# Linux Basics

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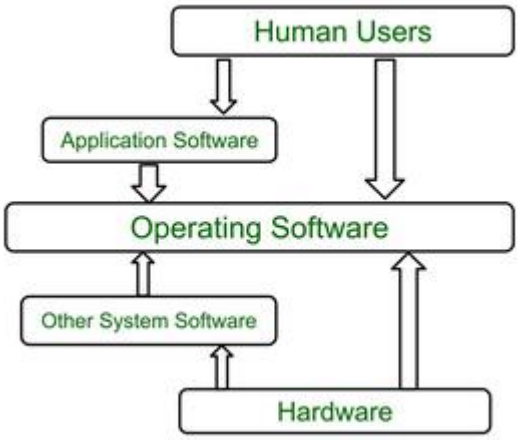
## What is an operating system?

Operating System lies in the category of system software. It basically manages all the resources of the computer. An operating system acts as an interface between the software and different parts of the computer or the computer hardware. The operating system is designed in such a way that it can manage the overall resources and operations of the computer. It is a fully integrated set of specialized programs that handle all the operations of the computer. It controls and monitors the execution of all other programs that reside in the computer, which also includes application programs and other system software of the computer. Examples of the operating system are Windows, Linux, Mac OS, etc.

> Diagram for an Opering System:




## What is Unix?

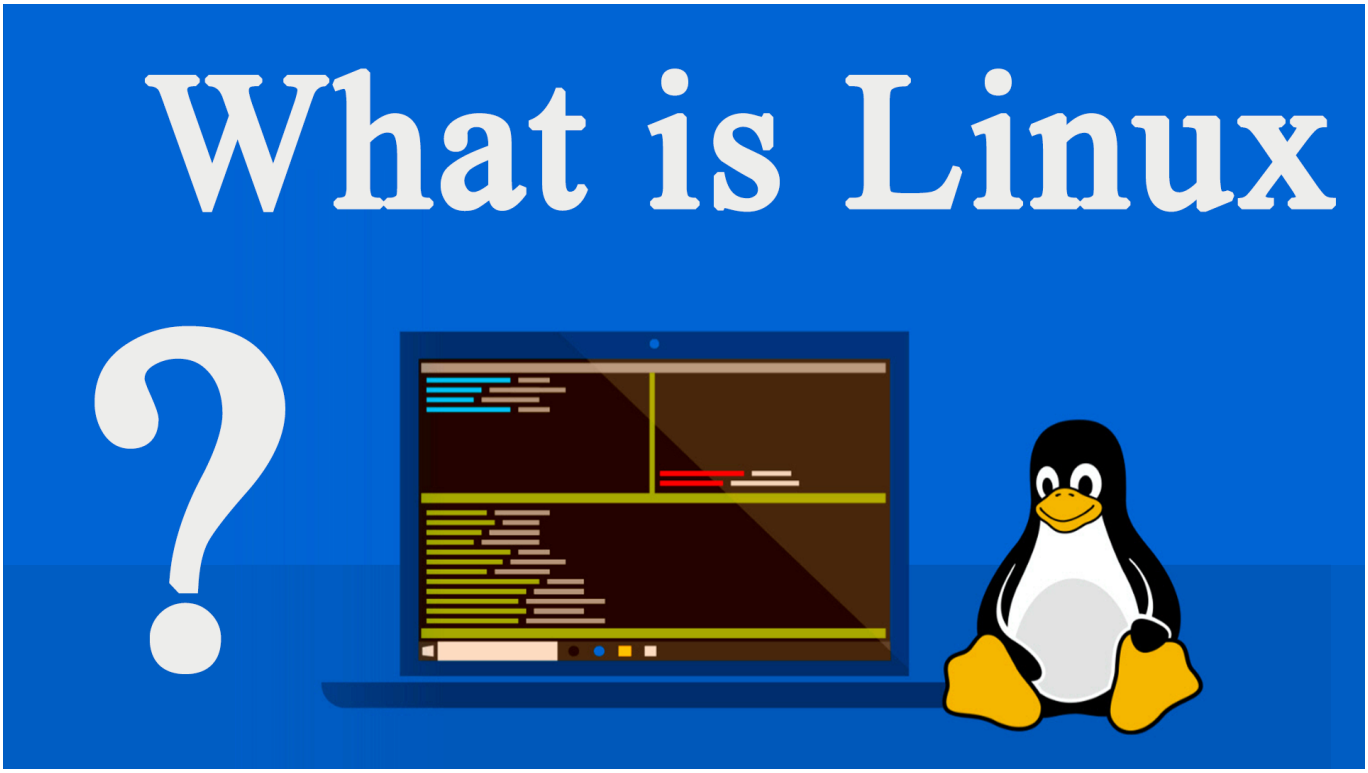
Most operating systems can be classified into two distinct families. Apart from Microsoft's Windows NT-based operating systems, almost everything goes back to Unix.

Linux, Mac OS X, Android, iOS, Chrome OS, Orbis OS used on the PlayStation 4, whatever firmware is running on your router - all of these operating systems are often called "Unix-like" operating systems.

## Windows NT?


All of Microsoft's operating systems are based on the Windows NT kernel today. Windows 7, Windows 8, Windows RT, Windows Phone 8, Windows Server, and the Xbox One's operating system all use the Windows NT kernel. Unlike most other operating systems, Windows NT wasn't developed as a Unix-like operating system.

## What is Linux? - Linux.com

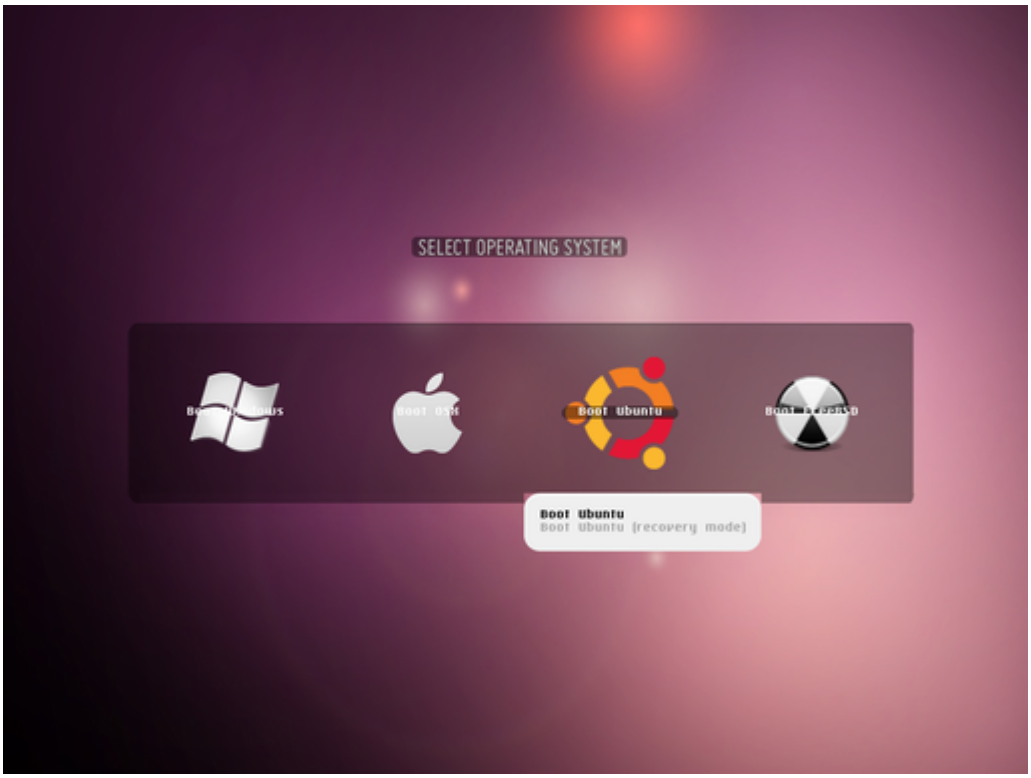



Just like Windows, iOS, and Mac OS, Linux is an operating system. In fact, one of the most popular platforms on the planet, Android, is powered by the Linux operating system. An operating system is software that manages all of the hardware resources associated with your desktop or laptop. To put it simply, the operating

system manages the communication between your software and your hardware. Without the operating system (OS), the software wouldn't function.

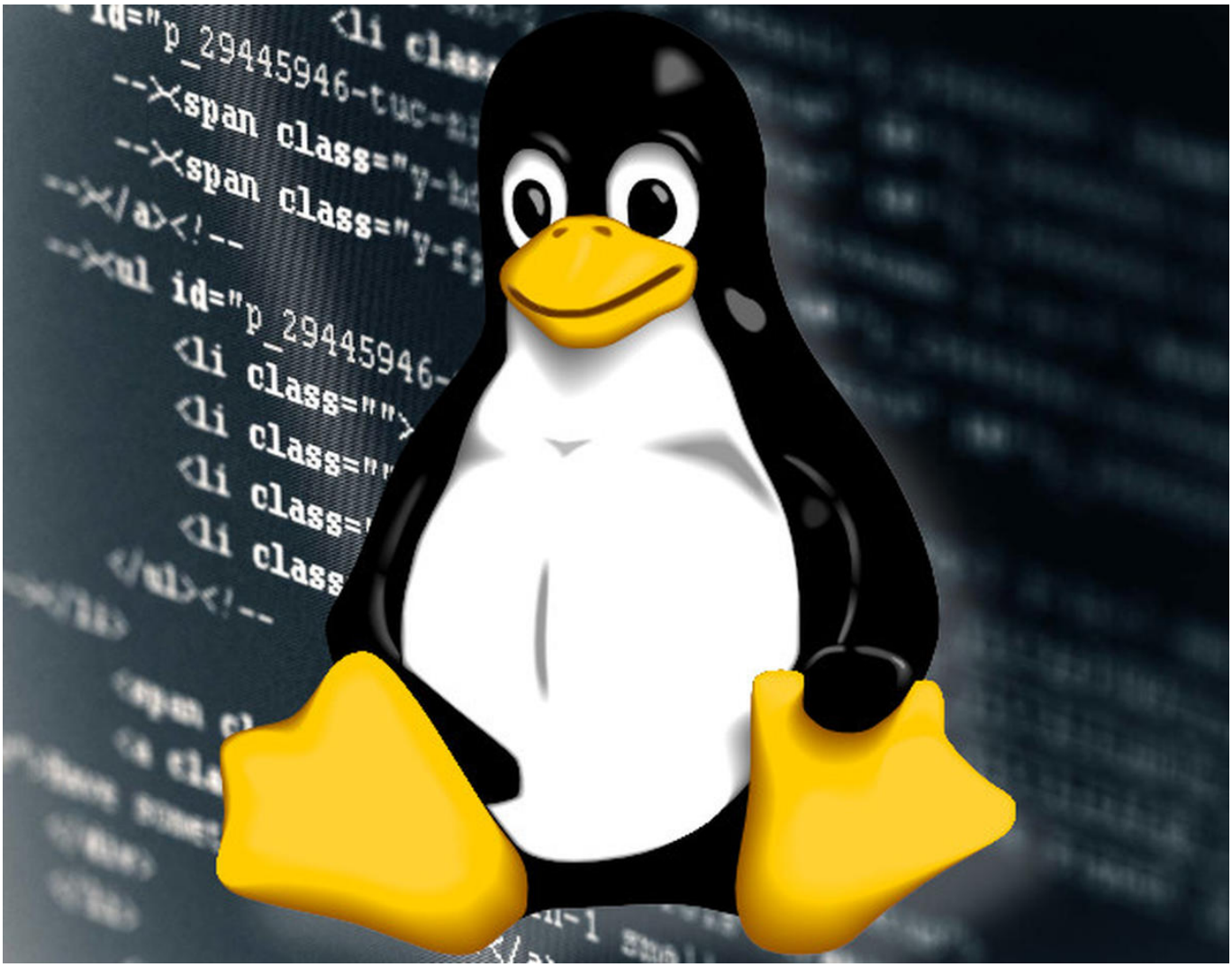
The Linux operating system comprises several different pieces:

## Bootloader



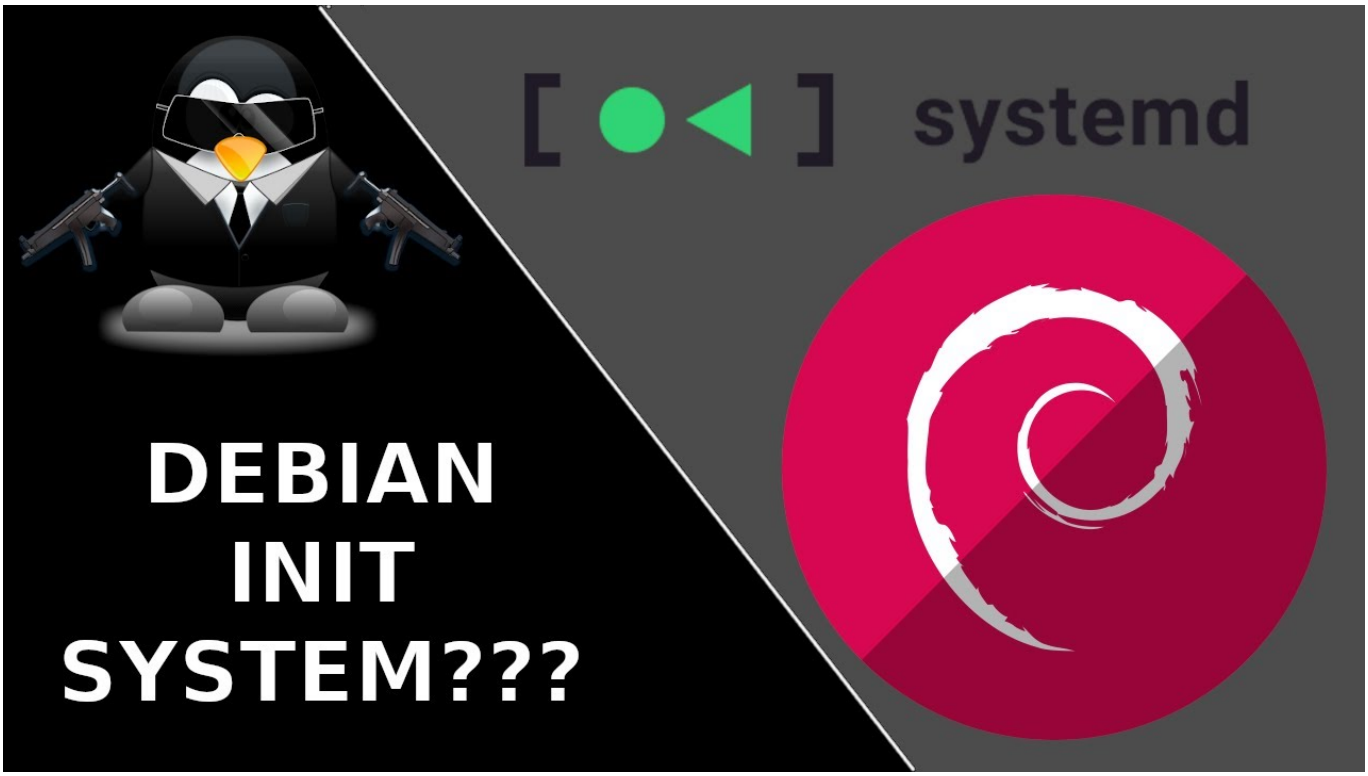

The software that manages the boot process of your computer. For most users, this will simply be a splash screen that pops up and eventually goes away to boot into the operating system.

## Kernel



This is the one piece of the whole that is actually called ‘Linux’. The kernel is the core of the system and manages the CPU, memory, and peripheral devices. The kernel is the lowest level of the OS.

## Init system




This is a sub-system that bootstraps the user space and is charged with controlling daemons. One of the most widely used init systems is systemd, which also happens to be one of the most controversial. It is the init system that manages the boot process, once the initial booting is handed over from the bootloader (i.e., GRUB or GRand Unified Bootloader).

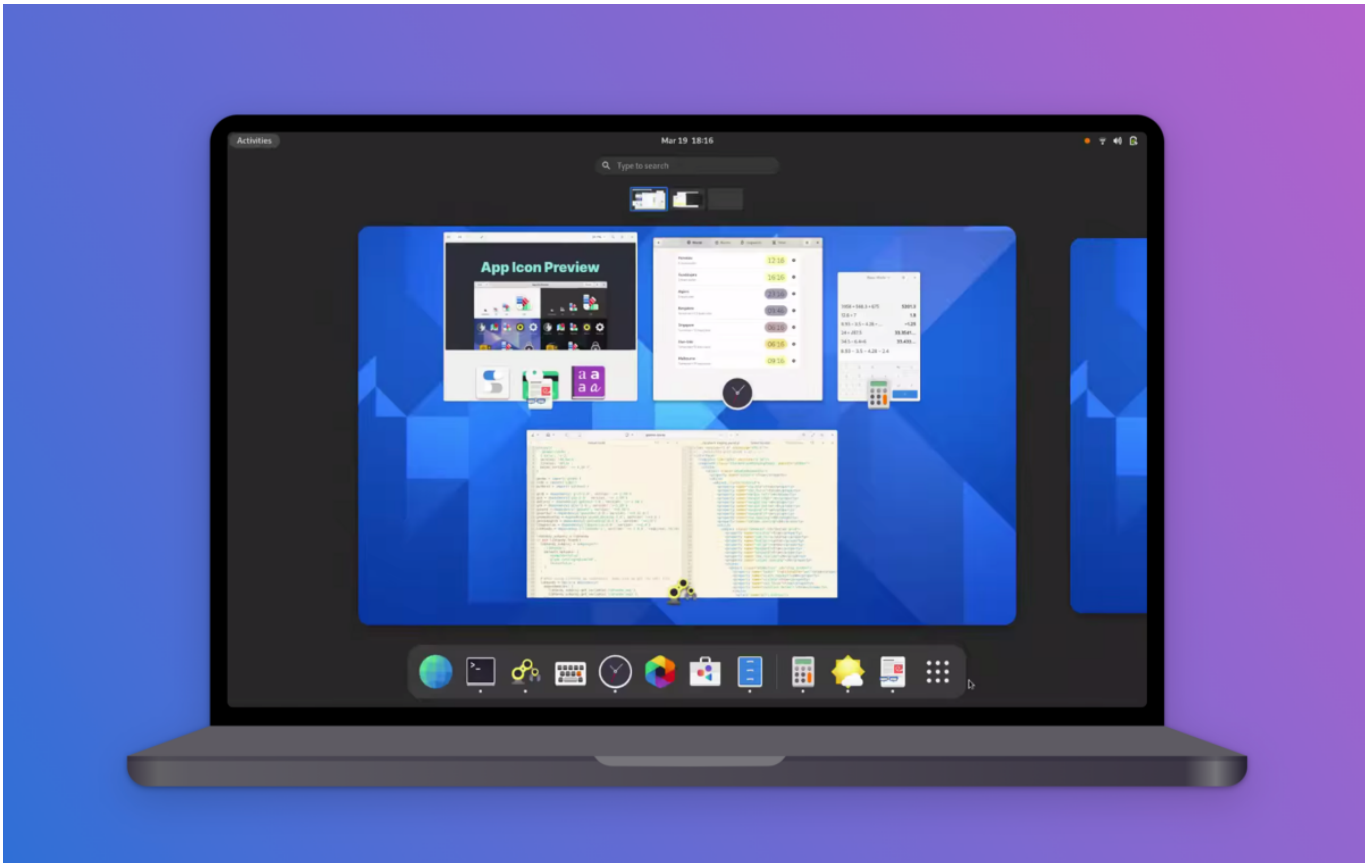
## Daemons


These are background services (printing, sound, scheduling, etc.) that either start up during boot or after you log into the desktop.

## Graphical server

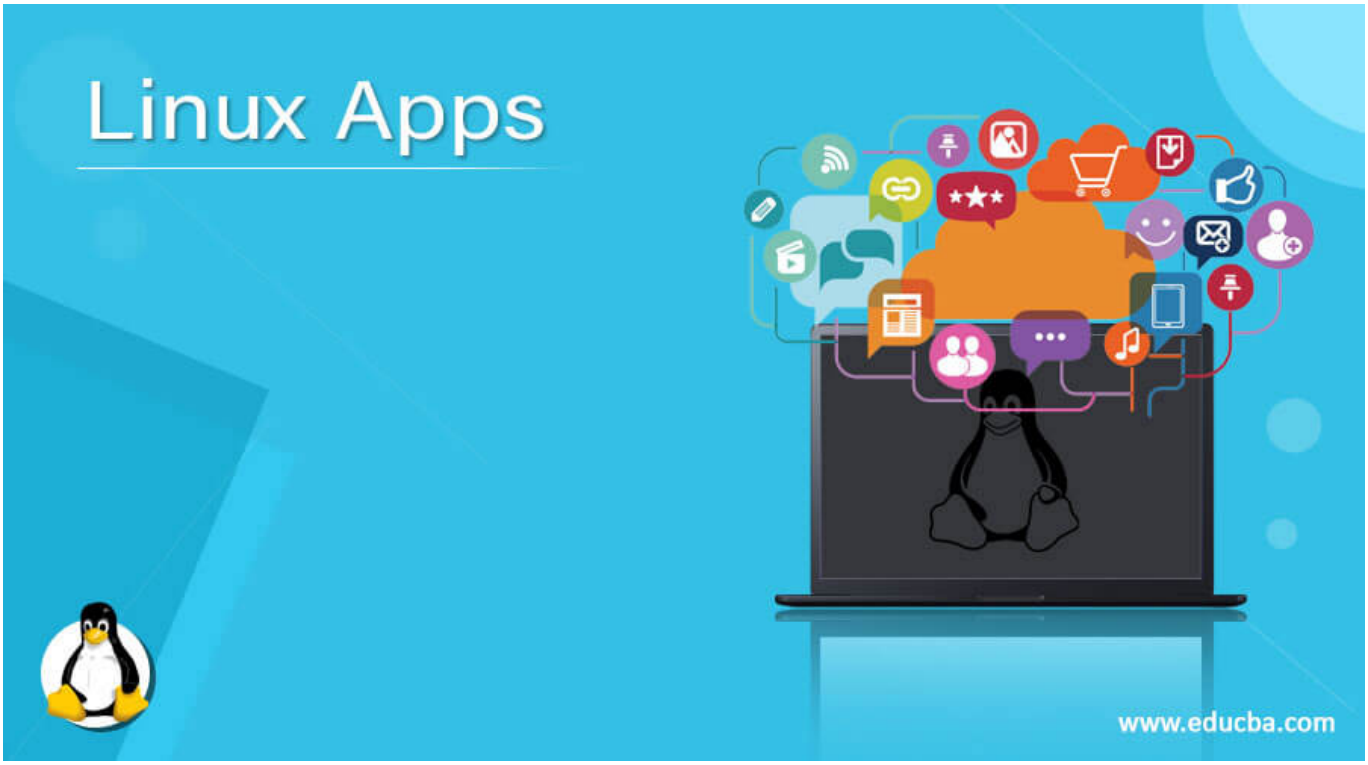
This is the sub-system that displays the graphics on your monitor. It is commonly referred to as the X server or just X.

## Desktop environment



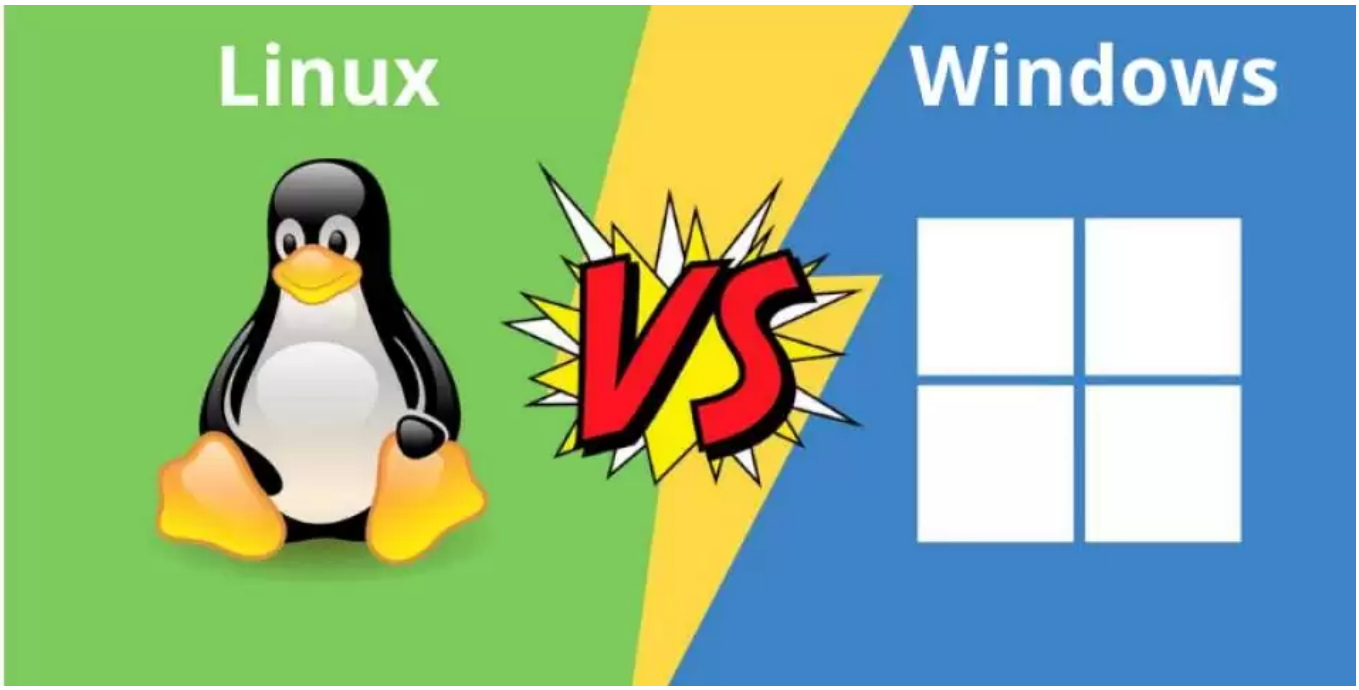
This is the piece that the users actually interact with. There are many desktop environments to choose from (GNOME, Cinnamon, Mate, Pantheon, Enlightenment, KDE, Xfce, etc.). Each desktop environment includes built-in applications (such as file managers, configuration tools, web browsers, and games).

## Applications




Desktop environments do not offer the full array of apps. Just like Windows and macOS, Linux offers thousands upon thousands of high-quality software titles that can be easily found and installed. Most modern Linux distributions (more on this below) include App Store-like tools that centralize and simplify application installation. For example, Ubuntu Linux has the Ubuntu Software Center (a rebrand of GNOME Software) which allows you to quickly search among the thousands of apps and install them from one centralized location.

## Why Linux?




Simplicity


This is the one question that most people ask. Why bother learning a completely different computing environment, when the operating system that ships with most desktops, laptops, and servers works just fine?

Problemless


To answer that question, I would pose another question. Does that operating system you're currently using really work "just fine"? Or, do you find yourself battling obstacles like viruses, malware, slow downs, crashes, costly repairs, and licensing fees?

## Zero cost


If you struggle with the above, Linux might be the perfect platform for you. Linux has evolved into one of the most reliable computer ecosystems on the planet. Combine that reliability with zero cost of entry and you have the perfect solution for a desktop platform.

That's right, zero cost of entry… as in free. You can install Linux on as many computers as you like without paying a cent for software or server licensing.

## Trouble free

If zero cost isn't enough to win you over–what about having an operating system that will work, trouble free, for as long as you use it? I've used Linux for nearly 20 years (as both a desktop and server platform) and have not had any issues with ransomware, malware, or viruses. Linux is generally far less vulnerable to such attacks. As for server reboots, they're only necessary if the kernel is updated. It is not out of the ordinary for a Linux server to go years without being rebooted. If you follow the regular recommended updates, stability and dependability are practically assured.

## Open-sourced

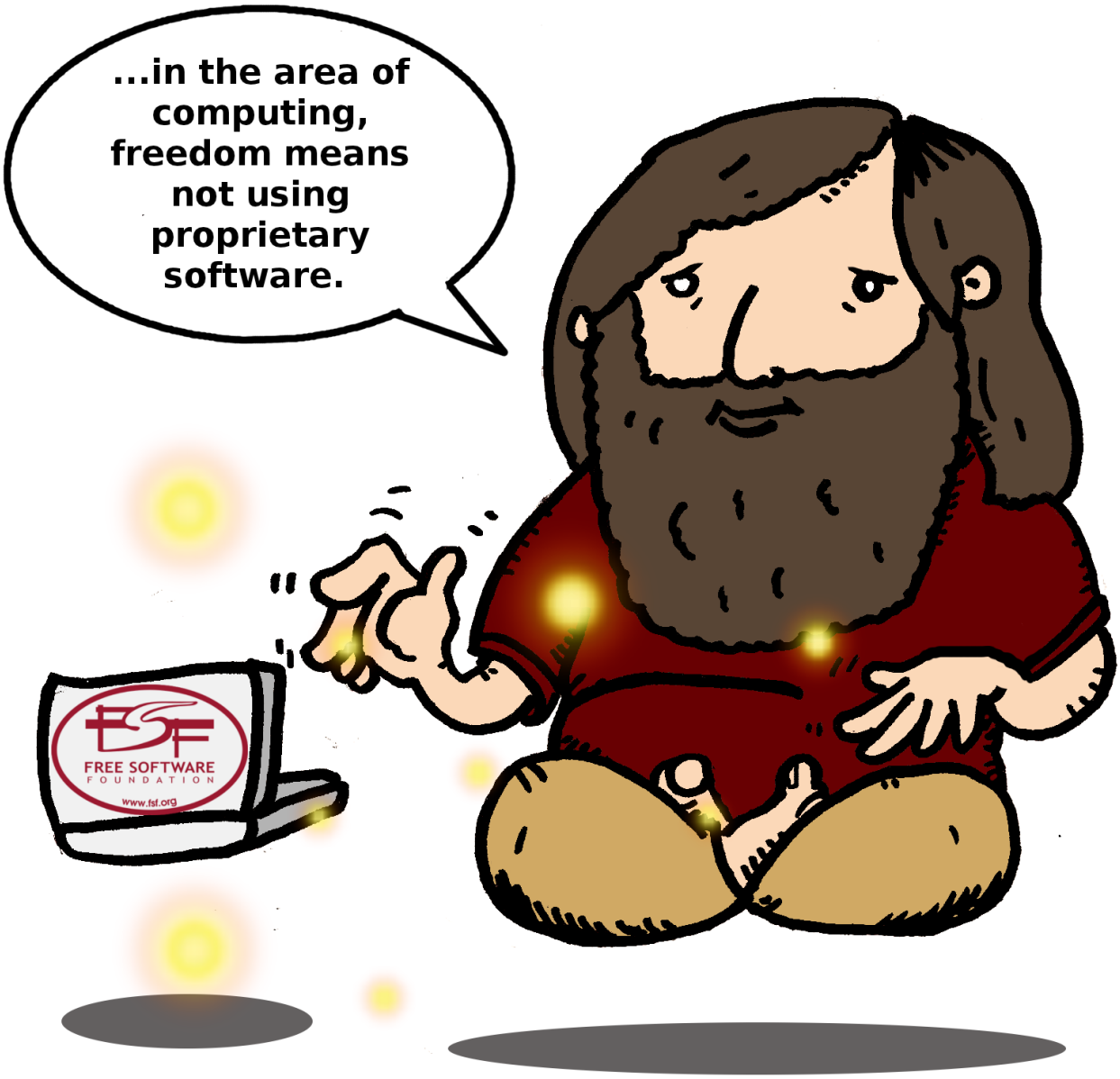

Linux is also distributed under an open source license. Open source follows these key tenants:

- The freedom to run the program, for any purpose.
- The freedom to study how the program works, and change it to make it do what you wish.
- The freedom to redistribute copies so you can help your neighbor.

- The freedom to distribute copies of your modified versions to others.

It is all about freedom


> These points are crucial to understanding the community that works together to create the Linux platform. Without a doubt, Linux is an operating system that is “by the people, for the people”. These tenants are also a main factor in why many people choose Linux. It’s about freedom and freedom of use and freedom of choice.




## For who?

- How skilled of a computer user are you?
- Do you prefer a modern or a standard desktop interface?
- Server or desktop?

### Newbie friendly

If your computer skills are fairly basic, you'll want to stick with a newbie-friendly distribution such as Linux Mint, Ubuntu (Figure 3), Elementary OS or Deepin. If your skill set extends into the above-average range, you could go with a distribution like Debian or Fedora. If, however, you've pretty much mastered the craft of computer and system administration, use a distribution like Gentoo. If you really want a challenge, you can build your very own Linux distribution, with the help of Linux From Scratch.

### Server only (Non-GUI)

If you're looking for a server-only distribution, you will also want to decide if you need a desktop interface, or if you want to do this via command-line only. The Ubuntu Server does not install a GUI interface. This means

two things your server won't be bogged down loading graphics and you'll need to have a solid understanding of the Linux command line.

### Out of the box distributions

However, you can install a GUI package on top of the Ubuntu Server with a single command like sudo apt-get install ubuntu-desktop. System administrators will also want to view a distribution with regards to features. Do you want a server-specific distribution that will offer you, out of the box, everything you need for your server? If so, CentOS might be the best choice. Or, do you want to take a desktop distribution and add the pieces as you need them? If so, Debian or Ubuntu Linux might serve you well.

## Linux installation

For many people, the idea of installing an operating system might seem like a very daunting task. Believe it or not, Linux offers one of the easiest installations of all operating systems. In fact, most versions of Linux offer what is called a Live distribution, which means you run the operating system from either a CD/DVD or USB flash drive without making any changes to your hard drive. You get the full functionality without having to commit to the installation. Once you've tried it out, and decided you wanted to use it, you simply double-click the "Install" icon and walk through the simple installation wizard.

Typically, the installation wizards walk you through the process with the following steps (We'll illustrate the installation of Ubuntu Linux):

### Preparation

Make sure your machine meets the requirements for installation. This also may ask you if you want to install third-party software (such as plugins for MP3 playback, video codecs, and more).

### Wireless setup

If you are using a laptop (or machine with wireless), you'll need to connect to the network, in order to download third-party software and updates.

### Hard drive allocation

This step allows you to select how you want the operating system to be installed. Are you going to install Linux alongside another operating system (called "dual booting"), use the entire hard drive, upgrade an existing Linux installation, or install over an existing version of Linux.

### Location

Select your location from the map.

### Keyboard layout

Select the keyboard for your system.

### User setup

Set up your username and password.

# Configuration

That's it. Once the system has completed the installation, reboot and you're ready to go. For a more in-depth guide to installing Linux, take a look at "How to Install and Try Linux the Absolutely Easiest and Safest Way" or download the Linux Foundation's PDF guide for Linux installation.

## Installing apps

Just as the operating system itself is easy to install, so too are applications. Most modern Linux distributions include what most would consider an app store. This is a centralized location where software can be searched and installed. Ubuntu Linux (and many other distributions) rely on GNOME Software, Elementary OS has the AppCenter, Deepin has the Deepin Software Center, openSUSE has their AppStore, and some distributions rely on Synaptic.

### Application resources

Regardless of the name, each of these tools do the same thing: a central place to search for and install Linux software. Of course, these pieces of software depend upon the presence of a GUI. For GUI-less servers, you will have to depend upon the command-line interface for installation.

### Package managers

Package management is very important in Linux, and knowing how to use multiple package managers can proof life saving for a power user, since downloading or installing software from repositories, plus updating, handling dependencies and uninstalling software is very vital and a critical section in Linux system Administration.

#### DPKG – Debian Package Management System

Dpkg is a base package management system for the Debian Linux family, it is used to install, remove, store and provide information about .deb packages.

#### APT (Advanced Packaging Tool)

It is a very popular, free, powerful and more so, useful command line package management system that is a front end for dpkg package management system.

Users of Debian or its derivatives such as Ubuntu and Linux Mint should be familiar with this package management tool.

#### Aptitude Package Manager

This is also a popular command line front-end package management tool for Debian Linux family, it works similar to APT and there have been a lot of comparisons between the two, but above all, testing out both can make you understand which one actually works better.

#### Synaptic Package Manager

Synaptic is a GUI package management tool for APT based on GTK+ and it works fine for users who may not want to get their hands dirty on a command line. It implements the same features as apt-get command line tool.

#### RPM - Red Hat Package Manager

This is the Linux Standard Base packing format and a base package management system created by RedHat. Being the underlying system, there several front-end package management tools that you can use with it and but we shall only look at the best and that is:

#### YUM (Yellowdog Updater, Modified)

It is an open source and popular command line package manager that works as a interface for users to RPM. You can compare it to APT under Debian Linux systems, it incorporates the common functionalities that APT has.

#### DNF – Dandified Yum

It is also a package manager for the RPM-based distributions, introduced in Fedora 18 and it is the next generation of version of YUM. If you have been using **Fedora 22** onwards, you must have realized that it is the default package manager.

#### Pacman Package Manager – Arch Linux

It is a popular and powerful yet simple package manager for Arch Linux and some little known Linux distributions, it provides some of the fundamental functionalities that other common package managers provide including installing, automatic dependency resolution, upgrading, uninstalling and also downgrading software.

#### Zypper Package Manager – openSUSE

It is a command line package manager on OpenSUSE Linux and makes use of the libzypp library, its common functionalities include repository access, package installation, resolution of dependencies issues and many more.

#### Portage Package Manager – Gentoo

It is a package manager for Gentoo, a less popular Linux distribution as of now, but this won't limit it as one of the best package managers in Linux.

# Administration

## Users and groups

### Current logged username

**who** is used to get information about the currently logged in user on the system. If you do not specify an option or arguments, the command displays the following information for each logged-in user.

- User login name
- User terminal
- Date & Time of login
- User's external hostname

```
$ who
admin    tty2         2022-02-10 01:36 (tty2)
root     pts/1        2022-02-15 00:29 (10.190.95.154)
```

**System username**

**whoami:** returns the system username.

```
$ whoami
Yilmaz Mustafa
```

**User and Group IDs**

**id:** displays user identification (the real and effective user and group IDs) information

```
$ id
uid=1000(sj) gid=1000(sj)
groups=1000(sj),4(adm),24(cdrom),27(sudo),30(dip),46(plugdev),120(lpadmin),131(lxd
),132(sambashare)
```

**Display all groups**

**groups:** command is used to display all the groups to which the user belongs.

```
$ group
sj: sj, adm, cdrom, sudo, dip, plugdev, lpadmin, lxd, sambashare
```

**Display all logged-in users**

**users:** displays usernames of all users currently logged on to the system.

```
$ users
root
```

PATTERN SEARCH

**grep:** It is a powerful pattern search tool to find information about a specific user in the system accounts file: /etc/passwd.

```
$ grep -i sj /etc/passwd
sj:x:1000:1000:sj,,,:/home/sj:/bin/bash
```

**W Command:** It(W) is a command-line utility that displays information about currently logged in users and what each user is doing.

```
w [OPTIONS] [USER]

Example:
w
 18:45:04 up  2:09,  1 user,  load average: 0.09, 0.07, 0.02
USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
sj       :0       :0               01:27   ?xdm?   1:14   0.01s /usr/lib/gdm3/g
```

**last of lastb:** Displays a list of last logged in users on the system. You can pass usernames to display their login and hostname information.

```
last [opties] [gebruikersnaam...] [tty...]

Voorbeeld:

root     pts/1        xx.xxx.xx.xxx    Tue Feb 15 00:29   still logged in
root     pts/2        xx.xxx.xx.xxx    Mon Feb 14 03:45 - 06:59  (03:13)
root     pts/1        xx.xxx.xx.xxx    Mon Feb 14 01:21 - 04:35  (03:13)
root     pts/1        xx.xxx.xx.xxx    Sun Feb 13 21:28 - 00:43  (03:15)
root     pts/1        xx.xxx.xx.xxx    Sun Feb 13 09:46 - 10:20  (00:33)
root     pts/1        xx.xxx.xx.xxx    Sat Feb 12 21:30 - 23:44  (02:13)
root     pts/1        xx.xxx.xx.xxx    Sat Feb 12 11:15 - 11:56  (00:40)
root     pts/1        xx.xxx.xx.xxx    Sat Feb 12 11:08 - 11:15  (00:06)
root     pts/1        xx.xxx.xx.xxx    Sat Feb 12 02:06 - 05:19  (03:12)
```

**lastlog:** Het `lastlog` commando wordt gebruikt om de details te vinden van een recente login van alle gebruikers of van een bepaalde gebruiker.

```
$ lastlog

Username         Port     From             Latest
root             pts/1    xx.xxx.xx.xxx    Tue Feb 15 00:29:27 -0500 2022
daemon                                     **Never logged in**
bin                                        **Never logged in**
sys                                        **Never logged in**
sync                                       **Never logged in**
```

```
games                                   **Never logged in**
man                                     **Never logged in**
lp                                      **Never logged in**
mail                                    **Never logged in**
news                                    **Never logged in**
```

↥ terug naar boven

# Directory Commands

## Viewing directories

**pwd** ( Present Working Directory ) commando wordt gebruikt om de naam van de huidige/aanwezige werkdirectory af te drukken, beginnend bij de root.

```
$ pwd
/home/chef/Desktop/Linux
```

## Creating directories

Met het commando **mkdir** ( make directory ) kunnen gebruikers mappen of directories maken.

```
$ mkdir ubuntu
$ ls
ubuntu
```

De optie '-p' wordt gebruikt om meerdere directories of bovenliggende directories in één keer aan te maken.

```
$ mkdir -p dir1/dir2/dir3
$ cd dir1/dir2/dir3
~/Desktop/Linux/dir1/dir2/dir3$
```

## Removing directories

**rmdir** ( remove directories ) wordt gebruikt om *lege* directories te verwijderen. Kan ook gebruikt worden om meerdere lege directories te verwijderen. Veiliger om te gebruiken in vergelijking met `rm -r FolderName`. Dit commando kan ook geforceerd worden om niet-lege directories te verwijderen.

- Remove empty directory:

```
rmdir FolderName
```

- Remove multiple directories:

```
rmdir FolderName1 FolderName2 FolderName3
```

- Remove non-empty directories:

```
rmdir FolderName1 --ignore-fail-on-non-empty
```

- Remove entire directory tree. This command is similar to `rmdir a/b/c a/b a`:

```
rmdir -p a/b/c
```

- Remove directory: The rm command with -r option is used to remove the directory and its contents recursively.

```
rm -r myDir
```

- Remove directory forcefully: The rm command with -rf option is used to forcefully remove directory recursively.

```
rm -rf myDir
```

# File commands

## Removing files

**rm**: The rm ( remove ) command is used to remove objects such as files, directories, symbolic links etc from the file system.

- Remove file: The rm command is used to remove or delete a file

```
rm file_name
```

- Remove file forcefully: The rm command with -f option is used for removal of file without prompting for confirmation.

```
rm -f filename
```

## Creating files

**touch**: The touch command is is used to create, change and modify timestamps of a file without any content.

- **Create a new file:** You can create a single file at a time using touch command. The file created is an empty file.

```
touch file_name
```

- **Create multiple files:** You can create the multiple numbers of files at the same time.

```
touch file1_name file2_name file3_name
```

- **Change access time:** The touch command with `a` option is used to change the access time of a file.

```
touch -a file_name
```

- **Change modification time:** The touch command with `m` option is used to change the modified time.

```
touch -m file_name
```

- **Use timestamp of other file:** The touch command with `r` option is used to get timestamp of another file.

```
touch -r file2 file1
```

> In the above example, we get the timestamp of file1 for file2.

- **Create file with Specific time:** The touch command with 't' option is used to create a file with specified time.

```
touch -t 1911010000 file_name
```

- **cat**: The cat command is used to create single or multiple files, view contain of file, concatenate files and redirect output in terminal or files.

**View file contents:** You can view contents of a single or more files by mentioning the filenames.

```
cat file_name1 file_name2
```

Linux CheatSheet

| Sl.No. | Commands | Description |
|---|---|---|
| 01. | ls | directory listing |
| 02. | ls -al | formatted listing with hidden files |
| 03. | cd dir | change directory to dir |
| 04. | cd | change to home |
| 05. | pwd | show current directory |
| 06. | mkdir dir | create a directory dir |
| 07. | rm file | delete file |
| 08. | rm -r dir | delete directory dir |
| 09. | rm -f file | force remove file |
| 10. | rm -rf dir | force remove directory dir * |
| 11. | cp file1 file2 | copy file1 to file2 |
| 12. | cp -r dir1 dir2 | copy dir1 to dir2; create dir2 if it doesn't exist |
| 13. | mv file1 file2 | rename or move file1 to file2 if file2 is an existing directory, moves file1 into directory file2 |
| 14. | ln -s file link | create symbolic link link to file |
| 15. | touch file | create or update file |
| 16. | cat > file | places standard input into file |
| 17. | more file | output the contents of file |
| 18. | head file | output the first 10 lines of file |
| 19. | tail file | output the last 10 lines of file |
| 20. | tail -f file | output the contents of file as it grows, starting with the last 10 lines |

↥ **terug naar boven**

## Authorizations (Access levels)

> chmod octal file – change the permissions of file to octal, which can be found separately for user, group, and world by adding
> 4 – read (r)
> 2 – write (w)
> 1 – execute (x)

- `chmod 777` – read, write, execute for all
- `chmod 755` – rwx for owner, rx for group and world

Since Linux is a multi-user operating system, it is necessary to provide security to prevent people from accessing each other's confidential files. So Linux divides authorization into 2 levels,

## Ownership

Each file or directory has assigned with 3 types of owners i. **User:** Owner of the file who created it. ii. **Group:** Group of users with the same access permissions to the file or directory. iii. **Other:** Applies to all other users on the system

## Permissions

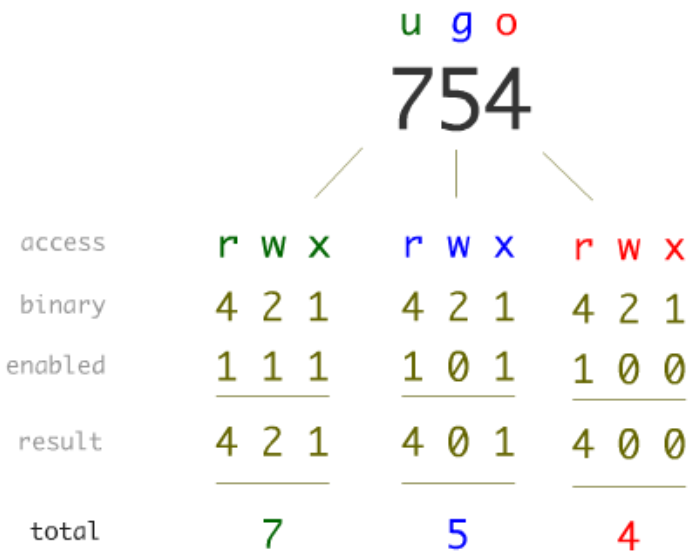
Each file or directory has following permissions for the above 3 types of owners.

i. **Read:** Give you the authority to open and read a file and lists its content for a directory.
ii. **Write:** Give you the authority to modify the contents of a file and add, remove and rename files stored in the directory.
iii. **Execute:** Give you the authority to run the program in Unix/Linux. \

The permissions are indicated with below characters,

r = read permission
w = write permission
x = execute permission
- = no permission

The above authorization levels represented in a diagram




There is a need to restrict own file/directory access to others.

**Change access**

The `chmod` command is used to change the access mode of a file. This command is used to set permissions ( read, write, execute ) on a file/directory for the owner, group and the others group.

```
chmod [reference][operator][mode] file...

Example
chmod ugo-rwx test.txt
```

There are 2 ways to use this command,

**Absolute mode**

The file permissions will be represented in a three-digit octal number.

The possible permissions types represented in a number format as below.

| Permission Type | Number | Symbol |
|---|---|---|
| No Permission | 0 | --- |
| Execute | 1 | --x |
| Write | 2 | -w- |
| Execute + Write | 3 | -wx |
| Read | 4 | r-- |
| Read + Execute | 5 | r-x |
| Read + Write | 6 | rw- |
| Read + Write + Execute | 7 | rwx |

Let's update the permissions in absolute mode with an example as below,

```
chmode 764 test.txt
```

**Symbolic mode**

In the symbolic mode, you can modify permissions of a specific owner unlike absolute mode.

The owners are represented as below,

| Owner | Description |
|---|---|
| u | user/owner |
| g | group |
| o | other |
| a | all |

and the list of mathematical symbols to modify the file permissions as follows,

| Operator | Description |
|---|---|
| + | Adds permission |
| - | Removes the permission |
| = | Assign the permission |

### Changing Ownership and Group

It is possible to change the the ownership and group of a file/directory using `chown` command.

```
chown user filename
chown user:group filename

Example:
chown John test.txt
chown John:Admin test.txt
```

### Change group-owner only

Sometimes you may need to change group owner only. In this case, chgrp command need to be used.

```
chgrp group_name filename
```

Example:

```
sudo chgrp Administrator test.txt
```

| # | Permission | rwx | Binary |
|---|---|---|---|
| 7 | read, write and execute | rwx | 111 |
| 6 | read and write | rw- | 110 |
| 5 | read and execute | r-x | 101 |
| 4 | read only | r-- | 100 |
| 3 | write and execute | -wx | 011 |
| 2 | write only | -w- | 010 |
| 1 | execute only | --x | 001 |
| 0 | none | --- | 000 |

For a directory, execute means you can enter a directory.

| User | Group | Others | Description |
|---|---|---|---|
| 6 | 4 | 4 | User can read and write, everyone else can read ( Default file permissions ) |
| 7 | 5 | 5 | User can read, write and execute, everyone else can read and execute ( Default directory permissions ) |

- u - User
- g - Group
- o - Others
- a - All of the above

```
ls -l /foo.sh            # List file permissions
chmod +100 foo.sh        # Add 1 to the user permission
chmod -100 foo.sh        # Subtract 1 from the user permission
chmod u+x foo.sh         # Give the user execute permission
chmod g+x foo.sh         # Give the group execute permission
chmod u-x,g-x foo.sh     # Take away the user and group execute permission
chmod u+x,g+x,o+x foo.sh # Give everybody execute permission
chmod a+x foo.sh         # Give everybody execute permission
chmod +x foo.sh          # Give everybody execute permission
```

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# Networking

## Display network information

`ifconfig` command is used to display all network information ( ip address, ports etc )

```
ifconfig -a
```

## Test connection to a remote machine

Send an echo request to test connection of a remote machine.

```
ping <ip-address> or hostname

Example:
ping 10.0.0.11
```

## Show IP Address

Display ip address of a currennt machine

```
hostname -I
(OR)
ip addr show
```

### Active ports

Shows active or listening ports

```
netstat -pnltu
```

### Find information about domain

`whois` command is used to find out information about a domain, such as the owner of the domain, the owner's contact information, and the nameservers used by domain.

```
whois [domain]
```

Example:

```
whois google.com
```

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## Disk Usage

### Synopsis

`du` command is used to check the information of disk usage of files and directories on a machine

```
du [OPTION]... [FILE]...
```

### Disk usage of a directory

To find out the disk usage summary of a /home/ directory tree and each of its sub directories

```
du  /home/
```

### Disk usage in human readable format

To find out the disk usage in human readable format

```
du  -h /home/
```

### Total disk usage of a directory

To find out the total disk usage

```
du  -sh /home/
```

### Total disk usage of all files and directories

To find out the total disk usage of files and directories

```
du  -ah /home/
```

### Total disk usage of all files and directories upto certain depth

Print the total for a directory only if it is N or fewer levels below the command

```
du  -ah --max-depth 2 /home/
```

### Total disk usage with excluded files

To find out the total disk usage of files and directories, but excludes the files that matches given pattern.

```
du -ah --exclude="*.txt" /home/
```

### Help

This command gives information about `du`

```
du  --help
```

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## System and Hardware Information

### Print all information

`uname` is mainly used to print system information.

```
uname -a
```

### Print kernel name

```
uname -s
```

### Print kernel release

```
uname -r
```

### Print Architecture

```
uname -m
```

### Print Operating System

```
uname -o
```

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## Search Files

### Pattern search

The `grep` command is used to search patterns in files.

```
grep pattern files
grep -i // Case sensitive
grep -r // Recursive
grep -v // Inverted search
```

```
Example:
grep "^hello" test.txt // Hello John
grep -i "hELLo" text.txt // Hello John
```

### Find files and directories

The `find` command is used to find or search files and directories by file name, folder name, creation date, modification date, owner and permissions etc and perform subsequent operations on them.

**Search file with name**

```
find ./directory_name -name file_name

Example:
find ./test -name test.txt // ./test/test.txt
```

**Search file with pattern**

```
find ./directory_name -name file_pattern

Example:
find ./test -name *.txt // ./test/test.txt
```

### Search file with executable action

```
find ./directory_name -name file_name -exec command

Example:
find ./test -name test.txt -exec rm -i {} \; // Search file and delete it after confirmation
```

### Search for empty files or directories

The find command is used to search all empty folders and files in the entered directory or sub-directories.

```
find ./directory_name -empty

Example:
find ./test -empty
//./test/test1
//./test/test2
//./test/test1.txt
```

### Search for files with permissions

The find command is used to find all the files in the mentioned directory or sub-directory with the given permissions

```
find ./directory_name -perm permission_code

Example:
find ./test -perm 664
```

### Search text within multiple files

```
find ./ -type f -name file_pattern -exec grep some_text  {} \;

Example:
find ./ -type f -name "*.txt" -exec grep 'World'  {} \; // Hello World
```

### Whereis to locate binary or source files for a command

The whereis command in Linux is used to locate the binary, source, and manual page files for a command. i.e, It is used to It is used to find executables of a program, its man pages and configuration files.

```
whereis command_name

Example:
whereis netstat //netstat:  /bin/netstat /usr/share/man/man8/netstat.8.gz ( i.e, executable and location of its man page )
```

### Locate to find files

The locate command is used to find the files by name. This command is faster compared to find command because it searches database for the filename instead of searching your filesystem.

```
locate [OPTION] PATTERN

Example:
locate "*.txt" -n 10 // 10 file search results ending with .txt extension
```

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## SSH (Secure Shell)

SSH is a network protocol that enables secure remote connections between two systems.

### Connect to remote machine

#### Connect using IP address or machine name

The remote server can be connected with local user name using either host name or IP address

```
ssh <host-name> or <ip-address>

Example:
ssh 192.111.66.100
ssh test.remoteserver.com
```

**Connect using username**

It is also possible specify a user for an SSH connection.

```
ssh username@hostname_or_ip-address

Example:
ssh john@192.0.0.22
ssh john@test.remoteserver.com
```

**Connect using custom port**

**:Connect remote machine using custom port** By default, the SSH server listens for a connection on port 22. But you can also specify the custom port.

```
ssh <host-name> or <ip-address> -p port_number

Example:
ssh test.remoteserver.com -p 3322
```

## Generate an SSH key

**Generate SSH keys using keygen:** SSH Keygen is used to generate a key pair which consists of public and private keys to improve the security of SSH connections.

```
ssh-keygen -t rsa
```

**Copy SSH keys**

**Copying SSH keys to servers:** For SSH authentication, `ssh-copy-id` command will be used to copy public key ( id_rsa.pub ) to server.

```
ssh-copy-id hostname_or_IP
```

**Copy a File Remotely over SSH:** SCP tool is used to securely copy files over the SSH protocol.

```
scp fileName user@remotehost:destinationPath

Example:
scp test.txt test@10.0.0.64:/home/john/Desktop
```

### Config file

**Edit SSH Config File** SSH server options customized by editing the settings in `sshd_config` file.

```
sudo vim /etc/ssh/sshd_config
```

### Run commands on remote servers

**Run commands on a remote server** SSH commands can be executed on remote machine using the local machine.

```
ssh test.remoteserver.com mkdir NewDirectoryName // Creating directory on remote
machine
```

**Restart SSH service:** You need to restart the service in Linux after making changes to SSH configuration.

```
sudo ssh service restart
(or)
sudo sshd service restart
```

### SSH CheatSheet

| Sl.No. | Commands | Description |
|---|---|---|
| 01. | ls | Show directory contents (list the names of files). |
| 02. | ls -a | List all files in a directory |
| 03. | ls -h | List files along with file sizes |
| 04. | ls *.html | list all files ending in .html |
| 05. | cd | Change directory (e.g. cd /var/www will put you in the www directory) |
| 06. | cd ~ | Go to the home folder |
| 07. | cd / | Go to the root directory |
| 08. | cd - | Go to the previous directory |

| Sl.No. | Commands | Description |
|---|---|---|
| 09. | cd .. | Move up one directory |
| 10. | mkdir | Create a new folder (e.g. mkdir myfoldername) |
| 11. | touch | Create a new file. |
| 12. | rm | Delete a file (e.g. rm filename.html) |
| 13. | rmdir | Delete a folder (e.g. rmdir foldername) |
| 14. | cat | Show the contents of a file (e.g. cat filename.html) |
| 15. | pwd | Show current directory (full path to where you are right now). |
| 16. | cp | Copy a file (e.g. cp index.html /mydirectory/index.html) |
| 17. | mv | Move a file (e.g. mv index.html /mydirectory/index.html) |
| 18. | grep | Search for a string (e.g. grep "word" index.html). Searches for “word” in the index.html file |
| 19. | find | Search files and directories. |
| 20. | vi/nano | Text editors. |
| 21. | history | Show last 50 used commands. |
| 22. | clear | Clear the terminal screen. |
| 23. | tar | Create & Unpack compressed archives. |
| 24. | wget | Download files and store them in your current directory (e.g. wget https://website.com/filename.ext) |
| 25. | du | Get file size. |
| 26. | vim | Open or create a file with the Vim text editor (e.g. vim filename.html). |
| 28. | nano | Open or create a file with the nano text editor (e.g. nano filename.html) |
| 29. | zip | Compress a folder (e.g. zip -r folder.zip folder). Takes “folder” and compresses it as a file called “folder.zip” |
| 30. | unzip | Decompresses a folder (e.g. unzip folder.zip) |
| 31. | chmod | Change a file’s permissions (e.g. chmod 604 folder). Use this Unix permissions calculator to determine which chmod command you should be using |
| 32. | netstat | Display network connections |
| 33. | free-m | Display your machine’s current memory usage |

| Sl.No. | Commands | Description |
|---|---|---|
| 34. | exit | Exit the remote server and return to your local machine SSH Keys |
| 35. | cat filename.txt | cat the contents of filename.txt to your screen |
| 36. | tail | like cat, but only reads the end of the file |
| 37. | tail /var/log/messages | see the last 20 (by default) lines of /var/log/message |
| 38. | tail -f /var/log/messages | watch the file continuously, while it's being updat |
| 39. | tail -200 /var/log/messages | print the last 200 lines of the file to the screen |
| 40. | more | like cat, but opens the file one screen at a time rather than all at once |
| 41. | more /etc/userdomains | browse through the userdomains file. |
| 42. | pico | friendly, easy to use file editor |
| 43. | pico /home/burst/public_html/index.html | edit the index page for the user's website. |
| 44. | vi | another editor, tons of features |
| 45. | vi /home/burst/public_html/index.html | edit the index page for the user's website. |
| 46. | grep root /etc/passwd | shows all matches of root in /etc/passwd |
| 47. | grep -v root /etc/passwd | shows all lines that do not match root |
| 48. | touch /home/burst/public_html/404.html | create an empty file called 404.html in the directory /home/burst/public_html/ |
| 49. | ln | create's "links" between files and directories |
| 50. | ln -s /home/username/tmp/webalizer webstats | Now you can display http://www.yourdomain.com/webstats to show your webalizer stats online. You can delete the symlink (webstats) and it will not delete the original stats on the server. |
| 51. | rm filename.txt | deletes filename.txt, will more than likely ask if you really want to delete it |
| 52. | rm -f filename.txt | deletes filename.txt, will not ask for confirmation before deleting. |
| 53. | rm -rf tmp/ | recursively deletes the directory tmp, and all files in it, including subdirectories. |
| 54. | last | shows who logged in and when |
| 55. | last -20 | shows only the last 20 logins |

| Sl.No. | Commands | Description |
|---|---|---|
| 56. | last -20 -a | shows last 20 logins, with the hostname in the last field |
| 57. | w | shows who is currently logged in and where they are logged in from. |
| 58. | netstat | shows all current network connections. |
| 59. | netstat -an | shows all connections to the server, the source and destination ips and ports. |
| 60. | netstat -rn | shows routing table for all ips bound to the server. |
| 61. | top | shows live system processes in a nice table, memory information, uptime and other useful info. |
| 62. | ps | ps is short for process status, which is similar to the top command. It's used to show currently running processes and their PID. |
| 63. | ps U username | shows processes for a certain user |
| 64. | ps aux | shows all system processes |
| 65. | ps aux --forest | shows all system processes like the above but organizes in a hierarchy that's very useful! |
| 66. | file | attempts to guess what type of file a file is by looking at it's content. |
| 67. | file * | prints out a list of all files/directories in a directory |
| 68. | du | shows disk usage. |
| 69. | du -sh | shows a summary, in human-readble form, of total disk space used in the current directory, including subdirectories. |
| 70. | du -sh * | same thing, but for each file and directory. helpful when finding large files taking up space. |
| 71. | wc | word count |
| 72. | wc -l filename.txt | tells how many lines are in filename.txt |
| 73. | cp filename filename.backup | copies filename to filename.backup |
| 74. | cp -a /home/burst/new_design/* /home/burst/public_html/ | copies all files, retaining permissions form one directory to another. |
| 75. | find * -type d | xargs -i cp --verbose php.ini {} |
| 76. | kill | terminate a system process |
| 77. | kill -9 PID EG | kill -9 431 |

| Sl.No. | Commands | Description |
|---|---|---|
| 78. | kill PID EG | kill 10550 |

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# Vi Editor (Text Editor)

Vi editor is the most popular text editor from the early days of Unix. Whereas Vim ( Vi IMproved ) is an improved version of vi editor to be used in CLI ( command line interface ) for mainly text editing tasks in many configuration files. Some of the other alternatives are Elvis, Nvi, Nano, Joe, and Vile. It has two main operation modes,

- **Command Mode:** It allows the entry of commands to manipulate text.
- **Entry mode ( Or Insert mode ):** It allows typed characters on the keyboard into the current file.

## Start with Vi Editor

You can create a new file or open an existing file using `vi filename` command.

```
 vi <filename_NEW> or <filename_EXISTING> // Create a new file or open an existing
file

 Example:
 vi first.txt
```

Let's see how do you create file, enter the content and leave the CLI by saving the changes.

1. Create a new file named `first.txt`
2. Press `i` to enter the insert mode
3. Enter the text "Hello World!"
4. Save the text and exit by pressing `:wq!` command
5. Check the entered text

## Cursor movement

These commands will be used in Command mode.

### Move cursor

You can use arrow keys ( left, right, up and down ) to move the cursor on the terminal. But you can also other keys for this behavior.

```
h       # Move left
j       # Move down
k       # Move up
l       # Move right
```

**Jump one word**

These commands used to jump one word at a time

```
w        # Jump forwards to the start of a word
W        # Jump forwards to the start of a WORD
e        # Jump forwards to the start of a word
E        # Jump forwards to the start of a WORD
b        # Jump backwords to the start of a word
B        # Jump backwords to the start of a WORD
```

**Jump to start or end of a line or next line**

These commands used to jump starting or ending of a line or a next line.

```
^        # Jump to the start of a current line
$        # Jump to the end of a current line
return   # Jump to the start of a next line
```

**Move sides**

These commands used to moves all sides of the screen

```
Backspace # Move cursor one character to the left
Spacebar  # Move cursor one character to the right
H ( High )   # Move cursor to the top of the screen
M ( Middle ) # Move cursor to the middle of the screen
L ( Low )    # Move cursor to the bottom of the screen
```

**Paging and Scrolling**

Paging is used to moves the cursor up or down through the text a full screen at a time. Whereas Scrolling happens line by line.

```
Ctrl + f     # move forward one full screen
Ctrl + b     # move backward one full screen
Ctrl + d     # move forward half a screen
Ctrl + u     # move backward half a screen
```

## Inserting Text

These commands places vi in entry mode from command mode. First, you need to be in command mode to use the below commands.

**Insert**

```
i    # Insert text to the left of the cursor
I    # Insert text at the beginning of a line
ESC  # Exit insert mode
```

**Append**

```
a    # Insert ( or Append ) text to the right of the cursor
A    # Insert ( or Append ) text at the end of a line
```

**Open a line**

```
o    # Open a line below the current cursor position
O    # open a line above the current cursor position
```

## Editing Text

**Change word:** Change word/part of word to right of cursor

```
cw
```

**Change line** Change entire line

```
cc
```

**Change line from specific character** Change from cursor to end of line

```
C
```

## Deleting Text

**Deleting One Character:** Position the cursor over the character to be deleted and type x

```
x
X       //To delete one character before the cursor
```

**Deleting a Word:** Position the cursor at the beginning of the word and type dw

```
dw
```

**Deleting a Line:** Position the cursor anywhere on the line and type dd.

```
dd
```

## File oprations - Backend Mode

Copy, Cut and Paste operations can be done in either Normal or visual Mode.

**Normal mode:** This mode appears on click of `Esc` key.

### Copy

**Copy** There are various copy or yank commands based on amount of text to be copied. The `y` character is used to perform this operation.

i. Copy an entire line: Just place the cursor at the beginning of the line and type `yy`

```
yy
```

ii.Copy three lines: Just place the cursor from where to start copying and type `3yy`

```
3yy
```

iii. Copy word with trailing whitespace: Place the cursor at the beginning of the word and type `yaw`

```
yaw
```

iv. Copy word without trailing whitespace: Place the cursor at the beginning of the word and type `yiw`.

```
yiw
```

v. Copy right of the cursor: Copy text right of the cursor to the end of line using `y$` command

```
y$
```

vi.Copy left of the cursor: Copy text left of the cursor to the end of line using `y^` command

```
y^
```

vii. Copy text between the cursor and character: Copy text between the cursor and specified character.

```
ytx ( Copy until x and x is excluded )
yfx ( Copy until x and x is included )
```

**Cut**

**Cut** There are various cutting or deleting commands based on amount of text to be deleted. The `d` character is used to perform this operation.

i. Cut entire line: Cut the entire line where the cursor is located

```
dd
```

ii.Cut three lines: Cut the three lines starting from the place where cursor is located

```
3dd
```

iii.Cut right of the cursor: Cut the text from the right of the cursor till the end of line

```
d$
```

iii.Cut left of the cursor: Cut the text from the left of the cursor till the beginning of line

```
d^
```

**Paste**

**Paste** This operation is performed using `p` command to paste the selected text

```
p
```

## File oprations - Visual Mode

1. **Visual Mode** In this mode, first select the text using below keys
2. v ( lowercase ): To select individual characters
3. V ( uppercase ): To select the entire line
4. Ctrl+v: To select by block

and perform copy, cut and paste operations using y,d and p commands

### Exiting

These commands are used to exit from the file.

```
:w     # Write (save) the file, but don't exit
:wq     # Write (save) and quit
:wq! # Force write (save) and quit
:q     # Quit, but it fails if anything has changed
:q!     # Quit and throw away for any changes
```

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## Process Management

| Sl.No. | Commands | Description |
|---|---|---|
| 01. | ps | display your currently active processes |
| 02. | top | display all running processes |
| 03. | kill pid | kill process id pid |
| 04. | killall proc | kill all processes named proc * |
| 05. | bg | lists stopped or background jobs; resume a stopped job in the background |
| 06. | fg | brings the most recent job to foreground |
| 07. | fg n | brings job n to the foreground |

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## SSH

- ssh user@host – connect to host as user
- ssh -p port user@host – connect to host on port port as user
- ssh-copy-id user@host – add your key to host for user to enable a keyed or passwordless login

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## Searching

- grep pattern files – search for pattern in files
- grep -r pattern dir – search recursively for pattern in dir
- command | grep pattern – search for pattern in the output of command

- locate file – find all instances of file

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## System Info

| Sl.No. | Commands | Description |
|---|---|---|
| 01. | date | show the current date and time |
| 02. | cal | show this month's calendar |
| 03. | uptime | show current uptime |
| 04. | w | display who is online |
| 05. | whoami | who you are logged in as |
| 06. | finger user | display information about user |
| 07. | uname -a | show kernel information |
| 08. | cat /proc/cpuinfo | cpu information |
| 09. | cat /proc/meminfo | memory information |
| 10. | man command | show the manual for command |
| 11. | df | show disk usage |
| 12. | du | show directory space usage |
| 13. | free | show memory and swap usage |
| 14. | whereis app | show possible locations of app |
| 15. | which app | show which app will be run by default |

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## Compression

| Sl.No. | Commands | Description |
|---|---|---|
| 01. | tar cf file.tar files | create a tar named file.tar containing files |
| 02. | tar xf file.tar | extract the files from file.tar |
| 03. | tar czf file.tar.gz files | create a tar with Gzip compression |
| 04. | tar xzf file.tar.gz | extract a tar using Gzip |
| 05. | tar cjf file.tar.bz2 | create a tar with Bzip2 compression |
| 06. | tar xjf file.tar.bz2 | extract a tar using Bzip2 |
| 07. | gzip file | compresses file and renames it to file.gz |
| 08. | gzip -d file.gz | decompresses file.gz back to file |

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## Network

- ping host – ping host and output results
- whois domain – get whois information for domain
- dig domain – get DNS information for domain
- dig -x host – reverse lookup host
- wget file – download file
- wget -c file – continue a stopped download

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## Installation

- dpkg -i pkg.deb – install a package (Debian)
- rpm -Uvh pkg.rpm – install a package (RPM)

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## Install from source

- ./configure
- make
- make install

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## Shortcuts

- Ctrl+C – halts the current command
- Ctrl+Z – stops the current command, resume with
- fg in the foreground or bg in the background
- Ctrl+D – log out of current session, similar to exit
- Ctrl+W – erases one word in the current line
- Ctrl+U – erases the whole line
- Ctrl+R – type to bring up a recent command
- !! - repeats the last command
- exit – log out of current session

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## Command History

```
!!            # Run the last command

touch foo.sh
chmod +x !$   # !$ is the last argument of the last command i.e. foo.sh
```

## Navigating Directories

```
pwd                       # Print current directory path
ls                        # List directories
ls -a|--all               # List directories including hidden
ls -l                     # List directories in long form
ls -l -h|--human-readable # List directories in long form with human readable
sizes
ls -t                     # List directories by modification time, newest first
stat foo.txt              # List size, created and modified timestamps for a file
stat foo                  # List size, created and modified timestamps for a
directory
tree                      # List directory and file tree
tree -a                   # List directory and file tree including hidden
tree -d                   # List directory tree
cd foo                    # Go to foo sub-directory
cd                        # Go to home directory
cd ~                      # Go to home directory
cd -                      # Go to last directory
pushd foo                 # Go to foo sub-directory and add previous directory to
stack
popd                      # Go back to directory in stack saved by `pushd`
```

## Creating Directories

```
mkdir foo                       # Create a directory
mkdir foo bar                   # Create multiple directories
mkdir -p|--parents foo/bar      # Create nested directory
mkdir -p|--parents {foo,bar}/baz # Create multiple nested directories

mktemp -d|--directory           # Create a temporary directory
```

## Moving Directories

```
cp -R|--recursive foo bar                                  # Copy directory
mv foo bar                                                 # Move directory

rsync -z|--compress -v|--verbose /foo /bar                 # Copy directory,
overwrites destination
rsync -a|--archive -z|--compress -v|--verbose /foo /bar # Copy directory, without
overwriting destination
rsync -avz /foo username@hostname:/bar                     # Copy local directory to
remote directory
rsync -avz username@hostname:/foo /bar                     # Copy remote directory to
local directory
```

## Deleting Directories

```
rmdir foo                          # Delete non-empty directory
rm -r|--recursive foo              # Delete directory including contents
rm -r|--recursive -f|--force foo # Delete directory including contents, ignore
nonexistent files and never prompt
```

## Creating Files

```
touch foo.txt           # Create file or update existing files modified timestamp
touch foo.txt bar.txt   # Create multiple files
touch {foo,bar}.txt     # Create multiple files
touch test{1..3}        # Create test1, test2 and test3 files
touch test{a..c}        # Create testa, testb and testc files

mktemp                  # Create a temporary file
```

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## Standard Output, Standard Error and Standard Input

```
echo "foo" > bar.txt        # Overwrite file with content
echo "foo" >> bar.txt       # Append to file with content

ls exists 1> stdout.txt     # Redirect the standard output to a file
ls noexist 2> stderror.txt # Redirect the standard error output to a file
ls 2>&1 out.txt             # Redirect standard output and error to a file
ls > /dev/null              # Discard standard output and error

read foo                    # Read from standard input and write to the variable
foo
```

## Moving Files

```
cp foo.txt bar.txt                                  # Copy file
mv foo.txt bar.txt                                  # Move file

rsync -z|--compress -v|--verbose /foo.txt /bar    # Copy file quickly if not
changed
rsync z|--compress -v|--verbose /foo.txt /bar.txt # Copy and rename file quickly
if not changed
```

## Deleting Files

```
rm foo.txt            # Delete file
rm -f|--force foo.txt # Delete file, ignore nonexistent files and never prompt
```

## Reading Files

```
cat foo.txt            # Print all contents
less foo.txt           # Print some contents at a time (g - go to top of file,
SHIFT+g, go to bottom of file, /foo to search for 'foo')
head foo.txt           # Print top 10 lines of file
tail foo.txt           # Print bottom 10 lines of file
open foo.txt           # Open file in the default editor
wc foo.txt             # List number of lines words and characters in the file
```

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## Finding Files

Find binary files for a command.

```
type wget                                  # Find the binary
which wget                                 # Find the binary
whereis wget                               # Find the binary, source, and manual
page files
```

`locate` uses an index and is fast.

```
updatedb                                   # Update the index

locate foo.txt                             # Find a file
locate --ignore-case                       # Find a file and ignore case
locate f*.txt                              # Find a text file starting with 'f'
```

`find` doesn't use an index and is slow.

```
find /path -name foo.txt                   # Find a file
find /path -iname foo.txt                  # Find a file with case insensitive
search
find /path -name "*.txt"                   # Find all text files
find /path -name foo.txt -delete           # Find a file and delete it
find /path -name "*.png" -exec pngquant {} # Find all .png files and execute
pngquant on it
find /path -type f -name foo.txt           # Find a file
find /path -type d -name foo               # Find a directory
```

```
find /path -type l -name foo.txt           # Find a symbolic link
find /path -type f -mtime +30              # Find files that haven't been modified
in 30 days
find /path -type f -mtime +30 -delete      # Delete files that haven't been
modified in 30 days
```

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## Find in Files

```
grep 'foo' /bar.txt                         # Search for 'foo' in file 'bar.txt'
grep 'foo' /bar -r|--recursive              # Search for 'foo' in directory 'bar'
grep 'foo' /bar -R|--dereference-recursive  # Search for 'foo' in directory 'bar'
and follow symbolic links
grep 'foo' /bar -l|--files-with-matches     # Show only files that match
grep 'foo' /bar -L|--files-without-match    # Show only files that don't match
grep 'Foo' /bar -i|--ignore-case            # Case insensitive search
grep 'foo' /bar -x|--line-regexp            # Match the entire line
grep 'foo' /bar -C|--context 1              # Add N line of context above and
below each search result
grep 'foo' /bar -v|--invert-match           # Show only lines that don't match
grep 'foo' /bar -c|--count                  # Count the number lines that match
grep 'foo' /bar -n|--line-number            # Add line numbers
grep 'foo' /bar --colour                    # Add colour to output
grep 'foo\|bar' /baz -R                     # Search for 'foo' or 'bar' in
directory 'baz'
grep --extended-regexp|-E 'foo|bar' /baz -R # Use regular expressions
egrep 'foo|bar' /baz -R                     # Use regular expressions
```

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### Replace in Files

```
sed 's/fox/bear/g' foo.txt              # Replace fox with bear in foo.txt and
output to console
sed 's/fox/bear/gi' foo.txt             # Replace fox (case insensitive) with
bear in foo.txt and output to console
sed 's/red fox/blue bear/g' foo.txt     # Replace red with blue and fox with bear
in foo.txt and output to console
sed 's/fox/bear/g' foo.txt > bar.txt    # Replace fox with bear in foo.txt and
save in bar.txt
sed 's/fox/bear/g' foo.txt -i|--in-place # Replace fox with bear and overwrite
foo.txt
```

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## Symbolic Links

```
ln -s|--symbolic foo bar            # Create a link 'bar' to the 'foo' folder
ln -s|--symbolic -f|--force foo bar # Overwrite an existing symbolic link 'bar'
ls -l                               # Show where symbolic links are pointing
```

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# Compressing Files

## zip

Compresses one or more files into *.zip files.

```
zip foo.zip /bar.txt                # Compress bar.txt into foo.zip
zip foo.zip /bar.txt /baz.txt       # Compress bar.txt and baz.txt into foo.zip
zip foo.zip /{bar,baz}.txt          # Compress bar.txt and baz.txt into foo.zip
zip -r|--recurse-paths foo.zip /bar # Compress directory bar into foo.zip
```

## gzip

Compresses a single file into *.gz files.

```
gzip /bar.txt foo.gz           # Compress bar.txt into foo.gz and then delete
bar.txt
gzip -k|--keep /bar.txt foo.gz # Compress bar.txt into foo.gz
```

## tar -c

Compresses (optionally) and combines one or more files into a single *.tar,*.tar.gz, *.tpz or*.tgz file.

```
tar -c|--create -z|--gzip -f|--file=foo.tgz /bar.txt /baz.txt # Compress bar.txt
and baz.txt into foo.tgz
tar -c|--create -z|--gzip -f|--file=foo.tgz /{bar,baz}.txt    # Compress bar.txt
and baz.txt into foo.tgz
tar -c|--create -z|--gzip -f|--file=foo.tgz /bar              # Compress directory
bar into foo.tgz
```

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# Decompressing Files

## unzip

```
unzip foo.zip          # Unzip foo.zip into current directory
```

### gunzip

```
gunzip foo.gz           # Unzip foo.gz into current directory and delete foo.gz
gunzip -k|--keep foo.gz # Unzip foo.gz into current directory
```

### tar -x

```
tar -x|--extract -z|--gzip -f|--file=foo.tar.gz # Un-compress foo.tar.gz into
current directory
tar -x|--extract -f|--file=foo.tar              # Un-combine foo.tar into current
directory
```

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## Disk Usage

```
df                      # List disks, size, used and available space
df -h|--human-readable # List disks, size, used and available space in a human
readable format

du                      # List current directory, subdirectories and file sizes
du /foo/bar             # List specified directory, subdirectories and file sizes
du -h|--human-readable # List current directory, subdirectories and file sizes in
a human readable format
du -d|--max-depth       # List current directory, subdirectories and file sizes
within the max depth
du -d 0                 # List current directory size
```

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## Memory Usage

```
free                    # Show memory usage
free -h|--human         # Show human readable memory usage
free -h|--human --si    # Show human readable memory usage in power of 1000 instead
of 1024
free -s|--seconds 5     # Show memory usage and update continuously every five
seconds
```

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## Packages

```
apt update              # Refreshes repository index
apt search wget         # Search for a package
apt show wget           # List information about the wget package
apt install wget        # Install the wget package
apt remove wget         # Removes the wget package
apt upgrade             # Upgrades all upgradable packages
```

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## Shutdown and Reboot

```
shutdown                      # Shutdown in 1 minute
shutdown now "Cya later"      # Immediately shut down
shutdown +5 "Cya later"       # Shutdown in 5 minutes

shutdown --reboot             # Reboot in 1 minute
shutdown -r now "Cya later"   # Immediately reboot
shutdown -r +5 "Cya later"    # Reboot in 5 minutes

shutdown -c                   # Cancel a shutdown or reboot

reboot                        # Reboot now
reboot -f                     # Force a reboot
```

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## Identifying Processes

```
top                     # List all processes interactively
htop                    # List all processes interactively
ps all                  # List all processes
pidof foo               # Return the PID of all foo processes

CTRL+Z                  # Suspend a process running in the foreground
bg                      # Resume a suspended process and run in the background
fg                      # Bring the last background process to the foreground
fg 1                    # Bring the background process with the PID to the
foreground

sleep 30 &              # Sleep for 30 seconds and move the process into the
background
jobs                    # List all background jobs
jobs -p                 # List all background jobs with their PID

lsof                    # List all open files and the process using them
lsof -itcp:4000         # Return the process listening on port 4000
```

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## Process Priority

Process priorities go from -20 (highest) to 19 (lowest).

```
nice -n -20 foo        # Change process priority by name
renice 20 PID          # Change process priority by PID
ps -o ni PID           # Return the process priority of PID
```

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## Killing Processes

```
CTRL+C                 # Kill a process running in the foreground
kill PID               # Shut down process by PID gracefully. Sends TERM signal.
kill -9 PID            # Force shut down of process by PID. Sends SIGKILL signal.
pkill foo              # Shut down process by name gracefully. Sends TERM signal.
pkill -9 foo           # force shut down process by name. Sends SIGKILL signal.
killall foo            # Kill all process with the specified name gracefully.
```

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## Date & Time

```
date                   # Print the date and time
date --iso-8601        # Print the ISO8601 date
date --iso-8601=ns     # Print the ISO8601 date and time

time tree              # Time how long the tree command takes to execute
```

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## Scheduled Tasks

```
   *      *         *         *           *
Minute, Hour, Day of month, Month, Day of the week
```

```
crontab -l                # List cron tab
crontab -e                # Edit cron tab in Vim
crontab /path/crontab     # Load cron tab from a file
crontab -l > /path/crontab # Save cron tab to a file
```

```
* * * * * foo              # Run foo every minute
*/15 * * * * foo          # Run foo every 15 minutes
0 * * * * foo             # Run foo every hour
15 6 * * * foo            # Run foo daily at 6:15 AM
44 4 * * 5 foo            # Run foo every Friday at 4:44 AM
0 0 1 * * foo             # Run foo at midnight on the first of the month
0 0 1 1 * foo             # Run foo at midnight on the first of the year

at -l                     # List scheduled tasks
at -c 1                   # Show task with ID 1
at -r 1                   # Remove task with ID 1
at now + 2 minutes        # Create a task in Vim to execute in 2 minutes
at 12:34 PM next month    # Create a task in Vim to execute at 12:34 PM next
month
at tomorrow               # Create a task in Vim to execute tomorrow
```

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## HTTP Requests

```
curl https://example.com                                # Return response body
curl -i|--include https://example.com                   # Include status code and
HTTP headers
curl -L|--location https://example.com                  # Follow redirects
curl -o|--remote-name foo.txt https://example.com       # Output to a text file
curl -H|--header "User-Agent: Foo" https://example.com # Add a HTTP header
curl -X|--request POST -H "Content-Type: application/json" -d|--data
'{"foo":"bar"}' https://example.com # POST JSON
curl -X POST -H --data-urlencode foo="bar" http://example.com
# POST URL Form Encoded

wget https://example.com/file.txt .                             # Download a file
to the current directory
wget -O|--output-document foo.txt https://example.com/file.txt # Output to a file
with the specified name
```

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## Network Troubleshooting

```
ping example.com            # Send multiple ping requests using the ICMP protocol
ping -c 10 -i 5 example.com # Make 10 attempts, 5 seconds apart

ip addr                     # List IP addresses on the system
ip route show               # Show IP addresses to router

netstat -i|--interfaces     # List all network interfaces and in/out usage
netstat -l|--listening      # List all open ports
```

```
traceroute example.com      # List all servers the network traffic goes through

mtr -w|--report-wide example.com                                    # Continually
list all servers the network traffic goes through
mtr -r|--report -w|--report-wide -c|--report-cycles 100 example.com # Output a
report that lists network traffic 100 times

nmap 0.0.0.0                # Scan for the 1000 most common open ports on
localhost
nmap 0.0.0.0 -p1-65535      # Scan for open ports on localhost between 1 and 65535
nmap 192.168.4.3            # Scan for the 1000 most common open ports on a remote
IP address
nmap -sP 192.168.1.1/24     # Discover all machines on the network by ping'ing
them
```

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## DNS

```
host example.com            # Show the IPv4 and IPv6 addresses

dig example.com             # Show complete DNS information

cat /etc/resolv.conf        # resolv.conf lists nameservers
```

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## Hardware

```
lsusb                   # List USB devices
lspci                   # List PCI hardware
lshw                    # List all hardware
```

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## Terminal Multiplexers

Start multiple terminal sessions. Active sessions persist reboots. `tmux` is more modern than `screen`.

```
tmux             # Start a new session (CTRL-b + d to detach)
tmux ls          # List all sessions
tmux attach -t 0 # Reattach to a session

screen           # Start a new session (CTRL-a + d to detach)
screen -ls       # List all sessions
screen -R 31166  # Reattach to a session
```

```
exit            # Exit a session
```

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## Secure Shell Protocol (SSH)

```
ssh hostname                # Connect to hostname using your current user name
over the default SSH port 22
ssh -i foo.pem hostname     # Connect to hostname using the identity file
ssh user@hostname           # Connect to hostname using the user over the default
SSH port 22
ssh user@hostname -p 8765   # Connect to hostname using the user over a custom
portlan
ssh ssh://user@hostname:8765 # Connect to hostname using the user over a custom
port
```

Set default user and port in `~/.ssh/config`, so you can just enter the name next time:

```
$ cat ~/.ssh/config
Host name
  User foo
  Hostname 127.0.0.1
  Port 8765
$ ssh name
```

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## Secure Copy

```
scp foo.txt ubuntu@hostname:/home/ubuntu # Copy foo.txt into the specified remote
directory
```

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## Bash Profile

- bash - `.bashrc`
- zsh - `.zshrc`

```
# Always run ls after cd
function cd {
  builtin cd "$@" && ls
}
```

```
# Prompt user before overwriting any files
alias cp='cp --interactive'
alias mv='mv --interactive'
alias rm='rm --interactive'

# Always show disk usage in a human readable format
alias df='df -h'
alias du='du -h'
```

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## Bash Script

### Variables

```
#!/bin/bash

foo=123                # Initialize variable foo with 123
declare -i foo=123     # Initialize an integer foo with 123
declare -r foo=123     # Initialize readonly variable foo with 123
echo $foo              # Print variable foo
echo ${foo}_'bar'      # Print variable foo followed by _bar
echo ${foo:-'default'} # Print variable foo if it exists otherwise print default

export foo             # Make foo available to child processes
unset foo              # Make foo unavailable to child processes
```

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### Environment Variables

```
#!/bin/bash

env        # List all environment variables
echo $PATH # Print PATH environment variable
```

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### Functions

```
#!/bin/bash

greet() {
  local world = "World"
  echo "$1 $world"
  return "$1 $world"
```

```
}
greet "Hello"
greeting=$(greet "Hello")
```

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## Exit Codes

```
#!/bin/bash

exit 0   # Exit the script successfully
exit 1   # Exit the script unsuccessfully
echo $?  # Print the last exit code
```

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## Conditional Statements

### Boolean Operators

- `$foo` - Is true
- `!$foo` - Is false

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### Numeric Operators

- `-eq` - Equals
- `-ne` - Not equals
- `-gt` - Greater than
- `-ge` - Greater than or equal to
- `-lt` - Less than
- `-le` - Less than or equal to
- `-e` foo.txt - Check file exists
- `-z` foo - Check if variable exists

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### String Operators

- `=` - Equals
- `==` - Equals
- `-z` - Is null
- `-n` - Is not null
- `<` - Is less than in ASCII alphabetical order
- `>` - Is greater than in ASCII alphabetical order

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### If Statements

```
#!/bin/bash

if [[$foo = 'bar']]; then
  echo 'one'
elif [[$foo = 'bar']] || [[$foo = 'baz']]; then
  echo 'two'
elif [[$foo = 'ban']] && [[$USER = 'bat']]; then
  echo 'three'
else
  echo 'four'
fi
```

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### Inline If Statements

```
#!/bin/bash

[[ $USER = 'rehan' ]] && echo 'yes' || echo 'no'
```

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### While Loops

```
#!/bin/bash

declare -i counter
counter=10
while [$counter -gt 2]; do
  echo The counter is $counter
  counter=counter-1
done
```

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### For Loops

```
#!/bin/bash

for i in {0..10..2}
  do
    echo "Index: $i"
  done
```

```
for filename in file1 file2 file3
  do
    echo "Content: " >> $filename
  done

for filename in *;
  do
    echo "Content: " >> $filename
  done
```

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**Case Statements**

```
#!/bin/bash

echo 'What's the weather like tomorrow?'
read weather

case $weather in
  sunny | warm ) echo 'Nice weather: ' $weather
  ;;
  cloudy | cool ) echo 'Not bad weather: ' $weather
  ;;
  rainy | cold ) echo 'Terrible weather: ' $weather
  ;;
  * ) echo 'Don't understand'
  ;;
esac
```

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## Case study

Case study de ne yapacak

### Hello World

### Calculator

### Search

### Hangman (Optional)

## Knowledge check

To double check that you understood the most essentials about Linux, please answer the following questions.

### Fill required info about kernels

Most operating systems can be classified into two distinct families. Operating systems using Microsoft's _____ kernel, or all Linux distributions using _____ kernel.

### Which character is used to provide execute permission?

- ☐ r
- ☐ w
- ☐ x
- ☐ .

### Which command returns the system username?

- ☐ whoisthis
- ☐ whoami
- ☐ currentusr
- ☐ whom

### What is the file name extension for shell scripts?

- ☐ .bash
- ☐ .sh
- ☐ .ps1
- ☐ .bat

## Summary

In this training you will gain skill on Java programming. I will explain basics of programming as well as syntax of Java. Then you have learned how to make simple programs. There were 2 case studies: one Hello World, another was a calculator.