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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 what-so-ever to do with it.

Linus Torvalds, creator of the Linux kernel

1

Getting Started

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

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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:

- Linux is released under the GNU Public License that ensures it can remain free to all users. 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 seldom needs a reboot.
- 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 **L**inux, **A**pache, **M**ySQL, **P**HP, which combines operating system, web server, database, and server-side scripting.

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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.

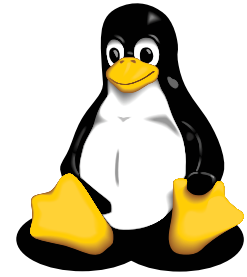
By 1991, the GNU Project had created a lot of software tools including the GNU C Compiler written by Stallman himself. At that time many of these tools were incorporated into a Unix-compatible operating system by a 21-year old student at the University of Helsinki. His name was Linus Torvalds and he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

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.

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!



This penguin is "Tux" – the happy Linux mascot.



The term "GNU" is a recursive acronym for **GNU's Not Unix**. Discover more about the GNU General Public License online at gnu.org/licenses/gpl.html



Discover more about the Gnome graphical desktop online at 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:

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 “IoT” for cloud-based ecosystems.

Pros: Widely used, excellent community support, innovative.

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

Free download from getfedora.org



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.



“Choose Freedom.
Choose Fedora.”

...cont'd

openSUSE

The community-based “openSUSE” distro 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 by far. The fixed release “Leap” distro is the base for the openSUSE award-winning SUSE Linux Enterprise (SLE) products, and the rolling release “Tumbleweed” distro provides the very latest stable versions of all software.

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

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

Free download from **opensuse.org**

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, “IoT” for Internet of Things devices, and “Cloud” for cloud computing. 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**

Linux Mint

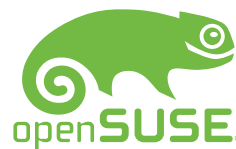
A modern, elegant operating system that is easy to use. It is based on the Ubuntu operating system and works straight out of the box, with full multimedia support. All Linux Mint distros are LTS releases that appear shortly after each Ubuntu LTS release, and are supported for five years. Users are encouraged 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 than Mint.

Free download from **linuxmint.com**



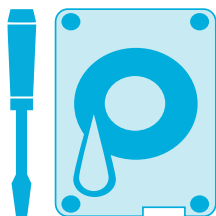
“The makers’ choice for sysadmins, developers and desktop users.”



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



“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 **H**ard **D**isk **D**rive (HDD or simply “hard drive”) can be partitioned into one or more regions so that the operating system can manage each region separately.



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.

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:

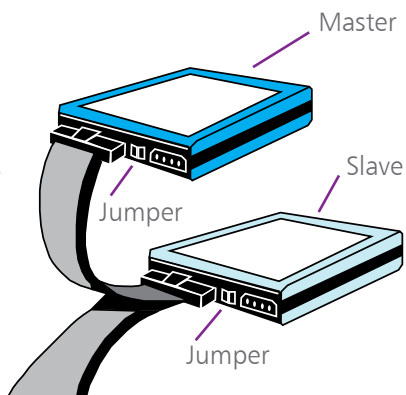
- The free space on the Windows drive is not reduced.
- It removes the risk of data loss through partition resizing.
- The familiar Windows operating system is retained.
- It distinctly separates the two operating systems.
- Drive failure would only disrupt one operating system.

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Adding a Second Hard Drive

Older IDE (Integrated Drive Electronics) hard drives need to be configured as a master/slave relationship by setting “jumpers” on the hard drive. The drives can then be connected in tandem by a single ribbon cable.

Most modern PCs now have SATA hard drives that do not need a master/slave configuration. Providing you have a Windows drive installed, your PC will automatically recognize an additional drive as secondary:



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.

- 1 Turn off your PC, open up the case and find the existing hard drive – located in a cage
- 2 Install an additional SATA drive in the cage, then follow the cable of the first drive to identify where it plugs into the motherboard – usually a connector marked “SATA”
- 3 Plug your new drive’s SATA cable into an adjacent SATA connector on the motherboard, and plug the other end into the new SATA drive itself
- 4 Attach a power cable from the PC’s power unit to the SATA drive, then close the case and turn on your PC
- 5 Right-click the Start button and choose **Disk Management** to see an “Initialize Disk” dialog appear
- 6 Click **OK** to initialize the new hard drive, then back in Disk Management, right-click on the new drive and choose **New Simple Volume** from the context menu
- 7 Repeatedly click **Next** in the “New Simple Volume Wizard” to format the drive and allocate it a drive letter



SATA (Serial Advanced Technology Attachment) is the standard for connecting devices to the PC’s motherboard.



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



linuxmint.iso

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:

- **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:

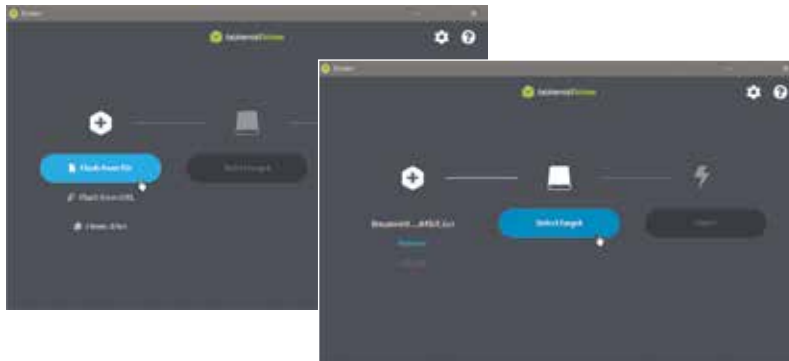
- 1 Launch a web browser, then navigate to the download page linuxmint.com/download.php
- 2 Next, click on the **Cinnamon** link



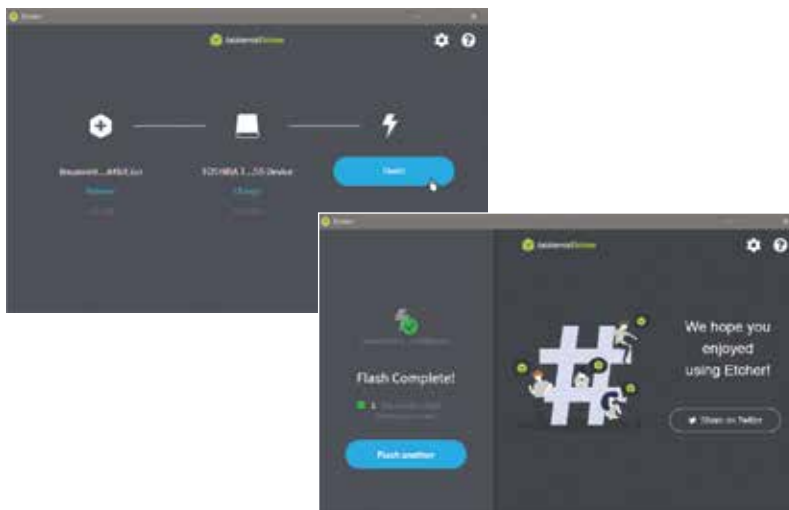
- 3 Now, click a **Download mirror** link for your country from the list that appears
- 4 Choose to save the ISO image file in a preferred location on your system to begin the download
- 5 When the download completes, you now need an app to burn the image onto the USB flash drive. Linux Mint recommends the **Etcher** app. Navigate your web browser to balena.io/etcher and download the installer for your system, such as “Download for Windows (x86/x64)”

...cont'd

- 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 **Flash from file** button, then select the ISO image file you downloaded



- 9 Click the **Select target** 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



The UEFI (**U**nified **E**xtensible **F**irmware **I**nterface) in modern PCs replaces the BIOS (**B**asic **I**nput/**O**utput **S**ystem) firmware interface in earlier PCs. These control how your PC boots up.



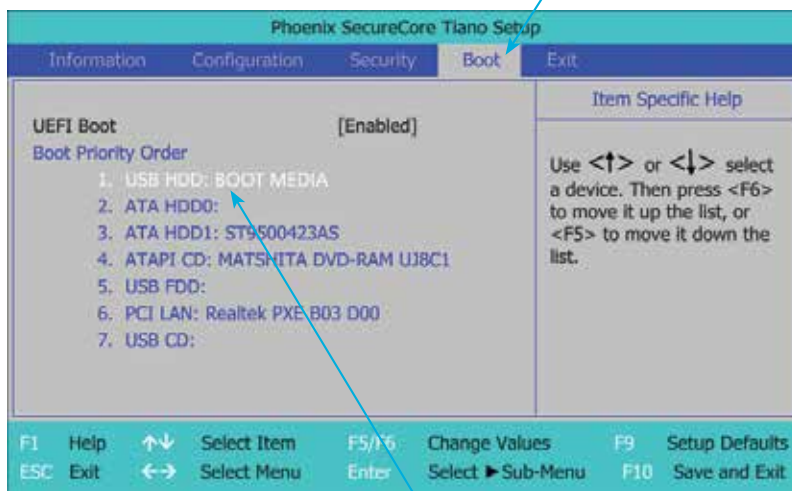
The Setup utility is unique to your PC, so its appearance will probably differ from the one shown here. Most PCs will, however, provide a way to change the Boot Priority Order so you can boot the PC from the USB flash drive.

Starting a Live Session

Having created the boot media by following the steps on pages 14-15, 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.

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:

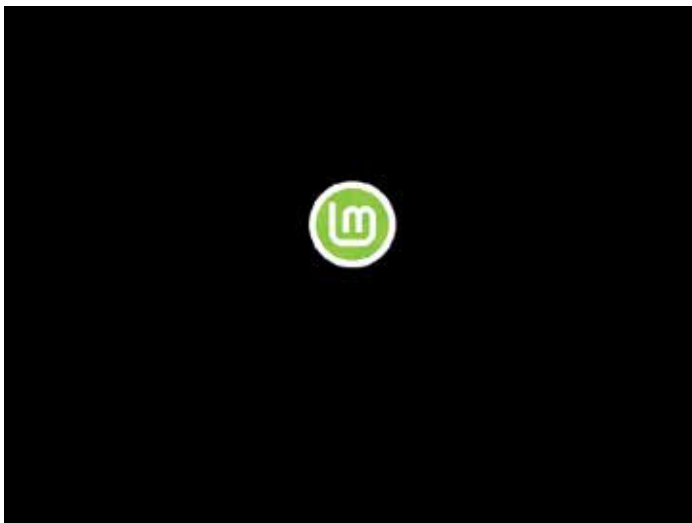
- 1 Consult your PC’s documentation to discover how to access its **Setup** utility. This often requires you to press the F2 key while starting the PC – but it does vary
- 2 Connect the USB flash drive boot media to your PC
- 3 Start up your PC and enter the Setup utility
- 4 Select the section relating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

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- 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

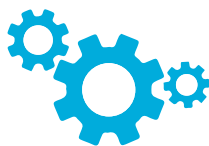


When there is an option to choose between UEFI boot mode and legacy BIOS mode, UEFI offers several advantages – UEFI supports large hard drive partitions, has secure booting, and provides efficient system management.

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.



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



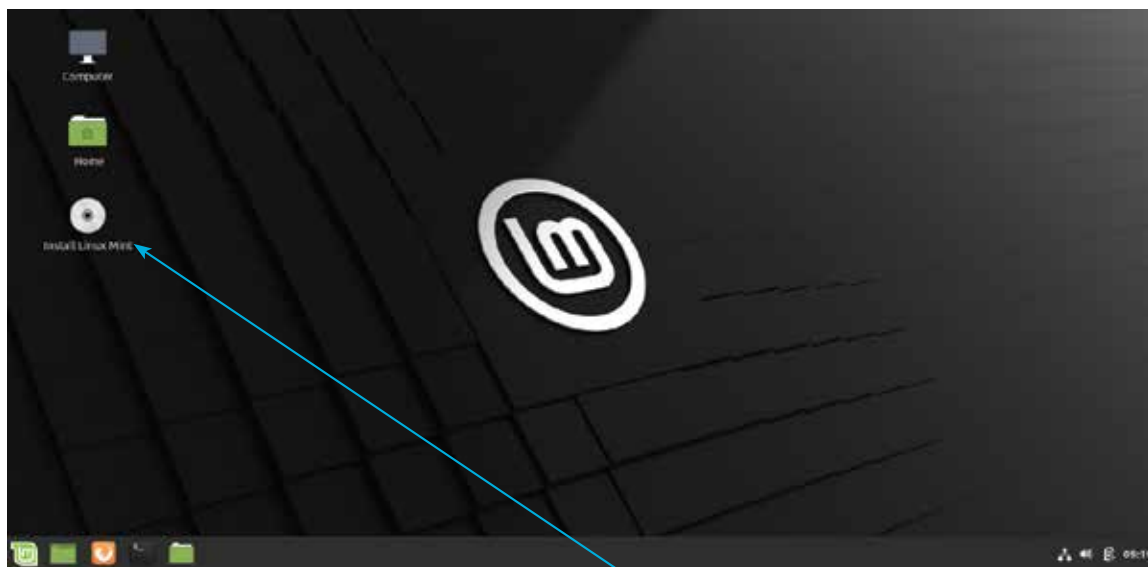
Beginning Installation

Having started a Live Session by following the steps on pages 16–17, 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 user name in a Live Session is “mint”. If asked for a password you can simply hit the Enter key to proceed.

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



1

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

...cont'd

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



This book features Linux Mint version 20 (Ulyssa) Cinnamon throughout. This version has Long Term Support until 2025.

- 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 Choose your wireless connection when asked, then check the box to install codecs and click the **Continue** button



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



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. Although the operating system occupies around 15GB, this partition should ideally be 100GB+.



Attempting to create a dual-boot setup can be problematic on some PCs – erase the entire disk and install Linux Mint.

Completing Installation

5 On the “Installation type” screen...

If you want only the Linux operating system on your PC (recommended), 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 retain Windows, the installer will resize the Windows operating system and install Linux in the free space created. A boot menu should appear so you can choose between operating systems whenever you start your PC – a “dual-boot” setup.

6 After choosing the installation type in either case, adjust the space suggested for each operating system if desired, then click the **Install Now** button to proceed

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7

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.

8

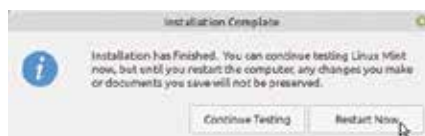
On the “Who are you?” screen, enter your details then click the **Continue** button to install system files



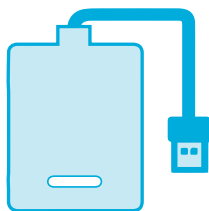
If you are the only user of the PC you can select the option to **Log in automatically** so you will not be asked for your password whenever you start Linux Mint. You may also select the **Encrypt my home folder** option if you are concerned about security.

9

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



For help with installation refer to the online Linux Mint forums at forums.linuxmint.com



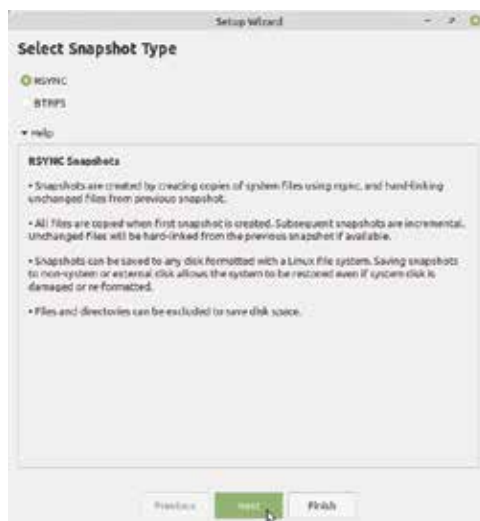
Enabling Backups

Having completed the installation process by following the steps on pages 18–21, 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:

- 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



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

...cont'd

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 for backups)



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.

5

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



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.

6

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



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 file system 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.