Build-Benedictions

Aliases: `buildben`, `bube`

Managing Multiple (Python) Projects & Dependencies

using

```
$ bube init-proj
```

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What's `buildben`?

ChatGPT:

> *“buildben is like **Cookiecutter** plus automatic virtual-env creation, dependency locking, and helper tasks.”*

... and what's a Cookiecutter?

> *"A **Cookiecutter** is a project template that can be used to create new projects with a predefined structure and configuration. It is a tool that helps developers quickly set up new projects by providing a standardized starting point."*

Main Modules:

- `$ bube init-proj` : Create a new **project**. — ✅ *99% Done*
- `$ bube add-experiment` : Add a new **experiment** to a project. — 🤞 *80% Done*
- `$ bube env-snapshot` : Dockerize current project for reproducibility. — 🤞 *80% Done*
- `$ bube init-database` : Create a new central **database**. — 🏗️ *60% Done*

Disclaimer

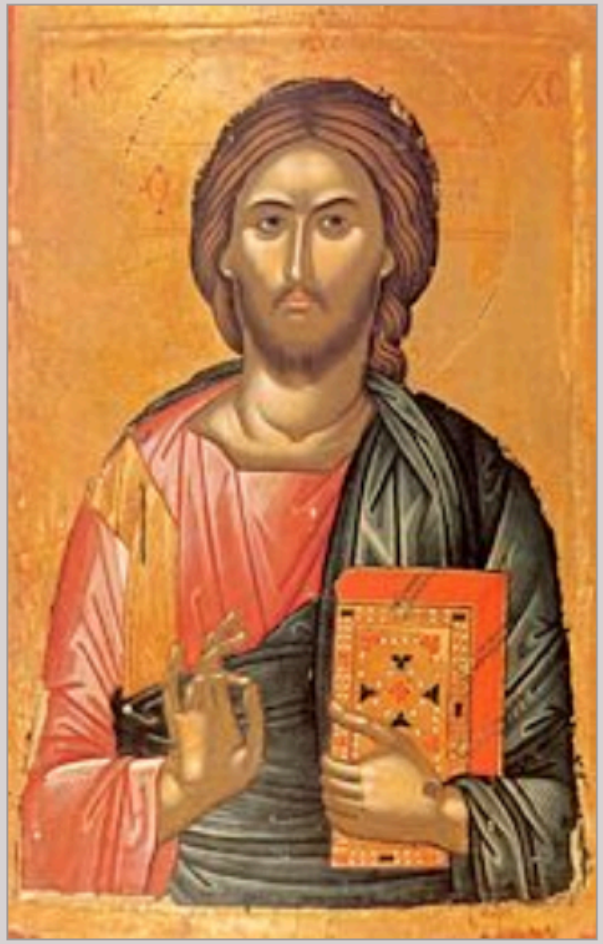
- `buildben` is very easy to use. (Goal is to make work simpler)
- This presentation is for python beginners.

But ...

- ... `buildben` solves **a lot** of *behind-the-scenes-problems* at once.
  → The logic behind `buildben` is **not beginner-friendly**.
- Some problems are hard to understand if you haven't encountered them yet...
  (I myself don't understand them fully either, *I simply trust the best practices..!*)
- I'll give my best to explain python standards and my personal decisions.
- If anything is unclear, please ask immediately! (But expect some *(un)organized chaos*...)

How This all Started:

- I had one big mono-repository containing multiple projects. It was a MESS.
- After splitting into smaller repos: Managing multiple separate projects is painful, too..!
  - "Let's just start developing, I can add a `setup.py` later!"
  - "When did I last update the `requirements.txt` / `setup.py`?"
  - "When anyone tries to use this code, the setup will probably break..."
- I had scripts to automate tasks, all of them poorly documented & scattered across repos!
- I needed one centralized standard to solve **all** my problems:
  - Think ahead, avoid problems, read my mind, etc.
  - Minimal interaction: No more than 1 CLI-command to do 100 things at once.
  - (*like a quick prayer doing miracles ...* 🙏😇)



Icon of *Jesus Christ Pantokrator* by Theophanes the Cretan. His right hand is raised in benediction.

From Wikipedia:

*"A **benediction** (Latin: bene, 'well' + dicere, 'to speak') is a short **invocation** for divine help, blessing and guidance [...]."*

*"**Invocation** is the act of calling upon a deity, spirit, or supernatural force, typically through prayer, ritual, or **spoken formula**, to seek guidance, assistance, or presence."*

My Projects before `buildben`:

1. Make a virtual environment (`.venv`) for each project:

```
python -m venv ".venv"  # Prevents polluting your OS with project-related chaos
source .venv/bin/activate  # Activate virtual environment
```

2. Collect my dependencies in a `"proj-requirements.txt"` file.
3. `pip`: Collects *dependencies of my dependencies* and installs everything:

```
pip install -r "proj-requirements.txt"  # Resolve Environment & install dependencies
```

4. Compile all installed dependencies + versions for further reinstalls:

```
pip freeze > "requirements.txt"  # Compile list of dependencies installed in current .venv
```

`proj-requirements.txt`

- Manually created by me: Whenever I `pip install` a new package, I add it to this file.
- Used by `pip` to *"resolve the environment"* (= collect *dependencies of dependencies*)

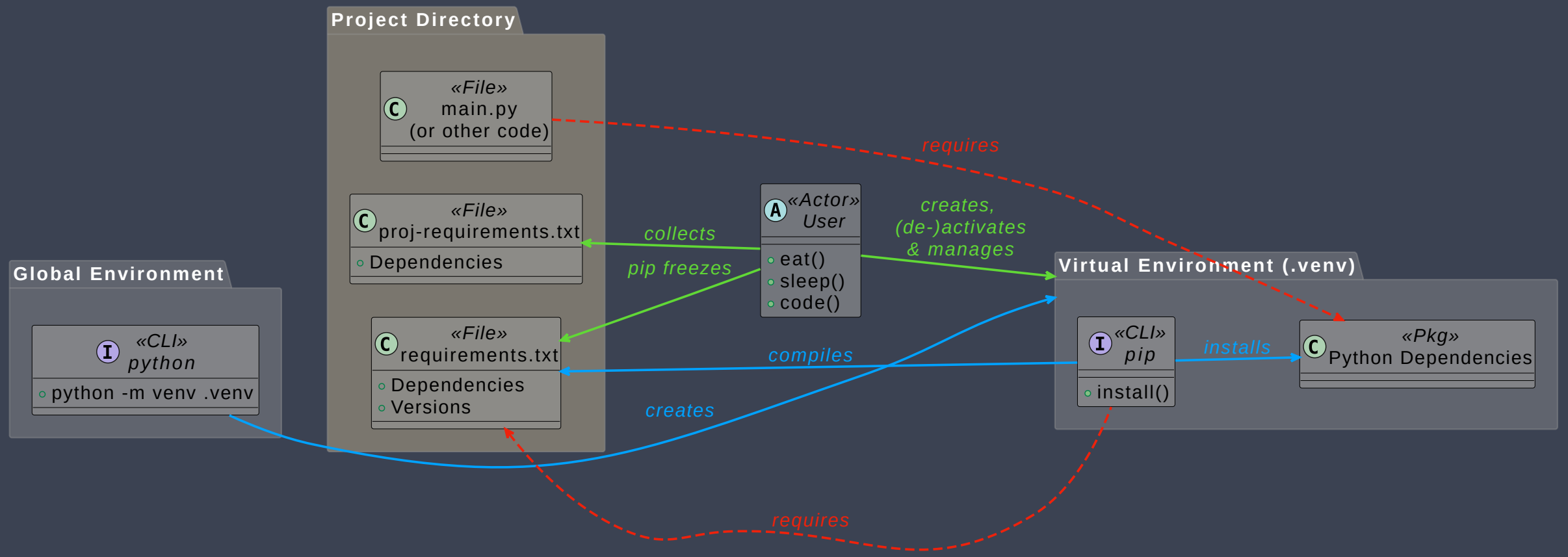
```
ipykernel
jupytext    # Convert .ipynb to .py
numpy
openpyxl    # For reading Excel files
pandas
matplotlib
seaborn     # Better plotting
pytest
```

requirements.txt

```
pip freeze > "requirements.txt"  # Compile list of dependencies installed in current .venv
```

```
asttokens==3.0.0
build==1.2.2.post1
click==8.2.1
comm==0.2.2
debugpy==1.8.14
decorator==5.2.1
ipykernel==6.29.5
ipython==9.4.0
ipython_pygments_lexers==1.1.1
jedi==0.19.2
jupyter_client==8.6.3
jupyter_core==5.8.1
matplotlib-inline==0.1.7
# ...
```

My Projects before `buildben`: Architecture



"I will add a `pyproject.toml` later..!"

My Projects before `buildben`: Setup

```
git clone "<repo-url>"          # Download
cd "<repo-name>"
python -m venv ".venv"          # Prevents polluting your OS with project-related chaos
source .venv/bin/activate       # Activate virtual environment
```

If there's only a `"requirements.txt"`:

```
pip install -r "requirements.txt"   # Install only dependencies
```

If there's a `pyproject.toml`:

```
pip install -e .                    # Editable install
```

My Projects before `buildben`: 2 Main Problems

1. Dependencies are pinned by hand:

- `requirements.txt` must be manually updated.

2. Imports rely on current working directory:

- `requirements.txt` only holds dependencies, not the **project structure**.
- Cannot import anything outside the current working directory (no `import ../module`)
- VS Code (sometimes) struggles with **refactoring** & **typing** across packages.

Further Annoyances:

1. `requirements.txt` mixes runtime and development dependencies.
2. (De-)Activating `.venv` can be forgotten or annoying.
3. Too many CLI-commands to remember & type *(especially when working with 4 Repos at the same time)*.
4. How to properly write unit-tests mid-development..?

Solutions:

Building Block	Why beginners should care	Standard
`pyproject.toml`	Single file that stores metadata and tool config	PEP 621
`pip install -e .`	Code changes are picked up without re-install	PEP 660
`src/` layout	Forces tests to run on the installed package	PyPA guide
`pip-tools`	Auto-generates (and syncs) `requirements*.txt`	(realpython.com)
`direnv`	Activates the correct virtual env when you `cd`	(direnv docs)
`just`	Saves “one-liners” like `just insco`	(just README)

`bube proj`: Workflow

1. **`$ bube proj` sets up a *ready-to-use* project directory (*Cookie-Cutter*):**
   - `pyproject.toml`: Pre-configured for `src`-layout, basic dependency list, etc.
   - `.envrc`: Tells `direnv` to create & activate virtual environment automatically.
   - `justfile`: Comes with working recipes (functions) to install, etc.
   - Many more...
2. **Use `just` recipes for everyday tasks:**
   - Installing your project: `just install-compile`
   - Resetting environment: `just reset-venv`
   - Upgrading dependencies: `just upgrade-deps`
   - You can add more yourself!

`bube proj` : Demonstration

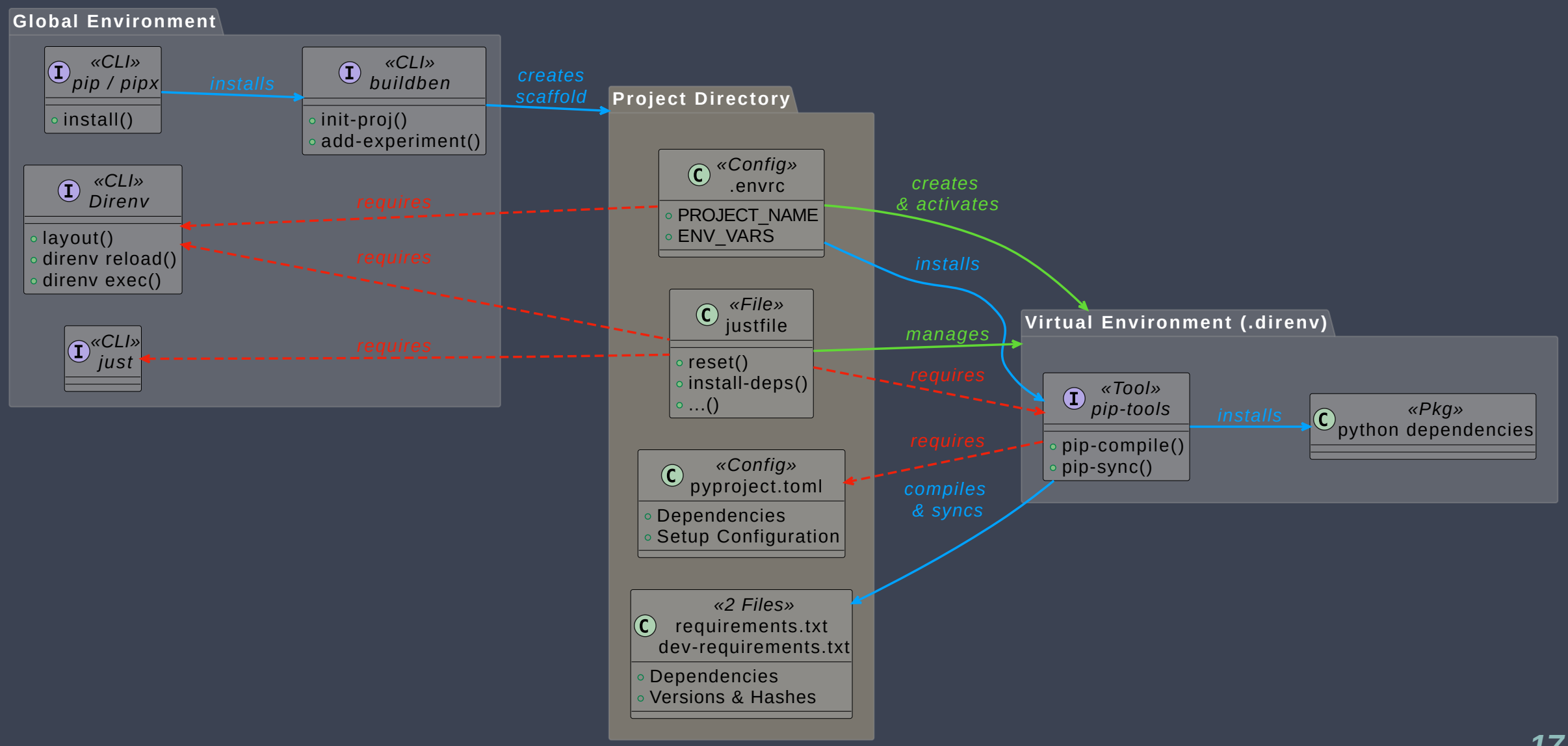
```
bube -h                                # Show help message
bube proj -h                           # Shorthand for `buildben init-proj -h`
bube proj "sheesh" -t . -g -u "<your_github_username>"  # Cookiecutter project
cd "sheesh"                            # Change to project directory
direnv allow                           # Trust & execute .envrc
# A .direnv directory is created containing the virtual environment
just                                   # Show available recipes
just install-compile                   # Install project, compile requirements.txt

cd ..                        # Demonstrate auto-deactivation of direnv
cd bla_a                     # Demonstrate auto-activation of direnv
cd ../sheesh                 # Demonstrate auto-deactivation and activation of direnv

just reset-venv              # Fully Nuke the virtual environment, start fresh!
```

`bube proj`: Minimal Example

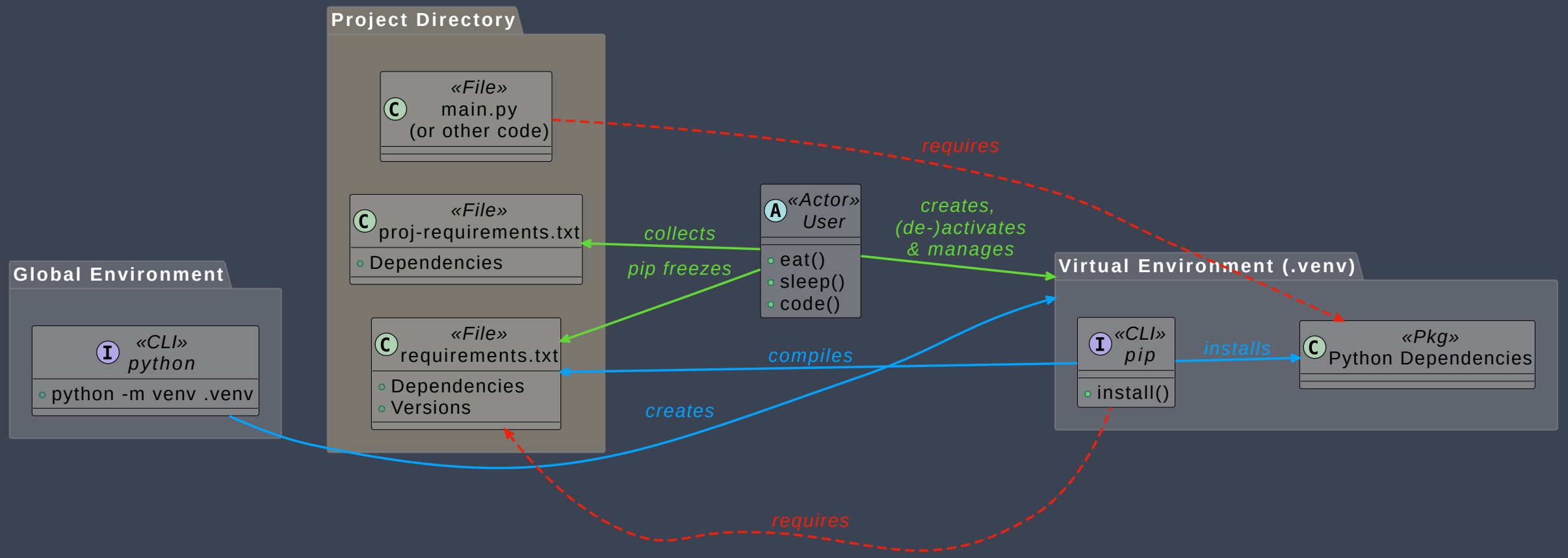
4 Lines to set up a new project.

```
bube proj "sheesh" -t . -g -u "<your_github_username>"
cd "sheesh"
direnv allow
just install-compile
```

With `buildben`:



Without `buildben`:



`pyproject.toml`

- Contains metadata about the project, dependencies, and build system.
- Used by `pip` & `pip-sync` to install the project and its dependencies.
- Used by `pip-compile` to generate lock-file: `requirements.txt`.

`pyproject.toml`

Keep in mind:

- Whenever you `pip install` something, add it under `[project.dependencies]`, or for development dependencies under `[project.optional-dependencies]`.
- Other `buildben` projects can be added as a dependency via their Git-URL: `"sheesh2 @ git+https://github.com/HisQu/sheesh2.git@<branch, tag or commit>"`,
  or as a local path: `"sheesh2 @ file://../sheesh2"`
  → No need for GitHub submodules
  → No need for publishing on PyPI
- Package any non-`.py` file under `[project.package-data]`

`just` Recipe Syntax

A "Recipe" is a bash function that can be called from the command line.

```
# Docstring for the recipe (optional)
recipe-name *ARGS:
    echo "Hello, World!"
    echo "This is a recipe."
    rm {{ARGS}}     # Pass arguments
alias rcp-nm:=recipe-name  # Create an alias for the recipe
```

Project Structure: `src/`-Layout

```
# src layout (good)
myproject/
├── src/
│   └── myproject/
│       ├── main.py
│       └── package/module.py
├── tests/
│   └── test_module.py
├── README.md
```

```
# flat layout (risky)
myproject/
│
│
├── main.py
├── package/module.py
├── tests/
│   └── test_module.py
├── README.md
```

Benefits:

- Avoids imports from working directory via `PYTHONPATH`
  → Forces tests to run on installed code: `pip install -e .` → Catches `import` bugs
- Builds **clean wheels**: Stray files never ship to PyPI

Project Structure: Inside `src/`

```
myproject/
├── src/
│   └── myproject/            # Single directory, same name as project root (Recommended)
│       ├── __init__.py       # Marks directory as package; runs on first import!
│       ├── main.py           # Optional CLI entry-point (wired in via pyproject.toml)
│       ├── shishkebab.py     # >>> import myproject.shishkebab
│       ├── clients/          # >>> import myproject.clients
│       │   ├── __init__.py   # Sub-package "clients"
│       │   ├── llm.py        # >>> import myproject.clients.llm
│       │   └── embedding.py  # >>> import myproject.clients.embedding
│       └── utils/            # >>> import myproject.utils
│           ├── __init__.py   # Sub-package "utils"
│           ├── cooltool.py   # >>> import myproject.utils.cooltool
│           └── module6.py    # >>> import myproject.utils.module6
```

Project Directory: Auxiliary Files in Project Root

```
myproject/
├── .venv/                  # Virtual environment (or .direnv!)
├── .env                    # Environment variables (& secrets)
├── .gitignore
├── .git/                   # Repository metadata
├── src/
│   └── myproject/         # Separate source code from tests!
├── tests/
│   └── test_module1.py     # Tests for module1
├── justfile                # Development tasks
├── pyproject.toml          # Project metadata, Setup!
├── requirements.txt        # Dependencies
├── requirements-dev.txt    # Development dependencies
├── README.md
├── LICENSE
```

Installation of `buildben`

Prerequisites:

- Python installed on your OS (and you know its executable in your `$PATH`)
- A Package manager (`apt`, `brew`, `winget`, etc.)

🏃 Quick & Dirty:

```
git clone https://github.com/markur4/buildben.git
pip install -e buildben    # venv recommended. (Also, you might want just & direnv.)
```

🏗️ Full Install (recommended):

1. Install `pipx`:

To use `buildben` globally and to keep the OS-python clean, we recommend `pipx`.

```
sudo apt install pipx          # For Ubuntu
# brew install pipx            # For MacOS
# py -m pip install --user pipx   # For Windows (Not tested!)
pipx ensurepath                   # Add pipx to PATH, if not already done
pipx upgrade-all                  # !! Never run pipx with sudo !!
```

2. Clone & install `buildben`:

```
git clone https://github.com/markur4/buildben.git
cd buildben          # Needed, `pipx install buildben` does NOT work!
pipx install -e .    # Editable for direct modifications.
```

🏗️ Full Install (recommended):

3. Install `just`:

```
sudo apt install just     # For Ubuntu
# brew install just       # For MacOS
# pipx install rust-just  # Windows requires the cross-platform version (not tested!)
```

4. Install `direnv` & hook it into your shell:

- *Either* follow the instructions for install & hook,
- *Or* run `src/buildben/setup_zsh.sh` to install both `zsh` & other useful plugins, including `direnv`.