CI/CD: Tools & Automation

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Group Programming

Larger group sizes call for an increased amount of structure. Too little structure in a large team results in chaos. Too much structure in a small team hampers productivity.

Your developer habits need to be tweaked to work in a team setting. More communication, less YOLO.

Working in Feature or Pizza Teams

"If you can't feed a team with two pizzas, it's too large.
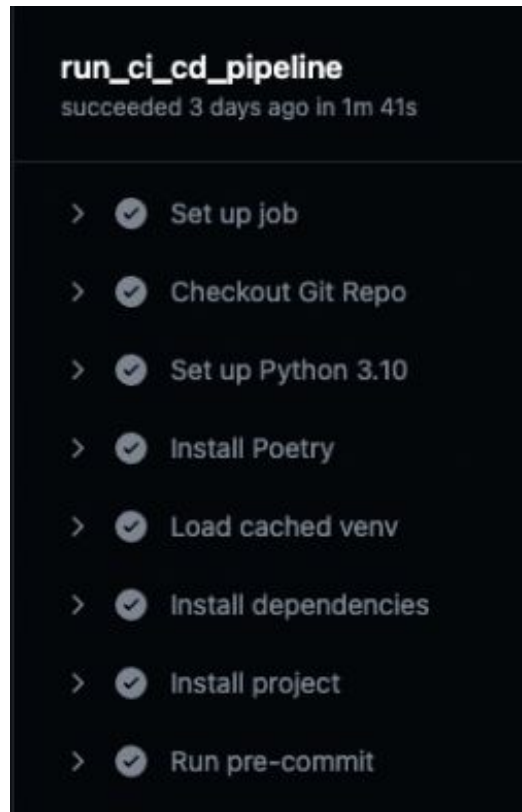- Jeff Bezos, CEO, Amazon

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CI/CD

- Automatically run pipelines on new code changes to check for issues or bugs.
- Fast feedback loop for developers.
- Shared rules which lead to better code quality.
- Promotes transparency and knowledge sharing.

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CI/CD in Practice

1. Develop code changes.

2. Commit and push code to Github.

3. Github automatically detect new code and starts CI on a server which installs the project.

4. CI tests the code and alerts the developer if there are any errors.

5. Developer fixes problem and starts CI again.

run_ci_cd_pipeline
succeeded 3 days ago in 1m 41s

> ✓ Set up job

> ✓ Checkout Git Repo

> ✓ Set up Python 3.10

> ✓ Install Poetry

> ✓ Load cached venv

> ✓ Install dependencies

> ✓ Install project

> ✓ Run pre-commit

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CI/CD in Practice

CI/CD can also do other things.

- Train and test the ML model.
- [Create reports and share them with stakeholders](#).
- [Ask chatGPT for code improvements](#) .
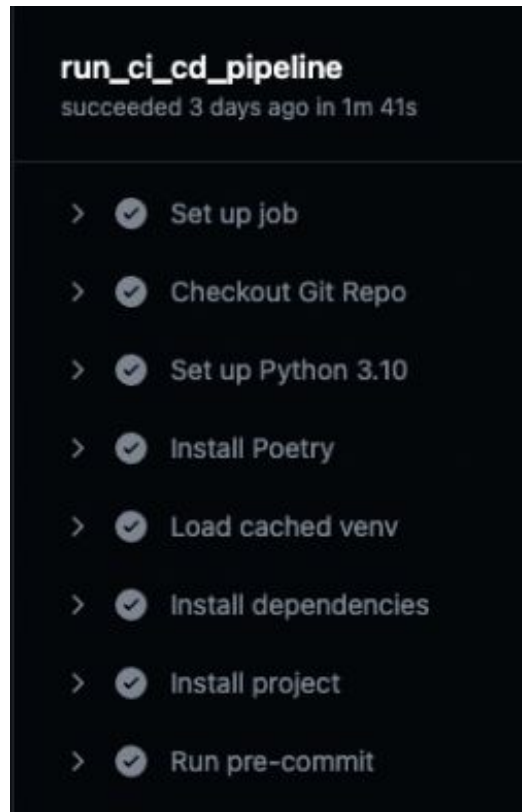
What *should* CI/CD do?

It depends on the project situation. CI will run often, so you don't want it to be expensive (OpenAI API) or run very slowly (train a big ML model).
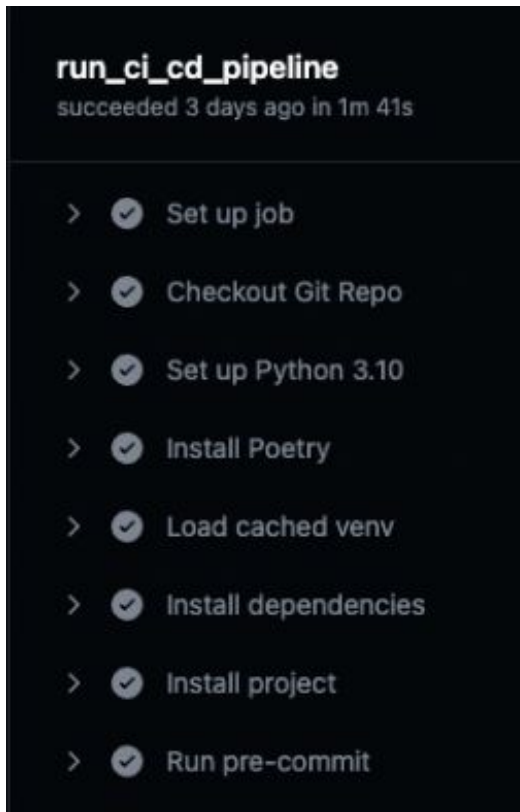
CI/CD in Practice

What will we do in the project.

- Download code from github.

- Install our python requirements into our venv.

- Check our code for style/format errors.

- Run tests.

- (Anything else you want to try for fun). 🤔

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CI/CD Config File

GitHub reads the config file

my-git-repo/.github/workflows/example.yaml

We can configure

- When the workflow runs. Every git push. Every sunday.

- What OS should be used (Mac, Windows, …)

- What Python version we should use. We can even repeat the same workflow with different Python versions

```yaml
name: Python run CI CD
on: pull_request
jobs:
 run_ci_cd_pipeline:
   runs-on: ubuntu-latest
   steps:
   # Git clone repo
   - name: Checkout Git Repo
     uses: actions/checkout@v3

   # Install Python
   - name: Set up Python 3.10
     uses: actions/setup-python@v4
     with:
       python-version: '3.10'

   # Install requirements
   - name: Install dependencies
     run: |
       pip install -r requirements.txt

   # Run tests
   - name: Test with pytest
     run: |
       pytest tests/
```

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Black: Code formatter

🙏Black: https://github.com/psf/black 🙏

Changes your code to follow the black "style".

Only cosmetic changes. Code behaves 100% the same.

Easier to read code - avoids different styles in large teams

```python
# python_example.py
# Before
a=1
b = [1,2
3]



c = 1*2 + 5
# After black formats the code 👇.
Space between operators, simplify,
reduce number of new-lines and many
other things.
a = 1
b = [1,2,3]


c = 1 * 2 + 5
```

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isort: Import organizer

isort: https://github.com/PyCQA/isort

(Not as nice as Black, but pretty good! 🤗)

Changes the order of your imports at the top of the file

1. Python "built-ins" e.g. time, random, pathlib, os, sys
2. Third party e.g. pandas, numpy, dash
3. Project specific imports. For files and functions you created yourself

```python
# Before
import pandas as pd
from my_project import make_paper_clips
from pathlib import Path
import numpy as np
from my_project.matrix import subdue_human_race
import os


# After isort formats the code 👇.
# 1. Python built-ins
import os
from pathlib import Path


# 2. Third party
import numpy as np
import pandas as pd


# 3. Our own code
from my_project import make_paper_clips
from my_project.matrix import subdue_human_race
```

Tests

Tests help identify and fix issues, leading to higher-quality software and reducing the risk of important errors.

Great for detecting unintended side-effects. Describes how the code is intended to be used and provide examples of its expected behavior.

🤭Tests can be skipped in certain cases, such as small hobby projects with minimal consequences for errors, compared to high-stakes applications like self-driving cars.🤭

"The more you trust your tests, the more you're like, oh, I got a pull request and the tests pass, I feel okay to merge that, the faster you can make progress."

George Hotz
(Famous hacker/programmer)

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Tests: Different Types

- **Unit Tests**: Focus on verifying the smallest testable units of code, such as individual functions or methods.

- **Integration Tests**: Integration tests verify the interaction and integration between different modules or components.

- **Regression Tests**: Help identify any unintended side effects or regressions caused by the modifications.

- More types of tests. Acceptance Tests, Functional Tests, Performance Tests, Security Tests etc… What matters is that there are **different types of tests** - the **importance depends** on the project.

You want your tests to be fast. That allows them to run often without disturbing the developers productivity.

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Pytest

Pytest: https://docs.pytest.org/

Most popular testing framework in Python.

Pytest can be used to create and run tests.

Pytest will automatically find your tests if you start their names with "test".

```
# Put test code under tests/
├── src
│   └── newsfeed
│       ├── example1.py
│       └── example2.py
└── tests
    ├── test_example1.py
    └── test_example2.py
```

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Pytest

```python
# tests/test_example1.py
import platform


# Pytest find this function cuz it starts with "test"
def test_correct_python_version():
    python_version = platform.python_version()
    assert python_version == "3.10.2"


# Pytest ignores this one
def helper_function_not_starting_with_test():
    return 😓
```

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Pytest advanced

```python
from typing import Generator

import pytest
from src.api.database import Credentials, get_cursor,
get_routes_from_db
from src.api.datamodel import Waste
from src.utils.datatypes import Error


@pytest.mark.order("first")
def test_connect_db() -> None:
    try:
        get_cursor(Credentials.routes())
    except Exception as err:
        pytest.exit(f"Couldn't connect to the database.")


def test_setup_db(setup_db: Generator) -> None:
    pass
```

```python
def test_stored_procedure(setup_db: Generator) -> None:
    route_db_cursor = get_cursor(Credentials.routes())
    waste = [Waste(waste_type="HEMSORT")]
    routes = get_routes_from_db(waste)
    assert not isinstance(routes, Error)
    for route in routes:
        if route.vehicle == "22":
            assert len(route.stops) == 3, route
        if route.vehicle == "21":
            assert False, route
        if route.date != "TOMORROW":
            assert False, route
```

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Pre-commit

⭐Pre-commit: https://pre-commit.com/ ⭐

Mini CI/CD that runs on your laptop every time you make a git commit.

Save so much time since it's much quicker than Github CI/CD

```yaml
# .pre-commit-config.yaml
repos:
- repo: https://github.com/pre-commit/pre-commit-hooks
  rev: v4.4.0
  hooks:
  - id: trailing-whitespace
  - id: check-yaml
  - id: check-toml
  - id: check-added-large-files
  - id: debug-statements
    language_version: python3
- repo: https://github.com/jumanjihouse/pre-commit-hook-yamlfmt
  rev: 0.2.3
  hooks:
  - id: yamlfmt
- repo: https://github.com/psf/black
  rev: 23.3.0
  hooks:
  - id: black
    language_version: python3
- repo: https://github.com/pycqa/isort
  rev: 5.12.0
  hooks:
  - id: isort
    name: isort (python)
```

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Honorable Mentions

Flake8 https://flake8.pycqa.org/en/latest/

Can tell you if you have created variables that are never used and many more helpful code checks.

Ruff https://github.com/astral-sh/ruff

New tool that is growing very quickly. Looks like this will be the default tool soon - but the older tools have better compatibility right now :)

```python
import math


def calculate_circle_area(radius):
    diameter = radius * 2  # Flake8 warning: Variable not used
    area = radius * radius * math.pi
    return area
```

"Ruff can be used to replace Flake8, isort, pydocstyle, yesqa, eradicate, pyupgrade, and autoflake, all while executing tens or hundreds of times faster than any individual tool."

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