A Quick Intro to Version Control with git

https://github.com/gabindu/git-intro

Gabriel Indurskis, based on slides by Max Joseph

Nov. 12, 2025

Discuss

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1. How do you manage different file versions?

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2. How do you work with collaborators on the same files?
3. How much would your science/work/life suffer if your computer exploded right now? (scale from 1-10)

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Version control system (VCS)

- manage different versions of files
- collaborate with yourself
- collaborate with other people
- in principle a commandline tool, but can be used conveniently via graphical interfaces (in particular in VS Code)
- various websites offer free remote storage (GitHub/GitLab/BitBucket)

Why use git

"Always remember your first collaborator is your future self, and your past self doesn't answer emails"

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    - if you use Emacs, install `magit` package.

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    - Copy & Paste your **public** key, usually found in `~/.ssh/id_ed25519.pub` (or maybe `id_rsa.pub` if you already had an older key)

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    - Copy & Paste your **public** key, usually found in `~/.ssh/id_ed25519.pub` (or maybe `id_rsa.pub` if you already had an older key)
    - This enables a quicker way to up- and download files directly from the commandline, without the need of entering passwords.

Command line git

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Somewhere on your computer, create a new directory with a (text) file, e.g. `test.tex` or `test.txt`, and fill it with some example content (at least a few lines). (You could also just copy an already existing document.)

You can do this with your usual methods, or on the commandline, for example with:

```
mkdir my-first-git-repo
cd my-first-git-repo
echo "This is a fancy test!" > test.txt
```

You can also create other files, of whatever type you want (LaTeX, Markdown, HTML, Python scripts, ...) - binary files are ok as well!

Tell git to keep track of your files

Initializing a repository (only once)

On the commandline, make sure that you are inside the directory you created, then execute:

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git init
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Behind the scenes, `git` has now created a hidden folder `.git/` directory. This is where git does its magic, and you should therefore never touch this directory or its contents!

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You should notice that there are "untracked" files. Right now, git does not actually do anything with your files yet, we first have to tell it to "track" them.

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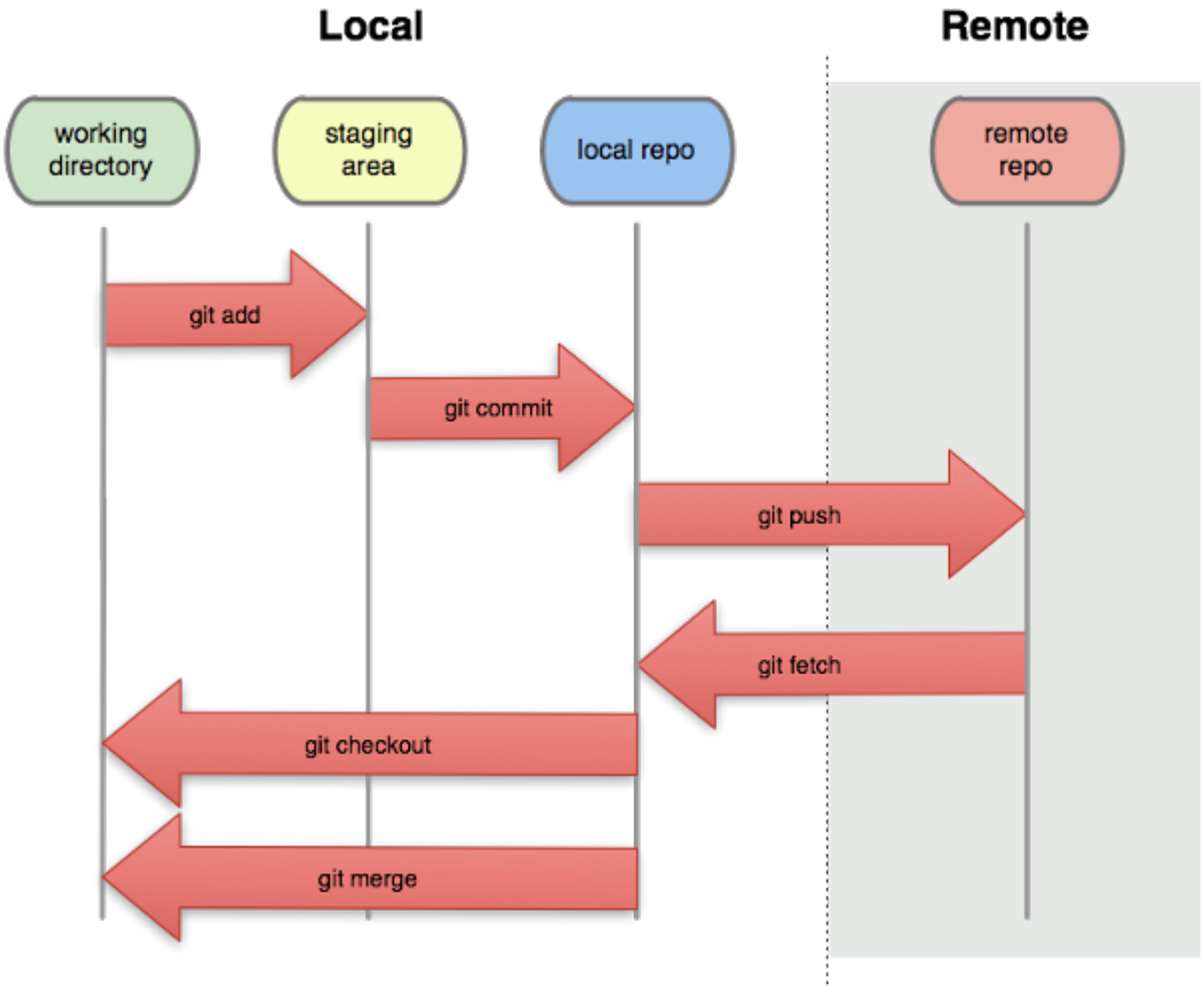
or, to add all changed/new files (careful, this might add undesired temporary files):

```
git add --all
```

For future reference: If you want to avoid adding temporary files (like LaTeX auxiliary files etc.), you can add a file `.gitignore` which tells git to *never* even propose to track these files. You can download an appropriate `.gitignore` file for whatever type of document you're working on at https://www.gitignore.io/

Your changes are now "staged"



(Image from Software Carpentry)

Committing

Changes aren't final until they're committed

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Checking the log

You can see the list of all recent commits (in reverse order) with the command

```
git log
```

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Warning:

If you just use `git commit` *without a message*, git will open a (commandline text) editor to **ask** you for a commit message. This editor might be strange to you, and you might not even know how to save or to exit! (Chances are the editor is `vim`, and to save and exit, you can press the `ESC` key, and then `ZZ`.)

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Amending a commit message

If you're unhappy with your last log message, you can change it using the command

```
git commit --amend
```

(This will open the editor with your previous log message.)

Commit messages

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(https://xkcd.com/1296)

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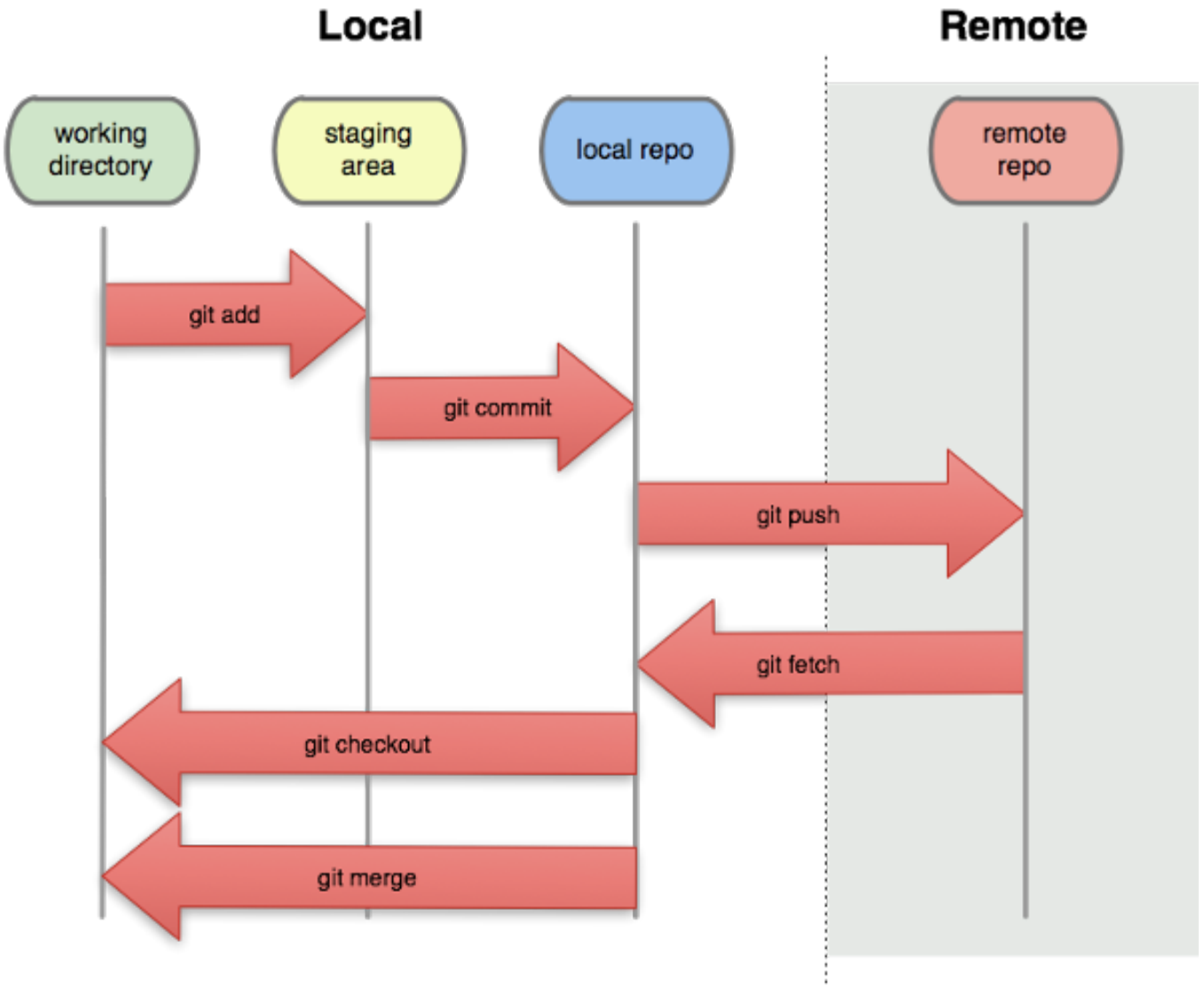
- Hang on, we do!

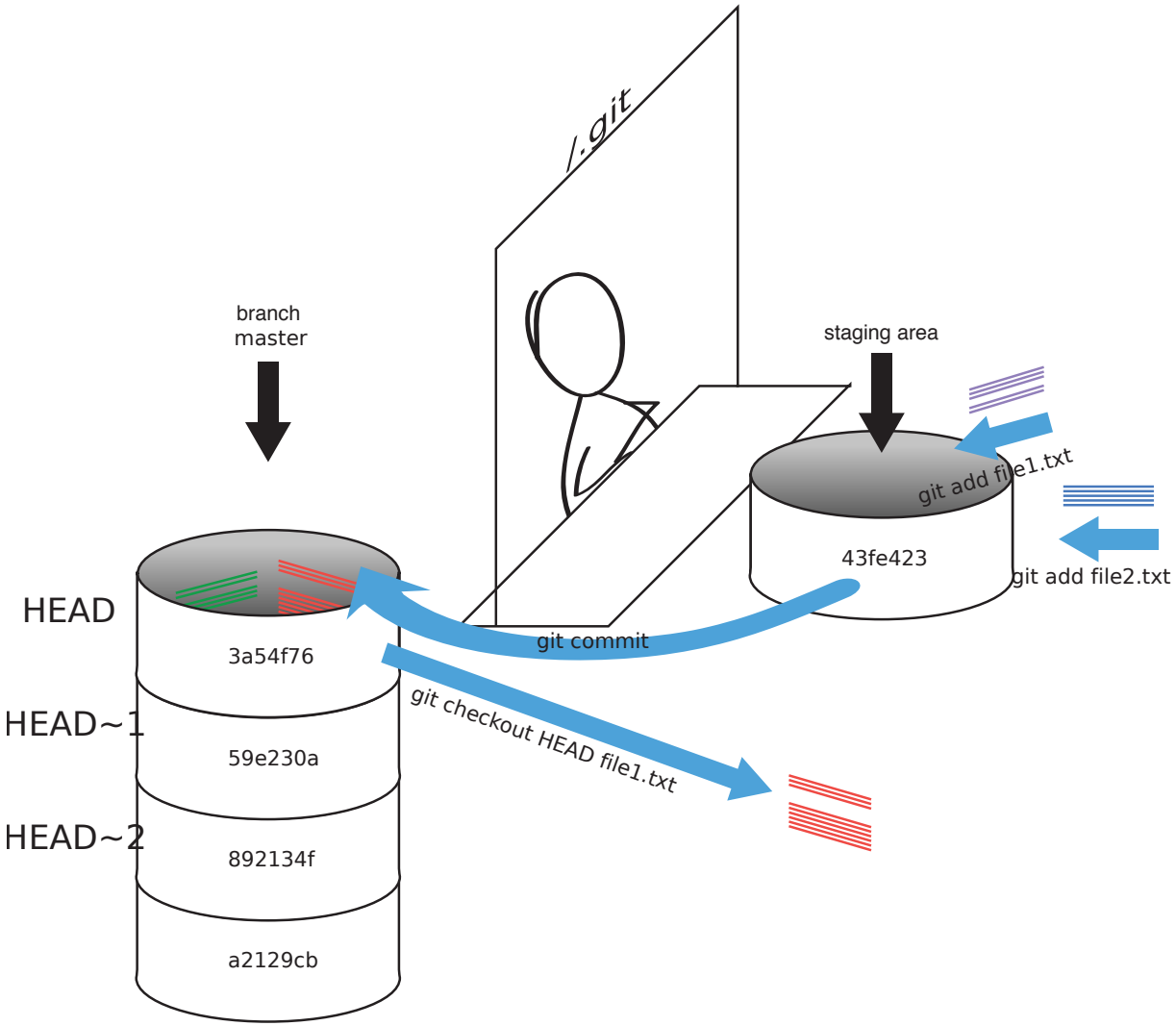
```
git diff
git checkout HEAD test.txt
```

What happened?



(Image from Software Carpentry)

Wait, what does HEAD refer to?



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There are several popular websites which offer **free** accounts and remote repository storage (public or private):

- GitHub: The "original", used by many open-source projects. Integrates very easily with Visual Studio Code (as both are owned by Microsoft).

Note: Free accounts on these services used to have varying limitations on the number of private repositories or collaborators - but these limitations have now (as of 2025) been removed.

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4. Verify the path of the remote:

   ```
   git remote -v
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Push (or "publish") your changes:

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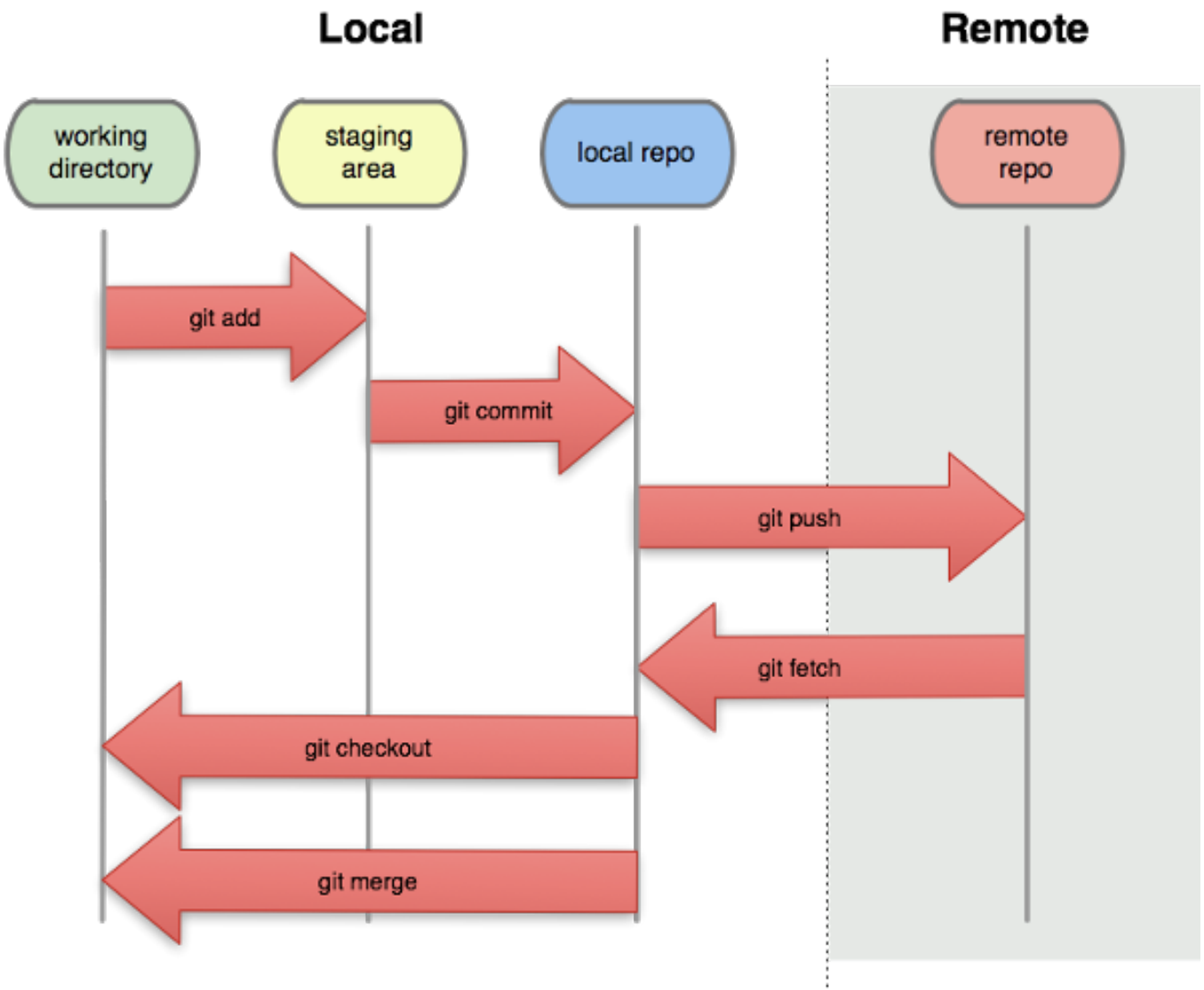
Technical detail: `git fetch` only checks the status of the remote, while `git pull` actually applies those changes in your working directory.

Overview



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- Important rule to remember: Always `git pull` before starting to edit your local files!

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If you want to base your work on something somebody else already has created, you can create a “fork” of their online repository. We’ll use a repository I created on Github as an example:

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- This new repository is yours to do with as you please, it is independent of the original source repository. (But it still remembers where it came from, more on that later.)

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Now let's get the files onto your own computer:

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  - Open a new window (if necessary)
  - Click on "Clone Git Repository"
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- This automatically connects your new local repo with the remote, so you can directly use `git push` and `git pull`.

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- This is the basic principle of how you can **contribute to an open-source project**!

Branches

- Any repository has a default "branch" in which all files are stored, usually called "main". This branch is usually reserved for the current most up-to-date, well-working production version (good example to keep in mind: the live files for a website, e.g. http://math.mychamplain.ca)

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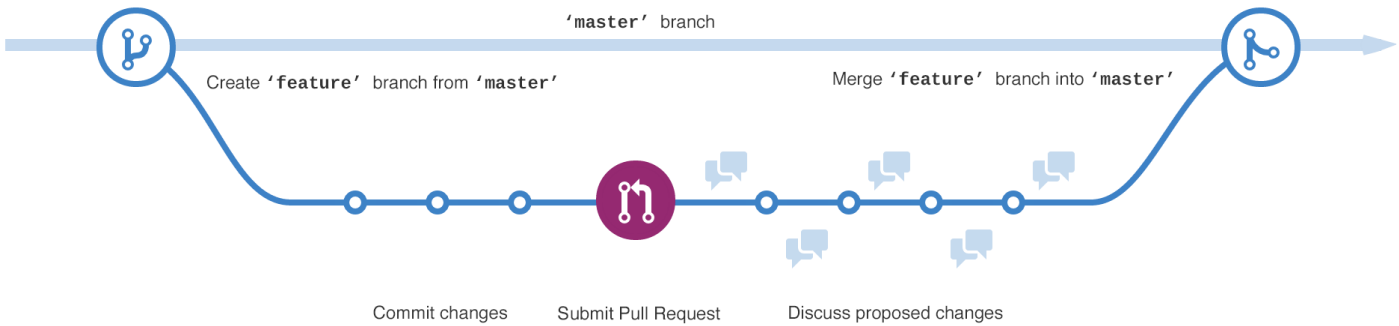
- But when working on new "features", it's usually not a good idea to immediately put those into the main branch!
- So, instead, you create a new branch (or fork!), work in there without danger of destroying anything for others, and finally ask for the changes to be **merged** into the main branch:



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Merge your changes into `main`

When you're satisfied with your work (and you pushed to the remote), it's time to "merge" it into the main branch. If you're the owner of both the original and the new branch, you can do this yourself, with the `git merge` command (or via the GUI in VSCode).

But if the original repository is owned by somebody else, you need to **create a "Pull Request"**, which is easiest done on the website, using "Contribute" - "Create Pull Request".

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- *Always* use `git pull` before you start editing. This pulls in any changes made by others (or yourself on another computer!) from the remote repository.

Using a graphical user interface (GUI) to git

Now that you're comfortable with the principles behind git, you are ready to do everything with a few clicks (instead of typing `git add`, `git commit`, etc. all the time)!

In Visual Studio Code

Click the  button (usually the third on the left):

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