comparison between **Windows**, **macOS (Mac)**, and **Linux**.

# Intro

Operating systems (OS) are the backbone of modern computing, providing the interface between users and hardware. Among the most widely used desktop operating systems today are **Windows**, **macOS**, and **Linux**. Each of these systems offers a unique approach to performance, usability, customization, and software compatibility. While **Windows** dominates the global market and is known for its broad application support, **macOS** is praised for its sleek design and seamless integration with Apple hardware. **Linux**, on the other hand, stands out for its open-source nature, flexibility, and strong presence in servers and development environments. Understanding the differences between these operating systems can help users make informed decisions based on their needs, preferences, and technical skills.

### 1. Directory Structure

| **Feature** | **Windows** | **macOS / Linux** |
| --- | --- | --- |
| Root Directory | C:\ (and other drive letters) | / (single root for everything) |
| System Files Location | C:\Windows\System32 | /bin, /sbin, /lib, /usr |
| User Files | C:\Users\Username\ | /home/username/ |
| Drive Mounting | Each drive has a letter (C:, D:) | Mounted under /mnt or /Volumes |

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### **2.** Naming Convention

| **Feature** | **Windows** | **macOS / Linux** |
| --- | --- | --- |
| Case Sensitivity | Not case-sensitive by default | Case-sensitive (e.g., file.txt ≠ File.txt) |
| Allowed Characters | Disallows some (<, >, :, \*) | Allows most characters except / and null |
| File Extensions | Important for file type recognition | Optional, but used for convenience |

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### **3.** File Systems

| **Feature** | **Windows** | **macOS** | **Linux** |
| --- | --- | --- | --- |
| Default File System | NTFS | APFS (modern macOS), HFS+ | ext4, xfs, btrfs, etc. |
| External Drive FS | Often exFAT, FAT32 | exFAT, FAT32, APFS | ext4, exFAT, FAT32 |
| Journaling Support | Yes (NTFS) | Yes (APFS) | Yes (ext4, xfs) |

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### **4.** Executable File Types

| **Feature** | **Windows** | **macOS / Linux** |
| --- | --- | --- |
| Binary Executables | .exe, .bat, .msi | No extensions required (but often .out, .sh, or just no extension) |
| Permission Needed | No (just double-click) | Yes (file must be marked executable using chmod +x) |

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### **5.** Script Execution

| **Feature** | **Windows** | **macOS / Linux** |
| --- | --- | --- |
| Shell Used | Command Prompt (cmd.exe) or PowerShell | bash, zsh, sh |
| Script Types | .bat, .ps1 | .sh, .bash, Python (.py), etc. |
| Execution Command | script.bat or powershell script.ps1 | ./script.sh or bash script.sh |
| Requires Permissions? | Usually no | Yes — script must have execute permission (chmod +x) |

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