Essential Linux Directories & Files (Core)

Linux Commands Course · Section 8

IDSchool

Goal

Understand the **layout of the Linux filesystem** and the **key configuration files** that make the system work.

Knowing what lives where helps you troubleshoot, configure, and navigate with confidence.

Linux Filesystem Philosophy

Everything in Linux is organized under a **single root directory** `/`.

- No drive letters (like C: or D:)
- All devices, users, and applications live under `/`
- Each directory has a specific purpose

Think of it as a **tree**, with `/` as the root and everything branching from it.

Core Directory Layout Overview

Directory	Purpose
/bin	Essential user binaries (commands needed for all users)
/sbin	System binaries (commands for system administration)
/usr/bin	Most user commands and applications
/usr/sbin	System admin tools not required for booting
/etc	System configuration files
/var	Variable data (logs, mail, cache)
/home	User home directories
/tmp	Temporary files (cleared on reboot)
/dev	Device files (represent hardware or virtual devices)
/proc	Virtual filesystem exposing process and kernel info
/sys	System and hardware information (kernel interface)
/opt	Optional or third-party software packages

/bin and /sbin

Contain the most **fundamental executables**.

Examples:

```
ls /bin
ls /sbin
```

Typical contents:

- /bin/ls, /bin/cp, /bin/mv, /bin/cat
- /sbin/reboot, /sbin/ifconfig, /sbin/fsck

Used during system boot and single-user recovery mode.

/usr/bin and /usr/sbin

/usr = “Unix System Resources.”

Holds the **main body of user utilities** and optional system tools.

```
ls /usr/bin | head
ls /usr/sbin | head
```

Applications like vim, python, gcc, systemctl, etc., live here.

This is where most installed software resides.

/etc — Configuration Files

Contains **system-wide configuration** for all programs and services.

Examples:

```
ls /etc
```

Subdirectories like /etc/network, /etc/ssh, /etc/systemd hold their respective configs.

These files are usually **plain text**, editable with a text editor.

/var — Variable Data

“Variable” because contents change frequently.

Common uses:

- /var/log/ → log files (syslog, auth.log)
- /var/spool/ → print/mail queues
- /var/cache/ → cached data
- /var/lib/ → application state (databases, package info)

Example:

```
ls /var/log
```

Logs are vital for troubleshooting.

/home — User Directories

Each user has a personal workspace under /home.

Example structure:

```
/home/alice
/home/bob
```

Contains personal files, downloads, and shell settings.

```
ls ~
```

The ~ symbol always refers to your current user's home directory.

/tmp – Temporary Storage

Used for short-lived files and data exchange between programs.

```
cd /tmp
ls
```

Cleared on reboot or after a set time.

Accessible to everyone but protected by the **sticky bit** so users can’t delete others’ files.

/dev — Devices as Files

Represents hardware and virtual devices as files.

```
ls /dev | head
```

Examples:

- /dev/sda — first hard drive
- /dev/null — data sink (discards anything written)
- /dev/tty — current terminal
- /dev/random — random data source

Device files enable programs to interact with hardware using normal file operations.

/proc — Process and Kernel Info

A **virtual filesystem** reflecting live system state.

```
ls /proc | head
```

Contains pseudo-files for each running process (/proc/<PID>/).

Key files:

- /proc/cpuinfo — CPU details
- /proc/meminfo — memory usage
- /proc/uptime — uptime information

Read-only for observation; data is generated dynamically.

/sys — Kernel and Device Management

/sys is similar to /proc but more structured.

Contains live info about devices, drivers, and kernel modules.

Example:

```
ls /sys/class
```

Used by udev and other system components to manage devices dynamically.

/opt — Optional Software

Holds **add-on applications** installed outside the package manager.

Example paths:

- /opt/google/chrome/
- /opt/lampp/

You can place self-contained programs or third-party tools here.

Must-Know System Files

File	Description
/etc/passwd	User account information (username, UID, home, shell)
/etc/shadow	Encrypted passwords and aging info (root-only)
/etc/group	Group membership definitions
/etc/fstab	Filesystems to mount at boot
/etc/hosts	Local hostname-to-IP mapping
/etc/resolv.conf	DNS resolver configuration
/etc/sudoers	sudo access control rules
~/.bashrc	User-specific shell customization
~/.profile	Environment setup on login

/etc/passwd Example

```
cat /etc/passwd | head -3
```

Example line:

```
student:x:1000:1000:Student User:/home/student:/bin/bash
```

Fields (colon-separated):

1. Username
2. Placeholder (historically password, now stored in /etc/shadow)
3. UID (User ID)
4. GID (Group ID)
5. Comment / full name
6. Home directory
7. Login shell

/etc/shadow Example

Only readable by root.

```
sudo head /etc/shadow
```

Stores encrypted passwords and password aging information.

Never edit this file manually — use passwd command instead.

/etc/group Example

Defines group memberships.

```
cat /etc/group | head
```

Each line: group name, password placeholder, GID, and members.

/etc/fstab – Filesystem Table

Defines which partitions and devices to mount automatically at boot.

Example:

```
UUID=xxxx-xxxx  /  ext4  defaults  0 1
UUID=yyyy-yyyy  /home  ext4  defaults  0 2
```

View safely:

```
cat /etc/fstab
```

/etc/hosts and /etc/resolv.conf

/etc/hosts – manual hostname resolution.

Example:

```
127.0.0.1   localhost
192.168.1.10 server.local
```

/etc/resolv.conf – nameserver (DNS) configuration.

Example:

```
nameserver 1.1.1.1
nameserver 8.8.8.8
```

/etc/sudoers

Controls who can run commands as other users (usually root).

Always edit with **visudo** to prevent syntax errors:

```
sudo visudo
```

Example rule:

```
alice ALL=(ALL:ALL) ALL
```

Meaning: Alice can run any command as any user.

User Configuration Files

~/.bashrc – executed for interactive non-login shells.
Custom aliases, colors, and shell variables live here.

~/.profile – executed for login shells; sets environment variables like PATH and locale.

```
cat ~/.bashrc | head
```

Keep personal shell tweaks in .bashrc, system-wide ones in /etc/bash.bashrc.

Recap

- Linux filesystem is a single tree rooted at `/`.
- Know what each main directory stores.
- Learn critical system files under `/etc` and your home.
- Configuration lives in plain text.
- Reading these files (not editing them blindly) is key to system literacy.

Practice

1. List files in `/etc` and identify one configuration file you recognize.
2. View `/proc/cpuinfo` and `/proc/meminfo`.
3. Check your user entry in `/etc/passwd`.
4. Find your DNS nameservers in `/etc/resolv.conf`.
5. Open `~/.bashrc` and add a custom alias (then reload with `source ~/.bashrc`).

Next Up

Processes, Services & Logs (Core) — understanding how Linux runs and monitors programs.