How to use ~~GitHub~~ git

Let's look into it at KIT

What do I use git for?

To track changes on:

→ a source code

→ a LaTeX manuscript

→ a PDF presentation

What do I use git for?

To collaborate with others

→ work on a presentation with collaborators

→ work on a source code with your coworkers

→ ask for a review of your article to your co-authors

What do I use git for?

To share my work

→ public sharing on a public GitHub repository (with a license! Mandatory in Germany[eupl])

→ private sharing to some collaborators

→ manage your personnal pages? using the GitHub

[eupl] European Union Public License is what you should use if you want to open your code the best way, compatible with the European laws.

Vocabulary[1]

[1] All of it here: https://git-scm.com/docs/gitglossary

git

An open source, distributed version-control system.

GitHub

A platform for hosting and collaborating on Git repositories.

Alternatives: GitLab, Bitbucket, SourceForge, Google Cloud Source Repositories...

(git) repository

Where all your changes are stored.

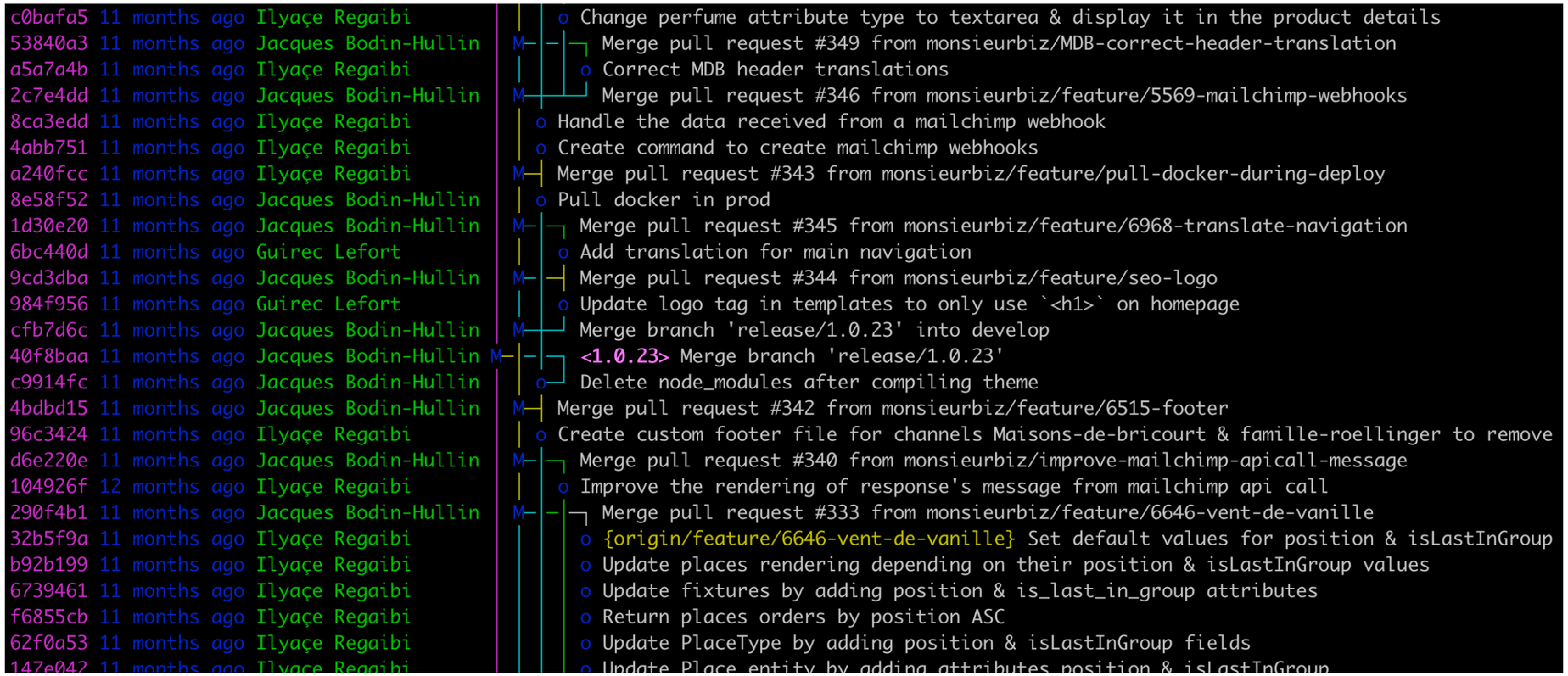
commit

A state of changes. Every commit is identified by a reference (the `sha1`***).***

A commit contains a lot of information such as: author, commiter, message, description, dates...

tree

The stored representation of your git repository.



merge commit

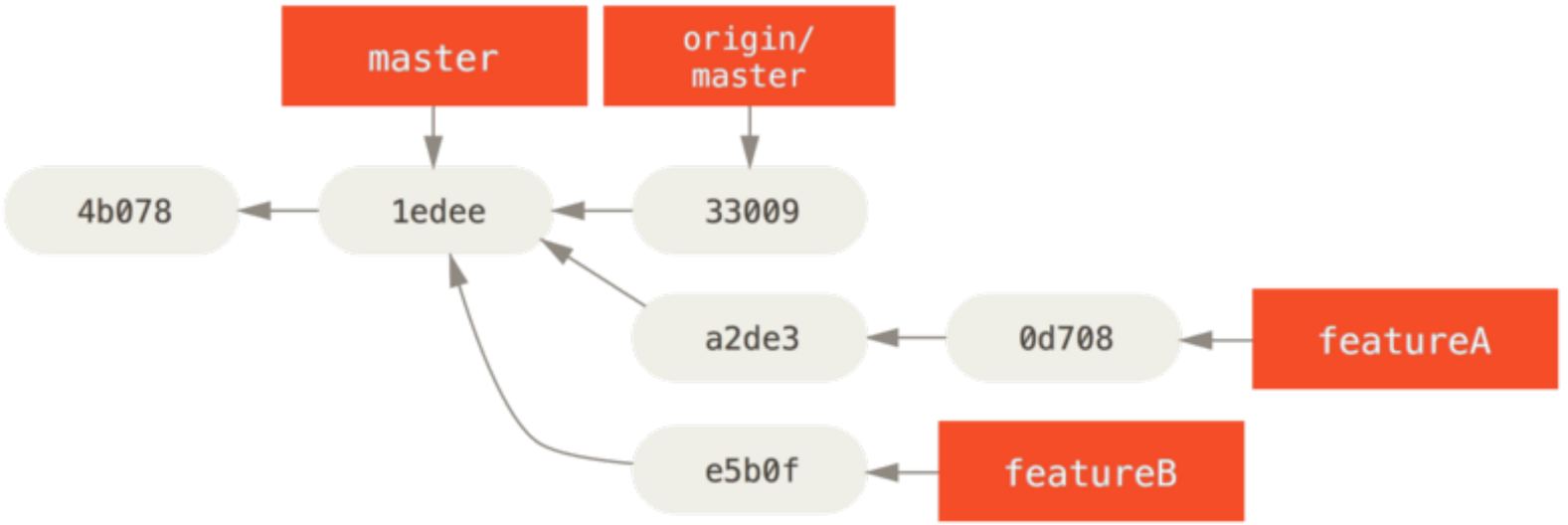
When two (or more) branches join and form a commit

😱 An octopus is formed when you merge three branches or more together octopus merge are rare!

octopus merge are rare I've never done it.

branch

An active line of development. The most recent commit on a branch is referred to as the tip of that branch.



"master" branch

Common used name for the default branch.

You could use `main` as well if you don't want to use `master`, or any name you want [not today].

[not today] I'll say `master` here as it's easier for me, because I use `master` for ~12 years now...

local repository

The repository on your machine.

It's represented by a `.git/` folder.

remote repository

Identifies your repository on a remote server (like GitHub).

They are *almost always* a local and a remote repositories. It's rare (and dangerous) to only have a local repository. You use the remote as a backup server! What a nice feature! 💪

All remotes are identified in the `.git/config` file!

"origin"

The most common used default remote name. 99% of the time the default remote will be named `origin`.

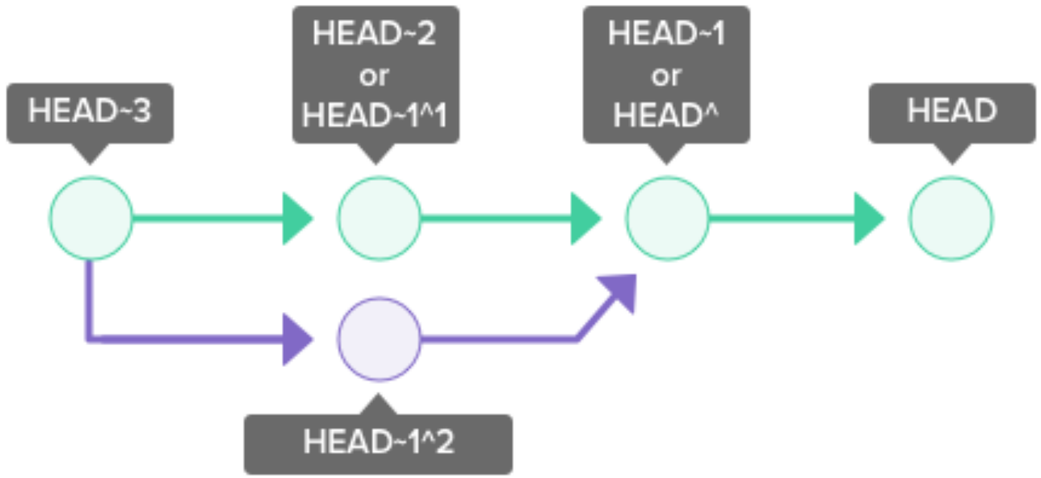
And most of the time you'll have only one remote.

master or origin/master?

`master` ***alone is your local branch named*** `master`**.**
`origin/master` ***is the*** `master` ***branch on the*** `origin` ***remote.***

HEAD or head?

HEAD



~(tilde) and ^(caret) symbols point to a position relative to the commit

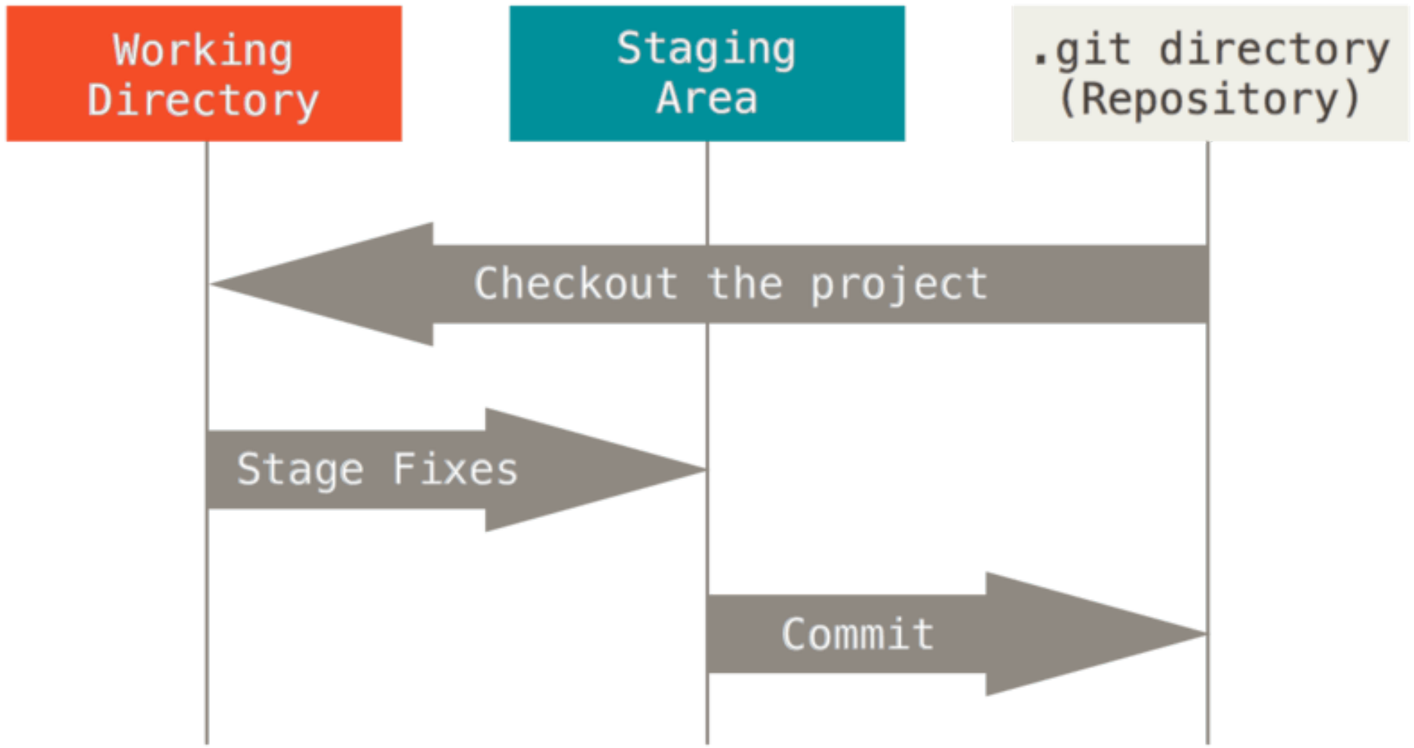
clone

A copy of your git repository

We "clone" a repository from a remote. Then we have a copy of this repository on our local machine (or wherever we made the clone).

staging area

Eveything in this area will define your next commit



Visualization

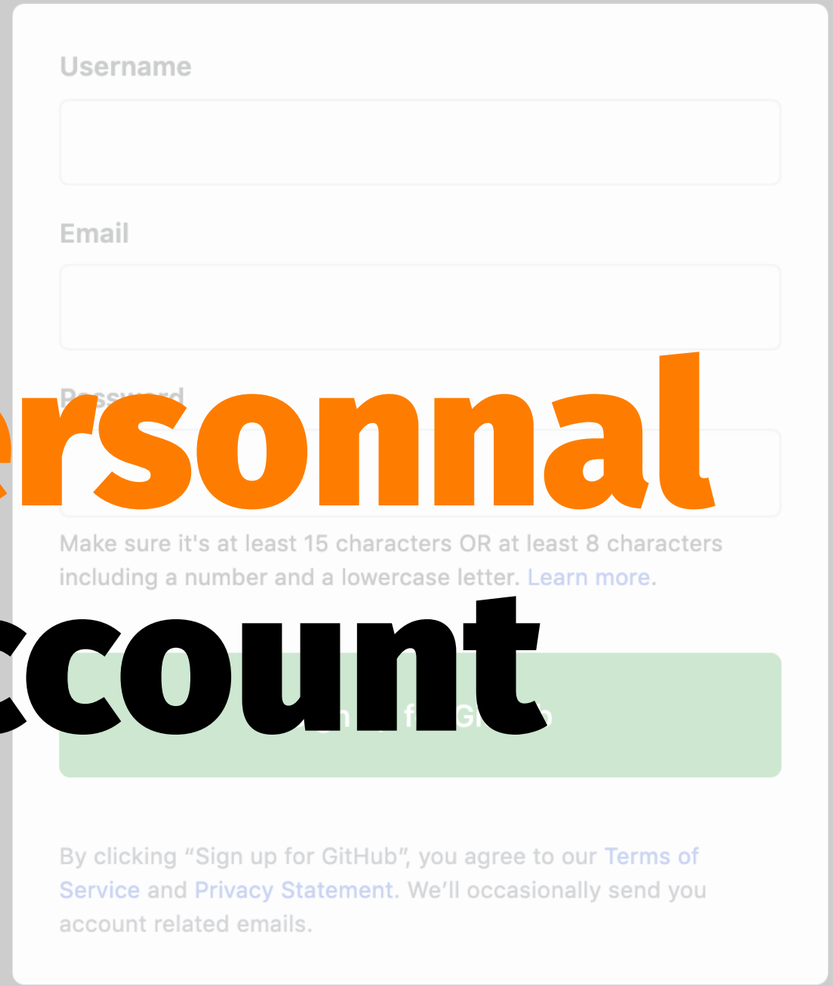
```
seconds ago j.bodinhullin o [master] Added translation.
minutes ago j.bodinhullin M─┐ Merge branch 'merge-me-please'
minutes ago j.bodinhullin │ o [merge-me-please] last minute fixes.
minutes ago j.bodinhullin │ o They came from... Behind
minutes ago j.bodinhullin │ o Fixed the build.
minutes ago j.bodinhullin │ o de-misunderestimating
minutes ago j.bodinhullin o─┘ Fixed compilation errors
minutes ago j.bodinhullin o I did it for the lulz!
minutes ago j.bodinhullin o marks
minutes ago j.bodinhullin o Another commit to keep my CAN streak going.
minutes ago j.bodinhullin │ o [my-fancy-branch] Fixed a bug cause John said to
minutes ago j.bodinhullin │ o Crap. Tonight is raid night and I am already late.
minutes ago j.bodinhullin │ o One little whitespace gets its very own commit! Oh, life is so erratic!
minutes ago j.bodinhullin │ o minor changes
minutes ago j.bodinhullin │ o Landed.
minutes ago j.bodinhullin │ o Does anyone read this? I'll be at the coffee shop accross the street.
minutes ago j.bodinhullin │ o more debug... who overwrote!
minutes ago j.bodinhullin │ │ o [my-second-branch] tagging release w.t.f.
minutes ago j.bodinhullin │ │ o Switched off unit test 15 because the build had to go out now and there was no time to fix it proper
minutes ago j.bodinhullin │ │ o Ugh. Bad rebase.
minutes ago j.bodinhullin │ │ o $(rm -rvf .)
minutes ago j.bodinhullin │ │ o They came from... Behind
minutes ago j.bodinhullin │ │ │ o [my-first-branch] I am Spartacus
minutes ago j.bodinhullin │ │ │ o rats
minutes ago j.bodinhullin │ o─┼─┘ I must have been drunk.
minutes ago j.bodinhullin │ o │ Is there an award for this?
minutes ago j.bodinhullin │ o │ I honestly wish I could remember what was going on here...
minutes ago j.bodinhullin o─┴─┘ unh
minutes ago j.bodinhullin o Nitpicking about alphabetizing methods, minor OCD thing
minutes ago j.bodinhullin o Do things better, faster, stronger
minutes ago j.bodinhullin o So my boss wanted this button ...
minutes ago j.bodinhullin I I cannot believe that it took this long to write a test for this.
```

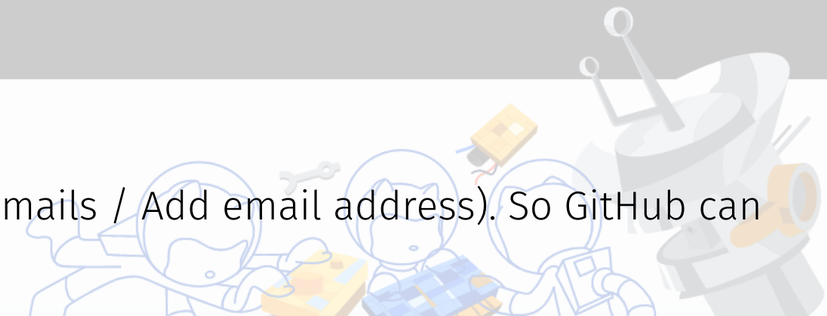
On Mistral

```
# ~/.bash_profile

# git
module load git/2.27.0-gcc-9.1.0
export PATH=$PATH:/sw/rhel6-x64/vcs/tig-2.2.1/bin

# some git aliases
alias g='git'
alias gs='git status'
```

Let's start!

Create a personnal GitHub account





⚠️ Don't forget to link your professional email to your GitHub account too! (Settings / Emails / Add email address). So GitHub can recognize all your commits.

Then generate your SSH key, to identify you over SSH

```
$ ssh-keygen -t ecdsa
```

```
Generating public/private ecdsa key pair.
Enter file in which to save the key (/Users/jacques/.ssh/id_ecdsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /Users/jacques/.ssh/id_ecdsa.
Your public key has been saved in /Users/jacques/.ssh/id_ecdsa.pub.
The key fingerprint is:
SHA256:MtED4WQBZ3GlWLeuJz1bqTSo0Mz3Od8U8XvUEmbiklA jacques@JBH.local
The key's randomart image is:
+---[ECDSA 256]---+
|    ..X+o.E      |
|     * * + .     |
|      + = . . =  |
|       . + o + +.|
|      o S + . o +|
|     + o + . . +.|
|    . + = * o ...|
|     . o =.B o  .|
|      .   =o. .  |
+----[SHA256]-----+
```

Two files to backup

Your identification (private key) has been saved in `/Users/jacques/.ssh/id_ecdsa`.

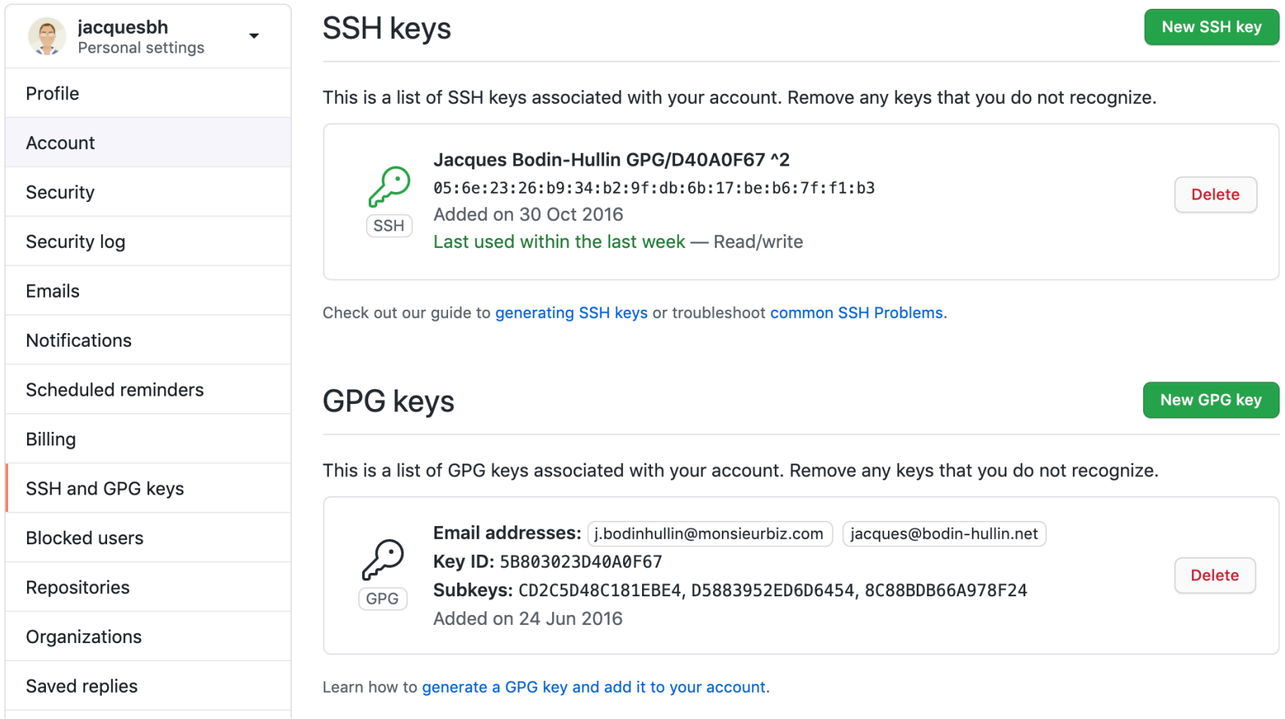
Your **public key**[to share] has been saved in `/Users/jacques/.ssh/id_ecdsa.pub`.

[to share] From now on, you'll only share your public key. **NEVER share your private key** (but backup it!!!).

Tip: generate 2 keys: one on Mistral, one on your machine

Copy your public key's content into your GitHub account

Top right menu / Settings / SSH and GPG keys / New SSH key



If you've generated 1 key on Mistral and 1 key on your local machine: add the two keys on GitHub.

Configure your machine

Who are you?

```
$ git config --global user.name "Your Name, in full, or alias…"
$ git config --global user.email "Your email, personnal or professional"
```

This is stored in your `~/.gitconfig`, so it's a one time operation, even on Mistral:

```
$ cat ~/.gitconfig
[user]
        name = Jacques Bodin-Hullin
        email = j.bodinhullin@monsieurbiz.com
```

Our first repository

The simple way

Create a new repository on GitHub:
https://github.com/new

Public or Private, it's your choice.
If you choose Public, don't forget to add a `LICENSE` file.

EUPL: https://eupl.eu/1.2/de/ or https://eupl.eu/1.2/en/

Create a new repository

A repository contains all project files, including the revision history. Already have a project repository elsewhere? Import a repository.

Owner * **Repository name** *

jacquesbh / my-model

Great repository names are short and memorable. Need inspiration? How about **urban-potato**?

Description (optional)

Public
Anyone on the internet can see this repository. You choose who can commit.

Private
You choose who can see and commit to this repository.

Skip this step if you're importing an existing repository.

Initialize this repository with a README
This will let you immediately clone the repository to your computer.

Add .gitignore: None | Add a license: None

Create repository

Quick setup — if you've done this kind of thing before

Set up in Desktop or HTTPS SSH git@github.com:jacquesbh/fortran-model.git

Get started by creating a new file or uploading an existing file. We recommend every repository include a README, LICENSE, and .gitignore.

...or create a new repository on the command line

```
echo "# fortran-model" >> README.md
git init
git add README.md
git commit -m "first commit"
git remote add origin git@github.com:jacquesbh/fortran-model.git
git push -u origin master
```

...or push an existing repository from the command line

```
git remote add origin git@github.com:jacquesbh/fortran-model.git
git push -u origin master
```

Then clone it!

```
$ git clone git@github.com:jacquesbh/fortran-model.git
Cloning into 'fortran-model'...
warning: You appear to have cloned an empty repository.

$ cd fortran-model
```

What is my current state?

```
$ git status
On branch master

No commits yet

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

Protocol

Let's create 2 files: `john.txt` and `doe.txt`

```
$ touch john.txt doe.txt
```

```
$ git status
On branch master

No commits yet

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        doe.txt
        john.txt

nothing added to commit but untracked files present (use "git add" to track)
```

Add a file to the staging area

For a specific file: (that's what we do)

```
git add john.txt
```

Or for all the files: (just FYI)

```
git add .
```

```
$ git status
On branch master

No commits yet

Changes to be committed:                          <<
  (use "git rm --cached <file>..." to unstage)    << THIS IS THE STAGING AREA
        new file:   john.txt                      <<

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        doe.txt
```

Commit our stage

```
$ git commit -m"My special message to you, John"
[master (root-commit) 0ff051c] My special message to you, John
 1 file changed, 0 insertions(+), 0 deletions(-)
 create mode 100644 john.txt
```

You can also do a simple `git commit`, then an editor[editor] will open for you to enter the commit message.

[editor] `vi(m)`, `nano`, `emacs`...

```
$ git status
On branch master
Your branch is based on 'origin/master', but the upstream is gone.
  (use "git branch --unset-upstream" to fixup)

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        doe.txt

nothing added to commit but untracked files present (use "git add" to track)
```

Push your changes to the origin (to GitHub in our case)

```
$ git push
Enumerating objects: 3, done.
Counting objects: 100% (3/3), done.
Writing objects: 100% (3/3), 627 bytes | 627.00 KiB/s, done.
Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
To github.com:jacquesbh/fortran-model.git
 * [new branch]      master -> master
```

Add a commit on GitHub directly

Fetch the changes

```
$ git fetch
remote: Enumerating objects: 5, done.
remote: Counting objects: 100% (5/5), done.
Unpacking objects: 100% (3/3), 634 bytes | 317.00 KiB/s, done.
remote: Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
From github.com:jacquesbh/fortran-model
   0ff051c..80a3c54  master     -> origin/master
```

Where are we?

```
$ git log
commit 0ff051ca08ad68226928139bd317521303d0ca6c (HEAD -> master)
Author: Jacques Bodin-Hullin <j.bodinhullin@monsieurbiz.com>
Date:   Wed Jul 1 13:41:24 2020 +0200

    My special message to you, John
```

Where is my GitHub commit??

```
$ git log --all
commit 80a3c543ab923922effd1ff292095880ca1f0088 (origin/master)
Author: Jacques Bodin-Hullin <j.bodinhullin@monsieurbiz.com>
Date:   Wed Jul 1 13:44:34 2020 +0200

    Be strong John.

commit 0ff051ca08ad68226928139bd317521303d0ca6c (HEAD -> master)
Author: Jacques Bodin-Hullin <j.bodinhullin@monsieurbiz.com>
Date:   Wed Jul 1 13:41:24 2020 +0200

    My special message to you, John
```

git log is powerful.

```
$ git log --all --graph --oneline
* 80a3c54 (origin/master) Be strong John.
* 0ff051c (HEAD -> master) My special message to you, John
```

Let's create an alias quickly

```
$ git config --global alias.tree "log --graph --all --oneline"

$ git tree
* 80a3c54 (origin/master) Be strong John.
* 0ff051c (HEAD -> master) My special message to you, John
```

Update my current state

```
$ git merge origin/master
Updating 0ff051c..80a3c54
Fast-forward
 john.txt | 1 +
 1 file changed, 1 insertion(+)
```

git pull

It is the combination of `git fetch` ***and*** `git merge`

That's cool!

The merge command can perform a *fast-forward* if there is no risk of conflict. So do the `git pull` command!

```
$ git status
On branch master
Your branch is up to date with 'origin/master'.

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        doe.txt

nothing added to commit but untracked files present (use "git add" to track)
```

Ignore some files

```
echo "/doe.txt" >> .gitignore
```

```
$ git status
On branch master
Your branch is up to date with 'origin/master'.

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        .gitignore

nothing added to commit but untracked files present (use "git add" to track)
```

`doe.txt` is ignored by all git operations and we have a new file of course…

Let's do a simple `git add .`

```
$ git status
On branch master
Your branch is up to date with 'origin/master'.

Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
        new file:   .gitignore
```

How to remove from the stage?

```
$ git reset .gitignore
```

```
$ git status
On branch master
Your branch is up to date with 'origin/master'.

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        .gitignore

nothing added to commit but untracked files present (use "git add" to track)
```

Let's commit `.gitignore` and change the content of `john.txt`.

```
$ git add .gitignore

$ git commit -m"Ignore doe.txt"
[master 588fb2b] Ignore doe.txt
 1 file changed, 1 insertion(+)
 create mode 100644 .gitignore

$ echo "I know." > john.txt
```

```
$ git status
On branch master
Your branch is ahead of 'origin/master' by 1 commit.
  (use "git push" to publish your local commits)

Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   john.txt

no changes added to commit (use "git add" and/or "git commit -a")
```

How do I change `john.txt` back to it's original content?

```
$ cat john.txt
I know.

$ git diff
diff --git a/john.txt b/john.txt
index 4bfe9c8..456de31 100644
--- a/john.txt
+++ b/john.txt
@@ -1 +1 @@
-Be strong.
+I know.

$ git checkout john.txt
Updated 1 path from the index

$ cat john.txt
Be strong.
```

```
$ git status
On branch master
Your branch is ahead of 'origin/master' by 1 commit.
  (use "git push" to publish your local commits)

nothing to commit, working tree clean

$ git tree
* 588fb2b (HEAD -> master) Ignore doe.txt
* 80a3c54 (origin/master) Be strong John.
* 0ff051c My special message to you, John
```

Let's push our changes.

```
$ git push
Enumerating objects: 4, done.
Counting objects: 100% (4/4), done.
Delta compression using up to 12 threads
Compressing objects: 100% (2/2), done.
Writing objects: 100% (3/3), 691 bytes | 691.00 KiB/s, done.
Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
To github.com:jacquesbh/fortran-model.git
   80a3c54..588fb2b  master -> master

$ git tree
* 588fb2b (HEAD -> master, origin/master) Ignore doe.txt
* 80a3c54 Be strong John.
* 0ff051c My special message to you, John

$ git status
On branch master
Your branch is up to date with 'origin/master'.

nothing to commit, working tree clean
```

I have a new idea!

```
$ git branch new-idea

$ git checkout new-idea
Switched to branch 'new-idea'

$ git tree
* 588fb2b (HEAD -> new-idea, origin/master, master) Ignore doe.txt
* 80a3c54 Be strong John.
* 0ff051c My special message to you, John
```

Let's add a new file, and commit it.

```
$ echo Hallo KIT! > kit.txt

$ git add kit.txt

$ git status
On branch new-idea
Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
        new file:   kit.txt

$ git commit -m"Hello to KIT"
[new-idea 4e4c997] Hello to KIT
 1 file changed, 1 insertion(+)
 create mode 100644 kit.txt
```

```
$ git tree
* 4e4c997 (HEAD -> new-idea) Hello to KIT
* 588fb2b (origin/master, master) Ignore doe.txt
* 80a3c54 Be strong John.
* 0ff051c My special message to you, John
```

Let's go back to `master`, create a new branch, add a file, commit it.

```
$ git checkout master
Switched to branch 'master'
Your branch is up to date with 'origin/master'.

$ git checkout -b second-idea
Switched to a new branch 'second-idea'

$ echo "Eurêka" > albert.txt

$ git add .

$ git commit -m"Well said Albert"
[second-idea b1adf2d] Well said Albert
 1 file changed, 1 insertion(+)
 create mode 100644 albert.txt
```

```
$ git tree
* b1adf2d (HEAD -> second-idea) Well said Albert
| * 4e4c997 (new-idea) Hello to KIT
|/
* 588fb2b (origin/master, master) Ignore doe.txt
* 80a3c54 Be strong John.
* 0ff051c My special message to you, John
```

Safety rules 

Do NOT delete your `.git` directory!

Have fun!

Contact :

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j.bodinhullin@monsieurbiz.com

But your best friends are `man` and https://git-scm.com/doc.