

# Setup

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# Setting Up Your Digital Workspace

**Goal for Today:** Ensure everyone has a consistent and powerful work environment. This helps us learn faster and avoids the classic “but it works on my machine!” problem.



# What is an Operating System (OS)?

Think of an OS as the **manager** of your computer's resources.



- It's the software that runs everything else.
- It manages the **CPU** (the brain), **memory** (the workspace), and **storage** (the filing cabinet).
- It provides a **user interface** (UI) for you to interact with the machine.

We'll be focusing on two main families:

-  **Windows:** The most common desktop OS.
-  **Linux:** A powerful, open-source OS family, dominant in servers, cloud computing, and scientific research.

# What is a Filesystem?

A filesystem is the **library catalog** for your computer. It's how the OS organizes, stores, and finds your files. 📁

# Windows (NTFS)

- Uses **drive letters** (e.g., C:, D:).
- Path separator is a **backslash (\)**.
- Example:

C:\Users\YourName\Documents\MyFile.txt

## Linux (ext4, Btrfs, etc.)

- Has a single, unified **root directory** (/).
- Everything, including devices, is treated like a file.
- Path separator is a **forward slash** (/).
- Example: /home/yourname/documents/myfile.txt

**Key takeaway:** *Understanding the path structure is crucial for finding your files and running programs from the command line!*

# Why a Standard Environment? (The “Linux” Choice)

We are standardizing on a **Linux-based command-line environment** because:

- **Industry Standard:** It's the backbone of the web, cloud computing (AWS, Google Cloud), and scientific computing.
- **Powerful Tooling:** Offers unparalleled tools for programming, automation, and data manipulation.
- **Transparency:** Helps you understand what the computer is *actually* doing.

Now, let's explore your options for getting this environment set up!

# Your Three Paths to Linux

## 1. Native Linux Installation:

- **What:** Linux is the main OS on your computer.
- **Best for:** Maximum performance and full immersion.

## 2. Virtual Machine (VM):

- **What:** A complete Linux computer running inside a window on your current OS.
- **Best for:** Safe, isolated, and easy to reset.

## 3. Windows Subsystem for Linux (WSL):





- **What:** A compatibility layer to run a real Linux environment directly inside Windows.
- **Best for:** Tight integration between Windows and Linux tools.



## Option 1: Native Linux Installation

This means you install a Linux distribution (like Ubuntu or Fedora) directly on your computer's hardware, either replacing or alongside Windows ("dual-booting").

## Pros & Cons

-  **Pro: Best Performance.** No overhead; Linux has direct access to all hardware (CPU, GPU).
-  **Pro: Full Immersion.** Forces you to learn and adapt to the Linux environment.
-  **Con: Complex Setup.** Can be tricky, with risks of data loss if not done carefully (backup is essential!).
-  **Con: Hardware Compatibility.** Some specific hardware (Wi-Fi cards, webcams) might require extra configuration.

## Who is this for?

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Students who are adventurous, comfortable with computer hardware, or have a spare machine to experiment with.

# Setup Steps

1. **Choose a distribution:** We recommend **Ubuntu 22.04 LTS** for its great support.
2. **Create a bootable USB drive:** Use tools like [Rufus](#) or [BalenaEtcher](#).
3. **Partition your hard drive:** This is the most critical step if you plan to dual-boot. **BACK UP YOUR DATA FIRST!**
4. **Boot from the USB drive** and follow the installer instructions.

## Option 2: Virtual Machine (VM)





A VM uses a **hypervisor** (like VirtualBox or VMWare) to emulate a full computer system inside your existing OS. We provide a pre-configured image to make this easy!

## How it Works: Networking

Your VM needs network access to download software (`apt install`) or use `git`.

- The hypervisor creates a virtual network adapter for your VM.
- It usually uses **NAT (Network Address Translation)**, which acts like a router, allowing the VM to share your host computer's internet connection securely.

## Pros & Cons

-  **Pro: Safe & Isolated.** The VM is a sandbox. If you break it, it doesn't affect your main OS. You can easily delete it or reset it from a snapshot.
-  **Pro: Easy Setup.** Just install VirtualBox and import the provided course image.
-  **Con: Resource Heavy.** Requires significant RAM (8GB+ recommended for your whole system) and CPU power, as you are running two operating systems at once.
-  **Con: Slower Performance.** Slower than a native install due to the overhead of virtualization.

## Who is this for?

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Almost everyone! It's the safest, most recommended, and most consistent option for this course.




## Setup Steps

1. **Install VirtualBox:** Download and install the latest version of [VirtualBox](#) and its “Extension Pack”.
2. **Download the Course VM Image:** Get the .ova file from the course website.
3. **Import the Appliance:** In VirtualBox, go to File > Import Appliance and select the .ova file you downloaded. Follow the on-screen prompts.
4. **Start your VM:** Select the imported machine and click “Start”. That’s it!





## Option 3: Windows Subsystem for Linux (WSL) +

WSL lets you run a genuine Linux kernel and environment directly on Windows, without the overhead of a full VM. It provides powerful integration between the two systems.

## How it Works: Filesystem & Networking

- **Networking:** WSL automatically shares the network connection of your Windows host. It just works!
- **Filesystem Integration:** Your Windows drives (like C:) are automatically mounted inside Linux under /mnt/. For example, your C:\Users\YourName folder is accessible at /mnt/c/Users/YourName.  
 **Important:** For best performance, always work with your files inside the Linux filesystem (/home/yourname/), not on the mounted Windows drives (/mnt/c/).

## Pros & Cons

-  **Pro: Excellent Performance.** Near-native speed for command-line tools.
-  **Pro: Great Integration.** Easily call Linux tools from Windows and vice-versa. You can use VS Code on Windows to edit files directly inside WSL.
-  **Con: "Headless" by Default.** WSL is primarily a command-line tool. Running Linux GUI apps requires extra setup (WSLg).
-  **Con: Potential for Complexity.** Some advanced networking or hardware access can be more complex than in a VM or native install.

## Who is this for?

Windows users who want a fast, integrated command-line environment and are comfortable working primarily in a terminal.

## Setup Steps

1. **Enable WSL:** Open PowerShell **as an Administrator** and run this single command:

```
wsl --install
```

This command will enable the required Windows features, download the latest Linux kernel, and install **Ubuntu** as the default distribution.

2. **Reboot** your computer when prompted.
3. **Create a User Account:** After rebooting, a terminal window will open to complete the Ubuntu installation. You will be asked to create a username and password. **Remember this password!**
4. **You're Ready!** You can launch your Linux terminal from the Start Menu (search for "Ubuntu").

## Summary & Next Steps

You have three great options. Your choice depends on your comfort level and computer.

Feature	Native Install	Virtual Machine (VM)	WSL
<b>Performance</b>	★★★★	★★★	★★★★
<b>Safety/Isolation</b>	★	★★★★	★★★
<b>Ease of Setup</b>	★	★★★★	★★★
<b>Recommended For</b>	Experts/Hobbyists	<b>Everyone (Default)</b>	Windows Users

## Your Task Now:

1. **Choose one** of the three methods.
2. Follow the setup instructions to get it running.
3. Open a terminal and be ready for our next session!

**Having trouble? Don't worry!** Ask your professors, teaching assistants, or classmates for help. Getting your environment set up is the first important step. Good luck! 🎉