Linux Fundamentals

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$ echo "By Ali Zaidi and Mohammed Haaris Javed"
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Topics to be covered

- Why learn Linux ?
- Important concepts
  - Introduction to Linux
  - Understanding Distros
  - Linux Shell
  - Users, files and permissions
  - Filesystem Hierarchy Standard(FHS)
- Quiz
- Useful commands
- Activity - Capture the Flag

Why learn Linux ?

- If you intend to work professionally in any sort of technical capacity, chances are that you will run into it.

Some stats...

- 100% of world's top 500 supercomputers use Linux.
- Out of Top 25 websites in the world, only 2 aren't using Linux.
- 90% of all cloud infrastructure operates on Linux and all the best clouds use it.
- 96.3% of the world's top 1 million servers run on Linux.
- World's most used Operating system: Android, is built on top of Linux.
- 83.1% of developers prefer Linux as their work platform.

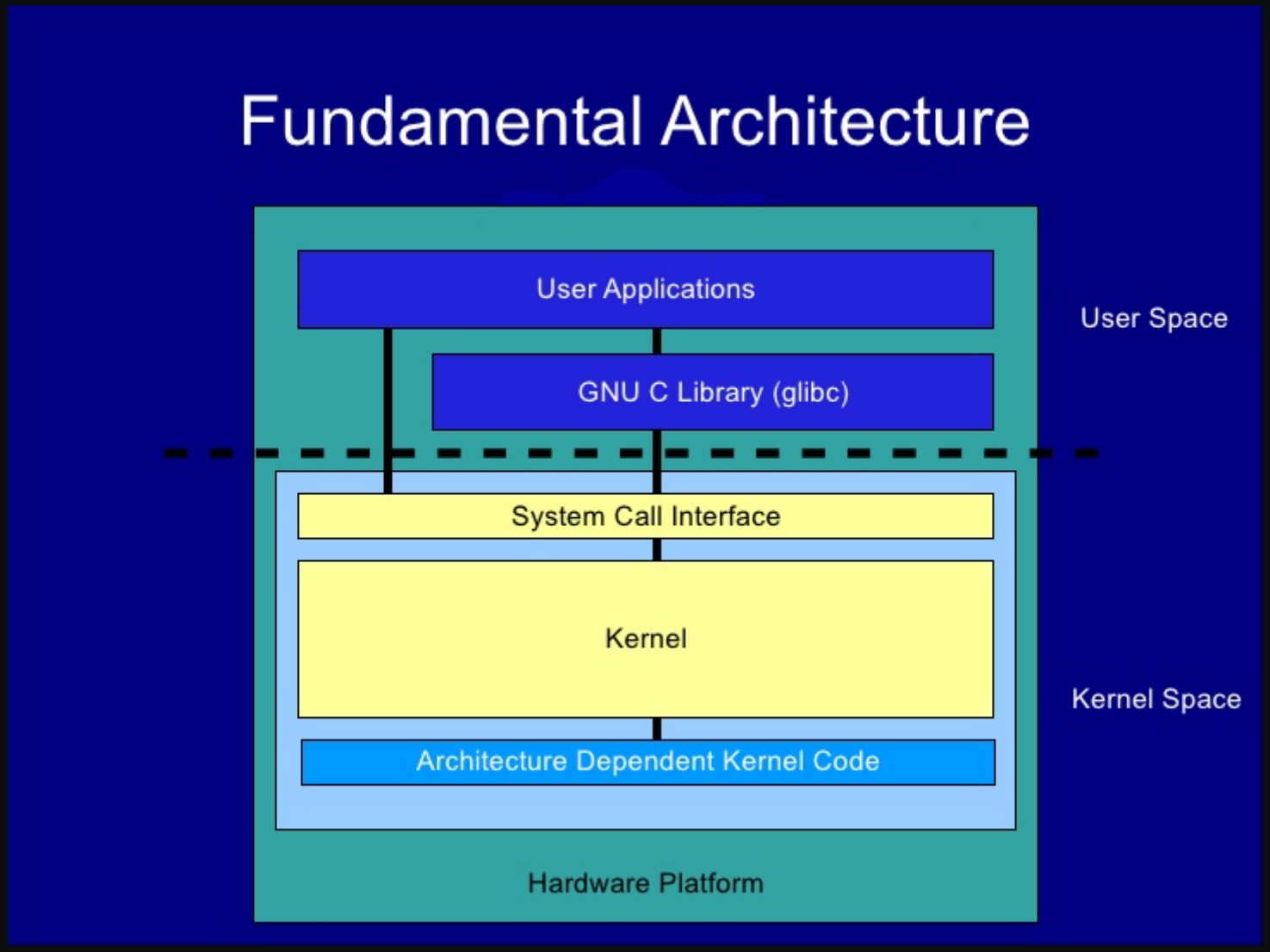
Other benefits

1. Privacy
2. Fast
3. Lightweight
4. Customizable
5. Free and open source and more...

Introduction to Linux

- Linux is a family of free and open source operating systems based on the Linux kernel
- It is a Unix clone.
- Created by Linus Torvalds, first released on September 17, 1991.
- Linux usually comes packaged in a Linux Distribution.

Understanding Linux Distros

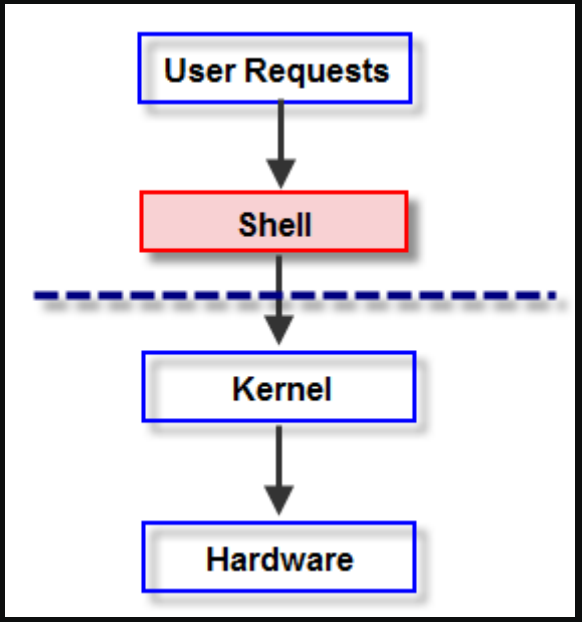


- Most Linux distros package standard C library and userspace software/utils by the GNU project.
- There are exceptions such as Alpine Linux which uses musl C library and Busybox software suite. Also Android which has its own architecture stack above the Linux kernel.
- For the desktop use, Linux distros also come packaged with graphical display servers such as Xorg or Wayland.
- Popular GNU/Linux Distros: Ubuntu, Pop!_OS, Fedora, Linux Mint, Manjaro, Arch Linux, Gentoo, Elementary OS...

How are they different ?

- Default software and configuration
- Package managers
- UI/UX
- Update cycle

Shell



- It can be either GUI or CLI. We will be focusing on CLI.
- A Shell takes user input, makes system calls and displays the output.
- Shell is basically a command interpreter.
- Example shells: sh, bash, zsh, fish, ksh etc.

Users

- Linux is a multi-user OS.
- It follows the Unix concepts of file ownership and permissions to provide security at a filesystem level.

- There two types of users: system users and regular users.
- system users are non-interactive and are used to run background processes on a system.
- Regular users are interactive, they are used for logging in and running processes interactively.
- In addition to the above two, there is also a superuser or root user. That has the highest privilege in the system.

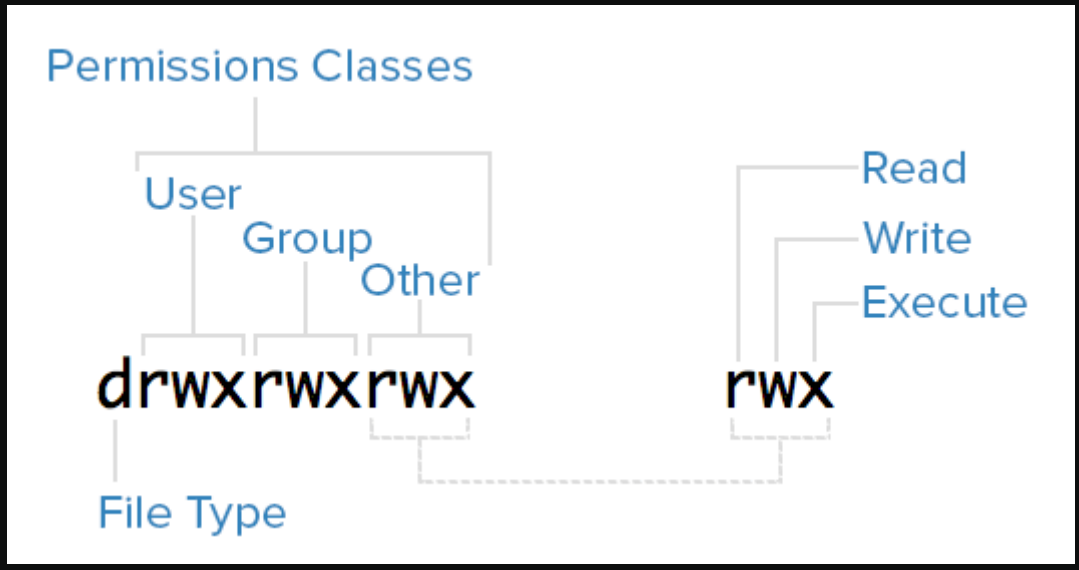
- A normal user can also be configured to assume superuser rights temporarily using a tool called sudo ("superuser do")
- It is considered best practice to create a normal user with "sudo" previleges for administrative tasks.

A little about Groups

- Group is a collection of 0 or more users.
- They are useful for setting group level permissions.
- For example: Users in the group docker can use docker commands while others who are not added to that group will not be able to.

Files and Permissions

- Everything is a file
- Two basic types of files: normal and special.
- File permissions are divided into three sections: User, Group, Other.
- There are three permission types/symbols:
  - r: read permission
  - w: write permission
  - x: execute permission


Permissions Classes
User
Group
Other
drwxrwxrwx
File Type
Read
Write
Execute
rwx

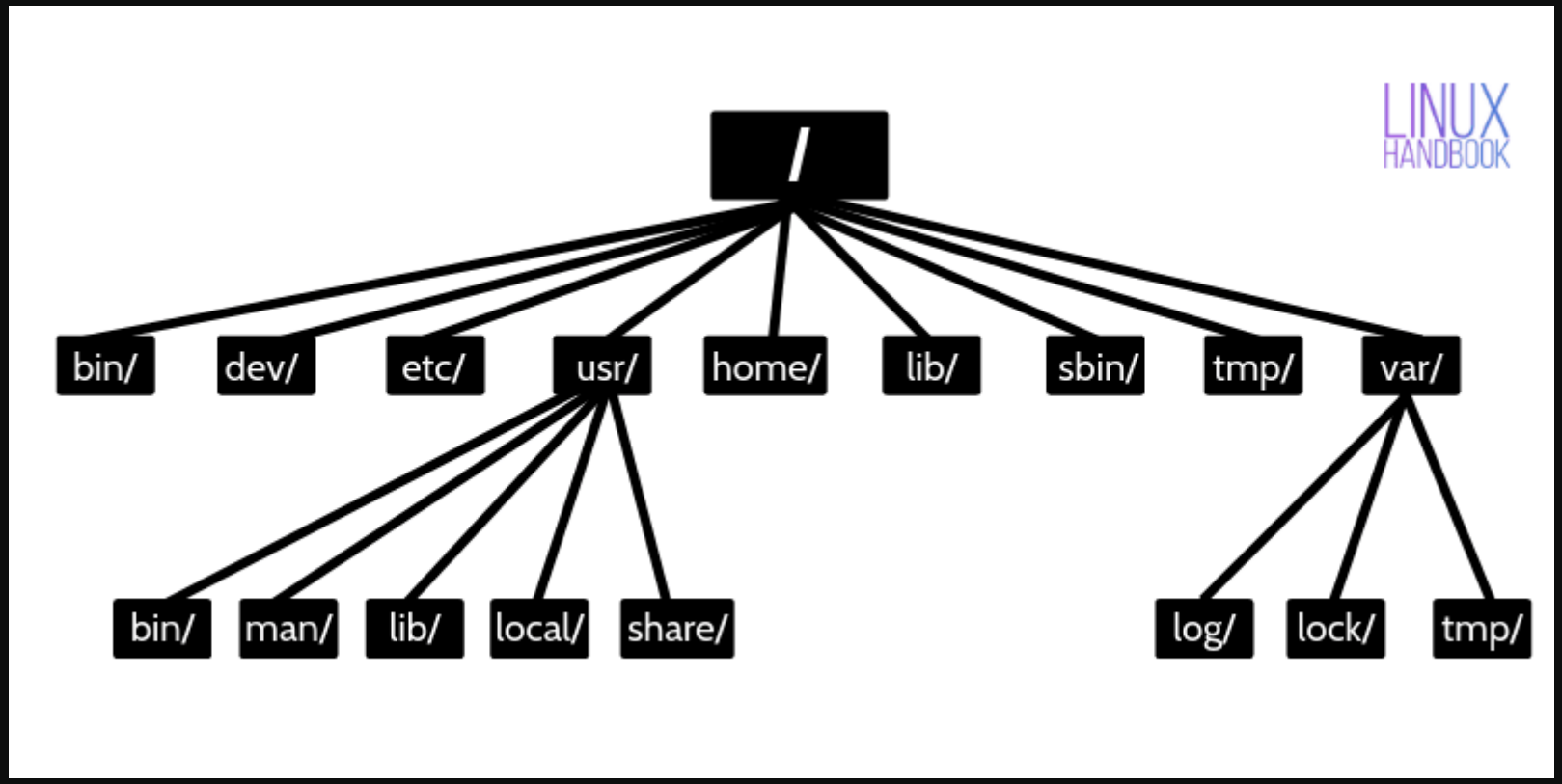
- `-rw-------`: Only accessible by its owner.
- `-rw-r--r--`: Readable/Writable by owner. Only readable by groups and others.
- `-rwxrwxrwx`: a file that is readable, writable and executable by everyone on the system.
- `drwxr-xr-x`: a directory that is readable and accessible be everyone on the system.

- Some commands to modify file permissions: chmod, chown, chgrp.

Octal Representation

0	000	-	-	-	No permissions
1	001	-	-	x	Only Execute
2	010	-	w	-	Only Write
3	011	-	w	x	Write and Execute
4	100	r	-	-	Only Read
5	101	r	-	x	Read and Execute
6	110	r	w	-	Read and Write
7	111	r	w	x	Read, Write and Execute

FileSystem Hierarchy Standard(FHS)



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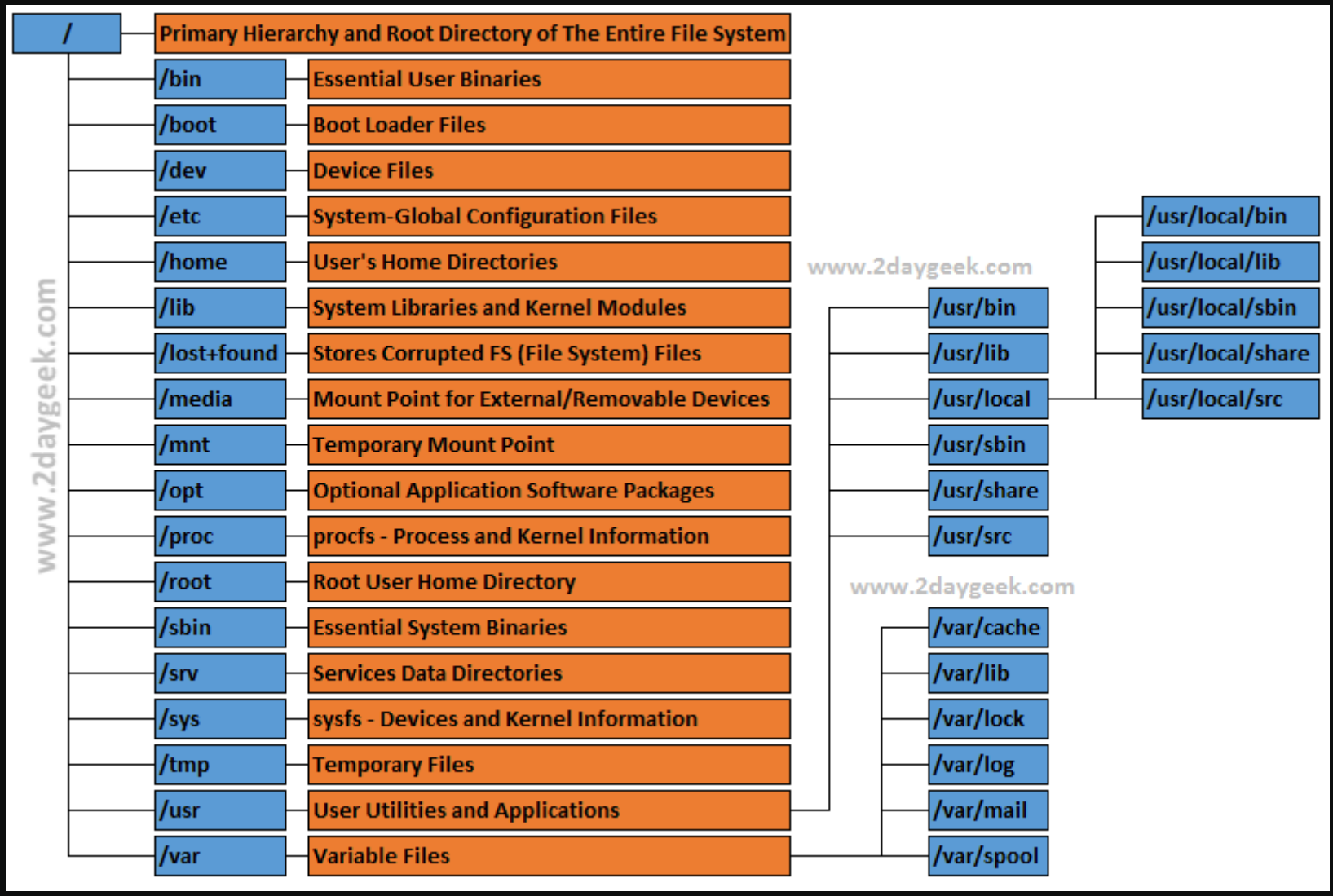
ls /
```

- All files and directories appear under root "/" directory, even if they are stored on different devices.
- Common to most Linux Distributions.


/
Primary Hierarchy and Root Directory of The Entire File System
/bin
Essential User Binaries
/boot
Boot Loader Files
/dev
Device Files
/etc
System-Global Configuration Files
/home
User's Home Directories
/lib
System Libraries and Kernel Modules
/lost+found
Stores Corrupted FS (File System) Files
/media
Mount Point for External/Removable Devices
/mnt
Temporary Mount Point
/opt
Optional Application Software Packages
/proc
procfs - Process and Kernel Information
/root
Root User Home Directory
/sbin
Essential System Binaries
/srv
Services Data Directories
/sys
sysfs - Devices and Kernel Information
/tmp
Temporary Files
/usr
User Utilities and Applications
/var
Variable Files
/usr/bin
/usr/lib
/usr/local
/usr/sbin
/usr/share
/usr/src
/usr/local/bin
/usr/local/lib
/usr/local/sbin
/usr/local/share
/usr/local/src
/var/cache
/var/lib
/var/lock
/var/log
/var/mail
/var/spool
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