

04834580 Software Engineering (Honor Track) 2025-26

DevOps

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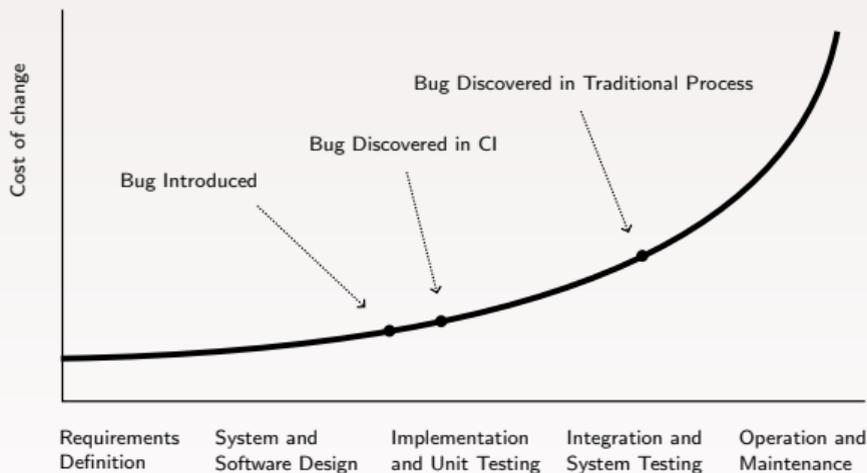
Definition

DevOps is a collaborative and multidisciplinary effort within an organization to automate continuous delivery of new software versions, while guaranteeing their correctness and reliability. [1]

In 1994, Grady Booch stated [2] that in the context of iterative development, *internal releases represent a sort of **continuous integration** of the system.*

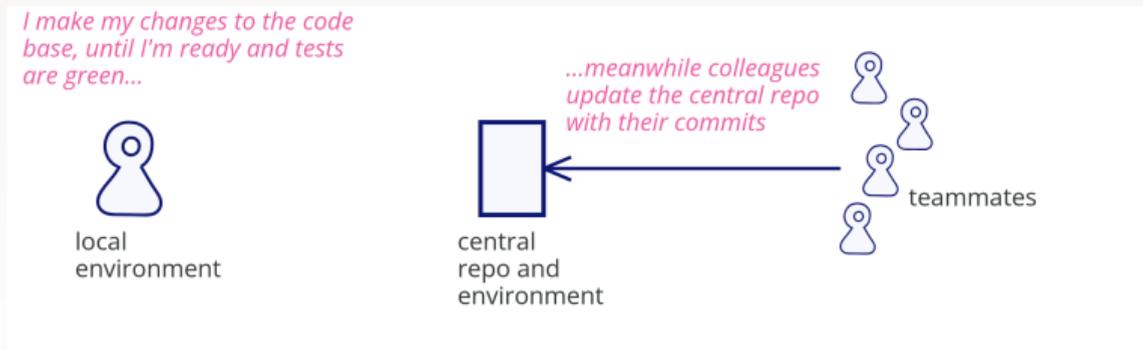
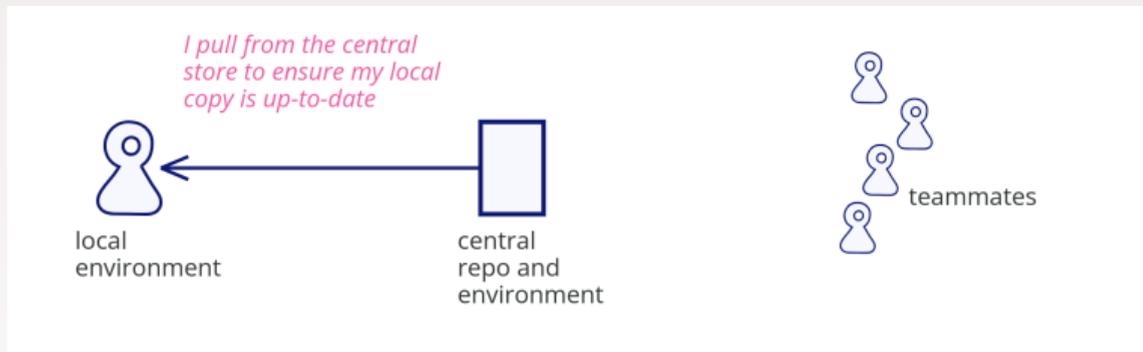
Regarding the frequency of releases, he wrote that *for a modest-sized project, an organization may produce an internal release **every two to three months**. For more complex projects that require much greater development effort, this might mean a release **every six months** or so, according to the needs of the project.*

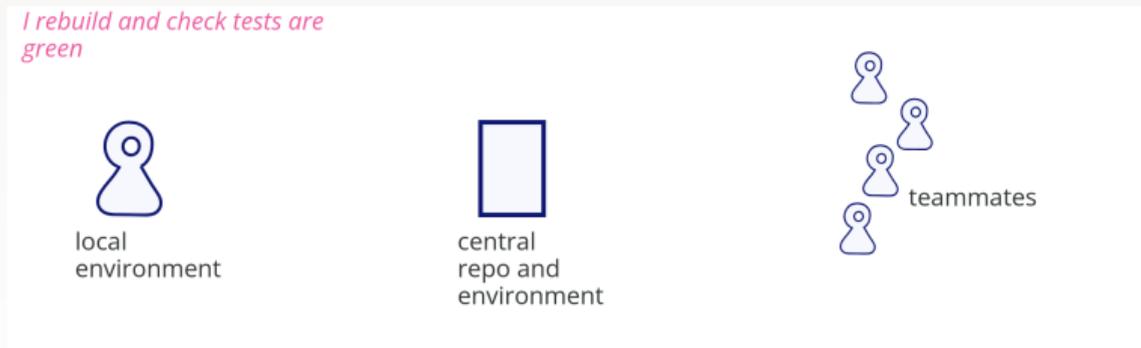
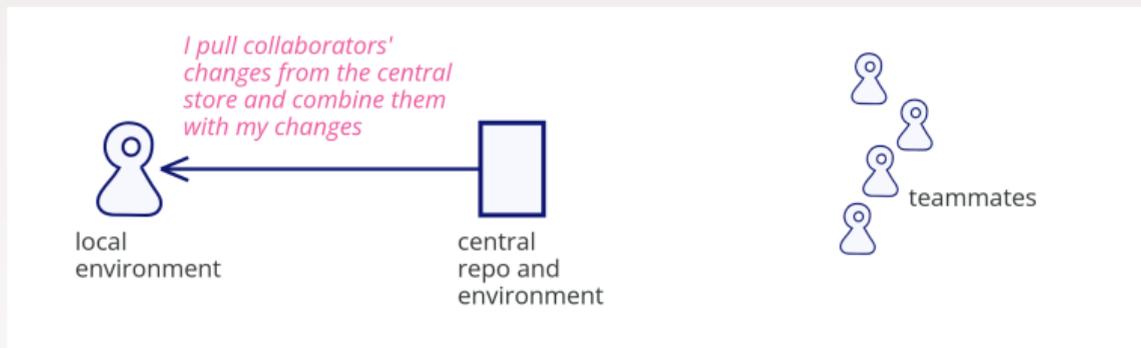
In 1998, Kent Beck (extreme programming) proposed frequent integration [3]: “code is integrated and tested **after a few hours** — a day of development at most.”

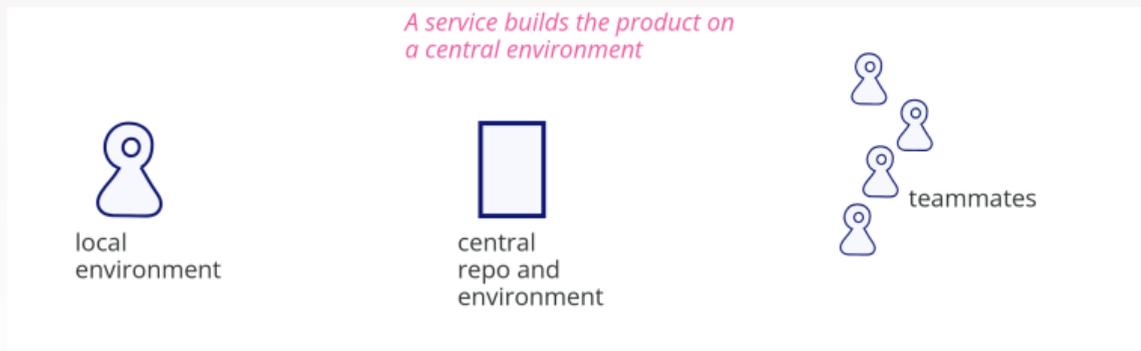
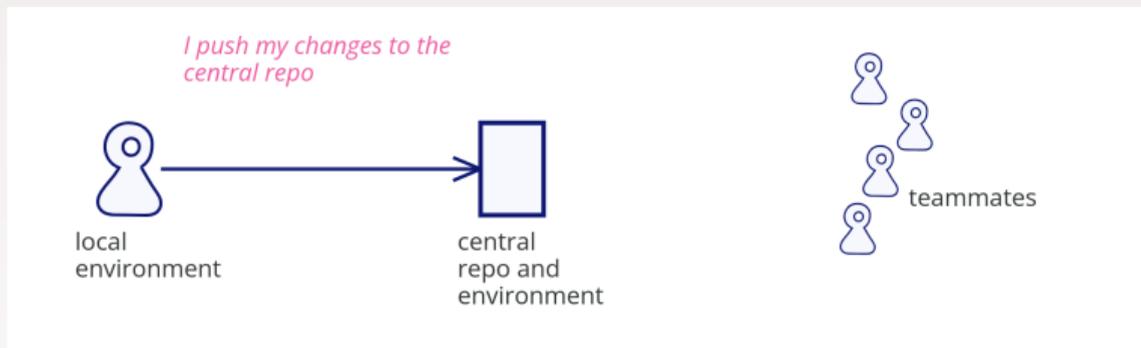


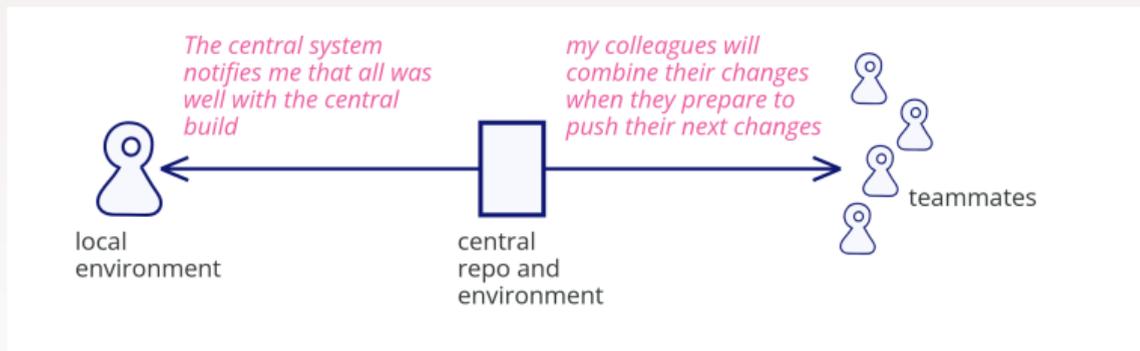
Kent Beck also mentioned another benefit:

Integrating one set of changes at a time works well because it is obvious who should fix a test that fails — we should, since we must have broken it, since the last pair left the tests at 100%.









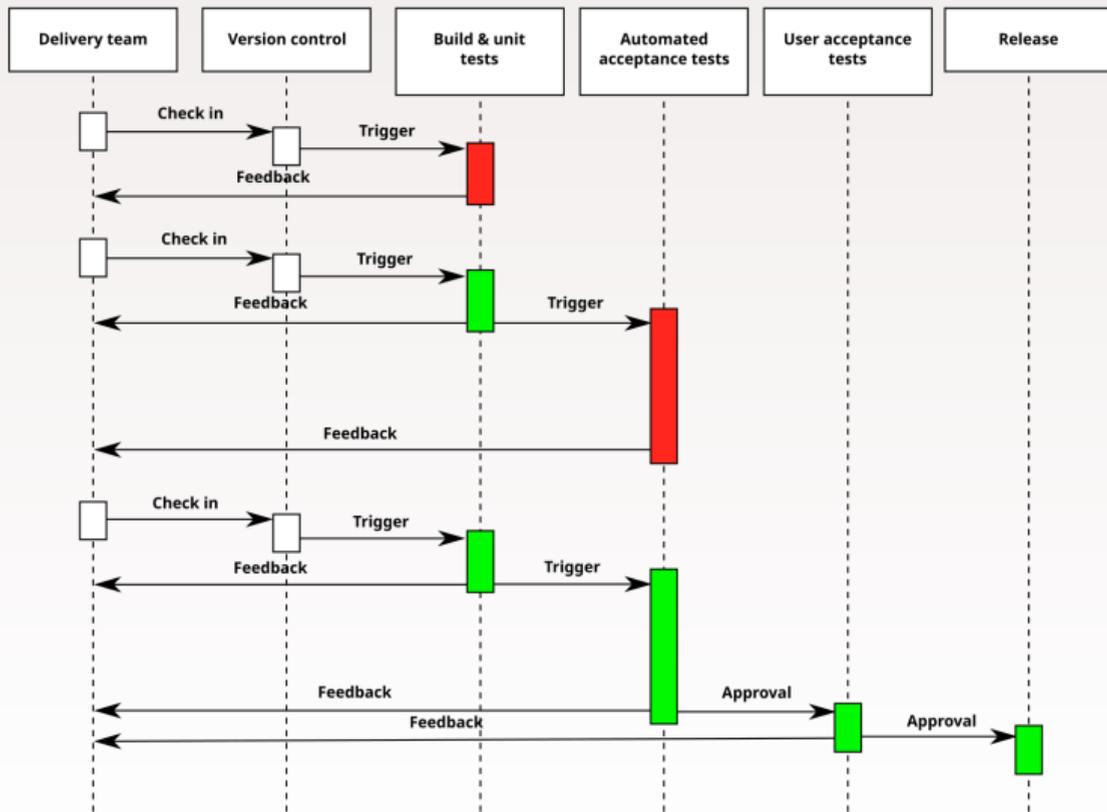
Even if it “works on my machine”, it may still fail on the CI service.

Definition

A **deployment pipeline** is an automated implementation of your application's build, deploy, test, and release process. It is in essence the principle of continuous integration taken to its logical conclusion. [5]

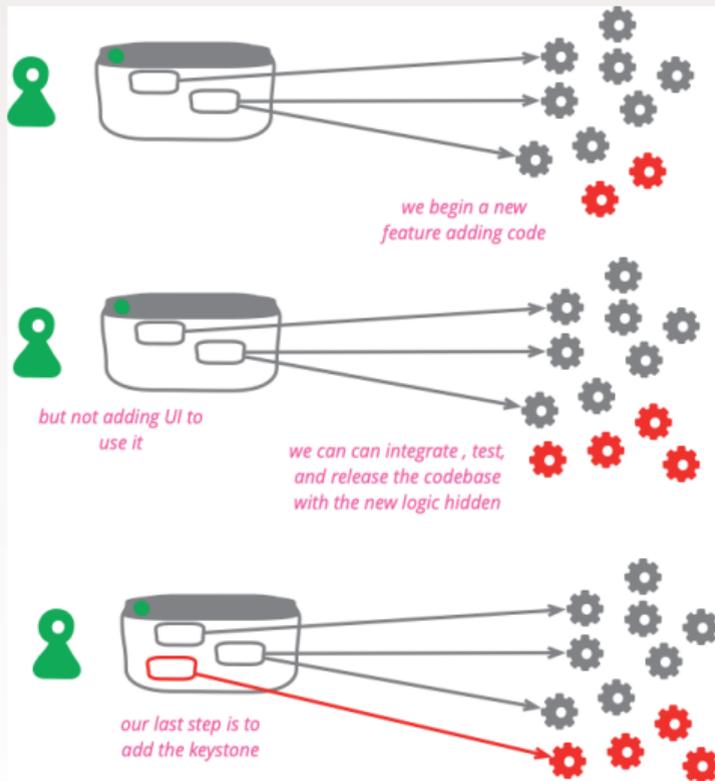
- ▶ Without automation, errors will occur every time they are performed, time wasted on debugging deployment errors.
- ▶ A manual deployment process has to be documented. A set of automated deployment scripts serves as documentation.
- ▶ Automated deployments encourage collaboration, because everything is explicit in a script.
- ▶ Manual deployments depend on the deployment expert. If he or she is on vacation or quits work, you are in trouble.
- ▶ Manual deployments is boring and repetitive and yet needs significant degree of expertise.
- ▶ An automated process is fully auditable.

- ▶ The longer the release cycle, the longer the development team has to make incorrect assumptions before the deployment occurs, and the longer it will take to fix them.
- ▶ In large organizations where the delivery process is divided between different groups such as development, DBA, operations, testing, etc., the cost of coordination between these silos can be enormous.
- ▶ The bigger the difference between development and production environments, the less realistic are the assumptions that have to be made during development.

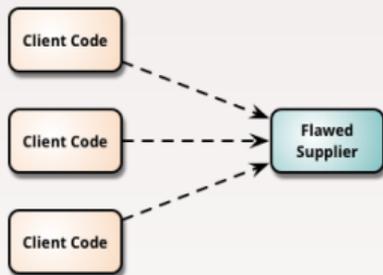


How to integrate/deliver before a user-visible feature is fully formed and ready for release?

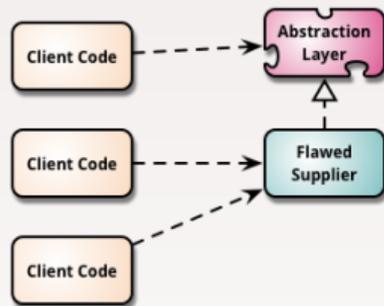
- ▶ Keystone interface
- ▶ Dark launching
- ▶ Feature flags
- ▶ Branch by abstraction



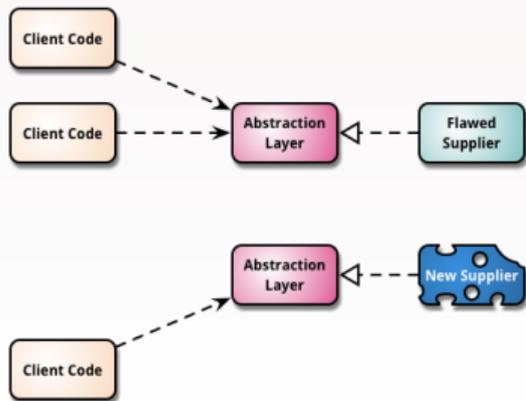
1.



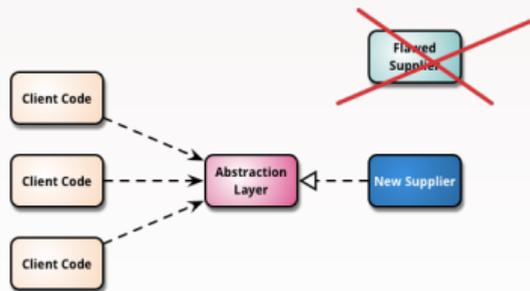
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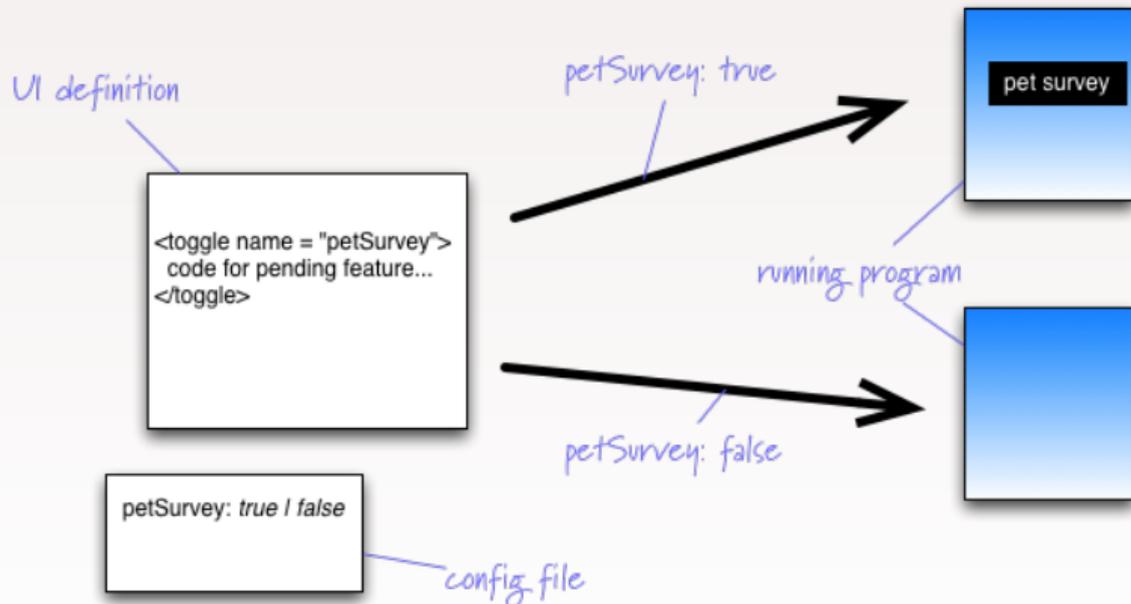
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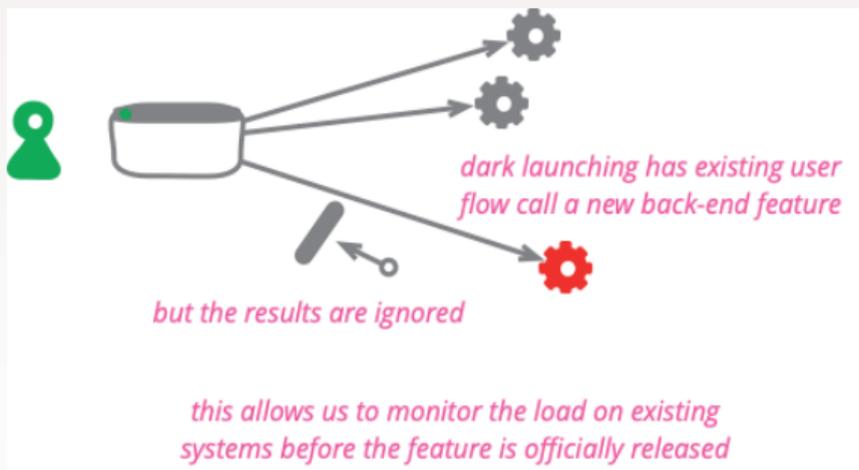
4.



The running application then uses feature flags from configuration in order to decide whether or not to show the new feature.



Dark launching a feature means taking a new or changed back-end behavior and calling it from existing users without the users being able to tell it's being called.



Gitflow [10] is a branching model proposed by Vincent Driessen in 2010.

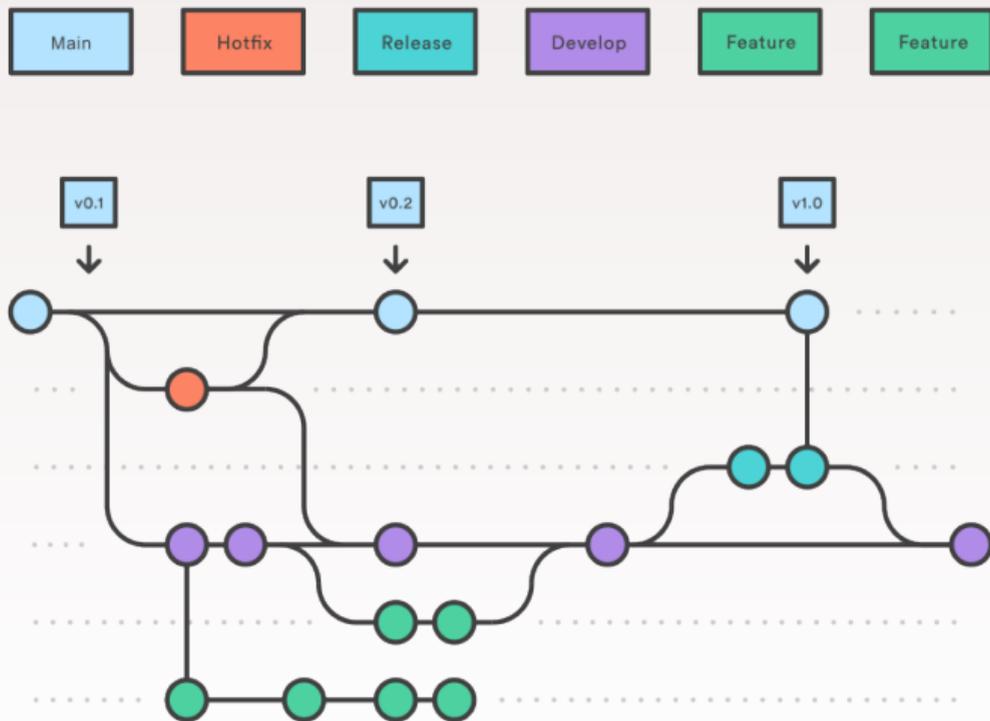
Main branches:

main reflects a production-ready state.

develop reflects a state with the latest development changes for the next release.

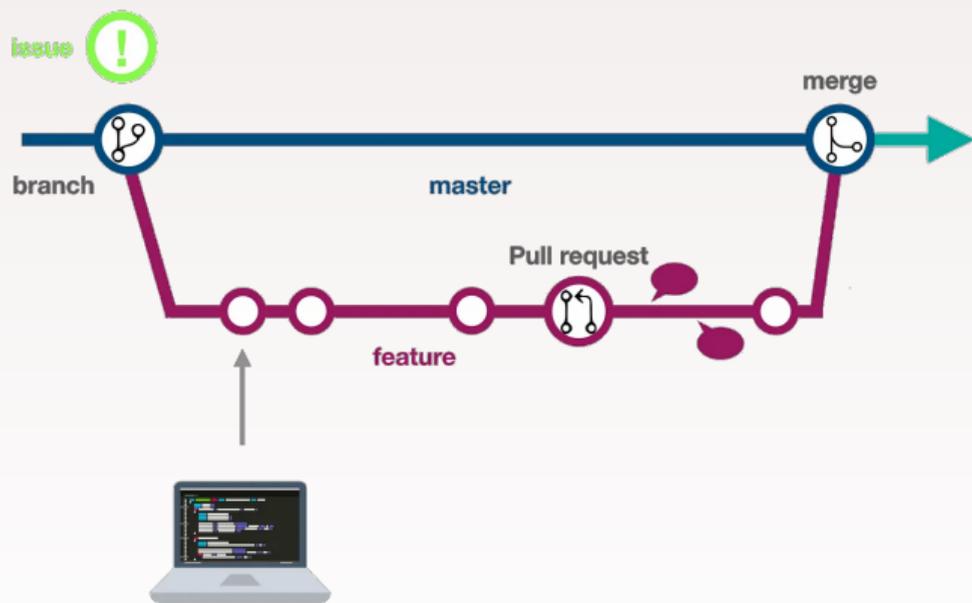
Supporting branches:

- ▶ feature branches to develop new features for the upcoming or a distant future release;
- ▶ release branches to support preparation of a new production release;
- ▶ hotfix branches for unplanned releases.



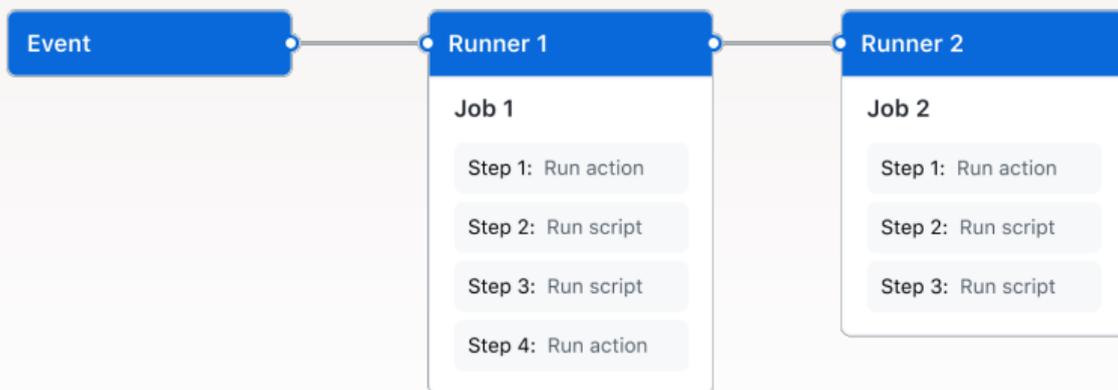
GitHub Flow [11] is a simplified Gitflow:

- ▶ Anything in the main branch is deployable.
- ▶ To work on something new, create a descriptively named branch off of master (ie: `new-oauth2-scopes`).
- ▶ Commit to that branch locally and regularly push your work to the same named branch on the server.
- ▶ When you need feedback or help, or you think the branch is ready for merging, open a **pull request**.
- ▶ After someone else has reviewed and signed off on the feature, you can merge it into **main**.
- ▶ Once it is merged and pushed to main, you can and should deploy immediately.



GitHub Actions is GitHub CI/CD service.

- ▶ **workflow** to be triggered when an **event** occurs in your repository
- ▶ **workflow** contains one or more **jobs**
- ▶ each **job** will run inside its own virtual machine **runner**
- ▶ each **step** either runs a script or an action (a reusable extension)



Defined in yaml files:

```
name: learn-github-actions
run-name: ${{ github.actor }} is learning GitHub Actions
on: [push]
jobs:
  check-bats-version:
    runs-on: ubuntu-latest
    steps:
      - uses: actions/checkout@v4
      - uses: actions/setup-node@v4
        with:
          node-version: '20'
      - run: npm install -g bats
      - run: bats -v
```

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