

Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Information Engineering



Bachelor Thesis

Comparison of Linux Distributions

Motlatsi Ernest Dube

© 2021 CULS Prague

Declaration

I declare that I have worked on my bachelor thesis titled "Comparison of Linux Distributions" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 15/03/2021

Acknowledgement

I would like to thank doc. Ing Arnošt Veselý for the advice and support during my work on this thesis.

Comparison of Linux Distributions

Summary

The main characteristics of Linux distributions will be described. Mainly their support of different kinds of file systems, the way of their installation and administration, provided graphical interfaces, hardware compatibility, universality of its use, security etc.

At the end comparison of the four Linux distributions mainly Fedora, Ubuntu, Debian and SUSE will be discussed in terms of their characteristics and support for Multimedia, that is working with videos and graphics. Further more comparison will be made based on their support for Scientific calculations, support for games, and database system.

Keywords: Linux Distributions

Contents

1	Introduction.....	1
2	Objectives and Methodology.....	2
2.1	Objectives.....	2
2.2	Methodology.....	2
3	Desktop Enviroments	2
3.1	GNOME	3
3.1.1	System minimum requirements	5
3.2	KDE	5
3.2.1	System minimum requirements	8
4	Linux File System	8
4.1	Brief Description of what journaling is.....	9
4.2	Table of file systems	9
4.3	Editing Files.....	10
4.4	Fragmentation.....	10
4.5	File system Structure.....	10
5	Installation	11
5.1	Ubuntu Installation.....	12
5.1.1	System minimum requirements	13
5.2	Fedora Installation	13
5.2.1	System minimum requirements	15
5.3	Suse Installation.....	15
5.3.1	System Minimum Requirements	16
5.4	Debian Installation	16
5.4.1	System Minimum requirements.....	20
6	Comparison of Linux distributions	21
6.1	Multimedia.....	22
6.1.1	Ubuntu.....	22
6.1.2	Fedora.....	23
6.1.3	Debian.....	23
6.1.4	SUSE.....	23
6.2	Scientific Calculation.....	24
6.2.1	Fedora Scientific.....	24
6.2.2	Debian.....	24
6.2.3	SUSE.....	24
6.2.4	Ubuntu.....	25
6.3	Gaming.....	25

6.3.1	Kubuntu.....	25
6.3.2	Fedora Game Spin.....	26
6.3.3	Debian.....	26
6.3.4	SUSE.....	26
6.4	Support for servers.....	26
6.4.1	Ubuntu.....	27
6.4.2	SUSE.....	27
6.4.3	Debian.....	27
6.4.4	Fedora.....	27
7	Conclussion.....	27
8	References.....	28

List of pictures

GNOME sample diagram 1
GNOME sample diagram 2
KDE sample diagram 1
KDE sample diagram 2
Create Bootable USB diagram
Fedora Installation diagram
Install the live image to your hard drive diagram
Suse Installation diagram
Debian Installer diagram
Ubuntu Studio
Fedora game spin
Fedora Scientific

List of tables

2.1.2 System Minimum Requirements
2.2.3 System Minimum Requirements
3.2 Table of file systems

1 Introduction

Linux distribution which is often abbreviated as distro is nothing other than an operating system (OS) made from a software collection normally referred to as package. This package is based on Linux Kernel.

Users of Linux can obtain their operating system by downloading one of the Linux distribution which are available for a wide variety of systems ranging from embedded systems and personal computers (for example Linux Ubuntu) to powerful supercomputers (for example (Rocks cluster distribution)

Linux distribution is build of Kernel which I would write bit about it in this thesis. It also comprises of GNU tool and libraries, documentation, window system of which the most common is x window system, windows manager and a desktop environment.

Most of the software included are what we normally refer to as free and open source which are made available in binaries or in source code . By that we generally refer to a program in which the source code is available to the general public for use and or modification from its original design free of charge. Open source code is typically created a collaborative effort in which programmers improve upon the code and share the changes within the community.

Almost six hundred Linux distributions exist, with close to five hundred out of those in active development. Because of the huge availability of software, distributions have taken a wide variety of forms, including those suitable for use on desktops, servers, laptops, notebooks, mobile phones and tablets, as well as minimal environments typically for use in embedded systems. There are commercially backed distributions, such as Fedora (Red Hat), openSUSE (SUSE) and Ubuntu (Canonical Ltd.), and entirely community-driven distributions, such as Debian, Slackware, Gentoo and Arch Linux. Most distributions come ready to use and pre-compiled for a specific instruction set, while some distributions (such as Gentoo) are distributed mostly in source code form and compiled locally during installation.

Because there are so many Linux distributions out there, I will only focus on four types on this thesis, mainly Ubuntu, Fedora, Suse and Debian. I will write about installation guide lines per each distribution. I will also write about file systems, graphical interface and hardware components per each distribution named above. Last but not least, I will compare the four mentioned Linux distribution in terms of their characteristics and support for Multimedia, that is working with videos and graphics. Furthermore comparison will be made based on their support for scientific calculations, support for games and database system.

2 Objectives and Methodology

2.1 Objectives

The aim of this thesis is to describe the most used Linux distributions and to find out of the four Linux distributions mainly Ubuntu, SUSE, Debian and Fedora the best for Multimedia support, database servers, scientific calculations, and games.

2.2 Methodology

The main characteristics of the Linux distribution will be described, mainly their support of different kinds of file systems, the way of their installation and administration, provided graphical interfaces, hardware compatibility.

Comparison in terms of their characteristics, Support for Multimedia, database servers, games and scientific calculations will be described.

3 Desktop Environments

When it comes to desktop environment for Linux distributions, there are so many choices and this thesis will cover only two most popular namely GNOME and KDE. However it is worth mentioning at least the most popular available out there as well which are Unity, Cinnamon, MATE, Xfce, and LXDE. All of them does offer sophisticated point and click graphical user interface often abbreviated as (GUI). All of them are on the same level with the desktop environments found in Windows and Mac OS X. Surprisingly when you ask which one is best, you will often get multitudes of different answers. So the question of which one is best will always remain and be individualistic.

The best thing about desktop environments is that you can have more than one installed on your computer or machine. Each time you login there will be a possibility of which one you want to use at that time.

Each desktop environment comes with its own set of applications. Should it happen that more than one desktop environment is installed, one will notice a couple of more extras on the menu. What I mean by that is for example, GNOME use Nautilus as its default browser while KDE uses Dolphin. So if you have both on the same machine namely KDE and GNOME you will notice both on the menu no matter what environment you are running at that time.

Apart from that, each desktop environment has its own set of application that one can download and install from the distro's package manager. It is worth mentioning also that it is possible to use set of application from one environment to another however most people choose to use applications tailored specifically for the environment they are using just because they will have tighter integration with the desktop environment. For example, GNOME users prefer to use Pidgin as their IM client, while KDE users tend to use Kopete. That said, certain apps like Firefox, Chrome, and the GIMP come to mind are designed with the GTK toolkit (upon which GNOME and XFCE are based), but are often used across other desktop environments, simply because they're the best at what they do. In the end, it's individual that is why Linux will always be on top because of multitude personalization options it offers.

3.1 GNOME

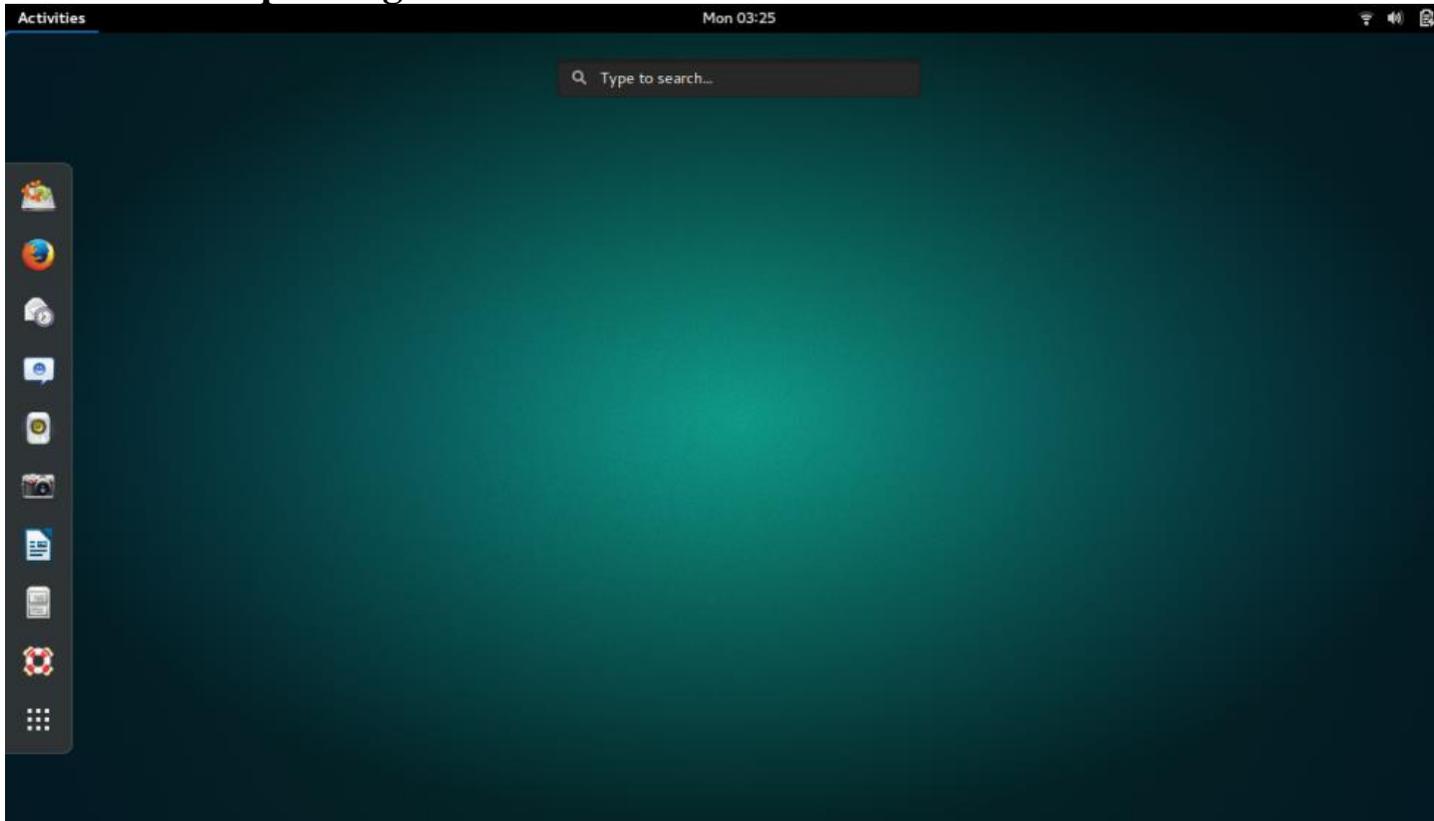
GNOME is desktop environment that is composed entirely of free and open source software and it was originally an acronym for GNU Network Object Model Environment

It is the most popular Linux desktop environment out there and it is most likely the preferred one or the familiar one on Ubuntu users. It does not consume large chunk or portion of system resources. One can say it is very low on system resources and **very** simple to use hence great news for new Linux users especially those who not sound technically, not outstanding technically so to say.

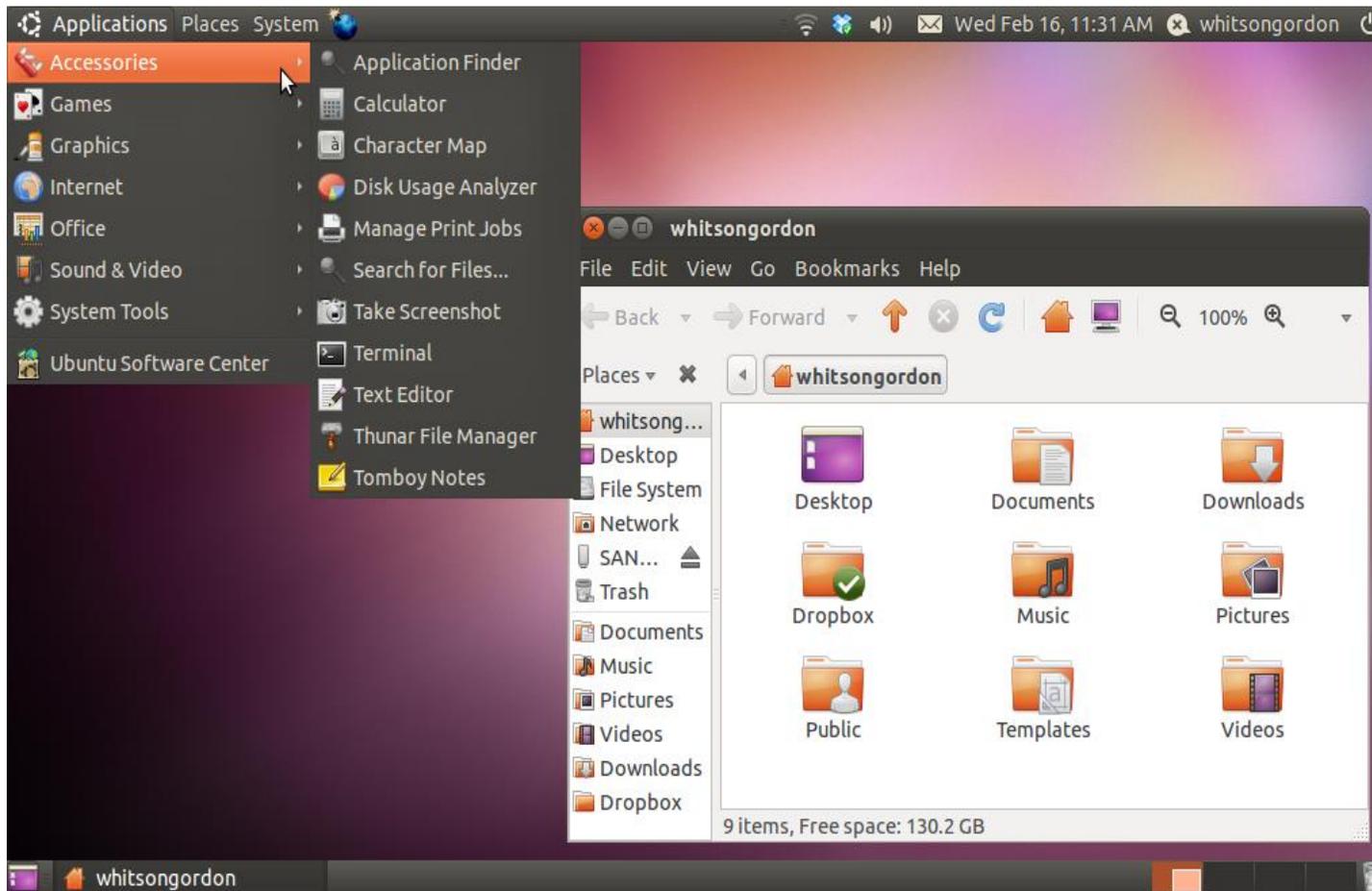
Having said that, that doesn't mean advanced Linux users won't like it. It has quite a few advanced settings that will enable to configure their desktop environment to their most liking. It features a top bar holding (from left to right) an Activities button, an application menu, a clock and an integrated system status menu. The application menu displays the name of the application in focus and provides access to functions such as accessing the application's preferences, closing the application, or creating a new application window. The status menu holds various system status indicators, shortcuts to system settings, and session actions including logging out, switching users, locking the screen, and suspending the computer.

Clicking on the Activities button, moving the mouse to the top-left hot corner or pressing the Super key brings up the Overview. The Overview gives users an overview of current activities and provides a way to switch between windows and workspaces and to launch applications. Notifications appear from the bottom of the screen.

GNOME sample diagram 1



GNOME sample diagram 2



It should also be mentioned that GNOME has a wealth of applications which are designed for its desktop, but they can also be used in the other desktop environments as well;

Following are a few applications and components of GNOME:

Window Manager: Mutter (GNOME 3.x shell)

File Manager: Nautilus

Office Suite: GNOME Office (which includes AbiWord and Gnumeric)

Music Player: Rhythmbox

Video Player: Totem

CD/DVD Burner: Brasero

Games: GnomeGames

Widget Toolkit: GTK +

3.1.1 System Minimum Requirements

Required RAM	768 MB
Required CPU	400 MHz

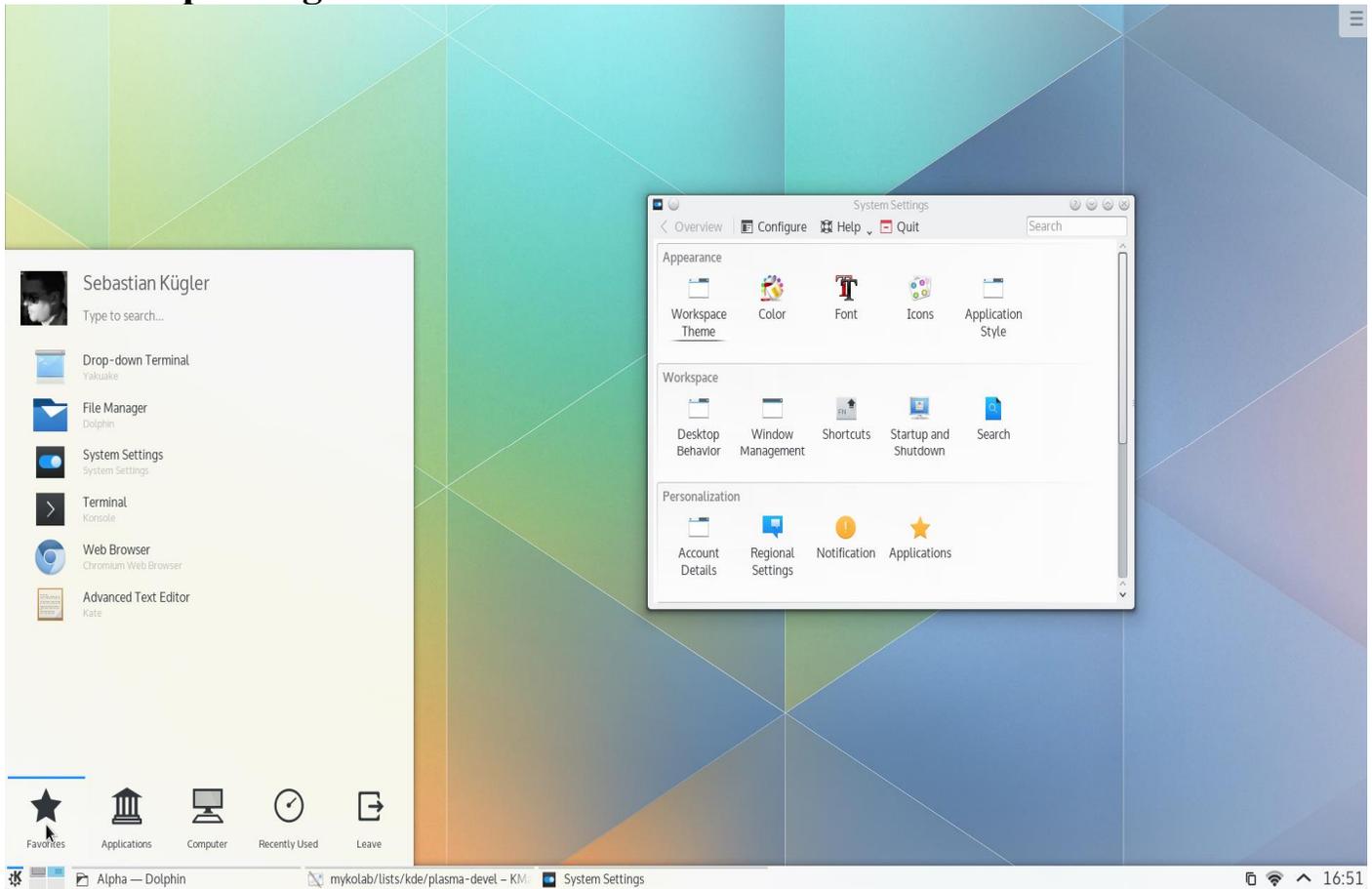
3.2 KDE

KDE is another most popular desktop environment out there, perhaps second most popular. Unlike GNOME which I have discussed above, it is more resource-heavy, i.e. it consumes a relatively large chunk of machine or computer resources as compared to GNOME. On top of that, it is a bit more complex than GNOME.

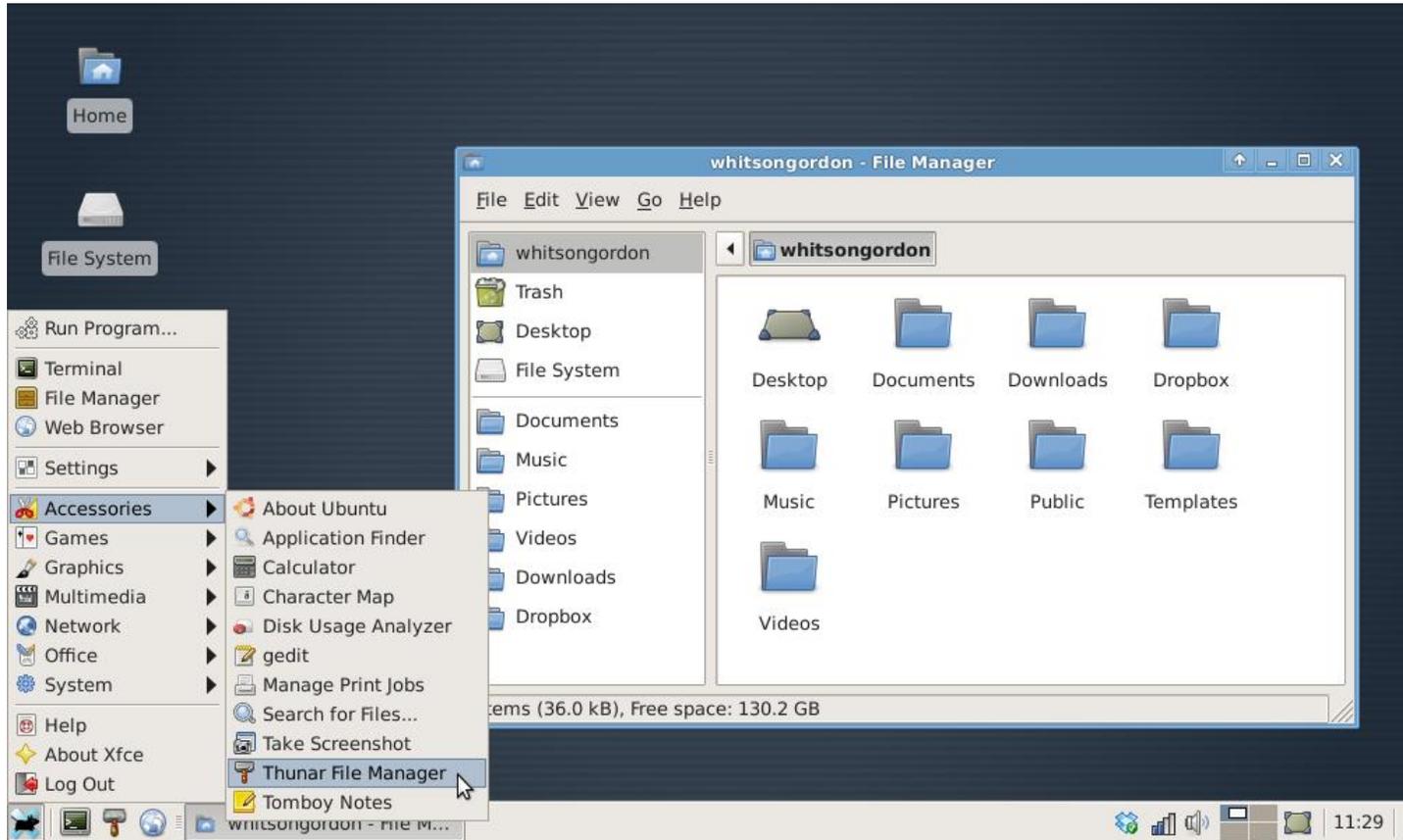
It focuses more about adding lots of functionality and evolving weather be for complete beginners or advanced users other than focusing on simple user interface. However it is probably most good looking desktop environments out there and it has a very cool widget-based desktop built in to the environment.

Its menus are set up very much like Windows, with one main menu located in the bottom left corner of the taskbar from which you launch apps and view settings. KDE actually has a ton of different configuration options available from this menu, but it's pretty hard to navigate, even if you're comfortable with computers and Linux in general (especially when the settings are part of the desktop widgets, which also manage everything you see in the taskbar). There are just so many different preference panes and settings that it can take awhile to figure out where the settings you want to tweak are located. It also has a few characteristics that will confuse new users—like the fact that dragging and dropping files *always* results in it asking you whether you'd like to move a file or copy a file—that you can't seem to change. If you're an advanced user looking for a lot of configuration options, KDE is a great choice—just know that there will be a learning curve, even if you're a fairly advanced user.

KDE sample diagram 1



KDE sample diagram 2



The current **official** Software Compilation consists of the following packages, many of which contain multiple applications and/or libraries:

- a) KDE-Libs: The software libraries that compose the KDE Developer Platform, required by all KDE applications.
- b) KDE-Base:
 - Runtime: Additional software components required by many KDE Applications to perform properly.
 - Applications: Applications that are central to a basic desktop experience, such as a file manager or webbrowser.
 - Workspace: The KDE Workspaces that provide the tools and user environments for a Desktop, Netbook or Mobile experience
- c) KDE-Plasma-Addons: Additional themes and applets for the desktop and panel.

- d) KDE-Network: Networking applications such as an instant messenger and download manager.
- e) KDE-Pim: Mail client, addressbook, organizer and groupware integration.
- f) KDE-Graphics: Document viewer, image viewer and selected other graphics applications.
- g) KDE-Multimedia: Includes a video player as well as different audio players.
Phonon: Multimedia layer that supports different backends, on different operating systems, for multimedia output.
- h) KDE-Accessibility: Applications to improve computer access for disabled people such as a text-to-speech system.
- i) KDE-Utilities: Useful utilities like an archiving tool and a calculator.
- j) KDE-Edu: Education and science applications.
- k) KDE-Games: Classic and modern games.
- l) KDE-Toys: KDE's fun stuff.
- m) KDE-Artwork: Additional icons, styles, wallpapers, screensavers and window decorations.
- n) KDE-Admin: Various tools to aid with system administration.
- o) KDE-SDK: Script and tools which simplify development of KDE applications.
- p) KDE-Bindings: bindings for various programming languages (Python, Ruby, Perl, Java...).

3.2.1 System minimum requirements

Required RAM	512 MB
Required CPU	1GHz

4 Linux File System

When it comes to Linux distribution, one of the very important things that new users should be aware or know about it is the file system. It is a different story to microsoft as it is not worth that much to worry about, the default being NTFS (New Technology File System) developpt by Microsoft.

Due to the fact that Linux is built on the platform of open source and different opinions, it is not limited like NTFS and therefore new Linux users should have an understanding of what file system is and how it affects the machine. There are several different attributes which are necessary in defining file systems, these include their max file size, max partition size, whether they journal or not.

4.1 Brief Description of what journaling is

It is file system that keeps track of changes not yet committed to the file system main part by recording the intentions of such changes in data structure known as **journal** which is usually a circular log. In the event of a system crash or power failure, such file systems can be brought back online more quickly with a lower likelihood of becoming corrupted

One can say journaling file system is more reliable when it comes to data storage. However it does not prevent data corruption. The positive thing that it does is to prevent data inconsistency. If a power failure happens while you are saving a file, the save will not complete and you end up with corrupted data and an inconsistent file system. Instead of actually writing directly to the part of the disk where the file is stored, a journaling file system first writes it to another part of the hard drive and notes the necessary changes to a log, then in the background it goes through each entry to the journal and begins to complete the task, and when the task is complete, it checks it off on the list. Thus the file system is always in a consistent state (the file got saved, the journal reports it as not completely saved, or the journal is inconsistent (but can be rebuilt from the file system)). Some journaling file systems can prevent corruption as well by writing data twice.

4.2 Table of file systems

Below is a very brief comparison of the most common file systems in use with the Linux world.

File System	Max File Size	Max Partition Size	Journaling	Notes
Fat16	2 GiB	2 GiB	No	Legacy
Fat32	4 GiB	8 TiB	No	Legacy
NTFS	2 TiB	256 TiB	Yes	(For Windows Compatibility) NTFS-3g is installed by default in Ubuntu, allowing Read/Write support
ext2	2 TiB	32 TiB	No	Legacy
ext3	2 TiB	32 TiB	Yes	Standard linux filesystem for many years. Best choice for super-standard installation.
ext4	16 TiB	1 EiB	Yes	Modern iteration of ext3. Best choice for new installations where super-standard isn't necessary.
reiserFS	8 TiB	16 TiB	Yes	No longer well-maintained.
JFS	4PiB	32PiB	Yes (metadata)	Created by IBM - Not well maintained.
XFS	8 EiB	8 EiB	Yes (metadata)	Created by SGI. Best choice for a mix of stability and advanced journaling.

4.3 Editing Files

Those used to a Windows file system (NTFS, FAT) know that it isn't normally possible to change files while they are open. This restriction does not exist in a Unix file system. This is because in Unix file systems, files are indexed by a number, called the inode, and each inode has several attributes associated with it, like permissions, name, etc. When you delete a file, what really happens is the inode is unlinked from the filename, but if some other program is using the file, it still has a link open to the OS, and will continue to be updated. A file is not really deleted until all links have been removed (even then, the data is still on the disk, but not indexed in anyway and thus very hard to recover). All of this means that you can delete executing programs while they're running without crashing and move files before they're finished downloading without corruption.

4.4 Fragmentation

Another common Windows practice that is not needed in Unix is defragmenting the hard drive. When NTFS and FAT write files to the hard drive, they don't always keep pieces (known as blocks) of files together. Therefore, to maintain the performance of the computer, the hard drive needs to be "defragged" every once in a while. This is unnecessary on Unix File systems due to the way it was designed. When ext3 was developed, it was coded so that it would keep blocks of files together or at least near each other.

No true defragmenting tools exist for the ext3 file system, but tools for defragmenting will be included with the ext4 file system.

4.5 File system Structure

In Linux, everything is configured as a file. This includes not only text files, images and compiled programs (also referred to as executables), but also directories, partitions and hardware device drivers.

Each file system (used in the first sense) contains a control block, which holds information about that file system. The other blocks in the file system are inodes, which contain information about individual files, and data blocks, which contain the information stored in the individual files.

There is a substantial difference between the way the user sees the Linux file system (first sense) and the way the kernel (the core of a Linux system) actually stores the files. To the user, the file system appears as a hierarchical arrangement of directories that contain files and other directories (i.e., subdirectories). Directories and files are identified by their names. This hierarchy starts from a single directory called root, which is represented by a "/" (forward slash). (The meaning of root and "/" are often confusing to new users of Linux. This because each has two distinct usages. The other meaning of root is a user who has administrative privileges on the computer, in contrast to ordinary users, who have only limited privileges in order to protect system security. The other use of "/" is as a separator between directories or between a directory and a file, similar to the backward slash used in MS-DOS.)

The File system Hierarchy Standard (FHS) defines the main directories and their contents in Linux and other Unix-like operating systems. All files and directories appear under the root directory, even if they are stored on different physical devices (e.g., on different disks or on different computers). A few of the directories defined by the FHS are /bin (command binaries for all users), /boot (boot loader files such as the kernel), /home (users home directories), /mnt (for mounting a CDROM or floppy disk), /root (home directory for the root user), /sbin (executables used only by the root user) and /usr (where most application programs get installed).

To the Linux kernel, however, the file system is flat. That is, it does not (1) have a hierarchical structure, (2) differentiate between directories, files or programs or (3) identify files by names. Instead, the kernel uses inodes to represent each file.

An inode is actually an entry in a list of inodes referred to as the inode list. Each inode contains information about a file including (1) its inode number (a unique identification number), (2) the owner and group associated with the file, (3) the file type (for example, whether it is a regular file or a directory), (4) the file's permission list, (5) the file creation, access and modification times, (6) the size of the file and (7) the disk address (i.e., the location on the disk where the file is physically stored).

The inode numbers for the contents of a directory can be seen by using the -i option with the familiar ls (i.e., list) command in a terminal window:

```
ls -i
```

The df command is used to show information about each of the file systems which are currently mounted on (i.e., connected to) a system, including their allocated maximum size, the amount of disk space they are using, the percentage of their disk space they are using and where they are mounted (i.e., the mountpoint). (Here file systems is used as a variant of the first meaning, referring to the parts of the entire hierarchy of directories.)

df can be used by itself, but it is often more convenient to add the -m option to show sizes in megabytes rather than in the default kilobytes:

```
df -m
```

A column showing the type of each of these file systems can be added to the file system table produced by the above command by using the --print-type option, i.e.:

```
df -m --print-type
```

This command generates a column labeled Type. For a Ubuntu Linux installation on a home computer most of the entries in this column will probably be ext3 and/or ext2.

5 Installation

Installing Linux is quite easy and straight forward. since it is an open source, as a very first step one will need to download his or her choice of Linux ISO file. The ISO file is available on the webpage of each linux distribution. after downloading, one needs to burn the ISO file, Then boot from the disc and follow the self explanatory steps to install the linux. Perhaps the only trickiest part is configuring the PC to boot from the CD or USB and that can be set by making BIOS changes.

5.1 Ubuntu Installation

Download Ubuntu:

One first need to download a Ubuntu .ISO CD image file. It is important that you download the **Desktop** version. If you download the **Server** version it will not install any graphical desktop and you will have to add that manually

Check if Your Computer will Boot from USB

Make BIOS Changes

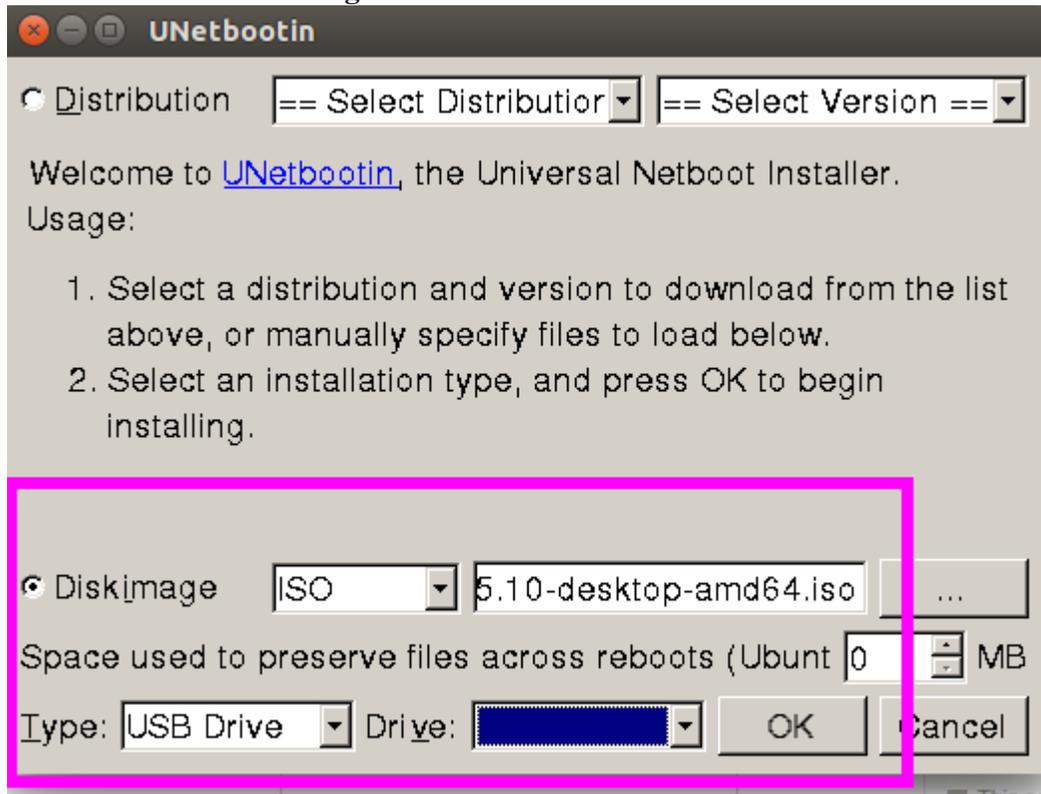
Try Ubuntu Before you Install It:

If you want to try Ubuntu before installing that you can run it from the USB drive using UnetBootin (Which we use in the next section to create the bootable USB). Also the Ubuntu installation screens will give you that option too.

Create Bootable USB:

Download and install UNetbootin and use that to create a bootable USB. This will create a bootable partition on the disk and copy Ubuntu there. Trying to make a bootable USB drive by yourself is otherwise complicated

Create Bootable USB diagram



Install Ubuntu

Create a username, password, and computer name. You will login with this user id after the installation is complete.

5.1.1 System minimum requirements

700 MHz processor (about Intel Celeron or better)

512 MiB RAM (system memory)

5 GB of hard-drive space (or USB stick, memory card or external drive but see LiveCD for an alternative approach)

VGA capable of 1024x768 screen resolution

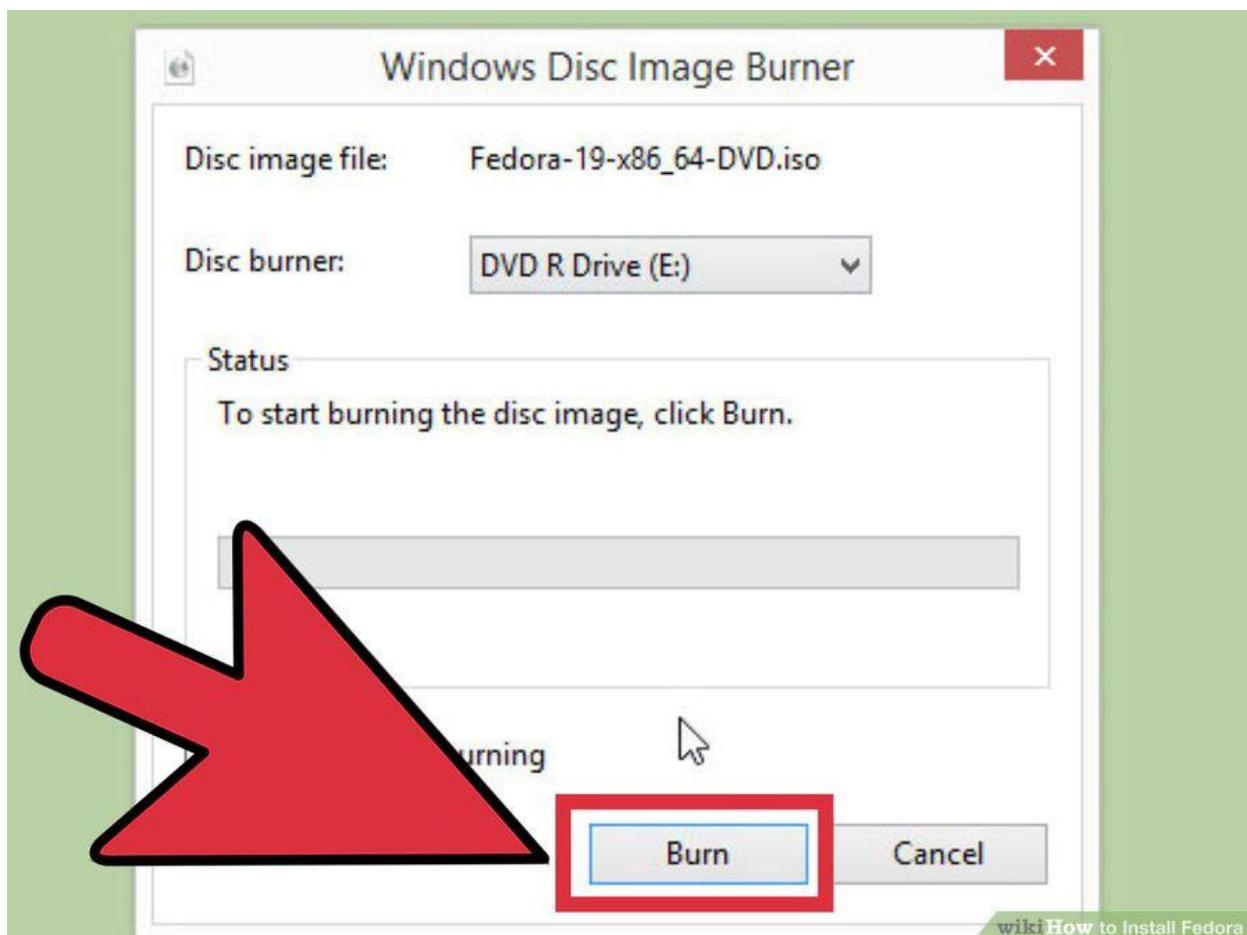
Either a CD/DVD drive or a USB port for the installer media

Internet access is helpful

5.2 Fedora Installation

Download the live image from the <https://getfedora.org/> . If you are KDE fan:

Fedora Installation diagram



Burn the .iso image onto the USB or CD/DVD

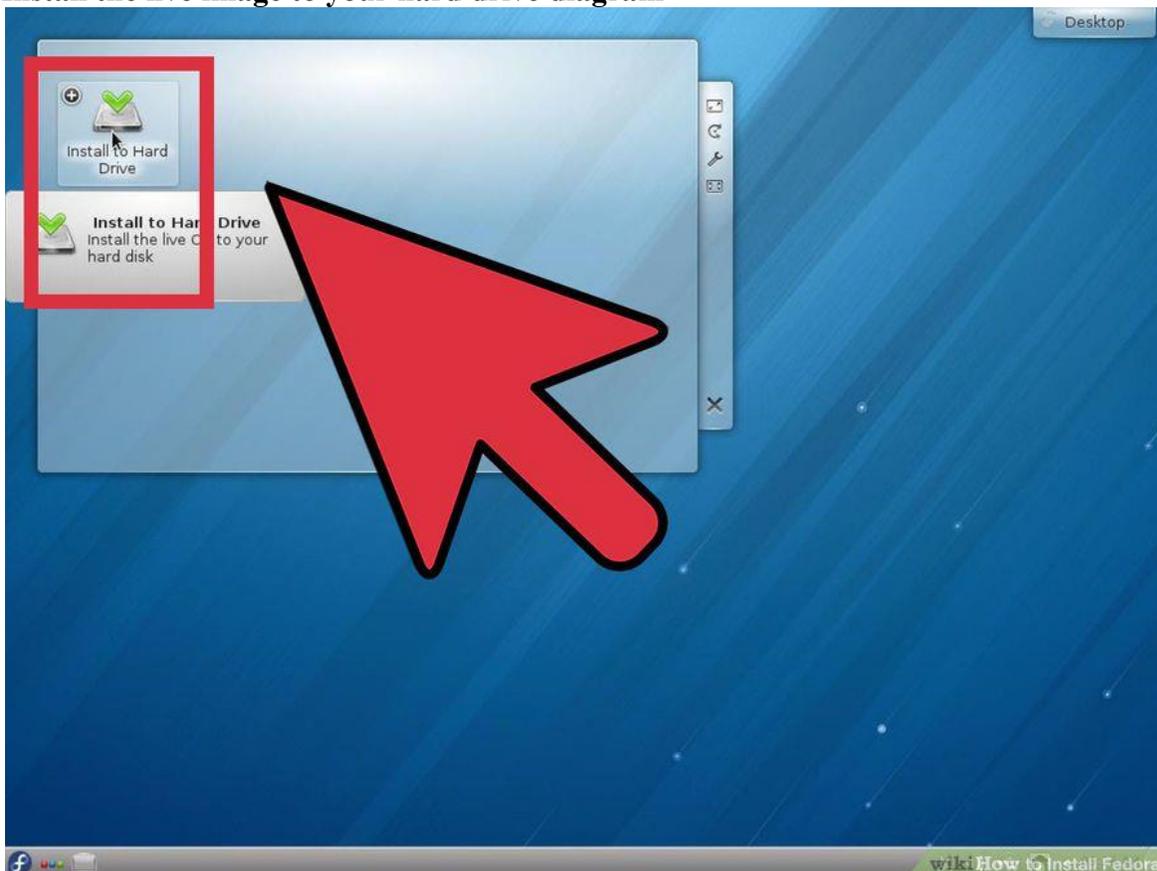
Make the BIOS Settings:

If you are using a live USB, you might need to go into your BIOS and change the boot priority in order to boot from your USB. You can access your computer's BIOS by pressing -F2 or -Delete on most computers when the computer is booting up. If you are using a CD or DVD, ignore this step as generally CDs are first in boot priority.

Be sure to select "Live Drive" when the option screen first appears. If you select to install it, it can potentially delete everything from your system.

Explore the system. The most notable thing about you should toy with is the window manager which allows you to see pretty cool effects. You should also explore around the applications already installed in the OS and see what else is available with their package manager.

Install the live image to your hard drive diagram



Click on next when the installer starts and then select your keyboard layout
Click on next each time with desired option up until the end

5.2.1 System minimum requirements

6GB plus the required disk space recommended by the guest operating system per guest. For most operating systems more than 6GB of disk space is recommended.

One processor core or hyper-thread for each virtualized CPU and one for the hypervisor.

2GB of RAM plus additional RAM for virtualized guests.

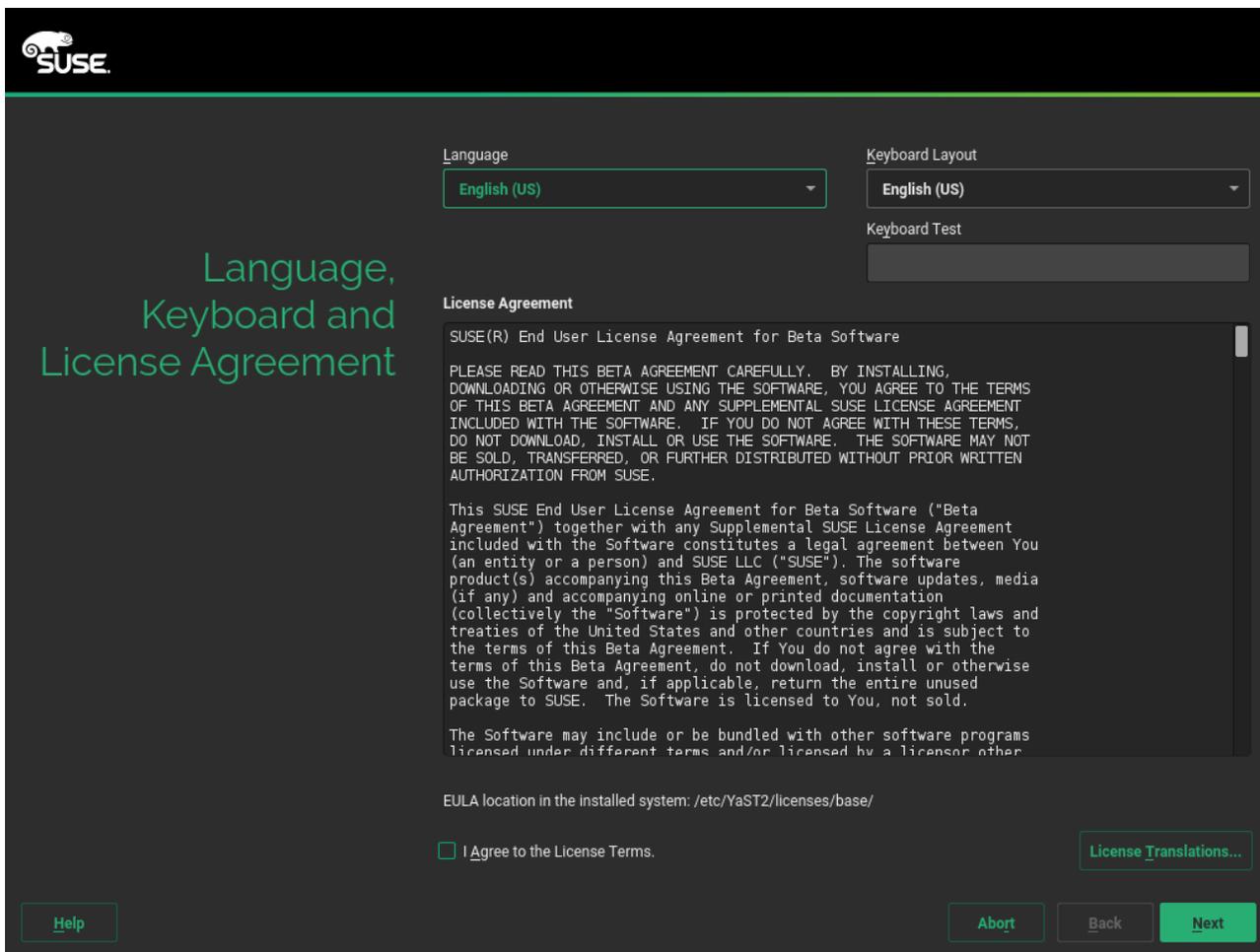
5.3 Suse Installation

Insert the SUSE Linux Enterprise Desktop DVD into the drive, then reboot the computer to start the installation program. On machines with a traditional BIOS you will see the graphical boot screen shown below. On machines equipped with UEFI, a slightly different boot screen is used. Select Installation on the boot screen, then press Enter. This boots the system and loads the SUSE Linux Enterprise Desktop installer.

The Language and Keyboard Layout are initialized with the language settings you have chosen on the boot screen.

Read the License Agreement. It is presented in the language you have chosen on the boot screen. License Translations are available. You need to accept the agreement by checking I Agree to the License Terms to install SUSE Linux Enterprise Desktop. Proceed with Next.

Suse Installation



Click on next each time with desired option up until the end to complete the installation

5.3.1 System Minimum Requirements

- a) any AMD64/Intel* EM64T processor (32-bit processors are not supported)
- b) 512 MB physical RAM (1 GB or more recommended)
- c) 3.5 GB available disk space (more recommended)
- d) 800 x 600 display resolution (1024 x 768 or higher recommended)

5.4 Debian Installation

First go to Debian download page. This page will allow the user to select from the installation CD or DVD.

The DVD tends to contain a Live version of Debian as well as the necessary installation utility. Be sure to pick the proper architecture for the PC on which Debian will be installed!

Use **dd** command to copy the newly download ISO to a USB stick or use burning software to burn the ISO to a CD/DVD (software such as **K3B** or **Nero** can accomplish this task). The easiest method however is the Linux **dd** utility and a USB stick. The command syntax is very simply but take extra caution to make sure that the proper arguments are provided. To accomplish this, change directory to the Downloads folder.

```
hrtturner@LM17 ~/Downloads $ ls -l deb*
-rw-r--r-- 1 hrtturner hrtturner 675282944 Apr 15 14:18 debian-7.8.0-amd64-CD-1.iso
-rw-r--r-- 1 hrtturner hrtturner 646971392 Apr 22 10:57 debian-jessie http://www.tecmint.com
```

Download Debian 8 Jessie

Then plug in a USB drive that doesn't contain any important data. This process is destructive! All data on the USB drive will be removed. Determine the hardware name for the newly inserted USB drive using **lsblk** command.

```
hrtturner@LM17 ~/Downloads $ lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda   8:0    0 465.8G 0 disk
├─sda1 8:1    0   33G 0 part /
├─sda2 8:2    0    1K 0 part
├─sda3 8:3    0 185.7G 0 part
├─sda4 8:4    0 231.9G 0 part /home
├─sda5 8:5    0  15.2G 0 part [SWAP]
sdb   8:16   1  15.1G 0 disk
├─sdb1 8:17   1   15.1G 0 part /media/hrtturner/corsair
sdc   8:32   1   7.4G 0 disk
├─sdc1 8:33   1   7.4G 0 part /media/hrtturner/Debian 7.8.0 amd64 http://www.tecmint.com
```

Check USB Device Name

In this example, `/dev/sdc` will be used to create the bootable Debian installation media. Now it is time to build the **dd** command to copy the ISO to the USB drive (You can't simply copy the ISO file to the USB drive, it will not boot)!

```
hrtturner@LM17 ~/Downloads $ sudo dd if=debian-jessie-DI-rc3-amd64-CD-1.iso of=/dev/sdc bs=1M http://www.tecmint.com
```

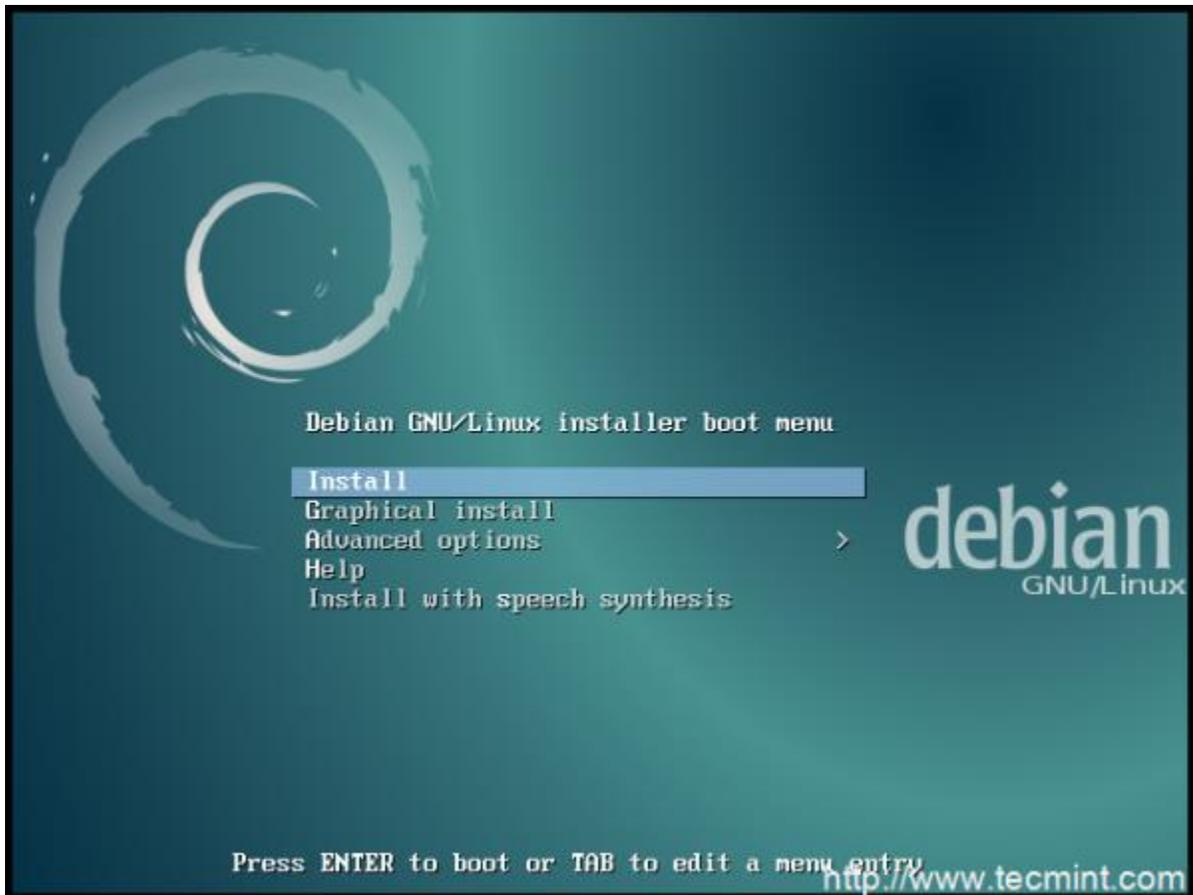
Create Bootable USB Using dd Command

dd command will not provide any feedback that anything is happening. If the USB drive has an **LED** indicator, look at the light and see if the light is flashing. **dd** will finish and return the user to the command prompt after it completes.

Be sure to safely **eject/remove** the drive from the machine. Linux has a tendency to cache data and write it later! Now that the flash drive is ready, it is time to put the USB drive into the computer and boot to the Debian installer.

The installer will boot to a **Debian** splash screen that provides several options for advanced installation options.

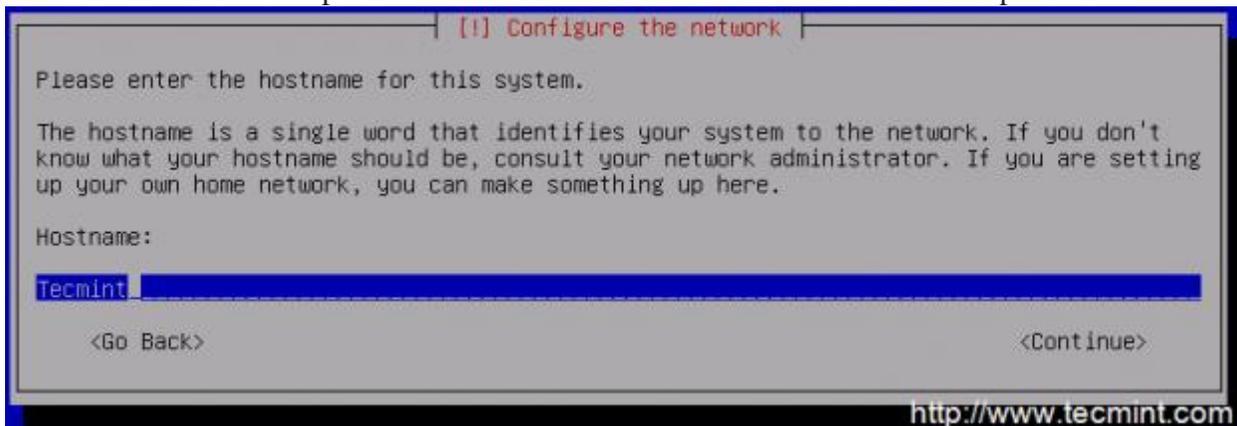
Debian Installer diagram



Debian 8 Boot Menu

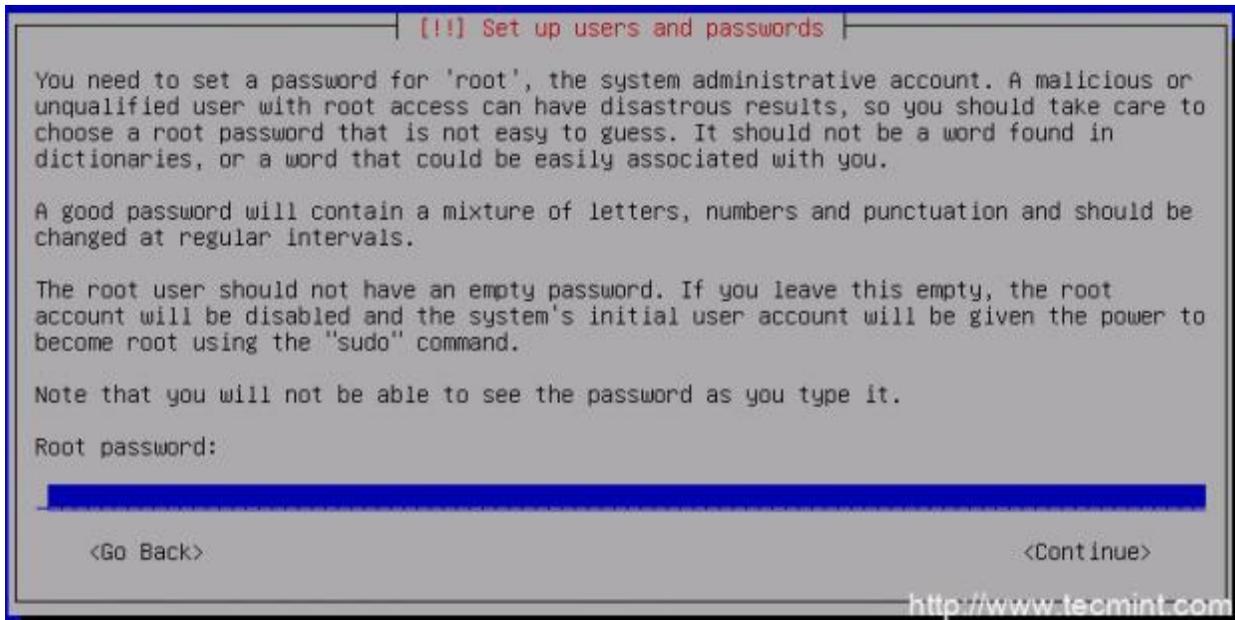
Use the keyboard to select the boot option desired; For now the **Graphical Install** will be used since most users are comfortable with a mouse.

This will boot Debian into the installer. The first few options will require the user to select the **keyboard** and **localization** to use. The next step is to set your computer's **hostname** and allow the installer to setup a **network connection** for access to the software repositories.



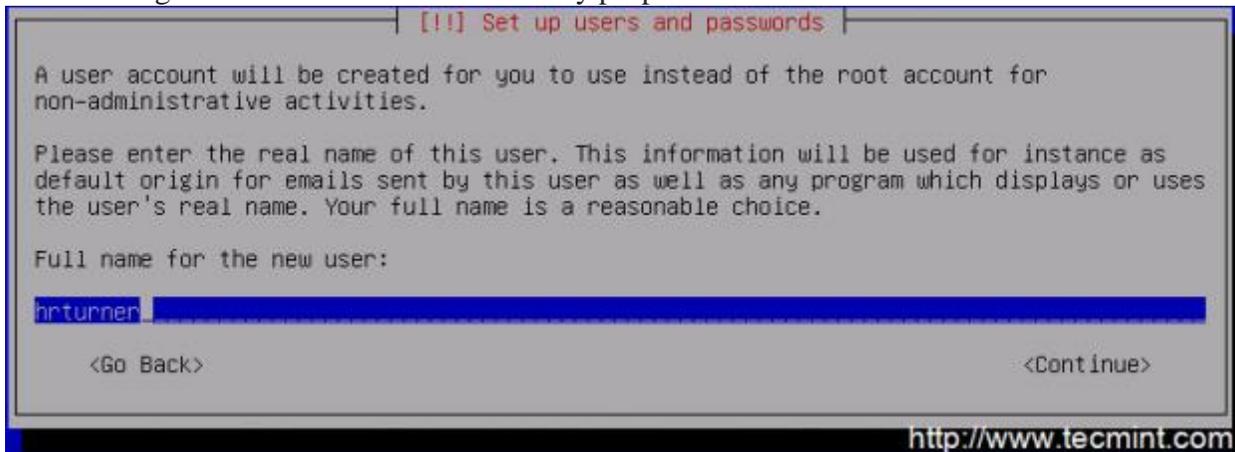
Set Hostname for Debian 8 Jessie

After hostname configuration, the system will ask the user to create a **root** user password. Be sure to not forget this password as it is not a fun process to try to recover!



Create and Set root User Password

After the root user configuration, a normal non-root user will need to be configured. This should be something different than `root` for security purposes.



Create Non Root User

After the **root** and **non-root** users are setup, the installer will attempt to download some packages from the repositories and as such, a network connection is very helpful (however, it isn't necessary and the installer will install the base system regardless).

Now the installer will prompt the user to set up the **partition scheme** to be used on this system. For most normal installations, the **Guided – Use entire disk** option will suffice but do realize that this will overwrite all data on the disk!.



Select Guided Disk Partitioning

The next page will ask the user to confirm the partition changes, write the changes to the disk, and begin the installation process of the base files of Debian.

5.4.1 System Minimum requirements

Minimum RAM: 256MB.

Recommended RAM: 512MB.

Hard Drive space: 10 GB.

Minimum 1GHz Pentium processor.

6 Comparison of Linux distributions

In this section we will be looking at comparing the four Linux distributions in terms of their characteristics, support for Multimedia, support for games, support for database systems, support for scientific calculations and system security.

6.1 Multimedia

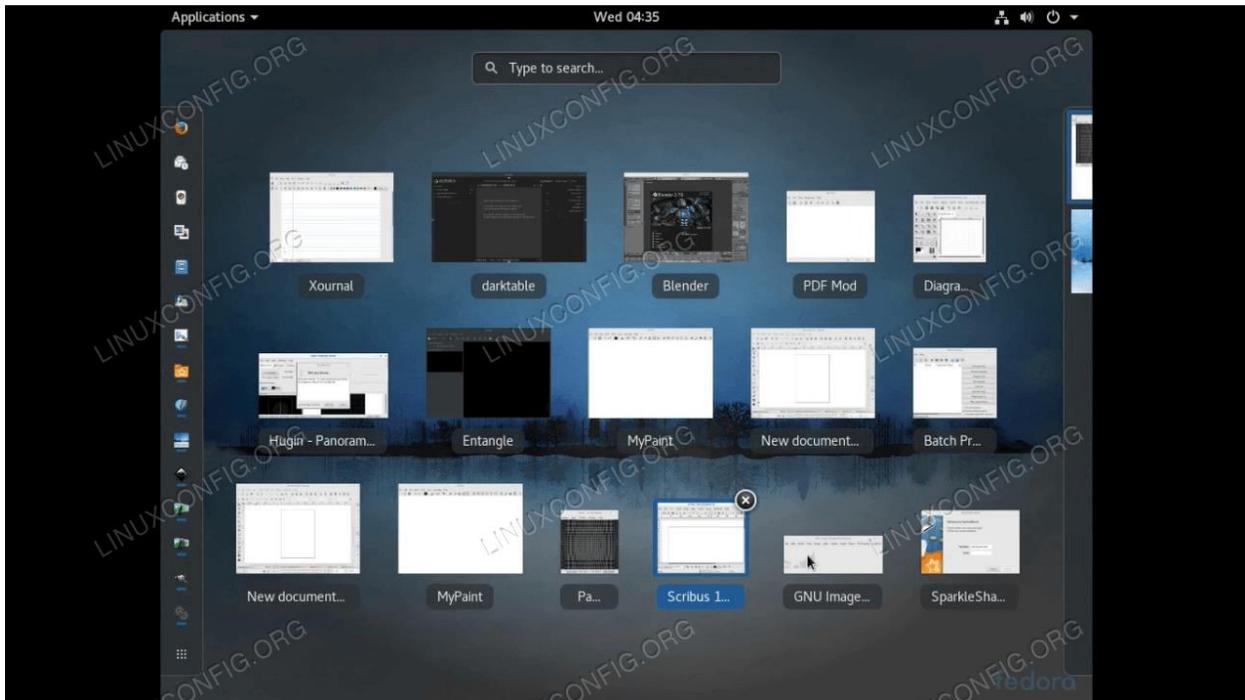
6.1.1 Ubuntu Studio:



Ubuntu has under its arm Ubuntu Studio. if you already have Ubuntu installed, you can install the full Ubuntu Studio suite of applications by using the following command in terminal:
`$ sudo apt install ubuntu-studio-installer`

Ubuntu Studio is a well rounded multimedia distro, featuring a lot of apps for photo editing, video editing, and audio production. Ubuntu works tremendously well as an everyday operating system, and this is basically just regular Ubuntu packed with a bunch of multimedia tools for content creators.

6.1.2 Fedora Design Suite



Fedora has under its wing Fedora Design Suite. It comes decked out with various multimedia tools, but with a heavy focus on image creation and editing. The distro is even used by the Fedora design team themselves for all the Fedora branding

6.1.3 Debian

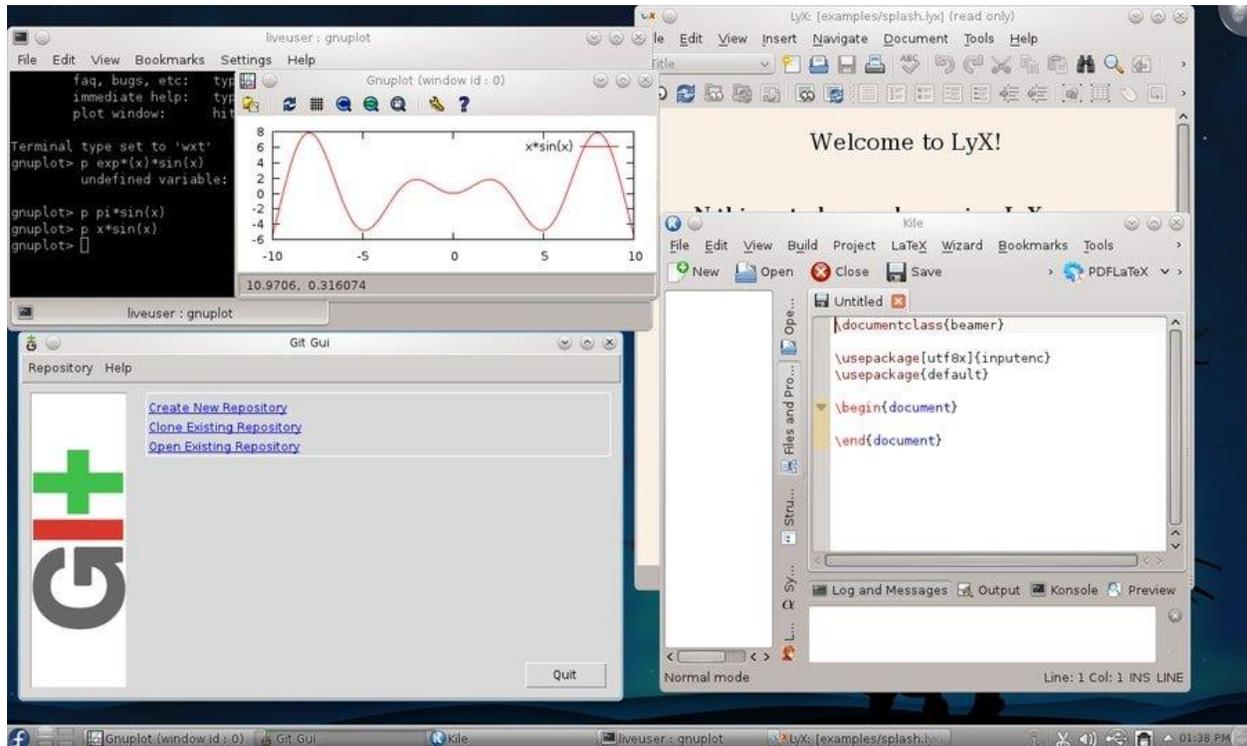
When it comes to Debian there is no dedicated fully decked out distro with multimedia tools. The only work around will be to search and install individually the application or software needed and that can be a hustle and a pain as there are some dependencies in binaries and compatibility issue always comes into play.

6.1.4 SUSE

Like Debian,SUSE has not specialized distro decked with multimedia tools and the same work around of having to search and find individually the software needed will be a way to go.

6.2 Scientific Calculation/computing

6.2.2 Fedora Scientific



Fedora in terms of scientific computing has a couple of dedicated distros under its wing and would specifically talk about Fedora Scientific.

Some of its key features is a wide range of scientific tools for Physics, Mathematics, and other branches. It is a great distro for software engineers as it has some useful software built into it. It has beautifully written online documentation that will help even beginners to get started with this distro. software highlights include Maxima, a complete algebra suite. It also include LaTeX for creating documents and presentations. It has Mayavi for 3D data visualization and the version control trifecta: git, Mercurial and subversion.

6.2.3 Debian

When it comes to scientific computing, unlike Fedora, Debian has no dedicated distro decked up with scientific software or application. It will be up to an individual to search and find the needed software and their dependency to install them manually

6.2.4 SUSE

Just like Debian, SUSE has no dedicated distro as well and it will be up to an individual to find the needed software. It is worth mentioning that not all the binaries are compatible for all distros hence pain and hustle to find the needed software, if found at all.

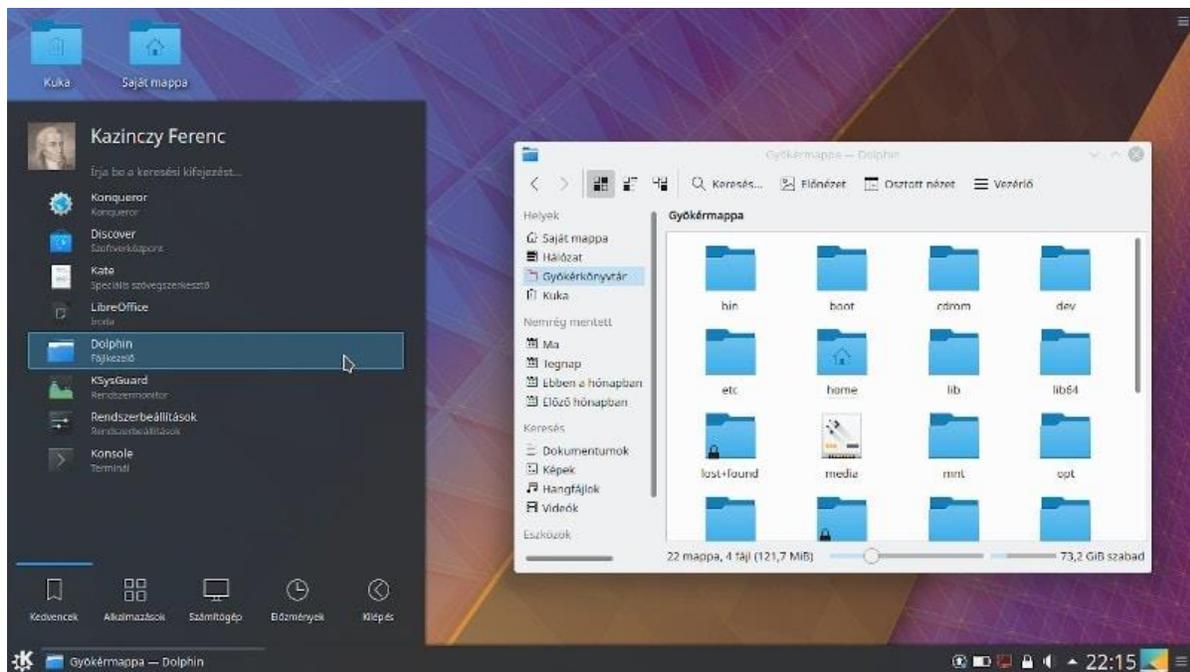
6.2.5 Ubuntu

Again like Debian and SUSE, no dedicated distro for scientific computing was found upon a research and the only work around would be to find the compatible needed software and install them individually.

6.3 Gaming

Primarily, your system resources matter for the game to perform well. So, technically, you may prefer a distribution that is snappy and resource-friendly. The distribution should be resource-friendly. The distribution should be easy to use. The software tools that you need to get started should be readily available and easy to install.

6.3.2 Kubuntu



Ubuntu has under its wing Kubuntu which offers KDE's plasma workspace experience and its easy on the system resources which improves their gaming experience.

6.3.3 Fedora Game Spin



Fedora Games Spin is designed for gamers. The fact that there are thousands of games that come pre-installed and tools to install more is what makes it worth getting. Unlike most of the Linux distros, this is fast, light, and stable.

6.3.4 Debian

Unlike the above two mentioned, Debian doesn't have any dedicated distro for games which either comes with multitudes pre-installed games or platform to make games more appealing. A work around of manual installation would be needed though doesn't guarantee harmonic experience and the software tools are not easy to install manually.

6.3.5 SUSE

Just like Debian, there is no dedicated distro from SUSE for gamers. A work around of manual installation would be needed as well though doesn't guarantee harmonic experience.

6.4 Support for database servers

Operating systems are not perfect. That is why manufactures or developers provide support for their products and bug fixes from time to time to keep up the pace with the evolving technology. For a database server I would certainly choose an operating system that is more stable, that has abundance of manuals online and have a short period of bug fixes.

6.4.2 Ubuntu

Ubuntu server is efficient for building top-performance, highly scalable, flexible, and secure enterprise data centers. It offers remarkable support for big data, visualization, and containers, IoT (Internet Of Things); you can use it from most if not all common public clouds. Ubuntu server can run on x86, ARM, and Power architectures.

With the **Ubuntu Advantage**, you can get commercial support and services such as a systems management tool for security audit, compliance, and the Canonical livepatch service, that helps you to apply kernel fixes and many more. This is coupled with support from a robust and growing community of developers and users.

6.4.3 SUSE

It is developed to power physical, virtual and cloud-based servers. It is well suited for cloud solutions with support for visualization and containers. It runs on the modern hardware environments for ARM System on Chip, Intel, AMD, SAP HANA, z Systems, and NVM Express over Fabrics. Users can get technical support and services under various categories including priority support, dedicated engineer among others, with SUSE Subscription.

6.4.4 Debian

It generally supports a larger number of computer architectures including 64-bit PC (amd64), 32-bit PC (i386), IBM System z, 64-bit ARM (Aarch64), POWER Processors and many more. It has a bug tracking system and you can get support for Debian by reading through its documentation and free web resources.

6.4.5 Fedora

Fedora has a reputation for focusing on innovation, integrating new technologies early on and working closely with upstream Linux communities. It is more of a test for other distro like RedHat, that is why it has a very short life cycle for each version.

7 Conclusion

This thesis has been aimed to talk about the important aspects of Linux distribution and putting more emphasis on the comparison of the four Linux distributions mainly Ubuntu, SUSE, Fedora and Debian in terms of support for multimedia, database system, games and scientific calculations or computing.

Based on the research and our findings I came to conclusion and recommendation that for Multimedia support, Ubuntu Studio under the wing of Ubuntu boast my recommendation due to the fact of its abundance of applications it possesses and the fact that it does not only put focus on image creating and editing unlike its competitors on this thesis like Fedora Design Suite. When it comes to games for gamers, Fedora game spin under the wing of Fedora boast my recommendation for the fact that it comes with multitudes of pre-installed games and for the fact that its light on resources and fast enough.

Furthermore upon our comparison in terms of support for database systems, Ubuntu takes spot number one due to its abundance of its online manuals and support and bug fixes. No one want to run a database on an operating system that has no good support and good history. Though Debian has good reputation in terms of its stability, Ubuntu beats it in terms of support. For scientific computation or calculations, Fedora Scientific under the wing on Fedora claims the number one spot and boast my recommendations. The reason is simple, its competitors in this thesis has no dedicated scientific distro.

Comparison in terms of their installation, the four distro follows a similar approach of downloading iso file, burning it into a CD or USB and following the self explanatory steps all the way until the installation is complete. For Ubuntu installation the steps were much more clearer.

All the four distro support different file systems though have different default file name.

8 References

Ubuntu installation: <https://help.ubuntu.com/community/Installation/SystemRequirements>

Debian installation: <https://www.debian.org/>

Fedora Installation: <http://www.tecmint.com/fedora-21-workstation-installation/>

Suse installation: https://www.suse.com/documentation/sled-12/singlehtml/book_quickstarts/book_quickstarts.html

Distro Watch : <https://distrowatch.com/>

Itø FOSS : <https://itsfoss.com/linux-gaming-distributions/>

OpenSource : <https://opensource.com/article/19/10/linux-server-security>

TecMint : <https://www.tecmint.com/>

Ubuntu : <https://www.ubuntupit.com/best-scientific-linux-distros/>

Linux Config : <https://linuxconfig.org/>