Unpack the box 3
Operating Systems 4
Installation 6
Loading the O/S 7
Raspbian 8
Command line: Learn the ropes 10
Packages: How do they work? 16
RaspBMC 20
Camera controller 22
Sending output 26
Minecraft Pi 30
Postscript 32
Unpack the box

Inside the box you will find the Raspberry Pi board, a 5V Power Supply (optional) and a 8GB microSD card.

Depending on which bundle you might have purchased you might also receive a case or other accessories. Feel free to put those items together prior to starting up your Pi. The Pi requires 5V 1A power so if you did not purchase a power supply you will need to locate one that has a Micro USB tip on the end. Many smartphone and tablets use Micro USB charging cables, those will work just fine.
Operating Systems

Let’s take a look at a sweet selection of tasty operating systems for the Raspberry Pi.

The Raspberry Pi phenomenon appears to go from strength to strength; like a runaway train, it’s ploughing ahead and forging itself a place in the record books.

It’s hardly surprising – the hardware alone is developed perfectly for the goals of the Raspberry Pi Foundation, the pricing is pitched perfectly, and having the unique versatility of Linux as the operating system seals the deal nicely.

Most buyers, once they get their hands on their new RPi, make a move towards the official Raspberry Pi site and follow the getting started instructions therein; the end result is the user running Raspbian ‘Wheezy’, the Foundation’s recommended operating system, creating, learning and programming, and strapping the poor wee beast on to a weather balloon and sending it to the outer edge of the atmosphere.

What many RPi users don’t realize, though, is that there’s a wealth of other operating systems available for their beloved Pi.

We thought, therefore, that those users who aren’t aware of these other sweet toppings for the Raspberry Pi need to be informed, and what’s more, they need to have a chocolate box selection presented to them.

How we tested...

Therefore, to get a true all-round perspective, we took the time to install the operating systems on a fresh 8GB microSD Card card. The areas we’re looking at are installation, default software, media playback (out-of-the-box), looks and usability, the community behind the OS and their respective attitudes toward software freedom. Basically, the very stuff that makes a Linux user decide on what system to use.

We also want to gauge this from the point of view of someone who’s not as familiar with Linux as other people are, so that they can jump into the project without too much hassle, and not end up leaving it feeling disheartened.
Wheezy, the Foundation’s recommended end result is the user running Raspbian getting started instructions therein; the official Raspberry Pi site and follow the most buyers, once they get their hands operating system seals the deal nicely. The unique versatility of Linux as the pricing is pitched perfectly, and having the software you may want to use such as a graphical environment, for example. You should find the information you need at bit.ly/3APmgA. Taking it from this initial state to a working system will require a bit of work, but along the way you’ll learn about how the internals of a Linux distribution fit together. Whether or not this is worth all the work, does of course, depend on you.

Raspbian
This is the recommended distro by the Raspberry Pi Foundation. Unless you have good reason to use a different one, it’s probably your best bet. It’s based on Debian Wheezy, so you can easily install anything from the huge Debian repositories. The default desktop environment is LXDE, which is very lightweight, but a little basic for some tastes. Xfce is available for people who like a few more graphical niceties. It has the raspi-config program, which is probably the easiest way of configuring your Pi. The Raspberry Pi was designed to get children into programming, and Raspbian was designed with this in mind. You’ll find idle (a Python IDE) and Scratch (a programming environment for young children) on the desktop. It’s available from: www.raspberrypi.org

RaspBMC
The Raspberry Pi may have been designed as an educational tool, but hobbyists have been pretty quick to make it a toy. This distro is designed to turn your Pi into a media center that can be used to control your TV. It’s based on XBMC, which allows you to play music and videos that you have as files, or stream them from the internet. The image can be downloaded from: www.raspbmc.com. For details of how to install it and set it up, see the following pages. If you have a MythTV back-end set up, you can use XBMCPi to provide a front-end interface. Depending on what type of media you want to play, you may need to purchase the codec packs that provide access to patent-protected video and audio algorithms.

Arch Linux
While Raspbian has been created to try to shield users from the internal setup of the OS, Arch Linux is designed to help users understand how the system works.

The initial image, available from www.raspberrypi.org, includes just the basic system to get your Pi running and connected to the network. It doesn’t include much of the software you may want to use, such as a graphical environment, for example. You should find the information you need at bit.ly/3APmgA.

Taking it from this initial state to a working system will require a bit of work, but along the way you’ll learn about how the internals of a Linux distribution fit together.

Whether or not this is worth all the work, does of course, depend on you.

Risc OS
The difference with the Risc OS is that it is small and fast. Developed when the fastest desktop computer was an 8MHz ARM2 with 512KB of RAM. The core system including windowing system and a few apps fits inside 6MB. That means it’s fast and responsive on modern hardware. The memory taken by apps is usually counted in the kilobytes.

To Risc OS a 700MHz 512MB Raspberry Pi is luxury, what to do with all that memory? Risc OS like Raspbian, takes you to a nice GUI at the startup. One feature of the Risc OS is that it boots to the desktop in 1080P by default. The Risc desktop is a little retro but is functional in its default mode. The Risc OS take a little getting used it, one caveat is that the Ethernet port is disabled at launch so it requires some configuration before using.

The initial image, available from www.raspberrypi.org, includes just the basic system to get your Pi running and connected to the network. It doesn’t include much of the software you may want to use, such as a graphical environment, for example. You should find the information you need at bit.ly/3APmgA.

Taking it from this initial state to a working system will require a bit of work, but along the way you’ll learn about how the internals of a Linux distribution fit together.

Whether or not this is worth all the work, does of course, depend on you.
Installation

Do you need a PhD to install the OS?

The NOOBS operating system installation is as easy as copying files onto your SD card.

The installation of an operating system image is fairly well documented, as per the area on the Raspberry Pi site titled Guide for beginners which can be found here: goo.gl/S3xqP, along with the simple installation routine of using either dd on Linux, or with the new NOOBS image you simply unzip the image download and copy the files onto a blank formatted microSD card in Windows. The process is relatively painless, it’s what happens after you insert the microSD card into the Raspberry Pi and apply some power that the fun starts.

The six operating systems on the NOOBS card – Raspbian, Risc OS, Arch Linux, OpenELEC, RaspBMC and Pidora – each have their own nuances, and methods by which to install and provide the user with a base working graphical desktop. While having a GUI isn’t absolutely necessary, it does cover the large percentage of users who are new to Linux. That being the case, the definition of ‘installation’ must include getting to the point whereby the new user can recognize the operating system as they would a standard Linux desktop – in other words, be presented with a graphical user interface. In a world where easing the user into the bath water of Linux is paramount, Raspbian has the most user friendly desktop, but the other offerings have just as good a start for the user.

Raspbian, for example; once transferred to the SD card and booted, we are rapidly launched into a colorful and friendly GUI, with relatively detailed messages informing us of any issues during the initial boot and setup. From here, we can simply click on the ‘Configure’ icon and begin to alter any settings we see fit.

Arch Linux for the RPi is a different beast, booting the user into a terminal environment and leaving them to download, install and configure their OS. Arch, once fully appreciated, is one of the best operating systems available, but it takes some tweaking to get to a standard desktop.

OpenELEC is the simplest version of XBMC, starting directly into the XBMC GUI without any additional configuration required.

RaspBMC makes it easy for you, once you select this operating system you are taken directly to the GUI, no scary terminal prompts to deal with. Once you have completed the configuration screens and RaspBMC has checked for updates, you will be ready to go.

Pidora which is a remix of the Fedora Linux distribution is fairly easy to configure. Once you select this O/S, you will be presented with several configuration screens and then the desktop will load. One thing to watch out for here is the terminal commands are a little different than the other operating systems (distros in Linux language). The foundation that compiled Pidora has a good tutorial here bit.ly/1pC2LA.

In summary, Raspbian would be the easiest to use and has the most support from the Raspberry Pi Foundation. OpenELEC offers the most media support if that is the route you would like to go. The other operating systems all have their advantages and disadvantages. It is up to you to decide which way you would like to go.
Loading the O/S

The memory card is affectionately referred to as NOOBS.

NOOBS is a way to make setting up a Raspberry Pi for the first time much, much easier. You won’t need network access, and you won’t need to download any special imaging software.

Insert the microSD card in the memory slot underneath the board. Plug your power cord into the port next to the HDMI video port. When you boot up for the first time, you’ll see a menu prompting you to install one of several operating systems into the free space on the card. The choice means you can boot the Pi with a regular operating system like Raspbian, or with a media-center specific OS like RaspBMC.

Once you’ve selected the O/S you’d like (see the O/S section for more information), make sure you check the dialogue box at the bottom of the page for the proper language that you prefer. The installer will build the O/S that you selected (a good time for a sandwich or a cup of coffee).

Once you’ve installed an operating system, your Pi will boot as normal. However, NOOBS stays resident on your card, by holding Shift down during boot you can return to the recovery interface. This allows you to switch to a different operating system, or overwrite a corrupted card with a fresh install of the current one; it also provides a handy tool to let you edit the config.txt configuration file for the currently installed operating system, and even a web browser so you can visit the forums or Google for pointers if you get stuck.

Once the installation is complete your Pi will restart and a bunch of strange looking text will appear on your screen. If you are new to Linux this might take you back to the “DOS” days. Not to fear this is called the “command line” You will see at the bottom of the page the last line reads – raspberrypi login:

Next you will need this information. The default username and password are:

Username: pi
Password: raspberry

When you hit the enter key you will see the following line

Pi@raspberrypi - $  

Type the following to launch the desktop:

startx

Congratulations! You now have started up your Pi! Now go explore.

The microSD card slot is located on the underside of the Raspberry Pi board.
Raspbian

For the majority of people who use it, Raspbian will be the graphical face of the Raspberry Pi.

It can be obtained and installed on to an SD card by following the instructions on the previous page.

Once it’s up and running, it’s a good idea to grab the latest versions of all the software by connecting your Pi to the internet, opening a terminal and running:

```
sudo apt-get update
sudo apt-get upgrade
```

The killer feature of Raspbian is the raspi-config program. This will start automatically the first time you boot, or can be run at any time by typing `sudo raspi-config` in a terminal.

It has got quite a few options, but the most important are:

- **expand_rootfs** Because of the way Raspbian is installed, it will only create a 2GB filesystem, so if you have a larger card, any remaining space will remain unused. You can use this option to expand the filesystem to take advantage of any wasted space.

- **memory_split** The Raspberry Pi uses the same chunk of memory for both the main processor and the graphics chip. Using this option, you can change the amount allocated to each.

- **overscan** This option can be used on some displays to make the graphics expand to fill the whole screen. You can safely ignore it unless you have problems.

- **overclock** Get an extra 50 per cent performance at no extra cost! See ‘Overclocking’ for more details.

- **boot_behaviour** This rather cryptically named option changes whether your Pi boots into a graphical environment or a text one.

The installed software has been kept to a minimum. This is a good idea, but you may find that tools you use on other desktop distros aren’t there. Fortunately, as Raspbian is linked to the Debian Armhf repositories, you have access to more software than you’re ever likely to need. If you like using a mouse, you may want to install a graphical package manager. We recommend Synaptic. To install it, type:

```
sudo apt-get install synaptic
```

in a terminal. It can then be opened by going to the ‘LXDE menu > Preferences > Synaptic Package Manager’. You can then install any software you want.

- **Like all good distros, Raspbian comes with a selection of addictive time-wasters. This is Squirrels from the Pygames selection.**
### 12 COOL RASPBERRY PI PROJECTS

- The complete channel one temperature monitor and alarm project
- The Raspberry Pi softball camera
- The Raspberry Pi karaoke machine
- The Drinkmotizer: a Raspberry Pi drink mixing robot
- New Year's Eve countdown timer with fireworks launching ability
- Raspberry Pi remote fish tank controls; AKA Project Goldie
- The scary door
- RaspWatt: discover power consumption using a Kill-A-Watt & Pi
- Build your own Gertboard experimenter kit
- Raspberry Pi enabled Christmas lights
- Ultimate Raspberry Pi bundle security system
- Pumpkin Pi project for Halloween and a second helping of pumpkin Pi

www.element14.com/raspberrypiprojects

---

### Overclocking

The processor at the heart of the Raspberry Pi is designed to run at 700MHz. That is, perform 700,000,000 operations per second. Of course, ‘designed to run’ doesn’t mean ‘has to run’. You can increase this speed. However, doing this will increase the power consumption, which in turn increases the amount of heat generated. If it gets too hot, you’re liable to have a smoking pile of silicon rather than a functional processor.

Fortunately, Raspbian includes a tool to help you ramp up the speed while also keeping a careful eye on the temperature. And because this is an official tool, using it won’t void your warranty (unlike earlier unofficial methods). Overclocking your Raspberry Pi is simply a matter of running `sudo raspi-config` and then selecting ‘Overclocking’.

There are a few options to choose from, depending on how brave you’re feeling.

If you find that your Pi becomes unstable, reboot with the Shift key held down to disable overclocking, then change the option in raspi-config. The maximum setting should give you a whopping 50 per cent extra speed, which we found makes a real difference to the desktop user experience, especially for web browsing.

If you want to keep an eye on your core temperature, you can add the Temperature widget to the LXDE panel. However, your Pi will automatically turn off overclocking once it reaches 85°C.

**Overclocking will increase the amount of power that your Pi draws, and so may become less stable if running a number of USB devices.**
Command line: Learn the ropes

Get to grips with your Raspberry Pi’s command line interface and unleash its full power without using the mouse.

As you have no doubt discovered, Raspbian has a graphical interface similar to that of Windows or Mac OS X.

You can do most of your day-to-day tasks in this interface. There’s a file manager, web browser, text editor and many other useful applications. However, sometimes you need an interface that’s a bit more powerful, and this is where the command line interface (CLI) comes in. It’s also known as the terminal or shell.

This is an entirely text-based interface, where you type in commands and get a response. We won’t lie to you: it will seem confusing at first. Don’t worry, though – once you’ve had a bit of practice, it will start to make sense, and spending a little time learning it now will pay dividends in the future.

The first thing you need to do is open up a terminal. Click on ‘LXTerminal’ on the Raspbian desktop. You should now see a line that looks like:

pi@raspberrypi ~ $

This is the command prompt. Whenever you see this, you know the system is ready to receive input. Now type `pwd`, and press Enter. You should see:

/home/pi

If you’ve changed your username, then you’ll see a different line. The rather cryptically named `pwd` command stands for Print Working Directory, and the system simply outputs the directory you’re currently in. When you start a terminal, it will go to your home directory.

Now we know where we are, the next logical thing to do is move about through the directories. This is done using the `cd` (change directory) command. Try entering:

```bash
cd ..
pwd
```

You should find that the system returns `/home`. This is because we’ve `cd`ed to ‘..’ and two dots always points to the parent directory. To move back to your home directory, you can enter `cd pi`.

There is also another way you can do it. The `~` (pronounced tilda) character always points to your home directory, so wherever you are in the filesystem, you can enter `cd ~` and you’ll move home.

Now type `ls` and hit Enter. This will list all the files in the current directory. One of the big advantages of commands is that we can tell them exactly how we want them to behave. This is done using flags, which come after the command and start with a ‘-‘. For example, if we want to list all the files in the current directory (including hidden ones, which start with a ‘.’ on Unix-based systems), we use the flag `-a`. So, in your terminal, type `ls -a`.

This time, you should see more files appear. Another flag for `ls` is `-l`. This gives us more information about each file. Try it out now by typing `ls -l`. You can even combine flags, such as in `ls -al`.

Interactive programs

Most of the commands we’re dealing with here are non-interactive. That means you set them running and then wait for them to finish. However, not all command line programs work like this. For example, when you first booted Raspbian, it started a config tool that ran in the terminal. There are a few other programs that work in a similar way. Traditionally, the most common has been text editors that allow you to work on files if you don’t have a graphical connection. There are a few quite complicated ones that are great if you spend a lot of time working from the command line, but they can be hard to learn. There’s also an easy-to-use terminal-based text editor called `nano`.

Enter `nano` followed by a filename at the command prompt to start it. You can then navigate around the text file and make any changes you need. Press `Ctrl+X` to save your work and exit back to the prompt.