Linux User Management & File Permissions for Software Developers

Class 14

26/4/2025

Acknowledgement

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Ministry of Economy, Trade and Industry

Overseas Employment Corporation

What you have Learnt Last Week

We were focused on following points.

- Usage of control and loop flow statement
- Performing Linear Algebra in Numpy
- Inspecting and Understanding Data
- Why Requirement Analysis is so important in the process?
- Machine Learning algorithms
- Software development Life cycle
- Importance of Security compliance
- Detailed steps for launching a new EC2 instance.

What you will Learn Today

We will focus on following points.

- 1. Understanding the Linux file system hierarchy and user roles
- 2. Step-by-step guide on creating users and groups
- 3. Changing File Permissions and Ownership
- 4. Basic and System level Linux commands
- Quiz
- Q&A Session

Exploring the Linux File System Hierarchy

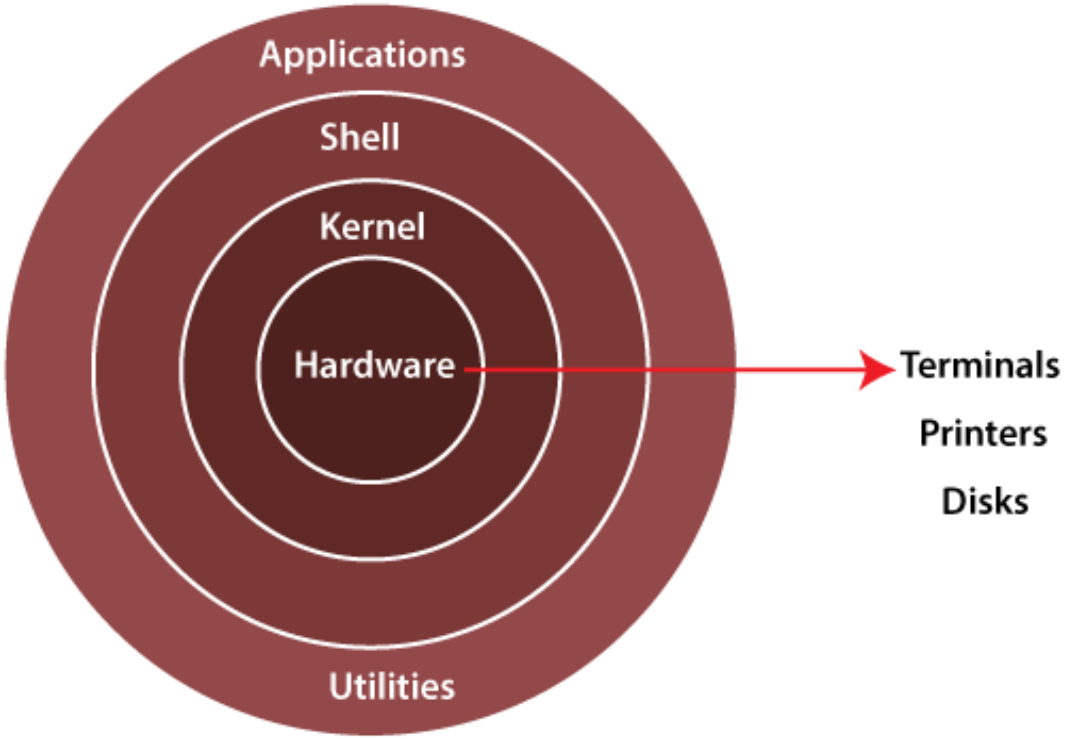
Understand how Linux organizes its files and directories

What is a File System?

A method for storing and organizing files on a storage device.

Why Hierarchy Matters in Linux?

Everything in Linux is treated as a file and follows a tree-like structure starting from / (root)



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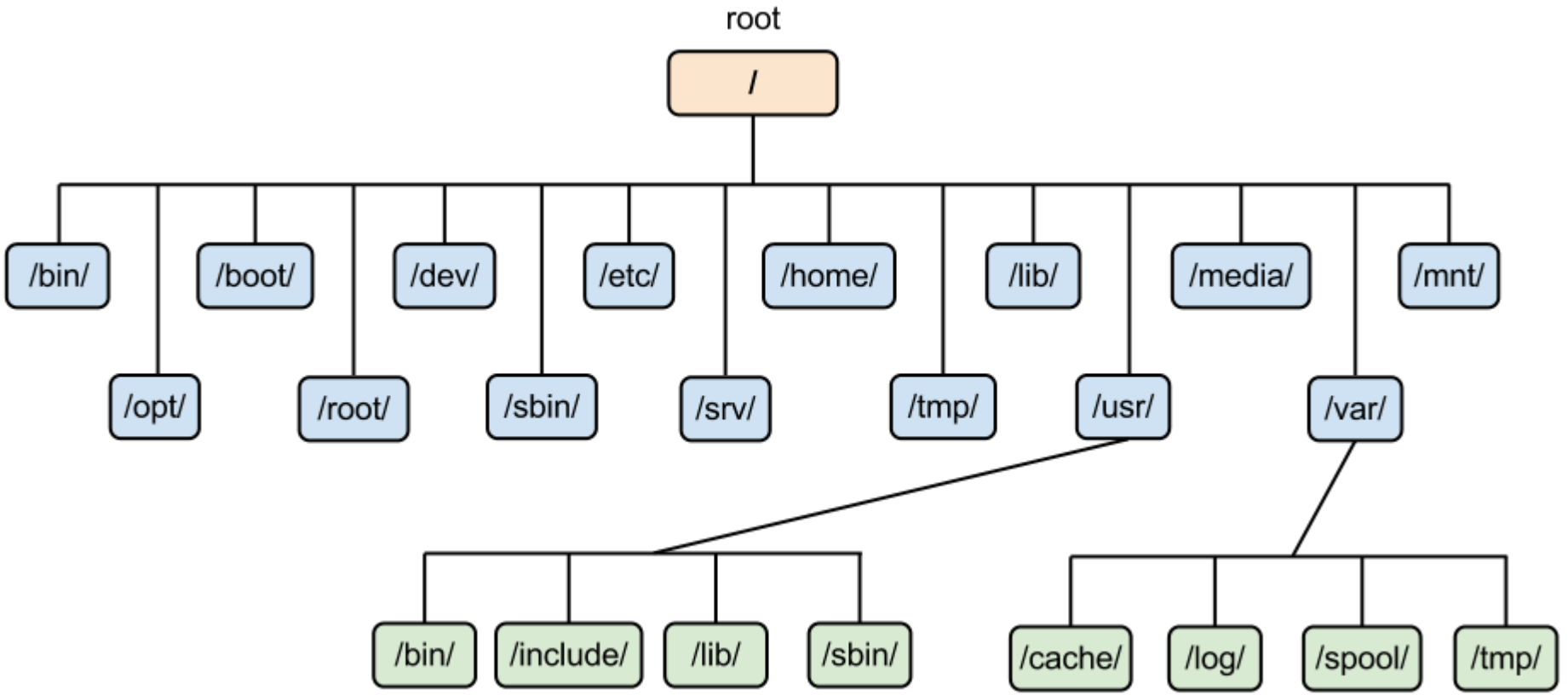


Key Directories and Their Purposes:

Key Directories and Their Purposes:

/ – Root directory (base of the file system)

/bin – Essential binaries (e.g., ls, cat)

/etc – Configuration files (e.g., network settings)

/home – User personal directories (e.g., /home/john)

/var – Variable data like logs, mail, etc.

/usr – User-installed applications and libraries

/tmp – Temporary files

/root – Home directory for root user

/opt – Optional packages/software

Paths and File Types

How to move and identify files in Linux

Absolute Path: Full path from root

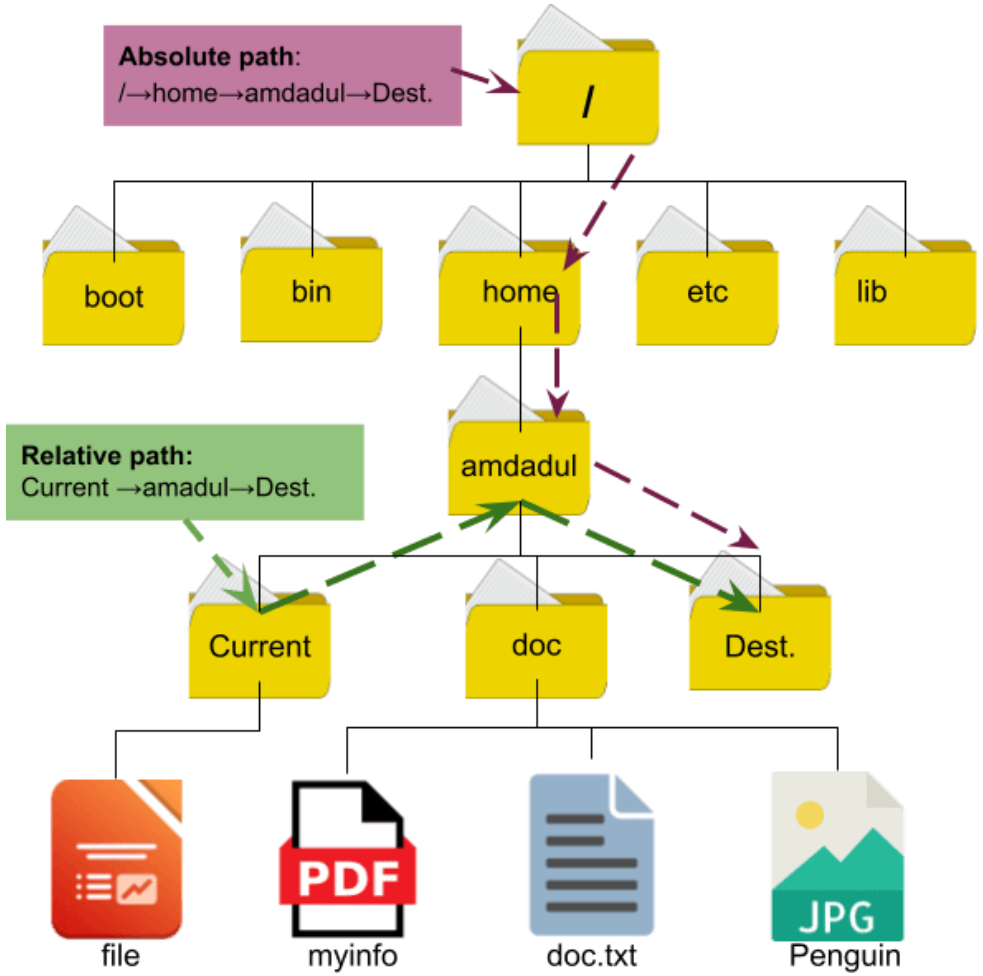
Example: /home/user/file.txt

Relative Path: Based on current location

Example: ../Documents

File Types:

- - → Regular files
- d → Directory
- | → Symbolic link
- c/b → Character/Block device



Users, Groups, and Permissions

Who owns what and who can do what?

Root user: Superuser with all privileges

Normal users: Limited access to system

System users: Run background processes (e.g., mysql, www-data)

Important Files:

/etc/passwd – List of all users

/etc/shadow – Encrypted passwords

/etc/group – Group memberships

Example:

```
cat /etc/passwd | grep hamza
hamza:x:1001:1001:Hamza Munir:/home/hamza:/bin/bash
```

LINUX COMMANDS

Basic Navigation and File Handling

Essential Commands:

- **cd** – Change directory
- **ls** – List files/directories
- **pwd** – Print working directory
- **cp** – Copy files/folders
- **mv** – Move/rename files
- **rm** – Delete files/directories
- **mkdir** – Create a directory
- **touch** – Create an empty file
- **cat** – Display file contents
- **less** – View file contents (scrollable)

Working with Text Files

Text Editors & Viewers:

nano file.txt – Easy-to-use text editor

vim file.txt – Powerful editor for advanced users

head -n 5 file.txt – First 5 lines

tail -n 10 file.txt – Last 10 lines

Search and Extract:

grep 'error' log.txt – Search for "error"

cut -d ':' -f 1 /etc/passwd – Extract usernames

System Monitoring Commands

Monitor System Resources:

- **top** – Real-time process monitor
- **free** -h – Show memory usage
- **df -h** – Disk space usage
- **du -sh folder/** – Size of a folder
- **uptime** – System running time
- **htop** – Colorful version of top (may require install)

Example:

df -h /home
free -m

Process Management Commands

View & Manage Processes:

- **kill Ps aux** – List running processes
- **ID** – Terminate a process by PID
- **kill -9 PID** – Force kill

Example:

ps aux | grep apache
kill 12345

User Session and Log Commands

User Identity and Session Info:

- **who** – Logged in users
- **whoami** – Current user
- **w** – Detailed session info
- **last** – Last logged in users
- **id** – UID, GID, and group info

Creating a New User

Commands:

- **useradd username** – Add new user (basic)
- **adduser username** – Interactive version (recommended)
- **passwd username** – Set password for user

Example:

adduser john

passwd john

✅ Automatically creates home directory and prompts for full name & password.

Creating a New Group

Commands:

groupadd groupname – Create a new group

Example:

groupadd devs

✅ Used to manage permissions for multiple users working on the same project or service.

Adding Users to Groups

Primary Group: Assigned when user is created.

Secondary Groups: Extra groups for access management.

Commands:

usermod -aG groupname username – Add user to group (append)

Example:

usermod -aG devs john

✅ Ensure you **use -aG** (append) to avoid removing existing group memberships.

Viewing User and Group Information

Commands:

- **groups username** – Lists all groups the user belongs to
- **cat /etc/passwd** – User account info
- **cat /etc/group** – Group info
- **id username** – Shows UID, GID, and group memberships

Example:

id john

groups john

Deleting Users and Groups

Commands:

- **userdel username** – Deletes user
- **userdel -r username** – Deletes user & home directory
- **groupdel groupname** – Deletes group

Example:

userdel -r john

groupdel devs

🚫 Be careful: This action is **irreversible** and removes user data if -r is used.

Understanding File Permissions Structure

Every file/directory has permissions for:

- **User (u)** – file owner
- **Group (g)** – group members
- **Others (o)** – everyone else

Permissions:

- **r** – Read
- **w** – Write
- **x** – Execute

Example Output:

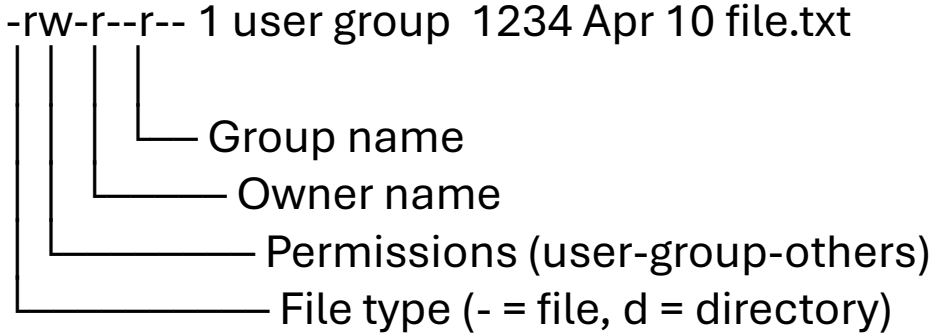
-rwxr-xr-- 1 user group 1234 Apr 10 file.sh

Viewing Permissions with ls -l

Command:

ls -l filename

Breakdown:



Changing Permissions Using chmod

Symbolic Mode:

chmod u+x file.sh # Add execute to user

chmod g-w file.txt # Remove write from group

[Permission]

- r=4, w=2, x=1
- chmod 755 script.sh → rwxr-xr-x
- chmod 644 file.txt → rw-r--r--

Changing Ownership with chown

Command:

chown newuser file.txt # Change owner

chown newuser:newgroup file # Change owner & group

Example:

chown hamza:devs project.log

⚠️ Needs **sudo** to modify ownership.

Changing Group with chgrp

Command:

chgrp newgroup file.txt

Example:

chgrp staff notes.txt

Used when only changing the **group**, not the file owner.

Practical Scenarios for Permissions

Restricting Access:

chmod 600 secrets.txt

✅ Only the owner can read/write

Shared Directory:

chmod 770 shared/

chown :developers shared/

✅ All devs can read/write/execute

Quiz Section

Quiz

Everyone student should click on submit button before time ends otherwise MCQs will not be submitted

[Guidelines of MCQs]

1. There are 20 MCQs
2. Time duration will be 10 minutes
3. This link will be share on 12:25pm (Pakistan time)
4. MCQs will start from 12:30pm (Pakistan time)
5. This is exact time and this will not change
6. Everyone student should click on submit button otherwise MCQs will not be submitted after time will finish
7. Every student should submit Github profile and LinkedIn post link for every class. It include in your performance

Assignment

Assignment should be submit before the next class

[Assignments Requirements]

1. Create a post of today's lecture and post on LinkedIn.
2. Make sure to tag @Plus W @Pak-Japan Centre and instructors LinkedIn profile
3. Upload your code of assignment and lecture on GitHub and share your GitHub profile in respective your region group WhatsApp group
4. If you have any query regarding assignment, please share on your region WhatsApp group.
5. Students who already done assignment, please support other students

Q&A Session

ありがとうございます。
Thank you.
شکریا

For the World with Diverse Individualities