

Git & Github

A Gérad Tutorial

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with help from

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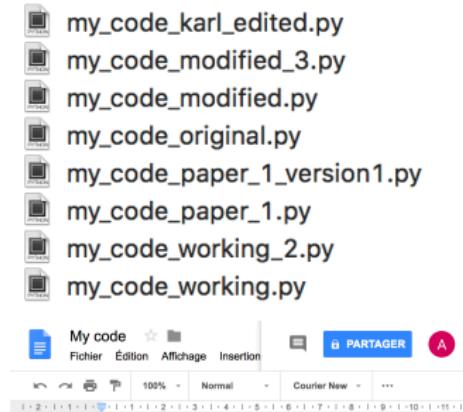
17th of May 2018

Motivation

Problem setting

-  my_code_karl_edited.py
-  my_code_modified_3.py
-  my_code_modified.py
-  my_code_original.py
-  my_code_paper_1_version1.py
-  my_code_paper_1.py
-  my_code_working_2.py
-  my_code_working.py

Problem setting



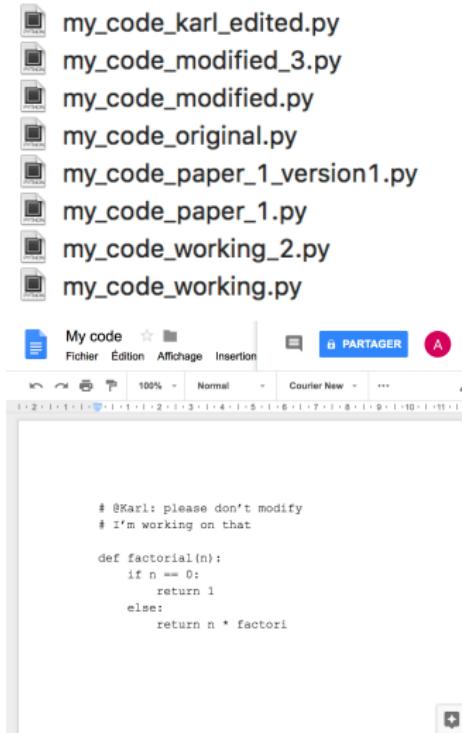
```
# @Karl: please don't modify
# I'm working on that

def factorial(n):
    if n == 0:
        return 1
    else:
        return n * factori
```

Problem setting

- ▶ Organize
- ▶ Collaborate
- ▶ Back-up
- ▶ Publish

For code!



The image shows a file explorer on the left with several Python files listed:

- my_code_karl_edited.py
- my_code_modified_3.py
- my_code_modified.py
- my_code_original.py
- my_code_paper_1_version1.py
- my_code_paper_1.py
- my_code_working_2.py
- my_code_working.py

Below the file explorer is a code editor window titled "My code". The code in the editor is:

```
# @Karl: please don't modify
# I'm working on that

def factorial(n):
    if n == 0:
        return 1
    else:
        return n * factori
```

The code editor has a toolbar with icons for file operations, zoom, and font selection. A status bar at the bottom shows "100% Normal Courier New".

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!

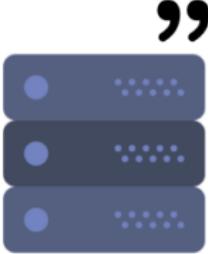
- ▶ [Git website](#) (doc, tools, community)
- ▶ [Cheat-sheet from Github](#)
- ▶ [Visualization of commands and states](#) (ndpsoftware)
- ▶ [Try Git: Interactive commands](#)
- ▶ [Atlassian Tutorial](#)
- ▶ And so many more!

“



ShareLaTeX

= LATEX +



“



ShareLaTeX

= LATEX +



GitHub

= git +



Big picture

- ▶ A repository is a project (*i.e.* folder)
- ▶ 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).

Git works on the side, you can work in your folder as usual.

Repository status

```
$ git status
On branch master

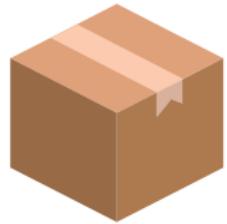
No commits yet

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

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

The commit

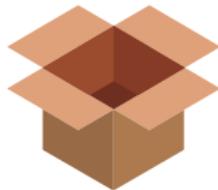
- ▶ Smallest modification in the project,
- ▶ A checkpoint and/or a set of changes,
- ▶ Save the current changes to the tracked¹ files
- ▶ Always possible to come back to a commit
(immutable²)!



¹Not all files are tracked by git.

²Possible 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 description"
```

Actually making a commit

```
$ git commit
```

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

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

Commit names

	COMMENT	DATE
O	CREATED MAIN LOOP & TIMING CONTROL	14 HOURS AGO
O	ENABLED CONFIG FILE PARSING	9 HOURS AGO
O	MISC BUGFIXES	5 HOURS AGO
O	CODE ADDITIONS/EDITS	4 HOURS AGO
O	MORE CODE	4 HOURS AGO
O	HERE HAVE CODE.	4 HOURS AGO
O	AAAAAAA	3 HOURS AGO
O	ADKFJSLKDFJ5DKLFJ	3 HOURS AGO
O	MY HANDS ARE TYPING WORDS	2 HOURS AGO
O	HAAAAAAAAANDS	2 HOURS AGO

AS A PROJECT DRAGS ON, MY GIT COMMIT MESSAGES GET LESS AND LESS INFORMATIVE.

Interacting with history

```
$ git log
```



Show branch history

Interacting with history

```
$ git log
```



Show branch history

```
$ git diff
```

Show difference between commits / current modifications.

[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

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Go to specific commit - Enter detached HEAD state

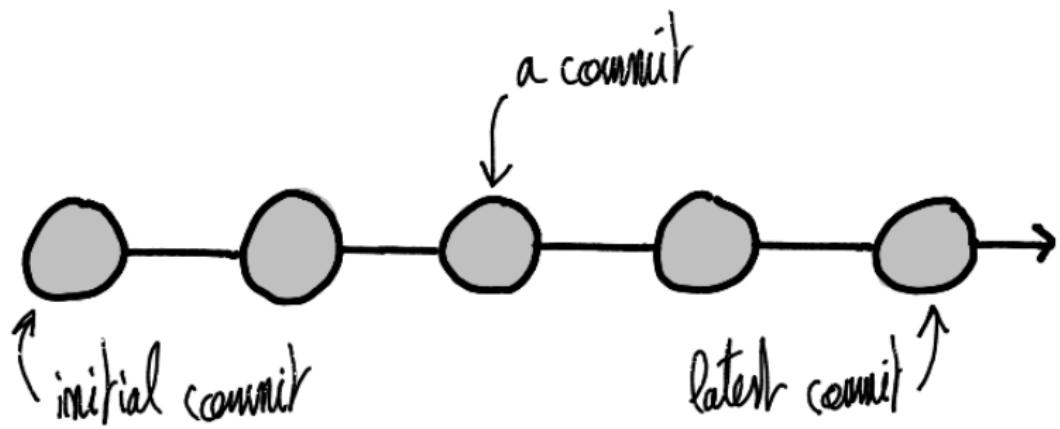
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Make a commit that undoes another one.

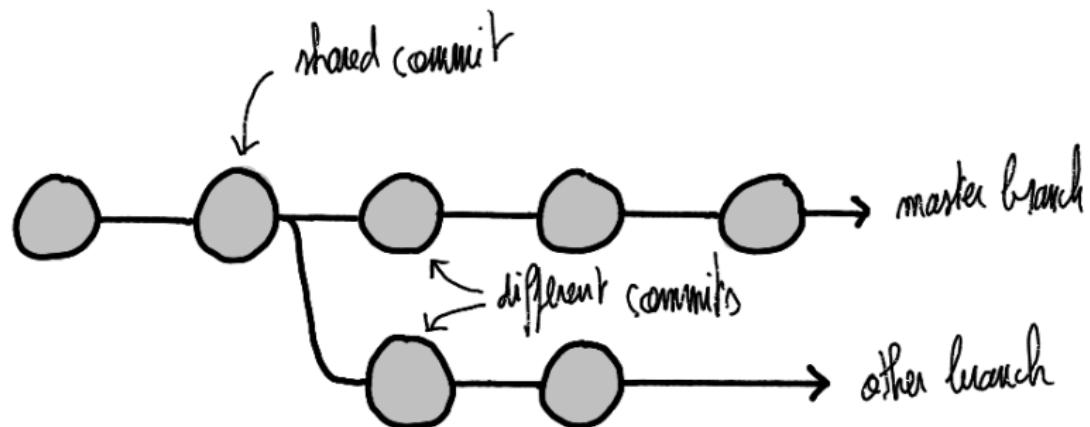
```
$ git reset
```

Multiple usages: unstage, rewrite history

Branch representation



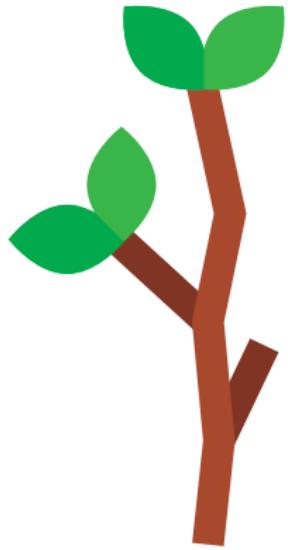
Branches



Branches

```
$ git branch
```

List branch



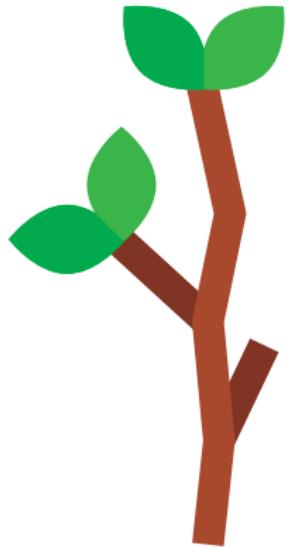
Branches

```
$ 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 uncommitted changes to be able to change branch;
- ▶ All branch (merge and rebase) commands are **relative to the current branch**.

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

Change branch

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- ▶ All branch (merge and rebase) commands are **relative to the current 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).

[Advanced] Stashing

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```
$ git stash
```

Put uncommitted changes aside

[Advanced] Stashing

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```
$ git stash
```

Put uncommitted changes aside

```
$ git stash pop
```

```
$ git stash apply
```

Retrieve the stashed changes

Merging branches

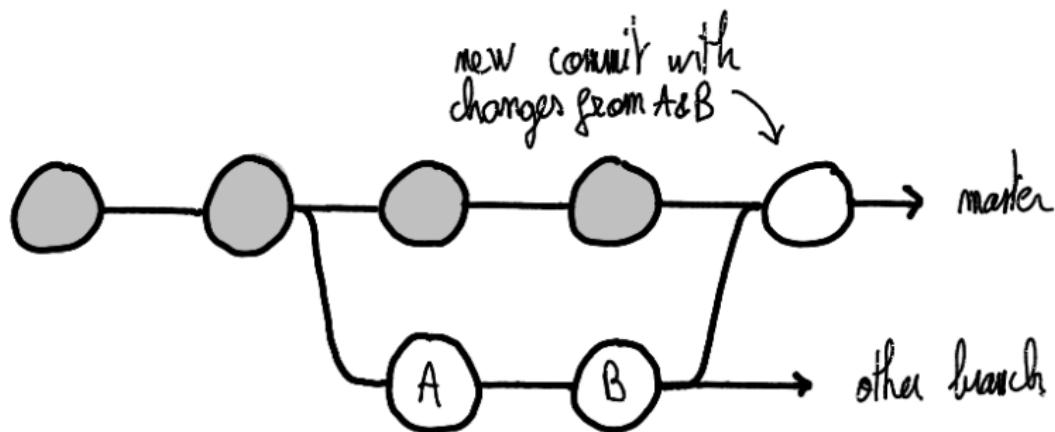
```
$ git merge <other_branch>
```

Merge other branch into current branch

Merging branches

```
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Rebasing branches

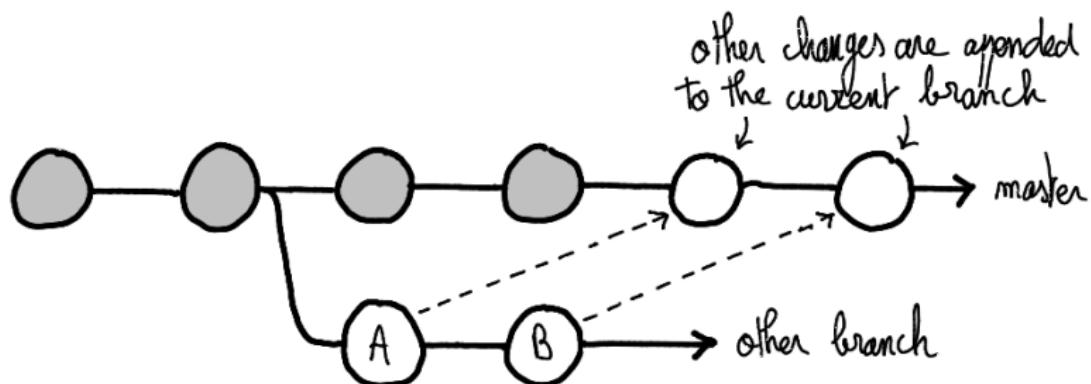
```
$ git rebase <other_branch>
```

Rebase other branch into current branch

Rebasing branches

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

Rebase other branch into current branch



Conflicts

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

Conflicts

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

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)

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```
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```

Add the change (mark the conflict as resolved)

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

Continue merging process

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$ git add
```

Add the change (mark the conflict as resolved)

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$ git merge --continue
```

Continue merging process

Trust git and git status to lead you through this process

Confused much?

- ▶ *How often do I commit?*
A commit is a *valid* contribution.



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When you're gonna break everything, or for horizontal work.

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- ▶ *When do I merge branches?*

When the purpose of the branch is accomplished.

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- ▶ *When do I merge branches?*
When the purpose of the branch is accomplished.
- ▶ Best: *branch and merge.*

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A commit is a *valid* contribution.
- ▶ *When do I make a new branch?*
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.

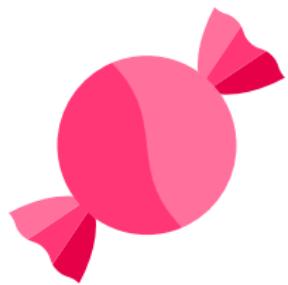
Recap



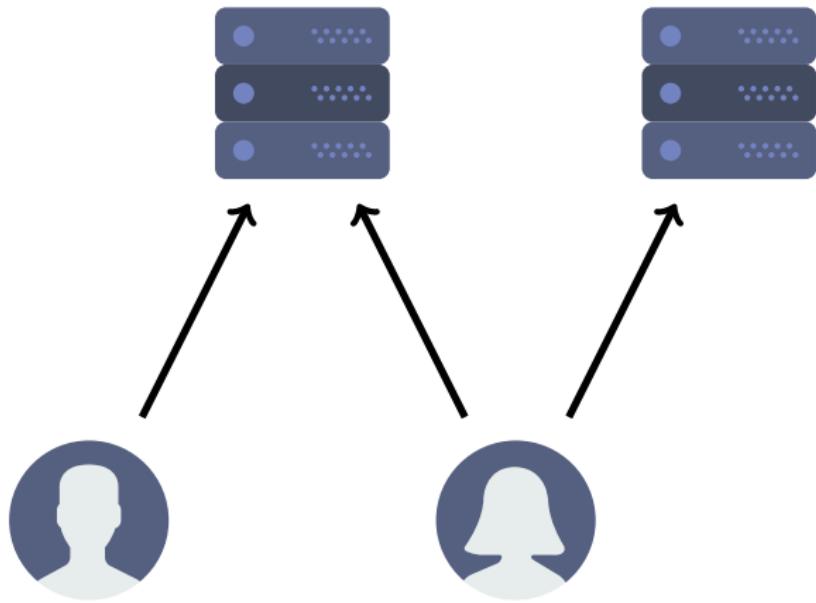
Collaboration

The idea

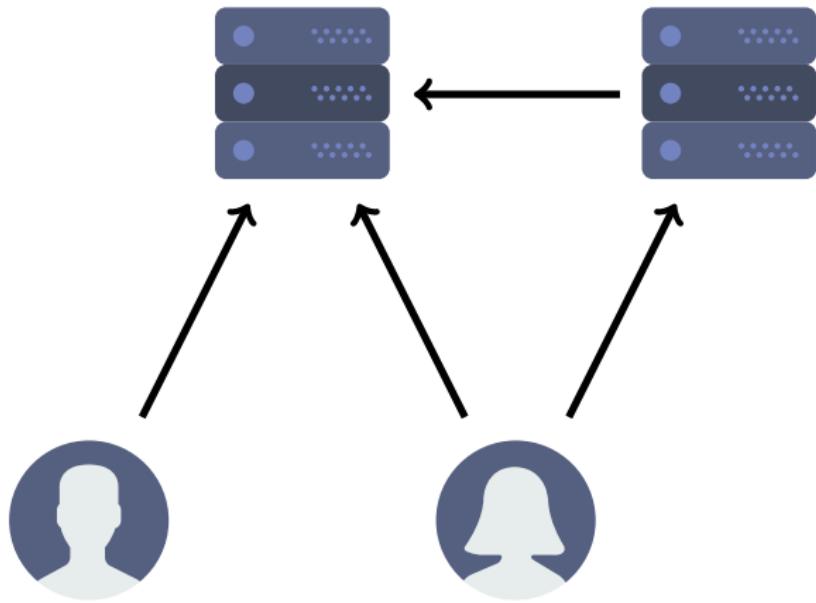
- ▶ Collaboration is just making interaction between branches on different repository;
- ▶ With syntactic sugar.



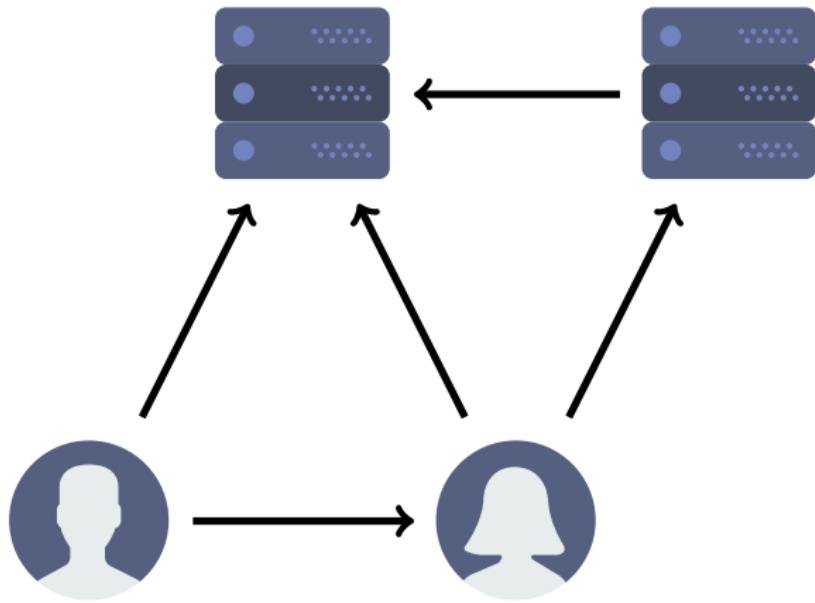
Remotes



Remotes

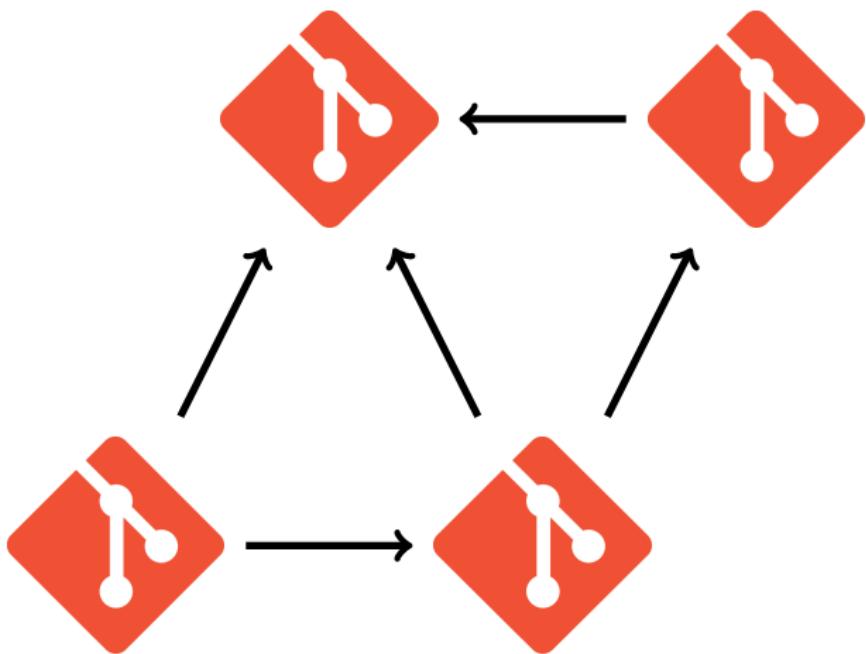


Remotes



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

Remotes



Remote commands

```
$ git remote -v
```

Show remotes (verbose)

- ▶ Remotes are other git repository¹;
- ▶ 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

¹Actually aliases for repository URL.

Clone

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

Copy a remote repository



Clone

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



Copy a remote repository

- ▶ Create a new repository by copying all information;
- ▶ Define the remote;
- ▶ Set the local branches to track the remote ones.

Clone

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

Copy a remote repository



- ▶ 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)

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

Merge remote commits in current branch

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)

Pushing local changes

```
$ git push
```

Push your local commits to the remote(s).

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 projects are hosted on Github;

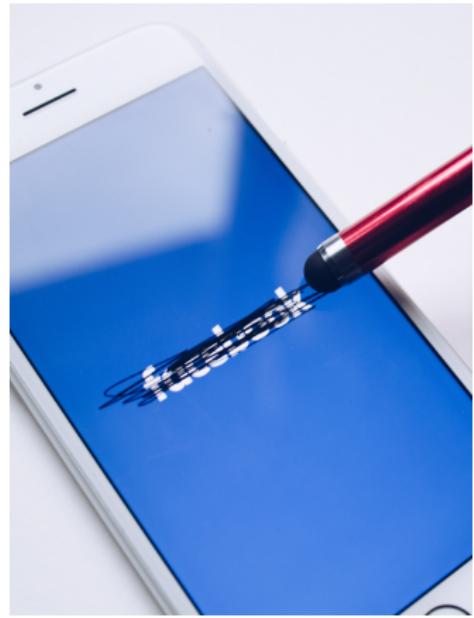


Photo by Thought Catalog on Unsplash.

Being social

- ▶ A dramatic amount of open source project are hosted on Github;
 - ▶ You can follow people, trends, and project;



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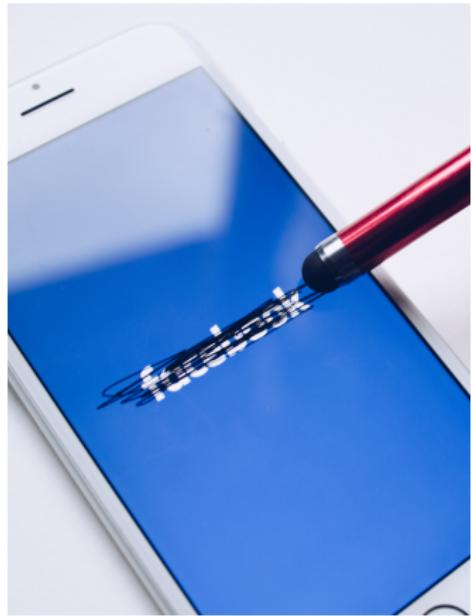
Being social

- ▶ A dramatic amount of open source project are hosted on Github;
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 - ▶ You can use Github to publish your code;



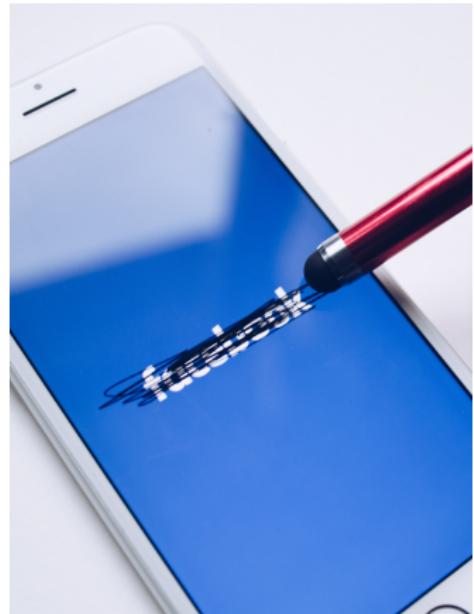
Being social

- ▶ A dramatic amount of open source project are hosted on Github;
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 - ▶ 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);



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- ▶ Free static website hosting via **Github Pages**



Public code

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

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What I thought would happen



YOUR CODE SUCKS

memegenerator.net

What really happens

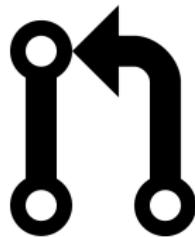


Powerful integrations

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



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

Idea: for big project and open source, we cannot have everybody with write permission to the repository.

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Idea: for big project and open source, we cannot have everybody with write permission to the repository.

- ▶ 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] Forks

Idea: for big project and open source, we cannot have everybody with write permission to the repository.

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- ▶ Two fetch remote & one push remote;
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This is what you do if you want to contribute to some *distant* project.

[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

 Bitbucket



And more

Graphical interfaces



Github Desktop

- ▶ Free
- ▶ Simple



Git Kraken

- ▶ Free and paying options
- ▶ Advanced



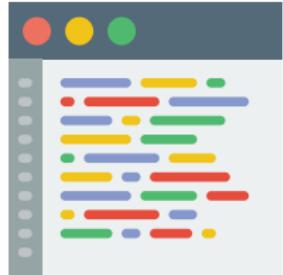
Tower

- ▶ 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 sample¹ 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 committing *.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](#))

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