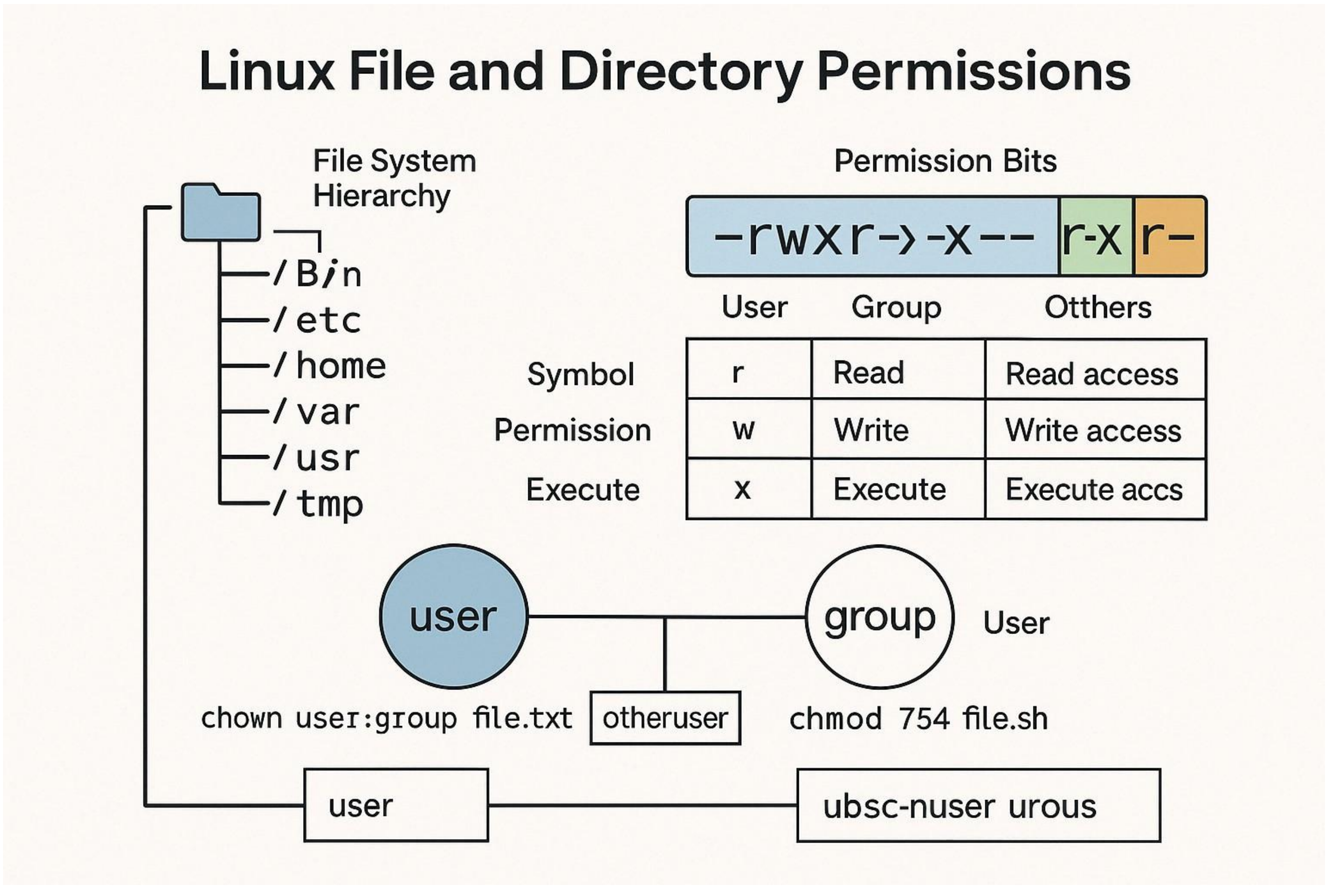
LINUX FOR NETWORK ENGINEER

LINUX BASICS

STRUCTURE

LINUX



INTRODUCTION - WHAT IS LINUX?

Linux is the **operating system of the internet**. From network devices to cloud servers and automation controllers, Linux powers them all. For network engineers, understanding Linux isn't optional — it's foundational.

WHY LINUX?

- Used in routers (Cisco IOS XR, JunOS), firewalls, load balancers
- Core OS for servers, automation, and DevOps
- Flexible, open-source, scriptable
- Supports powerful networking tools: tcpdump, nmap, wireshark, netstat, etc.

In this guide, we'll explore everything from distro selection to permissions, from scripting to automation.

VISUAL GUIDE TO LINUX PERMISSIONS, FILE SYSTEM & OWNERSHIP

Understanding file permissions and the Linux filesystem hierarchy is critical for both system security and automation scripts. This visual diagram provides a comprehensive view of how Linux handles:

FILE SYSTEM HIERARCHY

- Root (/) is the starting point of everything.
- Key directories like /bin, /etc, /home, /var, /usr, and /tmp organize the OS and user data.

PERMISSION BITS BREAKDOWN

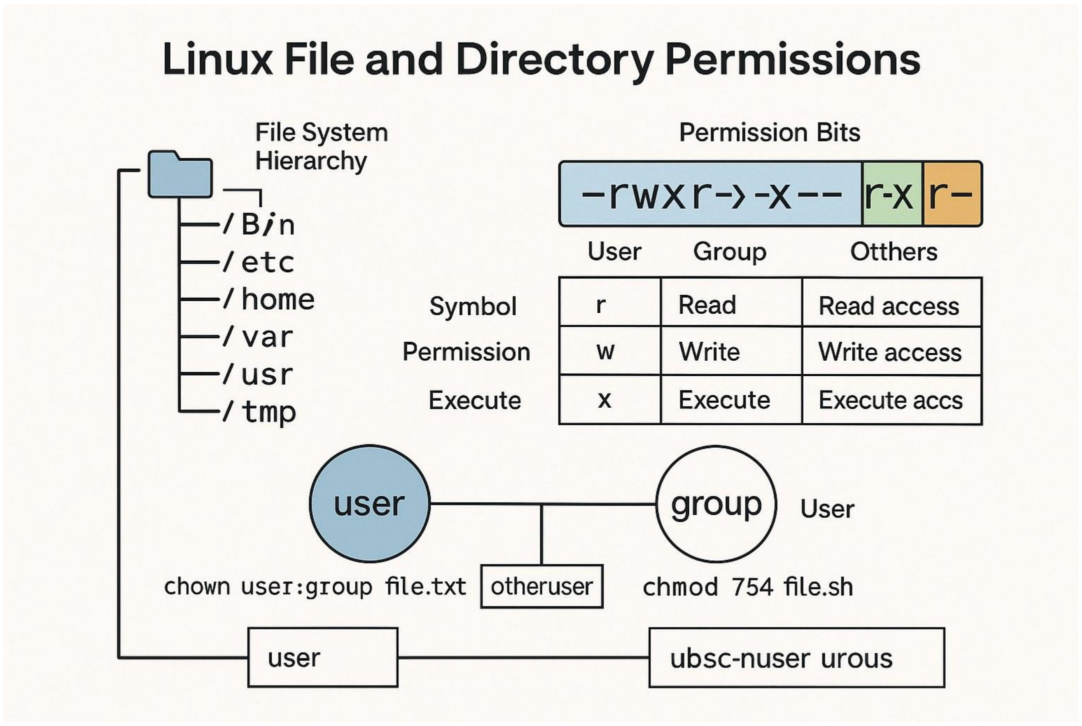
Linux permissions are expressed using a symbolic and numeric format:

- -rwxr-xr-- = file with user (rwx), group (r-x), others (r--)
- This translates to **read**, **write**, and **execute** rights for different users.

Symbol	Meaning	Applies To
r	Read access	User, Group, Others
w	Write access	User, Group, Others
x	Execute access	User, Group, Others

Use chmod to change permissions:

```
chmod 754 file.sh
```



CHOOSING THE RIGHT LINUX DISTRO

There are hundreds of Linux distributions. Here’s how to choose based on **purpose**:

Distro	Based On	Use Case	Best For
Ubuntu	Debian	Labs, cloud, DevOps	Beginner-friendly
Debian	-	Stable routers/firewalls	Minimalist systems
CentOS/AlmaLinux	RHEL	Data center, enterprise use	Red Hat environments
Kali Linux	Debian	Security, pen testing	Ethical hacking
OpenWRT	Custom	Embedded routers	IoT, firmware
Arch Linux	-	Learning Linux deeply	Advanced users

Example: Want to use Ansible, Git, Docker? Go for Ubuntu 22.04 LTS.

Installation tools:

- Rufus (Windows) to create bootable USB
- dd command (Linux/Mac)
- Try inside VirtualBox/VMware for a lab

TEXT EDITORS

A network engineer often needs to modify configuration files, create scripts, or troubleshoot logs. That's where text editors come in.

Popular Text Editors:

1. **Nano (Simple & Friendly)**

```
nano /etc/network/interfaces
```

- Ctrl+O: Save
- Ctrl+X: Exit

2. **Vim (Powerful but has learning curve)**

```
vim /etc/hosts
```

- i: Insert mode
- Esc: Exit insert
- :wq: Save and quit

3. **VS Code (Graphical, Modern IDE)**

```
sudo snap install code --classic
```

Use Vim for remote SSH sessions; use VS Code for local DevOps scripting.

LINUX FUNDAMENTALS

Understanding Linux begins with mastering its **core commands** and internal logic. Linux is a **command-line-first OS**, meaning its real power is unlocked through the terminal.

1. NAVIGATING THE FILESYSTEM

```
pwd                  # Show current directory path
cd /etc              # Move to /etc directory
cd ~                 # Go to user's home directory
cd ..                # Move one directory up
cd -                 # Jump to previous directory
ls                   # List files
ls -l                # List with permissions, owner, size, date
ls -a                # Include hidden files
ls -lh               # Human-readable sizes
```

Tip: Use tree to view folder structure visually.

```
sudo apt install tree
tree /etc | head -20
```

2. VIEWING AND EDITING FILES

```
cat /etc/os-release          # Show contents of file
less /var/log/syslog         # View long file, scrollable
head -n 10 file.txt          # Show first 10 lines
tail -n 20 file.txt          # Show last 20 lines
tail -f /var/log/auth.log    # Live monitor logs
```

less allows scroll with spacebar (down) and b (back).

3. CREATING FILES & DIRECTORIES

```
touch myfile.txt                # Create new empty file
mkdir backups                   # Create directory
mkdir -p configs/interfaces     # Nested directory creation
```

-p ensures parent directories are created if missing.

4. FILE TYPE AND CONTENT INSPECTION

```
file /bin/bash              # See file type (binary, text, etc.)
wc -l filename.txt          # Count lines
wc -w filename.txt          # Count words
stat filename.txt           # Detailed file info (modification time, etc.)
```

5. SEARCHING FOR FILES AND CONTENT

FIND FILES:

```
find /etc -name "hosts"              # Exact match
find . -type f -name "*.conf"         # All .conf files in current dir
```

SEARCH INSIDE FILES:

```
grep "interface" /etc/network/interfaces
grep -rn "hostname" /etc              # Recursive + show line number
```

📌 Use egrep or grep -E for extended regex:

```
grep -E "eth[0-9]+" interfaces.txt
```

6. UNDERSTANDING COMMAND STRUCTURE

Most commands follow this format:

command [options] [arguments]

EXAMPLE:

```
ls -al /etc
# command = ls
# option = -a (all files), -l (long format)
# argument = /etc (directory)
```

7. WILDCARDS & EXPANSION

Wildcards help target multiple files:

```
ls *.conf              # All .conf files
ls a*                  # Files starting with 'a'
```

Brace expansion:

```
mkdir folder_{1..5}    # Creates folder_1 to folder_5
```

8. KEYBOARD SHORTCUTS (COMMAND LINE EFFICIENCY)

Shortcut	Action
Tab	Auto-complete
Ctrl + C	Kill current process
Ctrl + D	Log out / end input
Ctrl + U	Delete whole line

Ctrl + A	Move to beginning of line
Ctrl + E	Move to end of line
!!	Run last command again
!ssh	Run last command starting with ssh

9. ALIASES (CUSTOMIZE YOUR SHELL)

Aliases save time:

```
alias ll='ls -alF'
alias gs='git status'
alias pingg='ping google.com'
```

To make them permanent, add to ~/.bashrc:

```
echo "alias cls='clear'" >> ~/.bashrc
source ~/.bashrc
```

10. SHELL ENVIRONMENT VARIABLES

```
echo $HOME
echo $USER
echo $PATH
export MYVAR="NetworkEngineer"
```

To persist across sessions, add to ~/.bashrc or ~/.profile.

11. GETTING HELP

```
man ls              # Manual page
ls --help           # Brief help
whatis grep          # One-line description
which tcpdump         # Path to binary
```

Use man -k <keyword> to search man pages:

```
man -k network
```

PRO TIPS FOR NETWORK ENGINEERS:

- Always use less or grep when analyzing log files.
- Use alias for long commands you run daily (e.g., BGP traceroutes).
- Combine tools in pipelines:

```
netstat -tunap | grep :22 | less
```

UNDERSTANDING THE LINUX FILE SYSTEM

```
/
├── bin/        → Essential binaries (e.g., ls, cp)
├── etc/        → System configs (e.g., networking)
├── home/       → User home directories
├── root/       → Root user's home
├── usr/        → User applications
├── var/        → Logs, spools
├── tmp/        → Temporary files
├── dev/        → Devices (e.g., /dev/sda)
```

Commands:

```
df -h            # Disk usage
du -sh *         # Size of current dir
mount            # Mounted filesystems
```

/etc/ is critical for sysadmins and neteng — store configs like DNS, network, sshd.

FILE TOOLS, OWNERSHIP, PERMISSIONS

Use ls -l to view permissions:

```
-rwxr-xr-- 1 root root 1234 Apr 20 file.sh
```

Meaning:

- - : Regular file
- rwx : Owner can read/write/execute
- r-x : Group can read/execute
- r-- : Others can only read

Ownership Commands:

```
chown netadmin:neteng file.txt   # Change owner
chmod 755 file.txt               # rwx for owner, rx for others
```

Use umask to define default permissions.

COPY, MOVE, DELETE FILES

Copy files

```
cp file.txt /backup/
cp -r configs/ /etc/                # Recursive copy
```

Move files

```
mv file.txt /var/tmp/
mv *.log /var/logs/
```

Delete files

```
rm file.txt
rm -rf /tmp/old_logs/
```

Deletion is permanent — no Recycle Bin. Use trash-cli if needed:

```
sudo apt install trash-cli
trash-put file.txt
```

USERS, GROUPS & PASSWORDS

Linux is a **multi-user OS**.

Create users:

```
sudo adduser netadmin
sudo passwd netadmin
```

Groups:

```
sudo groupadd neteng
sudo usermod -aG neteng netadmin
```

File to know:

- `/etc/passwd` – user accounts
- `/etc/shadow` – encrypted passwords
- `/etc/group` – group memberships

View info:

```
id netadmin
groups netadmin
```

PERMISSIONS DEEP DIVE

OCTAL VALUES

Symbol	Meaning	Value
r	Read	4
w	Write	2
x	Execute	1

```
chmod 755 file.sh      # Owner rwx, Group rx, Others rx
chmod 600 config.cfg  # Only owner can read/write
```

SYMBOLIC MODE:

```
chmod u+x script.sh    # Add execute to user
chmod go-rwx file.txt # Remove all access from group and others
```

Use stat filename to see detailed permission + ACLs.

PROCESSES

Linux manages processes with IDs (PIDs).

View Processes:

```
ps aux | grep ssh
top                  # Live usage
htop                 # Better UI
```

Kill Processes:

```
kill 1234           # Send SIGTERM
kill -9 1234        # Force kill (SIGKILL)
```

Background Jobs:

```
./long_job.sh &
jobs
fg %1               # Resume job
```

`nohup` and `screen` let you run persistent processes over SSH.

INSTALLING PACKAGES

APT (Debian/Ubuntu)

```
sudo apt update
sudo apt install net-tools curl
sudo apt remove apache2
```

YUM/DNF (Red Hat)

```
sudo yum install tcpdump
sudo dnf remove nginx
```

Search for packages:

```
apt-cache search nmap
```

Use snap and flatpak for containerized applications.

BUILD A NETWORK TOOLBOX

```
sudo apt install rsyslog
sudo nano /etc/rsyslog.conf
```

Enable UDP logging:

```
module(load="imudp")
input(type="imudp" port="514")
```

Restart:

```
sudo systemctl restart rsyslog
```

Check logs:

```
tail -f /var/log/syslog
```

Configure routers to send syslog to this server.

BASH SCRIPTING FOR NETWORKING

Script: IP Interface Reporter

```
#!/bin/bash
echo "Checking all interfaces..."
ip -brief addr show | grep -v lo | while read line; do
  echo $line
done
```

Save it as interfaces.sh:

```
chmod +x interfaces.sh
./interfaces.sh
```

Automate:

```
crontab -e
# Add:
0 7 * * * /home/user/scripts/interfaces.sh >> /home/user/logs/report.log
```

CONCLUSION: YOUR LINUX JOURNEY BEGINS HERE

You’ve just explored a deep dive into the Linux universe — not as a generic user, but as a **network engineer with a mission**: automation, DevOps, visibility, and control over infrastructure.

WHAT YOU'VE ACCOMPLISHED

- Mastered **Linux distributions** and picked the right one for network and automation labs
- Gained fluency in **navigation, file systems, and file permissions** — the backbone of Linux
- Learned how to create, move, edit, and search through files like a sysadmin
- Understood how **users, groups, and permissions** work — critical for securing multi-user environments
- Used real-world networking tools: tcpdump, nmap, iperf, rsyslog, and even wrote your first **bash script**
- Practiced **package management**, **process handling**, and **text editing** with confidence

WHY THIS MATTERS

In today's world, **networking is not just cables and routing protocols** — it’s automation, configuration management, cloud provisioning, container orchestration, and observability. And behind all of that? **Linux**.

Whether you're:

- Troubleshooting packet drops with tcpdump
- Writing Ansible playbooks to configure routers
- Running Docker containers for NetBox or Grafana
- Monitoring logs from routers via a Linux syslog server

Linux is the core toolset that connects everything.