Linux Operating System and Applications

Linux Overview

History

History of Unix

- ❑ **Origins at Bell Labs (1969–1971):**

    - ▪ **UNIX was created in 1969** at **AT&T's Bell Labs** by **Ken Thompson**, **Dennis Ritchie**, and others.

    - ▪ It started as a side project after the failure of the ambitious Multics operating system.

    - ▪ Written in assembly at first, UNIX introduced a new philosophy: **simplicity**, **modularity**, and **reusability** — with tools that do one thing well.

- ❑ **Portability Breakthrough (1973):**

    - ▪ UNIX was **rewritten in the C programming language**, also developed at Bell Labs.

    - ▪ This made UNIX highly **portable**, meaning it could be adapted to run on different hardware — a revolutionary idea at the time.

History of Unix

❑ **Early Expansion and Forks (1970s–1980s):**
- ▪ **Version 6 UNIX (1975)** became widely adopted in universities, especially at **UC Berkeley**, where it evolved into **BSD UNIX** (Berkeley Software Distribution).
- ▪ AT&T continued developing its own versions (e.g., System III, System V).
- ▪ Different organizations created their own variants, leading to the **"UNIX wars"** of the 1980s.

❑ **Commercialization and Standards (1980s–1990s):**
- ▪ UNIX became the basis for many **commercial operating systems**, such as:
  - • SunOS/Solaris (Sun Microsystems)
  - • AIX (IBM)
  - • HP-UX (Hewlett-Packard)
- ▪ Industry standards like **POSIX** and **The Single UNIX Specification** were created to unify different versions.

History of Unix

❑ **Influence on Linux and Modern Systems:**

- ▪ **UNIX inspired Linux**, which started in 1991 as a UNIX-like system using GNU tools.

- ▪ macOS, FreeBSD, and many embedded systems are **UNIX or UNIX-like**.

- ▪ The UNIX philosophy shaped software engineering and operating system design.

❑ **UNIX Today:**

- ▪ While traditional commercial UNIX systems have declined, **UNIX's legacy lives on** through:

  - • **Linux**

  - • **BSD variants (FreeBSD, OpenBSD)**

  - • **macOS (based on BSD UNIX)**

- ▪ The principles of UNIX — simplicity, composability, and transparency — continue to influence modern computing.
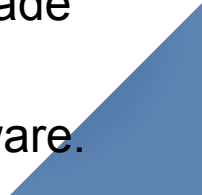
History of Linux

1. Origins (Early 1990s):

- In **1991**, **Linus Torvalds**, a Finnish computer science student, began developing a free, Unix-like operating system kernel as a personal project.
- He announced his work on a Usenet newsgroup, asking for feedback and contributions.
- The kernel was combined with GNU software (developed by the Free Software Foundation) to form a complete operating system: **GNU/Linux**.

2. Growth of Open Source Community:

- The project gained rapid support from developers worldwide due to its open-source license (GNU General Public License).
- Contributions came in the form of code, bug fixes, drivers, and utilities.

3. First Major Distributions (Mid 1990s):

- Distributions like **Slackware (1993)**, **Debian (1993)**, and **Red Hat (1994)** made Linux easier to install and use.
- These distros packaged the Linux kernel with system tools, GUIs, and software.

History of Linux

4. Adoption in Servers and Enterprises (2000s):

- Linux became popular for running **web servers**, **databases**, and **enterprise applications** due to its stability, performance, and cost-effectiveness.
- Companies like IBM and Oracle began supporting Linux.

5. Rise of Ubuntu and User-Friendliness (Mid 2000s):

- **Ubuntu (2004)** focused on ease of use, bringing Linux to desktops and making it accessible to a broader audience.

**6. Cloud, Containers, and DevOps (2010s–Present):**

- Linux became dominant in **cloud computing**, **DevOps**, and **containerization** (e.g., Docker, Kubernetes).
- Most cloud services (AWS, Google Cloud, Azure) use Linux as the base operating system.

7. Linux Today:

- Linux powers a wide range of systems: from **supercomputers**, **web servers**, and **mobile devices (Android)** to **IoT devices** and **automotive systems**.
- It is maintained by a global community, with support from companies like Red Hat (IBM), Canonical, Google, and others.

Linux distro

- Derbian
    - Ubuntu
    - Knoppix
    - Raspbian/Raspberry Pi
- Red Hat (IBM)
    - Fedora
    - Red Hat Enterprise Linux
    - CentOS
- openSUSE
    - SUSE Linux Enterprise
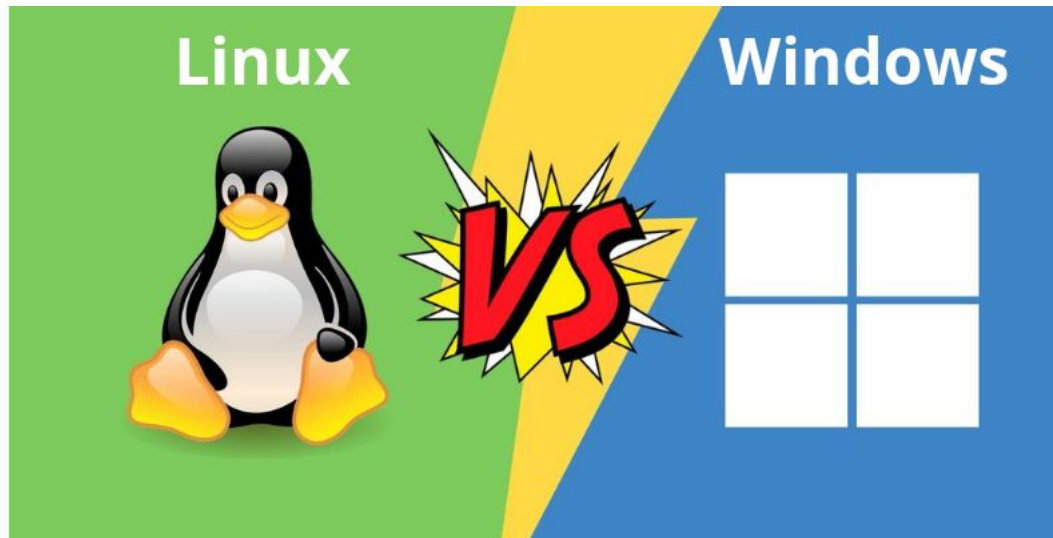- Arch Linux
- Slackware
- Gentoo (Novel)
    - Chrome OS
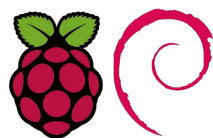
Discussion

Why Linux?

Why Linux?

❏ **Open Source and Free**

- **No licensing fees** — you can download, modify, and use it freely.

- Full access to the source code gives developers control and transparency.

- Encourages a global community of contributors and innovators.

❏ **Stability and Reliability**

- Linux systems can run for years without rebooting.

- It's the top choice for servers, supercomputers, and critical infrastructure because of its uptime and fault tolerance.

❏ **Security**

- Designed with multi-user architecture and permission controls.

- Fewer vulnerabilities and faster security patches compared to many proprietary systems.

- Preferred in cybersecurity and penetration testing fields.

Why Linux?

❑ **Performance and Efficiency**
- Low system requirements make it ideal for both modern hardware and older machines.
- Frequently used in data centers, cloud platforms, and embedded devices for its performance-to-cost ratio.

❑ **Flexibility and Customization**
- You can choose from hundreds of distributions, each tailored for a specific purpose (e.g., Ubuntu for desktops, CentOS for servers, Kali for security).
- Highly configurable: you can build a minimal system or a full-featured desktop environment.

❑ **Development-Friendly**
- Supports a wide range of programming languages and tools.
- Ideal for software development, DevOps, and cloud-native application development.
- Powers containers (Docker), orchestration tools (Kubernetes), and CI/CD pipelines.

Why Linux?

❑ **Community Support**
  ▪ Extensive documentation and forums.
  ▪ Active user and developer communities provide troubleshooting help and updates.

❑ **Ubiquity in Technology**
  ▪ Runs on everything: **phones (Android), TVs, routers, cars, smart appliances**, and more.
  ▪ Dominates the **cloud**, **web servers**, and **supercomputing** industries.

Companies that use Linux (Tech)

Company	How They Use Linux
Google	Runs on custom Linux servers and Android (a Linux-based OS)
Amazon	AWS uses Linux extensively (Amazon Linux, EC2, etc.)
Facebook (Meta)	Backend infrastructure is powered by Linux
Microsoft	Azure supports Linux VMs; contributes to the Linux kernel
IBM	Invested in Linux (owns Red Hat), uses Linux across enterprise solutions
Netflix	Uses Linux servers for streaming content globally
Twitter	Runs its entire infrastructure on Linux
Tesla	In-car systems and backend services use Linux
Intel	Develops and tests hardware with Linux support
Apple	While macOS is based on BSD Unix, Linux is widely used internally for testing and development

Companies that use Linux

Financial & Enterprise

Company	Use Case
Goldman Sachs	Uses Linux for trading platforms and servers
JP Morgan Chase	Relies on Linux for secure, scalable systems
Deutsche Bank	Uses Linux in cloud-based financial services
CitiBank	Utilizes Linux for backend operations

Telecom & Networking

Company	Use Case
Cisco	Networking hardware and routers run Linux
Verizon	Uses Linux in its telecom infrastructure
AT&T	Runs on Linux-based platforms in its networks

What Can Linux Be Used For?

- **Servers**: Web, database, mail, and file servers

- **Development**: Programming, testing, and deployment

- **Networking**: System administration, firewalls, DNS, SSH

- **Cybersecurity**: Ethical hacking and security tools (e.g., Kali Linux)

- **Cloud & DevOps**: Containers, CI/CD, cloud infrastructure

- **Embedded Systems**: Routers, IoT devices, smart appliances

- **Desktops**: Personal computing, education, and multimedia

Books and Learning Resources

📚 Books

- *The Linux Command Line* – William Shotts

- *Linux for Beginners* – Jason Cannon

- *How Linux Works* – Brian Ward

- *UNIX & Linux System Admin Handbook* – Nemeth et al.

🌐 Websites

- LinuxJourney.com – Interactive learning

- LinuxCommand.org – Shell tutorials

- DigitalOcean Community – Real-world guides

- OverTheWire.org – Linux wargames

- Linux Foundation – Courses & certs

- Server-Word.info - Linux services tutorials

Tools

❏ Linux: CentOS, Ubuntu

❏ VMware Workstation, Virtual Box

❏ Visual CertExam Manager

❏ Testking/ Pass4sure

Q&A