RASPBERRY PI **4**

STARTER

GUIDE

Get to know your brand new **Raspberry Pi 4**

By **Sean McManus**

I t's been a month since Raspberry Pi 4 came out and we've been seeing a lot of people on social media get stuck in with their new incredible computer. We've also seen a lot of new Raspberry Pi users finally take the plunge and get their first Raspberry Pi, and to those people we say: welcome!

Some of you may still be getting your heads around your new Raspberry Pi, so we're here to help with our Starter Guide that should teach you some of the basics (and beyond!) of how to use it. Grab a microSD card and find a spare monitor, because it's time to have some fun.

Basic setup

01 The heart of your new computing experience: Raspberry Pi 4. Find out the full, amazing specs here: **magpi.cc/benchmarks**

02 Power up to two 4K monitors with Raspberry Pi 4's dual micro-HDMI ports

03 With a keyboard and mouse, you can easily use it as a desktop computer

04 The USB 3.0 ports allow for high-speed file transfers
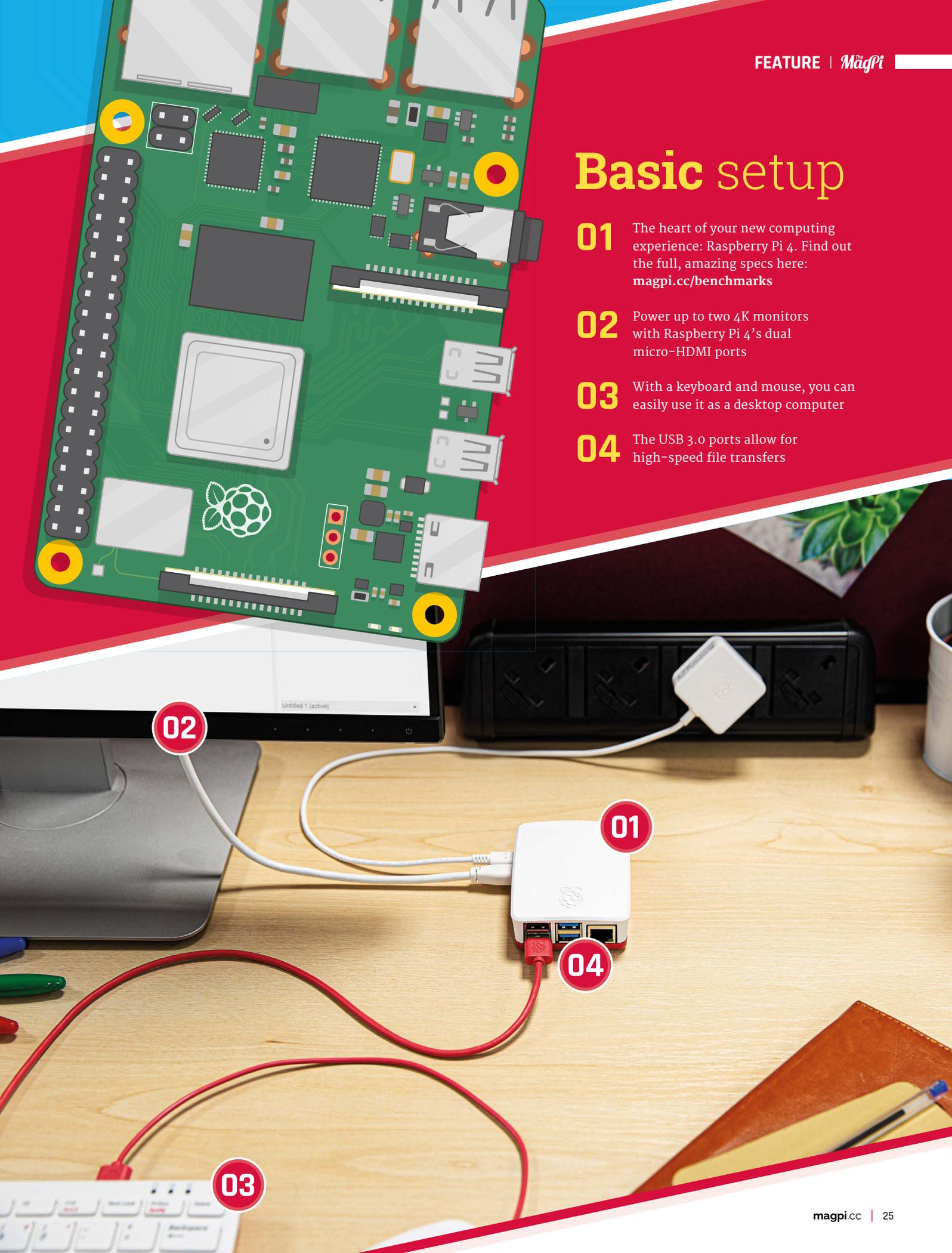
FIRST STEPS WITH RASPBERRY PI

Now you've set up your Raspberry Pi, discover some of its accessories and explore the Raspbian operating system. **Sean McManus** is your guide

Raspberry Pi Case

Protect your Raspberry Pi from spills and dust with a chic case. Official Raspberry Pi cases come in red/white and grey/black, but there are plenty of cases available from other companies too. If you'll be building electronics projects, look for a case that gives you easy access to the GPIO.

magpi.cc/YNvYfF

Raspberry Pi Camera Module V2

You can plug a Raspberry Pi Camera Module into a dedicated connector on Raspberry Pi and it has an 8-megapixel sensor. It works with Raspberry Pi 1, 2, 3, and 4. Shoot a movie in high definition, get close to nature with a bird-box cam, or secure your home.

magpi.cc/camera

CamJam EduKit #3

With its easy control of electronic circuits, Raspberry Pi is ideal for robots. This kit contains everything needed to build your first robot, including a motor controller board, sensors, and wheels. Make a chassis from Lego, 3D-print one, or even use the box.

magpi.cc/RhpjZh

Sense HAT

HATs (short for Hardware Attached on Top) are accessories that plug onto a Raspberry Pi's GPIO pins. The Sense HAT includes a colourful 8×8 grid of LEDs and a five-button joystick. It's packed with sensors: gyroscope, accelerometer, barometric pressure sensor, magnetometer, thermometer, and humidity sensor. It's a portable science lab!

magpi.cc/sense-hat

Fan SHIM

Raspberry Pi 4 is a bit more power hungry than earlier models. If you find it runs hot for your application, try using the Fan SHIM. It provides a software-controllable fan to cool a Raspberry Pi. You can use it together with HATs, by fitting a booster header to lift them above the fan. Read more in our review on page 76.

magpi.cc/qZYBWd

Meet Raspbian with Desktop

01 Click the Raspberry Pi logo to open the applications menu. This is where you'll find the software that's pre-installed in Raspbian, and anything else you add later.

02 Click the globe for quick access to the Chromium web browser.

03 Click the folders to open the File Manager. You can use it to find, move, copy, and delete files on your storage devices. Why not explore the Linux file system?

04 Find the Terminal here. It gives you powerful tools for managing your files and devices, and the command line is often the quickest way to get things done.

05 Volume control. Right-click to select audio output.

06 WiFi options. Turn WiFi on and off, and switch networks here. If the icon is blue like this, you're connected. You can also
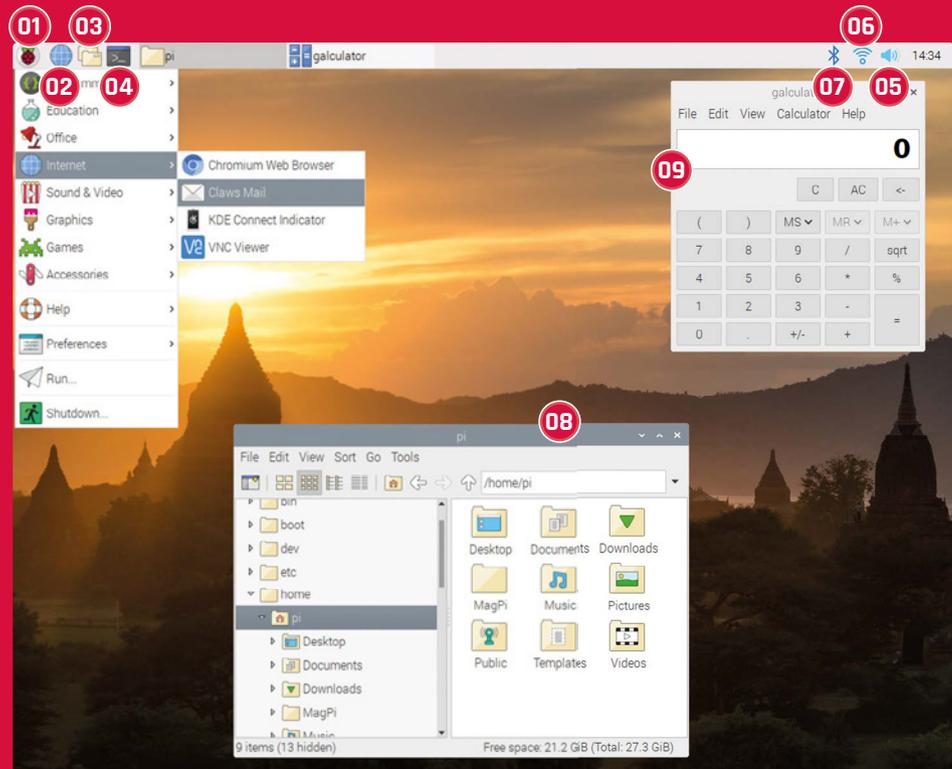
hover the mouse pointer over the icon to see your Raspberry Pi's IP address.

07 Manage Bluetooth connections. You can use Bluetooth devices such as keyboards and mice to

wirelessly control your Raspberry Pi device.

08 File Manager. Use the hierarchical browser on the left or the Go menu to find devices connected to Raspberry Pi. You should

store your files in the **/home/pi** folder.

09 With basic, scientific, and paper modes, this calculator is handy. Find it in the Accessories section of the applications menu.

Raspberry Pi Configuration

Need to adjust some settings? The Raspberry Pi Configuration tool is in the Preferences section of the applications menu. In its System tab, you can change your password, adjust display options, and set Raspberry Pi to boot to the command-line interface (CLI) instead of the desktop.

In the Interfaces tab, you can enable connections, including remote GPIO access and the camera.

To adjust the amount of memory for the GPU or to set older Raspberry Pi models to run faster (overclocking), visit the Performance tab.

You can change the time zone, keyboard, and other geographic options in the Localisation tab.

There are separate options in Preferences for configuring the appearance, audio, main menu, mouse and keyboard, and screen.
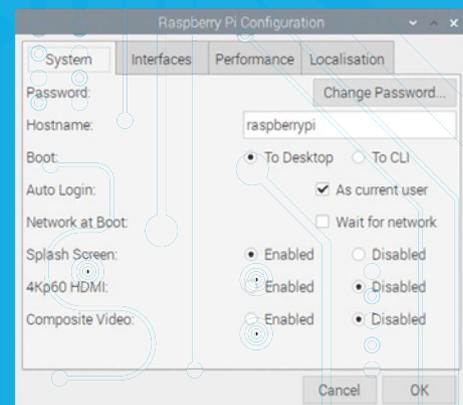
AWESOME APPLICATIONS

Discover some of the software that comes with Raspbian, and find out how to install more

Raspbian comes with a selection of pre-installed software (which depends on which version you install), so you can start working, learning, and making things straight away. Ranging from productivity suites to games, you'll find a well-curated collection of software is just a click away, in the applications menu. There are lots more packages to browse and install, too.

LibreOffice Writer | OFFICE
No computer is complete without a word processor. LibreOffice Writer has all the font and formatting options you would expect, and has basic compatibility with Microsoft Word.

LibreOffice Calc | OFFICE
Work out your budgets with this spreadsheet package. If you're familiar with Microsoft Excel, you'll feel at home here. LibreOffice Calc can open and use typical Excel files.

LibreOffice Impress | OFFICE
If you're presenting to a room of people, don't panic: Impress has your back. Use it to craft and display your slide deck. It's largely compatible with Microsoft PowerPoint.

Chromium | INTERNET
Chromium is the open-source version of Google Chrome. The default search engine in Raspbian is Duck Duck Go, which promises not to track you online.

Claws Mail | INTERNET
Send and receive email. The setup wizard helps you add your email account, and the streamlined interface shows you your mailboxes, message list, and a preview of the selected message.

VLC | SOUND & VIDEO
Listen to music while you're coding using VLC, a fully featured media player for music and video. It can play digital files, streams, and physical media such as CDs and DVDs.

Minecraft Pi | GAMES
We call it a game, but it's more a way of life. With Minecraft Pi, you can build things in Creative mode, and write programs to change the (game) world.

Python Games | GAMES
These tea-break games are fun, but they're also great Python demos. Find the code in the **/usr/share/python_games** folder, and open it in a Python editor to see how it works.

SmartSim | PROGRAMMING
Experiment with designing and testing digital logic circuits. You can develop custom components, and then incorporate them into other circuits. Download examples and read tutorials at **smartsim.org.uk**.

Sense HAT Emulator PROGRAMMING
This emulator features on-screen controls to simulate temperature, pressure, humidity, and device position changes. A great way to try out the Sense HAT before you buy one!

Updating your software

Linux software comes in packages, which are compressed archives that you can download. A package manager is used to find and install them, including any other software they need to work.

Use Add/Remove Software to update your packages. From the menu, choose Preferences > Add / Remove Software. Click on Options and Check for Updates.

You can also update from Terminal. In Raspbian, the package manager is called APT. Updating all the software from the Terminal is a two-step process. First, enter `sudo apt-get update` in the Terminal to update the cache of available software. Then enter `sudo apt-get upgrade` to update the software installed on Raspberry Pi. You'll be told what changes will be made and asked to confirm by typing **Y** and pressing **ENTER**.

Why not install these?

Fritzing | PROGRAMMING
Design and document your electronics circuits based on Raspberry Pi with this design tool. We use it to make circuit diagrams in *The MagPi*.

GNU Image Manipulation Program (GIMP) | GRAPHICS
GIMP is a powerful image editor. You can use it to create digital art, but its best feature is probably the clone tool, which enables you to retouch holiday photos.

Mathematica PROGRAMMING
Good for more than just maths, Mathematica uses the Wolfram language, which has data and intelligence built in. Install it from Recommended Software, in the Preferences section of the applications menu.
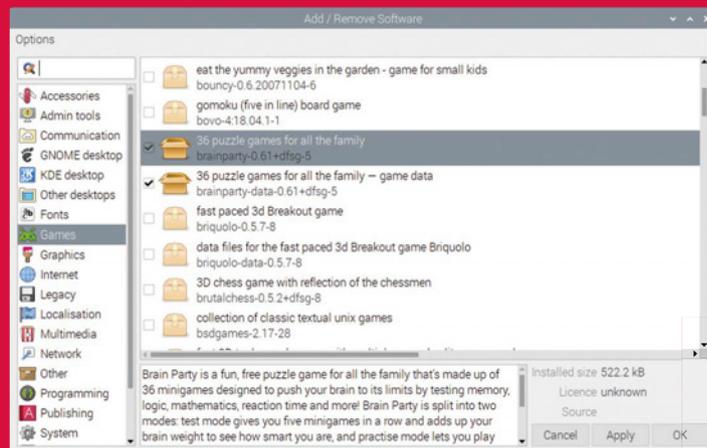
Installing software

The easiest way to manage software is to use the Add / Remove Software tool in the Preferences part of the applications menu. It provides a visual front-end for the package manager.

You can click a category on the left to browse applications, or enter a keyword in the search box in the top-left to look for a particular application. Choose the applications you want to install by ticking the box beside them. Some packages require other packages to work properly, but the tool will take care of that for you. To remove an application, untick its box. When you've made your choices, click OK to install or remove your software.
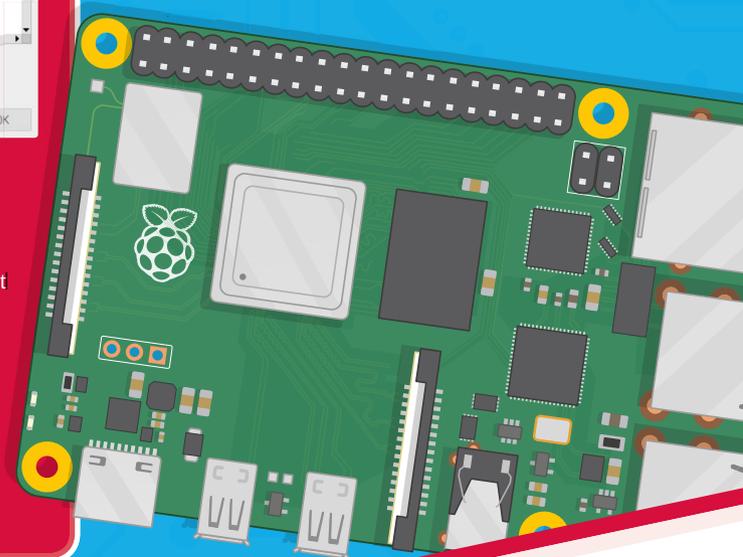
GET CONNECTED

If your Raspberry Pi is in a tree photographing nature, you don't want to climb up there just to update it. Log in remotely and take control

There are two technologies you can use to connect to your Raspberry Pi: Secure Shell (SSH) and Virtual Network Computing (VNC). Before you can use them, they need to be switched on in the Raspberry Pi Configuration settings. To do so, click the Interfaces tab, then enable SSH and/or VNC.

Both approaches require you to know the IP address of your Raspberry Pi device. To find out, click the Terminal icon on the taskbar, and enter `ifconfig` at the prompt. It will show you all your network connections. You're looking for an IP address, which will be four numbers with a dot between them, like 198.51.100.0. You'll find it beside 'inet', in the details for wlan0 if you're using WiFi or in the eth0 summary if you're plugged in to the network.

Using SSH

SSH enables you to use the command line on your Raspberry Pi remotely, so it's very handy for installing software and fixing configuration files. You can't use SSH to run any applications that need the graphical desktop, though.
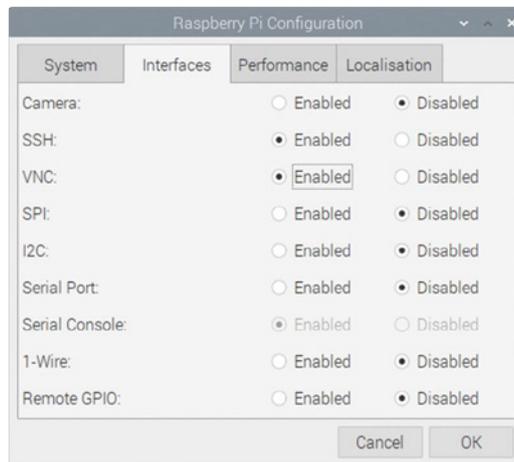
▲ Enable SSH and VNC before you try to use them

The software for SSH is pre-installed on Linux, macOS, and Windows 10. Start by opening the command line. On a Mac, find it by typing 'Terminal' into the Spotlight search. On Windows 10, Use ⊞+**R** to open the Run dialog box, then type in **cmd**.

Once you're in the command line, enter `ssh pi@198.51.100.0`, but replace the numbers with the IP address of your own Raspberry Pi device. The 'pi' bit is your username.

> ❝ SSH enables you to use the command line on your Raspberry Pi remotely, so it's very handy ❞

The first time you connect to a device using SSH, you'll see a warning that shows the ECDSA key for the device you're trying to connect to. You can (if you wish) validate that this is correct by using `ssh-keygen -l -f /etc/ssh/ssh_host_ecdsa_key.pub` in the Raspberry Pi Terminal. But it's usually OK to just type in **yes** and then press **ENTER** to confirm you want to connect.

You'll be asked to enter the password for your Raspberry Pi device. You won't see the cursor move while you do this, so type on regardless. When you press **ENTER**, you're in! You'll see a Linux welcome message, the date and time of your last login, and then the Raspbian command prompt, waiting for instructions. When you've finished, enter `exit` to leave the SSH session.

If you're using an earlier version of Windows, download PuTTY from **putty.org**. Enter your Raspberry Pi's IP address in the Host Name box, and click Open. Again, you'll see a warning if this is your first connection, which you can safely dismiss. Log in as **pi**, and enter your password. Raspberry Pi is now at your command!

▲ Using VNC Viewer to manage Raspberry Pi from an iPad

Using VNC

Virtual Network Computing (VNC) enables you to remotely access the Raspberry Pi desktop, so you can manage files and run software using it. Some people use VNC to share their keyboard, mouse, and monitor between a PC and Raspberry Pi.

Raspbian includes VNC Server, which runs automatically in the background if you've enabled it in your settings. You'll need to download and install VNC Viewer (**magpi.cc/FuGnye**) on the device you want to use to control Raspberry Pi. VNC Viewer is available for Windows, macOS, and Linux. There are also Android and iOS apps, so you can use VNC to control Raspberry Pi from a mobile device, although it's rather fiddly without a real mouse and keyboard. Optionally, by creating a RealVNC account and registering your Raspberry Pi, you can then access it from anywhere in the world using VNC Viewer.

When you start VNC Viewer, it'll ask you to enter a VNC Server address. This is the IP address you noted when you ran `ifconfig` on your Raspberry Pi.

The first time you connect to a device, VNC Viewer warns you that it has no record of connecting to this device before, and shows you the device's signature and identification catchphrase. To verify you're connecting to the correct device, click the VNC icon on the right of the taskbar in Raspbian to see your device's details.

VNC Viewer prompts you to enter the username and password for the device you're connecting to. You'll then see your Raspbian desktop in the VNC Viewer window. You can now use your keyboard and mouse (or touchscreen on a mobile device) to control the Raspbian desktop, including using programs installed on Raspberry Pi.

Top Tips for VNC
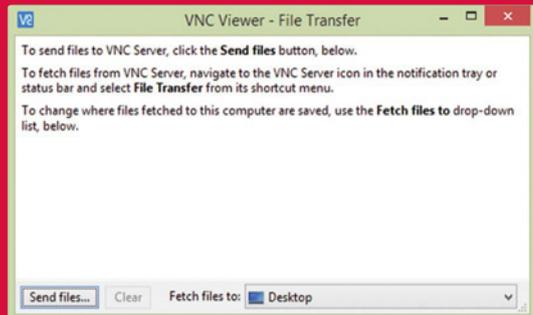
▲ At the top of VNC Viewer in the middle is a tiny toolbar. The File Transfer option enables you to easily copy files to Raspberry Pi.
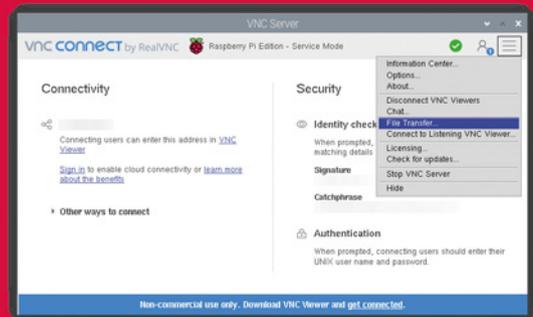
▲ Send files from Raspberry Pi using the File Transfer option in VNC Server in Raspbian. Use the three-bars menu (top-right) to find it.
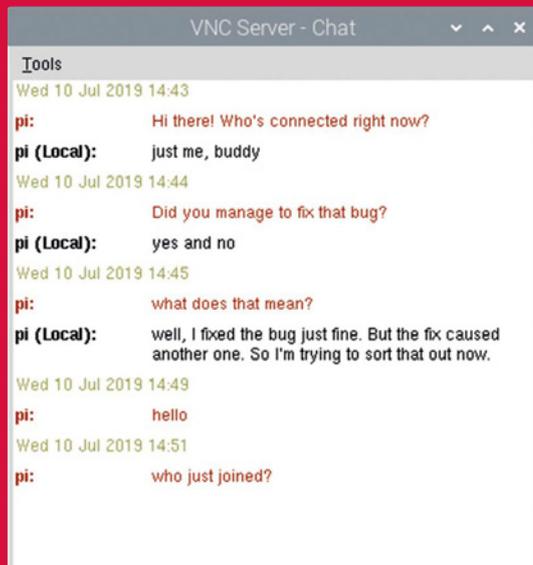
▲ Use the toolbar in VNC Viewer to start a chat session with anyone using the server (Raspberry Pi device) and anyone else connected to it remotely.

CODE TO JOY

Raspberry Pi comes with everything you need to start programming

If you've never programmed before, you're **in for a treat.** Raspbian comes with several integrated development environments (IDEs) you can use to write your own programs, supporting languages that are friendly to use, and fun to tinker with. If you're a veteran coder, you'll find powerful IDEs are included to help you be productive, too.

Scratch 2
LANGUAGE: SCRATCH

With its friendly drag-and-drop commands and a library of sprites and sound effects, Scratch makes it simple to get started with coding. By minimising typing, and guiding you to sensible block combinations, it helps you to avoid common mistakes. Don't be fooled by its accessibility, though: it's a fully-fledged programming language, with plenty of potential.

### Thonny
LANGUAGE: PYTHON

Python is one of the most popular languages on Raspberry Pi, and Thonny is our favourite way to edit it. In a single window it shows you your code, the shell, and your data (variables), so you can easily see what's going on and fix any bugs that creep in.

Sonic Pi
LANGUAGE: SONIC PI

Learn how to compose and perform music with code! Sonic Pi incorporates synths, samples, and effects that you can control by writing programs using a language based on Ruby. You can develop and modify programs while the music plays, to perform live concerts or improvise at home.
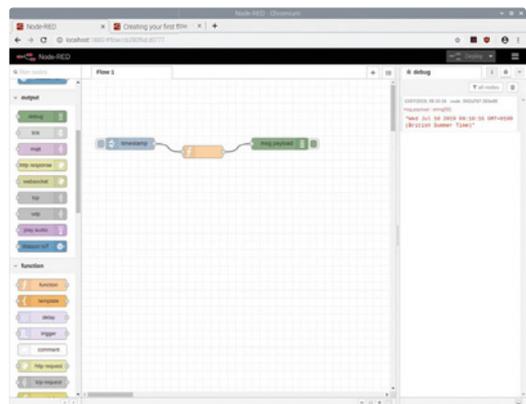
Node-RED
LANGUAGE: JAVASCRIPT/NODE-RED

Node-RED enables you to use a flowchart to program data flows for Internet of Things applications on Raspberry Pi. It uses JavaScript, the language of the web. Run the Node-RED console in Raspbian and then visit **http://localhost:1880** in your browser to program it. For help, see **nodered.org**.

Greenfoot
LANGUAGE: JAVA

Java is one of the world's most popular programming languages. Greenfoot makes it easier to learn, by providing a friendly environment for building simple games. The editor incorporates a game world, and you add Java code to image objects to control their interactions. Find out more at **greenfoot.org**.
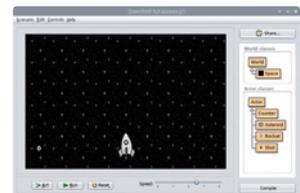
Geany
LANGUAGE: LOTS!

If you're looking for a lightweight but powerful IDE, try Geany. It supports many languages, including HTML, C, Java, PHP, JavaScript, and Perl. Its code auto-completion and syntax highlighting can help you code faster, and reduce errors. Our favourite feature? Code folding, used to show or hide logical chunks of code in a long program.

FURTHER RESOURCES

There's a wealth of resources available to support you as you learn more about Raspberry Pi and Raspbian

The Official Raspberry Pi Beginner's Guide

Available to buy in print and as a free PDF, this book shows you how to set up Raspberry Pi, and gets you started with programming it in Scratch and Python. It also covers the Sense HAT and Raspberry Pi Camera Module, with code examples you can build and tailor.

magpi.cc/BGbook

Official Raspberry Pi Documentation

The documentation provides concise user guides for Linux, Minecraft, Sonic Pi, Scratch, and Python. It's also the place to go for advice on configuring Raspberry Pi, hardware specifications, and remote access tips. Useful for both beginners and power users.

rpf.io/docs

GPIO Zero Documentation

See how easy it is to start programming your own electronics projects for Raspberry Pi. The documentation for GPIO Zero shows you how to connect up sensors, LEDs, motors, and more. With a bag of cheap components, you can start building your first circuits.

rpf.io/gpiozero

Conquer the Command Line

We publish a series of short books called *The MagPi Essentials*, and this one explains the Terminal, including using it for connecting disks, compiling software, and backing up. You can download all the books in the series, and past issues of *The MagPi*, at **magpi.cc/issues**.

magpi.cc/CLIbook
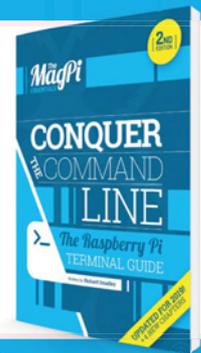
Hacking and Making in Minecraft

Minecraft on Raspberry Pi is a great way into the world of coding. This book, another in *The MagPi Essentials* series, shows you how to shape the world with Python code, use a connected LED as a treasure sensor, and use Sonic Pi and Node-RED together with Minecraft.

magpi.cc/MCbook
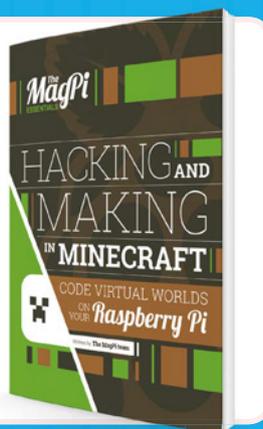
Python Games

Go behind the scenes of the Python games that come pre-installed in Raspbian with Al Sweigart's free online book. It explains the program code for seven of the games in detail, and lets you study another four listings yourself.

magpi.cc/RTfkvD