PrioTestCI: Efficient Test Case Prioritization in GitHub Workflows for CI Optimization

PrioTestCI is a lightweight, **history-based test prioritization framework** for GitHub Actions. It reorders and executes tests based on past failures, enabling early fault detection and reduced CI runtime. Integrated seamlessly into existing workflows, PrioTestCI is language-agnostic and **achieves up to 81.55% faster test execution** in real-world projects.

How does it work ?

1. Collects previous test results from CI logs
2. Ranks tests by historical failure frequency
3. Executes top- ranked tests first
4. Stops early on failure or continues if all pass
5. Reports execution time and outcomes
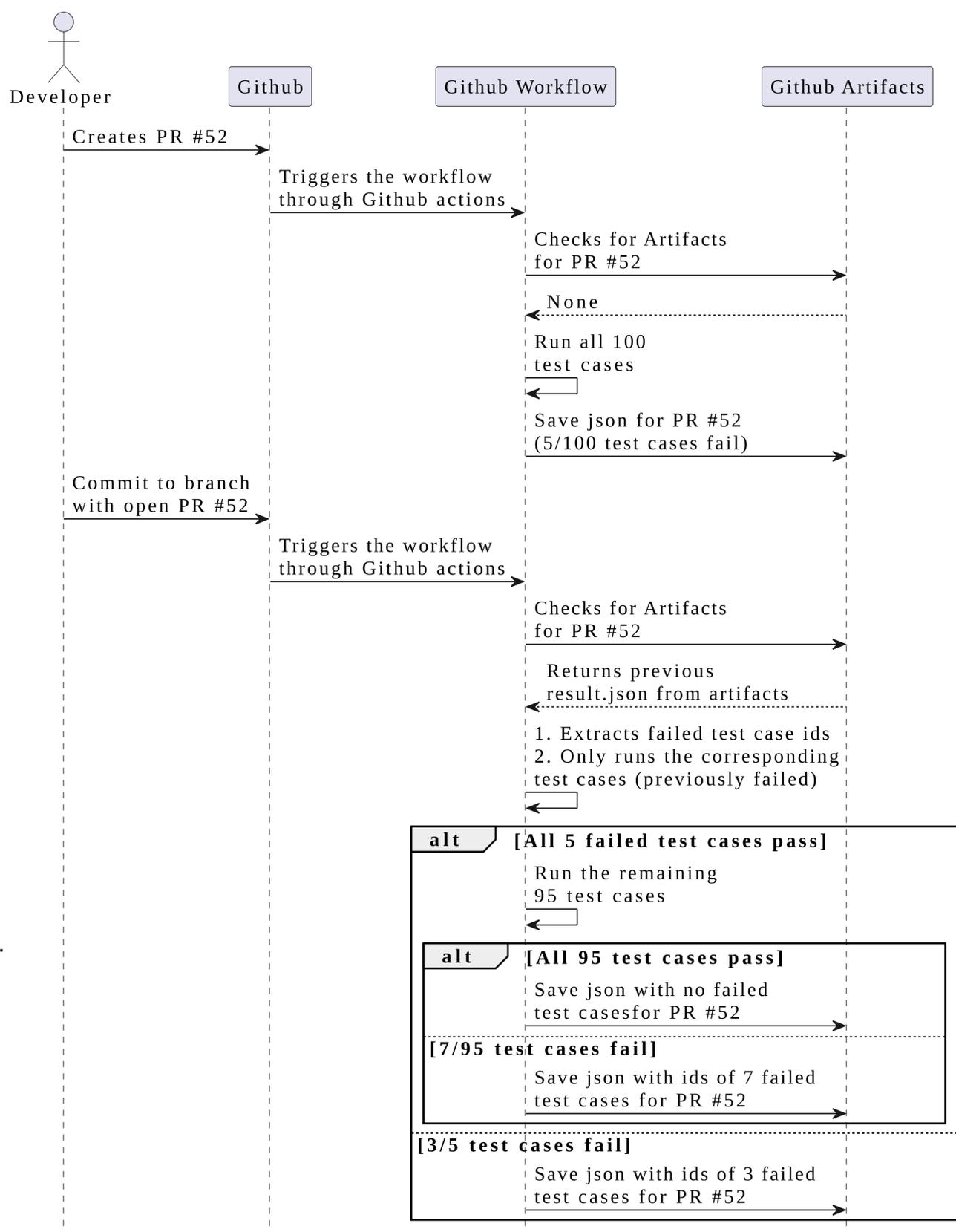
How are tests prioritized?

$$\text{Priority}(t_i) = \frac{f_i}{\sum_{j=1}^{n} f_j}$$

- f_i :number of past failures for test t_i.
- Tests with higher priority values run first.
- Ranking updates dynamically after each CI run.

What are the assumptions?

- Past failures are good predictors of future failures.
- Reliable test history is available in CI.
- Partial execution (early stopping) does not harm correctness.

How does it integrate in GitHub workflows ?

Developer — Github — Github Workflow — Github Artifacts

- Creates PR #52
- Triggers the workflow through Github actions
- Checks for Artifacts for PR #52
- None
- Run all 100 test cases
- Save json for PR #52 (5/100 test cases fail)
- Commit to branch with open PR #52
- Triggers the workflow through Github actions
- Checks for Artifacts for PR #52
- Returns previous result.json from artifacts
- 1. Extracts failed test case ids
  2. Only runs the corresponding test cases (previously failed)

alt [All 5 failed test cases pass]
- Run the remaining 95 test cases

alt [All 95 test cases pass]
- Save json with no failed test casesfor PR #52

[7/95 test cases fail]
- Save json with ids of 7 failed test cases for PR #52

[3/5 test cases fail]
- Save json with ids of 3 failed test cases for PR #52

Shubham Vasudeo Desai
shubhamdesai303@gmail.com
https://github.com/ShubhamDesai

Shonil Sateesh Bhide
shonilsbhide@gmail.com
https://shonilbhide.netlify.app/

Souhaila Serbout
souhaila.serbout@uzh.ch
https://souhaila-serbout.me

Luciano Marchezan
lucianomarchezan94@gmail.com
https://lucianomarchezan.github.io/

Wesley K. G. Assunção
wguezas@ncsu.edu
https://wesleyklewerton.github.io/

NC STATE UNIVERSITY — Universität Zürich UZH — Université de Montréal