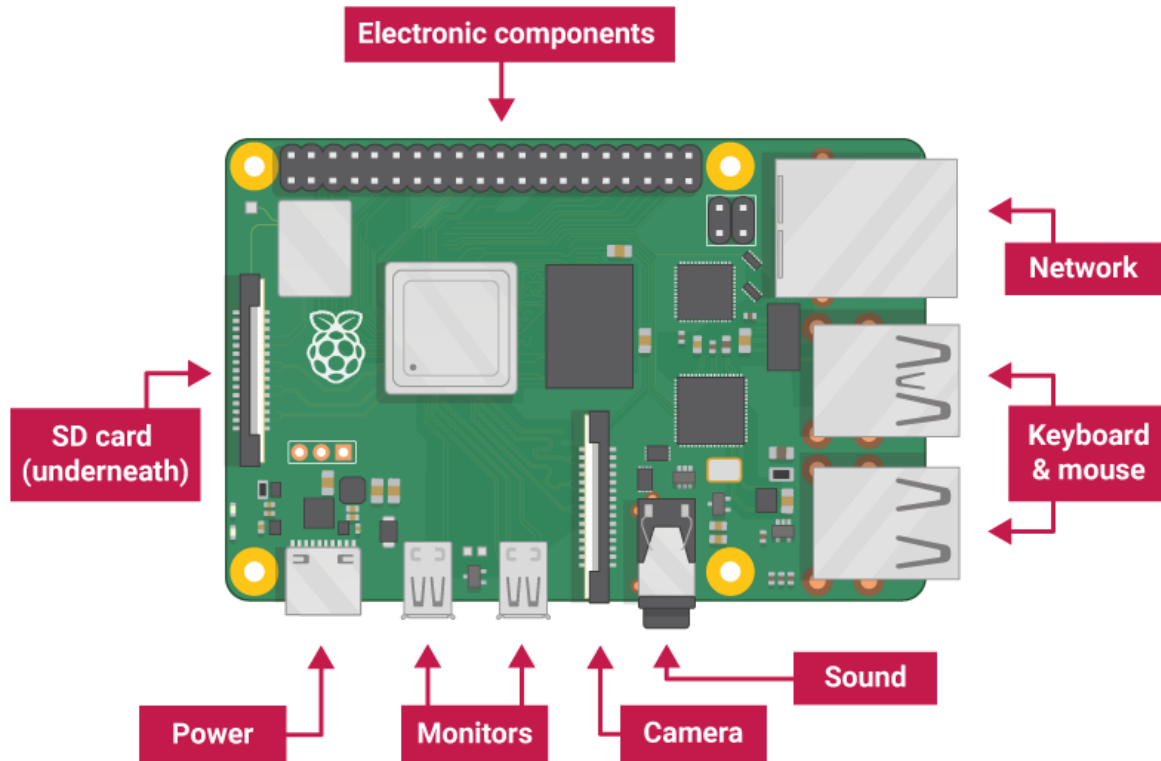

- **GPIO pins:** At the top of the board, you'll find two rows of General-Purpose Input/Output (GPIO) pins, which are used to connect and interact with additional electronics components such as buttons and LEDs; I'll explain more about this later in the course

- **Ethernet port:** Along the right-hand side, you'll find an Ethernet port for optionally connecting to a wired network

- **USB ports:** There are four USB ports for connecting a variety of devices such as keyboards, cameras, and external storage drives; two of these (the blue ones) are faster USB 3 ports and the other two are USB 2 ports

- **USB C power:** Along the bottom, you'll find the USB-C power connector; a Raspberry Pi doesn't have an on/off switch, but turns on when you connect the power and off when you shut it down

- **Micro HDMI ports:** To the right of the power connector, there are two micro HDMI ports for connecting screens

You'll need an adaptor if you have a regular HDMI cable. If your HDMI monitor has a speaker, you'll also be able to play sound through the monitor.

- **3.5mm audio jack:** The audio jack is helpful if your monitor doesn't have a speaker
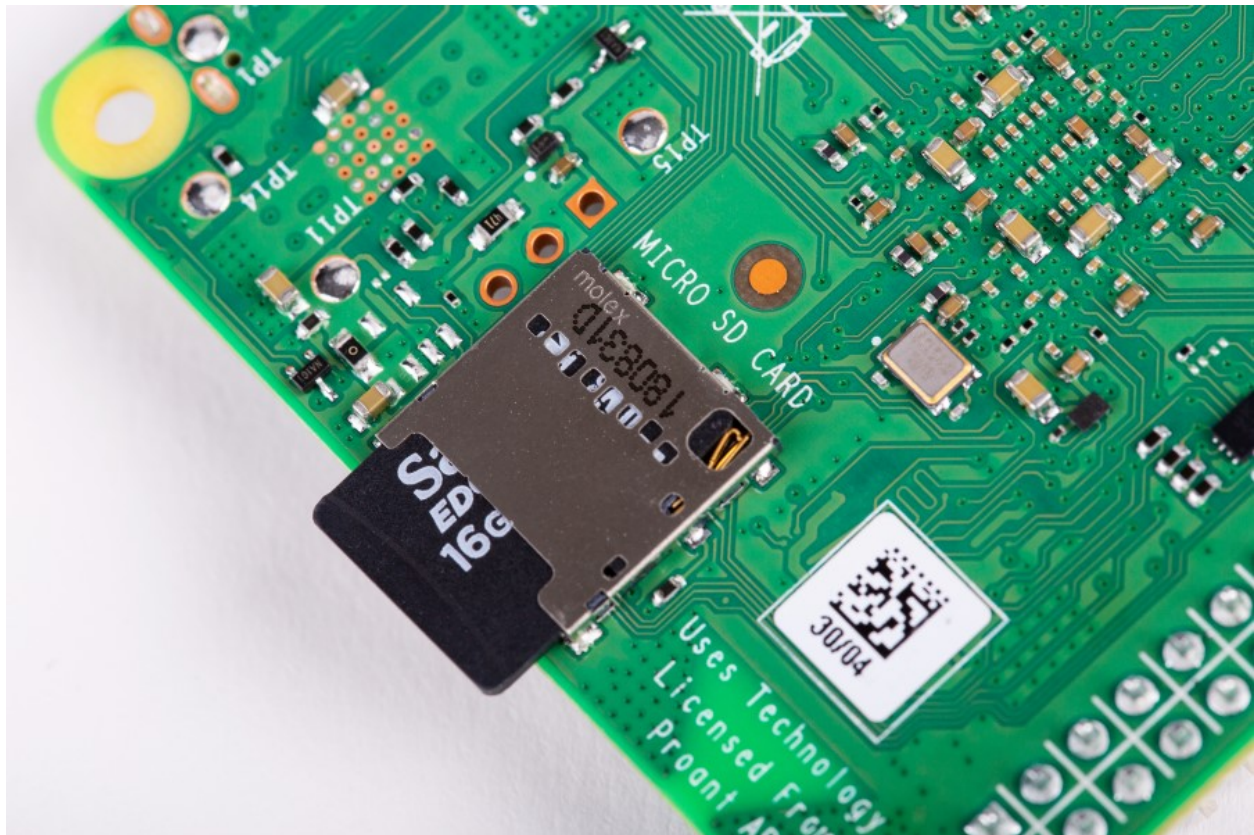
- **microSD card slot:** Turn your Raspberry Pi board upside down and you'll see the SD card slot where you can place the SD card that you prepared in the previous step

The SD card stores the Raspberry Pi OS and your programs and files. The data remains on the SD card when you turn your Raspberry Pi off and will still be there when you turn it on again.

In the next section, you will look at additional components that you will need to make a fully functioning desktop computer and it will be time to get started connecting everything together.

Setting up your hardware

In this section, you'll look at the other components you need to get started, bring everything together, and set up your Raspberry Pi hardware.

What else do you need?
Raspberry Pi is a single-board computer. To turn it into a complete desktop computer system, you'll need some additional items.

If you have the official [Raspberry Pi 4 Desktop Kit](), most of these items will be included.

You'll need:

- A microSD card with a capacity of at least 8GB, either prepared with Raspberry Pi OS as in the previous step of this course, or preinstalled with NOOBS

- A USB keyboard and mouse (you can also use wireless RF or Bluetooth devices later, but you may need USB for the set-up)

- An HDMI monitor (or two) and a micro HDMI-to-HDMI cable (or two). Raspberry Pi 4 has smaller micro HDMI ports, so if you have a regular HDMI-to-HDMI cable, you'll need an adapter

- A speaker or headphones if your monitor does not have a speaker; these can have a USB or 3.5mm jack connector

- A 15W USB-C power supply; we recommend the official Raspberry Pi USB-C Power Supply
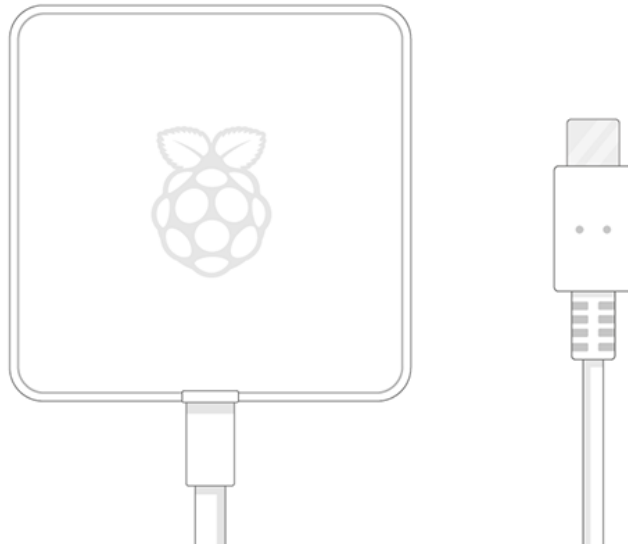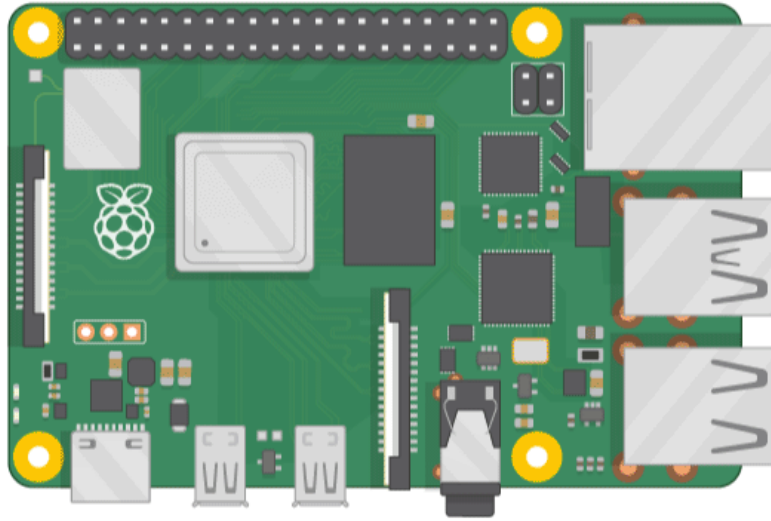
If you want to connect to a wired network, you'll need an Ethernet cable, but you can also connect to a wireless network.

It's also useful to have a case to protect your Raspberry Pi, but it's not necessary.

Connecting everything up
Now it's time to connect everything to your Raspberry Pi. It's important to leave the power supply until last, to avoid damaging any components.

Take the SD card that you prepared with Raspberry Pi Imager, or one preinstalled with NOOBS, and insert it into the microSD card slot on the underside of your Raspberry Pi. The metal connector pins need to be facing upwards. The SD card has a lip on the bottom that you can use to remove the card if you need to update or swap it.

Your SD card may have arrived inside a larger adapter; you can slide the smaller card out using the lip.
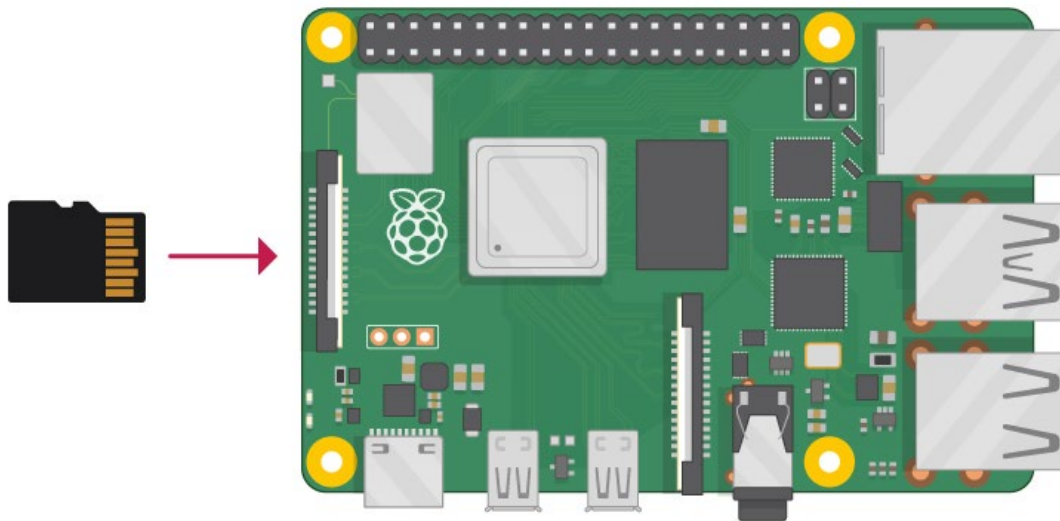
Connect the mouse to a USB port on your Raspberry Pi; it doesn't matter which port you use. Connect the keyboard in the same way.

Plug in your HDMI monitor and turn it on. Look at the shape of the HDMI ports on your Raspberry Pi; they have a longer flat side on top. The connector on the cable is the same shape, and you need to make sure you have it the correct way up.

Use a cable to connect the monitor to the first of Raspberry Pi 4's HDMI ports, the one labelled HDMI0 on the board. Don't expect anything to happen yet, as your Raspberry Pi isn't running. It's important to have the monitor turned on and connected before you power on your Raspberry Pi, so that it can detect the monitor.
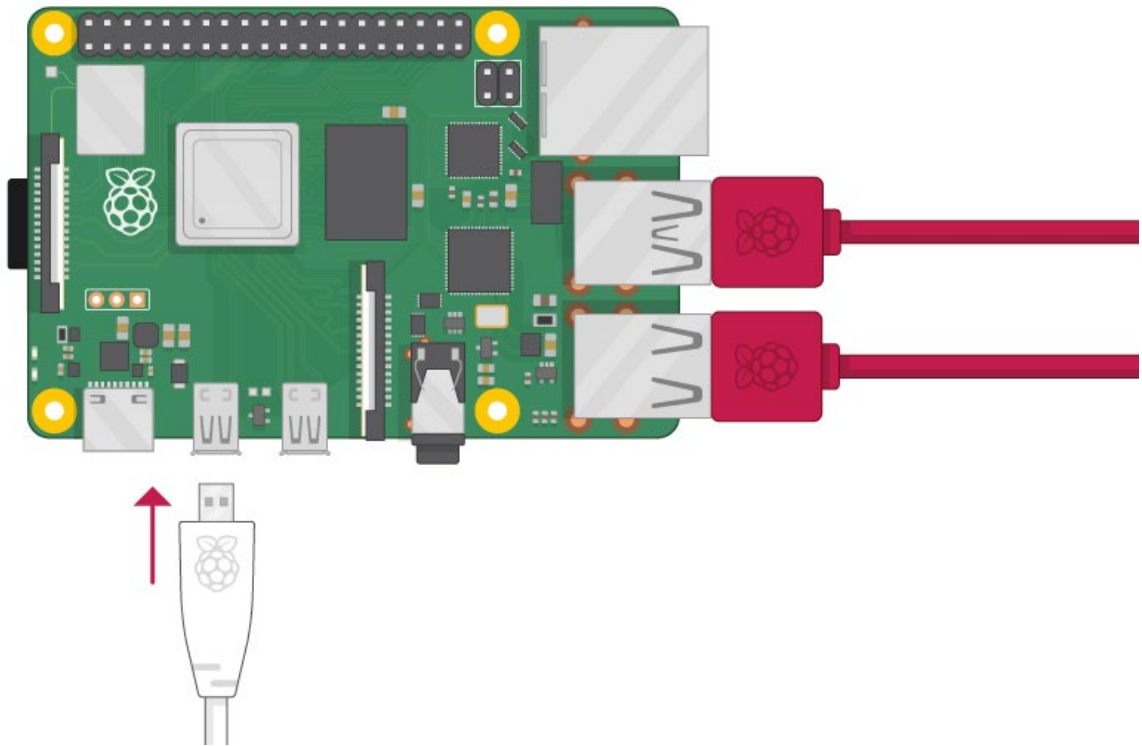
If the HDMI monitor you are using has speakers, sound will play through them. If you're using separate speakers or headphones, connect them via a USB port or the 3.5mm audio jack.

If you want to connect your Raspberry Pi to your computer network via Ethernet, use an Ethernet cable to connect the Ethernet port on your Raspberry Pi to an Ethernet socket on the wall or on your internet router. You don't need to do this if you want to use wireless connectivity, or if you don't want to connect to a computer network.

Finally, plug the USB power supply into a socket and connect it to your Raspberry Pi's USB-C power port. Your Raspberry Pi doesn't have a power switch and will turn on as soon as you connect it to a power outlet.
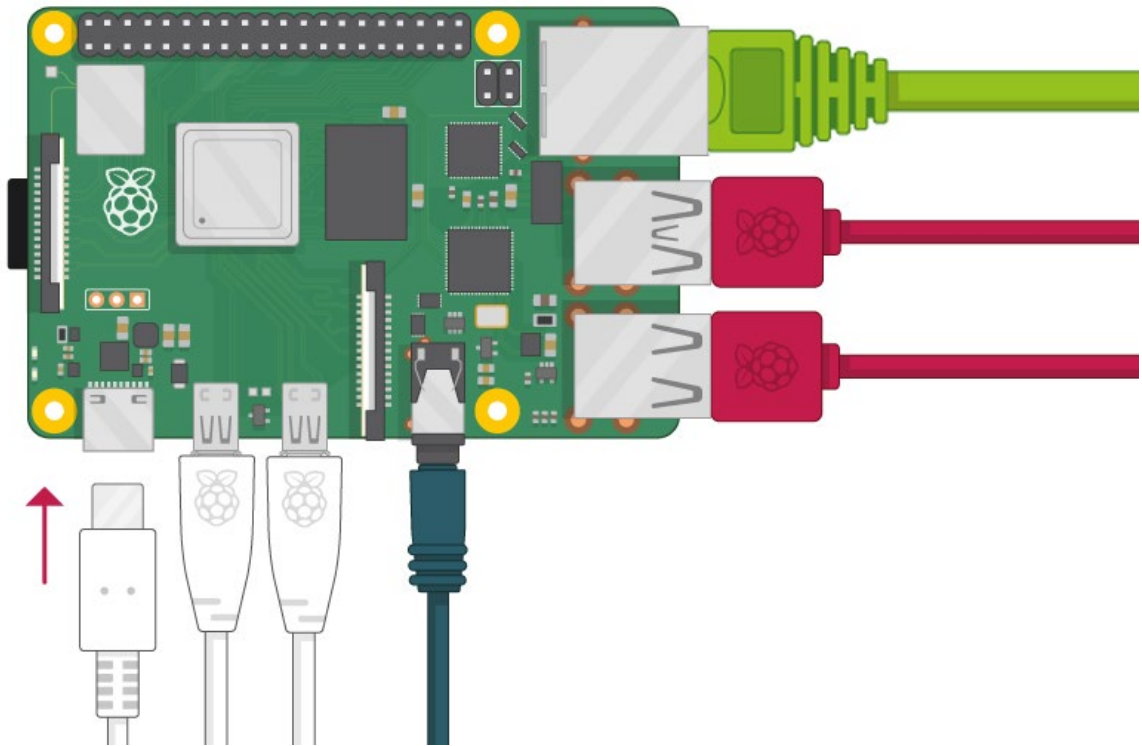
You should see a red LED light up on your Raspberry Pi, which indicates that it is connected to power. As it starts up (this is also called 'booting'), you will see raspberries appear in the top left-hand corner of your screen.

Over to you

Now it's your turn. Make sure you have the parts for a complete Raspberry Pi desktop computer system and set it up.

Setting up your Raspberry Pi operating system

Once Raspberry Pi OS has started, having used either the Raspberry Pi Imager or NOOBS, you will be invited to set up your operating system. Click on **Next** to begin.
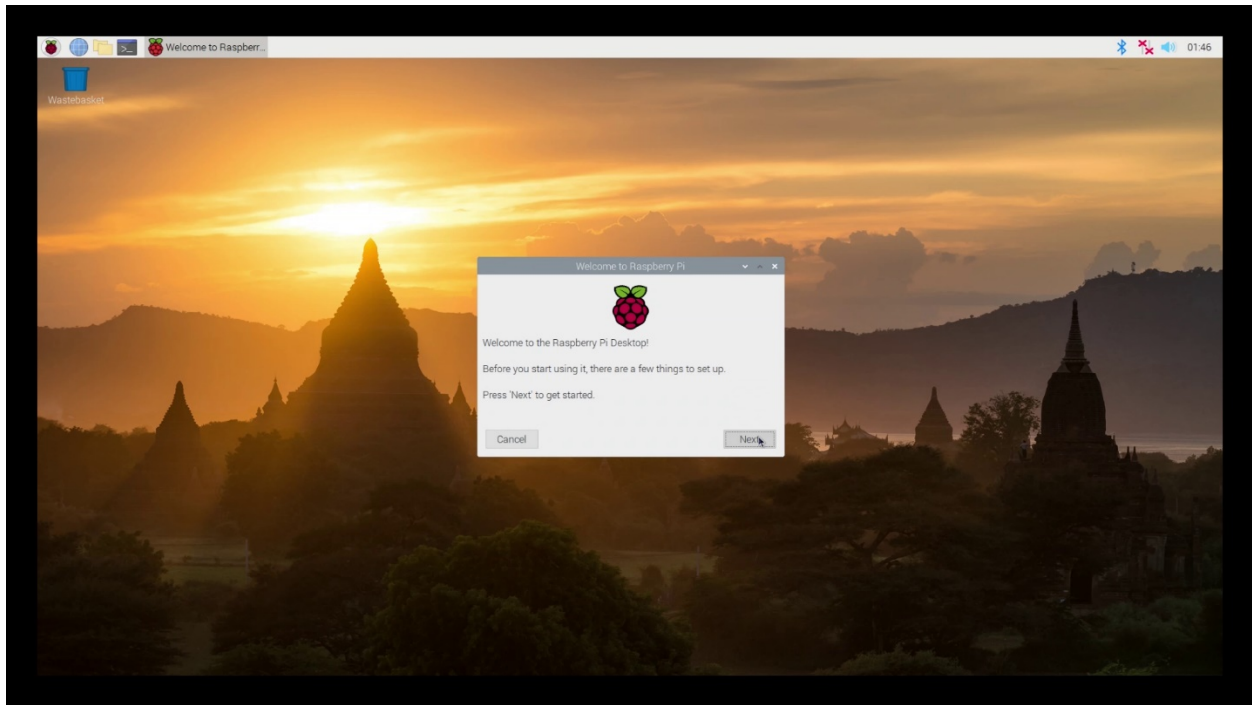
You can now set up your **locales**. Choose your **Country**, **Language**, and **Timezone**. You can optionally choose to **Use English language** and **Use US keyboard**, regardless of the country you choose.
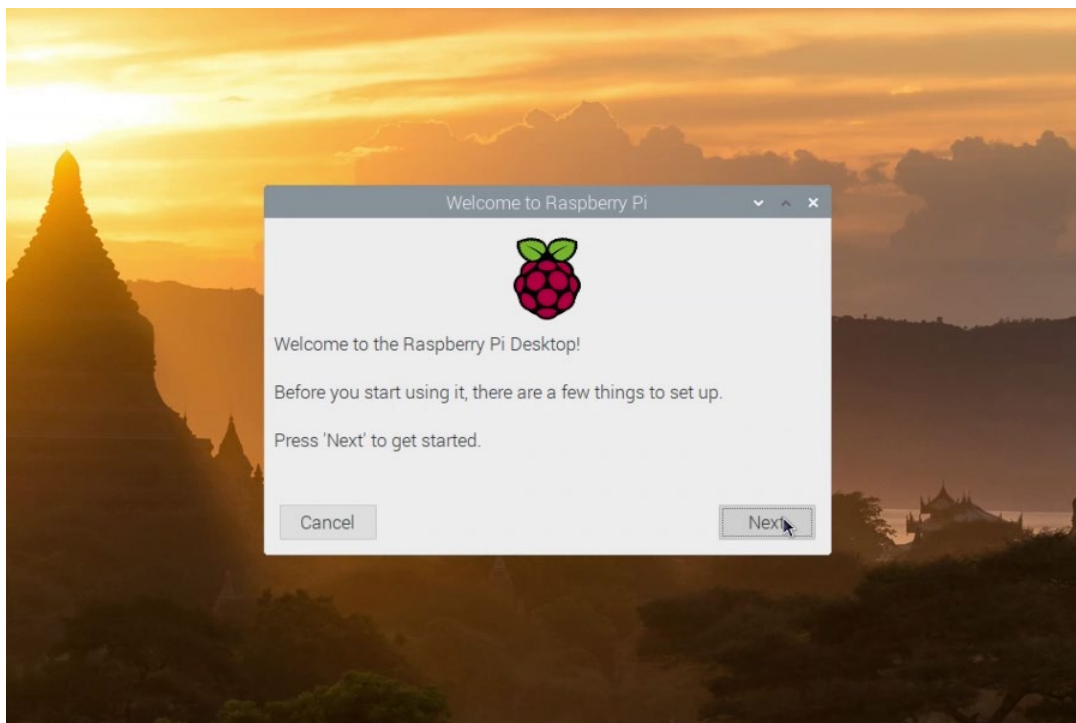
Click on **Next** when you are happy with your choices.

Almost every operating system requires you to sign in with a username and password, and Raspberry Pi OS is no different. Raspberry Pi OS has a default user called **pi**, and a default password, which is **raspberry**.

As every Raspberry Pi OS install initially has a widely known username and password, this could be a security risk, especially if you connect your Raspberry Pi to your home or work network. Anyone that happens to also be on your network would have full access to your Raspberry Pi. To protect against this, you need to choose a new password in the next step in the set-up routine.
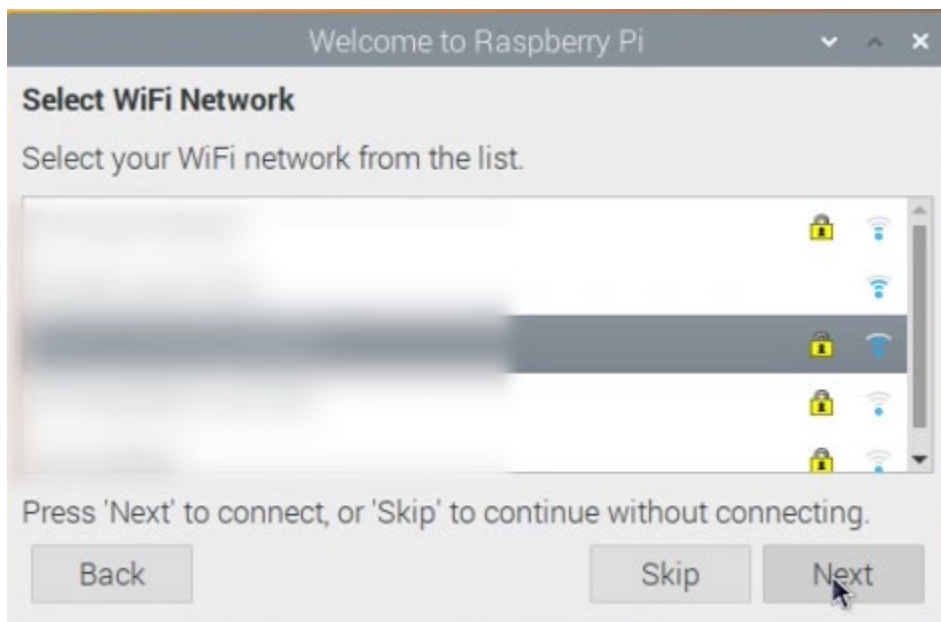

Sometimes, depending on your monitor or TV, you can get a black border around the edge of your desktop. If this is the case, then on the next dialog box, you should check the box, and then click **Next**. If not, then just click **Next**.
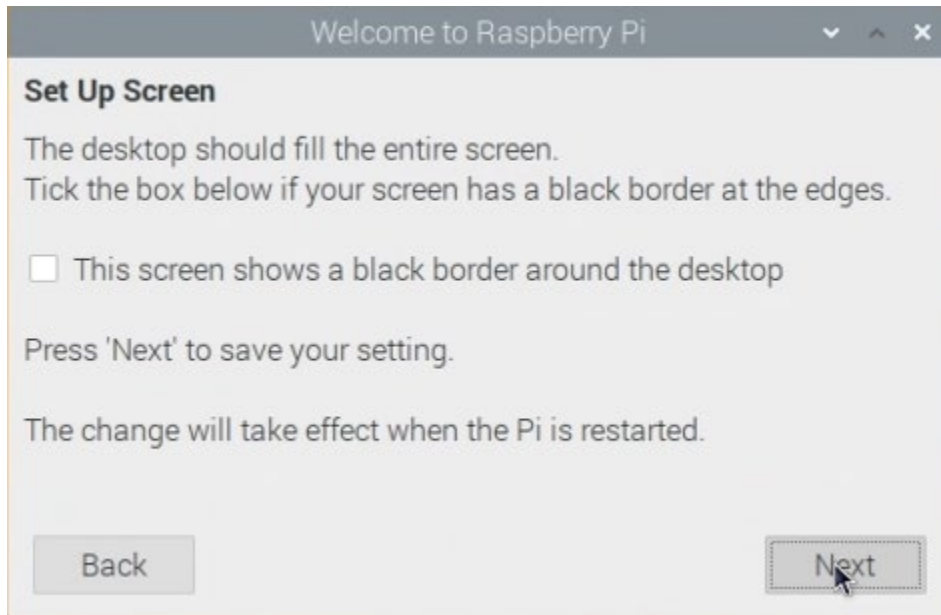
If you have a WiFi network available, the next step will allow you to connect to it. Choose your WiFi network from the displayed list and click **Next**.

In the next dialog box, enter the password for your WiFi network.

Once you are connected to a network, you will be given the option to update your Raspberry Pi OS install.

Debian-based Linux systems use a piece of software called APT to manage installation and updates of software on your computer. APT uses security certificates, so you always know that the software you are downloading is from a legitimate source, and these certificates require that your computer's clock is set to the correct time.

Most computers have a hardware clock. This is a device that uses a battery, so that even when your computer is switched off, the clock can keep ticking. Raspberry Pi has no hardware clock. Instead, it connects to the internet and requests the time from a Network Time Protocol (NTP) server.

Before you can update the software on your Raspberry Pi, you need to make sure the time is correct. Wait until the time display in the top right of the screen is correct before proceeding with an update.
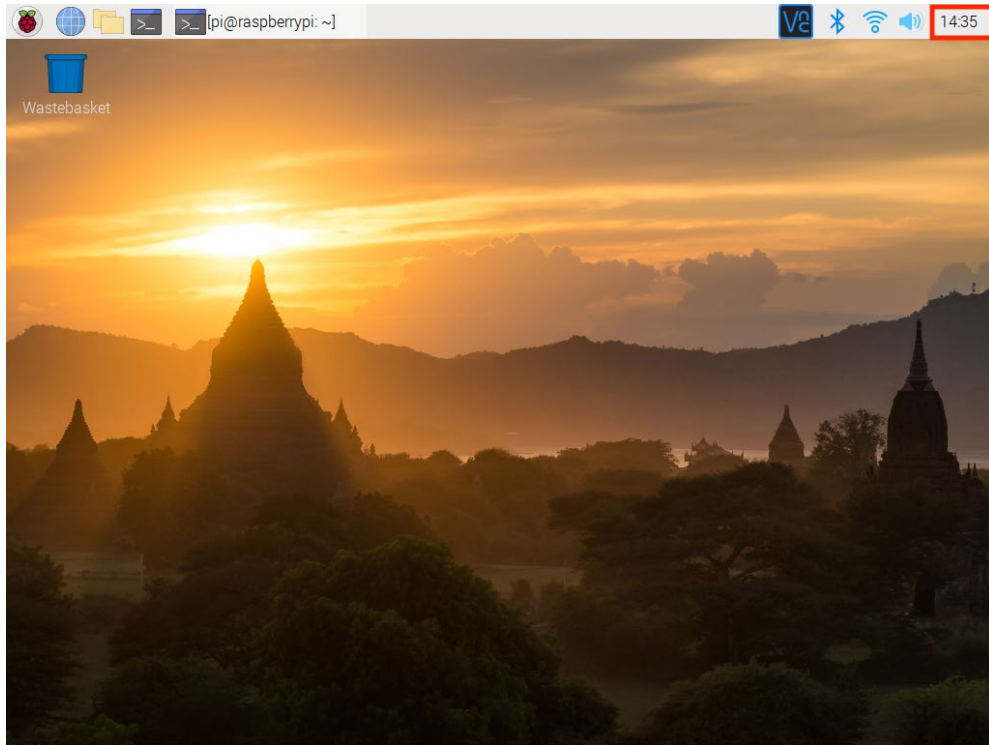
Click on **Next** when the time is correct; your operating system will then collect and install updates.
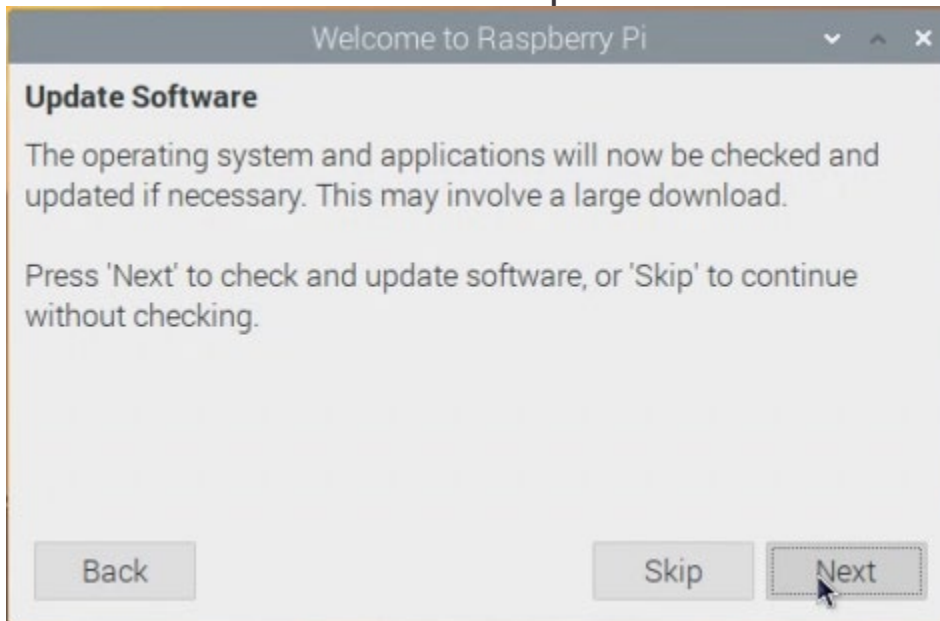
When the update is finished, click on **OK** and then click on **Restart**.

You Raspberry Pi operating system is now ready to be used. In the next step, you'll take a tour of the Raspberry Pi Desktop, the graphical user interface for Raspberry Pi OS.