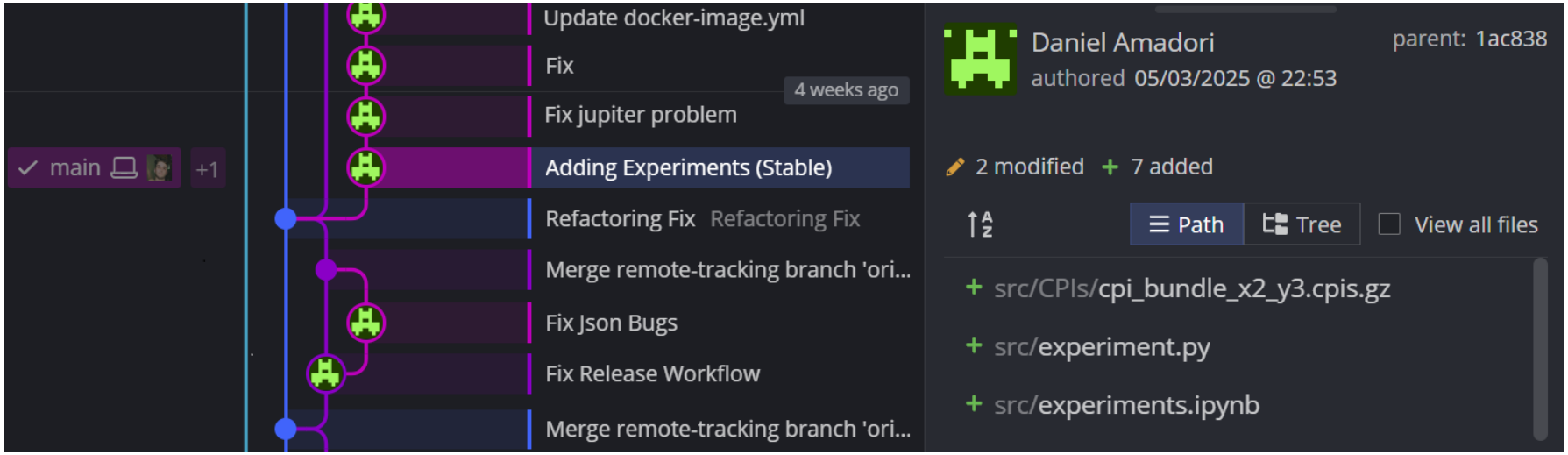
Introduction
to
Git & GitHub

https://git-scm.com/

https://github.com

Version Control System

- a way to manage files and directories
- track changes over time
- recall previous versions



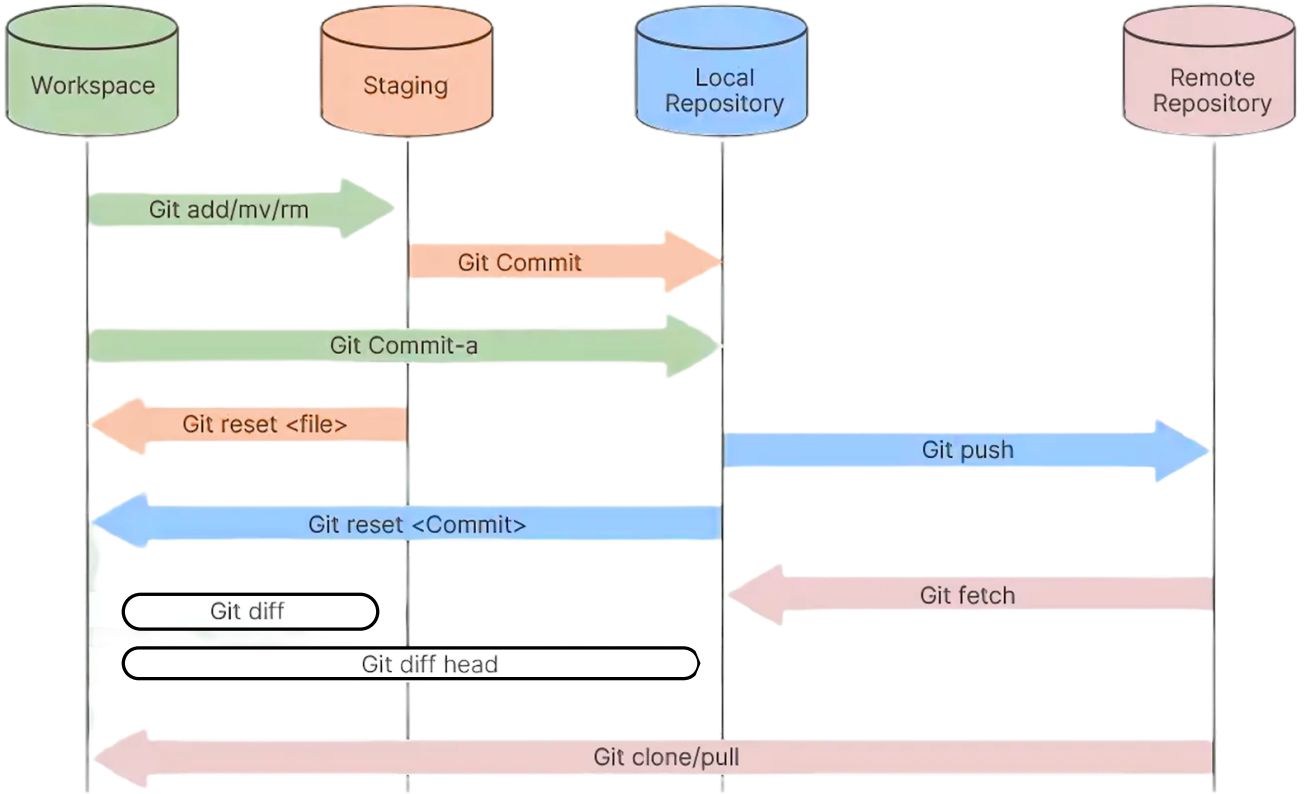
Git

- created by Linus Torvalds, April 2005
- a command line version control program
- uses checksums to ensure data integrity
- cross-platform
- open source, free

Repository

- usually used to organize a single project
- repos can contain:
  - folders, files, images, videos,
  - code and data sets
  - anything your project needs

Git architecture



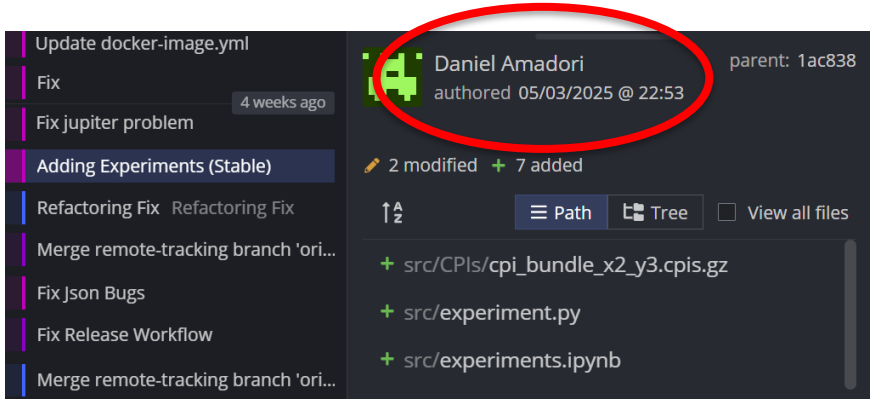
Before starting to use git

- Setup your name and email so others can know who committed changes.
- git config --global user.name “name”
- git config --global user.email “email”

  Note: set for all repositories on your computer

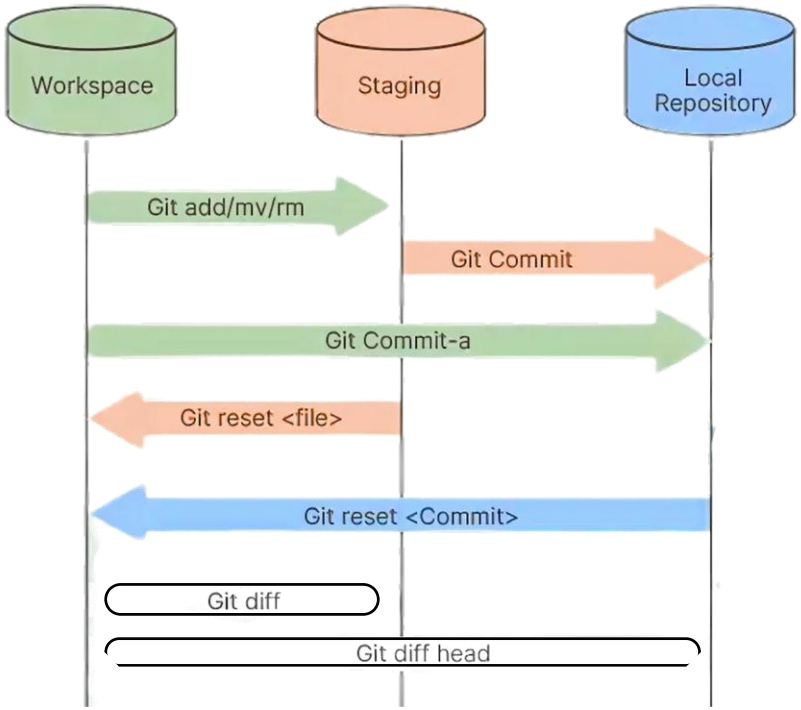
- git config --local user.email “email”

  Note: can set differently for each repository



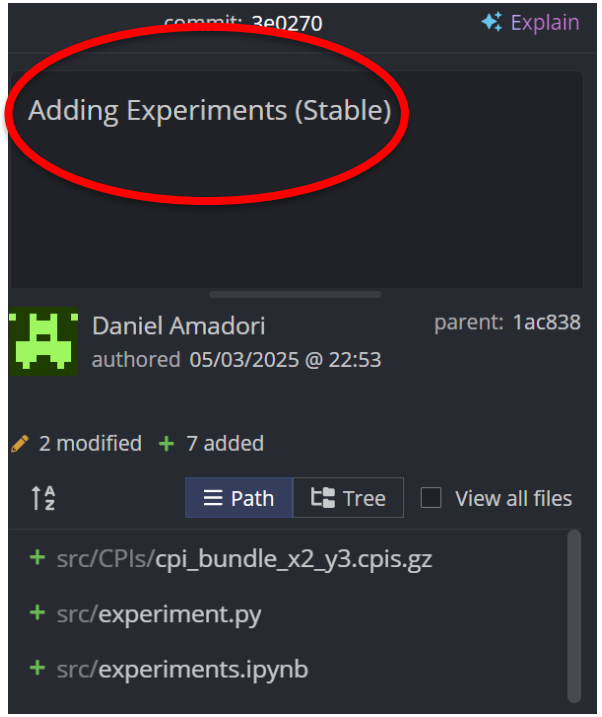
A simple Git workflow

1. Create a Project folder:
   mkdir
2. Initialize a new project in a directory:
   git init
3. Create a file:
   touch <filename>
4. Add in the staged files:
   git add <filename>
5. Commit the change to the repo:
   git commit -m “important message here”
6. Watch changes:
   git logs



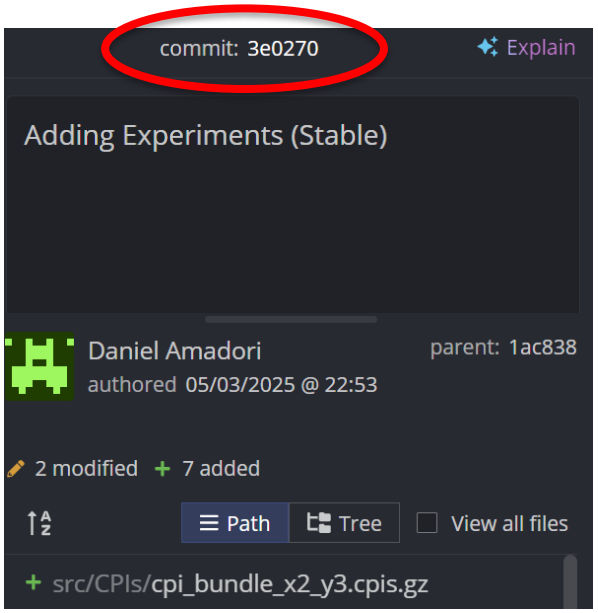
Commit messages

- Tell what it does (present tense)
- Single line summary followed by blank space followed by more complete description
- Short summary of changes
- More detailed explanatory text, if necessary.



SHAs

- Checksums generated by SHA1 encryption algorithm



The HEAD pointer

- points to a specific commit in repo
- as new commits are made, the pointer changes
- HEAD always refers to the latest commit on the currently active branch.

Basic Git Commands Overview

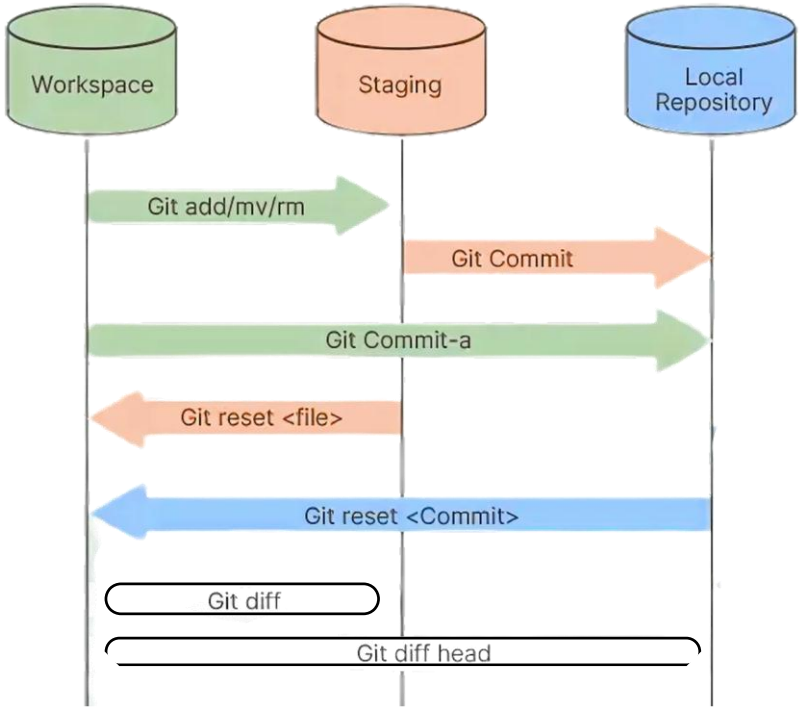
- See where files are in the three tree scheme

  git status

- Committing and adding message

  git commit –a

  - Allows one to add to staging index and commit at the same time
  - Grabs everything in working directory
  - Files not tracked or being deleted are not included



- Compares changes to files between repo and working directory

  git diff

- Deleting files from the repo

  git rm <filename>

  moves deleted file change to staging area
  It is not enough to delete the file in your working directory. You must commit the change.

- Moving (renaming) files

  git mv filename1.txt filename2.txt (Note: File file1.txt was committed to repo earlier)

- Grabs the file from the repo, removing all changes since last commit

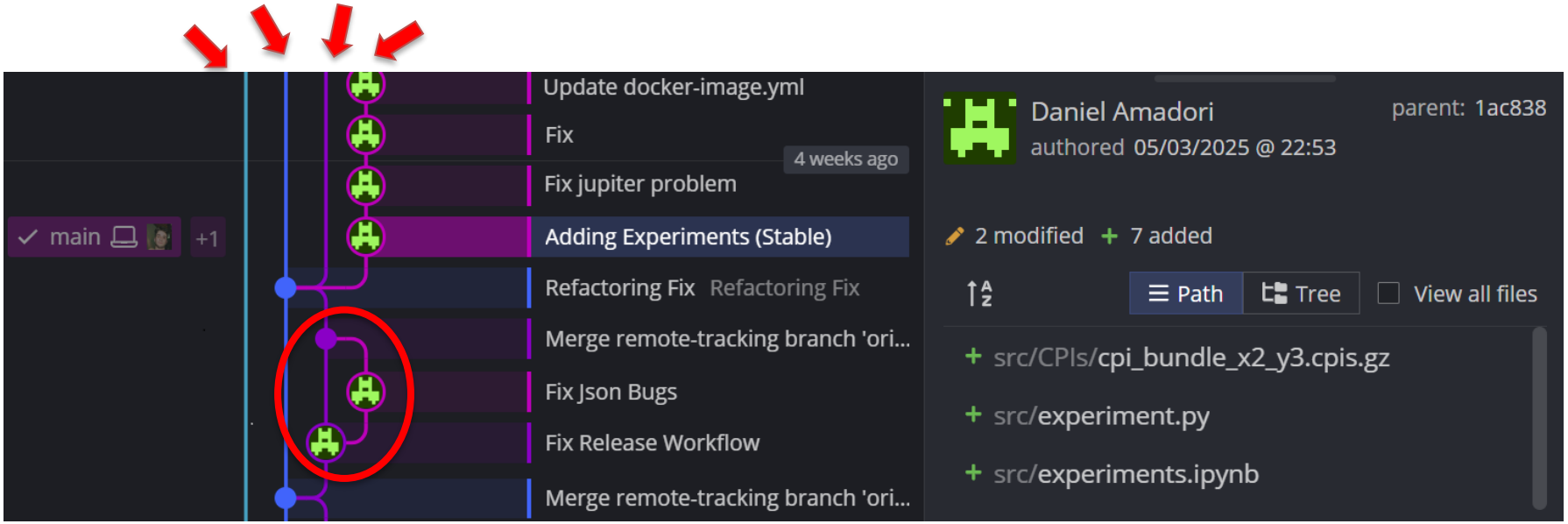
  git checkout <filename>

- Undo changes added to staging area

  git reset HEAD <filename>

Branches in Git

- allows one to try new ideas
- If an idea doesn't work, throw away the branch. Don't have to undo many changes to master branch
- If it does work, merge ideas into master branch.



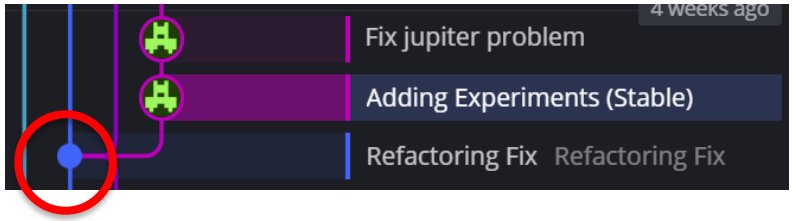
Branch Management

- Check current branch

  git branch

- Create a new branch

  git checkout -b <branch>



  - Note: At this point, both HEADs of the branches are pointing to the same commit (that of master)

- Switch to another branch

  git checkout <branch>

  - At this point, one can switch between branches, making commits, etc. in either branch, while the two stay separate from one another.
  - Note: In order to switch to another branch, your current working directory must be clean (no conflicts, resulting in data loss).

- Compare two branches

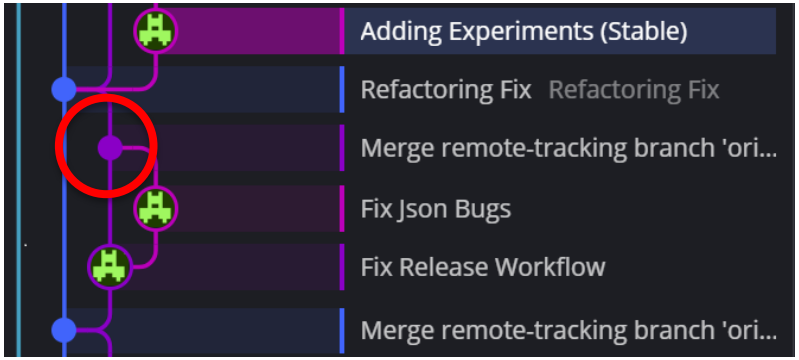
  git diff <branch1>..<branch2>

Merge Branches

- Merge from the branch into which you want to merge another branch

  git merge <branch to merge>

  - Note: Always have a clean working directory when merging



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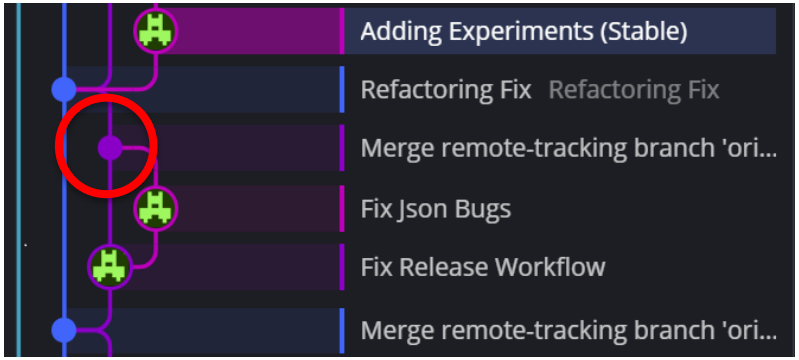

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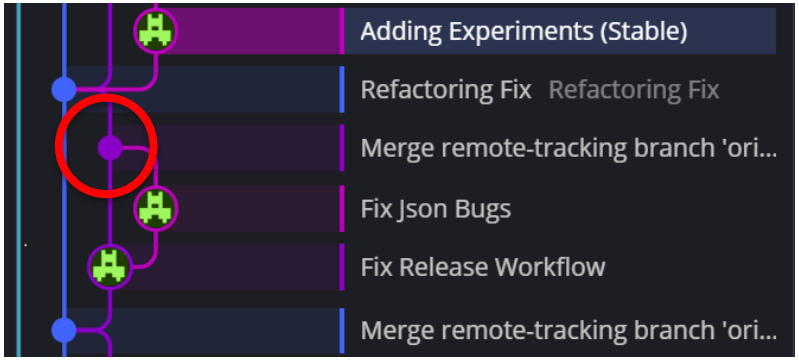


So easy?

What if there are two changes to the same line in two different commits?

Merge conflicts

https://www.reddit.com/r/ProgrammerHumor/comments/cgf0b8/git_merge/#lightbox

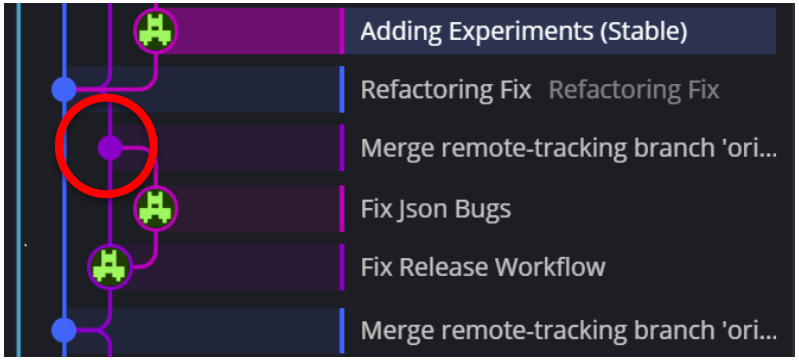
Merge Branches

- Resolving merge conflicts
  1. Abort the merge using

     git merge --abort

  2. Manually fix the conflict

  Note: Git will notate the conflict in the files!



Understanding a Merge Conflict

- When Git detects conflicting changes, it marks them in your file using:
  - <<<<<<< HEAD
  - Changes from your branch
  - =======
  - Changes from the other branch
  - >>>>>>> branch-name
- You must manually resolve the conflict:
  - Choose one side’s changes
  - Combine both
  - Rewrite the content
- Remove all conflict markers after editing.

Tips to reduce merge pain

- Merge Often

  Integrate changes regularly to catch conflicts early, while they’re easier to fix.

- Keep Commits Small & Focused

  Write commits that solve one issue at a time, is easier to review, test, and roll back

- Regularly Pull from Main

  Keep your feature branch up to date using 'git pull origin main' or 'git rebase' to reduce conflict risk.

Renaming and deleting branches

- git branch -m/--move <old name> <new name>
- git branch -d <branch name>

  Note: Must not be in <branch name>

  Must not have commits in <branch name> unmerged in branch from which you are deleting
- git branch -D <branch name>

  Note: If you are really sure that you want to delete branch with commits

Managing Work with Git Stash

- Allows you to save your work and change branch

  git stash save “message”
  - Note: used for switching quickly between branches
    don’t leave the code in stash for a long period of time

- Lists all current stashes

  git stash list
- Applies and deletes the most recent stash

  git stash pop <index>
- Applies a stash but keeps it in the list

  git stash apply <index>
- Creates a new branch starting from a stash

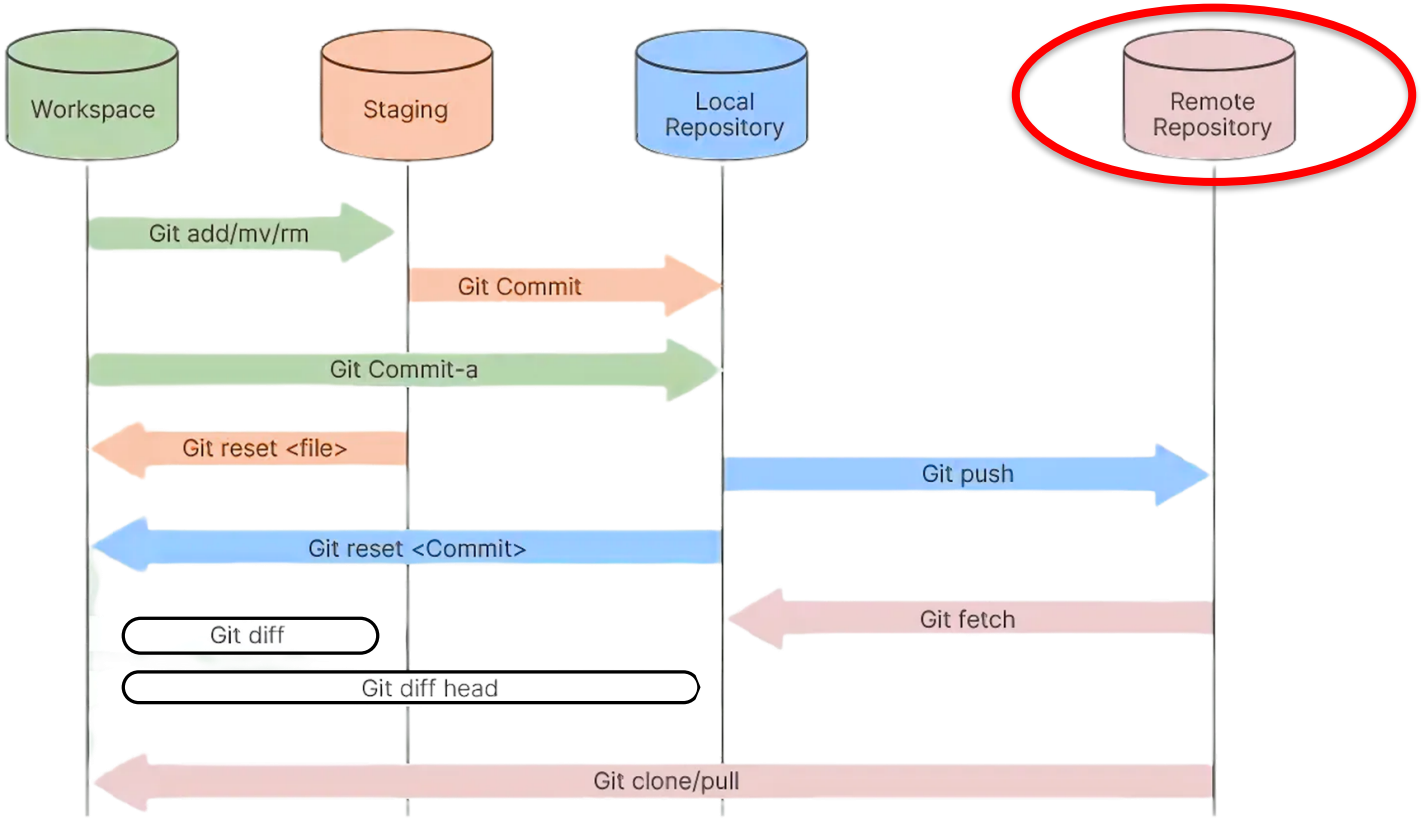
  git stash branch <branch name> <index>
  - Note: useful for long-term feature development.

GitHub

https://github.com

- Platform to host code repositories
- launched in 2007
- most popular Git host
- allows users to collaborate on projects from anywhere
- GitHub makes git social!
- Free to start (can pay for private repositories and additional features)

Git architecture



Other Git Commands

- Copying (cloning) files from remote repo to local machine

  git clone URL <new dir name>

- Pushing to a remote repo

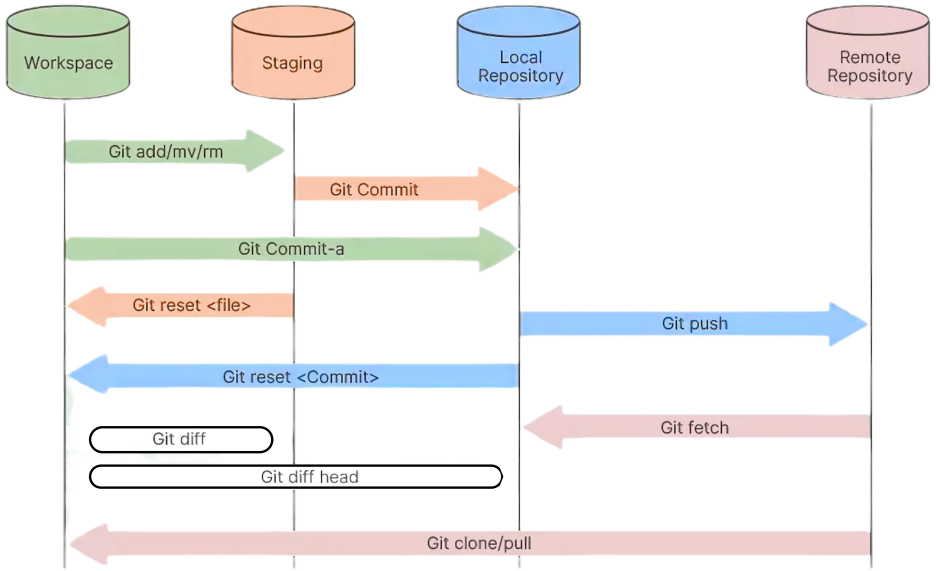
  git push <remote name> <branch name>

- Fetch

  git fetch <remote repo name>

  Note:

  - doesn't change your working dir or any commits that you've made
  - git merge must be done to merge fetched changes into local branch



- Fetch and merge changes to local branch and working directory

  git pull <remote repo name>

Other Git Commands

- Link my local repo to a remote repo
  git remote add <alias> <URL>
  Note: just establishes a connection…no files are copied/moved
  You may have more than one remote linked to your local directory!

- Tag specific points in history as being important, such as releases versions (v.1.0, 2.0, …)
  git tag

Forking a Repository (GitHub)

- Click “Fork” on a repository page on GitHub
  - What it does:

    Creates a personal copy of someone else's repository in your own GitHub account

    Allows you to freely experiment, edit, or contribute without affecting the original

  - Why it matters:

    Essential for open-source collaboration

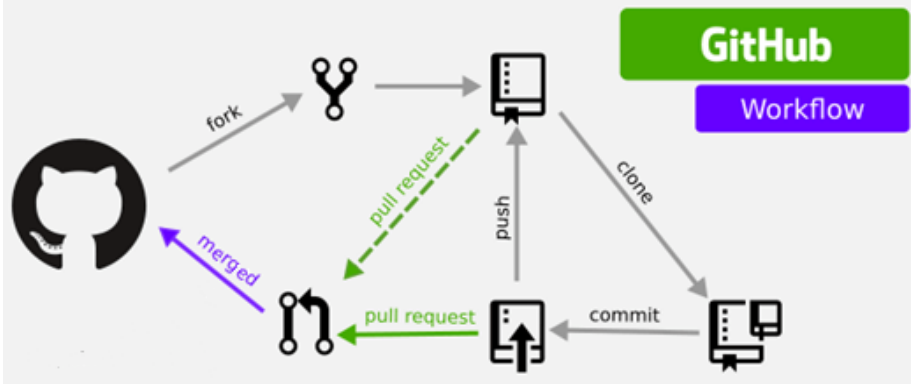
    Used in the 'Fork and Pull Request' workflow

  - Typical flow:

    1. Fork a repo on GitHub

    2. Clone your fork locally:

    3. Create a branch, make changes, push, then open a pull request



https://levelup.gitconnected.com/how-to-sync-forked-repositories-using-git-or-github-2933e497fa16

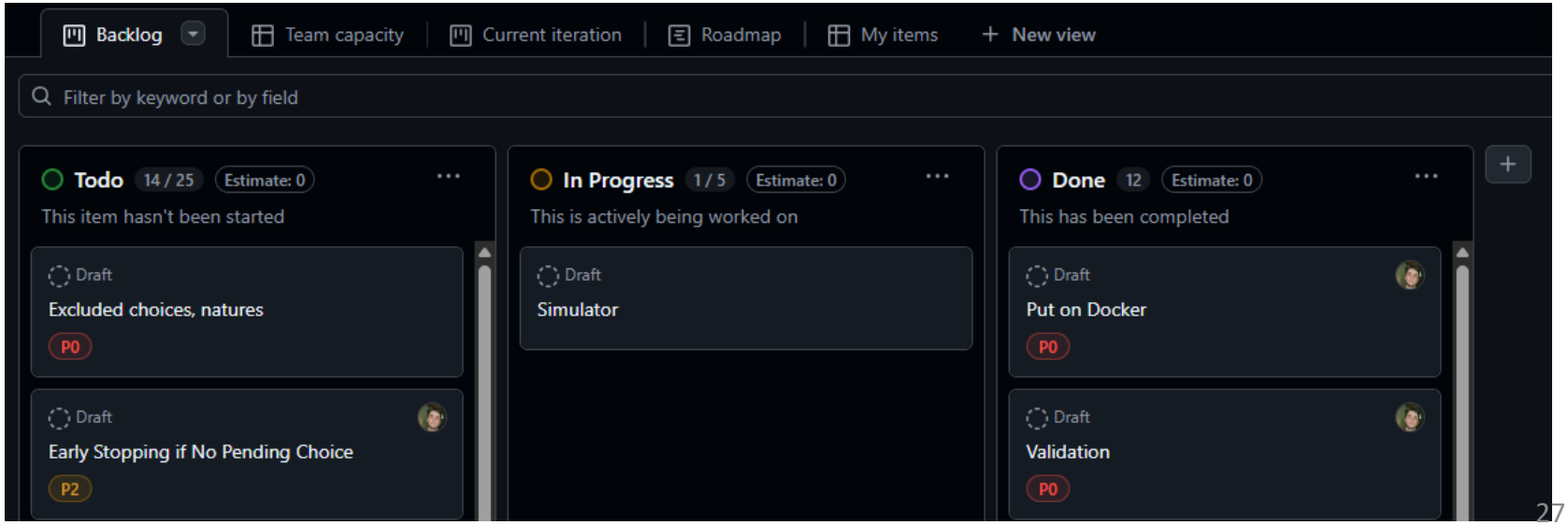
GitHub Projects (Backlog)

Backlog:

- prioritized list of work items that need to be completed (features, bugs, and tasks)

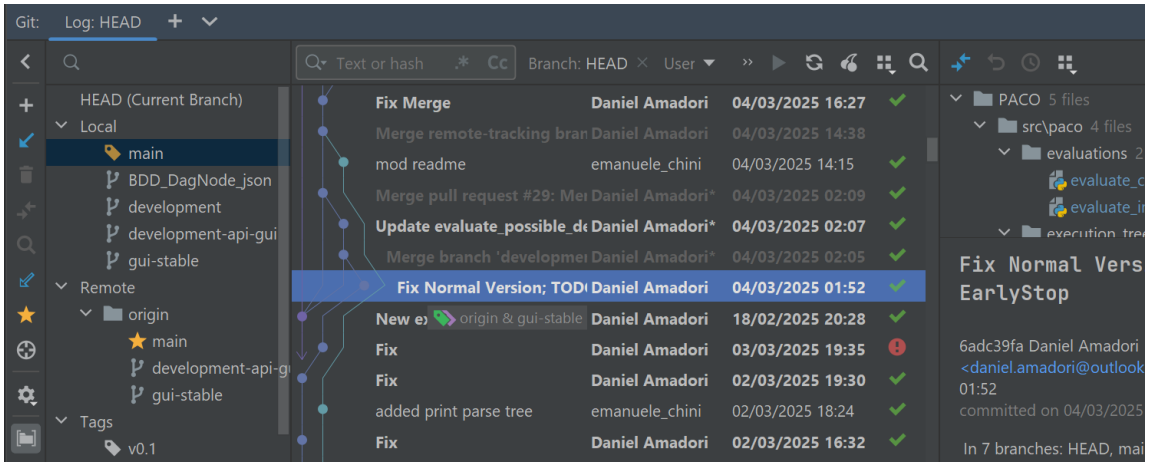
In Agile:

- Contains user stories, tasks, and issues
- Continuously updated and reprioritized

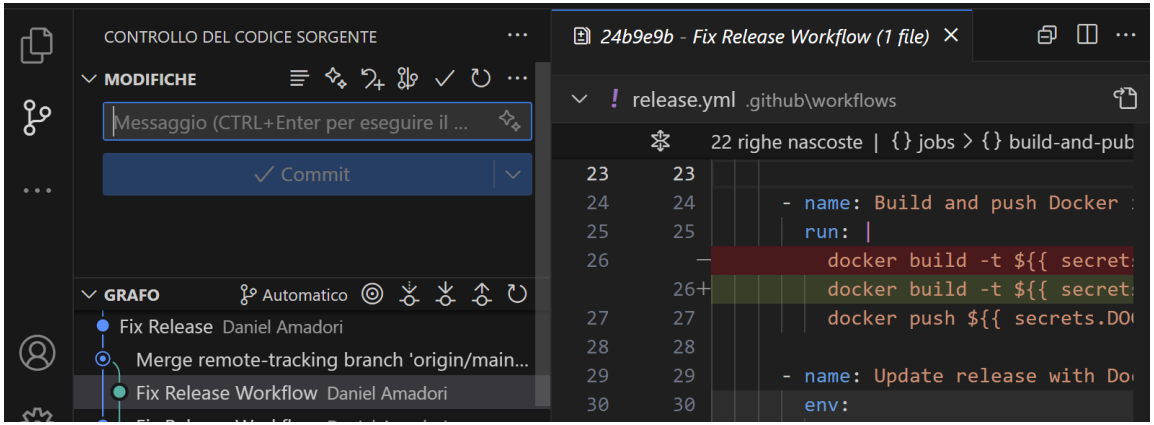


Git in IDE

PyCharm



Visual Studio

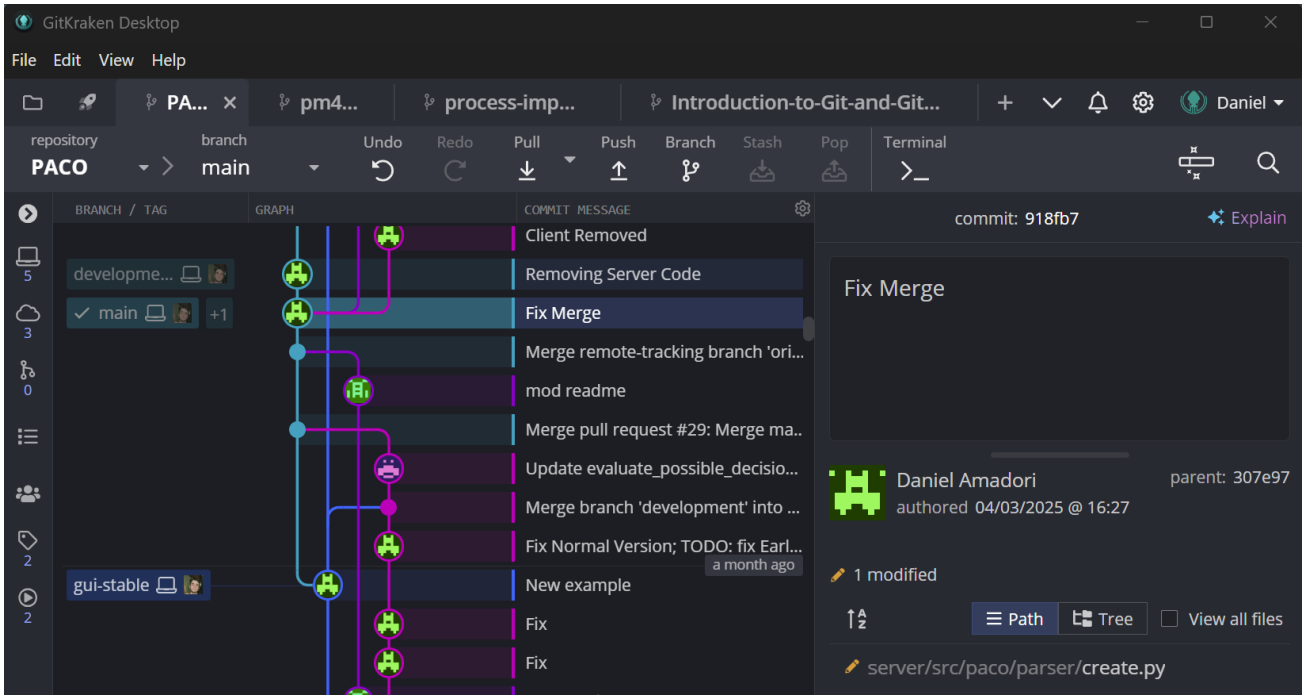


Repo Management

GitHub GitLab

[GitKraken](#)

Bitbucket Azure DevOps



Resources

- Git: https://git-scm.com/
- Try GitHub: https://try.github.io/