🧠 What is `virtualenv`?

> `virtualenv` is a **tool to create isolated Python environments**. It helps you install and manage packages **without polluting your system-wide Python**.

🔍 Why use `virtualenv`?

✅ Different projects = different dependencies ✅ Avoid version conflicts ✅ Keep your system Python clean ✅ Essential for deployment & teamwork

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🛠️ Step-by-Step Guide

1️⃣ Prerequisites – Check Python & pip

Make sure Python and pip are installed.

✅ Check Python:

```
python --version
# or
python3 --version
```

✅ Check pip:

```
pip --version
```

If not installed, download Python from https://www.python.org/downloads/

2️⃣ Install `virtualenv`

```
pip install virtualenv
```

🔄 To upgrade:

```
pip install --upgrade virtualenv
```

3️⃣ Create a Virtual Environment

```
virtualenv env_name
```

📂 This creates a folder called `env_name` with a complete isolated Python setup.

> Optionally specify Python version:

```
virtualenv -p python3.11 myenv
```

4️⃣ Activate the Environment

💻 On Windows:

```
.\env_name\Scripts\activate
```

🐧 On macOS/Linux:

```
source env_name/bin/activate
```

💡 You'll see the environment name in your prompt:

```
(env_name) PS C:\your_path>
```

5️⃣ Install Packages Inside Virtualenv

```
pip install package_name
```

🎯 Example:

```
pip install requests flask
```

6️⃣ Save Installed Packages

```
pip freeze > requirements.txt
```

📄 This creates a file you can share or use for deployment.

7️⃣ Install from `requirements.txt`

```
pip install -r requirements.txt
```

📦 Useful for rebuilding the same environment on another system or server.

8️⃣ Deactivate the Environment

```
deactivate
```

🧹 This will return you to the global Python environment.

🗑️ 9️⃣ Remove the Virtual Environment

Simply delete the folder:

```
rm -rf env_name       # macOS/Linux
rmdir /s env_name     # Windows PowerShell
```

🧪 Bonus: Tips & Best Practices

✅ Tip 1: Use `.gitignore`

If you're using Git, don't commit your virtualenv folder.

Add this to `.gitignore`:

```
env/
venv/
```

✅ Tip 2: Use `requirements.txt` for teams or deployment

```
pip freeze > requirements.txt
```

✅ Tip 3: Use `virtualenvwrapper` (Linux/macOS)

```
pip install virtualenvwrapper
```

Lets you manage multiple environments more easily with commands like:

```
mkvirtualenv myenv
workon myenv
deactivate
```

✅ Tip 4: Use Virtualenv in VS Code

- Open project folder
- Press `Ctrl+Shift+P` → "Python: Select Interpreter"
- Pick your `env/Scripts/python.exe`
- VS Code now uses your environment automatically 🎉

🛠️ Troubleshooting

❌ Problem: `virtualenv: command not found`

✅ Fix:

```
pip install virtualenv
```

or

```
python -m pip install virtualenv
```

❌ Problem: "Activate not recognized on Windows"

✅ Use:

```
.\env_name\Scripts\activate
```

Make sure you're **in the project directory**.

❌ Problem: No pip in virtualenv

☑️ Fix:

```
python -m ensurepip --upgrade
```

☑️ Summary Cheatsheet

Task	**Command**
Install virtualenv	`pip install virtualenv`
Create environment	`virtualenv venv`
Activate (Win)	`.\venv\Scripts\activate`
Activate (Mac/Linux)	`source venv/bin/activate`
Deactivate	`deactivate`
Save packages	`pip freeze > requirements.txt`
Install from file	`pip install -r requirements.txt`
Delete env	`rm -rf venv` or `rmdir /s venv`

🗂️ Real-world Use Case

Project Setup:

```
python -m venv venv
source venv/bin/activate   # or .\venv\Scripts\activate
pip install flask pymongo requests
pip freeze > requirements.txt
```

Deploy:

```
git clone myproject
cd myproject
python -m venv venv
source venv/bin/activate
pip install -r requirements.txt
```
