






Bioinfo Primer

Git, GitHub, and GitHub Actions: Using Developer Tools for Scientific Software

Presentation Outline

1.  Brief Introduction
2.  Git Concepts
3.  GitHub Features




Brief Introduction

  Hi, I'm Dave!



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Git • Preamble

-  Git has many interesting but confusing aspects which may result in lost time.
-  **Software gardening approach:** development is messy, we're all learning and growing.
-  Focus on **good communication** and **progress** instead of perfection.

Git • Preamble

Distinguish between:

1. **Coding:** doing the programming / problem solving.
2. **Source control (Git):** saving and sharing the work.
3. **GitHub:** communication and automation for code.

Git • Definitions

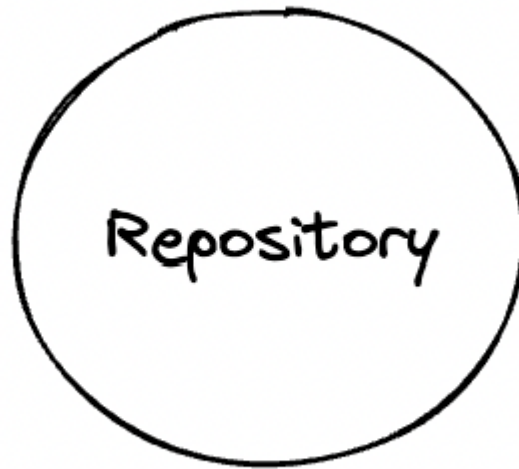


<https://www.xkcd.com/1597>

Git • Definitions

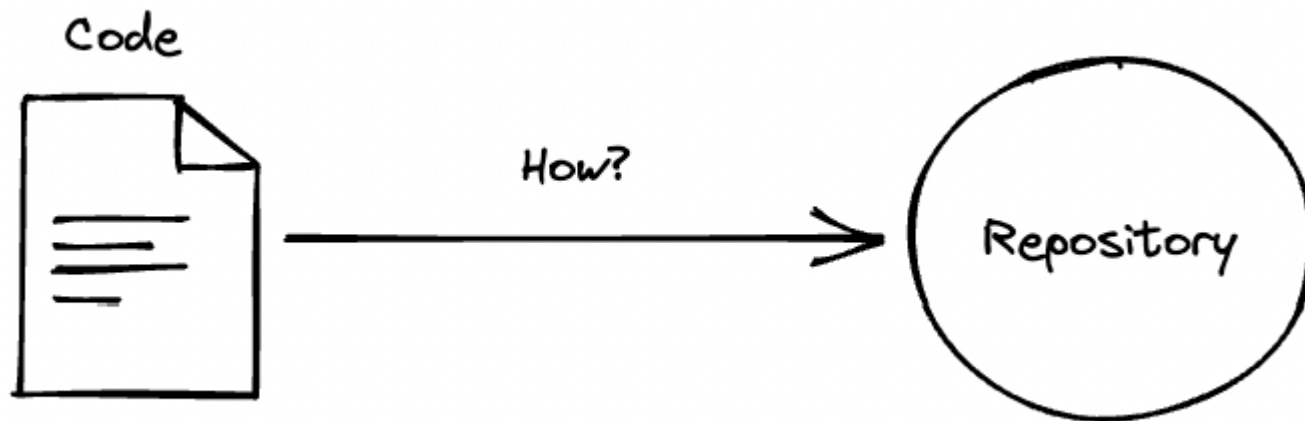
- **Git** is software for managing code collaboration.
- **GitHub** is a *platform* which enables code collaboration and hosting through **Git**.
- One can use Git independent of GitHub.

Git • Concepts



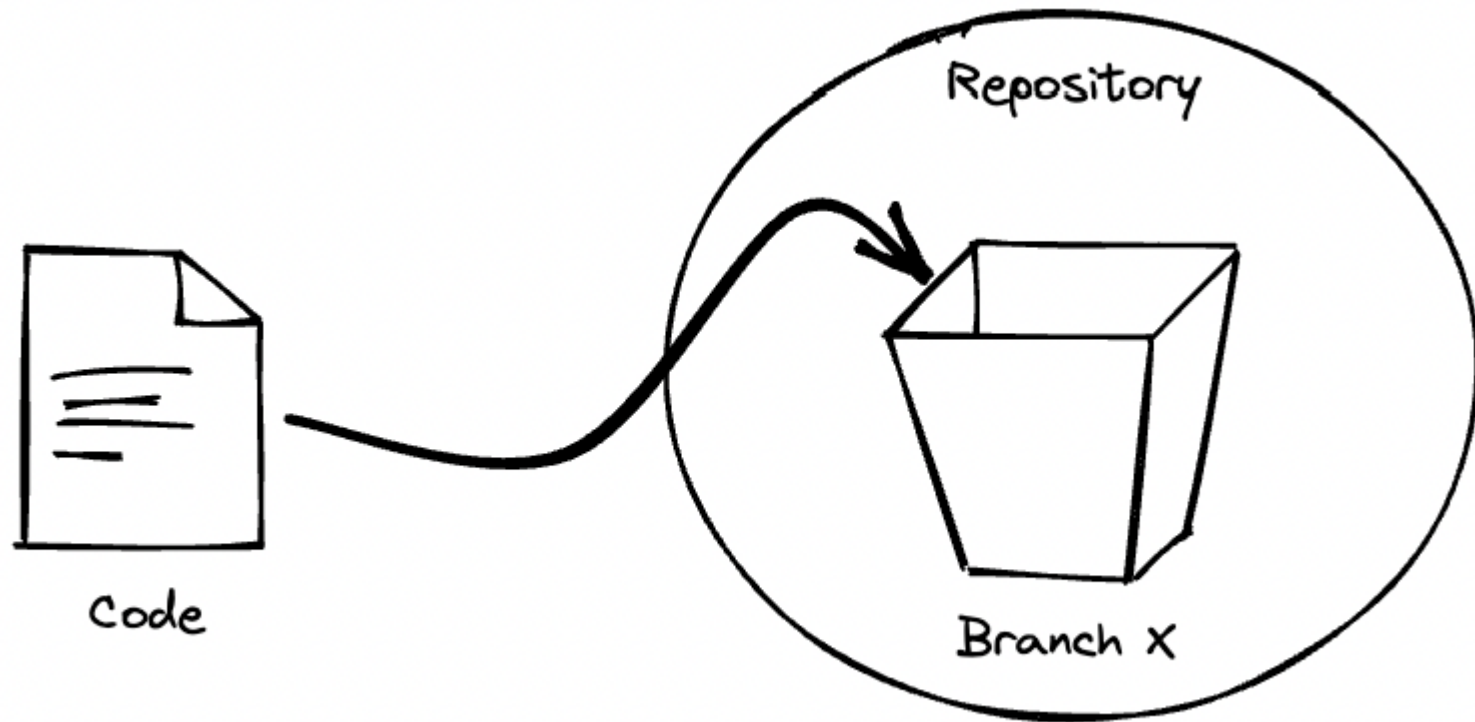
Git keeps track of code using **repositories** ("repos").

Git • Concepts



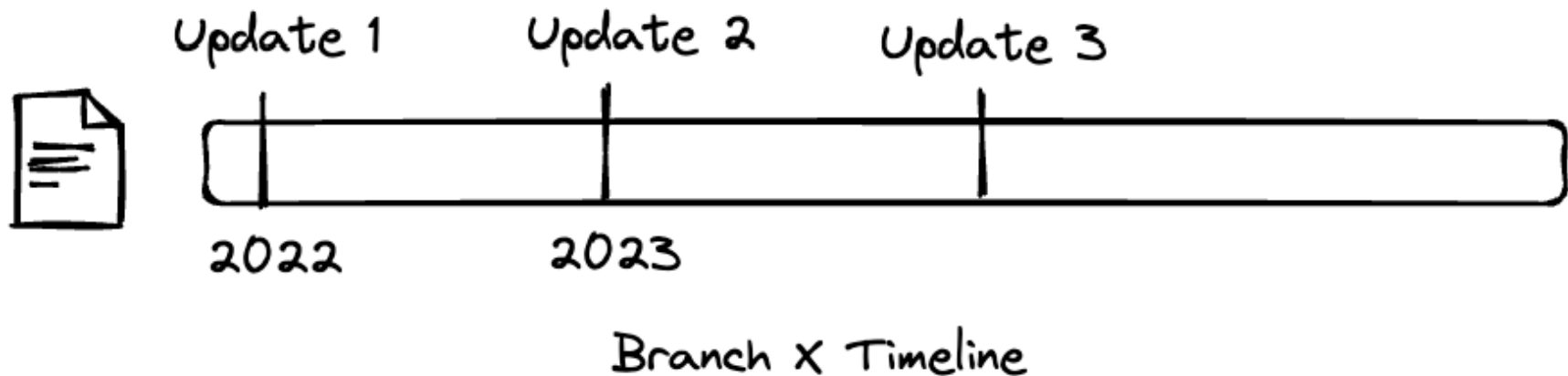
How do we add code to repositories in Git?

Git • Concepts



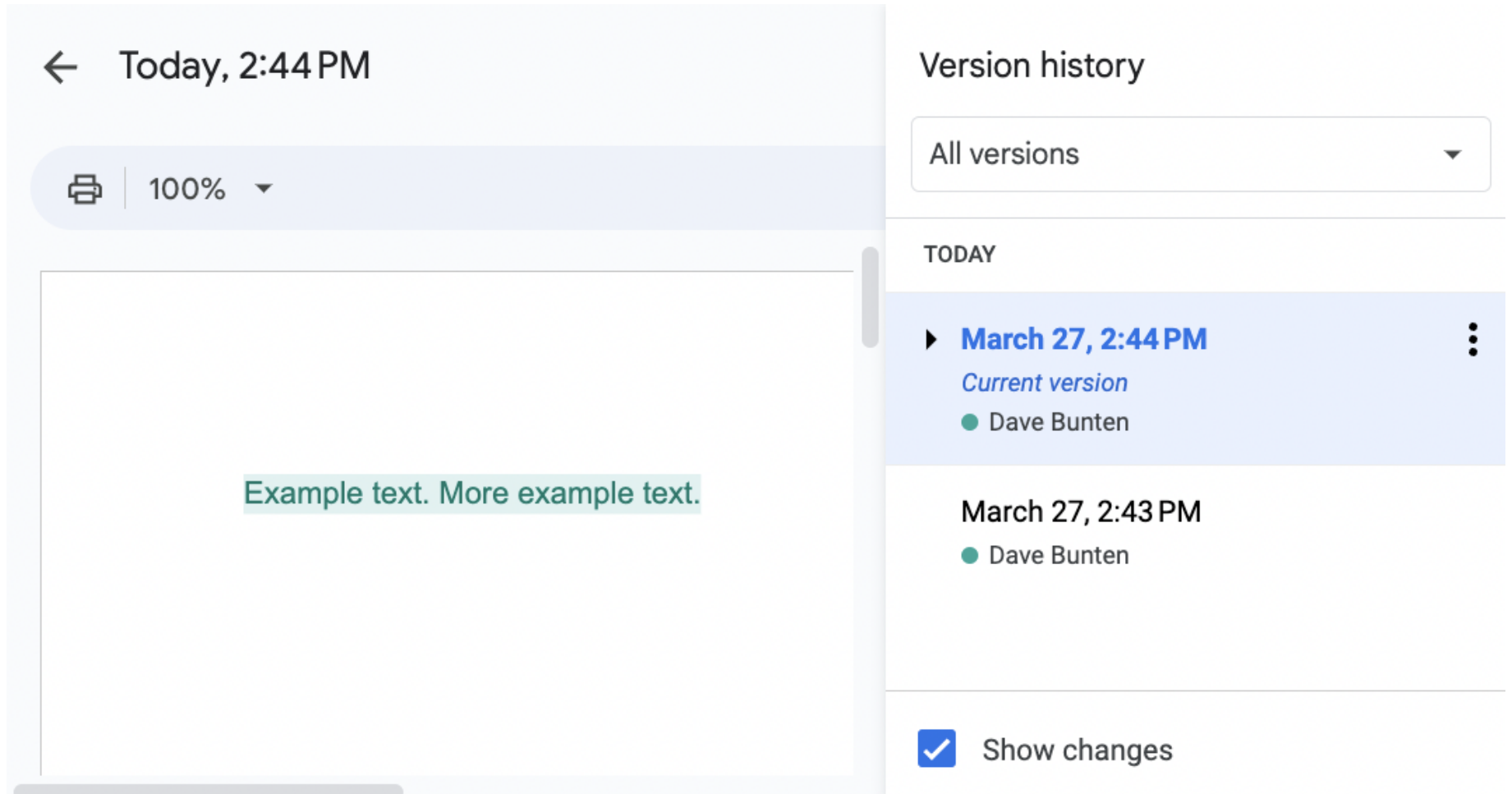
Code is stored inside a repository **branch**.

Git • Concepts



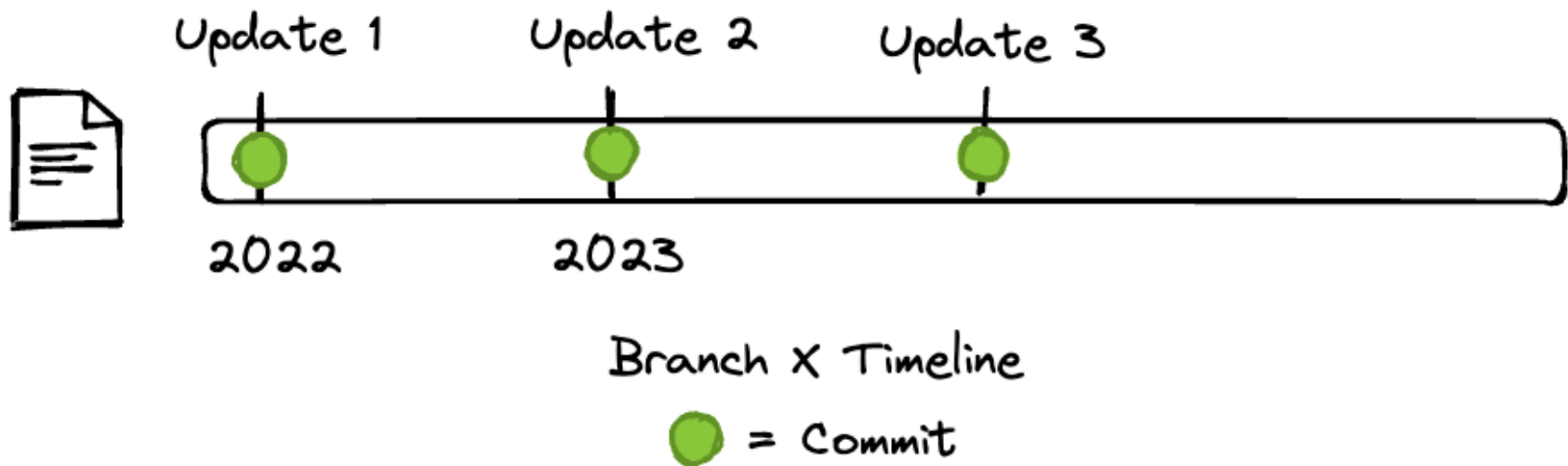
Branches are timelines of code changes.

Git • Concepts



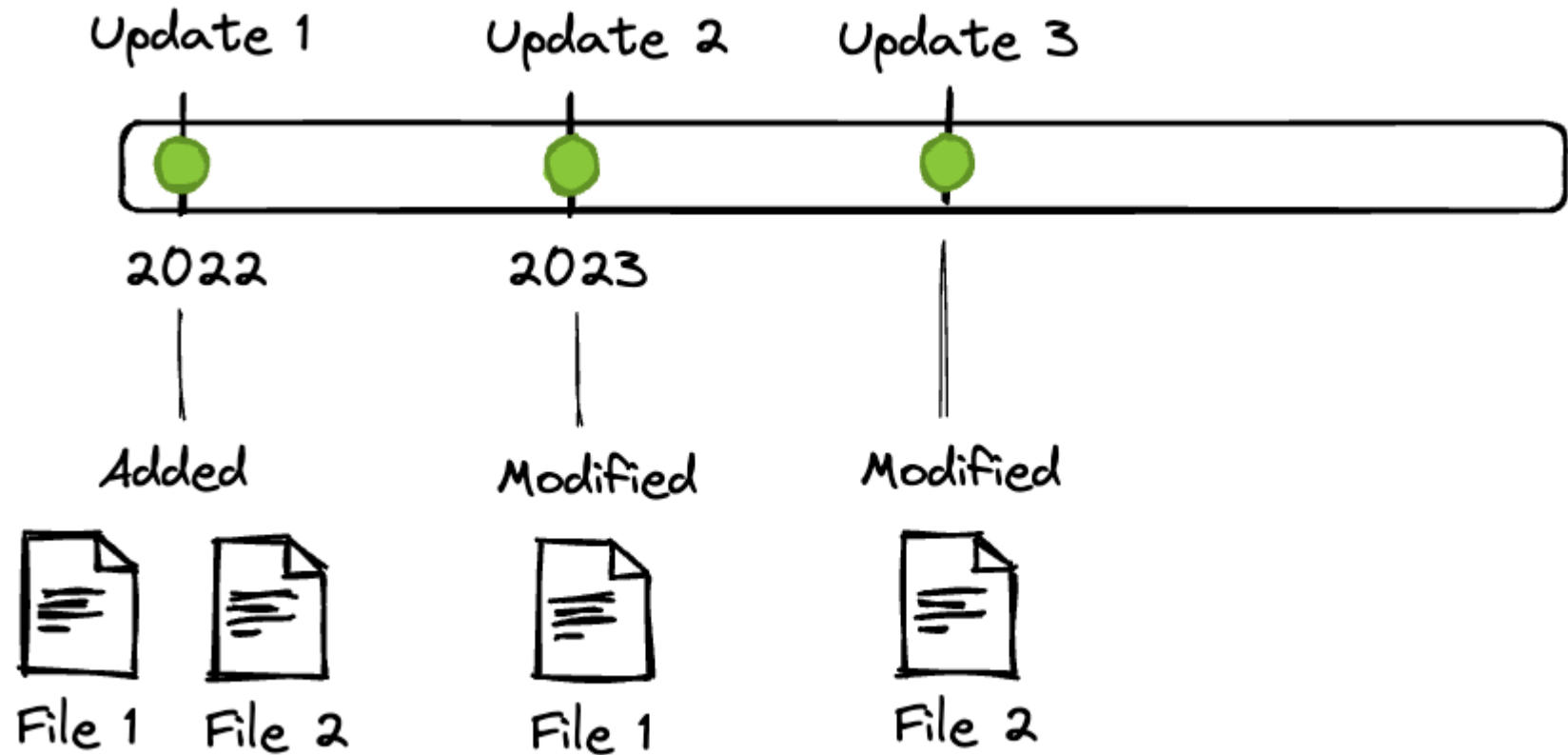
Think of these timelines like Google Docs revision history.

Git • Concepts



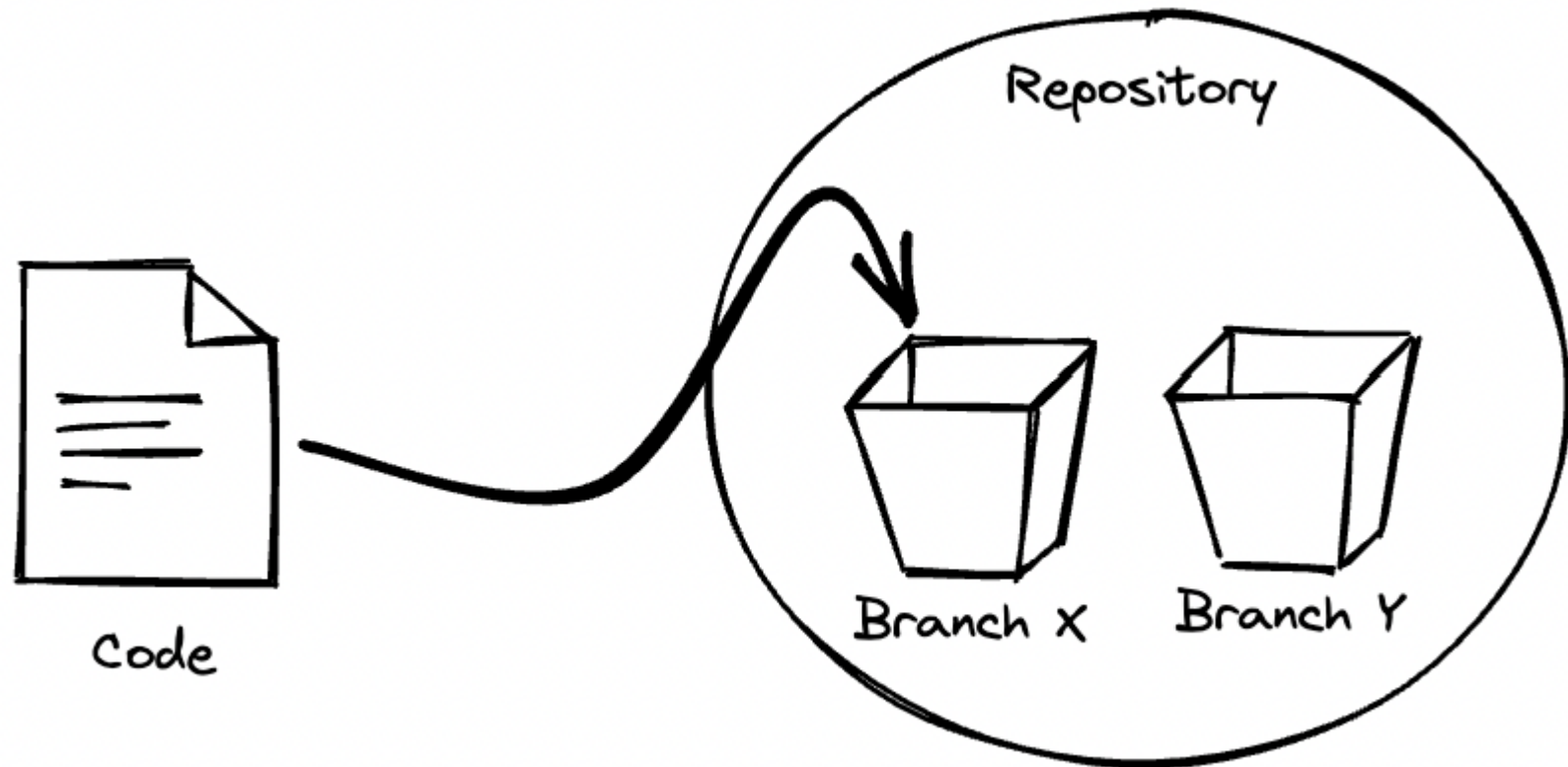
Branch timeline changes are recorded in **commits**.

Git • Concepts



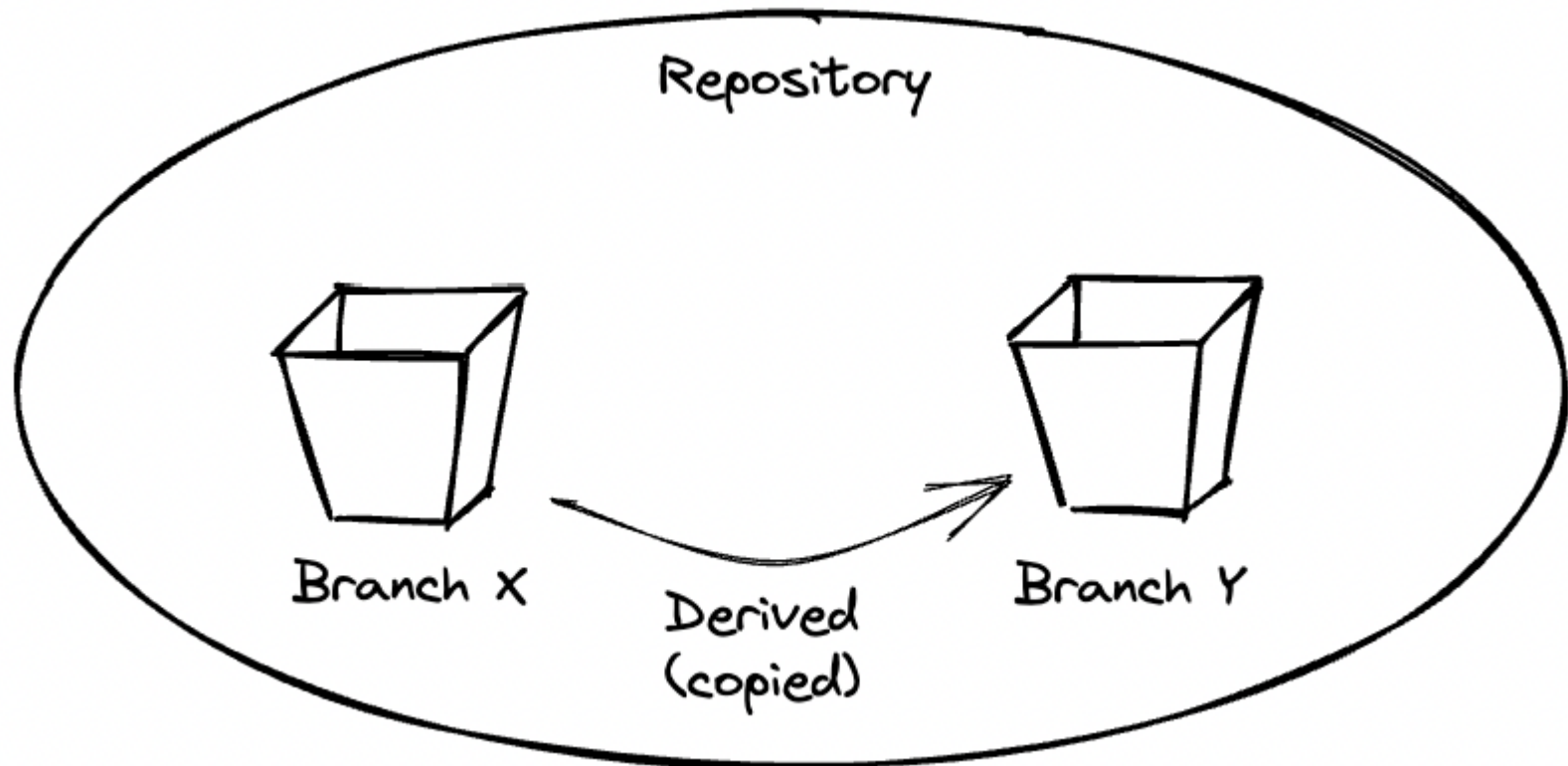
Commits record changes in one or many files.

Git • Concepts



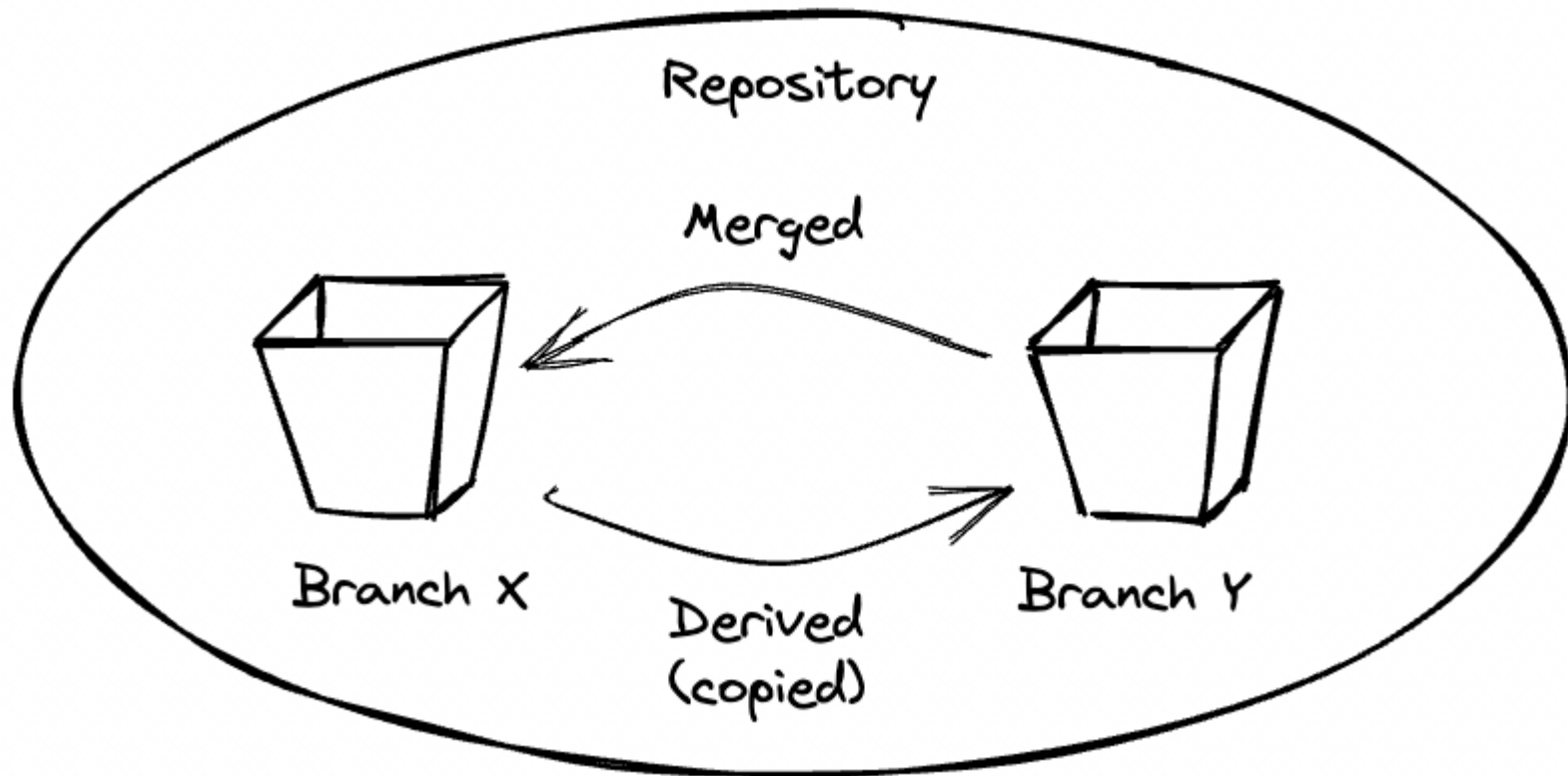
Repositories may have multiple branches.

Git • Concepts



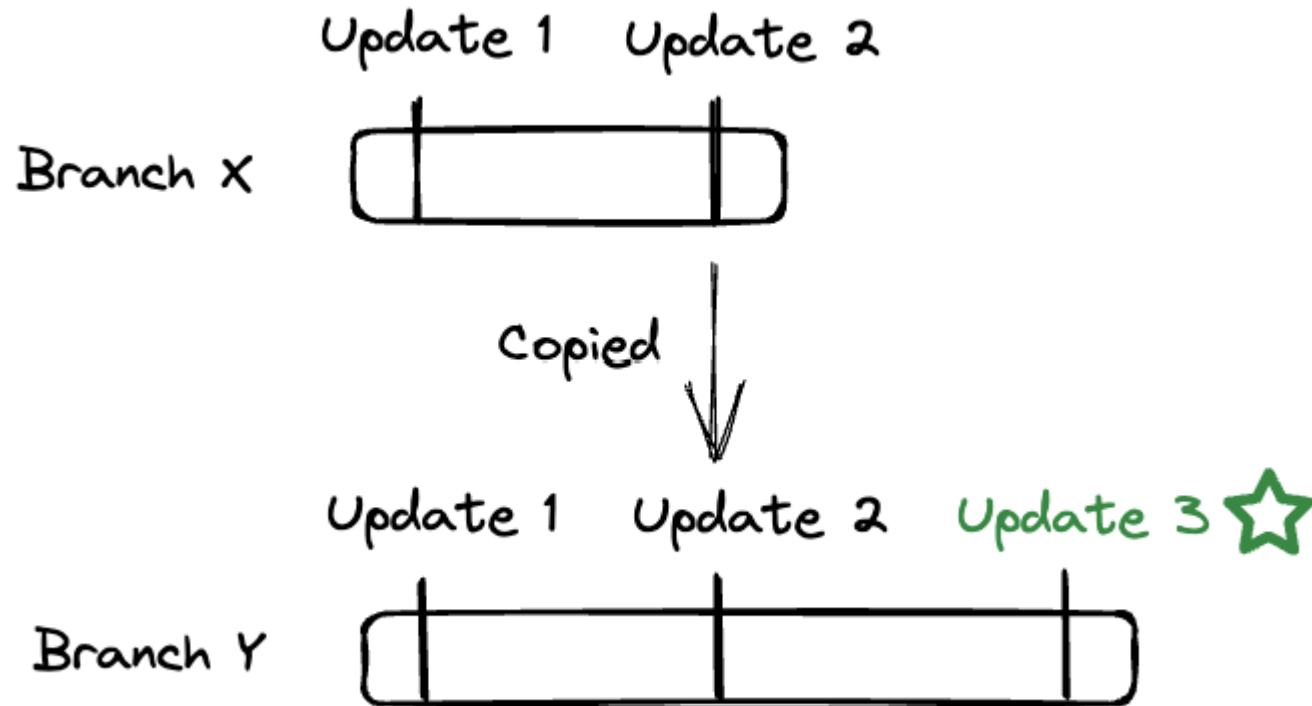
Branches are usually **based** on one another.

Git • Concepts



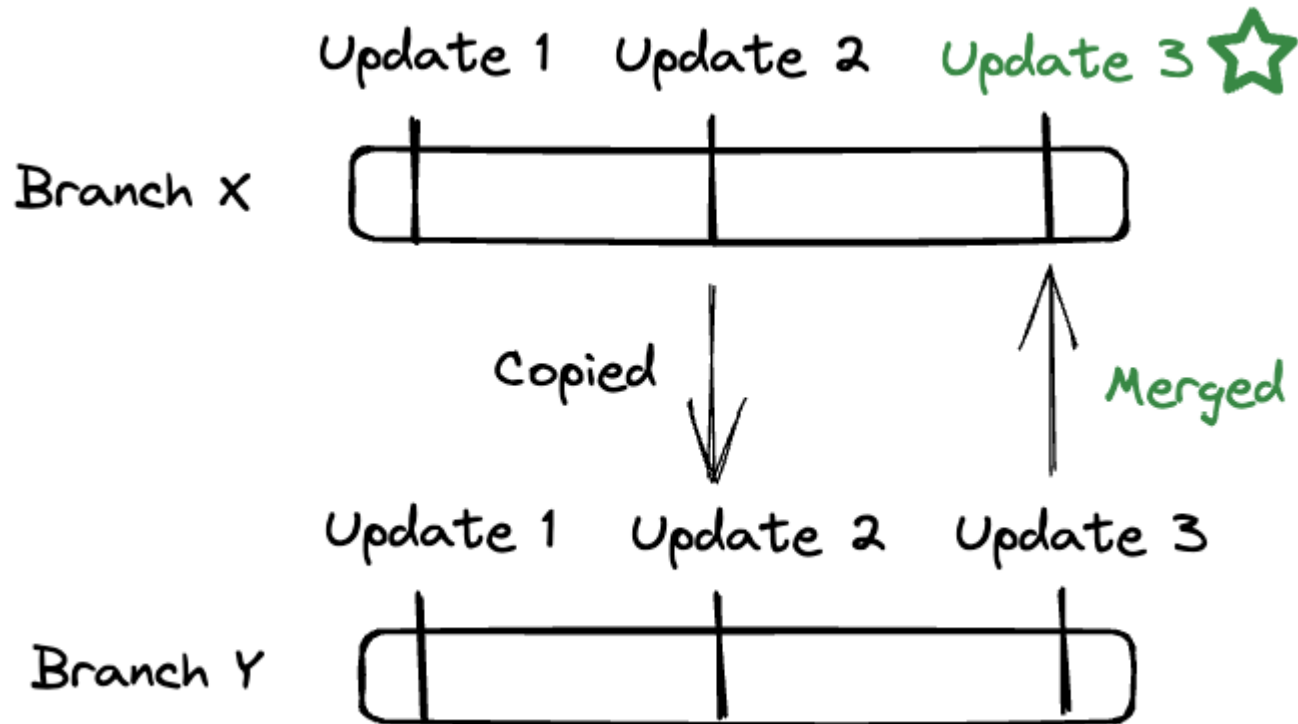
Branches are often **merged** to include new changes.

Git • Concepts



Changes can be independent at first...

Git • Concepts



Changes can be merged to unify the timelines.

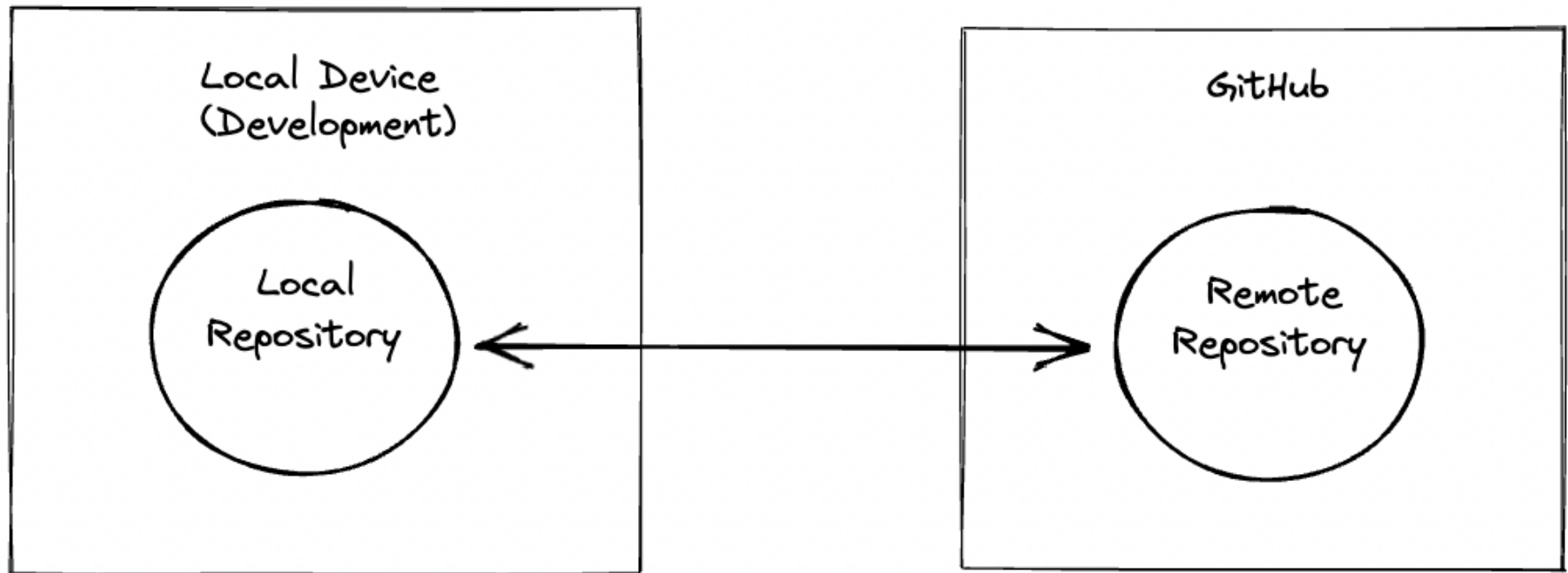
Git • Concepts



Merging from another branch is also called **pulling***.
(*pulling technically involves **fetching** updates then **merging**)

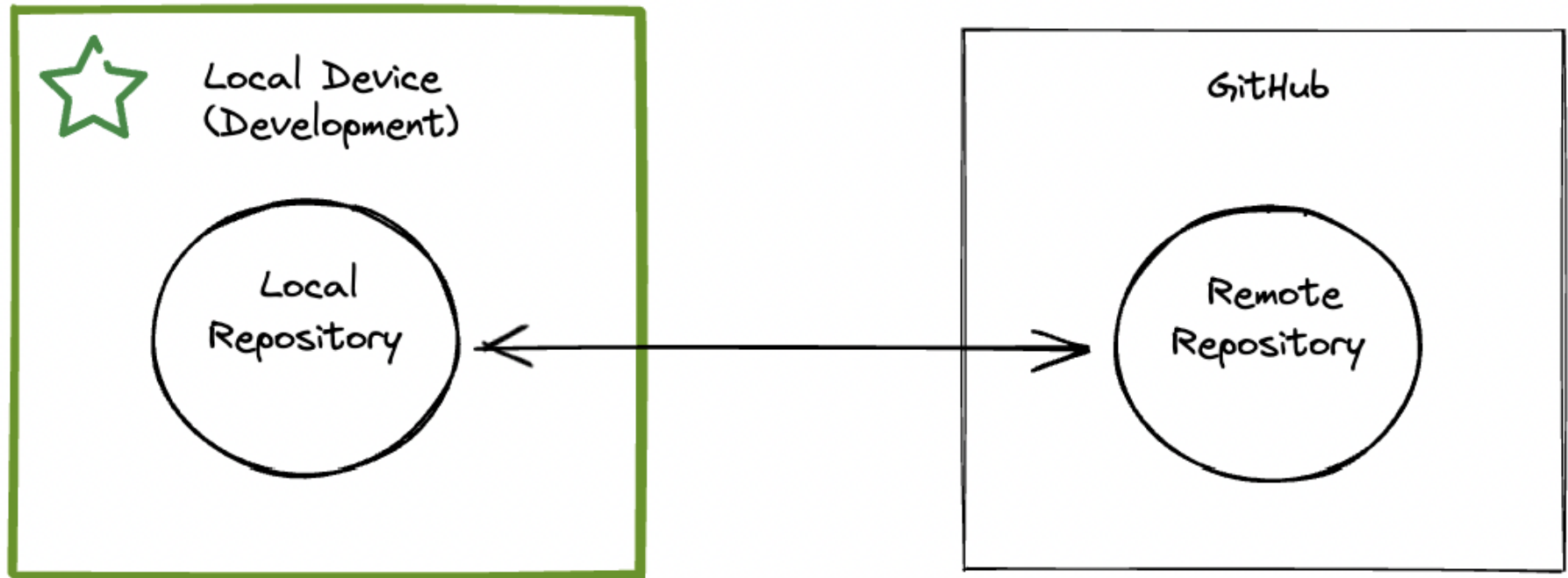
(Image from [Wikimedia Commons](#))

Git • Concepts



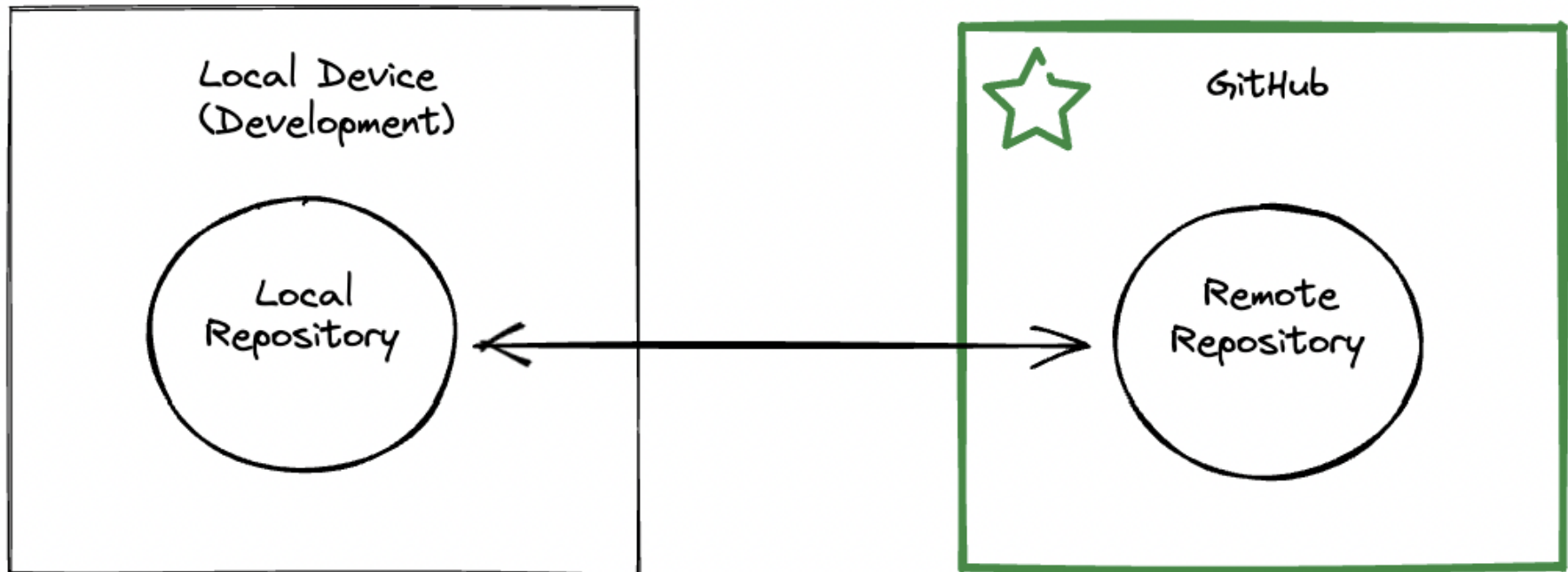
Repositories are stored **locally** and **remotely**.
(GitHub provides remote repository hosting)

Git • Concepts



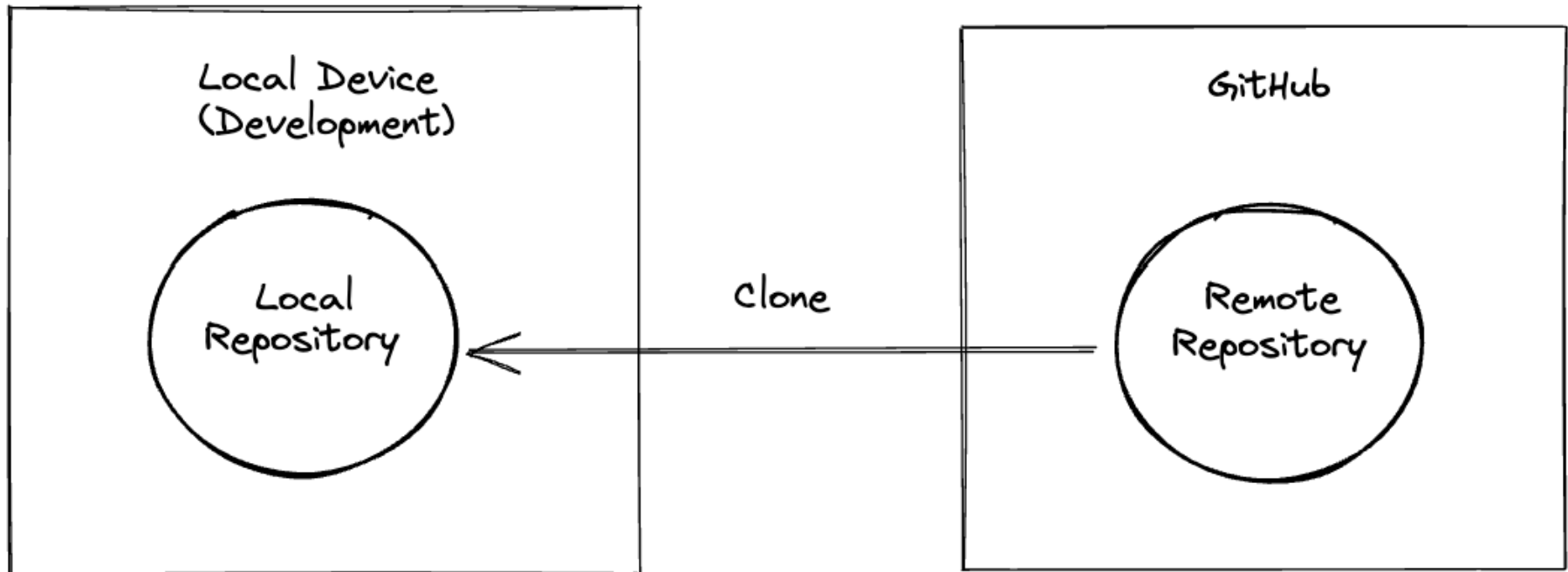
Development usually happens in a local repository.

Git • Concepts



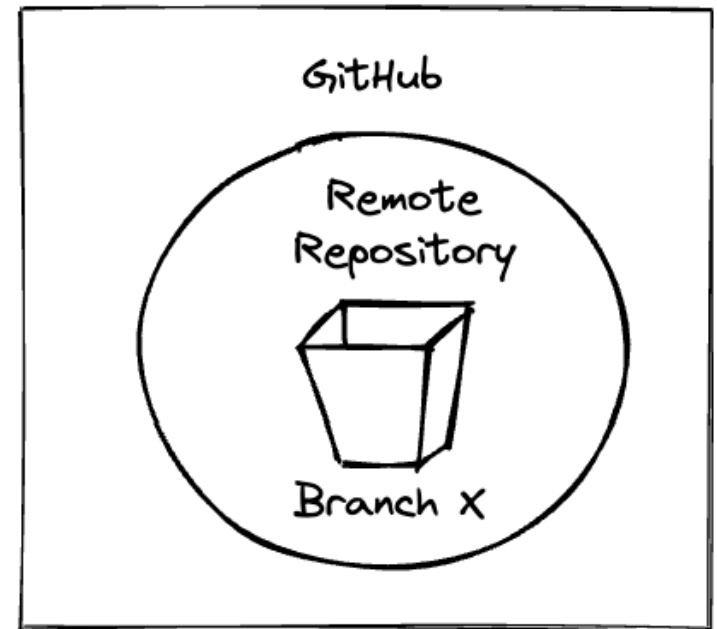
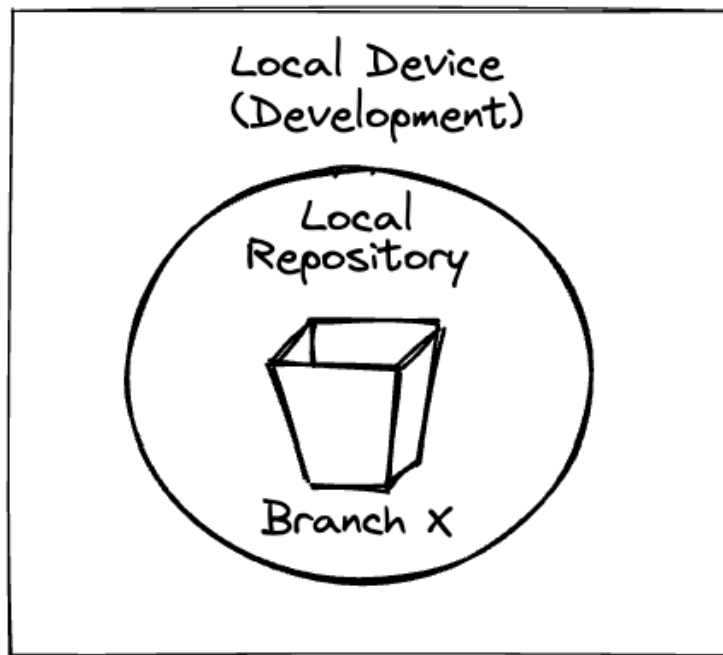
Local work may be synchronized with **remotes**.

Git • Concepts



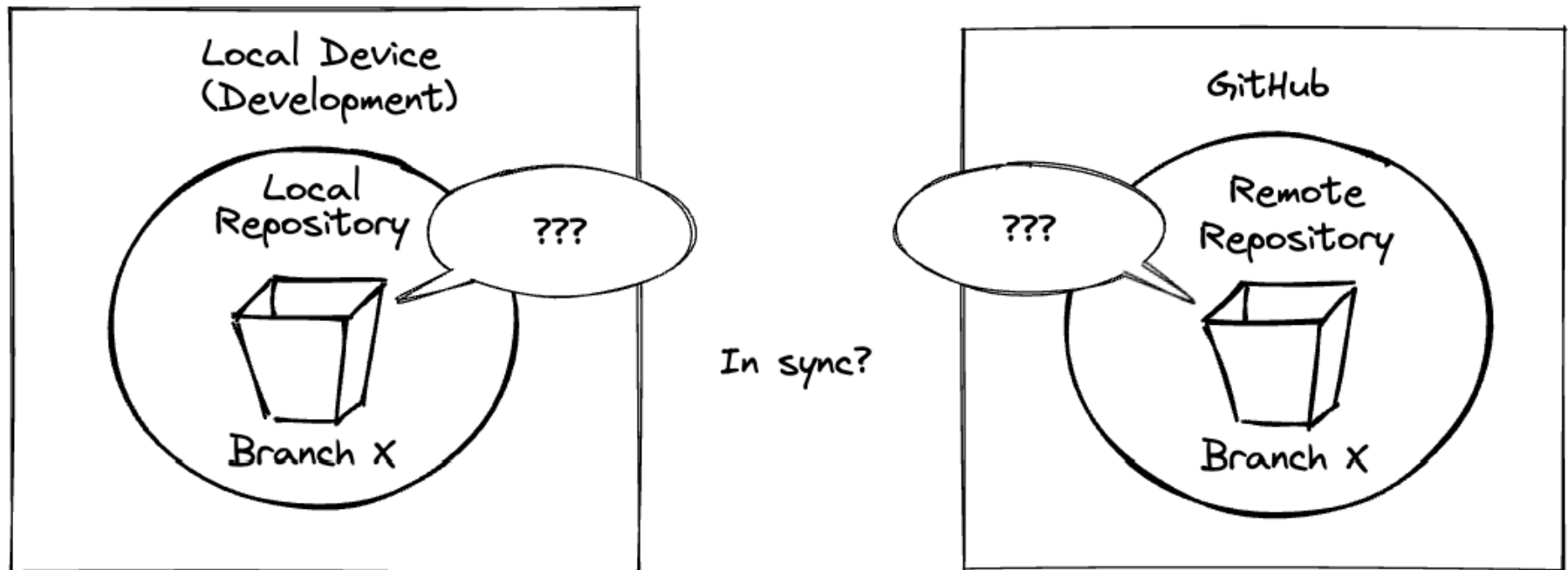
Duplicating a repository locally is called **cloning**.

Git • Concepts



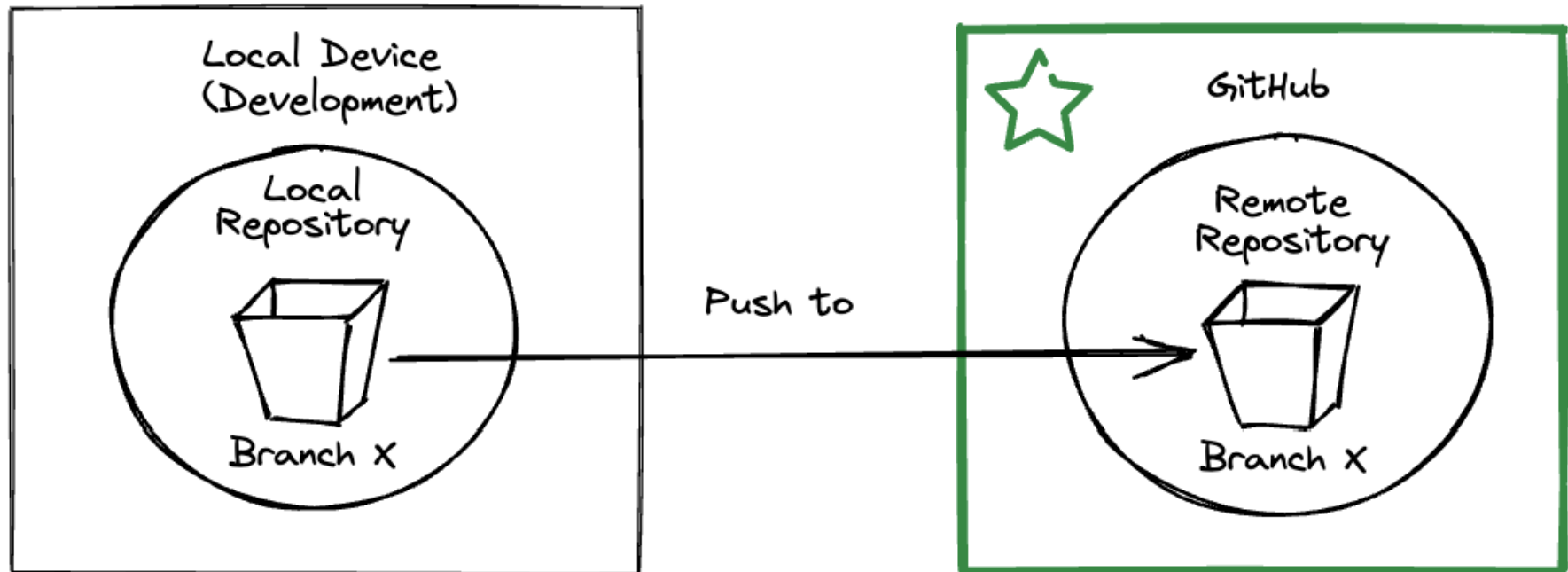
Cloned repositories include references to remote branches.

Git • Concepts



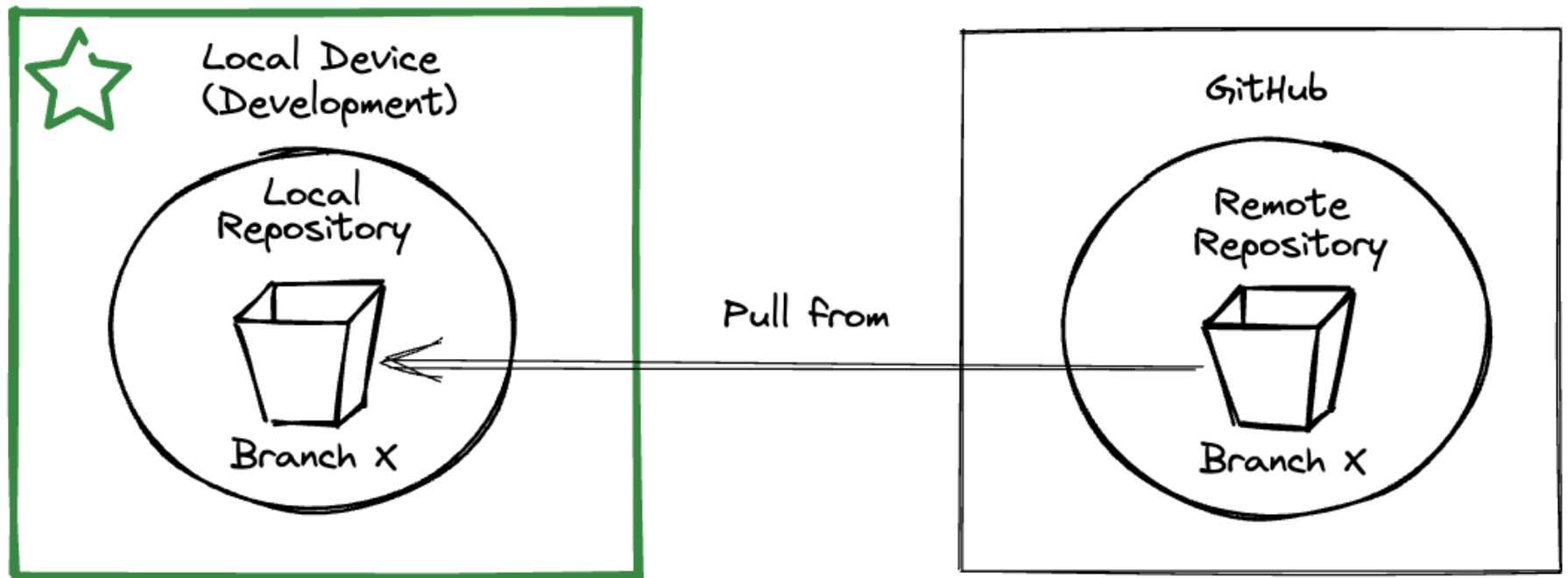
Local and remote repositories are not automatically in sync.
(after updates are made)

Git • Concepts



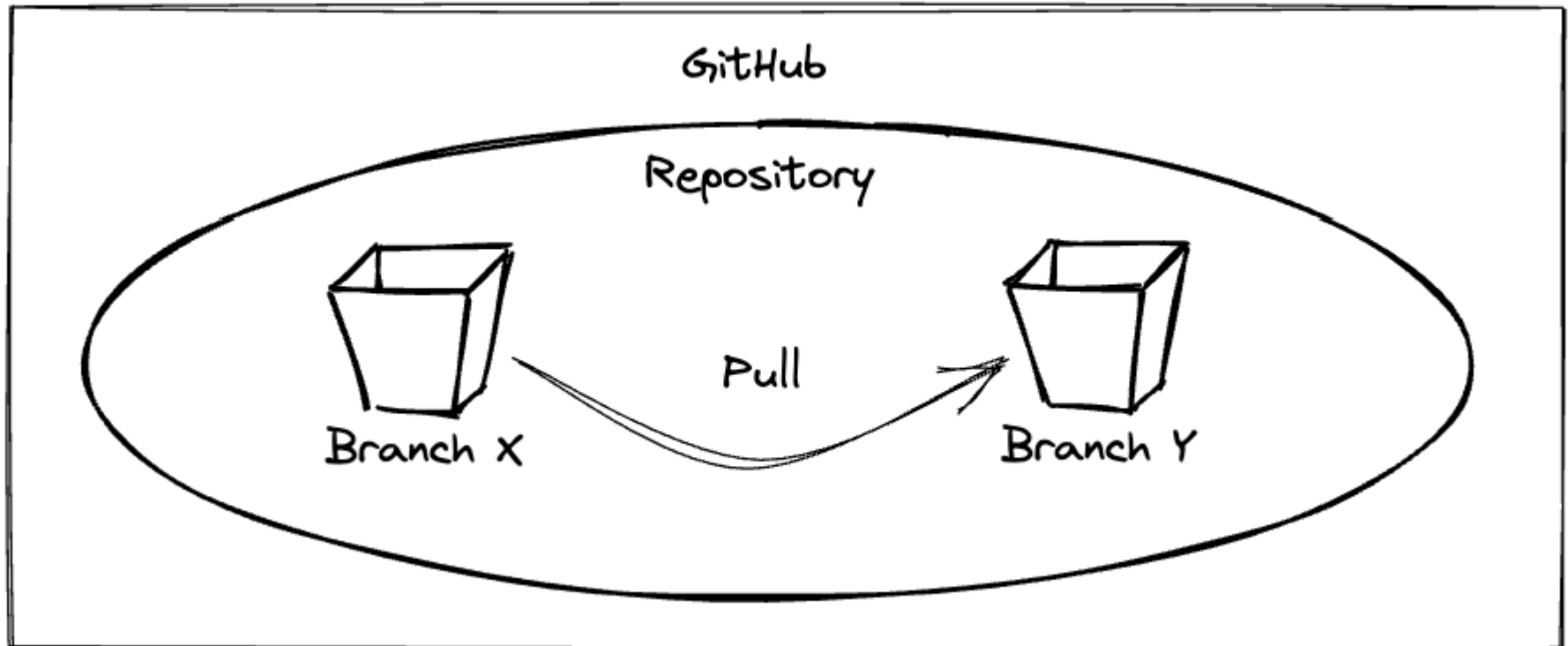
Local branch updates are **pushed** to remotes.

Git • Concepts



Local branches may **pull** updates from remotes.

Git • Concepts



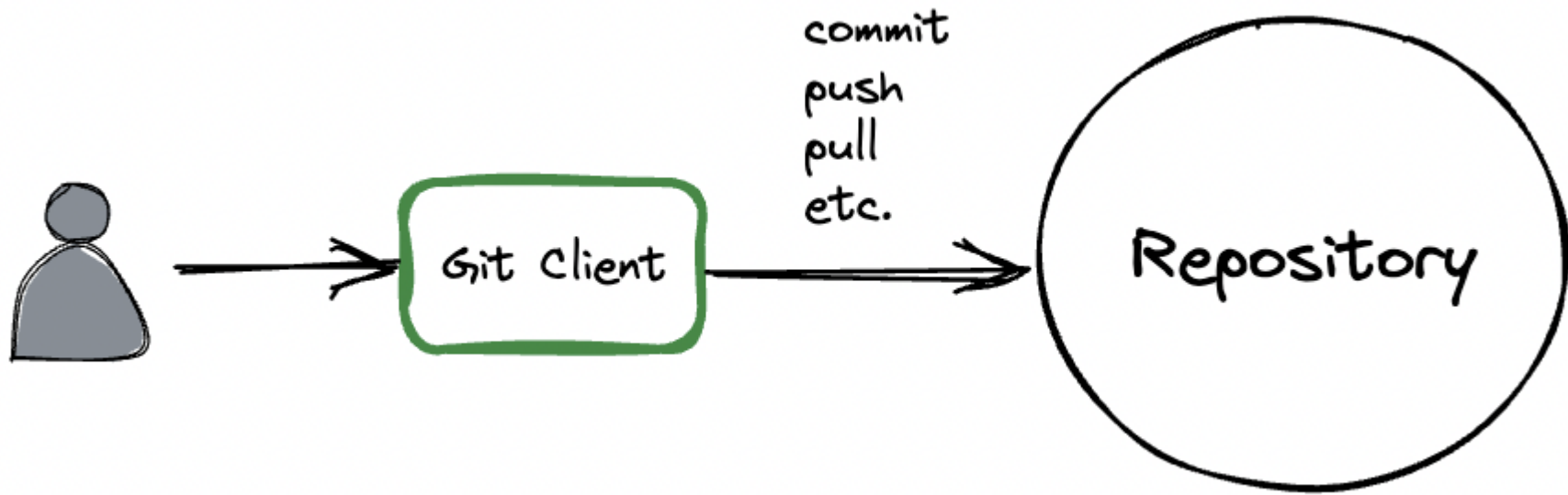
Remote branches may also **pull** updates from each other.
(similar to local branches)

Git • Concepts

Recommended repository files:

- **README .md**: General documentation.
- **LICENSE**: Licensing and copyright details.
- **.gitignore**: What to keep out of repo.

Git • Concepts

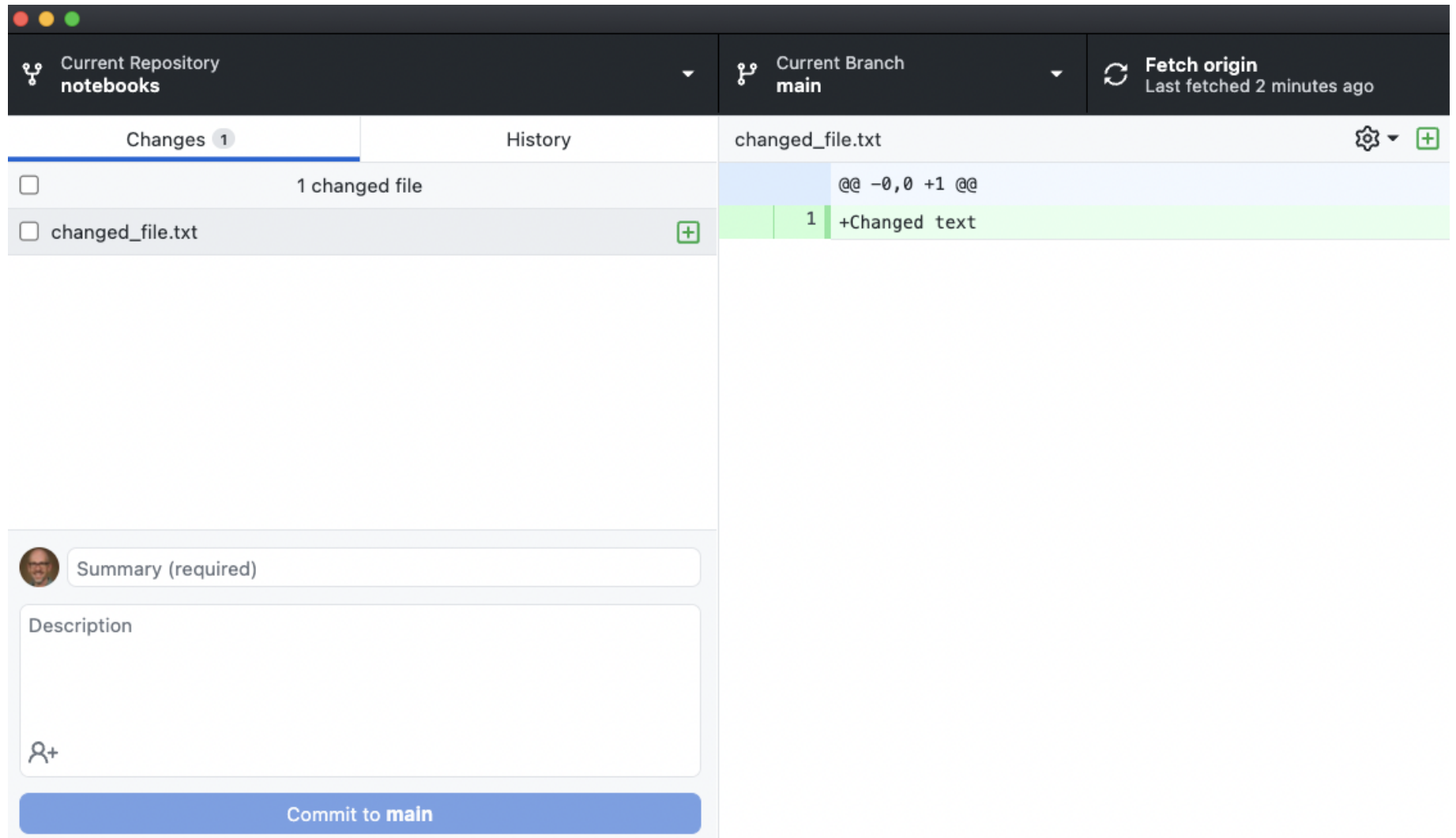


A developer uses a **Git client** to interact with repositories.

Git • Client

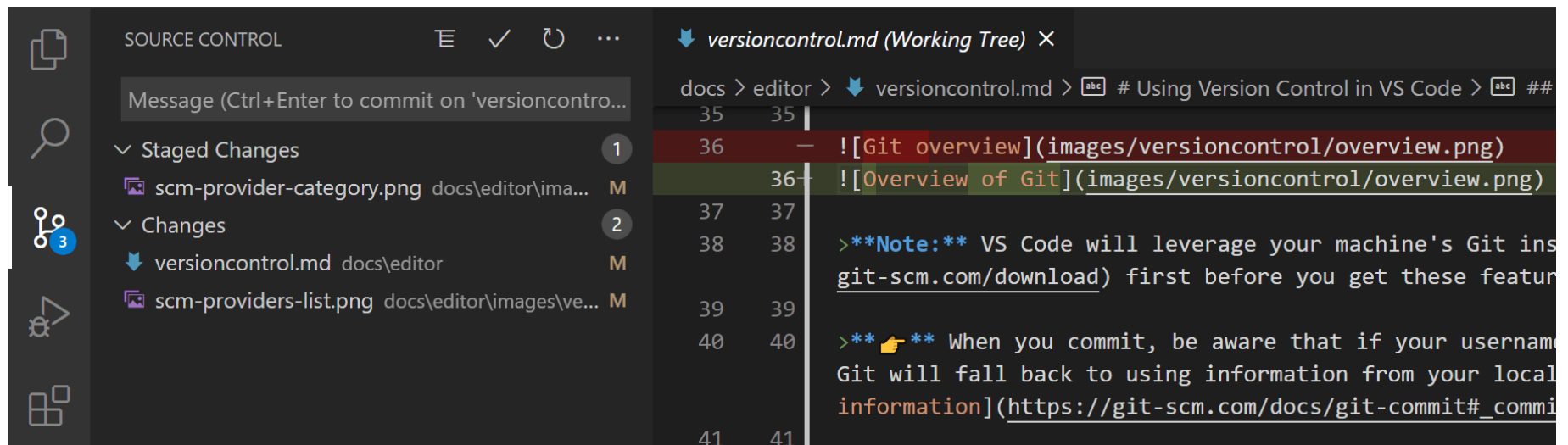
Use a Git client which reduces barriers
or brings joy to ***you(!)***.

Git • Clients



GitHub Desktop (<https://desktop.github.com/>)

Git • Clients



Visual Studio Code: Source Control (<https://code.visualstudio.com/>)

Git • Clients

```
username ~ % git --help
usage: git [-v | --version] [-h | --help] [-C <path>] [-c <name>=<value>]
          [--exec-path[=<path>]] [--html-path] [--man-path] [--info-path]
          [-p | --paginate | -P | --no-pager] [--no-replace-objects]
          [--git-dir=<path>] [--work-tree=<path>] [--namespace=<name>]
          [--super-prefix=<path>] [--config-env=<name>=<envvar>]
          <command> [<args>]

...

```

Git command line (<https://git-scm.com/downloads>)

Git • Clients

The screenshot shows the GitHub repository page for 'github/docs'. At the top, the repository name 'github/docs' is displayed with a 'Public' badge. To the right are buttons for 'Watch' (2.1k), 'Fork' (59.3k), and 'Star' (13.3k). Below this is a navigation bar with links for 'Code', 'Issues' (103), 'Pull requests' (46), 'Discussions', 'Actions', 'Projects' (4), 'Security', and 'Insights'. The main content area shows the 'main' branch selected, with 21 branches and 1 tag. There are buttons for 'Go to file', 'Add file', and 'Code'. A table of recent commits is visible, including a merge pull request by Octomerger and several updates to .devcontainer, .github, .husky, and .vscode files. On the right, the 'About' section describes the repository as 'The open-source repo for docs.github.com' and includes links to 'docs.github.com', 'docs', 'hacktoberfest', and 'works-with-codespaces'. It also mentions a 'Readme' and 'CC-BY-4.0, MIT licenses found'.

github / docs Public

Watch 2.1k Fork 59.3k Star 13.3k

<> Code Issues 103 Pull requests 46 Discussions Actions Projects 4 Security Insights

main 21 branches 1 tag Go to file Add file <> Code

Octomerger Merge pull request #2475... fd4ab3e 1 hour ago 38,203 commits

.devcontainer	Update devcontainer.json	2 days ago
.github	move schema check openapi tests into feature ...	yesterday
.husky	Rm translations directory (#33720)	2 months ago
.vscode	Translation cleanup (#33738)	2 months ago

About

The open-source repo for docs.github.com

docs.github.com

docs hacktoberfest works-with-codespaces

Readme

CC-BY-4.0, MIT licenses found

The Github website provides git-like capabilities.

Git • Demonstration


An opinionated demo of concepts using:

- Github website to create a repo.
- Github Desktop app to interact with the repo.
- VS Code to make some changes.

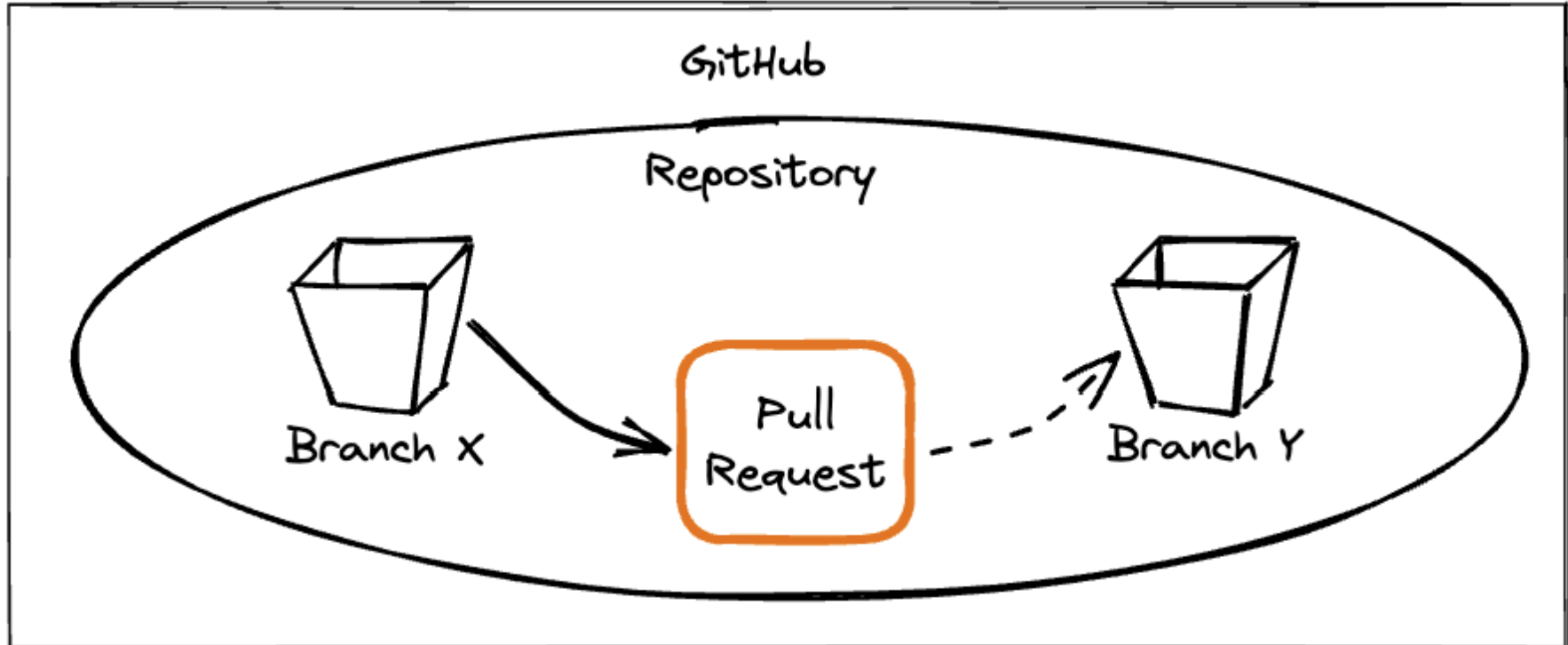
GitHub Features

GitHub adds features on top of Git to help save time, communicate, and more.

GitHub Features - Brief Notes

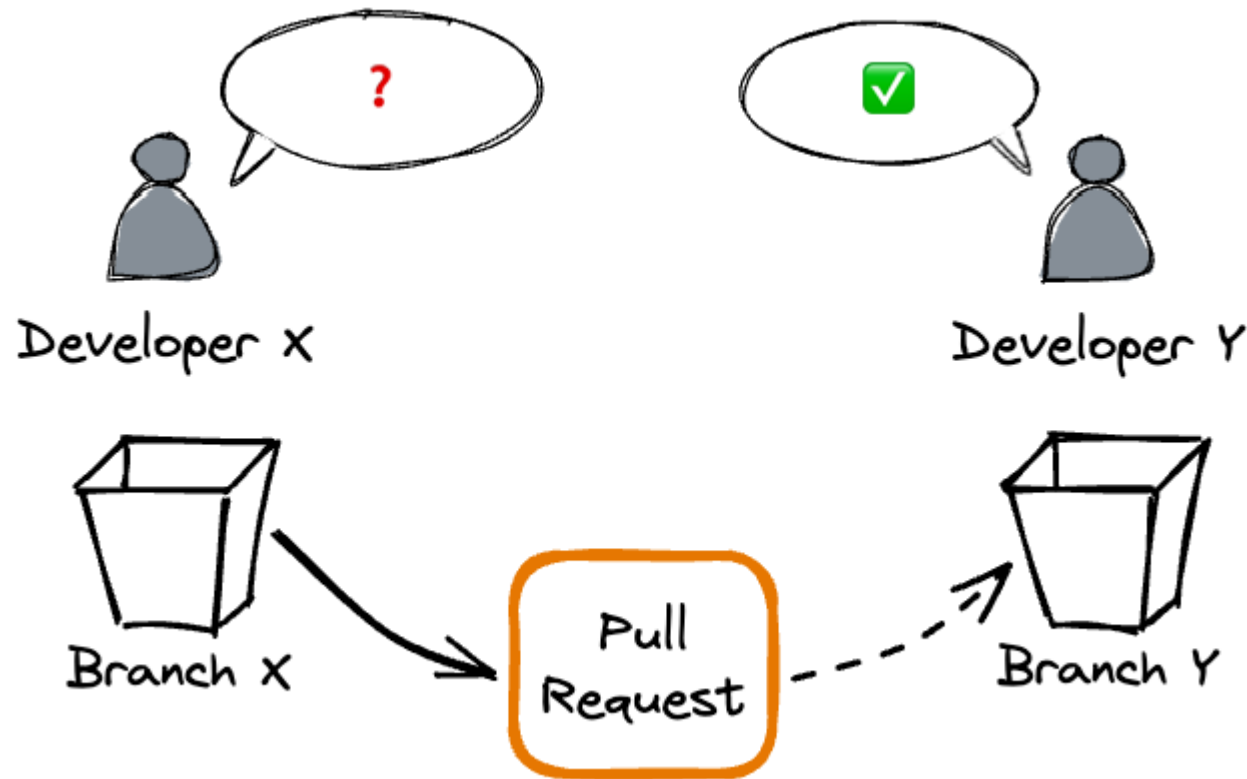
-  Software can be a **team** sport!
- Treat changes like "**shots on goal**".
- Leaning on and learning from your team gives you **strength**.
- **Communicate** and act with **kindness**.

GitHub Features - Pull Requests



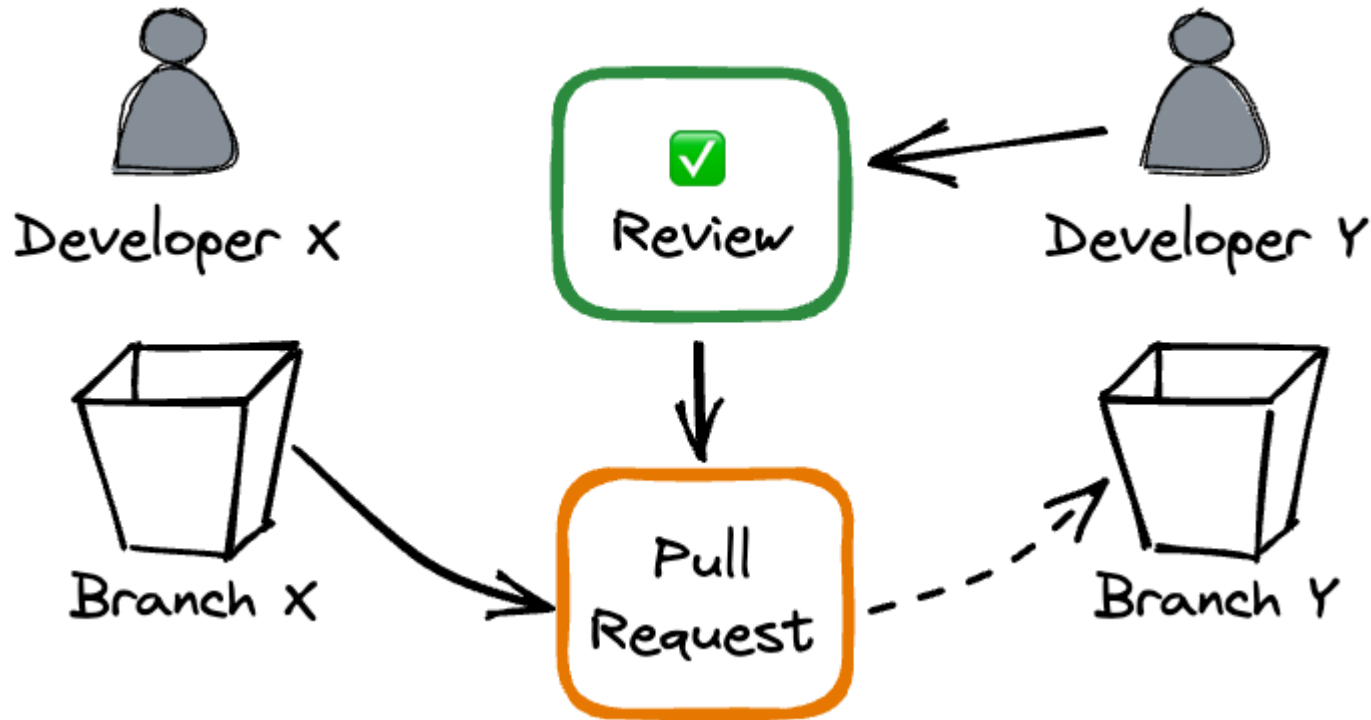
Updates are requested between branches using **Pull Requests**.

GitHub Features - Pull Requests



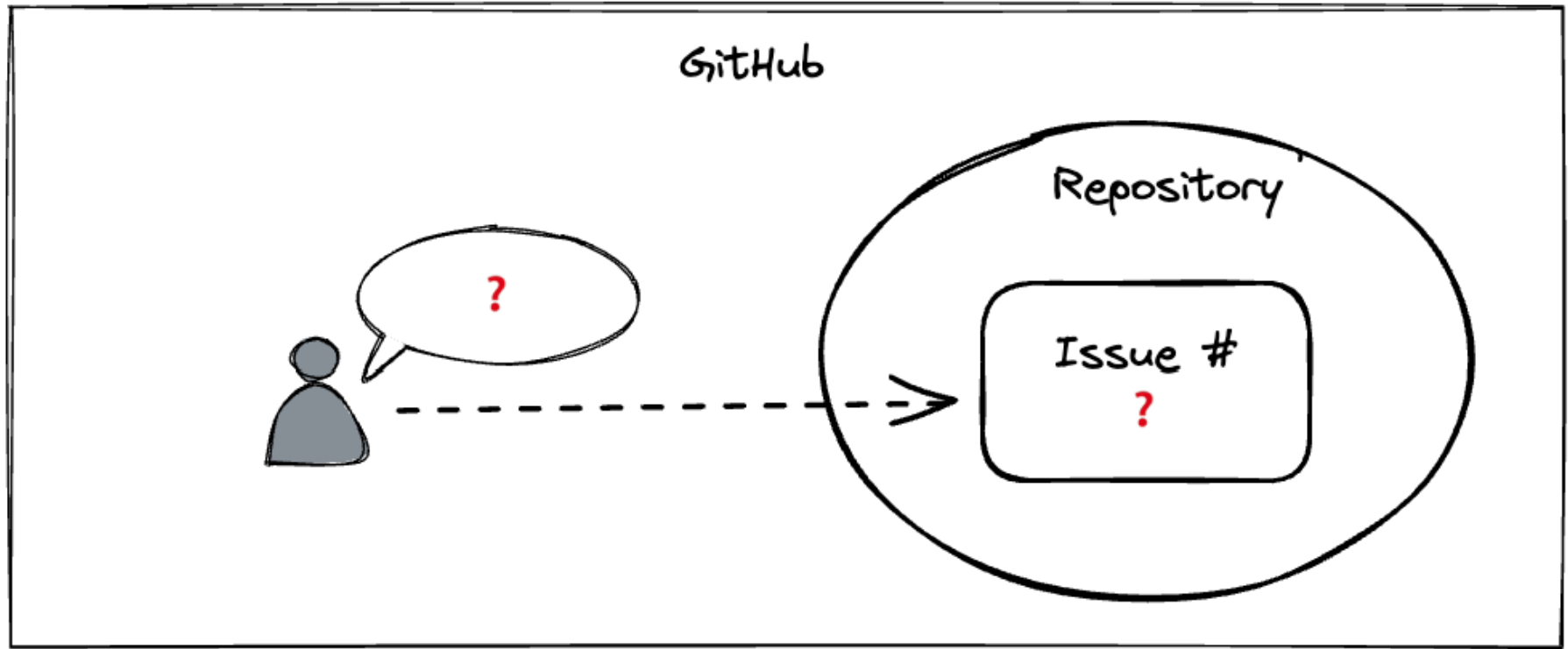
Pull Requests are a way to ensure changes are ready for a merge.

GitHub Features - Pull Requests



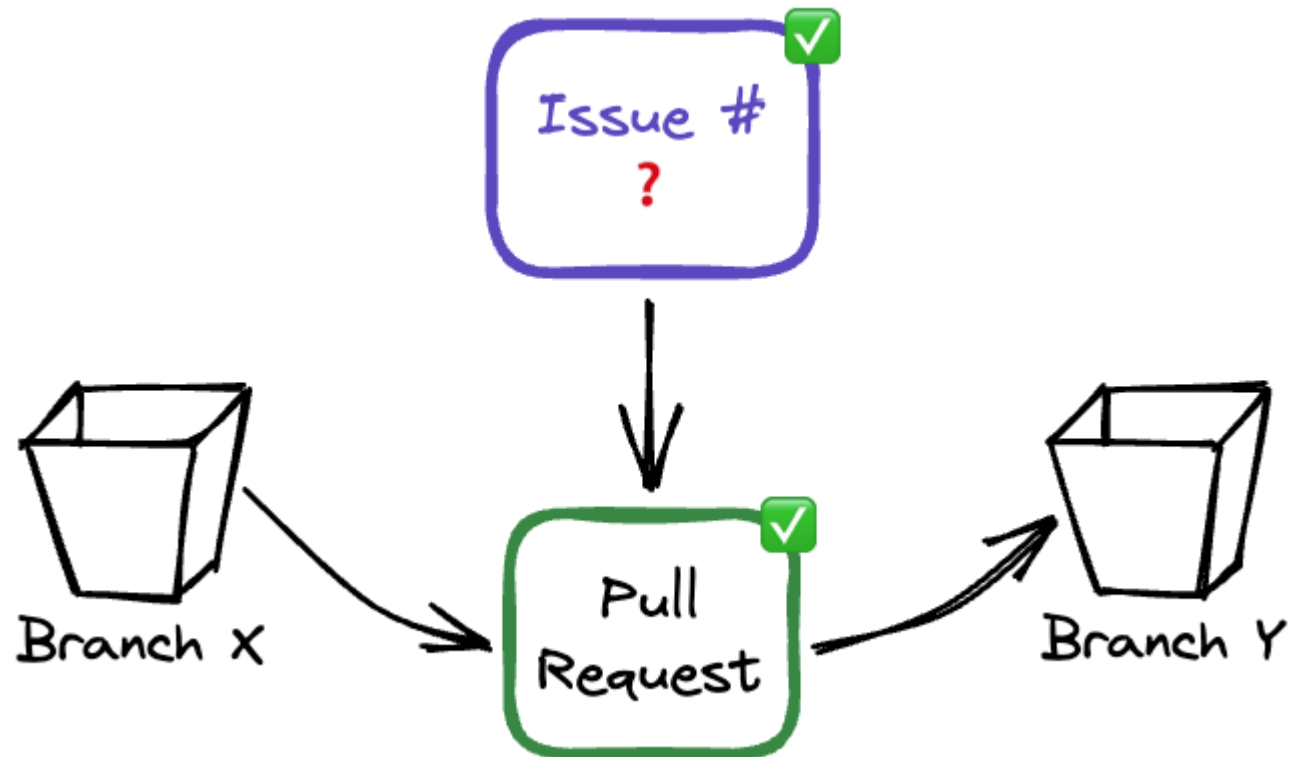
Pull Request Reviews are added to PR's to formalize and track decisions.

GitHub Features - Issues



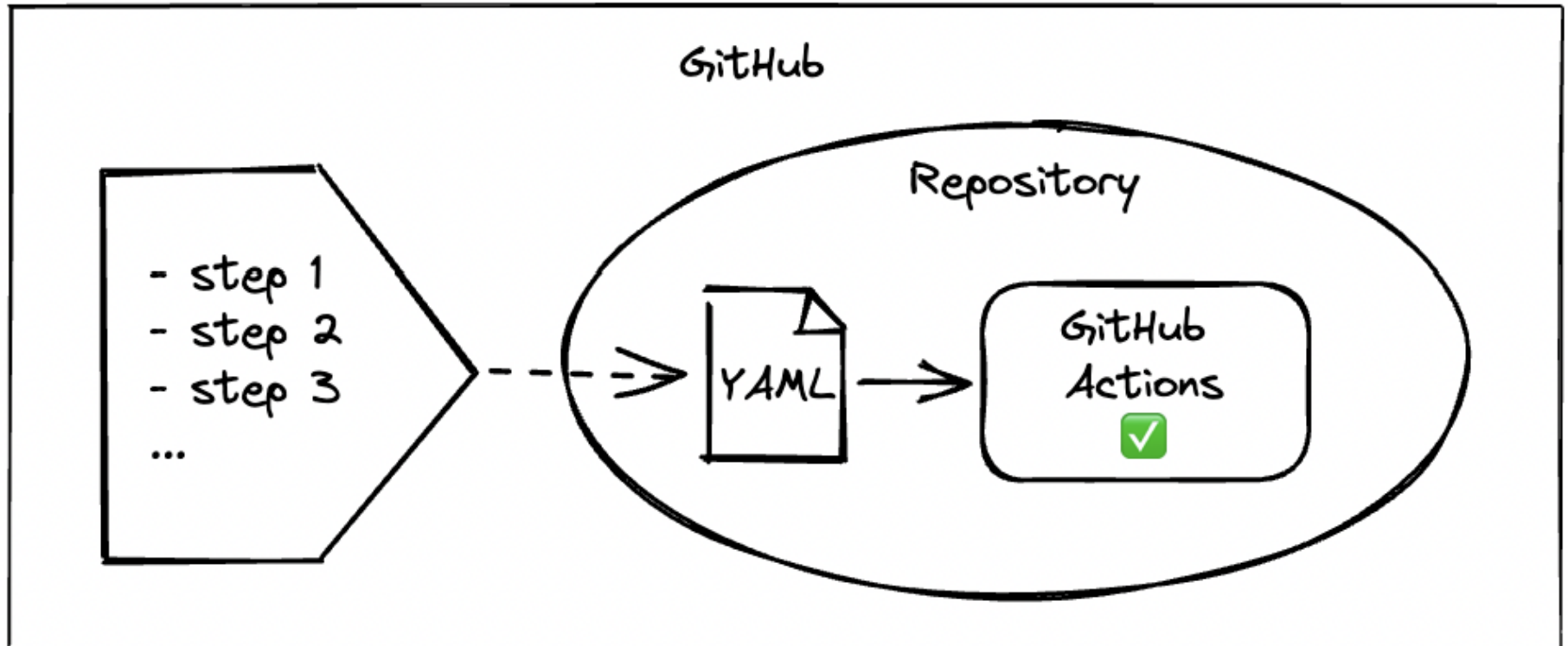
GitHub Issues provide a way to track bugs, features, and questions in a repo.

GitHub Features - Issues



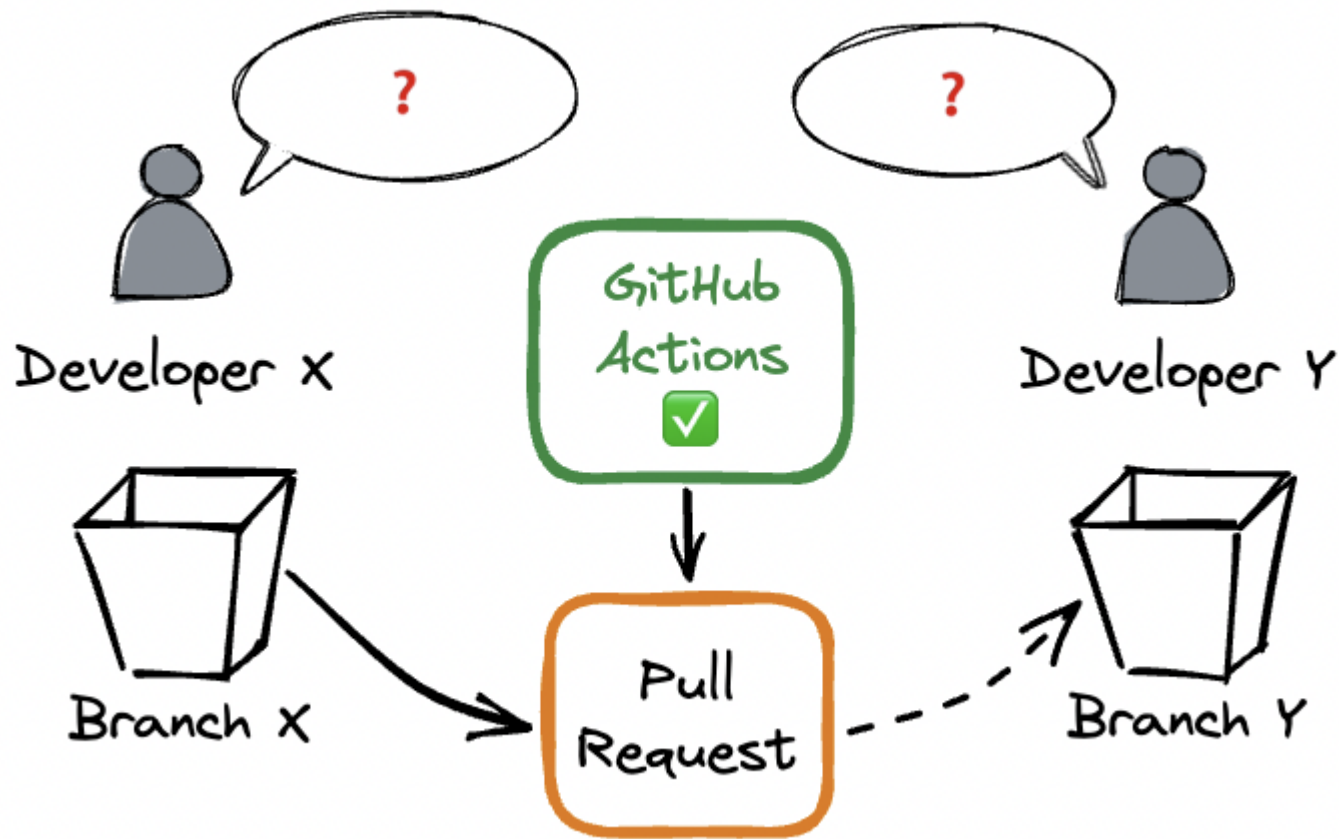
Pull Requests can reference and help **close** issues.

GitHub Features - GitHub Actions



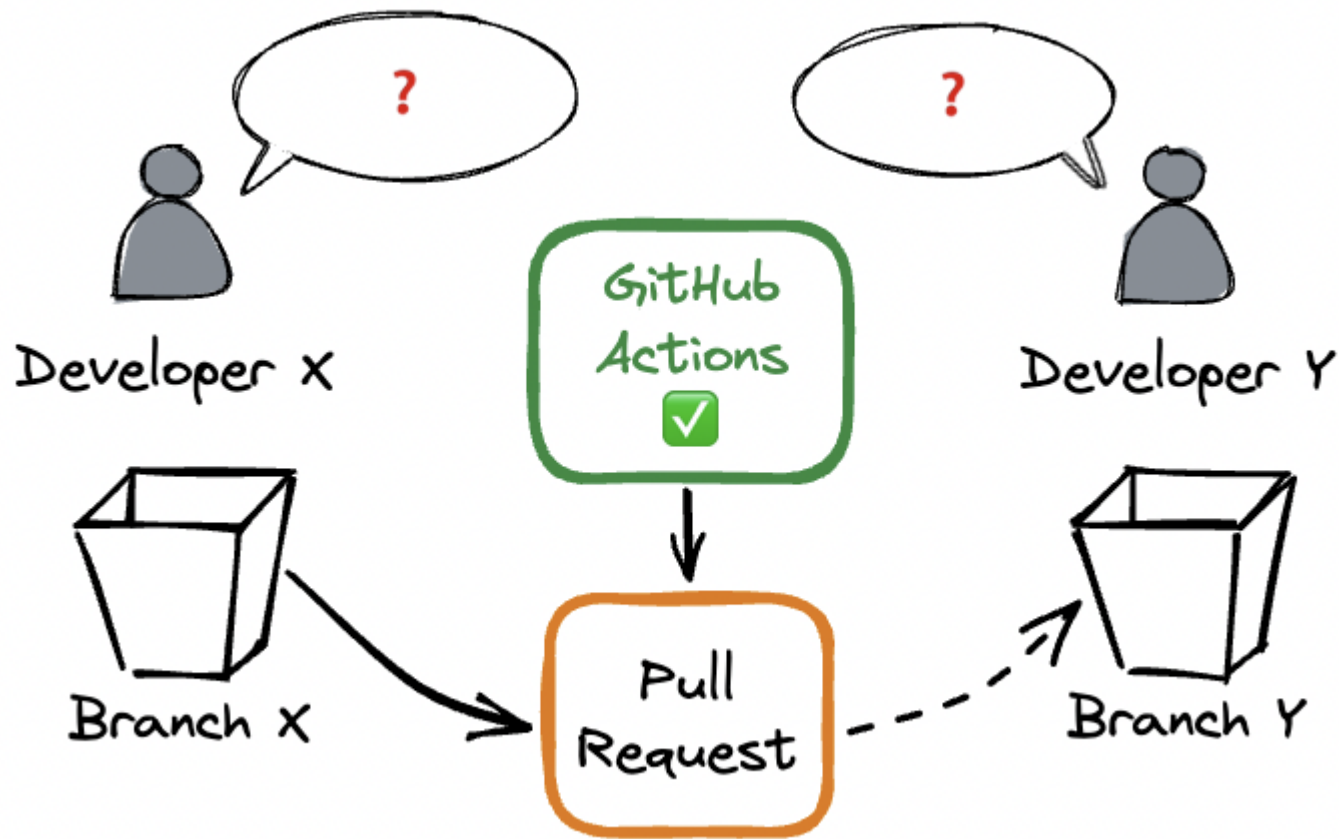
GitHub Actions are triggered **workflows** for repos.

GitHub Features - GitHub Actions



GitHub Actions can provide automatic checks for PR's.

GitHub Features - GitHub Actions



GitHub Actions can provide automatic checks for PR's.

GitHub Features - Demonstration

The screenshot shows the GitHub repository page for `r-lib/lintr`. At the top, the repository name is displayed with a 'Public' badge. To the right, there is a 'Watch' button showing 21 watchers. Below this is a navigation bar with links to 'Code', 'Issues' (188), 'Pull requests' (16), 'Actions', 'Projects', 'Wiki', and 'Security'. Under the navigation bar, there are buttons for 'main' (selected), '20 branches', and '22 tags', along with 'Go to file', 'Add file', and a green 'Code' button. The main content area shows a commit by user 'Bisaloo' titled 'Add matrix_apply_linter()' (#1869) with a green checkmark, commit hash '01500d8', and '2 days ago'. It also shows '1,610 commits'. Below the commit, there is a list of files and folders with their commit history:

File/Folder	Commit Message	Time
<code>.dev</code>	implement indentation_linter (#1411)	5 months ago
<code>.github</code>	Quit in-progress CI runs on new commit (#1925)	last month
<code>R</code>	Add <code>matrix_apply_linter()</code> (#1869)	2 days ago

A quick walkthrough of these features on
<https://github.com/r-lib/lintr>

Further references:

- **Pull Requests:** <https://cu-dbmi.github.io/set-website/2023/02/13/Branch-Review-and-Learn.html>
- **GitHub Actions:** <https://cu-dbmi.github.io/set-website/2023/03/15/Automate-Software-Workflows-with-Github-Actions.html>

Thank you!

Questions / Comments?

