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LINUX FORMAT PRESENTS

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THE COMPLETE GUIDE

Everything you need to know to get started with Ubuntu Linux

100 PAGES OF UBUNTU GUIDES

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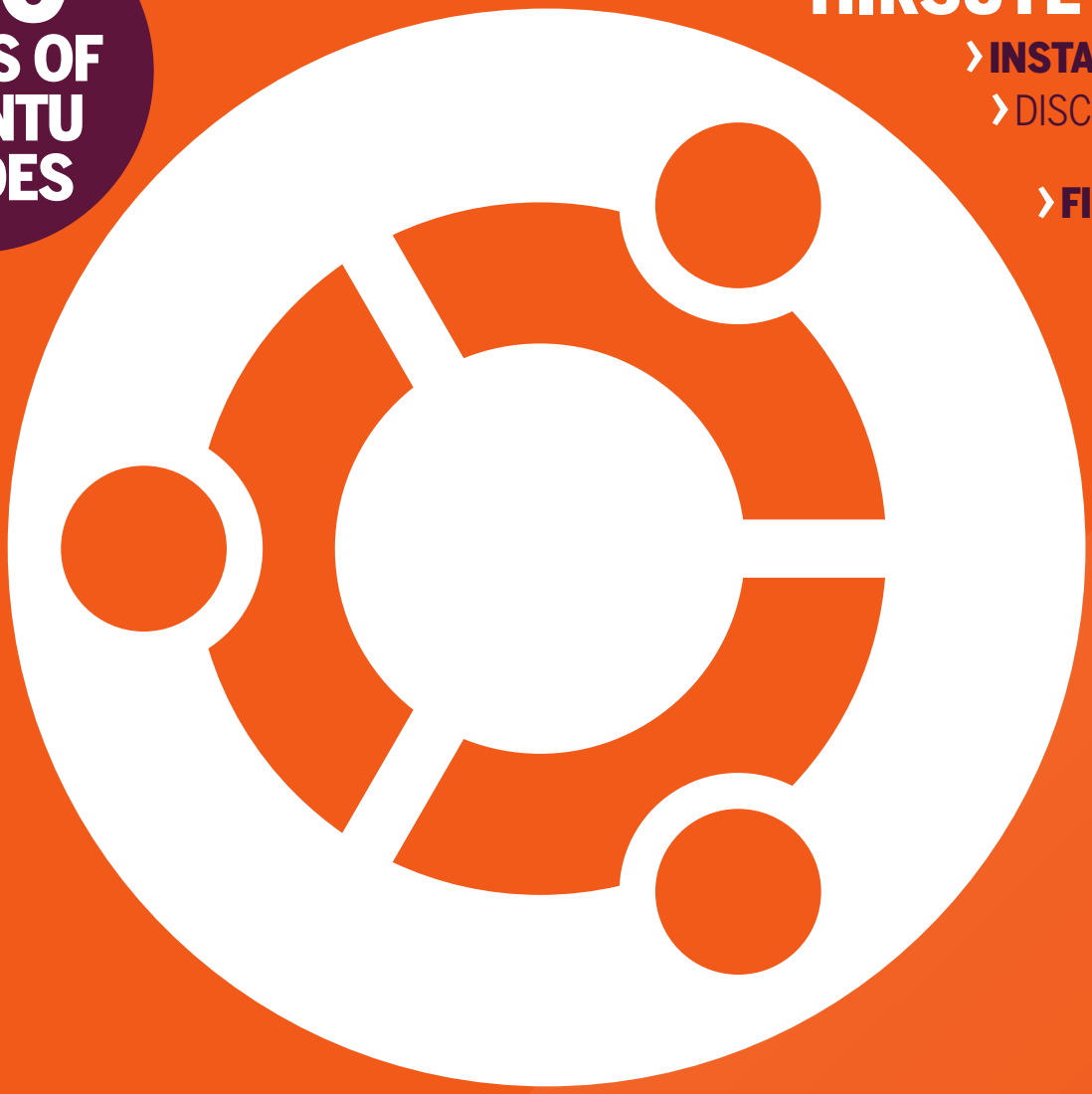
- **INSTALL UBUNTU**
- DISCOVER GREAT FEATURES
- **FIX COMMON ISSUES**
- LOVE LINUX!



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FUTURE

ELEVENTH EDITION

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THE COMPLETE GUIDE

Linux is taking over the world and the last place it has to conquer is your desktop. If you're desperate to dump Windows, curious enough to try Ubuntu or want to jump feet-first into the open source world, this Ubuntu special is the best place to get started. Inside this bookazine are all the guides, tutorials and advice you need to successfully install, get started and use Ubuntu for the first time. We'll be holding your hand as you leave Windows behind and get Ubuntu up and running on your home systems.

The great thing about Ubuntu and Linux is that if you want to keep things simple, you can, but if you want to hit the bare metal and dive into the inner workings of the operating system, you can do that, too. We're here to guide you into the world of Linux. We won't pretend it's completely easy – you need to be prepared to look for support and ask questions – but there's a wealth of friendly help available from the Ubuntu and Linux communities. So what are you waiting for? Turn the page and start your Ubuntu adventure!

FUTURE

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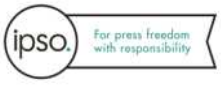


ubuntu
THE COMPLETE GUIDE

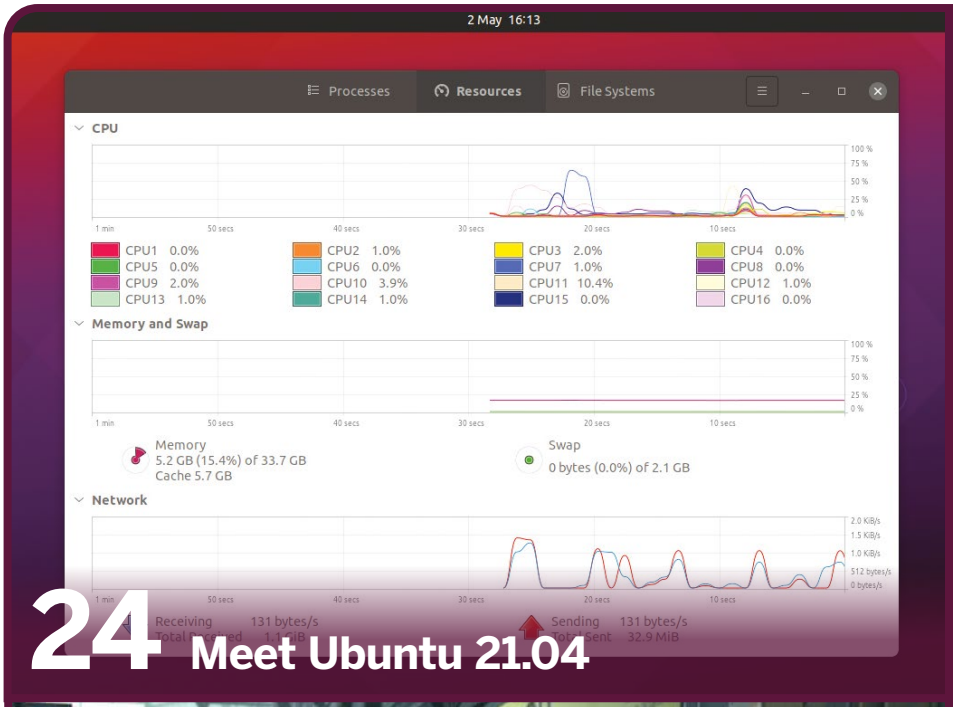
Had enough of Windows? Looking for something new to play with? Step into the vast world of open source and Linux – we've got plenty here to keep you entertained!

Get started

If you're not already, we'll get you up and running with Ubuntu in no time.

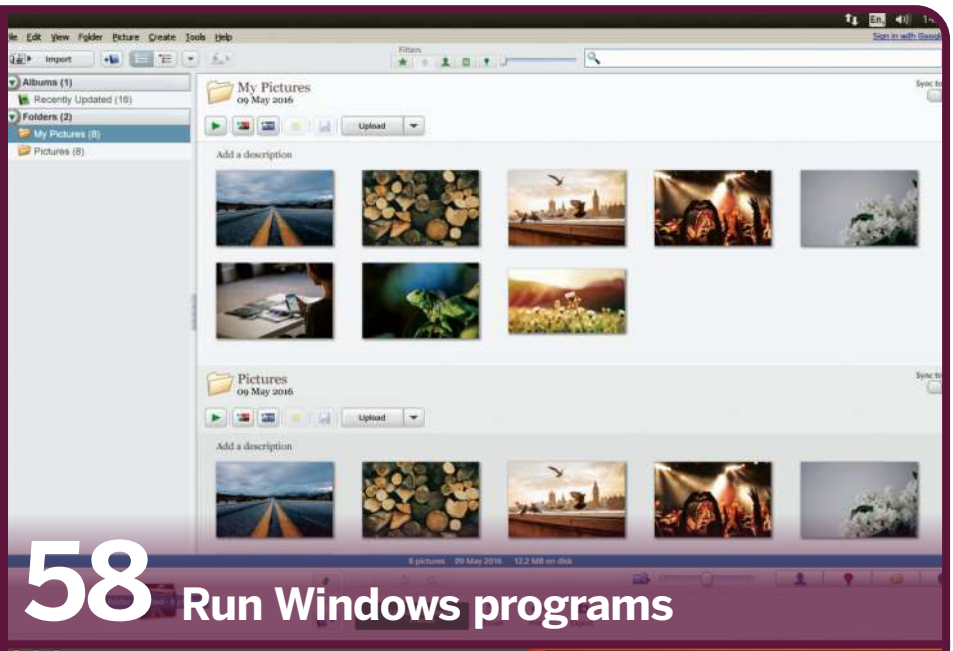
Linux apps

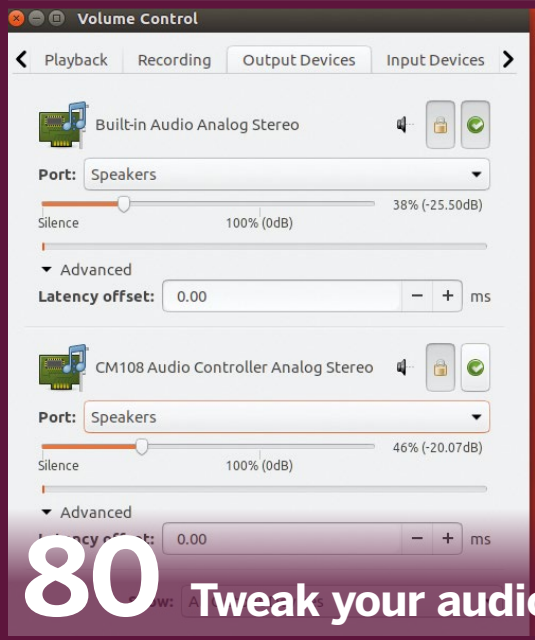
Ubuntu comes with a library packed full of amazing apps.

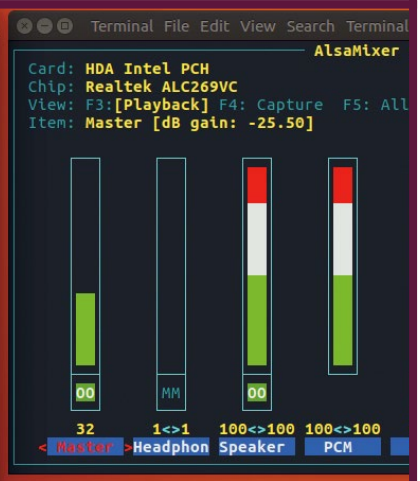


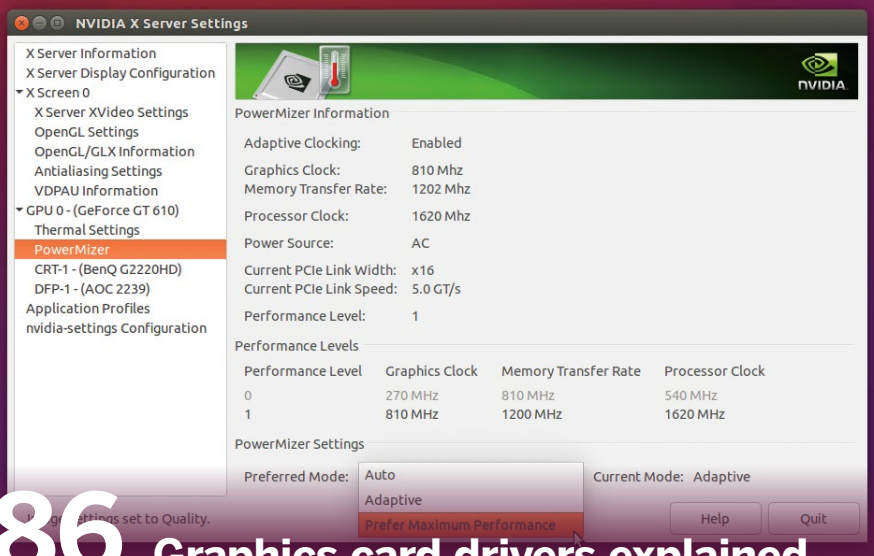
24 Meet Ubuntu 21.04

46 Play games on Linux









Doing more

Now you have the basics down, it's time to try your hand at more involved projects and tasks.

System settings

Now you're using Ubuntu, here's how you can fix the most common Linux issues when it goes wrong!

Get started

What is Ubuntu?

It's an operating system, it's computer freedom, it's your gateway to open source and a community that shares software for everyone to use.

Ubuntu versions

Like most software, Ubuntu has released versions and code names. If you've never come across Ubuntu before then these can be a bit, erm, unusual and confusing so let us explain. Canonical, the company that develops Ubuntu, releases two versions a year and it then increases the version number by one. The releases are in April (04) and October (10), so version 19.04 was released in April 2019. The release after was 19.10 in October 2019.

Each normal release gets nine months of support updates. Every two years there's a Long Term Support (LTS) release that gets three years of support releases. The current one is 21.04 LTS; the next will be 22.04 LTS. If you want something more stable, we suggest opting for one of these releases. To add to the quirkiness, every release gets an interesting release name, after an animal that cycles the alphabet for each release. Recent names are:

16.04 LTS Xenial Xerus
16.10 Yakkety Yak
17.04 Zesty Zapus
17.10 Artful Aardvark
18.04 LTS Bionic Beaver
18.10 Cosmic Cuttlefish
19.04 Disco Dingo
19.10 Eoan Ermine

If we say Microsoft Windows or Apple macOS, you know what they are. But if we say Ubuntu, are you left blank? If you've picked up this copy of *Linux Format Presents: Ubuntu The Complete Guide*, it's more than possible you've heard of Linux, and you've possibly heard of Ubuntu. If you have, then dive in, but for those new to Linux, Ubuntu and open source software freedom, let's first get you up to speed with what it's all about.

So what is Linux? What is Ubuntu? And how does the concept of open source software work? If you've seen the little penguin fellow hanging around various pages and on the covers of *Linux Format*, his name is Tux. He's the mascot of the world-famous open source system called Linux. It's the control software at the heart of most open source operating systems, such as Android and Ubuntu, and it's known as a kernel. You'll find that Linux is used in hundreds of operating systems, and one of the most popular is Ubuntu. Just as Windows has its own kernel, and Apple's macOS has its Darwin kernel, so Ubuntu has Linux.

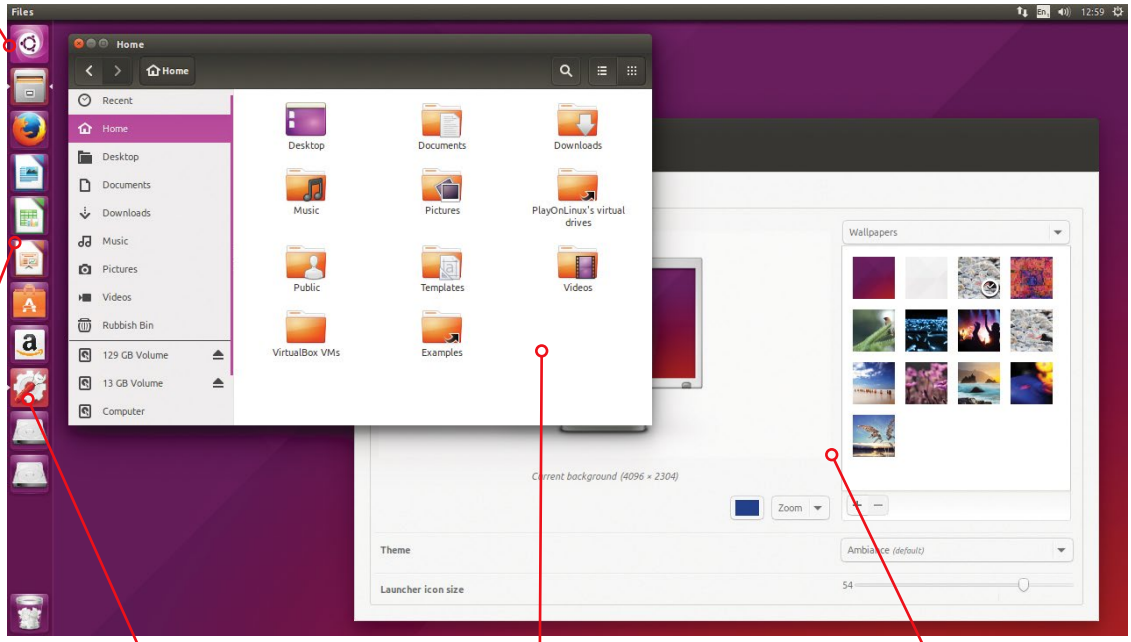
While Linux has been developed since 1991, Ubuntu first appeared in 2004, and thanks to its easy-to-approach philosophy and short six-month development cycle, it rapidly became the most popular open source Linux operating system in the world. Ubuntu is an operating system, just like Windows and macOS, but it's also more than either of those. Within the Linux world, it's called a distribution, aka distro.

As you get more into Ubuntu and open source, you'll find choice is a huge element. Ubuntu is a distro that doesn't just provide the

What does Ubuntu look like?

Desktop search
This search system is how you'll find and access more programs and other files and documents. You can filter and even search online.

Launcher
The Launcher lives down the left of the desktop. It holds recently run programs. You can add and remove items and adjust the icon size.



Settings
You'll find most system settings can be easily accessed through this handy system.

Files
Files and folders can still be accessed through a file explorer system. The Linux filesystem is more complex than Windows but stick to the Home folder.

Desktop
Like all PC desktops, Ubuntu has one, too. You can keep it as clean or messy as you like with icons, and can choose your own background.

software that installs and runs Linux on your PC, it provides the Unity desktop software, it bundles in the *Firefox* browser, the *LibreOffice* office package, the *Gimp* art package, the *Audacity* audio editor and so much more. It's a distro, because it packages and handles an entire software library in one.

This is only possible because of the open source philosophy under which the Linux kernel is developed, the Ubuntu distro is created, and the open source licence that all the programs used are released under.

Open source is a key element to software freedom; the idea that all of us should be able to freely use computers without being locked in to any single vendor or reliant on any single operating system publisher. It's a complex idea to get your head around initially, especially if you've been used to the Microsoft and Apple ways of doing things, but you're about to break free of any restrictions and start to use computers as you want. The way it should be – it's all quite exciting really.

Over the page, you'll find out how to install and get started with Ubuntu. We assume you're already running a Windows system here. If you do already have a Windows system, then you have two choices: wipe over Windows and be rid of it forever, or dual boot Ubuntu beside Windows, leaving your files intact. The latter is preferable if your system has room for it, and is probably the best option for anyone new to Linux.

> **"It's a complex idea but you're about to break free of any restrictions"**

Once you are up and running, Ubuntu gives you access to literally thousands of free open source apps. Many of which rival the abilities of anything you could buy for Windows or macOS, and many even surpass their abilities. You'll also find the range of software to be enormous, (see page 34 for more on apps) and it encompasses such diverse areas as coding, mathematics, physics, engineering, space and beyond.

Finally, it's important to remember that Ubuntu isn't just limited to one distro. There's a whole range of options available for you, and we encourage you to experiment, look around and try out a few different options to help find the one that suits you best. We'll outline the many available here, but suffice to say that they cover tailored builds for desktop systems, internet servers, low-power systems, embedded internet-of-things devices, tablets and more.

So what are you waiting for?

Ubuntu: Quick install guide

Linux isn't scary or hard. You can be up and running in just 4 minutes, honestly! Would we lie to you? Don't answer that...

Honestly, modern Linux is easier, faster and less hassle to install than any recent release of Windows. That's the truth. No messing with keys, no worrying about activation and no digging out that lost install disc or USB drive. The beauty of Linux is that because it's free software anyone can download and start using it immediately. You don't even have to install anything! Linux technology and its free and easy licence means that it can be run straight off a CD or DVD. It's not as fast and you can't save work as such, but it's an ideal way to quickly try out Linux without worrying about installing or setting up anything else. As long as you have an optical drive and can persuade your PC to boot from it – not always an easy task – then you can be trying out Linux in just a few minutes.

Perhaps you want something a little more permanent? If you've tried Ubuntu and decided it's for you then it'll easily help you install it permanently on your local hard drive. It can even automatically shrink Windows to fit Ubuntu on there. If that sounds too complex then why not use a virtual version? We'll look at how using *VirtualBox* you can run Ubuntu at the same time as Windows. Another big win with Linux and Ubuntu is that it doesn't require anywhere near the space of Windows. The minimum space is around 7GB, obviously more is always better, but to try out Ubuntu just 10GB is more than enough.

Quick tip

We didn't include times to download anything, as that's so variable and unnecessary. We also excluded any POST delays, but we also excluded the many times we popped out to make a nice Cup of Tea. Otherwise times include writing to any discs and the entire boot-up process.

Easy ways to Linux

If you're not a big Linux user then you probably won't want to destroy your existing Windows or Mac system. And the truth is that you don't need to either, Linux is flexible enough that it can be run in a number of ways: beside, on top or alongside most other operating systems and on most types of hardware, and from virtual versions to versions running off USB drives, DVDs or on hardware like the Raspberry Pi.

Booting a DVD is the easiest and fastest way to try Linux and Ubuntu. Here, at *Linux Format* Towers, after navigating the DVD menu we can have Ubuntu loaded up in less than four minutes. Getting the disc to boot, however, can be easier said than done. If your system doesn't automatically run the disc when turned on with it in the drive. Ideally, it's no more complex than pressing the correct key to open a Boot Menu from which you can select the DVD to run.

There's an additional issue that can happen with PCs using the more recent UEFI boot system that replaces the BIOS – these tend to be on PCs made after 2010 – where the UEFI can block the disc from running for security reasons.

To circumvent this system it's necessary to run the DVD in a compatibility mode. As mentioned in the box (see *Disc Booting Problems*) use the suitable button to enter the UEFI/BIOS. In the UEFI, disable QuickBoot/FastBoot and Intel Smart Response Technology (SRT). If you have Windows 8/10, also disable Fast Startup.

The procedure to disable the Secure Boot differs from machine to machine, and in some rare cases it's outright impossible (where the manufacturer doesn't want the original OS replacing). Look in the Boot UEFI settings for Classic-BIOS mode, CSM or Legacy to be able to run the DVD.

Going virtual

Another option is to install *Oracle VirtualBox* software from **www.virtualbox.org/wiki/Downloads**. Install and run this. It looks complex, but creating a virtual PC is pretty easy if you stick to the default settings. The main stumbling block is ensuring you add the ISO file to the virtual optical drive under the Storage settings. (*See box Installing VirtualBox*).

> **"If you're not a big Linux user then you probably won't want to destroy your existing Windows or Mac system. And the truth is that you don't need to either, Linux is flexible enough that it can be run in a number of ways"**

Installed on a virtual PC 7m 00s

Installing to a VirtualBox

1 Get VirtualBox

Head to **www.virtualbox.org** and download *Virtual Box 6* for your operating system, be that Windows or macOS . Install it and be aware you'll need around 20GB of space drive space to store the virtual OS file. You'll also need the Ubuntu ISO file from **www.ubuntu.com**. Once installed, start it, click the 'New' button and call it Ubuntu.

2 Create a machine

Choose Ubuntu and the bits should match the ISO you downloaded, click 'Next'. Under Memory we'd recommend 2048, but if you have an 8GB PC 4096 is best. You can leave all the rest as default settings, apart from the dynamic hard drive size. The default is 8GB, we'd suggest at least 32GB just in case. Finish and click Start to get going.

3 Starting virtual Ubuntu

A prompt will appear asking for a disc, locate the Ubuntu ISO file and click 'Start'. Linux Ubuntu will start, once loaded you're free to try out Ubuntu or use the Install icon to properly install it to the virtual machine. For extended use in the virtual machine's settings under Display, you'll want to enable 3D acceleration and allocate 16MB.

If you find you want to keep using the virtual version of Ubuntu ensure you install the *VirtualBox* additions, this provides better screen scaling, seamless mouse integration, combined clipboard and seamless dragging and dropping from the host machine to the virtual Ubuntu. To do this run the VirtualBox Ubuntu, once the desktop has loaded select the Devices > Insert Guest Additions CD image... What this does is add another virtual optical disc with the required software. After a few seconds a window should open asking if you want to run the disc, choose 'Run' and allow the software to install, this can take a while.

Use the View, Input and Devices menus at the top of the *VirtualBox* window to adjust and control all of the previously mentioned integration features. They make using the *VirtualBox* much more comfortable, as well as enable a wider range of resolutions.

There are more options available including writing the ISO file to a suitable USB thumb drive and following a similar boot process as discussed above, running Linux from this. To get this to work you'll need to use a write tool, such as *UNetbootin* from **http://unetbootin.github.io**. This can be a helpful option if your device doesn't have an optical drive that you can boot from or you've downloaded the relevant disc image (ISO) file from **www.ubuntu.com/download/desktop**.

Using USB

There are some pretty exotic solutions for running Ubuntu and other versions of Linux from a USB stick, eg so you can carry your OS around with you and boot it on almost any PC you happen across, but we're just looking at running a basic Live Disc so you can at least try it out. (*See Ubuntu on a USB drive for more details.*)

You'll need at least a 2GB stick, larger ones give you the option of using the spare space as storage, ensure you enter a suitable value into *UNetbootin*. Also be aware using USB storage brings its own set of issues. We had no problem with a Toshiba 16GB stick, but a San Disk 32GB stick would start but Ubuntu wouldn't then load. »

Quick tip

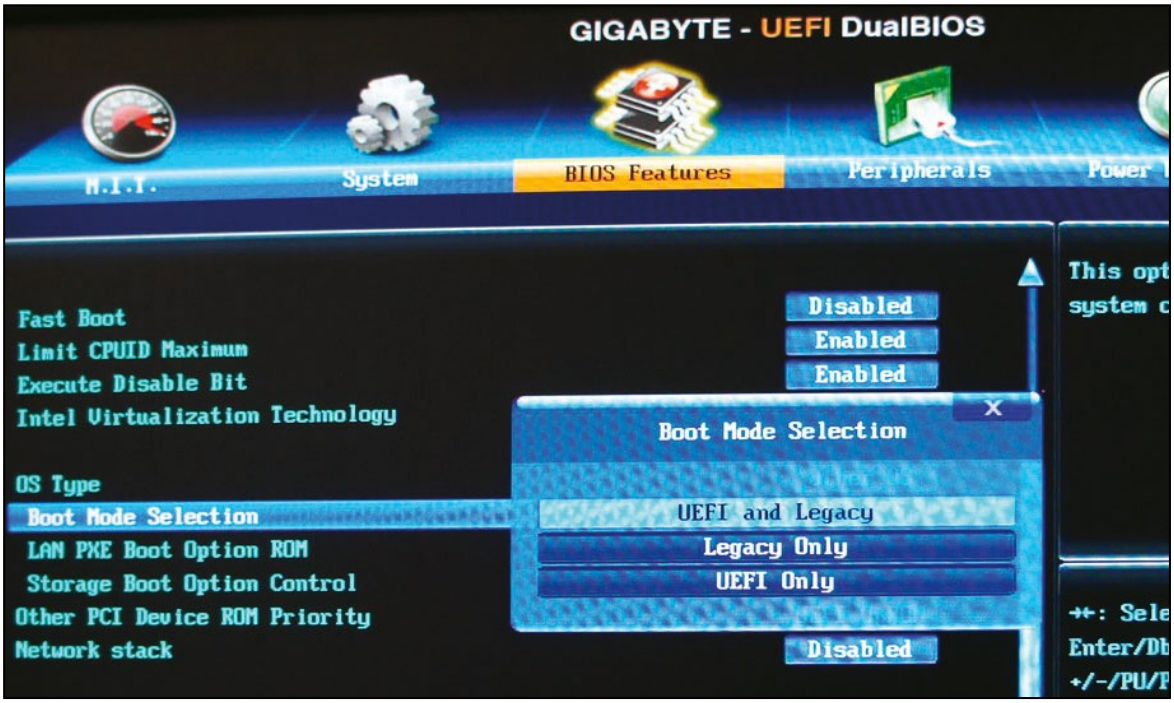
On the Mac you have to hold c when your system is turned on to get it to boot from an optical drive. As we go into some depth when you first turn on a PC you can usually get it to boot from alternative media by pressing F11/F12.

Disc booting problems

The first problem that many people encounter is booting their desktop or laptop from a DVD. Many systems no longer check the optical drive for boot media, as it slows down the start process. You have two options, one is to open any provided Boot Menu – not all devices offer this – the key used varies. HP systems use F9, Dell and Lenovo use F12, older AMIBIOS-based systems use F8, Award-based systems use F11. You need to slowly tap the key just after switching on the system. Select any CD-ROM/Optical drive option and you're good to go.

If no boot menu seems available the other option is to select the order of boot devices within the BIOS/UEFI settings. Typically a message should flash up during the system start explaining which key to press. Just as with the boot menu pressing one of Del (the most common), F1, F2, Esc or a 'special' maintenance key should provide access. In the BIOS locate the Boot Device menu and ensure a DVD/ optical drive is first in the list. Save and reboot!

› This is our boot menu, there are others like it, but this one is ours.



› UEFI has replaced the BIOS and can block discs from running for security reasons.

» We don't really have space here to go into the full ins and outs of backing up any existing Windows partition, resizing partitions and installing Ubuntu by hand. The good news is Ubuntu will largely do the last two automatically for you, if you let it. Be warned though, it's easy to destroy your Windows partition, the Windows bootloader or to leave your PC unusable if you should choose the wrong options or if something else goes wrong along the way. We don't recommend installing or upgrading any OS unless you have backed up any files, created an image of your drives and the system isn't critical to any business, personal use or other operation. With that dire warning out of the way, on to the fun!

As a general rule if you have Windows on the boot drive, Ubuntu will happily resize this and fit itself alongside Windows on the drive. Before trying to ensure the drive has enough free space. These days drives can be easily 500GB or larger, as long as there's 20GB free there shouldn't be an issue; more space is required than just for Ubuntu as there needs to be space to move Windows files out of the way too. If there isn't this free space, run the *Windows Disk CleanUp Tool*, ideally choose to re-run it as Administrator, and get it to remove unused system files too.

If you don't have 20GB free then it's best that you don't try to install Ubuntu. Once you start the Ubuntu install process don't interrupt it. If you break your bootloader or partition tables then they can be a real pain to fix, but if you do manage to break something don't panic Windows will still be there.

Ubuntu on a USB drive

1 UNetbootin Linux

To run Ubuntu from a USB stick, you first need a USB drive at least 2GB in size, 8GB would be ideal. You'll need the Ubuntu ISO file from **www.ubuntu.com** as discussed in the *VirtualBox* walkthrough and we'll use the download tool *UNetbootin* from **http://unetbootin.github.io**. This installs the Live Disc ISO file directly to your USB drive.

2 Install Ubuntu

The tool can download the ISO image, but it's best practice to do this yourself. So select Diskimage, locate the file in the **Download** folder. Use the Ubuntu storage box to create reusable space—512MB should be fine use more on larger sticks. Ensure you have the correct USB drive select in the bottom pull-down menu and click 'OK' to create the drive.

3 Boot and run

You can now boot your PC from the USB drive. However, you'll need to ensure your PC selects the USB drive as the boot device. Usually when you first turn on your PC a message says press F8, F9, F11 or F12 to select the boot device. Some PCs have their own specific button, consult your manual or manufacturer for details. Ubuntu will now run.

Ubuntu blasts off!

Ubuntu is back and it's better than ever. Read on to find out why **Jonni Bidwell** is out of this world over this new release...

Canonical's latest Ubuntu release, "Focal Fossa", hit the mirrors at the end of April. So by the time you read this thousands of people will have downloaded it, installed it and (we'll wager) been downright impressed with what it has to offer. If you haven't yet tried it, then you're in for a treat.

We'll show you what's new and what you can do with Canonical's finest. And if you've never tried Linux before, Ubuntu 20.04 LTS Focal Fossa is a great place to start. You can try it right now (well, in the time it takes you to download and write it to a USB stick) without interfering with your current setup. We've got guides to trying Ubuntu in a virtual machine and, when you're ready, even installing it on to bare metal.

There are all kinds of reasons to switch to Linux, and with the new Ubuntu release comes one more. Be the envy of your proprietary OS-using friends. Never see your computer crippled by updates again. Enjoy a desktop that's not an advertising space. Explore the phenomenal selection of free software, which more often than not is at least as good as commercial offerings, and in many cases is demonstrably superior. Video editing, 3D modelling, high-powered number crunching and even AAA gaming are all just a few clicks away.

If your desktop habits are more sedentary, though, don't worry: Ubuntu's got you covered, too. Fast web browsing, easy email, fuss-free media playing are all yours out of the box. Read on to see just how powerful this operating system really is.

Focal fossa bossa nova

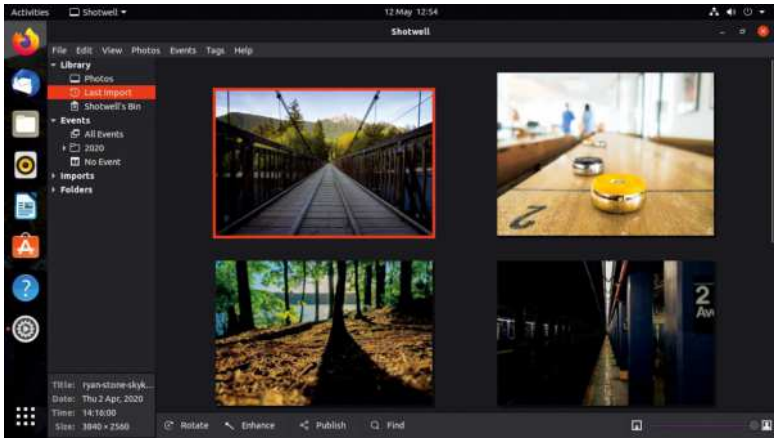
It's hard to know what to focus on with this new release, so here's a quick summary of Focal Fossa's highlights.

Naturally, everything under the Ubuntu hood has been refreshed. The new 5.4 kernel brings support for new hardware and fixes for old. What most home users will be interested in is the desktop, and you'll find Gnome 3.36 looks and behaves better than ever. It seems like there's been a two-year game of bug whack-a-mole, both within Gnome and Ubuntu's take on it, to address niggling performance and memory issues. But with this release, it's smooth like the inferior type of peanut butter.

"The darkening" has come finally to Ubuntu. Like so many desktops and programs it now offers a dark mode, which some people find easier on the eyes. Light or dark, we think you'll love the new bold icons and Yaru theme. Gnome's application folders feature, by which you can drag icons in the Applications menu on top of one another to make a folder, is less clumsy now. And if you remove all but one item from a folder, then the singleton is automatically promoted back to the main menu and the folder removed. Tidy.

If you have a HiDPI display you'll be pleased to hear that fractional scaling is finally here. And (unlike in 19.10) you don't need to invoke *Gsettings* from the command line to use it. Previously, only integer scaling was available, which meant users often had to choose between tiny text and giant text. Now the Goldilocks Zone can be enabled through a simple switch in Settings>Screen Display, but do note the small print warning about increased power usage and decreased sharpness. At time of writing, there seem to be issues using this with the proprietary Nvidia driver, so keep an eye on this bug: **https://bugs.launchpad.net/ubuntu/+source/gnome-control-center/+bug/1870736**.

Speaking of Nvidia, its drivers are included on the install medium. No need to resort to a PPA or (shudder) downloading them from Nvidia's website. Gamers will be pleased to hear that Feral's GameMode is part of a standard install. This can rejig CPU frequency governers, schedulers and other frobs to boost framerates. And in case you're concerned about the 32-bit library palaver, don't be: everything needed by *Steam*, *Wine* and *Lutris* is still in the repos. If you're running old 32-bit applications you might experience difficulties, so test these before getting rid of your 18.04 install. There's an opportunity to help the community here if you find one that doesn't work – do your bit and package it up as a Snap. Learn more from this blog post: **https://snapcraft.io/blog/how-to-preserve-old-software-with-snaps**.



› Ubuntu's delightful wallpapers all have a 'focal' theme goin' on.

The *Ubuntu Software* tool now serves Snaps as the default. Indeed, most applications we searched for were only available in this format, but some packages can be installed from the traditional Ubuntu repos. Of course, you can still install packages from the command line with *apt* if you're not sold on the 'app store' mentality. We predict Snaps (and Flatpaks) are going to gain serious traction in the coming months and years.

As you'll see from the Software application, a number of tools are now packaged as Snaps. And this number will increase as developers side-step the old method of relying on distros to package up their offerings.

Where's my cover disc?

Usually, at this point we'd be telling people to fire up our DVD and get started with Ubuntu right now. But there is no physical DVD this month, and the 'free download' we're offering features Fedora and Manjaro. The thinking (there was thinking behind this decision, honest!) was that since we're telling people to download something anyway, they may as well download Ubuntu straight from the official site: https://ubuntu.com

Of course, we're sorry for those people who don't have the connectivity to go downloading a couple of gigabytes on a whim. But these are a small minority of users, and these are exceptional times. This whole kerfuffle might serve to illustrate an important point: the distros we would normally put on our DVD are exactly the same as the ones we're telling you to download. They might hide behind a retro, VGA resolution menu, and sometimes there are sneaky hacks to make them boot that way, but once that menu is gone they behave exactly as if you had downloaded the ISO in question and written it to a DVD yourself.

We tell you this not because we don't want to make DVDs in the future – it's the closest thing Jonni gets to a break after all – but rather to empower you to go forth in the spirit of enquiry, download distros and seek out your version of desktop perfection.

Installing Ubuntu

You've got to try it to love it, but you've got to install it to really feel its power.

Just uttering the phrase "Installing Linux" will send a shiver down the spines of most humans, but it's not as terrifying as it used to be. Don't get overzealous, though: it's still possible to wipe out your existing OS by pushing the wrong button, and you should spend a couple of hours trying out Ubuntu before committing to installing it.

Running the live environment, or installing to a virtual machine will give you a handle on the look 'n' feel of this pinnacle of free software. There are a couple of hoops to jump through before we get there though. You can download the Ubuntu install image from whatever operating system you're comfortable with. Fire up your browser and head to **https://ubuntu.com/download/desktop** and press the Download button. If you're feeling charitable you can also make a donation to Canonical and choose how the company invests it, but this is optional. We'd recommend making a cup of tea while the download completes. You should now have a 2.5GB disk image (ISO) file which you can write to a DVD using the software of your choice (for example, *Toast* on macOS, *CDBurnerXP* on Windows, *Brasero* on Linux). We know that many PCs and most laptops don't have optical drives nowadays, but that's okay – the image can be written to a USB stick, which will probably boot much faster and certainly will be much quieter than booting from DVD. There are programs like *Unetbootin* that can automatically download distros and set them up in all kinds of fancy ways, but we prefer to keep things simple so here we're recommending the cross-platform *Etcher* tool. Grab it from **https://etcher.io**, start it up, plug in a USB drive (make sure there's nothing precious on it because its contents will all be destroyed), and away you go.

Using the ISO image

"We know that many PCs and most laptops don't have optical drives nowadays, but that's okay – the image can be written to a USB stick."

Boot from your ISO file

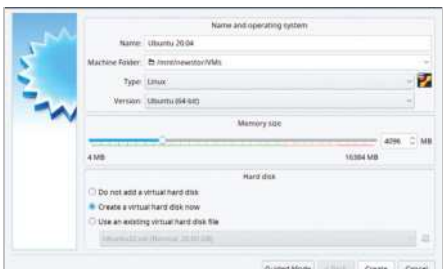
You'll need to figure out how to make your PC boot from USB or optical media before you can enjoy Ubuntu. You have two options: one is to open any provided Boot Menu – not all devices offer this – the key used varies. HP systems use F9, Dell and Lenovo use F12, older AMIBIOS-based systems use F8, Award-based systems use F11. You need to slowly tap the key just after switching on the system. Select any CD-ROM/Optical drive option and you're good to go.

If no boot menu is available the other option is to select the order of boot devices within the BIOS/UEFI settings. A message should appear during the system start saying which key to press. Just as with the boot menu pressing either Del (the most common), F1, F2,

Installing to a VirtualBox

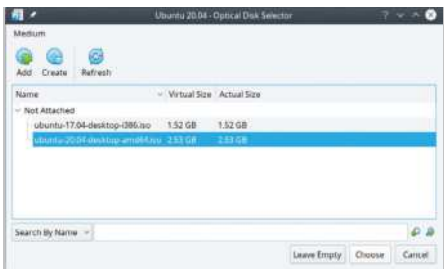
1 Get VirtualBox

Head to **www.virtualbox.org** and download *VirtualBox 6* for your operating system, be that Windows or OS X. Install it and be aware you'll need at least 20GB of space drive space to store the virtual OS file. You'll also need the Ubuntu ISO file from **www.ubuntu.com/desktop/download**. Once installed start it and click the New button and call it Ubuntu.



2 Create a machine

Choose Ubuntu and the bits should match the ISO you downloaded, then click Next. Under Memory we'd recommend 2,048, but if you have an 8GB PC 4,096 is best. You can leave all the rest as default settings, apart from the dynamic hard drive size. The default is 8GB, but we'd suggest at least 32GB if you can spare. Finish and click Start to get going.



3 Starting virtual Ubuntu

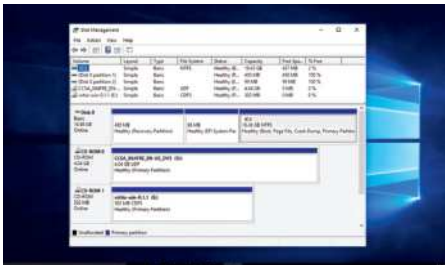
A prompt will appear asking for a disc – locate the Ubuntu ISO file and click Start. Linux Ubuntu will start, and once loaded you're free to try out Ubuntu or use the Install icon to properly install it to the virtual machine. For extended use, in the virtual machine's settings under Display, you'll want to enable 3D acceleration and allocate 16MB

Esc or a 'special' maintenance key should give access. In the BIOS locate the Boot Device menu and ensure the DVD/optical drive is first in the list. Save and reboot!

You can explore the live environment risk free, but for maximum pleasure and performance install Ubuntu to your hard drive or SSD using the handy six-step guide over the page. If you have one we'd recommend installing Ubuntu to its own device, rather than resizing the Windows partition per steps one and two. It should all work fine, and in fact it's possible to carry out those steps from the Ubuntu installer. But we've been around long enough to know things don't always go as they should. So back up any important data before proceeding. If you have a spare device, just select it and use the Erase disk and install Ubuntu option in step four. Molto semplice. If you want to play it safe, another option is to install Ubuntu to a virtual machine using Oracle's *VirtualBox* and the guide below.

› Modern UEFI interfaces should make it easy to change the boot device. This one even makes it possible for you to take screenshots, which is frankly witchcraft.

Install Ubuntu with windows



1 Make room

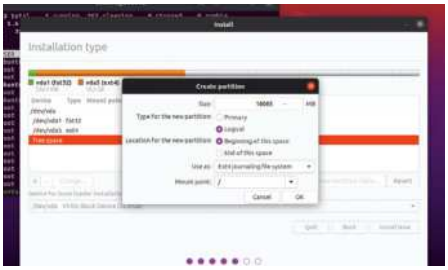
To create an empty partition for your Ubuntu installation, you'll first have to squeeze your existing Windows partition. Fire up the Disk Management tool in Windows, and right-click your main partition that's typically assigned the drive letter C. Then select the Shrink Volume option from the pop-up menu.

2 Shrink Windows

This brings up the Shrink dialog that shows you the total size of the hard drive and the maximum amount of space that you can squeeze out of the selected partition. To create a new partition, specify the size of the partition in the space provided in megabytes and click Shrink to start the process.

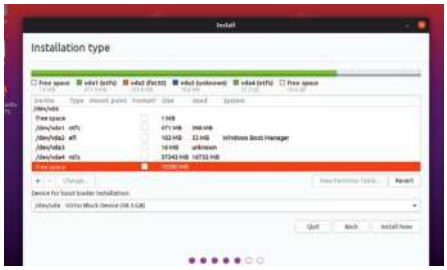
3 Updates and plugins

After your computer boots from the Ubuntu installation medium, it'll display a checklist. Toggle the two available checkboxes on this screen. The first checkbox option will fetch any available updates from the Internet, and the other will install the plugin required to play MP3 content and Wi-Fi firmware.



1 Use free space

In the screen labelled Installation type, toggle the 'Something else' radio button to manually partition the disk. Ubuntu will now show you a list of partitions on the hard drive. Select the one labelled Free Space and click the plus sign (+) to create a partition out of this space you freed up in Windows.



2 Define partitions

In the Create partition box enter the size for the Ubuntu partition. Then use the 'Mount point' pull-down menu to select the / option. If you like, you can create a separate home partition (if you want to keep user files and system files separate) in exactly the same way. Just select **/home** from the menu.

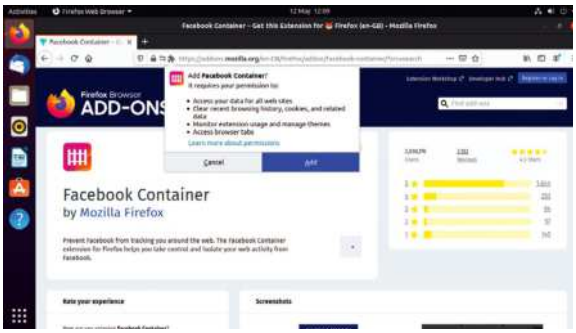
3 Localise and personalise

And that's it. The installer will now start the process of installing Ubuntu. While the files are being copied to the hard drive in the background, it'll ask about your locale. In the last screen you'll be asked to enter your desired login and password details, as well as a name for your computer.

Desktop deep dive

Here's a quick guide to Ubuntu's top-notch take on the Gnome desktop.

Coming from Windows or macOS, Ubuntu at first glance appears dramatically different, and perhaps even a little daunting. But don't worry, soon it will feel just like home. Your first port of call might be the Applications menu, which you can access by clicking in the top left of the screen, or by pressing the Super (Windows) key. This shows any running applications, or if there aren't any will show frequently used ones. So the first time you click it this view will be barren. You'll find a grid of installed applications (pictured in the annotation below, which hopefully helps you get your bearings) by clicking in the bottom right, so have a nosey around to see what interests you.

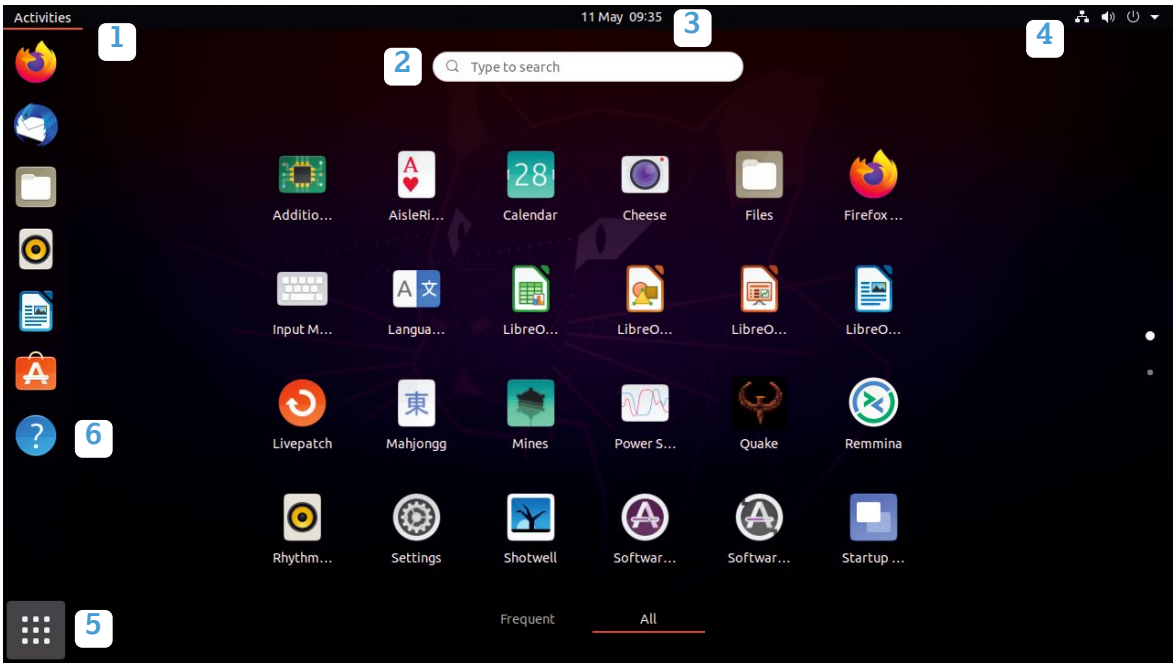


› If you can't banish Facebook, you can at least contain it thanks to this excellent Firefox plugin.

The standard install includes everything you need to get started, and tries to avoid bundling things that you don't. Perhaps we should have mentioned earlier the minimal install option if you don't need an office suite, games or other computing fripperies. This saves you around half a gigabyte.

Sooner or later you'll want to add an application or several, and the easiest way to do this is through the Ubuntu Software shortcut in the dock (the one that looks like an orange briefcase). One of our first additions is the Gnome Tweaks tool, which makes it possible for you to customise the desktop's appearance and behaviour in lots of ways. Depending on who you believe, this either should not exist at all, or should be included

Getting to Gnome you...



1 Activities
Clicking here (or pressing the Super key) launches the Activities view. Helpfully, it shows previews of running programs.

2 Search Box
Start typing in the Activities view (there's no need to click in the box) to search Apps, Docs and more.

3 Calendar and Notifications area
Click here to control music, see any appointments (if you've connected an appropriate service) or activate Do not Disturb mode.

4 Status Menu
Network settings (including VPN), volume controls and application indicators can be found here. The button in the bottom left launches the all-important Settings tool.

5 Applications menu
Click here to open/close a view of frequently used applications. You can see all installed applications from the selector at the bottom of this menu.

6 Dock
Launch your favourite applications from here. Right-clicking a running application (denoted by a dot) enables you to add it to the dock for easier access.

KDE Plasma is traditional in the sense that there's a menu in the bottom left, but it's sleek and modern looking, too.

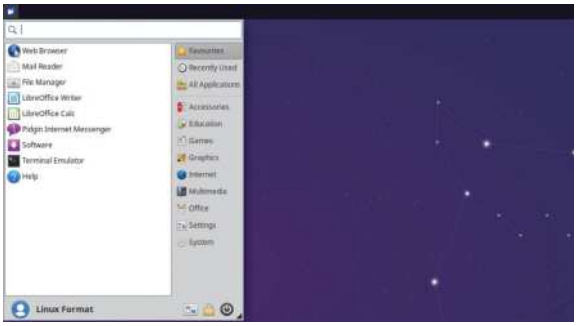
by default on the Gnome desktop. We'll let you be the judge: just search for tweak in Ubuntu software, click the green install button, and confirm with your password.

The installer will have prompted you to add any online accounts you have, such as Facebook or Google. These will integrate with your desktop calendar and file manager as appropriate, so you can browse Google Drive or receive Facebook notifications. If you didn't add these accounts earlier you can always add them by going to Settings>Online Accounts. You'll probably find you need to log out and log back in before calendars and other things sync properly. If you have successfully connected accounts and are tired of all these notifications you can remove them from here too. Alternatively, the Do Not Disturb switch in the calendar panel will silence these and hopefully keep you focused.

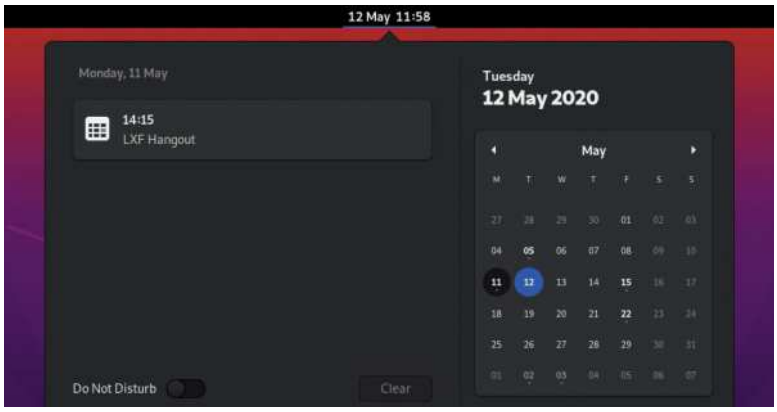
Browser wars

We're particularly enamoured with *Firefox 76* and its stylish new interface. If you're coming from the proprietary world then *Google Chrome* may be your browser of choice, and if you really want that then it's straightforward enough to install (and its open source sibling *Chromium* is even easier). But we think you should give Firefox a chance, if only for the privacy-preserving Facebook Container add-on. And indeed the multi-account container add-on, because tracking on the web is out of control nowadays.

Often it's the hate-ridden Windows updates that cause people to switch to Linux. Ubuntu is much more considered in its updates. There's an unattended upgrades service that applies urgent fixes in the background, but you'll be told (not forced) about general package updates. These can be applied at a convenient time from the *Software* application, or the command



The Xubuntu flavour is great for lower-powered systems, or for people who prefer their desktops to stay out of the way.



The Gnome session lacks Ubuntu's characteristic left sidebar. And the darker colours bring looming deadlines into stark relief.

line. Contrary to what you might read elsewhere, it's entirely possible to use desktop Linux without memorising a bunch of strange command line incantations or having a PhD in regular expressions. It's hard to overestimate how powerful the terminal is, but for desktop use you'd be better off memorising a couple of keyboard shortcuts for Gnome instead:

- **Super (Windows key)** – Bring up the activities view
- **Super-Left/Right** – Tile current application left or right (so it fully occupies one half of the screen)
- **Super-Up/Down** – Maximise/Restore current application
- **Super-PgUp/PgDown** – Switch virtual desktops
- **Super-Shift-PgUp/Dn** – Move current application to next/previous virtual desktop.

Keep things up to date

"Often it's the hate-ridden Windows updates that cause people to switch to Linux. Ubuntu is much more considered in its updates."

Favourite flavour

If you don't like Ubuntu's desktop, there are other flavours available. Kubuntu, powered by the slick KDE Plasma desktop, has a slightly more Windows-like feel. Visit **https://ubuntu.com/download/flavours** to see the whole selection. You don't need to install a whole new distro just to try a new desktop, though. For example, if you want to try pure Gnome (without Ubuntu's tweaks) then fire up the Terminal app and type the following:

```
$ sudo apt install ubuntu-gnome-desktop
```

You can then choose the Gnome session from the login screen: just click the cog icon in the bottom-right and choose Gnome. Unlike the Ubuntu session, this uses the newer Wayland protocol for talking to the displays. This should work well (at least with open source drivers) by now, but if you run into difficulties try Gnome on Xorg instead. Other desktop environments can be installed this way too, via the `kubuntu-desktop`, `ubuntu-mate-desktop`, `ubuntu-budgie-desktop` and other such packages. Once you've settled on your favourite desktop, you may consider reinstalling the corresponding flavour in the name of tidiness. Each desktop will install its own core applications, so there will be some duplication

Under the hood

There are subtle changes and understated improvements in Ubuntu 20.04 that really deserve mentioning...

We get it. A new Ubuntu release, even an LTS, isn't the cause célèbre it once was. Even management get that now. Daubing the cover in orange and superlatives like 'must-have' and 'revolutionary new features' (*those are good ideas!–Ed*) isn't going to fool anyone, especially savvy Linux users.

We've always said that this lack of ground-breaking change is a good thing. It shows Ubuntu has reached such a level of maturity that refinement, and not radical rewriting of the rules, is the optimal path. We also understand that there are plenty of other distros suitable for beginners (and let's stress here that Ubuntu is popular with professionals too), and maybe some of those don't get the attention that Ubuntu does. All that aside, Ubuntu remains one of the most popular distros among our readers, and indeed Linux users in general.

Ubuntu fancies a slice of pi

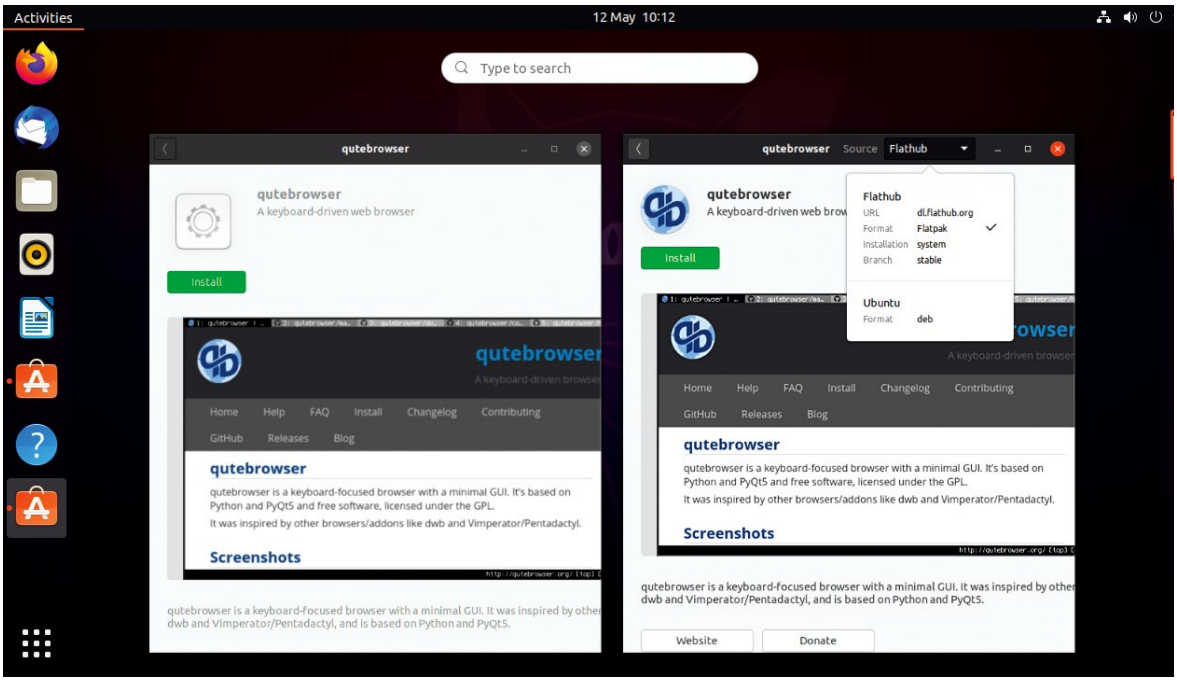
"Having Canonical's certification will encourage enterprises to do great things with the Raspberry Pi (models 2, 3 and 4).

In this new outing you'll find support for AMD's Navi 12 and 14 GPUs as well as their new APUs, and the open source Nouveau driver has improved colour management. There's support for Intel's Comet Lake chips and initial support for their 11th-generation Tiger Lake architecture. The Kernel Lockdown security module also debuts in this release, which limits how userspace code (even if it's running as root) from interfering with kernel operations. First proposed by security guru Matthew Garrett some years ago, this is aimed at admins who want to limit the damage a compromised root account can cause.

There are a couple of noteworthy filesystem changes: support for Microsoft's newly (sort of) open sourced exFAT, as well as the speedy VirtIO-FS for sharing directories with virtual machines. Ubuntu also backport lots of features from newer kernels, and one notable addition is support for *Wireguard* VPNs. In an age of surveillance and dubious sponsored 'best VPN' listicles, this will surely be a boon for privacy. It's early days yet, but we forsee *Wireguard* being key to demystifying the VPN sphere. It's small, fast and much easier to get your head around than OpenVPN, being much more akin to setting up an SSH server.

Storage options

Moving into lower userspace, there's systemd 245, which features the new home directory regime `systemd-homed`. Don't worry though, Ubuntu doesn't use



› Two software tools, both alike in dignity in fair Ubuntu where we lay our scene.

this by default, and to be honest we weren't able to activate it so it looks like this feature hasn't been built into the package. Again, early days. There's also an experimental option to install using the next-generation ZFS filesystem, whose roots go back to Oracle's Solaris. Licencing conflicts have kept this out of the Linux kernel, and it's not a thing your average user will want. But if you have insane storage, lots of memory and deduplication requirements, ZFS is a mere checkbox in the installer away. Ubuntu's zsys middleware will automatically snapshot filesystems before software updates, so that these can be undone if things go south.

There's a new officially supported target to get excited about, the Raspberry Pi (models 2, 3 and 4). Not only is this great for home users, particularly those who want to take advantage of the Pi 3 and 4's Aarch64/ARMv8 OS hardware, but having Canonical's certification will encourage enterprises to do great things with the Pi. Read more about this on Rhys Davies post on the official Ubuntu blog at **https://ubuntu.com/blog/ubuntu-20-04-lts-is-certified-for-the-raspberry-pi**.

The certification only applies to Ubuntu Server, and that's the only Raspberry Pi download that's offered through Canonical's website, but it's straightforward to add a desktop, for example. via the **xubuntu-desktop** package. If you have a Pi 4 and want to take advantage of its extra oomph, why not install KDE Plasma? At the moment the official Gnome desktop isn't supported on the Pi, but don't forget an Ubuntu MATE SD card image is available (from **https://ubuntu-mate.org**) if you want a ready-to-roll desktop. The MATE desktop is ideal for lower-powered devices, or just people who liked Gnome 2. MATE Images are also available for UMPCs such as the GPD Pocket and MicroPC.

Flatpaks can't be installed from the *Ubuntu Software* app, but are available from the command line. If you want to install them GUI style you can install the vanilla Gnome Software application, add the Flatpak plugin and then add the Flathub repo with:

```
$ sudo apt install gnome-software gnome-software-plugin-flatpak
$ flatpak remote-add --if-not-exists flathub https://flathub.org/repo/flathub.flatpakrepo
```

Note the message about the search path: a restart is required before Flatpak apps show up in the Applications Menu. Slightly confusingly, you'll now find two app stores, *Ubuntu Software* and *Software*, in the applications menu. The latter will enable you to install from the whole gamut of package sources: Flatpaks, Snaps or good old-fashioned DEBs. So you could even uninstall the `snap-store` package if you want. The screenshot (*left*) shows the differences between the Snap and Flatpak versions of *Qutebrowser*.

Our security feature in **LXF262** showed you a few things you can do with hardware tokens such as the Nitrokey and Yubikey. If you have a FIDO (Fast IDentity Online) or U2F (Universal second Factor) device, then not only can you use it, as we showed in that feature, to log in locally (using the **pam_u2f** module), you can also use it remotely. New key types introduced in OpenSSH 8.2 can work with these devices, enhancing security when logging in to your Ubuntu device via SSH. You might already be familiar with the idea of using an SSH key instead of (or as well as) a password. Basically, generate a key on the local system with `ssh-keygen` then copy it to the remote one with `ssh-copy-id`. Well now, if you attach your hardware token and run

```
$ ssh-keygen -t ecdsa-sk
```

then you'll be prompted to tap the authenticator as well as provide an optional password. You can then copy this key to remote systems as before. In order to log in with the new key, for now, you'll need to specify it with the following:

```
$ ssh -i ~/.ssh/id_ecdsa_sk myserver.com
```

Get your hardware secured, Elliptic Curve DSA SSH key game on with OpenSSH 8.2.

That's all folks

And with that, we must go (*to the printers, like now – Ed*). We haven't covered the dark art of running Ubuntu on Windows via *WSL* yet, but with *WSL 2* going mainstream soon, that certainly will be an interesting endeavour, though perhaps one that interests developers more than home users. If you're running Ubuntu 18.04 on your server, it's probably wise to hold off upgrading until the 20.04.1 point release.

There's much more to Ubuntu and we'd love to hear your opinions on it and its other flavours. There are some great Ubuntu derivatives out – be sure to check out our Regolith and Pop!_OS reviews, and there will be a slew of others in the coming weeks and months. Happy fossicking among the Focal Fossa famalam!

Out with the old…

We made a big deal last issue of the fact that 32-bit PC users won't be able to enjoy this new release. There's no upgrade path from 32-bit 18.04, as there was from 16.04 – the last LTS to offer a 32-bit install medium. And that's a bit of a shame because it's great. But those users can continue to use 18.04 for another three years, so no need to panic yet. Also gone from the default install is Python 2, and the vast majority of packages in the repositories have been upgraded to use Python 3. The older version reached end-of-life at the start of this year, but the package is still available for the few projects that still rely on it.

Finally, a small thing, but one that makes us incredibly happy. That horrible Amazon link in the launcher has gone. It has irked us since it debuted in 2012. The only thing it was useful for was teaching users how to remove icons from the dock. Veterans will recall that previous Ubuntu releases included Amazon links when searching in the Unity HUD, but those days are long gone. Speaking of Unity, if you really miss that desktop, you can install it from the `ubuntu-unity-desktop` package. Alternatively, you can go all out and try the Unity remix. Find out more about this at **https://discourse.ubuntu.com/t/ubuntu-unity-remix-20-04.**

Remember back in LXF195 when we told you Python 2 is going away? It's still going away.

Hirsute Hippo

It may not be packed full of eye-catching new features, but Ubuntu 21.04 features plenty of improvements.

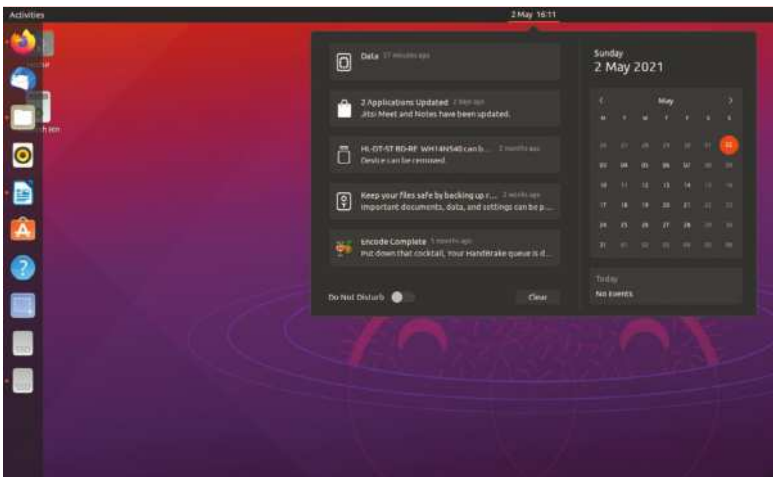
Wayland may be dominating the headlines, but it's by no means the only new feature that's arrived in Ubuntu 21.04. Several other features are linked to Wayland, of course – the PipeWire project for one, with its aim to "greatly improve handling of audio and video under Linux". It's basically a replacement for *pulseaudio* and *JACK*, designed to work with containerised Flatpak applications but also tying in neatly with Wayland's tighter security requirements.

In practical terms, its primary function is to restore the ability to both screen-share and record your desktop with compatible applications such as *OBS Studio* and *Discord*. It'll also improve audio support in sandboxed applications such as those installed through Flatpak.

One interesting choice made in Ubuntu 21.04 is the one to stick with GNOME 3.38 (or, more precisely, 3.38.5). This means that the desktop remains a familiar one, despite the recent release of GNOME 40. As a result, no radical desktop changes – such as the controversial switch to dynamic horizontal workspaces – have been implemented this time around, although selected GNOME applications, including System Monitor, have been updated to their GNOME 40 versions behind the scenes. There are also some subtle changes to the desktop's appearance, such as a shift to using the Dark Theme by default for UI elements on the menu bar, including status menus and *Calendar* tool. In addition, look out for some small, but pleasing updates to the Nautilus File Manager, including icon redesigns incorporating rounded corners.

Productivity Boost

"A new desktop extension finally handles drag-and-drop interactions between desktop and applications"



› One minor tweak sees all menu bar items – including the Calendar – switch to the Dark Theme by default.

Desktop improvements

One major change that should make life a lot simpler is the incorporation of a new desktop extension that finally handles drag-and-drop interactions between desktop and applications (such as via the file manager) properly. Take a trip to Settings>Power where you should find – assuming your configuration has proper kernel support – that you can now configure power profiles from the friendly GUI. Simply switch between 'balanced power' and 'power saver' as required. This feature is clearly aimed at laptop users, with the only downside being that your settings won't survive a reboot.

The default programs *Thunderbird*, *Firefox* and *LibreOffice* have also been updated to the latest versions at time of release – *LibreOffice* is now officially up to 7.1.2.

Security improvements

There are several welcome security updates in Ubuntu 21.04 worthy of highlighting. First, users' Home folders have finally been made private. This means that users can no longer easily browse the contents of other users' home folders unless their permissions have been tweaked accordingly.

If you're planning on installing Ubuntu 21.04 from scratch on an encrypted partition, you'll be glad to know that a fail-safe now exists in the form of an optional recovery key file, which you can use to recover your system if anything untoward happens. Look out for the option appearing during the install process.

The built-in firewall now has *nftables* as its default back-end. You can still use the more user-friendly *ufw* frontend to manage the firewall from the command line and should notice no difference in functionality. The main advantages of using *nftables* over *iptables* are that it's easier to use when addressed directly, has no pre-defined tables or chains making it fully configurable, and should be easier to update with new protocols.

Finally, UEFI Secure Boot has been improved to support SBAT-capable *shim*, *grub2* and *fwupd* – a necessary consequence of the recent BootHole security vulnerabilities disclosed. The desktop also gains support for smartcard authentication, which can be used in place of passwords for logging on to your system.

The kernel has also been upgraded to 5.11 (Ubuntu 20.10 ships with kernel 5.8), and in addition to further security fixes you'll also benefit from the latest hardware support and other performance improvements. Notable examples include reduced

memory swapping thanks to better anonymous memory management, fsync() performance improvements for both ext4 and btrfs filesystems, and support for the latest graphics technologies such as Intel Rocketlake and AMD Vangogh.

Developer and server changes

In its blog announcing Ubuntu 21.04, Canonical focused largely on enterprise users and developers, stressing new Microsoft-friendly integrations such as native Microsoft *Active Directory* integration and support for Microsoft's *SQL Server*, which have also been backported to Ubuntu 20.04.2 LTS.

Elsewhere you'll find key toolchains have been updated too, including Python (now 3.9), Perl, Ruby and PHP. OpenJDK 16 sits alongside OpenJDK 11 for Java support.

Canonical also appears keen to push LTS server users into upgrading to this new release with lots of major component updates. *Rails 6* is a particular highlight, with support for rich text material and a controller-like mailbox along with parallel and action cable testing.

There's also *Openvpn 2.51*, with the promise of faster connection setup and improved *TLS 1.3*, while *Needrestart for Servers* is now preinstalled to provide additional help during the update process. It identifies which daemons need to be restarted after library updates and upgrades.

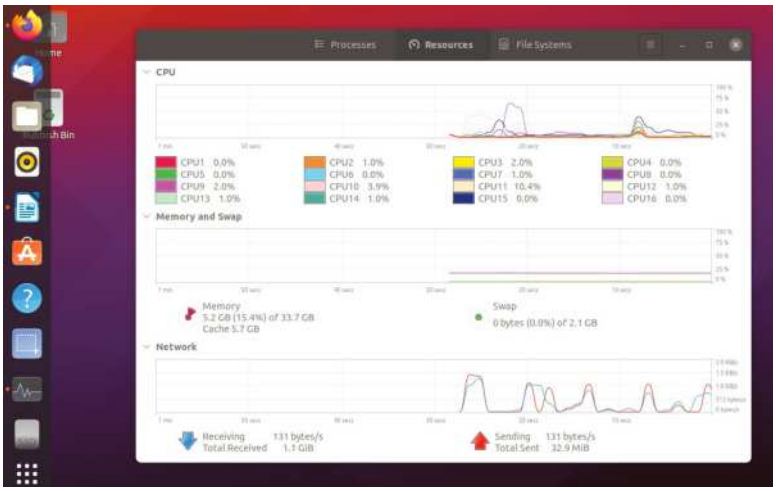
There are more than dozen other package updates, including QEMU (5.2), Libvirt (7.0), DPDK (20.11.1), Containerd (1.4.4) and Docker.io (20.10.2). Check the release notes at **https://discourse.ubuntu.com/t/hirsute-hippo-release-notes/19221** for full details.

Is it time to upgrade?

It's true to say Ubuntu 21.04 is likely to be remembered as the update that finally made Wayland stick as the new default desktop server. But while there isn't anything major to get excited about, there are enough minor improvements to easily justify moving on up from Ubuntu 20.10 sooner rather than later. Being able to drag and drop files between desktop and applications is potentially worth the update on its own.

It's a harder sell if you're currently running Ubuntu 20.04 LTS, however. Given the new kernel (5.11) will be shipping in the next point release (20.04.3), there's no immediate rush to upgrade. Unless you have an urgent need to switch to Wayland, we'd recommend waiting for 22.04 next year – the windowing system will almost certainly be the default by then, and any major issues such as the Nvidia block should be resolved.

It's a trickier call for those running the LTS version of Ubuntu Server, but given that you can update manually to many of the new packages, you may still prefer to hold fire. Either way, if you can't wait until next year to upgrade, check out the box (*below*) to find out how to do so now.



Although GNOME itself hasn't been updated to version 40, many underlying GNOME tools have.

Where's my cover disc?

If you're running Ubuntu 20.10 on your PC, then keep an eye out for the prompt to update to Ubuntu 21.04. If you miss it, just open Software Updater and it should be offered to you.

At time of writing, the upgrade option was being held back because of a potential issue that prevents PCs running older EFIs from booting. This problem should be resolved by the time you read this, but if not, open Terminal and then issue the following command:

```
$ dmesg|grep "EFI v"
```

So long as the version number is greater than 1.10 you shouldn't be affected by the bug. If you're impatient to upgrade, force the upgrade with the following command:

```
$ sudo do-release-upgrade -d
```

If you're running Ubuntu 20.04 LTS on the desktop, then you're less than a year away from the next LTS release in April 2022. If you've decided you're ready to switch from the long-term support channel to the six-monthly release channel, then open Software & Updates, switch to the Updates tab and change the 'Notify me of a new Ubuntu version' drop-down to 'For any new version'. By now a month has passed since Ubuntu 21.04 made its first appearance, and any initial bugs should have been ironed out, although if you're feeling ultra-cautious, we recommend waiting another month or two before taking the plunge.

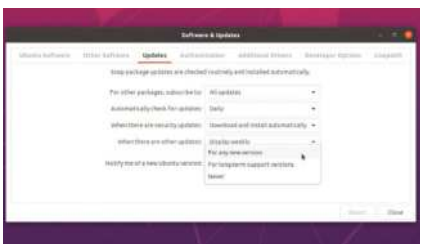
After you switch release channels, open Software Updater and you should be told that Ubuntu 21.04 is now available – click Upgrade... to install it.

Users who are running Ubuntu Server on their system will need to edit the release-upgrades file:

```
$ sudo nano /etc/update-manager/release-upgrades
```

Change the `Prompt=lts` line to `Prompt=normal`, then save the file and exit. Finally, issue this command:

```
$ sudo do-release-upgrade
```



Switch release channels if you're ready to abandon LTS support for Ubuntu 21.04.

Introducing the Ubuntu desktop

Ubuntu's desktop might seem a little alien to new users, but it's very easy to get the hang of.

Like Windows, the desktop of Ubuntu is where you'll spend most of your time. It's where you can open your programs and interact with them, and you can also customise your desktop with wallpaper backgrounds. However, while the Ubuntu desktop and the Windows desktop share some things in common, there are also many differences between them. Once you get used to it, though, you'll find that the Ubuntu desktop isn't just easy to use, but it has loads of great features that will make you quickly forget about Microsoft's way of doing things.

When you first load up the Ubuntu desktop, you'll see the Launcher menu, which runs down the left-hand side of the screen. This is where you can quickly access all of your favourite apps. Pre-installed apps such as the *Firefox* web browser and *Libre Office* appear here, and you can add other programs by searching for them and dragging their icons on to the Launcher bar.

To search for programs, files and more on your PC, you need to use Dash, which can be opened by clicking on the Ubuntu icon at the top of the Launcher. Once Dash is open, you can simply type in the name of what you are looking for, and Dash displays the results. One of the best things about Dash is that it doesn't just search your PC; it can also offer up suggestions from the internet as well.

If your searches are bringing back too many results, you can choose what sort of files or programs you're after by clicking on one of the icons along the bottom of the Dash screen, which bring up so-called Lenses, which filter your results. For example, you could search your applications, documents, videos, music or photos individually.

File management

Below the Dash icon on the Launcher is the Files icon. This opens up Ubuntu's file manager, which is a lot like Windows Explorer. Here you can easily find, open and modify your files and folders directly from the Ubuntu desktop. As with Windows, Ubuntu helps you keep things organised by creating folders such as Documents and Music to store your files.

On the Launcher menu, you'll also see an orange shopping bag icon with a letter A on it. Clicking this opens up the *Ubuntu Software Center*, which enables you to find, download and install new applications for Ubuntu. We take a more in-depth look at the *Software Center* later in this bookazine.

Underneath that is an icon for Amazon, which takes you to the popular online store. Its inclusion is a little contentious among Linux users, so if you don't like it being there, right-click on the icon on the Launcher menu bar and select Unlock From Launcher.

Beneath that is the Settings shortcut, which opens up Ubuntu's settings. From this window you can alter the way Ubuntu behaves, and with some careful tweaking, you'll be able to get the operating system working exactly how you want it to.

You'll also occasionally see an icon with a big A and a circle of arrows. This lets you know when there are updates for Ubuntu. Although Ubuntu (and Linux as a whole) is a lot more secure than Windows, it's worth keeping it updated to make sure any security flaws or performance issues are fixed.

Finally, at the bottom is an icon of a trash can. This works in exactly the same way as the Recycle Bin in Windows, so if you delete a file that you later want to restore, check here before you tear your hair out.

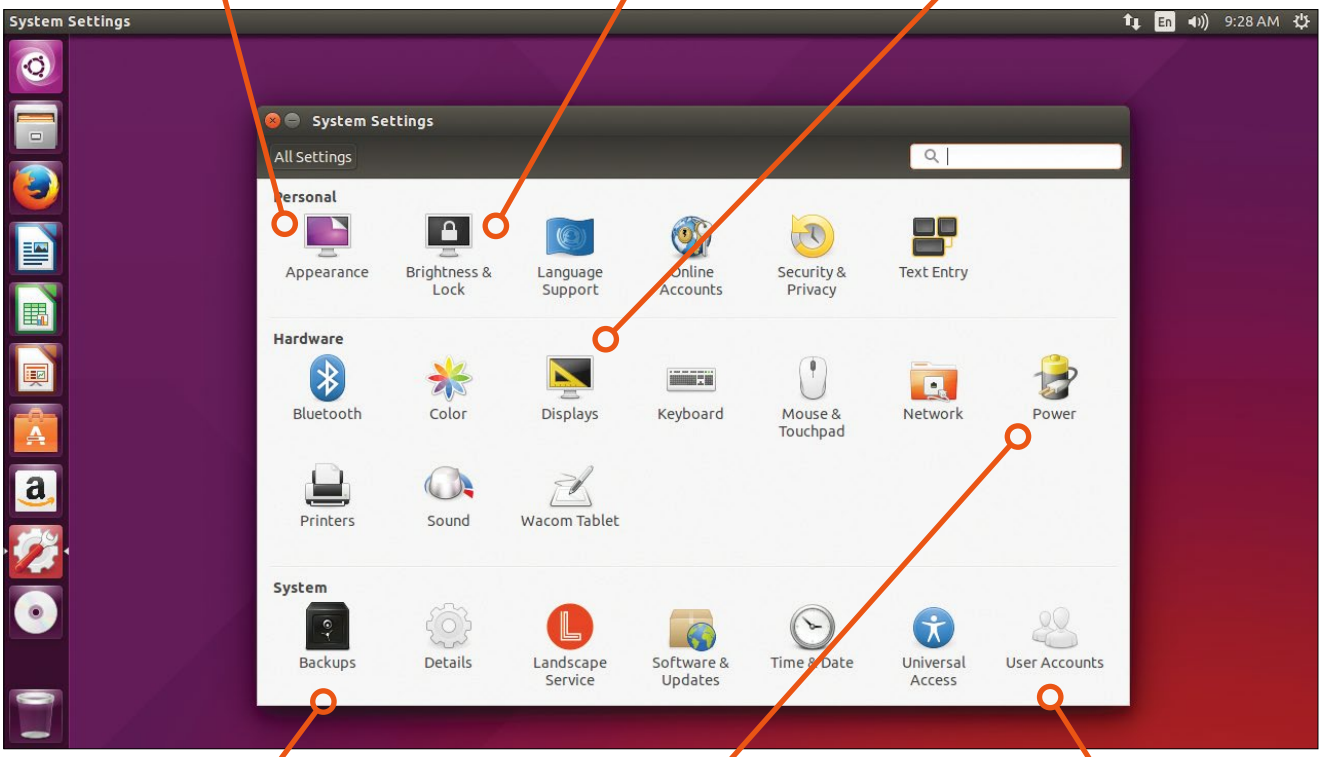
Ubuntu settings

Clicking Settings on the Ubuntu desktop enables you to customise your PC.

Appearance
Ubuntu is an attractive operating system, but if you want to tweak its look and give it a personalised feel with your own desktop background, click here to change its appearance.

Brightness & Lock
If you want to save energy and have your monitor power down when you're not using your PC, click here to set when to turn off your screen, as well as making it necessary to enter a password to unlock your PC.

Displays
This enables you to change the resolution of Ubuntu to better suit your screen. If you have more than one monitor, you can also select the order they display Ubuntu from this screen as well.



Backups
This setting enables you to set up a schedule for Ubuntu to back up your files and settings. This is great if something goes wrong and you need to restore your machine to a previous working version.

Power
If you've installed Ubuntu on your laptop, then the Power settings are essential, because they can help you preserve the battery life of your device when it's not plugged in.

User Accounts
If you share your Ubuntu machine with other people, you can create extra user accounts for everyone, which lets them configure Ubuntu the way they want, without messing with your own settings. It also keeps their files and folders separate from your own.

The Desktop

We reveal how to give your Ubuntu desktop a makeover, plus tweak its settings to better suit the way you work and make it your own.

Quick tip

If you don't like *Launcher's* default place, you can move it using the *Unity Tweak Tool*. Launch the tool and select Appearance, then choose 'Bottom' under Position to have the Launcher run along the bottom of the screen instead.

Ubuntu's Unity desktop is a radical departure from many Linux desktops in that it doesn't attempt to emulate the bog-standard Windows user interface with a taskbar running along the bottom of the screen complete with Start menu. Nevertheless, there are still plenty of common elements that make it reasonably intuitive to grasp. Once you've familiarised yourself with the basic layout, you'll no doubt be itching to give it your personal touch.

As you'd expect, Ubuntu can accommodate just about any type of tweak you'd like to throw at it. Some of these can be applied from within Ubuntu's own Settings panel, but if you find its limited set of tools restrictive, we'll show you how to use a more powerful tool to take things to the next level.

The most obvious form of customisation is to change the background wallpaper and change other desktop elements like windows and menu bars in terms of colour and font. Go to Settings > Appearance and you'll see controls for switching wallpaper, with 14 images supplied (you can add your own pictures by clicking the + button – remember to make sure the image is at least the size of your desktop resolution). If you'd rather set a plain or graduated colour background, click the 'Wallpapers' drop-down menu and choose 'Colours & Gradients' – choose the type of effect first,

You'll also see a Theme drop-down menu for making changes to the design and colour of windows and menu bars. Three themes are provided: just select one and the desktop will instantly update to that theme. The choice is rather restrictive, but the good news is that you can download more themes online. You can't apply these using Appearances, but the powerful Unity Tweak Tool allows you to do this as well as apply other customisations not supported by Ubuntu's Settings panel. See the box for more details, and keep an eye out for more references throughout this tutorial.

You'll find many themes online, but a good place to start is **www.ubuntuthemes.org**. It applies a registration and checkout process for obtaining and downloading themes, but most are completely free; simply browse for those you like and add them to the cart. Once through checkout, a link to a compressed archive containing the theme's files is provided, which you can click to download to your Downloads folder.

The contents of the archive need to be extracted to the **/usr/share/themes** folder – this requires elevated access, so open Terminal and type the following:

```
$ cd Downloads
```

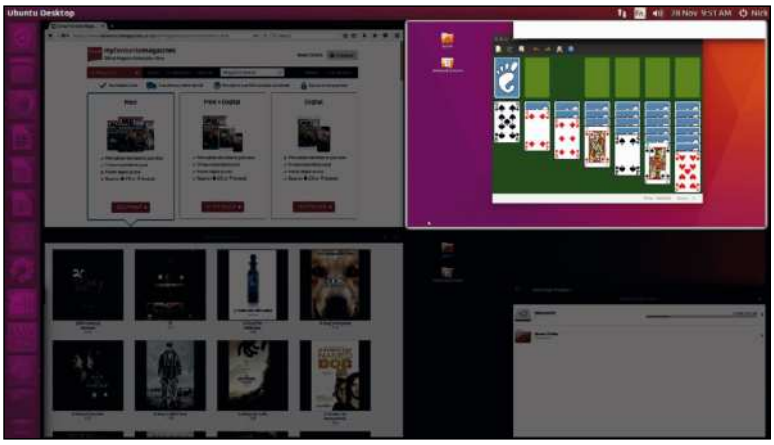
Then, if the file extension is .tar.gz, type:

```
$ sudo tar xf filename.tar.gz -C /usr/share/themes
```

If you have downloaded a zip file instead, use the following command instead:

```
$ sudo unzip filename.zip -d /usr/share/themes
```

In both cases, substitute 'filename' with the actual name of the file. Once extracted, open *Unity Tweak Tool* and select



› Spread your cluttered application windows across four (or more) virtual desktops to make them easier to manage.

The Unity Tweak Tool

If you want to take your desktop customisation to the next level, open the *Software Centre* and search for 'unity tweak tool'. This powerful free app gives you much greater control over the look, feel and behaviour of the Unity desktop.

Once launched you'll see it closely resembles the Settings tool, with a series of icons split into various sections. Select Launcher and you'll see it mirrors all the options found under Settings > Appearance, plus adds more of its own (see the Top Tip above). Switch to the Search tab to tweak both the Dash's look and behaviour, or customise the main menu bar from the Panel tab, including making it semi-transparent and choosing which elements appear in the top right-hand corner of the screen.

There's a whole section dedicated to Unity's window manager – choose 'Window snapping' to determine how windows behave when snapped to the sizes or corners of the screen, and Hotcorners to create hotspots for switching workspaces, toggling desktop view and spreading windows. Use the Additional tab to control behaviour when double-clicking title bars.

The tool also gives you more granular control over themes, allowing you to mix and match icon sets, cursor designs and fonts. One final highlight is 'Desktop Icons', which allows you to place your choice of Home Folder, Network, Rubbish Bin and connected device icons (such as removable drives) on the desktop for quick access.

› The Unity Tweak Tool gives you far greater control over how your desktop is customised.

Theme under Appearance, where you should find your new theme is available to switch to.

Customise the Launcher

Install a new app from the *Software Centre*, and its icon will automatically be pinned to the *Launcher*. Other icons will appear temporarily while an application is running, then disappear when the app is closed – you can make these permanent fixtures by right-clicking the app icon and choosing 'Lock to Launcher'. Unwanted icons can be removed by right-clicking and choosing 'Unlock from Launcher'.

You can rearrange icons simply by clicking and dragging them up and down the Launcher to their desired location – you'll see the other icons helpfully shift to make room. Let go, and the icon moves to its new home.

If you find the Launcher distracting, open *Settings* via its *Launcher* icon and choose Appearance. Start by changing the size of the icons displayed on the Launcher using the 'Launcher icon size' slider – to fit more on, decrease the size.

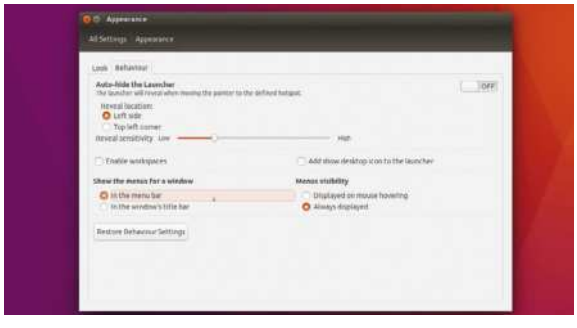
To go further, switch to the Behaviour tab and flick the 'Auto-hide the Launcher' switch to On. The Launcher will vanish, only appearing when you drag the mouse over to the left-hand edge of the desktop – use the 'Reveal sensitivity' slider to tweak how quickly the Launcher will pop up, or change its trigger area to the top-left corner of the screen if you prefer by selecting the appropriate radio button. Tick the 'Add show desktop icon to the launcher' box if you'd like to be able to clear the clutter with a single click (it works like Windows: all app windows are minimised on the first click, then click again to bring them back).

Virtual desktops

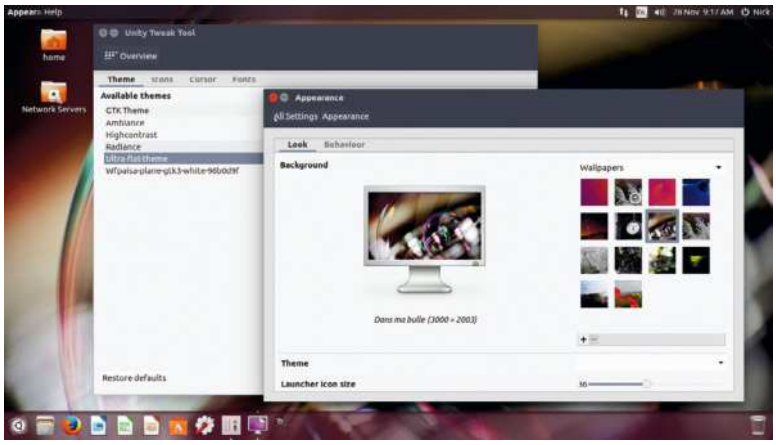
If you frequently have three or more app windows open, your desktop can soon start to feel a little cluttered. If you're looking to keep things relatively clean, or introduce a secondary layer of organisation, you need to look at Ubuntu's workspaces feature. Workspaces are virtual desktops, and you can drag and drop application windows between them to free up space on individual desktops or to group related applications together (for example, your email, chat and Solitaire apps for those work break moments).

To enable workspaces, go to Settings > Appearance > Behaviour tab and tick 'Enable workspaces' and a new button will appear in the Launcher. Click this (or press the [Win] + [S] keys) and the screen divides into four. Drag open windows from one virtual space to another to move them, then click the desktop you wish to jump to. The Launcher remains in place across all windows, so simply click the Workspaces icon again to access this screen to switch back.

The beauty of workspaces is that the *Launcher* remains consistent across all your desktops, so you can easily switch between apps on different desktops by clicking the app icon



› **Use the Settings to adjust how Unity works.**



› **Give your desktop a more radical makeover by applying a new theme to it alongside other Unity Tweak Tool enhancements.**

in the *Launcher* – Ubuntu will then magically switch to the correct desktop. You can also move between desktops by holding the [Ctrl] + [Alt] keys and pressing the cursor keys to move around – a mini thumbnail of all four desktops will appear on-screen to guide you to the desktop.

Four virtual desktops should be enough for most people, but you can increase this number if you're the type of person who has multiple apps open at once. When you invoke the workspace switcher you'll see the desktops are arranged in a square table, equating to two rows and two columns. To increase the number of available virtual desktops, use the *Unity Tweak Tool* – click 'Workspace Settings' under 'Window Manager' to increase the number of available desktops by adding extra rows or columns to the workspace manager.

And there's more...

One of Ubuntu's quirks is that the window controls – such as minimising, maximising or closing the window – aren't displayed on the window's title bar itself, but appear in the main menu bar at the top of the screen when you roll the mouse over it, along with an application's menus. If you'd rather the controls were placed within the in-app menu bar instead, go to Settings > Appearance > Behaviours tab and select 'in the window's title bar'. Finally, select 'Always displayed' to force a program's menus to be permanently on display instead of only appearing when you roll the mouse over the menu bar.

One last tweak: if you've got two or more displays set up, head over to Settings > Screen Display to customise how they work – you can choose to mirror displays or (more likely) extend the screen display between both monitors. Click and drag the displays into the desired placement based on their physical location (so the left-hand display sits on the left, for example). Most controls are logical, but the Sticky Edges feature (on by default) refers to whether or not to maximise windows by dragging them to the edge of the screen – if you don't like this behaviour, flick the switch to off.

Scale your display

If you're fortunate enough to own a high-DPI display such as a 4K monitor, you'll need to tweak settings to make the display comfortable to read. Start by going to Settings > Screen Display and experimenting with the 'Scale for menu and title bars' slider to make the menus and title bars more readable.

Now go back to All Settings and select Universal Access. Flick the 'Large Text' switch to On. Switch to Appearance and scale up your *Launcher* icons using the 'Launcher icon size' slider. Finally, if your cursor is too small, open *Unity Tweak Tool* and tick 'Use large cursors' in the Cursors section of the tool.

Linux apps

Programs: How to install new software

Getting fresh programs onto your Linux system is, despite what you may have heard, utterly straightforward, foolproof and safe.

Your Linux system comes pre-installed with a whole host of useful applications and software, but there will come a time – there always does – that you want something new. There are various complex ways of getting hold of new things, and perhaps they'll be routes you explore later on in your Linux life. For now, there's a much easier way to find new programs for your computer: a package manager.

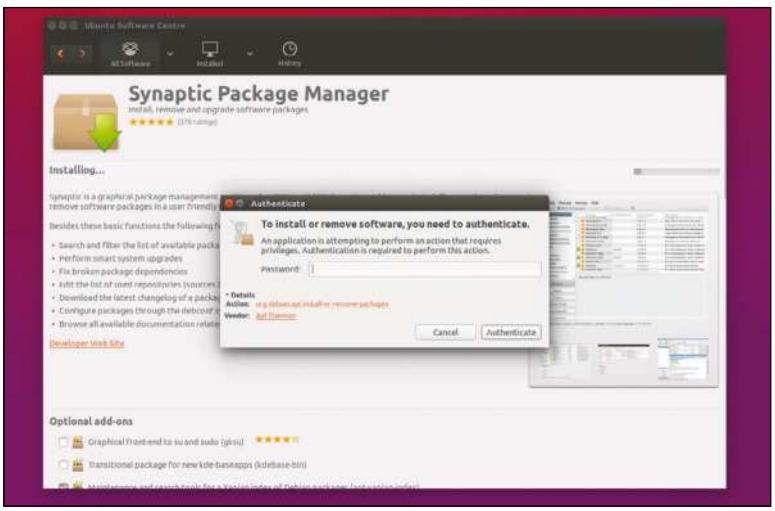
Package managers deal with everything for you. They retrieve the very latest versions of your desired software from the internet. They sort out any dependencies – items your computer might be missing – that are required for you to be able to run that software. They install everything automatically. And, once your software is firmly ensconced in your PC, they deal with the process of upgrading or removing it later on. You never have to get your hands dirty. And, all being well, everything will work perfectly first time.

You might have come across something similar on your smartphone. Apple's App Store and the Android Play Store are each examples of package managers – it's unlikely you've ever had to manually download and install any apps on a modern phone. The whole process is seamless. Apple has brought the system to Mac OS X, and Windows converts may know that Microsoft has been trying a similar scheme since Windows 8: the Microsoft App Store. Cynically, you might look at that as a way for Microsoft to control its software ecosystem, and you'd probably be right to be cynical, but it's also a way to get hold of (some) programs without the hassle – and potential danger – of downloading random things from the internet. It makes sense. It hasn't really worked, but the theory is sound.

Ubuntu's desktop package manager is called *Software Centre*. It accesses a number of sources – known as repositories – to grab the right version of your chosen program for your computer. Or at least it does for now – Ubuntu will soon be replacing it with an alternative, *GNOME Software*, in the 16.4 release of Ubuntu. But for now, let's look at how you might use *Software Centre* to download, install and remove software – *GNOME Software*'s interface and philosophy barely differ, so this will stand you in good stead.

Quick tip

You can also install software from Ubuntu's dashboard. Click the search button at the top of the left hand bar, the apps icon at the bottom, and search for what you want.



› Installing software requires that you have admin rights to your system – it's a good way of stopping other users from installing software you don't want!

Central reservation

As you can see from the annotation above right, there's not really an awful lot to *Ubuntu Software Centre*'s core interface. A big categorised list of software, buttons so you can see what's available, installed, what you've done and how downloads and installations are getting on. The key element for us is the search box at the top right of the window. It doesn't only search by software names – handy, considering the baffling monikers of most Linux packages – but by descriptions, too. So, for example, if we wanted to find a game, we might search, yes, 'game'. And everything with 'game' in its title, short description, and long description will pop up. Obviously that's a very broad example, but imagine you're looking for a new email client: it makes a lot more sense to type 'email' and find what you're looking for than it does to type 'MBoxImporter'.

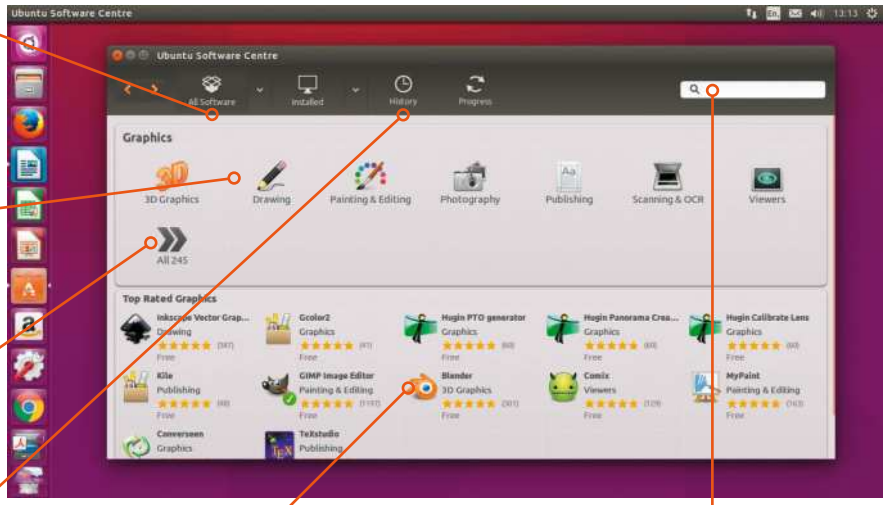
Teeth-grindingly annoying nomenclature aside, then. Let's install something. And why don't we get a bit meta? Before *Software Centre*, Ubuntu featured a program called *Synaptic Package Manager*, which we'd wager will still be available after the move to *GNOME Software*. It does the same things

Inside the Ubuntu Software Centre

Everything
To return to the main menu of *Software Centre*, click this button. You can also use its menu to select where the software comes from – official Ubuntu releases or from Canonical's partners.

Categories
Once you've chosen a category in All Software, that category's subcategories are displayed, meaning you can drill down further to the software you really want.

See it all
Wondering just what there is to choose from in your current category? Click here to see the whole confusing list.



Past tense
What has *Software Centre* actually installed? Not just the big packages, but the little ones? The history page will let you know.

Top picks
The best (or at least the highest rated) apps in each category are listed here along with their average ratings and number of reviews (in brackets).

Search bar
Searching is vital if you're not sure of a package name, or not sure what category your chosen package is in. Just type in here and hit [Return].

(searching for packages, fixing dependencies, upgrading and the like) with a lot more information on hand. Perhaps it's not the best for Linux newcomers, but it's handy to have around when you take the next step.

Typing 'package manager' into the search box doesn't do us an awful lot of good. Synaptic is in the list, sure, but it's not easy to find. So hit 'All Software' and let's see if we can find it in a slightly more organic way. It's actually nestled in the typically opaque category 'Themes and Tweaks', so click that in the left hand column of the main page and you should see it listed in the top rated section of the window that follows. If not, click the All button at the top and you should see a much more manageable list.

Actually Installing

Click on *Synaptic Package Manager* and you'll see a host of information about it, a link to its web site, a screenshot (isn't it pretty?) and, on the right, an Install button. Before you go ahead and click it, scroll down a little – *Synaptic* comes with a host of add-ons that you might be interested in, and these can be installed simply by marking their individual check boxes. Scroll a bit further and you'll find reviews of the package – very useful if you're installing an unknown bit of software, as fellow users are rarely shy about sharing negative experiences – and *Software Centre* doesn't exactly have a stringent cruft filter – so these can be a big red flag in a lot of cases. When you're ready, hit Install. Type your password, hit Authenticate, and *Software Centre* will do the rest.

Head to the History panel to see what changes have actually been made. You should see that a package called synaptic has been installed, but look at items installed at a similar time; the list will include a host of *Synaptic*'s dependencies that have also made their way onto your system without you having to lift a finger. Beyond the finger you used to click the install button, that is.

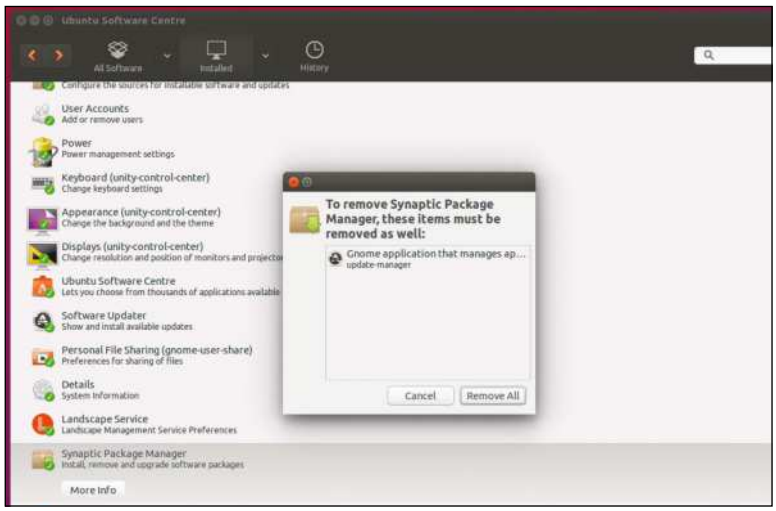
Once removed

Let's reverse the process, while we're at it. Click the Installed button at the top of the window to find a list of software divided by category. We know that *Synaptic Package Manager* is in Themes and Tweaks, so click the arrow to the left of that category to expand it and find *Synaptic* in the list. Click it once and you see a pair of buttons appear – More Info, which is especially useful if you're weeding your system and can't remember what a particular bit of software actually does, and Remove. Click the latter.

If applicable, *Software Centre* will now warn you of things which also must be uninstalled at the same time. In this case it's a package called update-manager, which we can reinstall later using the same technique we used to install *Synaptic Package Manager*. Click Remove All, enter your password, and the removal will happen – check the History tab for confirmation. Now go ahead and experiment with *Software Centre*. Install some games, remove some of the default apps, go crazy!

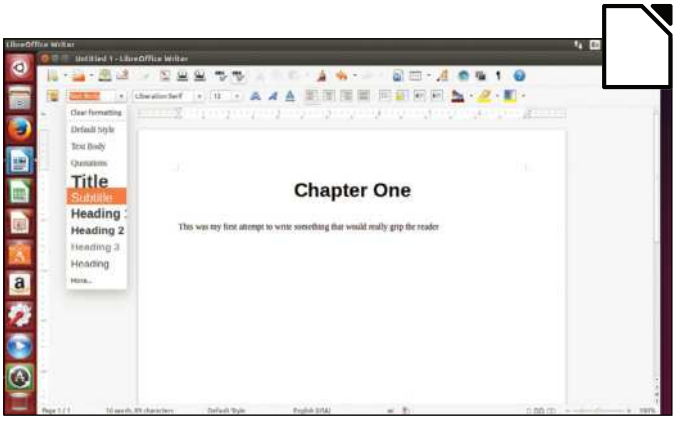
Quick tip

Most graphical package managers are just a front-end for terminal apps like *apt-get*, which you can use directly. We have more on this starting on p60.



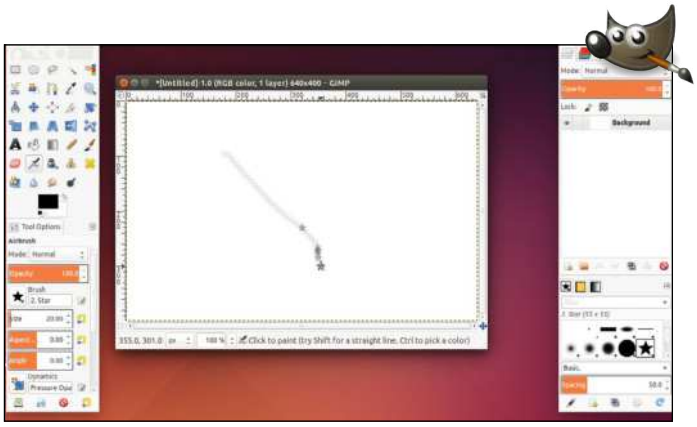
› Otherwise-redundant dependencies will be automatically removed when you uninstall packages – and sometimes you'll have to remove additional things too.

Twelve Linux replacements for



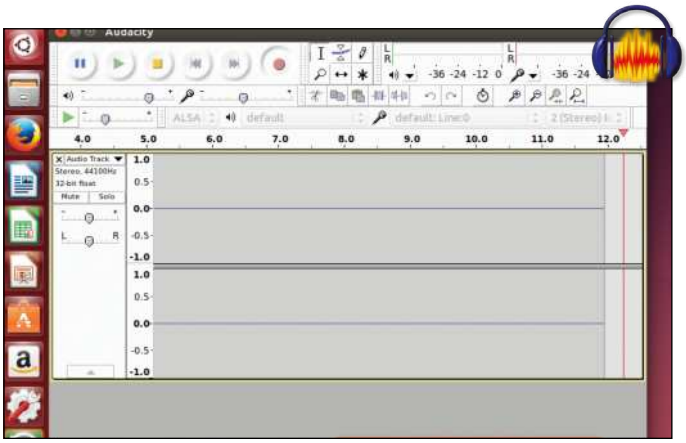
Libre Office (MS Office)

Don't worry about missing *Microsoft Office* when you jump to Linux, because *Libre Office* does everything that Microsoft's office suite can, but it's less bloated, doesn't have the annoying Ribbon interface and, best of all, it's completely free.



GIMP (Photoshop/Paint)

If you're a keen photo and image editor, then *GIMP* should definitely be on your list of apps to download. It's simple enough to replace *Microsoft Paint,* but also has enough depth to give *Photoshop* a run for its money.

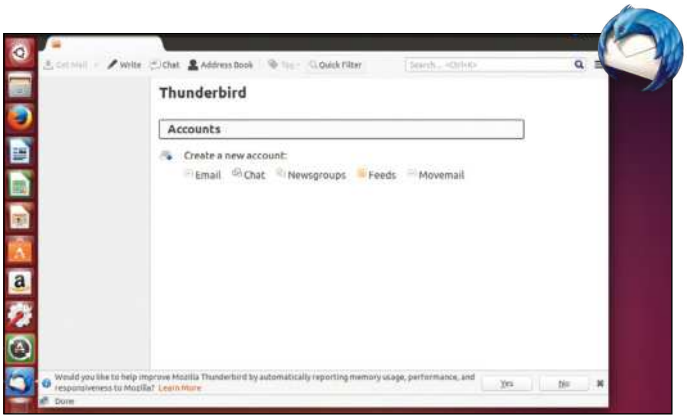


Audacity (Audio editor)

If audio editing and music creation are more your thing, *Audacity* is an excellent replacement for professional tools such as *Cubase* and *Sibelius.* Even if you're not particularly musically talented, *Audacity* is handy for editing voice memos and other sound files.

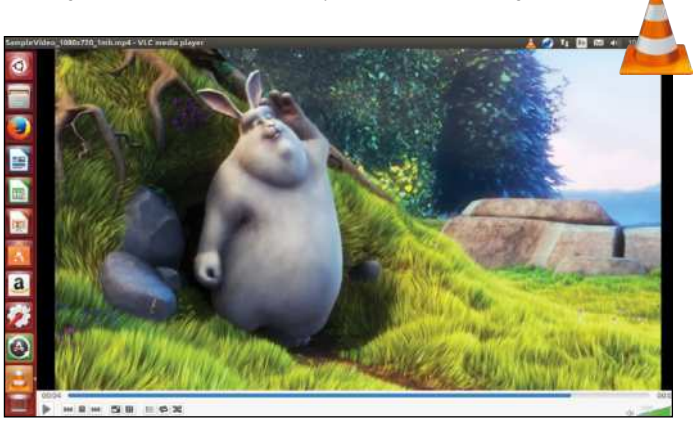
Firefox (Internet Explorer)

You won't find *Internet Explorer* on Linux (which some people would say is a good thing), but handling the web browsing duties by default on many versions of Linux is *Firefox,* which is faster, more secure and allows you to install add-ons to improve its functionality.



Thunderbird (Outlook)

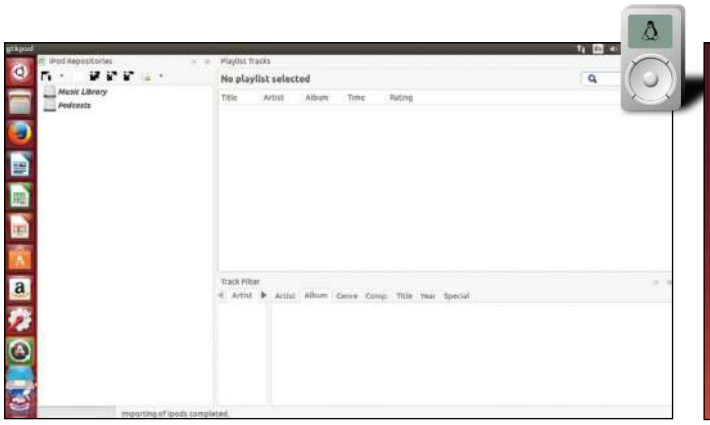
Do you use *Outlook* to manage your emails in Windows? Then you'll want to install *Thunderbird,* which is an incredibly versatile desktop email client. Like *Firefox* (they are both created by the same company), you can install add-ons to tailor it exactly to your needs.



VLC (Media Player)

If you use *Windows Media Player* or a third-party application such as *Cyberlink PowerDVD,* you can use *VLC* to solve all your media-playing woes. It's much more flexible than *WMP* and can play a huge variety of media files, and unlike *PowerDVD,* it's completely free.

common Windows programs

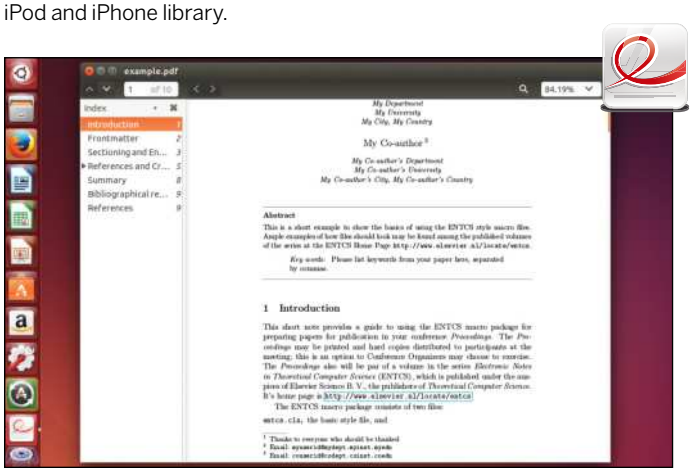


Gtkpod (Apple iTunes)

Got an iPhone or iPod? You might be worried that because you can't get *iTunes* on Linux, you won't be able to sync your music with your device, but never fear, because *Gtkpod* can help you manage your iPod and iPhone library.

Amarok (Media Player)

Do you use *iTunes* or *Windows Media Player* to just listen to music? Then you'll want to get *Amarok,* which will help you organise and listen to your digital music collection on your computer. It can also help you import and export music to your MP3 player.

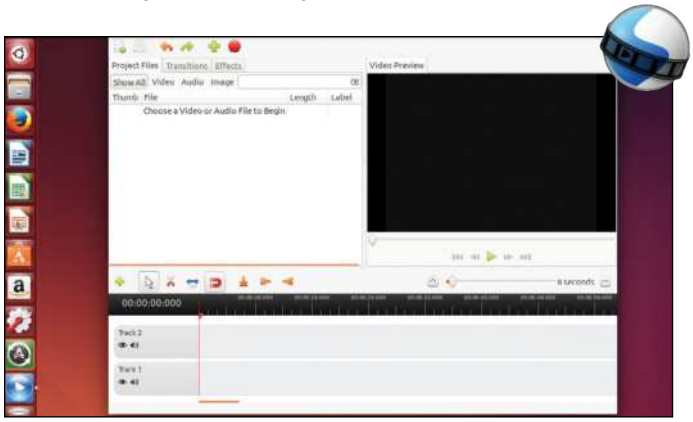


Evince Viewer (Acrobat reader)

PDF is one of the most prevalent file types online, and just because Linux doesn't have *Adobe Reader,* you're not left out. *Evince Document Viewer* is faster, lighter and does everything Adobe's software can. It's also installed by default on many Linux distros.

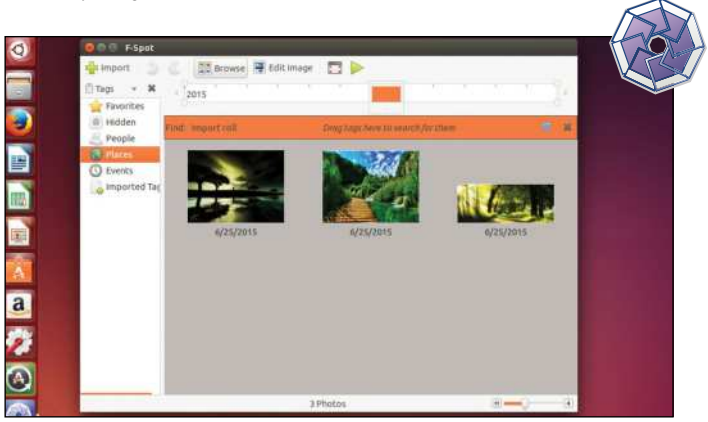
K3b (CD/DVD writer)

If you use Windows Explorer or a third-party program such as *Nero Burning ROM* to write CDs and DVDs with your own data, then *K3b* is an excellent alternative that does the job just as well, and once again it's completely free.



OpenShot (Movie Maker)

For any budding directors out there – don't worry about the lack of *Windows Movie Maker* or *Sony Vegas* and the like, because *OpenShot* is a versatile and powerful video editor that will help transform your home movies when using Linux.



F-Spot (Image Viewer)

For organising your photos, tagging them, making light edits and then sharing them with the world, *F-Spot* is the perfect replacement for *Windows Image Viewer.* This is the ideal program for photographers with hard drives bursting at the seams with digital snaps.

Rhythmbox: Playing media

Get your music collection blasting from your speakers and super-organised, then watch some videos too, it's all in a day's work for Ubuntu!

Quick tip

When it comes to online music, there's a desktop client for Spotify that can be added to Ubuntu and Google Play Music works through the browser. Netflix can be accessed if you install the Chrome browser, or use the User Agent Override add-on in Firefox.

Remember the days when we used to buy CD players with built-in radios, or cassette tapes for listening to our music? No? You're not alone. When it's possible to carry around a lifetime's worth of tunes on your phone, and stream audio wirelessly to your TV or HiFi system wirelessly, why on Earth would you invest in something so archaic?

We'll wager everyone needs a good media player on their desktop, however. Whether it's to enjoy music or internet radio while you work, or watch a movie on your laptop while travelling by train, digital media should be enjoyable whenever, wherever and however you need it.

And fortunately, Ubuntu has all the tools you need for playback built-in. If you're coming from Windows, there is one key adjustment you'll have to make. Microsoft's operating system comes with the all-encompassing *Windows Media Player* built-in, which is a hub for both music and video played back from a local source – like a hard drive or USB key – or a networked drive. For entertainment purposes, Ubuntu has separate applications for video and music playback.

For music, that application is *Rhythmbox*, which can manage your audio library, stream from remote services or a household server, and rip CDs directly to your hard drive. For video, the *Totem* player – which appears in the Unity launcher under the name Videos – serves similar purposes.

Living in a Rhythmbox

As far as audio goes, *Rhythmbox* is as fully featured as you need. It can be used to playback music from a local library, rip CDs, add album art to digital files automatically, purchase songs online and stream from another PC or network attached storage.

Before you start using *Rhythmbox*, however, there's one important thing you'll need to bear in mind. By default, Ubuntu doesn't include the software codecs required to playback the common MP3 format which many people use to store songs diigtally. Because many parts of the MP3 codec are still protected by patents, Linux distributions are unable to include it as standard without paying a licence fee.

Fortunately, the way around this is simple. Open up the *Ubuntu Software Centre* and search for "Ubuntu Restricted Extras". If it's not installed yet, click to download and there's little your PC will left unable to play.

Back to *Rhythmbox*, and the first time you open it up you'll want to point it at the place where you keep your song files stored in order to build up its library list. Open up the Edit menu and click Preferences, then Music. Click the Browse button to direct *Rhythmbox* to your Music library folder if it's not the default one, and then put a tick in the box "Watch my library for new files". Now any songs and albums in your library will be added to the *Rhythmbox* home screen, and any time you rip a CD, purchase music through *Rhythmbox* or add music from a portable player it'll be saved to the same physical place.

You'll also see options in this screen to select the format and quality for ripping music, and also for the naming convention you prefer in filenames that are automatically generated.

Once you've loaded some music up, the main view for *Rhythmbox* is fairly straightforward (see boxout above). You'll notice that the column on far left is pretty sparse initially, with some basic library options for selecting music, podcasts (see boxout) or internet radio stations. You can also see what's coming up in the play queue.

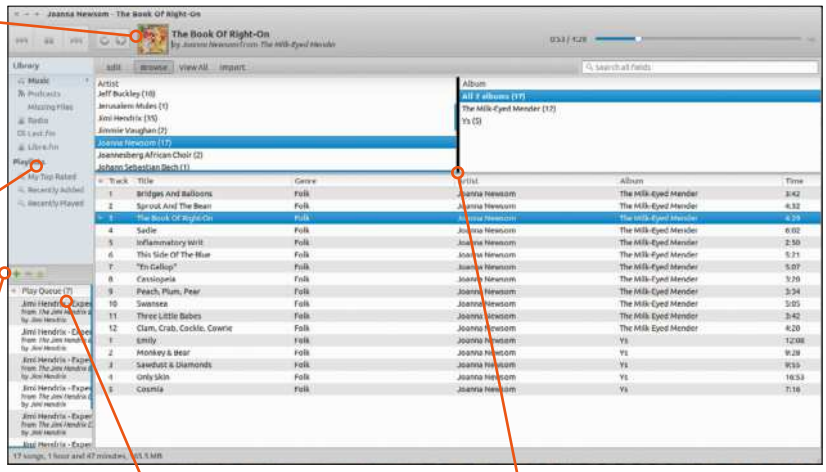
To start adding extra options here, you'll need to visit the Plugins menu, which you'll find if you click on Tools in the menu bar.

Rhythmbox comes with extra features which are disabled by default. In this menu you can turn extras such as Last FM scrobbling and the Jamendo music store. The selection of plugins is fairly limited initially, but you can add more with ease.

The one essential plugin to install is the *Grilo* suite, which will enable you to stream from other computers and libraries on your network. If *Grilo* isn't already installed, open up the *Software Centre* and search for grilo-plugins, then install the

› Probably the best Ubuntu video player, VLC is a must-have install.

Exploring the Rhythmbox interface



Album art
Rhythmbox will automatically pull album art from the net, but you might have to set-up the plug-in first.

Library
From here you can select local libraries, UPNP shares, internet radio or podcasts.

Add a source
The plus and minus buttons let you add a source for you library. This can be a folder on your hard drive, a URL or a shared drive.

Play queue
This list tells you what's up and coming on your playlist.

Artist list
On the left is the artist list, on the right their albums and in the main window a track listing.

Base package from there. Enabling this in the *Rhythmbox* Plugins section should result in any shared libraries on your network popping up in the left-hand menu.

Totem-ic

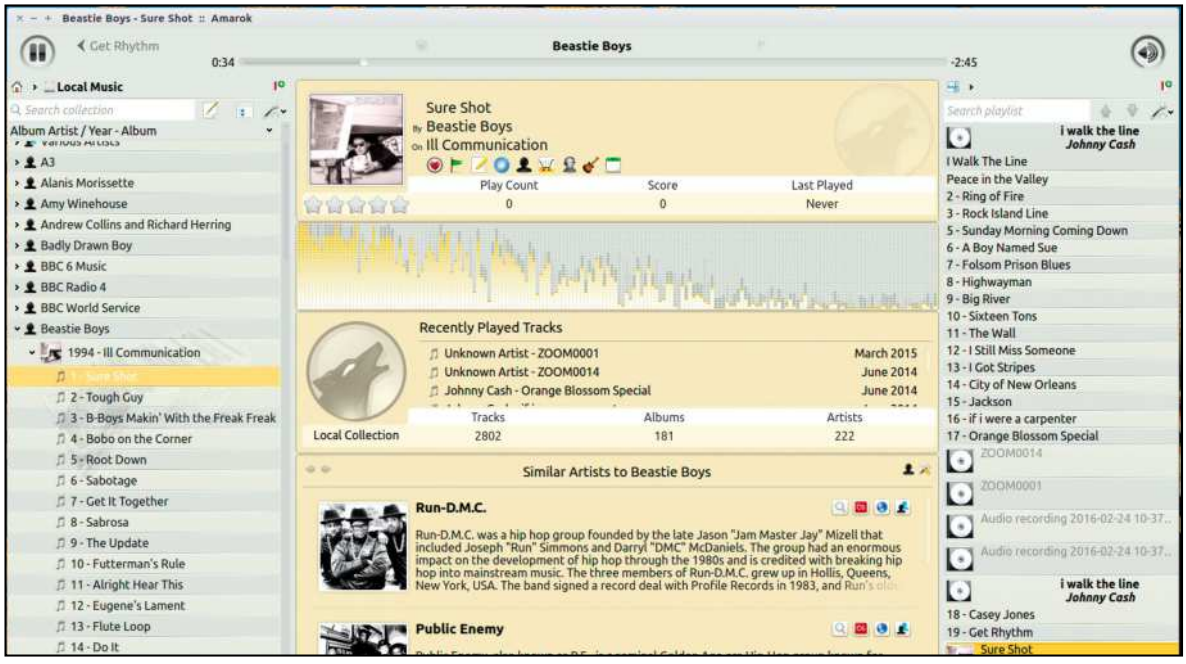
While *Rhythmbox* is reasonably well featured, *Totem* – the video player – is less so. It's fine for playing back videos selected directly from the file browser, but as a library manager it doesn't really cut it. You can add videos one by one, but there's no option to import a whole folder of videos or to automatically detect UPnP servers on your network.

Totem does have one very useful feature though. If you open up it up by selecting Videos from the Unity launcher and click the Channels option at the top of the screen, you'll get a selection of web videos including the latest movie trailers from Apple. You can add more from the Plugins menu.

For videos, we'd recommend installing *VLC*. It has a reasonably good library manager, and is also more bulletproof when it comes to playing back odd file formats than *Totem*. Plus, it handles remote libraries over UPnP well.

The best all-round media manager, though, is arguably *Banshee*. If you're moving from Windows and want something that looks and feels like Media Player, this is certainly worth downloading and trying out. It handles music, video and UPnP better than the default apps, plus it can connect directly to the Amazon music store.

One thing that Ubuntu is very good at, however, is controlling your music or video while the player app is in the background. Once a song is playing in *Rhythmbox* or *Banshee* (or even Spotify) just click on the volume icon in the task bar and you'll get per-app volume controls and full playback tools without having to re-open the app itself.



› **A good alternative to Rhythmbox, Amarok includes a more colourful interface and more add-ons.**

Quick tip

Rhythmbox will automatically check for and download your favourite podcasts. Go to Podcasts > Add and you can search the iTunes and Miroguide libraries, or add your own via RSS.

Gimp: Editing photographs

Think you need professional tools to do a professional job? Think again: Linux includes the best free photo editor around.

Quick tip

For those who like to shoot in RAW mode on their cameras, there's two excellent options for processing on Linux. *Darktable* is a fully open source RAW editor you'll find in the Ubuntu repositories, while Corel's *AfterShot Pro* is a well supported commercial contendor.

There's one name which dominates digital photo editing all around the world. Adobe, and more specifically its *Photoshop* package, has been so popular for so long it's synonymous with the task and has become a verb. To "Photoshop" a picture is the same as conflating "to Google" for internet search or "to Hoover" for vacuuming the floor.

The bad news is that the vast majority of Adobe products aren't available on Linux operating systems. *Photoshop* certainly isn't and probably never will be.

Is that it then? The joys of Ubuntu and its ilk are not for photographers or those who like to tweak and digitally develop their snaps before sharing them with the world?

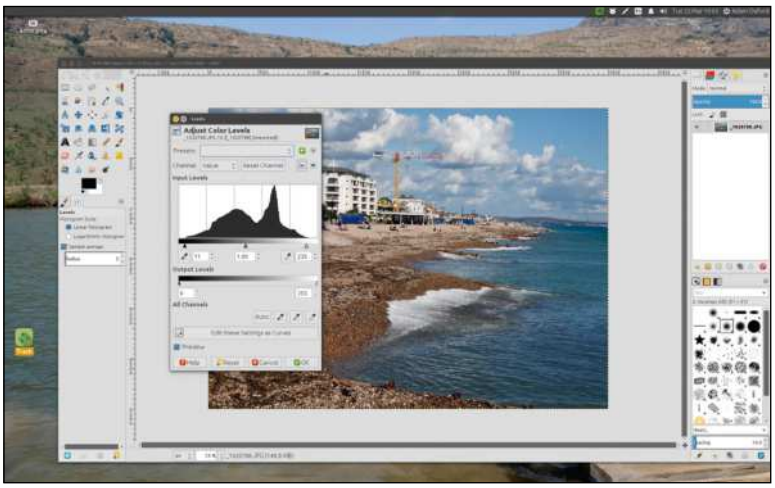
Of course it doesn't.

Get your Gimp on

We'd wager that even on Windows most people who "Photoshop" their pictures aren't using Photoshop. It's an expensive piece of software after all and there's lots of alternatives. One of the best, which is available on Windows and Linux, is the wonderfully named *GNU Image Manipulation Program*.

Gimp is astonishingly powerful, so much so that it really is almost as feature rich as *Photoshop* and certainly as capable for almost every task. It's installed by default in Ubuntu, but if you don't have it you'll find it in the *Software Centre*.

When you first open *Gimp* up, it can be a little intimidating. This is a professional piece of software and designed to be used by professionals. Don't be put off though, it's easy to get a grasp of the basics.



The Levels dialogue is the first port of call for photo fixing.

The first thing you'll notice is that not one but three windows have appeared on your desktop. In the classic layout, you'll find the tools menu in a thin window on the left, the main workspace in the middle and a window for extra controls like layers, colour channels and brushes on the right.

It can be tricky at first to work in three different windows simultaneously, and there's an option to display everything in one Window if this is putting you off. Just go to Windows and tick Single Window Mode. This will give you a simpler layout that you may be more accustomed too.

If you can bear with it, however, we'd strongly advise sticking to separate windows for all the docks. It allows you to create a working area on your desktop that's exactly customised for your needs, and if you have more than one monitor you can put the tools on one screen with the image full width on another.

Colour correction

Gimp is, as we've said, a very powerful piece of software. It includes tools for cutting out parts of an image, creating layer masks, the classic clone and heal brushes loved by art editors for removing traces of humanity from a model's skin and a wide range of filters and plug-ins – plus support for more – for adding effects and punishing pixels into submission.

To get you started, though, here's an easy exercise in brightening up an underexposed photo. First, you'll need to get your photo into *Gimp*. A quick note – while *Gimp* does support RAW files from cameras, we wouldn't recommend it. Better to convert your image to JPG, TIF or PNG first.

Now you can open your pic up just by dragging its icon from the Files browser over the *Gimp* launcher or into the workspace itself if *Gimp* is already running. You can also open an image using the File menu if you prefer.

Our underexposed image is a little dark, but we're not just going to increase the brightness. That would be crude and have the effect of removing some of the dynamic range leaving you with a flat, washed out looking shot. We want to try and keep rich shadows and preserve as much detail without leaving the picture looking washed out.

The way to do this is to click on Colours and select Levels. This is the tool that professionals use to correct exposure. What you can see is a histogram which describes the "tonal range" of your image. The left side of the graph represents the amount of pixels in dark areas areas of the shot, and the right side light.

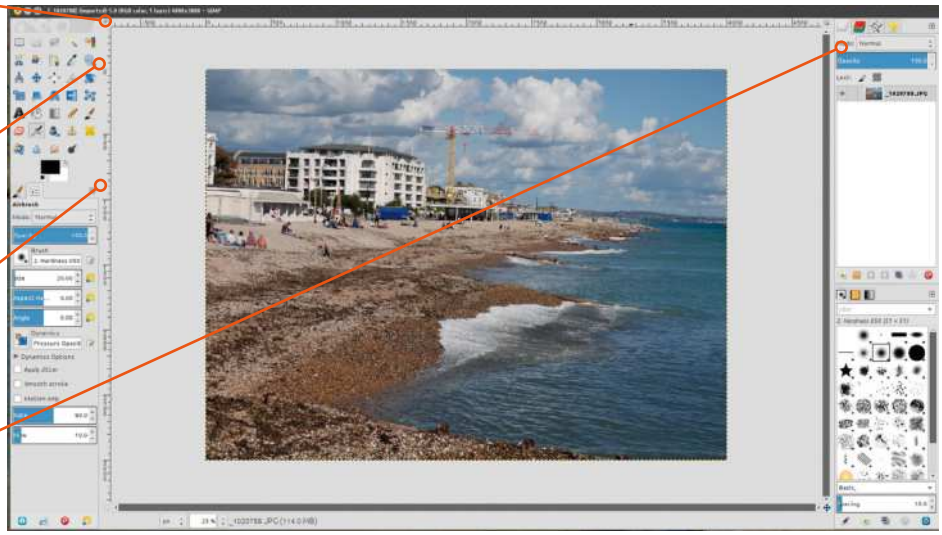
Gimp key features

Filters
The Filters menu has a host of tools for everything from adding blur to cartoony frames.

Tools
The tools are a standard photo editing kitbag. Everything you'd expect is here.

Options
Beneath the tools themselves you'll find a full array of customisation options for tweaking their use.

Layers
The Layers window acts much the same as *Photoshop*. You can split an image, add extra layers and edit areas here.



You'll notice three markers under the graph: one at either end and one in the middle.A well exposed shot will have readings all the way along the tonal range, depending on the contrast in the image captured. If a photo is underexposed, however, all the readings will be bunched up at the left-hand side of the graph with a flatline towards the right. The best way to correct this is to drag the marker from the right towards the area where the tonal values kick in, reducing the tonal range of the image to those values that have readings.

If you're lucky, this will brighten the picture without destroying detail. Because the midpoint will also automatically adjust, it should retain a good contrast too, which merely changing the brightness would wash out.

As if that wasn't enough, this single tools can also act to correct the "white balance" of your picture. If you've taken a photo indoors, for example, you might have captured a yellow cast from the overhead lights. To remove this, you can use one of the three pipette symbols in the same Levels dialogue.

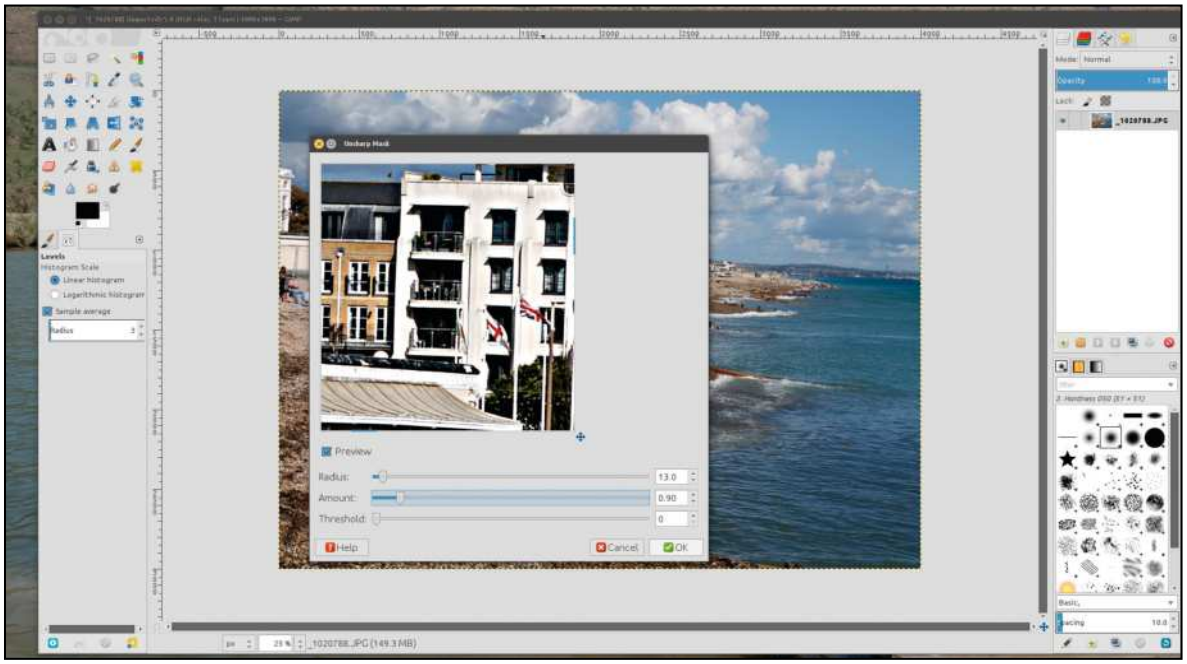
From left to right, these allow you to select the black point, gray point and white point of an image. *Gimp* will work out what the other colours should look like from there. The white point is the easiest to use – just click it then zoom in on a detail you know should be close to pure white. Teeth or eyes are are good, as are clothes or table clothes. Select that as your white point and watch the whole image adjust to something more natural looking.

And don't worry if you don't get it right first time. Just click on an different part of the image or the Reset button if all goes wrong.

That's really just scratching the surface of what *Gimp* can do. In the basic toolbox you can scale images, select areas, draw paths, rotate or add text. The only way to learn more is to try it out.

Quick tip

quick photo fixes there are tons of online photo editors that work in a Linux browser just as well as they do in Windows. **Pixlr.com** is the best known, and great for quickly fixing red eye etc.



› Gimp's Unsharp Mask is every bit as good at picking up detail in images as Photoshop's.

Openshot: Start video editing

Easily create home videos and slideshows with backing tracks using the OpenShot open source video editing package.

If you believed that switching to using Ubuntu Linux means giving up the ability to create videos and photos, rest assured nothing could be further from the truth.

The *OpenShot Video Editor* which is available from the *Ubuntu Software Centre* can be mastered in a few minutes but allows you to create high quality videos.

Although *OpenShot* isn't by any means the only video editor that will work well in Ubuntu, it strikes an effective balance between being simple to pick up, but having features advanced enough to create a professional looking video.

In this tutorial we will explore how to import both video clips and pictures into *OpenShot*, then export them as video.

In order to proceed, you will need to have imported the video, pictures and music you wish to use to your computer either via downloading it from the internet or digital camera.

Once your media is safely on your computer, click on the '*Ubuntu Software*' icon to open the *Software Centre* and search for '*OpenShot*'. Click 'Install' to download the program. Once complete a button marked 'Launch' will appear.

Your first step when launching *OpenShot* should be to create a new project. Either click the 'New Project' button at the top left or hold down Ctrl + N. A window will appear allowing you to name the project and choosing where to store the project files e.g in your Videos folder.

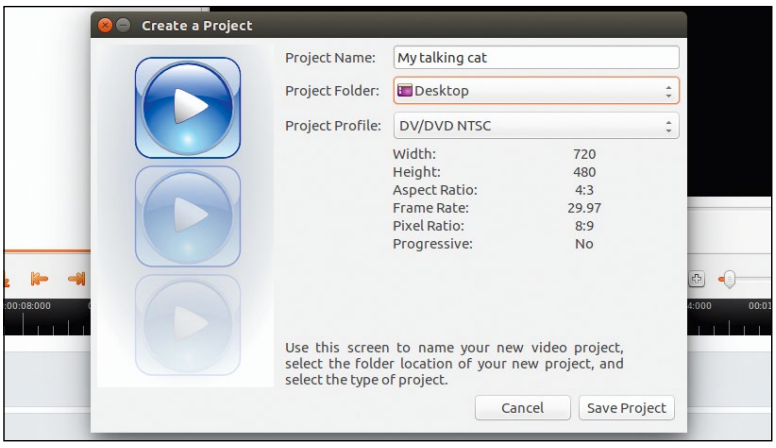
At this stage do not worry about the video settings under 'Project Profile' as they can be changed later. Choose 'Save Project' when you are done. The folder you chose will save a project file detailing the name of your project and the location of any media you have imported using the file extension .osp. This is not a video file and cannot be played in a media player, it's simply a way for you to save your work as you go in *OpenShot*. Creating a video will come later in the tutorial.

Quick tip

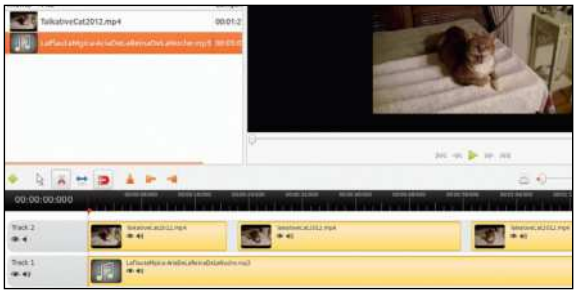
Other popular Ubuntu editors include *Pitivi* and *Kdenlive*. Both are available to install from the *Software Centre* if you want or need a more advanced editor.

Quick tip

If you want to trim a clip, consider using the 'Resize Tool' to the right of the Razor Tool. Move to the edge of a clip and then hold your left mouse button to resize.



› Click the 'New Project' button at the top left to choose a location to save your projects. This doesn't have to be the same place where you export your video.



› Background music has been added to Track 1, a cat video is on Track 2. Note the original audio has been muted.

Next, click the green + icon to import media files such as video clips. In the example below, a single video clip has been used but you can select multiple clips by holding down Ctrl and clicking on each file to select. Click on the 'Add' button at the bottom right to import the files. You will see they will appear in the 'Project Files' window at the top left.

Tracks, titles and timelines

Once your media has been imported, the next step is to drag them into the 'tracks' on the timeline. This is fairly self explanatory as the timing is displayed along the top and you can place your clips anywhere; for instance you may want one clip to begin playing after 3 seconds and another immediately after the first clip is finished. By default the timeline marks every 8 seconds though you can change this by sliding the bar at the top right.

You will notice there are two tracks displayed at first where you can copy content. You don't have to use more than one track, but if you plan to use more advanced features like transitions, titles and background music then it may be simpler to devote a track to each clip. Click the green + icon above the timeline to add more tracks if you wish.

It's advisable to have a dedicated track for any background music. Simply click the + button and drag an audio file into the new track. Unless you want the original video's sound to play too, click the loudspeaker icon on the left hand side of the video track to mute the audio.

At this stage you may also want to give your video a title. To do this, hold down Ctrl + T to open the Title Menu. Click the menu under 'Start Here' to choose the font and layout of your title, then 'Create New Title' to set the text. The title will appear in the Project Files and can then be dropped onto the timeline wherever you need it.

OpenShot Slideshows

If you wish to create a video from a series of photos, place them in a folder and make sure they are sequentially numbered. Most digital cameras will do this for your automatically.

Use the 'Import Files' button to load all the files into the 'Project Files' window. Next hold Ctrl+A to select all the files and right click them. Choose 'Add to Timeline'.

This new window that opens allows you to fine tune the video settings. The 'Timeline Location' section lets you alter the time at which the images are displayed – you may wish to leave a few seconds delay if you are going to add a title.

The 'Fade' section allows you to choose if the photos will fade in and out as well as set the duration, as the name suggests. Finally the 'Transition' section allows you to choose a transition between photos. This saves you the time and trouble of inserting transitions individually, but naturally it will be the same kind of transition e.g Vertical Blinds for every photo.

By default the odd numbered photos will be added to track 1 and the even numbered to track 2, although you can change this if you wish in the 'Timeline' location section. Click 'Add' when done.

At this point you may wish to add an additional track for background music. Slideshows are exported as video in the usual way by clicking the 'Export Video' button at the top and you're all done.

› Use the arrow keys on the left to change the order of the pictures.

Sometimes you may wish only to create a video with short clips from a larger recording, for instance to play speeches at a wedding. The Razor tool can be activated easily by clicking the scissors icon at the top of the timeline. Once you have done so, you'll notice that the cursor will change to a picture of a razor blade with a blue dotted line.

Left click your mouse to split your video into any number of clips. You can then right-click on individual clips and choose 'Remove Clip' to delete them altogether. If you want to move snipped clips around, click on the 'Arrow Tool' on the timeline to deactivate the razor tool and then move the clips to elsewhere on the timeline or a new track.

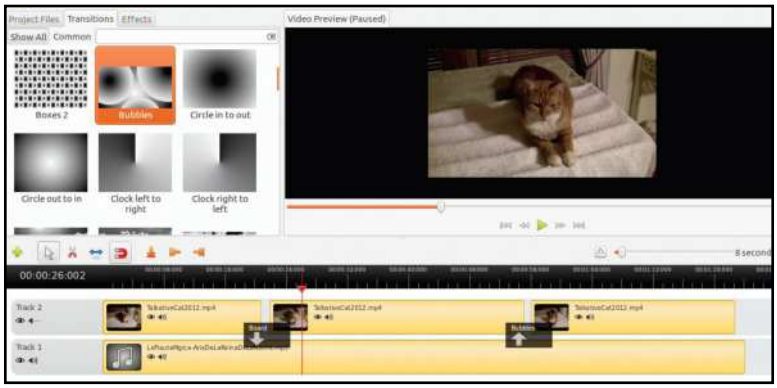
Effects and transitions

OpenShot contains dozens of built in video effects to enhance clips. Simply right-click on the clip in question and select 'Properties'. Next click the 'Effects' and the green + button on the bottom left to add an effect from the menu.

A mini preview of your video clip will display on the left-hand side. Click on the play button to see what your intended effect will look like before clicking 'Apply'. Remember you can apply more than one effect to the same clip. *OpenShot* helpfully places a small star on video clips which have been enhanced with effects. You can remove them at any time by going into the clip properties, highlighting the effect name with your mouse and clicking the red – button.

While you're inside the Clip Properties window, take time to explore the other tabs such as 'Speed' and 'Layout' to see where it's possible to fine tune the settings for each clip. This may be important if you wish to time your video exactly to music or simply change the length without using the razor tool. Click 'Apply' when you are done.

› Use the Play button in the 'Clip Properties' menu to experiment with different effects. Don't be afraid to explore the other tabs if you need to modify your clip.



› Click the 'Transitions' tab to drag and drop between video clips or photos. Right click on a transition and select 'Properties' to fine tune.

Transitions are particularly useful for moving between images or video clips in a stylish way. Click the 'Transitions' tab at the top-left to see the various kinds available e.g Vertical Bars and drag onto the timeline. It can be helpful to use different tracks for the transitions to avoid overlapping clips. If you wish to fine tune the settings for a transition, right click and select 'Properties'. You will be able to specify a new position, length and even direction for your transition.

Exporting videos

You can use the Play button on the built-in video player to check the project has been done to your satisfaction. You can also navigate by clicking the timeline and use the space bar to play and pause if you need to examine a specific section.

Once you are satisfied, click the red 'Export Video' button at the top of the window. Specify a filename for your video and choose a location e.g your Desktop. When it comes to choosing a profile if you plan to share the video online choose 'Web'. You can further fine tune the settings for individual websites e.g Youtube by using the 'Target' menu. Click the 'Export Video' button when done. The file will appear in your chosen folder once the progress bar is complete.

Further Reading

This guide only scratches the surface of the power of *OpenShot*. For more information on additional features visit the official manual at **www.openshotusers.com/help/1.3/en/**. For further help from friendly users and to see some stunning examples of videos created in *OpenShot* head over to the forum at **http://openshotusers.com/forum/**.

Quick tip

If you have many different types of media it can be confusing to navigate them all. Click on the 'Video', 'Audio' and 'Image' button to show only that type.

Audacity: Editing audio

Splicing, cutting and getting rid of awful noise are all within your grasp thanks to the free frills of Linux's top audio editor.

While Linux has a sterling reputation as a server and desktop operating system, it's less well known that many major studios also use Linux for their creative workstations too. When it comes to high end audio production, for example, there are many powerful and stable packages that professional studios use for mastering music and film soundtracks all around the world.

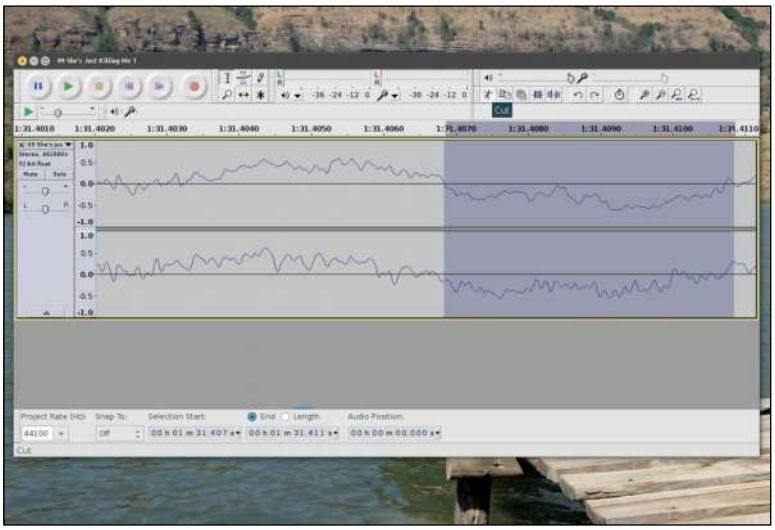
Industry grade programs for audio editing include the excellent *Ardour* and *LMMS* (formerly known as the Linux Multimedia Studio). You'll find both of these suites in the *Ubuntu Software Centre* and they're well worth looking at just to understand the full potential of your OS. Both are completely free to download and use, and open source to boot.

Before you get too involved, however, it's worth pointing out that *Ardour* and *LMMS* are top-end Digital Audio Workstations (DAWs). They're a complete recording studio in software form, with virtual mixing desks, WAV editors, MIDI sequencers and more built in; *Ardour* or *LMMS* give you the kind of environment the late George Martin would have paid millions for, literally for free. DAWs support a huge variety of inputs and external hardware for audio production, and include virtualised version of equipment that's the mainstay of audio engineers.

For the newcomer, however, they're more than a little bit intimidating. They each have multiple windows and are stuffed with technical jargon. What if you're not scoring your latest composition for six mics and a string quartet, but just want to edit a podcast or a recording of your kids' school choir into something you can upload online? Don't worry, Ubuntu has you covered there too.

Quick tip

If you're trying to remove a section of audio, zoom in and make sure you're only the file at the exact point the waveform goes across the zero line. Anywhere else, and the edit will have an audible click when played back. Also remember you can insert silences and background noise to make edits to speech sound more natural.



› If you need to remove segments of audio seamlessly, zoom in and cut at the exact point where it crosses the 0 line.

Sound it out

The "go to" software for audio editing in Ubuntu is *Audacity*. Actually, *Audacity* is the hero application for basic sound work on all platforms, it's really that good. In Ubuntu, you'll find it in the *Software Centre* just by searching for its name, so installing it is just a click and a password away.

By comparison to the DAWs mentioned above, *Audacity* is much more simple in its appearance. By default there's room in the window for a single stereo sample and a bunch of straightforward editing tools. Don't let that deceive you, however. *Audacity* has just about everything even a professional needs for preparing tracks.

First thing you'll need to do with *Audacity* is feed it some music, but before that you'll need to make sure that the music can be read. Just as with playing back music (*covered earlier*), if you want to work with sounds stored in popular but closed formats like MP3, you'll need to install Ubuntu Restricted Extras from the *Software Centre*. This will add all the codecs for common media files to your PC.

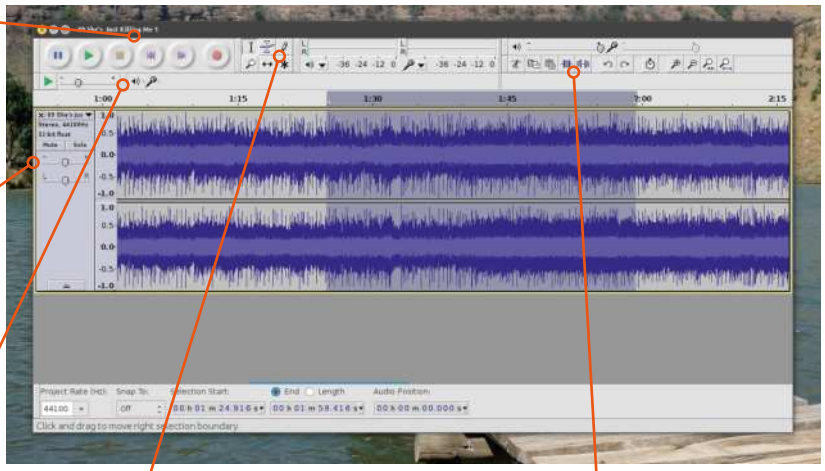
From *Audacity*, there are two ways to load music into the editing window. Under the File menu, you'll see options for Open and for Import. If you select Open, or you drag and drop an audio file into the *Audacity* workspace or onto its icon in the Dash, your file will open up as a new project. If you select Import, it will load as a new track (or tracks) into the project you're currently working on.

Once you've done that, you'll see your file represented as a wave form in the editor. If you imported a file recorded in stereo, you'll see two tracks in your workspace, one for the right source and one for the left. You can add extra tracks using the Tracks menu at the top of the screen – they'll appear underneath the initial one or two.

If you've never seen an audio file as a wave form before, it's fairly easy to understand. The middle of each track, at the 0 point on the y-axis, represents silence. So if there's a part of the audio with a long flat line in the middle, there's nothing recorded there. Sounds are represented as spikes on either side of that line.

At this point, there's two keyboard shortcuts you should learn by heart. The first is the spacebar, which starts the audio playing from wherever the current marker is and also stops playback. The second is the Control key. Hold this and scroll the mouse wheel to zoom in and out of the waveform. If you zoom in close, you can see that what looks like triangular chunks on both sides of the 0 line is actually one

Of all the Audacity!



Playback controls
Simple playback controls let you listen to the tracks you're editing. Make sure you hit Stop before saving.

Track controls
You can mute a track or change the stereo balance between left and right from here.

Mic in
You can record directly from a microphone into Audacity – tweak the levels so you get good peaks.

Draw tool
The pencil icon is the draw tool, with which you can make manual edits to the wave form.

Trim and silence
These two wave icons let you remove the rest of the track and leave your selection or vice versa.

long graph that moves rapidly above and below the line.

Using *Audacity* is simple. Move the marker by clicking your mouse on the time code, and you can play back from that point, mark it for editing later or slice a sample at the mark.

The main commands that you'll use to start with are Trim and Cut. These two are basically the inverse of each other: you begin by selecting an area of the file by click and dragging to highlight (or shift dragging from the current market position), then you can remove that section of a track using Cut or isolate it and remove everything else using Trim.

Remember, though, that if you're working on multi-track audio trimming or cutting one track might leave it out of sync with others.

The next most important part of is the Effects menu. Here's where you'll find a suite of industry standard filters you can apply to your sounds. Select and area or an entire track and you can amplify it, compress the dynamic range (so the quiet bits get louder and loud bits get quieter) or add echoes, speed up the tempo and more.

There's far too many filters to describe in detail, suffice to say that the majority are software versions of those that have been in use in recording studios for decades.

Once you've trimmed your audio track, added your effects and edited in open and closing theme songs (assuming you're working on a podcast), exporting it to something useful is simple. By default, *Audacity* will save an uncompressed WAV file as part of a project. Choose Export Audio from the File menu to save as an Ogg Vorbis, MP3 or any other more common format suitable for playback on any device later.

› **Hugely powerful but also hugely complex, Ardour is a full recording studio on your laptop.**

Quick tip

If you want to try out *Ardour* or *LMMS*, head over to their respective websites, **http://lmms.io** and **http://ardour.org**. There's tons of documentation at both sites to help you get started on your professional mastering station.

Web browsers: Pick the best

How do you see the web? Seems a simple question, but you might be surprised at the difference when you check out the best browsers available.

Quick tip

Each browser has a different way of importing bookmarks – check your chosen browser's help file for more details on how to do it.

What is a computer if not a portal to the internet, these days? Accessing the online world is absolutely essential, and Linux is not short of web browser options. Many of them will be familiar if you're used to going online in other operating systems, some are variations (based on the software, but not exactly the same) and some are fairly unique, unusual browsers to try as well.

The good news if you're fairly established with your current browser is that it's usually rather easy to transfer your bookmarks over, so you won't lose those vital links. So before we look at your options, let's back these up from another system so that we can import them later on.

Backing up bookmarks

In *Google Chrome*, click the three-lined hamburger menu icon, go to Bookmarks, and click Bookmarks Manager. Click the 'Organize' drop-down menu and select Export Bookmarks. This will create an HTML file which you can later import into the browser of your choice.

If you're using Internet Explorer you'll find the setting in File/Import and Export/Export Favourites. *Microsoft Edge*, despite being newer, isn't quite as friendly, but thankfully *Firefox* can import *Edge* bookmarks. To get them (and the rest of your bookmarks) out of *Firefox*, click the bookmarks icon, Show All Bookmarks, and follow the steps within Import and Backup.

Sadly we're not made of space here, so users of other browsers will have to hit up their favourite search engine to find out exactly how to extract those bookmarks. Time to look at your options for Ubuntu!

Browser history

The most established browser on Linux is probably *Firefox* which, although it's lost a little market share in recent years, displays the entire web perfectly and includes some neat features. Newer versions allow you to synchronise your tabs between devices if you sign in to all of them with the same Firefox Account, for example, so it's easy to pick up where you left off if you're jumping from machine to machine – or even user account to user account. Similarly, you can use the Firefox Hello system to browse the web simultaneously with other *Firefox* users, which is great for remote working, planning, or just hanging out online.

You may also find a browser named *Iceweasel* – this is, for all intents and purposes, *Firefox* in all but name. Certain minor elements and trademarks attached to *Firefox*, such as the logo, have been changed due to them violating the requirements of free software distribution. Also rebranded were email client *Thunderbird* (*Icedove*), 'internet application suite' *Seamonkey* (*Iceape*) and seemingly abandoned calendar app *Sunbird* (*Iceowl*). Expect these frigid alternatives to disappear soon, as distro creators seem to be working out their differences with *Firefox*'s parent company Mozilla.

Second to *Firefox* is *Chromium*, an open-source browser (available in a number of user-developed flavours) that forms the basis of *Google Chrome*. It doesn't include all of the

Alternative Browsers

Lynx
lynx.browser.org

Classic text-mode browsing, run from within a terminal window. *Lynx* is mostly a curiosity these days due to its archaic makeup, and it's only really useful on machines which absolutely cannot output anything other than text mode, but it can be interesting to see how the web looks without images or modern rendering techniques.

Midori
midori-browser.org

Using the GTKWebKit engine (a fork of the Blink rendering engine that powers *Chrome*, *Chromium* and *Opera*), *Midori* is the default browser of the xcfe window manager and features in a number of lightweight distributions (Bodhi, SystemRescueCD, Manjaro Linux). It does well on the tests we've listed in this article.

NetSurf
www.netsurf-browser.org

Originally coming from RISC OS – an ARM-based operating system that grew out of the Acorn Archimedes – *NetSurf* has been ported to a number of platforms since, including AmigaOS. It's not the absolute best browser, but it uses its own unique rendering engine, so if your Linux install struggles with others, give it a try.

Opera
www.opera.com

So often the browser bridesmaid but never the browser bride, *Opera* is a clean, fast and quite wonderful program that deserves more recognition than it gets. The Opera Turbo feature, which compresses your web traffic, is particularly useful if you've got a slow internet connection or if your ISP blocks access to certain sites.

Pale Moon
www.palemoon.org

A notable fork of *Firefox* that will please those who aren't too happy about the modern browser style, this clings to an old-school, fully-customisable user interface and uses its own rendering engine, Goanna, which forked from Gecko, the *Firefox* rendering engine. It's actively updated and high-performance, so well worth a look.

features of its big trademarked brother – usually missing things which use proprietary non-open technology like Flash player – but it runs the same rendering engine, which means web sites look just as good. It also manages memory in the same way, allocating a portion for each of your open tabs, which is both a blessing and a curse. A blessing because if one tab has a problem it doesn't bring down the rest with it, but a curse because *Chromium* requires a relatively large amount of memory to run multiple tabs.

While you're unlikely to find big-boy *Chrome* in your distro's package manger, it's simple to get hold of the real thing. Just head to **google.com/chrome**, click Download Now, and select the appropriate file for your distro (usually 64-bit deb, if you're using Ubuntu). Click Accept and Install, then open the resultant file with your package manager to get it installing. You'll need to run it from a terminal the first time; launch one by clicking the search button, searching for 'terminal' and selecting the Terminal application, then type `google-chrome-stable` to start it up. Once it's run once, it'll add its icon to your launcher so you can start it more easily.

In both cases here we'd suggest it's best to run *Firefox* and *Chrome* over their open source alternatives. While this doesn't match the freedom philosophy of Linux, you're probably not in this for philosophical reasons. Having the absolute latest version of your chosen web browser is vital for security and compatibility reasons, and sometimes forked software just doesn't keep up with the times.

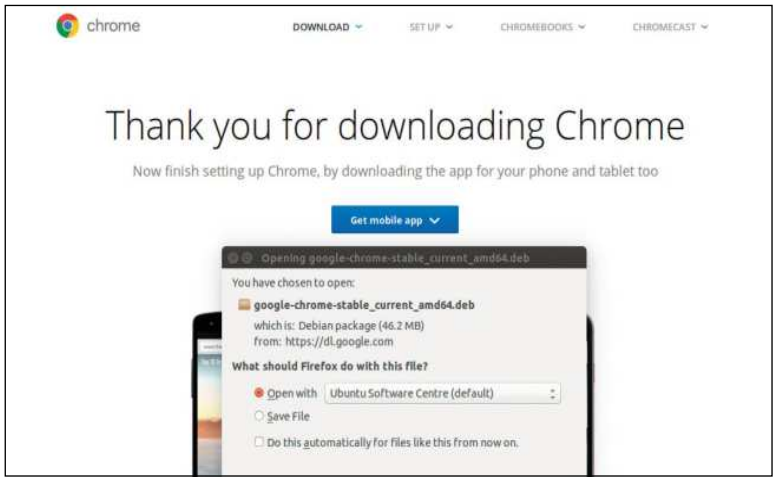
There are numerous other browsers available for Linux which all serve different purposes. Well, OK, usually they're there to provide you with a browsing experience that requires a smaller memory footprint for lower end machines. You'll find out more about these in the 'Alternative browsers' box.

Testing capabilities

How well does your browser actually perform? Different browser options render online elements in different ways, so it's worth testing your chosen browser (and its competitors) thoroughly to make sure you're getting the best experience.

Head first to the Acid tests at **www.acidtests.org**, a long-standing series of rendering engine-stretching challenges which will prove how well your browser adheres to particular web standards or, at least, it shows how well your browser performs these particular tests.

A more modern benchmark is the HTML5 Test, found at **html5test.com**. While this doesn't animate any pretty pictures or give you a visual representation of your browser's flaws (boo) it does give you a detailed list of everything your browser can or can't do, with a score to match. Many Linux browsers are going to lose a few points for leaving out closed source technologies, so bear this in mind before you rush to uninstall your current option. The vast majority of websites include fallback options away from proprietary software anyway, and many of these are now becoming the norm rather than the alternative.



› Chrome probably isn't available in your package manager, so you'll need to head to its website (in a different browser) to get hold of it.

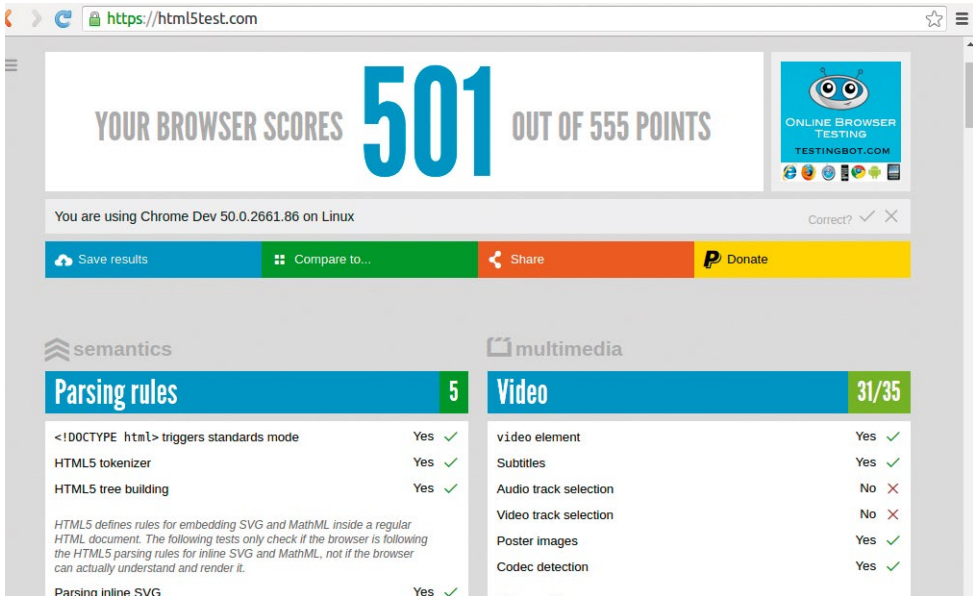
To the extreme

The most extreme rendering test we could find lives at **web.basemark.com**. Browsermark, for that is its name, runs a series of heavyweight tests that push your browser's performance in a number of ways, beyond just HTML5 or CSS, and might also give you some clues about the performance of your PC. Make sure your machine doesn't go to sleep while it's running, which should take about five minutes. When it's complete, you'll be given a final score, see which percentile your browser and desktop combined sits on, and even get a bit of information about the performance of your ISP.

While we've made some vague recommendations here, your choice of browser is really going to come down to personal taste and what works best for your Linux system. All computers and desktops perform differently, so you're always encouraged to experiment, install, test, and find the best choice for you. Once you've done that, the internet is your oyster. Happy browsing.

Quick tip

Don't fret if your browser doesn't max out every test – if you're happy with the way it displays pages, that test result doesn't really matter!



› The HTML5 test is a great way to see how muscular your browser truly is, but it's not the be all and end all of browser performance.

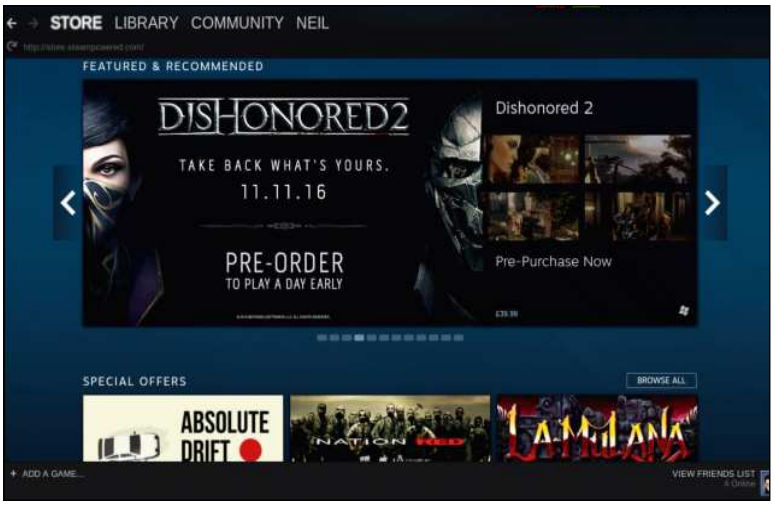
Steam: Play games on Linux

Linux is fun, no really! You can even play games and these days that's not just years old remakes, but same-day release big-name AAA releases.

Linux is great for work. Linux is great for servers. Linux is great for old PCs. No one says Linux is great for gaming, or do they? Go back just four years to 2012 and it's true, Linux was bereft of almost any native games. About the most fun you could have with Linux was recompiling the kernel to patch the latest zero-day exploit. Then Steam arrived, released in late 2012 the biggest digital gaming platform landed on Linux and gaming life was never the same again...

Several years on and Linux now offers over 2,000 gaming titles on Steam, a number that continues to grow steadily with over 500 titles being added during 2016 alone, including big-name titles such as Mad Max, Deus Ex 2, Rocket League, Life is Strange and the new Tomb Raider reboot. We'll take a look at how you can safely install Steam on Ubuntu 16.10 and get gaming as easily as possible.

Before we start we should say that not only is there a plethora of choice when it comes to gaming on Linux, it's now easier than ever to get started. Although Valve's proprietary storefront has its issues – such as game DRM– it does make installing and running games an incredibly simple process. It's also not the only game in the Linux-verse, Good Old Games (**www.gog.com**) is another service that sells games for Linux. It offers a mix of classic games (that have been made compatible with modern computers), new games and has a no-DRM policy. Another online store that lets you have fun and give to charity is **www.humblebundle.com** and offers a range of DRM-free Linux games.



› **Bring your Steam library with you, any Linux games will appear as if by magic**

Careful now

Do not install Steam via the Valve website. Valve in the correct way does offer a Linux install package on its Steam website, this will appear to install but due to required additional dependencies won't work. It also doesn't provide any useful error messages to help you work out the problem.

The correct way to install Steam is from the Ubuntu maintained repositories. We'll show you below, it involves the Terminal but don't worry it's really easy. You may also wonder why you can't find Steam in the official Ubuntu Software store, due to the cutting-edge release of Ubuntu 16.10 not all packages can be found here yet. So we have to revert to the traditional Terminal-based install.

Use the Dash Search (top-left icon) and type Terminal, click the Terminal icon to open the black text interface. Here type the line below, press enter and enter your password:

```
$ sudo apt-get install steam
```

You'll get a stream of text alluding to the required packages that need to be installed and a final line along the lines of below, type Y to accept:

```
0 to upgrade, 43 to newly install...
Need to get 22.4MB of archives.
After this operation, 190MB of additional disk space...
Do you want to continue? [Y/n]
```

A host of more text will scroll by, which is the Terminal installing all of these packages. A text dialog will appear, press tab to highlight YES and press return. Select I AGREE using the down arrow key and press Return to install Steam itself.

Steam is now installed, you can type Steam and press return in the Terminal to launch it. More easily you can open

the Dash Search, type Steam and launch it from there. This will place an icon in the Launcher dock.

Steam will download more of its own files - as it would on Windows – but with this you can log in (or create an account) and gain access to your gaming library, though restricted to Linux supported games.

Performance

Gaming is one of the more demanding things a home user can do with their PC. Modern games use more memory, processor power and 3D graphics resources than almost any other program. Most games offer a recommended and minimum specification. Take the latest Deus Ex 2 game, it has an incredibly high requirement of 16GB of memory and only the latest graphics cards just to play at 1080p resolutions.

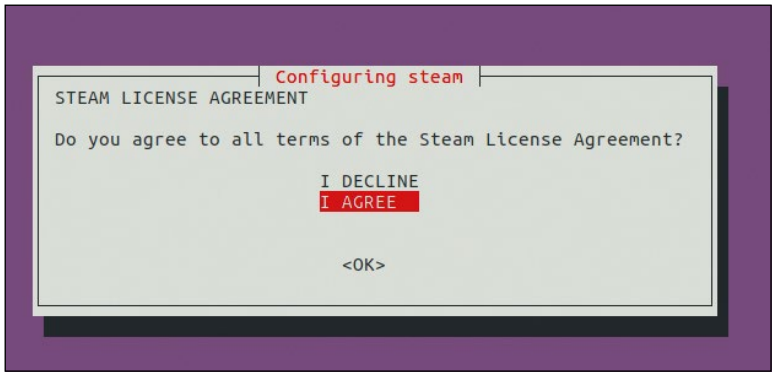
Linux does have something of a disadvantage against Windows, as currently few games are optimised for Linux, so many tend to perform around 20% slower on Linux. Now that Linux is established we'd expect newer games to provide better optimisations in the future.

Certainly though if you want to play any 3D games you will need a suitably powerful 3D graphics card. Newer Intel and AMD processors do have basic 3D capabilities that are able to power games on basic settings at 720p resolutions. Ideally though we'd recommend you to invest in a dedicated 3D graphics card such as the Nvidia GeForce 1050 or the AMD Radeon 460. Both of these cards costs around £120 and will provide great 3D performance. Just ensure you enable the proprietary drivers.

Ideally the rest of your PC needs to be up to scratch as well, otherwise having a lovely shiny new graphics card will be something of a waste. You'll want at least 4GB of memory but 8GB these days is more the thing. The processor also needs to be something that was made in the last five or six years and be at least dual core. This is as much about the overall speed of the system as it is just ensuring the system as a whole is fast enough to play modern games.

› The gaming police will be checking to see if you're running Linux or not and quite possibly mock you for gaming on a server platform. The future is harsh.

Of course, if you're more interested in older titles then an older, slower system will work just fine. But in that case you likely don't need the fancy new graphics card either! The Linux and open source world is awash with classic emulators so you can run classic software for the Amiga, ZX Spectrum, C64, classic arcade machines and even recent consoles. It's just a case of installing the emulator you're after, grabbing a few games that you own of course and firing it up. Most of these classic emulators don't require much power and even 15-year old systems should be able to cope!



› Ensure you choose the terminal install to make sure everything works.

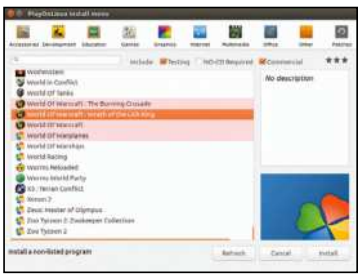
Windows games on Linux

Wine (see page 58 for a guide) is a compatibility layer that enables many Microsoft Windows programs to run on Linux. Although it's usually used for running office suites and other programs that haven't made it to Linux (or don't have an open source alternative), it can also be used for running Windows games in Linux as well. Of course, there's a performance impact to running a game via Wine rather than natively, so it's not really recommended for graphically demanding games – unless you have one hell of a machine. However if you have CDs of some old Windows games lying around, or you want to try an indie title that hasn't made it to Linux just yet – then Wine is a great possible solution.

To install, open up the Terminal and type

```
sudo add-apt-repository ppa:ubuntu-wine/ppa
sudo apt-get update
sudo apt-get install wine1.8
```

and a window will pop up asking you to read and agree to a EULA by Microsoft. You might have hoped you'd left all this behind, but it's a necessary step to using Wine. Once you've scrolled down and agreed, type in `$ winetricks`. To run the graphical user interface for Wine. You may have to install additional packages, and Wine will take you through the process. With 'Select the default wineprefix' selected click 'OK' and then you can begin installing required software to run Windows games in Linux.



›If a game isn't available then perhaps you can just run the Windows version?

Social: Network with friends

Integrate your social networking accounts into your Ubuntu Desktop.

The Firefox browser in Ubuntu can be used to access any number of social networks, however you may find it easier simply to access them from your desktop.

Ubuntu's Unity desktop integrates well with Google Drive, Flickr and Facebook to blend your online and offline data.

To get started, click the Search button at the top left of the screen and type in Online Accounts. Click the Online Accounts icon to launch the window. By default it will show accounts that are compatible with all applications on your computer.

Quick tip

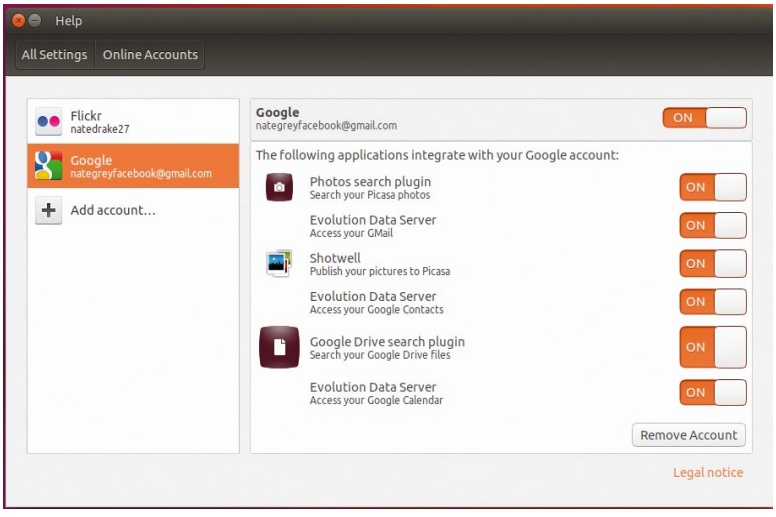
If your Google Account uses Two Step Verification, you may need to set up an app-specific password for the Ubuntu Desktop. See **http://bit.ly/LXF26social**

Integrating

Google Account Users can double click on the word Google to configure their account. Enter your username, then your password. You will then be asked to authorise Ubuntu to access your data. Click Allow to permit this.

Once setup is complete the online accounts window will list the applications that can integrate with your account. By default they are switched on individually. One of the most handy features is the Photo Search Plugin. This allows you to use the search icon to look for photos stored in Picasa (now known as Google Photos). Searches for files can now also include those stored in your Google Drive.

If you have any online Google calendars, the Calendar application in Ubuntu will also import them automatically. Take a moment to check they have been displayed correctly. The application is bidirectional in that any add or modify in Ubuntu will also update your online Google calendars.



› Click on Google to sign into your own account. You can control which individual applications will integrate with the Ubuntu desktop.

Flickr is an image hosting service similar to Picasa but is run by Yahoo. Anyone can access photos and videos uploaded to the website without an account but users must register in order to share their own content.

If you have a Yahoo e-mail address then you will be able to sign into Flickr right away. Click on Add Account on the left hand side of the Online Accounts window, then on Flickr. You will be asked to sign in with your Flickr ID.

Once you are signed in, the Photos Search feature will work in the same way as for Google Photos. Simply click on the Ubuntu search icon and enter your search terms.

If you use Ubuntu's photo manager *Shotwell*, you can also publish photos to Flickr and Google Photos from within the app itself. Simply highlight your photos or videos of choice and choose File ... Publish. If you have not previously used Shotwell to manage your photos, you can see more information on this in the official manual.

Desktop notifications

Certain websites like Gmail, Twitter and Facebook support push notifications that show a small pop-up even when you don't have their web page open. For instance Facebook can show an alert when you get a new message or notification.

This feature is available in Firefox but has not been fully implemented, so if you'd like to see pop ups for new Facebook notifications, tweets or e-mails, try installing the Chromium web browser from the *Ubuntu Software Centre*. Once *Chromium* is installed click the icon to launch it and visit your website of choice. You will be asked to agree to allow desktop notifications for that site. Click Allow for the notifications to appear. Each time an alert pops up you can click on it to be taken to the site in question.

Instant Messaging

There are a number of applications available in the *Ubuntu Software Centre* that will connect to multiple instant accounts such as *AOL Instant Messenger* or *Google Hangouts* without having to visit each website individually.

Previously Ubuntu came with the messaging client *Empathy* pre-installed, however this has been dropped in the most recent version the operating system. Fortunately it's very easy to install. Open your web browser and go to **https://apps.ubuntu.com/cat/applications/empathy**, then click the red button marked available in the *Ubuntu Software Centre*. A new window will open click Open Link to begin installing *Empathy*.

Once *Empathy* opens click Account Settings to open the Online Accounts window. You will see that there is a new

Setting up Skype

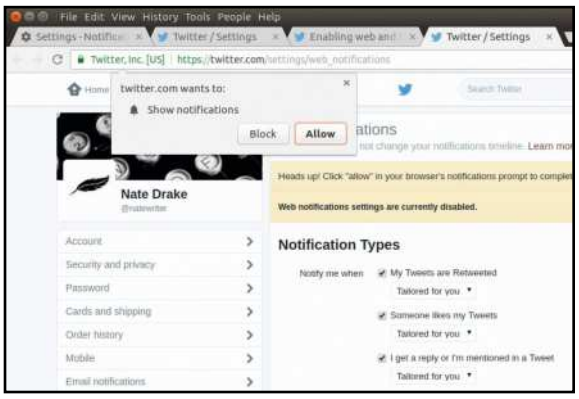
As Skype is currently developed by Microsoft and doesn't release its source code, you won't find it in the *Ubuntu Software Centre*.

Nevertheless, if you visit **www.skype.com** you will see that there is a version available for Ubuntu. Click on Choose your distribution and then Ubuntu 12.04 multiarch to begin downloading. A prompt will appear asking if you want to open the file with software install. Click OK. Once the file has downloaded open your *Ubuntu Software Centre* to see the entry for Skype and click Install. Launch Skype by typing the name into your search bar.

The official Skype Linux client is rather dated; the most recent major version was released in 2014. Skype Developers are trying to address this by launching a test alpha version. This version is still in an experimental phase and will have some bugs but if having Skype is important to you, you can help by installing and providing feedback. Visit **http://bit.ly/LXF26skype** and click Download Skype for Linux Alpha Deb. The alpha version is capable of calling Skype users on mobile devices and Windows and Mac computers but cannot call people using the official Linux client available from the main page.

There are a number of video conferencing programs available for Ubuntu besides Skype such as *Gajim* and *Psi*, both of which can be installed via the *Software Centre*.

› Choose Ubuntu 12.04 to get the installer for the official Skype 4.3 Linux Client.



› Click Allow on supported websites to show an alert on your desktop each time someone interacts with you.

option for *Empathy* Messenger. *Empathy* is very easy to use but if you run into difficulties, there is plenty of support available from the GNOME website at **https://wiki.gnome.org/Apps/Empathy**.

Although *Empathy* integrates well into Ubuntu's desktop, it doesn't support many different types of messaging protocols, nor is it very customisable.

Users who want to set up additional accounts and/or have more control over their messaging can install *Pidgin*. *Pidgin* is a very popular messaging program for Linux and supports *AOL Messenger*, Yahoo, *ICQ*, *MSN Messener*, *Google Hangouts*, Apple's Bonjour protocol and many more.

To install *Pidgin* visit **http://bit.ly/LXF26pidgin** and click the red APT Install button, then Install.

On the first run, *Pidgin* will give you a variety of accounts to set up, choose accordingly and set up your accounts. *Pidgin* supports cross messaging from one account to another as well as a variety of plug ins. (For instance there is one that lets you chat to Skype users). You can find help with getting started by reading *Pidgin's* manual at **https://developer.pidgin.im/wiki/Using%20Pidgin**.

Social setbacks

Ubuntu is designed to work well with social networks, so it's unlikely you will have any problems with your desktop. If after setting up an account you find that the connection is not working e.g your Google Calendar isn't appearing in the Calendar application, try logging out and in again as this usually fixes the issue.

If you choose to use desktop notifications for Twitter, Facebook, Gmail and so on with *Chromium*, although you don't need to have the pages for those sites open, *Chromium* itself needs to be running for you to see the alerts.

Neither *Pidgin*, nor *Empathy* support messaging via Facebook. This is because in April 2015 Facebook dropped support for the open XMPP (Extensible Messaging and Presence Protocol) which allowed third party apps to connect to their chat servers. Fortunately you can still access your Facebook messages via **https://facebook.com** or **https://messenger.com**.

Most Linux Messaging programs however do support XMPP (also known as Jabber), which uses a number of servers around the world to allow people to communicate with each other freely. Visit **www.jabber.org** for more information and tips for registering an account.

If you like using a particular program to manage your media or communications, don't worry if there doesn't seem to be a version available for Ubuntu. First check the website to make sure that is really the case ; there is a Linux version of Skype for instance (see Setting up Skype above).

If there's no downloadable application for your program of choice, you may be able to access it through your browser. Whatsapp for instance can be run from inside a Firefox window by visiting **https://web.whatsapp.com** and scanning in a code on your mobile phone.

If there's no Linux or web version, search in the *Ubuntu Software Centre* and on **http://askubuntu.com** to see if there's an equivalent program for what you need.

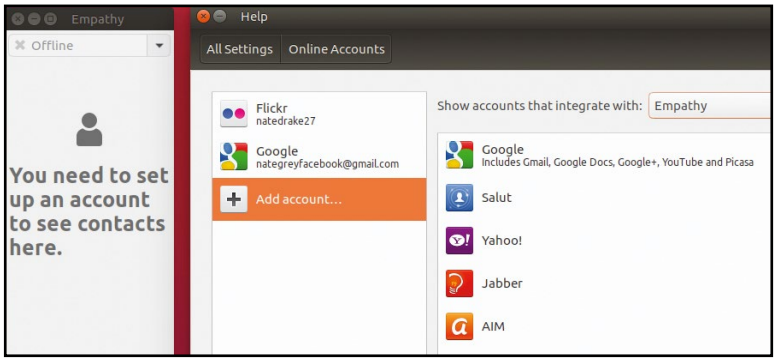
Remember that if you integrate social networking into your desktop or browser then anyone logged into your account will be able to see your profile and messages. Always ensure that you have a strong password and either suspend your session or log out of Ubuntu completely each time you leave your computer.

Quick tip

Online Accounts supports publishing to Facebook through *Shotwell* as well as searching through Facebook photos. Click Add Accounts then choose *Shotwell* from the drop down menu. Next click Facebook to set up your account.

Quick tip

If you are trying to set up Google *Hangouts* to work with *Pidgin*, click the Advanced tab in the setup screen and change the blank Server field to **chat.google.com**.



› Click Add Account on the left hand side of the window and choose Empathy from the drop down menu to show which messaging protocols are supported.

Thunderbird: Email made easy

Set up your very own desktop email client and keep your messages and contacts close at hand rather than losing them in the cloud.

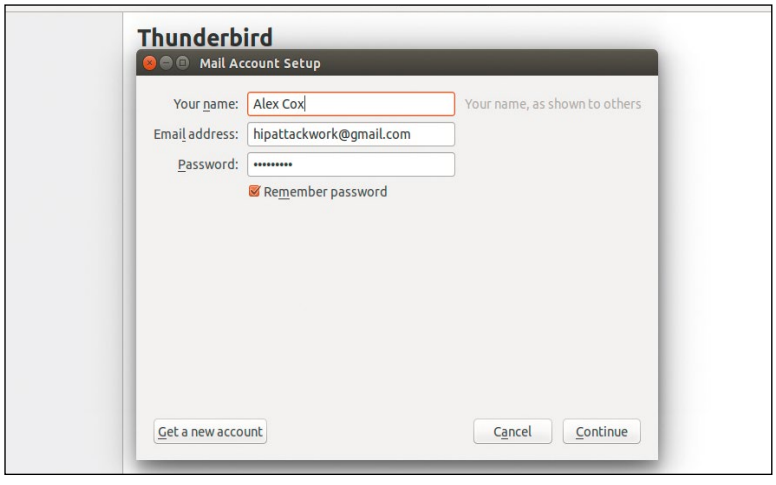
Quick tip

Thunderbird supports multiple email accounts at once – just go to File > New > Existing Mail Account to add another.

Email is one of the internet's oldest technologies. It outdates the web, it outdates instant messaging and it even outdates the internet's predecessor, Arpanet. MIT, so often the innovator in these fields, started using software called *Mailbox* and *SndMsg* to leave messages for each other in 1965. The @ symbol was introduced to route mail to specific computers during the development of Arpanet in the early 70s; by 1974 the US military was a heavy user, and by 1978 75% of all Arpanet traffic was email. You could even reasonably give credit to email for inspiring the earliest development of the internet: this was a closed-system technology that the public couldn't wait to use.

We'd stake money on you having at least one email address, and if you've been around for a while you probably have several. While most email accounts now have some kind of web interface for accessing your inbox and sending new messages, it's arguable that this may not be the best way to manage your mail. Say you lose your internet connection: your inbox, stored entirely online, will be completely inaccessible. So many of us rely on old messages to remind us of information, this probably isn't acceptable.

Security, too, should be a concern. How well do you trust your webmail provider not to snoop on your messages?



› Adding an account, if you're with a recognised provider, could not be easier – just add your email address and password.

What happens to your email archive if that provider goes bust, or a hacker forces their way in and changes your password? These, and many other reasons, are why it makes sense to use a desktop email client that can be backed up, store your messages offline, and live – if you have such a facility set up – in an encrypted partition away from prying eyes.

Positive Outlook

If you've been around computers for a while, it's probable that you've used Microsoft's *Outlook* or *Outlook Express*, packages which do just the job we're looking for: downloading mail from servers, storing it, sending new mails and replies, and backing up your inbox. Funnily enough, Microsoft's flagship mail package isn't available on Linux platforms, but Mozilla's well-weathered *Thunderbird* is just as capable and should be quite familiar to former Outlook users. We'll take you through installing it, configuring it to connect to an account, and beyond.

Let's start by getting hold of it. Many distributions will have it installed by default – including Ubuntu, which we're using here – but if you don't have it head to your local friendly package manager and search for *Thunderbird Mail*. Install as usual (see the start of this chapter for more information on package managers) then run it from its icon.

Postmaster

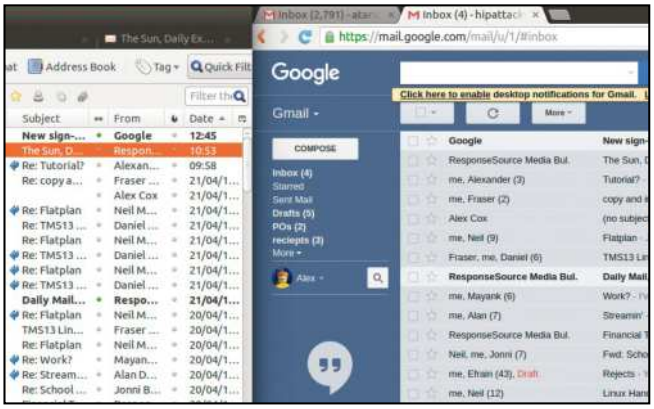
When you run *Thunderbird* for the first time, you'll be given the option to sign up for a new free email address – we're going to skip this particular step for this tutorial, so click Skip. Next, fill in your current email details. Your email address and password are the important parts here, the 'Your name' field doesn't have to match the name you usually use for the account, but it's useful to use your real name here so recipients know who's emailing.

Brilliantly, *Thunderbird* now queries a database of server information. If you're using a recognised provider like **gmail.com** or **outlook.com**, it'll automatically grab the correct ingoing and outgoing server details so you don't have to worry about it. More obscure providers may not be in the database, however, so you may have to fill in the blanks yourself. Your ISP or mailbox provider will provide the appropriate information; we can't tell you precisely what to

POP3 vs IMAP

There are two ways to receive email: POP3 (Post Office Protocol) and IMAP (Internet Message Access Protocol). POP downloads messages to your computer and (usually) deletes the originals from the server. It's the classic method, and good for those using a single machine or with a security-conscious bent: if the mails are gone from the server, it's going to be a lot more difficult for them to be traced or spied upon. There are big disadvantages when it comes to using POP3 on multiple machines – since it's a one-way transaction, there's no synchronisation between mailboxes, so you won't get an indication of the messages you've read or replied to, and your filing systems won't match up.

IMAP is a a two-way protocol, and probably the better choice if your provider offers it. Folders, read status and message deletions will all match up between the server and your mail client, meaning you can use the same account on multiple machines – and indeed use webmail and *Thunderbird* at the same time while keeping things synchronised.



put here, because very ISP is different. You can now choose whether to use POP3 or IMAP with your account – see the box above for more details on each – and hit Done. You may have to authorise the use of your email account in a further window, but you should only have to do this once.

A quick note for Gmail users: if you have Google's two-step authentication switched on (and you should do), you'll need to generate an app-specific password and use that, rather than your regular account password, to log in to your email through *Thunderbird*.

Split personality

Thunderbird's default main screen lists your email account and its subfolders on the left, and has a main window on the right split into two: the top pane contains the contents of your inbox, and the bottom pane contains the currently selected email. Try clicking on your inbox in the left column. *Thunderbird* will download all of your email from the server (this could take a while) and, if you've used IMAP, you should retain the read/unread status of your messages. By default, the inbox view displays messages in date order with the oldest at the top, but you can quickly re-sort your messages by clicking the column headers at the top.

Click on a message and you'll see it appear in the bottom pane of the main window. If this is a bit small, just hover your mouse over the bar between the panes and drag up to give yourself a bit more space. Still not enough room? Double-click the message and it'll open up in a tab of its own, giving you the full height and width of your *Thunderbird* window to play with. Click on the Inbox tab (or close the message tab) to get back where you were. Further layout options can be found in the View menu at the top of the screen.

In the book

While you have a message open, you'll see all the usual email functions (reply, reply all, forward etc.) lined up along the top of the window, and you can always hit the Write button to fire up a new mail.

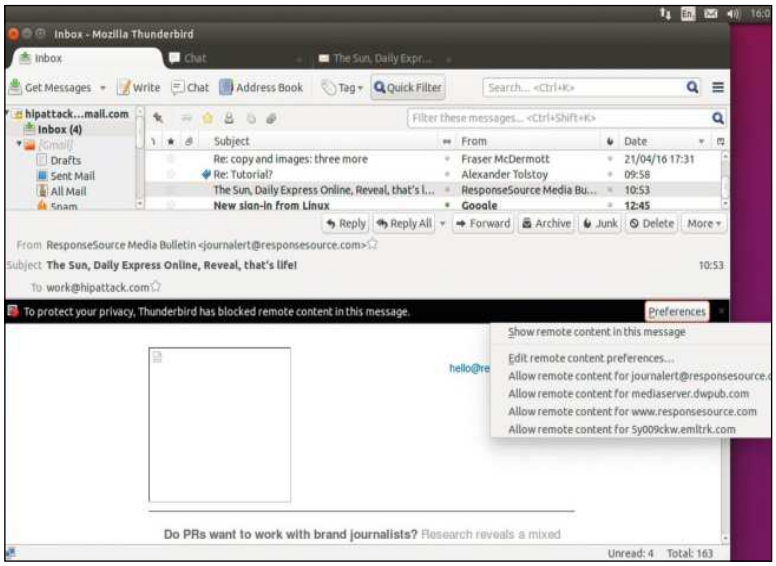
If an email includes embedded images linked from the internet, you'll also, at least initially, see a bar with a Preferences button. *Thunderbird* is restricting these images because, unlike plain old email, senders can use images to glean information about your computer, and whether you've read the message. Hit Preferences and you can choose to view images in just that email, for all messages from that address or domain, or head to the main Remote Content Preferences section where you can switch off this feature altogether.

When you're creating a new message, you'll probably discover that *Thunderbird* doesn't actually have an address book to start with, even if you've been using one with your webmail account. Manually importing your address book (Tools > Import) is the only way to get this done. The process is going to differ depending on your source, but it's not incredibly difficult.

Different versions of *Outlook* tuck away the export options in slightly different menus, but you should be able to find them buried somewhere deep within the File menu. Make sure you that export your address book as Comma Separated Values or .csv, as *Thunderbird* is happy to accept this format. In Gmail, the process is much more straightforward. Simply select the contacts section from the top left of the main window, (just above the Compose button), click More then Export to find the option.

Quick tip

You can set up a signature to add to the bottom of all of your outgoing messages in the Edit > Account Settings menu.



› Use the preferences button to determine which images you can see in emails you're sent – you can get quite specific.

Doing more

Dual boot: Set up two OSes

Afnan Rehman dives deep into the world of dual-boot systems to bring you the simplest solution to the two OS problem.

Quick tip

Make sure to disable Fast Startup before installing Ubuntu to avoid issues with *GRUB* detecting the Windows installation. You can disable it in the Windows power management advanced settings under 'Shutdown settings' where you can uncheck 'Turn on fast startup'.

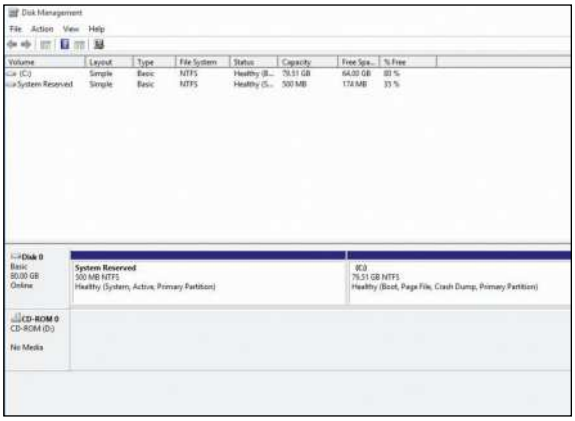
We live in a world where multiple operating systems hold a share of the desktop market and applications aren't always available on every platform that you want them to be, it's often necessary to have more than one OS available ready to boot. Virtual machines offer only a partial solution to this problem as do compatibility layer technologies such as *Wine*. The solution is to dual-boot two OSes on the same machine.

The boot managers of modern day OSes can manage multiple systems and allow the user to choose which one to boot at startup. This way you can have Windows OS and a Linux distro, so that you can keep the beautiful experience that is Linux while also accessing applications that still only work well on for work or play. (Not every game supports SteamPlay on Steam for Linux, although we're getting closer). In this tutorial, we'll focus specifically on dual-booting a Linux distribution (distro) with Windows. We will be using Ubuntu. However, the steps in this tutorial can be adapted to other Linux distros.

First, let's talk a little bit about why we dual boot. There are many reasons people pursue a dual-boot solution, the key reasons being performance and compatibility. As most users will tell you, it's best to run things natively with access to the computer's hardware resources. The fact is, virtual machines will severely restrict the amount of resources that you can use. When you implement a dual-boot system, you're able to boot as if Linux is the main OS and Windows weren't there and vice versa. That gives you access to all the processing cores, all system RAM and all expansion cards that the computer has to offer, making it easy to run intensive programs without slowdown. You also get access to all disks and externally connected devices such as USB devices at full speeds (as long as the OS supports them, of course).

How dual-booting works

For the sake of brevity, we will assume you are able to install Windows without a detailed explanation. It's safe to say that if you've ever installed a Linux distro, you are more than ready to install Windows on your own. If you're a newcomer to Linux – welcome! – and you're likely to have Windows installed on your current system (given that the Windows family still has around 90% of the market) and can proceed directly to creating a dual-boot system as a fresh reinstall of Windows isn't required. If you haven't tried installing Windows before, the process is simple and there are many guides online to help you. The installation media is usually sold on a disk or USB drive and can be often purchased online or in store. Once you insert the media and boot the computer, a series of steps will guide you through the installation.



› The Disk Management tool provides an easy to understand graphical interface for partitioning and managing storage on all disks that the OS has access to.

The version of Windows that you choose to install shouldn't matter, whether it's Windows 7, 8 or 10. The type of program that's used to get the system started after turning it on, either legacy BIOS or EFI boot, may matter in some cases but on most modern systems this won't cause any major issues. Let's get some basic terminology out of the way.

EFI stands for Extensible Firmware Interface, and most modern system partitions are in this format, which adheres to the UEFI (Unified Extensible Firmware Interface) standard. UEFI replaces the Basic Input/Output System (BIOS) that most PC devices used before. This is important mostly for more advanced users who wish to manually set partitions for more customised setups. Since most modern systems use UEFI, we'll work on the assumption that you will too.

Each hardware manufacturer has a different implementation of UEFI and each has its own unique quirks. Most have the same basic functions and structure, which allow for the installation of different operating systems. However, Different UEFIs can manifest major problems for some and instant success for others. Different button settings, boot menus, and startup sequences can cause problems when you are trying to mess with the boot sequence. It's best to research your manufacturer's UEFI manual beforehand and familiarise yourself with the settings before you try to change anything. Most system boot

What to do when you mess up

Should you need to repair the Ubuntu bootloader after trying to install a dual-boot system, the Ubuntu wiki has some great instructions for helping to repair the bootloader. The link is **https://help.ubuntu.com/community/RecoveringUbuntuAfterInstallingWindows**. The recommended way would be to use an Ubuntu live CD or USB that you created when first installing Ubuntu. The simple graphical way is to insert your disk or flash drive, reboot the computer and boot into the live CD environment. From this environment, you can choose the *Boot Repair* tool which is built into the Live CD.

The boot repair guides you through solving more frequent problems, such as those associated with dual-boot and can also generate error reports that you can share on forums or email to your genius friends who are more Linux savvy to get help with the issue. For recovering Ubuntu, you can click 'Recommended Repair' and allow it to work its magic. Then all you have to do is reboot and the usual boot menu should appear. If not, you can hold left Shift key while booting to select between the two operating systems. You can also try to repair it by opening a terminal. When you are given a standard *Bash* prompt, type:

```
# sudo grub-install /dev/XXX
```

Replace `XXX` with your Ubuntu install device (eg. **/dev/sdb**).

sequences will feature a splash screen where you can press a function key to gain access to boot settings menus (for example, it's F9 for HP, F12 for Dell and Lenovo, F8 in Amibios and F11 in an Award BIOS) and you'll need to know which key it is to open which menus and which settings to change. Knowing these things beforehand can save you a lot of headache should the need for troubleshooting arise.

Partition standards

You'll also hear the acronyms GPT and MBR thrown around. These terms relate to how partitions in the hard drive are organised and recorded. MBR, which stands for Master Boot Record, refers to the information stored in the first sector or partition of the hard drive that identifies how and where an operating system is located so that it can be loaded into the computer's main storage or RAM.

GPT, which stands for GUID Partition Table, is similar in function to MBR in that it stores partition information for the hard drive. This information includes where the partition starts and ends so that the OS knows which sectors belong to which partition and which ones are bootable. MBR, which was first introduced back in 1983, can only handle drives that are up to 2 terabytes in size and can support up to four partitions per drive. GPT is a newer standard that has been gradually replacing MBR and handles drives that are far larger and allows for a nearly unlimited amount of partitions. If you have Linux the *GRUB* bootloader, which handles OS booting just like the Windows boot loader, is often stored in the MBR or GPT. It's important to note that Windows can only boot a GPT drive on a UEFI-based machine. All current versions of Windows, Linux and Mac OSX support GPT and it's generally recommended to use this scheme on any new installs for the sake of compatibility and to avoid issues that MBR might bring.

There are benefits and drawbacks to either installing Windows or Linux first and every system is different. In this guide, we will be taking you through the process having Windows installed first. It's possible to install Ubuntu first, but there are far fewer issues when having Windows installed first, as the Linux *GRUB* bootloader can adapt easily to accommodate Windows. In contrast, the Windows bootloader will almost always disregard the presence of another existing OS, often overwriting the existing bootloader and rendering the other OS useless until it's repaired.

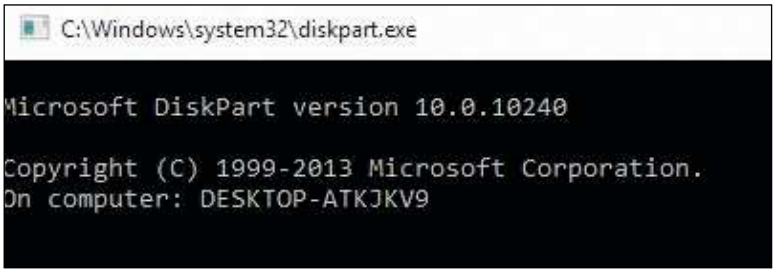
It's important to note that while most of Linux distros are good at handling dual-boot situations, there's always room for something to go wrong. We highly recommend performing a backup of any existing data to a separate storage device just in case the worst happens. Any files, settings or applications can be backed up in a variety of ways that will allow you to pick and choose what to save for later. It would be best to save this backup on a separate physical device, such as a different hard drive, a different computer or possibly cloud storage if you have enough space and a fast enough connection. The simplest way to back up everything you need to back up is to make a recovery disc which will back up Windows itself and set up a File History backup to take care of personal files. There are wizards located in the Control Panel that will guide you through both of these backup processes. The recovery disc will help you restore Windows system and boot files in case something goes wrong with the operating system. File History will automatically back up personal files to a designated device in case the worst comes to pass and your entire drive partition gets corrupted.

Now that you understand the basics, let's get to work. The first thing you'll need to do is choose your distro of Linux that you want to install. For this tutorial, we're using Ubuntu 16.04. The most important thing you will need to start is a copy of Ubuntu live CD on a USB flash drive or compact disc. You can download your preferred version of Ubuntu from its website at **www.ubuntu.com/download**. Here you can download an ISO file that you can use to create a DVD or bootable USB flash drive. We recommend creating a bootable flash drive as it's more versatile than a DVD, especially with optical drives getting phased out of many newer systems to save space, weight and power. Once you have a flash drive made you can move on to getting your partitions in order to prepare for the installation.

Of course, now you will only be able to resize the Windows partition if there's a decent amount of available space on it, so make sure you have room before you commit to undertaking this project. If your computer is running multiple hard drives you also have the option of installing Linux on an entirely different drive, leaving your Windows partition untouched. Now before you run out and purchase a brand new hard drive, I'll remind you that the two installations are perfectly capable »

Quick tip

Always keep a copy of the Ubuntu live CD and Windows installation disc on hand. These two discs are essential and will save your bacon should the worst happen. The tools and functionality will help reverse most common issues and can be used to help recover data in a pinch.



› **The *diskpart* tool allows you to accomplish partitioning and storage tasks with a command line interface for more advanced users and those who might wish for more custom settings.**

of running in harmony on different partitions of the same physical drive.

Partitioning methods

There are a few ways to handle partitioning, so I'll explain the one that assumes you have Windows already installed. If you already have Windows installed, the easiest method is to just use the *diskpart* utility built into Windows to help with this process. Every drive is different, and it's likely you'll have multiple partitions already existing on the hard drive, such as recovery, OEM and primary etc. Be careful resizing or deleting these partitions as messing with the wrong one will lead to major issues. Usually, the partition labelled 'Primary' is the largest and is where most of your files and data are held. Any partitions labelled 'System' or 'OEM' should not be modified at all, as those hold Windows system files and cannot be changed, lest you risk the entire system being corrupted. The Primary partition could be resized to give you space for your Linux installation. The easy way to do this is to go into the Disk Management application, find your drive with the primary Windows installation, right-click the partition and select 'Shrink Volume'. After that, just follow the onscreen instructions and you're good to go. Now you'll see a section of the drive with a black bar above it labelled as 'Unallocated'. This is where your shiny new Linux installation will go. Alternatively, if you're feeling brave you can lose any partition named 'Recovery' and install there. However, make sure you know what you're getting yourself into when you do this.

Now, you can restart and boot from a USB or disk into the Ubuntu live CD by holding down the Shift key while rebooting. On booting, hit the appropriate function key to load the boot menu, where you can select which device to boot from. Find your flash drive and hit Enter to commence the boot process. You'll be loaded into the Ubuntu live CD environment with its basic feature set. Here, you can start the installation process.

Now follow the onscreen instructions to install Ubuntu. Make sure to choose options that would allow for the Ubuntu install to exist alongside the existing Windows installation. Don't try to overwrite it, because that would be disastrous. This step will involve you as the user deciding how much space to allocate for your Linux installation. You've already set aside space for the Ubuntu installation in Windows Disk Management, but you also have the option to use more or less space depending on how you want to do things. In Ubuntu, there are two ways to install alongside Windows. First, there's an option labelled 'Install Ubuntu alongside Windows' which will handle everything for you. Some other Linux distros, such as those using *Calamares* installer, offer similar options to simplify the process. Otherwise, you can also make and resize partitions using the installer. If you choose this route, you can select 'Something Else' when prompted for installation type. You can resize the partitions based on your needs and use case. If you're mainly using Linux to experiment, you may not need as much space as if you were, for example, heavily invested in Linux gaming or dealing with other large amounts of data. Make sure that the boot loader remains the Windows Boot Manager.

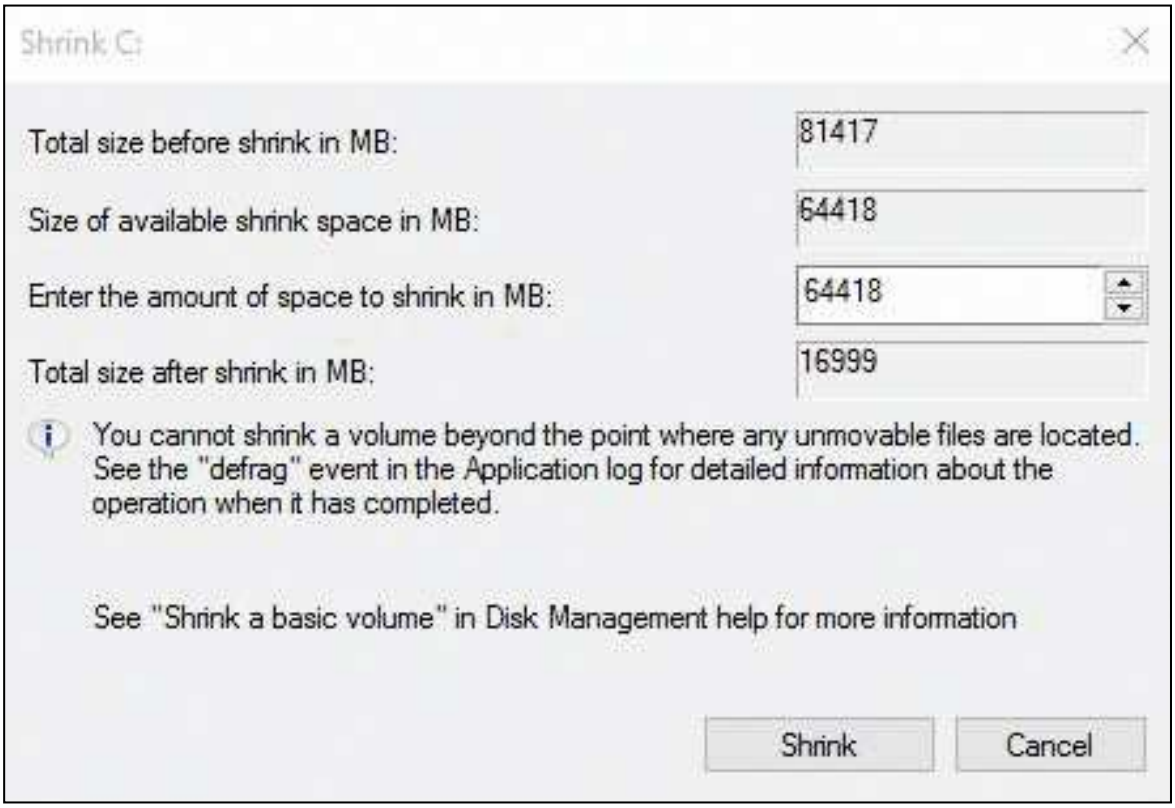
The installation process itself will vary depending on the Linux distro that you want to use. For Ubuntu, the process is a fairly simple step-by-step walkthrough. You can choose to install updates during the installation, however, you can skip this if you have a poor internet connection or just want to install them later. At the very end, you'll be asked to restart.

At this point, you're done and can start using your Ubuntu Install. Switching between OSes would involve a simple reboot. When booting you'll be given the option to load either Windows or Ubuntu, usually with a default option that will automatically boot after several seconds. If you're not receiving these options, try some basic troubleshooting by retracing your steps.

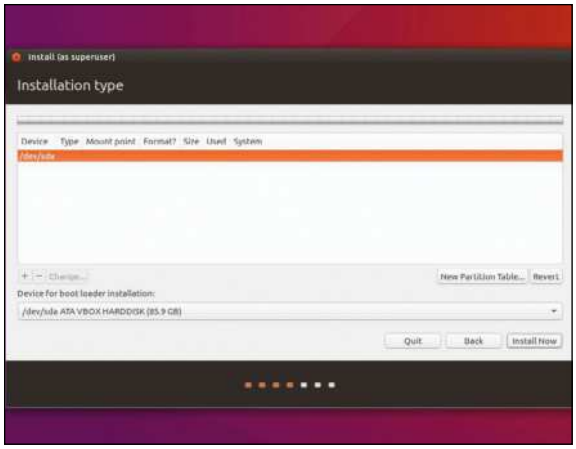
Sometimes you may find that you need to remove the Linux install for whatever reason. Remember, when removing Linux from the dual-boot process you must be very careful so as not to break your bootloader and, in turn, create a massive

Quick tip

When backing up your data, make sure your backup storage is separate, reliable, and spacious. By keeping it physically separate from the main device, and making sure it is reliable and spacious enough to hold all of your data, you will reduce potential issues with the backup failing.



› The shrink volume dialog box in Disk Management allows you to shrink a partition size, and also warns you if your desired shrinkage is too small.



The manual partitioning tool in the Ubuntu installer is similar to many partitioning GUI tools.

headache which can possibly go as far as rendering the Windows install unusable.

Removing Linux

To start, you'll need your Windows installation or recovery CD or an Ubuntu live DVD. To remove the *GRUB* bootloader, open the command prompt from the installation or recovery media environment. Next, type:

```
> bootrec /fixmbr
```

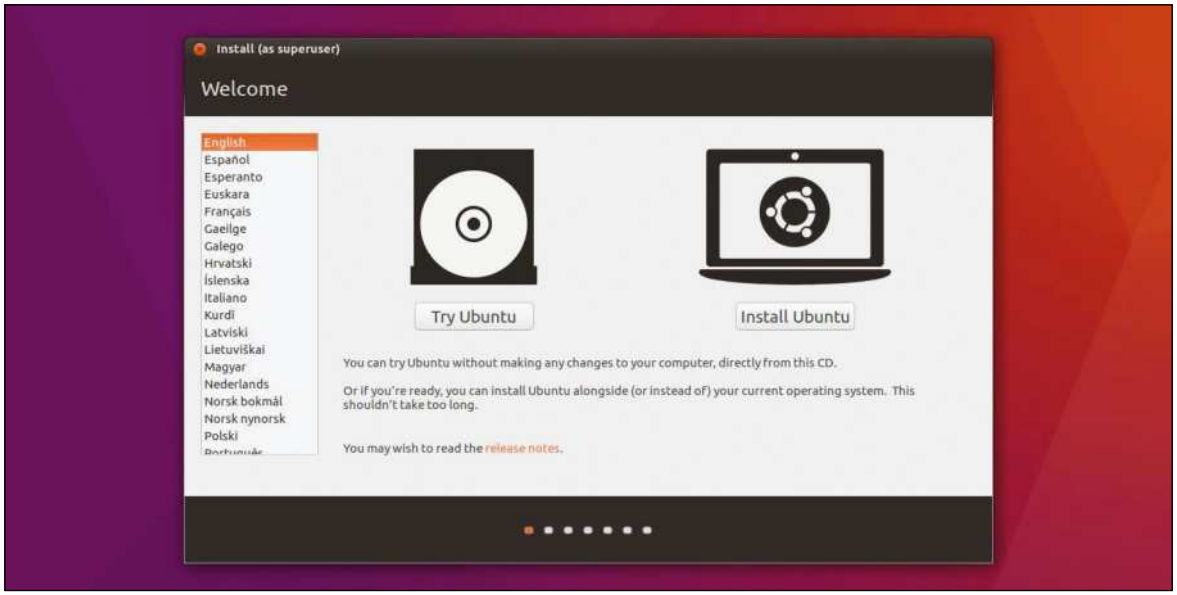
Reboot and boot into Windows. Then move onto using the Ubuntu live CD. Boot from the CD and choose *Boot-Repair*. If it isn't installed then you can try to install through a few simple terminal commands that you can type one by one:

```
$ sudo add-apt-repository ppa:yannubuntu/boot-repair
$ sudo apt-get update
$ sudo apt-get install boot-repair
```

Next, simply `boot-repair` and click the 'Recommended Repair' option.

Last, to remove the Ubuntu partitions you'll need to head back into Windows, reboot and boot into Windows and open Disk Management by searching for it in the Windows menu. In disk management, right click the Ubuntu partitions and select 'Delete'. This is the point of no return so make sure you're good to go before you click that button. If you plan to just keep using Windows then right click the Windows partition and select 'Extend Volume'. This will increase the size of the Windows partition to fill up the free space. That should be all that is needed to restore the machine to using only one operating system.

Now that you know how to add and remove operating systems to and from a computer in a dual-boot situation, you are ready to tackle your own project with other distros and combinations. As a final note, there's also the possibility of adding more OSes to your boot sequence, creating triple-boot or multi-boot systems. Adding systems essentially follows the same basic steps of partitioning and adding as space allows to the hard drive. With more operating systems comes more versatility and using the bootloader to your advantage can allow you to truly make your computer your own and design an environment suited to your needs.



The Ubuntu live environment allows you to try Ubuntu right off of the disc, so you can use it to test some features and prepare your machine before writing anything to disk.

Re-ordering the Boot Manager

You'll notice that when you boot from a shutdown state there's a certain order to things. The Windows operating system or the Linux one will be given priority and unless you press keys during startup you'll end up automatically booting into one system or the other, whether you wanted to or not.

This is a common issue that's easily remedied. You can use the EFI Boot Manager tool that you can access from an Ubuntu Live CD. Once in the Live CD environment open a terminal and install EFI Boot Manager with the following:

```
$ sudo apt-get install efibootmgr
```

Next use the following command to find out the current boot order situation:

```
$ sudo efibootmgr .
```

You'll get an output that looks something like this, with the boot order listed:

```
BootOrder: 0004,0001,0002,0005
Boot0001 Windows Boot Manager
Boot0002 Network
Boot0004 ubuntu
Boot0005 Hard Drive
Boot0006 CD/DVD/CD-RW Drive
```

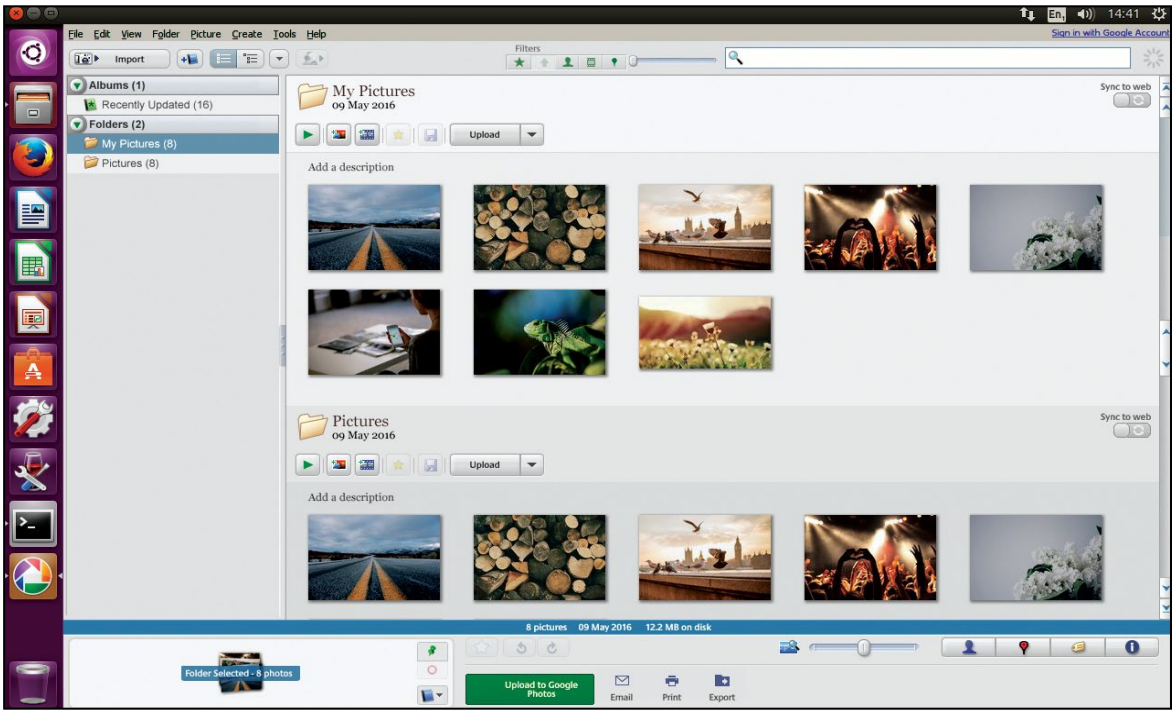
To change the boot order, we will have to use the numerical codes which correspond to the boot device that we want first. For example, in this case we want the system to try to boot from CD first, followed by Ubuntu and Windows. So, we will use the following command to change the boot sequence:

```
$ sudo efibootngr –o 0006, 0004, 0001
```

That's it, you're now ready to go.

Wine: Windows plays on Linux

Moving to Linux doesn't mean totally abandoning Windows, there is still a way to run some Windows programs right within Ubuntu.



Here's the Windows version of Picasa running under Ubuntu.

Ubuntu does provide everything a happy and free computer user should need, but being pragmatic sometimes it's not possible to totally cut ties with every Windows programs. For those programs that you still need there is a system called Wine – Wine Is Not an Emulator – that can attempt to provide an in-Ubuntu solution.

What it is and what it isn't: Wine is a compatibility layer, that's to say it inserts itself between Ubuntu and the Windows program making that program think it's still running under Windows. As it says it's not an emulator, in many ways an emulator like *VirtualBox* might do a better job, but takes more resources to work. Being a compatibility layer means Wine works with varying levels of success.

If there's a specific program you want to try to run with Wine it's advisable to first look at the Wine application database **https://appdb.winehq.org** this ranks compatibility using Platinum, Gold, Silver, Bronze and Junk statuses. While there will also be a detailed outline of what does and does not work. Anything ranked Bronze or Junk is highly likely not to be worth trying.

You'll notice that a lot of the entries are for games. Up until the end of 2012 Linux was very poorly serviced with gaming support and Wine offered the best way to enjoy Windows gaming without Windows. At the end of 2012 Valve Software started offering Linux support for its Steam platform and today a large number for indie and big-name games are available directly for Linux through Steam, GoG.com and other services. But for older games and applications Wine is still entirely relevant.

Start Wining

The way Wine works can be a little confusing, but Wine isn't something that runs in the background. You use it to run your Windows EXE files, this includes their original install files. Wine then sits as this "compatibility layer" between the Windows program and the strange, alien landscape of Ubuntu. This layer is pretty comprehensive but largely invisible, the most visibly obvious aspect of this is that Wine recreates the standard Windows file structure (the C: drive, Program files folder, Windows folder etc) within its own Linux Ubuntu folder.

This is for multiple reasons, not least this is how programs will expect things to be placed, but also the Linux and Windows file systems are incompatible. To start, Windows is

Wine - get started

1 Install Wine

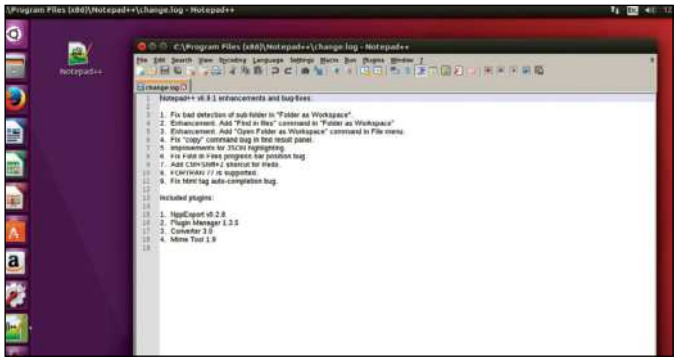
Open the Ubuntu Software program (it should be in the dock) and search for Wine. Oddly it's called Configure Wine, select this and click Install. Installation can take a while, but once it has completed before you do anything launch Wine. This enables Wine to do its initial configuration, such as building the base Windows folder system.

2 Ignore the GUI

You can nose around the Wine GUI, but at this point there's nothing you need change. It's useful to note that you're able to map more Ubuntu drives to standard Windows drives letters – ie add a D drive – through its Drives tab. Instead we're going to download a standard Windows program, *Notepad++* and install it.

3 Install Notepad++

Grab this from a reputable download site like **www.filehippo.com/download_notepad** save the install EXE to your desktop or Download folder. Once finished locate the file and right-click on it then select Open in Wine. Wine needs to handle the installation so it can set up the charade that *Notepad++* thinks it's in Windows land.



4 Run Notepad++

You're able to place Windows icons on the desktop – if you choose – and Wine is able to ensure they work correctly. Once the install has finished all that's left is to double click the desktop icon. Otherwise you can locate the program through the Dash Search. More technically files are stored under the standard **~/.wine** folder.

---

case insensitive that's to say a program called "HELLO" looks the same as one called "hello", under Linux they are treated as two entirely different files. Another oddity is under Windows folders are distinguished with a backslash **** under Linux it's a forward slash **/**.

These are more things to be aware of rather than worry about as for the basic use we're covering it shouldn't be an issue. Occasionally though when locating files from within Ubuntu, Wine and other Windows programs it's useful to be aware of this.

We've created a basic walkthrough that shows you how to install and run a standard Windows tool onto Ubuntu and then run it. We're using Wine at its very basic level, there's a whole world of more complex features that can improve compatibility but it's beyond this beginner's guide. Instead we can point you in the direction of some pre-build versions and bolt on paid-for services that try to make Wine work better.

The first and your first port of call should be **www.PlayOnLinux.com** this is a front-end to Wine and offers a large list of pre-built and tested configurations for many Windows games and programs. The PlayOnLinux system makes it very straightforward to install and launch your Windows programs. But why wouldn't you install this over Wine? First it requires Wine anyway and secondly it only supports a limited number of programs that are known to work well.

The commercial arm of Wine is a product called CrossOver available from **www.codeweavers.com** it's aimed at businesses and provides a dedicated support service for running Windows programs on Linux.

Another option to keep in mind is that the version of Wine maintained by Ubuntu is v1.6, the latest stable release is actually v1.8.x. It's worth reading the release notes to see if that improves compatibility for games or programs you want to use. Getting the latest version is a matter of following a few basic terminal commands, though ensure you uninstall any version via the Ubuntu Software tool, if you've already done it that way. A handy guide can be found at **https://wiki.winehq.org/Ubuntu**.

Really, Wine isn't the answer, we'd strongly suggest seeking out native Ubuntu apps rather than continuing with trying to use a Windows program. We've listed a number of common alternatives on page 34, but thousands more are out there just waiting to be discovered.

Terminal: How to get started

Flex those fingers and dive head first into the inky darkness of the terminal. Let us show you how to start handling its mysterious commands.

Quick tip

If you're struggling to type the right command, you can wipe all previous actions from view simply by typing **clear** and hitting Enter. Note this won't affect your command history.

The terminal is an incredibly important part of your Linux desktop. It doesn't matter how wedded you are to point and click over the command line, at some point you're going to have to dip your toe in the terminal's dark expanse and use it. Don't worry, though, because the terminal isn't as scary as it might appear, and if you take the time to learn the basics you'll discover it can be a far quicker and more effective way of getting certain tasks done.

As you'd expect, a terminal effectively gives you access to your Linux shell, which means it works in exactly the same way using the same language (*Bash*). This means you can do anything in the terminal you'd normally do at the command line, all without leaving the relative comfort of your desktop. That makes learning how to use the terminal – and *Bash* – doubly advantageous as it gives you your first glimpse into working with the underlying Linux shell.

We're basing this tutorial on Ubuntu, so start by opening the Dash and typing 'terminal' into the search box. You'll find the terminal of course, but you'll also see two entries called *UXTerm* and *XTerm* too. This highlights the fact there are multiple terminal emulators that you can run in order to interact with the shell. There are differences between them, of course, but fundamentally they do the same thing.

For the purposes of this tutorial we're sticking with the default terminal, which is basically the *gnome-terminal* emulator – technically it's emulating a TeleTYpe (TTY) session. It has all the functionality you'll need, but both *XTerm* and *UXTerm* are worth noting because although they are more minimalist tools and neither require any dependencies to run. This means if anything stops the main terminal from running, you can use either as a backup. As an aside, the only difference between the two is that *UXTerm* supports the expanded Unicode character set.

How Bash works

The Linux shell uses the *Bash* shell and command language to perform tasks, and it uses a relatively straightforward syntax for each command: `utility command -option`.

The 'utility' portion of the command is the tool you wish to run, such as `ls` for listing the contents of a directory, or `apt-get` to trigger the *APT* package management tool. The `command` section is where you specify exactly what you want the utility to do, eg typing `apt-get install` instructs the package management utility to install the named package, eg: `apt-get install vlc`.

The `-option` section is where one or more 'flags' can be set to specify certain preferences. Each flag is preceded by one or two dashes (--) and the most useful of all is the `--help` option, which provides a brief description of the utility, plus lists all available commands and options, eg `ls -l`.

```
nick@nick-ubuntu: ~
nick@nick-ubuntu:~$ apt-get --help
apt 1.0.1ubuntu2 for amd64 compiled on Jan 12 2016 20:13:58
Usage: apt-get [options] command
       apt-get [options] install|remove pkg1 [pkg2 ...]
       apt-get [options] source pkg1 [pkg2 ...]

apt-get is a simple command line interface for downloading and
installing packages. The most frequently used commands are update
and install.

Commands:
   update - Retrieve new lists of packages
   upgrade - Perform an upgrade
   install - Install new packages (pkg is libc6 not libc6.deb)
   remove - Remove packages
   autoremove - Remove automatically all unused packages
   purge - Remove packages and config files
   source - Download source archives
   build-dep - Configure build-dependencies for source packages
```

› The --help flag can be used with any command to find out what it does, plus what arguments to use.

Speed up text entry

It doesn't matter how fleet of hand your typing skills are, the command line can still be a time-consuming, frustrating experience. Thankfully the terminal comes equipped with lots of handy time-saving shortcuts. This issue let's take a look at how you can easily access previously used commands and view suggestions:

» **Up/down arrows** Browse your command history.

» `history` Use this to view your command history

» **Ctrl+r** Search command history. Type letters to narrow down search, with the most recent match displayed, and keep pressing Ctrl+r to view other matches.

» **Tab** View suggestions or auto-complete a word or path if only one suggestion exists. Press **~+Tab** to autofill your username, **@+Tab** to autofill your host name and **$+Tab** to autofill a variable.

Your first terminal commands

While it's possible to install and manage software using a combination of the *Software Center* and Ubuntu's *Software & Updates* setting panel, it's often quicker to make use of the *Advanced Package Tool* (*APT*) family of tools. Here's some key ways that they can be used (see *sudo* use below):

» `$ apt-cache pkgnames` Lists all available packages from sources listed in the **/etc/apt/sources.list** file.

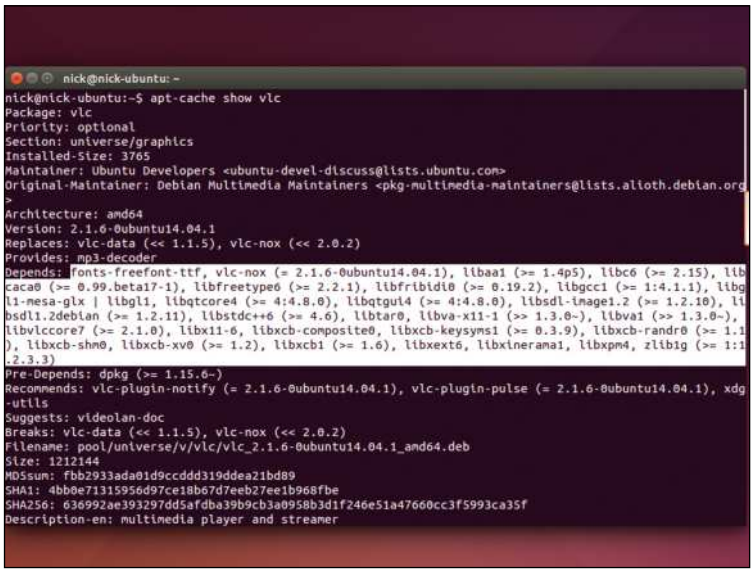
» `$ sudo add-apt-repository ppa:<repository name>` Adds a specific Launchpad PPA repository to the sources list.

» `$ sudo apt-get update` Gets the latest package lists (including updated versions) from all listed repositories.

» `$ sudo apt-get install <package>` Installs all the named package. This will also download and install any required dependencies for the packages.

» `$ apt-get remove <package>` Use this to remove an installed package. Use `apt-get purge <package>` to also remove all its configuration files, and `apt-get autoremove` to remove packages installed by other packages that are no longer needed.

» `$ sudo apt-get upgrade` Upgrades all installed software – run `sudo apt-get update` before running this. Other useful `apt-get` commands include `apt-get check` a diagnostic tool that checks for broken dependencies, `apt-get autoclean`, which removes Deb files from removed packages.



› **The `apt-cache` package can also be used to search for specific packages or reveal a package's dependencies.**

The `-l` flag tells the list directory tool to provide detailed information about the contents of the folder it's listing, including: permissions; who owns the file; the date it was last modified; and its size in bytes. Utilities can be run without any commands or options – eg `ls` on its own provides a basic list of all folders and files in a directory. You can also run utilities with a combination of commands and/or options.

Restricted access

Open the terminal and you'll see something like this appear: `username@pc-name:~$`. This indicates that you're logged on to the shell as your own user account. This means that you have access to a limited number of commands – you can run `ls` directly, eg, but not to install a package using `apt-get`, because the command in question requires root access. This is achieved one of two ways – if you're an administrative user, as the default user in Ubuntu is, then you can precede your command with the `sudo` command, eg `sudo apt-get install vlc`. You'll be prompted for your account password, and then the command will run. You should find that you can run more `sudo`-based commands without being re-prompted for your password (for five minutes) while the terminal is open. On some distros you can log on to the terminal as the root user with `su` – you'll be prompted for the root password at which point you'll see the following prompt: `root@pc-name:~$`.

Once logged in, you can enter commands with no restrictions. We recommend you use the `sudo` command rather than this approach and if you're running Ubuntu then you'll find `su` won't work because the root account password is locked for security reasons.

When installing some distros or adding new users to Ubuntu, you may find your user account isn't added to the `sudo` group by default. To resolve this, you need to open the terminal in an account that does have root access (or use the `su` command if supported) and type `sudo adduser <username> sudo`. You can also add the user to other groups with the command by listing all the groups you wish to add, eg: `sudo adduser <username> adm sudo lpadmin sambashare`.

Another handy tool is *gksudo*, which allows you to launch desktop applications with root privileges. It's of most use when wanting to use the file manager to browse your system with root access: `gksudo nautilus`. Make sure you leave the terminal open while the application is running, otherwise it'll close when the terminal does. When you're done, close the application window, then press Ctrl+c in the terminal, which interrupts the currently running program and returns you to the command line.

We've already discussed the `--help` flag, but there are other help-related tools you can use too. First, there's `whatis` – which you can type with any command to get a brief description of it and any specified elements, eg `whatis apt-get install vlc` will describe the *apt-get* tool, the install argument and what package **vlc** is. Flags are ignored.

If you're looking for a full-blown manual, then the *man* tool provides access to your distro's online reference manual, which is started with `man intro`. This provides you with a long and detailed intro to the command line. Once done press q to quit back to the terminal. For more advice on navigating the manual, type `man man` or pair it with a tool, eg `man ls`.

Now you've taken your first steps into the world of the terminal, check out the box (*Your First Terminal Commands, above*) for some useful package management commands you can work with. Next, we'll look at how to navigate your filesystem from the terminal, plus launch programs and delve into more useful shortcuts to help speed up the way you interact with the command line.

Terminal: Work with files

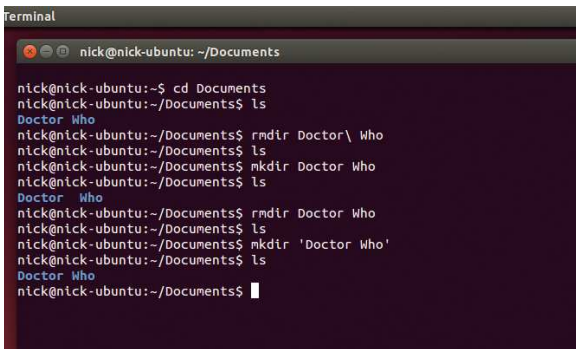
Time to turn our attention to navigating your file system and manipulating files and folders from the beloved Terminal.

Previously we introduced you to the basics of using the Terminal. We opened by revealing it works in the same way as your Linux shell; how commands are structured (utility command -option); plus gave you the tools to manage software packages and get further help. This time, we're going to look at how you can navigate your file system, work with files and folders and learn some more time-saving shortcuts in the bargain.

When you open a new Terminal window, the command prompt automatically places you in your own personal **home** folder. You can verify this using the `ls` command, which lists the contents of the current folder. The default Terminal application displays folder names in blue, and filenames in white, helping you differentiate between them. The `ls` command can be used in other ways too. Start by typing `ls -a` to display all files, including those that begin with a period mark (`.`), which are normally hidden from view. Then try `ls --recursive` , the `--recursive` option basically means that the contents of sub-folders are also displayed.

If you want more detail about the folder's contents – permissions settings, user and group owners, plus file size (in bytes) and date last modified, use `ls -l` . If you'd prefer to list file sizes in kilobytes, megabytes or even gigabytes depending on their size, add the `-h` option—so use `lh -h -l` instead. There are many more options for `ls` and you can use the `--help` option to list them all.

Navigating your file system is done using the `cd` command – to move down one level to a sub-folder that's inside the current directory use `cd <subfolder>` , replacing <subfolder> with the name of the folder you wish to access. Remember that folder and filenames are case sensitive, so if the folder begins with a capital letter – as your personal **Documents** folder does, eg – you'll get an error about the folder not existing if you type it all in lower case, eg, `cd documents` . You can also move down several levels at once using the following syntax: `cd subfolder/subfolder2` . To move back up to the previous level, use `cd ..` , you can also use the `/` character to move up multiple levels at once, eg `cd ../..` moves up two levels.



› Make good use of ‘ and \ characters when folder paths contain spaces and other special characters.

What if you want to go somewhere completely different? Use `cd /` to place yourself in the root directory, or navigate anywhere on your system by entering the exact path, including that preceding `/` character to indicate you're navigating from the top level, eg `cd /media/username` .

The `~` character works in a similar way to `/` , except this places you in your home directory. So typing `cd ~/Documents` is the same as typing `cd /home/username/`

Speedier navigation

In last part we revealed some handy keyboard shortcuts to help you enter commands more quickly, but the following keys will help you navigate the Terminal itself more efficiently:

» **Home/End** Press these to jump to the beginning or end of the current line.

» **Ctrl+left/right cursor** Move quickly between arguments.

» **Ctrl+u** Clear the entire line to start again.

» **Ctrl+k** Delete everything from the cursor's position onwards.

» **Ctrl+w** Delete the word before the cursor.

Accidentally omitted `sudo` from your command? Just type `sudo !!` and hit Enter to repeat the last command with `sudo` applied to it. And if you make a typo when entering a command, instead of retyping the entire command again, just use the following syntax to correct the mistyped word (in the following example, `dpkg` was originally mistyped as dkpg):

```
^dkpg^dpkg
```

Boost your learning

Now you're starting to flex your muscles in Terminal, how about expanding your knowledge by instructing it to display information about a random command each time you open it? To do this, you need to edit a file, so open the Terminal and type the following:

```
nano ~/.bashrc
```

This opens the file in the *nano* text editor. Use the cursor keys to scroll down to the bottom of the file, then add the following line to it:

```
echo "Did you know that:"; whatis $(ls /bin | shuf -n 1)
```

Press [Ctrl]+[o] to save the file (just hit Enter to overwrite it), then [Ctrl]+[x] to exit *nano*. Now close the Terminal window and open a new one to get a brief description of a command. Just type the following, with the actual command listed for a longer description: `<command> --help`.

`Documents`. One final trick —you've jumped to another directory, but how do you go back to the previous directory quickly? Simple, just type `cd -` to do so.

Working with files and folders

You can now list directories and navigate your file system, but what about doing something practical, like moving and copying files? You'll find a range of different commands exist, and the tricks you've learned about navigation will hold you in good stead here too.

Let's start by looking at commands for copying (`cp`) and moving (`mv`) files and folders. The same options apply to both commands. The basic syntax is cp/mv <source> <target>. The source and target can be complete paths following the same rules for the `cd` command, but it's generally good practice to first navigate to the folder containing the file or folder you wish to copy or move. Once done, you can simply specify the file or folder name as the source, like so `cp invoice.odt ~/Documents/Backup`.

This creates a copy of the file with the same name. The following copies the file to the specified directory and renames it too: `cp invoice.odt ~/Documents/Backup/invoice-backup.odt`. If you want to create a copy of the file within the same file, simply use `cp invoice.odt invoice-backup.odt`.

Substitute `mv` for `cp` in any of the above commands, and the file is moved, moved and renamed or simply renamed. What happens if there's already a file called **invoice-backup.odt** in existence? It'll be overwritten without as much as a by your leave, so make sure you're asked if you want to overwrite it by adding the `-i` flag like this `mv -i invoice.odt invoice-backup.odt`.

You can also copy folders using the `cp` or `mv` commands. Here, you need to include the recursive option, which ensures the folder is copied across with all its contents and correctly arranged in their original locations relative to the parent folder: `cp -r ~/Documents /mnt/sdb1/Backup/`.

If the **Backup** folder exists, then the **Documents** folder will be recreated inside it; if not, then the **Backup** folder is created and the contents of the **Documents** folder are copied into it instead.

Use the `rm` command to delete a single file, eg `rm invoice.odt`. The `rmdir` command deletes folders, but only empty ones. If you want to delete a folder and all its contents, use the command `rm -r foldername`.

You can also create new folders with `mkdir` command – simply type `mkdir` folder, replacing folder with your chosen folder name. Use the `touch` command to create an empty file, such as `touch config.sys`.

Wildcards are often used to speed things up in searches, and can also be applied to file commands too – the asterisk (`*`) character can be used to quickly access a folder with a long name, eg `cd Doc*`.

This works fine if there's only one folder beginning with Doc, but if there are two (say Doctor and Documents), then the command would open the first matching folder, which is Doctor in this instance. To avoid this, use `cd Doc*ts` instead (unless you have a folder called Documents and Doctorists).

Two characters that are more useful when navigating are the single quotation mark (`'`) and backslash (`\`) characters. Use single quotation marks around files or file paths that contain spaces, such as `cd ~\Documents\Doctor Who`.

You should also use quotation marks when creating folders in this way, eg simply typing `mkdir Doctor Who` will actually create two separate folders called **Doctor** and **Who**, so type `mkdir 'Doctor Who'` to get the folder you want.

You can also use the `\` character to get around this too, eg `mkdir Doctor\ Who` works in the same way, because the `\` character instructs `mkdir` to treat the following character (in this instance the space) as 'special'.

We finish off by revealing some handy characters that allow you to run multiple commands on a single line. The `&&` argument does just that, so you can do the following to quickly update your repos and update all available software:

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

`&&` is like the AND command in that the second command will only be performed if the first completes successfully. If you wanted the second command to only run if the first command failed then you'd use `||` instead. If you want the second command to run after the first regardless of what happens, then use the `;` eg,

```
sudo apt-get update ; sudo apt-get remove appname
```

instead: of `&&`.

Quick tip

Some file managers allow you to right-click a folder and open the Terminal at that location, but you have to manually add this option to Ubuntu's *Nautilus* file manager. Install **nautilus-open-terminal** from the Software Center, then open a Terminal window, type **nautilus -q** and press Enter. The option will now appear.

```
media                           VirtualBox VMs
Music                           wget-log
nick@nick-ubuntu:~$ ls -h -l
total 2.5M
drwxrwxr-x 2 nick nick 4.0K Feb 15 15:08 deja-dup
drwxr-xr-x 2 nick nick 4.0K Feb 28 17:21 Desktop
drwxrwxr-x 2 nick nick 4.0K Feb 26 17:35 Doctor
drwxr-xr-x 3 nick nick 4.0K Feb 26 17:44 Documents
drwxr-xr-x 4 nick nick 4.0K Feb 27 13:23 Downloads
-rw-r--r-- 1 nick nick 8.8K Nov 26 12:51 examples.desktop
drwxr-xr-x 2 root root 4.0K Feb  4 19:49 fedora
-rw-rw-r-- 1 nick nick 446K Jan 20 12:35 linuxdesktops-enlightenment.png
drwxr-xr-x 3 root root 4.0K Feb  4 19:50 media
drwxr-xr-x 2 nick nick 4.0K Nov 26 13:10 Music
drwx------ 2 nick nick 4.0K Feb 10 16:43 NoMachine
drwxr-xr-x 2 nick nick 4.0K Nov 26 13:10 Pictures
lrwxrwxrwx 1 nick nick   36 Dec 10 13:35 PlayOnLinux's virtual drives -> /home/n
ick/.PlayOnLinux//wineprefix/
drwxr-xr-x 2 nick nick 4.0K Nov 26 13:10 Public
-rw-rw-r-- 1 nick nick 871K Jan 13 10:22 steamos1.png
drwxr-xr-x 2 nick nick 4.0K Nov 26 13:10 Templates
-rw-rw-r-- 1 nick nick 1.1M Dec 24 22:09 tigervncserver_1.6.0-3ubuntu1_amd64.deb
drwxr-xr-x 2 nick nick 4.0K Nov 26 13:10 Videos
drwxrwxr-x 6 nick nick 4.0K Nov 30 09:43 VirtualBox VMs
-rw-rw-r-- 1 nick nick 3.5K Jan 21 11:39 wget-log
nick@nick-ubuntu:~$
```

Use ls to find out more about the files and folders in a current directory.

Scan and print: How to start

Let's run through some tips to get your printers and scanners up and running using systems and tools such as CUPS, SANE and XSANE.

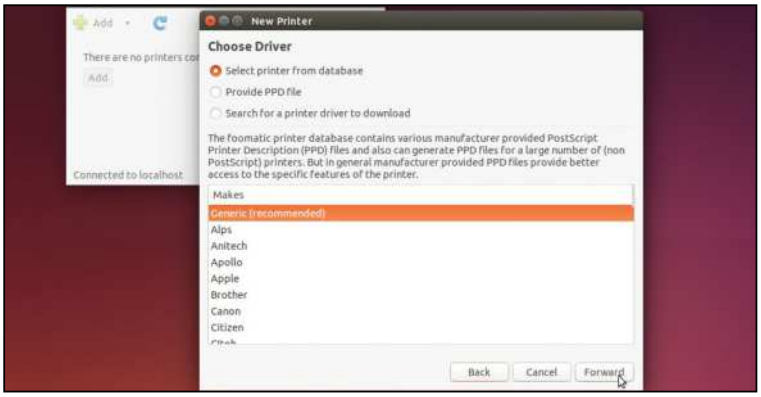
These days, it's almost mandatory to have a printer and scanner attached to your PC, but getting them set up in Linux can be a little tricky. Don't worry, though, because armed with the right drivers and tools you can quickly get things up and running. There are two core tools built into most Linux distributions (distros) that help simplify the process: *CUPS* for printers and *SANE* for scanners. *CUPS* provides a centralised management tool for adding and configuring your printers while *SANE* allows you to interface with your scanner in much the same way, as well as providing the tools you need to preview and scan images. We'll be focussing on these for this tutorial, coupled with some useful tools that mean you don't need to go into the terminal should you need to access or tweak them.

With other operating systems, you can usually plug and play your printer or scanner – the drivers will either already be pre-installed or you'll be prompted to download a driver, or insert a manufacturer's disc. While it's not quite that simple in Linux, the fact is that armed with the right procedure you shouldn't have to spend hours getting things set up.

The good news is that you don't need to start your search at your manufacturer's website when installing your printer. If you're lucky, you may find the drivers are already in place, particularly if your model is a network one, in which case all you need to do is open the *CUPS* front-end and see if it can detect your printer.

CUPS should be pre-installed with later versions of Ubuntu – including 16.04 LTS – and you can access it from System Settings by clicking 'Printers'. If it's not there, install it through the *Software Centre* (search for 'printer' and select Printers) or via the terminal using `sudo apt-get install cups`.

› Network printers can often be set up even without drivers thanks to CUPS.



Once installed, Click the 'Add' button to see if your printer is visible and supported. If your printer is connected via USB, but not showing up – as is likely – then you'll first need to locate suitable drivers for it. Start by looking for Linux drivers on your manufacturer's website and for your particular distro (you may need to find a unified package). Hopefully your exact distro (including version number) will be supported, but don't panic if it's not; we successfully installed a Dell B1265dnf all-in-one printer in Ubuntu 14.04.3 LTS using a unified package that only promised support up to 11.04.

If you're lucky, the driver may be supplied in a Deb package, in which case downloading and double-clicking it should launch the setup wizard. If your driver is provided as a tarball (with a .tar.gz extension), then it'll probably contain a shell script (.sh) installer, in which case follow the step-by-step guide opposite to discover how to get it up and running. Once done, re-open the *CUPS* front-end under System Settings and your new printer should be visible.

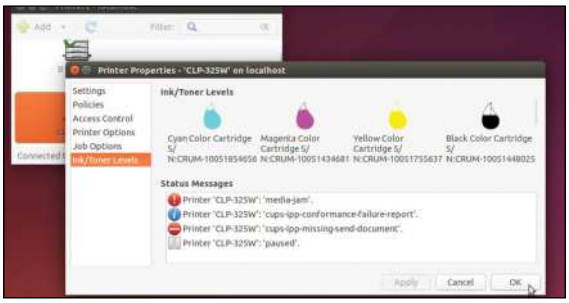
Network setup

If you're adding a networked printer, then you should be able to spot it without having to first source drivers. Click 'Add', expand 'Network Printer' and wait or click 'Find Network Printer'. After a short pause any detected printers should show up. Select yours and you'll see a choice of connection protocols appear. (*See What Connection Type? box, over the page for details of which one to choose if you're given the option.*) Select IPP if it's available, otherwise choose LPD or visit your manufacturer's website to see if it provides a driver that will likely offer an IPP connection if you install it.

If you're happy to proceed with the options offered by *CUPS*, click 'Forward' and it'll look for drivers, selecting them automatically if available. If it can't find any you'll be given three choices: select from database, provide a PPD file or search for a driver to download. Start by selecting your printer manufacturer to see if an exact match is available. If not, try a search – again, you may want to expand your search to your web browser, as it's limited in scope.

You can also use a PostScript Printer Description (PPD) file if your printer is a PostScript model and you can source one (search for your printer name and model and the word 'PPD'). This provides *CUPS* with a description of its capabilities, which it can use when outputting files.

If all else fails, don't worry: choose 'Select printer from database' again, but this time select 'Generic (recommended)' and click 'Forward'. A generic PCL driver will



› Once installed, administer your printers using the Printers tool under System Settings.

be pre-selected, so try this first: either the pxlmono or pxlcolor option depending on whether your printer is mono or colour. Click 'Forward' to install it – in most cases this will provide all the core functionality you need.

Whichever route you go down when adding your printer, you'll be prompted to provide a name, description and location for it, then asked to print a test page – we recommend this to verify the connection is working. Once done, you'll be taken to the printer's configuration screen, where you can examine its settings and see what control you can wield over it.

Tweak printer settings

The main Settings tab allows you to change your printer's description and location, plus change its URL. If you click 'Change…' next to 'Device URI' you can attempt to connect using a different protocol. This is also where you'll find options for printing test pages and maintaining the printer.

The Policies tab allows you to change the printer's state in terms of whether it's enabled, accepting jobs or shared. You can also define what happens if the printer encounters an error and switch on authentication for its 'Operation Policy' if supported and required (if you go down this route, access the printer via the *CUPS* web interface to set things up and running).

Access Control allows you to deny (or allow) access to the printer on a user level. You should spend some time in both Printer Options and Job Options tab where you configure key printer defaults. Printer Options is mainly concerned with default quality and paper settings, while Job Options lets you configure things like the number of copies, page orientation, and individual elements such as text and images.

Finally, if your printer allows it, the Ink/Toner Levels provides a handy glance at your printer's core components, including elements like the fuser.

Now your printer is set up, it's time to use it. Open an application and when you're ready, choose File > Print. Your printer should be listed, so it's simply a case of tweaking whatever options are made available to you in the application's own dialog and clicking 'Print'. If you have more than one printer installed, the default one will always be pre-selected; change this via the System Settings > Printers dialog by right-clicking your target printer and choosing 'Set as default'.

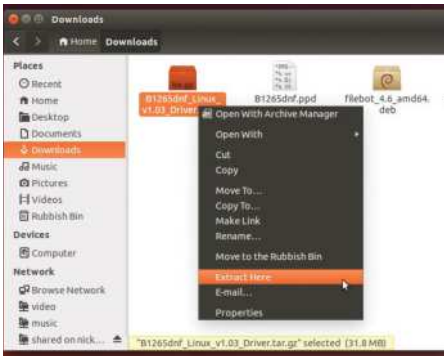
In most cases, the *CUPS* tool provided under System Settings should have all the options you need, but *CUPS* can also be administered from your browser: type `localhost:631` to access it. There's a handy overview and links to the *CUPS* forum should you need it, but use the tabs at the top of the page to navigate the web-based utility. Go to Printers and click your printer to access its settings – here, navigation is done through a series of drop-down menus. If you've installed a dedicated driver and were asked to assign a user to it, you'll be prompted at this point to enter the username and password to access the required pages.

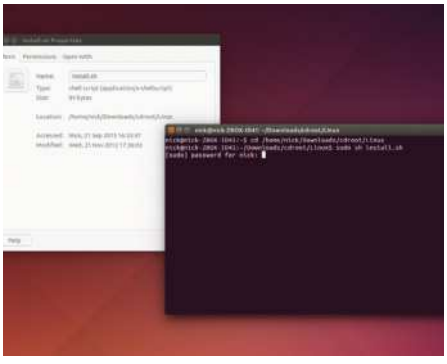
If you've set up a network-connected printer, you should also be able to access machine-level settings directly by typing in its IP address. If you don't know its IP address, it's »

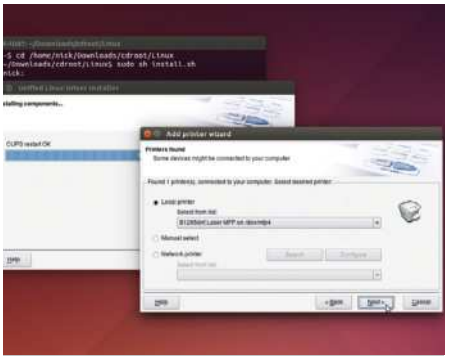
Quick tip

Struggling to get your printer to function correctly? Visit **http://openprinting.org/printers** and see if your model is covered. If it is, scroll down to the comments to see if anyone else can help (or post your own question in the forums).

Install a printer driver tarball package







1 Obtain & extract installer

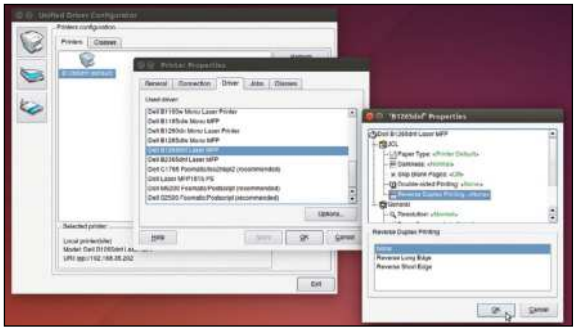
Browse to your manufacturer's website and locate the required driver for your Linux distro, which may be packaged as a unified driver. Save the gar.tz file to your **Downloads** folder, then right-click it and choose 'Extract Here'. Once that's done, open the extracted folder and locate a file called **install.sh**. Right-click it and choose 'Properties' to make a note of its location.

2 Start installation

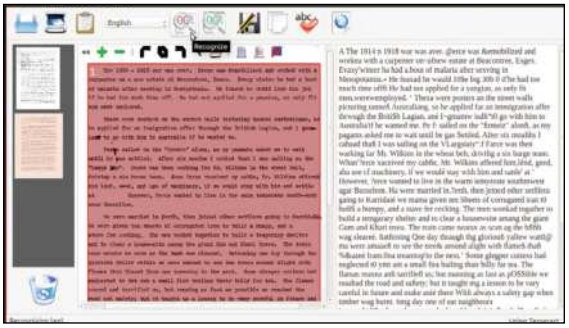
Now you'll need to open up a terminal window and type in `cd <path>`. You'll need to replace <path> with the path listed under Location for the **install.sh** file that's found in its Properties window. Now you'll need to type the following command and press Enter, followed by your root password when prompted: `sudo sh install.sh`. After a short pause you should see an installer wizard pop up.

3 Follow install guide

You'll need to work your way through the installer wizard and make sure that you tick your username to allow you to access the printer. Once the wizard's complete, you may then be prompted to configure the printer for CUPS and need to follow its wizard to set it up, entering name, description and location, if required, before going ahead and testing the printer to finish the process off.



› **Some printers ship with their own utilities, which may provide you with more control over its settings.**



› **The success – or failure – of OCR is largely down to the quality of the original document.**

» under the printer's Settings – click 'Change' next to 'Device URI' and expand Network Printer. The IP address will then be listed in brackets after your printer name. Enter the URL address and you'll be given access the printer itself, giving you even greater control over how it functions and who has access to it and when (eg setting up duplex options for double-sided printing).

Printer classes

CUPS allows you to group multiple printers into classes. This is mainly aimed at networks where lots of users want to share a limited number of printers. Each class has a hierarchy with those printers added first being preferred to those added later. When people come to print using a class, they're allocated a printer based on availability, so if one person is printing they'll always get access to the first printer, while if two are printing at the same time, the first person gets the preferred printer and the second gets the next available one.

With this in mind, it definitely pays to work out how you want your printers classed: do you want the faster ones made available first, or are you looking to try and steer people towards a high-volume printer such as a laser? Once done, open System Settings > Printers and click the '˅' button next to Add and select 'Class'.

You'll be prompted to provide a name, description and location in terms of a single printer, but it's better to think in terms of the class, eg, 'study-printers' or something similar. Once done, click 'Forward' and you'll be prompted to add existing printers to the class – remember to add them in order of preference. Once done, click 'Apply'. Once created, you can set this class as your default in place of a single printer – just right-click its entry and choose 'Set As Default'.

Linux also offers good built-in tools to help you access and make use of your scanner. In many cases – particularly with newer models – you can simply plug it in and there's a good chance it'll work. That's due in part to built-in support for SANE (Scanner Access Now Easy), which provides all the back-ends to scanning in Linux.

To see if you're lucky, plug in your scanner to a spare USB port and fire up *Simple Scan* to see if it detects it. If it does, you're in business – skip to the next section; if it doesn't – don't panic. First, check for Linux drivers with your manufacturer. Follow the instructions to download and install

Quick tip

If you're trying to extract text from a multi-columned document, make sure you use YAGF's tools for correcting page skew and selecting multiple columns before you attempt recognition to maximise your chances of having a successful extraction.

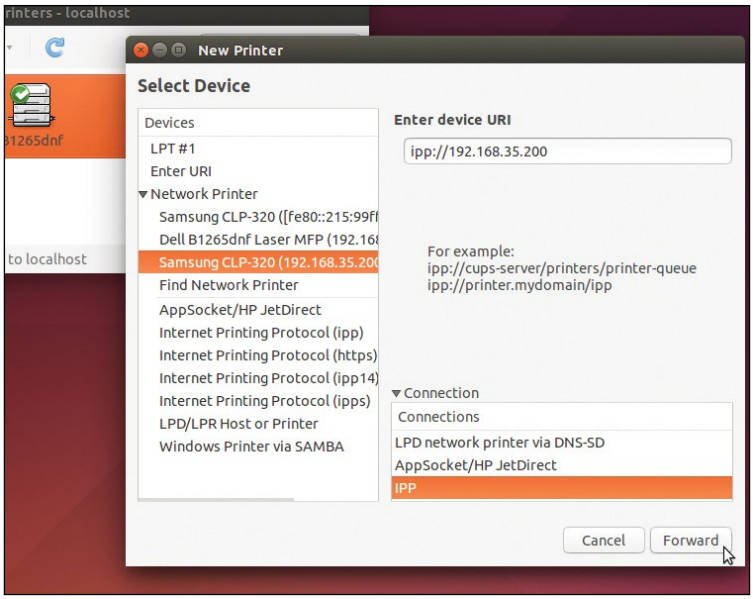
What connection type?

If you're hooking up a network printer, then you'll have been given a choice of connections when setting your printer up. But what are the different protocols and which one should you choose if given the choice?

The simplest protocol is AppSocket (also referred to as HP JetDirect). It's usually used when no other connection is possible, but its simplicity also means it lacks any kind of fine control: eg there's no queue management so you can't abort print jobs once they've been sent. There's also no way to find out the printer's status, making it impossible to discover ink and toner levels, eg.

Next up is LPD, which stands for Line Printer Daemon (also known as LPR, or Line Printer Remote). This does implement queue management, and can tell the difference between different types of data, such as raw text or PostScript information. There's neither support for remote setup nor management, though, and you can't query the ink or toner (although these may be provided anyway) and your print jobs can't be encrypted.

The final protocol – IPP – is the most contemporary and functional. It stands for 'Internet Printing Protocol' and is what CUPS uses as the basis for managing both print jobs and queues. It's the preferred method of communication as you get more feedback from the printer and wield more control over it thanks to its bidirectional nature.



› **Select your protocol carefully when configuring your network printer using CUPS, we'd suggest that IPP is the best if it's supported.**

Get unsupported scanners working

If, after your best efforts, you're still unable to get your scanner set up using SANE, then take a trip to **www.hamrick.com** where you'll find a program called *VueScan*, which promises to support over 2,500 scanners.

Click the supported scanners link to browse by manufacturer – if your model is listed, then download the tarball and extract the **VueScan** folder, then double-click *vuescan* inside to launch the program proper. It should detect your scanner automatically, then provide you with a simple step-by-step wizard to preview and scan using the program.

VueScan provides a lot of useful tools to help you get the perfect scan, and it works with many scanners that are already supported in Linux too, so if you're struggling to get to grips with *XSane*, consider giving it a whirl. The only downside is that it's not free – the Standard Edition costs $39.95, while the more fully featured Pro Edition costs $89.95 (you can upgrade from Standard to Pro for the difference at any time, too). The good news is that *VueScan* is fully functional for the purposes of evaluation (other than a watermark across all your scans), so you can be sure it's right for you before making a purchase.

these – again, if they're provided with an **install.sh** script, follow the step-by-step guide to get them installed.

If your scanner is part of a multi-function device than its drivers should be integrated with the printer's – if you added the printer component of a MFP without installing specific drivers, then you'll need to source and install these to get the scanner up and running. If you've installed drivers previously, but the scanner isn't detected, try installing them again over the top of the original drivers – we found this worked with our Dell B1265dnf after the scanner failed to show up. Once installed, your drivers may provide their own utility to help you verify the scanner is now recognised – eg Dell users should see a DELL Unified Driver Configurator shortcut on the desktop – or you'll need to fire up *Simple Scan* again at which point your scanner should now be visible.

For more troubleshooting advice on using SANE to detect your scanner, see **https://help.ubuntu.com/community/Scanners** or take a look at the box on *VueScan*.

As we've seen, Ubuntu comes with the *Simple Scan* front-end for SANE, which provides you with a simple, no-frills interface for your scanner. It's good for confirming your scanner works, but it lacks key tools like a preview function or the ability to fine-tune your scanner's settings.

Time to scan

However, if you really want to push the boat out, open the *Ubuntu Software Center* and search for 'xsane' to locate and install *XSane*, a more powerful scanning front-end. Once launched it'll display four windows – start by clicking 'Acquire preview' to create a preview of the image you're trying to scan. Once done, use the Standard Options window to select your image – choose 'Custom' under Page Format and then crop in using the four measurements beneath it.

Next, click the 1:1 magnifying glass button in the main window to zoom into the preview. Use the eyedropper tools to select white, black and grey parts of the image for colour correction purposes, then use the histogram's sliders in the top left-hand window to fine tune the colour balance. The right-hand window is where you choose where to save the file, what format to use and so on – choose 16 million (this is 24-bit) colours for photos and ensure the scan resolution is increased from 75dpi to 300dpi or 600dpi if you want a hi-res scan. There are also controls for adjusting brightness, contrast and gamma.

By default, your scan will open in *XSane's Viewer* window when you click 'Scan' – it's a good idea to perform one scan like this, so you can review your image and perform further optimisation. Once you're happy with your changes, click 'Viewer' and change it to Save, then click 'Scan' one last time.

Another benefit of *XSane* is that it integrates with *Gimp* – this allows you to scan directly to it, and then fine-tune your image accordingly. Launch *Gimp*, choose File > Create > *XSane* to select your scanner or perform a search for available devices. Everything's handled identically except for one critical part: there's no output option, so once you click 'Scan' the image will automatically be transferred to *Gimp*.

XSane also links in with the *goocr* tool to a built-in Optical Character Recognition (OCR) engine. This allows you to scan in printed documents and convert them into editable text. It's a flexible solution, but if you want to try something else then install both cuneiform and *YAGF* from the *Ubuntu Software Center*. Cuneiform is an alternative OCR engine while *YAGF* provides a neat front-end to both cuneiform and tesseract and is an OCR engine that's renowned for its accuracy. *YAGF* integrates nicely with *XSane* too – launch *YAGF*, click the 'Scan' button and it'll open *XSane*. Set the colour to 'Black and White – Line Art' and set the dpi to 600. Click 'Scan' and the document will be scanned and sent back to *YAGF*. From here, review the scan quality, then use the controls above the scanned image to prepare it for recognition. Once done, click the red 'OCR' button next to the language drop-down menu. *YAGF* will use Tesseract by default to decode the page, with the editable text placed in the right-hand pane for you to review and correct. Don't like the results? Choose Settings > OCR Settings, select cuneiform and click OK, then try that instead – in our tests, Tesseract performed better, but not by much. Be prepared to try and fine-tune the original scan if necessary to make the text as clear and legible as possible.

Once you're done reviewing and editing the text, you can save it as a TXT file or copy it to the clipboard, ready for pasting into Writer or another editing program.

Congratulations, your scanner is now set up to perform both standard and text-based scans.

Quick tip

It's also possible to use CUPS to 'print' documents to PDF file where no native PDF option is provided. Install **cups-pdf** from the *Ubuntu Software Center* – once done, a new PDF printer will appear as an option when printing.

› ***XSane* provides a comprehensive set of scanning tools.**

Backup: Don't lose your data

Make sure that your most important files are backed up simply and automatically with Ubuntu's own backup manager.

Quick tip

There are dozens of backup utilities available for Ubuntu. Head to **https://help.ubuntu.com/community/BackupYourSystem** to view a list of these along with details of their features.

Anyone who has worked in Tech Support will tell you that the most heartbreaking calls come from people who have lost data due to a computer error or failure. Ubuntu saves you this trouble by integrating a backup manager into its OS. With a few simple clicks of the mouse you can have peace of mind that your data is safe.

Before proceeding, it's best to buy an external hard drive that you will use exclusively for backing up. While the backup program *Déjà Dup* is able to delete older backups in favour of newer ones to save space, try to get as large a hard drive as possible to avoid losing any important older information.

Remember that backups exist to protect your data from physical damage like fire and theft, as well as software errors. Try to store the hard drive in a separate location to your computer when you're not carrying out backups.

Quick tip

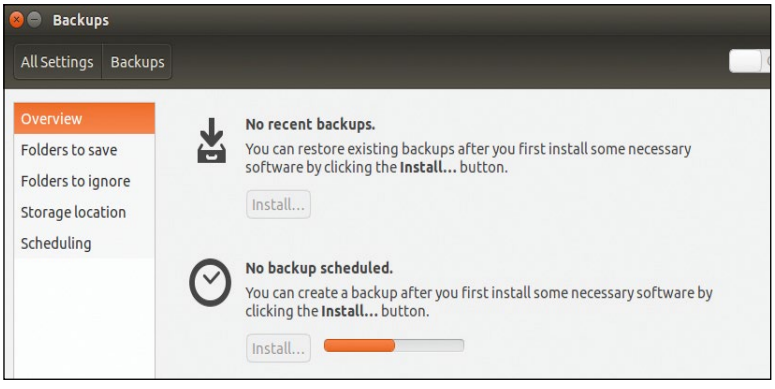
Remember that If you are unable to restore your data visit *Déjà Dup's* troubleshooting page at **https://wiki.gnome.org/Apps/DejaDup/Help/Restore/**

Backup Basics

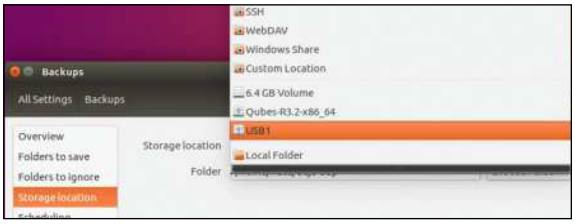
Click the search bar and type "backups" to launch the *Backup Manager*. You will see that Ubuntu asks you to install extra software to begin using backups. Click Install to proceed. You will need to enter your password to confirm you wish to install the backup utility *Déjà Dup*.

Once this is complete, the *Backup Manager* will inform you that you have no backups scheduled and you should either enable automatic backups or click Backup now. Before choosing either, it's important to fine tune your settings.

First click on Folders to Save on the left hand side of the window. By default your Home Folder is selected. This contains your Desktop, Documents, Pictures, Downloads, Music and Videos folders and is therefore likely to hold everything you created yourself. Other files like system files don't really need to be backed up as you can simply insert your DVD again but if you are aware of other folders outside your home folder where you have stored data, click on the + button at the bottom left to add these to your backups.



› Click Install to download the backup utility. Go through the options on the left before clicking Backup Now to control where, when and how your data is saved.



› Click "Local Folder" to change where you store your backups–external drive and online backups are supported.

If you have more than one user on your computer, while it's technically possible to add their home folder here, this can cause errors further down the line. Complete this guide and then have them log into their account and do the same from there. You can use the same hard drive to back up more than one account provided there's enough space. Click on Folders to Ignore, this section tells the backup manager which folders not to back up. By default the Downloads folder is excluded as these files tend to be easy to replace.

If you use a cloud storage provider like Dropbox, you may also want to exclude that folder from the backup as a copy already exists online as well as on your computer. Click the + icon once again and select the folder.

Storage and Scheduling

With your folders to save and ignore carefully chosen, click on Storage Location. If your external USB hard drive or memory stick isn't already connected, do so now.

You will see that by default backups are stored in your home directory in a folder named **deja-dup**. This is not a particularly reliable place to back up as if the data on your hard drive becomes corrupted in future or it suffers a breakdown, the backup would most likely be affected too.

Click on Local Folder to open the menu and select your external drive. Click the box besides Folder to specify a name for a new backup folder on the device e.g Backups1. All future backups will be stored in there.

Next, click on Scheduling on the left hand side of the window and click the rocker switch to turn on Automatic Backups. By default backups are performed weekly but you can change this to once a day if you wish. The Keep setting allows you to decide whether to delete old backups after a

› Check the progress of individual files click the small triangle next to details. Click Resume Later if you need to log out or shut down the machine for any reason.

certain amount of time e.g after 6 months or only to remove them to make way for newer backups (Forever).

Your first backup

In the Overview section to apply your changes and run your first backup. Click Back up Now to open the backup window.

At this stage you'll have the option to choose a password to encrypt backups. This is very important in order to protect your data, as otherwise anyone who can access the external drive will see your files. Try to choose a strong password to keep your data safe. If you are stuck for inspiration, you can easily generate secure passwords via the Diceware Passphrase Home Page (**http://world.std.com/~reinhold/diceware.html**). Make sure to write down your password and keep it in a safe place as you'll need it to restore your data.

Once the process is complete, the *Backup Manager* window will tell you that the last backup was today. You can head over to the folder on the external hard drive to view the files. Inside the folder you will see a file with the extension .manifest and a number of files with the extension tar.gz. Do not worry if you do not recognise the file names, they have been compressed in order to save space. The information in the .manifest file will allow them to be restored if necessary.

Restoring Backups

If the worst happens and you are forced to reinstall Ubuntu with a blank hard drive, you will need to repeat the steps in Backup Basics to reinstall *Déjà Dup* on your machine. Make sure to connect your external drive to your computer as well.

Open the *Backup Manager* and click Restore. A window will open asking Restore from Where? where you can give the exact location of your backup folder and click Forward. Next you will see the Restore from When? window. Any backups you've previously made will be listed in the drop down menu. If you had to reinstall your system due to a software bug, make sure to restore from a time where you're certain your computer wasn't experiencing any issues and click Forward. This takes you to the Restore to Where? window. Usually you will want files to be copied back to their original locations e.g your Home folder. However if there is data already inside those folders or you only want to restore some of your information, you can choose to restore elsewhere such as a new folder.

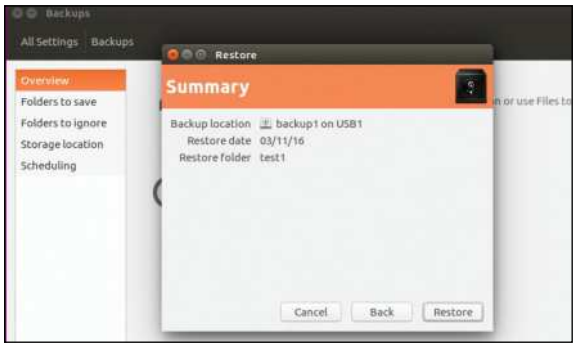
Finally you will see the summary window asking you to confirm the backup location, date and destination folder. Click Restore to proceed. If the backups are encrypted you'll also be asked for a password at this stage.

Backup Bothers

Although the *Backup Manager* is very handy, it's important to schedule backups and check that they are being run every now and then in the Overview section.

Déjà Dup has no built in method for recovering encrypted backups without a password so be sure to write this down on a piece of paper, as if you keep it on your computer, this may be lost if there is an error.

Ubuntu's *Backup Manager* cannot easily be configured to back up an entire computer including all user accounts and system data. If you want an exact copy of the entire hard drive, consider using a different backup utility like CloneZilla (**http://clonezilla.org**). There's also no elegant way to restore individual files but you can choose to retrieve your backup and place it into a new folder on your system. Be sure to delete any superfluous files when you are done to avoid duplicating data.



› Check the summary to ensure that you are restoring the correct backup. Here the files will be copied to a new folder named test1 instead of their original location.

Quick tip

Backups made through *Déjà Dup* are incremental, in that it backs up only those files that have changed since the last backup. This saves time and space.

Online Backups

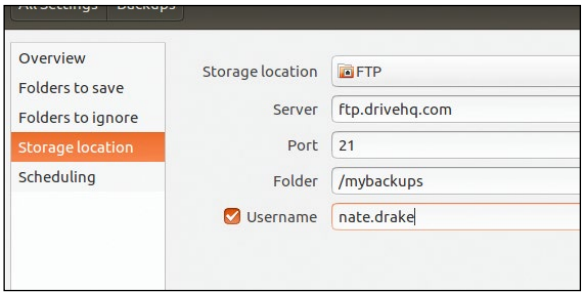
While keeping a backup on an external drive is relatively safe, you may prefer to have the peace of mind of storing it online. If you use a cloud storage provider with a sync client like Dropbox then anything placed inside the relevant folder will automatically be backed up. Simply click on the Storage Location tab, then Local Folder and change the backup location e.g **home/Dropbox/mybackups**.

Déjà Dup supports other types of online backup. The easiest to set up is probably FTP. In order to use this you will need to have FTP access to a server. DriveHQ (**www.drivehq.com**) for instance offers free FTP accounts with 1GB.

Once you have signed up for your account choose FTP from the Storage Location menu and fill in the information given by your provider. The Port Number is likely to be 21 or 22. You will also be asked to enter your FTPP username. The Folder"field simply asks where on the FTP server you want to store your backups e.g **/mybackups**.

Return to the Overview tab and click Back up Now. The first time you do this the *Backup Manager* will ask you to enter the password for your FTP account. Check the box to have the *Password Manager* remember this automatically in future.

If you are backing up online it's extremely important to encrypt your backups with a password to make sure they are safe. If you have very sensitive data it might be best to use a hard drive or USB stick instead.



› FTP is one of a number of supported methods to backup your files online. You'll be asked for your password.

Updates: Bug free & secure

Understand why, where and how to update your Ubuntu System.

Quick tip

You can also update individual applications from the Ubuntu *Software Centre*. Simply click the icon, then the Updates tab. Click Install beside each app to update.

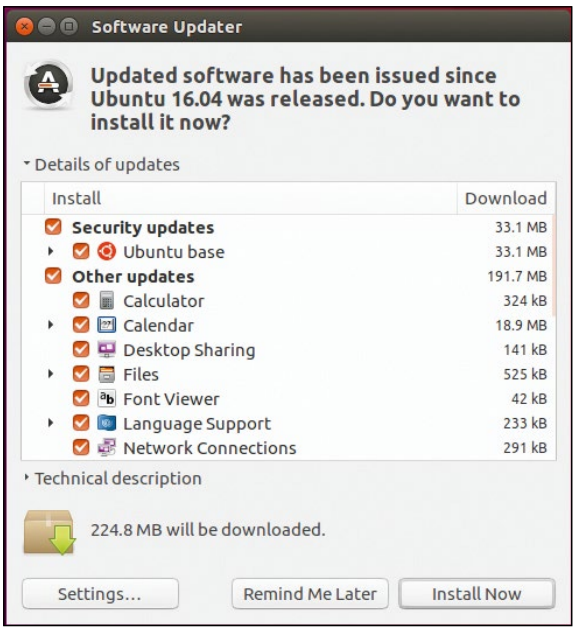
Users who are familiar with the rather aggressive manner in which Windows 10 was presented to some people may be wary of the Ubuntu update process. Updating in Ubuntu fortunately is much easier and you will remain in charge of the way you run updates.

There are two ways to make sure that your software is up to date – from the command line and using the handy built in *Software Updater*. Running commands using Terminal can often be the fastest and easiest way to update but the *Software Updater* is more user friendly.

Simply click the search button in your menu bar and search for *Software Updater* . Click the app icon to run it and the system will check for updates. If there are updates available a window will appear saying that new software has been released and asking if you wish to install.

It may be tempting simply to click immediately on Install Now and allow the updates to run in the background but it can be helpful to have a deeper understanding of updates in order to better understand your system.

You will see that individual applications may be listed as eligible for updates such as *Calculator*, as well as Ubuntu Base which is the underlying source code of your OS. You can untick certain boxes to update each application however you should only to do this if you're certain that updating may break a certain feature. This can be important if you're using plugins or features of a program that you know aren't compatible with the most recent version of Ubuntu (See Mastering the Backports boxout).



› You can click Install Now to apply available updates but consider clicking Settings first to configure your update preferences.

› The system has automatically selected the closest server for downloads, in this case in Ireland.

Clicking the Settings icon at the bottom left of the update window will display the *Software and Updates* window which allows you to fine tune your updates settings.

Reading Repositories

If you have previously used Microsoft Windows, you may be used to having to download individual programs from websites in order to install new applications. This can be time consuming and also isn't very safe, given that anyone can write a program that contains malicious code.

For an in-depth explanation of what repositories are and do, feel free to read Ubuntu's documentation at **https://help.ubuntu.com/community/Repositories** however in a nutshell they are servers which contain sets of software packages. They exist to make your life easier as thousands of programs can be gathered into a repository meaning you don't have to search around for the right application.

Some OSs like Ubuntu take this a step further and have a package manager (the *Ubuntu Software Centre*) which allows you to explore the available programs and see a short description to help you decide what you need. This is made even simpler by the fact that the *Ubuntu Software Centre* groups programs into categories such as Internet and Video.

There are many repositories available but the default ones used by Ubuntu are listed in the Ubuntu Software tab of the *Software and Updates* window you opened earlier. The first repository 'main' includes all software created by Canonical – the developers of Ubuntu. The 'universe' repository relates to free software which is maintained by the community through a dedicated group of people that contribute in their free time. This is often the reason that updates for certain apps do not come all at once, as different programs are maintained by different developers.

Mastering the Backports

Users who use the regular versions of Ubuntu which are released in April and October each year, will receive bug fixes and security updates through the *Update Manager* for nine months beginning from the date of release. Newer versions of software or features are not supported, however.

One solution to this is to use an LTS version of Ubuntu but for those who do not wish to upgrade at all, the backports repository offers a third way, mainly through providing new versions of individual applications which can be updated without breaking your system.

Although backport packages are tested by the Ubuntu Community there is a risk they may clash with a newer feature or program on your system so they should be used with caution. You can enable backports by ticking the checkbox next to Unsupported Updates in the Updates tab of *Software and Updates*. You will then be able to use the *Ubuntu Software Centre* to update your applications as usual.

There are very few situations where using Backports is better than upgrading to the next version of Ubuntu or using an LTS release. If your system is running very important software and you can't afford to take it offline, you may prefer to use the backports repository. Also updating via the backports repository can be more cost-effective if you pay for data you download versus installing an entirely new OS.

If you have used backports previously and want to upgrade your system, this can cause instability. Try disabling backports and updating your system before going ahead.

› The Plasma desktop is one example of a program that can be updated via Backports in Ubuntu.

The 'restricted' and 'multiverse' repositories contain software which isn't free and open. Examples could include software developed by private companies such as a driver for a laptop wireless card or Oracle's Java Runtime Environment. Updates for these are usually provided by the manufacturer, not the Ubuntu community.

Understanding the difference between various types of repositories helps you to make informed decisions about what you want. There are Linux zealots who do not use any kind of proprietary software for instance, using free alternatives or simply doing without. When you set up your installation of Ubuntu you usually check the box to say you wish to download software to support some restricted formats like MP3 files but if you did not, you can do so now.

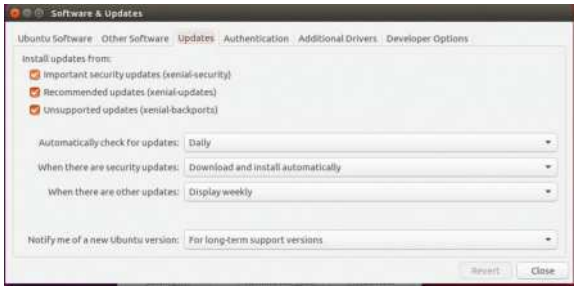
It is possible to add additional repositories to Ubuntu to allow installing additional packages. However Canonical have gone to great lengths to make sure that most of the applications you need are available in their official repositories so it's best to search the Ubuntu Software Centre first before adding new repositories.

Ubuntu should automatically 'ping' the nearest server for your country and display it but if you are having difficulty updating or Ubuntu has it wrong, you can change that here.

Ubuntu Updates

Clicking on the Updates tab in the Software and Updates window allows you to fine tune your updates further. It's advisable to leave both Important Security Updates and Recommended Updates checked. The Unsupported Updates are only important if you plan to keep using an regular non-LTS (Long Term Support) version of Ubuntu.

It is best to leave the other settings relating to when and how to install updates to their defaults. This way Ubuntu will automatically install any updates critical to the safety of your system but let you choose when to install other kinds.



› Leave the security settings as they are but you can change the frequency for other updates if you wish.

If you do make any changes in the *Software and Updates* window you will be prompted to reload your settings before being taken back to the Software Updater window. You'll need a working internet connection to apply any changes.

Once you are back at the Software Updater menu click Install Now to start updating. You may need to restart the machine to effect changes once the update is complete.

Ubuntu Upgrades

Since 2006 Canonical have been releasing two versions of Ubuntu per year, one in April, one in October. Each release is coded by month and year and has an alliterative animal name. Technically it's possible to simply insert new DVDs into your new computer with the latest version of Ubuntu to install and upgrade, but this would wipe any data already on your hard drive. For this reason, Ubuntu has a built in tool to allow you to upgrade from one version to another.

Although two versions of Ubuntu are released per year, every two years Canonical will release an LTS (Long Term Support) version of Ubuntu. These versions can be updated without upgrading to the next available release of Ubuntu for up to five years. Ubuntu 16.04 (Xenial Xerus) is an LTS version, which means Canonical will keep releasing security and maintenance updates for it until 2021. Ubuntu 16.10 is a regular release which means that updates will be supported for nine months after its release.

Using the regular version of Ubuntu makes it less likely that you will have a problem with recent software or new hardware. The LTS release however saves you the trouble of doing a full system upgrade every nine months.

If you wish to go ahead with an upgrade to the next available version of Ubuntu, first run a regular update using Software Updater. Next click Search and type Software and Updates. Click the Update tab and find the menu option reading Notify me of a new Ubuntu version. Choose For any new version. You'll be asked to enter your password to confirm. Close the window and then hold down Alt+F2. Type update-manager in the search bar and click the icon.

The update manager will appear saying the software for your current version is up to date but offering you the option to upgrade to the latest version of Ubuntu. Click Upgrade to read the release information, then Upgrade again to begin. This will take some time to download so make sure to save any work you have open.

Quick tip

The golden rule of upgrades is always to make a backup of your current system beforehand. See the Ubuntu Backups section for help with this.

Desktop: Install and switch DEs

Don't like your distro's desktop? No problem. Trade it in for an environment that's better suited to your needs.

One of Linux's great strengths is its versatility, and unlike other operating systems that ability to customise extends to your desktop environment (DE). Each distribution (distro) of Linux ships with its own DE, and while they share superficial similarities – specifically the point-and-click WIMP (Windows, Icons, Menus, Pointer) interface – there can be some quite radical differences in functionality as well as their look and feel.

The good news is that you're not locked into your distro's choice of desktop. Whether you're planning to switch to a different distro, but are put off by the desktop that it employs, or you're looking for a fresh way to interact with your desktop, Linux can accommodate you. In fact, you can even run multiple desktops side-by-side, allowing you to compare and contrast or use different desktops for different purposes.

Desktops are distributed as software packages, containing all the disparate elements required to make that desktop function (*see the Anatomy of a Desktop box, below*). Once desktops have been installed, you switch between them from the login screen by clicking the desktop icon that appears in the logon box next to your username.

So, if you're itching to try out some alternatives to your default distro, we'd say you can't go wrong starting with Cinnamon (**http://cinnamon.linuxmint.com**). It's the default desktop in Linux Mint, and is particularly popular with those switching from Windows as it utilises a similar style of desktop.

Quick tip

Don't like the look of your new Xfce desktop? Ubuntu sets the default *GTK* theme for Xfce, which means missing icons and ugly looking panels. Change this to the Xfce style and Tango icons by selecting Applications Menu > Settings > Appearance.

Spice things up

Cinnamon is highly configurable. Its main customisable elements – known as 'spices' – are its themes, applets, desklets (widgets you can place on the desktop) and extensions. These allow you to radically alter its capabilities as well as its look and feel – the step-by-step guide (*see right*) reveals how to tweak many of these settings.

Four other desktop environments worth looking at include Xfce (**www.xfce.org**), Gnome (**www.gnome.org**), LXDE (**www.lxde.org**), and KDE Plasma 5 (**www.kde.org**). Even if you wanted to use Ubuntu's default desktop, Unity, isn't available as a standalone desktop for use in other systems.

There are lots of things to consider when choosing your desktop. How it looks is an obvious starting point, but does that translate into making it easier for you to use? Some desktops, eg, aren't as configurable as Cinnamon, so it's important you explore all the options there are before deciding if a desktop has the functionality and flexibility you need in a package you're happy to look at. Despite their differences, you'll notice similarities between many Linux DEs. That's because they are basically variants of Gnome. Unity is the obvious example here, sharing many of its elements, but

The anatomy of a desktop

Your desktop is the virtual environment in which you work, and provides a friendlier user interface with which to interact with your PC. The desktop consists of a number of different elements to produce the working environment you know and love – or hate, if you're switching.

The desktop typically contains icons, windows, toolbars, folders, wallpapers and – optionally – desktop widgets. Most of what you'll see is provided by the window manager. As its name implies it determines how the desktop's windowing system works by taking responsibility for the placement and appearance of windows and their component parts, such as menus, title bars and control buttons. The desktop's graphical elements – buttons, scrollbars, icons etc – are stored in special libraries. These include the widget toolkit, which is also utilised by applications so they can work seamlessly with the desktop. Two main toolkits exist: *Qt* and *GTK*, and while you can run applications made in one toolkit on a desktop built using another, they don't tend to look as good.

Many of these elements are stored in a theme, which makes it easy for users to change a desktop's look and appearance by defining how key elements look in terms of shape, colour and other elements.

Desktops also ship with a number of core tools and utilities, designed specifically to work well with that environment. Typical elements include a file manager, image viewer, text editor and terminal emulator, as well as a tweak tool that allows various aspects of the desktop to be customised.

It doesn't matter how sophisticated your DE is, they all share the same building blocks: toolbars, desktop, widget and windows etc.

Remove unwanted desktops

You can install as many desktop environments as you like – aside from taking up space on your hard drive, they don't consume any resources unless you're actually running one.

But there may come a time when you've finished experimenting with desktops, settled on your favourite (or favourites) and want to remove the rest. It goes without saying you shouldn't be logged into the DE that you're planning to remove.

With that prerequisite out of the way, removing the desktop is best done from the Terminal, particularly if you plan to remove all the software the DE installed alongside itself. Here's the two commands you'll need:

```
$ sudo apt-get remove packagename
$ sudo apt-get autoremove
```

Replace 'packagename' with the desktop's package name, which will be one of the following: **cinnamon**, **plasma-desktop** (KDE Plasma 5), **gnome**, **lxde** or **xfce4** (Xfce).

even the likes of Cinnamon betray their roots through the use of similar applications, built using the *GTK* toolkit that Gnome employs. The big rival to Gnome is KDE, and its differences extend beyond the fact it employs the *Qt* toolkit rather than *GTK*. For starters, it's one of the most configurable tools out there, which makes it more popular with advanced users.

There's also a question of performance and power consumption. Some desktops are more resource hungry than others, eg Unity and KDE Plasma 5. The increased demands do come with benefits, such as: a wider feature set, a bigger range of tools and flashier looks, which are missing from lightweight alternatives such as LXDE. But that means they're less suitable for older and low-powered machines.

The best thing to do is run a couple of them and see how they perform – you should notice those with a smaller footprint are the most responsive, particularly on slow PCs. They also place fewer demands on power consumption, which should benefit those running on batteries. Remember, thanks to the fact you can easily switch between desktops, you can mix and match – a low-powered desktop while on the road, with a more fully featured environment for when plugged into the mains.

You're ready to start experimenting with desktops, so how do you install them? In some cases you can simply search for the desktop using your distro's software centre, but for others you may have to manually add the repositories (repos) yourself before installing through Terminal.

In the case of Ubuntu, you'll find Xfce (type `xfce4` into the Search box to locate it), Gnome and LXDE are all available through the *Software Center*. Click 'More Info' when you've found one – because they usually ship with optional components added in, you might want to review these before clicking the 'Install' button. Cinnamon and KDE Plasma 5 require a trip to the Terminal. In the case of Cinnamon, enter:

```
$ sudo add-apt-repository ppa:lestcape/cinnamon
$ sudo apt-get update && sudo apt-get install cinnamon
```

For KDE Plasma 5, use these commands:

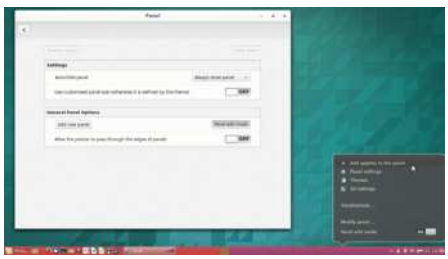
```
$ sudo add-apt-repository ppa:kubuntu-ppa/backports
$ sudo apt-get update && sudo apt-get install plasma-desktop
```

Working with desktops

Once you've installed a new desktop, log out of your account. When you find yourself back at the login screen you should see an icon next to your username. Click this and you'll see a list of available desktops appear – in some cases you'll see multiple options based on a single desktop. Select one, then enter your password and log in as normal to start using it.

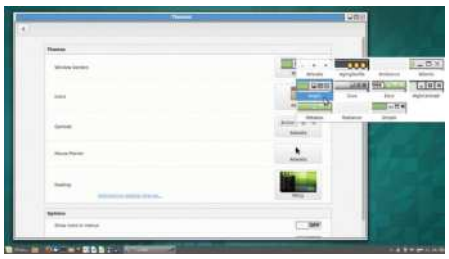
When you log into a new desktop for the first time, none of your existing preferences will come across from your old DE (but don't worry, they're all still there, ready and waiting for you the next time you log back into your original desktop). One of the benefits of having to make changes to your new desktop early on is that it forces you to explore, giving you insight into how it works and what tweaks you can perform.

Customise your new desktop



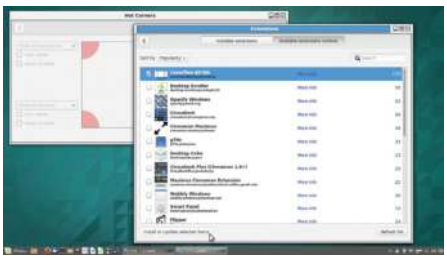
1 Tweak the taskbar

The Cinnamon's taskbar is called the panel and is split into three sections: menu button, app shortcuts and applets. You can pin app shortcuts to it by clicking 'Menu', right-clicking the app shortcut and choosing 'Pin to panel'. Right-clicking the panel reveals more options, like adding new applets or adding a second panel (choose 'Modify panel...').



2 Customise look and feel

Click the 'Menu' button and select the 'System Settings' button to change the way Cinnamon looks. In the Appearance section, you can change the background and system font (you'll see options from other desktops you've installed too). Selecting Themes and clicking 'Add/remove desktop themes...' you can download more themes to pick from.



3 Change behaviour

Hot Corners enable you to specify actions that occur when your mouse goes into a corner of the screen, such as showing the desktop or displaying all workspaces. Windows is where you can edit the way windows behave and alter the display of the task switcher. Finally, the Extensions allows you to customise using third-party plugins.

System settings

Settings: Tweak your install

Everyone likes to change the preferences to suite their own likes, we take you through the most important areas worth looking at.

It's highly likely that system settings are very important to you and rightly so, they ensure you can adjust how Ubuntu works to suit your tastes and needs. It's clear how important settings are a link to Settings is provided right there on the Launch bar – look for the cog and spanner icon. All the standard controls can be found here. A number of the big sections found here we look at elsewhere in this magazine, for example the Display and Sound (and Bluetooth) are looked at in the next two sections over the page. While Network, Printers, Backup and Updates have their own sections too.

Before we tackle those we're going to take a little time to ensure things are set to your liking, explain how to tweak the settings beyond the basics and improve the accessibility for people with visual and audio impairments.

To kick off we can cover the vital settings for the mouse and keyboard. We won't insult your intelligence for the mouse settings, as it's largely movement speed and mouse click speeds. Though there are options for click and dragging on touchpads. Keyboard settings include the ability to select your language and keyboard layout, alongside making it easier to access or opt for an on-screen keyboard if you don't have one attached.

Shortcuts

The most useful section is the Shortcut tab in the Keyboard settings. Here you're able to look up what the existing shortcuts are - this includes settings shortcuts for special keys that keyboards often have along the top - such as pressing Print Screen to grab the entire screen but also Shift Print enables you to select an area to grab.

Time and date options include, surprisingly, setting the time and date. It also enables you to set the timezone and region. More interestingly it also holds settings for how the time is displayed at the top of the screen and how appointment notifications are handled.

Device Colour Profiles is a largely overlooked area, partly as it's not always obvious why it's needed but also as the systems can seem needlessly complicated. We're not going to try and explain everything here but the basic idea of colour management is to try and match the original colours of an image with the output colours, be that on a monitor, projector or printer. Just as the colours produced by a display vary, colours printed are again very different from printer to printer – while a display generates pure white, a printer has to use paper white. The colour management system attempts to compensate for this ensuring colours in photos look correct when viewed on a monitor or printed. If your device offers an ICC colour profile you can import that through the Colour Management settings to get better colour reproduction. Alternatively if you own a colour calibration device, you can calibrate your monitor via this setting too.

Power consumption is unfortunately something that Linux often fails short of when compared to running Windows on the same device. It's partly to do with companies (that's largely Intel) not supplying the best chipset drivers to the Linux kernel, but it's also partly the basic power support Linux distros offer. You'll find a basic Suspend timer, click the Screen Brightness link to also access the screen off timer, but that's about it here. Using the Synaptic install you can add the *indicator-cpufreq* app to add a fine-grain control to the status bar at the top of the screen, after a reboot.

Users

User accounts are a key part of how Linux works, more so than with Windows. At its heart Linux is a multi-user system,

Tweak town

As is seemingly always the case with operating systems – Ubuntu, Windows or OSX – it seems the creators never really want you to change their beloved interface too much. Even with the open source, huggy, community feel to Ubuntu, they never let people actually adjust it too much. On one side you can just install a new desktop – see page 72 for how you can do that – but it'd be nice if you could just tweak the default desktop. Thankfully you can, by installing a little tool oddly called *Unity Tweak Tool*. The Ubuntu desktop system is called Unity, hence the name and you're able to install it through the *Software Centre*. Just tap *Unity Tweak Tool* into the search and click Install.

One of the key points that Ubuntu users have been calling for was the ability to shift the Launcher bar from the left-hand edge of the desktop down to the bottom edge. The *Unity Tweak Tool* was the first way to do that, though the functionality has been added to the official Display section.

› The main way to tweak Ubuntu is using its Unity Tweaking tool.

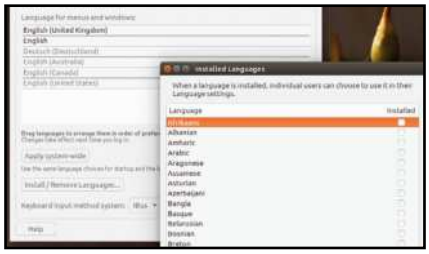
Language support

Generally you'll choose your native language and keyboard settings while Ubuntu is installing, so you can type and read things easily. If you need to change this post install or add additional languages you can do this through the Language Support settings. When first chosen you'll be prompted to install additional support files.

By default it'll show the current active languages that are used by Ubuntu in its menus and windows. These are listed in order of priority, so if the first language is not available it'll use the next one down. Installed languages that are not active will be shown in grey. To activate a language drag it above the base English option, wait a second and it'll activate. Use the Install/Remove Languages button to do just that, this opens up a huge array of languages, just tick the box of the new language you want to use. Activate it and click the Apple system-wide button.

The Regional Formats tab section enables you to control how numbers, dates and times are displayed. There's no fine control here, but it offers a wide range of base configurations for local regions.

Connected to the subject of language is the Text Entry settings. If you need to access more than one style of input language source, this provide controls over just that. Often people might need access to different keyboard layouts and this provides ways to switch between them using keyboard shortcuts and the top-bar language icon.



so it's been designed from the start to accommodate multiple users working on the same system, yet being entirely secure from each other. At its most basic this means more than person can use the same Linux system, their files are entirely separated from the other users and they can have their own settings. Alongside adding, removing and changing accounts you can also launch a secure guest session to enable friends or strangers to temporarily use your system securely.

You can configure what applications should be started at login, in addition to the default startup applications configured on the system. Use the Dash to find and open Startup Applications. Alternatively, you can press Alt+F2 and run the gnome-session-properties command. Click Add and enter the command to be executed at login (name and comment are optional). For example, to make *Firefox* start automatically, it's sufficient to type firefox in the Command field and confirm with Add.

Online accounts

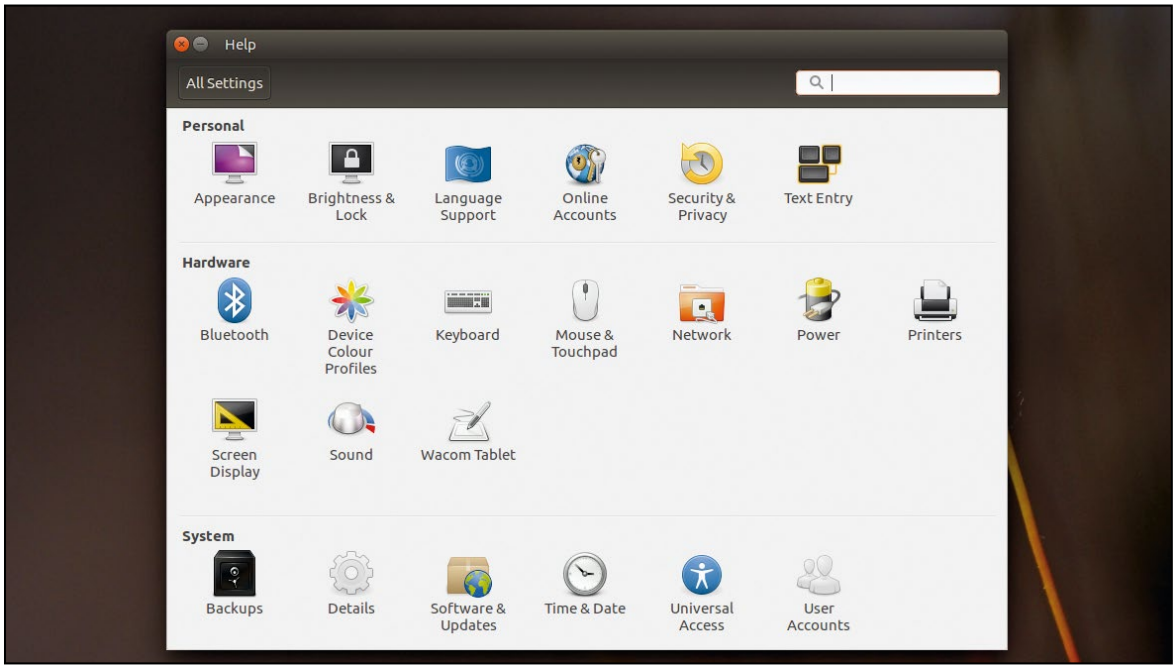
Ubuntu can tie directly into a range of online accounts, this enables the OS to drag into notifications, emails calendar events and more directly to the built-in notification system and install programs. The Online Accounts system manages all of these and provides support for a small but useful number of accounts including Facebook, Google, Jabber (a chat system), Flickr and Yahoo!. It usefully also enables you to filter the accounts by what programs they can be linked into, this is useful for example if you want to know which enable images to be managed from *Shotwell*, for example.

Security and privacy

People take their privacy far more seriously these days – it's a huge failing of Windows 10 and Google services – and even Ubuntu has had its slip ups. That's why there's a dedicated Security & Privacy section that's dedicated to ensuring your details stay secure and on your PC. The section kicks off with the usual protections over requiring a password to wake from sleep and a blank screen.

The next three tabs are about securing your details better. File & Application enables you to select what the Dash Search should return. You may want to remove your chat logs for example or if it's annoying, not have it search music and other files. The Search tab can eliminate searching online and Diagnostics will block sending details back to Ubuntu HQ.

There's also the Details section which provides just that on your system. Once you're familiar with Ubuntu it's not an area you'll need to use much but make yourself comfortable by tweaking the settings to your liking.



› The Ubuntu settings look pretty thin on the ground and in a way they are, which actually makes life easy!

Displays: Set all your screens

Master the basics of configuring you monitor options such as resolution, visual effects, screen savers and more.

Quick tip

If you want to fine tune Ubuntu further, install Unity Tweak Tool from the Ubuntu Software Centre. It can change system fonts, cursors, and even install new themes. See **https://help.ubuntu.com/community/UbuntuEyeCandy** for more information.

Ubuntu is designed to be easy to set up and the default settings for your display should make for a user friendly experience. However if the default settings aren't optimal or you wish to personalise Ubuntu, you should first click on Search and go to Appearance.

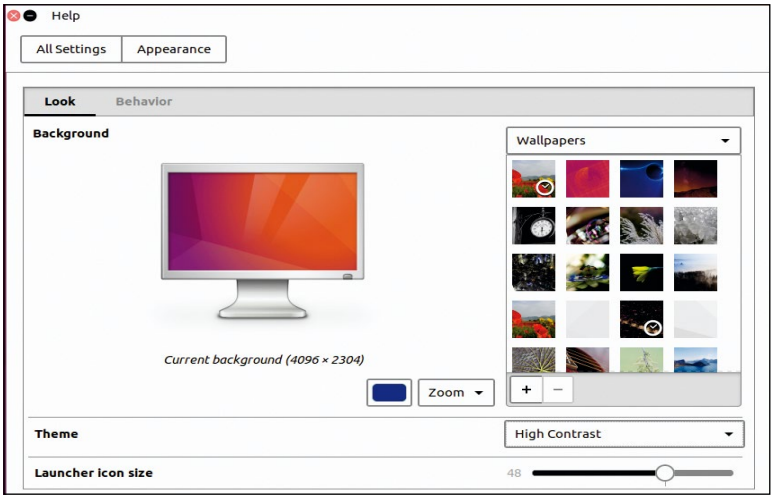
From here you will see that you can choose from various built in desktop backgrounds. If you have downloaded your own background from the internet, you can also use this. Simply place your chosen image in your Pictures folder and from the drop down menu in Appearance, click Wallpapers then choose Pictures Folder and select your image of choice.

Another useful tweak you can make here is to change your theme. As the name suggests themes are simply the way your system appears from the colour of window borders down to the fonts used. The default Ambiance theme can be changed to the lighter Radiance. You can also choose the High Contrast theme which might be useful for visually impaired users. Use the slider marked Launcher Icon Size to increase/decrease the size of icons on your launch bar.

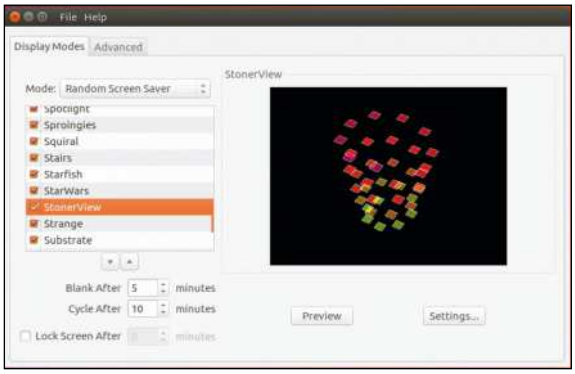
Ubuntu Screensavers

More recent versions of Ubuntu don't come with any screensavers built in. The monitor will simply switch off after a certain length of time. You can access these settings by going to System Settings > Brightness and Lock.

By default the screen will dim itself to save power then lock after five minutes of inactivity. The screen will also lock at that time meaning when you return to your machine you'll need your password to access your desktop again.



› Use the Appearance application to change your Wallpaper and Theme.



› By default Ubuntu will cycle through random screensavers but you can choose just one if you wish.

Most modern monitors and televisions are LCDs and do not suffer from the problems plaguing old CRT screens that used to result in images being burned into a screen if left on for too long, hence there being less need for screensavers.

Nevertheless if you prefer to see something more arousing on your machine than a blank screen when idle, you can do this by installing another. First click search and launch the Terminal application. Remove the existing screensaver by typing in the following command, then pressing return:

```
sudo apt-get remove gnome-screensaver
```

You will be asked to enter your login password to confirm that you wish to remove it. Do this and hit return. Next, hit Y to confirm that you do indeed wish to remove this program. This will only take a few moments. Now type the following command to install the new program along with a colourful selection of screensavers:

```
sudo apt-get install xscreensaver xscreensaver-data-extra xscreensaver-gl-extra
```

Hit Y once again and wait for the text to scroll past for the install to complete. Click the search button and type Screensaver to launch the new application.

You will see a variety of different screensavers in the box on the left hand side of the window. Feel free to scroll through these and then click the Preview button to see what they would look like full screen. As you will see from the Dropdown Menu Mode, the default setting sees Ubuntu cycle through the available screensavers randomly, however you have the option to tell it to choose one screen saver only or never to power off if you wish.

Multiple Monitors

To use another monitor with your device, first of all connect it to you machine and log in to the Ubuntu Desktop. Click the search bar and launch the Displays app. Click on your secondary monitor and then on the rocker switch below to turn it on or off. If you're unable to see your monitor try clicking the Detect Displays button. If your device has a built in display an alert box will show at the top left of your screen.

Once your secondary monitor has been enabled,feel free to drag it around to the position of your choice e.g you may wish to have it immediately below your current display. You can also choose to Mirror Displays if you prefer for them to show the same content e.g if you are giving a presentation. This may limit your resolution options if the displays have different capabilities. The General Options section show by default the Launcher on every display. Click All Displays to choose a primary monitor if you prefer.

Sticky Edges is an extremely useful feature which prevents you accidentally moving the mouse off screen onto the other monitor. When your mouse reaches the edge of one screen it will need an extra push to move to the other. By default this is switched on but hit the rocker switch if you want to turn this off.

› Multiple displays is easy!

Click the checkbox next to Lock in order to require the password when dismissing the screensaver.

If you want to fine tune your power settings click the Advanced tab and check the box next to Power Management Enabled. You can suspend or switch off your display after a certain amount of time.

Resolution and Rotation

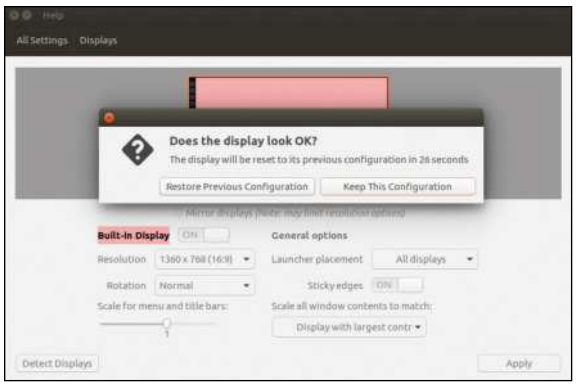
The display resolution is simply the number of pixels that can be displayed on your monitor, usually expressed as width x height e.g 1024 x 768. Ubuntu will try to detect the optimal resolution for your monitor but you may wish to change this if the display is too small or you have specific requirements.

Click the search button and type Displays. This application will allow you to change various aspects of your display including the resolution. Click the drop down menu to see the various settings supported by your monitor. Click Apply at the bottom right to effect your changes.

Below the resolution menu you can change the rotation of the screen if you have a specialised setup. You can also use the slider bar to increase the size of menu and title bars. The remaining settings pertain to using more than one display. See Multiple Monitors above for more help with this.

The Refresh rate is simply the number of times a second that images on your monitor are redrawn, measured in Hertz. For normal LCD displays a value of 60Hz is standard and Ubuntu should automatically detect the optimal settings for your monitor. However, newer high-end displays support faster rates up to 144Hz that you might need to select here but only if directed to by the manufacturer.

The easiest way to view and change the refresh rate is to install *CompizConfig Settings Manager* from the *Ubuntu Software Centre*. Once installed, click the icon to open it.



› You have 30 seconds to accept settings to ensure you don't select an incompatible screen setting.

› The Wobbly Windows effect isn't compatible with the Snapping Windows effect. When effects directly clash you are given a choice to disable the old effect and enable the new or vice versa.

Compiz manages many of the visual effects on your desktop (see below) and is a very powerful tool. As such you will see a warning when you first launch the *Compiz Configuration Manager*. Click OK to dismiss this, then on the General category on the left hand side. Next click Composite to view the settings for the monitor refresh rate. If you wish to manually change this, uncheck the box next to Detect Refresh Rate and then specify a new value in the box below.

Visual Effects

As mentioned the *Compiz Configuration Manager* is an extremely advanced tool and allows you to do much more than change a monitor's refresh rate. It also governs visual effects for your desktop, windows and much more.

It's not necessary to have these but it can make for a much slicker look and feel for your desktop. To explore the full range of options, first open your Terminal application and install some extra visual effects with the following command:

```
sudo apt-get install compiz-plugins-extra
```

Once installation is complete, open the *Compiz Configuration Manager* and click on Effects on the left hand side. You will see that certain window effects are already enabled such as Fading Windows. Feel free to experiment by enabling/disabling other effects. The *Compiz Manager* will alert you if you try to enable two effects which clash.

Display Dilemmas

As stunning as the visual effects are, they will place a greater strain on your graphics card which can be an issue for older or budget machines. The aforementioned Unity Tweak tool has a handy button for restoring your settings to default. You can also use the *Compiz Configuration Manager* to disable effects individually.

If you are still having issues with rich graphics overloading your system, consider switching to Lubuntu, a variation of Ubuntu which uses the same base code with the resource light LXDE (Lightweight X11 Desktop Environment). This uses a much simpler desktop and so needs far less system resources. See **http://lubuntu.net** for more information.

Sound: Tweak your audio

Explore Ubuntu's sound settings as well as how to connect external speakers and make everything sound perfectly sweet.

Quick tip

If you are playing music through the Firefox browser, you can disable sound in individual tabs by clicking the loudspeaker icon besides the small 'x'.

In this section we will explore how your sound is managed in Ubuntu as well as how to connect external speakers and microphones to your machine. We will also discuss suitable programs for recording and playing back audio as well as how to troubleshoot sound issues.

Your Ubuntu system's sound is managed by a program named Pulseaudio. Technically Pulseaudio is known as a sound server which sits between your various programs and sound hardware. It is capable of mixing several sounds together or playing to multiple devices at once, provided it is properly configured.

Volume and playback

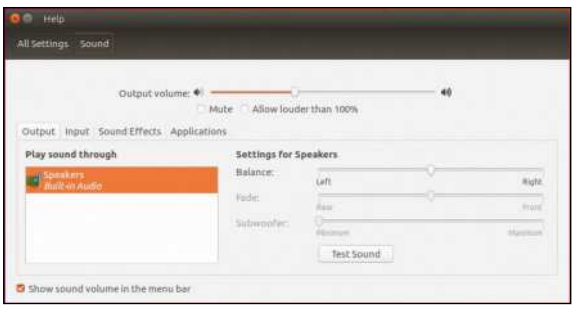
For most users audio will work out of the box after installing Ubuntu however if you wish to connect external speakers or adjust settings for individual applications you may need to access your Sound Settings.

Volume can be adjusted two ways in Ubuntu. Firstly by clicking on the sound icon in the menu bar to move the volume switch either to the left or the right. Secondly you can open the Sound Settings menu from here to fine tune audio. If you do not see the sound icon use the search bar to open *System Settings*, then click Sound.

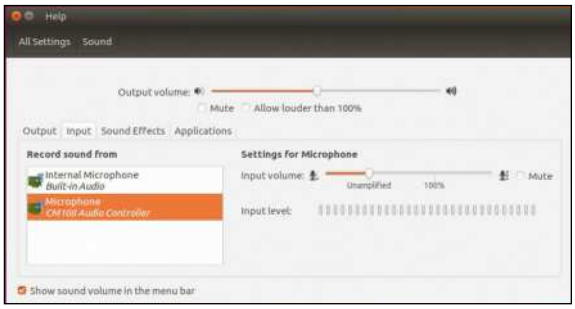
Some keyboards also have volume controls. Look for the loudspeaker icon. You may need to hold down the 'Fn'(Function) key before pressing them to alter the volume.

The sound settings menu also allows you to choose your audio output device. Simply click on the device on the left hand side of the window. If you use earphones or speakers with a 3.5mm jack then the Play Sound Through box will simply display headphones.

Depending on the speaker setup you have, you can take this opportunity to review the various settings for your speakers. The slider switches you'll find here are fairly self explanatory allowing you to adjust the balance, fade and subwoofer individually.



› Once the Sound Settings menu is open, click Test Sound to launch a window that will play sounds for each of your speakers e.g front left and front right.



› As with the Output tab you can choose your device from the pane on the left hand side. Adjust the input volume using the slider switch on the right.

The applications tab in Sound Settings is extremely useful as it allows you to adjust the volume for individual programs. If, say, you are listening to a music CD while browsing the BBC website, you may not want to hear the commentary from news videos, so you can mute the web browser's volume.

Input devices

Settings for Input devices like USB microphones or webcams with internal microphones can be accessed from the Input tab in Sound Settings. In the same way as for the speakers if your input device connects via USB it will be listed separately. Simply click it with your mouse to have Ubuntu use it for sound recording moving forward.

Take some time to look at the Settings for Microphone. Increasing the input volume will change how sensitive the microphone is. This is helpfully displayed in the Input Level bar below.

At the bottom of the Sound Settings window, you can choose to Show Sound Volume in the Menu Bar. If this is unticked for any reason click it to be able to access sound settings easily in future.

If you need a way to record short audio clips with minimal fuss, install the *Sound Recorder* application from the Ubuntu *Software Centre*. The interface is very basic but will allow you to record and play back short clips.

If you need a more fully featured audio recorder e.g for mixing various tracks or trimming your recordings, consider downloading *Audacity* which has many more features. Visit **www.ubuntuupdates.org/package/core/yakkety/universe/base/audacity** and click on the red button marked APT install to begin the installation. Ubuntu's bundled music player is called *Rhythmbox*. It has all the basic functions of a

Pairing Bluetooth speakers

Ubuntu can connect and play audio wirelessly to most Bluetooth speakers. If you want to proceed, in addition to Bluetooth compatible speakers your computer must support Bluetooth. Use the search bar to search for Bluetooth if you're uncertain if your machine supports this. If it isn't supported you'll see a message stating No Bluetooth adapters found.

Fortunately there are a number of small USB adapters online that you can plug in to make your device support Bluetooth. For a list of Ubuntu compatible Bluetooth USB adapters visit **http://bit.ly/LXF26blue**.

The device used for this illustration (see the screenshot right) was a Micro 10m USB adapter purchased from Argos for £9.99 which worked out of the box on a machine running Ubuntu 16.10.

Once Bluetooth is switched on, consult the manufacturer's instructions to put your speakers into Discovery mode so they can be detected by your computer.

Launch the Bluetooth application again from the search bar and make sure that both the switches at the top of the window are set to on, to activate bluetooth and make your computer discoverable.

Click the + button at the bottom left of the window to search for your bluetooth headset or speakers. Click to highlight when it appears in the pane and click Next at the bottom left. Ideally a message will appear saying that the new device has successfully been set up.

Click the volume icon to open your Sound Settings. You will see the Bluetooth device is now listed as a device in the Output tab. Select it to start playing sound over Bluetooth.

› Make sure to select the headset or speaker set as your playback device in Sound Settings too.

music player such as organising and playing tracks by album name, artist and genre. When you first run *Rhythmbox* it will automatically search your local music folder and display any tracks there.

As you will see (*screenshot below*) from the pane on the left hand side, *Rhythmbox* also supports playing internet radio and comes with a number of pre-loaded channels. Users can also search and subscribe to Podcasts by clicking on the Podcast sections

You can enhance *Rhythmbox* even further by accessing the Plugins via the Tools Menu. This allows you to add other channels, play FM radio and play *Rhythmbox* over the web.

Sound troubleshooting

If you are unable to hear sound on your machine, it's important to isolate exactly where the issue lies.

If sound plays for some media but not for others, it's likely you have an issue with certain formats of files. As Ubuntu is free software it doesn't include software for playing certain media types protected by copyright or patents such as Quicktime or Windows Media Video. For a full list of restricted formats visit **https://help.ubuntu.com/community/RestrictedFormats**.

When you initially set up Ubuntu you were given the option to download support for these formats. If you didn't do so at the time, you can do so now by opening the Terminal application on Ubuntu and running the command:

```
sudo apt-get install ubuntu-restricted-extras
```

Press return to enter the command, then Y to confirm you want to install. If you are still having trouble playing certain files, consider installing *vlc* from the Ubuntu *Software Centre*.

› Use the left pane to change between your own music collection, podcasts and internet radio. Portable music players such as iPods will also display here.

› The PulseAudio Volume Control (left) and the alsamixer app (right). Both are ideal for checking the playback or recording volume for individual devices.

This media player is capable of playing virtually any video or audio format.

If your sound is not working at all, first check your sound settings to make sure the correct output device is selected and the volume is turned up. If everything seems in order, you may need to adjust the sound for your particular output device.

Open Terminal on your machine and run the command `alsamixer`. This will display each of your playback devices and allow you to alter the volume for each. Use the left/right arrow keys to move between devices and the up/down keys to change the volume. Press Escape to exit when you are done, Ubuntu will remember the new settings.

In order to fine tune your sound settings even further consider installing the PulseAudio Volume Control application from the software centre. Not only is it easier on the eye but you can control more advanced settings like Ports and latency.

If you are having trouble connecting your bluetooth headset or speakers (*See Pairing Bluetooth Speakers*), try pairing them with another computer to make sure the discovery mode is enabled.

If all else fails you can reset your sound settings to default by opening the Terminal application and entering the following command:

```
sudo rm -r ~/.config/pulse; pulseaudio -k
```

For more in depth troubleshooting of sound in Ubuntu visit **https://help.ubuntu.com/community/SoundTroubleshootingProcedure.**

Quick tip

To see a full list of Ubuntu music players open the *Software Centre* and click audio under Categories. Next choose Players. If you're happy with *Rhythmbox* see the Getting Started guide at **https://help.ubuntu.com/community/Rhythmbox**.

Quick tip

If you're unsure if the sound is working for some files. Hold Alt + F2 and type `aplay /usr/share/sounds/alsa/Front_Center.wav`. You should hear a voice saying Front Centre.

Drives: Access flash and optical media

Your Linux install is not an island. Here's how to access both flash storage and optical media using Ubuntu's built-in tools.

Linux handles drives differently to Windows, so if you've migrated from a Windows PC, we recommend you first familiarise youself with how drives are labelled and accessed in Ubuntu. The good news is that – once you've over the initial shock – the transition isn't that big. And now you've understood how things work, you can go on to learn more about removable media, including USB flash storage as well as CD and DVD.

Working with USB drives

Ubuntu is more than happy to work with USB storage of any nature – hard drives and flash drives are treated equally. Just plug it in, and the drive will be automatically mounted and accessible, so long as it's formatted using a supported file system. Ubuntu ships with built-in support for both FAT32 and NTFS file systems as well as its own ext-based file system – once mounted, you can read and write to the drive like any other.

Larger drives – typically 64GB or bigger – are occasionally formatted in the exFAT format. Support for exFAT isn't included in Ubuntu by default, but you can quickly add full read/write support by opening the *Software Centre* and searching for 'exfat'. Install 'exfat-fuse' followed by 'exfat-utils' if you're running Ubuntu 64-bit, or choose the i386 labelled versions if you're running the 32-bit version. If you don't know which version you're running, go to System Settings > Details and examine the 'OS type' entry to find out. Once installed, full read/write support to any exFAT drive will be enabled.

USB drives are registered in the same way as hard drives – open Disks to confirm the individual label for your drive. Select its volume and you'll see it's something like **/dev/sdb1** or **/dev/sde1** depending on how many other drives are present. Unlike permanently attached drives, these identifiers aren't constant. They're applied on a first-come, first-served basis, so if you were to unplug one drive, then plug it back in having first attached another drive, its label will change. Always verify the label in Disks before performing any tasks that require you to identify or address it by its identifier.

Once plugged in, your drive should show up in the Nautilus file manager – its actual mount point can be found under **/media/<username>/<volumelabel>**, where **<volumelabel>** is the name you gave it when the partition was created. Unlike the drive's identifier, this does stay the same.

When you've finished with the drive and want to remove it, click the eject button next to the drive name in Nautilus to unmount it before unplugging it. If you need to remove a drive from the Terminal, use the **umount** command. By default, the umount command is used to remove individual volumes, but by including the **-a** flag you can ensure all volumes for a particular drive are unmounted, allowing you to remove the drive safely even if it's been partitioned. Point umount towards a specific volume or its mountpoint using the following syntax:

```
umount -a /dev/sde1
umount -a /media/nick/RPi0
```

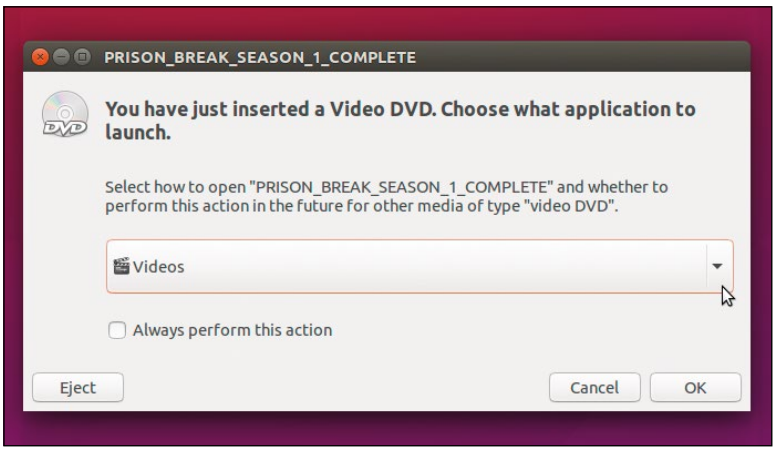
Once done, remove or eject the drive.

Read-only mount

Sometimes you may wish to access a USB drive in read-only mode, so data can't accidentally be written to the drive. By default, Ubuntu will mount any supported filesystem in read/write mode. The trick is to use the umount command with a

Quick tip

Verify what your CD or DVD drive is capable of doing in Ubuntu by opening a Terminal window, typing **wodim -prcap** and then hitting [Enter].



› Pop a media or blank disc into your DVD drive and Ubuntu will pop up this helpful dialogue box.

special flag (**-r**) to unmount the selected volume, then remount it in read-only mode – for example:

```
umount -r /media/nick/RPi0
```

If you find you can't unmount a drive using the **-a** command, you can use the **-r** flag instead on each mounted volume from that drive to remount them in read-only mode. This means you can then physically remove the drive without worrying about data loss.

Optical drives

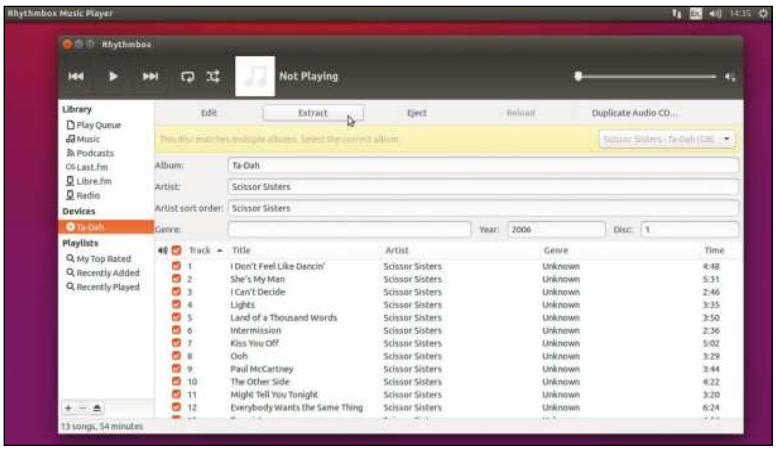
CD and DVD drives are handled differently to regular hard drives. First, they're assigned different IDs - **/dev/sr0, /dev/sr1** and so on. You'll also see they're marked as read-only by default, even if the drive itself is a burner.

How you interact with discs depends on the disc itself. If the disc is recognised, it'll be mounted inside the **/media/<username>** folder like other removable drives, making it accessible through the Terminal as well as via Nautilus. If the disc is a straightforward data disc, it should open in Nautilus, enabling you to browse and access its contents.

Other types – multimedia and writable discs – are handled slightly different. A pop-up window will appear, similar to that which appears when you insert a disc in Windows. You'll be asked if you want to open a specific application, which varies on the type of disc you've inserted, plus there are options for opening the drive in Files to explore its contents, or do nothing.

Your app choice depends on what's installed – Ubuntu ships with four apps that can be used from the off: *Rhythmbox* (playing and ripping audio CDs), *Videos* (watching DVD movies), *CD/DVD Creator* (burning data discs) and *Brasero* (burning all kinds of discs, including DVD, SVCD and audio CD).

By default, Ubuntu can't play certain restricted formats, including encrypted DVDs. To play commercial DVDs, install the *libdvd-pkg* software from the *Software Centre* – once done, you'll find *Videos* is able to play them, as will other third-party tools, including *VLC Media Player*.



› **Rhythmbox can extract audio from your CDs as well as play them back to you.**

Burn discs

Insert a blank disc and you'll be prompted to open CD/DVD Creator. This provides a similar interface to Nautilus – drag files onto the window, give your disc a suitable title and click 'Write to Disc' to burn a data disc.

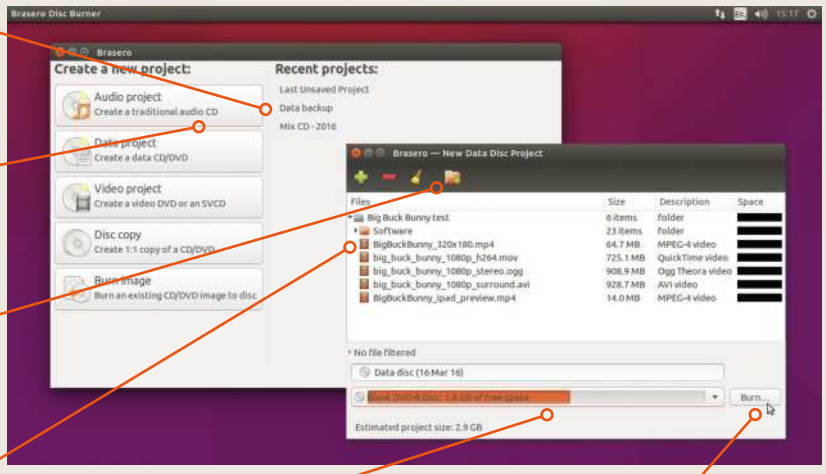
A more sophisticated tool for burning discs comes in the shape of *Brasero*. Launch this when prompted (or open it from the Dash) with a blank disc inserted into your drive, then select your project: you can create an audio CD, data disc, or video DVD/SVCD, plus there are tools for copying one disc to another as well as burning discs from support image formats (ISO, TOC and CUE). There's even a built-in cover editor (select Tools > Cover Editor) for designing and printing a cover for a regular CD jewel case, plus you can erase rewritable discs by selecting Tools > Blank...

Brasero is simple to use as the annotation below reveals – it's mostly just a case of dragging and dropping the files you wish to add to your disc in the correct order. There are also plenty of alternative burning tools out there – to create a video DVD with menus and try *DVDStyler*, for example, or check out *K3b* for a more general-purpose alternative.

Quick tip

You can also attach MMC/SD cards to Linux – if these are plugged directly into a card slot (as opposed to using a USB adapter), they'll be identified using **mmcblkx** rather than **sdx**. They work in the same way as other media.

Exploring Brasero



Access older projects

Choose File > Save to make a copy of your project before you're ready to burn it. You can then return to it for further tweaking.

Project type

Brasero allows you to burn all kinds of discs: audio, video and data, plus burn discs from image files and copy from one disc to another (two optical drives required).

File and folder controls

These buttons allow you to add and remove files to your project, plus perform other context-sensitive tweaks such as creating new folders for data discs.

File list

Review the current list of files, tracks or videos that you plan to burn – media tracks can be clicked and dragged to change their running order.

Choose media

Click this dropdown menu to switch between available drives or make a disc image. A handy guide tells you how much free space is left.

Burn disc

Once you're ready, click the Burn button. Set your speed, plus tweak options like leaving the disc open. You can even burn several copies if required.

Networks: Get and stay online

Connect to your local network and the internet via Ubuntu, we explain all the settings you'll need to know to manage your home network.

Quick tip

For more information on your current connection, click the network icon at the top right of the screen and choose Connection Information. Your ISP may need this information if you're having connection difficulties.

If you have previous experience with connecting your computer to a network then it's unlikely Ubuntu will hold any surprises. The easiest and fastest connections will be via a wired Ethernet cable.

If, as is more likely nowadays, you have WiFi in your home or office or have a more complicated setup, open the *Network Manager* by clicking the search bar and typing Network. You will see all available connections such as Wireless and Wired. If you use a cable connection click this to check the manager reads connected.

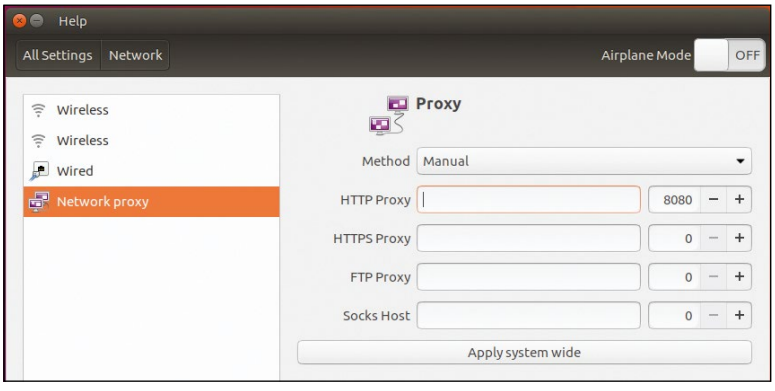
If your home or workplace uses a proxy server, this is also where to specify it. Simply click on Network Proxy on the left hand side, then click on None in the drop down menu. Choose Manual and enter the network settings given to you by your ISP (Internet Service Provider) or Network Administrator.

Wireless networking

Although it's possible to connect to wireless networks from within the *Network Manager*, it's easier simply to click on the network icon at the top right of the screen.

If you have a WiFi network in your home or office, it's likely you will have connected to it already when setting up Ubuntu, so before proceeding, check the name of your local wireless network and see if there is the option to disconnect. Launch the *Firefox* browser and try to visit a few web addresses to make sure your connection is working.

If you are not already connected, try to find your network name in the drop down list. Hover your mouse over more networks if you do not see yours listed there. If you find the menu too difficult to navigate consider using the Network Manager. Click Wireless on the left hand side to see all available networks. Your network will most likely be protected by a password or wireless key. You can usually find this in the documentation sent by your ISP with your router or written on the underside of the router itself. Enter the password and click Connect to link your computer to the wireless network.



› The Network Manager on a PC with two wireless cards and Ethernet port.

› If you have more than one wireless adapter (see below) the dropdown menu lets you choose which to use.

If you have a Hidden Wifi network then you will need to enter the password and the name of the wireless network and the type of security used such as WEP or WPA. You can obtain this information from whoever set up your wireless router.

Wireless USB

Not all wireless cards are compatible with Ubuntu as they use proprietary software drivers. If there is no Linux driver for your WiFi card you may be able to use the program *Ndiswrapper* to convert the Windows driver to work with it. See **https://help.ubuntu.com/community/WifiDocs/Driver/Ndiswrapper** for more information.

If your WiFi still doesn't work and you are unable to click Enable WiFi in the network menu, you may prefer to buy a USB WiFi dongle. The Ubuntu website has a non exhaustive list of wireless USB devices which will work with Linux at **https://help.ubuntu.com/community/WifiDocs/WirelessCardsSupported**.

If you have more than one working wireless device such as an internal wireless card in a laptop and a USB WiFi dongle, both devices will be listed separately in the network menu. They can also be connected to separate wireless networks. This can be useful if you wish to set up a WiFi Hotspot...

Wireless hotspots

If you have another method of connecting to the internet besides your WiFi card e.g another WiFi device, Ethernet cable or Bluetooth connection, you can set up a WiFi hotspot. This enables other devices to connect via wireless to your Ubuntu computer and share the internet connection.

› You'll need to give both the network name and security key to users who need to connect.

Open the *Network Manager* by clicking the search bar and typing Network, then press return. Click the Wireless tab on the left hand side (if you have more than one wireless device select the one you're not currently using), then the button marked Use as Hotspot. You will see a warning message asking you to confirm that you wish to create the hotspot.

The WiFi hotspot uses WEP for security which is considered very insecure these days so make sure there is no sensitive data on your machine before agreeing to use it as a WiFi hotspot.

Editing Connections

Ubuntu supports a number of other connections to networks such as Bluetooth, DSL and VPN. If you do not know what these are, it's unlikely you'll use them. Otherwise if you wish to add a new connection, click the network icon at the top right and choose Edit Connections. Click the Add button on the right hand side to choose various types of connections.

If you wish to connect to a VPN, bear in mind there are several types. By default Ubuntu supports PPTP (Point to Point Tunneling Protocol) which is commonly used by Microsoft systems. Your VPN provider however may use the OpenVPN standard which is generally considered to be more secure and reliable. To enable support for this open Terminal from the search bar and run the command:

```
sudo apt-get install network-manager-openvpn-gnome
```

Press Y to confirm you wish to proceed. The next time you open the *Network Manager* you will see the OpenVPN option.

Regardless of which connection type you choose the wizard will guide you to enter the fields with the data given by your network provider. Click Save when you are done to add the connection.

Connection issues

If your wireless connection is not working at all, there are simple steps you can take to arrive at the heart of the problem. If your computer previously worked with the same wireless network, then firstly check that it is not connected via an Ethernet cable. Also check the Network menu to ensure both Enable Networking and Enable WiFi are checked. You can also use the *Network Manager* to check you are connecting to the correct wireless network. Simply click on the Wireless option on the left hand side and make sure there is a tick next to your own WiFi network. This is important as Ubuntu may be connected to an unsecured WiFi hotspot.

If you use a USB device to connect wirelessly, try reseating it. If the wireless is built into your device e.g for a laptop make sure that the wireless isn't disabled as many portable computers have a key combination to do this.

If you are accessing folders on other devices over your network via Samba (See Sharing via Samba), you can experience username and password request, alongside read/write issues on certain folders or files. These options need to be changed on the networked systems.

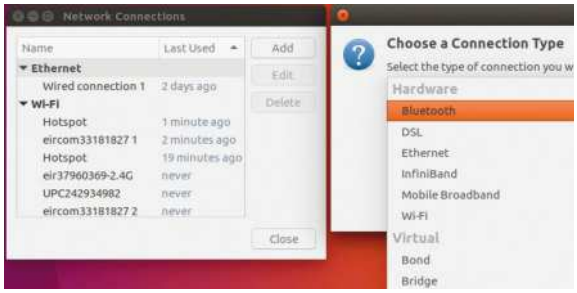
On Windows 10 this is done via the Advanced sharing settings. On Apple Macs follow the steps on the Apple Support page at **https://support.apple.com/en-ie/HT204445** and change permissions for Everyone to Read and Write to make sure the folder can be accessed without a password. Note that as Apple has its own protocol for file sharing it's very important to enable support for SMB when following the steps on the site.

Quick tip

Remember that The Official Raspberry Pi WiFi Adapter, available for £6 from the Pi Hut website will work out of the box in Ubuntu as it's designed for Linux.

Quick tip

Find more in-depth help with wireless troubleshooting at **http://bit.ly/LXF26network** and **https://help.ubuntu.com/community**



› Click Add in the Network Connections menu to choose a connection. VPNs using PPTP are supported by default, other connection types can be installed manually.

Sharing Folders across your network

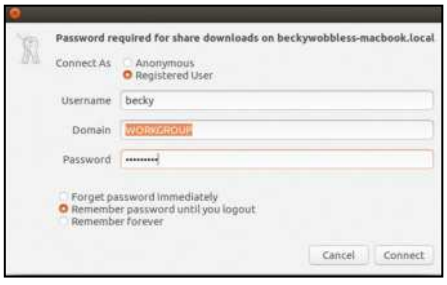
If you need to access folders on other machines in your home or workplace from Ubuntu, Samba or SMB (System Message Block) is a protocol that allows you to do this.

To get started, connect to your local network on the target device and enable sharing of the folder(s) via SMB. Windows 10 Users can find help with this in the Syncing and Saving section of Microsoft Support (**https://support.microsoft.com/en-us/products/windows?os=windows-10**). Mac OS users can find help on the Apple Support page at **https://support.apple.com/en-ie/HT204445**.

On the Ubuntu machine select the Files app then Other locations to see the remote folder. If it doesn't appear right away, try holding Alt + F2 and inputting the 'smb' address you were given by your Windows PC or Mac e.g **smb://192.168.42.1** and press return. You'll see the folder icon has a picture of a network cable to allow you to easily tell the difference between this and a local folder on your machine.

Once you have been able to access the folder consider right clicking and using the Add Bookmark to make it easy to access it next time. Any changes you make inside this folder will be reflected immediately on the target device. Similarly any files you move into here will exist on the other device only, not your Ubuntu machine.

If you need a way to make sure files are kept the same across all devices at all times, consider using a cloud sharing service like Dropbox to automate the process.



› You may be asked for a username & password when connecting via Samba. Ubuntu can remember these details, or you can tell the remote machine to allow anyone to access your sharing folders.

Hardware: Graphics card drivers

Let's take a long, hard look at the advantages and disadvantages of switching graphics card drivers and what that actually entails.

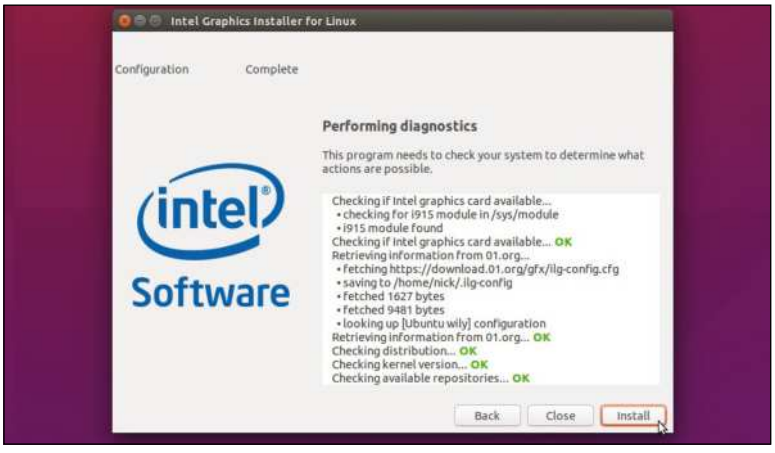
One of the most confusing aspects of switching from Windows to Linux is understanding how drivers – and in particular graphics card drivers – work. When you install Ubuntu on your PC, you'll notice it appears to install the drivers you need for graphics to work perfectly, and indeed this is the case in the vast majority of cases. These drivers are open source, designed to provide the key functionality for any graphics card to work with Ubuntu.

Because they're designed to just work, many of these drivers aren't interested in providing you with cutting edge performance. For day to day use – browsing the internet, word processing and even editing images – they're perfectly adequate, but if you have a modern graphics card, and want to take full advantage of its capabilities – particularly for gaming – you'll need to investigate the possibility of replacing them with dedicated drivers provided by the manufacturers.

This second set of drivers – with the exception of drivers for Intel graphics – are closed source, which means that while they're still free to install, you're relying on the manufacturer for support. The open-source drivers that ship with Ubuntu are updated through Ubuntu's own update tool, so they'll update organically with the rest of your system.

Quick tip

To find out more about your graphics chipset – including its capabilities – install *mesa-utils* from the *Software Centre*. Once done, simply open a Terminal window and type the following: **glxinfo | grep render**.



› Intel's graphics drivers are open source, unlike those provided by NVIDIA and AMD, so need to be installed manually.

Closed source – or proprietary – drivers rely on the manufacturer for updates to be delivered. The manufacturer may provide this functionality within the drivers themselves, or you may have to manually check the website to see if new drivers have been released.

What's available

The major three graphics card manufacturers – Intel, NVIDIA and AMD/ATI – all provide their own Ubuntu drivers. If you plan to upgrade to the closed-source graphics drive, the first thing to do is to identify your exact make and model of graphics card – particularly if you have no idea who the manufacturer is. If you head over to System Settings and select Details, you'll see a graphics section, but it won't tell you much. Instead, open a Terminal window and type:

```
lspci | grep vga
```

This will quickly list both manufacturer and model, which you'll need in order to determine if a proprietary driver is available for your card.

NVIDIA and AMD

If you have an NVIDIA or AMD graphics card, then the quickest way to see if a proprietary driver is available is by opening System Settings, selecting 'Software & Updates' and switching to the 'Additional Drivers' tab. If your card is compatible, you should see – after a short delay – a list of alternative drivers appear. Choose the latest version marked 'proprietary, tested' from the list and click 'Apply Changes'. When the process completes, reboot your PC.

Don't be surprised if your card isn't detected – if the card is more than five or six years old, then it's unlikely to be supported. AMD's support goes back to 2010 and the HD 5000 series, while NVIDIA cards date back to around the same time with GeForce 400 series. At first glance, you'll see that NVIDIA does still provide links to legacy drivers for older cards – see **www.nvidia.com/object/unix.html** – but these won't work with Ubuntu 15.10.

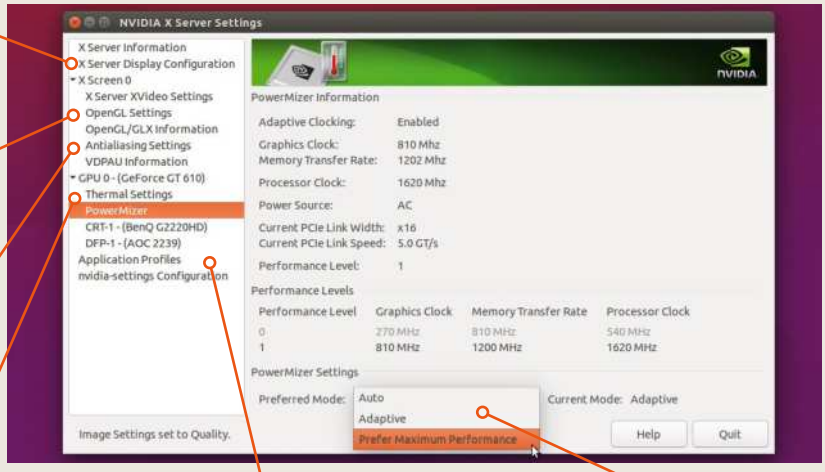
If your card is an older model, therefore, you're stuck with the open-source drivers – Nouveau for NVIDIA cards, and Radeon for AMD cards. Don't be too downhearted, both

Exploring the NVIDIA X Server interface

Display Configuration
Select this to tweak the resolution settings for each monitor attached to your PC – click a screen to select that monitor.

OpenGL settings
Access the 'Image Settings' slider from here, where you can try and strike a different balance between image quality and performance.

Antialiasing settings
This section allows you to configure the card's ability to smooth jagged edges and textures when rendering 3D objects using OpenGL.



Thermal Settings
This provides a temperature gauge for your graphics card – keep it open while you stress-test the card if you're worried about heat problems.

Application Profiles
Advanced users can fine-tune the various settings on offer for specific applications – typically games. Use the Help button to guide you.

PowerMizer
Some cards support different performance states – use this tab to view current settings and see if you can push the envelope if required.

provide more than basic functionality, with pretty decent 2D and 3D acceleration. They also support most older chipsets stretching back more than a decade. There's no need to install them either – if your card is correctly detected, the driver should already be in place. Visit **https://nouveau.freedesktop.org/wiki/** and **https://help.ubuntu.com/community/RadeonDriver** respectively for full details.

If you're lucky enough to be able to use the proprietary driver, then not only do you gain performance enhancements for gaming and other high-end purposes, you'll also be able to tweak your card using either the Catalyst Control Centre (AMD) or NVIDIA X Server utility – see the annotated screenshot for details of using the latter.

Intel chipsets

If your PC has an Intel processor and utilises its onboard graphics chip, you may be able to install the open-source Intel driver, which is found at **https://01.org/linuxgraphics**. At time of writing, the latest available driver is 1.4.0, which is designed for Ubuntu 15.10 and supports the following Intel graphics chips: 2nd-6th generation Intel Core processors, Bay Trail, Braswell and Hoxton Intel Celeron processors and the Intel Atom N450 (Pine Trail) chipset.

If your processor fits the bill, click the link under 'Latest download', then choose the 32-bit or 64-bit version depending on your Ubuntu build – if you don't know this, open up System Settings and click Details, then check the 'OS type'. Click the link to save the .deb file to your hard drive (or opt to open it in *Software Centre* if prompted). If necessary, double-click the file and click Install, then follow the prompts to install the utility. Once done, open the Dash and type 'Intel' to locate the graphics installer. Again, follow the prompts and if your chipset is correctly identified, click Install to add the driver.

Reboot when prompted, and you're done. There's no separate graphical configuration utility – instead, use Screen Display under System Settings to tweak your card's settings.

Troubleshooting

Sadly, not all driver updates are successful, and you can find yourself locked out of the Ubuntu desktop if one goes awry. If this happens with NVIDIA drivers, press [Ctrl] + [Alt] + [F1] to drop to the shell. Log in using your username and password, then enter the following command:

```
sudo ubuntu-drivers devices
```

This identifies which graphics drivers are installed. Assuming it reveals NVIDIA drivers, enter the following command next:

```
sudo apt-get autoremove –purge nvidia-*
```

Follow the prompts to purge the drivers from your system. Now add the following command:

```
supt apt-get install xserver-xorg-video-nouveau
```

Once done (don't worry if it tells you it's already present), type sudo reboot and you should hopefully regain access to your desktop.

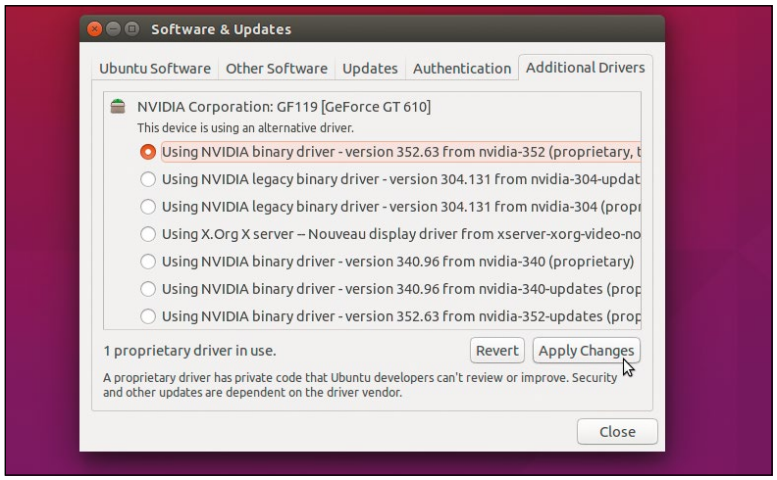
AMD users should try the following lines instead:

```
sudo apt-get autoremove –purge fglrx-*
supt apt-get install xserver-xorg-video-ati
```

While they're the most likely solutions, we're sorry to say that these may not work – if this is the case, you'll need to Google your problem to try some of the other suggestions on offer.

Quick tip

To avoid any worry when considering installing new drivers, take a drive image following the before you install the drivers, allowing you to roll back should the worst happen.



› Switching to proprietary graphics drivers is actually quite simple – assuming your card is supported, of course.

Malware: Linux virus protection

You wouldn't dare fire up Windows without a small arms pile of anti-virus protection, but does Linux need the same protections?

If you're moving to Linux from Windows then there's one thing you might be looking for and failing to find: anti-virus software or these days anti-malware. When it comes to Windows you can hardly move for people offering anti-malware packages, most new systems come installed with trials, while malware is so common even Microsoft includes its own *Windows Defender* software to try and combat the issue. So what about with Ubuntu and Linux?

You may have heard or if you do a quick search, might come across the line that Linux doesn't need anti-virus software. The truth is any computer system can be vulnerable to a virus, malware or other security threats. It so happens with Linux that for various reasons we'll cover in a bit, the ability for viruses to infect, run and spread are vastly reduced on Linux systems.

The biggest reason is Linux isn't widely used by consumers, virus and malware writers are motivated by money – a very small number by fame – so this means they target the most widely used systems and those are Windows PCs running on around 90% of the world's PCs. You wouldn't spend weeks developing an attack vector that can only be used on less than 2% of relatively secured PCs, verse over 90% of systems in all manner of precarious conditions.

› Linux does have virus scanners, available but you really don't need to use them.

The end result is that the total number of known Linux threats is around 59, none of which have caused a single outbreak in the wild. Contrast that with over 122 million (as reported in the Kaspersky Security Bulletin 2015) threats for Windows systems. Don't get blasé yet, Linux systems can be attacked in other ways, but first a little more on why Linux has dodged the malware bullet.

Built safer

On the whole Linux has been engineered in a way that makes it hard for malware to infect a system, to run and then to propagate themselves or cause further damage. Part of this is the Super User aka sudo and root mode that requires additional permissions to cause any damage. Standard users and by extension any malware can't alter the system without extra permissions. Windows introduced a similar system in Windows Vista and later versions.

The other major protection for Ubuntu and Linux is the use of centralised repositories. Many Windows system become infected by users downloading infected software from dodgy websites and other sources, with Ubuntu and most Linux distros almost all software comes from a centrally managed and protected software repository.

Then there's sensible and open update policies. Linux has always quickly rolled out security updates as and when required, this has always been done in the open, so anyone can see and understand what the updates are doing. Due to the open source nature of Linux distros when a system is

Password protection

The biggest threat the average user is in danger of are hack attacks on their online accounts' passwords. Many people being human reuse passwords alongside using weak passwords. This means if one account is hacked, the attacker can hack a large number of your other accounts using the same password and username details. The best way to protect against this is to use a password management system. In the past people used offline password managers, which are fine, but they don't help in the modern mobile world. The new generation of password managers live online as browser plugins and mobile apps. This enables you to take all your complex passwords with you and have the password manager log you into your various online services and sites when you authorise it.

We're going to recommend two systems the first is **https://keepersecurity.com** this combines a desktop program, browser plug in and mobile app for completeness. It also supports all the platforms you could want including Linux, OSX, Windows, Android and iOS.

The second is **https://lastpass.com** this is a browser and mobile app based system. It can tap into Google Authenticator for extra two-factor authentication to make it super secure. Both make excellent choices and will keep you far more secure online.

› Beef up your password security with a suitable password manager.

What's a malware?

Malware – a happy non-offensive term for any "bad" software. Malware includes any software that harms a system, the user, data, or processes. Many of the malware categories overlap like trojans and spyware.

› **Trojan** – A malware type that hide in apps to get into a user's system or they act as a program themselves. This malware does not replicate. So a hacker could make a password manager that will supposedly store users' passwords and enter them in for the user. Instead, the username, site, and password combinations are sent to the trojan maker instead of storing the data – this would be a spyware trojan.

› **Spyware** – This malware gathers a user's private data (financial info, passwords, usernames, etc.) and sends it to the spyware maker or other entity that will use the information.

› **Adware** – Software that displays ads is considered adware. Not all adware is bad.

› **Worms –** A replicating program that spreads to other computers. Most rely on networks for transportation. A virus attaches to programs and worms are standalone software. Viruses come on programs that users download and worms break in through the network.

› **Viruses** – Computer viruses are replicating code that spread by hiding inside of infected applications and installers.

› **Zombies** – A computer that is controlled by a malicious hacker, trojan, or computer virus to complete malicious tasks.

› **Scareware** – Malware that scares users into downloading malicious software or paying money for the fix. It could pop up a message saying: "Your data will be deleted unless you pay $100" or "Your computer is infected", you're then encouraged to pay money for a fantasy fix.

› **Ransomware** – A more recent attack that locks the computer and files and will not lift the restrictions until the user pays a ransom.

updated, it can be all updated. Under Windows separate software packages have to take care of updating themselves, but this extends to standalone software, codecs, drivers, shared libraries, add-ons etc.

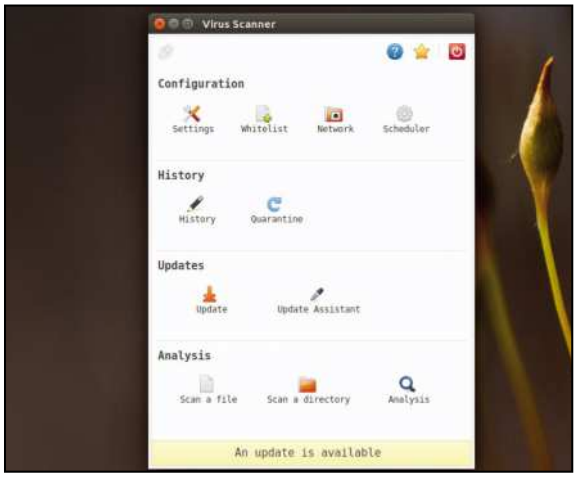
With Linux when the system is updated it's all updated. This is also done in a user friendly way, so updates can be done when the user wants. A new Live Patch system can even reduce the need to reboot too after a system update.

Scanners

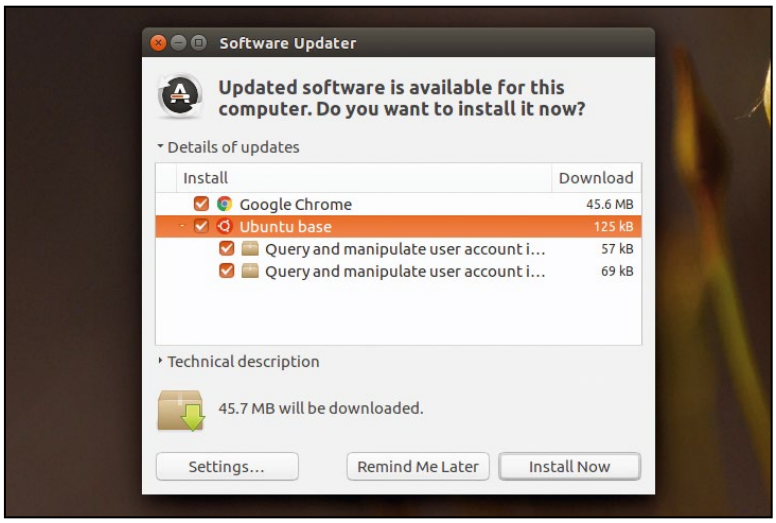
Having said all that there's still the potential risk of a viable attack and frankly there are far easier ways to be hurt financially through phishing and other online social engineering attacks. So all the usual advice applies as much to Linux as any other system: keep your system up to date, don't download software from untrusted sources, also don't run terminal commands from random sources, be wary online and use an up to date browser.

There are also arguments for running anti-virus software on a Linux system as it will still get to interact with Windows systems and the scanner could potentially intercept viruses passing through your system or you inadvertently downloading one and passing it on. There's other genuine reasons such as a business requirement, scanning a Windows drive or network drive or to protect a virtual PC.

The most popular on Linux is the free for personal use *ClamAV Antivirus*. You'll need to use the Terminal to install this but it's easy enough, press Ctrl Alt T to open a Terminal. To install the base engine use:



› **The basic interface for the ClamAV scanning system.**



› **Ensure you keep your systems up to date to avoid any new exploits.**

```
sudo apt-get install clamav
```

To install the automated scanner type:

```
sudo apt-get install clamav-daemon
```

It should automatically update, but you can force one with this, though it'll likely fail as *ClamAV* locks the log:

```
sudo freshclam
```

You can install a GUI front end through the *Software Centre* or else type:

```
sudo apt-get install clamtk
```

To scan a file you can just use the GUI or from the terminal to scan all the files and folders in your **/home** folder type:

```
clamscan -r /home
```

This recursively scans all the files in your default **/home** folder (the default store) you can add a -i option to only display infected files. So to scan all the files on a system use:

```
sudo clamscan -ri /
```

A full scan as with any system will take a while, you'll also likely get some errors, but don't panic those are just read issues not viruses!

So the main thing to take home is that a desktop Linux PC is largely safe from old-school direct threats like viruses as there simply aren't any. However, you as an individual are still vulnerable to having your online accounts hacked and falling for social engineering scams. On a wider scale Linux when used within online servers and Internet of Thing devices is also vulnerable to hacking attacks, but that's another story.

Startup: Fixing boot issues

It's all gone wrong. Of course it has. Here's how to resolve issues with non-booting PCs without having to reach for the panic button (or a hammer).

› If you're struggling to get the Boot-Repair tool disc to boot, experiment with the various fail-safe boot options.

Start-up problems. That moment when – having expected yourself to be getting on with your day's work or entertainment – you find yourself staring at a cryptic error message, or even worse, a blank screen. No matter how many times you press reset or restart, the same impenetrable barrier blocks your path. So, what can you do?

Start-up problems come in all shapes and sizes, and they can be difficult to track down. There are, however, some sound principles to use that will resolve many errors, and in this tutorial, we're going to look at the tools and techniques required to troubleshoot most start-up problems. You should start by examining how the boot process works (*see The Boot process box, right*). This reveals that the boot process can be split into three broad stages centred around the *Grub 2* boot loader: pre-*Grub*, *Grub* and post-*Grub*. Knowing this allows you to focus your troubleshooting efforts based on where in the process the error or freeze occurs.

Let's start at the beginning. You switch on your PC. If power comes on, but nothing else happens, chances are you've a hardware issue to sort – if you recently poked around the innards of your PC, then check everything is connected correctly. If not, unplug all external devices except your keyboard and try again. If this doesn't work, open the case carefully and disconnect your internal drives too. If the computer now boots to the splash screen, you can try reconnecting the internal drives and trying again; if you're now able to boot to the login screen, shut down your PC and start reconnecting your external peripherals to see if the problem has cleared itself or can be targeted to a single device, in which case try a different cable, or go online and Google for known boot problems involving that device.

If you're lucky, your motherboard will emit a series of beeps or flashing lights you can use – again by enlisting the help of the internet – to identify the likely problem. This may involve replacing a component or something more drastic.

If you're able to get as far as your PC's splash screen, but then your computer hangs or a 'missing operating system' error message appears, then first think back to any recent changes. If you've overclocked your PC, eg, you should now enter the system EFI or BIOS and look for the option to load fail-safe defaults. Try rebooting again.

If this fails, then the problem is likely to be with your hard drive, and so the first places to look are the MBR and *Grub*. If *Grub* isn't set to automatically appear when your PC starts, try rebooting while holding the Shift key or tapping Esc to bring up the *Grub* boot menu to confirm it's not able to even load itself. Jump to the *Boot-Repair* tool section once you've verified it's nowhere to be found.

If *Grub* is able to load, but can't find any bootable OS you'll find yourself with a number of scenarios: you may be presented with a basic command prompt such as `grub>` or `grub rescue>`, which indicates one or more files required by *Grub* are missing or corrupt. You may get a specific error

The Boot process

When you press your system's power button, control is initially given to your PC's EFI or BIOS, which starts its various components, performs basic diagnostics tests and attempts to find a bootable device, which is typically the first hard drive. Once located, the BIOS or EFI looks for the Master Boot Record (MBR) at the very beginning of the drive, which has a tiny program inside that loads the next stage of the boot loader, reading a file (eg **e2fs_stage_1_5**), which in turn is able to load the *Grub* boot loader. A 'missing operating system' error at this point means you need your rescue disc for diagnostics as something is missing – either in *Grub*, the MBR or the drive itself.

Once *Grub* loads successfully it reads a file called **menu.lst**, which contains the list of choices you see in the boot menu. Each entry basically identifies the drive, partition and file that contains the Linux kernel, plus RAM disk file used by the kernel as it boots. The entry will also contain any additional parameters passed to the kernel.

Control is now passed to the kernel, which attempts to mount the root file system. This is a key moment, and if it fails you may get a kernel panic, or things might grind to a halt. If successful, it'll create a single process to run the **/sbin/upstart** file (other distros use init) – if this goes wrong, you'll get a panic, it may halt again or drop you into a root shell. At this point, upstart starts running scripts and upstart events to start other services and eventually bring you to the logon screen.

› The *Grub* menu's appearance is a critical point in the boot process – if your system gets this far your recovery options are greater.

message or frozen splash screen, or you may just see *Grub* and nothing else, indicating it can't even find the most basic information required to proceed.

If you press c you may be able to enter the *Grub* Terminal mode to perform basic checks and repairs – you can attempt to manually initiate the boot by pressing Ctrl+X or F10, eg, or use the `set` command to review current settings and change basic settings such as the graphics mode. Visit **http://bit.ly/Grub2Troubleshooting** for a detailed guide to using *Grub*'s own troubleshooting tools, but remember that in most cases the simplest fix is to use the *Boot-Repair* tool.

If the *Grub* menu appears, then the issue may lie with its configuration file if things immediately grind to a halt after you select a menu option, but if Linux does start loading before grinding to a halt, the problem will lie with your operating system, in which case skip to the Post-*Grub* troubleshooting section (*see the next page*).

Boot-Repair tool

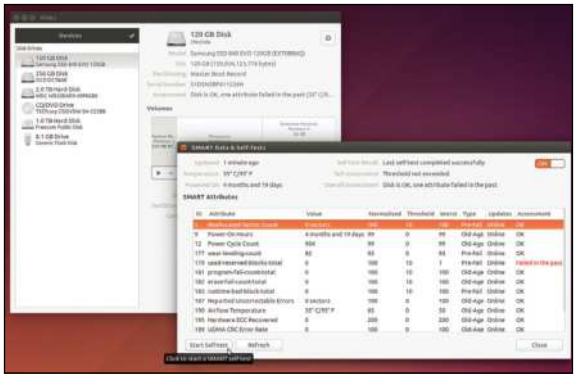
If you're struggling to fix *Grub* issues by hand, or there's no sign of *Grub* on your system at all, then you'll need to enlist the services of your rescue media and the *Boot-Repair* tool, which works with all Debian-based distros, including Ubuntu.

The *Boot-Repair* tool itself will launch automatically when you boot from a *Boot-Repair* tool disc, but if you're unable to create it, but have access to a Linux installation disc, use that in a live environment instead, then grab the *Boot-Repair* tool using the following commands:

```
$ sudo add-apt-repository ppa:yannubuntu/boot-repair
$ sudo apt-get update
$ sudo apt-get install boot-repair
$ boot-repair
```

The *Boot-Repair* tool is focussed on those early boot problems caused by the hard drive's boot sector, MBR and *Grub*. It basically provides a convenient and user-friendly graphical front-end to the tools required to fix many problems. The tool offers a 'Recommended repair' option that promises to fix most frequent problems, or you can click 'Advanced options' to see what it can do and manually select specific fixes without getting your hands dirty in the Terminal. The step-by-step guide (*see Tweak Boot-Repair tool Settings, over the page*) reveals what repairs and tweaks are possible, but note the tool is context-sensitive, and some options may be greyed out or missing depending on your setup.

The tool automatically generates a log of your system and what it attempts to do, which you can then share on the Ubuntu user forums if necessary. Before attempting any advanced tweaks on your own, it pays to try the recommended option first, then ask for help on the forums using the output logs generated – this will ensure you choose the right option and don't cause more damage.



› Give your hard drive the once-over when booting from your rescue disc to check it's working as it should.

Non-Grub boot issues

Your rescue disc will also come in handy should you not even get as far as *Grub* loading. Once booted, verify the existence and state of your hard drive. Open the file manager and see if your partitions are visible and if you can access the files on them – this is a good time to back up any precious files before you proceed further.

If nothing shows up, check whether the hard drive has been detected by opening the Disks utility from your Ubuntu Live CD – if you're using a *Boot-Repair* tool CD, you'll need to install the **gnome-disk-utility** through the Synaptic Package Manager under System Tools. Once installed, open it via the Accessibility menu. The *Disks* tool lists all physically attached drives – if yours isn't visible, you may find the drive has failed, in which case you'll be reaching for your latest backup after »

Quick tip

When you boot with your rescue media inserted your PC may automatically detect and boot from it; if it doesn't, look for an option to bring up a boot menu when your PC starts (typically a key like F11) to select it manually. Failing that, enter the EFI or BIOS configuration to set it as the first boot device.

» shelling out for a drive replacement, or starting again from scratch with a fresh Ubuntu installation and new-found love of backing up your system. Assuming your drive does show up, select it from the left-hand menu where you can examine the partition table plus check its physical health via its SMART [*Not all that smart – Ed*] attributes. Don't panic unless the drive is deemed on its last legs, but do focus your next check on the partitions themselves. If you run the *Boot-Repair* tool, its recommended settings will include a full disk check, but you can manually perform this check yourself using *GParted*, which is on both rescue discs.

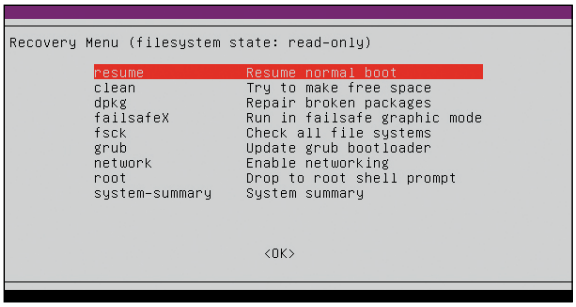
GParted enables you to see how your partitions are arranged, as well as revealing which one is the boot. Right-click this and verify Mount is greyed out before choosing 'Check to schedule a disk check using the *fsck* tool'. This will check for and attempt to repair any problems it finds as soon as you click 'Apply', but it's important the partition isn't mounted before the check is run. Also give it as long as it needs to complete – this could take hours or even days in some extreme cases, and cancelling or aborting will almost certainly corrupt the partition. Make sure the check is run on all partitions on the boot drive.

In most cases, assuming the drive isn't physically damaged or corrupt beyond repair, running these tests should ensure you're able to at least get *Grub* working again.

Post-Grub troubleshooting

If you find that *Grub* appears to be working fine, but your problems begin when you attempt to load Linux itself. Try switching to verbose mode during boot by pressing the Esc key to see if any clues appear in the messages that scroll past (or if it hangs at a certain point). Make a note of these and do a search online for them for more advice. If this doesn't happen, hold Shift at boot to bring up the *Grub* menu if necessary, then select 'Advanced options' followed by '(recovery mode)', which will launch Ubuntu in a minimal state, plus mount the file system in read-only mode. If this is successful, after a succession of scrolling messages you should find yourself presented with the Recovery Menu, offering nine options.

The options are all pretty much self-explanatory – the clean option may be of use if your hard drive is full, which can cause boot problems. If your problems started because a package failed to install properly, then *dpkg* will repair it and hopefully get things working again. The failsafeX option is a useful if you find yourself booting to a black screen or the graphical desktop doesn't appear to be working correctly – it basically bypasses problems with your graphics drivers or X server to give you a failsafe graphics mode to troubleshoot your problem from.



› Ubuntu's recovery mode lets you try various fixes when *Grub* works, but Ubuntu no longer wants to.

We've touched on *fsck* already – this will check the drive for corrupt files, which can clear many errors, particularly if your PC crashed and has failed to boot since. The grub option isn't relevant unless you've used *Grub*'s own recovery tools in place of the Boot-Repair tool to get this far in the boot process – selecting this will make your changes permanent.

Use the network option to re-enable networking, and the root option to drop to the shell prompt, allowing you to troubleshoot directly from there. If doing so, be sure to mount the file system in read/write mode using the following command: `mount -o remount,rw /`

You can also pass temporary kernel parameters to Ubuntu during the boot process, which may help in some scenarios. With your chosen operating system selected in *Grub*, press the e key to edit the kernel file. Scroll down to the line beginning `linux` – parameters are added to the end of this line after `quiet splash`. You'll need to make sure that you leave a space between each parameter. Once done, press Ctrl+x to boot with those parameters.

Note that any parameters you add here are temporary – in other words, they're removed the next time you boot, so you can experiment until you find a solution that works, then – if necessary – make it permanent by editing the *Grub* configuration file (**sudo nano /etc/default/grub**).

You can also pass parameters from the live CD environment using the *Boot-Repair* tool using the 'Add a kernel option', which includes 15 common parameters that

Quick tip

System logs are a valuable source of troubleshooting information – and you can access these from the **/var/log** directory using your rescue disc's file manager or *nano* in a shell. Look out in particular for syslog, and investigate the dmesg shell command too.

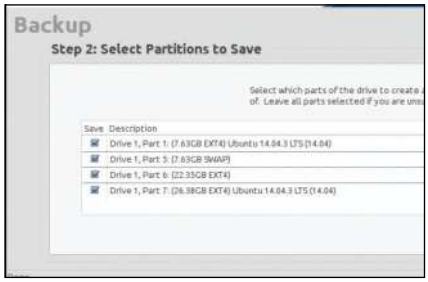
Take a fail-safe backup

It may seem strange, but if you're struggling with start-up issues, you should attempt to take a backup of your hard drive before you perform any repairs – this means if you mess things up completely you can always roll back your system to the state it was in when the start-up problem first manifested itself.

Of course, if you're diligent and you back up your system regularly, you could always simply roll things back now to a working state, although bear in mind there may be data loss involved if your **home** folder is on the same partition as your Linux installation (as is the case with default Ubuntu installs).

You'll need a suitable backup device – typically a USB-connected hard drive – and a tool that takes a complete drive image of your system. The *dd* command-line tool can be used from both Ubuntu and Boot Repair Tool live CD environments, but the backup drive needs to be at least the same size – and preferably – bigger than the drive you're copying.

At the other end of the complexity scale is *Redo Backup & Recovery*. You'll need a blank CD or DVD to burn its 261MB ISO file to, but it provides an easy to follow graphical UI. You'll find it at **www.redobackup.org** – or use the built in option covered earlier.



***Redo Backup & Recovery* offers by far the simplest way to make a fail-safe backup of your whole hard drive.**

can help with troubleshooting. Examples of these include acpi=off, which disables the ACPI system that's known to cause random reboots or system freezes on certain PCs, and nomodeset, which instructs Ubuntu to only load graphics drivers after the X environment has been loaded, and not before. These temporary parameters can be passed to your rescue disc too, in case you're having problems getting that working. Press [F6] at the initial boot screen to choose from the options on show. For more information on specific parameters, do an online search for the parameter or visit **http://bit.ly/KernelParametersList** for a complete list.

Repair install

There's one last thing you can try from the *Grub* boot menu – if your kernel has been upgraded, it's possible to boot using an older version of the kernel from the Advanced options screen under *Grub*. You'll see each version of the kernel listed – try the previous version if you believe your boot problem is linked to the latest kernel. If this works, you can make the version you've used permanent by editing the *Grub* configuration file – the simplest way to do this is by using the *Boot-Repair* tool.

If things look particularly bleak, then you may have luck reinstalling Ubuntu over the top of itself. Boot from the Ubuntu Live CD and choose the option to 'Install Ubuntu' when prompted. When you get to the 'Installation type' screen you'll be presented with a new option, pre-selected by default: 'Reinstall Ubuntu…'

This option basically reinstalls Ubuntu without touching your **home** folder or partition, which means not only should your documents and other files be preserved, but key settings and many programs may be left alone too. It'll also leave entries in your boot menu alone, ensuring you won't lose access to other operating systems.

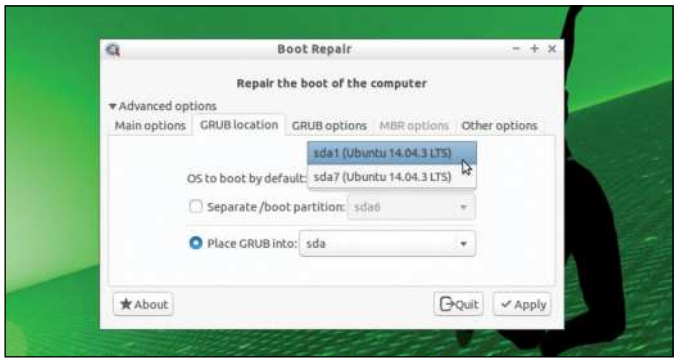
What will be replaced are system-wide files, which will hopefully root out any corrupt ones and get your PC up and running again. Although it doesn't affect your files, it's still good practice to back up the drive – or at least your **home** folder or partition – before you begin.

To ensure you don't lose anything from your system, make sure you recreate all user accounts with the same login and password, including – of course – your own during the install process.

Tweak Boot-Repair tool settings

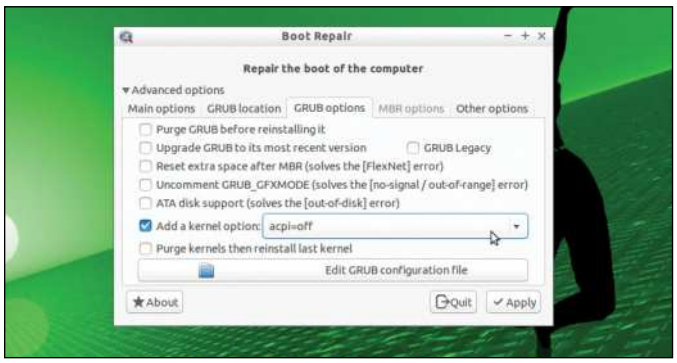
1 Main options

The first tab offers a convenient button for backing up your current partition table, boot sector and log – click this to copy this key information. It's also where you can reinstall *Grub*, restore the MBR and choose whether to hide the *Grub* menu. If you think your filesystem is corrupt, tick 'Repair file systems' to have it checked and fixed.



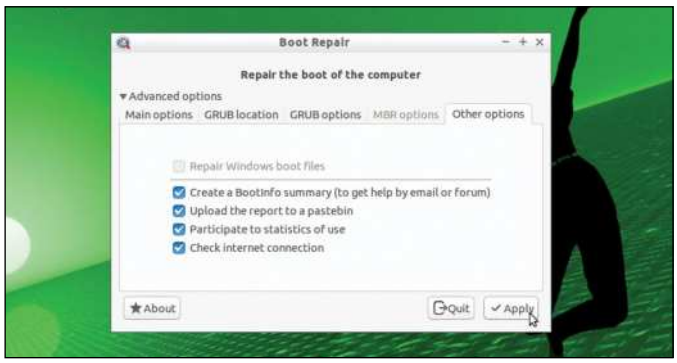
2 Grub location

This tab allows you to specify which OS to boot by default in a multi-boot setup. You can also choose to place *Grub* in its own separate **/boot** partition if you wish – typically this is only needed on encrypted disks, drives with LVM set up or some older PCs. The final option specifies which drive *Grub* itself will be placed (**sda** by default).



3 Grub options

This section opens with options for making sure *Grub* is updated to its latest version. There's also three specific error fixes offered. You can also add new kernel options to the *Grub* menu here, or purge all previous kernels before reinstalling the last one. You may even see an option allowing you to edit the *Grub* configuration file directly.



4 Other tweaks

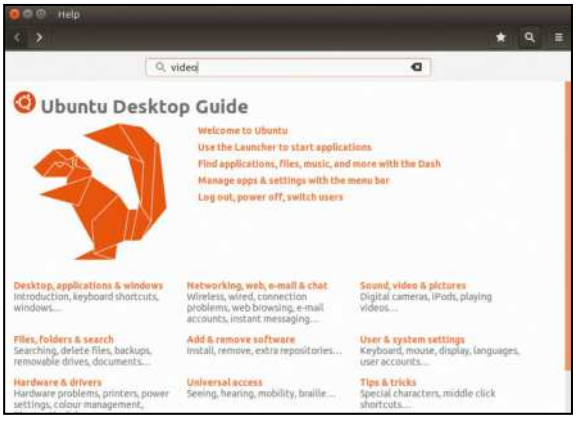
If the MBR options tab isn't greyed out, use it to restore your MBR from a backup and choose which partition gets booted from it. The final Other options tab offers an opportunity for repairing Windows files (irrelevant in most cases) and provides options for pasting a summary of your settings online for reference.

Help: How to fix problems

Something not working? Something broken? Something confusing? The Linux community is out there to dole out a little self help.

With open source and Linux much is made of community. The people that develop the software, that create the documentation, that use it and maintain it, all of these and more come together to form a community around the software. This is usually centred around the program's main website with forums, frequently asked questions, standard documentation for the software, social network accounts and more. This means that if you're having problems using a standard feature, something isn't working like it should or perhaps you even want to suggest a new feature there are places and people you can contact.

Of course, no one likes people who demand things and certainly in open source communities that is especially the case. It's not that people don't want to help, but if the question has already been answered, if you've not look to see if a bug has already been reported, or you're after details that are explained in the standard documentation then people are going to point this out first rather than help.



› Problems working out where something is? Try the built-in guide.

Using Ubuntu

Our first calling point is getting help with just using Ubuntu itself, you're going to find a lot of helpful pointers throughout this guide and we'd recommend looking out for our other Linux and Ubuntu Made Simple guides on sale in all good shops and over at **http://bit.ly/LXFspecial**. Ubuntu provides basic help, open the Dash, type Help and click the question mark.

This offers a basic guide to using different programs and parts of Ubuntu itself, alongside how to workaround and fix common problems. If you're having difficulties just using basic parts of Ubuntu this should be your first port of call. If you're having problems using specific programs within Ubuntu then you should turn your attention to the built-in help that's offered by each application itself.

You can open the built-in help by pressing F1 while using any program, and then there's the Help > Contents menu that all programs should offer. This provides the basic info you need to use individual programs. A new element of getting help with using these Ubuntu tools is YouTube, a modern trend is that many people have posted easy to follow video guides to using all aspects of Ubuntu and other Linux tools.

Terminal help

We look at the Terminal on page 60 and if you're serious about wanting to use Linux more and really get to grips with it, the Terminal is something you are going to have to use now and again. The truth is most of your Terminal use will be copying lines supplied by others, so really it shouldn't be that intimidating. With that said getting help with using the Terminal is pretty easy, it has a number of highly comprehensive help systems that we'll explain now how to use.

You can basic help on any command by typing `<command name> --help` this is a standard for Linux commands. It'll return a basic explanation of what the command does, what basic inputs it's expecting and a list of the options you can use with it, each explained in turn.

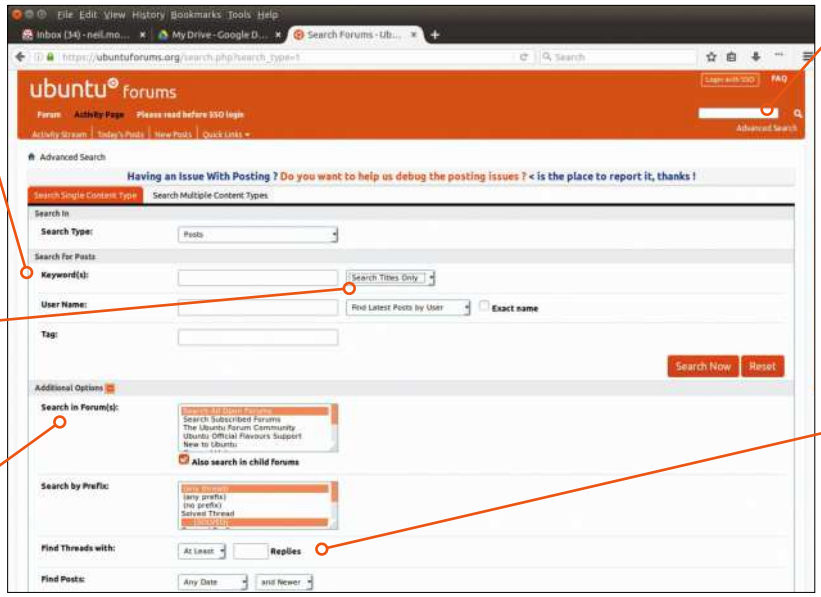
If you find you're getting too much text it's possible to pass the output through a program called less, this enables you to scroll through the text using the arrow keys and press q to quit. To do this you'd type `<command> --help | less` for a more relaxed time.

For a more in depth explanation there's the man command, just type `man <command name>` and a fuller manual will be displayed, and yes you can type `man man` to get help on man. Usefully typing man intro produces an introductory guide to using the Terminal, this includes the basics commands you will need day to day life.

An alternative and often more friendly approach is using the `info <command>` terminal option, this offers a more wordy description of what a command does, what you can use it for and what the various options are for.

› It's hard to use for beginners but there's plenty of help stored within the terminal.

Searching for help



Keywords
Use a minimal number of words, stick to the ones most relevant to your problem.

Search titles only
We suggest switching to Search titles only, this helps greatly narrow down the number of returned posts.

Search in Forum
Another excellent way to focus your search is limit it to only relevant forums here.

Forums website
Get started by heading over to **https://ubuntuforums.org** then use the top-right Advanced Search link.

Find Threads
It's worth limiting returned search to ones with at least 2 replies, it's unlikely any with less than this are useful.

Of course moving online opens up a world of potential help. For Ubuntu specifically your first stop should be **https://help.ubuntu.com** where you'll find an online version of the offline help manual you've already discovered. Clicking the Community Help Wiki link at the top will take you to a far more helpful area maintained by community contributors.

This opening page provides a list of the more popular topics such as installation, moving from another OS, basic applications and moving into help for specific types of hardware, activities and other versions of Ubuntu sometimes known as flavours. The next step is to click the Other resources section, which takes you to **https://help.ubuntu.com/community/OtherResources** area. Here you'll find links to lots of different online areas of help.

AskUbuntu is a newer system that enables people to ask one-off questions, have them answered and then have the answered ranked. It helps good answers get promoted for easier visibility, but before you post anything you should search to see if your question has already been answered.

The IRC section refers to a live chat system, but you're not able to access it directly from the website. There are web-based IRC systems such as **https://webchat.freenode.net**, you'll need to log in and join the **#ubuntu** channel, where if you're patient and polite you might find someone willing to answer your questions.

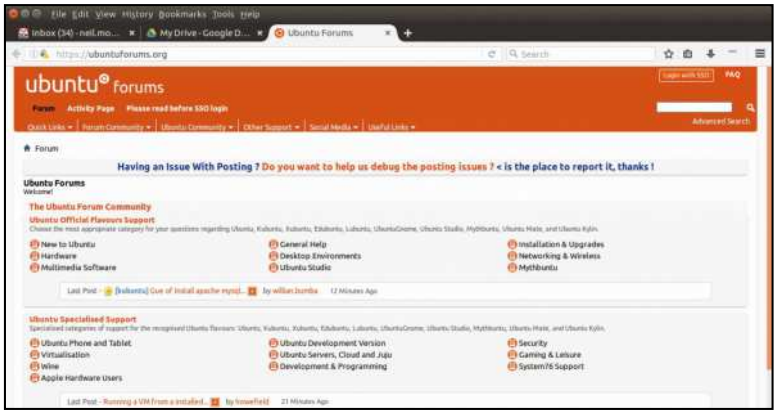
Another area you can get human support but also a huge database of fixed issues is the Ubuntu Forums over at **https://ubuntuforums.org** or from the previous Other Resources page. The Ubuntu forums have been running for over 12 years and are often the first time new users interact with other long-standing Ubuntu users. It's advised to ensure you search first to see if your problem has already been answered, this will save everyone lots of time including yourself. Of course be polite, don't repost the same problem across multiple sub-forums and try to provide as much information as possible. Stating "my screen is blank" isn't really going to help anyone.

Finding help with the forums is best done through the search tool in the top-right. You can dive into individual sections of the forum such as Installation, General Help, Hardware, but unless the issue is particularly timely or common it's highly unlikely you're going to stumble upon your specific issue very quickly. As an example the General Help forum has over 322,000 threads, each having who knows how many replies!

Clicking the Advanced Search will greatly enhance your ability to search for the problem you have, in the correct forum. Here are our top tips for a better search. To begin with, the keywords that you choose need to be the most relevant, so if you're using Ubuntu 16.10 and you're unable to write to a USB stick, limit your keywords to something like: "Ubuntu USB write error". We also strongly suggest switching the Keyword setting to Search Titles Only, rather than matching those keywords against the entirety of a post, just the title words are used.

Additionally use the Search in Forum option to limit any search to just the relevant one. Taking the last search as an example you'd like limit it to Hardware and perhaps General Help. We also suggest restricting returns to include at least two replies, which is an indicator of a useful reply. You may want to try setting the Find Posts to A Year Ago and Newer, to ensure you only get answers that are only a year old.

Of course you're able to search more generally through Google or similar search engines. You'll find plenty of help in many forums all over the internet, so keep searching and asking you'll find friendly people we promise.



The Ubuntu Forums are the best place to get help on all manner of issues.

Dozens of step-by-step tutorials for beginners and seasoned pros alike

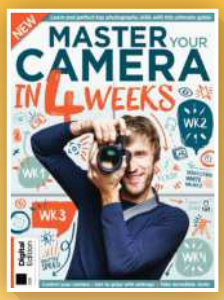
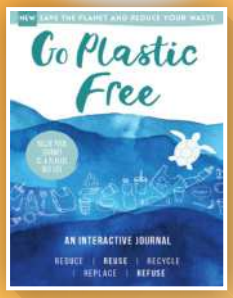
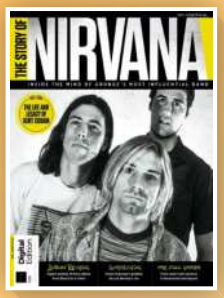
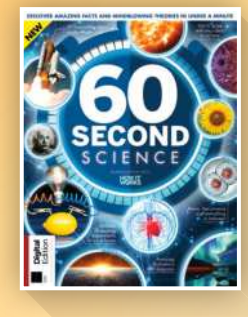
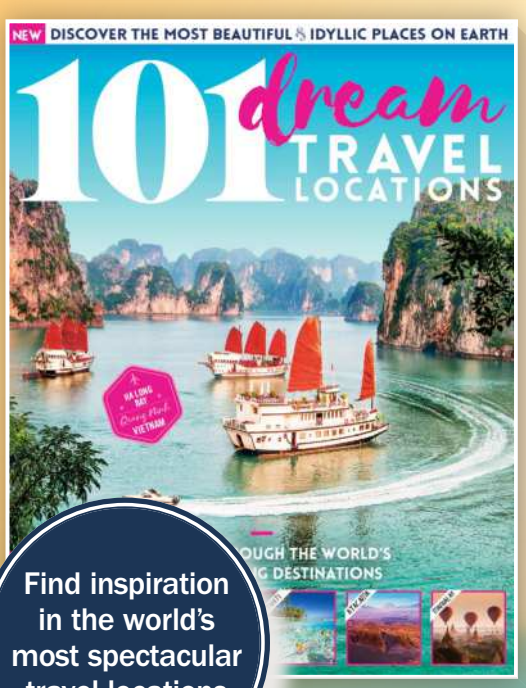


Chart the rise of Hitler and learn how he set Germany on the path to war









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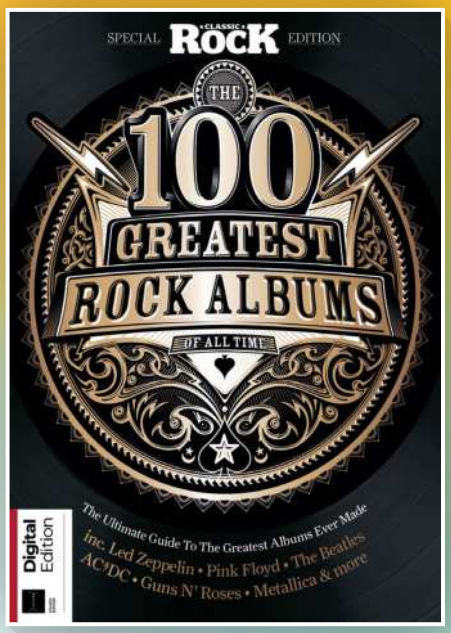

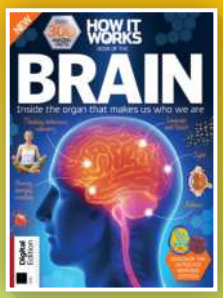

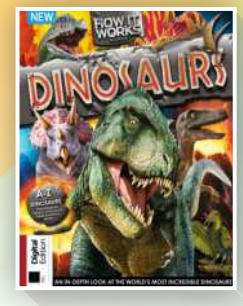

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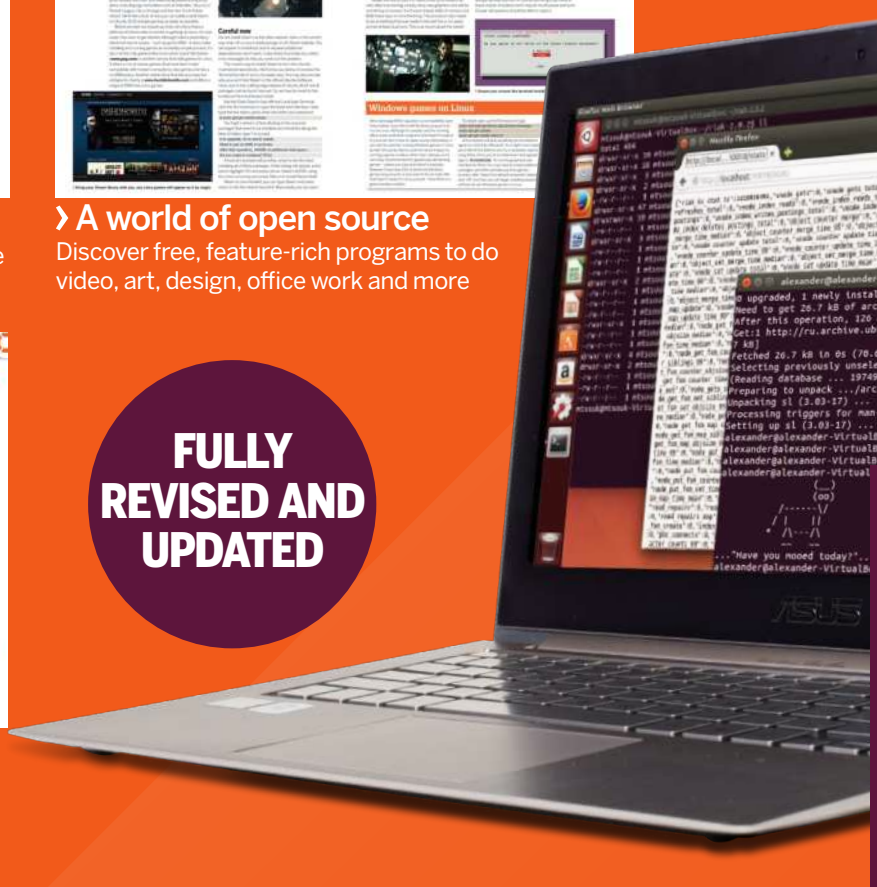

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