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Github Actions CI

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Github Actions

- CI system developed by Github
- Fully hosted, including runner
- Uses yaml based configuration
- Well documented
- Community-driven plugins, so-called "actions"
  - integrated marketplace

Advantages and Disadvantages

Advantages

- Well documented
- Known by many developers
- Premade actions for almost everything
- No hosting required
- Free for non-commercial open source

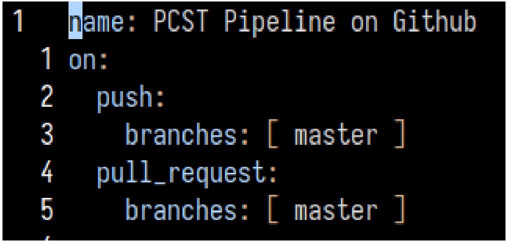
Disadvantages

- Vendor lockin
  - Closed source runner
  - pre made options only available on github
- High pricing for large scale
- Requires code to be hosted on Github
- Runner runs on Github servers
  - Possible compliance problems (GDPR)
  - US Company ⇒ CLOUD Act

High Level Workflow

1. Create yml file
   - `mkdir -p .github/workflows`
   - `touch .github/workflows/ci.yml`
2. Define when to run
3. define jobs with different steps. Including:
   - Checking out (getting) the code
   - Setting up the Environment
   - The actual work

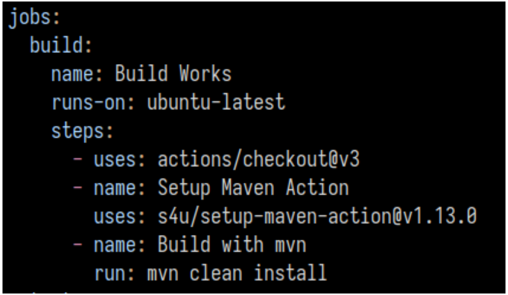
Config Breakdown: When to Run



```yaml
name: PCST Pipeline on Github
on:
  push:
    branches: [ master ]
  pull_request:
    branches: [ master ]
```

- Defined by on:
- in our case:
  - On every master commit
  - On every pull request against master
- Is a list, can contain multiple branches

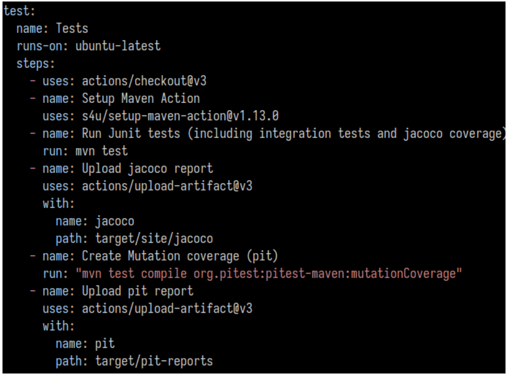
Config Breakdown: Build Job



```
jobs:
  build:
    name: Build Works
    runs-on: ubuntu-latest
    steps:
      - uses: actions/checkout@v3
      - name: Setup Maven Action
        uses: s4u/setup-maven-action@v1.13.0
      - name: Build with mvn
        run: mvn clean install
```

- Each bullet point is a step that runs one after another
- `actions/checkout` is a pre-made action by Github
  - git checkouts the newest version of the repo
- `s4u/setup-maven-action` is a community action to install maven
- `run:` allows for arbitrary shell code execution

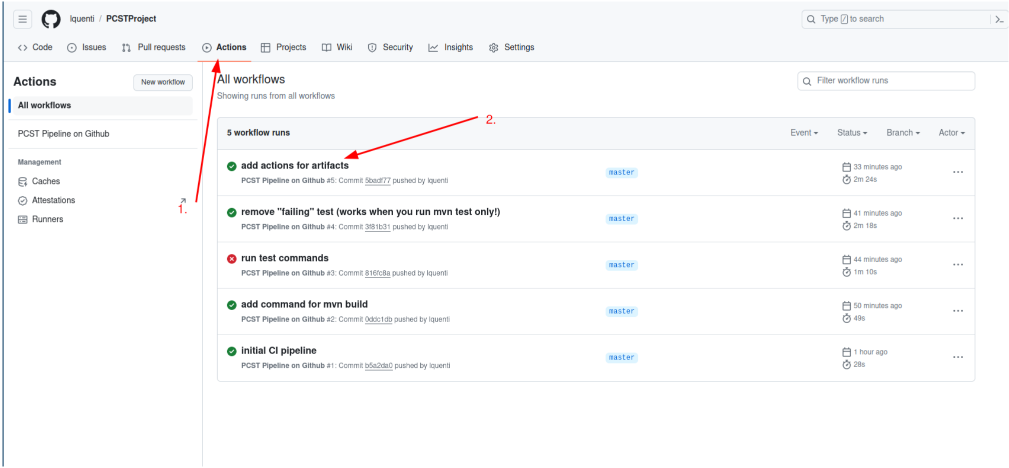
Config Breakdown: Test Job



```
test:
  name: Tests
  runs-on: ubuntu-latest
  steps:
    - uses: actions/checkout@v3
    - name: Setup Maven Action
      uses: s4u/setup-maven-action@v1.13.0
    - name: Run Junit tests (including integration tests and jacoco coverage)
      run: mvn test
    - name: Upload jacoco report
      uses: actions/upload-artifact@v3
      with:
        name: jacoco
        path: target/site/jacoco
    - name: Create Mutation coverage (pit)
      run: "mvn test compile org.pitest:pitest-maven:mutationCoverage"
    - name: Upload pit report
      uses: actions/upload-artifact@v3
      with:
        name: pit
        path: target/pit-reports
```

- Again: Checkout and Maven setup
- Run unit and integration test suite
  - Like in Terminal: `mvn test`
- Run Mutation test coverage with terminal command
- `actions/upload-artifact` is official action by GitHub
  - `with:` can be used to configure actions
  - `name:` defines name of the zip file
  - `path:` defines where the to-be-zipped files are located

Artifacts



All workflows

Showing runs from all workflows

5 workflow runs

add actions for artifacts
PCST Pipeline on Github #5: Commit 5badf77 pushed by lquenti — master — 33 minutes ago — 2m 24s

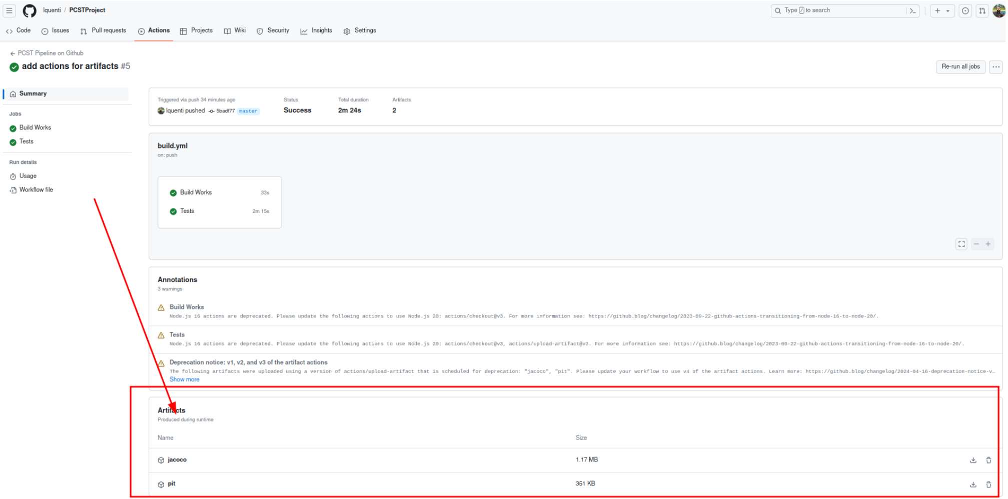
remove "failing" test (works when you run mvn test only!)
PCST Pipeline on Github #4: Commit 3f81b31 pushed by lquenti — master — 41 minutes ago — 2m 18s

run test commands
PCST Pipeline on Github #3: Commit 816fc8a pushed by lquenti — master — 44 minutes ago — 1m 10s

add command for mvn build
PCST Pipeline on Github #2: Commit 0ddc1db pushed by lquenti — master — 50 minutes ago — 49s

initial CI pipeline
PCST Pipeline on Github #1: Commit b5a2da0 pushed by lquenti — master — 1 hour ago — 28s

Artifacts



add actions for artifacts #5

Triggered via push 34 minutes ago	Status	Total duration	Artifacts
lquenti pushed -o- 5badf77 master	Success	2m 24s	2

build.yml

on: push

Build Works	33s
Tests	2m 15s

Annotations

3 warnings

⚠ Build Works

```
Node.js 16 actions are deprecated. Please update the following actions to use Node.js 20: actions/checkout@v3. For more information see: https://github.blog/changelog/2023-09-22-github-actions-transitioning-from-node-16-to-node-20/.
```

⚠ Tests

```
Node.js 16 actions are deprecated. Please update the following actions to use Node.js 20: actions/checkout@v3, actions/upload-artifact@v3. For more information see: https://github.blog/changelog/2023-09-22-github-actions-transitioning-from-node-16-to-node-20/.
```

⚠ Deprecation notice: v1, v2, and v3 of the artifact actions

```
The following artifacts were uploaded using a version of actions/upload-artifact that is scheduled for deprecation: "jacoco", "pit". Please update your workflow to use v4 of the artifact actions. Learn more: https://github.blog/changelog/2024-04-16-deprecation-notice-v…
```

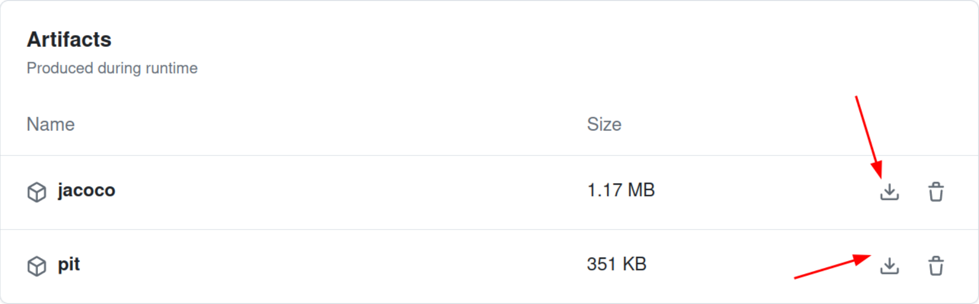
Show more

Artifacts

Produced during runtime

Name	Size
jacoco	1.17 MB
pit	351 KB

Artifacts

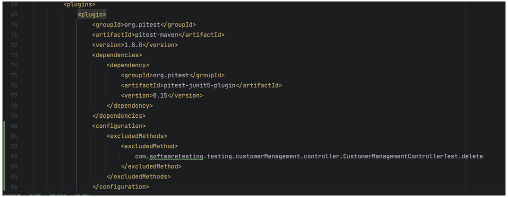


Artifacts

Produced during runtime

Name	Size
jacoco	1.17 MB
pit	351 KB

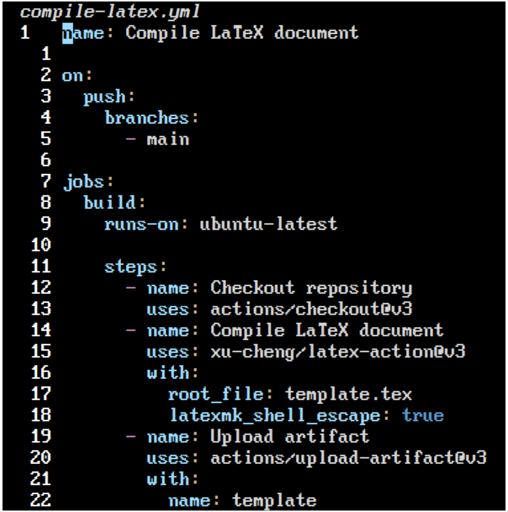
PIT+Integration tests



```
<plugins>
    <plugin>
        <groupId>org.pitest</groupId>
        <artifactId>pitest-maven</artifactId>
        <version>1.8.0</version>
        <dependencies>
            <dependency>
                <groupId>org.pitest</groupId>
                <artifactId>pitest-junit5-plugin</artifactId>
                <version>0.15</version>
            </dependency>
        </dependencies>
        <configuration>
            <excludedMethods>
                <excludedMethod>
                    com.softwaretesting.testing.customerManagement.controller.CustomerManagementControllerTest.delete
                </excludedMethod>
            </excludedMethods>
        </configuration>
```

- Integration tests work with `mvn test`, but not with PIT
- There is allegedly a feature to exclude tests with 100% coverage and 100% passing
- It’s not well-documented, so instead the tests were just commented out for now

Extra: LaTeX Github Actions!



compile-latex.yml

```yaml
name: Compile LaTeX document

on:
  push:
    branches:
      - main

jobs:
  build:
    runs-on: ubuntu-latest

    steps:
      - name: Checkout repository
        uses: actions/checkout@v3
      - name: Compile LaTeX document
        uses: xu-cheng/latex-action@v3
        with:
          root_file: template.tex
          latexmk_shell_escape: true
      - name: Upload artifact
        uses: actions/upload-artifact@v3
        with:
          name: template
```

- Build a new presentation on every commit
- First checkouts the git repo
- Pre-built Community action to do the compilation
- Official upload artifact action to provide the PDF

Thanks for your attention!