Git & Github

A Gerad Tutorial

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with help from
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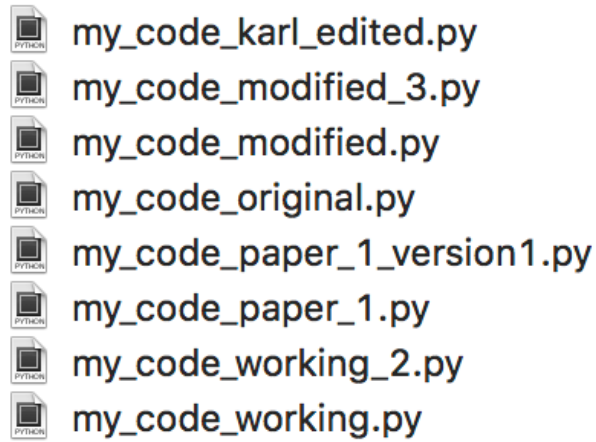
Motivation

Problem setting



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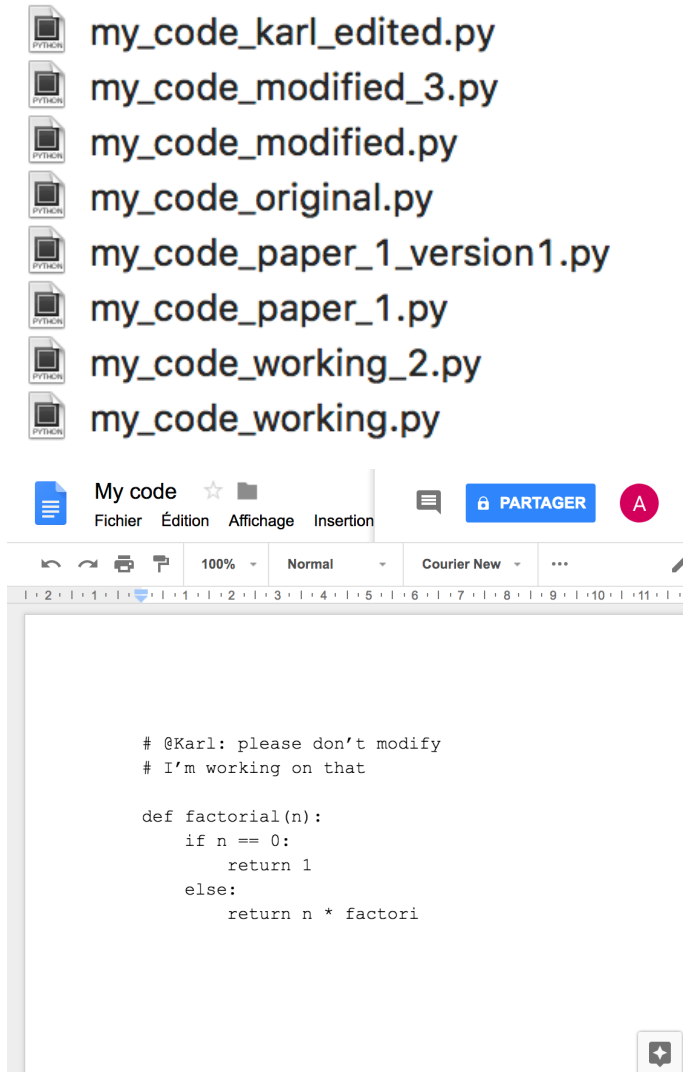
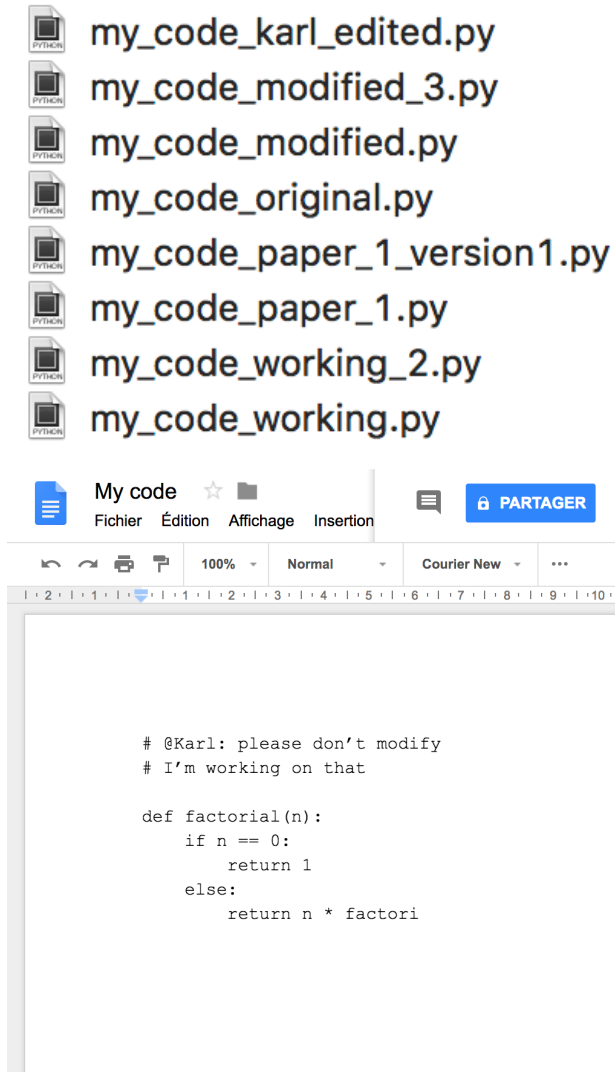


Problem setting

- Organize
- Collaborate
- Back-up
- Publish

For code!



Git

Manage code history, versions, and collaborate on projects !

- Version control system
- Free & open source
- Powerful! Used by most software developers on the most complex projects.
- Yet easy(ish) to use for simpler projects

Git

Plenty of (great) resources!

- Git website (doc, tools, community)
- Cheat-sheet from Github
- Visualization of commands and states (ndpsoftware)
- Try Git: Interactive commands
- Atlassian Tutorial
- And so many more!

Github

“  ShareLaTeX = LaTeX +  ”

Except that git softwares know how to talk to each other.

Github

“

ShareLaTeX = LaTeX +

”

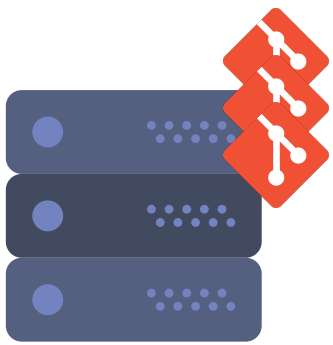
GitHub =

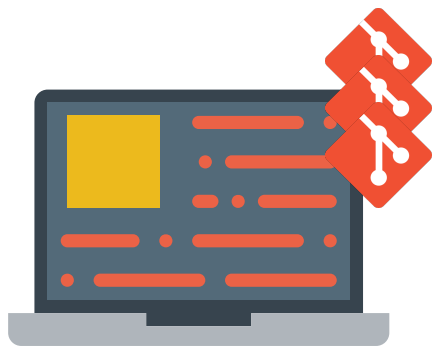
git +

Except that git softwares know how to talk to each other.

Big picture

- Multiple repository on one computer
- Repo on same machine are not related
- One repo per project





Project Management

Git commands

```
$ git <command>
```

```
$ git <command> -h
```

The help on the command.

Create a new empty local repository

```
$ git init
Initialized empty Git repository in ...
```

One folder (with subfolders) $\leftrightarrow$ one git repository.

Create a new empty local repository

```
$ git init
Initialized empty Git repository in ...
```

One folder (with subfolders) $\leftrightarrow$ one git repository.

```
$ ls -a
.      ..     .git
```

All the repository info are stored in the .git folder. Delete this folder to the repository (but not the files).

Repository status

```
$ git status
On branch master

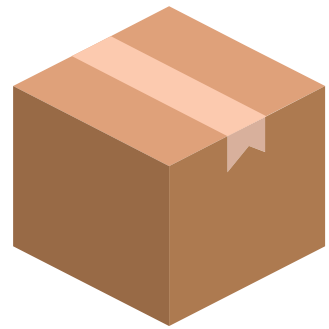
No commits yet

nothing to commit (create/copy files and use
    "git add" to track)
```

Very verbose, use often (and read the output) !

The commit

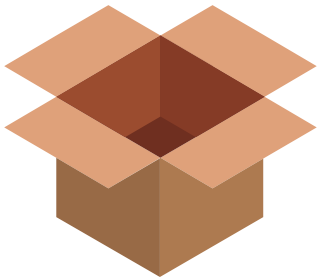
- Smallest modification in the project,
- Checkpoint in your project,
- Save the current changes to the tracked[1] files
- Always possible to come back to a commit (immutable[2])!



[1] Not all files are tracked by git.

[2] Possible to mutate history but you need to want it.

The staging area



- The staging area is the place we put changes,
- The only point is to make a commit,
- Sealing the box is making a commit.

staging area commands

```
$ git add
```

```
$ git rm
```

```
$ git mv
```

staging area commands

```
$ git add
```

```
$ git rm
```

```
$ git mv
```

```
$ git status
```

Again, use this one, a lot.

Actually making a commit

```
$ git commit
```

```
$ git commit -m "A useful descritption"
```

Actually making a commit

```
$ git commit
```

```
$ git commit -m "A useful descritption"
```

- All commit must have a description
- Choose appropriately
- All commit have a unique hash (identifier)

Commit names

Interacting with history

```
$ git log
```

Show branch history

Atlassian tutorial - Advanced git log

Atlassian tutorial - git diff

Interacting with history

```
$ git log
```

Show branch history

```
$ git diff
```

Show difference between commits / current modifications.

Atlassian tutorial - Advanced git log

Atlassian tutorial - git diff

[Advanced] Rollbacks

```
$ git checkout <sha>
```

Go to specific commit - Enter detached HEAD state

[Advanced] Rollbacks

```
$ git checkout <sha>
```

Go to specific commit - Enter detached HEAD state

```
$ git revert <sha>
```

Make a commit that undoes another one.

[Advanced] Rollbacks

```
$ git checkout <sha>
```

Go to specific commit - Enter detached HEAD state

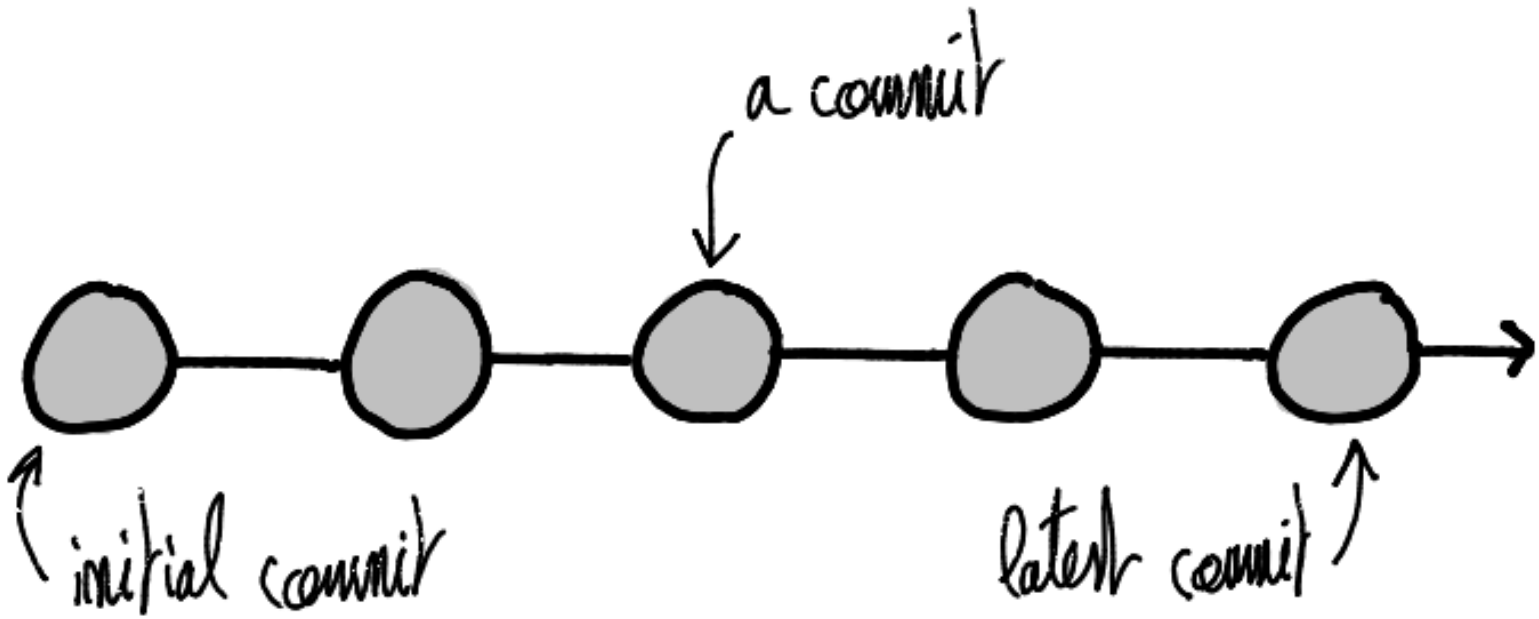
```
$ git revert <sha>
```

Make a commit that undoes another one.

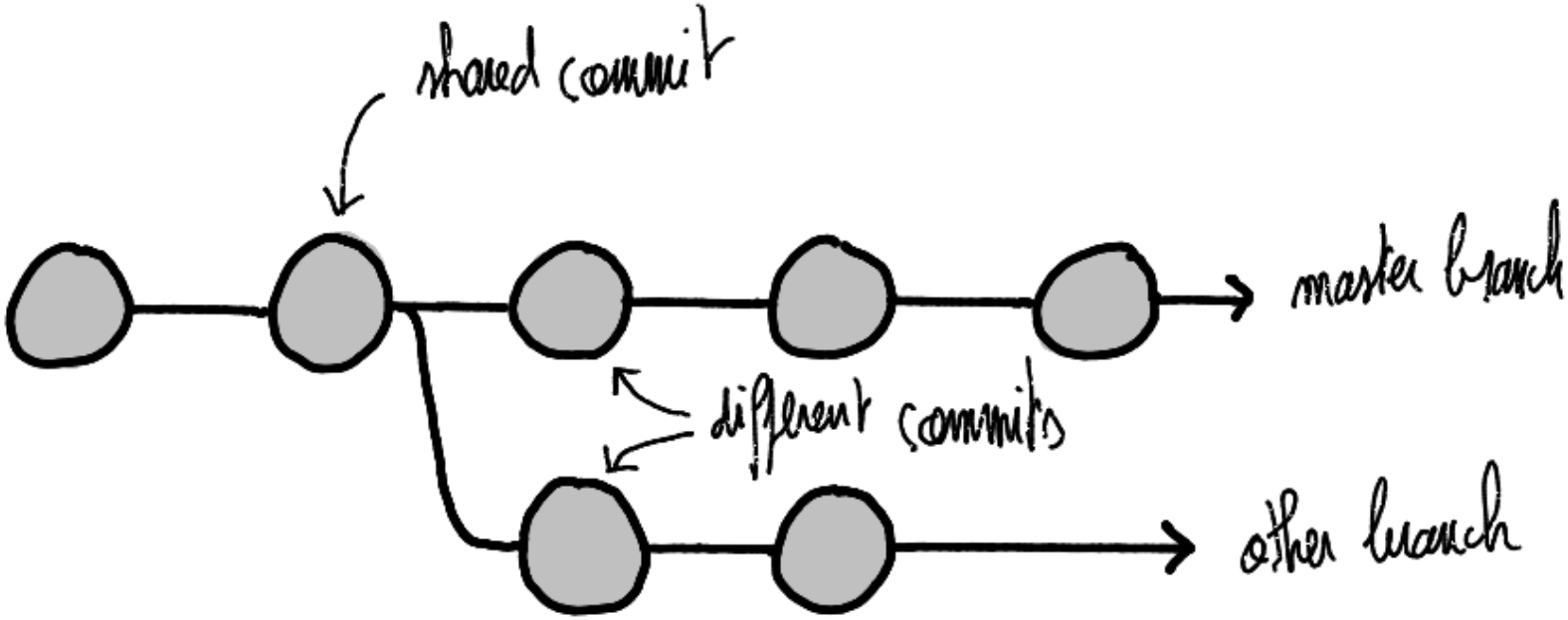
```
$ git reset
```

Multiple usages: unstage, rewrite history

Branch representation



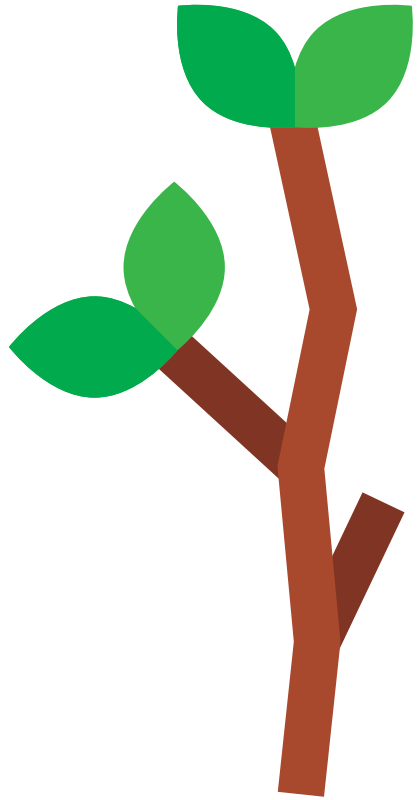
Branches


shared commit
master branch
different commits
other branch

Branches

```
$ git branch
```

List branch



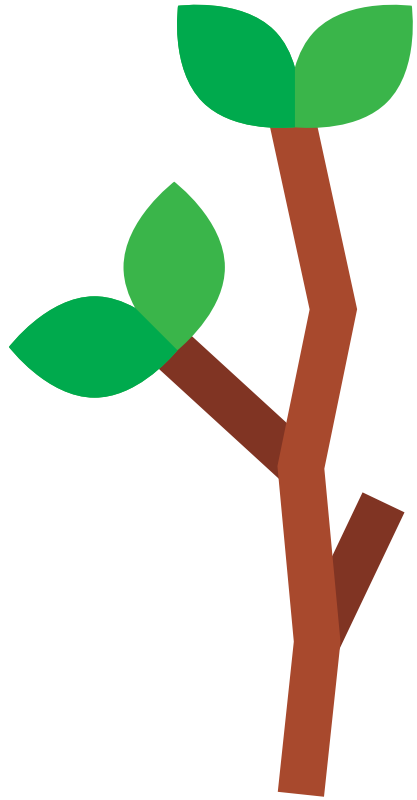
Branches

```
$ git branch
```

List branch

```
$ git branch <name>
```

Create new branch



Branches

```
$ git branch
```

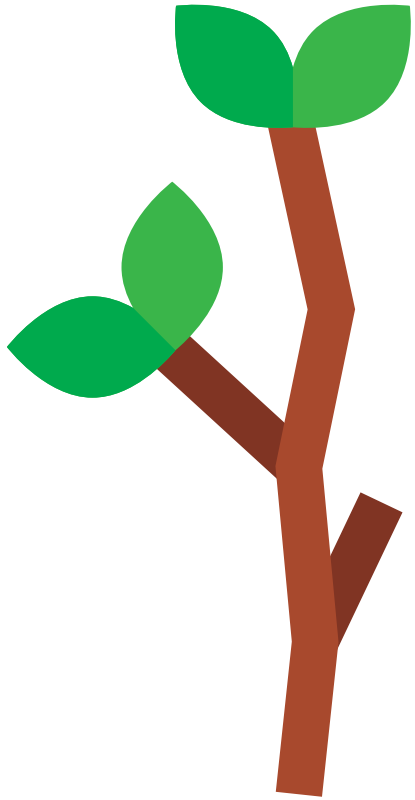
List branch

```
$ git branch <name>
```

Create new branch

```
$ git branch -d <name>
```

Delete branch



Branches

- You are on one branch at a time;
- The commit you make are appended to the current branch;
- You must not have uncommited changes to be able to change branch.

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```
$ git checkout <name>
```

Change branch

Branches

- You are on one branch at a time;
- The commit you make are appended to the current branch;
- You must not have uncommited changes to be able to change branch.

```
$ git checkout <name>
```

Change branch

```
$ git checkout -b <name>
```

Create new branch and change to the created branch.

[Advanced] Stashing

- If you don't want to commit changes, you can tell git to put them aside (called stashing);
- You can retrieve them later in the same branch or another one;
- You can stack up stashes (like branches).

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```
$ git stash
```

Put uncommited changes aside

[Advanced] Stashing

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```
$ git stash
```

Put uncommited changes aside

```
$ git stash pop
```

```
$ git stash apply
```

Retrieve the stashed changes

Merging branches

```
$ git merge <other_branch>
```

Merge other branch into current branch

Merging branches

```
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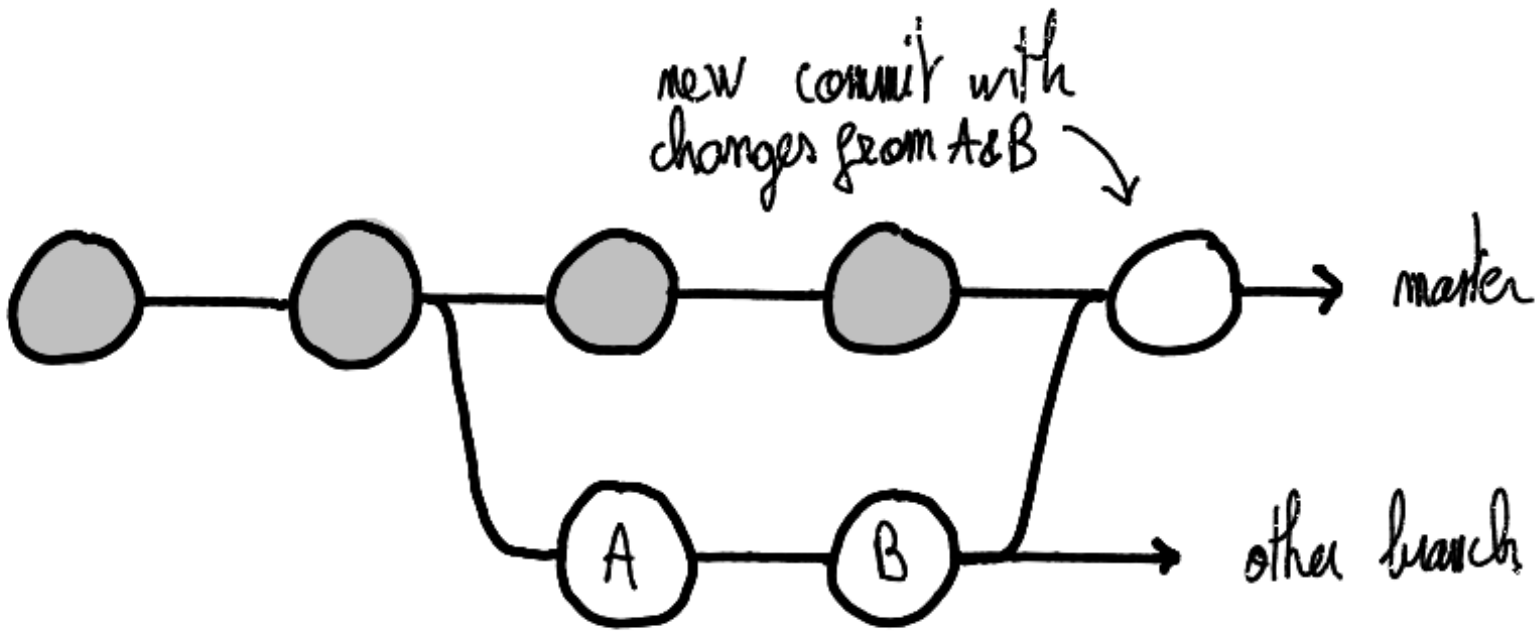
Merge other branch into current branch



Rebasing branches

```
$ git rebase <other_branch>
```

Rebase other branch into current branch

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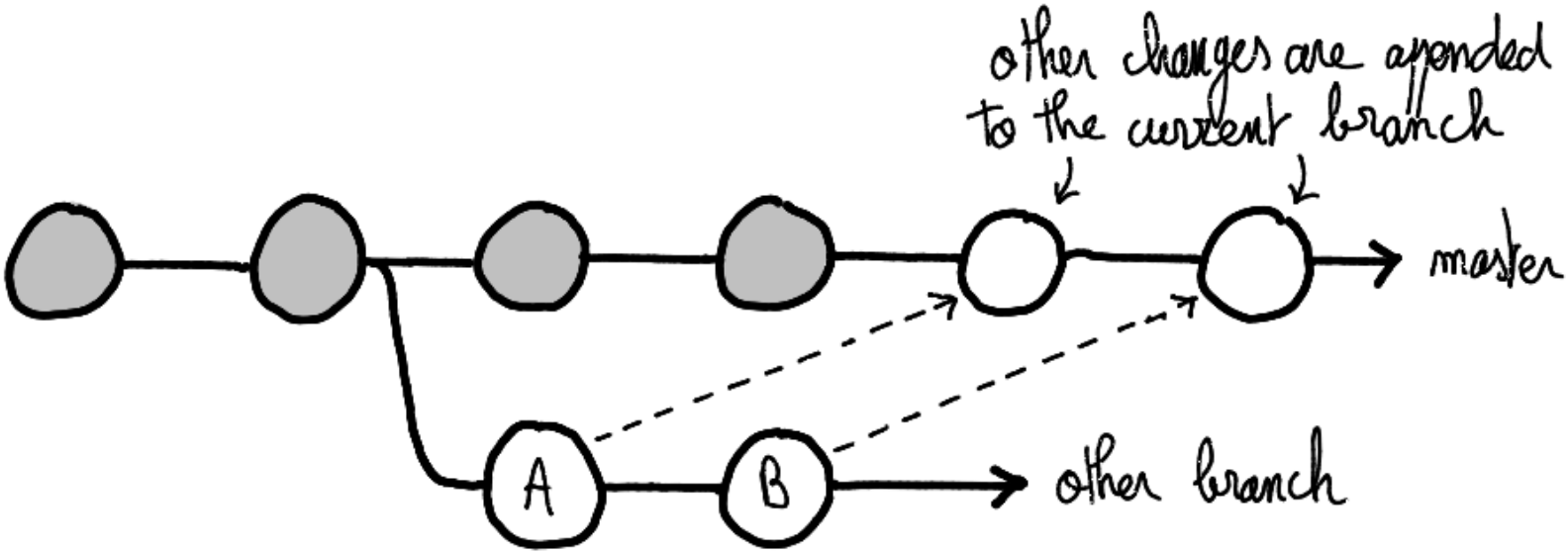
Rebase other branch into current branch



Conflicts

```
$ git merge <other_branch>
Auto-merging my_file.py
CONFLICT (content): Merge conflict in
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Automatic merge failed; fix conflicts and
    then commit the result.
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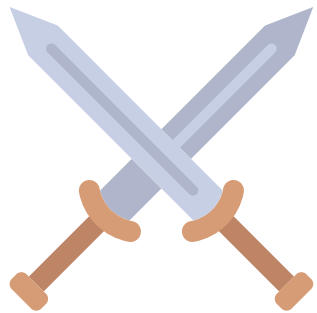
```

If the same line has been modified in the two branches, we cannot merge automatically. We enter **conflict resolution mode**.



Conflicts

```
if __name__ == "__main__":
<<<<<<< HEAD
  print("Bonjour le monde !")
=======
  print("Hello World!")
>>>>>>> other_branch
```

We need to choose the modification we want to keep

Conflicts

```
$ git add
```

Add the change (mark the conflict as resolved)

Conflicts

```
$ git add
```

Add the change (mark the conflict as resolved)

```
$ git merge --continue
```

Continue merging process

Conflicts

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$ git add
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Add the change (mark the conflict as resolved)

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$ git merge --continue
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Continue merging process

Trust git and git status to lead you through this process

Confused much?

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  When the purpose of the branch is accomplished.

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- Best: *branch and merge*.

Confused much?

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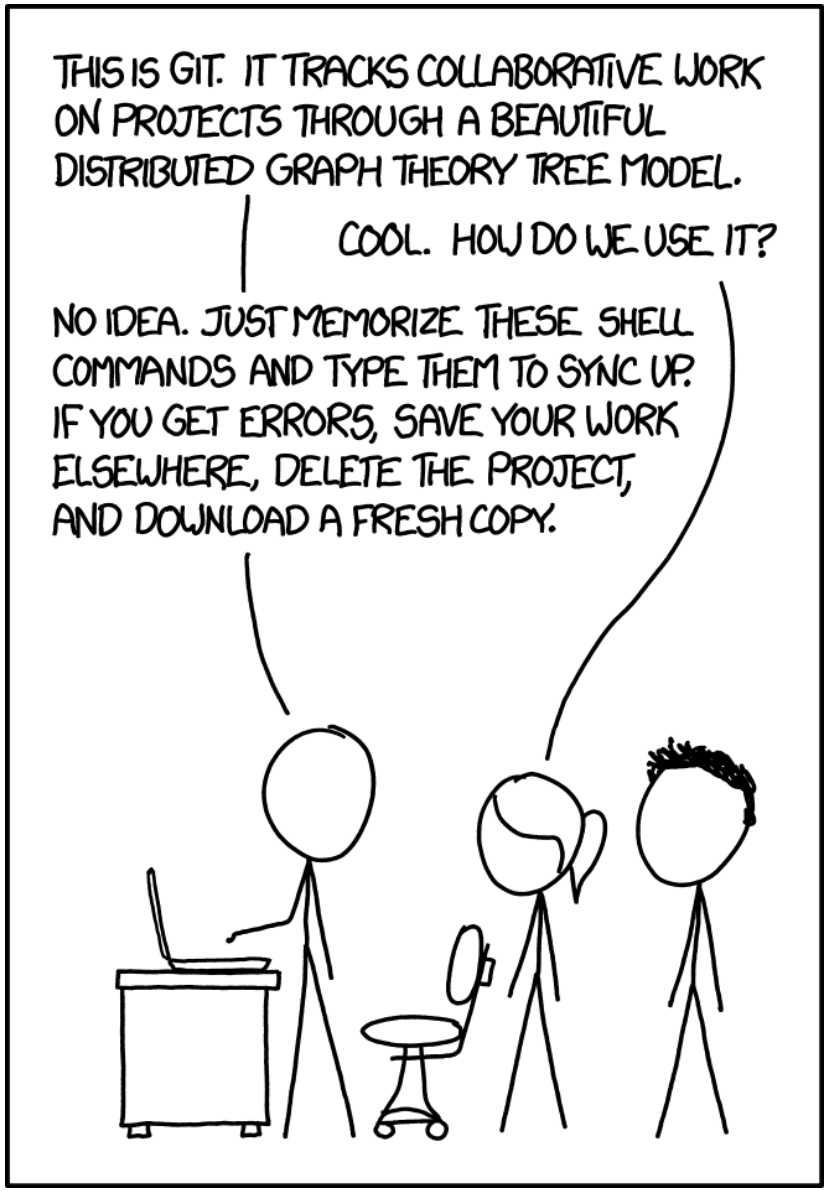
  When you're gonna break everything, or for horizontal work.
- *When do I merge branches?*
  When the purpose of the branch is accomplished.
- Best: *branch and merge*.
- Branch management (and merge vs rebase) is a long and complex discussion.

Recap

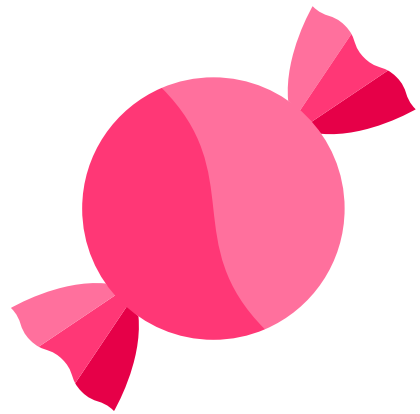


XKCD 1597

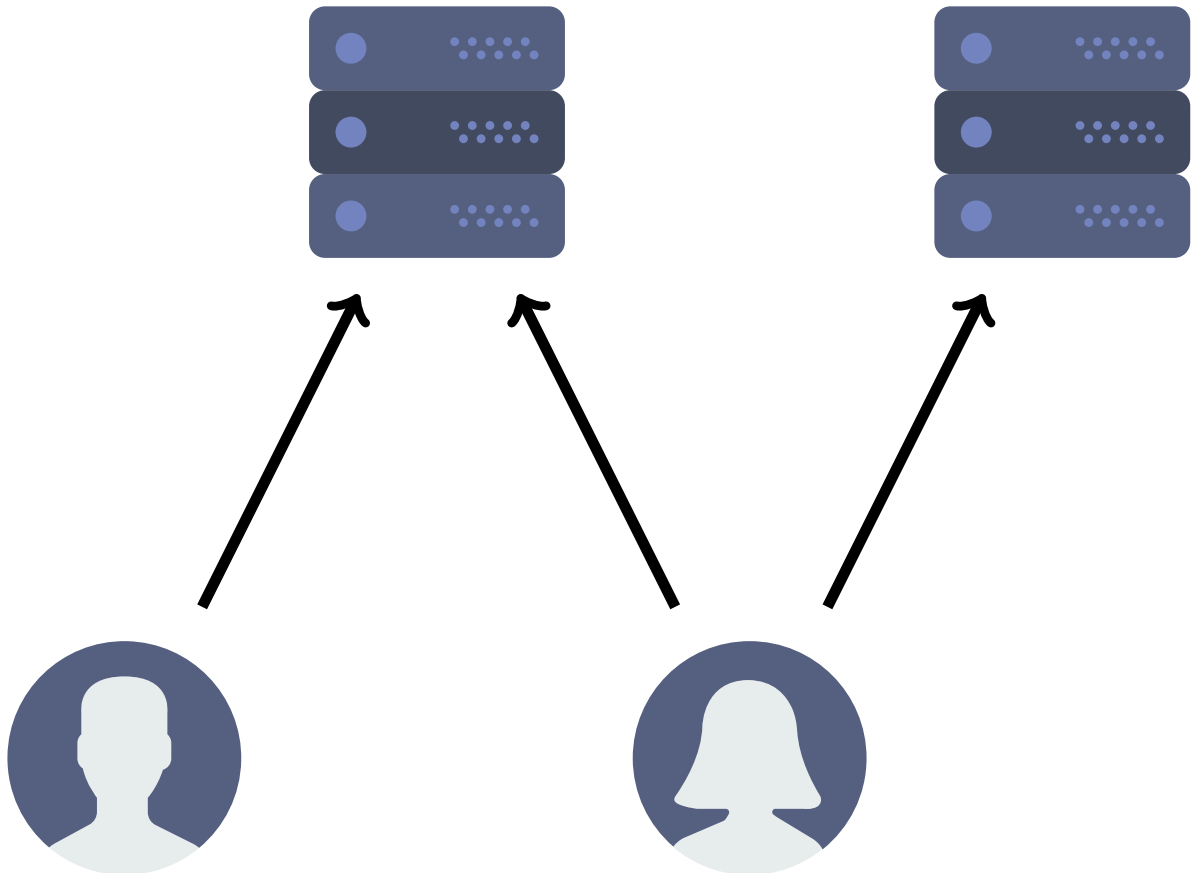
Collaboration

The idea

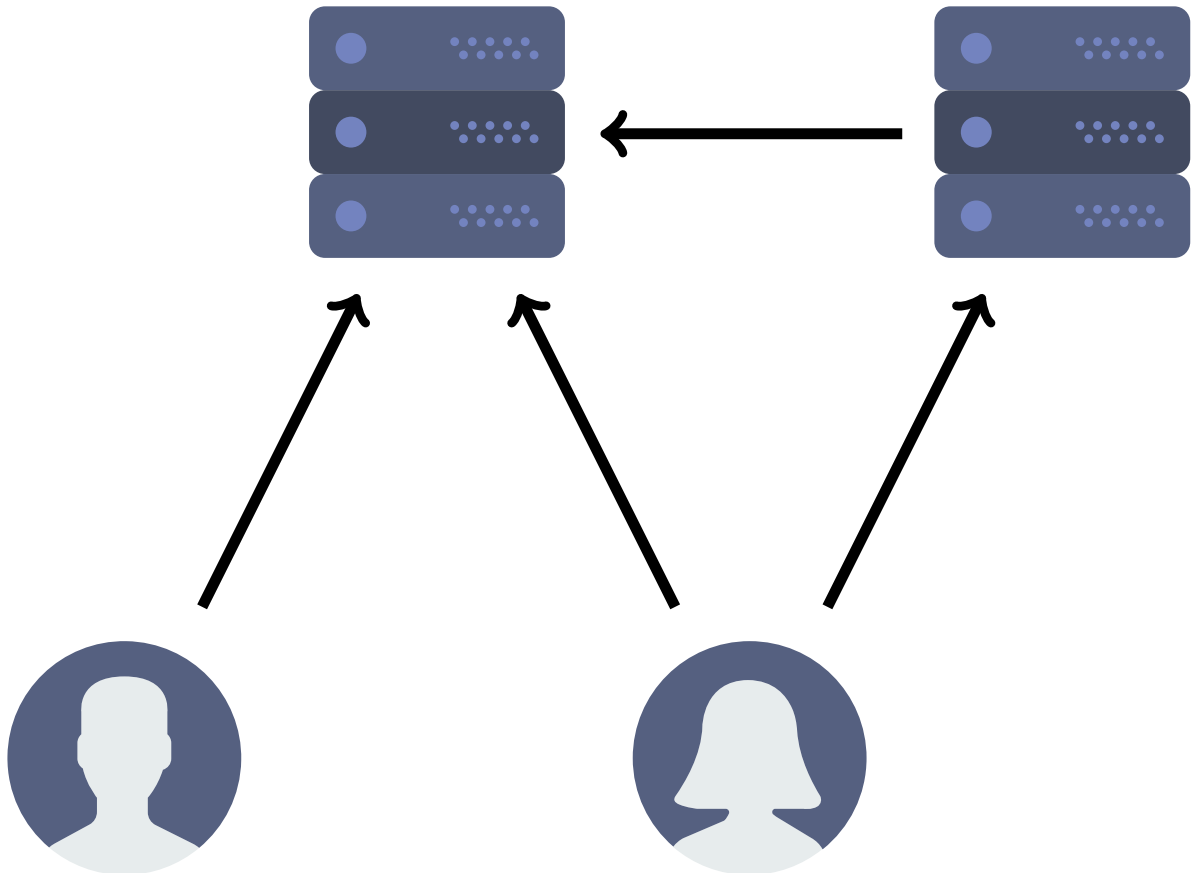
- Collaboration is just making interaction between branches on different repository;
- With syntaxic sugar.



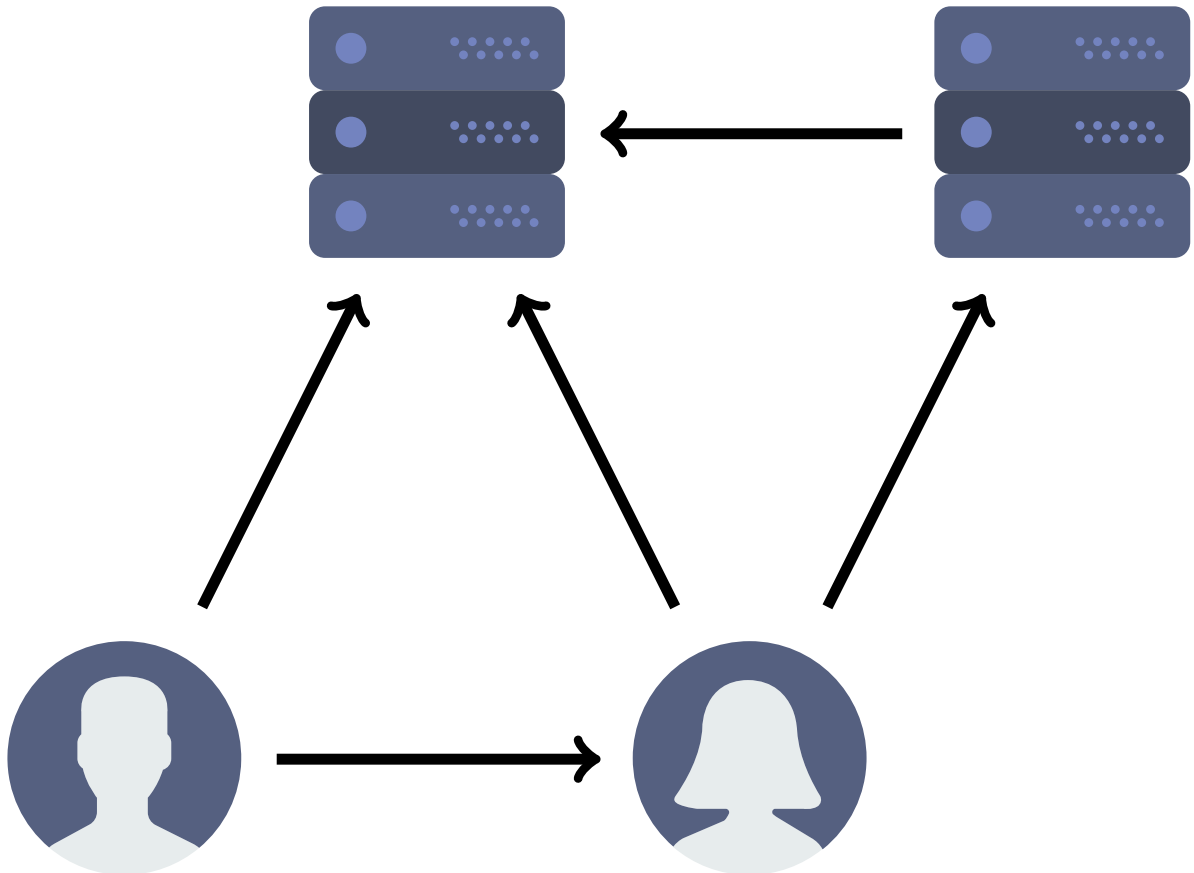
Remotes



Remotes

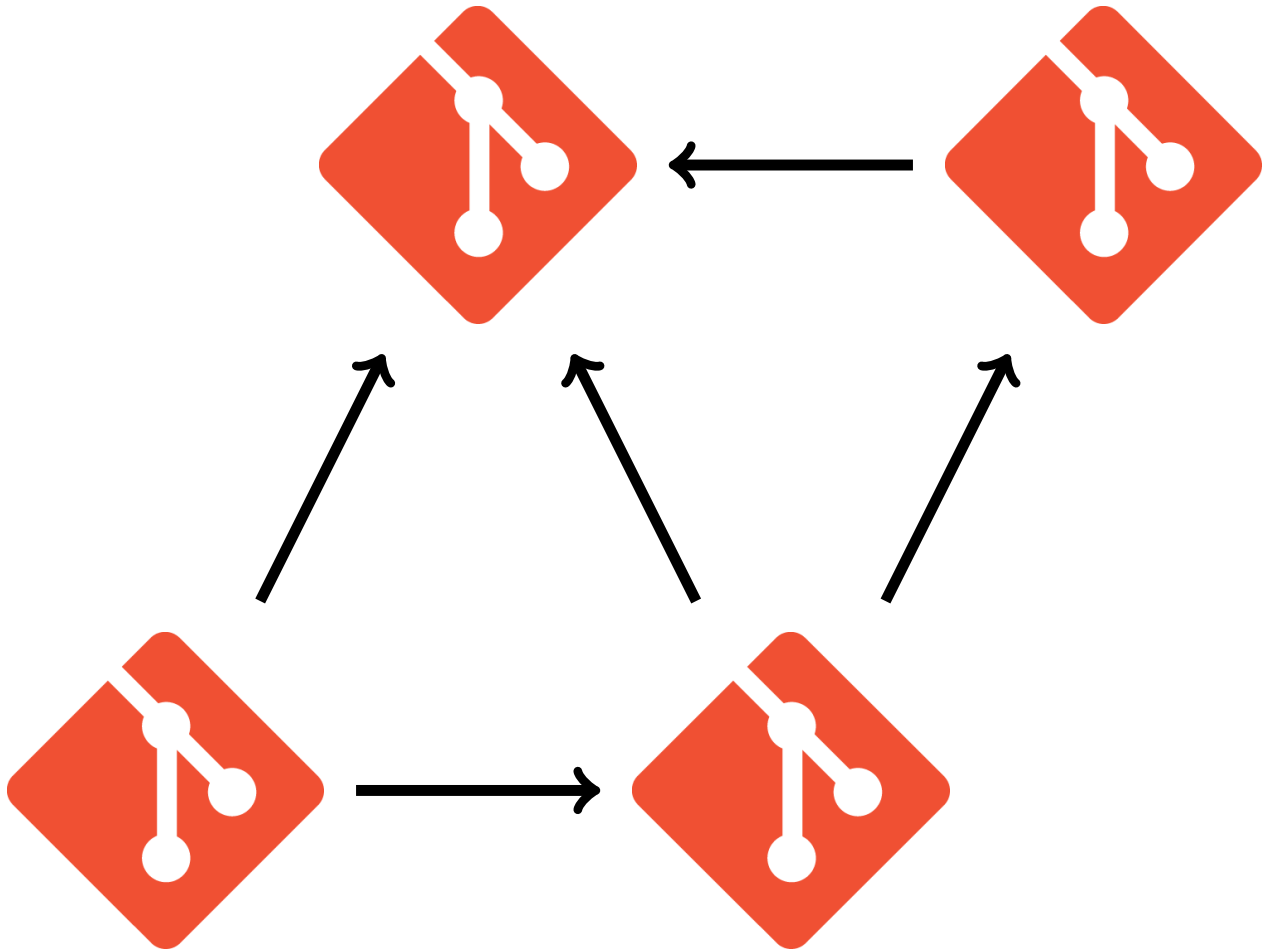


Remotes



In practice you cannot do user to user because we don't know the users computer's adress.

Remotes



Remote commands

```
$ git remote -v
```

Show remotes (verbose)

- Remotes are other git repository[1];
- You can get (fetch) or send (push) commits to the remote.

[1] Actually aliases for repository URL.

Remote branches

- More precisely, we can track specific branches;
- The idea is to have the "*same*" branch locally and on remote.

```
$ git branch -a -vv
```

Show all branches, verbose mode

```
$ git remote show <remote>
```

Information on the remote

[1] Actually aliases for repository URL.

Clone

```
$ git clone <url>
```

Show all branches, verbose mode

- Create a new repository by copying all information;
- Define the remote;
- Set the local branches to track the remote ones.
- **This is what you use in practice**

Getting remote changes

```
$ git fetch
```

Download remote commits
(not merged in your branch yet so harmless command)

+

```
$ git merge <remote>/<branch>
```

Merge remote commits in current branch

=

```
$ git pull
```

Download and merge (use this one in practice)

Better to use git fetch + git rebase –rebase if you are more than one on the same branch.

Pushing local changes

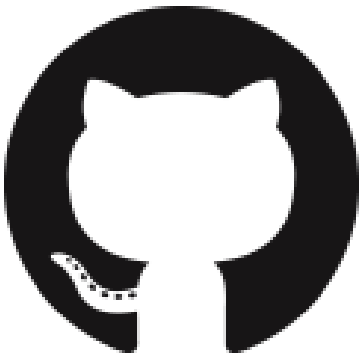
```
$ git push
```

Push your local commits to the remote(s).

- You cannot merge in remote repository from a local repository;
- Hence, to push commits you need to be up to date

Github

Overview



- Github is an online site to host git repository;
- Because your computer is not a dedicated server, people use a remote server to be the immutable reference for the project.

Being social

- A dramatic amount of open source project are hosted on Github;
- You can follow people, trends, and project;
- You can use Github to publish your code;
- People sometime use it when they just want to put something online (renders pdf, markdown and jupyter-notebooks);
- Free static website hosting via Github Pages

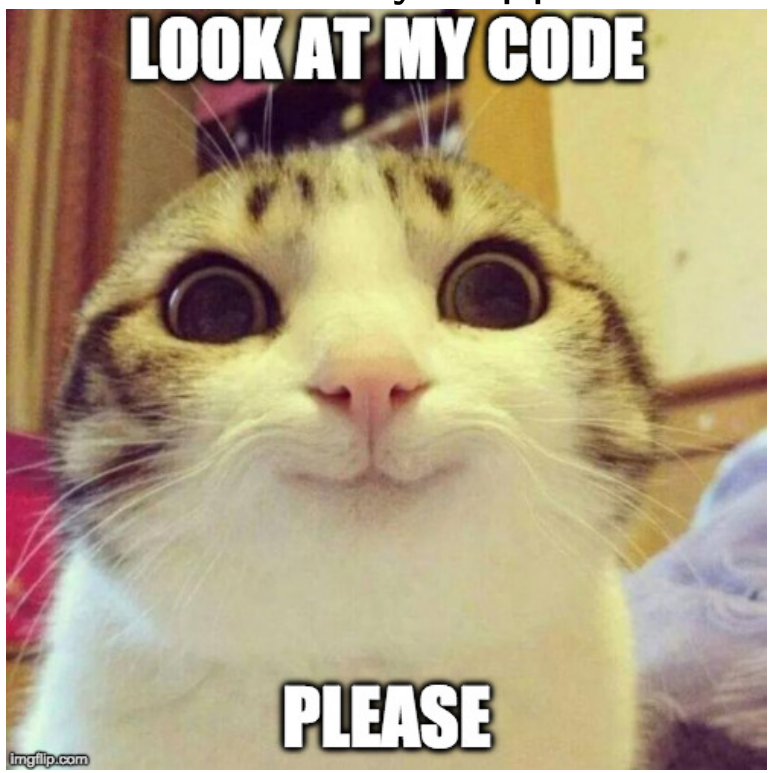
Photo by Thought Catalog on Unsplash.

Public code

- People cannot modify it without your permission;
- Free private repos for student (Student pack)

What I thought would happened

What really happens

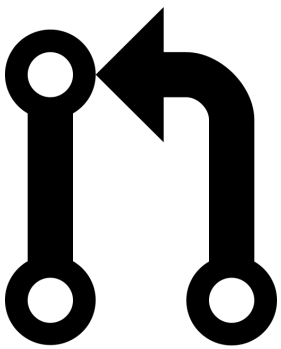


Powerful integrations

- Large ecosystem of Github App (Marketplace)
  From continuous integration to testing, and so on.
- Team and project management.

Photo by NeONBRAND on Unsplash.

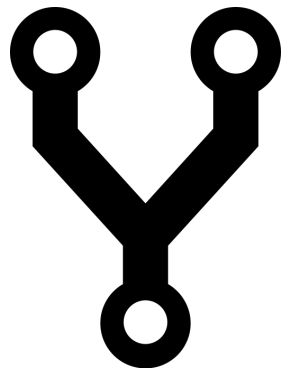
The pull request



- Merge a branch into the master on Github (on the remote repository);
- Gives an interface to comment, run test, and decide before merging;
- Best practice to control the contributions

[Advanced] Forks

- Copy another Github public repository (from anybody) to make a new one;
- Two fetch remote & one push remote;
- Possibility to make a pull request from forked to original.



[Advanced] Github authentication

You need to authenticate into Github in order to be able to push (pull).

- **Easy** set up credentials using Github Desktop
- **Moderate** Cache your password for git (how to)
- **Advanced** Set up SSH authentication (how to)

Other

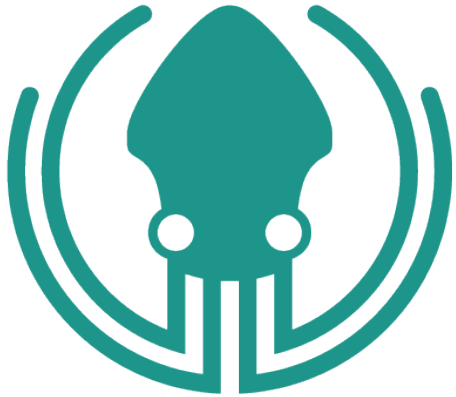
Other online provider

And more

Graphical interfaces

Github Desktop

- Free
- Simple



Git Kraken

- Free and paying options
- Advanced

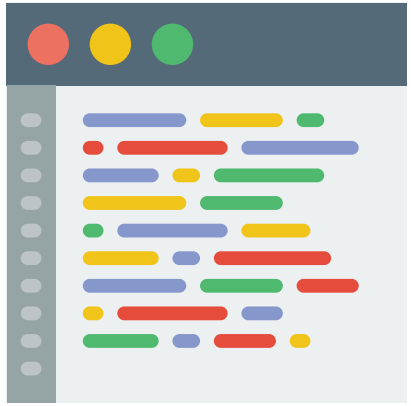
Tower

- Paying
- Advanced

More here

Text editor compatibility

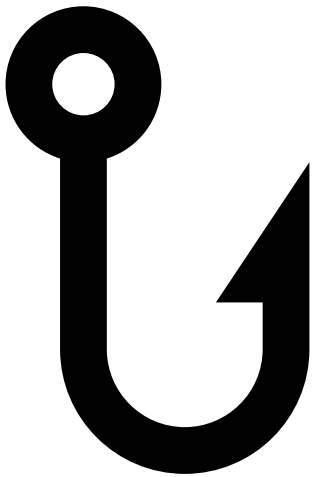
- All decent editor/ IDE should have git compatibility;
- Able to pass git commands;
- Show modified files and lines.



Clean Master

- Think of the master branch as the last version of your project;
- It's the version you want people to see / use

[Advanced] Git Hooks



- Have a action (script) execute whenever you commit / merge;
- Not specific to Github, builtin in git.

Bad practices

- **Do not commit** passwords, encryption keys (AWS for instance);
- **Do not commit** anything that is private (even on private repos);
- **Do not commit** large files
  Commit a very small sample[1] if needed or consider Git Large File Storage;
- **Do not commit** machine generated files, such as binaries.

[1] Make sure you comply with sharing policies if applicable.

.gitignore file

- Project file to tell git which files (file type) not to track;
- Exists for every language (you can add it when you create a repo on Github);
- E.g. for Python, avoids commiting *.pyc, __pycache__, ...
- All available here

Git config

```
$ git config
```

- A number of configurations (commit username)
- Exists at different level: repo, global

Command line stuff

- PS1: show current repository information in you prompt (git-prompt.sh)
- Shell completion: allow to have completion (when hitting tab) for the git sub commands, branches, tracked objects... (choose you shell at git completion)

Attributions

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