Build-Benedictions

```
$ buildben init-proj
```

Managing Multiple (Python) Projects & Dependencies

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`buildben`: Main Commands

(`bube` is the alias for `buildben`)

- `$ 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

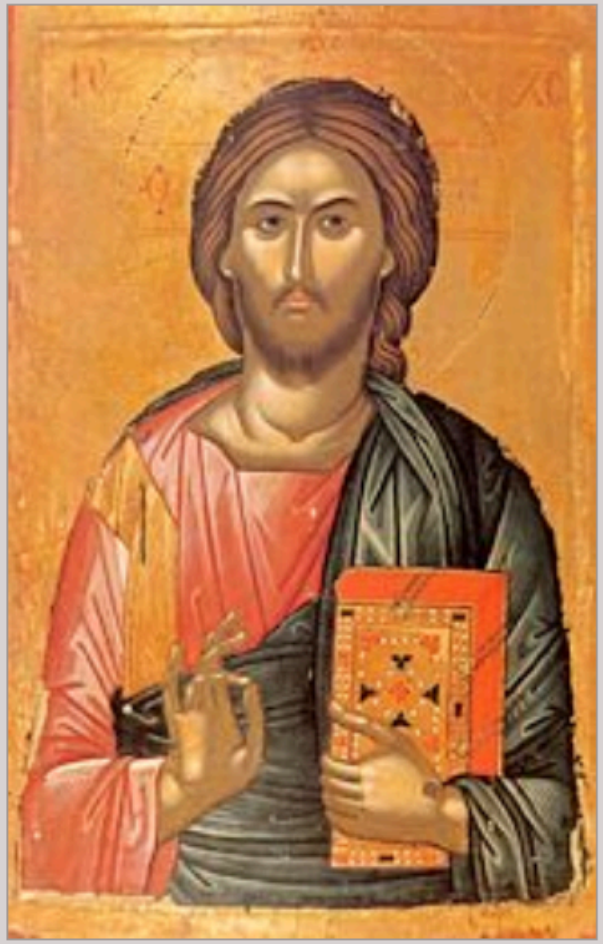
- `buildben` is very easy to use. (Goal is to make work simpler)
- This presentation is for python beginners.

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`: installs my dependencies and all *dependencies of dependencies*:

```
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*)

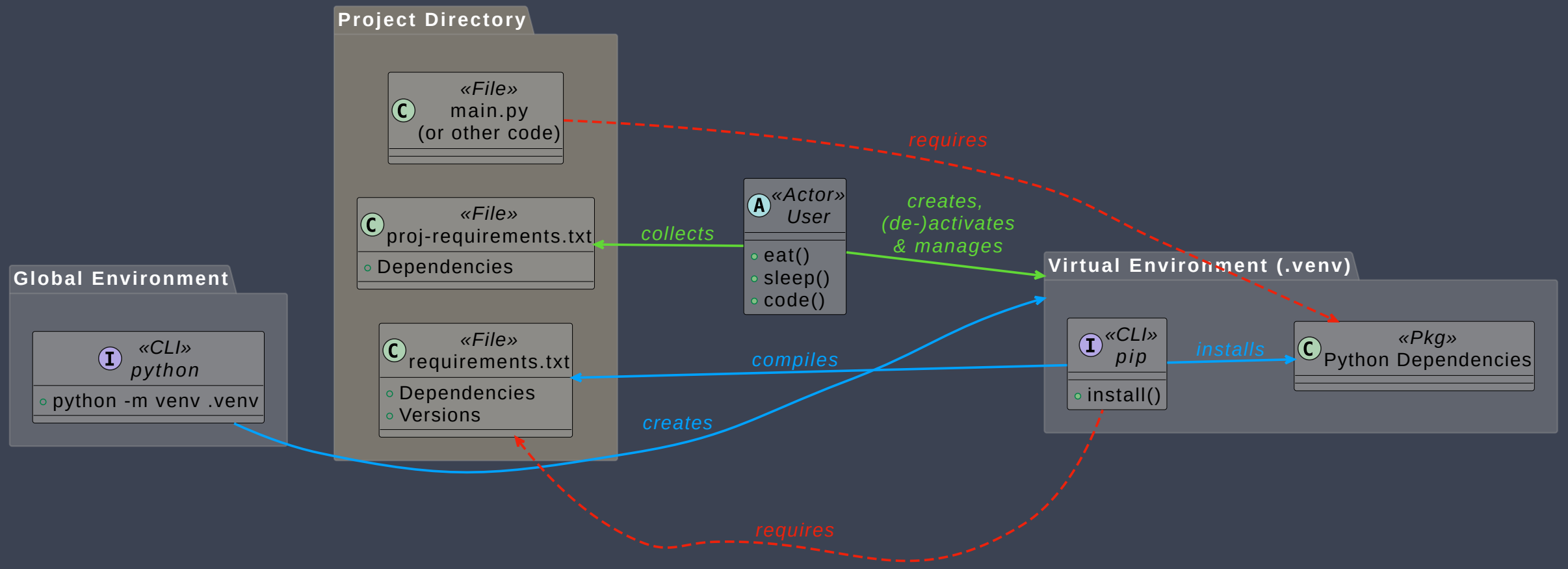
```
ipykernel
jupytext    # Convert .ipynb to .py
numpy
openpyxl    # For reading Excel files
pandas
matplotlib
seaborn     # Better plotting
pytest
```

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` once I need it!"

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..?

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

Build-Benedictions: Minimal Workflow

```
bube proj    # Shorthand for `buildben init-proj`
```

Build-Benedictions: Improving Setup & Maintenance

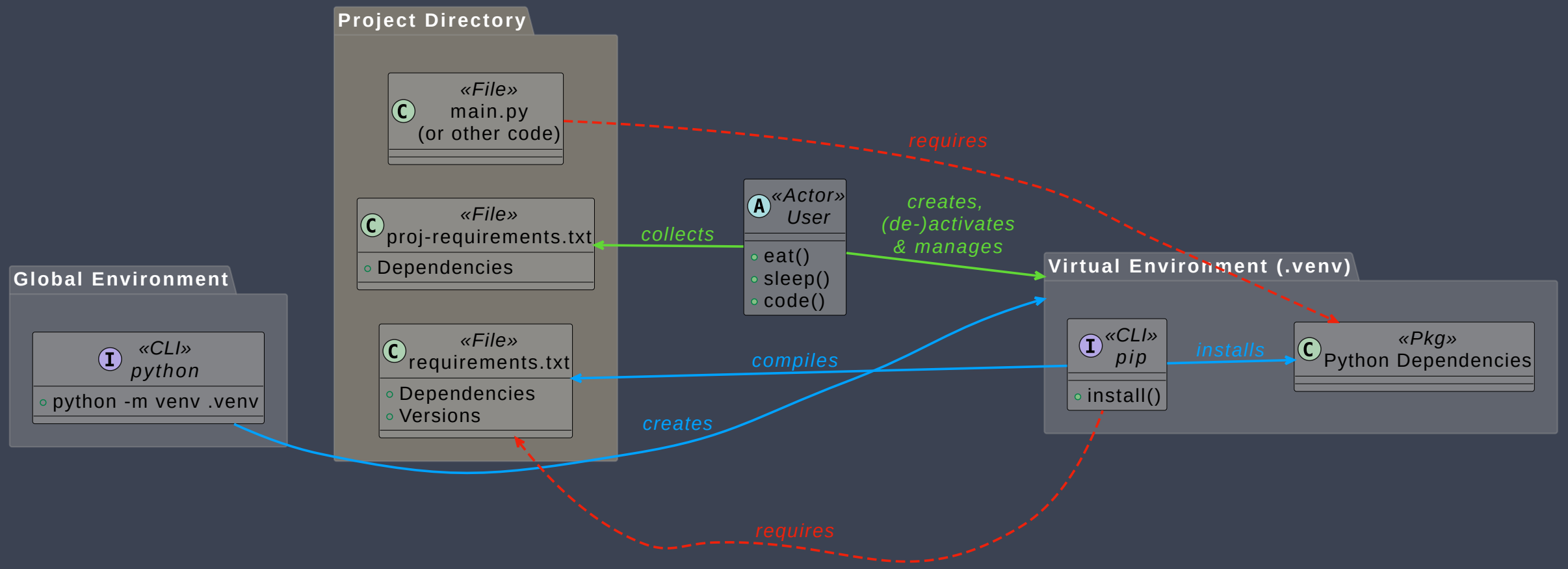
Standardize with template scaffolds:

- `$ bube init-proj`: Create a new **project**

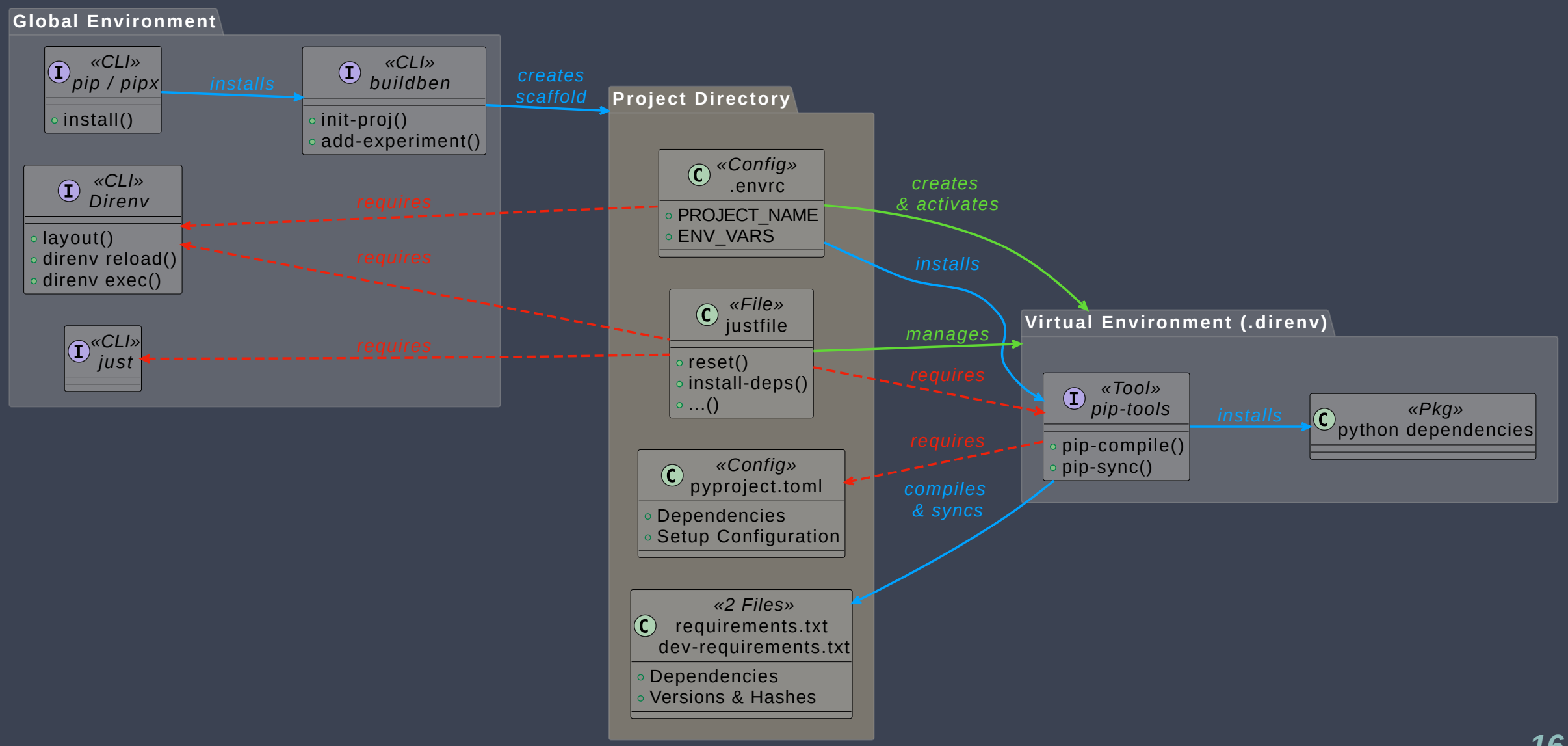
Automate workflow by integrating popular CLI-tools:

- `direnv`: Automate virtual **environments** & variables.
- `pip-tools`: Automate **dependency** management.
- `just`: Summarize tasks into **one-liners**: `just install`, `just upgrade`, etc.
- `docker`: **Snapshot** current state of project.

Without `buildben`:



With `buildben`:



Project Directory: `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
- Recommended by Python Packaging Authority (PyPA)

Project Directory: 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)
│       ├── sheesh.py         # >>> import myproject.sheesh
│       ├── 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
```