Lars Quentin, Valerius Mattfeld, Frederik Hennecke,
Daniil Markovichev

Github Actions CI

Table of contents

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

- 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 $\Rightarrow$ 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

```
1   name: PCST Pipeline on Github
  1 on:
  2   push:
  3     branches: [ master ]
  4   pull_request:
  5     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

```yaml
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
```

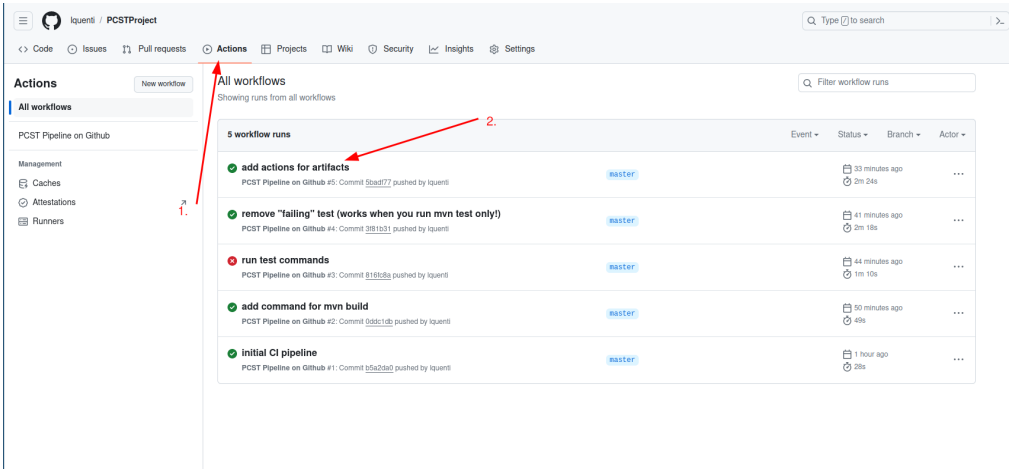
- Each bullet point is a step that runs one after another
- `actions/checkout` is a pre-made action by Github
  - git checkouts the newest version of the repo
- `s4u/setup-maven-action` is a community action to install maven
- `run:` allows for arbitrary shell code execution

Config Breakdown: Test Job

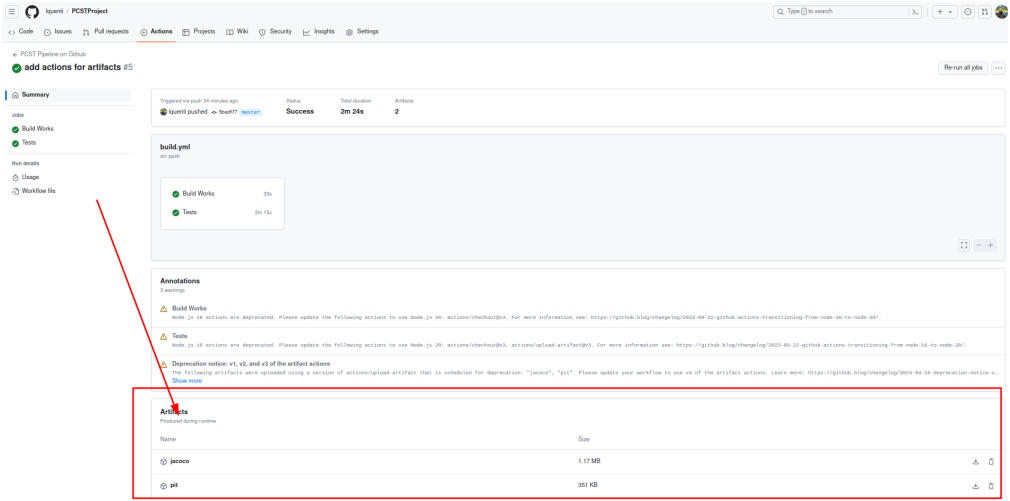
```yaml
test:
  name: Tests
  runs-on: ubuntu-latest
  steps:
    - uses: actions/checkout@v3
    - name: Setup Maven Action
      uses: s4u/setup-maven-action@v1.13.0
    - name: Run Junit tests (including integration tests and jacoco coverage)
      run: mvn test
    - name: Upload jacoco report
      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

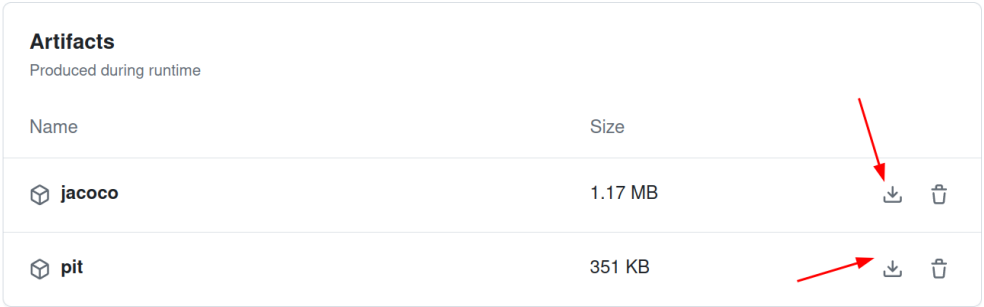
Artifacts


lquenti / PCSTProject
Type / to search
Code
Issues
Pull requests
Actions
Projects
Wiki
Security
Insights
Settings
Actions
New workflow
All workflows
PCST Pipeline on Github
Management
Caches
Attestations
Runners
All workflows
Showing runs from all workflows
Filter workflow runs
5 workflow runs
Event
Status
Branch
Actor
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
1.
2.

Artifacts


lquenti / PCSTProject
Code
Issues
Pull requests
Actions
Projects
Wiki
Security
Insights
Settings
PCST Pipeline on Github
add actions for artifacts #5
Re-run all jobs
Summary
Jobs
Build Works
Tests
Run details
Usage
Workflow file
Triggered via push 34 minutes ago
lquenti pushed 5bedf77 master
Status
Success
Total duration
2m 24s
Artifacts
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

```
<plugin>
    <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!

```yaml
# compile-latex.yml
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!