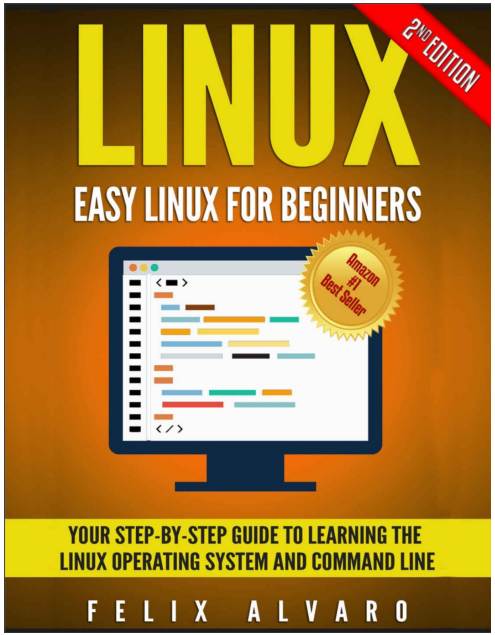
Linux for Beginners

PIAIC

Agenda

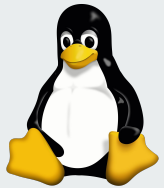
1. Getting Started
2. Understanding Linux
3. Your First Linux Experience
4. Post Installation Activities
5. Using the Linux Command Line
6. Basic Administration & Security
7. Introduction to Scripting



Chapter 1: Getting Started

- Overview of Linux
- Differences with Other OS

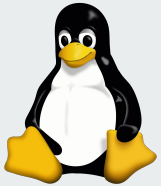
What is an Operating System?



A special kind of software which is between the hardware of the PC and the programs that you want to use and work with.

The OS is the software that brings together the a computer's hardware and the different programs you want to install on it.

The OS is responsible for the following tasks:

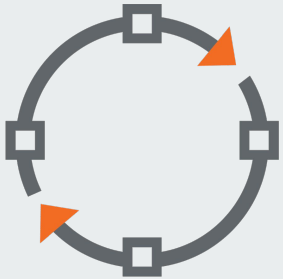


1. Detect hardware
2. Manage processes
3. Manage memory
4. Initiate user interfaces
5. Establish file systems
6. Manage access and user authentication
7. Provide a platform for administrative use
8. Startup-services

1. Detect Hardware

An OS is responsible for validating the components of a computer during boot up and loading the corresponding drivers and modules for the hardware to properly run.

2. Manage Processes



Similar to the way our mind works, several processes or applications are running on a computer at the same time.

It is the OS that is responsible for allocating CPU resources and sharing it among the processes.

The OS also provides the user the option to start, stop, or restart a process.

3. Manage Memory

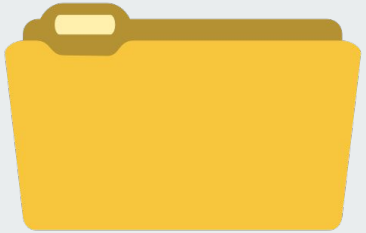
Each application needs a specific amount of RAM and swap memory to function.

The OS is responsible for assigning memory allocations and for handling memory requests.

4. Initiate User Interfaces

An OS offers users ways to access the system either via a command line or a graphical user interface (GUI).

5. Establish File Systems



The OS handles the management of files (access, directories, and structure), including the access to the file system.

6. Manage Access and User Authentication

An OS allows for creating user accounts with different permissions for access to files and processes.

7. Provide a Platform for Administrative Use

A computer's OS provides a platform for the administrator to add users, allocate disk space, install software, and to perform activities to manage the computer.

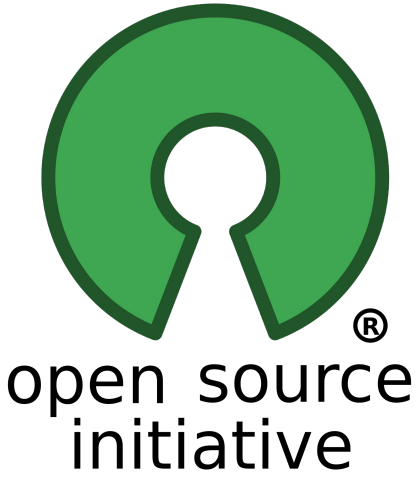
8. Start-up Services

The OS manages several processes running in the background known as *daemon processes*.

Linux is Open-Source

Linux is continuously developed collaboratively.

No single company owns the development and support of Linux.

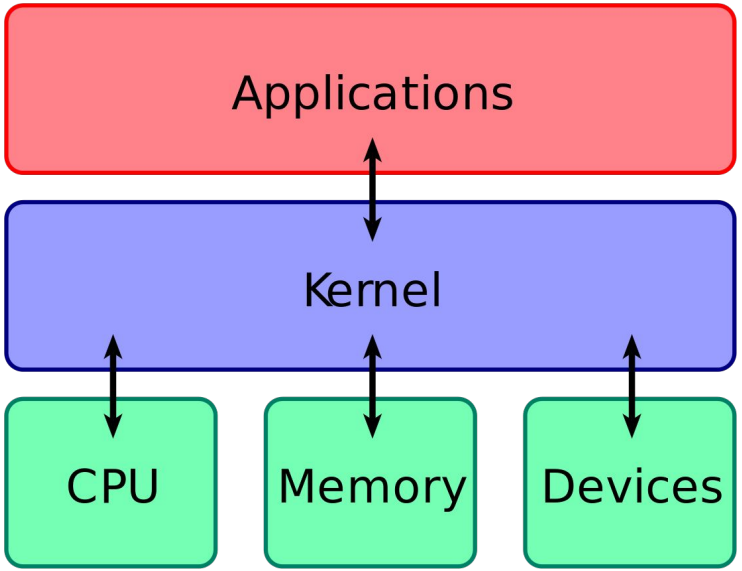


100+ Companies

There are more than 100 companies and over 1,000 developers who work together for every kernel release.

Kernel

Linux is composed of a kernel, the core control software, plus plenty of libraries and utilities that provide different features.

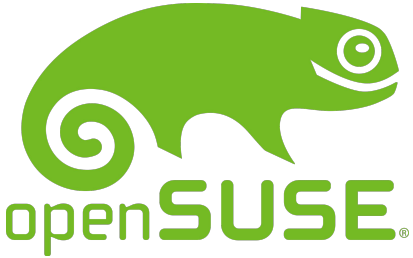


Distributions

Linux is available in many distributions.

These are called Linux flavors.

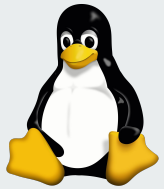
Distributions are groups of specific kernels and programs.



Linux has the largest market share when it comes to server OS

Least popular for personal and home use

Linux has the following additional characteristics:



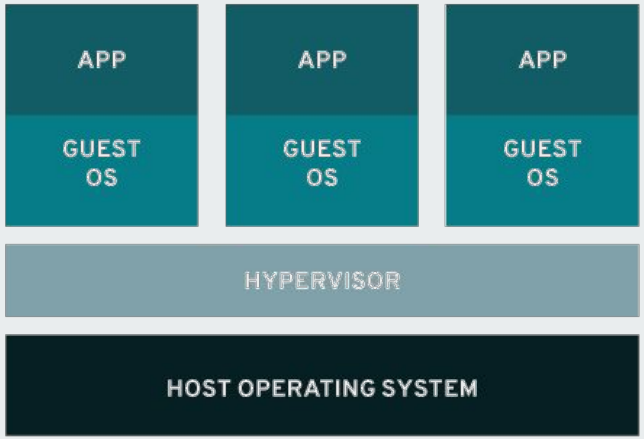
1. Supports clustering
2. Runs virtualization
3. Cloud computing
4. Options for storage

1. Supports Clustering

Multiple Linux systems can be configured to appear as one system from the outside.

Service can be configured among clusters and still offer a seamless experience.

2. Runs Virtualization



Virtualization allows one computer to appear as several computers to users.

Linux can be configured as a virtualization host - where you can run other OS such as Windows, macOS, or other Linux systems.

All the virtualized systems appear as separate systems to the outside world

3. Cloud Computing

Almost all cloud servers run on Linux.

4. Options for Storage

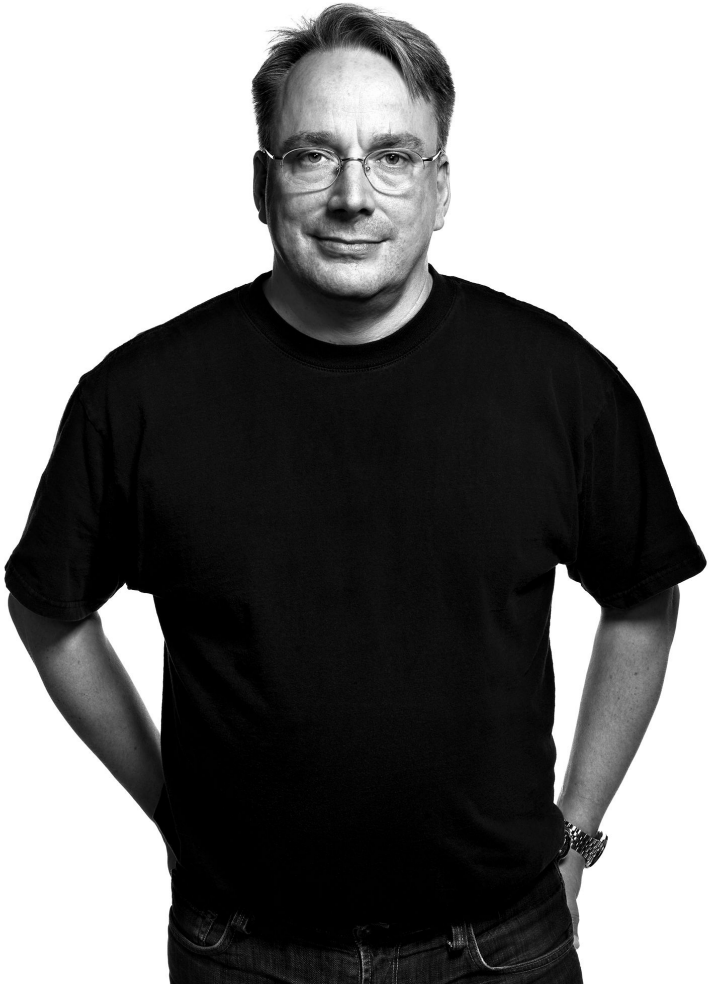
Data need not always be stored in your hard disk.

Linux offers different local and networked storage options such as Fiber Channel and iSCSI.

Linus Torvalds

A student from Finland, he created Linux in 1991 using C and assembly language.

Initially, he named it Freax, a combination of the words “Free” + “Freak” + “x”



Ari Lemmke

He was the FTP server administrator where Linus uploaded the files for the operating system.

He didn’t think Freax sounded good so he renamed the folder to Linux without telling Linus.

GNU GPL License

In 1992, Linux was licensed under the GNU GPL and the first Linux distributions (also called *distro*) were created.

GPL = General Public License

Slackware

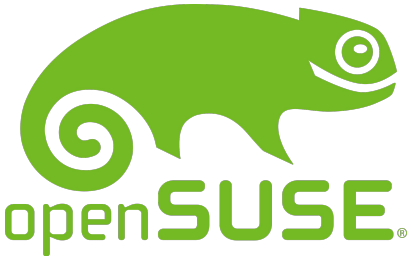
The oldest existing Linux distro

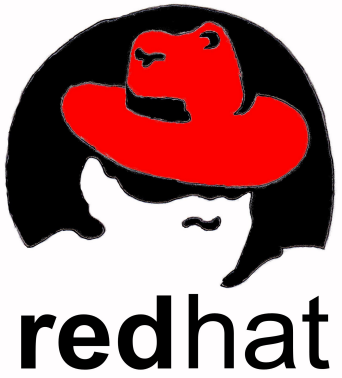
Debian

The largest community distribution

Suse
Red Hat

Commercial distributions





Market Share

UNIX

Server market revenue has already passed that of UNIX.

Android mobile OS has gained 75% market share.

98.8%

98.8% of the world’s fastest systems use the Linux kernel.

Is Linux Better than Other Operating Systems?

1. Cost
2. Viruses
3. System Stability
4. Installation
5. Support

1. Cost

Windows, if obtained legally, costs at least $100 and even more for the Pro and Commercial versions.

Linux is free of charge, even for commercial distros.

Companies sell services for support and documentation but not for the software.

2. Viruses

Linux hardly gets any viruses.

Since most people use Windows, attackers target windows.

Since its open-source, more developers are able to look for security flaws and help with fixes.

3. System Stability

Large scale systems can go for years without restarting the server.

Only time when restart is needed is kernel updates.

Even upgrading software only requires a service restart, not a node restart.

:(
Your PC ran into a problem that it couldn't handle, and now it needs to restart.
You can search for the error online: HAL_INITIALIZATION_FAILED

4. Installation

Basic software is provided with Linux OS installation:

- Text Editor
- Spreadsheet
- Presentation Program
- Photo Editor
- Web Browser
- Movie Player
- PDF Reader

Drivers are pre-installed and configured with the install

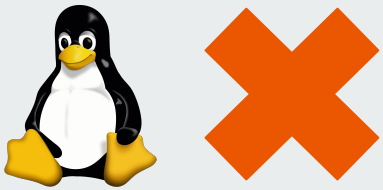
5. Support

Large online community:

- Get information
- Read FAQs
- Ask Questions

Unlimited number of resources to use and learn from. All for free.

Stick to your current OS if these conditions apply:

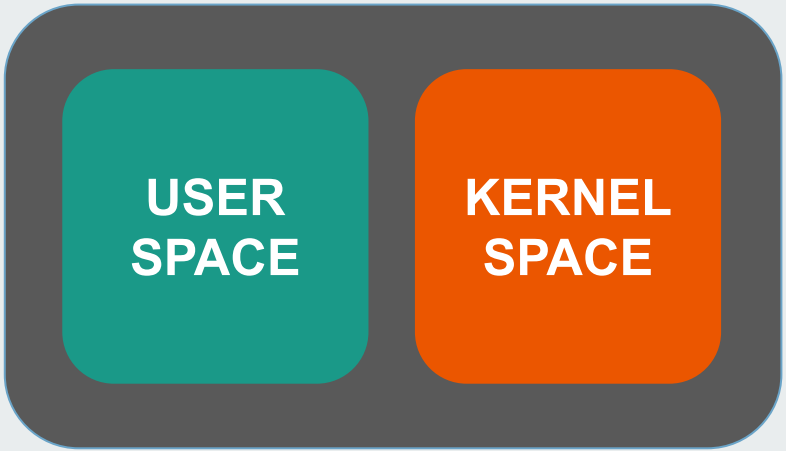


- You need to use proprietary software and cannot find an open-source equivalent
- If you are a serious gamer. Most PC games are made for Windows.
- Hardware compatibility issues - many hardware devices don’t come with Linux drivers

Chapter 2: Understanding Linux

- OS Architecture
- Different Flavors for Beginners

Linux Architecture

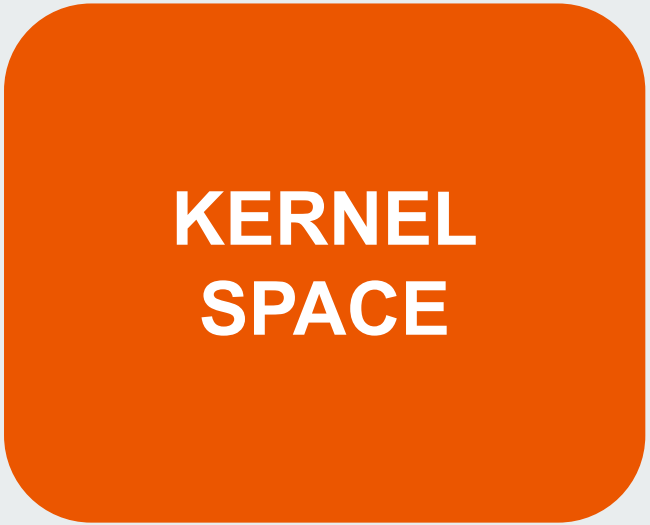


Linux architecture can be divided into two spaces.

1. User Space
2. Kernel Space

This is where applications are used.

The GNU C library, in the User Space, is the interface that connects to the kernel and transitions between User and Kernel space. This uses all available memory.



All Kernel services are processed here. The Kernel space is divided into 3 parts.

1. System Call Interface
2. Kernel Code
3. Architecture-Dependent Kernel Code

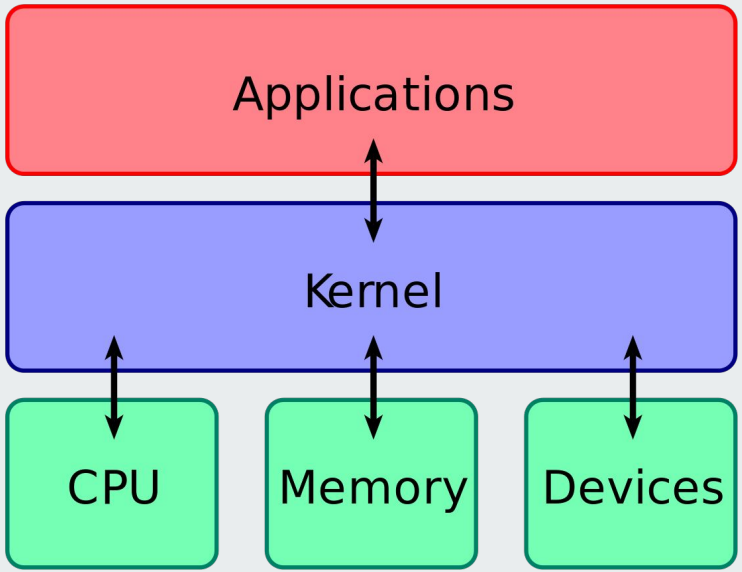
1. System Call Interface

A User process can access Kernel space through a System Call.

When a System Call is performed, arguments are passed from User to Kernel space.

This is the layer that implements basic functions.

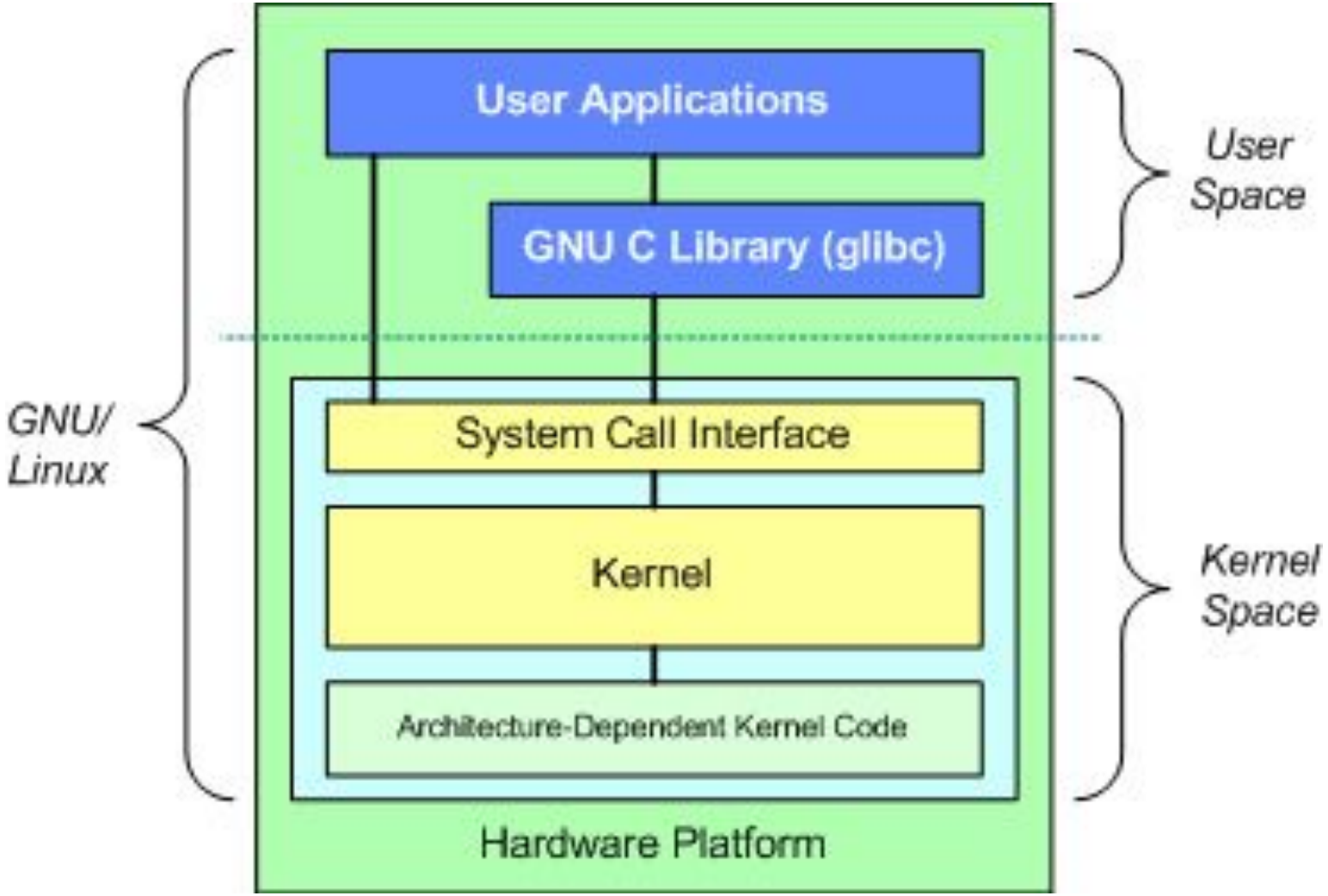
2. Kernel Code



This is architecture-independent code, and can be seen in all architectures that Linux supports.

3. Architecture-Dependent Kernel Code

This is the layer for platform-specific codes.


User Applications
GNU C Library (glibc)
System Call Interface
Kernel
Architecture-Dependent Kernel Code
Hardware Platform
User Space
Kernel Space
GNU/ Linux

Linux Distributions

Each Linux distro consists of a Linux kernel plus utilities and configuration files

Let's take a look at how several of the popular distros differ from each other based on the following criteria:

1. Availability
2. Package Format
3. Release Cycle

1. Availability

Linux is a free software, but companies offering a support contract and proprietary components offer it for a fee.

Red Hat Enterprise and SUSE Enterprise both offer Linux commercially, but they also have the free alternatives - Fedora and openSUSE

2. Package Format

Linux distros come in packages.

Packages are files grouped into one single file.

RPM is the most commonly used.

3. Release Cycle

How often a distro releases new software.

Shorter release cycles mean latest software is provided in the shortest possible time.

Longer release cycles aim to provide more stable environments.

Ubuntu offers a long term support (LTS) version with a longer release cycle which offers a more stable environment.

Also offers the latest software with a 6 month release cycle.

Distribution	Availability	Package Format	Release Cycle
Arch	Free	Pacman	Rolling
CentOS	Free	RPM	Approx. 2-yr
Debian	Free	Debian	2-yr
Fedora	Free	RPM	Approx. 6-mo
Gentoo	Free	Ebuild	Rolling
Mint	Free	Debian	6-month
openSUSE	Free	RPM	8-month
Red Hat Enterprise	Commercial	RPM	Approx. 2-yr
Scientific	Free	RPM	Approx. 6-mo
Slackware	Free	Tarballs	Irregular
SUSE Enterprise	Commercial	RPM	2-3 years
Ubuntu	Free	Debian	6-month

Choosing the Right Distribution

To choose the right distro for you, please consider all previously mentioned points.

In addition, research these:

1. Desktop Environment
2. Hardware Compatibility
3. Community Support

1. Desktop Environment

Find out if the particular distribution that you're eyeing has a basic look and feel that you like.

Is it customizable?

2. Hardware Compatibility

Depending on the hardware that you are using, some drivers may not be available.

Check from online resources first to know which ones can be supported out-of-the-box.

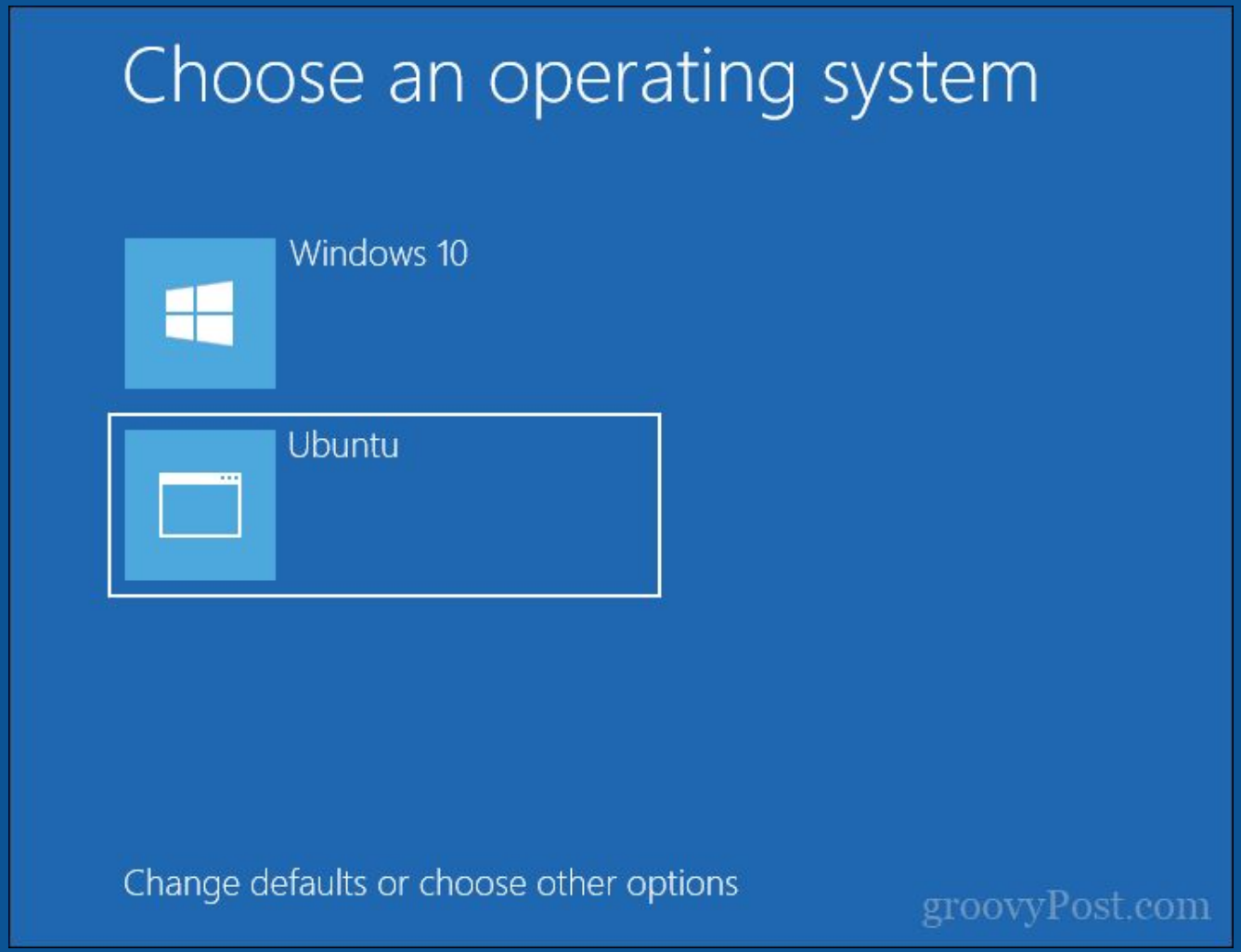
3. Community Support

Find a distro with a large online community.

The bigger the community, the easier to get support and find documentation.

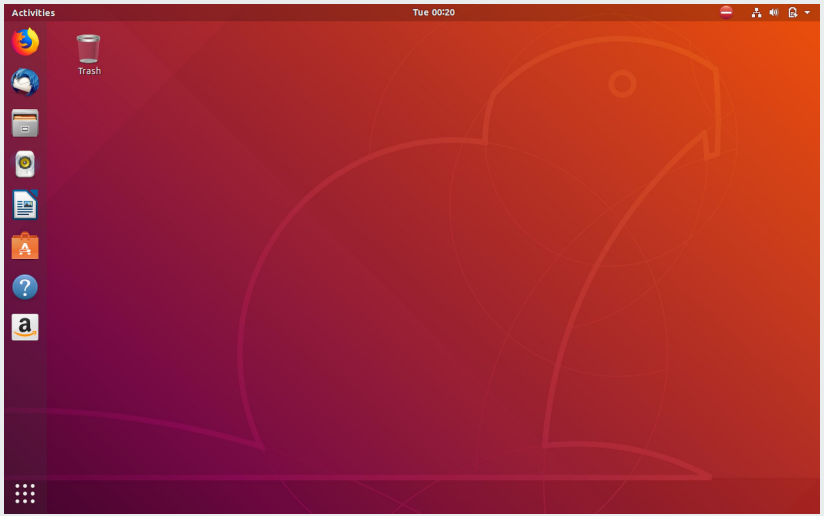
Assignment: Install Ubuntu

- Linux OS
- Dual Boot
- Virtual Machine with VirtualBox


Choose an operating system
Windows 10
Ubuntu
Change defaults or choose other options
groovyPost.com

Chapter 4: Your First Linux Experience

Turning on Your PC



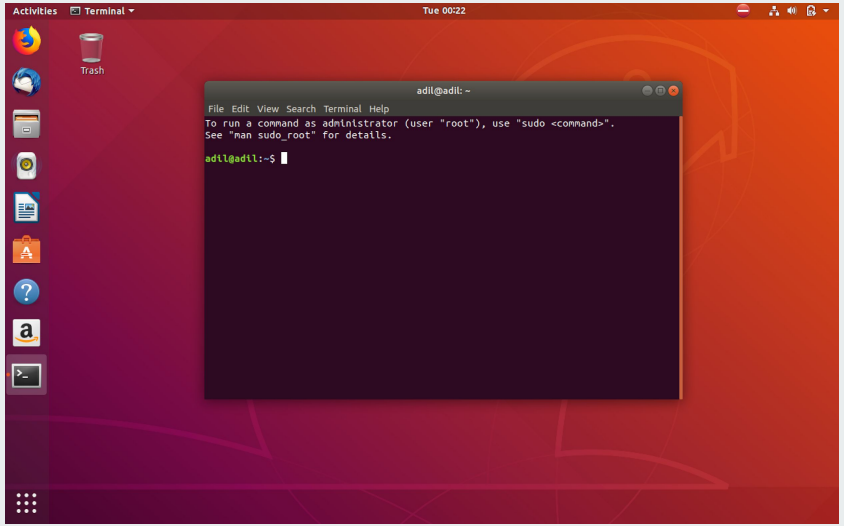
Once Linux boots, a graphical login screen will be shown.

Other distros don’t require login on startup.

Each distro uses the root username for administrator access.

The desktop that comes up is either KDE or GNOME.

Getting to Know Shell



Open Terminal.

The shell is where you can run executable files and shell scripts.

The shell is what we call the *command line*.

Commands are written using this general syntax:

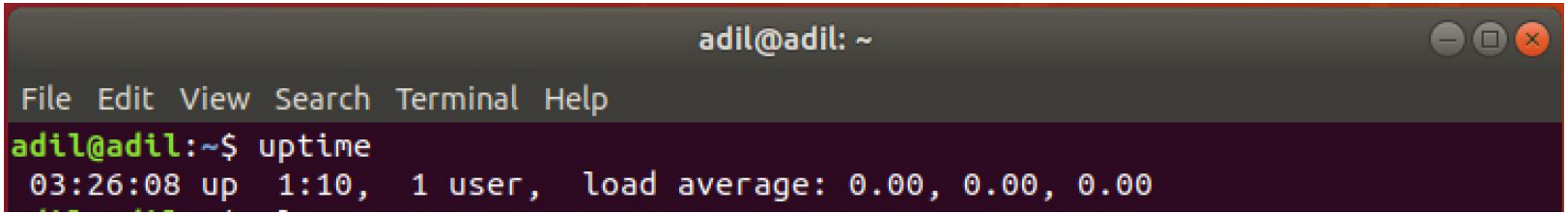
command option1 option2 … optionN

Let’s run some commands

1. uptime
2. uname -srv
3. man uname

uptime

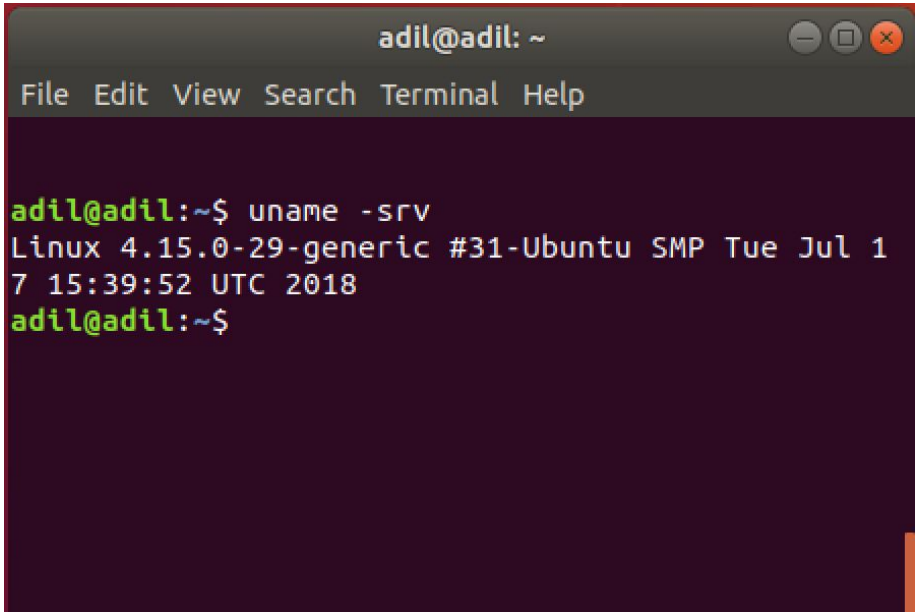
Uptime is the command that shows the duration the system has been up.



uname -srv

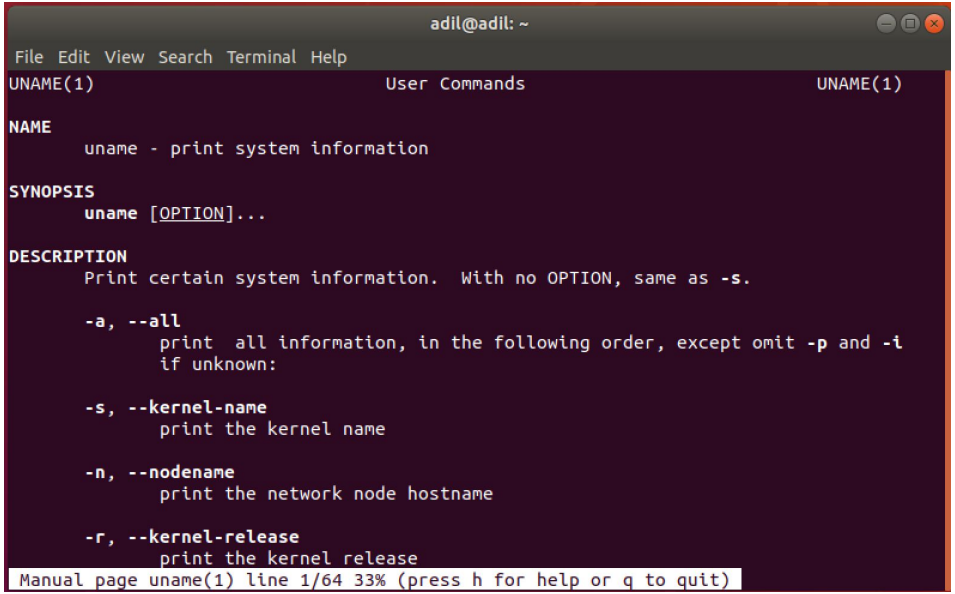
uname is the command to show the operating system name.

- -s (print the OS name)
- -r (print the OS release)
- -v (print the OS version)
- -a (display all options)

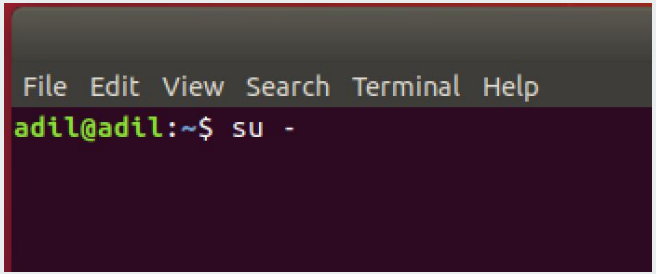


man uname

The man command displays all the commands you can use.



Switching to Root



Enter the ‘su -’ command and input your root password to switch to root.

This will allow you to run tasks that only administrators and superusers can do.

Commands for Processing Files

Copy Lines of Data - dd

https://www.computerhope.com/unix/dd.htm

The dd command copies a file, converting the format of the data in the process, according to the operands specified.

Use dd cautiously — improper usage or entering the wrong values could inadvertently wipe, destroy, or overwrite the data on your hard drive.

Copy Lines of Data - dd

https://www.howtoforge.com/linux-dd-command/

Comparing Files - diff

https://www.computerhope.com/unix/udiff.htm

The diff command analyzes two files and prints the lines that are different. In essence, it outputs a set of instructions for how to change one file to make it identical to the second file.

Comparing Files - diff

https://linuxize.com/post/diff-command-in-linux/

Comparing Files - diff

file1.txt:

apples

oranges

kiwis

carrots

file2.txt:

apples

kiwis

carrots

grapefruits

Comparing Files - diff

```
diff -y file1.txt file2.txt
```

Displaying Contents of Files - more

https://www.computerhope.com/unix/umore.htm

The more command displays text, one screen at a time.

more is a filter for paging through text one screen at a time. It does not provide as many options or enhancements as less, but is nevertheless quite useful and simple to use.

Displaying Contents of Files - more

more +3 file1.txt

more +/"carrots" file2.txt

Displaying Contents of Files - less

https://www.computerhope.com/unix/uless.htm

the less command is a feature-rich command-line file viewer.

less is a program similar to more, but it has many more features. less does not have to read the entire input file before starting, so with large input files it starts up faster than text editors like vi.

Displaying Contents of Files - less

less file1.txt

less -N file1.txt

Word Counts - wc

https://www.computerhope.com/unix/uless.htm

The wc command counts the words, newlines, or bytes of each input file, and outputs the result.

wc prints newline, word, and byte counts for each FILE, and a total if more than one FILE is specified. With no FILE, or when FILE is a dash ("-"), wc operates on standard input. (A word is a non-zero-length sequence of characters delimited by white space.)

Displaying Contents of Files - less

wc file1.txt

ls -1 | wc -l

Get Sections of a File - cut

https://www.computerhope.com/unix/ucut.htm

The cut command removes ("cuts out") sections of each line of a file or files.

Get Sections of a File - cut

https://linuxize.com/post/linux-cut-command/

Get Sections of a File - cut

```
cut -c 3 file1.txt

cut -c 1-3 file1.txt

cut -c 3- file.txt
```

Display Results of Finding Expressions - grep

https://www.computerhope.com/unix/ugrep.htm

The grep command processes text line by line, and prints any lines which match a specified pattern.

Display Results of Finding Expressions - grep

https://linuxize.com/post/how-to-use-grep-command-to-search-files-in-linux/

Display Results of Finding Expressions - grep

```
grep -w "kiwi" file1.txt
```

Editing Commands - sed

https://www.computerhope.com/unix/used.htm

sed is a stream editor: it filters and transforms text.

A stream editor is used to perform basic text transformations on an input stream. sed works by making only one pass over the input(s).

Editing Commands - sed

https://linuxize.com/post/how-to-use-sed-to-find-and-replace-string-in-files/

Editing Commands - sed

```
sed 's/carrots/mangos/g' file.txt > newfile1.txt
```

Splitting Files - split

https://www.computerhope.com/unix/usplit.htm

The split command splits a file into pieces.

Splitting Files - split

https://www.linuxtechi.com/split-command-examples-for-linux-unix/

Splitting Files - split

```
split -b 22 file.txt new
```

```
split -l 1 file1.txt new
```

Sorting data - sort

https://www.computerhope.com/unix/usort.htm

sort sorts the contents of a text file, line by line.

Sorting data - sort

```
sort file1.txt

sort file1.txt > file3.txt

sort -r file1.txt
```

Removing repeated lines - uniq

https://www.computerhope.com/unix/uuniq.htm

the uniq command reports or filters out repeated lines in a file.

uniq filters out adjacent, matching lines from input file INPUT, writing the filtered data to output file OUTPUT.

file4.txt

This is a line.

This is a line.

This is a line.

This is also a line.

This is also a line.

This is also also a line.

Removing repeated lines - uniq

uniq file4.txt

uniq -c myfile.txt

uniq -d myfile.txt

uniq -u myfile.txt

Compressing files - compress

https://www.computerhope.com/unix/ucompres.htm

The compress command compresses a file so that it becomes smaller.

Compressing files - compress

compress -v file1.txt

Uncompressing files - uncompress

https://www.computerhope.com/unix/uuncompr.htm

The uncompress command decompresses files that have been compressed using the compress command.

Uncompressing files - uncompress

uncompress file1.txt.Z

uncompress file1.txt