

DATE: 28/8/25

# LINUX FUNDAMENTALS

## Birth - of Linux

1969

→ Birth of C and Unix OS

1970

- Growth of Unix because open-sources collaboration
- Commercial sales of Unix

1980s

→ Companies developing their own Unix - IBM (AIX)  
Mid to late 1980s.

→ Birth of free software movement → GNU Project

1990s

- Linus Torvalds Put the Linux kernel source code online
- Resulted in usage of Linux + GNU

## What is Linux?

- \* Linux is operating system (OS) - like windows or Mac OS
- \* But unlike the Linux is open-source, meaning it's free and its code is public available.
- \* Linux is used in servers, cloud computing, mobile (Android), embedded systems, and DevOps (Ansible) -

## Why Linux?

- \* Open source
- \* Community support
- \* Highly customizable
- \* Most servers run on Linux
- \* DevOps most of the tools implements on Linux only
- \* Automation
- \* Secure

## unix vs Linux

- \* Today Linux is in great demand, the Linux is in everywhere. It's dominating on our servers, desktop, smartphones and even used in some electrical devices like refrigerators.
  - \* Some people think unix and linux as synonyms but that's not true. Many operating systems were developed to be like unix of them got the popularity as linux.
  - \* Linux is the clone of unix.
  - \* It has several features similar to unix still have some key differences.
  - \* Before linux and windows, computer world was dominated by unix.

# Difference between Linux & Unix

## Simple Table

feature	Linux	Unix
Definition	open source, free, os and x86 arch	Proprietary os, owned by vendor
Examples	Ubuntu, Redhat, fedora	IBM AIX, HP-ux, Sun Solaris, IBM os
Users	Anyone - student, home user, developers	Mainly servers, workstations, enterprise
Cost	free or low cost	Paid & decided by vendor
GUI	Command-line + GUI (GNOME, KDE)	Started command line, later added GUI
Shell / Interface	Default is Bash Support many shells	Originally Bourne shell Supports others
file system	Support many (ext, xfs, btrfs, etc)	Support fewer
Code	Unix-like code, but different code	Original AT&T code
Security	Very secure - bo-hoo viruses only	Secure - 85-120 viruses

# Structure of Linux:

User Applications  
Vim, Docker, Apache, etc..

Shell  
Bash, Ssh, fish etc..

System Libraries  
glibc, libc, openssl, etc..

System Utilities  
ls, grep, systemctl, etc..

Linux Kernel  
Processes, Memory, I/O, Network

Hardware  
CPU, RAM, Disk, Network  
Peripherals

Part of the OS

## Linux Distributions:

Linux is open source. So the people  
of Linux & other contributions. They have  
developed Linux & they made it  
open source. What is open source so  
you can download the code & you  
can add to it remove certain feature to  
it.

\* That is where companies like Canonical  
saw the opportunity. They take copy  
of open-source code. They add some  
more features. They add more wrappers  
on top of Linux OS & provide that OS  
as Ubuntu Linux distribution.

\* There is another company called  
Redhat which also does the same  
thing & provides that OS Redhat

\* Similarly, Debian, Alpine, Fedora  
all of them do the same thing.

## Here are some popular Linux distributions:

Ubuntu: One of the most beginner-friendly distros, widely used for personal & servers use. It has great community support.

CentOS [Discontinued, replaced by AlmaLinux / Rocky Linux]: Previously a popular choice for servers on Red Hat Enterprise.

Debian: ② very stable and reliable distro often used as a base for others like Ubuntu.

Fedora: ③ cutting-edge distro that introduces new features before they reach RHEL.

Arch Linux: ④ light weight Linux - release distro for advanced users.

Kali Linux: Designed for cyber security & penetration testing.

Alpine Linux: ⑤ light weight - security focused distro often used in containers.

What is Package manager?

A Package Manager is tool automated the process of unstalling, updating, configuring and removing software in a linux system.

Popular Package managers in linux

Linux Distro	Package manager	Command example
Ubuntu, Debian	APT (Advanced Package Tool)	Sudo apt update
Fedora, RHEL, CentOS	dnf or yum for older version	Sudo dnf install Nginx
Arch Linux	Pacman	Sudo Pacman -S Nginx
OpenSUSE	ZYPPER	Sudo zypper install Nginx

# Folder Structure

understanding the folder structure.

By default when you set up a linux machine there are a lot of folders that are available on that linux machine.

Let's try understand what is the significance of the folder

/sbin → /usr/bin

→ You will see that there are lot of system binaries in this particular folder.

What are these system binaries?

Basically the commands or the binary file that you can use to manage your system as an administrator and who

- \* lib → usr/lib
- \* It is library folder
- \* You will see there are different kinds of libraries that are available here and used by your linux kernel
- \* So as a user you don't use these libraries these are used by linux kernel for making system calls with the hardware or basically to execute it action

boot

- \* boot is basically for booting your linux machine that is starting or restarting your linux machine.

bin → usr/bin

So there is slight difference

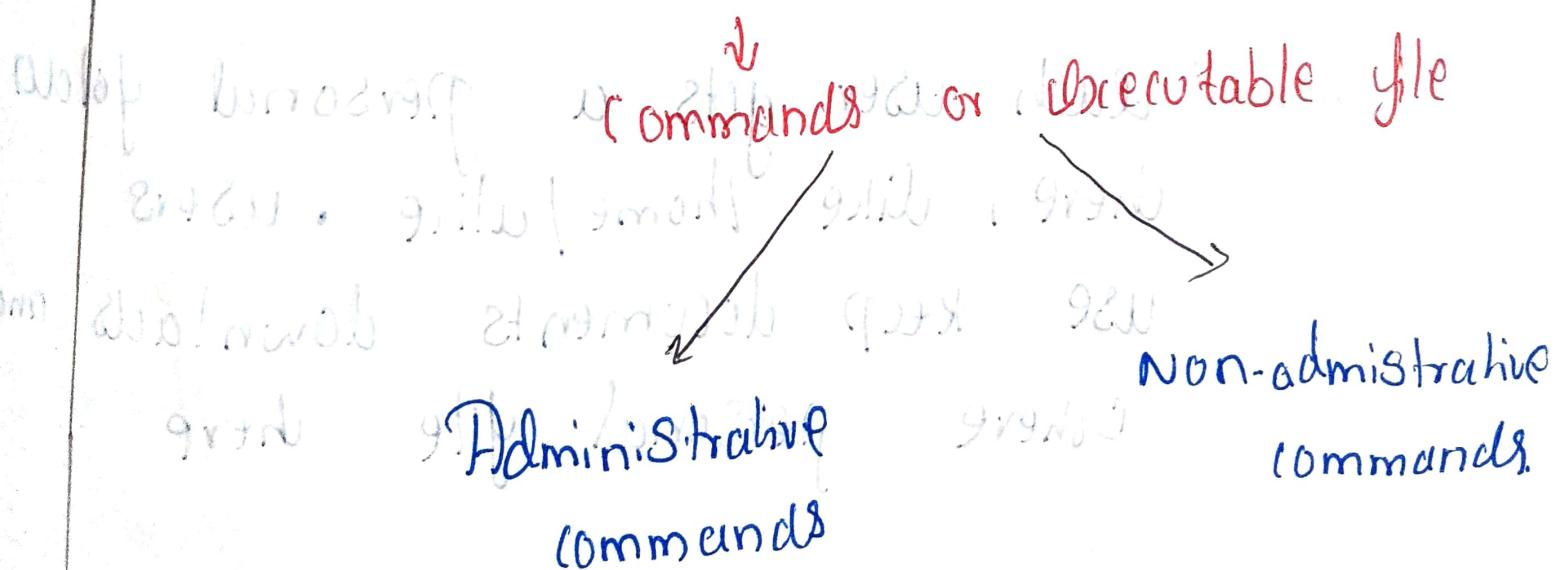
b/w 8bin & bin

What is difference b/w skin

\* Sbin stands for system binaries whereas bin stands for user binaries

- \* So if i go to /bin ~~you will~~ So you will find command there as well but these are not administrative commands ~~or these~~ are not the system command  
**Example** - date ~~it~~ The command it will just print the date & time on this linux machine

Now, this doesn't have to be administrative action right?



## Administrative commands

If you grant access to

these command to a

regular user he might

treat dummy users

so if a user creates

file in bin directory

he can't do anything

with it

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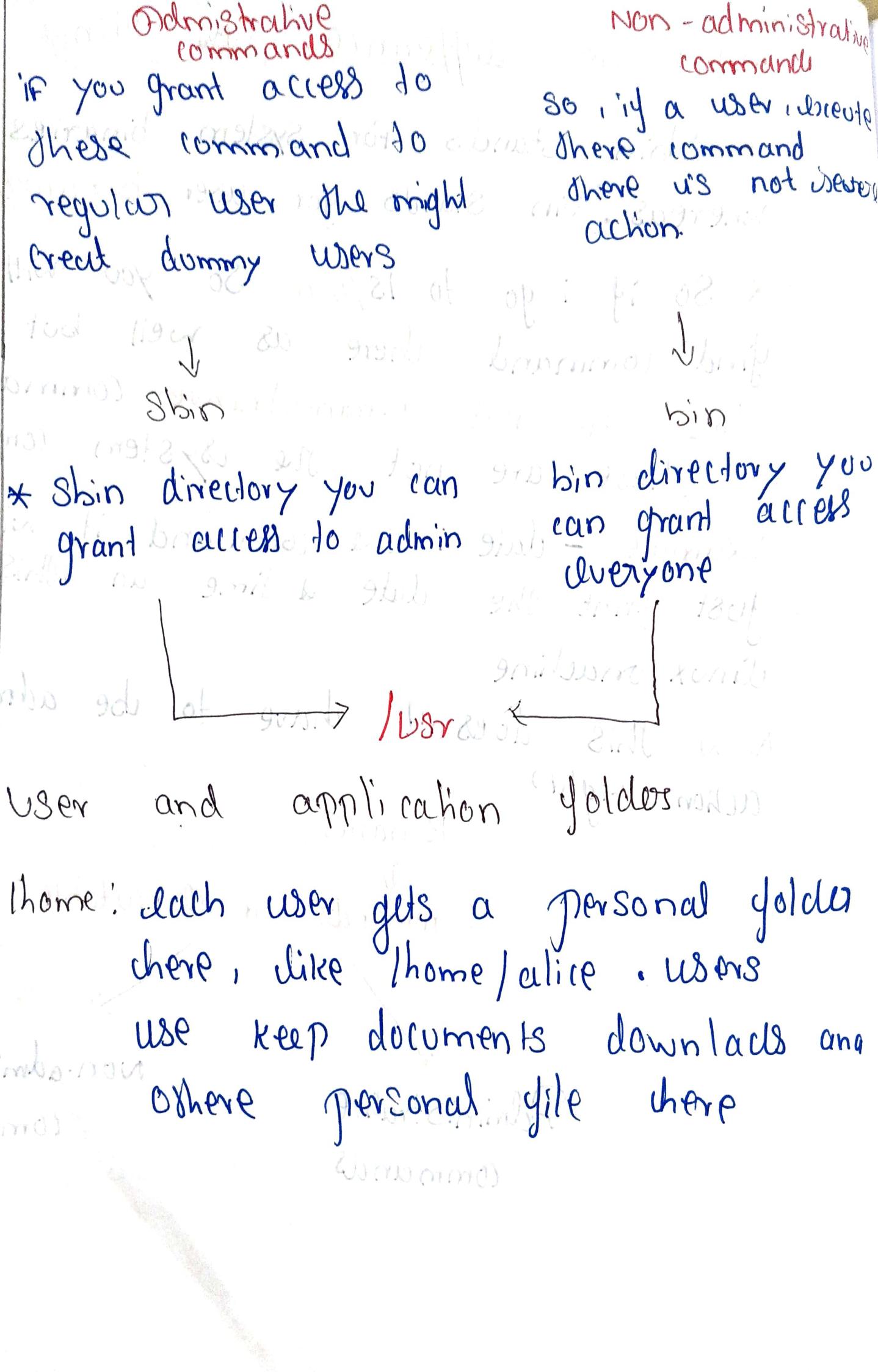
## Non-administrative commands

so if a user creates

file in bin directory

there's not user

action.



so if a user creates

file in bin directory

there's not user

action.

- /root : The "home" folder for the special root user (admin / superuser).
- /opt : Used for third-party software not uninstalled by default (example: custom software tools)
- /var : Stores data for services (like web server running on the machine)

## Device and system folders

- /dev : Contains files that represent devices (hard disk, USB drives, terminals, etc)
- /proc : A virtual folder that gives info about process and system status : updates in real time
- /sys : Another virtual folder for details about the system hardware and kernel modules.

/tmp : Temporary data about running processes : gets cleared on reboot

## Temporary and Log folders

• /tmp: for temporary files created by programs

Emptied. So nothing critical is stored

Where needed. Hostile to infections for

\* /var: keeps log files, cache, and any  
anyo that changes often, like mail  
spools or printer queues. check

Data and mount point

• /mnt and /media: used to mount external  
drives (USB, eSATA) and other file system

\* /data: often used by organizations  
to share files among users.

# QUICK REFERENCE TABLE

Folder	Main Purpose
/bin	User command (everyone uses)
/sbin	Admin command (only root uses)
/usr	Most user programs, extra tools
/lib	Libraries for basic commands
/boot	Whole file to boot / start Linux
/etc	Configuration / Settings for System
/home	User personal folders / files
/root	Home of root user (admin)
/dev	Device file (hardware)
/proc, /sys	Information about Process
/tmp	Temporary files
/var	Logs, cache, changing files
/etc	Data for running services
/data	Shared business file

# FILE AND DIRECTORY MANAGEMENT

- ls - list directory contents

cd - change directory

Pwd - Print working directory

cp - copy file and directory

Mv - Move or rename file and directory

Rmdir - Remove empty directories

Mkdir - Make directories

Touch - change file timestamps or create empty file.

Grep - Search for files in directory hierarchy

Locate - Find files by name

Tree - Display directories in a tree-like format

Chmod - Change file permission

Chown - change file owner and group

**chgrp** - change group ownership

**stat** - display file or filesystem status

## FILE VIEWING AND EDITING

**cat** - concatenate and display file content

**tac** - concatenate and display file

Content un-reverse

**more** - view file content interactively  
(page by page)

**less** - view file content interactively (scrollable)

**head** - output the first part of a file

**tail** - output the last part of a file

**nano** - Text editor (terminal-based)

**Vim/vi** - Advanced Text editor

**grep** - search text using patterns

**awk** - pattern scanning and processing language.

## Process management

ps - Report a snapshot of current process

top - Display linux tasks

htop - interactive process viewer

kill - Send a signal to a process

killall - Terminate process by name

bg - Resume a suspended job in background

fg - Bring a job to foreground

jobs - List active jobs

nice - Run program with modified scheduled priority

uptime - Show how long the system has been running

time - measure program run time

## Disk Management

**df -h** Report file system disk space usage information about the file system.

**du -sh /home/monu/yash** : Displays the size of files and directories.

**du -sh \*** : Show total size of directory of the root file system.

**Sudo fdisk -l** : Used for creating, deleting, resizing partitions.

**lsblk** :- disk information about storage devices.

**Mount** : mount a file system.

**Unmount** : unmount file system.

**Parted** : a partition manipulation program.

**Mkfs** : creates a file system.

**fsck** : file system consistency check.

useful command for repairing damage to the file system.

and working on file system.

# Networking Commands

ifconfig : configure network interface

ip : show/manipulate routing, device  
and tunnel

Ping : send ICMP-Echo request to  
network or host

netstat : network statistics

ss : socket statistics

traceroute : trace the route packets  
to network host

DNS lookup on host

wget : non interactive network downloader

curl : transfer data URLs

SCP : secure copy file between hosts

SSH : secure shell for remote login

FTP : file transfer protocol client

## User and group management

useradd - Add a user to the system

usermod - modify a user account

userdel - Delete a user account

groupadd - Add a group to the system

groupdel - Delete a group

passwd - change user password

whoami - Print current logged-in user

id - show user's group

## System information and monitoring

uname - Print system information

hostname - Show or set the system hostname

dmesg - Boot and system messages

free - Display memory usage

top - Display active tasks.

- vmstat** - Report virtual memory statistics
- lscpu** - Display information about a CPU architecture
- lsusb** - List USB devices
- lspci** - List PCI devices
- lshw** - List hardware configuration

## Archiving and compression

**tar** - archive file  
• used to combine multiple file / folders into a single file (called tarball)  
• it doesn't always compress by default but can work with gzip / bzip

**x264**

mountable

**ExamP/c**

**zip** - Package and compress file

unzip or zip archive

most tools will do

Unzip - Extract files using the gzip algorithm

gzip - compress files using the gzip algorithm

gunzip - Decompress files compressed with gzip

xz - compress file using the xz algorithm

unxz - Decompress files compressed with xz

## Package management in linux

Debian-based systems (Ubuntu, Debian, Linux mint)

i) apt-get - APT Package handling utility

(U2)

Sudo apt-get install nginx

Ctrl+C

Sudo apt uninstall nginx

Red Hat-based system (CentOS, Fedora, RHEL)

1) Yum - Package manager for RPM-based system

(ex) Sudo yum install httpd

2) dnf - next-generation package manager

(ex) Sudo dnf install httpd

In short

Ubuntu/Debian = apt-get / apt

CentOS/RHEL = yum

Fedora/CentOS8+/RHEL8+ = dnf

## File permissions and security

chmod - change file permission

chown - change file owner & group

chgrp - change the group ownership

umask - set default permission new file

setfacl - set file access control

passwd - change user's password

gpasswd - administer group password.