

Mike McGrath

6th  
Edition

# Linux

fully illustrated using Linux Mint

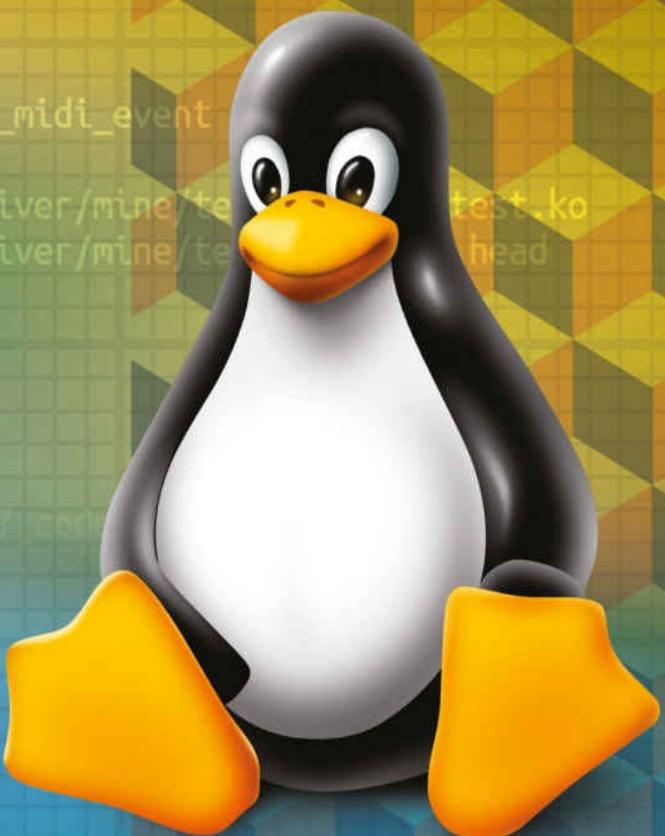
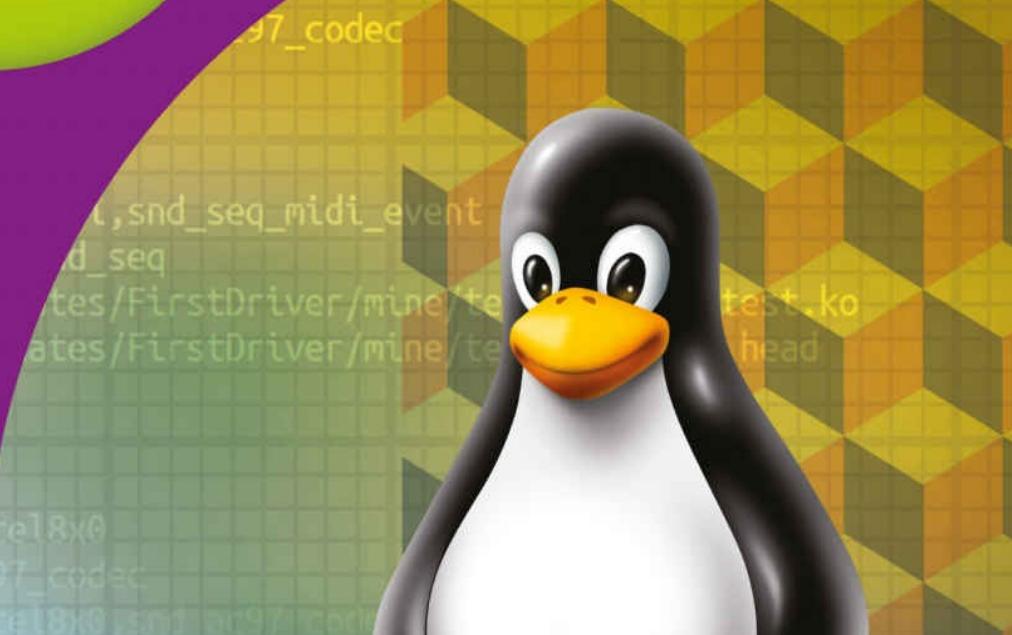
in  
**easy steps**

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IN FULL COLOR



Mike McGrath

# Linux



6th Edition  
Illustrated using Linux Mint

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Sixth Edition

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Guess what? Wheels have been round for a really long time, and anybody who “reinvents” the new wheel is generally considered a crackpot. It turns out that “round” is simply a good form for a wheel to have. It may be boring, but it just tends to roll better than a square, and “hipness” has nothing whatsoever to do with it.

**Linus Torvalds, creator of the Linux kernel**

# **Getting Started**

*This chapter introduces the Linux operating system and describes a typical installation procedure.*

**Introducing Linux**

**Choosing a Distro**

**Providing Disk Space**

**Creating Boot Media**

**Starting a Live Session**

**Beginning Installation**

**Completing Installation**

**Enabling Backups**

**Summary**

# Introducing Linux

Linux is a computer operating system that can run on a variety of hardware including the popular Intel system found on most desktop computers. It is a modern derivation of the powerful Unix operating system that was introduced way back in 1969. In recent years the popularity of Linux has increased dramatically as computer users have discovered its many benefits:



This penguin is “Tux” – the happy Linux mascot.

- Linux is released under the GNU General Public License that ensures it remains free to all users – no-one can charge for this operating system so you will never have to pay for it. It’s available as a free download on the internet, but you may have to pay a distribution charge if you prefer a copy on CD/DVD.
- Access to the source code of Linux is unrestricted and it may be changed. This has allowed thousands of programmers around the world to refine the code to improve performance.
- Linux is truly a multi-user, multi-tasking operating system that allows multiple users to simultaneously work with multiple applications without experiencing any traffic problems. Many of the world’s web servers run on Linux for this very reason.
- Linux is an extremely stable operating system – continuous uptimes of more than a year are not uncommon. It can be upgraded “on the fly” so it only needs a reboot to add hardware.
- There are a large number of quality applications available to run on the Linux platform. These are comparable to commercial applications that run on other operating systems but, like Linux, these too are free of charge. For instance,

the free LibreOffice suite offers similar functionality to the commercial Microsoft Office suite.

- With open-source software an administrator can know exactly what a program can do and the security dangers it presents. An open-source application cannot secretly gather information about the user or send confidential information to third parties.



Pronounce the name Linux with a short “i” – so it’s “li-nucks”, not “lie-nucks”.



Many web servers are said to have a “LAMP” configuration – an acronym for Linux, Apache, MySQL, PHP, which combines operating system, web server, database, and server-side scripting.

# The Evolution of Linux

In 1983 a visionary programmer named Richard Stallman began a movement called the GNU Project. Its philosophy was that software should be free from restrictions against copying or modification in order to make better and more efficient programs. This inspired programmers around the world to create programs driven by efficiency rather than by financial incentive.

By 1991 the GNU Project had created a lot of software tools including the GNU C Compiler written by Stallman himself. At that time many of these tools were incorporated into a Unix-compatible operating system by a 21-year old student at the University of Helsinki. His name was Linus Torvalds and he named the operating system Linux (Linus – Unix).



The term “GNU” is a recursive acronym for GNU’s Not Unix.

Linux was made available for download on the internet so other programmers could test and tweak the source code, then return it to Linus Torvalds. After a period of enthusiastic development, Linux 1.0 was made available globally under the GNU General Public License, which ensured it would remain free.



Discover more about the GNU General Public License online at [gnu.org/licenses/gpl.html](http://gnu.org/licenses/gpl.html)

Programmers were keen to explore Linux and soon found some amazing uses for it. In April 1996, researchers at Los Alamos National Laboratory used Linux to run 68 PCs as a single parallel processing machine to simulate atomic shock

waves. At \$150,000 this supercomputer cost just one-tenth the price of a comparable commercial machine. It reached a peak speed of 19 billion calculations per second, making it the 315th most powerful supercomputer in the world. It proved to be robust too – three months later it still didn't have to be rebooted.

Linux continued to grow in popularity as a text-based operating system, while Windows became the dominant graphical desktop operating system. Recognizing that most PC users want the point-and-click convenience of a graphical environment, the Linux camp began to develop a system comparable to the Windows desktop.

From a handful of enthusiasts in 1991 to millions of users now – Linux has come of age. Today's sleek K Desktop Environment (KDE) and the Gnome desktop environment now offer a user-friendly alternative for Windows users – Linux for the desktop!



Discover more about the Gnome desktop online at [gnome.org](http://gnome.org)

## Choosing a Distro

At the very heart of Linux is a bunch of tried-and-tested compiled code called the “kernel”. The kernel provides the operating system with its core functionality, much like the engine in a car. It takes care of the basics, such as helping other programs access hardware and sharing your computer’s processor among various programs.

In addition to the kernel, Linux contains a number of system-level programs, such as the services to handle your email, web connection and bootloader. Consider these as a car’s transmission, gears, and chassis – without these, the engine is not much use.

Linux distributions generally also include a large number of user-level programs – the applications for daily use: for instance, web browsers, word processors, text editors, graphics editors, media players, and so on. These are the finishing touches to the car that ensure a great ride – whitewall tires and soft leather upholstery.

All of these components are bundled together in a wide variety of Linux distribution packages, commonly referred to as “distros” – just as all the components of a car are bundled together to make a complete car.

In the same way that there are many makes and models of cars, there are many Linux distros to choose from. Some of the best known distros are RedHat, Fedora, SUSE, Ubuntu, and Mint. Each distro has its own installer and unique default configuration according to what the distributor considers to be the best arrangement. The ideal one for you will depend on your own personal preferences and how you want to use Linux. The most popular distros are described below to help you choose:



Most Linux distros are available as a “live” version that lets you run Linux from a disk – so you can try it out without installing Linux onto your hard drive.

## RedHat Fedora

One of the most publicized Linux distros, comprising the commercial RedHat Enterprise Linux product line and the free Fedora distro that is developed by the Fedora Project community. There are several editions of the Fedora distro – “Workstation” for PCs, “Server” for servers, and “Atomic” for cloud computing.

**Pros:** Widely used, excellent community support, innovative.

**Cons:** Limited product life-span of Fedora editions, poor multimedia support.

Free download from [getfedora.org](http://getfedora.org)



“Choose Freedom. Choose Fedora.”

## Novell SUSE

The community-based “openSUSE” distro, sponsored by Novell, is another distro with desktop focus that has received positive reviews for its installer and YaST configuration tools. The documentation, which comes with the boxed product, has been labeled as the most complete, thorough and usable by far. This distro provides the base for Novell’s award-winning SUSE Linux Enterprise products.

**Pros:** Attention to detail, easy-to-use YaST configuration tools.

**Cons:** Huge distro – including over 1,500 bundled packages.

Free download from [opensuse.org](http://opensuse.org)



“The makers’ choice for sysadmins, developers and desktop users.”

## Ubuntu

This sophisticated community distro typically employs the popular Gnome GUI desktop manager. It has the advantage of a fixed six-month release cycle, and every two years there is an LTS (Long Term Support) release that is supported for five years. There are several editions of the Ubuntu distro – “Desktop” for PCs, “Server” for servers, and “Core” for IoT (Internet of Things) devices. The default interface of the Ubuntu Desktop edition is quite different to that of the Windows desktop.

**Pros:** Great community, and fixed release cycle.

**Cons:** The interface will seem unfamiliar to Windows users.

Free download from [ubuntu.com](http://ubuntu.com)



“Fast, secure and simple, Ubuntu powers millions of PCs worldwide.”

## Linux Mint

A modern, elegant operating system that is easy to use. It is based on the Ubuntu operating system and works straight out of the box, with full multimedia support. All Linux Mint distros are LTS releases that appear shortly after each Ubuntu LTS release, and are supported for five years. Users are encouraged to send feedback so their ideas can be used to improve Linux Mint. This operating system typically employs the Cinnamon GUI desktop manager, which will feel familiar to those moving from the Windows operating system. For that reason, Mint is used throughout this book to demonstrate the features of a Linux operating system.

**Pros:** Great community, and the interface will seem familiar to Windows users – the best distro for beginners.

**Cons:** Ubuntu has a larger community of users. Free download from [linuxmint.com](http://linuxmint.com)



“Linux Mint. From freedom came elegance”.

# Providing Disk Space

An operating system is installed on an area of the hard disk drive called a “partition”. When Windows is the only installed operating system its partition will normally occupy the entire hard drive. To install Linux in this situation there are three possible options:

- **Delete the Windows partition** – replacing it with Linux partitions that occupy the entire drive. This option will delete the Windows operating system along with all the applications and data files. It creates a dedicated Linux computer that will immediately start Linux when the PC gets switched on.
- **Reduce the Windows partition size** – so that it no longer occupies the entire drive, then create Linux partitions in the resulting free space. This option will retain the Windows operating system, applications and data files. It creates a “dual-boot” computer that allows the user to choose whether to start Linux or Windows whenever the PC gets switched on.
- **Add a second hard drive to the system** – this allows Linux partitions to occupy the entire second drive and retains the Windows operating system, applications and data files on the first drive. It too creates a dual-boot computer that allows the user to choose whether to start Linux or Windows whenever the PC gets switched on.



A **Hard Disk Drive** (HDD or simply “hard drive”) can be partitioned into one or more regions so that the operating system can manage each region separately.

The option to install an additional hard drive for Linux is a popular choice for many people as they have often upgraded their original hard drive to a larger one, and so have their original drive spare. It also has several benefits over the other options:

- The free space on the Windows drive is not reduced.
- It removes the risk of data loss through partition resizing.
- The familiar Windows operating system is retained.
- It distinctly separates the two operating systems.
- Drive failure would only disrupt one operating system.



Resizing partitions is a scary process where data loss can, and does, occur – even in expert hands. All contents of the partition must be backed up before attempting this operation.

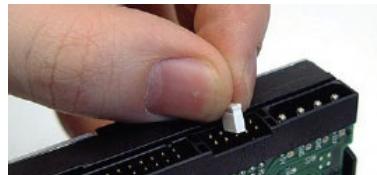
# Adding a Second Hard Drive

Most modern PCs can accommodate up to four EIDE (Enhanced Integrated Device Electronics) devices, such as hard drives and optical CD/DVD drives, but typically ship with just two – one hard drive and one optical drive. This means that more drives can be added by plugging them into the existing system.

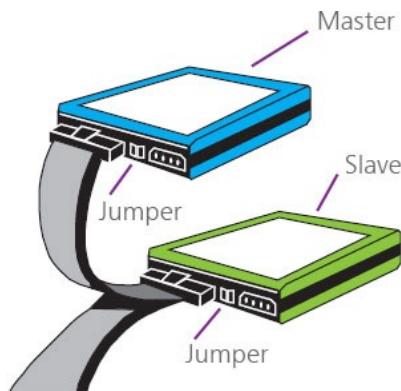
The first hard drive in a system is known as the “Master” drive and a second hard drive is called the “Slave” drive.

A “jumper” connects two tiny pins to determine if the drive should be regarded as a Master (MA) drive or Slave (SL) drive. The top of each hard drive usually has a diagram depicting which pins need to be connected in each case.

- 1 Ensure that the jumper on the original drive is set to Master, then set the jumper on the second drive to Slave



- 2 Connect the wide SATA data cable to the Master drive, by the plug at the end of the cable – not the plug part way along the cable



- 3 Now, connect the SATA data cable to the Slave drive, by the plug part way along the cable

- 4** Connect the power cables to both drives, then close the PC case
- 5** Start up the PC and check that both drives are now detected by the system – if the second drive is not detected, you may need to change the boot settings to “auto-seek” it when booting up



If you are not comfortable working inside your PC case, a computer store should be pleased to undertake the fitting of a second drive for a modest fee.



SATA (Serial Advanced Technology Attachment) is the standard for connecting devices such as hard drives and optical drives to the PC's motherboard.

# Creating Boot Media

The Linux Mint distro is available in three editions, with desktop environments called “Cinnamon”, “MATE”, and “Xfce” respectively. The most popular version is the Cinnamon edition that will be used throughout this book. It can be downloaded onto a USB flash drive to create “boot media”. This lets you try out Linux without making changes to your system, and lets you install Linux onto your system if desired. But first you will need to ensure your system meets these minimum requirements:



USB Flash Drive – also variously known as Thumb Drive, Pen Drive, Disk Key, Gig Stick, or Memory Stick.

- **1GB of RAM** (2GB preferred)
- **15GB of disk space** (20GB preferred)
- **1024 x 768 screen resolution**

Like other Linux distros, the Linux Mint download is an ISO image file whose content must be “burnt” onto the USB flash drive (not merely copied onto it) to create the boot media:

- 1 Launch a web browser, then navigate to the download page [linuxmint.com/download.php](http://linuxmint.com/download.php)
- 2 Next, click on the **Cinnamon 64-bit** link

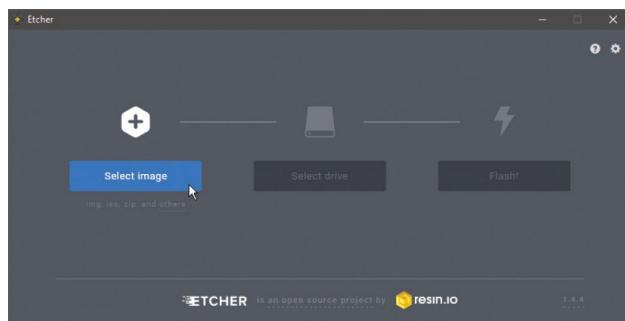
Download links				EDITION
Cinnamon	<a href="#">32-bit</a>	<a href="#">64-bit</a>		An edition featuring the Cinnamon desktop
MATE	<a href="#">32-bit</a>	<a href="#">64-bit</a>		An edition featuring the MATE desktop
Xfce	<a href="#">32-bit</a>	<a href="#">64-bit</a>		An edition featuring the Xfce desktop

- 3** Now, click a **Download mirror** link in your country from the list that appears
- 4** Choose to save the ISO image file in a preferred location on your system to begin the download
- 5** When the ISO download has completed, you now need an app to burn the image onto the USB flash drive. Linux Mint recommends the **Etcher** app. Navigate your web browser to [etcher.io](https://etcher.io) and download the installer for your system. For example, “Download for Windows x64”



The 32-bit versions are only provided for compatibility with older computers – typically those manufactured before 2008. You should generally download the 64-bit version. If your computer is not compatible you will simply see an error message – no harm will be done.

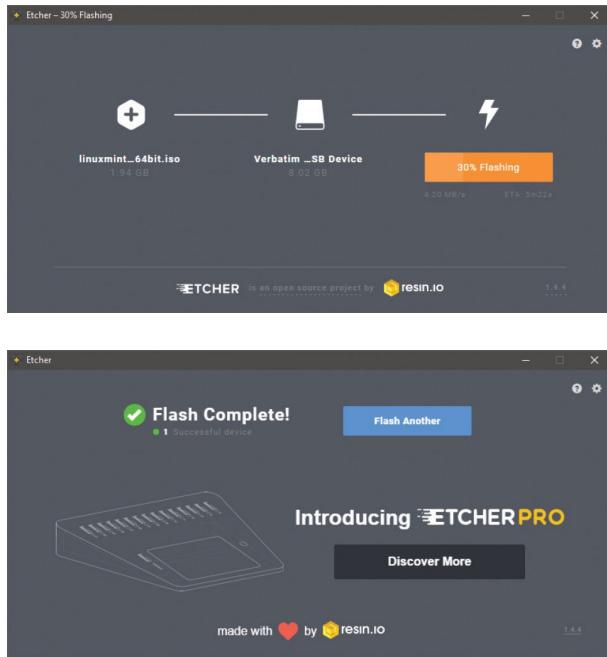
- 6** When the installer download has completed, run its **Setup** wizard to install Etcher on your system
- 7** Next, connect a USB flash drive to your computer
- 8** Now, start the Etcher app and click the **Select image** button, then select the ISO image file you downloaded



- 9** Click the **Select drive** button, then select the USB flash drive you connected to your computer

10

Click the **Flash!** button to burn the contents of the ISO onto the USB flash drive – creating the Linux boot media



If you wish to verify the ISO image file (recommended) you can find instructions on how to do so at [linuxmint-installation-guide.readthedocs.io/en/latest/verify.html](https://linuxmint-installation-guide.readthedocs.io/en/latest/verify.html)

## Starting a Live Session

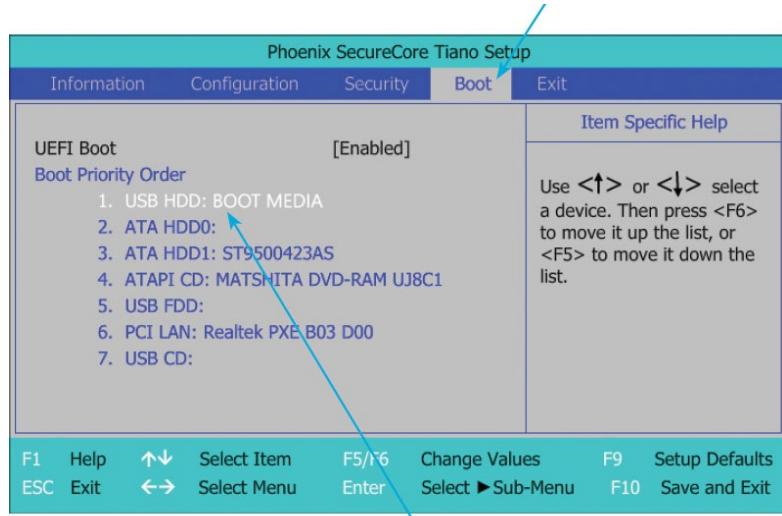
Having created the boot media, by following the steps [here](#), you now have the ability to run Linux Mint in a “Live Session”. This means you can safely explore the Linux operating system on a PC where Windows is already installed on the hard drive as its operating system.



The UEFI (Unified Ex~~tensible~~ Firmware Interface) in modern PCs replaces the BIOS (Basic Input/Output System) firmware interface in earlier PCs. These control how your PC boots up.

In order to begin a Linux Live Session your PC must be able to boot up from the USB flash drive containing the boot media. This requires the PC’s boot settings to seek instructions from the USB flash drive before seeking instructions on the hard drive. If your PC looks to boot from the hard drive first, you will need to change the settings:

- 1 Consult your PC’s documentation to discover how to access its **Setup** utility. This often requires you to press the F2 key while starting the PC – but it does vary
- 2 Connect the USB flash drive boot media to your PC
- 3 Start up your PC and enter the Setup utility
- 4 Select the section relating to the PC’s **Boot** process



- 5 Make the flash drive (USB HDD) the first boot device by following the Setup utility's **Help** instructions

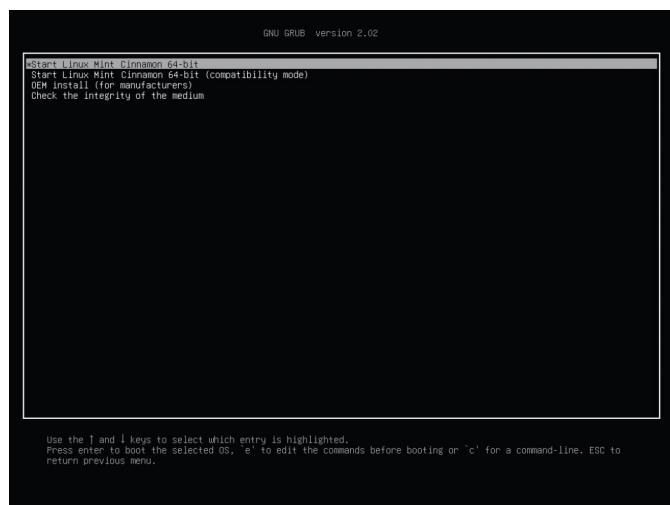


The Setup utility is unique to your PC, so its appearance will probably differ from the one shown here. Most PCs will, however, provide a way to change the Boot Priority Order so you can boot the PC from the USB flash drive.

- 6 Save the new settings and exit the Setup utility – typically by pressing the F10 key
- 7 If your PC is configured to boot in legacy BIOS mode, Linux Mint will now automatically start a Live Session



If your PC is configured to boot in UEFI mode, you will be presented with a menu. Select the “Start Linux Mint” option, then hit the **Enter** key to start a Live Session



When there is an option to choose between UEFI boot mode and legacy BIOS mode, UEFI offers several advantages – UEFI supports large hard drive partitions, has secure booting, and provides efficient system management.



You may also see “UEFI” referred to as “EFI” – UEFI is simply EFI 2.0.

# Beginning Installation

Having started a Live Session by following the steps [here](#), you can try out the Linux Mint operating system. It will perform in a similar manner to when it is permanently installed on the hard drive, but with these notable exceptions:

- **The Live Session is slower** – it is loaded from the USB flash drive, rather than quickly from a hard drive.
- **Changes are not permanent** – they are not saved on the USB flash drive, or written anywhere on your PC.
- **Some apps behave differently** – system utilities, such as the Update Manager, cannot be used effectively.

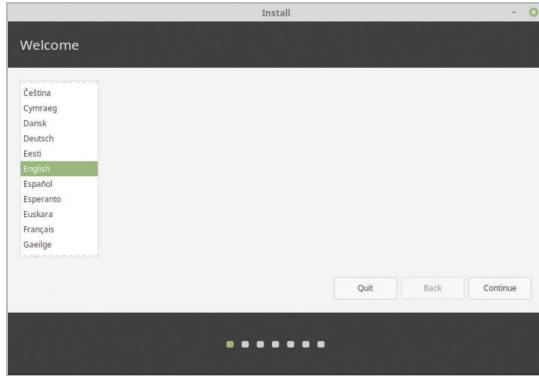
The Live Session provides an installer icon on the Desktop that can be used to begin permanent installation of Linux Mint:



This book features Linux Mint version 19 (Tara) Cinnamon throughout. This version has Long Term Support until 2023.

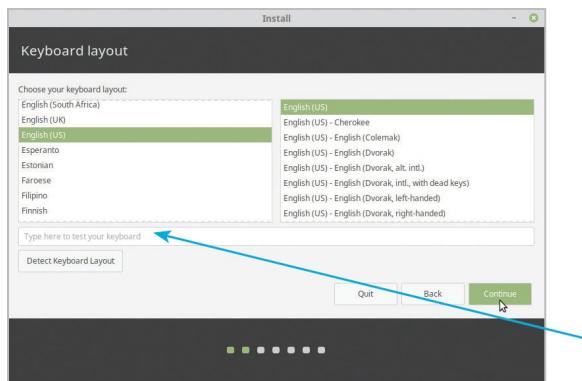
1

- Double-click on the “Install Linux Mint” icon to launch the installer wizard



The username in a Live Session is “mint”. If asked for a password just hit the **Enter** key.

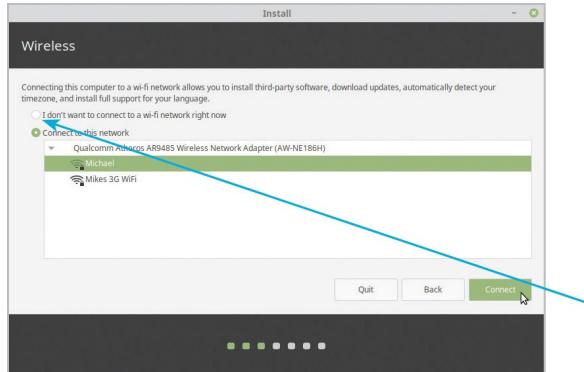
- 2 On the “Welcome” screen, select your preferred language, then click the **Continue** button
- 3 On the “Keyboard layout” screen, select your layout, then click the **Continue** button



If you are unsure of the keyboard layout you can type into this box and let

the installer figure it out.

- 4 On the “Wireless” screen, select your preferred network, then click the **Connect** button. Enter your password then click **Connect** again



You can choose the alternative option here to proceed without connecting to a network.

- 5 On the next screen, check the box to install codecs, then click the **Continue** button

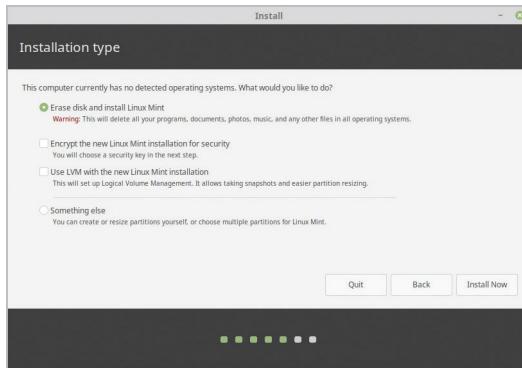


Third-party codecs are required for multimedia support in certain apps.  
You are almost certainly going to want them.

# Completing Installation

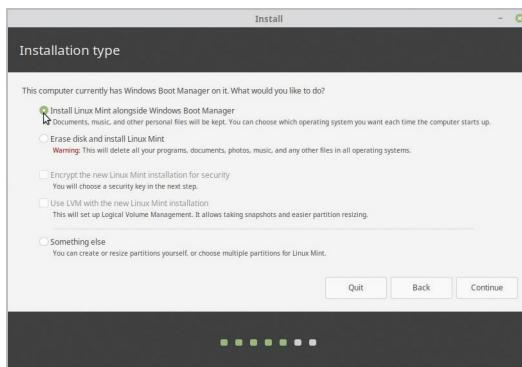
- 6 On the “Installation type” screen...

If you want this to be the only operating system on your PC, select **Erase disk and install Linux Mint**



OR

If Windows is installed and you also want to keep that on your PC, select the option to **Install Linux Mint alongside Windows Boot Manager**



If you choose to retain Windows alongside Linux Mint, the installer will automatically resize the Windows operating system then install Linux Mint in the free space created. A boot menu will appear so you can choose between operating systems whenever you start your PC – a “dual-boot” setup.

- 7 After choosing the installation type in either case, click the **Install Now** button to proceed



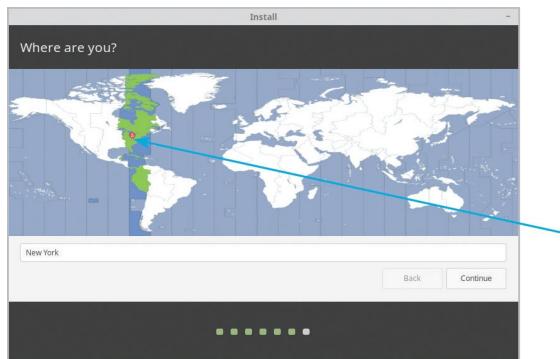
New users should avoid choosing the **Encrypt** and **LVM** options here as they can cause problems.



Advanced users can choose to manage disk partitions by choosing the **Something else** option here. Linux Mint requires one partition to be mounted on the root/directory. The operating system occupies around 15GB so this partition should ideally be 100GB+. The ext4 Linux filesystem is recommended. A swap partition is also required as a memory buffer, and this should be of equal size to the amount of RAM in your PC.

8

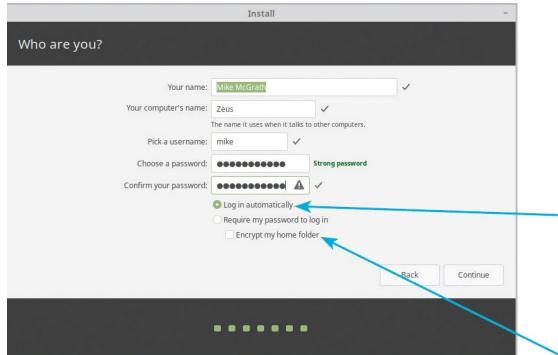
On the “Where are you?” screen, select your timezone then click the **Continue** button



Simply click your approximate location on the global map to select your

timezone.

- 9 On the “Who are you?” screen, enter your details then click the **Continue** button to install system files



If you are the only user of the PC you can select the option to **Log in automatically** so you will not be asked for your password whenever you start Linux Mint. You may also select the **Encrypt my home folder** option if you are concerned about security.

- 10 Enjoy the slideshow while Linux Mint gets installed, then upon completion click the **Restart Now** button



# Enabling Backups

Having completed the installation process, by following the steps on the previous pages, Linux Mint will launch to your Desktop. Before you start using the operating system it is recommended you enable the “Timeshift” backup utility. This is like “System Restore” on Windows and will allow you to restore the operating system to an earlier backup should any problems arise:



Timeshift Utility

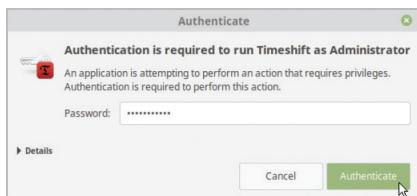
1

Click on **Menu (“Start” button), Administration, Timeshift**



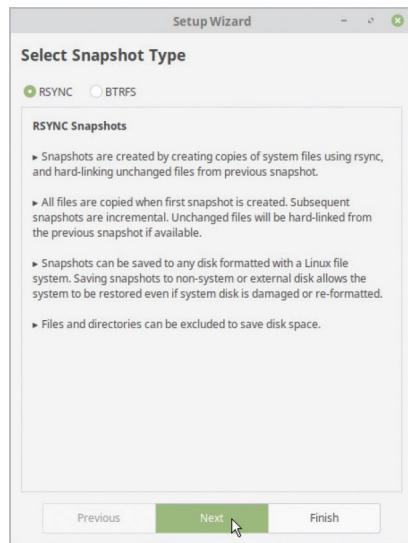
2

Next, enter the password you chose in the “Who are you?” dialog during the installation process, then click the **Authenticate** button



3

Now, select the “RSYNC” option, then click the **Next** button



The “Timeshift” utility is a new feature that was introduced in Linux Mint version 19 (Tara).



“RSYNC” is a disk-based backup system that only backs up what has changed since the previous backup.

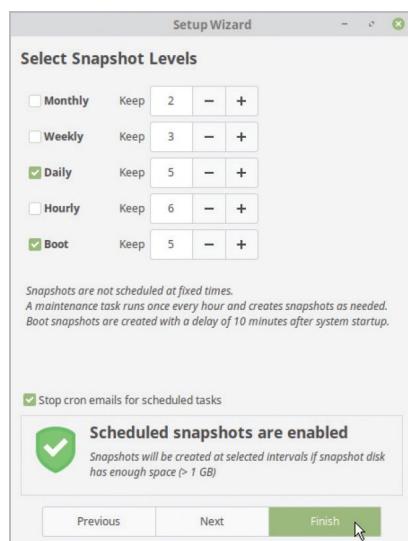
4

Select the device on which you want the system backup snapshots to be saved, then click the **Next** button. (Here, the chosen device is an external hard drive that is connected, but you could alternatively connect a USB flash drive and choose that device)



5

Select the frequency for when you would like system backup snapshots to be saved on your chosen device, then click the **Finish** button



6

Re-open Timeshift in the future and select a saved backup snapshot, then click the **Restore** button to restore your Linux Mint system





Do not choose your main hard drive as the location at which to save backup snapshots – this would not help you if your hard drive fails.



Backup snapshots are saved in a newly-created **timeshift** directory at the root level on the chosen device. Boot snapshots are performed in the background so do not affect the speed at which the system boots.

# Summary

- **Linux** is a free, stable multi-user operating system that is derived from the powerful Unix operating system.
- The name “Linux” combines letters from the first name of its originator, **Linus** Torvalds, with the final letter of **Unix**.
- Both **KDE** and the **Gnome** desktop are user-friendly graphical user interfaces, providing the same point-and-click convenience of the Windows desktop.
- The **kernel** provides the core functionality of Linux.
- Linux **distros** bundle the kernel, system-level programs, and free user-level programs in a variety of combinations.
- The most popular Linux Mint distro employs the **Cinnamon** desktop manager, and is the best distro for beginners.
- Minimum hardware **requirements** to run Linux Mint are 1GB of RAM, 15GB of disk space, and a screen resolution of 1024 x 768 – but higher specifications will perform better.
- A second **hard drive** can easily be added to a PC so it can dual-boot to Linux or Windows.
- A Linux distro can be downloaded and burned as a filesystem image onto a USB flash drive to create **boot media**.
- In order to boot from a USB flash drive it may be necessary to change the boot device order using the boot **Setup Utility**.
- A **Live Session** lets you try out most features of Linux Mint before installation, and also provides an installer.
- The Linux Mint **installer** allows you to install Linux as the sole operating system, or install it alongside Windows.
- Before you start using the Linux Mint operating system it is recommended you enable the **Timeshift** backup utility so you can restore your system should problems arise.

# Exploring the Desktop

*This chapter describes the Linux Mint interface, explains how to use it, and demonstrates how to customize it.*

[Meeting the Interface](#)

[Configuring the Desktop](#)

[Adding Desklets](#)

[Adjusting the Taskbar](#)

[Launching Apps](#)

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## Meeting the Interface

When you start up the Linux Mint operating system, the first thing you see while the system begins loading is a black screen displaying the operating system name and version number:



Linux Mint version 19 – codename “Tara”.

Unless you selected the option to “Log in automatically” during the installation process (see [here](#)), the next thing you see is the **Log in** screen shown below:

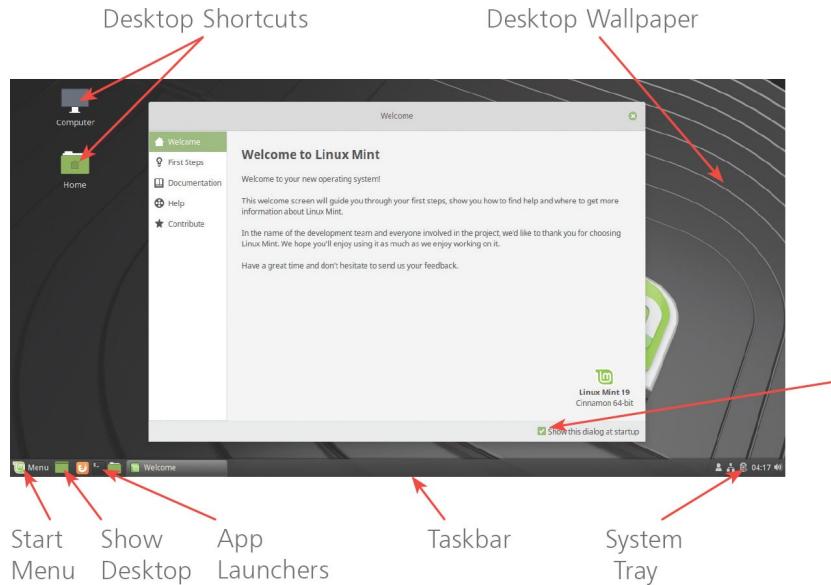


You can now enter the password you chose, then click the arrow button that appears in the password box (or hit the **Enter** key) to log in to the Linux Mint operating system.



The current time is also shown at the top right of the **Log in** screen. Hover your mouse cursor above the time to see the current date appear in a pop-up **Tooltip** box.

After you log in to Linux Mint, whether via the **Log in** screen or by choosing the automatic option, the **GUI (Graphical User Interface)** Desktop and Taskbar will appear, as shown below:

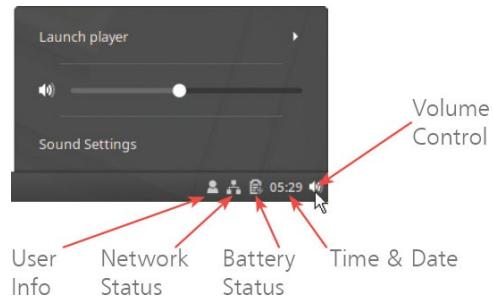


The **Welcome** dialog provides helpful information for new users. Uncheck this option if you don't want to see this dialog again. Click the X button in the top right of any window to close that window.

If you have experience of the Windows operating system, the Linux Mint Desktop will seem familiar – as is the intention.

# System Tray

The System Tray contains, by default, five icons that provide access to useful features when you click on the icon:

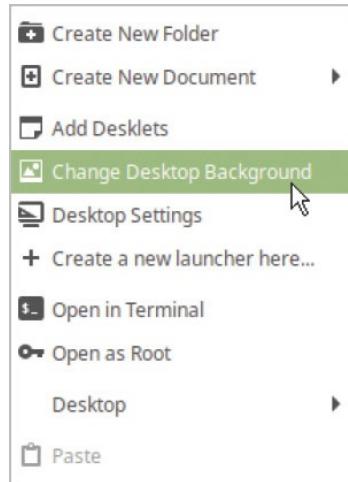


Hover your mouse cursor above any System Tray icon to see information appear in a pop-up **Tooltip** box.

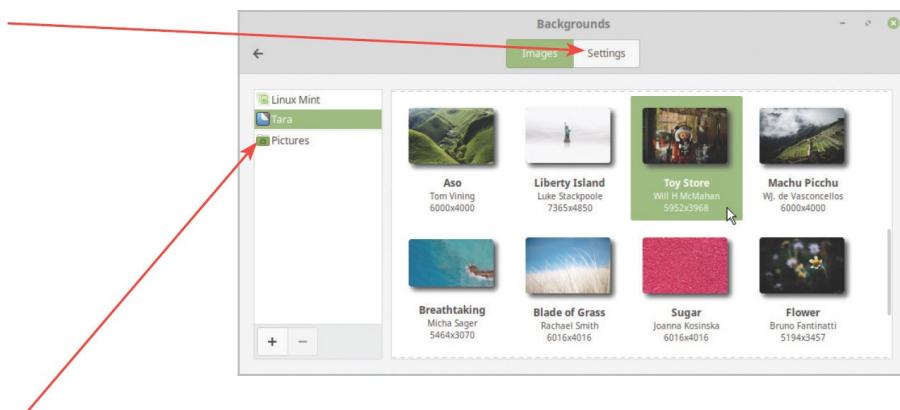
# Configuring the Desktop

One of the first changes many people want to make to their Linux Desktop is to the background “wallpaper” of the Desktop:

- 1 Right-click anywhere on the Desktop wallpaper – to open a context menu
- 2 On the context menu, select the **Change Desktop Background** option – to open a “Backgrounds” settings window



- 3 Choose **Tara** in the left-hand pane – to see a selection of wallpaper images appear in the right-hand pane





You can click the **Settings** button to adjust how the image fits your Desktop, or to choose a background color instead of an image.



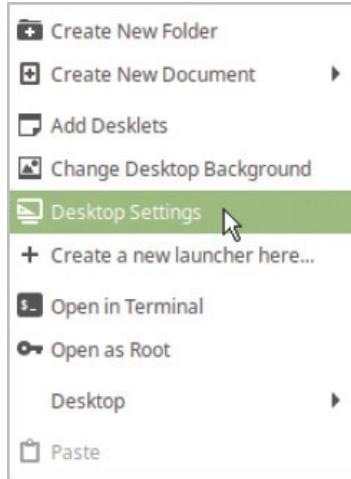
You can also click on the **Pictures** folder to choose one of your own images.

- 4 Scroll down and click on any image – to see it instantly applied as background wallpaper on your Desktop



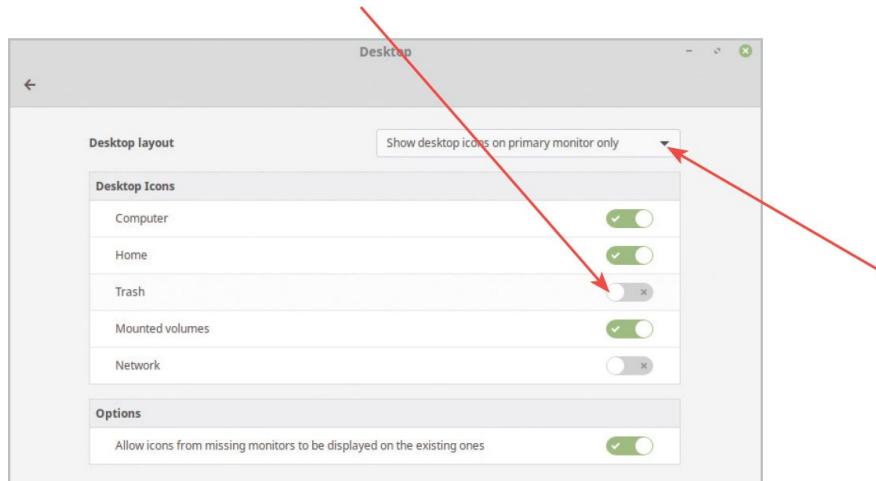
If you are used to seeing the “Recycle Bin” icon on the Windows Desktop, or would simply like to restore deleted files easily, you will want to see the “Trash” icon on Linux Mint’s Desktop:

- 1 Right-click anywhere on the Desktop wallpaper to open the context menu and select **Desktop Settings** – to open a “Desktop” settings window



2

See that the toggle switch for the **Trash** icon is in the “Off” position



You can select options from this drop-down list for dual monitor setups and to hide all Desktop icons. Your selection of “On/Off” settings will be remembered for the next time you choose to show all Desktop icons.

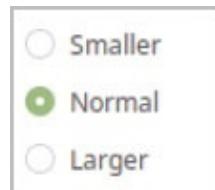
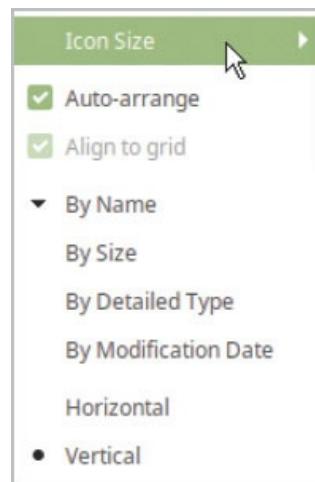
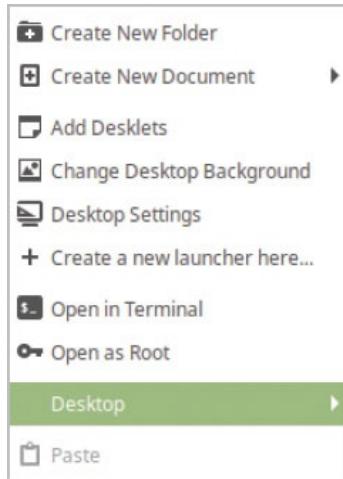
3

Slide the toggle switch to the “On” position to see the Trash icon now appear on the Desktop



4

To adjust the Desktop icons, right-click on the Desktop and expand the **Desktop** option



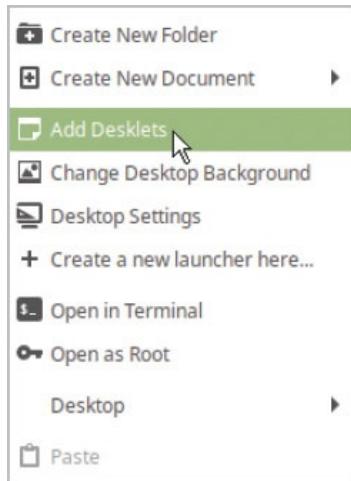
5

Select your preferred icon size and arrangement from the options

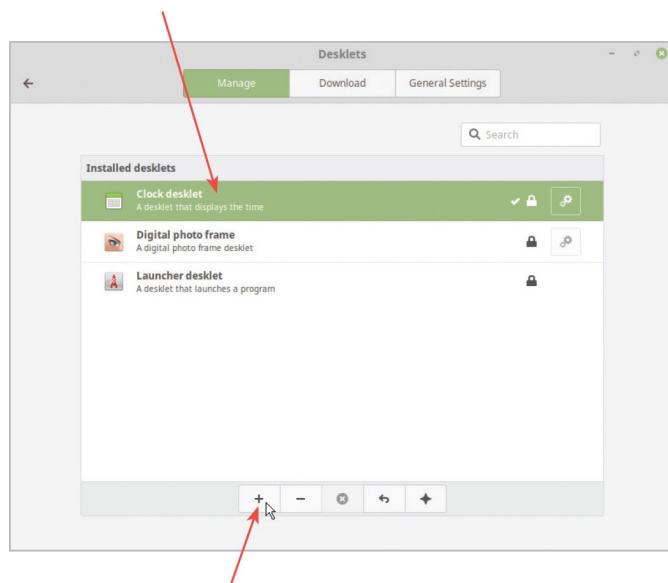
# Adding Desklets

Linux Mint offers a number of small apps (“applets”) that run on the Desktop. These are similar to the Desktop widgets you may have seen in Windows but are called “Desklets” (Desktop applets) in Linux Mint. Three desklets are installed as standard, and you can download many more:

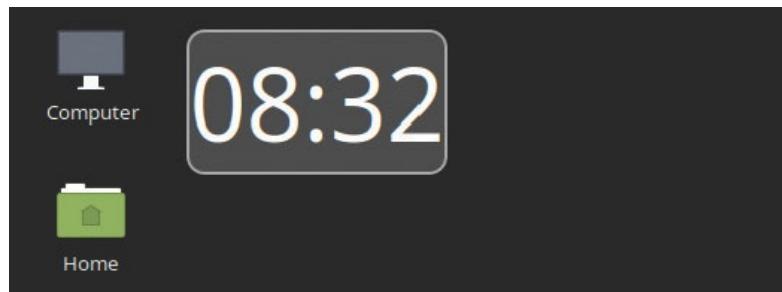
- 1 Right-click anywhere on the Desktop wallpaper to open the context menu, then select **Add Desklets** – to open a “Desklets” settings window



- 2 Next, select an installed desklet, such as the **Clock desklet**



- 3** Now, click the **+ Add** button to instantly add the desklet to your Desktop

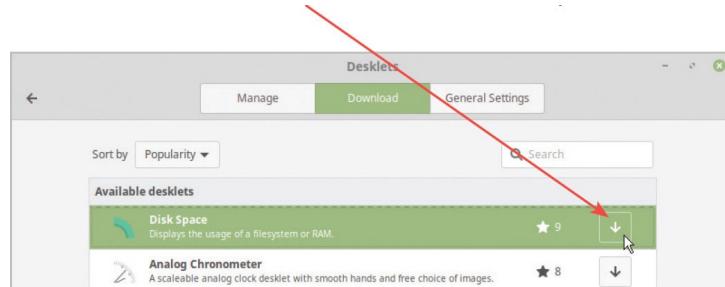


You can click the **General Settings** button in the Desklets window to modify width and decoration aspects of your desklets.

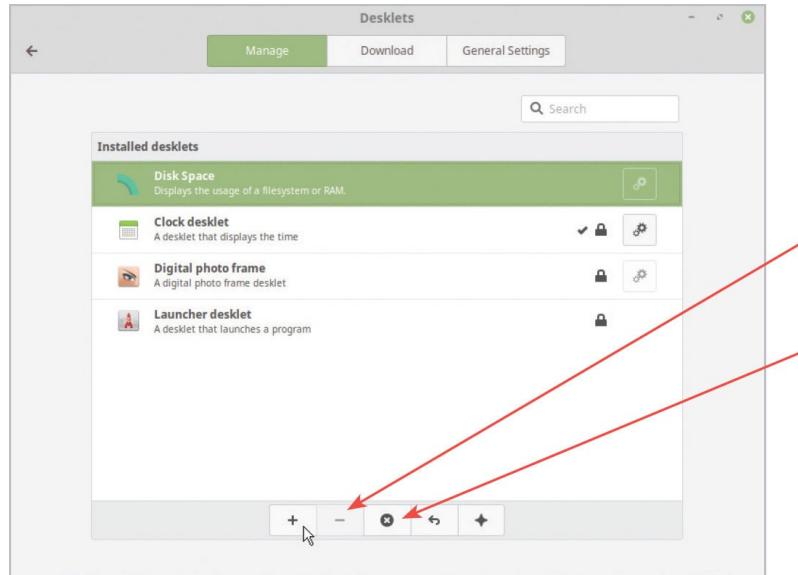


You can drag desklets around the Desktop to arrange them to your preference.

- 4** Click the **Download** button, then choose a desklet and click the down arrow button to install it on your PC



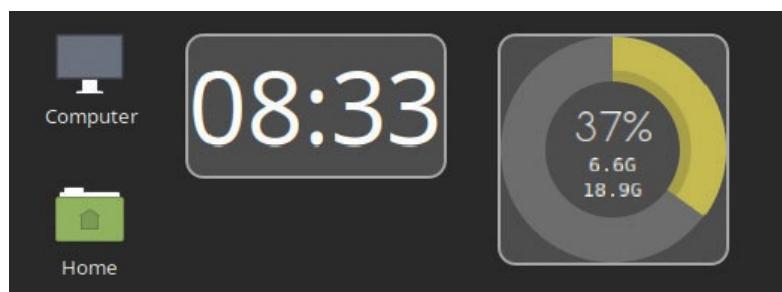
- 5** Click the **Manage** button to see your chosen desklet has been added to the list of installed desklets



Click the - button to remove a selected desklet from the Desktop, or click the x button to uninstall a selected desklet.

6

- Select the newly-installed desklet, then click the + Add button to instantly add it to your Desktop



When you select the **Download** button a dialog might advise you that

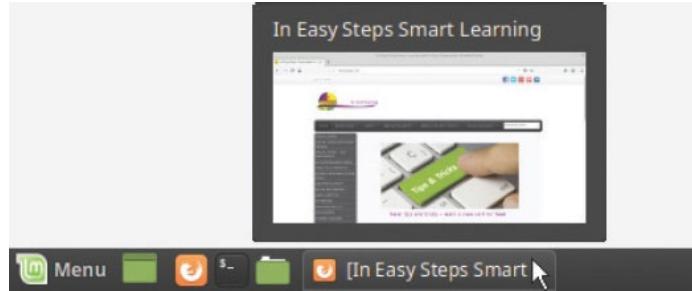
“Your cache is out of date”. Click the **Yes** button on the dialog to update it now.



Right-click on a desklet to see a context menu that offers configuration options and an option to remove the desklet from the Desktop.

# Adjusting the Taskbar

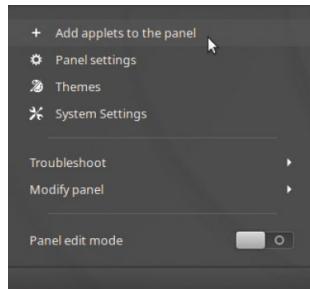
The Taskbar panel contains an icon for each running app window that you can click to restore a minimized window to its original size. Usefully, you can hover the mouse cursor over the icon of a minimized app to see a thumbnail preview of that window:



Additionally, you can add useful applets to the Taskbar panel:

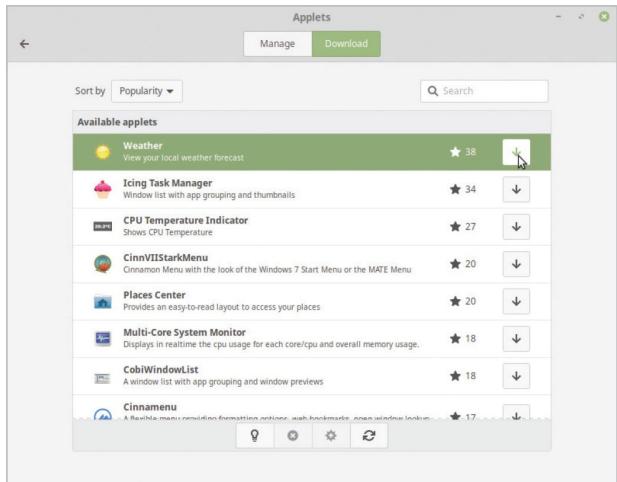
1

Right-click on the **Taskbar** to open a context menu



2

Select the option to **Add applets to the panel** – to open an “Applets” settings window

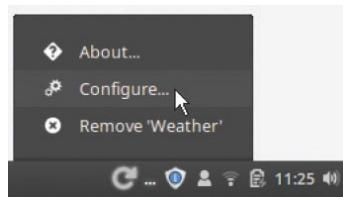


You can click the **Panel settings** item on this context menu for options to automatically hide the Taskbar panel, add more panels, and edit panels.



Notice that the **Applets** settings window functions much like the **Desklets** settings window described here.

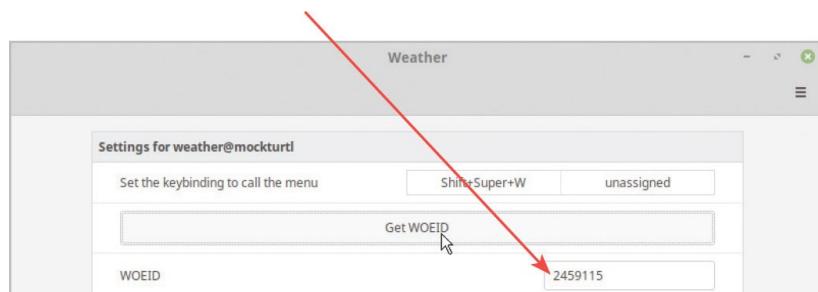
- 3 Click the **Manage** button to select from a list of installed applets, or click the **Download** button to install another applet – for example, download the “Weather” applet
- 4 Click the **Manage** button and select the Weather applet, then click the **+ Add** button to add it to the Taskbar panel
- 5 The weather app needs you to choose a location. Right-click on the applet then choose the **Configure...** option



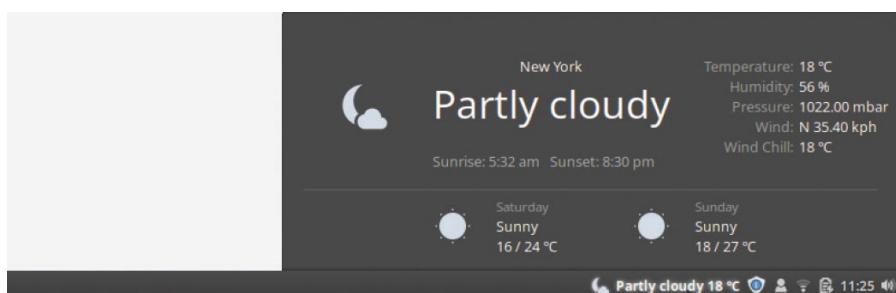
- 6 In the Weather settings window, click **Get WOEID** and enter a location in the “Search Place” box that appears



- 7 Click the **Lookup** button to get a WOEID number, then enter the number here and close the window



- 8 Now, click the Taskbar applet to see the weather for your chosen location



A WOEID (Where On Earth IDentifier) is a unique number that identifies any feature on planet Earth.

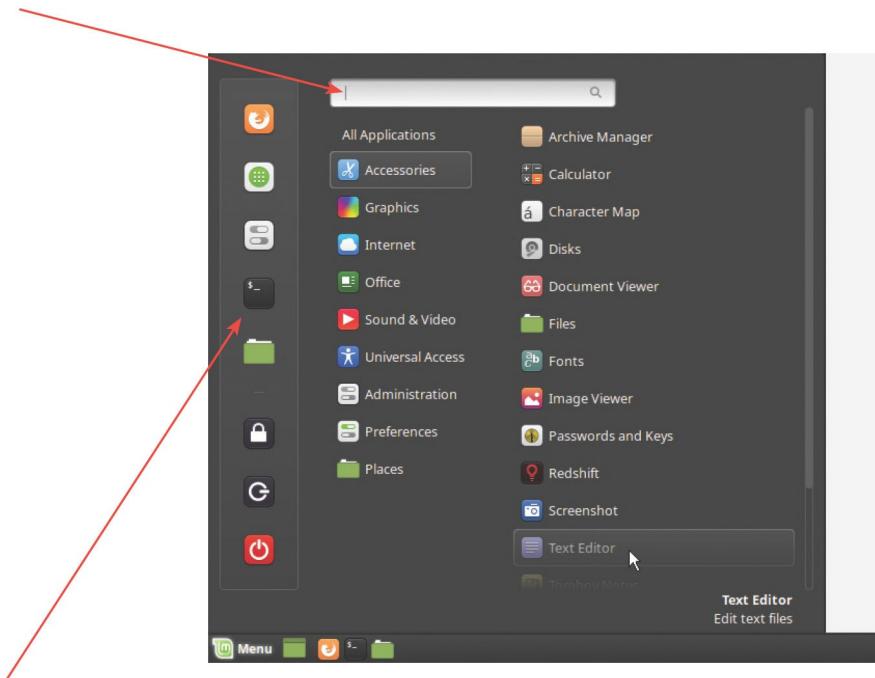


Right-click on an applet to see a context menu that offers configuration options and an option to remove the applet from the Desktop.

# Launching Apps

Apps can be launched in Linux Mint from the (Start) Menu and additional launchers can easily be added to the Taskbar, or on the Desktop, for frequently-used applications:

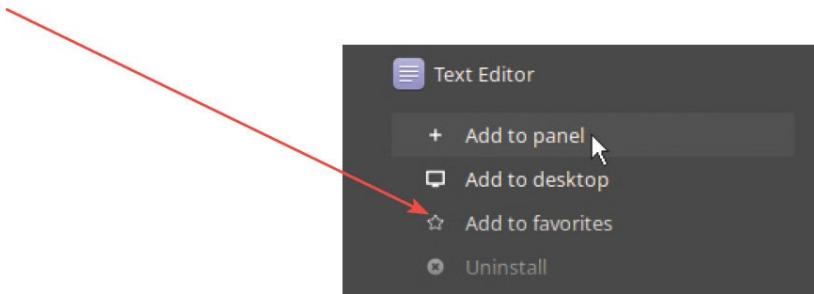
- 1 Click the  **Menu** button, at the far left of the Taskbar, then position the mouse pointer over the **Accessories** category to see that category's list of apps
- 2 On the Accessories menu list, click the **Text Editor** item to launch the Text Editor app



You can also type the name of an app into this **Search** box to find it.

- 3 Right-click on the Text Editor item in the Accessories menu, then choose

**Add to panel** from the context menu to create a launcher button on the Taskbar



The launchers in the sidebar are “Favorites”. You can choose **Add to favorites** on the context menu to add a launcher in the sidebar.



The apps on the menus shown here are from the Linux Mint distro – those on other distros will vary.

- 4 Click the new launcher that has been added to the Taskbar to launch the Text Editor



- 5 Right-click on the Text Editor item in the Accessories menu, then choose **Add to desktop** from the context menu to create a launcher icon on the Desktop
- 6 Click the shortcut launcher icon that has been added to the Desktop, to launch the Text Editor



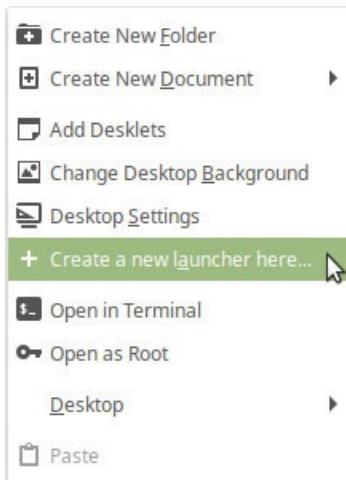
Text Editor



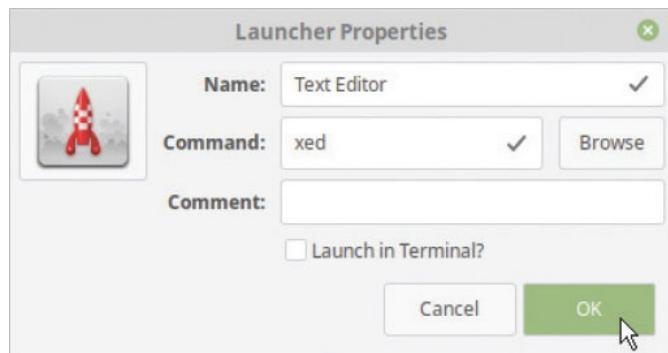
To delete a launcher from the Taskbar, right-click on it and choose **Remove**. To remove a launcher from the Desktop, right-click on it and choose **Delete**.

You can also create a Desktop launcher icon for any application if you know its precise command name. In this instance, the Text Editor for the Cinnamon Desktop is named “xed”.

- 7 Right-click on the Desktop, then choose **Create a new launcher here...** from the context menu that appears



- 8 Type a name and the **xed** command name into the appropriate input fields in the “Launcher Properties” dialog, then click its **OK** button to create the Desktop launcher

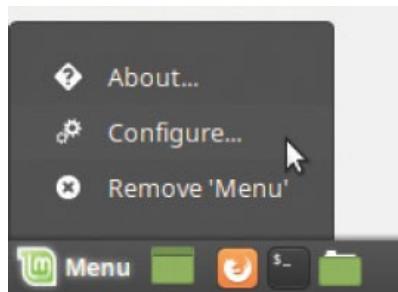


You can also launch apps from a command prompt in a Terminal window. Simply type the app's command (`xed` in this case) then hit the **Enter** key to launch the app.

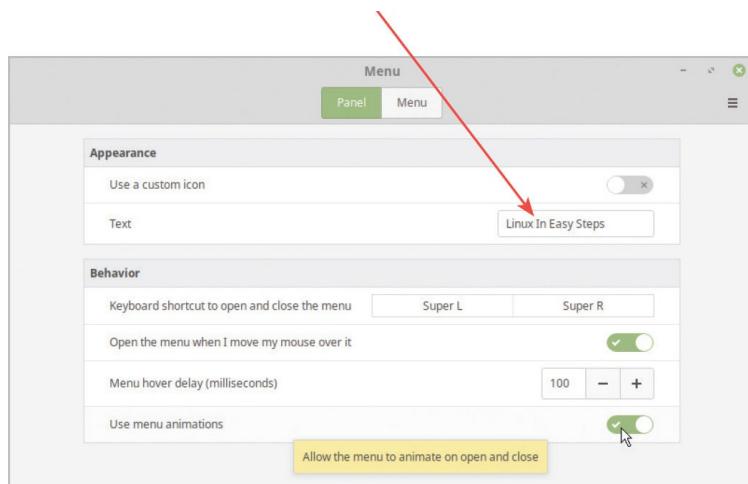
# Editing the Menu

Like many things in the Linux Mint operating system, the (Start) Menu can be customized to suit your personal taste:

- 1 Right-click on the **Menu** button, at the far left of the Taskbar, then select the **Configure...** option



- 2 Click the **Panel** button and select from the available options to adjust Appearance and Behavior. For example, change the Menu button's **Text** value

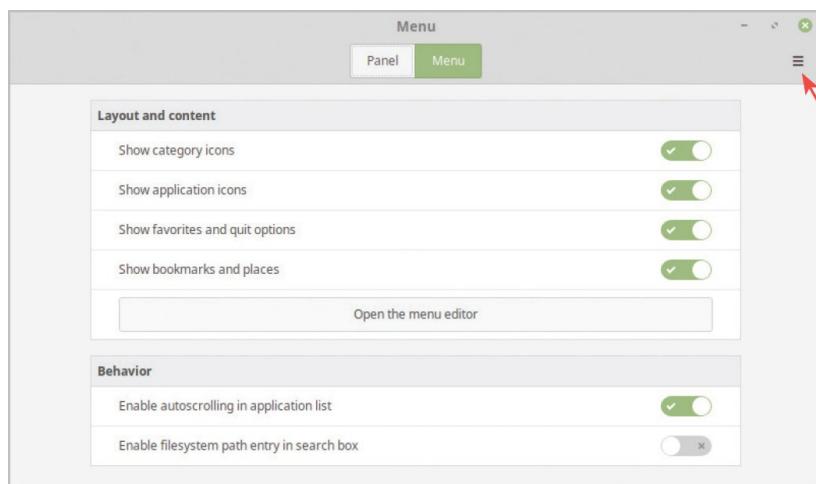


- 3 See that your selected options are instantly applied to the Menu

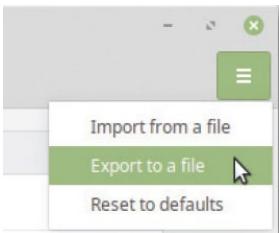


4

Click the **Menu** button in the “Menu” window, then click the **Open the menu editor** button



You can click the hamburger button and save your Menu settings as a file, which can be imported later to resume those settings.

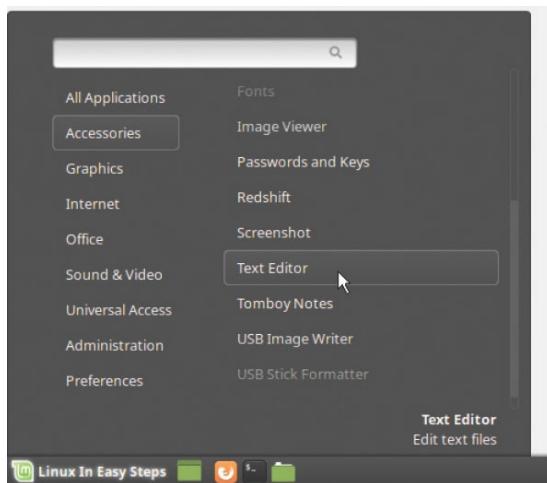


The “Super” key refers to the special key on your keyboard. Typically, this is the Windows Key. Press it once to open the Menu, then press it again to close the Menu.



5

Slide all toggle switches to the “Off” position to simplify the Menu

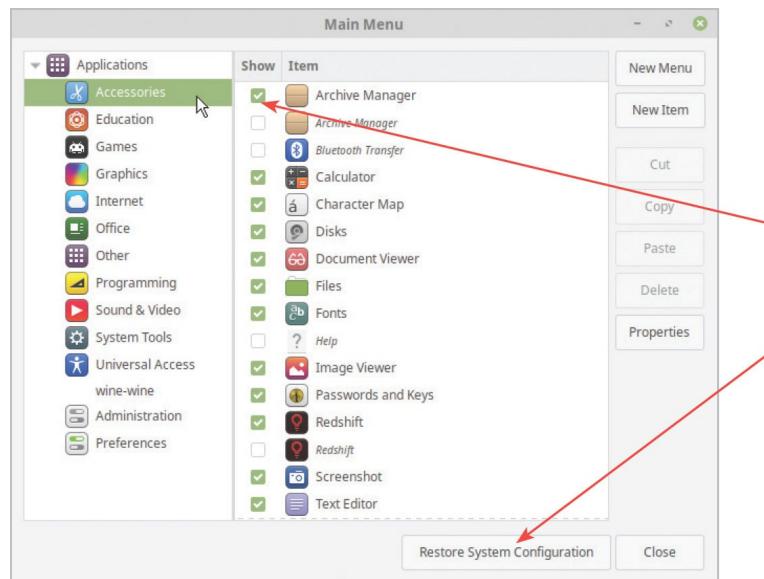


6

Now, click the **Open the menu editor** button

7

Click any category in the left-hand pane, then select Menu items in the right-hand pane

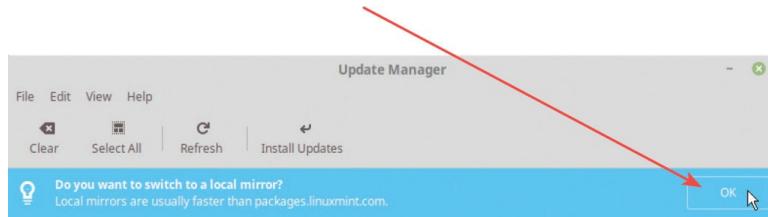


You can uncheck the individual items to remove them from the Menu and click the **Restore System Configuration** button to resume its default appearance.

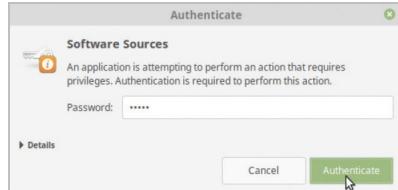
# Installing Updates

Having set up Timeshift to make regular backups of your Linux Mint operating system (see [here](#)), it is recommended that you regularly apply all updates available for your system:

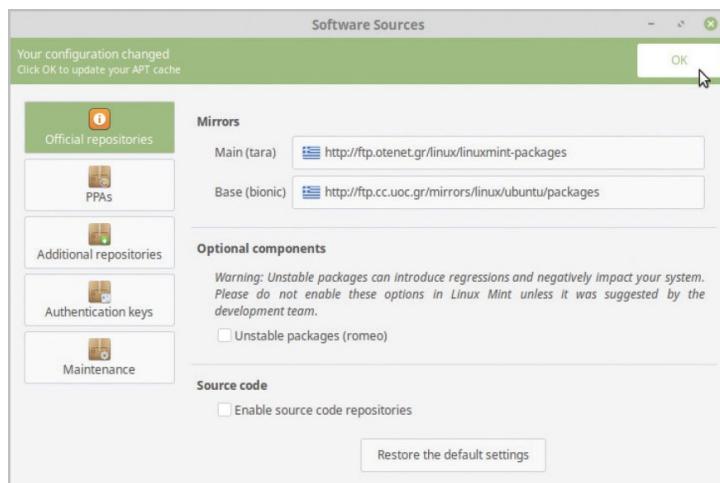
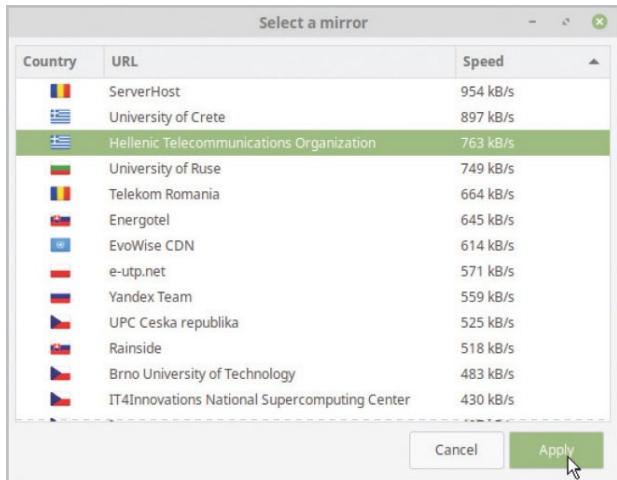
- 1 Connect your PC to the internet, then click **Menu, Administration, Update Manager** to open an “Update Manager” window
- 2 If the Update Manager suggests you switch to a local mirror server, click this **OK** button



- 3 Enter your password, then click the **Authenticate** button – to open a “Software Sources” dialog



- 4 Double-click in the **Main (tara)** box and select a local mirror from the list that appears, then click **Apply**



5

Now, select a local mirror for the **Base (bionic)** box, then click **OK** to close the “Software Sources” dialog

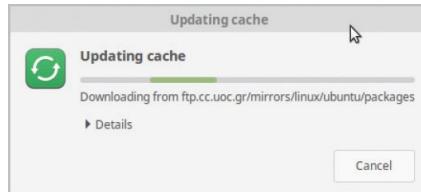


A “Welcome” screen may appear when you first open the Update Manager. Click its **OK** button to proceed.

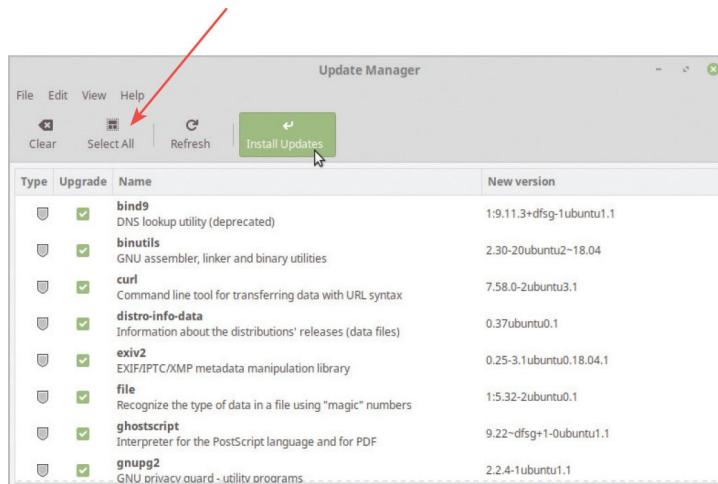


Previous versions of Linux Mint recommended you perform selective updates, in case they introduce problems. Timeshift backups changed that, as you can now restore the system.

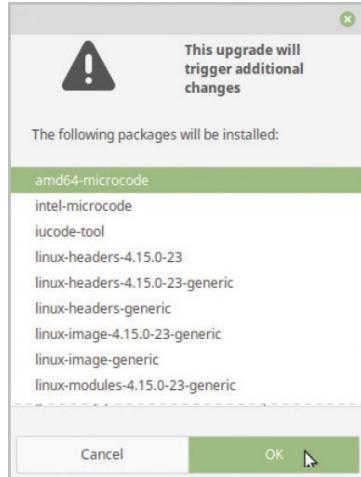
- 6 Wait while the software list gets updated, then return to the “Update Manager” window



- 7 Click the **Select All** button, then click **Install Updates**

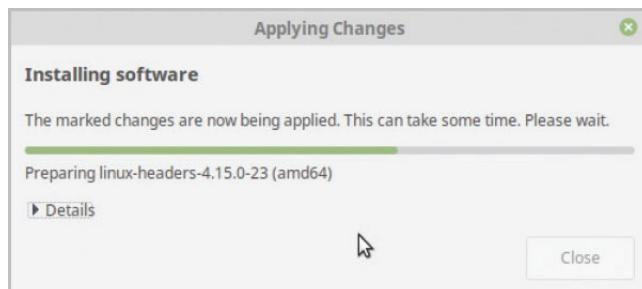
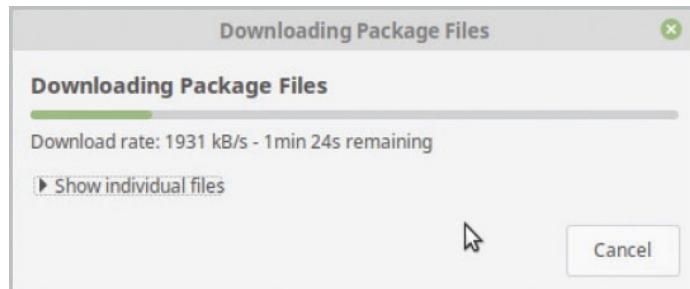
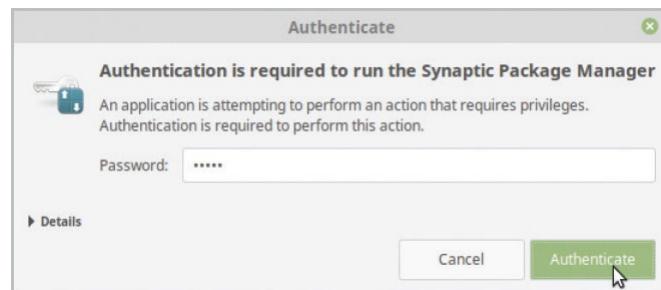


- 8 If advised additional packages are required, click **OK**



9

- Enter your password, then click the **Authenticate** button – Linux Mint will now download and install available updates





It can take a little time to update the cache and download updates, so it is important to choose a fast local mirror server.



Notice that in Linux Mint the updates are referred to as “packages”. These are managed by the **Synaptic Package Manager**, which can be found in the Administration category on the Menu.

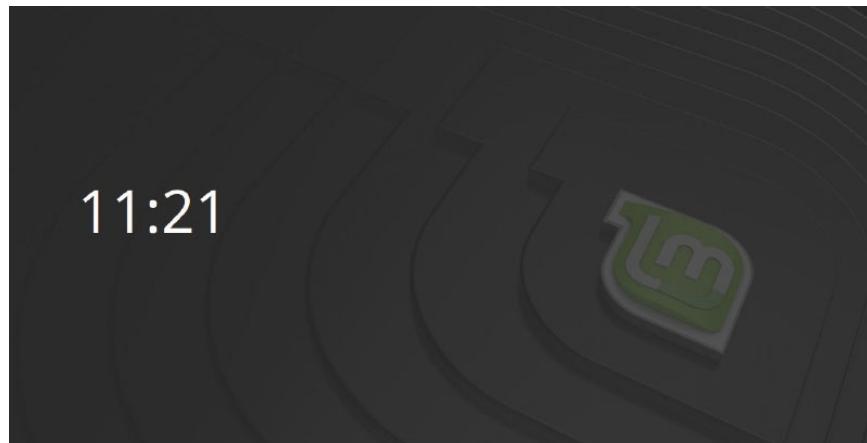
# Closing the Desktop

If your Linux Mint operating system is left unused it will, by default, automatically replace the Desktop with a screensaver and lock the screen. This means you will need to enter your password to get back to the Desktop. If you wish to leave your PC, you can immediately lock the screen for security purposes:

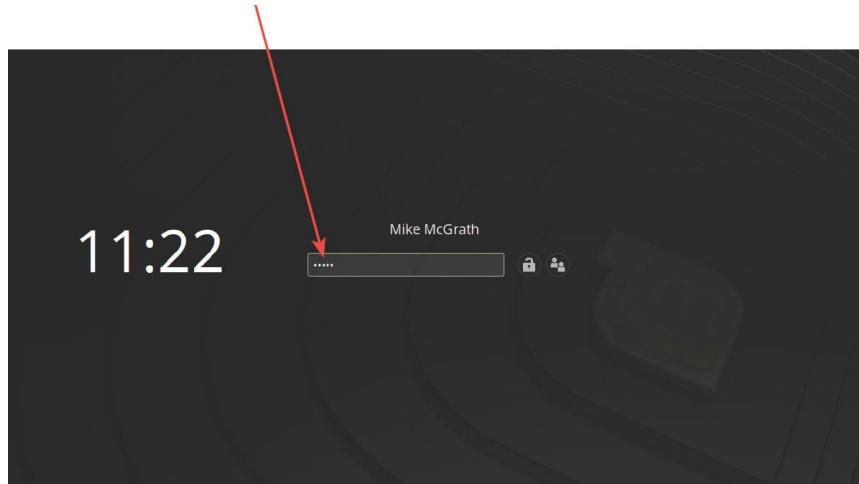
- 1 Click **Menu**, then click the “Lock screen” button to instantly close the Desktop



- 2 See the screensaver now fills the screen so your PC cannot be used



- 3 Move your mouse when you want to unlock your PC, and you will be presented with a password request – enter your password to return to the Desktop



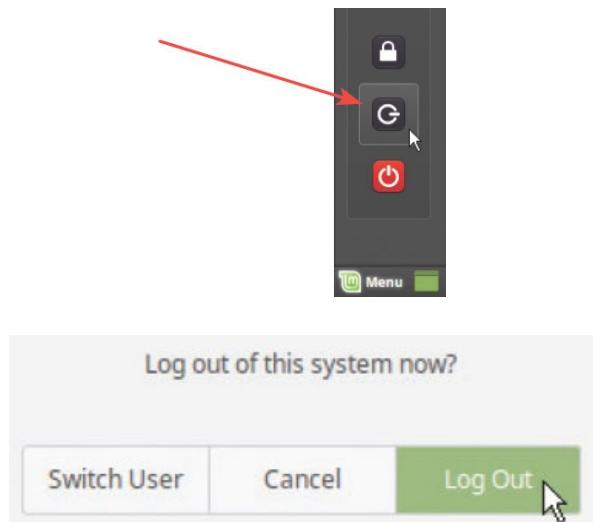
You can also lock the screen using the **Ctrl + Alt + L** keyboard shortcut. To discover more Linux Mint shortcuts, click **Menu, Preferences, Keyboard** to open the “Keyboard” window, then click the **Shortcuts** button. Select a category, such as **System**, in the left-hand pane to see available shortcuts in the right-hand pane.



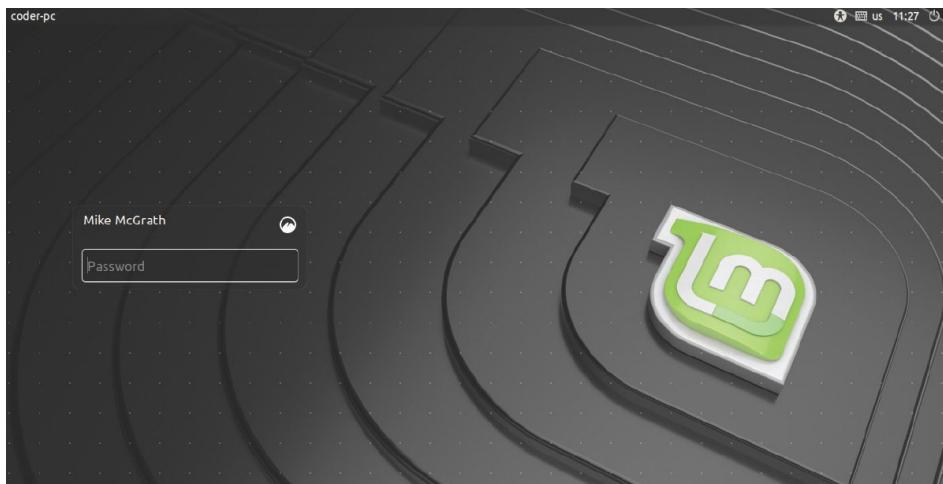
You can click the  **Switch User** button to log out – you will then see the **Log in** screen illustrated here.

You may sometimes want to log out of the Linux Mint operating system for security purposes or to switch users:

- 1 Click **Menu**, then click the “Log Out” button to see a “Session” options dialog appear



- 2 Click the **Log Out** option button, or the **Switch User** option button, to see the **Log in** screen appear



The **Switch User** option saves your session state to allow someone else to log in. When they log out and you log back in, you will be back where you left off – your open apps will still be running. The **Log Out** option, on the other hand, ends the session and closes your open apps – when you log back in they will not be running.

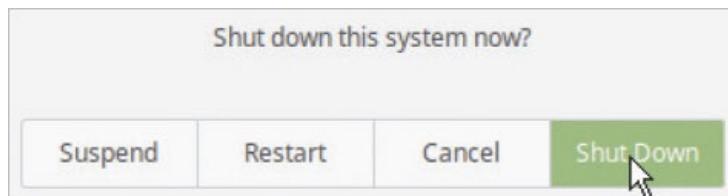
When you are going to be away from your PC for a long time you will probably

want to shut down the operating system:

- 1 Click **Menu**, then click the “Quit” button to see a “Shut down this system now?” options dialog appear



- 2 Click the **Shut Down** option button to exit Linux Mint and power off your PC



The **Suspend** option stops all apps, and the system state is saved in RAM as your PC goes into low-power mode. Hit any key to awaken the PC exactly where you left off.

# Summary

- Unless the “Log in automatically” option was selected during installation, the **Log in** screen will request your password whenever you start the Linux Mint operating system.
- The Linux Mint GUI comprises a **Desktop** and **Taskbar**.
- The **Desktop** contains shortcuts and background wallpaper.
- The **Taskbar** contains a Menu button, Show Desktop button, app launchers, and the System Tray.
- The **System Tray** provides access to User Info, Network Status, Battery Status, Time & Date, and Volume Control.
- The Desktop can be configured to have different background **Wallpaper** and to contain different **Shortcut** icons.
- **Desklets** are small apps that run on the Desktop.
- Hovering the mouse cursor over the Taskbar icon of a running app will display a **Thumbnail Preview** of that app.
- Useful **applets** can be added to the Taskbar panel.
- App launchers are grouped by **category** on the Menu.
- App launchers can be added to the **Taskbar** and **Desktop**.
- The Menu can be configured to customize its **Appearance** and its **Behavior**.
- With the Timeshift backup utility enabled, all updates can be regularly applied with the **Update Manager** app.
- Selecting local mirrors as **Software Sources** usually allows updates to be downloaded faster.
- The Desktop can be closed by switching to the **Lock screen** for security.
- The **Log Out** option and **Switch User** option closes the Desktop and opens the **Log in** screen.
- The **Shut Down** option closes the Desktop and powers off the PC.

# **Setting Preferences**

*This chapter describes some useful ways you can set up your Linux Mint system to suit your preferences.*

**Selecting Appearance**

**Managing Windows**

**Personalizing Options**

**Controlling Connections**

**Adding Printers**

**Pairing via Bluetooth**

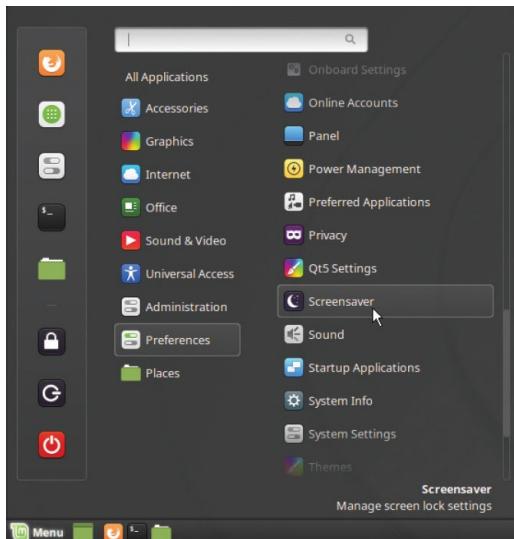
**Summary**

# Selecting Appearance

By default, your Linux Mint Desktop will automatically switch to the screensaver if you do not interact with your PC for a while. This means you may frequently have to enter your password to return to the Desktop and is unnecessary if your PC is located in an environment where security is not a concern. Fortunately, you can disable this behavior so the Desktop will always be visible unless you choose to explicitly lock the PC.

You may also choose how the screen appears by selecting a custom screensaver, and you can add a message to the Lock screen:

- 1 Click **Menu, Preferences, Screensaver** to open a “Screensaver” window



- 2 Next, click the **Settings** button

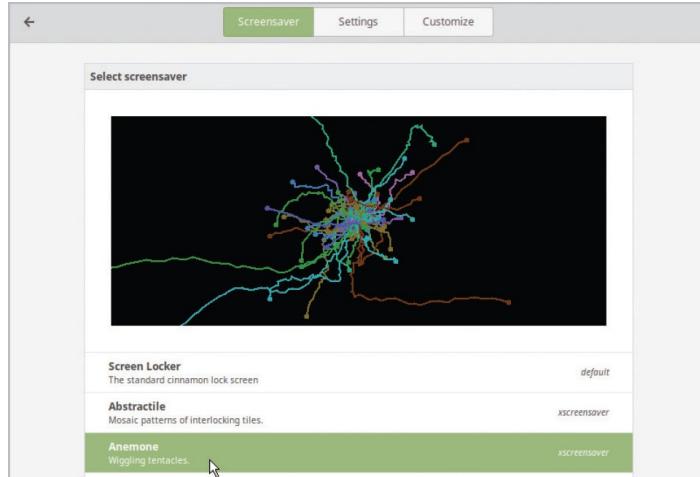


- 3 Now, open the drop-down menu for “Screensaver settings” and select the **Never** option – to stop your PC automatically switching to the Lock screen
- 4 Click the **Screensaver** button



Notice that you can choose to extend the delay before the screensaver will appear if you don't want to totally disable the screensaver.

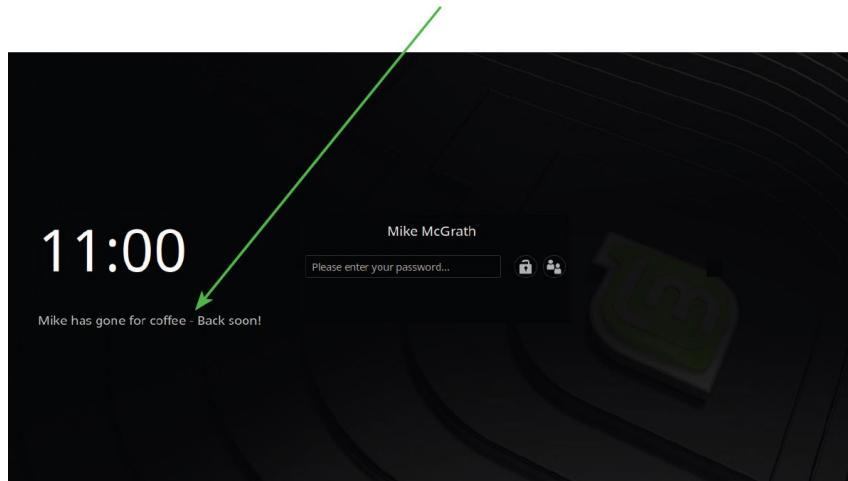
- 5 Choose any item in the **Select screensaver** list to see its preview play in the “Screensaver” window – your final choice will become your screensaver



- 6 Next, click the **Customize** button, then type a custom **Away message** to be displayed on the Lock screen



- 7 Click the  **Lock screen** button to see your screensaver, then click to see your message on the Lock screen



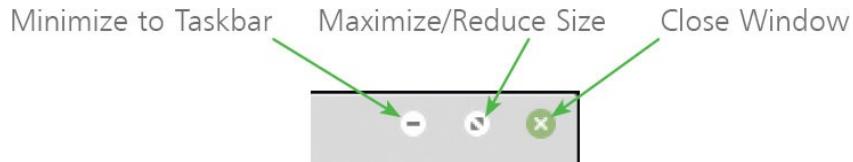
All screensavers are animations except for the standard Cinnamon Lock screen “Screen Locker”.



There is also a Customize option to “Ask for a custom message when locking the screen from the menu” – so you can add a unique message when you leave your PC.

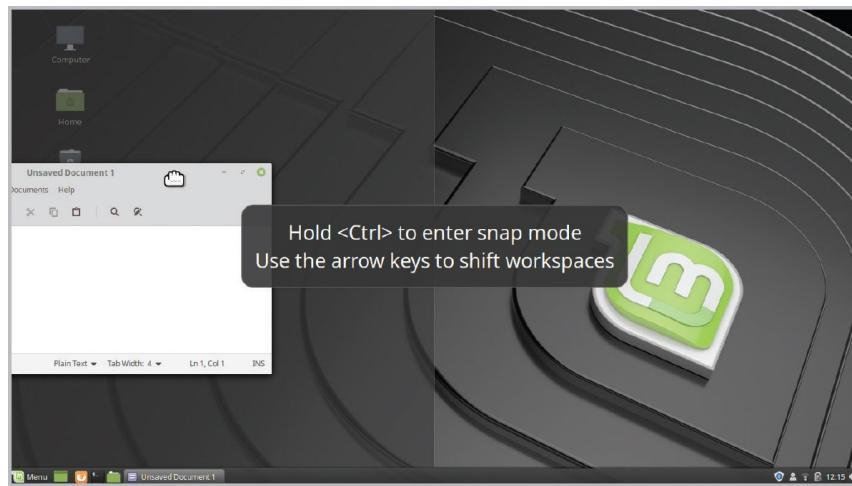
# Managing Windows

The control buttons on the Linux Mint window title bars perform the same actions as those in the Windows operating system:



You can also snap windows to the screen edges, tile windows to the corners of the screen, and move windows between workspaces:

- 1 Click **Menu, Accessories, Text Editor** to open the Text Editor app
- 2 Click the window's  control button to reduce it from full-screen size
- 3 Next, click on the window's title bar and hold down the mouse button, then drag the window to any screen edge
- 4 When you see a zone preview, release the mouse button to snap the window to that edge – filling half of your screen



- 5 Now, click on the window's title bar and hold down the mouse button, then drag the window to any screen corner

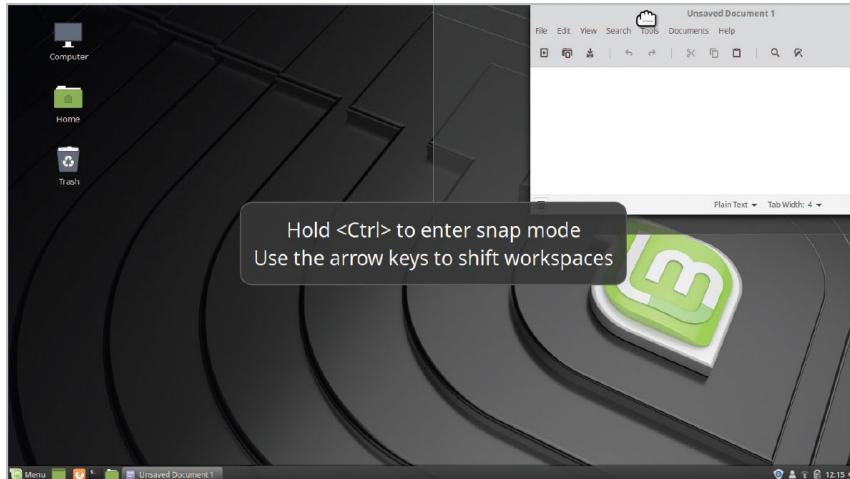


Windows that are not full-size, snapped, or tiled, can be resized by dragging their edges or corners.

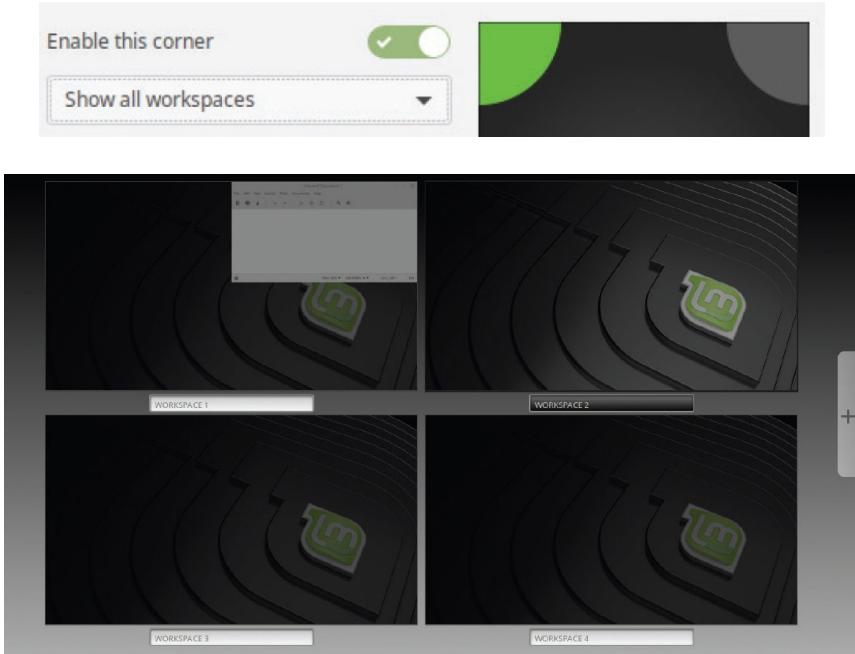


You can ignore the on-screen instruction to **Hold <Ctrl>**. Simply snap two apps to the left and right sides of your screen to work on two documents at the same time.

- 6 When you see a zone preview, release the mouse button to snap the window to that corner – filling a quarter of your screen



- 7 Click **Menu, Preferences, Hot Corners** to open a “Hot Corners” window
- 8 Enable the top left-hand corner to show workspaces, then move the mouse cursor to that corner to see the workspaces



You can tile up to four apps. Also, you can snap and tile. For example, tile two apps at the top corners and snap another app across the bottom half of the screen to work on three documents at the same time.

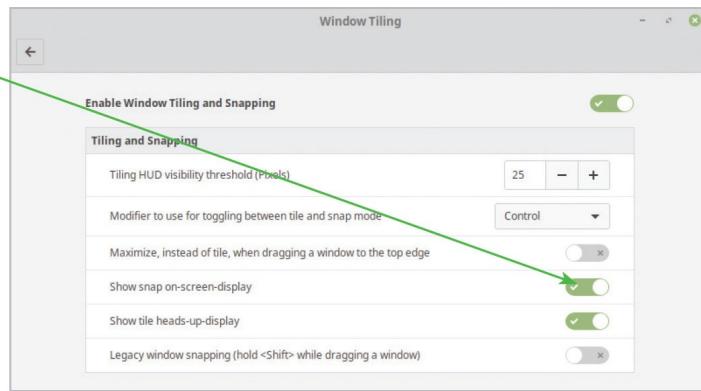


You can drag apps from one workspace to another and click any workspace to begin working there in full screen. The apps remain running on the hidden workspaces so you can switch back to them.

# Personalizing Options

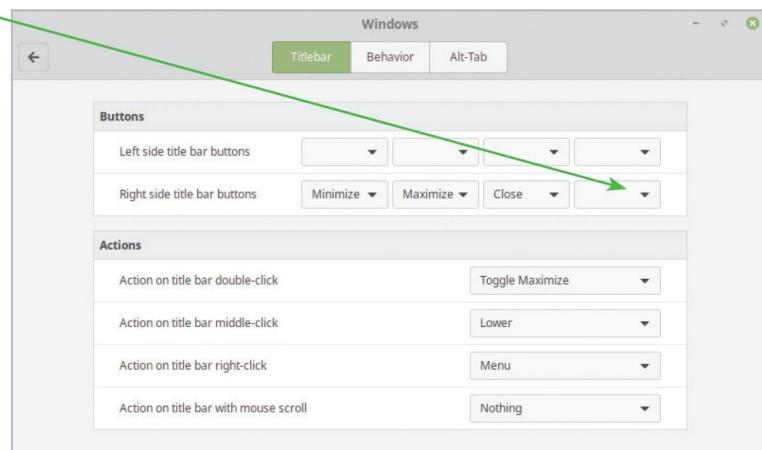
You can personalize the behavior and appearance of windows by specifying preferences on your Linux Mint operating system. For example, many people prefer to change the default light gray windows to dark gray:

- 1 Click **Menu, Preferences, Window Tiling** to open a “Window Tiling” window – here you can disable Tiling and Snapping or modify its behavior

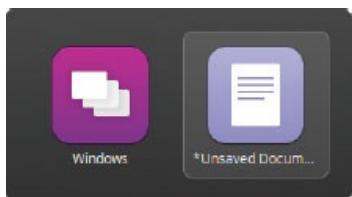


Slide this toggle switch to the “Off” position to disable the **Hold <Ctrl>** message when snapping or tiling your windows.

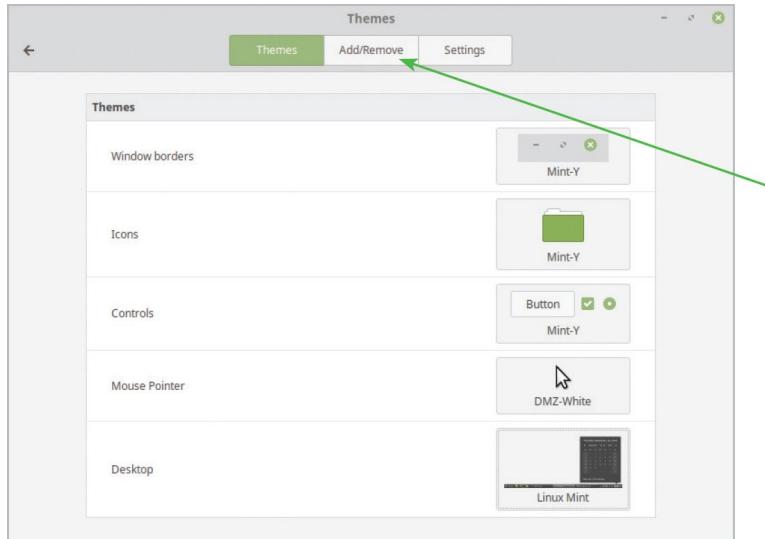
- 2 Click **Menu, Preferences, Windows** to open a “Windows” window – here you can modify title bar actions and window actions



Select the **Shade** option on this drop-down menu to add an extra button that lets you minimize a window in another way. Click the **Alt-Tab** button at the top of the dialog and explore switcher style options. To use the window switcher hold down the **Alt** key then jab the **Tab** key to select a window. Release the **Alt** key to give that window focus.

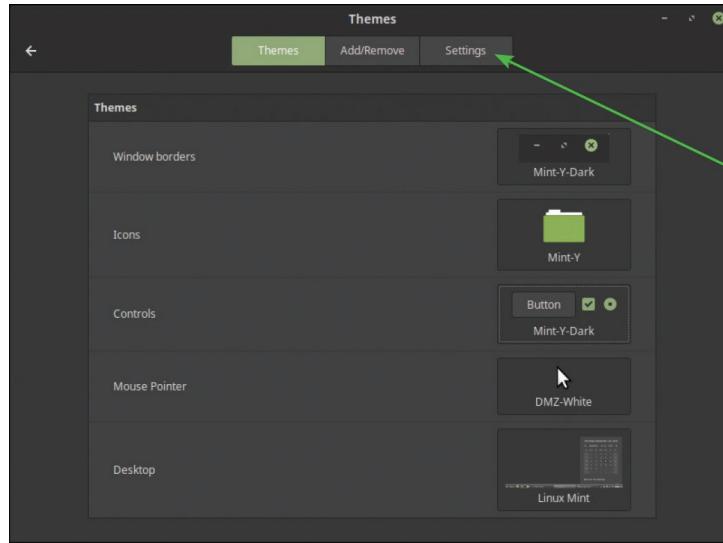


- 3 Click **Menu**, **Preferences**, **Themes** to open a “Themes” window, then click the **Themes** button to see the current appearance settings



Click the **Add/Remove** button to see a list of themes you can download and install. These provide additional options on the fly-out menu for the Desktop.

- 4 Click the current **Mint-Y** setting for “Window borders” to open a fly-out menu, then select the **Mint-Y-Dark** option to instantly change the border appearance
- 5 Similarly, click the current **Mint-Y** setting for “Controls”, then select **Mint-Y-Dark** on the fly-out menu to instantly change the appearance of window controls



Click the **Settings** button to see options to show or hide icons on window buttons and menus.

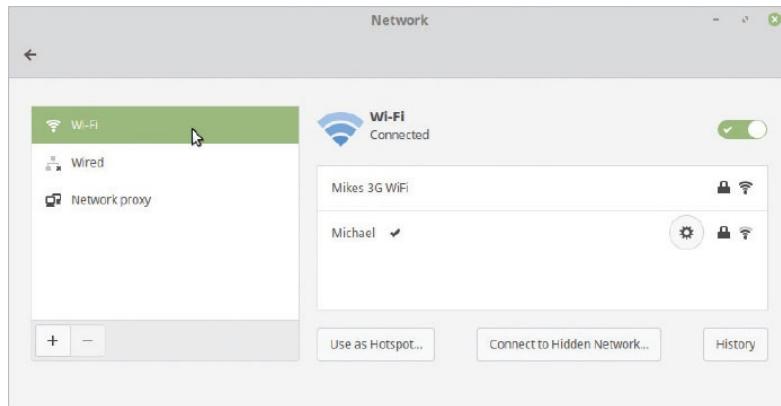
# Controlling Connections

Linux Mint allows you to easily control how you connect to the internet via wireless Wi-Fi or wired Ethernet connections. You can also mask your presence via a proxy server or through a Virtual Private Network (VPN) connection:



Wi-Fi network

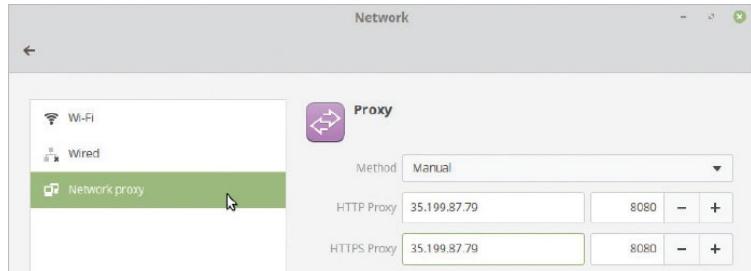
- 1 Click **Menu, Preferences, Network** to open a “Network” window, then click **Wi-Fi** in the left-hand pane – to see available wireless connections in the right-hand pane



- 2 Similarly, click **Wired** to see available wired connections



- 3 Click **Network proxy** to see or add details for a proxy server with which you could mask your presence



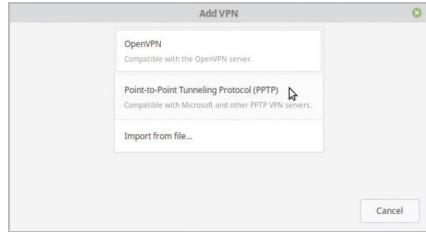
You can also click the “Wireless connection” icon on the **System Tray** to view network status.



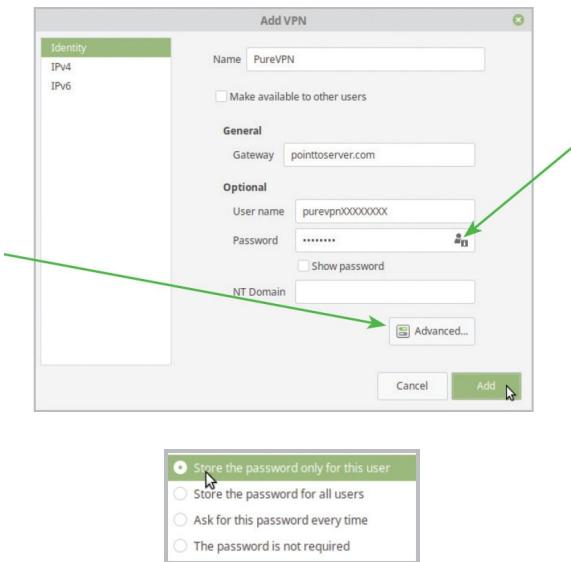
Proxy servers and VPNs both hide your IP address but, unlike VPNs, proxies do not encrypt your connection – it is safer to use a VPN to mask your presence.

4

- Click the **+ Add** button to open an “Add VPN” dialog, then choose the **Point-to-Point Tunneling Protocol (PPTP)** option



- 5 Next, enter the Name, URL, and User details of your VPN service, then click the **Advanced...** button

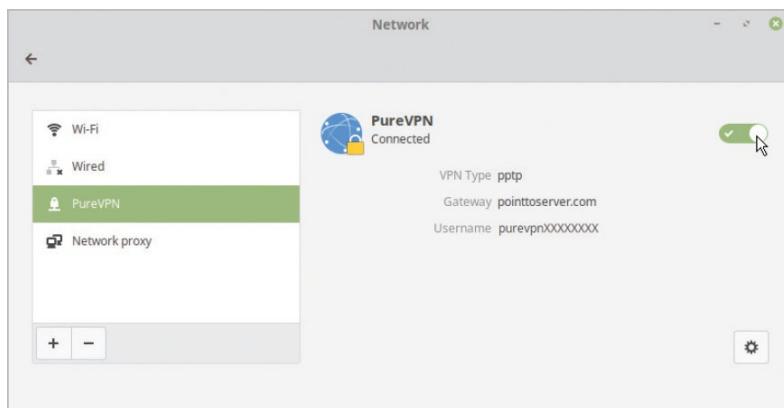


You will need to click this icon and choose whether to store the password before you can enter a password.

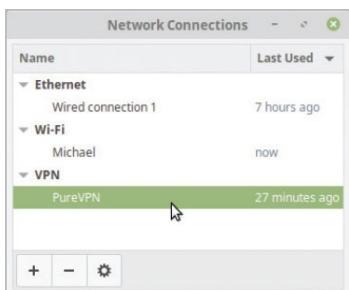
- 6 Select authentication and security options and click OK, then click the + **Add** button on the “Add VPN” dialog



- 7 Click the newly-added VPN entry in the “Network” window, then slide the toggle switch to the “On” position to connect



Also in the “Preferences” category there is a **Network Connections** app that displays your connection history. You can double-click any network item to open an **Editing** dialog for that connection.

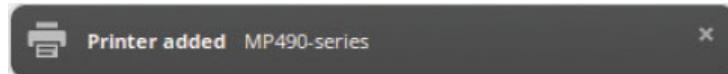


# Adding Printers

Linux Mint provides drivers for a wide range of printers, so adding a printer is often simply a matter of connecting the printer to a USB port on your PC and turning the printer on. The operating system should recognize the printer and display a notification that it has been automatically added to your system:



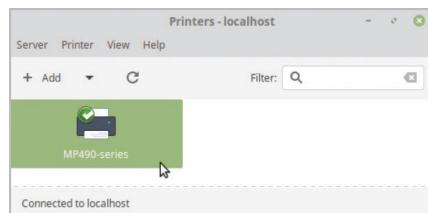
USB connected printer



The properties and options of added printers can be found in the “Printers” app, which can also be used to add network printers:

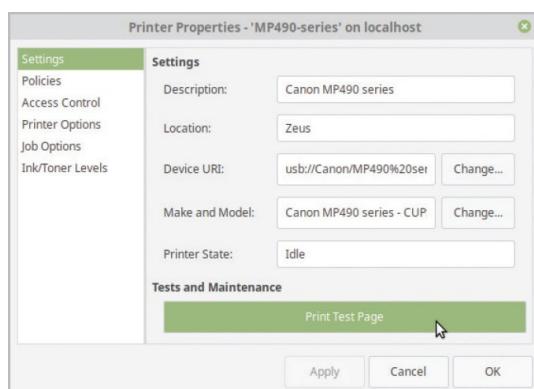
1

Click **Menu, Administration, Printers** to open a “Printers” window

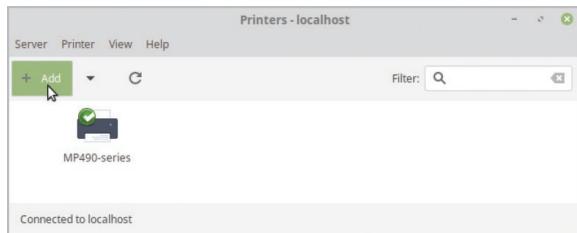


2

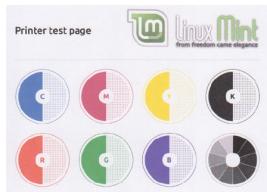
Double-click on an installed printer to open its “Properties” dialog



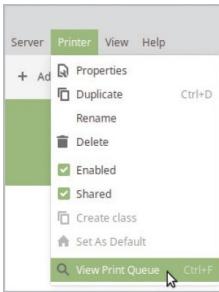
- 3** Next, turn on a network printer and press its Wi-Fi button to make it visible to the network
- 4** Now, click the **+ Add** button on the “Printers” window – to open a “New Printers” dialog, listing available printers



You can click the **Print Test Page** button on the “Properties” dialog to test your printer.

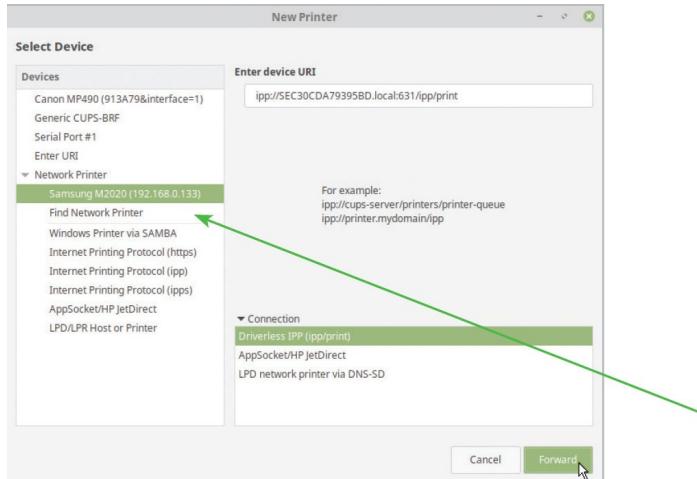


Click the **Printer** menu and select the **View Print Queue** option to open a “Document Print Status” dialog where you can control print jobs.



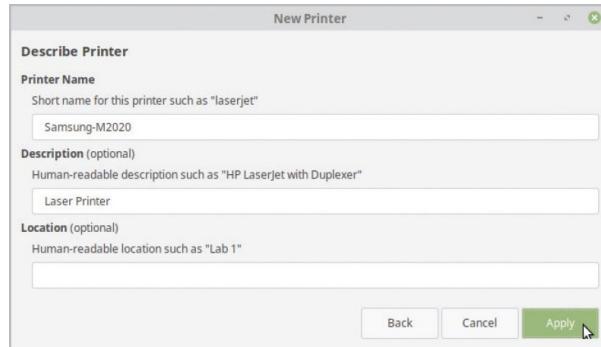
Wi-Fi connected printer

- 5 Expand the **Network Printer** category, then select your printer and click the **Forward** button

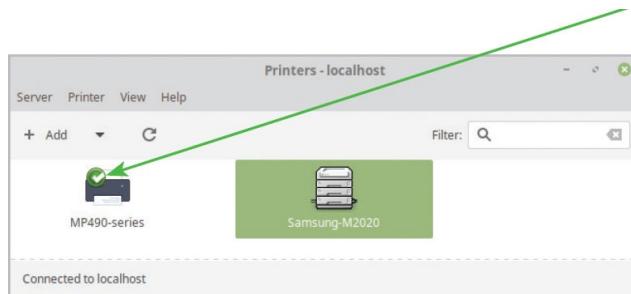


If your printer is not immediately listed you can click the **Find Network Printer** option to seek your printer.

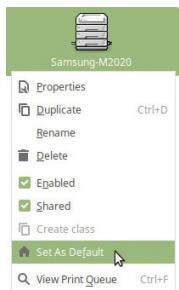
- 6 Enter a name and description of the printer, then click the **Apply** button



- 7 See that the network printer is now added to the “Printers” window and is ready to print



The printer icon marked with a check mark denotes the system-wide default printer. You can change the default printer from its right-click context menu.



# Pairing via Bluetooth

Linux Mint allows you to connect an external device that supports Bluetooth wireless technology, such as a Beats Pill speaker, using a USB dongle and the Bluetooth device manager:

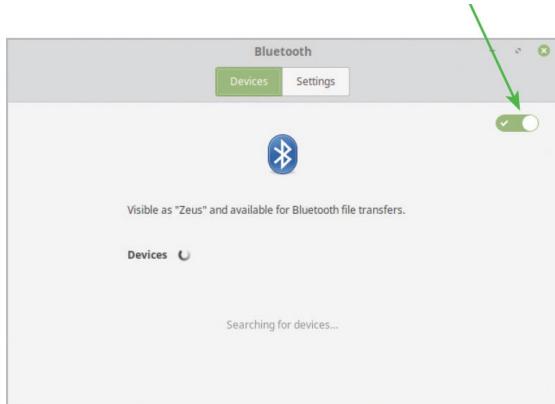
- 1 Connect a Bluetooth dongle to a USB port on your PC



- 2 Turn on the Beats Pill speaker



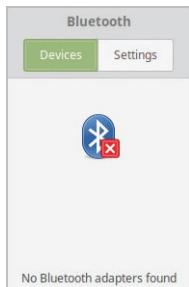
- 3 Press and hold the speaker's "b" button for three seconds to switch the speaker into pairing mode
- 4 On your PC, click **Menu, Preferences, Bluetooth** to open the Bluetooth device manager
- 5 Slide the toggle switch to the "On" position to search for nearby Bluetooth devices



You can discover more about Bluetooth technology online at [bluetooth.com](http://bluetooth.com)



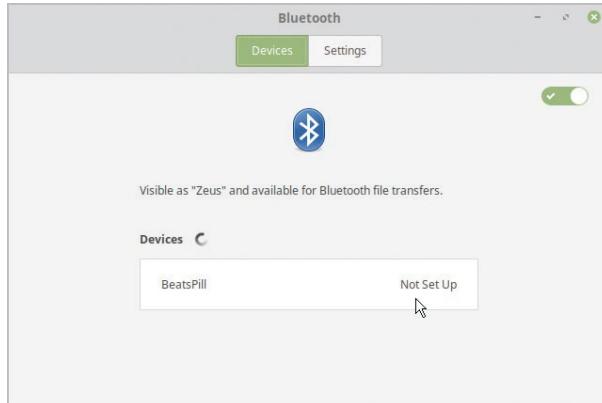
You only need to connect a dongle if your PC does not have a built-in Bluetooth adapter.



Slide the toggle switch on the Bluetooth device manager to enable or disable Bluetooth.

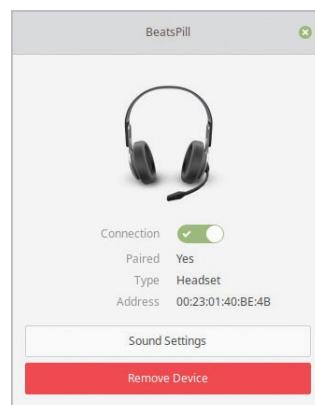
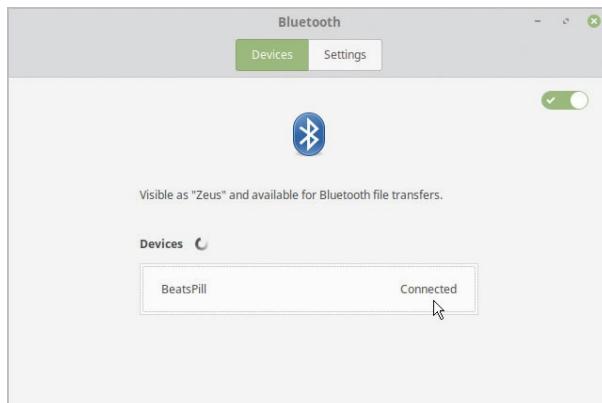
6

When the speaker is found, click on the **BeatsPill** item in the “Devices” list to pair it with your PC



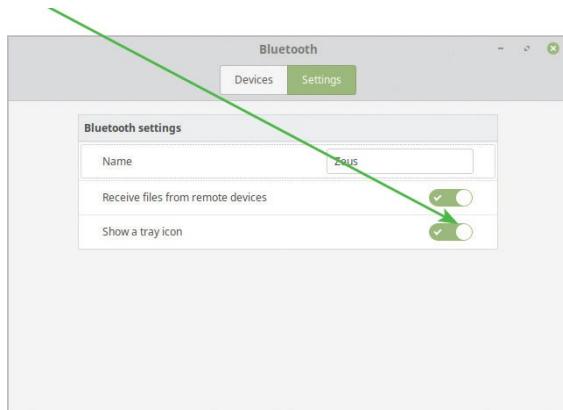
7

When the speaker is connected, click on the **BeatsPill** item in the “Devices” list to see its status dialog



8

Click the **Settings** button and slide the toggle switch to the “On” position for the **Show a tray icon** setting



9

Place the cursor over the System Tray Bluetooth icon to see the pairing



For security reasons the Bluetooth device manager will sometimes require you to confirm a device's PIN in order to establish a connection.



Once paired, you can disconnect and reconnect to the device, but if you remove it you will need to pair it again to re-establish a connection.

# Summary

- The **Screensaver** app can be used to disable the screensaver or to choose an animated screensaver.
- The **Lock screen** can be customized to display an “Away message” for times when the user is absent.
- The window title bars in Linux Mint contain familiar **Minimize**, **Maximize/Reduce**, and **Close** buttons.
- Windows can be **Snapped** to the screen edges and **Tiled** to the screen corners.
- The **Hot Corner** feature can be enabled to display workspaces.
- Windows can be dragged from one **Workspace** to another and the apps will remain running on hidden workspaces.
- The **Window Tiling** app can be used to disable Tiling and Snapping or to modify their behavior.
- The **Windows** app can be used to modify title bar actions and to modify window actions.
- A window can be selected with the **Window Switcher** feature, by pressing the Alt and Tab keyboard keys.
- The **Themes** app can be used to change the look of Window Borders, Icons, Controls, Mouse Pointer, and Desktop.
- Wi-Fi connections, wired connections, and proxy connections can be controlled with the **Network** app.
- The Network app can also be used to add a **VPN** connection to mask your presence when online.
- Linux Mint should automatically detect and add a **Printer** when it is directly connected to the PC.
- The **Printer** app can be used to add a network printer to the system to enable printing via a Wi-Fi connection.
- The **Bluetooth** app can be used to pair the PC with a nearby Bluetooth device.

# Touring the File System

*This chapter describes the Linux file system and explains its directory structure.*

**Meeting the Directory Tree**

**Recognizing Directories**

**Navigating with Nemo**

**Handling Files**

**Creating Shortcuts**

**Locating Files**

**Understanding Permissions**

**Summary**

# Meeting the Directory Tree

When moving from Windows, the new Linux user needs to be aware of some differences between the two operating systems:

- Linux is case-sensitive – Windows is not. For instance, files named “readme.txt” and “README.txt” are seen as two different files in Linux, but there is no distinction in Windows.
- Linux directories and files have ownership permissions that can restrict accessibility to the owner or group – Windows directories and files are generally universally accessible.
- Linux was developed as a multi-user network operating system – Windows evolved from MS-DOS (Microsoft Disk Operating System) as a single-user home operating system.
- Linux desktop users cannot change system settings; only the “root” Super User may do so – Windows desktop users have free reign to wreak havoc.
- Linux partitions are created using the Ext4 filesystem – Windows partitions use FAT, FAT32 or NTFS filesystems.
- Linux path names contain forward slash characters – Windows path names contain backslash characters: for instance, a Linux path `homemike` and a Windows path `C:\Users\mike`.
- Linux does not have any drive letters – Windows typically uses C: for the hard disk drive, D: for the optical drive, E: for an external drive, and so on.

The lack of drive letters in Linux indicates what is, probably, the biggest difference between Linux and Windows – the way their directory structures are arranged. In Linux everything is contained within a single unified hierarchical system – beginning with the “root” directory, symbolized by a single forward slash “/”.

The Linux installation creates a number of standard sub-directories within the root directory. Each one of these, in turn, houses its own sub-directory structure, thereby creating a directory “tree” – the “root” directory of / is the root of the tree.

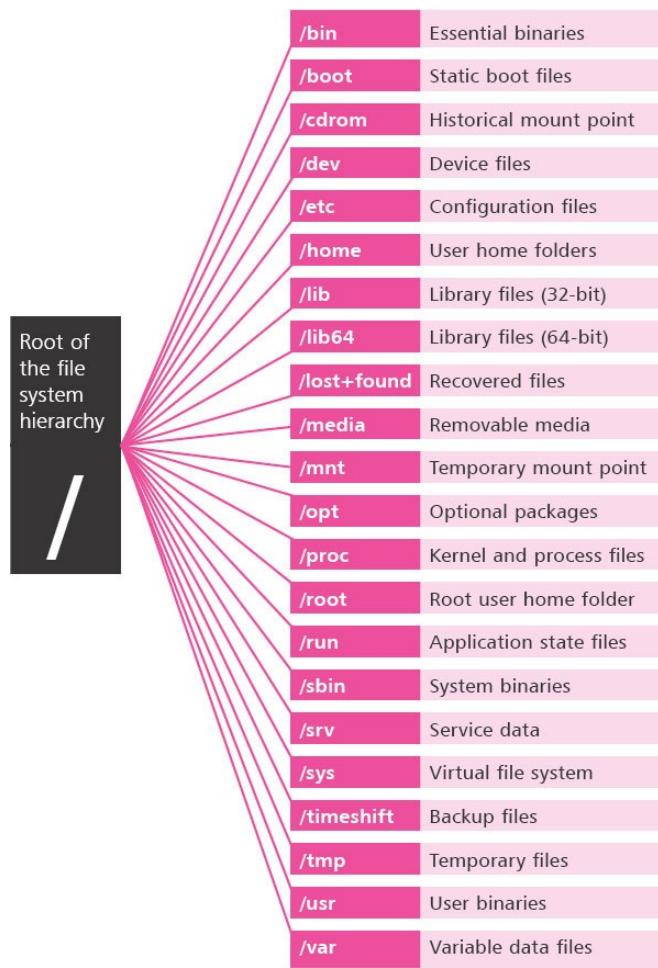


See here and here for more on access permissions.



See here for more on the Linux file system.

Contents of peripheral drives appear in the tree in the directory at which they are “mounted” by Linux, creating a unified structure. The table below lists the directory structure of the Linux Mint file system. All are sub-directories of the basic root directory “/”.



The purpose of each standard Linux directory is described in more detail on the ensuing pages of this chapter.



Do not confuse the **/root** directory (the home directory of the root superuser) with the **/** root of the file system.

# Recognizing Directories

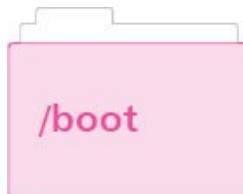
## /bin

Contains small executable programs (binaries) that are required when your PC boots up, and programs that execute basic commands. This directory is roughly equivalent to the `C:\Windows` directory in Windows.



## /boot

Contains important files required when your PC boots up and also the Linux kernel itself – the heart of the operating system. The kernel controls access to all the hardware devices your computer supports, and allows multiple programs to run concurrently and share that hardware.



## /cdrom

This is historically a directory in which CD-ROMs inserted into the system were mounted – the standard location is now `/media`.



## /dev

Contains special file system entries that represent devices that are attached to the system. These allow programs access to the device drivers that are essential for the system to function properly – although the actual driver files are located elsewhere. The entry `devsda` represents the first hard drive on your PC.



## /etc

Contains system configuration files storing information about everything from user passwords and system initialization to screen resolution settings. These are plain text files that can be viewed in a text editor. The files in this directory are roughly equivalent to the combination of `.ini` files and the Registry entries found in the Windows operating system.



## /home

Contains a sub-directory for each user account to store personal data files. If there is a user account named “mike” there will be a `homemike` directory where that user can store personal files – other users cannot save files there. This directory is where you store all your working documents, images, and media files.



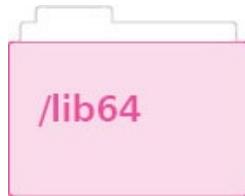
## /lib

Contains 32-bit library files that are used by the executable programs in the `/bin` and `/sbin` directories. These shared libraries are particularly important for booting the system and executing commands within the root file system. They are roughly equivalent to the `.dll` (**D**ynamic **L**ink **L**ibraries) in Windows.



## /lib64

Contains 64-bit library files that are used by the executable programs in the `/bin` and `/sbin` directories.



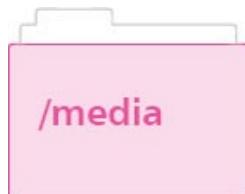
## /lost+found

Contains misplaced files that may be corrupted, but from which data can still be recovered.



## /media

This is a directory in which removable media inserted into the system gets mounted. When you connect a USB flash drive to your PC a sub-directory, such as `mediaflash-drive`, is created.



## /mnt

This is a directory in which the system administrator can temporarily mount an additional file system.



## /opt

Contains nothing initially, but this directory provides a special area where optional add-on application software packages can be installed. If “example” is the name of a particular software package in the `/opt` directory, then all its files could be placed within sub-directories of an `/opt/example` directory.



## /proc

Contains special files that relay information to and from the kernel. The hierarchy of “virtual” files within this directory represents the current state of the kernel. Unlike binary and text files, most virtual files are listed as zero bytes in size and are time-stamped with the current date and time. This reflects the notion that they are constantly updating.



## /root

This is the home directory of the root account superuser – for security reasons regular users cannot access this directory.



## /run

Contains transient files required by applications at runtime to supply data such as process IDs.



### /sbin

Contains executable system programs (binaries) that are only used by the root superuser and by Linux when the system is booting up or performing system recovery operations. For instance, the clock program that maintains the system time when Linux is running is located in the `/sbin` directory. This directory is roughly equivalent to the `C:\Windows\system` directory in Windows.



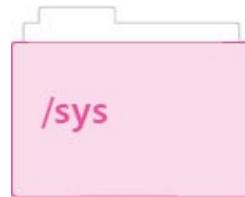
### /srv

Contains files that supply data for services provided by the system.



### /sys

This is a virtual file system that stores the kernel's view of the system and of the devices connected to the system.



### /timeshift

Contains backup snapshots of the system taken at intervals specified by the Timeshift app.



## /tmp

Contains temporary files that have been created by running programs. Mostly these are deleted when the program gets closed, but some do get left behind – periodically these should be deleted. This directory is roughly equivalent to the `C:\Windows\Temp` directory in Windows.



## /usr

Contains sub-directories storing programs that can be run by any user of that system: for instance, games, word processors and media players. This directory is roughly equivalent to the `C:\Program Files` directory in Windows.



## /var

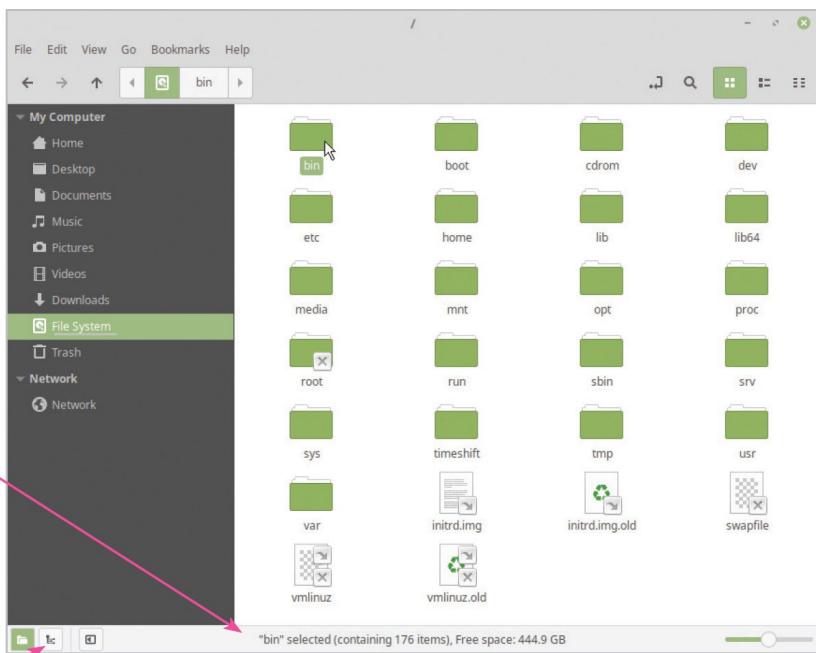
Contains variable data files that store information about ongoing system status, particularly logs of system activity. The system administrator (root superuser) can type `more /var/log/messages` at a root prompt to see the record of system activity messages.



# Navigating with Nemo

The standard Linux sub-directories can be viewed graphically by opening the Nemo file browser app in the / system root location. In Linux Mint, Nemo can be launched by clicking the  “Files” button on the Taskbar or by selecting “Files” on the Menu.

- 1 Click **Menu, Accessories, Files** to open the file browser – see the sub-directories within your home directory
- 2 Expand the **My Computer** list in the left-hand sidebar
- 3 Click the **File System** item – to see all the system’s standard sub-directories within the / system root directory



Notice that when you click on a folder icon, information about its contents appears at the bottom of the window – see how many folders are empty.



You can click these buttons to change the sidebar view and to show/hide the sidebar.

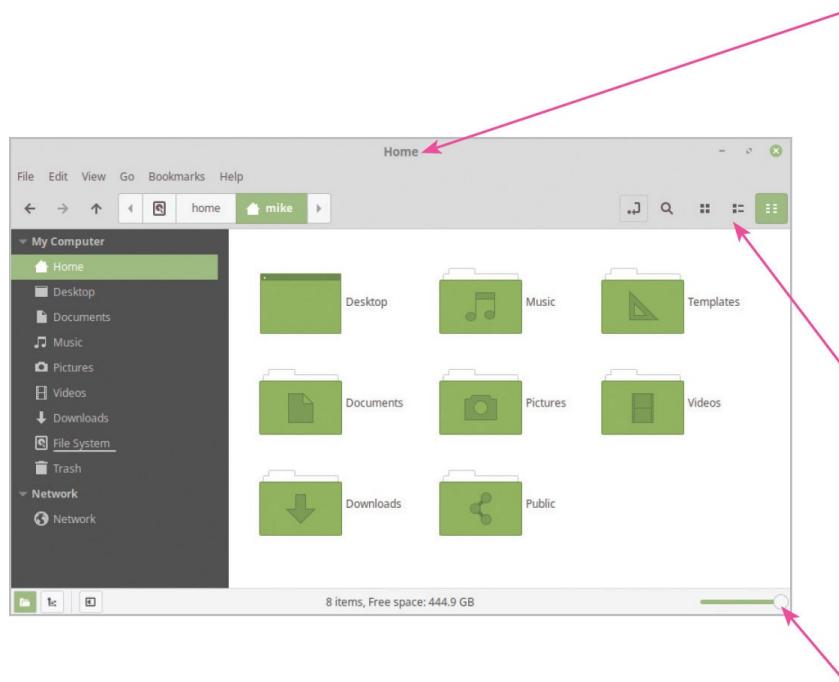
- 4 Click any directory folder to explore the system's standard sub-directories
- 5 Click the back button above the sidebar to go to the previously-visited location



If you cannot see the sidebar when you open Nemo, hit the F9 key to show the sidebar.

You can navigate through the file system with Nemo by clicking on a folder or by clicking on a location in the sidebar. Also, you can click the button on the toolbar to open a location field, then type in a directory address and hit the Return key.

- 6 Click the folder icon of the `/home` directory ("home") – there will be a folder there bearing your username
- 7 Click on the folder bearing your username to see the contents of your home directory



Notice that Nemo displays the name of the currently-displayed directory on its title bar.



You can click these buttons to change how the folders are viewed.



You can drag this slider to adjust the zoom level.

8

- On the Nemo file browser toolbar, click the up button twice to

navigate back up to the / root location

9

Click the **Home** item in the sidebar to navigate to the user's home directory once more – then return to / again

10

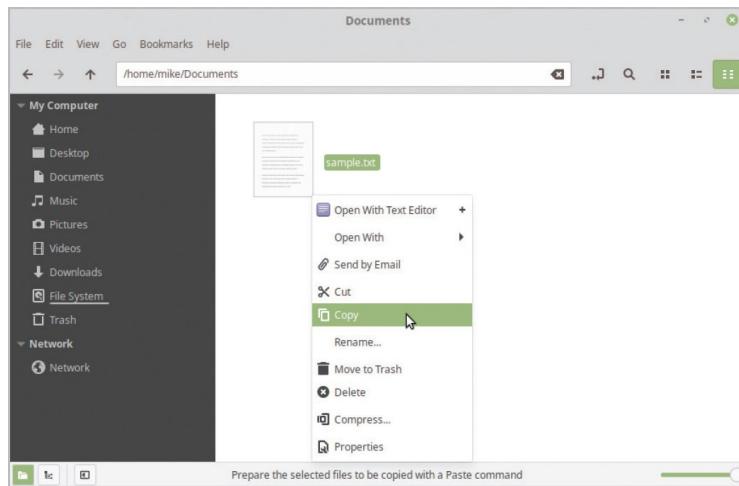
Click the ↗ button on Nemo's toolbar to reveal the location field, and type the address of the user's home directory (in this case `homemike`), then hit Return to navigate to the home directory one more time



# Handling Files

All data files you create in Linux should only be saved in your home directory, or a sub-directory (“folder”). They can be revisited at any time using the Nemo file browser and can be easily copied, moved, renamed, or deleted:

- 1 Click on **Menu, Accessories, Text Editor** to launch a plain text editor, then type in some text and click the  Save button on the toolbar (or click the File, Save menu)
- 2 In the “Save As” dialog, double-click your **Documents** folder to open it, then type a name for the text document (say, **sample.txt**) and click the  Save button
- 3 Launch the Nemo file browser, then open the **Documents** folder that is located in your home directory and find the saved text file
- 4 Right-click on the file’s icon and choose **Copy** from the context menu – to copy that file to the “clipboard”



- 5 Next, right-click on the **Public** folder within your home directory, then choose **Paste Into Folder** from the context menu – to deposit a copy of the file



The **clipboard** is a memory buffer provided by the operating system and is used for short-term data transfer.

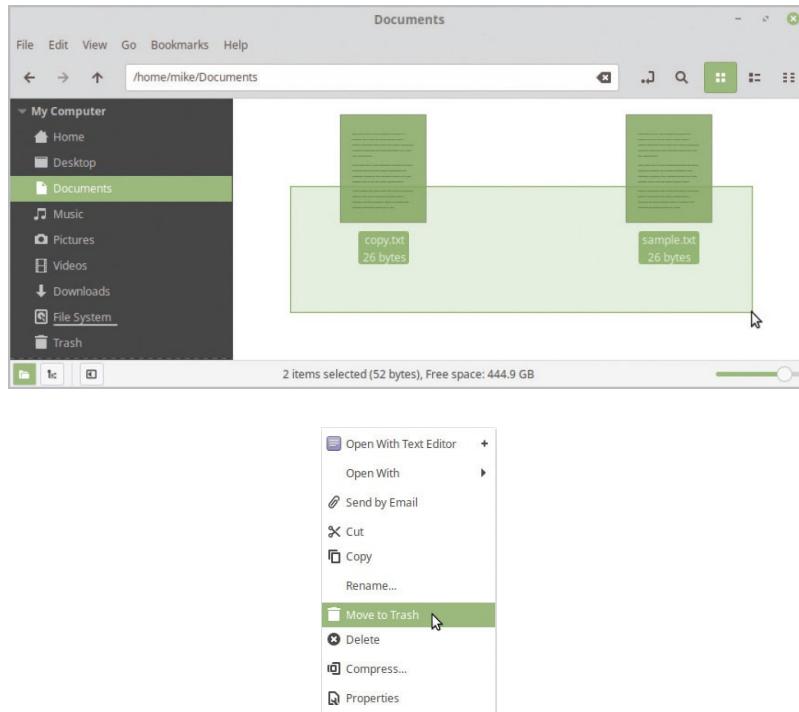


Directories may contain hidden files – click the **View, Show Hidden Files** menu in the Nemo file browser to also show hidden files.

- 6 Open the Public folder, then right-click on the copied file and choose **Rename** from the context menu to see the file name get highlighted – ready to be changed



- 7 Now, type a new file name (“copy”, for instance), then hit **Return** to rename the file as `copy.txt` – the file extension `.txt` remains
- 8 Right-click on the renamed file and choose **Cut** from the context menu
- 9 Navigate back into the Documents folder, then right-click on the file browser window and choose **Paste** from the context menu – depositing the renamed file
- 10 Drag the mouse pointer across both files, then right-click and choose **Move to Trash** to delete the files



You can right-click in the file browser and choose **Create New Folder** from the context menu to add a new directory – but remember that this should be within your home directory hierarchy.

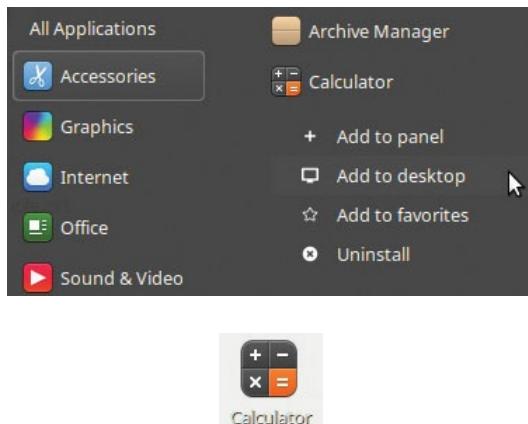


To recover a trashed file, click the **Trash** icon on the file browser's sidebar (or the one on the Desktop), right-click the file icon, then choose the **Restore** option from the context menu.

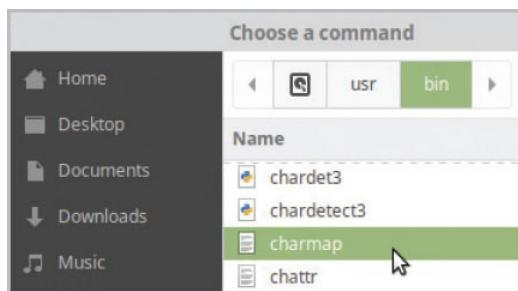
# Creating Shortcuts

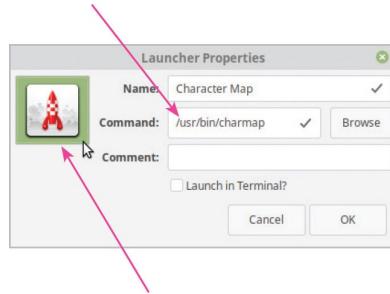
It is often convenient to create Desktop shortcuts to the apps and files you access most frequently. Shortcuts for apps can be created from options on the Menu, or from the Desktop context menu. Shortcuts for files can be created as links using the file browser:

- 1 Right-click an app icon on the Menu, then click the **Add to desktop** option to place a shortcut on the Desktop



- 2 Right-click anywhere on the Desktop, then choose **Create a new launcher here** from the context menu – to open a “Launcher Properties” dialog box
- 3 Enter a shortcut Name, then click the **Browse** button to open a “Choose a command” dialog
- 4 Navigate to the `/usr/bin` directory and select the app for which you want to create a shortcut – to add its path in the Command field





- 5 Click the icon button to open a “Choose an icon” dialog

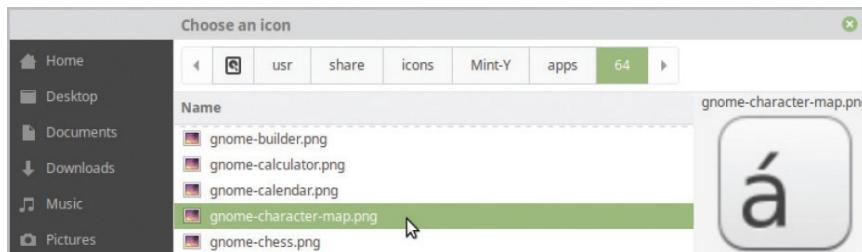


A shortcut or a link can be deleted in the same way as a file – select its icon then hit the **Delete** key. Alternatively, right-click on the icon then choose **Delete** or choose **Move to Trash**.



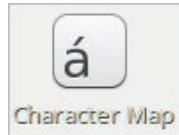
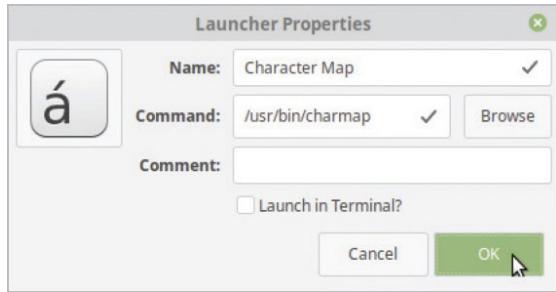
The **/usr** directory contains sub-directories storing programs that can be run by any user.

- 6 Next, navigate to the Linux Mint icons directory at **usrshare/icons/Mint-Y/apps/64** and select an appropriate icon for the shortcut



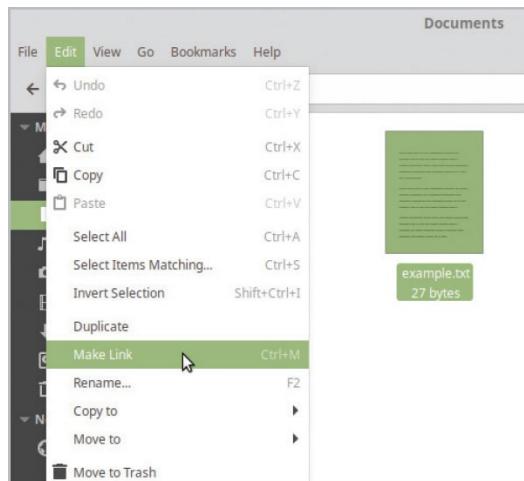
- 7 The selected icon should now appear in the “Launcher Properties” dialog

- 8 Click the **OK** button to place a shortcut on the Desktop



9

Open the file browser in your home Documents directory, then right-click on a text file and choose the **Edit, Make Link** menu – a shortcut icon now appears in that directory and has an arrow denoting it to be a link



10

Drag the link icon from the file browser and drop it onto the Desktop to create a shortcut that can be clicked to launch a Text Editor displaying the target file





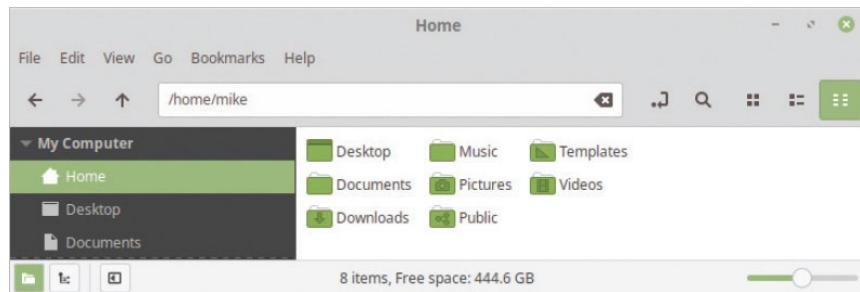
If a selected icon does not appear in the **Launcher Properties** dialog it will not appear on the shortcut – a default icon will appear.



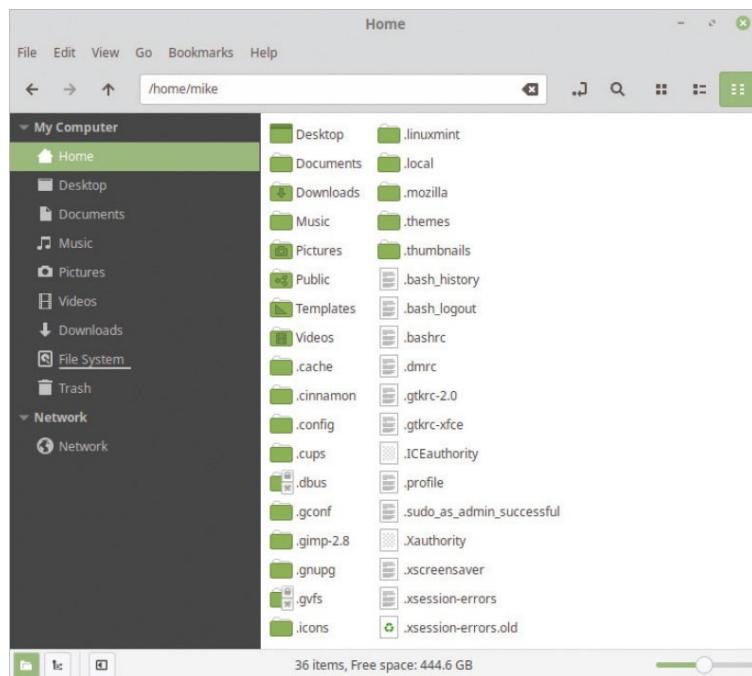
Care must be taken to maintain links, as changes to the target file, such as renaming or moving it, will leave the links “orphaned” – no longer pointing correctly at the target file.

# Locating Files

It is important to recognize that many directories in Linux contain hidden sub-directories and hidden files containing configuration data. These are like the “System” files that are hidden by default in the Windows operating system. In Linux, the name of each hidden directory and file always begins with a dot.

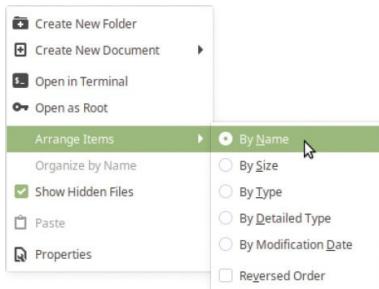


- 1 Open the file browser in your home directory
- 2 Now, click **View, Show Hidden Files** to see all contents





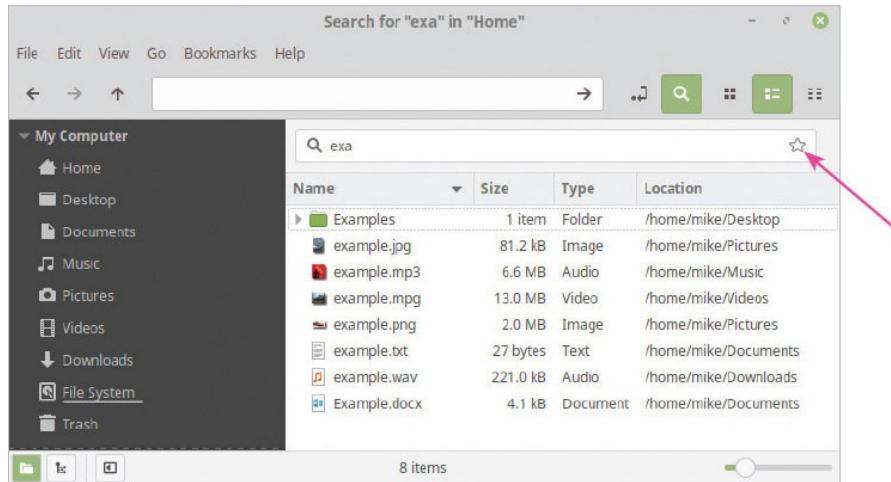
Right-click on the file browser window then select **Arrange Items** from the context menu to choose how you would like the contents arranged.



The easiest way to find a file on your system is with the “Search” box in the Nemo file browser. You can find all files of a particular file type by entering a file extension into the Search box. For example, enter `.txt` to find all files with a “.txt” file extension.

Conversely, you can find all files of a known name regardless of the file extension by entering a name into the Search box. The file browser begins searching as soon as you enter three characters into the Search box, so you don't need to know the full name, and the letters need not be the first three letters of the name – just three consecutive letters within the name. You can substitute the `*` wildcard character for unknown letters too. The search is not case-sensitive, so the results will include uppercase and lowercase matches to the name (or part-name) that you enter:

- 1 Open the file browser in your home directory
- 2 Click the Search button on the toolbar
- 3 Type three characters into the Search box to match a file name or sub-directory within your home directory

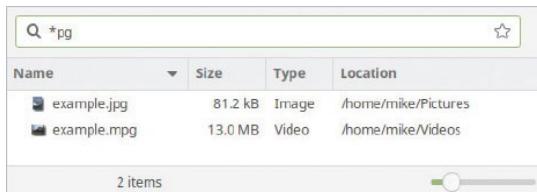


You can click the **Favorites** button to save or forget searches, and right-click it to display saved favorites to quickly make a search again.



4

Type three characters in the Search box to match any file type whose file extension ends with “pg”



The Search results will not include hidden files.

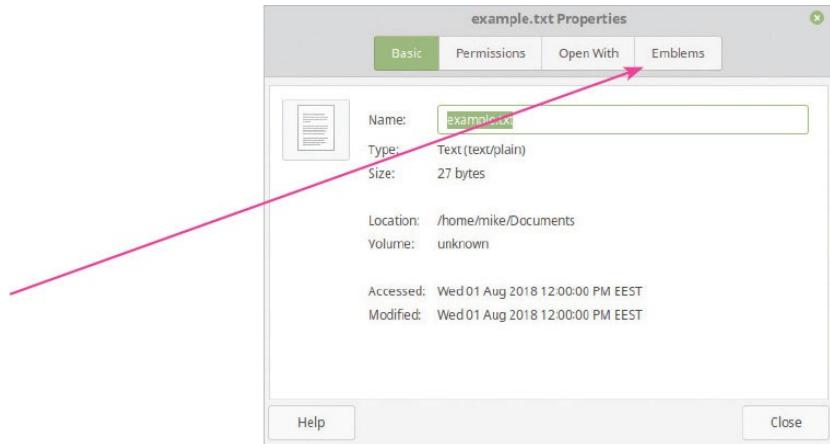
# Understanding Permissions

In Linux each file and directory has an “Owner” – generally, this is the user who created it. The Owner has full permission to read the file, write to the file, and to execute the file (if it’s executable).

The Owner may also set permissions to specify if other users can read, write, and execute the file. The file’s accessibility can be restricted to the Owner, or to a “Group” of which the owner is a member, or to any user of the system (“Others”).

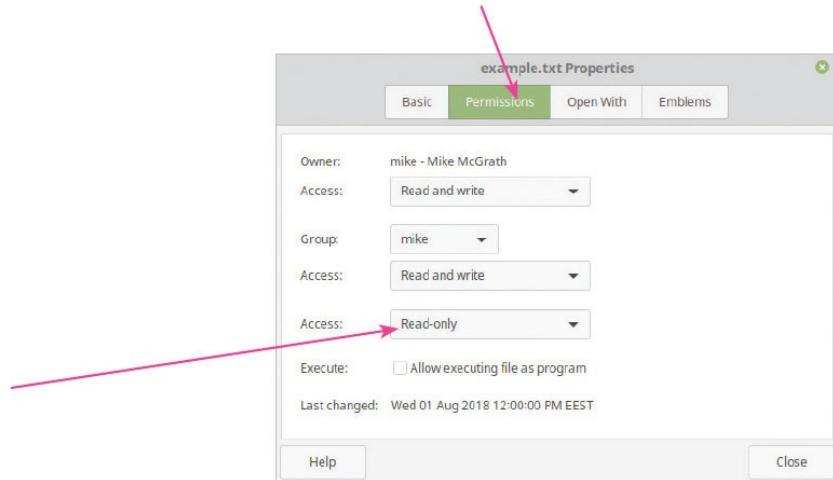
Permission settings of a file can be found on the Permissions tab of its Properties dialog:

- 1 Right-click on a file, then choose the **Properties** item from the context menu – to launch the “Properties” dialog



You can select the **Emblems** tab to add a symbol to the file icon – for example, denoting the file as important.

- 2 Click on the **Permissions** tab to view the current settings



Here, the **Owner** and **Group** have “Read and write” permission, but **Others** have “Read-only” permission.

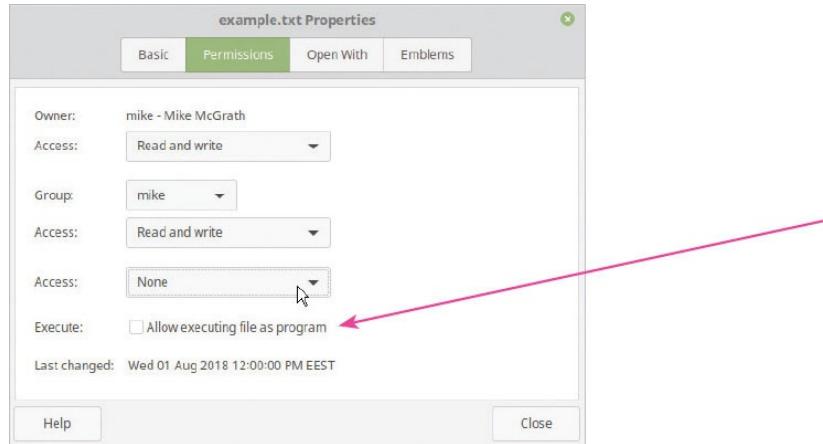


When a user account is created, a **Group** of the same name is also created – of which that user is a member.

Usually the Owner, Group and Others will have permission to at least read the file. If you are the owner of the file, the Owner will have permission to write – and to execute the file if it’s executable.

As the owner of the file you can use the arrowed buttons to change the access permissions of this file:

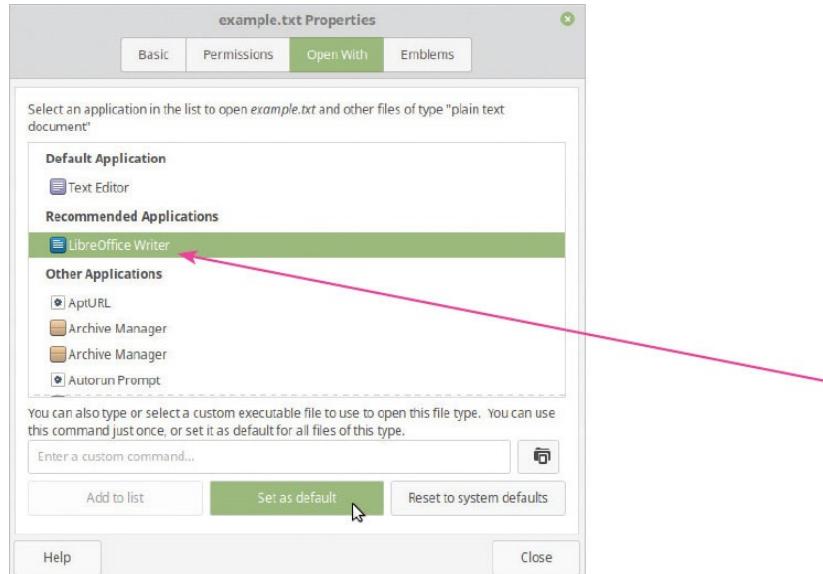
- 3 Click the arrowed button in the “Others” field, then choose **None** from the drop-down menu to restrict access to the Owner and Group members



Checking this option makes the file executable for those users who have permission to access it.

4

Click on the **Open With** tab if you would also like to change the default app that opens this file





Changing the default app is applied to all files of this file type, whereas changing permissions is applied to this file only. Here, the change will make LibreOffice Writer the default app to open all plain text files instead of the Text Editor app.



If you need to change permissions on files where you are not the owner, you need root superuser status – see [here](#) for details.

# Summary

- The Linux **file system** comprises a number of standard directories arranged hierarchically beneath the / system root.
- Data files created by a user should only be stored in the `/home` directory structure – in the user’s **home** directory.
- A user can navigate around the filesystem graphically using the **Nemo file browser** app.
- An individual **file** can be copied, moved, renamed, and deleted with the file browser.
- Desktop launcher shortcuts are easily created by selecting the **Add to desktop** option on the Menu.
- The “Launcher Properties” dialog can create shortcuts to apps.
- A shortcut to a local file can be created as a **link**, which is merely a reference to the target file.
- Care must be taken to avoid orphaning links when the target file gets moved or renamed.
- It is important to recognize that many Linux directories contain **hidden** sub-directories and files.
- Hidden files and directories always have names that begin with a . period character.
- The **View, Show Hidden Files** menu in the file browser allows all content to be seen.
- Files can be located using the file browser’s **Search** box to match file names or file extensions.
- The owner of a file can specify access permissions to allow the **Owner**, **Group**, and **Others** to read, write, and execute.

# **Engaging the Internet**

*This chapter demonstrates popular Linux apps for your online activities.*

**Browsing the Web**

**Customizing Firefox**

**Exchanging Email**

**Chatting Online**

**Downloading Content**

**Getting More Apps**

**Summary**

# Browsing the Web

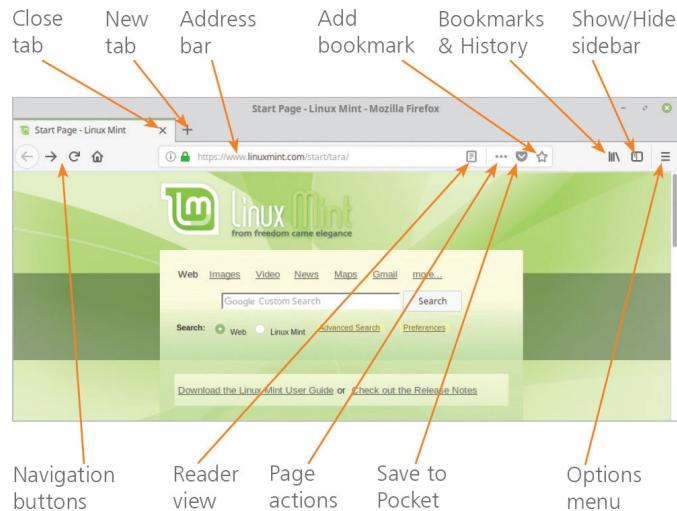
Most Linux distros include the open-source Mozilla Firefox web browser. This popular free browser is available for various platforms and is highly customizable. It has been developed by the open-source community from original Netscape browser source code into a strongly standards-compliant product:



Firefox Web Browser

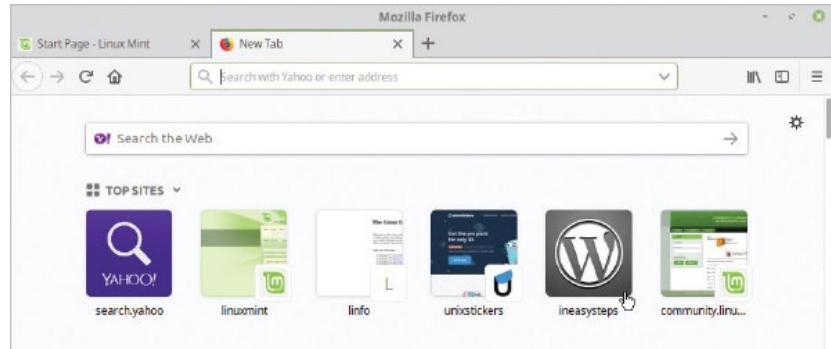
1

Ensure you are connected to the internet, then click **Menu, Internet, Firefox Web Browser** to launch the web browser at its “Start Page”



2

Click the + New Tab button to open a new tab containing a Search box and links to “Top Sites”



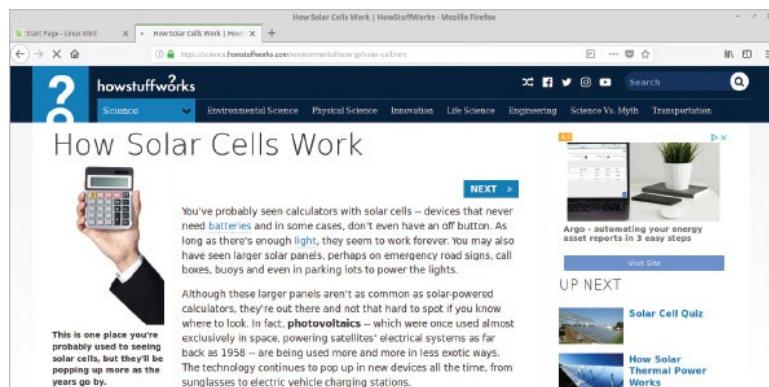
You can enter a URL in the address bar and hit **Return** to visit a web page. The address bar is also a Search box for the Yahoo! search engine.



The **Save to Pocket** feature lets you save web pages so you can view them later on any device.

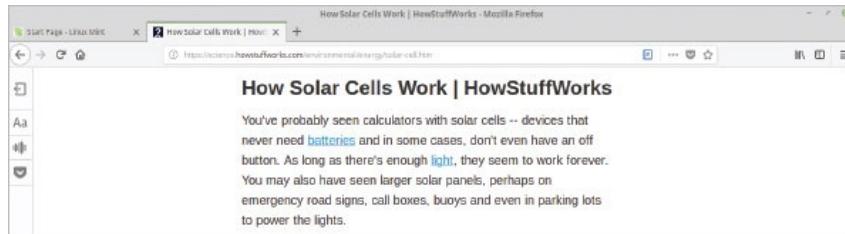
3

Search for an item of interest, such as “How solar cells work”, then select a link from the results to visit the page



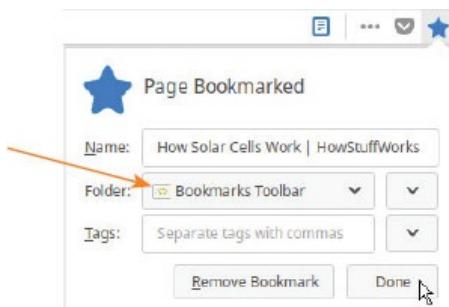
4

Next, click the **Reader view** button on the toolbar to see the page without distractions



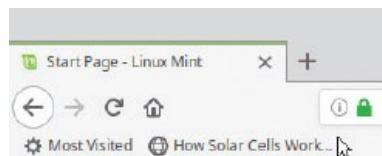
5

Now, click the **Add bookmark** button on the toolbar, then choose the **Bookmarks Toolbar** folder option



6

Click the **Done** button to see the item now appear on a “Bookmarks Toolbar” so you can revisit the page



The **Reader view** button is not available for all web pages, but when visible it toggles between views. Click it to return to the regular page view.

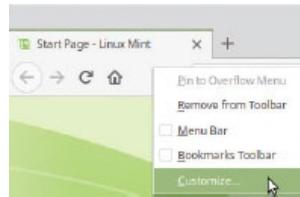


Click the **Show/Hide sidebar** button and choose the **Bookmarks** option to see your bookmarks appear in the sidebar.

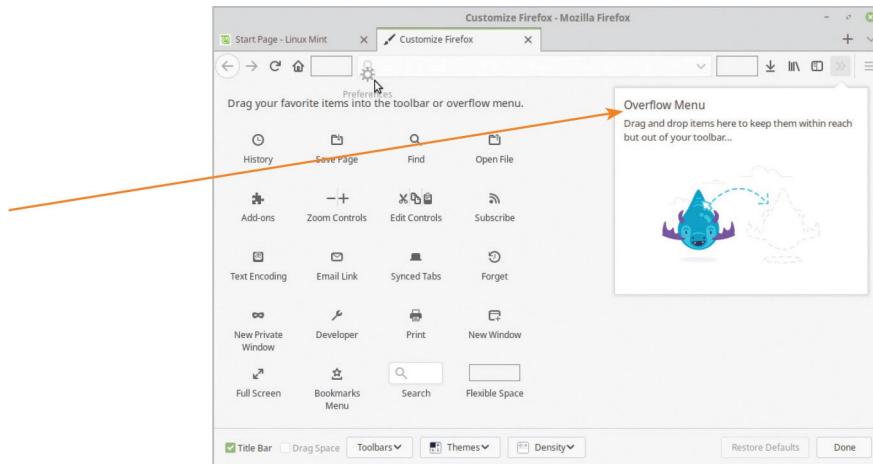
# Customizing Firefox

The interface of the Firefox web browser is highly customizable and you can install “add-ons” for extra functionality:

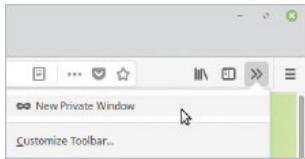
- 1 Right-click on the toolbar, then choose the **Customize** option on the context menu – to open a “Customize Firefox” window



- 2 Drag any item onto the toolbar to add it, or drag an item onto the customize menu to remove it

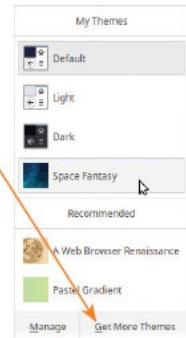


You can also drag items onto the **Overflow Menu**, which you can access later by clicking the toolbar's >> button.



3

Click the **Themes** button and choose from the “My Themes” list of installed themes, or click on **Get More Themes** to install additional themes



4

See your chosen theme instantly applied to the Firefox interface

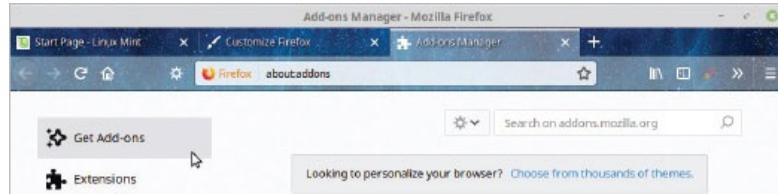


Click the **Toolbars** button to add or remove more toolbars, and click the **Density** button to adjust the size of the toolbar icons.

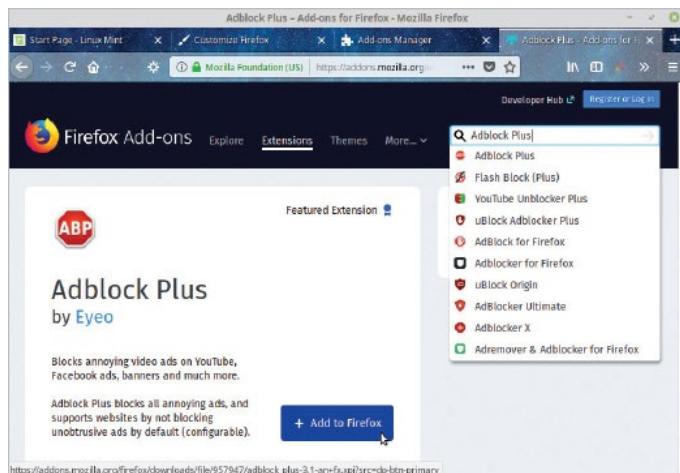




- 5 Next, click the **Manage** button on the My Themes list to open an “Add-ons Manager” window



- 6 Click the **Get Add-ons** option, then scroll to the bottom of the page and click the **See more add-ons!** button



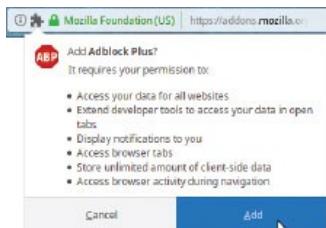
- 7 Use the Search box to find an extension, such as “Adblock Plus”, then click the **Add to Firefox** button to install it
- 8 Now, click **Add** to give permissions and install the add-on



You can also use the Add-ons Manager to remove add-ons later.



**Adblock Plus** is a top-rated free add-on with over 11 million users. It automatically blocks advertisements and puts a button on the Firefox toolbar. This displays the number of ads blocked and provides options to allow non-intrusive ads.



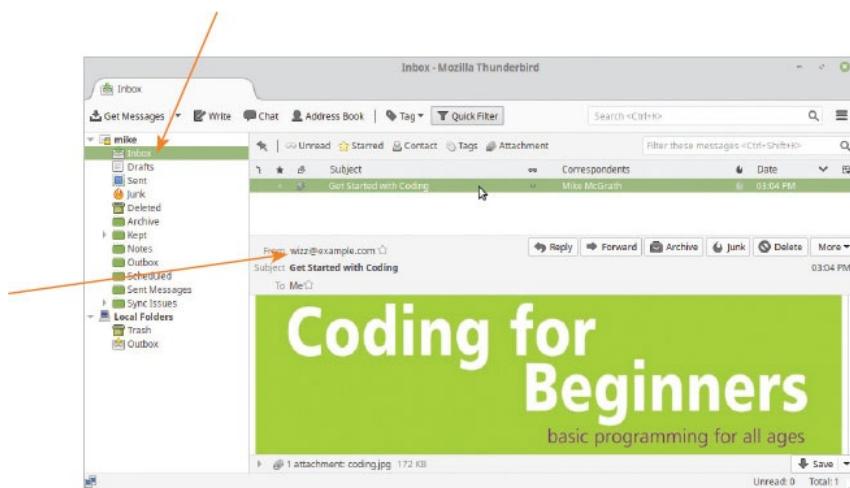
# Exchanging Email

Many Linux distros include the popular Thunderbird email app. The first time Thunderbird gets started it offers you a new email account or the option to use an existing email account. Typically, you will need to supply the name of your ISP's mail servers (POP and SMTP), and your email address and password. When this is complete, and you have an internet connection, you can start sending and receiving email messages:



Thunderbird Mail

- 1 Click **Menu, Internet, Thunderbird Mail**, then click the **Get Messages** button on Thunderbird's toolbar
- 2 Expand the folders list in the left-hand pane, then click the **Inbox** to see received messages in the top right-hand pane





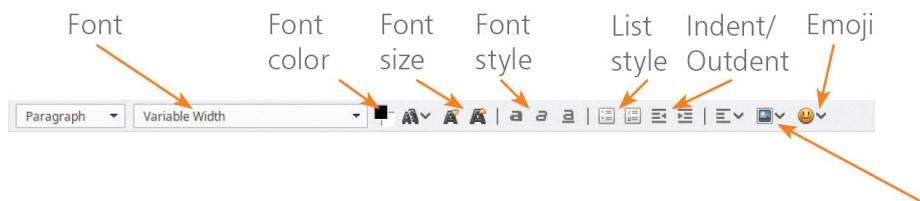
Thunderbird is also a contact manager. Right-click this “From” field and choose **Add to Address Book** then click the **Address Book** button on the toolbar to see your contacts list.

- 3 Click on a received message in the top right-hand pane to see its contents appear in the bottom right-hand pane
- 4 To write a message, click the **Write** button on the toolbar to open a “Write” window – as seen opposite
- 5 In the Write window’s **From** field, select the account from which to send the message
- 6 In the **To** field, type the email address you are sending to
- 7 In the **Subject** field, type a short message title



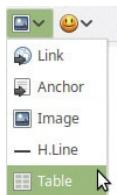
The POP (Post Office PSimple Mail Transfer P

- 8 Now, type your message in the main window
- 9 Use the options on the formatting bar to adjust the font, layout, content, and insert a **Smiley face emoji**

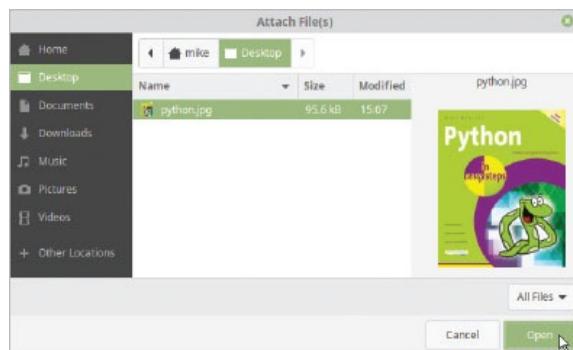




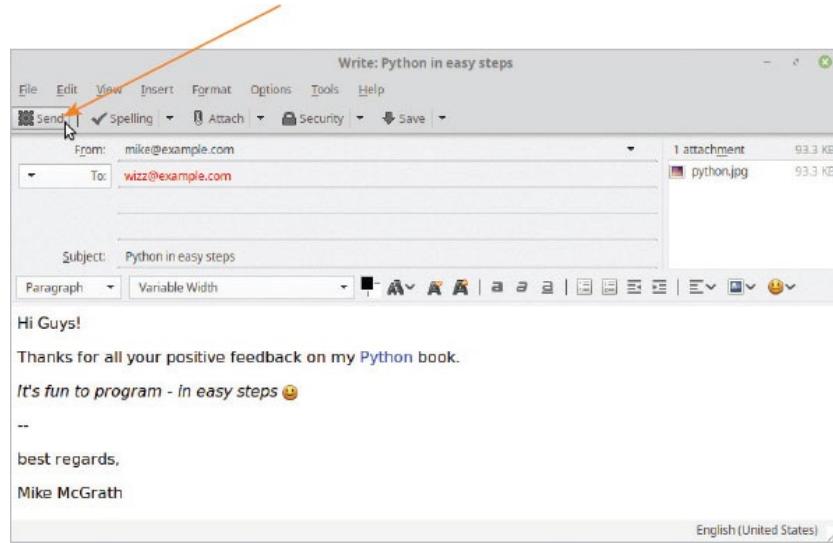
Click this button to insert various content directly into your message.



- 10 To add an attachment, click the **Attach** button on the toolbar to launch the “Attach File(s)” dialog
- 11 Navigate to the file and click the **Open** button



- 12 Check the message for spelling errors by clicking the **Options, Check Spelling** menu
- 13 Click the **Send** button on the toolbar to send the message



The **Edit, Preferences** menu in the main “Write” window allows you to edit all kinds of Thunderbird settings for composition, security, and much more.

# Chatting Online

Linux distros typically include a cross-platform instant messaging application. Linux Mint includes the free open-source HexChat IRC (Internet Relay Chat) app. This can be used to chat about Linux and other topics on the “freenode” IRC network:

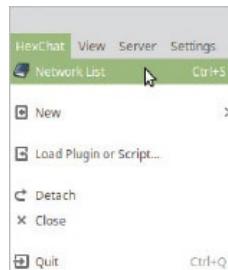


HexChat Client

- 1 Click **Menu, Internet, HexChat** to launch the app – connecting to the “Official Linux Mint Support Channel”



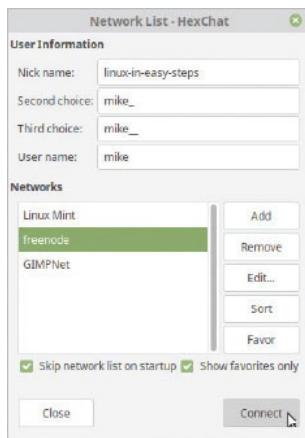
- 2 Next, click the **HexChat, Network List** menu option – to open the “Network List” dialog



- 3 Enter a **Nick name** and a **User name**, then select the “freenode” network

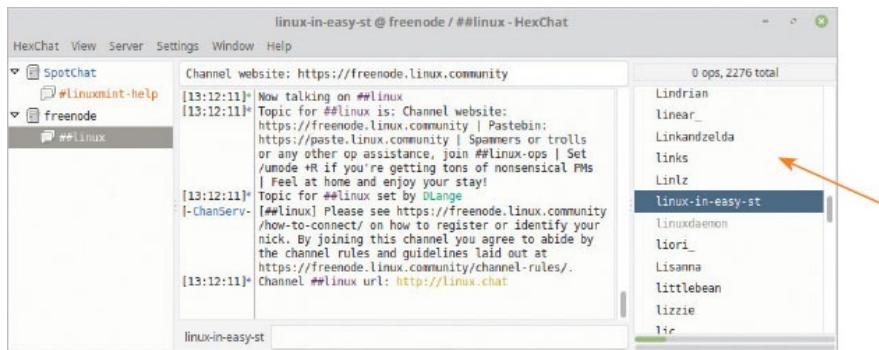
4

Now, click the **Connect** button – to connect to the “freenode” network



5

Once connected, enter the command `/join ##Linux` in the HexChat text field – to join freenode’s Linux Support Channel



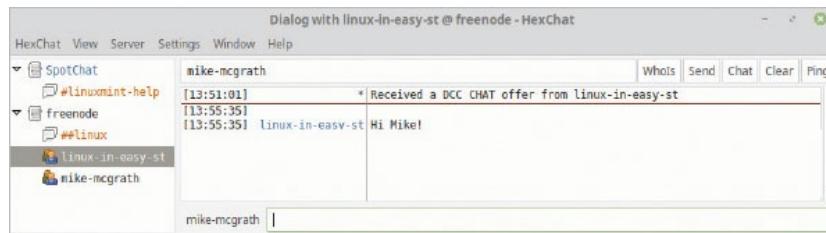
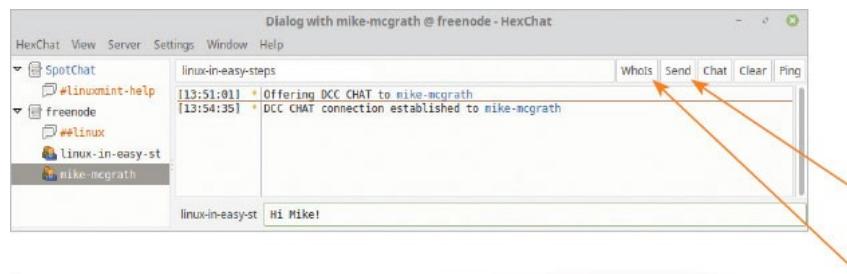
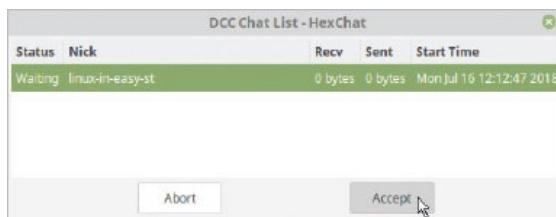
If the “User List” is not visible, click the **View, User List** menu options to make it appear.



The **Nick name** will be your name visible in the IRC channels and the

**User name** is your identity to the server.

- 6 Enter comments or questions in the HexChat text field to chat with other users connected to this channel
- 7 Double-click on any user in the **User List** to switch to a “Dialog with” window to chat directly with that user
- 8 Click the **Chat** button to send a chat request to that user
- 9 Wait until the user accepts the request, then begin to chat



You can click the **Send** button to send a file to the user, and click the **Whois** button to see user connection details.

# Downloading Content

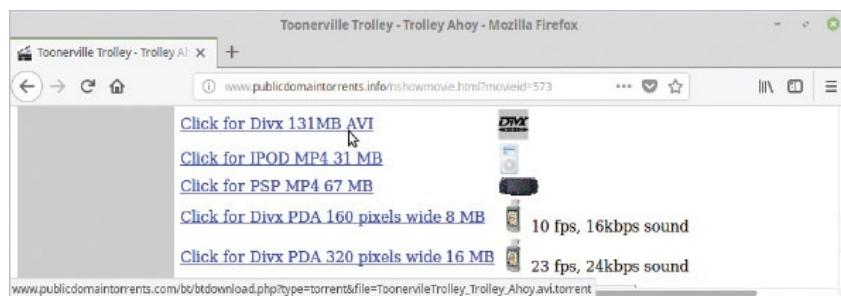
Linux distros typically include the Transmission BitTorrent Client app to acquire content via the BitTorrent protocol. This lets you download directly from other groups of people – in which each person is called a “peer”. Pieces of content from various peers are automatically assembled, making the BitTorrent protocol very efficient and reliable, particularly for large content files.



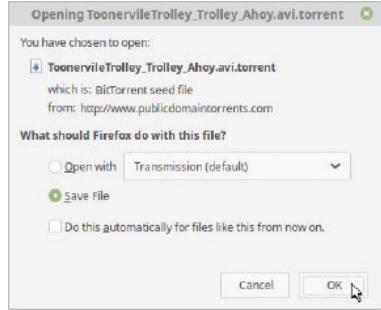
Transmission BitTorrent Downloader

The Transmission BitTorrent Client first requires you to download a “torrent file” containing information about the content you wish to acquire. These can be found in a BitTorrent directory such as Public Domain Torrents ([publicdomaintorrents.info](http://publicdomaintorrents.info)), Internet Archive ([archive.org](http://archive.org)), or Legit Torrents ([legittorrents.info](http://legittorrents.info)):

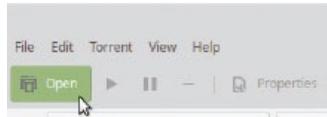
- 1 Open the **Firefox** web browser and visit a BitTorrent directory, then select an item you would like to download



- 2 Choose to save the torrent file – by default to the **Downloads** folder within your home directory



- 3 Click **Menu, Internet, Transmission** to launch the app
- 4 Click the **Open** button on the Transmission toolbar – to open an “Open a Torrent” dialog

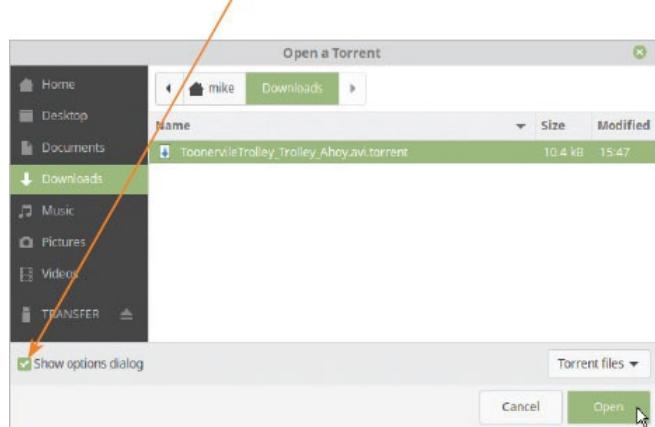


Torrent downloads are often associated with illegal downloads, but free open content can be legally downloaded.



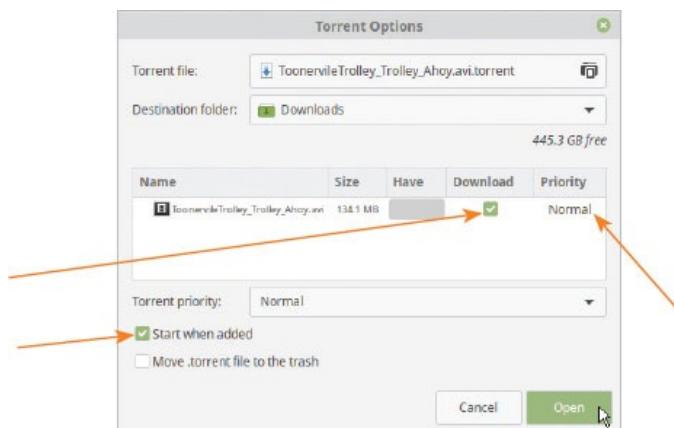
The first time you launch the **Transmission** app a dialog will appear in which you need to agree to share content responsibly.

- 5 Select the torrent file you downloaded and check the **Show options dialog** option



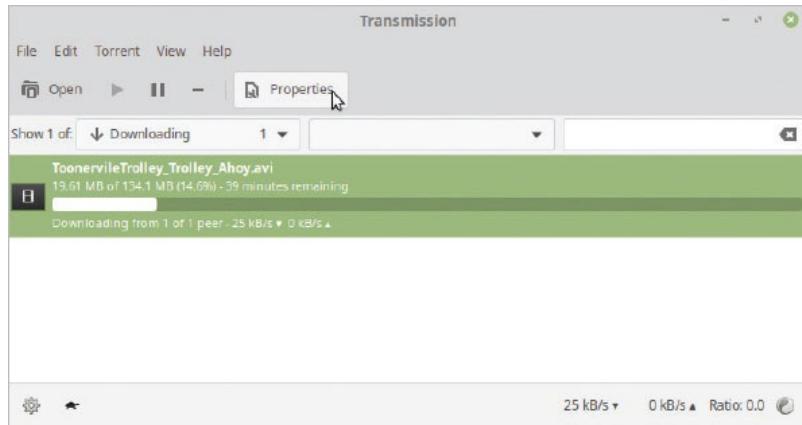
6 Click the **Open** button – to open a “Torrent Options” dialog

7 Check the **Download** and **Start when added** options



You can download multiple torrents simultaneously and click here to set each one's priority to **Low**, **Normal**, or **High**.

8 Click the **Open** button to start downloading the content

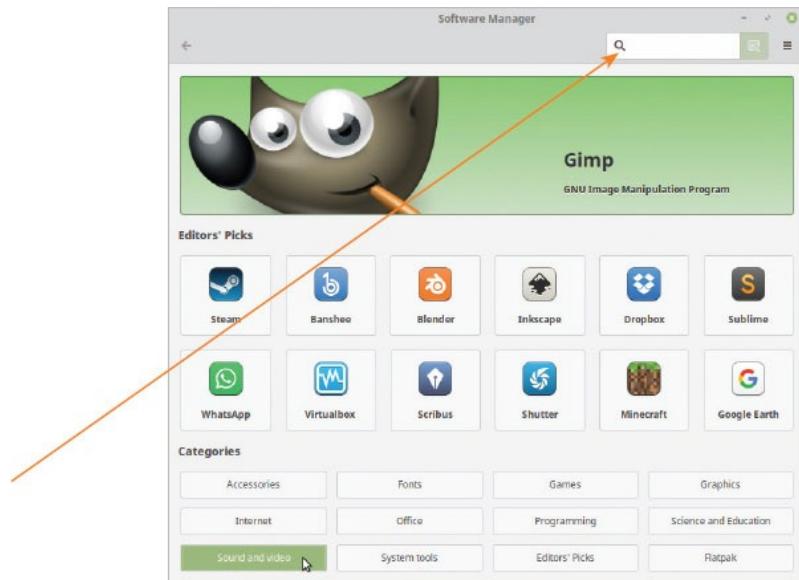


Click the **Edit, Preferences** menu to specify how your downloads should be managed.

# Getting More Apps

In addition to the apps that are supplied with your Linux distro, there are many more free apps that can be easily installed. The Linux Mint distro includes a Software Manager utility app that lets you search for more apps by name or by category. When you select an app, there is a description and screenshot accompanied by user reviews that help you decide if you want to install that app:

- 1 Click **Menu, Administration, Software Manager** to launch the utility
- 2 Click a category button for the type of app you are seeking – for example, to find a music streaming app click the **Sound and video** button



If you know the name of the app you can use the Search box to find it.

- 3 Click any item listed in your chosen category to see a description and reviews of that app



Software Manager

Sound and video

Amarok  
Easy to use media player based on the KDE Platform ★★★★☆ 3.8 139 Reviews

Spotify  
Spotify streaming music client ★★★★☆ 4.5 30 Reviews

Software Manager

Spotify  
Spotify streaming music client ★★★★☆ 4.5 50 Reviews

Install

https://www.spotify.com

Play Queue

Details

Package: spotify-client  
Version: 1.1.0.80480.g51b03c3-13  
Size: 97.5 MB to download, 230.2 MB of disk space required

Reviews

★★★★★ Great thanks for this version it works perfectly!  
jake  
2017.12.20

★★★★★ Fantastic player. Love it.  
kzmina  
2017.12.02

★★★★☆ Good  
X\_lina  
2017.11.21

Click [here](#) to add your own review.



You can click this link to open the app's Homepage in your web browser and discover more about the app.



You can click this link if you would like to add a review of your own.



The “Software Manager” received many improvements in Linux Mint version 19 (Tara) to enable faster searches and to allow searching by category.

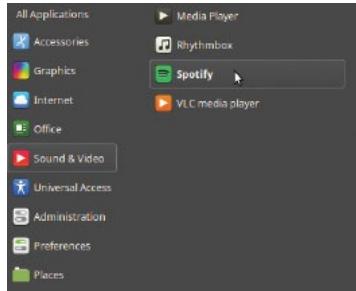


See here for more on installing apps.

- 4 Click the **Install** button if you decide you want this app
- 5 Enter your password to download and install the app



- 6 Now, click **Menu, Sound & Video** to see a launcher has been added in an appropriate category





The description page of an installed app has a **Remove** button (in place of the **Install** button) that you can click to uninstall that app.



# Summary

- The **Mozilla Firefox** web browser is included with most Linux distros.
- The **+ New Tab** button in Firefox opens a new tab containing a Search box and links to “Top Sites”.
- Firefox provides **Reader view** to hide page distractions.
- Firefox web browser is highly customizable and allows the installation of **add-ons** for extra functionality.
- Many Linux distros include the **Thunderbird** app with which to send and receive email messages.
- The **formatting bar** in Thunderbird allows you to adjust the font, layout, and content, and to insert emojis in your message.
- The **Thunderbird** email app is also a contact manager.
- Linux Mint includes the **HexChat** cross-platform instant messaging app.
- The **Official Linux Mint Support Channel** is available to chat about Linux topics.
- The **Transmission** app can download content using the BitTorrent protocol.
- Transmission requires a **torrent file** containing information about the content to be acquired.
- Pieces of content from various **peers** are automatically assembled, making the BitTorrent protocol very efficient.
- Linux Mint includes a **Software Manager** utility app that groups available apps by category.
- Software Manager provides a **description** and **reviews** of each available app.
- The Software Manager app can **Install** and **Remove** apps from the system.

# **Producing with Office**

*This chapter describes the productive apps within the free LibreOffice suite.*

[\*\*Creating Documents\*\*](#)

[\*\*Exporting Documents\*\*](#)

[\*\*Creating Spreadsheets\*\*](#)

[\*\*Creating Presentations\*\*](#)

[\*\*Creating Visualizations\*\*](#)

[\*\*Running Macros\*\*](#)

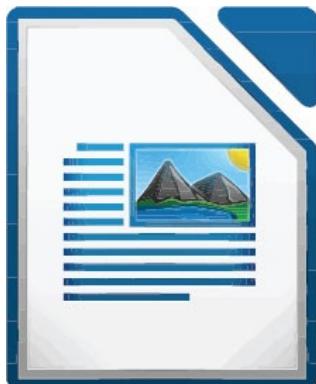
[\*\*Adding Interaction\*\*](#)

[\*\*Handling Data\*\*](#)

[\*\*Summary\*\*](#)

# Creating Documents

The LibreOffice suite that is included with most Linux distros contains a set of office tools similar to those in Microsoft Office: word processor, spreadsheet, and presentation programs, together with a program to create charts, graphs and diagrams, and a database app. If you are familiar with Microsoft Office you will feel instantly at home with the LibreOffice equivalents.



LibreOffice Writer

Most importantly, LibreOffice contains file filters that allow it to work with standard Microsoft Office documents from Word, Excel and PowerPoint. Files can be saved in Microsoft Office file formats, as well as formats native to LibreOffice, and objects (OLE objects, plugins, video, applets, charts) can be embedded within a document in much the same way as in Microsoft Word:

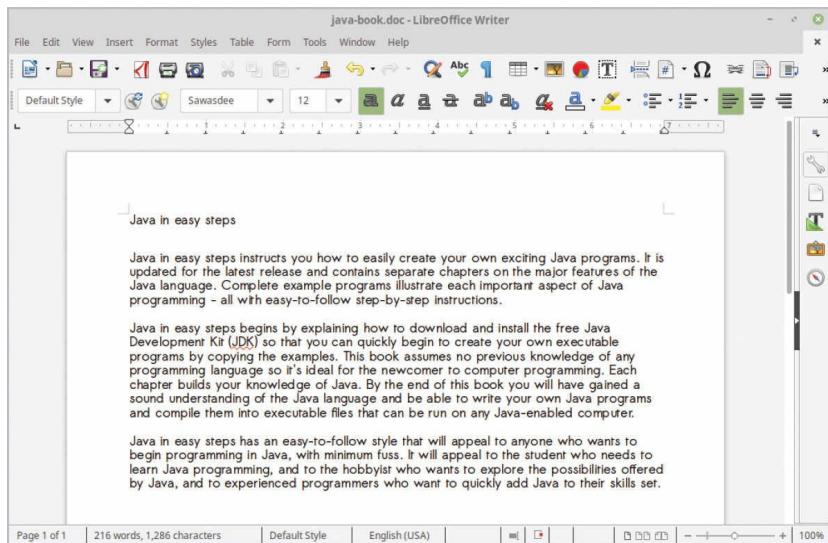
1

- Click **Menu, Office, LibreOffice Writer** to launch a word processor with a new blank document open



2

Type some content in the new document



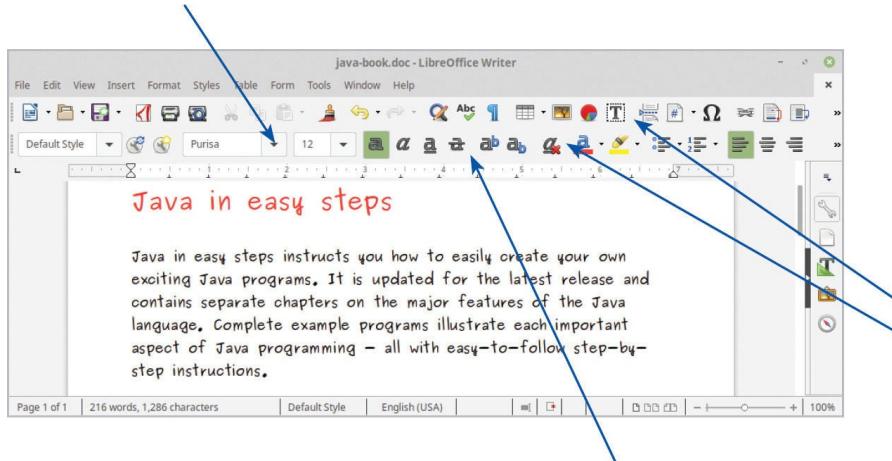
LibreOffice is forked from OpenOffice, which was based on original code from the StarOffice application by Sun MicroSystems. Sun made the code freely available for development by the open-source community – so LibreOffice has no proprietary ties.



There are versions of LibreOffice for Linux, Mac and Windows – all available for free download at [libreoffice.org](http://libreoffice.org)

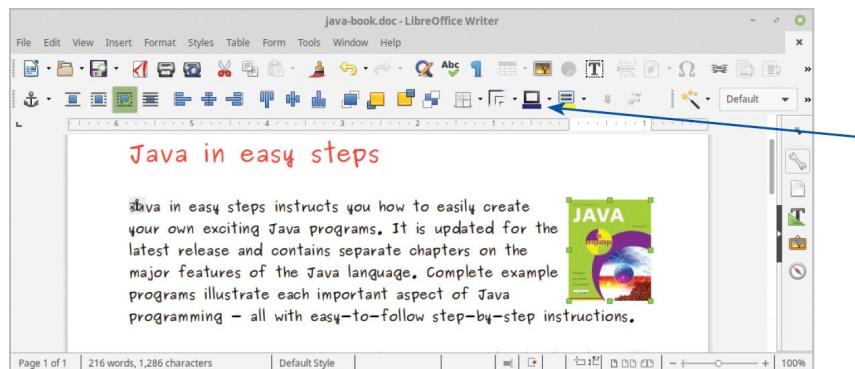
3

Click the **Edit, Select All** menu item (or press **Ctrl + A**) to select all content, then choose a font from this drop-down list on the toolbar



The Writer interface shown here contains the **Standard toolbar** and **Formatting toolbar**.

- 4 Select the heading text then use these toolbar buttons to modify the font height, font weight and font color
- 5 Click the **Insert, Image** menu item to launch an “Insert Image” dialog, then choose an image file to add to the document at the current cursor position
- 6 Click on the image and drag it to position it over the text body, then drop it to see the text automatically wrap around





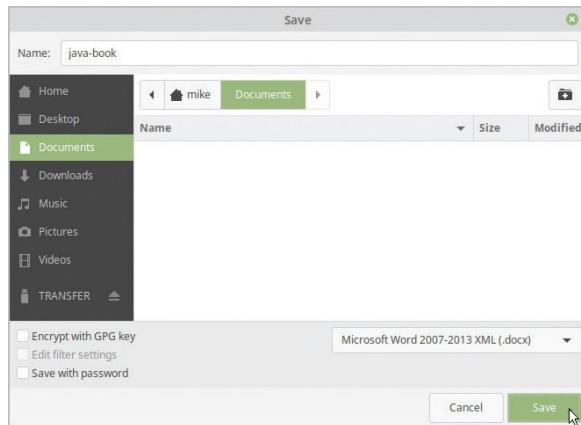
Notice that an **Image** toolbar automatically replaces the Formatting toolbar when an image is selected. Double-click the image to open an “Image” dialog where you can adjust the **Wrap** spacing, and much more.

- 7 Click **File, Properties** to open a “Properties” dialog where you can add a document description and security options

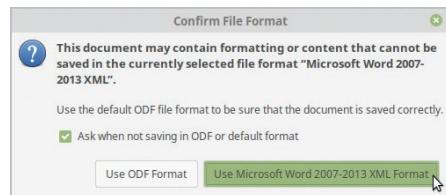
# Exporting Documents

When saving documents from the LibreOffice word processor, the default file format used is the ODF (Open Document Format) Text format (.odt). Many alternative file formats are available, however, so your documents can be made compatible with Microsoft Office:

- 1 Click **File, Save** (or press **Ctrl + S**) to launch the “Save” dialog, then type a document name in the **Name** field
- 2 Click the arrowed file type button to open a list of possible formats in which to save the document – choose the format **Microsoft Word 2007-2013 XML (.docx)**
- 3 Choose a location at which to save the document, such as your Documents folder, then click the **Save** button



- 4 If a “Confirm File Format” dialog appears, click the button to confirm you wish to save using the **.docx** file format – the file is then saved at the chosen location

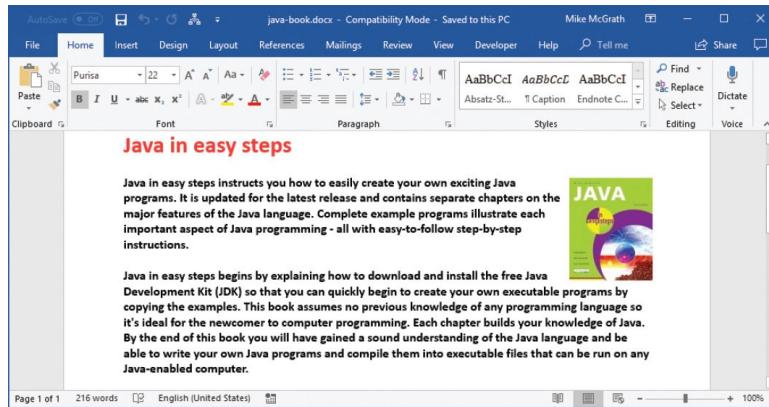




In the **Save** dialog you don't need to include a file extension in the Name field – it gets added automatically.

LibreOffice Writer has built-in support for the PDF (**P**ortable **D**ocument **F**ormat) format. This allows you to create read-only versions of your documents in the popular PDF format, without any additional software. The PDF format maintains the style and content of the original document in a very compact file that can be easily transferred around networks and the internet:

- 5 Click **File, Export As, Export as PDF** to create a PDF version of the document – with the same file name but with a **.pdf** file extension
- 6 Copy the documents created in LibreOffice on Linux to a Windows system for comparison





The uneditable PDF version maintains its appearance precisely, but the editable DOCX version may substitute a different font if the original is not also installed in Windows – more importantly, both versions maintain color and layout formatting.

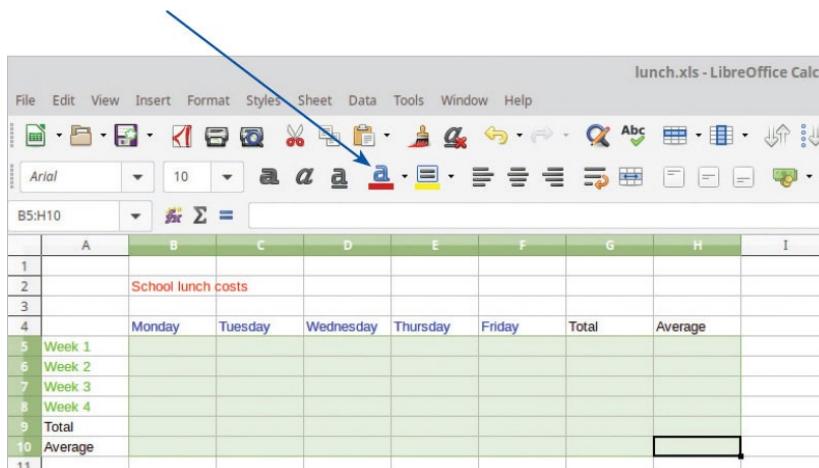
# Creating Spreadsheets

The spreadsheet app that is part of the free LibreOffice suite provides the powerful ability to perform calculations on data entries using given formulas. It also allows spreadsheets to be saved in the format compatible with Microsoft Excel (.xlsx):



LibreOffice Calc

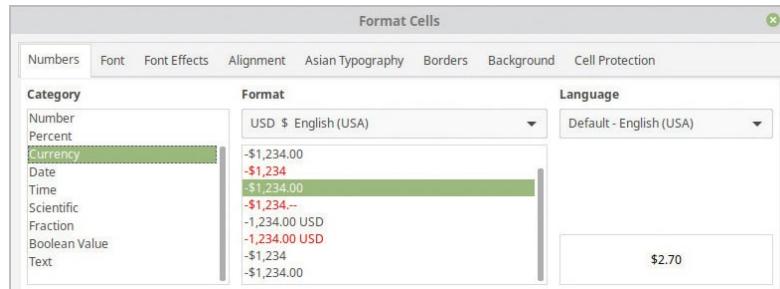
- 1 Click **Menu, Office, LibreOffice Calc** to launch the spreadsheet app with a new blank spreadsheet open
- 2 Enter some row and column headings, then use the **Font Color** button to accent their purpose



- 3 Drag over all cells that will contain data, then right-click and choose **Format Cells** from the context menu – to open a “Format Cells” dialog

4

- Choose the **Currency** category in the dialog, then click the dialog's **OK** button to apply the selection



5

- Enter numerical values in all cells for each week row and day column – each value is treated as a currency amount



You can choose cell colors, fonts, borders, alignment, and more in the **Format Cells** dialog.

6

- Drag the mouse across each day cell on a row and its “Total” cell, then click the  $\Sigma$  character on the toolbar – a **SUM** formula appears in the formula field and a row total value appears in the Total cell

7

- Repeat the previous step for each row and column

	A	B	C	D	E	F	G	H
1								
2		School lunch costs						
3								
4		Monday	Tuesday	Wednesday	Thursday	Friday	Total	Average
5	Week 1	\$2.70	\$2.30	\$2.50	\$2.65	\$2.90	\$13.05	\$2.61
6	Week 2	\$2.75	\$2.20	\$2.40	\$2.00	\$2.60	\$11.95	\$2.39
7	Week 3	\$2.70	\$2.70	\$2.70	\$2.25	\$2.35	\$12.70	\$2.54
8	Week 4	\$2.70	\$2.70	\$2.60	\$2.70	\$2.20	\$12.90	\$2.58
9	Total	\$10.85	\$9.90	\$10.20	\$9.60	\$10.05	\$50.60	
10	Average							

8

- Type **=AVERAGE** in an “Average” cell at a row end and hit **Return**, then drag across the day cells on that row and hit **Return** again – a row average appears in the Average cell

9

Repeat the previous step for each row and column

	A	B	C	D	E	F	G	H
1								
2		School lunch costs						
3								
4		Monday	Tuesday	Wednesday	Thursday	Friday	Total	Average
5	Week 1	\$2.70	\$2.30	\$2.50	\$2.65	\$2.90	\$13.05	\$2.61
6	Week 2	\$2.75	\$2.20	\$2.40	\$2.00	\$2.60	\$11.95	\$2.39
7	Week 3	\$2.70	\$2.70	\$2.70	\$2.25	\$2.35	\$12.70	\$2.54
8	Week 4	\$2.70	\$2.70	\$2.60	\$2.70	\$2.20	\$12.90	\$2.58
9	Total	\$10.85	\$9.90	\$10.20	\$9.60	\$10.05	\$50.60	
10	Average	\$2.71	\$2.48	\$2.55	\$2.40	\$2.51		\$2.53

10

Click **File, Save** (or press **Ctrl + S**) to launch the “Save” dialog, then type a spreadsheet name in the **Name** field

11

Click the arrowed file type button to open a list of possible formats in which to save the spreadsheet – accept the default ODF Spreadsheet format (**.ods**) or choose the format **Microsoft Excel 2007-2013 XML (.xlsx)**



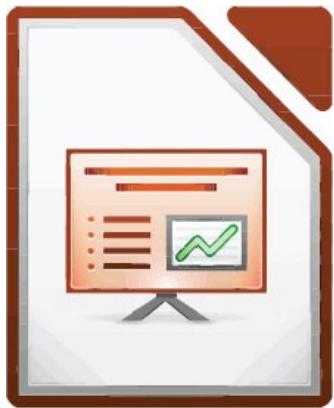
You can use the **Background Color** button to accent the purpose of each cell.



You can open this file in Excel on a Windows system to see that all formatting and formula functions are preserved.

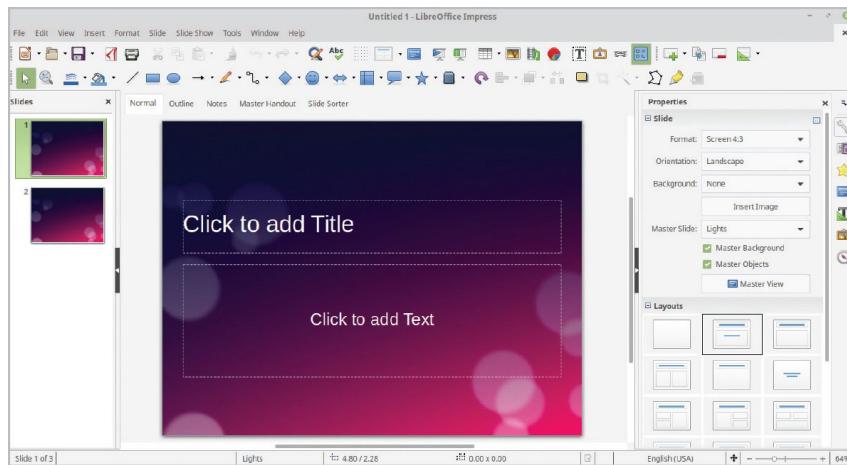
# Creating Presentations

The presentation app that is part of the free LibreOffice suite provides the ability to easily produce great slideshows. It also allows presentations to be saved in the format compatible with Microsoft PowerPoint (.ppt).

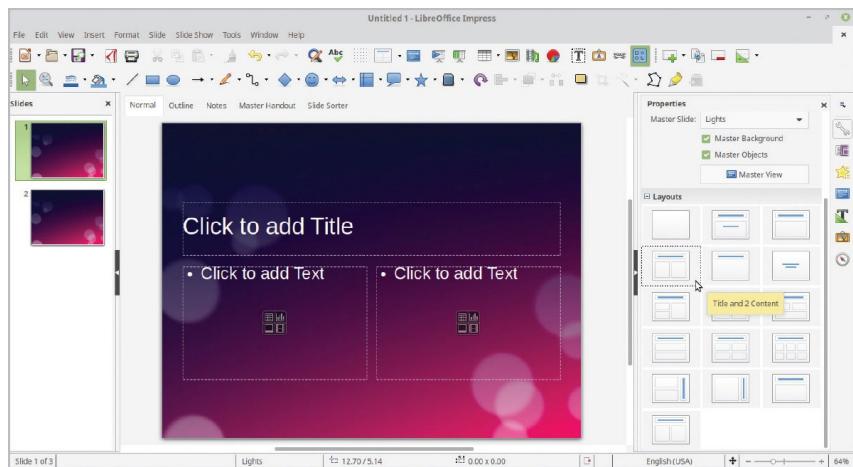


LibreOffice Impress

- 1 Click **Menu, Office, LibreOffice Impress** to launch the app with a new blank presentation open
- 2 A “Select a Template” dialog should also appear when you launch the app – select a template, such as **Lights**



- 3 Select how you want the content grouped from an option in the “Layouts” pane, such as **Title and 2 Content**



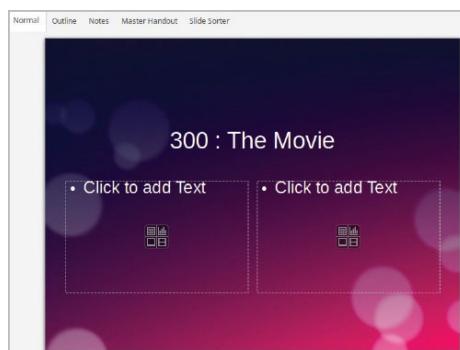
If the “Select a Template” dialog does not appear when you launch the app, click the **File**, **Close** menu to close the blank presentation, then select **Templates** in the “backstage” window.



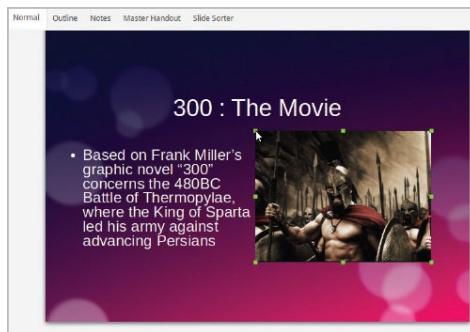
If the “Layouts” pane is not immediately visible, click **View**, **Slide Layout** to make it appear.

4

Click on the “Click to add Title” box, then type a title



- 5** Click **Format, Align, Center** to position the title
- 6** Next, type some narrative text in the left “Click to add Text” box
- 7** Click on the right “Click to add Text” box, then click **Insert, Image** to launch an “Insert Image” dialog
- 8** Choose an appropriate image to add to the slide, then use the grab handles around the image to adjust its size to your liking



- 9** Right-click this slide in the “Slides” pane, then choose **New Slide** to add a slide with the same template and layout – make further slides to complete the presentation



- 10** Click **Slideshow, Start from First Slide** (or press F5) to run the presentation
- 11** Click **File, Save** (or press **Ctrl + S**) to launch the “Save” dialog, then type a presentation name in the **Name** field
- 12** Click the arrowed file type button to open a list of possible formats –

accept the default ODF Presentation format (**.odp**) or choose **Microsoft PowerPoint 2007-2013 XML (.pptx)**



You can switch to “Master Slide View” where you can add elements you want to appear on all slides. Slides you have created are not visible when in Master Slide View, so it looks like they have disappeared. Click **View**, **Normal** to continue working on your slides.



If the “Slides” pane is not immediately visible, click **View**, **Slide Pane** to make it appear.

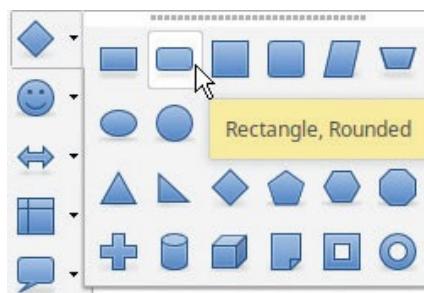
# Creating Visualizations

The LibreOffice suite includes an accomplished drawing tool that can be launched from any LibreOffice app to quickly create drawings, charts, diagrams and graphs:



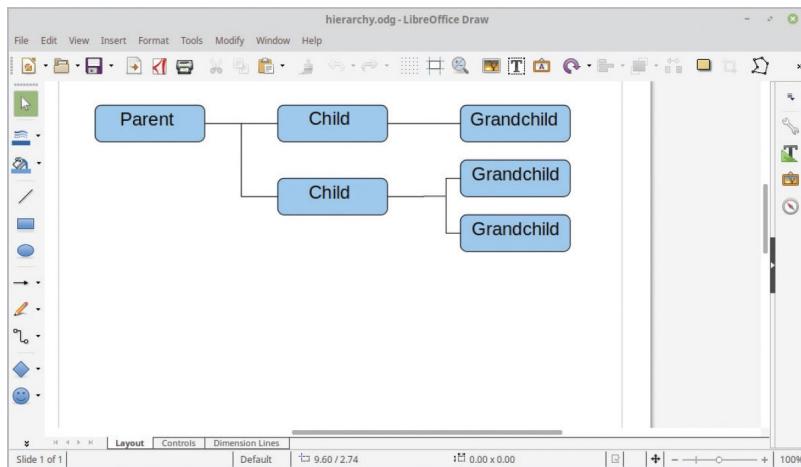
LibreOffice Draw

- 1 From any LibreOffice app, click **File**, **New**, **Drawing** or click **Menu**, **Office**, **LibreOffice Draw** to launch the app
- 2 Click the arrowed button beside the **Insert Basic Shapes** button on the Drawing toolbar, then choose the rounded rectangle object from the selection offered



- 3 Drag the mouse in the drawing area to create a rectangle and press **Ctrl + C** to copy the object, then press **Ctrl + V** five times to paste five more rectangles on top of the first
- 4 Drag the rectangles to separate areas, then click the  **Connector** button on the Drawing toolbar

- 5** Click on a rectangle, then drag to another rectangle to create connecting lines
- 6** Now, click the  **Text** button and label each rectangle

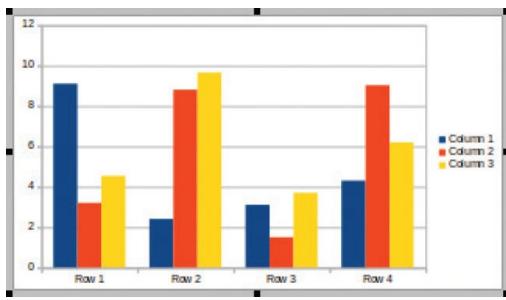


If the Drawings toolbar is not immediately visible, click **View**, **Toolbars**, **Drawing** to make it appear.

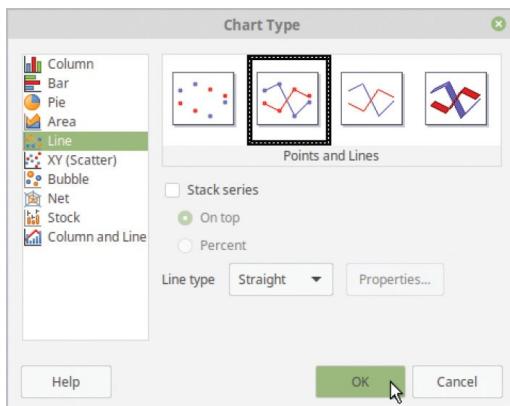


Drawings can be saved in the native ODF (**Open Document Format**), Drawing format (**.odg**), or exported in a variety of image formats such as PNG (**.png**), GIF (**.gif**), and SVG (**.svg**).

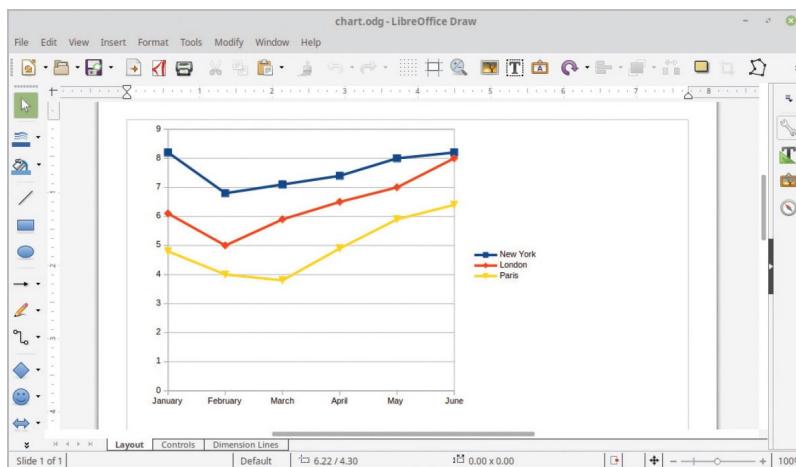
- 7** Click the **Insert**, **Chart** menu to add a default bar chart to the drawing area – a chart Formatting toolbar also appears



- 8 On the Formatting menu, click the **Data Table** button and modify the default values in the “Data Table” dialog that appears, then close that dialog
- 9 Click the **Chart Type** button to launch a “Chart Type” dialog, then choose **Line** in the left-hand pane and **Points and Lines** as the type of chart



- 10 Click the **OK** button to close the “Chart Type” dialog and apply the chosen line style





The chart Formatting toolbar can be launched from the **View, Toolbars**, menu – after you have inserted a chart.

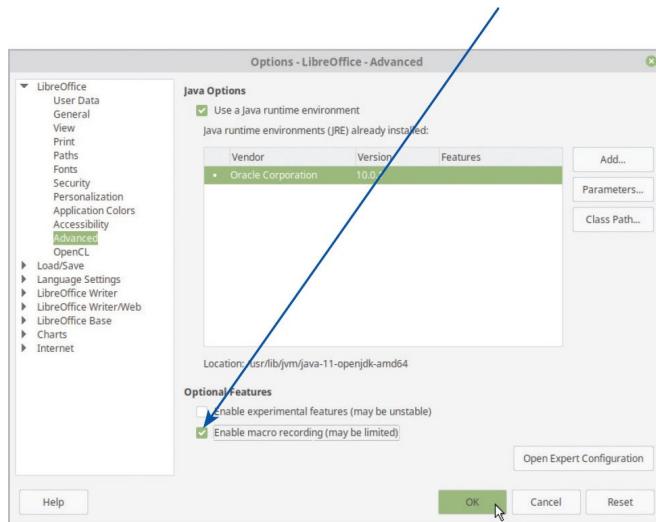


To insert an existing chart into a document, click **Insert, Object, OLE Object** – but to insert the default editable chart just click **Insert, Chart**.

# Running Macros

A “macro” is a recorded sequence of keystrokes that are stored with a given name. Running a macro replays the sequence, writing into the current document. This is particularly useful for recreating frequently-typed text within spreadsheets in LibreOffice Calc and within text documents in LibreOffice Writer:

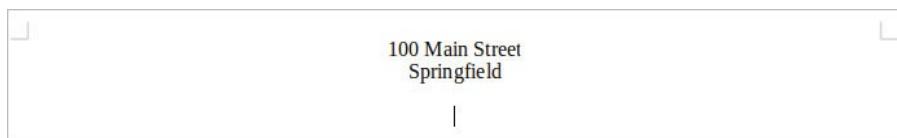
- 1 Launch Writer, then click **Tools**, **Options**, **LibreOffice**, **Advanced** and check the **Enable macro recording** option



- 2 Next, click **Tools**, **Macros**, **Record Macro** to begin recording – a small window appears, bearing a **Stop Recording** button



- 3 Click the  **Center** button on the toolbar, then type your address



- 4 Click the **Stop Recording** button in the small window, then see a “Basic

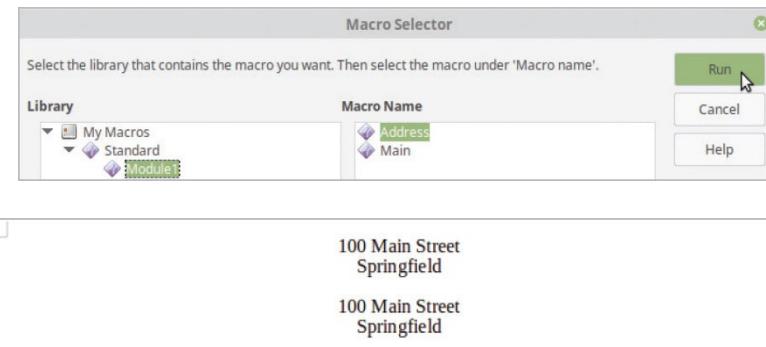
“Macros” dialog appear

- 5 In the **Macro Name** text field, replace the name “Main” by the name “Address”, then click the **Save** button

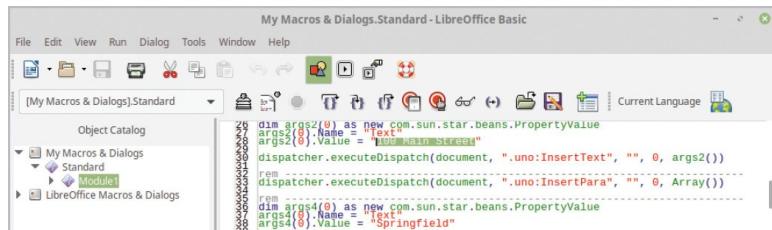


A Java Runtime Environment (JRE) is required on the Linux system to run macros. Linux Mint includes the OpenJDK Runtime Environment for Java, but you may need to install a Java Runtime Environment on other distros.

- 6 To run this macro at any time, first click **Tools, Macros, Run Macro** to launch a “Macro Selector” dialog
- 7 Select the Address macro from **My Macros, Standard, Module1**, then click the **Run** button to write your address



- 8 To edit this macro, click **Tools, Macros, Edit Macros** to launch a “My Macros” dialog, then select the Address macro to see the code behind the macro actions



- 9** Locate the text values describing your address, then replace them with different values and click **File, Save** to apply the changes
- 10** Finally, repeat steps 6 and 7 to run this macro once more and see the modified address values written



The macro recorder only records actions relating to document content in the window where it was started, and it only works with the LibreOffice Writer and Calc apps.



Click on **Tools, Macros, Organize Macros, LibreOffice Basic**, then select an existing macro and use the **Delete** button to remove it.

# Adding Interaction

LibreOffice apps allow interactive “form” controls to be added to documents – much like those found in web forms. These allow the user to quickly produce a finished document by providing minimal input, and this is particularly useful when repeatedly producing the same document with differing data:



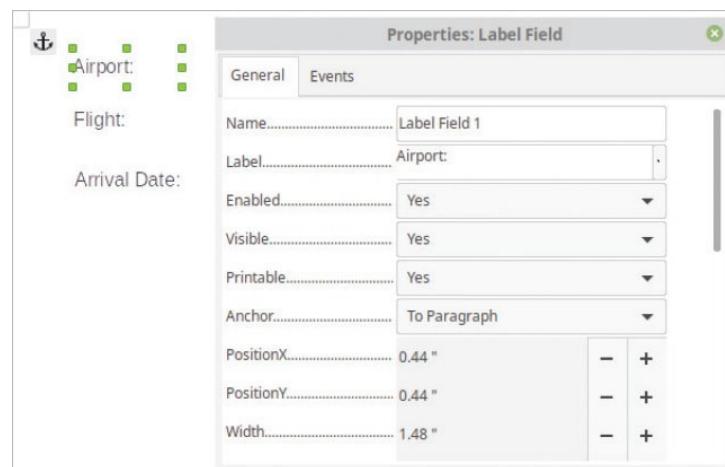
- 1 In LibreOffice Writer, click **View**, **Toolbars**, **Form Controls** to open a “Form Controls” dialog, then click its **Design Mode** button to set it to On – so form controls can be added



- 2 Click the **Label Field** button on the “Form Controls” dialog, then drag the mouse on the document to create three labels – by default, these will each contain the text “Label Field”



- 3 Double-click on each label in turn to open their “Properties” dialog, and change the value of each **Label** property, then hit **Return** to see the label text change



- 4 Click the **Text Box** button on the controls dialog, then drag the mouse on the document to create two text boxes



Right-click on a control, select **Position and Size** from the context menu, and choose **Anchor, To Paragraph** from the dialog that appears to allow easier positioning of the control.

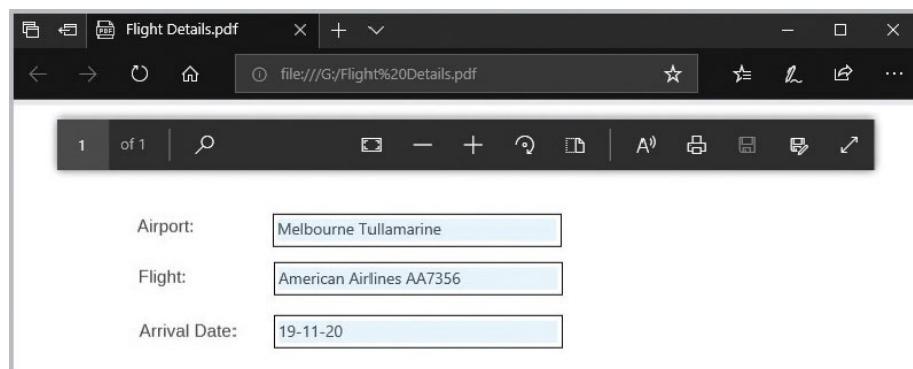
- 5 Click the **Date Field** button in the “Form Controls” dialog, then drag the mouse to create a date field box



- 6 Double-click the date field box to open its “Properties” dialog, then set its **Drop-down** property to “Yes” and its **Date Format** property to “Standard (long)”
- 7 Now, click the **Design Mode** button to set it to Off, then enter data in the text boxes and use the **Drop-down** menu to choose a date

Airport: Melbourne Tullamarine  
Flight: American Airlines AA7356  
Arrival Date: Wednesday, November 20, 2019  
Nov 2019  
S M T W T F S  
27 28 29 30 31 1 2  
3 4 5 6 7 8 9  
10 11 12 13 14 15 16  
17 18 19 20 21 22 23  
24 25 26 27 28 29 30  
1 2 3 4 5 6 7  
Today None

- 8 Save the file, then click **File, Export As, Export as PDF** to create a version that can be sent to others





The data entered into form fields can be edited later to produce new completed forms.



Notice that the date is preserved but not in the chosen long date format.

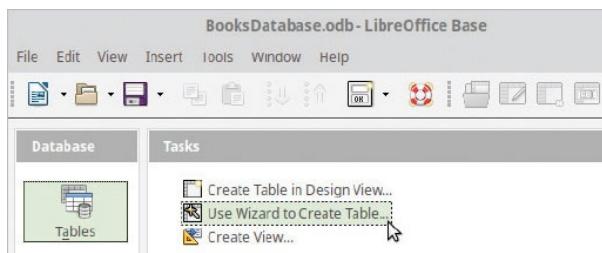
# Handling Data

The LibreOffice suite includes a database app that, like Microsoft Access, lets you store data and easily extract specific items of data:

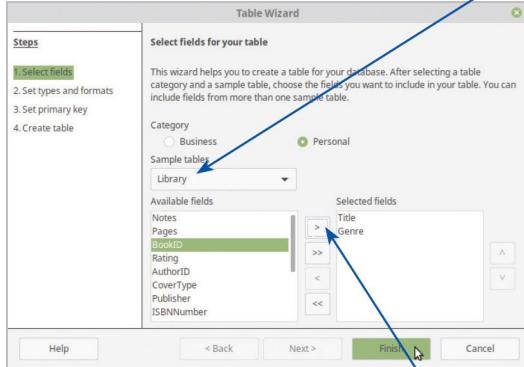


LibreOffice Base

- 1 Click **Menu, Office, LibreOffice Base** to launch the app, then select “Create a new database” and click **Finish** – to open a “Save” dialog
- 2 Enter a **Name**, then click **Save** to close the dialog
- 3 Select **Tables**, then click **Use Wizard to Create Table** – to open a “Table Wizard” dialog



- 4 Choose the **Personal** category, then select a **Sample table** – to see the available fields within that table



- 5 Click an available field, then click the > button to move it to the **Selected fields** pane – to include it in your table
- 6 Select all the fields you want, then click **Finish** to close the dialog and see a “Table Data View” window appear



The **Design View** and **Create View** options offer greater control but the **Wizard** is simpler.

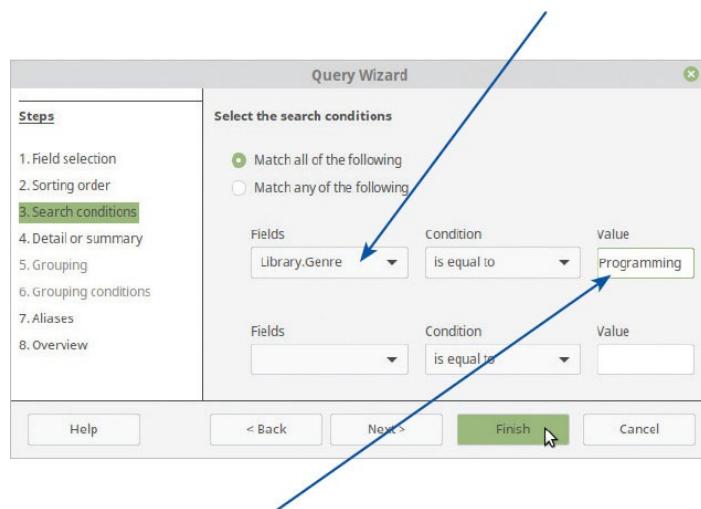


You can limit fields to accept only particular types of data in the **Set types and formats** step. By default, a field can accept up to 100 characters of text.

- 7 Enter and save your data, then close the window

ID	Title	Genre
1	Coding for Beginners	Programming
2	HTML 5	Web Design
3	Python	Programming
4	CSS 3	Web Design
5	PHP 7	Programming

- 8 Select **Queries**, then click **Use Wizard to Create Query** – to open a “Query Wizard” dialog
- 9 Click the >> button to select all fields, then click **Next**
- 10 Select **Search conditions**, then choose a field to query



- 11 Enter a value to match within the chosen field, then click the **Finish** button – see that a query icon gets added in the app’s “Queries” pane
- 12 Double-click the query icon to see the results in a “Table Data View” window – extracting only specific data

ID	Title	Genre
1	Coding for Beginners	Programming
3	Python	Programming
5	PHP 7	Programming



There is a “Report Wizard” that can quickly produce a summary of your data.



You can specify other conditions, such as **Greater than** for numerical values, and you can specify multiple conditions for finer-precision queries.



There is also a “Form Wizard” that can quickly produce a user form for data entry.

# Summary

- LibreOffice contains a set of office tools similar to those in the Microsoft Office suite.
- Files can be saved in **Microsoft Office file formats** and file formats native to LibreOffice apps.
- LibreOffice **Writer** is a word processor app for documents that can contain text and embedded objects.
- LibreOffice Writer has built-in support for the **Portable Document Format (PDF)**.
- LibreOffice **Calc** is a spreadsheet app that can perform calculations on data entries using given formulas.
- LibreOffice Calc provides a **Format Cells** facility to specify how cell content should appear.
- LibreOffice **Impress** is a presentation app that can produce slideshows.
- LibreOffice Impress provides a number of standard **Templates** and offers many standard **Layouts**.
- LibreOffice **Draw** is a drawing app that can create illustrations, charts, diagrams, and graphs.
- LibreOffice Draw provides a **Chart Type** facility that provides many standard charts.
- A **macro** is a recorded sequence of keystrokes that can be replayed to repeat those keystrokes.
- LibreOffice apps can add **form controls** to a document for interaction with the user.
- LibreOffice **Base** is a database app that can store data and retrieve specific items of data.
- LibreOffice Base provides wizards that can create **Tables** and perform **Queries** in a database.

# **Enjoying Media**

*This chapter describes how to enjoy media content with various popular Linux apps.*

[\*\*Viewing Images\*\*](#)

[\*\*Managing Photos\*\*](#)

[\*\*Scanning Images\*\*](#)

[\*\*Editing Images\*\*](#)

[\*\*Emulating Photoshop\*\*](#)

[\*\*Watching Movies\*\*](#)

[\*\*Playing Music\*\*](#)

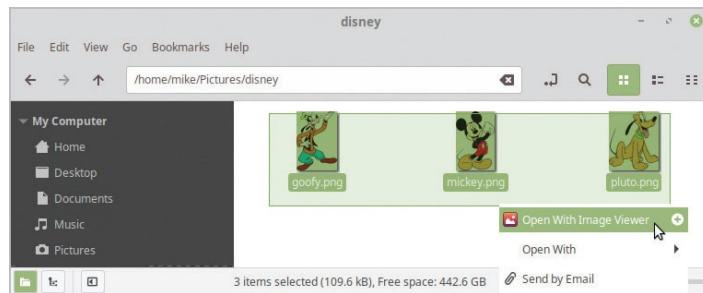
[\*\*Streaming Content\*\*](#)

[\*\*Summary\*\*](#)

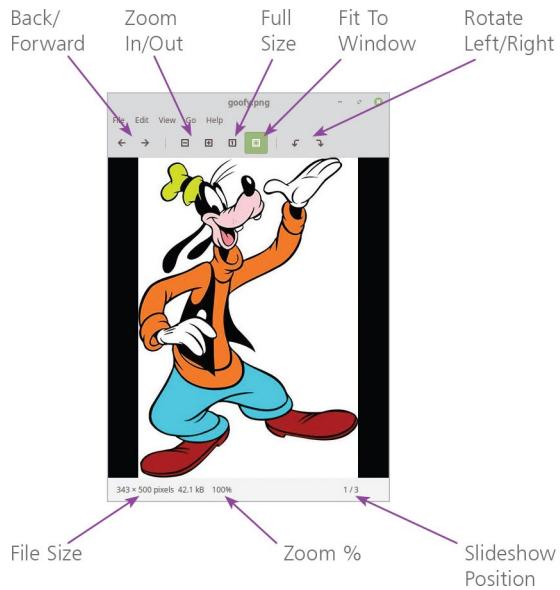
# Viewing Images

Many Linux distros include a simple Image Viewer app (**xviewer**) that can zoom and scroll. In Linux Mint you can find its launcher on the menu in the Accessories category, but usually you will launch it from a right-click context menu:

- 1 Drag the mouse over image file icons to select them, then right-click and choose **Open with Image Viewer**



- 2 See the Image Viewer app launch, displaying the first image alphabetically





You can also double-click on any file icon to instantly open that image in Image Viewer.



You can use your mouse to zoom too. Place the cursor over an image in Image Viewer then use the mouse wheel to zoom in and out.

- 3 Click the **Forward** button to view all the selected images, or click **View, Slideshow** to view them full-screen

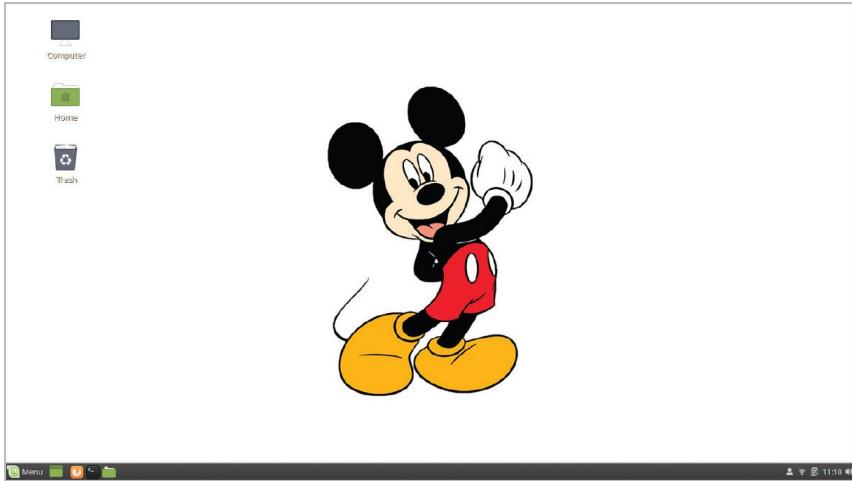




- 4 Click **View, Image Gallery** to open a scrollable gallery pane within the Image Viewer window



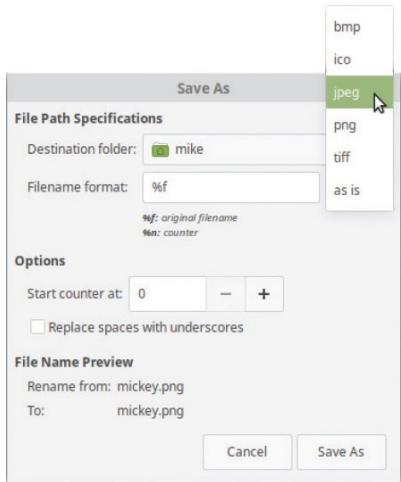
- 5 Scroll to an image, then click **File, Set as Wallpaper** to make that image your Desktop background



A full-screen slideshow displays each image for five seconds, but you can change this with **Edit**, **Preferences**, **Slideshow**. Click **Esc** to quit a running slideshow.



You can convert images to different file formats using the image gallery. Press **Ctrl + A**, to select all images in the gallery, then click **File**, **Save As** and choose the preferred file format in the dialog.



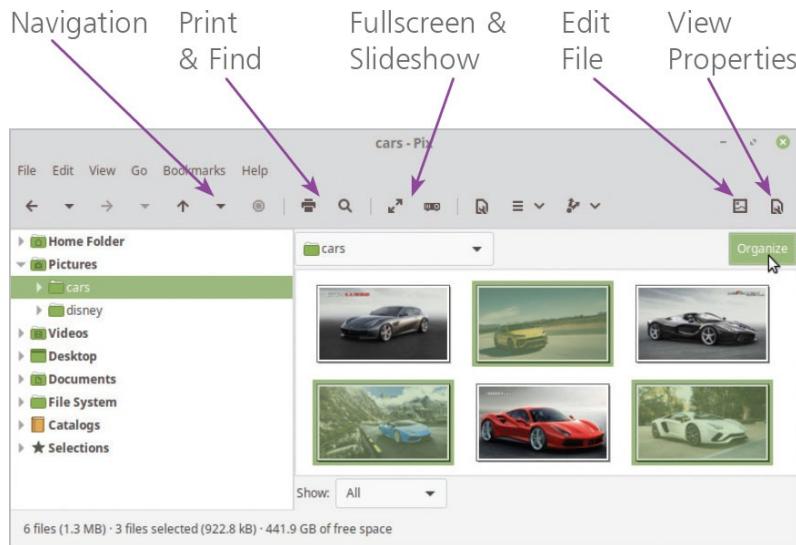
# Managing Photos

In addition to the simple Image Viewer app described [here](#), Linux Mint includes the Pix viewer app that enables you to arrange images and photos in catalogs:

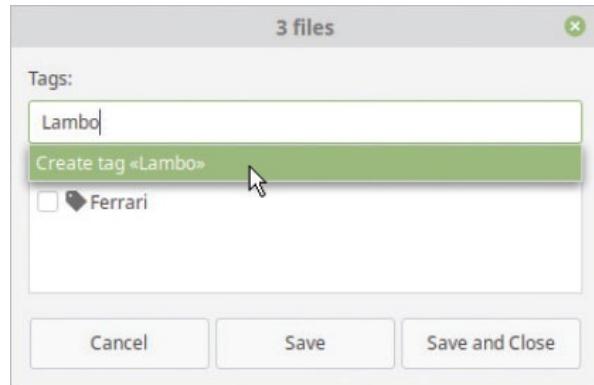


Pix Image Viewer

- 1 Click **Menu**, **Graphics**, **Pix** to launch the app, then select an image folder in the left-hand pane to see the photos inside



- 2 Hold down the **Ctrl** key, then click on photos to select them for inclusion in a catalog
- 3 Right-click and select **Tags** from the context menu – to open an “**n files**” dialog



- 4 Enter a tag name and click “Create tag”, then click the **Save and Close** button – to tag the selected photos



The Pix app starts in **Browser mode**. Double-click on a photo to open it in **Viewer mode**, as shown below.

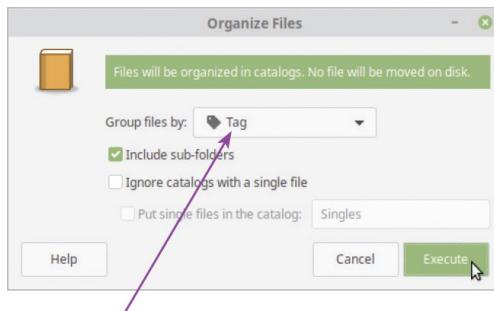


The context menu also has options for **Add to Selection**, **Add to Catalog**, and **Comment**.

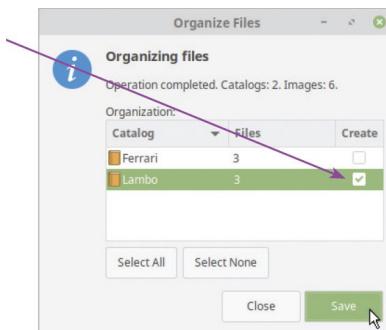


Descriptive comments can be saved within a photo file as “metadata”.

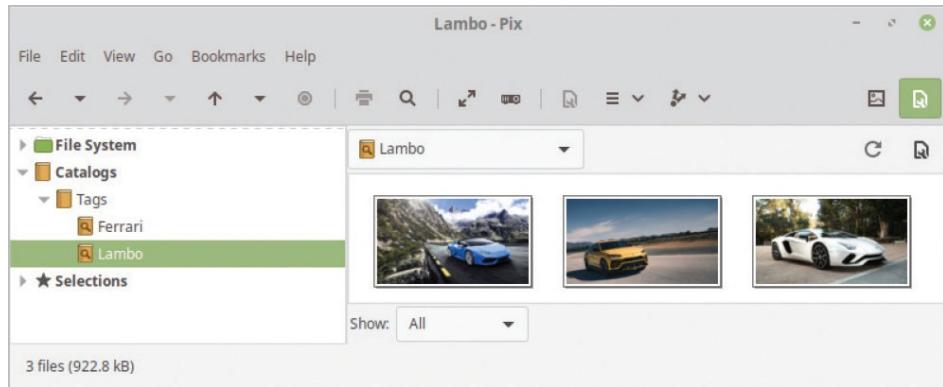
- 5 Next, click the **Organize** button just above the photos – to open an “Organize Files” dialog



- 6 Select “Tag” in the drop-down menu, then click the **Execute** button
- 7 Check the **Create** option beside the tag name you have assigned to the selected photos



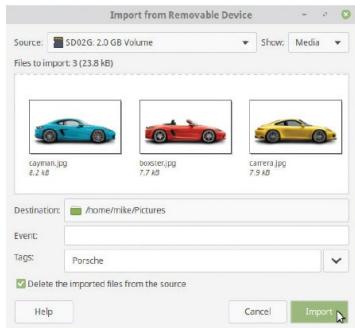
- 8 Click the **Save** button to create the new catalog and close the dialog
- 9 Expand **Catalogs**, **Tags** in the left-hand pane of the Pix window, then click on any catalog icon to see its photos



You can click the **Edit File** button to see lots of quick editing options.



The Pix app can automatically open an “Import” dialog when you connect a digital camera or memory card containing photos.



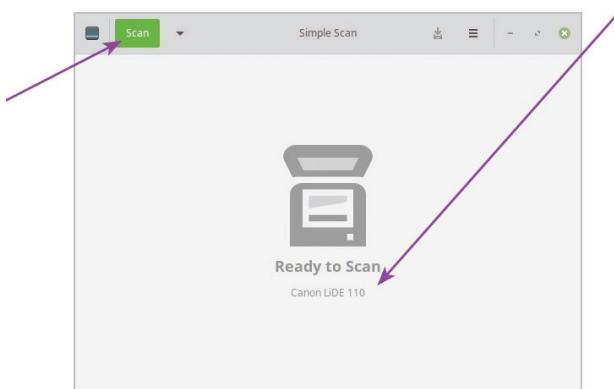
# Scanning Images

Linux Mint includes a Simple Scan app that, as its name suggests, makes it simple to import images from a scanner:



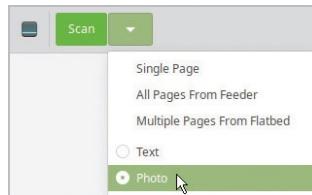
Connected scanner

- 1 Connect a scanner to your PC and switch the scanner On
- 2 Click **Menu, Graphics, Simple Scan** to launch the app and see it should automatically identify your scanner

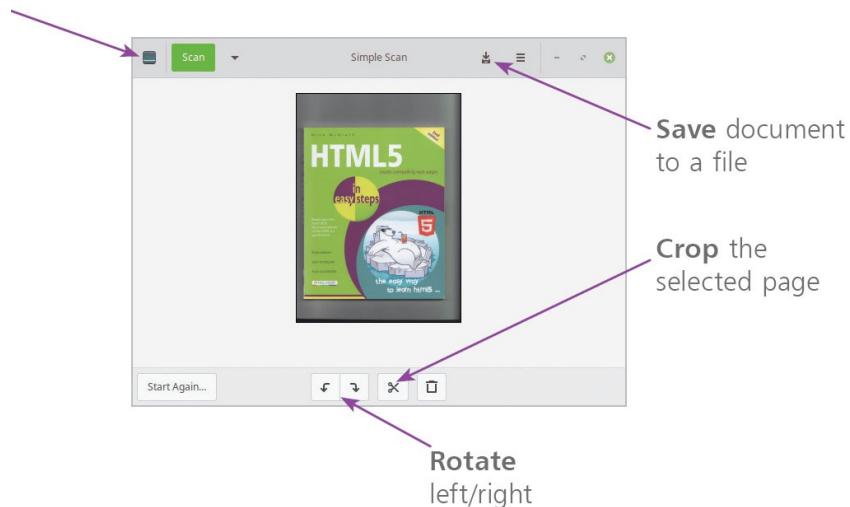


The **Scan** button changes to a **Stop** button when scanning is in progress – so you can click it to abort the current scan.

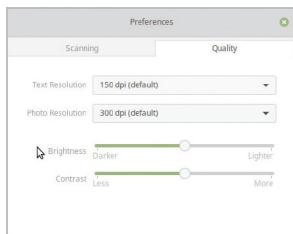
- 3 Click the arrow beside the “Scan” button, then choose from the menu whether the content you want to scan is **Text** or **Photo**



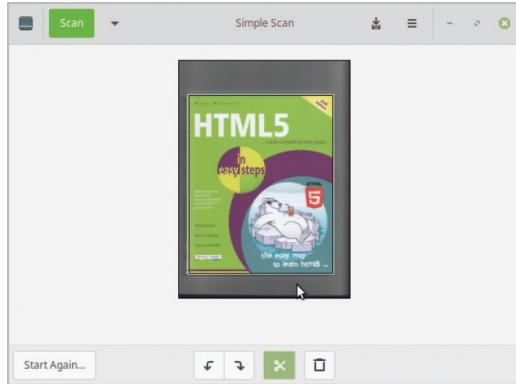
- 4 Now, click the **Scan** button to scan your content – see the image of the content gradually appear in the app window



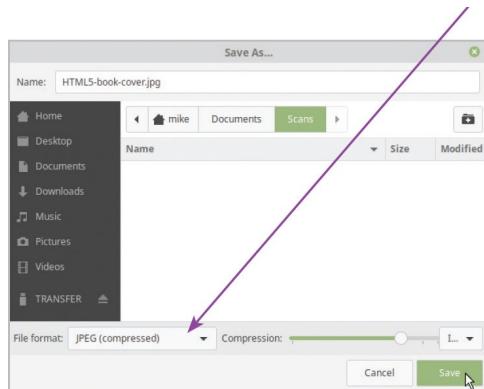
Click the **Document** button to open a menu, then select **Preferences**, **Quality** to specify resolution, brightness, and contrast settings.



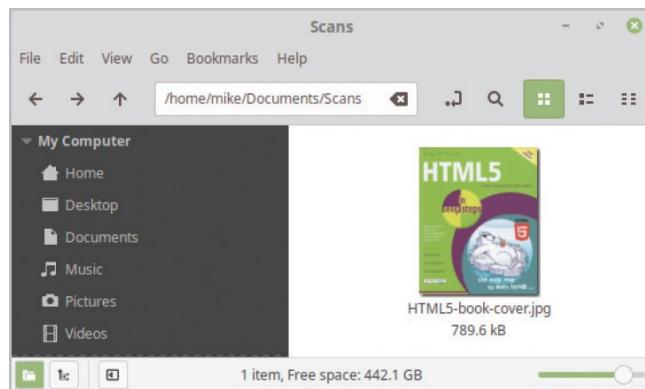
- 5 Click the **Crop** button to see a frame appear over the image, then drag the frame's edges to the desired position



- 6 Next, click the app’s **Save** button to open a “Save As” dialog, then choose a file format from this menu

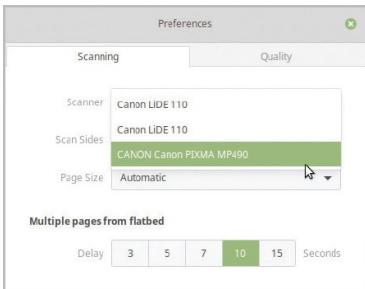


- 7 Next, click the dialog’s **Save** button to import the cropped scan to an image file





Click the **Document** button to open a menu, then select **Preferences**, **Scanning** to choose a scanner if there is more than one connected.



Multiple scans can be made to add pages in the Simple Scan window. Click the button, then choose **Reorder Pages** to see options for how to rearrange them.



You can double-click the image file to view it in the Image Viewer app.

# Editing Images

The primary image editing application in Linux is the GIMP ([GNU Image Manipulation Program](#)) open-source app that includes over 220 plugins in a standard installation. These provide the GIMP with many of the capabilities of Adobe Photoshop but do not provide native support for CMYK colors.



GIMP Image Editor

The GIMP is highly configurable and has powerful scripting support, but has an unusual appearance that places the tools in a different window to the image you are working on. GIMP can be used to edit images and to create attractive web page graphics:

- 1 Click **Menu, Graphics, GNU Image Manipulation Program** to launch the app – see it starts with a blank GIMP window and a “Toolbox” window
- 2 In the GIMP window, click the **File, New** menu to launch a “Create a New Image” dialog
- 3 In the “Create a New Image” dialog, set **Width** to **600px** and set **Height** to **240px**
- 4 Expand **Advanced Options** and set **Fill With** to **Transparency**, then click **OK** to close the dialog – see the new image appear in the GIMP window
- 5 In the GIMP window, click the **Select, All** menu, to select the entire area, then click **Select, Rounded Rectangle** – rounding the selection corners to a 50% radius
- 6 Click the color blocks in the “Toolbox” window to open their “Change Color” windows in turn – then, in the **HTML notation** box, set the

foreground to F35F28 and background to F5D087



- 7 Choose the  **Bucket Fill Tool**, then click inside the selected area in the image window – filling that area with the foreground color



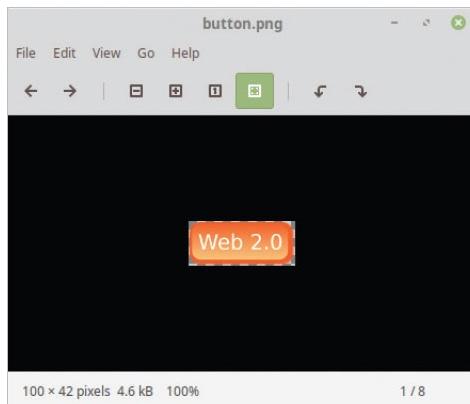
If a Toolbox window is not immediately visible, click **Windows, New Toolbox** in the GIMP window to make a Toolbox appear.



- 8 In the GIMP window, click the **Filters, Light and Shadow, Drop Shadow** menu to launch the “Drop Shadow” dialog – set **X** and **Y Offset** to **4**, **Blur radius** to **10**, **Color** to **F35F28**, and **Opacity** to **80**
- 9 Choose the  **Rectangle Select Tool** and drag from coordinates X:20,Y:20 to X:580,Y:220 to select an area, then click the **Select, Rounded Rectangle** menu – rounding the corners to a 50% radius as before
- 10 Choose the  **Blend Tool**, then drag over the selected area from bottom to top – applying a linear gradient fill of foreground-to-background color
- 11 Now, set the foreground to **FFFFFF**, then choose the  **Text Tool** and

click on the selected area – type “Web 2.0”

- 12 Select all the text and adjust the font size to **120**, then drag the corner of the text to center it over the image
- 13 In the GIMP window, click **Layer, Merge Down** to flatten the text layer onto the image
- 14 Click **Image, Scale Image** and resize the dimensions to **100px** wide and **42px** high
- 15 Click **File, Export** and name the image **button.png**, then click the **Export** button to save the image file



- 16 Right-click on the saved image file icon and choose to **Open With Image Viewer** to see how it looks



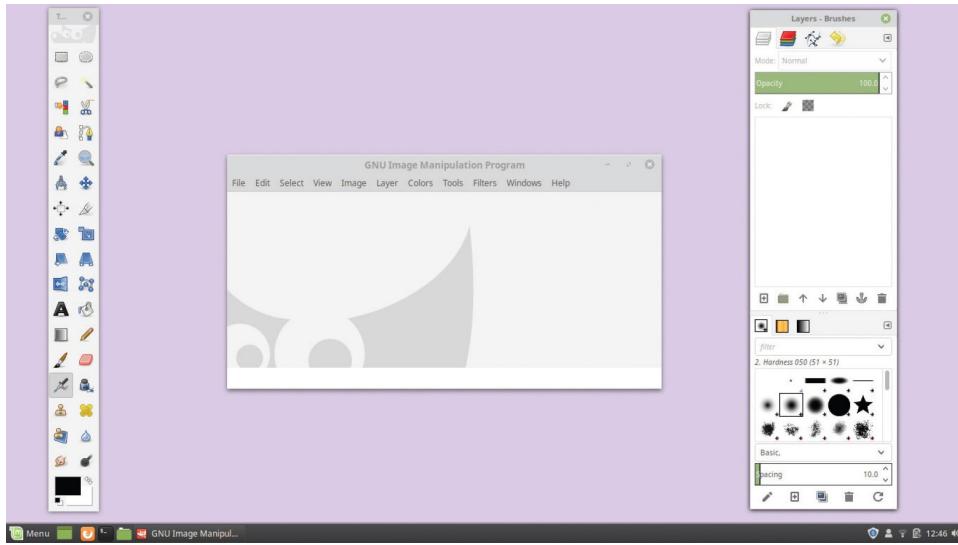
The GIMP can read many image file types – including PSD files produced by Photoshop.



The results of some GIMP plugins can be less predictable than those in Photoshop for inexperienced users.

# Emulating Photoshop

The GIMP app is a great image editor, but many who are familiar with Adobe Photoshop find its default interface unfriendly:



You can, however, replace the default GIMP configuration folder with a custom Theme to emulate the look and feel of Photoshop. The popular GimpPs Theme for this purpose is available from the online GitHub repository, which requires the Git package to be installed on your system in order to clone the GimpPs Theme. Backup of the original GIMP configuration folder, installation of the Git package, and cloning of the GimpPs Theme can all be easily achieved by issuing commands in the Linux Terminal:

- 1** Click **Menu**, **Administration**, **Terminal** to launch a command-line “Terminal” window
- 2** At the prompt, precisely enter this command to rename the GIMP configuration folder – and so create a backup `mv .gimp-2.8 .gimp-2.8-backup`
- 3** Next, enter this command to install the Git package `sudo apt-get install git-all`



The GimpPs Theme supports GIMP version 2.8 and may not succeed with other versions. Installation instructions are correct at the time of writing but may be subject to change. Find more details online at [github.com/doctormo/GimpPs](https://github.com/doctormo/GimpPs)

- 4 Enter your password then, when asked, press the **Y** key and hit **Return** to proceed with the installation
- 5 Upon completion, precisely enter this command to clone the Theme folder from the GitHub repository

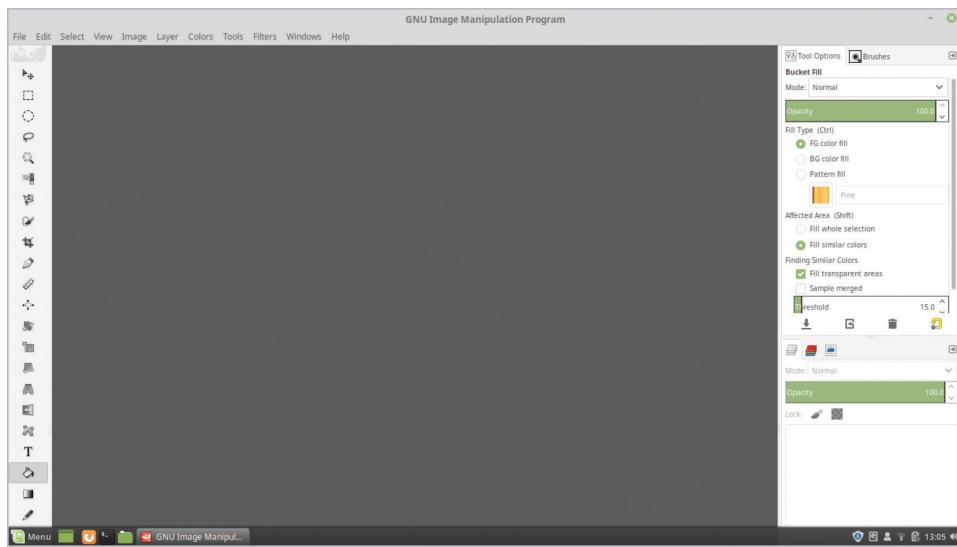
```
sh -c "$(curl -fsSL https://raw.githubusercontent.com/doctormo/GimpPs/master/tools/install.sh)"
```

mike@linux-pc:~\$ sh -c "\$(curl -fsSL https://raw.githubusercontent.com/doctormo/GimpPs/master/tools/install.sh)"  
Cloning GimpPs...  
Cloning into '/home/mike/.gimp-2.8'...  
remote: Counting objects: 81, done.  
remote: Compressing objects: 100% (78/78), done.  
remote: Total 81 (delta 1), reused 78 (delta 1), pack-reused 0  
Unpacking objects: 100% (81/81), done.  
GimpPs successfully installed  
Enjoy!  
mike@linux-pc:~\$



The backslash character here simply allows the command to continue on the next line.

- 6 Click **Menu, Graphics, GNU Image Manipulation Program** to launch the GIMP app – see that the window layout and feel now emulates Photoshop



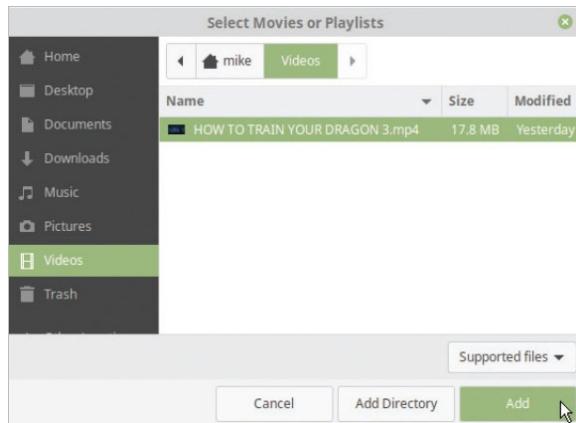
Cloning creates a new configuration folder. You can restore the backup with two commands

```
rm -r ~/.gimp-2.8
mv ~/.gimp-2.8-BAK \ ~/.gimp-2.8.
```

# Watching Movies

Many Linux distros include a fast light-weight Media Player app (**xplayer**) that can play audio and video content in many file formats including AVI, MPG, WMV, WAV, MP3, and many more. On the Google Play Store this app is even named “Video Player All Format”. In Linux Mint it is the default media player for audio or video file playback:

- 1 Click **Menu, Sound & Video, Media Player** to launch the app
- 2 Click **File, Open** to launch a “Select Movies or Playlists” dialog showing the contents of your Videos folder



- 3 Select a movie, then click the **Add** button to see it immediately begin to play in the display area





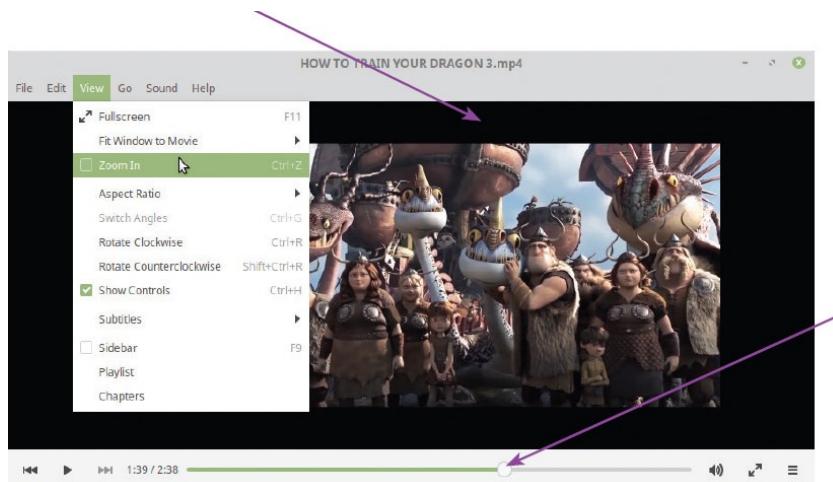
The Media Player also supports subtitles – click **View**, **Subtitles**, **Download Movie Subtitles**, then select a language and click the **Find** button to search for a subtitle file.



Click the Volume button and drag its pop-up slider to adjust the volume level.



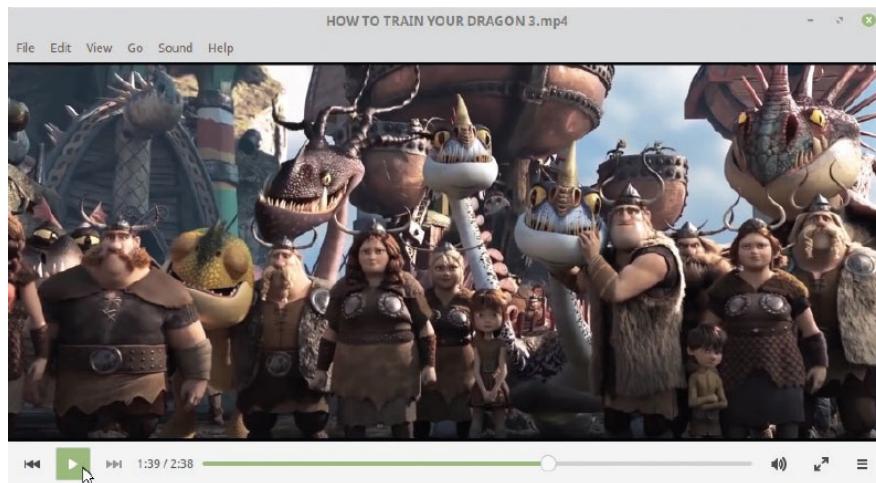
- 4 Click the **Pause** button to halt playback
- 5 Drag the corner of the window to change its size – see border areas appear around the movie in the display area





You can advance a paused movie by dragging the slider, or by placing the cursor over the display area and rolling your mouse wheel.

- 6 Click **View, Zoom In** to fit the movie to the width of the display area
- 7 Click the **Play** button to resume playback



- 8 Click **Edit, Take Screenshot** to place an image of the current movie frame in your Pictures folder



Click **File, Properties** to discover details about the current movie file.

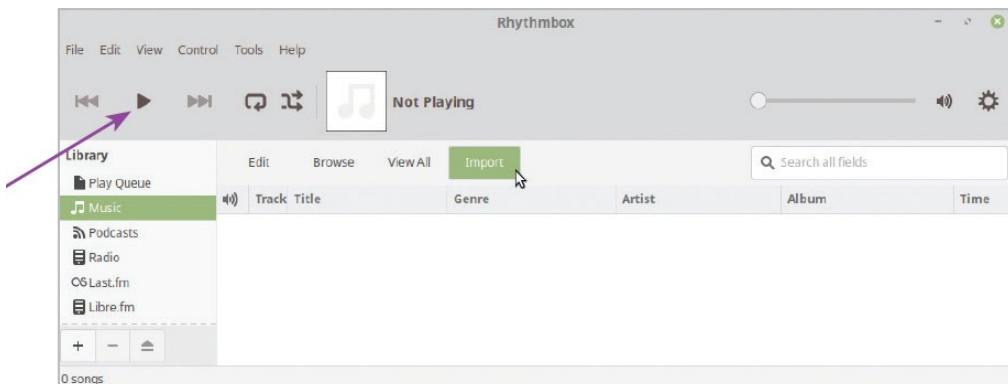
# Playing Music

The Rhythmbox music player is great for playing music files and is also a podcast aggregator – and an internet radio tuner:



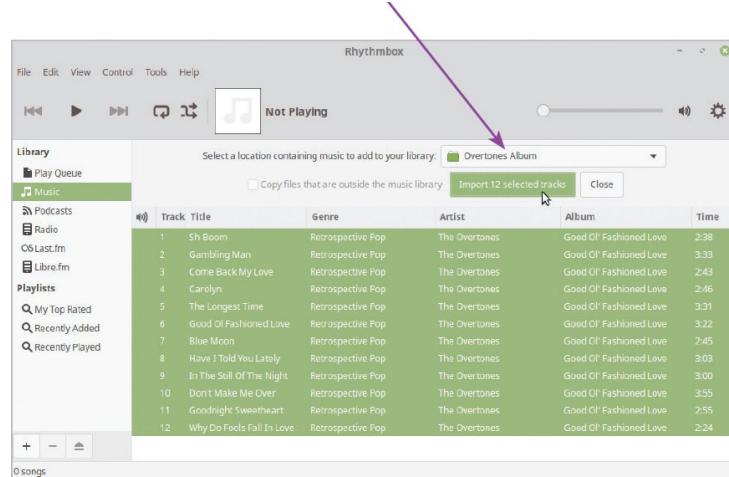
Rhythmbox Music Player

- 1 Click **Menu, Sound & Video, Rhythmbox** to launch the Rhythmbox app
- 2 Select **Music** in the “Library” pane, then click the **Import** button on the toolbar



The Play button will change to a Pause button during playback.

- 3 Use the drop-down menu to choose a folder containing music files, such as a sub-folder within your **Music** folder



- 4 See Rhythmbox list the music files within the chosen folder as “tracks”
- 5 Click on the tracks in the list to select them, then click the **Import n selected tracks** button to make a playlist

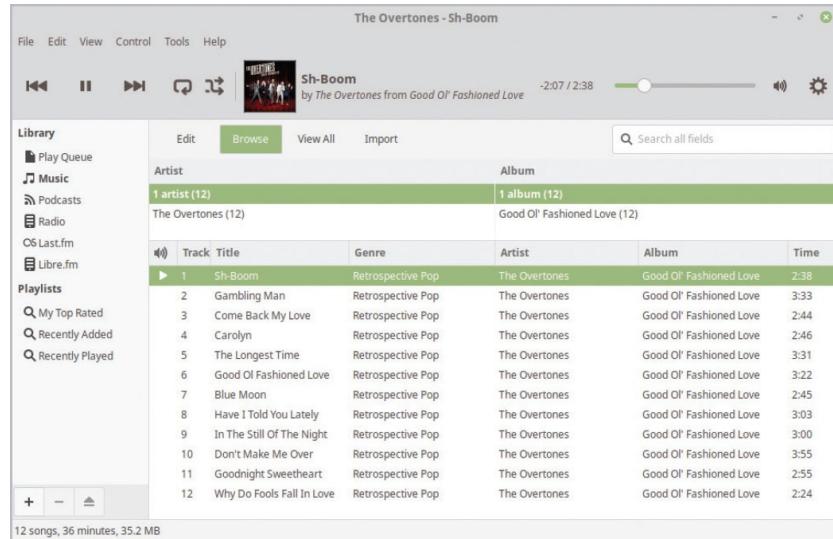


Right-click on a track and choose **Remove** to delete it from the playlist.

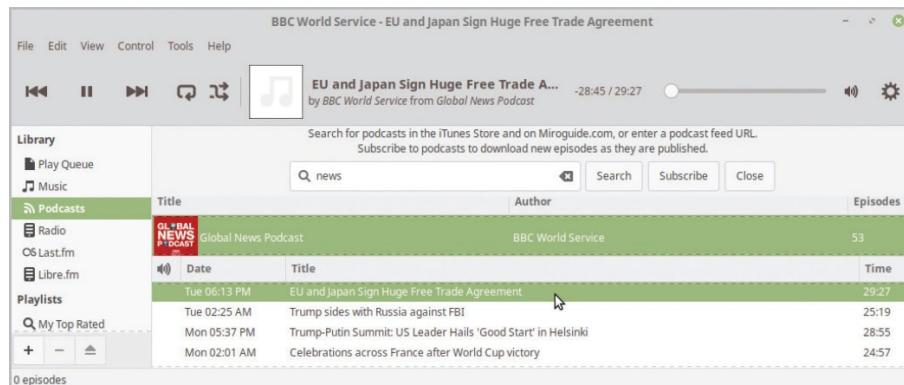


You can also right-click on a music file icon and choose **Open with, Rhythmbox** to play it.

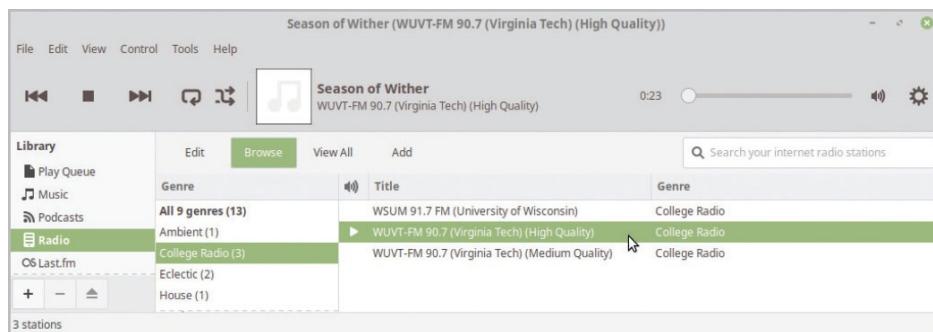
- 6 Click the **Play** button to start playing from “Track 1” or double-click any listed track to play that track



- 7 Select **Podcasts** in the “Library” pane, then click the **Add** button on the toolbar and search for podcasts by topic



- 8 Double-click a listed podcast to begin playback, then select **Radio** in the “Library” pane and double-click one of the listed radio stations to start listening





A icon gets added to the System Tray when playback begins of music, podcasts, or radio. You can close the Rhythmbox window and playback will continue. Click the icon and use the controls on the panel that appears to control playback, or click its X button to quit playback.



You can add more radio stations by clicking the **Add** button and entering a URL – use a search engine to find URLs for internet radio stations and podcasts.

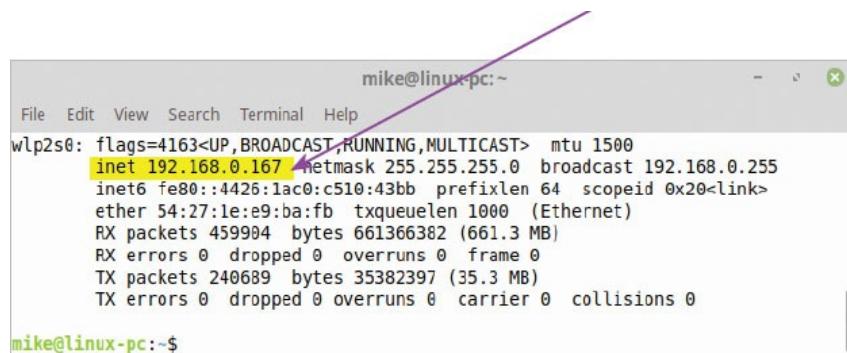
# Streaming Content

The VLC media player is a powerful cross-platform media player for audio and video. It can also be used to stream media across your network. This means you can broadcast music and video from your Linux PC to other devices connected to your Wi-Fi router:



VLC Media Player

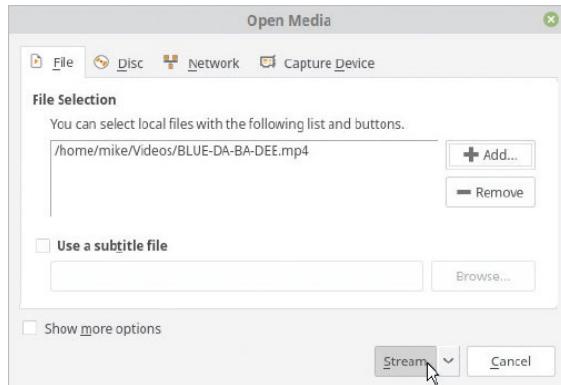
- 1 Click **Menu, Administration, Terminal** to open a window at a command prompt
- 2 Enter the command `ifconfig` to discover the IP address assigned to your PC on the network



A terminal window titled "mike@linux-pc:~" showing the output of the "ifconfig" command. The output lists network interface "wlp2s0" with IP address 192.168.0.167 and netmask 255.255.255.0. Other details include broadcast address 192.168.0.255, MAC address fe80::4426:1aco:c510:43bb, and various statistics for RX and TX packets.

```
mike@linux-pc:~$ ifconfig
wlp2s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.0.167  netmask 255.255.255.0  broadcast 192.168.0.255
              inet6 fe80::4426:1aco:c510:43bb  prefixlen 64  scopeid 0x20<link>
                ether 54:27:1e:e9:ba:fb  txqueuelen 1000  (Ethernet)
                  RX packets 459904  bytes 661366382 (661.3 MB)
                  RX errors 0  dropped 0  overruns 0  frame 0
                  TX packets 240689  bytes 35382397 (35.3 MB)
                  TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0
mike@linux-pc:~$
```

- 3 Click **Menu, Sound & Video, VLC media player** to launch the app, then click **Media, Stream** to open an “Open Media” dialog
- 4 Click the **Add** button and select a video file to stream, then click the **Stream** button



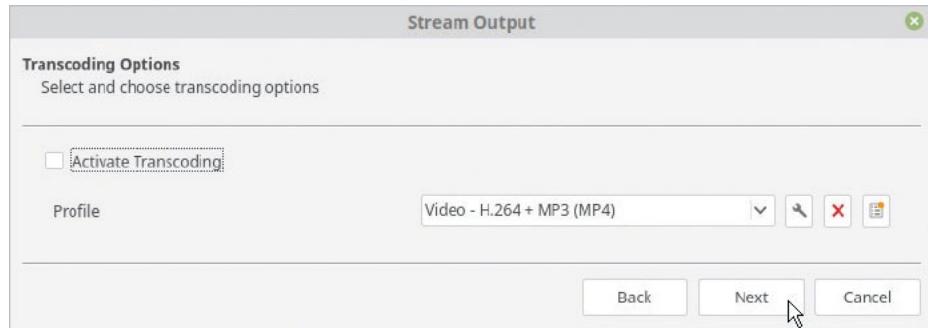
- 5 See that the Source is selected, then click the **Next** button



If you get a message “VLC is unable to open the MRL” when trying to open a network stream it may be that your firewall is blocking it. In Linux Mint, click **Menu, Preferences, Firewall Configuration** then add a rule to allow VLC to stream media.

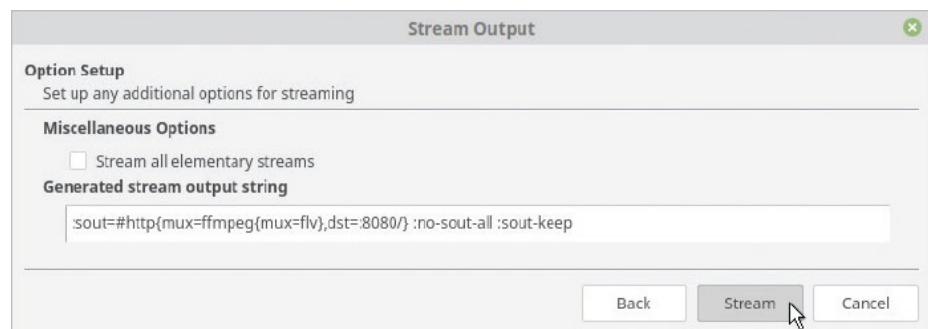


- 6 Set the destination to **HTTP**, then click the **Add** button
- 7 Notice that the default port is **8080**, then click **Next**
- 8 Uncheck the **Activate Transcoding** option, then set the “Profile” to the selected file’s format and click **Next**



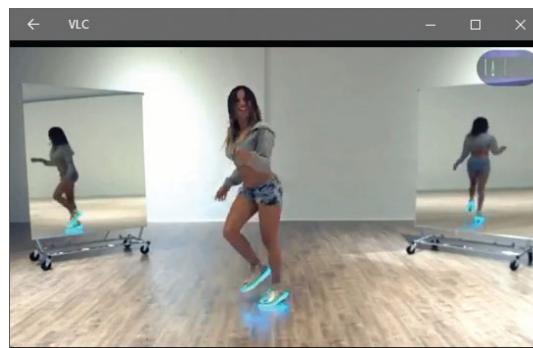
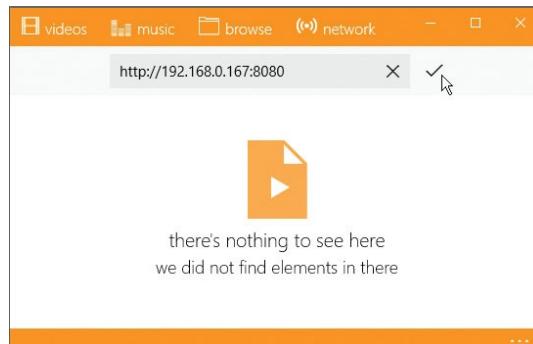
9

Click the **Stream** button to broadcast the video



10

Open the VLC app on another network device, then enter the IP address and port of the broadcasting PC to open the network stream





Transcoding to MP4 format is not required here, as the video file is already in that format.



The IP address of your PC will most likely differ from the address used in this example.



This is the VLC Universal app on a network PC running Windows 10 receiving the stream from the Linux PC.

# Summary

- The **Image Viewer** app displays images and can create a slideshow of multiple images.
- Image Viewer can make a selected image the Desktop background **wallpaper**.
- The **Pix** viewer app has a Browser mode and a Viewer mode.
- Pix viewer can arrange images and photos in a **Catalog** by grouping them with a common tag.
- The **Simple Scan** app can import images from a scanner.
- Scanned **text** and **photos** can be cropped and saved as a file.
- The GNU Image Manipulation Program (**GIMP**) is the primary image editing application in Linux.
- The GIMP app includes over 220 **plugins** that provide many of the capabilities of Adobe Photoshop.
- The default GIMP configuration folder can be replaced with a custom **Theme** to emulate the look and feel of Photoshop.
- The online GitHub repository contains **packages** that can be installed by issuing commands in the Linux Terminal.
- The **Media Player** app can play audio and video content in many file formats.
- Media Player can **zoom** and change the aspect ratio of the movie it is playing.
- The **Rhythmbox** music player is also a podcast aggregator and an internet radio tuner.
- Rhythmbox can import selected music files as **tracks** within a library.
- The **VLC** media player is a powerful cross-platform media player for audio and video.
- VLC can **stream** music and video from a Linux PC to other devices connected to the Wi-Fi router.

# **Using Accessories**

*This chapter describes some of the useful accessory apps included with Linux Mint.*

**Writing Text**

**Doing Calculations**

**Managing Archives**

**Taking Notes**

**Grabbing Screenshots**

**Reading Documents**

**Summary**

# Writing Text

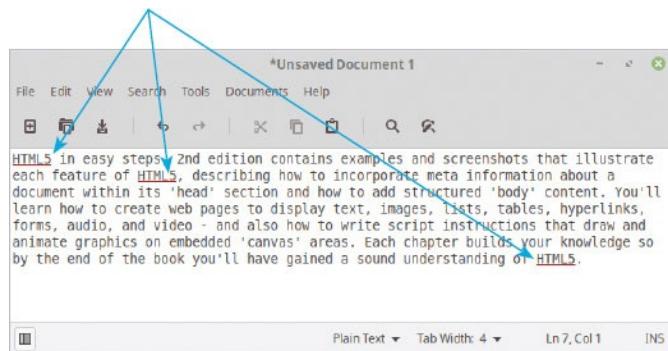
The plain text Text Editor app (**xed**) in Linux Mint is the equivalent of the Notepad app in Windows – but Text Editor has many more features. It can number lines, sort lines into alphanumeric order, and it provides syntax highlighting for a whole range of scripting, programming, and markup languages.



Text Editor

You must recognize, however, that Linux does not treat text line endings in the same way as Windows. Linux adds a non-printing line feed `\n` (“newline”) character, whereas Windows adds non-printing carriage return and line feed `\r\n` characters. This means that text files created in Linux do not maintain their line endings correctly when viewed on a Windows system. The Text Editor app provides an option when saving text files that lets you choose your preferred type of line endings:

- 1 Click **Menu, Accessories, Text Editor** to launch the app
- 2 Next, click **Tools, Autocheck Spelling** to turn the spellchecker on
- 3 Now, type in some lines of text – see the spellchecker place red underlines beneath suspicious items



- 4 Click **Edit**, **Preferences**, **Editor**, then slide the “Display line numbers” toggle switch to the On position – to see the lines get numbered
- 5 Turn off the spellchecker and click **Edit**, **Select All** (or press **Ctrl + A**) to select all text, then hit the **Delete** key to remove all text

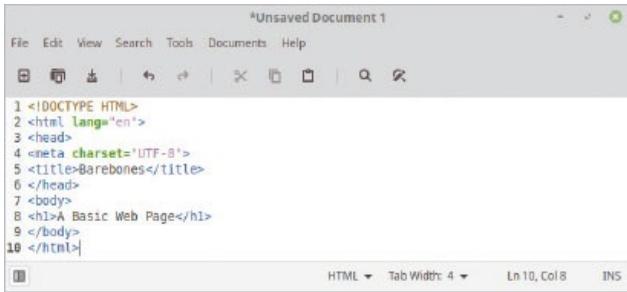


The Notepad app in versions of the Windows 10 operating system from October 2018 supports both Linux **\n** and Windows **\r\n** line endings.



You can click **Edit**, **Sort lines** to rearrange the lines into alphanumeric order, then click **Edit**, **Undo** to revert to the original order.

- 6 Select **View**, **Highlight Mode**, **Markup**, **HTML** to turn on syntax highlighting for HTML markup code
- 7 Now, type in some HTML markup tags – see the elements, attributes, and content appear colored



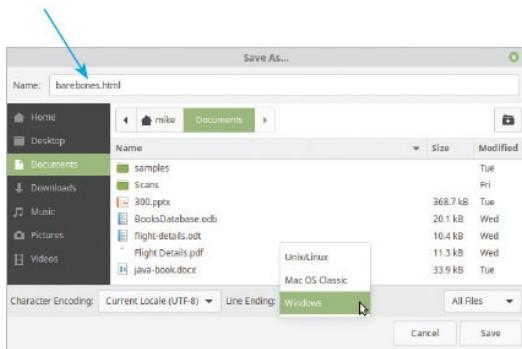
The screenshot shows a text editor window titled "Unsaved Document 1". The menu bar includes File, Edit, View, Search, Tools, Documents, Help. The toolbar contains icons for New, Open, Save, Print, Find, Replace, and others. The main text area displays the following HTML code:

```
1 <!DOCTYPE HTML>
2 <html lang="en">
3 <head>
4 <meta charset="UTF-8">
5 <title>Barebones</title>
6 </head>
7 <body>
8 <h1>A Basic Web Page</h1>
9 </body>
10 </html>
```

At the bottom right of the editor, it says "HTML", "Tab Width: 4", "Ln 10, Col 8", and "INS".

8

- Click **File, Save As** to open a “Save As” dialog, then enter a file name and choose the **Windows** line ending option



9

- Click the **Save** button, then copy the file to a Windows system and see the line endings are preserved



The line numbers appear only in the Text Editor window – they are not inserted into the text.



This file saved with Linux line endings may appear like this on older versions of Windows Notepad.

A screenshot of the Windows Notepad application window titled "barebones.html - Notepad". The menu bar includes File, Edit, Format, View, and Help. The main text area contains the following HTML code:

```
<!DOCTYPE HTML><html lang="en"><head>
<meta charset="UTF-8">
<title>Barebones</title></head><body>
<h1>A Basic Web Page</h1></body></html>
```

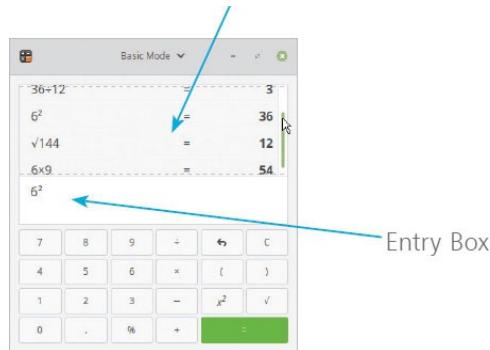
# Doing Calculations

Linux Mint includes a Calculator app that can perform many different types of calculations and conversions. It provides a scrollable History View of your previous calculations so you can select a previous calculation to manipulate further.

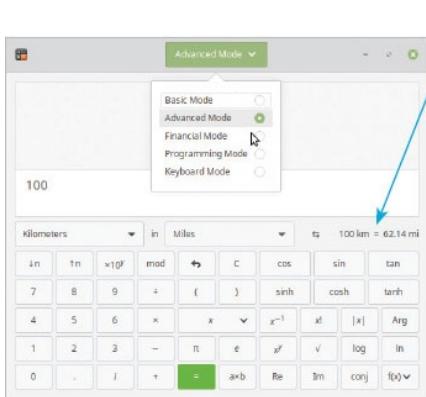


There are five modes available in the Calculator app in which you can enter basic equations, execute math and financial functions, and perform conversions of currency, size, and number base:

- 1 Click **Menu, Accessories, Calculator** to launch the app in “Basic Mode”
- 2 Enter some equations to see the result and see them get added to the **History View** area



- 3 Select “Advanced Mode” from the title bar menu, then select options to convert a measured distance

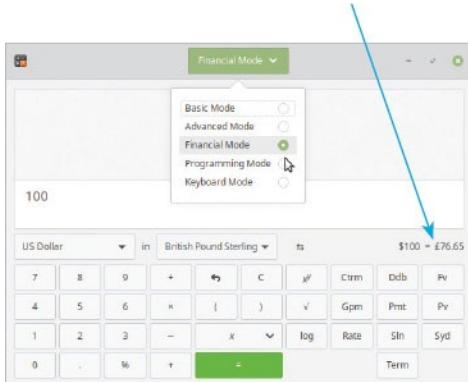


There is no limit to the number of calculations in the **History View** area.



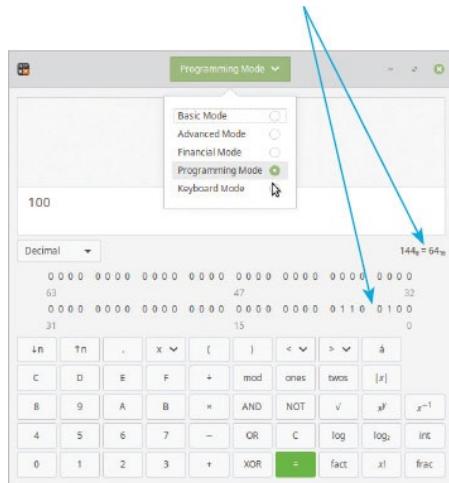
The **Advanced Mode** provides additional buttons that perform math functions, such as logarithm (**log**).

- 4 Select “Financial Mode” from the title bar menu, then select options to convert a sum of currency

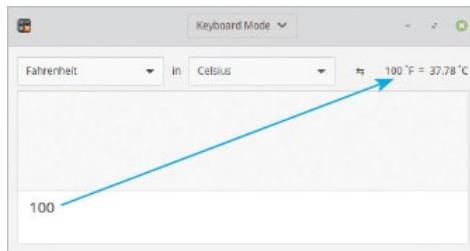


- 5 Select “Programming Mode” from the title bar menu, then select options

to convert number bases



- 6 Select “Keyboard Mode” from the title bar menu, then select options to convert temperature scales



The **Financial Mode** provides additional buttons that perform financial functions such as future value (**Fv**).



Decimal 100 is binary **1100100**, which represents the sum of  $64+32+0+0+4+0+0$ . Decimal 100 is also octal **144** and hexadecimal **64**.



The **Programming Mode** provides additional buttons that perform programming functions, such as Boolean algebra (**AND**, **OR**, **XOR**, **NOT**).

# Managing Archives

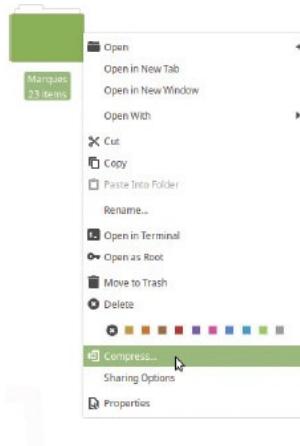
The Linux Mint distro includes a versatile Archive Manager app that can compress files into many archive file formats. If you choose the popular ZIP (.zip) format you can password-protect the archive, but this format often does not produce the smallest archive file size. You can find the Archive Manager launcher on the Menu in the Accessories category, but usually you will launch it from a right-click context menu:



Archive Manager

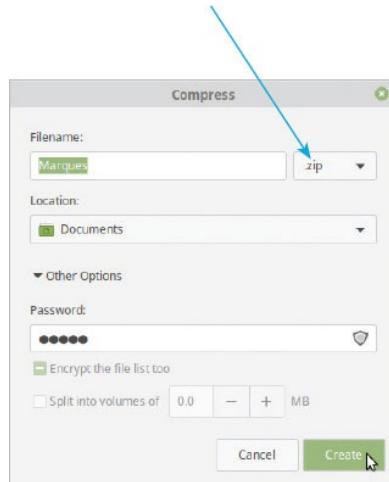
1

- Right-click on a folder you would like to compress, and choose **Compress...** on the context menu – to open a “Compress” dialog



2

- Enter an archive file name, then select the .zip archive file format



- 3 Choose a location and expand “Other Options”, then enter a password
- 4 Click the **Create** button to make an archive copy of the original folder and its contents at your chosen location
- 5 Right-click on the original folder and choose **Delete** on the context menu – to remove the folder and its contents



Not all archive file formats support password protection.



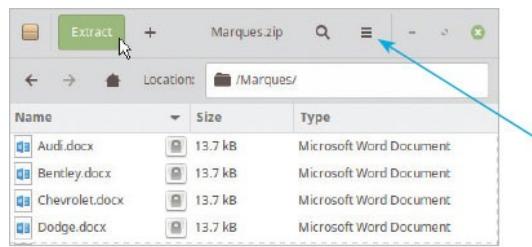
The archive does not replace the original folder – it is created in addition to the original.

- 6 Next, right-click on the archive file and choose **Open With Archive Manager** – to see its contents



7

Now, click the **Extract** button in an attempt to extract the folder and its contents

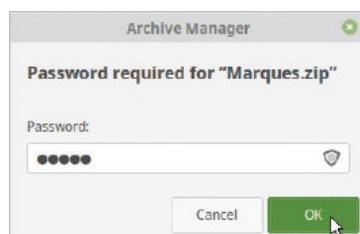


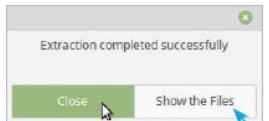
You can check an archive for errors by choosing the **Test Integrity** option on this menu.



8

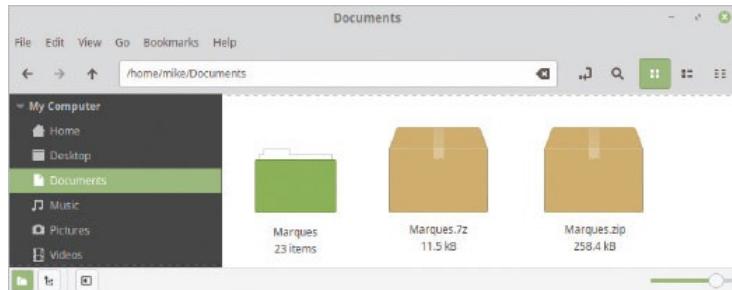
Enter the password for this archive, then click the **OK** button – to extract a copy of the folder and its contents





Click the **Show the Files** button to see the folder's contents listed in the Nemo file manager.

- 9 Click the **Close** button to exit the Archive Manager app
- 10 Create another archive of the same folder using the 7-ZIP (.7z) archive file format, and compare the file sizes



See here for more on archive management.

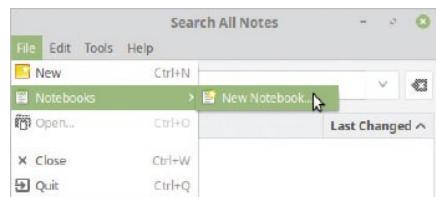
# Taking Notes

Linux Mint includes the Tomboy Notes app that lets you keep track of small pieces of information. You can use this in much the same way as “Sticky Notes” on Windows, but you can also add one or more links in a Tomboy note to reference your other notes, and you can group Tomboy notes by topic in notebooks:

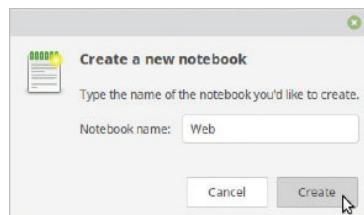


Tomboy Notes

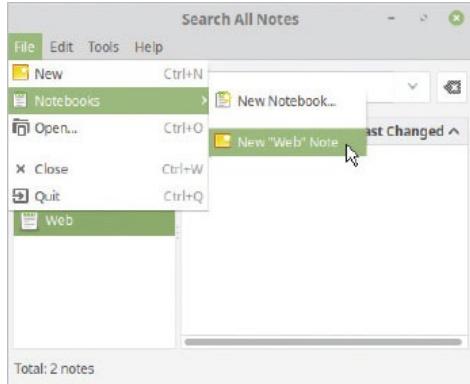
- 1 Click **Menu, Accessories, Tomboy Notes** to launch the app
- 2 Select **File, Notebooks, New Notebook...** to open a dialog



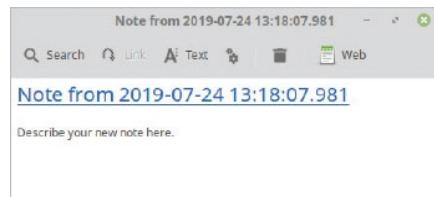
- 3 Enter a name for the notebook, such as “Web”, then click the **Create** button – see a “Web” notebook icon get added in the left-hand pane of the app



- 4 Next, click **File, Notebooks, New “Web” Note** to create a new note that opens in a separate window



- 5 See that by default the new note is named with the current date and time, which is also a hyperlink

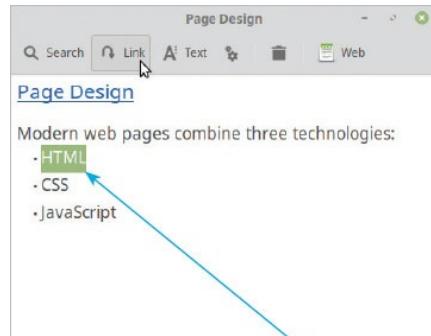


You can use the **Tools** menu to export notes as HTML documents that you can view in the Firefox web browser.



You can right-click on a note and choose **Always on Top** to see it above other open windows.

- 6 Edit the new note to give it a name and text content



- 7 Highlight some text within the note, then click the **Link** button to create a new note named as that text
- 8 See that the highlighted text has become a hyperlink to the new note, then repeat this to create more linked notes

Notebooks	Note	Last Changed
All Notes	JavaScript	Today, 12:59 PM
Unfiled Notes	CSS	Today, 12:54 PM
Web	HTML	Today, 12:52 PM
	Page Design	Today, 12:48 PM



Right-click on a notebook or note and choose **Delete** to remove it.



Click the **Text** button and choose options from its menu to edit the appearance of a note.



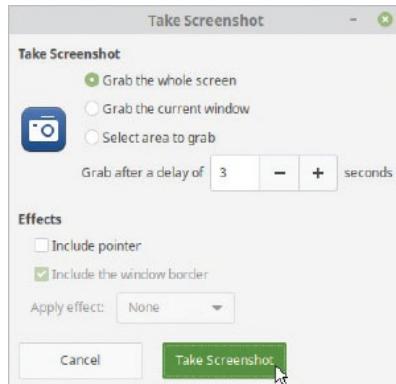
# Grabbing Screenshots

As with the Windows operating system, in Linux Mint you can press the “print screen” button (**PrtSc**) to immediately capture an image of your screen or use the **Alt + PrtSc** key combination to immediately capture the currently-active window. Additionally, Linux Mint includes a Screenshot app that provides delay and other options – much like the Snipping Tool app in Windows:

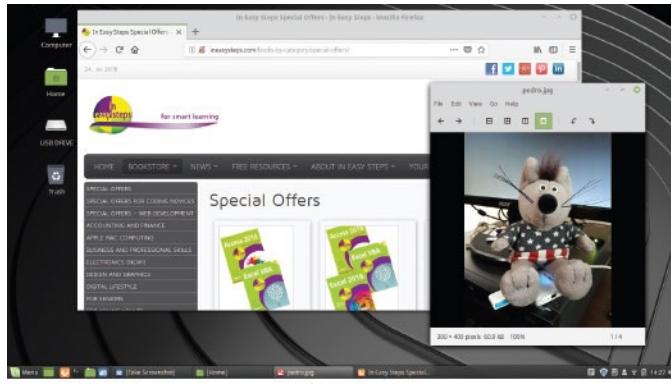
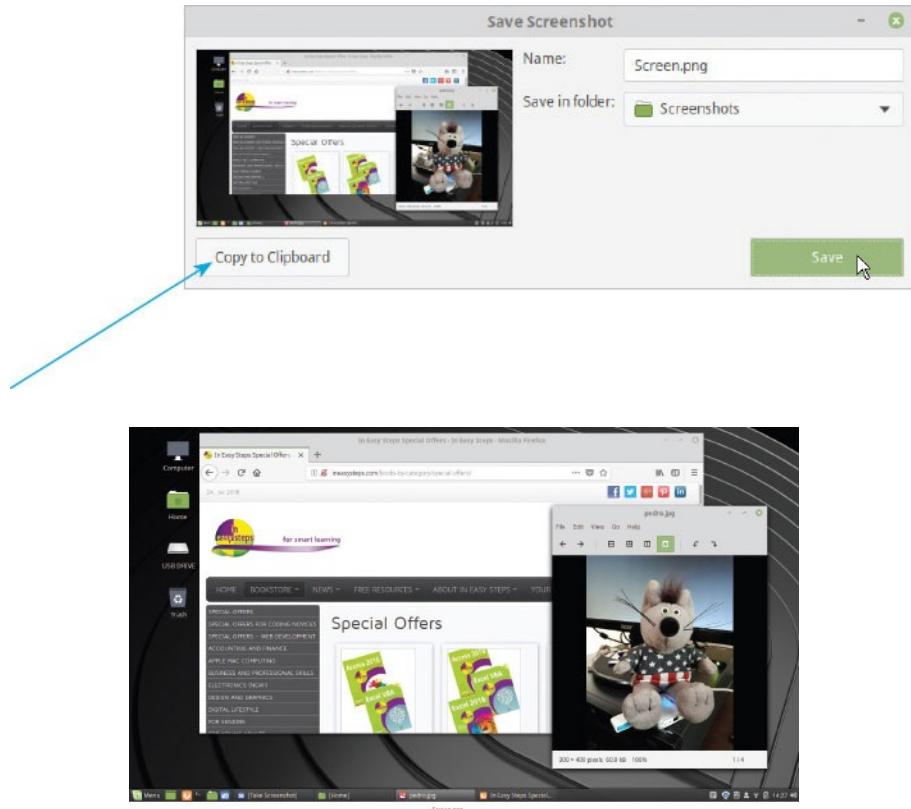


Screenshot

- 1 Click **Menu, Accessories, Screenshot** to launch the app
- 2 Choose the “Grab the whole screen” option and select a delay period, then click the **Take Screenshot** button



- 3 Edit the Name and location, then click the **Save** button



You can also click **Copy to Clipboard** and close this dialog, then paste a screenshot into the GIMP app for editing.



Notice that some options are “grayed out” (indicating they are not available) depending on the type of screenshot you have chosen.

- 4 Relaunch the app, then choose the “Grab the current window” option
- 5 Select the “Include pointer” option, then click the **Take Screenshot** button



6

Edit the Name and location, then click the **Save** button

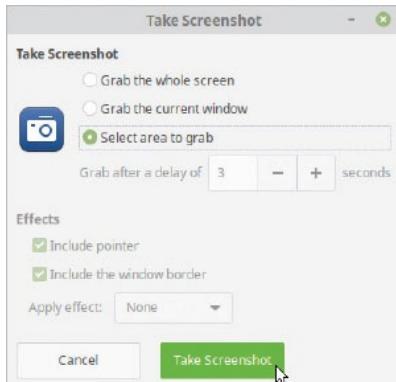


7

See that the screenshot includes the cursor and any pop-up tooltips

8

Relaunch the app, then choose the “Select area to grab” option, then click the **Take Screenshot** button



9

Drag the cursor to select a rectangular area of the screen, then release the mouse button to capture that area

10

Edit the Name and location, then click the **Save** button



You can open the **Apply effect** drop-down menu to choose an effect when grabbing the current window.



You can also press **Shift + PrtSc** to see the cursor change to a crosshair so you can select an area of the screen to grab.

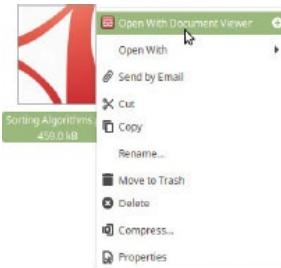
# Reading Documents

The Linux Mint distro includes a Document Viewer app (**xreader**) that is useful when reading multi-page documents such as a user guide. Typically, these type of documents are in the Portable Document Format (.pdf) that can contain annotations and are sometimes protected by a password. You can find the Document Viewer launcher on the Menu in the Accessories category, but usually you will launch it by double-clicking on a PDF document's file icon or from a right-click context menu:

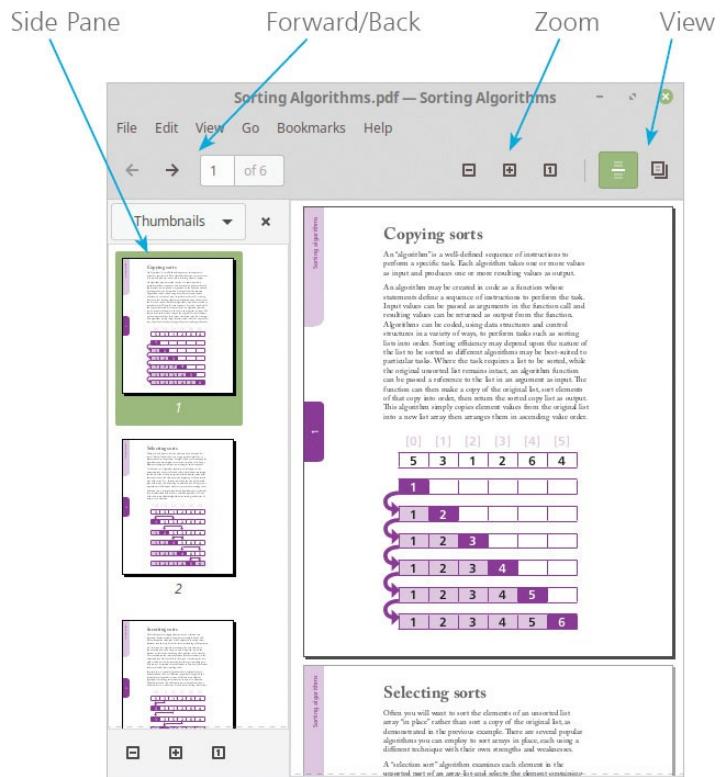


Document Viewer

- 1 Right-click on a document file icon and choose **Open With Document Viewer** to launch the app

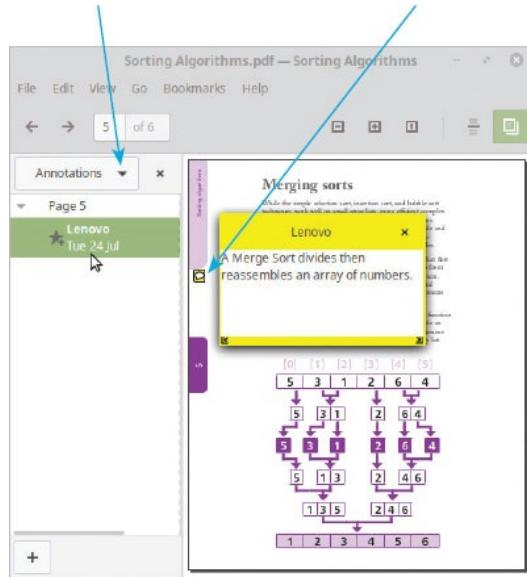


- 2 If an “Enter password” dialog appears, enter the password then click the dialog’s **Unlock Document** button – to see the first page of the document

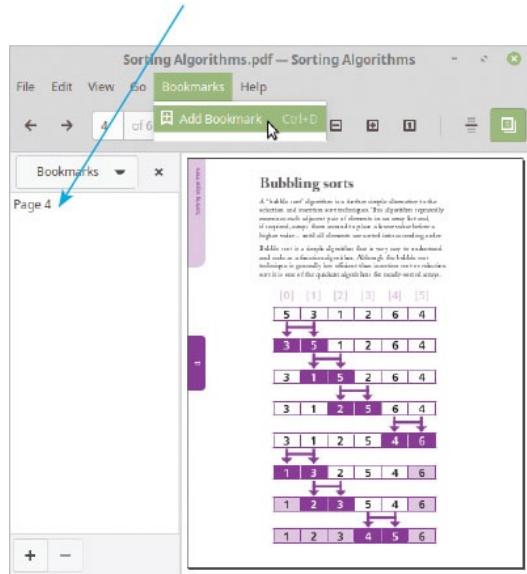


If the Side Pane is not immediately visible, click **View, Side Pane** to make it appear.

- 3 Click the **Forward** button to advance the pages, or click on a “Thumbnail” in the Side Pane to jump to a page
- 4 Select the “Annotations” option in the Side Pane drop-down menu, then click on its icon to see the note



- 5 Select the “Bookmarks” option in the Side Pane menu, then to mark a page click **Bookmarks, Add Bookmark**



Use the View buttons to choose whether or not to view Continuous pages in the window, and click **View, Dual** to view facing pages.



You can click **File, Properties** to discover a document's origin.



# Summary

- The **Text Editor** app is a plain text editor that can number lines and sort lines alphanumerically.
- Text Editor can provide **syntax highlighting** for many scripting, programming, and markup languages.
- Linux does not treat text **line endings** in the same way as Windows, but Text Editor supports both types of endings.
- The **Calculator** app can perform basic equations, execute math and financial functions, and perform conversions.
- Calculator provides a scrollable **History View** of previous calculations so they can be quickly recalled.
- The **Archive Manager** app compresses files into many archive file formats.
- The **ZIP** file format supports password-protection but may not produce the smallest archive files.
- The **7-ZIP** file format produces smaller compressed archive files than the ZIP file format.
- The **Tomboy Notes** app can keep track of small pieces of information grouped in notebooks.
- Tomboy Notes supports **hyperlinks** to other notes.
- The **Screenshot** app can capture an image of the entire screen, current window, or a selected area.
- Screenshot provides a **delay** and border options.
- The **Document Viewer** app can display multi-page documents and provide Thumbnail views of each page.
- Document Viewer supports **bookmarks** that mark a page for future reference.
- Document Viewer supports **annotations** that provide additional information on a page.

# **Commanding the Terminal**

*This chapter introduces the power of the command-line Terminal for file management and text manipulation.*

**Invoking the Terminal**

**Navigating at the Prompt**

**Operating on Directories**

**Managing Files**

**Examining File Properties**

**Comparing Files**

**Finding Files**

**Reading Text Files**

**Writing Text Files**

**Manipulating Text Content**

**Matching Text Patterns**

**Summary**

# Invoking the Terminal

At the very heart of the Linux operating system is a core series of machine instructions known as the “kernel” – this is a technical program that is not user-friendly, as it is mainly designed to communicate with electronic components. A Linux “shell” is a facility that allows the user to communicate directly with the kernel in a human-readable form. It translates command-line instructions so they can be processed.

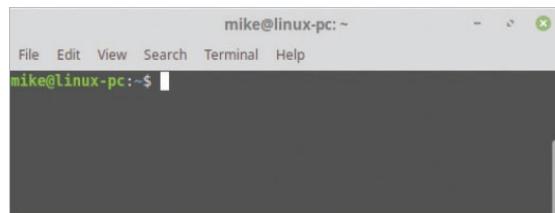


Terminal Most Linux distros include several shell programs that offer different features. The default Linux shell program, however, is called Bash (Bourne Again SHell), which is an updated version of the original Bourne shell found in the Unix operating system.

The shell understands a large number of commands, and each has a number of “options” that may (optionally) be specified to modify their behavior – usually these are prefixed by a hyphen. Many also accept “arguments” that provide data to be used by the command. The typical syntax of a shell command looks like this: ***command -option argument***

Shell commands can be executed at a prompt in a Terminal window on a graphical desktop interface:

Click **Menu, Administration, Terminal** (or click the launcher on the Taskbar) to launch a Terminal window



The Terminal window above displays the default bash command prompt and

places the cursor after the prompt – ready to receive a command. The default prompt here comprises the current user name (**mike**), a separator character (@), the host domain name (**linux-pc**), the current directory (~ tilde character denoting the Home directory), and a final terminating character (\$).



You can learn more about Bash in the companion book in this series: **Bash in easy steps**.



Options are not standardized – the same option can have different meanings for different commands.

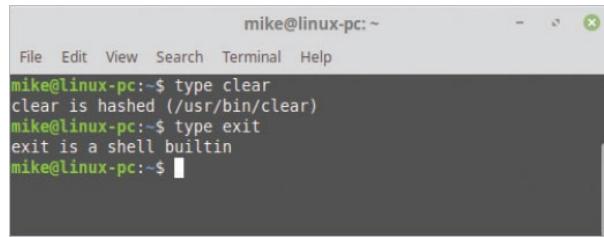
You can confirm the current user and domain name at any time with the **whoami** and **hostname** commands:

Type the **whoami** command at a prompt, then hit **3** Return Now, type the **hostname** command and hit Return again

```
mike@linux-pc:~$ whoami
mike
mike@linux-pc:~$ hostname
linux-pc
mike@linux-pc:~$
```

Some commands call upon individual programs that reside on your system – for example, the **clear** command that removes previous content from the Terminal. Others are “builtin” commands that are built into the shell itself – for example, the **exit** command that quits the shell and closes the Terminal window. You can determine whether a command is a builtin using the **type** command and the command’s name as its argument:

Type **clear** and hit Return to remove the previous content, then enter **type clear** and hit Return again to discover the location of the **clear** command p am Enter **type exit** and hit Return to discover that the **exit** command is a shell builtin instruction, then type the **exit** command and hit Return to quit the shell



```
mike@linux-pc:~$ type clear
clear is hashed (/usr/bin/clear)
mike@linux-pc:~$ type exit
exit is a shell builtin
mike@linux-pc:~$
```



Commands use lowercase only – in uppercase the command will not be recognized.



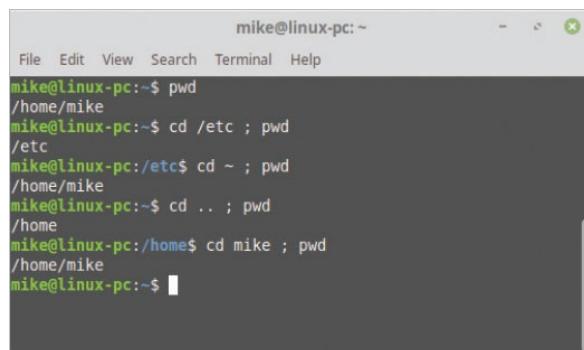
Type a **--help** argument (two hyphens & “help”) after any command, then hit Return, to see a list of options for that command.

# Navigating at the Prompt

When you start a shell session you are, by default, located in your home directory of the Linux file system. You can switch to any directory to which you have access permission by stating its absolute address as the argument to the `cd` command. Similarly, you can return to your home directory by stating its absolute address as the argument to the `cd` command, or using its tilde alias with the command `cd ~`.

For shorter hierarchical moves, the command `cd ..` moves up one level to the parent directory of the current directory. Stating just the name of an immediate sub-directory as the argument to the `cd` command moves down one level to that sub-directory:

Launch a shell window then enter the `pwd` command at the prompt to print the current working directory **1**. Enter the combined command `cd /etc ; pwd` to switch to the `/etc` directory and confirm it as the working directory **2**. Next, enter the combined command `cd ~ ; pwd` to return to the home directory and confirm the location **3**. Enter the combined command `cd .. ; pwd` to switch to the parent directory and confirm the location **4**. Now, enter the combined command `cd mike ; pwd` to switch to the named sub-directory and confirm it **5**.



```
mike@linux-pc:~$ pwd  
/home/mike  
mike@linux-pc:~$ cd /etc ; pwd  
/etc  
mike@linux-pc:/etc$ cd ~ ; pwd  
/home/mike  
mike@linux-pc:~/home$ cd .. ; pwd  
/home  
mike@linux-pc:/home$ cd mike ; pwd  
/home/mike  
mike@linux-pc:~$
```



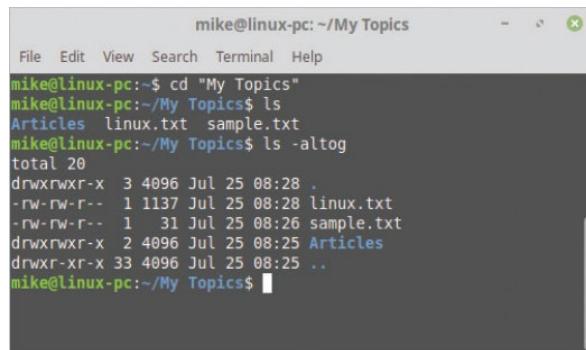
There must be space between the command and its argument.

The contents of the current directory can be revealed using the **ls** command to display a list of its files and immediate sub-directories. This is a comprehensive command that has many useful options: Use the **-a** option to see all directory contents – including hidden files and hidden sub-directories.

- Use the **-l** option to see long format listing for each item – including user and group ownership names.
- Use the **-t** option to sort the contents by the time they were created or last modified.
- Use the **-o** option to suppress group ownership details.
- Use the **-g** option to suppress user ownership details.

Options can be combined to produce a complex option where each parameter is applied:

Enter the command **cd "My Topics"** to move to an immediate sub-directory whose name contains a **space**. Next, enter the **ls** command to simply list all its **contents**. Enter the command **ls -altog** to list all contents including hidden files, in long format, listed by modification time – but with user and group details suppressed



A screenshot of a terminal window titled "mike@linux-pc: ~/My Topics". The window shows a command-line interface with the following text:  
mike@linux-pc:~\$ cd "My Topics"  
mike@linux-pc:~/My Topics\$ ls  
Articles linux.txt sample.txt  
mike@linux-pc:~/My Topics\$ ls -altog  
total 20  
drwxrwxr-x 3 4096 Jul 25 08:28 .  
-rw-rw-r-- 1 1137 Jul 25 08:28 linux.txt  
-rw-rw-r-- 1 31 Jul 25 08:26 sample.txt  
drwxrwxr-x 2 4096 Jul 25 08:25 Articles  
drwxr-xr-x 33 4096 Jul 25 08:25 ..  
mike@linux-pc:~/My Topics\$



Directory names that contain spaces must be enclosed within quotation marks when specified as a command argument – to avoid truncation of the name.



All absolute directory addresses begin with a “” character – as they descend from the root location.

# Operating on Directories

It is sometimes useful to be able to extract the name of a file, program, or directory from the end of a path address using the **basename** command.

Conversely, you can use the **dirname** command to remove the final part of the path address to a file – leaving just the path to its parent directory.

A new directory can be created in the current working directory by specifying a directory name of your choice as the argument to the **mkdir** command.

Alternatively, a new directory can be created elsewhere by specifying a full path as the argument:

To discover the location of the **bash** program that is the default shell, at a prompt enter the command **echo \$SHELL**

Issue a **basename \$SHELL** command to extract the program name from the path

a **3** Press Issue a **dirname \$SHELL** command to extract the parent directory of the

**bash** program name from the **4** path Enter the command **mkdir Sub1** to create a

directory named “Sub1” in the current working **5** directory Enter the command

**mkdir /home/mike/Data/Sub2** to create a directory named “Sub2” using an absolute path address

```
mike@linux-pc:~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ echo $SHELL
/bin/bash
mike@linux-pc:~/Data$ basename $SHELL
bash
mike@linux-pc:~/Data$ dirname $SHELL
/bin
mike@linux-pc:~/Data$ mkdir Sub1
mike@linux-pc:~/Data$ mkdir /home/mike/Data/Sub2
mike@linux-pc:~/Data$ pwd ; ls
/home/mike/Data
Sub1 Sub2
mike@linux-pc:~/Data$
```



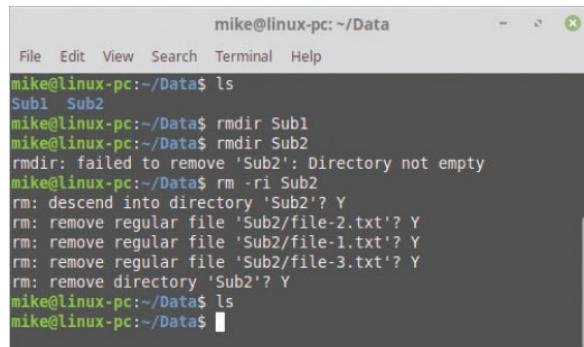
The **basename** and **dirname** commands simply manipulate the path

string – they do not implement any action.

Directories can be removed in the shell using the **rmdir** command. This takes the directory name as its argument and will instantly remove an empty directory, but will simply warn you that the directory is not empty if it contains files.

Having to delete files manually, one by one, may provide safeguards but can be tedious. An intelligent alternative is available by using the recursive interactive **-ri** option of the **rm** command. This steps inside the directory and examines every file – requesting your confirmation before deleting each file. When all files have been deleted it then asks if you want to delete the directory:

Launch the Text Editor using the **xed** command, and create three text files in the “Sub2” directory  
Issue the command **rmdir Sub1** to remove the empty “Sub1” directory  
Now, issue the command **rmdir Sub2** to attempt to remove the non-empty “Sub2” directory  
Enter the command **rm -ri Sub2** to interactively delete the files within the “Sub2” directory, and remove the directory itself, by replying “Y” (yes) to each question



```
mike@linux-pc:~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ ls
Sub1 Sub2
mike@linux-pc:~/Data$ rmdir Sub1
mike@linux-pc:~/Data$ rmdir Sub2
rmdir: failed to remove 'Sub2': Directory not empty
mike@linux-pc:~/Data$ rm -ri Sub2
rm: descend into directory 'Sub2'? Y
rm: remove regular file 'Sub2/file-2.txt'? Y
rm: remove regular file 'Sub2/file-1.txt'? Y
rm: remove regular file 'Sub2/file-3.txt'? Y
rm: remove directory 'Sub2'? Y
mike@linux-pc:~/Data$ ls
mike@linux-pc:~/Data$
```



You can use a **-v** option with both the **rmdir** command and the **rm** command to produce verbose output – describing what is happening.



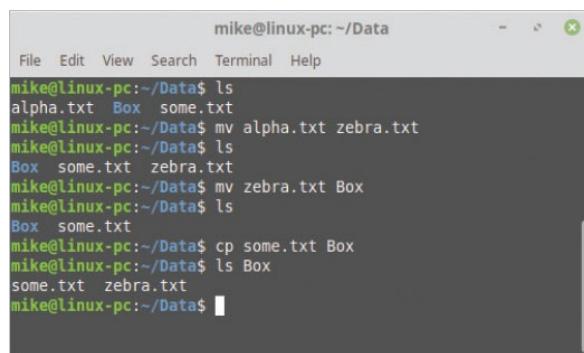
If you're feeling brave, and are absolutely certain that the directory contains nothing you will miss, you can use the **rm** command with just a **-r** option to instantly delete a directory and its entire contents – use with care!

# Managing Files

The shell **mv** command lets you easily move files around your Linux system from the command line. This command requires two arguments stating the name of the file to be moved, and the destination to which it should be moved. Interestingly, the **mv** command can also be used to rename a file by stating its current name and a new name as its two arguments.

If you wish to copy rather than move a file to a new location, the **cp** command can be used. This command can accept one or more files to be copied as its arguments, stating the destination as the final argument:

Launch a shell Terminal window, then enter an **ls** command to see the contents of the current directory. Issue an **mv** command to rename an existing file – for example, from “alpha.txt” to “zebra.txt” with **mv alpha.txt zebra.txt** – and an **ls** command to confirm the name change. Enter **mv zebra.txt Box** to move the renamed file to a **Box** sub-directory – and an **ls** command to see it. Enter **cp some.txt Box** to copy a file named “some.txt” to the same sub-directory. Issue an **ls** command with the name of the sub-directory – confirming a file was moved and a file was copied.



mike@linux-pc: ~/Data  
File Edit View Search Terminal Help  
mike@linux-pc:~/Data\$ ls  
alpha.txt Box some.txt  
mike@linux-pc:~/Data\$ mv alpha.txt zebra.txt  
mike@linux-pc:~/Data\$ ls  
Box some.txt zebra.txt  
mike@linux-pc:~/Data\$ mv zebra.txt Box  
mike@linux-pc:~/Data\$ ls  
Box some.txt  
mike@linux-pc:~/Data\$ cp some.txt Box  
mike@linux-pc:~/Data\$ ls Box  
some.txt zebra.txt  
mike@linux-pc:~/Data\$



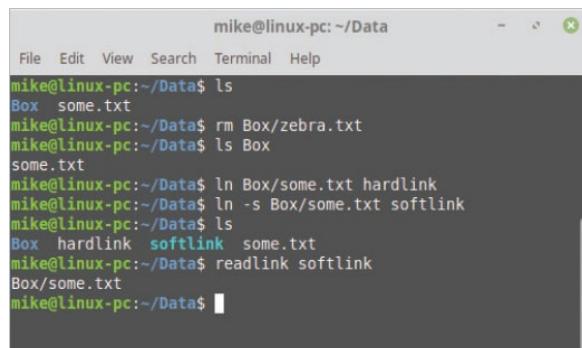
Use the **-i** option with the **mv** command to prompt before overwriting a file of the same name.

The **rm** command can be used to delete one or more files named as its arguments. The **\*** wildcard can also be used to delete all files in a directory – if you are absolutely certain none are needed.

You can create hard links, pointing to the system address of a file, and soft (symbolic) links, storing the path to a file, with the **ln** command. By default this will create a hard link to the file named as its argument – use its **-s** option to create a symbolic link.

The **readlink** command can be used to discover the target to which a symbolic link is pointing:

Enter **rm Box/zebra.txt** to delete a file in a sub-directory and an **ls Box** command to confirm it<sup>7</sup> one Enter **ln Box/some.txt hardlink** to create a hard link named “hardlink” to a file in the sub-di<sup>8</sup> Now, enter **ln -s Box/some.txt softlink** command to create a soft link named “softlink” to the sa<sup>9</sup> file Enter an **ls** command to see both links have been created in the home di<sup>10</sup> Enter a **readlink softlink** command to see the target to which the soft link points



```
mike@linux-pc:~/Data$ ls
Box some.txt
mike@linux-pc:~/Data$ rm Box/zebra.txt
mike@linux-pc:~/Data$ ls Box
some.txt
mike@linux-pc:~/Data$ ln Box/some.txt hardlink
mike@linux-pc:~/Data$ ln -s Box/some.txt softlink
mike@linux-pc:~/Data$ ls
Box hardlink softlink some.txt
mike@linux-pc:~/Data$ readlink softlink
Box/some.txt
mike@linux-pc:~/Data$
```



The wildcard **\*** character means “all” and should be used with caution.



You can find more details on shortcut links here.

# Examining File Properties

The Linux shell provides many commands that can be used to examine attributes of any file. The most comprehensive is the **stat** command that lists every important attribute of the file stated as its argument.

If you just want to discover the file size, use the **du** disk usage command with its **-b** option to count the number of bytes.

Use the **wc** word count command to quickly discover how many newlines, words, and bytes a text file contains, or assess what type of file it is with the **file** command:

Enter **stat Box/some.txt** to discover the attributes of a file named “some.txt” in a **Box** sub-directory. Enter **du -b Box/some.txt** to discover the size of this file in byte units. Enter **wc Box/some.txt** to discover that file’s line count, word count, and byte count. Now, enter **file Box/some.txt** and **file Box/tux.png** commands to discover the file type of two files

```
mike@linux-pc:~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ stat Box/some.txt
  File: Box/some.txt
  Size: 1137          Blocks: 8          IO Block: 4096
Device: 802h/2050d   Inode: 21106964    Links: 1
Access: (0664/-rw-rw-r--)  Uid: ( 1000/    mike)
Access: 2019-07-25 08:59:15.859457000 +0300
Modify: 2019-07-25 08:28:31.476969000 +0300
Change: 2019-07-25 09:05:39.946732490 +0300
 Birth: -
mike@linux-pc:~/Data$ du -b Box/some.txt
1137  Box/some.txt
mike@linux-pc:~/Data$ wc Box/some.txt
 29 175 1137 Box/some.txt
mike@linux-pc:~/Data$ file Box/some.txt
Box/some.txt: UTF-8 Unicode text, with very long lines
mike@linux-pc:~/Data$ file Box/tux.png
Box/tux.png: PNG image data, 407 x 480, 8-bit/color RGBA, non-
-interlaced
mike@linux-pc:~/Data$
```



Use the **wc** command with its **-m** option to just see a total word count.



See that here the **wc** command reveals the number of newlines (29), words (175), and bytes (1137) of this file.

The **touch** command introduces some interesting possibilities, as it can change the Last Accessed and Last Modified timestamp attributes of a file. Used alone it simply updates these to the present time, but used with a **-d** option it allows you to specify a date in a variety of formats – specify a day number and month number to set the timestamps to midnight on that day of the current year, or specify a complete date including year and time.

- 5 Enter **touch -d “02/21” more.txt** to update the timestamps of a file named “more.txt” to that date in the current directory. Enter a **stat more.txt** command to confirm the timestamps have been updated. Now, enter **touch -d ‘06/15/2020 12:00’ more.txt** to update timestamps to the specified date, time, and directory. Enter a **stat more.txt** command to confirm the timestamps have been updated once more

```
mike@linux-pc: ~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ stat more.txt
  File: more.txt
  Size: 0          Blocks: 0          IO Block: 4096
Device: 802h/2050d  Inode: 21106961  Links: 1
Access: (0644/-rw-r--r--) Uid: ( 1000/    mike)
Access: 2018-02-21 00:00:00.000000000 +0200
Modify: 2019-02-21 00:00:00.000000000 +0200
Change: 2019-07-25 09:17:02.182427105 +0300
 Birth: -
mike@linux-pc:~/Data$ touch -d \
> "06/15/2020 12:00" more.txt
mike@linux-pc:~/Data$ stat more.txt
  File: more.txt
  Size: 0          Blocks: 0          IO Block: 4096
Device: 802h/2050d  Inode: 21106961  Links: 1
Access: (0644/-rw-r--r--) Uid: ( 1000/    mike)
Access: 2020-06-15 12:00:00.000000000 +0300
Modify: 2020-06-15 12:00:00.000000000 +0300
Change: 2019-07-25 09:17:59.051465798 +0300
 Birth: -
mike@linux-pc:~/Data$
```



Date numbers supplied as an argument to the touch command must be enclosed within quotes.



See that the properties indicate the date and time of the last change and the new timestamp after modification.

# Comparing Files

The shell provides several ways to compare two files. You can check to see if two files are identical with the **cmp** command. If they are indeed identical the command reports nothing, but if they differ it reports the location of the first difference.

Text files can be compared line-by-line with the **comm** command. Its output is slightly unusual, as it creates three columns to indicate lines that match in each file:

- Column 1** – lines found in the first file, but not the second.

- Column 2** – lines found in the second file, but not the first.
- Column 3** – lines found in both files.

- 1 Use a text editor to create a file named **abc.txt**, with three lines “Alpha”, “Bravo”, and “Charlie”, and a file named **acd.txt** with three lines “Alpha”, “Charlie” and “Delta” – save the files in the current directory
- 2 Launch a shell Terminal window and enter the command **cmp abc.txt acd.txt** to discover where the first difference occurs between these two files
- 3 Enter **comm abc.txt acd.txt** to see a line-by-line comparison

mike@linux-pc: ~/Data

```
mike@linux-pc:~/Data$ cmp abc.txt acd.txt
abc.txt acd.txt differ: byte 7, line 2
mike@linux-pc:~/Data$ comm abc.txt acd.txt
      Alpha
Bravo
      Charlie
      Delta
mike@linux-pc:~/Data$
```



The **cmp** command can also be used to compare binary files such as images.



The **comm** command has options to suppress column output – the option **-12** suppresses the first two columns to show only lines that are common to both files.

The **diff** command offers an alternative to the **comm** command for comparison of text files. It too compares line-by-line, and it produces a detailed report showing any unique lines. It can also be used to compare two directories to reveal unique files.

Files may also be compared using checksum numbers to verify their integrity. Checksum numbers are often found on internet download pages so the user can ensure that a downloaded file is intact – typically, the checksum is made using the md5 algorithm.

The **md5sum** command produces a 32-byte checksum for the file specified as its argument, and should exactly match that stated by the originator if the file is indeed intact.

An alternative checksum can be created in much the same way by the **cksum** command. This generates a CRC (Cyclic Redundancy Check) value and includes the file's byte size in the output.

- 4 Enter a **diff abc.txt acd.txt** command to discover those lines that are unique to each file Now, enter **md5sum abc.txt** to create a checksum number for the file Similarly, enter **cksum abc.txt** to create another checksum number for that file

```
mike@linux-pc:~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ diff abc.txt acd.txt
2d1
< Bravo
3a3
> Delta
mike@linux-pc:~/Data$ md5sum abc.txt
7479c2794490d3026db00e5315c19bd1  abc.txt
mike@linux-pc:~/Data$ cksum abc.txt
3884172171 20 abc.txt
mike@linux-pc:~/Data$
```



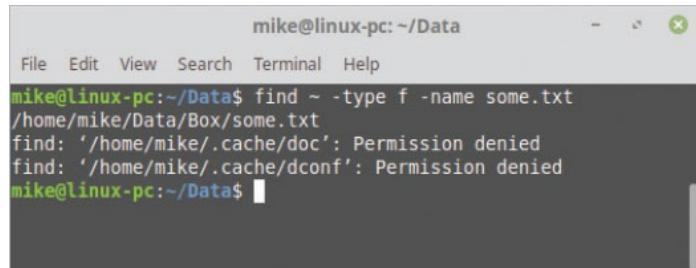
You can enter the command **man diff** to discover more about the diff output from its manual page.

# Finding Files

Locating a file on your system can be achieved from a shell prompt using the **find** command. This is a very powerful command, with over 50 possible options, but it has an unusual syntax. Possibly the one most often used looks like this: **find DirectoryName -type f -name FileName** The directory name specifies the hierarchical starting point from which to begin searching. If you know the file exists somewhere in your home directory structure, you could begin searching there (~). The **-type f** option specifies that the search is for a file – denoted by the letter “f”. The **-name** option makes the search by name – seeking the specified file name.

The search may include “Permission denied” error messages, relating to cached copies, but you can exclude error messages by appending **2>/dev/null** to the command:

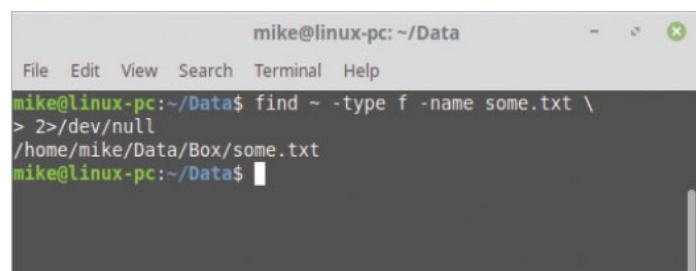
Enter **find ~ -type f -name some.txt** to seek all files named **some.txt** within your home directory structure – see the result locate the file and include an error message



```
mike@linux-pc:~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ find ~ -type f -name some.txt
/home/mike/Data/Box/some.txt
find: '/home/mike/.cache/doc': Permission denied
find: '/home/mike/.cache/dconf': Permission denied
mike@linux-pc:~/Data$
```

2

Now, enter **find ~ -type f -name some.txt \ 2>/dev/null** – to see the result now locate the file without an error message



```
mike@linux-pc:~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ find ~ -type f -name some.txt \
> 2>/dev/null
/home/mike/Data/Box/some.txt
mike@linux-pc:~/Data$
```



Use the wildcard \* with the file name when you know the name but not the extension.



You can recall the last command entered by pressing the **Up** arrow key.

By default, the **find** command will only report the location of actual files, but you can also have it include symbolic links in the report by adding a **-L** option as its very first argument:

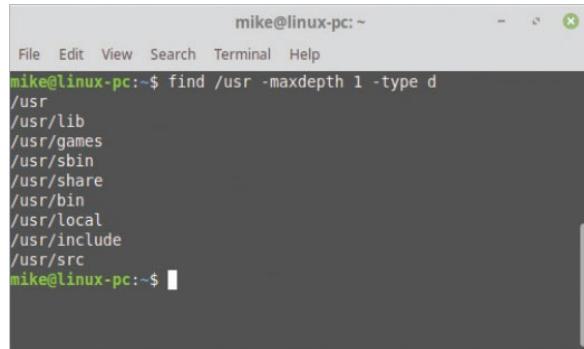
Enter **find -L ~ \ -type f -name some.txt 2>/dev/null** to seek the location of a file, report the location of any softlinks to that file, and suppress error messages

```
mike@linux-pc: ~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ find ~ -type f -name some.txt \
> 2>/dev/null
/home/mike/Data/Box/some.txt
mike@linux-pc:~/Data$
```

In addition to searching for files, the **-type** option can specify that the search is for directories – denoted by the letter “d”.

When searching deep directory structures, with many sub-directory levels, it is sometimes desirable to limit the depth of search with the **find** command’s **-maxdepth** option. This requires an integer argument to specify the number of levels to search:

Enter **find /usr -maxdepth 1 -type d** to report only those directories that are direct descendants of the **/usr** directory



```
mike@linux-pc: ~
File Edit View Search Terminal Help
mike@linux-pc:~$ find /usr -maxdepth 1 -type d
/usr
/usr/lib
/usr/games
/usr/sbin
/usr/share
/usr/bin
/usr/local
/usr/include
/usr/src
mike@linux-pc:~$
```

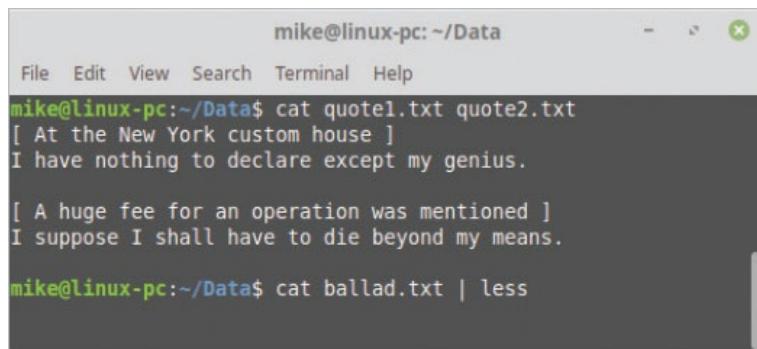


The `/usr` directory has many levels – remove the `-maxdepth 1` option from the command in Step 4 and run the command again to see all directories.

## Reading Text Files

The simplest way to view a text file in the shell is with the **cat** command. Just state one or more files to view as its arguments and it will display their content, concatenating the text together. Viewing one or two small text files will fit comfortably in a single window so you will see the entire text. Larger files, however, will exceed the space in a single window so you will only see the final part of the text. The solution is to send the text stream to the **less** command via the “|” pipe operator. This means that the text is displayed one screen at a time, starting from the beginning:

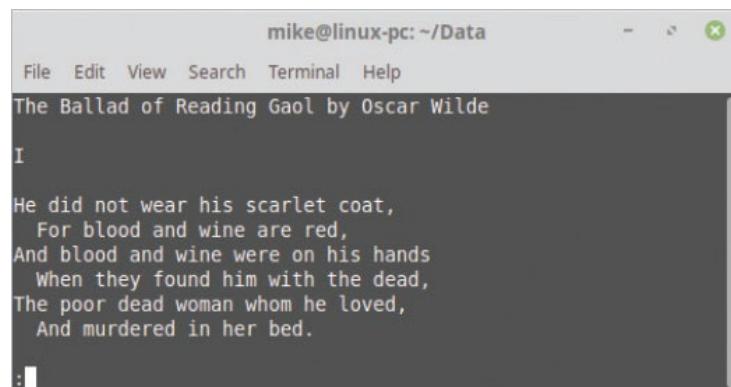
At a shell prompt, enter **cat quote1.txt quote2.txt** to display the content of two text files on standard output



mike@linux-pc: ~/Data  
File Edit View Search Terminal Help  
mike@linux-pc:~/Data\$ cat quote1.txt quote2.txt  
[ At the New York custom house ]  
I have nothing to declare except my genius.  
  
[ A huge fee for an operation was mentioned ]  
I suppose I shall have to die beyond my means.  
  
mike@linux-pc:~/Data\$ cat ballad.txt | less

2

Now, type **cat ballad.txt | less** then hit Return to display the file contents in **less** mode – in which a “:” prompt appears below the content text where you can enter special **less** mode commands to display selective text



mike@linux-pc: ~/Data  
File Edit View Search Terminal Help  
The Ballad of Reading Gaol by Oscar Wilde  
  
I  
  
He did not wear his scarlet coat,  
For blood and wine are red,  
And blood and wine were on his hands  
When they found him with the dead,  
The poor dead woman whom he loved,  
And murdered in her bed.  
  
:



You can use a **-n** option with the **cat** command to number each line on standard output.



The “less” facility offers many great options – press the H key in less mode to see them all.

- 3 Use the Page Up and Page Down keys to scroll through the text in **less** mode, then press the > key to skip to the end of the text and hit the Q key to quit **less** mode

The **head** command lets you preview the first 10 lines of a text file, and its companion **tail** command lets you preview the final 10 lines – great for skipping to the end of a long log file.

You can also display text with added line numbers using the **nl** number line command that provides useful control over numbering. Its **-v** option specifies an integer at which to start numbering, and its **-b t** option numbers only non-empty lines.

- 4 Enter the command **tail ballad.txt** to preview the last 10 lines of text within the file (including empty **5** es) Now, enter **nl -v 0 -b t ballad.txt | head** to preview the first 10 lines of text – numbered starting at zero, and numbering only non-empty lines

```
mike@linux-pc:~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ tail ballad.txt
The man had killed the thing he loved,
And so he had to die.

And all men kill the thing they love,
By all let this be heard,
Some do it with a bitter look,
Some with a flattering word,
The coward does it with a kiss,
The brave man with a sword!

mike@linux-pc:~/Data$ nl -v 0 -b t ballad.txt | head
0 The Ballad of Reading Gaol by Oscar Wilde

1 I

2 He did not wear his scarlet coat,
3 For blood and wine are red,
4 And blood and wine were on his hands
5 When they found him with the dead,
6 The poor dead woman whom he loved,
7 And murdered in her bed.
mike@linux-pc:~/Data$
```



The shell pipeline technique allows the output from any command to be redirected as input for another command.

# Writing Text Files

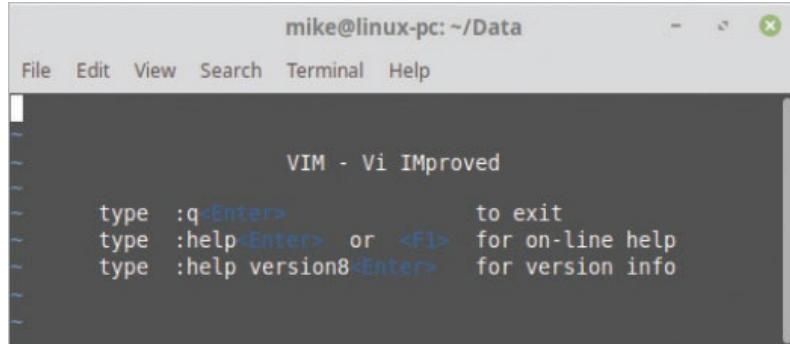
The classic Linux shell program for creating and editing text files is the compact



**vi** application that is also found on Unix systems:

Text Editor

Type **vi** at a shell prompt, then hit Return to open the text editor in the shell window at its “splash screen”



The vi editor does not have automatic word wrap at line ends – it will wrap mid-word unless you hit Return to wrap a word manually.

The **vi** (vim) editor displays a tilde character at the beginning of each empty line. You cannot enter any text initially, as **vi** opens in “command mode” where it will attempt to interpret anything you type as an instruction:

Press the **Insert** key to change to “insert mode” where text can be put in insert mode, type some text into the **vi** editor – the splash screen information disappears as you begin typing

mike@linux-pc: ~/Data

File Edit View Search Terminal Help

```
This is some simple text that is being written using  
the Vi text editor in a Linux shell.
```

- 4 To save your text as a file, first hit the **Esc** key to exit “insert mode”, switching **vi** to “command mode”
- 5 Type a “**:**” colon to begin a **vi** command – a colon character appears at the bottom-left corner of the editor. Now, type a lowercase “**w**” (for “write”) followed by a space and a name for the text file – **simple.txt**, for example. Hit the Return key to write the file – in the current directory by default. Type a “**:q**” **vi** command then hit Return to close **vi** and return to a regular shell prompt

mike@linux-pc: ~/Data

File Edit View Search Terminal Help

```
This is some simple text that is being written using  
the Vi text editor in a Linux shell.
```

:w simple.txt

You can launch **vi** and open a file for editing in one single action by typing “**vi**” at a prompt, followed by a space and the file name:

At a shell prompt, enter the command **vi simple.txt** to re-open the text file in the **vi** editor

mike@linux-pc: ~/Data

File Edit View Search Terminal Help

```
This is some simple text that is being written using  
the Vi text editor in a Linux shell.
```

"simple.txt" 2 lines, 90 characters



Using vi needs a little practice. Some distros, such as Linux Mint and Ubuntu, ship with other text editors – try typing “nano” at a prompt to launch an alternative text editor app.

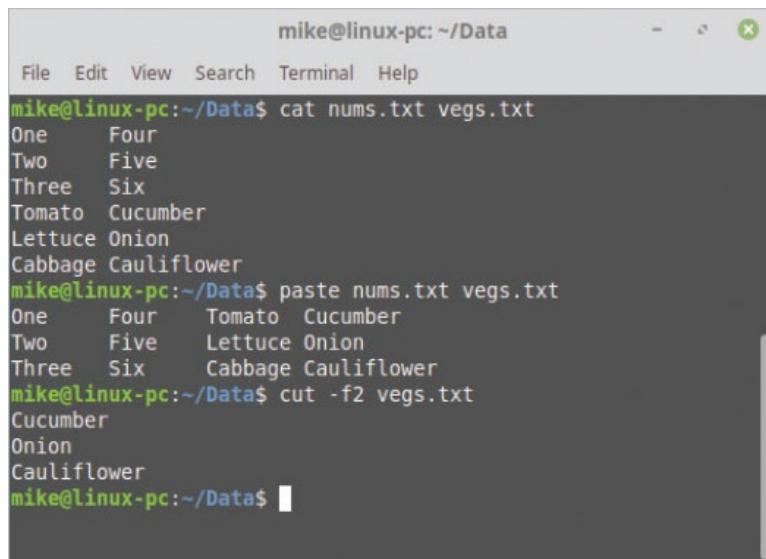


To edit a file opened in vi you need to first hit the Insert key to enter insert mode.

# Manipulating Text Content

The shell **cut** and **paste** commands may not be what you expect. They work with text arranged in columns, delimited by an invisible tab character. Each column of text is known as a “field” and the **cut** command can specify which field to display – for instance, the option **-f3** chooses the third column from the left. The **paste** command is the opposite of the **cut** command, combining columns from multiple files for display horizontally:

Use **vi** to create two text files “nums.txt” and “vegs.txt”, each with two columns of text separated by tab characters. Enter **cat nums.txt veggies.txt** to display the file contents vertically, one above the other. Now, enter **paste nums.txt veggies.txt** to display the file contents horizontally, side-by-side. Enter **cut -f2 veggies.txt** to just display the contents from the second column of one file.



```
mike@linux-pc:~/Data$ cat nums.txt veggies.txt
One    Four
Two    Five
Three  Six
Tomato Cucumber
Lettuce Onion
Cabbage Cauliflower
mike@linux-pc:~/Data$ paste nums.txt veggies.txt
One    Four    Tomato  Cucumber
Two    Five    Lettuce  Onion
Three  Six    Cabbage  Cauliflower
mike@linux-pc:~/Data$ cut -f2 veggies.txt
Cucumber
Onion
Cauliflower
mike@linux-pc:~/Data$
```



Use a **-T** option with the **cat** command to display the invisible tab characters as “^I” on standard output.

```
mike@linux-pc:~/Data$ cat -T vegs.txt
Tomato^ICucumber
Lettuce^IONion
Cabbage^ICauliflower
```



Multiple fields can be specified as a comma-separated list, like `-f1,3` or as a range such as `-f2-4`.

Simple text transformations can easily be made by piping a text stream to the `tr` command. This requires two arguments to specify what to change, and how it should be changed. For instance, the command `tr a “*”` changes all occurrences of the letter “a”, replacing each one with an asterisk on standard output.

Typically, the `tr` command is used to transform capitalization on output. The `sort` command is often used at the end of a pipeline to display lines of text sorted alphabetically. It can also be used to order lines numerically if a `-n` option is used. The `tee` command is useful in a pipeline that ends with a `sort` instruction to write the text stream as a file before sorting. The file name is specified by the argument to the `tee` command and the file is created in the current directory:

Enter `cat quote3.txt ;\ cat quote3.txt | tr “a-z” “A-Z”` to display the contents of a file named “quote1.txt” – both in its original format and after transformation to uppercase. Enter `cut -f2 vegs.txt | sort` to just display the contents of a second column, sorted alphabetically. Now, enter `cut -f2 vegs.txt | tee vegs-column2.txt | sort` to save a second column as a text file before displaying it sorted alphabetically on standard output. Finally, enter `cat vegs-column2.txt` to display the file

```
mike@linux-pc:~/Data$ cat quote3.txt ; \
> cat quote3.txt | tr "a-z" "A-Z"
I can resist everything except temptation.

I CAN RESIST EVERYTHING EXCEPT TEMPTATION.

mike@linux-pc:~/Data$ cut -f2 veggies.txt | sort
Cauliflower
Cucumber
Onion
mike@linux-pc:~/Data$ cut -f2 veggies.txt \
> | tee veggies-column2.txt | sort
Cauliflower
Cucumber
Onion
mike@linux-pc:~/Data$ cat veggies-column2.txt
Cucumber
Onion
Cauliflower
mike@linux-pc:~/Data$
```



Remember that the sequence of characters specified to the `tr` command must be enclosed in quotes.

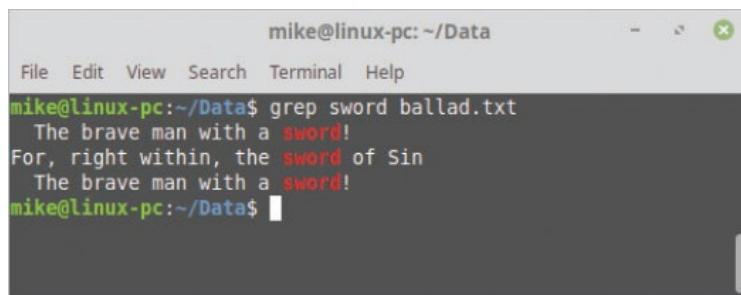


Use a `-a` option with the `tee` command to append text to a file, rather than overwriting previous text.

# Matching Text Patterns

The **grep** command is one of the most useful of all commands. It has many possible options, but its purpose is simply to display all lines from a text file that contain a specified string or pattern. A **grep** command can specify a string to seek as its first argument, and a file name in which to search as its second argument:

At a shell prompt, enter **grep sword ballad.txt** to display all lines in this text file that contain the word “sword”



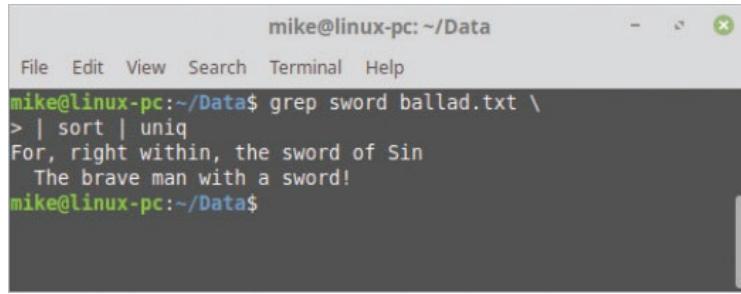
mike@linux-pc:~/Data  
File Edit View Search Terminal Help  
mike@linux-pc:~/Data\$ grep sword ballad.txt  
The brave man with a **sword**!  
For, right within, the **sword** of Sin  
The brave man with a **sword**!  
mike@linux-pc:~/Data\$



The **grep** command can also match regular expressions. For instance, **grep [Y] ballad.txt** would output all lines that have an uppercase Y. See the **grep** man page for more on regular expressions.

Notice that the output above has two duplicate lines. The **sort** command can be used to re-order lines, to make duplicate lines appear in succession, and duplicated successive lines can be removed with the **uniq** command. Output from the **grep** command can be piped to a **sort** command to make the duplicate lines successive, then piped to **uniq** so only unique lines remain:

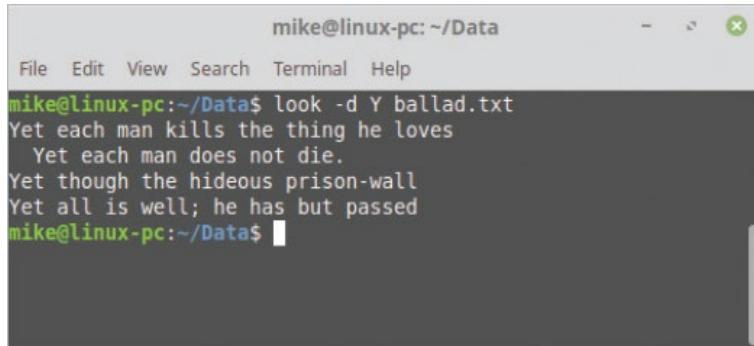
Enter **grep sword ballad.txt | sort | uniq** to display all unique lines in this text file that contain the word “sword”



```
mike@linux-pc:~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ grep sword ballad.txt \
> | sort | uniq
For, right within, the sword of Sin
    The brave man with a sword!
mike@linux-pc:~/Data$
```

The **look** command is useful to quickly output all lines of text from a file that begin with a specified prefix. It can accept a **-d** option to only seek to match alphanumeric characters.

- 3 Enter **look -d Y ballad.txt** to see a list of lines beginning with the letter “Y” from this file, ignoring spaces and tabs



```
mike@linux-pc:~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ look -d Y ballad.txt
Yet each man kills the thing he loves
    Yet each man does not die.
Yet though the hideous prison-wall
Yet all is well; he has but passed
mike@linux-pc:~/Data$
```



You can also use the **look** command with a string argument to see a list of words starting with that string – taken from an editable dictionary file that is normally located at `/usr/share/dict/words`

The **aspell** program is a powerful spellchecker that has a **-c** option that lets you interactively check a file for spelling errors. This highlights possible errors and suggests alternatives that you can choose to replace or ignore each highlighted word in turn:

Enter **aspell -c ballad.txt** to begin the spellchecker for this file. Type the number against a suggested replacement to immediately replace the highlighted word

with it

```
mike@linux-pc: ~/Data
File Edit View Search Terminal Help
And the sky above my head became
  Like a casque of scorching steel;
And, though I was a soul in pain,
  My pain I could not feel.

1) Basque          6) case
2) basque         7) Cassie
3) masque         8) cask
4) claque         9) caste
5) Case            0) cirque
i) Ignore          I) Ignore all
r) Replace         R) Replace all
a) Add             l) Add Lower
b) Abort           x) Exit

?
```



Press the **i** key to ignore a word, the **R** key to type your own replacement, or the **x** key to exit the **aspell** spellchecker.

# Summary

- The **whoami** command reveals the user name, **hostname** reveals the domain name, **clear** empties the shell window, and **exit** terminates the shell session.
- The **pwd** command reveals the current working directory and the directory location can be changed with the **cd** command.
- The ~ tilde character is an alias for the home directory and any directory's content can be revealed by the **ls** command.
- The **basename** command returns the last part of an address, whereas the **dirname** command returns just the first part.
- New directories are created with the **mkdir** command and empty directories can be removed by the **rmdir** command.
- Files are moved or renamed with the **mv** command, copied with the **cp** command, and removed with the **rm** command.
- The **ln** command is used to create hard links and soft links, but the **readlink** command can only be used with soft links.
- The **stat** command lists all file properties, **du** reports the file size, and the **file** command reports the file type.
- Timestamps of a file can be modified by the **touch** command, and the **wc** command can be used to report the word count.
- Files can be compared with **cmp**, **comm**, and **diff** commands, and checksums generated by the **cksum** and **md5** commands.
- The **find** command locates a file, **grep** locates a string within a file, and **look** locates lines beginning with a given letter.
- Files can be viewed using the **cat** command, lines numbered with **nl**, and spelling checked by the **aspell** command.
- The **head** command displays the first 10 lines of a file, whereas the **tail** command displays its final 10 lines.
- The **vi** editor can be used to create text files and individual text columns manipulated by the **cut** and **paste** commands.
- A shell pipeline directs output to be used as input for another command and

can include **tee** to write a file, **tr** to transform the output, and **sort** to order the output alphanumerically.

**10**

# **Performing Operations**

*This chapter demonstrates how to perform useful operations with the Linux command-line shell app.*

**Becoming the Superuser**

**Installing Packages**

**Handling Archives**

**Examining File Systems**

**Working with Accounts**

**Setting Access Permissions**

**Controlling Processes**

**Exploring the Network**

**Printing from the Shell**

**Evaluating Expressions**

**Scripting the Shell**

**Summary**

# Becoming the Superuser

A regular user can call upon many shell commands, but some are only available to a privileged “superuser”. These restricted commands typically perform system administration functions to which regular users should not be allowed instant access.



Terminal On a typical home Linux system the default user created during installation is given access to the **sudo** command, which allows commands to be executed as if the regular user is the superuser.

The **sudo** command is most often needed where you receive a “Permission denied” message when attempting to perform an operation. Prefixing the previous command with the **sudo** command effectively grants the required permission. If the previous command was lengthy, you can simply issue a **sudo !!** command to run it again with the required **sudo** prefix:

At a shell prompt, enter **parted devsda** to attempt to launch the partition editor for the hard-drive ② ice As the shell informs you that you are not the superuser, type **c** then hit Return to cancel the attempt

```
mike@linux-pc: ~
File Edit View Search Terminal Help
mike@linux-pc:~$ parted /dev/sda
WARNING: You are not superuser. Watch out for permissions.
Error: Error opening /dev/sda: Permission denied

Retry/Cancel? c
mike@linux-pc:~$
```

A screenshot of a terminal window titled "mike@linux-pc: ~". The window has a standard Linux desktop interface with a menu bar. In the terminal, the user has typed "parted /dev/sda" and received an error message: "WARNING: You are not superuser. Watch out for permissions." followed by "Error: Error opening /dev/sda: Permission denied". The user then types "Retry/Cancel? c" and hits Enter. A small green circle highlights the number "2" next to the word "ice" in the warning message, likely referring to the hard-drive being referred to.

- 3 Now, enter **sudo parted /dev/sda** (or just enter **sudo !!**) to launch the partition editor successfully. At the **(parted)** prompt, enter a **print** command to list the partition information for the hard drive. Now, enter a **help** command to see the available operations that may be performed, or enter a **quit** command to exit the partition editor.

```
mike@linux-pc:~$ sudo parted /dev/sda
[sudo] password for mike:
GNU Parted 3.2
Using /dev/sda
Welcome to GNU Parted! Type 'help' to view a list of commands
(parted) print
Model: ATA ST500LT012-1DG14 (scsi)
Disk /dev/sda: 500GB
Sector size (logical/physical): 512B/4096B
Partition Table: gpt
Disk Flags:

Number Start End Size File system Name
Flags
 1 1049kB 538MB 537MB fat32      EFI System
                           Partition boot
 2 538MB 500GB 500GB ext4

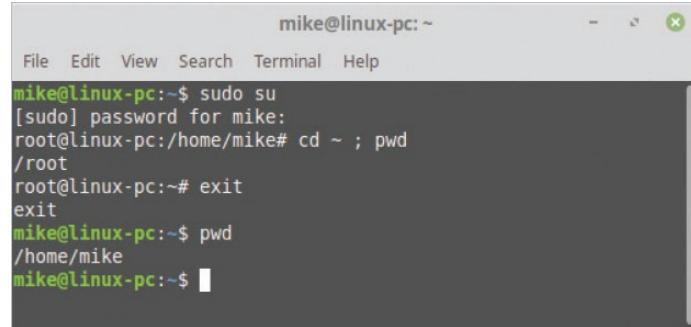
(parted) quit
mike@linux-pc:~$
```



The hard drive is a Small Computer System Interface (SCSI – pronounced “scuzzy”) device. These are labeled alphabetically so the first device on your system is **scsi device “a” (sda)**.

To assume superuser status in order to perform system administration, the **sudo** command can be used together with the **su** (switch user) command. This makes you the “root” user, with system-wide access, whose home directory is the **/root** directory:

Issue the **sudo su** command, then enter your regular user password to assume superuser status. Enter **cd ~ ; pwd** to navigate to the root superuser’s home directory and display its location. Log out from the root superuser account by entering the **exit** command – to resume regular user status back in the user’s home directory.



```
mike@linux-pc:~ File Edit View Search Terminal Help mike@linux-pc:~$ sudo su [sudo] password for mike: root@linux-pc:/home/mike# cd ~ ; pwd /root root@linux-pc:~# exit mike@linux-pc:~$ pwd /home/mike mike@linux-pc:~$
```



The root superuser can access any file or program on the system – with the potential to wreak havoc! Only log in as the root superuser if it's absolutely essential.



For security, the shell displays no characters for password entries.

# Installing Packages

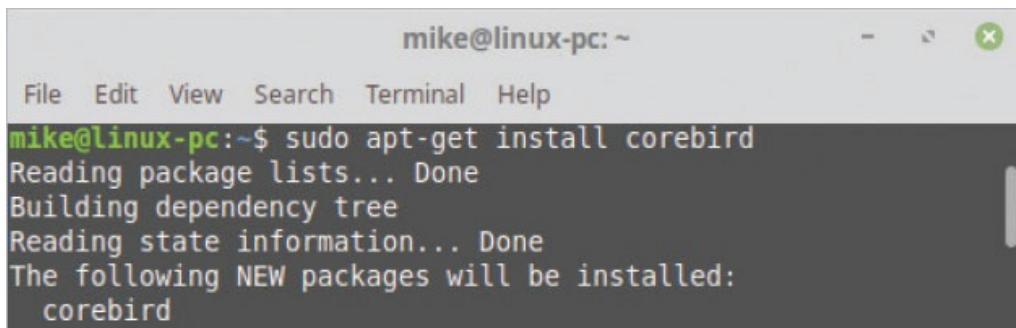
The Advanced Packaging Tool (APT) is a command-line tool that automates the process of retrieving, configuring, and installing software packages. It relies upon online repositories to locate software and resolve dependencies – so that the installation package will include any libraries required by the application. Unsurprisingly, as package installation modifies your system, all APT commands must be run using **sudo** for superuser privileges.

The APT's **apt-get** command has several options with which to manage packages. It's useful to first execute an **apt-get update** command to update the list of available repository packages, before issuing an **apt-get install package-name** command.

Once installed, a package can be upgraded to the latest version with an **apt-get upgrade package-name** command.

After a package has been installed it can be removed later using an **apt-get remove package-name** command – but this retains the configuration files for that package. For complete removal of a package and its configuration files you can instead use the command **apt-get --purge remove package-name**.

- 1 Enter the **sudo apt-get update** command to ensure the package list is up-to-date
- 2 Now, issue a command to install a package – for example, enter **sudo apt-get install corebird** to install the “Corebird” Twitter client package



mike@linux-pc: ~

```
mike@linux-pc:~$ sudo apt-get install corebird
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
corebird
```



Use **apt-cache search package-name** to locate an installed or available package.



Use **man apt-get** to see the full range of options.

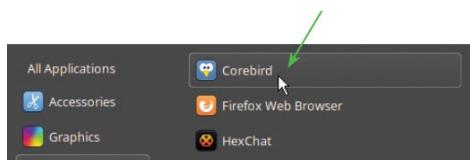
3

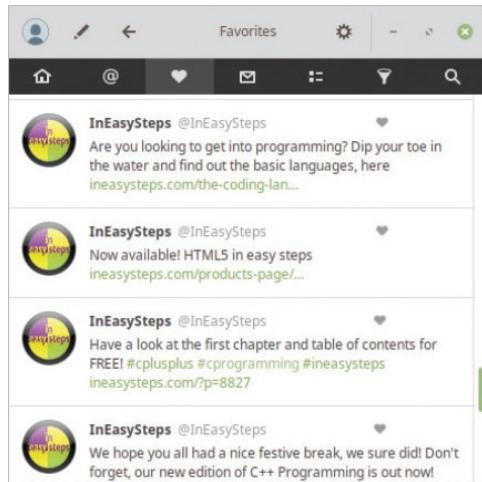
Some packages request confirmation before installation that requires you to type **Y** and hit Return if you are happy to proceed, or enter **N** to cancel the installation

```
Fetched 521 kB in 1s (620 kB/s)
Selecting previously unselected package corebird.
(Reading database ... 318755 files and directories currently
installed.)
Preparing to unpack .../corebird_1.7.3-1_amd64.deb ...
Unpacking corebird (1.7.3-1) ...
Processing triggers for mime-support (3.60ubuntu1) ...
Processing triggers for desktop-file-utils (0.23+linuxmint3)
Setting up corebird (1.7.3-1) ...
Processing triggers for libglib2.0-0:amd64 (2.56.1-2ubuntu1)
Processing triggers for man-db (2.8.3-2) ...
Processing triggers for gnome-menus (3.13.3-11ubuntu1) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
mike@linux-pc:~$
```

After the packages are retrieved, unpacked, and set up, the installation is complete and the application is ready to run:

Check the Menu to see that a launch icon has been added for the newly-installed package – in this case, click **Menu, Internet** to see a Twitter client app launcher





The Synaptic Package Manager is a user-friendly graphical interface for the Advanced Packaging Tool (APT) – in Linux Mint, click **Menu**, **Administration**, **Synaptic Package Manager** to launch the app.

# Handling Archives

The traditional file compression tool in Linux uses the **gzip** command to compact one or more files into a single archive – adding a “.gz” file extension and replacing the original files. Its companion **gunzip** command can be used to extract files from an archive created with **gzip** – replacing the compressed archive:



Archive

Enter **du -b ele\*** to learn the byte size of local files whose names begin “ele” – in this case it’s one named **e 2 .txt**. Next, enter **gzip elegy.txt** to create a compressed archive of that file – named with an added “.gz” file ext**3**ion. Now, use a further **du -b ele\*** command to compare the file size of the compressed **gzip** archive to the origi**4** file. Enter **gunzip elegy.txt.gz** to extract the original file

```
mike@linux-pc:~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ du -b ele*
6239  elegy.txt
mike@linux-pc:~/Data$ gzip elegy.txt
mike@linux-pc:~/Data$ du -b ele*
3051  elegy.txt.gz
mike@linux-pc:~/Data$ gunzip elegy.txt.gz
mike@linux-pc:~/Data$
```

The modern **bzip2** compression tool gets better compression than **gzip** but is less widely used – distributing **bzip2** archives may not find universal acceptance. It works like the **gzip** tool, but adds a “.bz2” file extension and has a companion **bunzip2** uncompressor:

Enter **du -b ele\*** to learn the byte size of local files whose names begin “ele” – in this case it’s one named **e 6 .txt**. Next, enter **bzip2 elegy.txt** to create a compressed

archive of that file – named with an added “.bz2” file extension. Now, use a further **du -b ele\*** command to compare the file size of the compressed **bzip2** archive to the original file



A **bzip2** archive file size is smaller than gzip and zip archives – notice the size of the archives in these examples.

- 8 Enter **bunzip2 elegy.txt.bz2** to extract the original file – being sure to include the added “.bz2” file extension

```
mike@linux-pc:~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ du -b ele*
6239 elegy.txt
mike@linux-pc:~/Data$ bzip2 elegy.txt
mike@linux-pc:~/Data$ du -b ele*
2768 elegy.txt.bz2
mike@linux-pc:~/Data$ bunzip2 elegy.txt.bz2
mike@linux-pc:~/Data$
```

A screenshot of a terminal window titled "mike@linux-pc: ~/Data". The window has a standard Linux-style title bar with icons for minimize, maximize, and close. The menu bar includes "File", "Edit", "View", "Search", "Terminal", and "Help". The terminal itself shows a sequence of commands and their outputs:  
1. "du -b ele\*" shows the size of "elegy.txt" as 6239 bytes.  
2. "bzip2 elegy.txt" creates a compressed archive "elegy.txt.bz2".  
3. "du -b ele\*" shows the size of "elegy.txt.bz2" as 2768 bytes.  
4. "bunzip2 elegy.txt.bz2" extracts the file back to "elegy.txt".  
The terminal ends with an empty line for input.

Compressed archives created in Windows systems invariably use the zip compression format. In Linux systems their contents can be extracted by the **unzip** command and archives created for distribution to Windows users with the **zip** command. The **unzip** command does not delete the archive file after extraction:

Enter **zip elegy.zip elegy.txt** to specify the archive name and the file it should contain in compressed form. Issue another **du -b ele\*** command to compare file sizes, then enter **unzip elegy.zip** to extract the archive contents. When asked, choose the “r” option, then rename the extracted file **elegy.unzipped** – to differ from the original

```
mike@linux-pc:~/Data$ zip elegy.zip elegy.txt
   adding: elegy.txt (deflated 52%)
mike@linux-pc:~/Data$ du -b ele*
6239   elegy.txt
3191   elegy.zip
mike@linux-pc:~/Data$ unzip elegy.zip
Archive:  elegy.zip
replace elegy.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename: r
new name: elegy.unzipped
   inflating: elegy.unzipped
mike@linux-pc:~/Data$
```



The **zip** command requires the archive name as its first argument, followed by a list of files to be included in that archive.

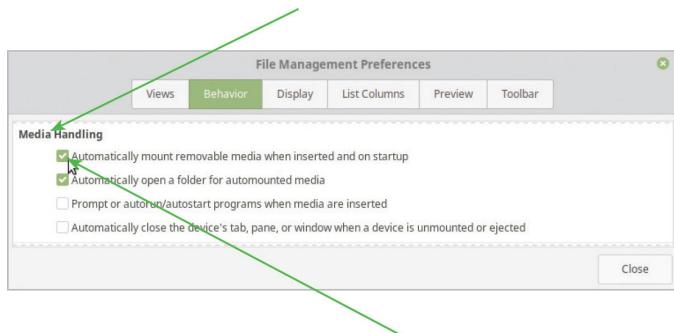


Use a **-c** option with **gunzip**, **bunzip2**, or **unzip** commands to display the content of compressed text files on standard output.

# Examining File Systems

A Linux system may span multiple hard disk drives and extend across many disk partitions. Each partition is represented by a special file in the `/dev` directory – typically, `devsda1` may represent the first partition on your master hard disk drive. During installation of the Linux operating system, each partition is formatted as a persistent storage “file system” on the hard drive in which files can be stored and recalled. Similarly, media drives are formatted with their own file systems in which to store data. Media drives must be “mounted” onto the Linux file tree in order to make them accessible, and this can be achieved automatically:

Click **Menu, Accessories, Files** – to open the “Nemo” file manager. In Nemo, click **Edit, Preferences, Behavior**, then scroll down to the “Media Handling” category



- 3 Now, ensure that the option to “Automatically mount removable media when inserted and on startup” is selected. Click the **Close** button to confirm the selection and to close the “File Management Preferences” dialog

The `df` disk free command shows how file systems are being used by indicating free space. It has a `-h` option to make the output more understandable and a `-T` option to display file system types:

Insert a flash drive into a USB port on your machine. Open a **Terminal** window, then enter the command `df -hT` to discover how the file system currently appears

```
mike@linux-pc:~$ df -hT
Filesystem      Type  Size  Used Avail Use% Mounted on
udev            devtmpfs 1.9G   0  1.9G  0% /dev
tmpfs           tmpfs   384M  1.3M 382M  1% /run
/dev/sda2        ext4   457G  23G  412G  6% /
tmpfs           tmpfs   1.9G  24M  1.9G  2% /dev/shm
tmpfs           tmpfs   5.0M  4.0K  5.0M  1% /run/lock
tmpfs           tmpfs   1.9G   0  1.9G  0% /sys/fs/cgroup
/dev/sda1        vfat   511M  4.7M  507M  1% /boot/efi
tmpfs           tmpfs   384M  44K  384M  1% /run/user/1000
/dev/sdb1        vfat   3.9G  44K  3.9G  1% /media/mike/USB DRIVE
mike@linux-pc:~$
```



The **df -T** option (uppercase) will display file system types, whereas the **df -t** option (lowercase) specifies which file system types to list.

Here the hard drive file systems on **devsda1** and **devsda2** were automatically mounted onto the Linux file tree during the boot process, and the media drive filesystem on **devsdb1** was automatically mounted when the flash drive was inserted into the device port. A file system can be manually unmounted using the **umount** command to perform maintenance on it without fear of file corruption. For instance, the root superuser can run the **fsck** file system check command to check for integrity and errors:

Enter **umount devsdb1** to unmount the file system on the USB flash drive. Now, issue the command **sudo fsck devsdb1** to check the USB flash drive file system for errors. When the check completes, remove the flash drive from the USB port – reinsert it into the port to mount it again.

```
mike@linux-pc:~$ umount /dev/sdb1
mike@linux-pc:~$ sudo fsck /dev/sdb1
fsck from util-linux 2.31.1
fsck.fat 4.1 (2017-01-24)
There are differences between boot sector and its backup.
This is mostly harmless. Differences: (offset:original/backup)
 65:01/00
 1) Copy original to backup
 2) Copy backup to original
 3) No action
? 3
/dev/sdb1: 6 files, 23/1000176 clusters
mike@linux-pc:~$
```



See that there are many items of the “tmpfs” type, but these are merely temporary file system storage facilities in volatile memory. Only the highlighted items identify persistent storage devices.



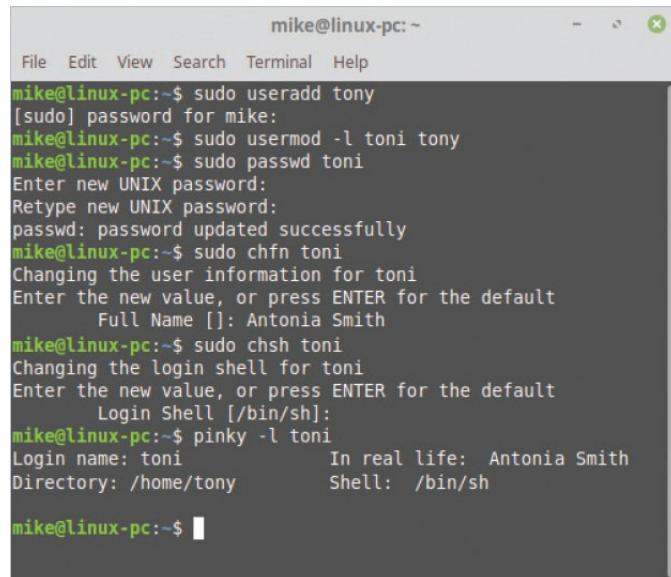
The **fsck** command uses the same file system checker that is used during the boot process prior to the mount procedures – it should not be used on mounted devices.

# Working with Accounts

User accounts are administered by the superuser. The **useradd** command will create a new user of a specified name, the **usermod** command can modify a specified user, and the **userdel** command can delete a specified user. A user's login password can be changed by the **passwd** command. The user's full name can be changed by the **chfn** command, and their default shell program can be changed by the **chsh** command. Each user may employ these to change their own details, or the superuser can change the user's details. The **pinky -l** command will show the details of any specified user:

Enter the command **sudo useradd tony** and your regular user password – to create a new user named “tony”

Next, enter the command **sudo usermod -l toni tony** to rename the user named “tony” to “toni”, then enter the command **sudo passwd toni** and set a login password Issue the command **sudo chfn toni** and enter the full name of this user, then issue the command **sudo chsh toni** and enter **binbash** to set the bash program as the default Enter the command **pinky -l toni** to see this user's details



```
mike@linux-pc:~$ sudo useradd tony
[sudo] password for mike:
mike@linux-pc:~$ sudo usermod -l toni tony
mike@linux-pc:~$ sudo passwd toni
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
mike@linux-pc:~$ sudo chfn toni
Changing the user information for toni
Enter the new value, or press ENTER for the default
    Full Name []: Antonia Smith
mike@linux-pc:~$ sudo chsh toni
Changing the login shell for toni
Enter the new value, or press ENTER for the default
    Login Shell [/bin/sh]:
mike@linux-pc:~$ pinky -l toni
Login name: toni          In real life: Antonia Smith
Directory: /home/tony      Shell: /bin/sh

mike@linux-pc:~$
```



Never change any aspect of the root user account.



The user's personal information details are typically more extensive than the brief details in this example – they are simplified here for brevity.

A “group” is a set of user accounts whose rights can be modified simultaneously by the superuser. For example, a group may be granted permission to access a previously inaccessible file – all users who are members of that group are then allowed access.

Any user can discover which groups they belong to with the **groups** command and can specify a username as its argument to reveal the group membership of one particular user. The superuser can employ the **groupadd** command to specify the name of a new group, or **groupmod -n** to change the name of an existing group, or **groupdel** to delete a specified group. The superuser can also add a user to an existing group with the **usermod -G** command – stating the group name and username as its arguments:

Enter the command **groups toni** to discover that this user is only a member of a group named “tony” – added when the user account was created. Enter the command **sudo groupmod -n tony tony** to change the group name to match the modified user name. Enter **sudo groupadd fund** to create a new group named “fund”, then enter **sudo usermod -G fund toni** to make the user a member of the new group. Issue the command **groups toni** once more to see all groups of which this user is now a member.

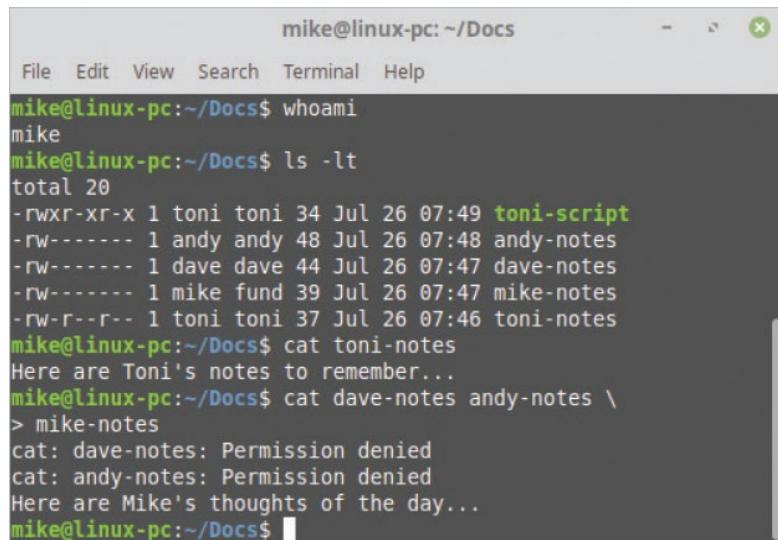
```
mike@linux-pc:~$ groups toni  
toni : tony  
mike@linux-pc:~$ sudo groupmod -n toni tony  
mike@linux-pc:~$ sudo groupadd fund  
mike@linux-pc:~$ sudo usermod -G fund toni  
mike@linux-pc:~$ groups toni  
toni : toni fund  
mike@linux-pc:~$
```



Group information is typically stored in a file at **etcgroup** that lists all group names, together with a comma-separated list of users belonging to each group.

# Setting Access Permissions

The **ls -l** long listing command reveals the access permissions of each item in the current directory as a string of 10 characters at the start of each line. The first is a **d** for a directory, or a dash for a file, followed by sequential Read (**r**), Write (**w**) and Execute (**x**) permissions for the owning User, Group, and Others. In the listing below, a script may be Read and Executed by everyone and the owner may also Write to it. The owner can both Read and Write a text note but others may only Read it. Three other text files may be Read or Written to only by their respective owners.



mike@linux-pc: ~/Docs  
File Edit View Search Terminal Help  
mike@linux-pc:~/Docs\$ whoami  
mike  
mike@linux-pc:~/Docs\$ ls -lt  
total 20  
-rwxr-xr-x 1 toni toni 34 Jul 26 07:49 toni-script  
-rw----- 1 andy andy 48 Jul 26 07:48 andy-notes  
-rw----- 1 dave dave 44 Jul 26 07:47 dave-notes  
-rw----- 1 mike fund 39 Jul 26 07:47 mike-notes  
-rw-r--r-- 1 toni toni 37 Jul 26 07:46 toni-notes  
mike@linux-pc:~/Docs\$ cat toni-notes  
Here are Toni's notes to remember...  
mike@linux-pc:~/Docs\$ cat dave-notes andy-notes \  
> mike-notes  
cat: dave-notes: Permission denied  
cat: andy-notes: Permission denied  
Here are Mike's thoughts of the day...  
mike@linux-pc:~/Docs\$

Each set of permissions can also be described numerically where Read = 4, Write = 2, and Execute = 1. For instance, a value of 7 describes full permissions to Read, Write and Execute ( $4 + 2 + 1$ ), 6 describes permissions to Read, Write ( $4 + 2$ ), and so on.

Permissions can be changed at a shell prompt with the **chmod** command, stating the permission values and the file name as its arguments. For example, the command **chmod 777 myfile** sets full permissions for a file named “myfile”. You must first assume root superuser status with the **sudo** command if you are not the owner. The **chgrp** command can be used to change the group membership of a file by stating a group name and the file name as its arguments. Similarly, the **chown** command can specify a username and the file name to change the user ownership.



Notice that this user is a member of the group named “fund” that was created here.



See here for more on access permissions.

- 1 Enter **chmod 644 mike-notes** to allow everyone to read this owned file, then enter **sudo chown mike andy-notes** to change ownership of that file – so this user can **2** read it Next, enter **sudo usermod -G fund dave**, to make the user “dave” a member of the group named “fund”, then enter **sudo chgrp fund dave-notes** to change the file’s **3** group Now, enter **sudo chmod 640 dave-notes**, to allow all members of the group to read this file, then **reboot** the system to apply the group permission changes

```
mike@linux-pc: ~/Docs
File Edit View Search Terminal Help
mike@linux-pc:~/Docs$ whoami
mike
mike@linux-pc:~/Docs$ chmod 644 mike-notes
mike@linux-pc:~/Docs$ sudo chown mike andy-notes
mike@linux-pc:~/Docs$ sudo usermod -G fund dave
mike@linux-pc:~/Docs$ sudo chgrp fund dave-notes
mike@linux-pc:~/Docs$ sudo chmod 640 dave-notes
mike@linux-pc:~/Docs$ reboot
```

- 4 When the system has restarted, issue an **ls -l** command to see the changes, then read the files where access was previously denied

```
mike@linux-pc: ~/Docs
File Edit View Search Terminal Help
mike@linux-pc:~/Docs$ ls -l
total 20
-rw----- 1 mike andy 48 Jul 26 07:48 andy-notes
-rw-r----- 1 dave fund 44 Jul 26 07:47 dave-notes
-rw-r--r-- 1 mike fund 39 Jul 26 07:47 mike-notes
-rw-r--r-- 1 toni toni 37 Jul 26 07:46 toni-notes
-rwxr-xr-x 1 toni toni 34 Jul 26 07:49 toni-script
mike@linux-pc:~/Docs$ cat dave-notes andy-notes
Here are some pearls of wisdom from Dave...
Here are acts of software derision from Andy...
mike@linux-pc:~/Docs$
```



Do not fall into the habit of setting everything to permissions of 777 – use access permissions thoughtfully to maintain useful restrictions.

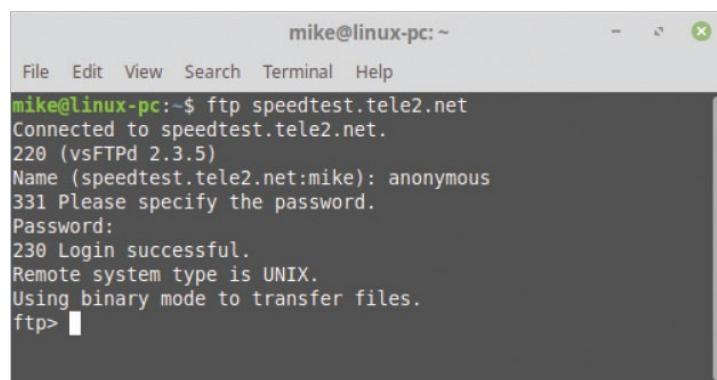


Group access permissions are typically established when the system starts up, so changes to them require a system restart.

# Controlling Processes

A Linux system has many processes running at any given time representing open apps, shell jobs, and background services. Each process has a unique PID (Process IDentity) number. You can see a list of every current process with the `ps -e` command, or those for a particular user, with `ps -u` followed by the username. The process owner can terminate a process by stating its PID number as the argument to a `kill` command:

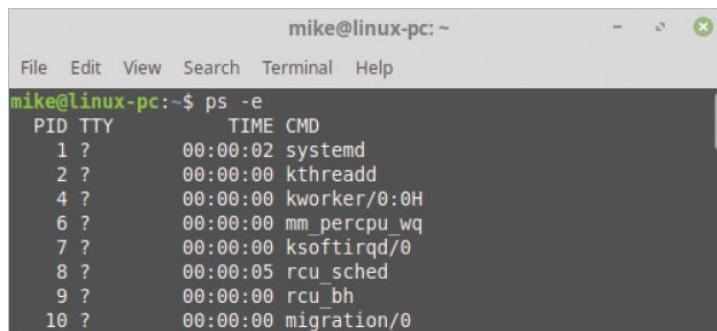
Open a **Terminal** window, then enter a command to begin a new process – for example, to start the `ftp` internet file transfer program



```
mike@linux-pc:~$ ftp speedtest.tele2.net
Connected to speedtest.tele2.net.
220 (vsFTPd 2.3.5)
Name (speedtest.tele2.net:mike): anonymous
331 Please specify the password.
Password:
230 Login successful.
Remote system type is UNIX.
Using binary mode to transfer files.
ftp> 
```

2

Next, open a second **Terminal** window, then enter the command `ps -e` to see a long list of all processes



```
mike@linux-pc:~$ ps -e
  PID TTY      TIME CMD
    1 ?        00:00:02 systemd
    2 ?        00:00:00 kthreadd
    4 ?        00:00:00 kworker/0:0H
    6 ?        00:00:00 mm_percpu_wq
    7 ?        00:00:00 ksoftirqd/0
    8 ?        00:00:05 rcu_sched
    9 ?        00:00:00 rcu_bh
   10 ?        00:00:00 migration/0
```

3

Scroll down the list to find the Terminal windows listed as “pseudo terminals” named as `pts/0` and `pts/1`



Enter the command **man ftp** to discover more about the **ftp** file transfer program.



Each PID is dynamically allocated by the operating system when a process is launched, to identify that particular process instance.

- 4 Now, enter the command **ps -e | grep pts** to refine the list to just the processes running in each Terminal window. See that the first number against each listed process is its PID number – the **ftp** program is PID 2627 in this case

```
mike@linux-pc:~$ ps -e | grep pts
2619 pts/0    00:00:00 bash
2627 pts/0    00:00:00 ftp
2826 pts/1    00:00:00 bash
3163 pts/1    00:00:00 ps
3164 pts/1    00:00:00 grep
mike@linux-pc:~$
```

- 6 Enter the command **kill 2627** to terminate the **ftp** program process in the

first window

```
mike@linux-pc:~$ ftp speedtest.tele2.net
Connected to speedtest.tele2.net.
220 (vsFTPd 2.3.5)
Name (speedtest.tele2.net:mike): anonymous
331 Please specify the password.
Password:
230 Login successful.
Remote system type is UNIX.
Using binary mode to transfer files.
ftp> Terminated
mike@linux-pc:~$
```

7

- Enter the command **ps -e | grep pts** once more to see the process is no longer in the list



```
mike@linux-pc:~  
File Edit View Search Terminal Help  
mike@linux-pc:~$ kill 2627  
mike@linux-pc:~$ ps -e | grep pts  
2619 pts/0 00:00:00 bash  
2826 pts/1 00:00:00 bash  
3205 pts/1 00:00:00 ps  
3206 pts/1 00:00:00 grep  
mike@linux-pc:~$
```

Highlighted here are the **ftp** program process PID and the message in the first window after you issue a **kill** command.



At a prompt you can enter the **top** command to view the most active processes – press the **Q** key to quit.

# Exploring the Network

In much the same way that each house on a street has a unique address, to which mail can be addressed for direct communication, every computer on a network has a unique number, known as its IP (Internet Protocol) address, which can be used to directly communicate with a particular computer.



Wi-Fi Network You can discover the IP address of the computer behind a web address by stating the URL as the argument to the `host` command. In some cases, for large-scale websites, this may reveal multiple IP addresses:

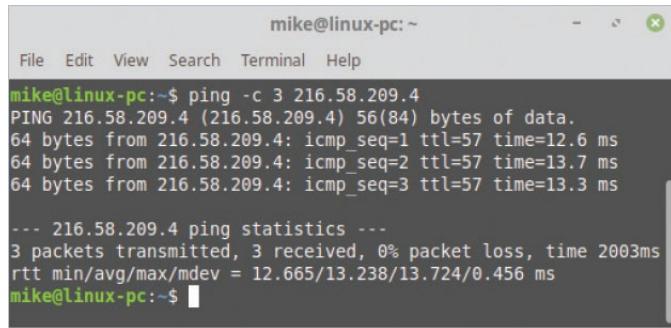
At a shell prompt, enter `host www.google.com` to discover the IP address for that URL

A screenshot of a terminal window titled "mike@linux-pc: ~". The window has a standard Linux-style title bar with icons for minimize, maximize, and close. Below the title bar is a menu bar with "File", "Edit", "View", "Search", "Terminal", and "Help". The main area of the terminal shows the command "host www.google.com" being run and its output. The output indicates that "www.google.com has address 216.58.209.4" and "www.google.com has IPv6 address 2a00:1450:4017:803::2004". The prompt "mike@linux-pc:~\$" is visible at the bottom of the terminal window.

```
mike@linux-pc:~$ host www.google.com
www.google.com has address 216.58.209.4
www.google.com has IPv6 address 2a00:1450:4017:803::2004
mike@linux-pc:~$
```

The most basic test to see if another computer is reachable across the network sends tiny data packets to its IP address using the `ping` command. This continues sending test packets until you stop it, but you may limit the number of packets by adding a `-c` option stating the total number of packets to send:

Enter the command `ping -c 3 216.58.209.4` to send three packets to this IP address – to see if it is reachable



```
mike@linux-pc:~$ ping -c 3 216.58.209.4
PING 216.58.209.4 (216.58.209.4) 56(84) bytes of data.
64 bytes from 216.58.209.4: icmp_seq=1 ttl=57 time=12.6 ms
64 bytes from 216.58.209.4: icmp_seq=2 ttl=57 time=13.7 ms
64 bytes from 216.58.209.4: icmp_seq=3 ttl=57 time=13.3 ms

--- 216.58.209.4 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 12.665/13.238/13.724/0.456 ms
mike@linux-pc:~$
```



Add a **-a** option to a **host** command to see all information about that host.



The IP address used here is one of those for the Google URL – revealed by the **host** command in Step 1.

In Linux you can discover the IP address of your own computer by issuing the **ifconfig** command to display the network interface configuration. If you know the connection device name, you can specify that as the argument to the **ifconfig** command to see an individual report. If your computer has multiple network connection devices, each one will be listed separately:

Issue a plain **ifconfig** command to discover the network IP address of your computer

```
mike@linux-pc:~$ ifconfig
enp3s0f2: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
          ether 78:24:af:6d:3b:bd  txqueuelen 1000  (Ethernet)
          RX packets 0  bytes 0 (0.0 B)
          RX errors 0  dropped 0  overruns 0  frame 0
          TX packets 0  bytes 0 (0.0 B)
          TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
      inet 127.0.0.1  netmask 255.0.0.0
      inet6 ::1  prefixlen 128  scopeid 0x10<host>
          loop  txqueuelen 1000  (Local Loopback)
          RX packets 3192  bytes 296885 (296.8 KB)
          RX errors 0  dropped 0  overruns 0  frame 0
          TX packets 3192  bytes 296885 (296.8 KB)
          TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

wlp2s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
      inet 192.168.0.166  netmask 255.255.255.0  broadcast 192.168.0.255
      inet6 fe80::4426:1ac0:500:43bb  prefixlen 64  scopeid 0x20<link>
          ether 54:27:1e:e9:ba:fb  txqueuelen 1000  (Ethernet)
          RX packets 26896  bytes 21006543 (21.0 MB)
          RX errors 0  dropped 0  overruns 0  frame 0
          TX packets 22548  bytes 4498695 (4.4 MB)
          TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

mike@linux-pc:~$
```

The computer in this example has a network connection through a wireless router, with an IP address of **192.168.0.166**, via a device named **wlp2s0**.

Traditionally the devices were named “eth0”, “eth1”, *etc.* for Ethernet devices and “wlan0”, “wlan1”, *etc.* for wireless devices, but a new naming scheme was introduced to overcome identification problems where multiple network interfaces are available on modern networks. The new naming scheme identifies the devices more specifically, to avoid confusion. With the connection above, the devices identified are Ethernet (**enp3s0f2**), localhost (**lo**), and wireless LAN (**wlp2s0**).



The “lo” loopback interface is useful for testing network applications locally before live deployment.



The **ifconfig** command only displays the status of active interfaces – add a **-a** option to include inactive interfaces.

# Printing from the Shell

The **lpr** command takes a file name or path as its argument to establish a print job to send the specified file to the printer. Each job is placed in a queue awaiting transmission to the printer – when the job reaches the front of the queue, data from the file is sent to the printer and gets printed.



Wi-Fi connected printer You can examine jobs in the print queue with the **lpq** command – each job is automatically assigned a job number. A job can be removed from the queue, before it gets sent to the printer, using the **lprm** command together with its job number:

At a shell prompt, enter **lpr tux.png** to create a print job – to print an image file named “tux.png”

Enter **lpr ballad.txt** to create another print job – to print the specified text file “ballad.txt”

Issue an **lpq** command to see the current print queue

A screenshot of a terminal window titled "mike@linux-pc: ~/Data". The window shows the following command history and output:

```
mike@linux-pc:~/Data$ lpr tux.png
mike@linux-pc:~/Data$ lpr ballad.txt
mike@linux-pc:~/Data$ lpq
Samsung-M2020 is ready and printing
Rank   Owner   Job     File(s)
active  mike    1      tux.png
1st    mike    2      ballad.txt
mike@linux-pc:~/Data$ lprm 2
mike@linux-pc:~/Data$
```

The print queue reveals that the printer is actively printing job number one – the image file.

4

Before print job number one completes, issue the command **lprm 2** (or alternatively, the command **cancel 2**) to remove that job from the print queue

The printer removes that job while continuing to print the image file – the text file in job number two is not sent to the printer, so does not get printed.



A print job can only be removed from the print queue by its owner or the root superuser.

Printing from a shell prompt is not restricted to simply printing files – data can also be queued for printing using the **lpr** command together with the | pipe character:

Enter **ls -l /etc | lpr** to print a list of the **/etc** directory – by piping results of an **ls** command to the **lpr** command. While the list is printing, issue an **lpq** command to see the print queue source is piped from standard input

```
mike@linux-pc: ~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ ls -l /etc | lpr
mike@linux-pc:~/Data$ lpq
Samsung-M2020 is ready and printing
Rank   Owner   Job     File(s)          Total Size
active  mike    3      (stdin)        14336 bytes
mike@linux-pc:~/Data$
```

The ability to print in Linux is provided by the CUPS (Common Unix Printing System) facility. This provides a print spooler, which buffers data in a format the printer will understand, and a scheduler, which sends the buffered data to the printer when it is ready to be received.

The **lpstat** command has individual options to provide CUPS status information about the scheduler, spooler, and printer/s:

Issue the command **lpstat -t** option to see printer status

```
mike@linux-pc: ~/Data
File Edit View Search Terminal Help
mike@linux-pc:~/Data$ lpstat -t
scheduler is running
system default destination: Samsung-M2020
Samsung-M2020 accepting requests since Thu 26 Jul
printer Samsung-M2020 now printing
Samsung-M2020-3      mike          14336
mike@linux-pc:~/Data$
```



Where more than one printer is available, use **lpr -P** to nominate the printer to print the job.

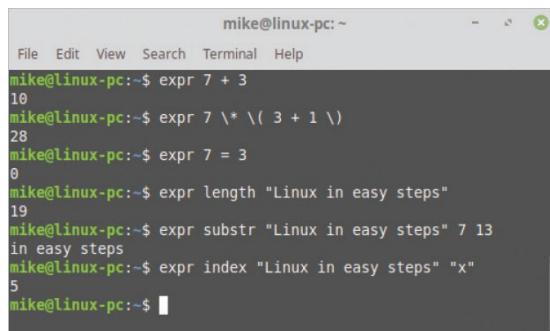
# Evaluating Expressions

The **expr** command enables you to perform simple math calculations at the shell prompt. It recognizes all the usual arithmetic operators, but those that have other meanings in the shell need to be prefixed by a backslash \ escape character. For instance, the \* wildcard must be escaped for multiplication.

Each argument must be separated by whitespace, and parentheses can be used to establish operator precedence in longer expressions – but each parenthesis character must be escaped.

The **expr** command can also perform Boolean evaluations that return either true (1) or false (0) answers, and perform simple string manipulation with functions **length**, **substr**, and **index**.

- 1 At a shell prompt, enter **expr 7 + 3** to perform addition, and **expr 7 \\* 3** to perform multiplication Enter **expr 7 \\* \(\ 3 + 1 \)** to evaluate a complex expression, and **expr 7 = 3** to make a Boolean equality evaluation Issue the command **expr length "Linux in easy steps"** to discover the length of the specified string Issue the command **expr substr "Linux in easy steps" 7 13** to extract a substring of the specified length Issue the command **expr index "Linux in easy steps" "x"** to discover the position of the first "x" in the string



mike@linux-pc:~

```
mike@linux-pc:~$ expr 7 + 3
10
mike@linux-pc:~$ expr 7 \* \(\ 3 + 1 \)
28
mike@linux-pc:~$ expr 7 = 3
0
mike@linux-pc:~$ expr length "Linux in easy steps"
19
mike@linux-pc:~$ expr substr "Linux in easy steps" 7 13
in easy steps
mike@linux-pc:~$ expr index "Linux in easy steps" "x"
5
mike@linux-pc:~$
```



The arithmetic operators are + add, - subtract, \* multiply, / divide, and % modulo.



You can quickly launch a graphical calculator from a Terminal window using the **xcalc** command.

The result of an expression evaluation can be made to cause a particular action using an **if-then-else** statement. This has three separate parts that specify a test expression, the action to perform when the test is true, and the action to perform when it is false.

The **if** keyword begins the statement and is followed by the test expression enclosed within a pair of [ ] square brackets. Each part of the entire statement must be separated from the next by whitespace, to enable the shell to evaluate the expression.

The **then** keyword begins the second part of the statement, specifying the commands to execute when the test is true. Similarly, the **else** keyword begins the third part of the statement, specifying the commands to execute when the test is false. Finally, the **fi** keyword must be added to mark the end of the statement.

You may type the first part of the statement then hit Return to be prompted to enter the rest of the statement, or type the entire statement separating each part with a semicolon:

Type **if [ `expr 7 % 2` = 0 ]** to test if the remainder of dividing seven by two is zero, then hit **7** At the statement prompt, enter **then echo “Even Number”**

Now, enter **else echo “Odd Number”**

Type **fi** then hit Return to perform the appropriate **10** Make a similar test in a continuous statement by typing **if [ `expr 8 % 2` = 0 ]; then echo Even; else echo Odd; fi**, then hit Return to perform the appropriate action

```
mike@linux-pc:~$ if [ `expr 7 % 2` = 0 ]
> then echo "Even Number"
> else echo "Odd Number"
> fi
Odd Number
mike@linux-pc:~$ if [ `expr 8 % 2` = 0 ]; then echo Even; else echo Odd; fi
Even
mike@linux-pc:~$
```



You must leave a space after the **if** keyword to avoid an error. Also leave a space after the [ bracket and before the ] bracket to avoid an error.



The backtick ` operators enclose **expr 7 % 2** so that operation gets performed before the test expression is evaluated – in this case, the remainder of 1 is substituted, making the expression **if [ 1 = 0 ]**.

## Scripting the Shell

Lengthy shell routines, like those [here](#), can be conveniently saved as a shell script for execution when required. Shell scripts are simply plain text files that begin their first line with `#!/bin/bash`, specifying the location of the bash program, and are typically given a `.sh` file extension.

Once a shell script file has its access permission set to “executable” it can be executed at any time by prefixing its name or path with the `./` dot-slash characters at a shell prompt.

A script might, perhaps, employ the `$RANDOM` shell variable that generates an integer from zero to 32,767 each time it is called. These are not truly random, however, as the same sequence is generated given the same starting point (seed) – in order to ensure different sequences, it is necessary to set it with different seeds.

One solution is to extract a dynamic value from the current time using the `date +%s` command to deliver the current number of seconds that have elapsed since **00:00:00 GMT January 1, 1970**. Using this to seed the `$RANDOM` variable gets better random number generation.

Arithmetic can be performed on shell variables, such as `$RANDOM`, by including the `let` command in a script:

Open any plain text editor and begin a new file with the line `#!/bin/bash` On a new line, type a line to seed the `$RANDOM` variable `RANDOM=`date +%s``

Add a line to assign a value 1-20 to a variable `let NUM=( $RANDOM % 21 )` On the next line, type an instruction to clear the window `clear` Add these lines to output text for the user `echo "I have chosen a number between 1 and 20"` `echo "Can you guess what it is?"`



Enter `RANDOM=1` then `echo $RANDOM` three times to see the pattern.

Repeat both commands to see the pattern repeat.



You must not introduce whitespace around the = character in the assignments.

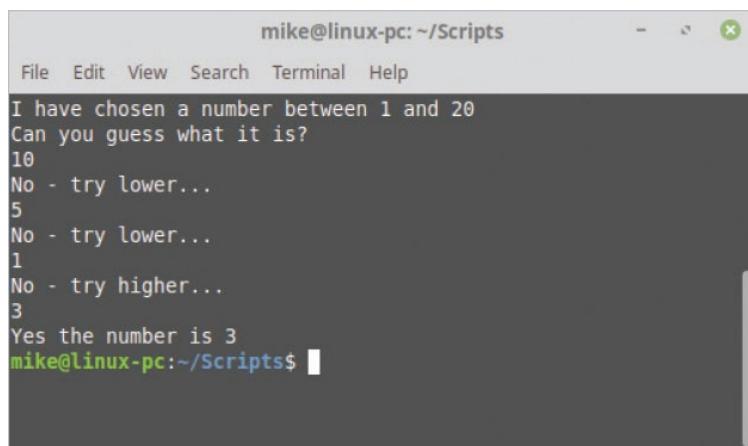
- 6 Now, add a line to read the user's guess into a variable `read GUESS`
- 7 Type the following lines exactly to evaluate whether the user's guess matches the generated number and output an appropriate response for each incorrect attempt `while [ $GUESS -ne $NUM ]`

**do**

```
if [ $GUESS -gt $NUM ]
    then echo "No - try lower... "
    else echo "No - try higher... "
fi read GUESS
```

# done

- 8 Add a line to confirm a correct guess `echo "Yes the number is $NUM"`
- 9 Save the script as `guess.sh` in the current directory At a shell prompt, change the access permissions to make the script executable by its owner with this command `chmod 711 guess.sh` Enter `./guess.sh` to execute the script, then guess the number randomly selected by the script



mike@linux-pc: ~/Scripts

```
File Edit View Search Terminal Help
I have chosen a number between 1 and 20
Can you guess what it is?
10
No - try lower...
5
No - try lower...
1
No - try higher...
3
Yes the number is 3
mike@linux-pc:~/Scripts$
```



The **while-do** statement is a loop that employs the **-ne** (not equal) comparison operator and a **-gt** (greater than) comparison operator. Other Bash shell comparison operators include **-eq** (equal) and **-lt** (less than).

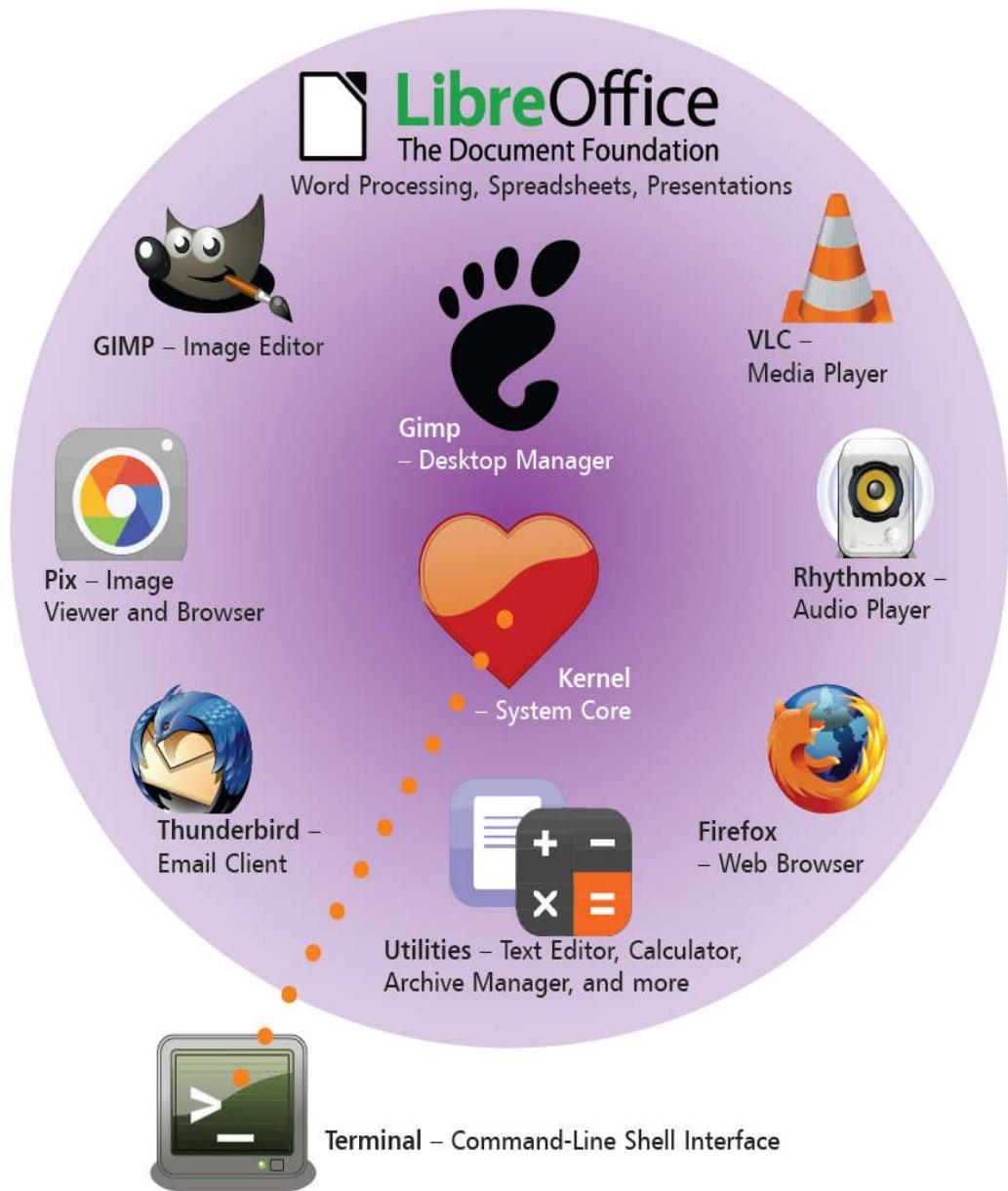


Remember that the square bracket characters are operators – there must be space around them to avoid errors.

# Summary

- The **sudo** command executes commands at a shell prompt as if a regular user is the root superuser.
- The Advanced Packaging Tool (APT) list of packages can be updated with **apt-get update**, packages installed with **apt-get install**, and removed with **apt-get remove**.
- Files can be compressed with **gzip**, **bzip2**, or **zip**, and uncompressed with their companions **gunzip**, **bunzip2**, **unzip**.
- File systems can be attached to the tree with **mount**, detached with **umount**, and checked with the **fsck** command.
- User accounts can be created and edited by the root superuser with the commands **useradd**, **userdel** and **usermod**.
- Login passwords can be changed with the **passwd** command, and personal details can be edited with the **chfn** command.
- The **groups** accounts can be created and edited by the superuser with **groupadd**, **groupdel** and **groupmod**.
- Access permissions can be modified using the **chmod** command, and ownership changed using **chown** and **chgrp**.
- Each process has a unique Process ID (PID), revealed by the **ps** command, and may be terminated by a **kill** command.
- The IP address of a URL can be discovered with the **host** command, and that of your own computer with **ifconfig**.
- Print jobs can be created with **lpr**, removed with **lprm**, listed with **lpq**, and status displayed with the **lpstat** command.
- Expressions can be evaluated with the **expr** command, and strings manipulated with **length**, **substr**, and **index** functions.
- Bash shell scripts begin with **#!/bin/bash** and are executed at a prompt by prefixing the file name by **./** dot-slash characters.

# Linux Essential Components



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