

# CSE 403

Software Engineering

Spring 2023

**#15: CI/CD**

# Logistics

## WEEK 5

04/24 L: Build Systems

04/25 T: DUE: [DnA!!!](#)

04/26 L: Testing [Testing & CI/CD \(TCC\)](#)

04/27 P:

04/28 L: CI/CD

## WEEK 6

05/01 L: Test Coverage

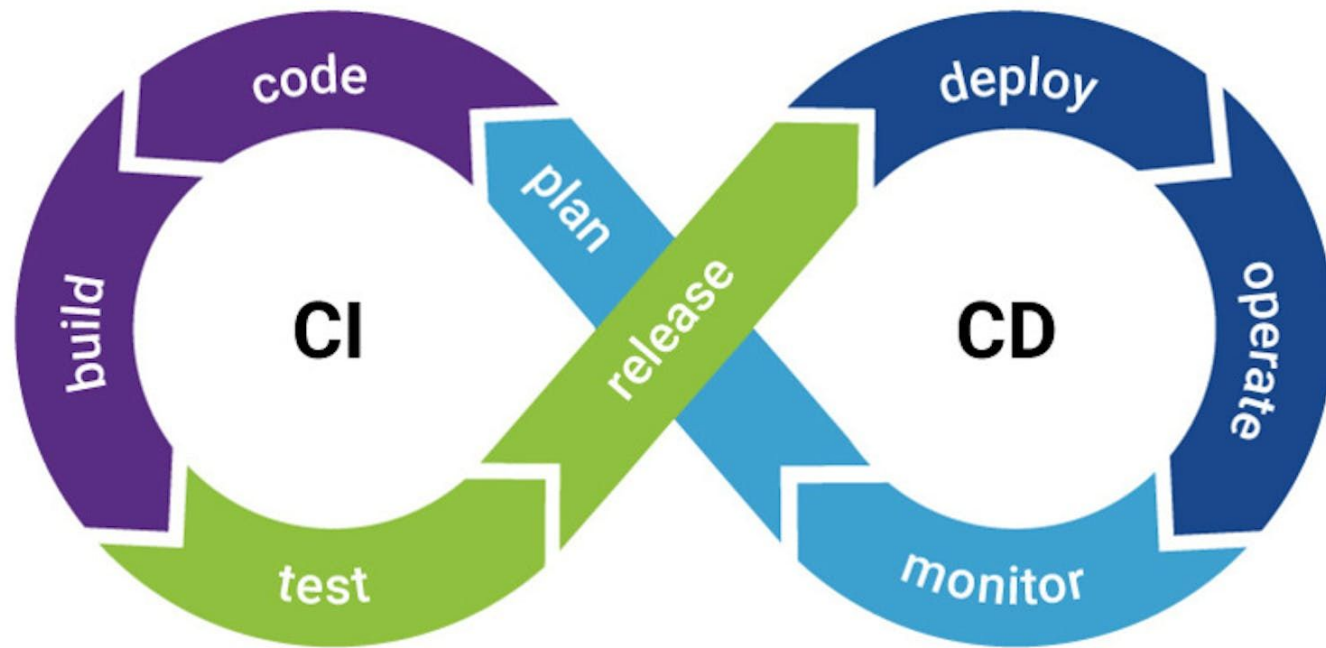
05/02 T: DUE: [TCC!!!](#)

05/03 L: Mutation Testing [Alpha Release \(R1\)](#)

05/04 P:

05/05 LX: Code Defenders

# Continuous Integration & Continuous Delivery



# CI/CD: What's the difference?

## **Continuous Integration (CI)**

- Integrates code into a shared repository.
- Builds/tests each change automatically.
- Complements local developer workflows (subset of tests vs. all tests).

## **Continuous Deployment (CD)**

- Builds on top of CI.
- Software can be deployed at any time.
- Automatically pushes changes to production.

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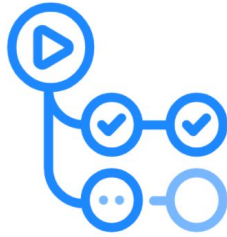
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**403 focuses on establishing good CI practices.**

# Continuous Integration & Delivery Tools



**Jenkins**



GitHub Actions



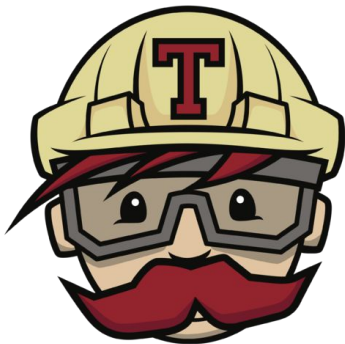
AWS  
CodePipeline



GitLab



Bitbucket Pipelines



Travis CI

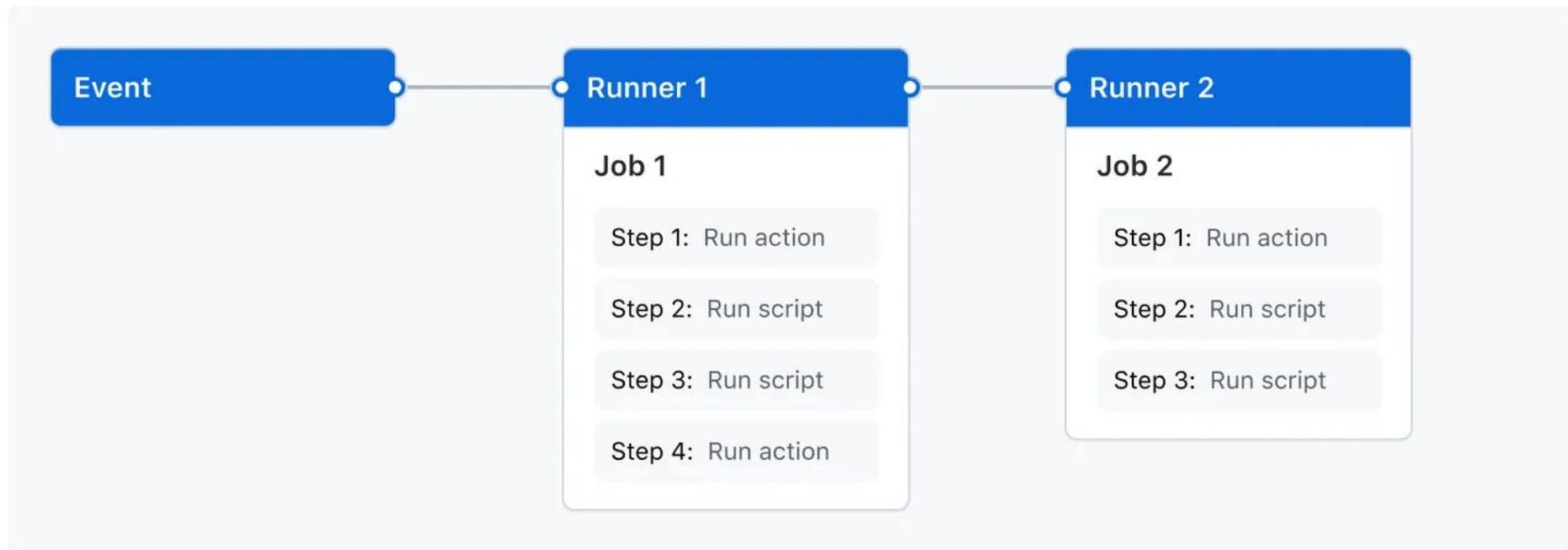


Azure Pipelines



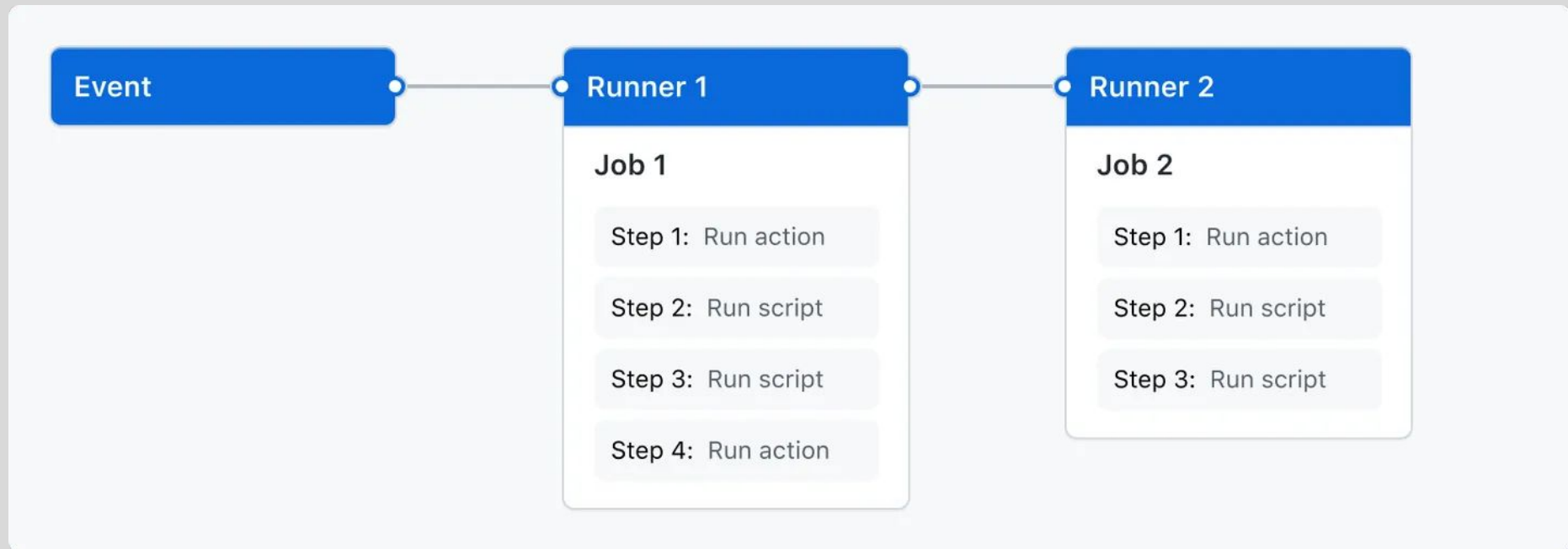
circleci

# CI (w/ GitHub Actions) Basics



**Terminology:** Workflow (pipeline), Event, Job, Action, Runner

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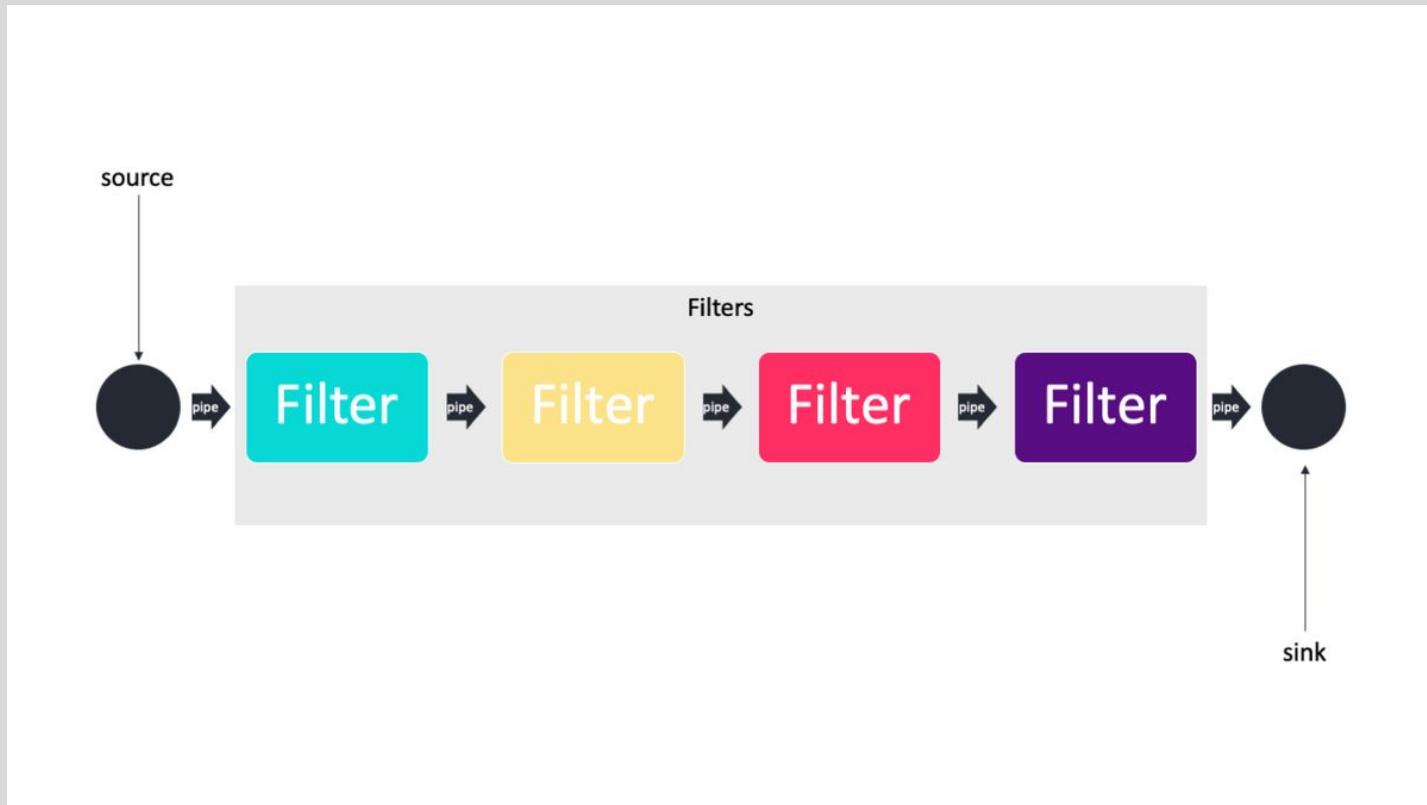


**Terminology:** Workflow (pipeline), Event, Job, Action, Runner

**BTW: What SW Architecture do you think CI/CD uses?**



# SW Architecture #1: Pipe and Filter



The pipe-and-filter **architecture** doesn't specify the **design** or **implementation** details of the individual components (the filters)!

# Live example: CI in action

The screenshot shows the GitHub Actions interface for the repository `labinthewild / LITW-API`. The main heading is `CI Tests run only on push for now. PL + Push was duplicating runs. #15`. A summary table shows a successful run triggered by a push from user `nigini` at 0eaf405, with a duration of 1m 26s. The workflow file `ci-test.yml` is shown with the configuration `on: push` and a matrix job `test` that has completed successfully.

Search or jump to... Pull requests Issues Codespaces Marketplace Explore

labinthewild / LITW-API Private Edit Pins Unwatch 2

Code Issues 3 Pull requests 1 Actions Projects 1 Security Insights Settings

← CI - UnitTesting

### ✓ CI Tests run only on push for now. PL + Push was duplicating runs. #15

Summary

| Jobs               | Triggered via push 1 minute ago  | Status  | Total duration | Arti |
|--------------------|----------------------------------|---------|----------------|------|
| ✓ test (3.11, 6.0) | nigini pushed · 0eaf405 ci_tests | Success | 1m 26s         | —    |

Run details

- Usage
- Workflow file

#### ci-test.yml

on: push

Matrix: test

✓ 1 job completed

Show all jobs

# Live example: CI in action

```
name: CI - UnitTesting
on: [push]
jobs:
  test:
    runs-on: ubuntu-latest
    strategy: <2 keys>

    steps:
      - uses: actions/checkout@v3
      - name: Set up Python ${{ matrix.python-version }}
        uses: actions/setup-python@v3
        with: <1 key>
      - name: Set up MongoDB ${{ matrix.mongodb-version }}
        uses: supercharge/mongodb-github-action@1.8.0
        with: <1 key>
      - name: Install dependencies
        run: python3 -...tall hatch
      - name: Pre-fly setup
        run: cp $GITHU...GITHUB_ENV
      - name: Test with hatch
        run: |
          hatch run test:test
```

Reuse other people's work!

Remember L13?  
One command!

# Live example: CI in action

The screenshot displays the GitHub Actions interface for a workflow named 'CI - UnitTesting'. The top navigation bar includes links for Code, Issues (3), Pull requests (1), Actions (selected), Projects (1), Security, Insights, and Settings. The main content area shows a successful run of the 'test (3.11, 6.0)' job, which completed 1 minute ago. The job summary includes a list of steps, all of which were successful.

← CI - UnitTesting

✓ **CI Tests run only on push for now. PL + Push was duplicating runs. #15**

Summary

Jobs

- ✓ **test (3.11, 6.0)**

Run details

Usage

Workflow file

**test (3.11, 6.0)**  
succeeded 1 minute ago in 1m 16s

- > ✓ Set up job
- > ✓ Build supercharge/mongodb-github-action@1.8.0
- > ✓ Run actions/checkout@v3
- > ✓ Set up Python 3.11
- > ✓ Set up MongoDB 6.0
- > ✓ Install dependencies
- > ✓ Pre-fly setup
- > ✓ Test with hatch
- > ✓ Post Set up Python 3.11
- > ✓ Post Run actions/checkout@v3
- > ✓ Complete job

# Live example: CI in action

```
(litw-api) nigini@librarian-xps:~/WORKSPACE/LITW/litw-api$ git push
```

# Example: CD in action

GitHub Pages

## Websites for you and your projects.

Hosted directly from your [GitHub repository](#). Just edit, push, and your changes are live.



# Example: CD in action

The screenshot shows the GitHub repository settings for `nigin / SWEng`. The repository name and public status are highlighted in a purple box. The navigation bar includes links for Code, Issues (4), Pull requests (9), Actions, Projects, Wiki, Security, Insights, and Settings (highlighted in a purple box). The left sidebar lists various settings categories: General, Access (Collaborators, Moderation options), Code and automation (Branches, Tags, Rules (Beta), Actions), Webhooks, Environments, Codespaces, and Pages (highlighted in a purple box). The main content area is titled "GitHub Pages" and displays the live site URL: `https://nigin.github.io/SWEng/`, last deployed by `nigin` 2 days ago. Under "Build and deployment", the source is set to "Deploy from a branch", the branch is `main`, and the directory is `/ (root)`. A "Save" button is visible. A link to "add a Jekyll theme" is provided at the bottom.

nigin / SWEng Public

<> Code Issues 4 Pull requests 9 Actions Projects Wiki Security Insights Settings

General

Access

- Collaborators
- Moderation options

Code and automation

- Branches
- Tags
- Rules (Beta)
- Actions
- Webhooks
- Environments
- Codespaces
- Pages**

## GitHub Pages

GitHub Pages is designed to host your personal, organization, or project pages from a GitHub repository.

Your site is live at <https://nigin.github.io/SWEng/>  
Last deployed by `nigin` 2 days ago

## Build and deployment

**Source**

Deploy from a branch

**Branch**

Your GitHub Pages site is currently being built from the `main` branch. [Learn more.](#)

`main` / (root) Save

Learn how to [add a Jekyll theme](#) to your site.

# Example: CD in action

nigini / SWEng Public

<> Code Issues 4 Pull requests 9 **Actions** Projects Wiki Security Insights Settings

## ✓ pages build and deployment #52

### Summary

#### Jobs

- ✓ build
- ✓ report-build-status
- ✓ deploy

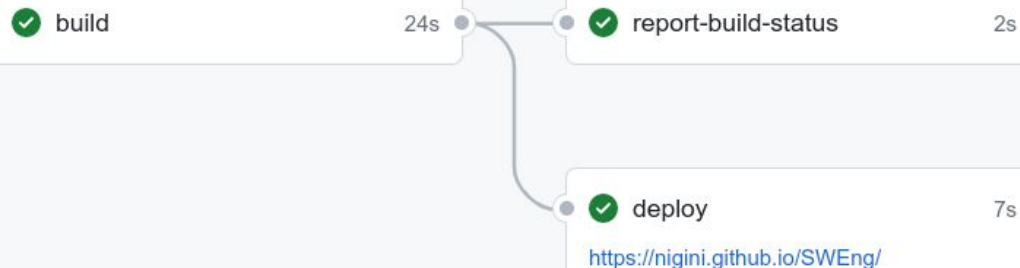
#### Run details

Usage

|                                  |                |                |           |
|----------------------------------|----------------|----------------|-----------|
| Triggered via dynamic 2 days ago | Status         | Total duration | Artifacts |
| nigini 4169aa2                   | <b>Success</b> | <b>52s</b>     | <b>1</b>  |

### pages-build-deployment

on: dynamic





# Example: CD in action

**build**  
succeeded 2 days ago in 24s

Jobs

- ✓ build
- ✓ report-build-status
- ✓ deploy

Run details

Usage

```
138 ./project/05_project_testing.html
139 ./project/10_project_reflection.html
140 ./project/07_project_r2.md
141 ./project/03_project_github_setup.html
142 Run actions/upload-artifact@v3
143 name: github-pages
144 path: /home/runner/work/_temp/artifact.tar
145 retention-days: 1
```

Jobs

- ✓ build
- ✓ report-build-status
- ✓ deploy

Run details

Usage

```
> Set up job
  ✓ Deploy to GitHub Pages
    1 Run actions/deploy-pages@v2
    2 Artifact exchange URL:
      https://pipelines.actions.githubusercontent.com/iXEm1qjPBbT
      s?api-version=6.0-preview
    3 Creating Pages deployment with payload:
    4 {
    5   "artifact_url":
    6     "https://pipelines.actions.githubusercontent.com/iXEm1qjPBbT
    7     artifactName=github-pages&%24expand=SignedContent",
    8   "pages_build_version": "4169aa2de4dd7a71f855d4827155
    9   "oidc_token": ""
   10 }
   11 Created deployment for 4169aa2de4dd7a71f855d482715533226fbdd
   12 Getting Pages deployment status...
   13 Reported success!
  ✓ Complete job
    1 Evaluate and set environment url
    2 Evaluated environment url: https://nigini.github.io/SWEng...
    3 Cleaning up orphan processes
```

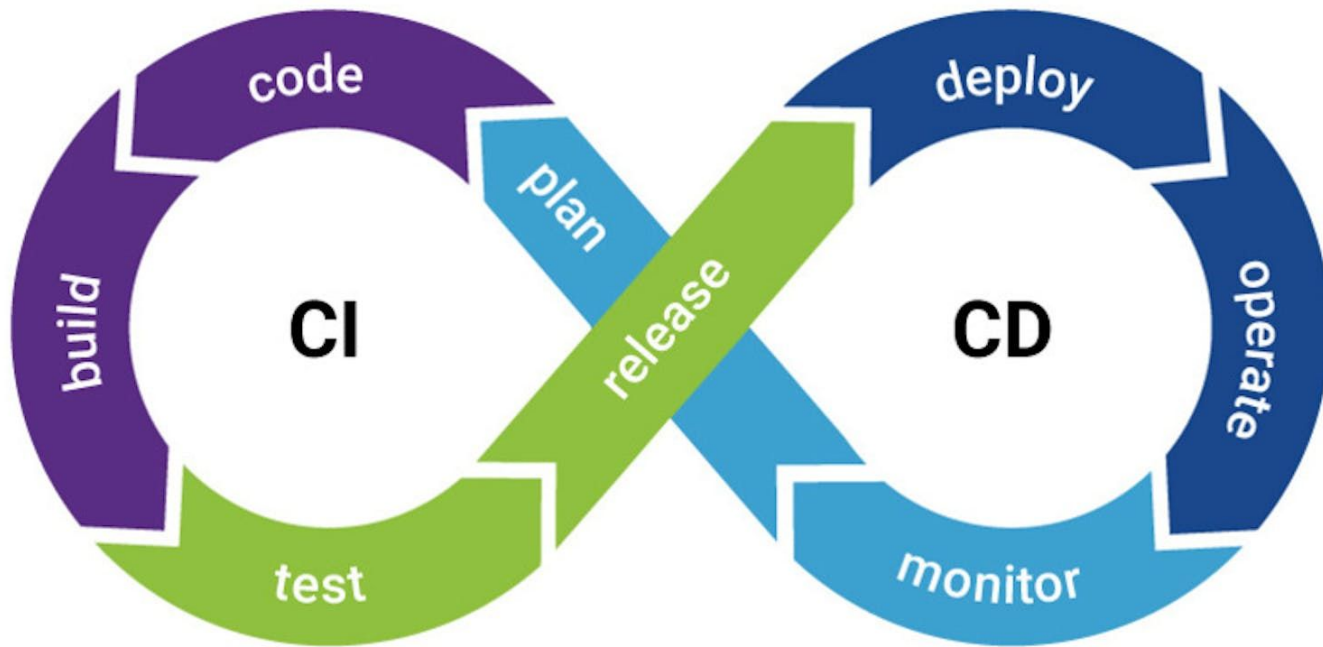
# Example: CD in action

```
nigini@librarian-xps: ~/WORKSPACE/TEACHING/SWEng × nigini@libraria
```

---

```
nigini@librarian-xps:~/WORKSPACE/TEACHING/SWEng$ git push
```

# Continuous Integration & Continuous Delivery



Questions, please!!!