Passionate Developers

CNC – Cloud Computing

PDF

CHAPTER :01

LINUX

Chapter One: Getting Started

STUDY SCHEDULE

Syllabus	Dates
1(13 pptx)	1
(13 pptx) reg(6)	2
2 (13 pptx)	3
(13 pptx) reg(6)	4
3 (13 pptx)	5
(13 pptx) reg(6)	6
4 (13 pptx)	7
(13 pptx) reg(6)	8
5 (13 pptx)	9
(13 pptx) reg(6)	10
6 (13 pptx)	11

Topics for Today

What is Operating System ?

What is LINUX ?

What is an Operating System?

A computer, complete with all its parts – the CPU, mouse, monitor, and keyboard – will not work without a central program that will piece it all together. In order to use a PC, you need a piece of software inside which will take care of making the hardware work for you. A special kind of software which is between the hardware of the PC, and the programs that you want to use and work with. This piece of software is the Operating System, or more easily referred to as just an OS. In short, an operating system is the software that brings together a computer's hardware and the different programs that you want to install on it. Without it, when you booted up your PC, you would not get anything on the monitor, and neither mouse nor keyboard will work. You would be unable to watch videos, listen to music, edit photos, or to simply write a note.

TASKS of O/S

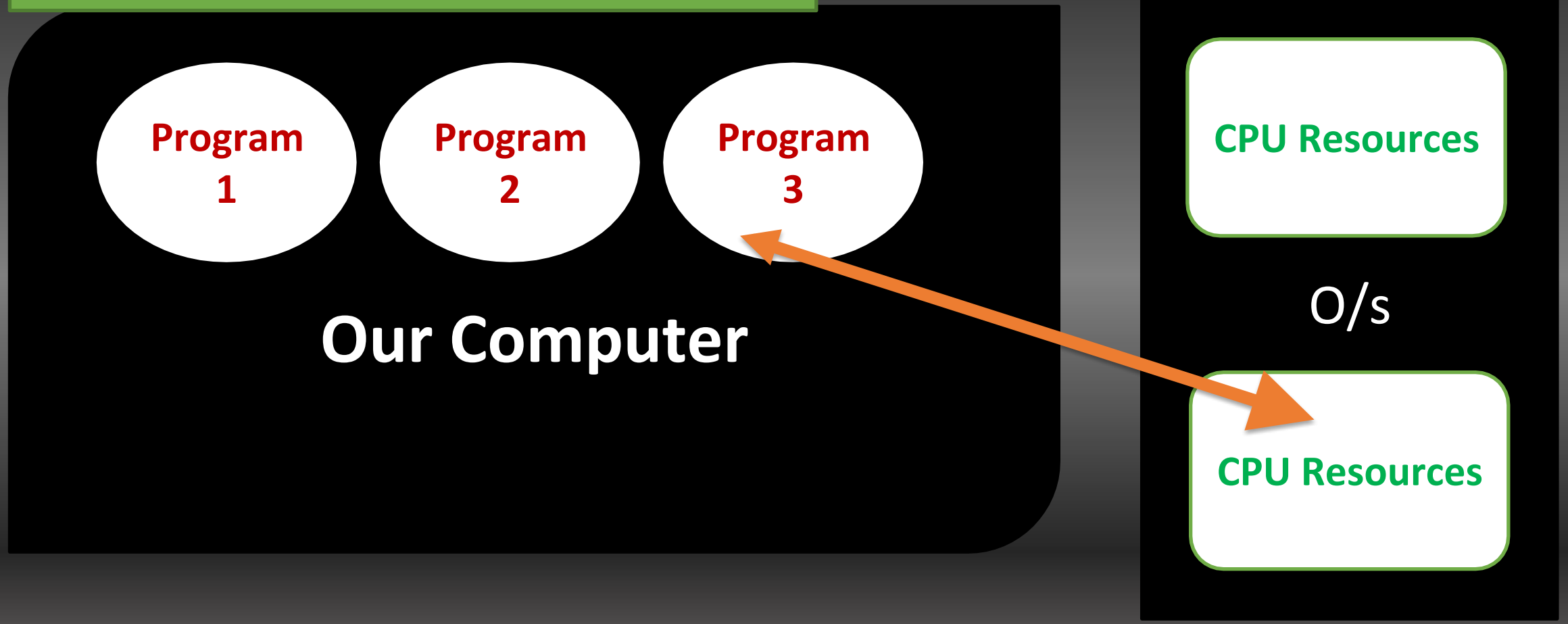
1- Detect hardware
2- Manage processes
3- Manage memory
4- Initiate user interfaces
5- Establish file systems
6- Manage access and user authentication
7- Provide a platform for administrative use
8- Start-up services

With that said, an operating system is responsible for doing the following tasks:

Detect hardware – An OS is responsible for validating the components of a computer during boot up (hard drive, CPU, network cards, mouse, etc.) and loading the corresponding drivers and modules for the hardware to properly run.

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.

2- Manage processes



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

Establish file systems

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

3- Manage memory

Application

NEEDS

SWAP MEMORY

RAM

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

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.

Start-up services – The OS manages several processes running in the background known as daemon processes

Let’s take it in a setting that we can all relate to – a manager at work. An OS is like a manager who keeps the different parts of the team in check, assigns tasks, distributes work load, and checks everyone’s performance. While every member of a team has specific job responsibilities, a manager keeps the team working together cohesively. Examples of an operating system that you have probably heard of are Windows 10 (and its p

What is Linux?

Linux is an operating system, similar to the examples mentioned in the previous section, and is often described as Unix-like. The stark difference between Linux and other operating systems lies in the fact that Linux is an open-source operating system. This means that Linux is continuously developed collaboratively. Unlike Windows and OS X which are both tied to the respective companies (Windows and Apple), not one company owns Linux' development and support. Builder Linux is a shared vision, with different companies sharing research, development, and the associated costs. This open source cooperation among companies and developers has led to making Linux one of the best ecosystems for use from small digital wristwatches to servers and supercomputers. Based on statistics, there are at least 100 companies and more than 1000 developers who work together for every kernel release.

Linux is composed of a kernel, the core control software, plus plenty of libraries and utilities that provide different features. Linux is available through many distributions. These are what we can call Linux flavours. Distributions are groups of specific kernels and programs. The most popular ones include Arch, SUSE, Ubuntu, and Red Hat. The book focuses on functions present on most Linux distributions, although these distributions have their own specific tools at times. This operating system was first used as a server OS and then was used as a base for Android developers Now, Linux has the largest market share when it comes to server OS, but is one of the least popular for personal and home use such as desktops and laptop computers. In the next sections, we will have an in-depth discussion of the reasons why Linux is better when compared to other operating systems.

TASKS OF LINUX

Supports clustering

Runs virtualization

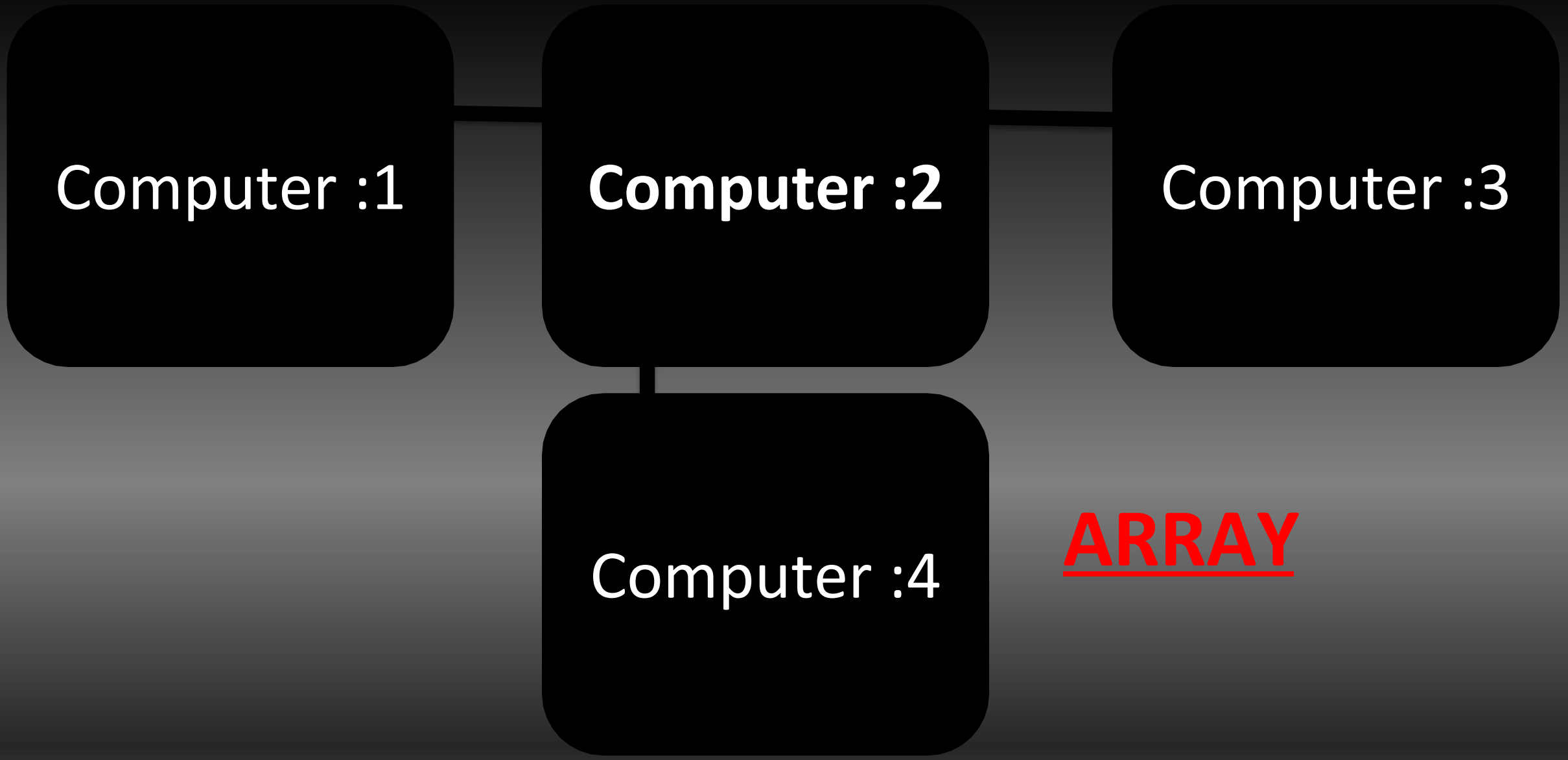
Cloud Computing

Options for Storage

In addition to the tasks performed by an operating system, Linux has the following characteristics:

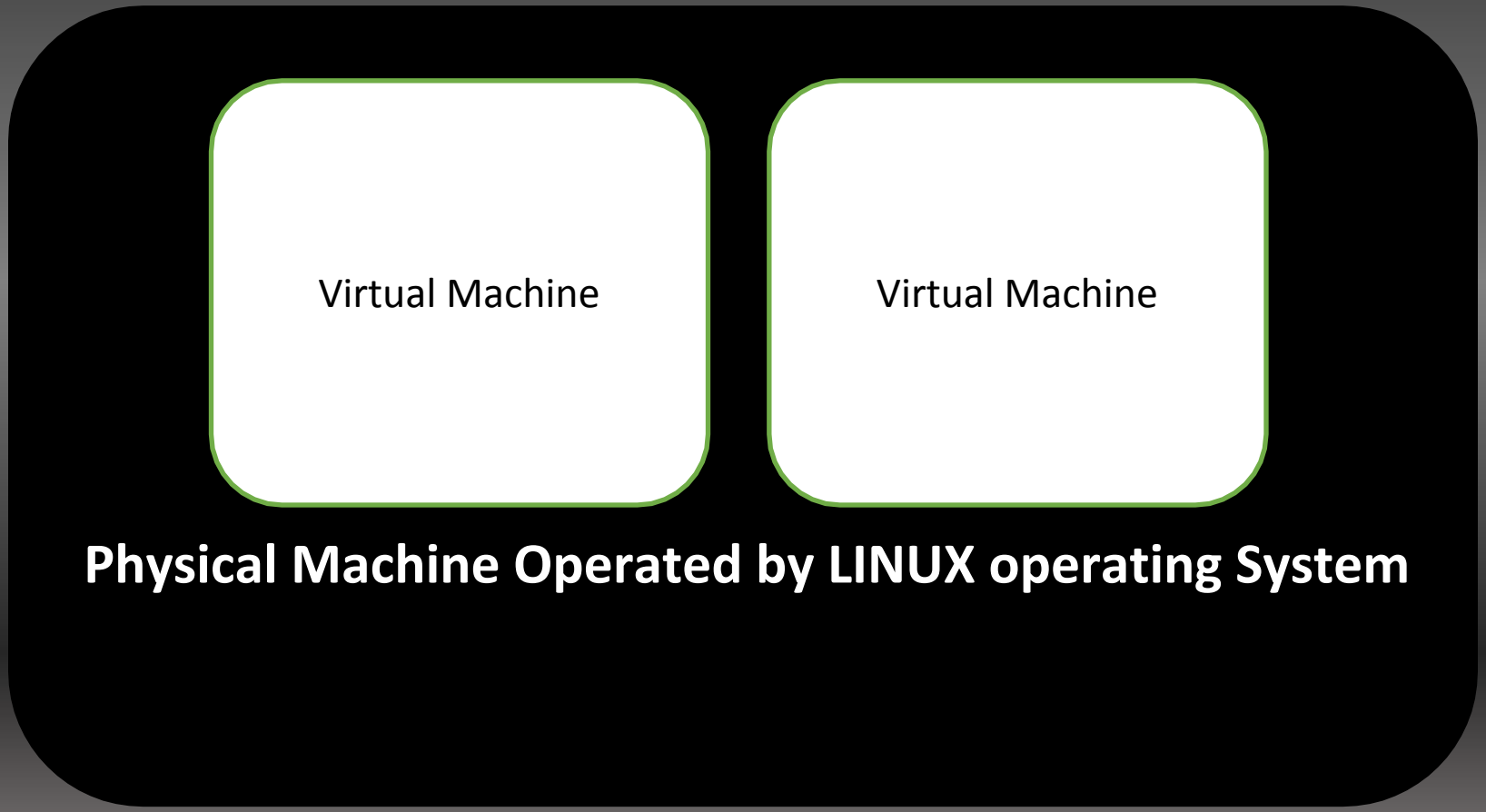
Supports clustering – Multiple Linux systems can be configured to appear as one system from the outside. Service can be configured among clusters and still offer a seamless user experience.

Runs virtualization – Virtualization allows one computer to appear as several computers to users.

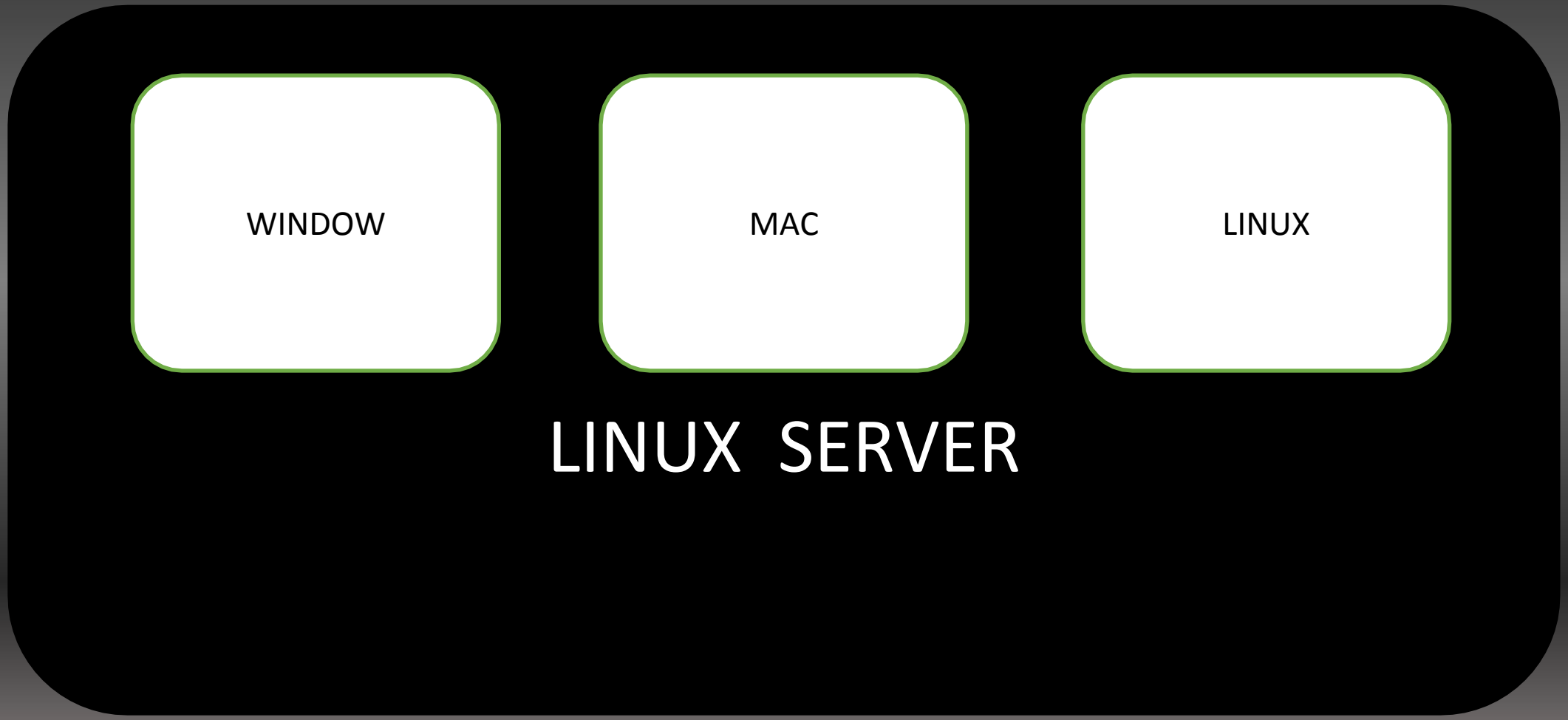


Supports clustering

Runs virtualization



Virtualization Host



Linux can be configured as a virtualization host

– where you could run other OS such as Windows, Mac OS, or other Linux systems. All the virtualized systems appear as separate systems to the outside world.

Cloud Computing

– Linux can handle complex, large-scale virtualization needs – including virtual networks, networked storage, and virtual guests.

Options for Storage

– Data need not always be stored in your computer's hard disk. Linux offers different local and networked storage options such as Fiber Channel and iSCSI.

History of Linux

Linus Benedict Torvalds, a student from Finland, created Linux in 1991 using C and assembly language. Linux was developed as a free, open source, open license operating system, which enables developers around the world to study and modify the OS. Since the **release of the initial source code** in 1991, it has grown now to more than 18 million lines of code under GNU General Public License. Initially, Torvalds **named the operating system** he invented **as Freax**, a combination of the words **“free”, “freak”, and “x”.** He uploaded his files to an FTP server where his colleague, **Ari Lemmke**, was the FTP server administrator. **Lemmke thought Freax** was not a good sounding name so he renamed the folder to **Linux** without telling Torvalds. Later on**, Torvalds approved** the name change.

In 1992, Linux **was licensed under** GNU GPL

The **first Linux distributions** (**also called distro**) were created – Boot-root

MCC Interim Linux, Softlanding Linux System (SLS), and Yggdrasil Linux where one of the first few released in the same year.

Several distributions have been created over time:

Slackware - the **oldest existing distro**,

Debian - the **largest community distribution**, and

commercial distributions Red Hat and SUSE.

In recent years, Linux has seen more developments.

The server market **revenue of Linux** has already exceeded that of Unix.

The Linux-based mobile OS Android has gained **75% of the market** share.

In 2015, Linux **Kernel Version 4.0** was released.

Through collaborative works, Linux is now one of the most powerful operating systems.

Data shows that **98.8% of the world's fastest systems** use the Linux kernel.

Isn't it comforting to know that you are using the same OS as these supercomputers?

~~Linux as Compared to other Operating Systems~~

Now, let's get to the important question:

~~Is Linux better than the others?~~

Let's compare Linux with other well-known operating systems. Cost If you **~~obtained Windows legally~~**, you would have paid more than $100 or even more for the Pro version.

~~Linux~~, on the other hand, is **~~free of charge~~**.

For **~~Linux commercial distributions~~**, companies sell services such as support and documentation, but the OS itself comes for free.

~~Viruses~~ Linux hardly gets any viruses. Since most PCs run on Windows, attackers target Windows OS. The **~~open-source policy~~** of Linux is key.

~~With many developers~~ working on Linux, there are more eyes focused on seeing security flaws. There's plenty of help too, if ever a real Linux virus comes around. Proprietary operating systems are tied with the number of employed engineers and resources they have.

With Linux, any developer from around the world can simply download the source code and help out with finding and solving flaws

Linux is used in servers and supercomputers.

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

The time when a **proper restart** is performed is during kernel upgrades

Even **upgrades for software** running on a Linux server only perform a **service restart** and not a **node restart**.

Compare that to the number of times you've experienced **losing data because** the program crashed or the time when you plugged in a device and you saw the "Blue Screen of Death" in Windows.

I am not saying that you will **not turn off your computer** when running on Linux, but the option is there, if you wish to do so.

Installation When you **install Linux** (any of its flavors – Ubuntu, Fedora, etc.), you get all the stuff that you need :text editor, spreadsheet, presentation program, photo editor, web browser, movie player, PDF reader, and the like. As compared to **Windows** and other OS, once you have the OS set-up, you will have to install all the other software that you need one-by-one.

This also holds true for **hardware drivers** too. In **Windows**, you would have to install the drivers first. Drivers usually come in CDs when you purchase hardware. Now, think about the time when you would need to install the driver and you couldn't find the CD for it? You would have to go to the manufacturer's website to download the specific driver. In **Linux**, drivers are included in the Linux Kernel installation – you get to save time and it's a lot more convenient. **Support Linux** has a large community online where new users can get information, read FAQs, and ask questions if there are programs or features that you think are not working right. The **great thing about open-source** is that with plenty of people involved in the OS, there are an unlimited number of resources that you can **use** and **learn** from. All these come for free too!

These are some of the reasons why Linux is a better OS compared to others. However, do note that Linux uses open-source software, so if you are concerned about any of the items listed below, then you should **stick to Windows** or your current OS:

-You need to work using **proprietary software**. If you absolutel cannot find an open source program that will match the proprietary software that you need, keep your current OS.

- You are a **serious gamer**. The majority of games are only made compatible with Windows

. - **Hardware** is not yet supported in Linux. Very new hardware like those released only in the few months prior might not yet be supported in Linux. Hardware vendors usually **release drivers** only for Windows and Mac since these are the most popular. Most individuals with Linux installed do away with these issues by what is called **dual-booting.** This is the option of installing both Windows and Linux on your device so you can choose either of the OS depending on your needs.

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Chapter Two: Understanding Linux

Linux Architecture

LINUX architecture can be divided into two spaces. The User Space and the Kernel Space.

User Space – This is where the 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 the available memory.

Transition

A **transition from user space** to **kernel space** is the entry into a system call, and a **transition from kernel space** to **user space** is the return **from** a system call.

Kernel Space – All Kernel services are processed here. The Kernel space is further divided into 3.

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.

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

Architecture-Dependent Kernel Code – This is the layer for platform-specific codes.

Linux Distributions

Each Linux distribution consists of a Linux kernel plus utilities and configuration files. Most Linux distributions can be downloaded from their websites. Let’s take a look at how several of the popular Linux distributions, or flavors, differ from each other based on the following criteria:

Availability

As previously mentioned, 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 open SUSE.

Package Format

Linux distributions come in packages. Packages are files grouped into one single file. RPM (Red-hat Package Manager) is the most commonly used.

- Release Cycle

- This is how often a distribution releases new software. The ones with **shorter release cycles** provide the latest software in the shortest possible length of time, while those distributions with **long release cycle** aim to offer the most stable environments possible. A distribution can have it done both ways. Take a look at Ubuntu who releases both long-term support (LTS) versions (longer cycle) and the latest software through a 6month cycle.

Desktop environment: Do your research and find out if the particular distribution that you're eyeing has a basic look and feel that you like, please check how customizable it is

Hardware Compatibility: Depending on the hardware that you are using, some drivers might not be available yet by the time you install your distro. Check from online resources first to know which ones can be supported out-of-the-box.

Community Support: Find the one with a large online community. The bigger the community is, the easier it will be to find documentation and get support.

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Chapter Three: Linux Installation

CHAPTER :04

LINUX

Chapter Four: Your First Linux Experience

In this Lecture in the beginning the user interface of the Ubuntu is shown and discussed how it id loaded on the computer

Now the command section of Linux comers

uptime

19:26 up 29 days, 1:39, 2 users, load averages: 1.32 1.36 1.34

uptime is the command that shows the duration that the computer has been up. In this case, the computer has been up for the last 29 days, or almost 1 month.

uname –srv

Linux 3.9.31.5-127.fc12.i686 #1 SMP Mon Nov 18 18:21:25 EST 2015

uname is the command to show the operating system name. –s (print the operating system name), -r (print the operating system release), and –v (print the operating system version) are options that you can use for the uname command. In the particular example, we want to use all three so we put n – srv to simplify. If we want to display the results as if we used all the options, we can use the -a option.

man uname

The man command is extremely useful, especially for beginners. This displays all the options that you can use. Try to use the command for every Linux command that you encounter.

command su –

To switch to root while in the shell, enter the command su - and then input your root password. Changing to root password while in the shell environment will allow you to run tasks that only administrators and superusers can do.

Linux Desktops

There are two **commonly used GUIs** that come with Linux distributions:

1.GNOME

2.KDE

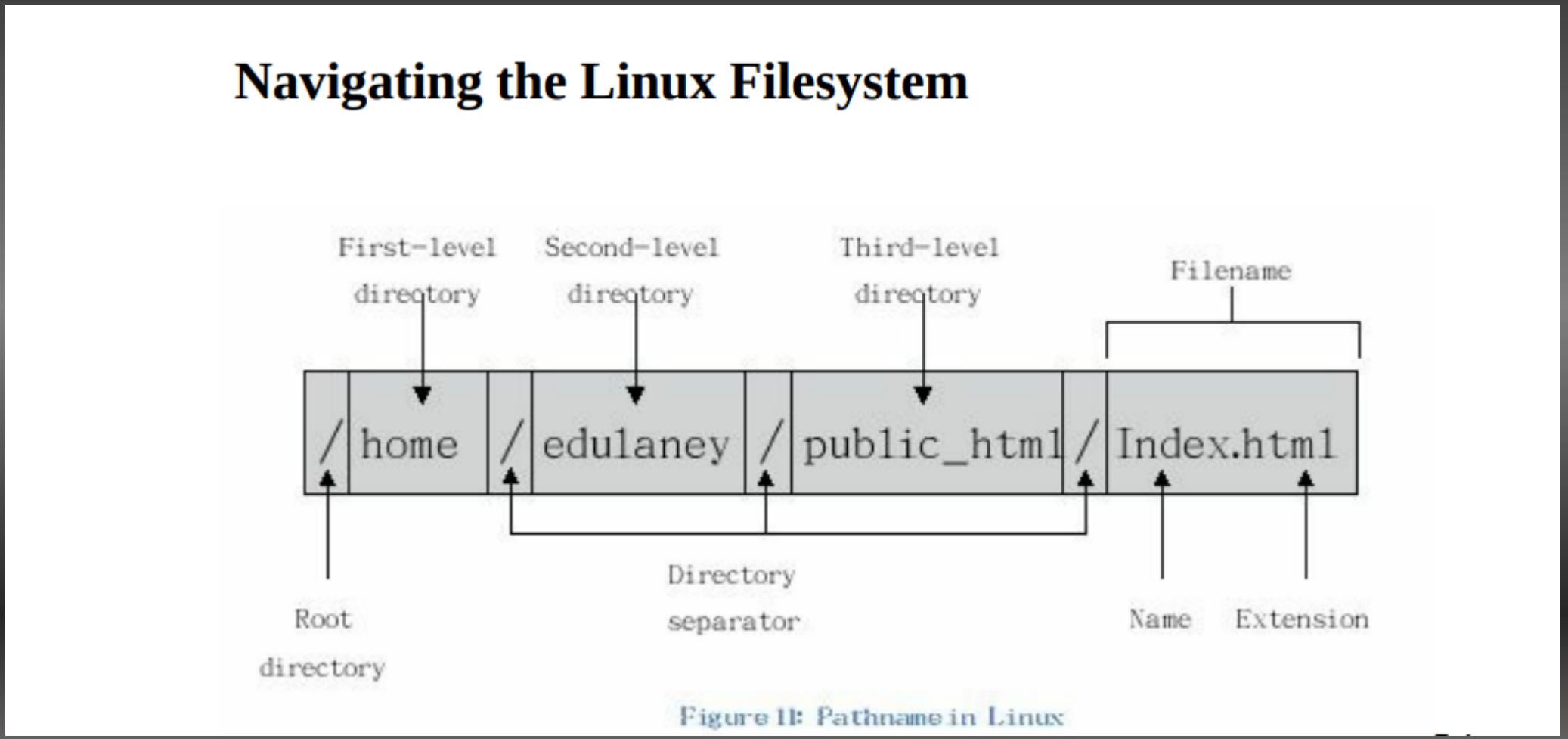
Both GUIs also run on Unix, and while there are **other GUIs** that can be installed on Linux, these two remain as the most popular in use

Criteria	GNOME	KDE
Availability	Free	Free
Minimum System Requirements	700 MHz CPU, 768 MB RAM	1 Ghz CPU, 615 MB RAM
Development Priorities	Focuses on freedom, accessibility, and developer-friendliness	Provides an aesthetically pleasing website with great configurability
Customization Experience	The interface is simple to use and great for first-time Linux users, advanced users may find its customization settings as limiting	Allow for versatile configuration that creates great looking desktop, but the user has to learn to navigate the options. Customization makes it more resource-intensive

Default appearance (Note that both offers customization options)	Default setting: Toolbar at the top and a dock that pops out featuring application icons	Default setting: toolbar at the bottom and a main menu.
Universal Search	Uses text-based search functionality	Uses text-based and menu-based navigation
Resource Usage and User Experience	Less resource-intensive than KDE	Good for users who came from Windows OS

Those are only some of the criteria on which the **two GUIs** differ. However, I encourage you to try both desktops so you can evaluate which one suits you best.

Navigating the Linux File system



Linux organizes files using a hierarchical system. **Files are stored** in directories and these directories can also contain **other directories**. When you **compare the Linux file system** to Windows, you will find that there are no drive letters in Linux. All files are stored in a single **root directory** noted as / regardless of where the data is physically stored (hard drive, external drive, or CR-ROM).

To **find a file** in Linux, you also need the information about the directory hierarchy known as the **pathname**. The **pathname is composed** of a top-level directory, a directory hierarchy, and the filename with the file extension. All are separated by a **forward slash** (/).

Top-Level Directory	Files that the directory contains
/	Single root directory – file system base
/bin	Executable files such as Linux commands cat,cp,ls
/boot	Files that the boot loaders access during start-up – including the Linux kernel
/dev	Files for the different hardware/devices
/etc.	Initialization scripts and system config files
/home	User directories
/lib	Library files which includes driver modules
/lost+found	For lost files
/media	Mounting removal media filesystems
/mnt	Temporary directory for mounted filesystems
/opt	For storing application packages
/proc	Information on Linux processes
/root	Root user home directory
/sbin	Executable files for commands used by root user
/srv	For services hosted by the system (e.g. FTP, web)
/tmp	Temporary directory – deleted during system reboot
/usr	Contains subdirectories for program files
/var	Log files

To **navigate in the directories** on Linux, you can either use the **GUI** to find a certain file by going through the folders, using the **universal text-based** search function, or by using the **command line**. You can use the following useful commands in your terminal to navigate and work in the file system:

Commands	What it does
ls	List down all the contents of a director
cd /bin/	Changes directory and goes to bin dir
cd ~	the tilde (~) sign signifies the user's home dir – change dir to home directory
cd.	Means to change directory one level up. For example, you are currently /home/edulaney/, using the command will take you to /home/
mkdir	A command used to create directories
pwd	Short for present working directory. This command will display the directory where you are currently in.

Here I'll give out more commands that you can use **to manage your files** using the command line. Try this out on your terminal.

Commands	What it does
cat */home/edulaney/files/file1.txt*	Command to print all the contents of file1.txt in the screen
cp */home/ /tmp/*	Copy contents of /home/ to /tmp
mv */home/edulaney/files/file1.txt /tmp/*	Move the file file1.txt to the /tmp/ directory. You can also use this command to move the entire directory to another directory
rm *file1.txt*	Delete the file file1.txt. Take extra precaution in using the rm command, especially when you are logged in as root.

find / *-name “linux*”*	The find command is a powerful tool that you can use when searching using the command line. The command here will search for any file or directory with a name that starts with *linux*

Explore more of the commands by using **the man command**.

Shutting Down your PC

Turning off your Linux PC is similar to how you do it in other operating systems. Click on the **Main Menu**, select Shutdown, and click on OK. This will initiate a system shutdown. **Some distributions** will not allow you to shut down the system without **logging out** first. To do this, click **on Log Out** and then **select Shutdown** in the login page.

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Chapter Five: Post-Installation Activities

Managing Hardware and Peripherals

CPU The operating system keeps programs and hardware working together smoothly. The **capabilities of Linux** are affected by the limitations of your system's hardware (for example, disk space and memory) so it is important to know more **details about your computer's hardware**. Let's start with the **CPU**. The **CPU performs** all the computing and its speed (in MHz) signifies how fast your computer can handle transactions. Your **CPU specs** will also tell you about the CPU family (most common are x86 and x86-64) and the number of cores that it has. To know more about your CPU, use the **Linux commands** below:

Commands	What it does
uname -a	This command displays information about the machine, the processor architecture, and the operating system details. Using the *-p* option will show you the machine processor name. An example is *i386* or *x86_64 AMD Phenom (tm) II X3 700e Processor*

lscpu	This command returns more information about the system such as the number of CPUs and the CPU speed. Sample output:

Architecture:	i686
CPU op-mode(s):	32-bit
Byte Order:	Little Endian
CPU(s):	4
On-line CPU(s) list:	0,1,2,3
Thread(s) per core:	4
Core(s) per socket:	2
Socket(s):	2
Vendor ID:	Intel
CPU falmity:	15
Model:	3
Stepping:	4
CPU MHz:	2800
BogoMIPS	5600.27

cat /proc/cpuinfo	This is a file that contains more information than the one displayed using the *lscpu* command. Snippet from a */proc/cpuinfo* file: processor: 1 vendor_id: Intel cpu family: 11 model : 2
	model name: Intel(R) Pentium(R) 4 CPU 2.86GHz stepping: 4 microcode: 0xe

Hard Disk Next, let's discuss your computer's hard disk. In the installation chapter, I spoke about the importance of making sure that your computer has enough disk space for Linux and the possible need for partitioning your hard disk if you want to **run two operating systems** at the same time. If you plan on adding a **new disk** in the future, learning how to partition will come in handy. Linux supports the following **partitioning tools**:

Fdisk Tools –

This is composed of the text-based tools: fdisk, cfdisk, and sfdisk. These tools are great for use in partitioning. However, it could be a bit overwhelming for beginners who are not yet familiar with partitioning.

libparted Tools –

The libparted library presents both GUI and textbased partitioning tools. One particular example is GParted .The interface makes it easier to use for beginners.

GPT fdisk Tools –

These are tools created for GPT (Globally Unique Identifier Partition Table) disks using the fdisk tools.

some commands

Commands	What it does
df -h	This command displays the disk space usage in all of the mounted devices. The *-h* option presents the results in a human-readable output, using G for gigabytes or M for megabytes sizes.
du */home/edulaney/files/*	This command displays all the files inside the specified directory and their corresponding file sizes. You can also specify a filename.
du -s */home/edulaney/files/*	The *–s* option provides the total file size of the specified directory

Removable Storage

Using storage such as **USB flash drives** and external hard disks in Linux works similarly when using Windows or Mac OS. **Plug** the device in and Linux will **detect** the device. Aside from accessing the drive via the ~~desktop GUI~~, you can also navigate to the /media directory and find the mounted subdirectory. After you use the removable media, unmount the disk before removing it to avoid any disk issues. You can **generally** right-click on the Device Name and click on any of the options such as Unmount, Eject Volume, or Safely Remove.


Home
Home
Open
Open in New Tab
Open in New Window
Add Bookmark
Remove
Rename...
Mount
Eject
Format...
fxdf
Other Locations
Desktop
Documents
Downloads
Music
Pictures
Public
Templates
Videos

USB Devices

You can connect other devices such as human-interface devices (keyboard, mouse), cameras, mobile phones, scanners and printers to your Linux computer and expect that these work in a **plug-and-play manner**. For printers, you will also need to set up **the printer configuration** after Linux detects the device

Installing Additional Software

Linux-compatible softwares come in **.rpm** for **RPM** (Fedore, SUSE) or .deb for Debian (Debian, Ubuntu, Xandros) packages. Even if the type of packages varies, both RPM and Debian packages can be **installed in any type of Linux distribution**. Popularly used distributions **provide a GUI** for installing additional applications. In this section, I will discuss the ways of installing software in Ubuntu and Fedora.

Shutter is a feature-rich screenshot program for **Linux** based operating systems such as Ubuntu

Shutteris the package name. Use the package name and run the **apt-get install** command again.

Aside from installing packages via the command line, you can also use the **Software & Updates Tool**. The GUI provides a simple and easy way to update your Ubuntu software and download packages.

Installing Applications in Fedora

Fedora uses **RPM packages**. If you are using a **GNOME desktop**, you can simply use the **Add or Remove Software** tool (similar to Windows) to install new software. Click on ⇨ **System Administration** then on **Add/Remove Software** to access the menu. The **utility** will then display the **Package Manager** box showing the list of all packages. **Select** the corresponding check box and click on **Apply or Update** (if you are updating the packages). Clicking on the **Apply button** will install (or uninstall) the specific packages.

~~CHAPTER :06~~

LINUX

Chapter Six: Linux Applications

CHAPTER :07

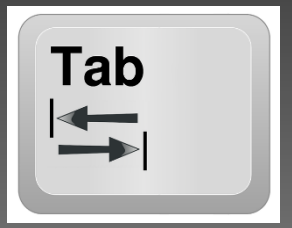
LINUX

Chapter Seven: Using the Linux Command Line

Information about any command

man

Automatically complete the word



Arrow keys to view previous commands.

Shift + Page up / Shift + Page Down for moving in terminal

Keys to Use	What it does
Arrow Up/Down	Display the previous commands from the more recent going to the oldest entered
Arrow Right/Left	Moves the cursor one character to the right/left
CTRL key + A	Transfers cursor to the beginning of the line
CTRL key + E	Transfers cursor to the end of the line
Delete key	The character under the cursor is deleted
Backspace	The character to the left of the cursor is removed
CTRL key + R	Search for a particular command from the command history. After you use CTRL key + R, type the first few letters of the command that you want to use

Essential Linux Commands

Command	What it Does
Help Commands	
Info	Shows online information about a command
Man	Shows details of a command
whatis	Shows a short description of a specific keyword
Type	Shows the location of a command file
Alias	Assign a command alias – especially useful for long commands
unalias	Remove command alias

Managing Files and Directories	
Cd	Change directory
Pwd	Displays the current directory
Ln	Create links to files and directories
touch	To trigger a file stamp update for a file
Finding Files	
Find	Search for a file based on the name
whereis	Search for executable files
which	Search for files in the directories part of the PATH variable

Processing Files	
Dd	Copy lines of data
Diff	Display the results of comparing two files
More	Show a text file one page at a time – display can only go forward
Less	Show a text file one page at a time – display can only go forward and backwards
Wc	Display the count of the number of characters, words, and lines in a file
Cat	Show a text file in one output
Cut	Get sections of text in a file
Grep	Display results of finding expressions in a file
Sed	Perform editing commands, then copy to a standard output
Split	Specify a size to break a file into
Sort	Arrange the lines in a file
Uniq	Keep unique lines in a file and delete duplicates

Compressing a File	
Compress	Use to compress a file
Uncompress	If a file was compressed with a *compress* command, use this to decompress
Gunzip	Use GNU Zip to decompress files
Gzip	Compress files with GNU Zip
Tar	Archive files with one or more directories

Date and Time	
Cal	Show the calendar for the specified month or year
Date	Show/Set the current date and time

Managing Processes	
Bg	Run a program or a process in the background
Free	Check for the free memory
Kill	Stop a process
Nice	Run a program with a low priority
Ps	Show current running processes
Top	Show list of CPU and memory utilization of processes
Reboot	Restart the computer
Shutdown	Turn off computer

CHAPTER :08

LINUX

Chapter Eight: Basic Administration and Security

Your system is now **up and running**. The next thing you should think about is **securing it**. System administrators consider **two aspects of security**– host security and network security. If **multiple users** are using a computer, user directories and files should be secured and should not be accessed by any unauthorized person. Since your computer is **connected to the internet**, you have to protect it from access over the internet too. Let's discuss these in the next sections.

Basic System Administration

Similar to popular operating systems like Windows and Mac OS, Linux distributions also come with the GUI tools that can be used for performing administrative tasks. Adding and removing user accounts, performing software upgrades, managing hardware, installing new applications, maintaining the system's performance, and setting up and monitoring security are some of the activities that an administrator executes.

The administrative tasks mentioned above can be performed using the YaST Toolwhen using SUSE. These functionalities are also available in Ubuntu and Fedora distributions.

Monitoring System Performance

To effectively **monitor your computer's performance**, the following aspects should be checked:

CPU and Memory Usage

To **see the processes** that are consuming the most CPU resources and memory allocation, use the **top command**. This **command displays** the CPU load and used memory averages, the process IDs, the percentage of CPU used by the process, and the percentage of the memory used. The **top command results** are **refreshed** every 5 seconds .To **exit the top command** output display, press Q. To get a snapshot of the system status at the time the command was issued, **use uptime** . This **command prints** the load average for the last one, five, and fifteen minutes.

Hard disk space

Monitor the hard disk space to ensure that there is enough space for the system to perform tasks such as logging and backups.Use the df - h command to validate the disk space.

Filesystem	Size	Used	Avail	Use %	Mounted on
/dev/hda1	7.1G	3.9G	2.9G	59%	/

Here’s a sample output: In the monitoring, set specific thresholds at which you, as the administrator will take an action. For example, once the used disk space percentage reaches a certain threshold, like 80%, do a file cleanup to free up disk space. If the CPU reaches the allowed threshold, investigate which processes are using up the resources and do the necessary action (e.g. wait for a process to finish, kill a process, etc.). This is similar to killing processes in windows using the Task Manager.

User Management

Linux automatically creates multiple user accounts upon installation, even if you are the only one using your computer. The system uses these accounts for running programs. Different accounts safeguard the system, including files and directories, from unauthorized access. Users can be assigned to groups for easier facilitation.

To add, modify, or delete a user or group account, you can either usethe GUI or do it via the command line. As a beginner, it would be good for you to try out both so you can see which one is the best method for you.

Managing Users and Groups Via GUI

Open YaST if you are using SUSE or the equivalent Settings Menu in your distribution. Click on the Security and Users or any similar User Management category.

Click on the Add user button and supply the necessary information such as the user's full name, preferred username, and password. You can explore and configure additional information such as login attempt limit, password settings, and user groups. Once done, click on the OK button to continue creating the user account.

You can also modify or delete an account using the GUI. Perform the necessary account modifications and click on the OK button to proceed with the changes.

To create, modify, or delete a group, select Groups instead of users. The photo below shows the YaST screen for adding a new group. Provide the necessary information and click on the OK button to finish creating the group

Managing Users and Groups via CLI

Adding a new user via CLI consist only of a few lines of command. First, login as root by using the command su –Use the command below to create a new account:

Next, set the password. Once you issue the command below, you will be prompted twice to enter and confirm the password.

To modify an account, use the usermod command, paired with the option that pertains to the information that you want to modify. To delete the user account, use the /usr/sbin/userdel username command.

To add a user group, you need to use the command group add group name For example, let’s create a group named office. To create this group, enter the command below

Since Kevin is a colleague at work, we will add him to the office group. To do this, use the command below: To delete the group, use the command groupdel office

Again, I encourage you to use the man command to know more about the options that can be used for a specific command.

File Ownership

A user and group account owns a Linux file or directory. To see the owner of a particular file, use the command

Here is a sample output of the command. Choose a filename and try it on your terminal too!

The first set of letters stands for the permission settings (execute, read, write). The second part with the value of kjones office signifies the user account and the group account that owns the file.

In case you want to change the ownership of the file from kjones to another user rbentley , login as root and use the command below:

Also, to change the group owner of the file, input the command:

Basic Security in Linux

Setting-up Passwords

When creating an account, make it a point as an administrator to create strong passwords that are difficult to crack. Remember to stay away from passwords formed from personal information (such as birthdays, street address, or names), single words that can be found in the dictionary, and simple combinations of alphanumeric numbers.

Use a password that contains mixed case (upper and lower- case letters), has numbers or punctuations, or is written in reverse order. Also implement other preventive mechanisms such as prompting the user to change his password every X number of days and to lock an account after Y number of login attempts.

Files Protection

To protect files from unauthorized access (viewing and modifying), revisit your file permissions setting. In the preceding section, we talked about assigning the user and group owner for a file. Next, we need to specify the correct file permissions for the owner, the group, and global (all other users). Let’s go back to the result of an ls command:

The first set of letters (in green) signifies the file permissions for the user. The next set (in blue) is for the group, while the section in orange stands for the global permission

r – permitted to read the file contents
w – permitted to write on the file
x – permitted to execute (if the file contains a bash script)

This means that kjones has read and write permissions to the file. This is the same permission as the office group account. All other users (global) will only be allowed to read the file.

To change permissions, use the octal representation of the permission and specify the value for the 3 levels (user, group, and global).

Permission	Representation
rwx	7
rw-	6
r--	4
r-x	5
--x	1

Let’s now try to remove the write access from the group.

When you list the details for file1.txt again, the write access for the group should be already removed.

There are several ways to secure your system such as setting up firewalls, securing internet services, encrypting files, and using digital certificates. For the purposes of this book (Linux for Beginners), I only discussed the basic and initial security practices.

CHAPTER :09

LINUX

Chapter Nine: Introduction to Scripting

Choosing A Text Editor

Shell scripts are text-based files. To start your scripting journey, choose a text editor that works best for you. Linux distributions come with preinstalled text editors, but the most commonly used ones are listed below:

vi – Usually installed by default. Preferred by administrators because it is a powerful editor that is small in size and flexible.
emacs – contains a lot of features but is not beginner-friendly
pico – simplified version of emacs (without the features)
nano – a clone of pico but comes with features

Download the packages for these editors and experience using it yourself. I personally use vi because of its ease in use, simplicity, and my overall comfort and familiarity with it.

Vi uses keys for commands. Here are some examples:

vi Command	What it does
O	Type this in command mode to insert a new line and enter text
I	Type I to insert succeeding character to the left side of the cursor
U	Undo changes
ESC	To quit insert mode
:wq!	To save your changes and quit

Simple Scripting

A script is a program that can be interpreted by a shell or a compiled program. We call them shell scripts in Linux because most scripts are run in bash or in any other shell (ksh, csh, bash).

Scripts are useful in automating and simplifying administrative tasks, log monitoring of the system, and data processing. To begin scripting, open a text file with vi or a text editor of your choice.

The first line in the file indicates which shell should be used to interpret the script.

This indicates that the bourne shell should be used to interpret the script.

Let’s make a simple script. Enter the following lines of script. Save the file as simplescript.sh. Ensure that the file permission for the user is set to 744 so you can run the script as we have learned in chapter 8.

Open a terminal and create a script using your vi editor

Type i to enter insert mode, start entering text. Paste the script below.

Once done, press on ESC and save the file using the command below.

Change the file permission:

Run the script along with 3 arguments:

The output should look like this:

```
My name is: Steve
I' m using Linux distro: Fedora
```

Here’s an example of how you can use it in maintaining your computer’s performance. If you have already used 80% of your disk space, it might be good to check which files are the biggest in your computer.

Write a new script with the command below:

This shell script will generate a new file called fileCleanup containing a list of old and big files. As an administrator, the next step is to contact the file owners to give them a notice before deleting these files.

As you might have observed, you can combine different Linux commands with variables, conditional expressions, loops and functions to create your scripts.

At this point, I highly encourage you to proceed in learning advanced Linux where you will learn about more sophisticated and more powerful awk and sed utilities. These two are especially handy when dealing with data.

Commands	What it does
ls	List down all the contents of a directory
cd /bin/	Changes directory and goes to bin directory
cd ~	the tilde (~) sign signifies the user's home dir – change dir to home directory
cd ..	Means to change directory one level up
mkdir	A command used to create directories
pwd	Short for present working directory. This command will display the directory where you are currently in
cat <filename>	Command to print all the contents of provided filename on the screen

cp /home/ /tmp/	Copy contents of /home/ to /tmp
mv /directoryName/file1.txt /newDirectoryName/	Move the file file1.txt to the /newDirectoryName/ directory. You can also use this command to move the entire directory to another Directory
rm file1.txt	Delete the file file1.txt. Take extra precaution in using the rm command, especially when you are logged in as root
find / -name “linux*”	The find command is a powerful tool that you can use when searching using the command line. The command here will search for any file or directory with a name that starts with linux
uname -a	This command displays information about the machine, the processor architecture, and the operating system details.

lscpu	This command returns more information about the system such as the number of CPUs and the CPU speed
cat /proc/cpuinfo	This is a file that contains more information than the one displayed using the lscpu command
df -h	This command displays the disk space usage in all of the mounted devices. The -h option presents the results in a human readable output, using G for gigabytes or M for megabytes sizes
du ~/Downloads	This command displays all the files inside the specified directory and their corresponding file sizes. You can also specify a filename
du ~/Downloads -sh	The –s option provides the total file size of the specified directory and -h makes it human readable form

Keys to Use	Purpose	Example
info	Shows online information about a command	$ info uname
man	Shows details (manual) of a command	$ man uname
whatis	Shows a short description of a specific keyword	$ whatis uname
type	Shows the location of a command file	$ type uname
alias	Assign a command alias – especially useful for long	$ alias t=type $ t uname

	commands	$ alias
unalias	Remove command alias	$ unalias t
pwd	Displays the current directory	$ pwd
ln	Create links to files and directories	$ *ln -s [file] [soft-link-to-file]* $ *ln -s abc.txt newAbc.txt*
touch	To trigger a file stamp update for a file	$ touch abc.txt

find	Search for a file based on the name	`$ find [dir-path] -name [filename]` `$ find . -name ap.jpeg`
whereis	Search for executable files	`$ whereis uname`
which	Search for files in the directories part of the PATH variable	`$ which uname`

dd	Copy lines of data	$ dd conv=ucase
		Type Hello world **ctrl+d**
		$ echo “hello world > abc.txt
		$ dd if=abc.txt of=newabc.txt conv=ucase
		$ cat newabc.txt

diff	Display the results of comparing two files	$ echo “hello world > abc.txt
		$ echo “hello world > abc1.txt
		$ diff abc.txt abc1.txt -s
		$ echo “hello world123 > newabc.txt
		$ diff abc.txt newabc.txt -s

more	Show a text file one page at a time – display can only go	$ ls -R > abc.txt $ more abc.txt

	forward	$ ls -R | more
less	Show a text file one page at a time – display can only go forward and backwards	$ less abc.txt $ ls -R | less
wc	Display the count of the number of characters, words, and lines in a file	$ wc abc.txt

cut	Get sections of text in a file	$ cut -b 1 abc.txt
		$ cut -b 1-3 abc.txt
		$ cut -b 1,3 abc.txt

grep	Display results of finding expressions in a file	$ cat abc.txt | grep Desktop
		$ cat abc.txt | grep -i desktop
		$ grep -i "desktop" abc.txt

sed	Perform editing commands, then copy to a standard output	First occurance in every line will be changed
		$ sed 's/Desktop/Dashboard/' abc.txt
		2nd occurance in every line will be changed
		$ sed 's/Desktop/Dashboard/2' abc.txt
		All occurances will be changed
		$ sed 's/Desktop/Dashboard/g' abc.txt

split	Specify a size to break a file into	$ split abc.txt
		$ ls
		$ rm x*
		-l100 is 100 lines per file
		$ split -l100 abc.txt
		$ ls

sort	Arrange the lines in a file	$ sort abc.txt
uniq	Keep unique lines in a file and delete duplicates	$ echo “Karachi Karachi

		Lahore
		Islamabad
		Islamabad
		Lahore" > abc.txt
		$ cat abc.txt
		$ uniq abc.txt
		$ uniq abc.txt -c
		$ uniq abc.txt -d

tar	Archive files with one or more directories	Archive the file
		$ tar -cf archive.tar file1 file2
		Extract the files
		$ tar -xf archive.tar

cal	Show the calendar for the specified month or year	$ cal
		$ cal -3
		$ cal -m 5
		$ cal -y 2020

date	Show/Set the current date and time	$ date
		Sets the system date and time to given date
		$ date -s "11/20/2003 12:48:00"

bg	Run a program or a process in the background	$ bg %[PID]
free	Check for the free memory	$ free
kill	Stop a process	$ kill <PSID>
nice	Run a program with a low priority, niceness values range from -20 to 19, with the former being most favorable, while latter being least	$ nice -10 ls -R $ nice --10 ls -R
ps	Show current running	$ ps

	processes	
top	Show list of CPU and memory utilization of processes	$ top
reboot	Restart the computer	$ reboot
shutdown	Turn off computer	$ shutdown

Adding user from CLI need few steps/commands at CLI

First, login as root by using the command su

```
aamir@ap-linux:~$ su
Password:
root@ap-linux:/home/a
```

- Add user by using following command syntax

```
root@ap-linux:/home/aamir# /usr/sbin/useradd -c "Test User" test
```

- Once done with above command type passwd

```
root@ap-linux:/home/aamir# passwd
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
root@ap-linux:/home/aamir#
```

- To modify an account, use the usermod command
- To delete the user account, use the /usr/sbin/userdel command
- To add a user group, you need to use the command group add
- For example, let’s create a group named office. To create this group,

root@ap-linux:/home/aamir# groupadd office

- To add test user which we create recently to above created office group

root@ap-linux:/home/aamir# usermod -G office test

- To delete the group, use the command groupdel office

- A user and group account owns a Linux file or directory. To see the owner of a particular file

aamir@ap-linux:~$ ls -l <filename>

- To change the ownership of any file from one user to another user

aamir@ap-linux:~$ chown <newuser> <filename>

- To change the group owner of the file

aamir@ap-linux:~$ chgrp <newgroup> <filename>