Version control with `git`

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Why version control? (*tout seul*)

Lots of good reasons - but the main ones[1] are:

- a complete **history of changes** (which means you can *undo*)
- **branches** (you can try new stuff out without breaking things)
- you can trace who did what when, **tag** versions of your manuscript / code
    - submitted, published
    - v1.0, feature-release

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[1] see e.g. "What is version control"

Why version control? (*avec amis*)

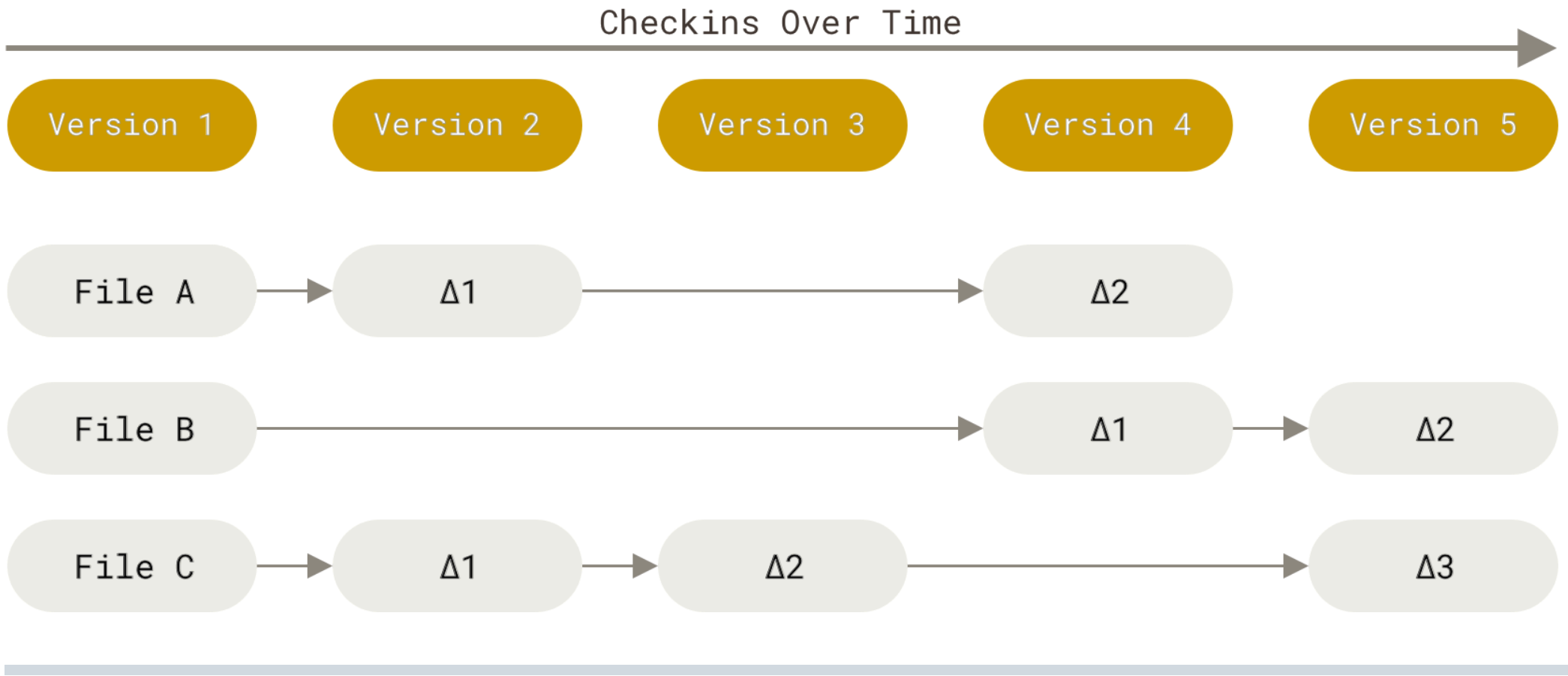
If you are **collaborating** on code / docs, in addition:

- you can trace **who** did **what** and **when**
- you can **resolve conflicts** (eg two potential fixes to same problem)

+ github.com

- if you use **github.com** lots of additional features
- discussions, issues, actions, pages ...

Imagine a typical project (code / notes)



How material changes over time...

Why `git`?

There are many *version control systems* (VCS). But `git` comes with some advantages:

- it's **distributed** (full version history in your local copy)
- corollary: you can work with it anywhere ✈️ or 🚋 (no need for network connection)
- it's widely used[1]

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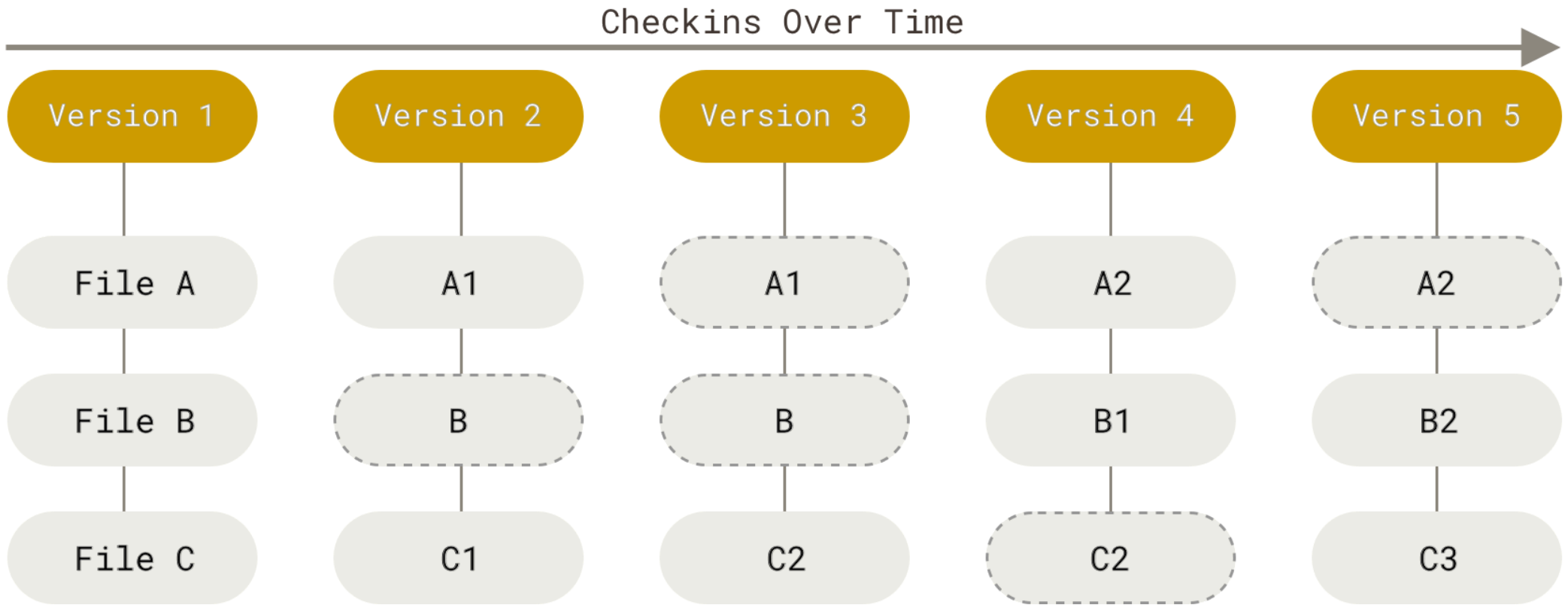
[1] see e.g. "Wikipedia / git"

`git` does snapshots

- think of this as snapshots
- what's the state of each file now?



How are things tagged?

[2] [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0)

How are things tagged?

- each **file** has a unique *fingerprint* (`shasum`)
- if the file changes, the *fingerprint* changes, too!
- `sha` = secure hash algorithm
- `sha` turns text/data into a 40 digit hexadecimal number

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hexadecimal numbers?

```
0...9  10 11 12 13 14   15  # decimal
0...9   a  b  c  d  e    f  # hexadecimal

0 1 10 11 100 101 ...  111  # binary
```

`shasum` of a file

```
shasum Introduction.md
# b5acbb35abd2511a4c05e48ef58f8990f139793a  Introduction.md
```

tiny change, e.g. add a space?! and calculate SHA again:

```
shasum Introduction.md
# 502bbcb5ab4f0d8127396675dd7d17d7d8b55b0a  Introduction.md
```

... completely different.

`git` nitty-gritty – for data club 😀

the `sha` actually refers to the

```
"blob + <size in bytes> + \0 + <the file contents>"
```

you can try this out by

```
echo 'Hello, World!' | git hash-object --stdin
# leads to
8ab686eafeb1f44702738c8b0f24f2567c36da6d
```

Note: the filename doesn't contribute to the `sha` of the file / blob ... which means renaming files is cheap (doesn't use up space)

How are things tagged (2)?

A similar trick works for a list of directory contents (the "tree")

➡️ **tree hash**

```
.
├── analysis
├── stimulusCode
│   └── stims
│       ├── houses
│       ├── normal
│       ├── objects
│       └── scrambled
└── unix-intro
```

How are things tagged (3)? - `commit`

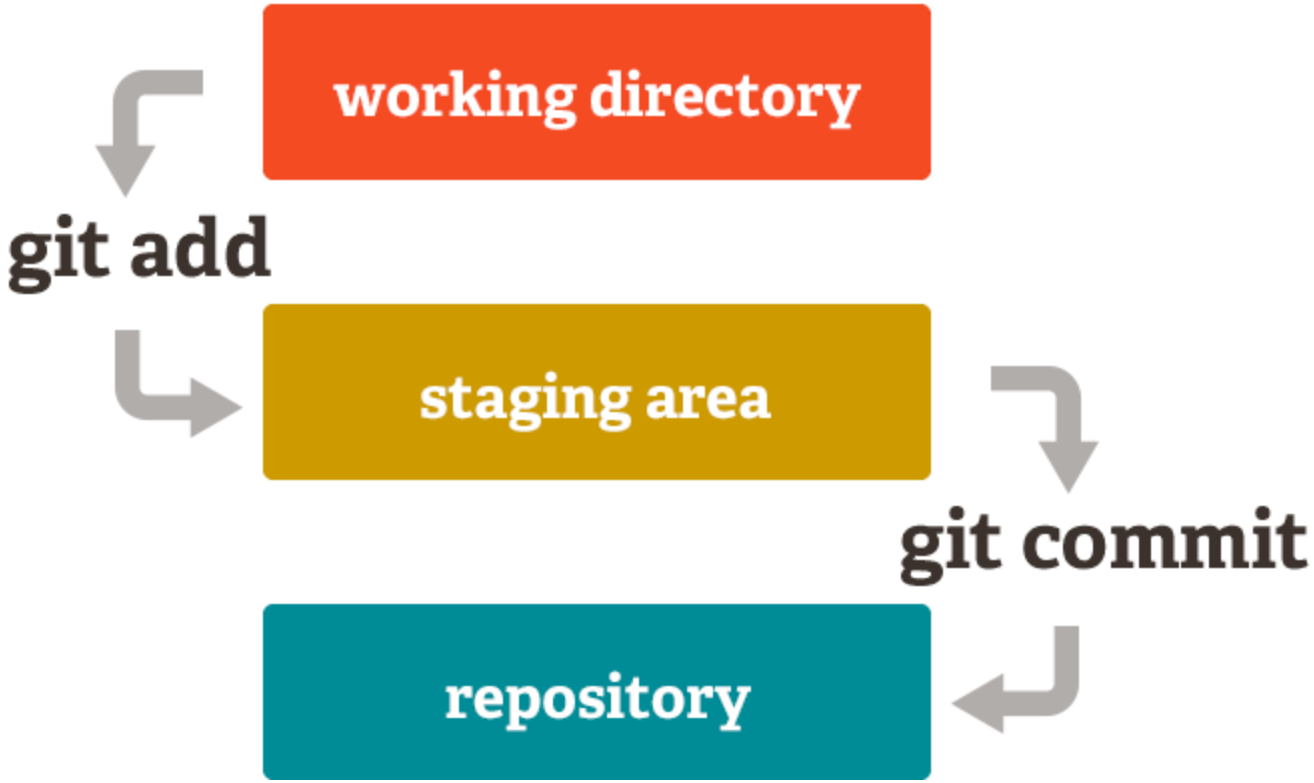
- information about files (aka **blobs**), their relationship to each other (the **tree**), the previous state (**parent**) and a message make up a `commit`

```
$ git cat-file -p HEAD

tree 80fc45cae348efbdbbb652642cf4c22e1ddaaf80
parent b2b3a018fa2569bc5aa54b0b744145f6758bcba7
author Denis Schluppeck <denis.schluppeck@gmail.com> 1517238320 +0000
committer Denis Schluppeck <denis.schluppeck@gmail.com> 1517238320 +0000

fixes http to https
```

Workflow



Files

3 scenarios to get us all thinking

1. you (on your own), several different computers
2. you, a couple of collaborators,+ code that changes a lot
3. you want to share materials with lots of people (details change: maybe once a year, maybe more often...)

- **new idea / analysis**: worth creating a new repo (**private??**)
- **on laptop:** work on code, `git add`, `git commit`, `git push`
- **on desktop:** `git clone`, use code (but if you find a bug while running on lab machine ... fix and push back to repo)

Scenario 2

WHO: you, a colleague + a PhD student

WHAT: analysis code

BRANCHES!

Branches - trying out new ideas

- **colleague and phd student:** want to try some new approach that might break things...

```
# they should make a new TRACKING BRANCH
git checkout -b whacky-idea-branch

# work on there, git add  / commit / push...
git checkout main
git merge whacky-idea branch # when ready ;)
```

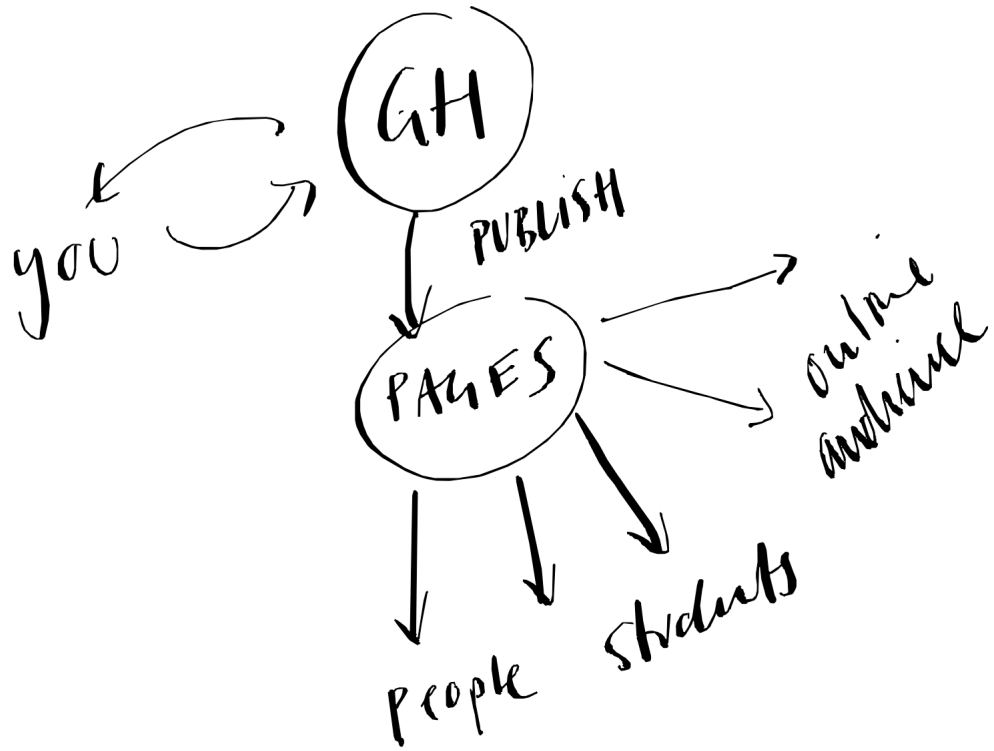
Scenario 3

WHO: you, tons of others

WHAT: materials, notes that change frequently

"PAGES"

Pages - sharing via static www hosting



- work on `markdown` (which gets converted to HTML via `jekyll`)
- or use HTML / javascript / anything that is client/browser only ("static") should work

Examples

- NG data club website is hosted this way: https://schluppeck.github.io/ng-data-club/
- r in browser

Local repo: Let's try it

- make a directory, `cd` into it
- initialize repo

```
mkdir test && cd test
git init
```

- make a text file `test.txt`
- write something into it and save it

Let's try it (2)

- add to staging area
- ... and try to commit with a message (`-m`)

```
git add test.txt
git commit -m 'my first commit'
```

Warnings?

- you'll see some warning messages
- for (only this first time), set up your `user.name` and `user.email`

```
git config --global user.name "First Last"    # your name
git config --global user.email "me@gmail.com" #  your email
```

- This info is stored on your machine in a little file, which you can inspect)e.g. on `macos`

```
more ~/.gitconfig
```

Now complete the commit

```
git status # read what's there

git commit -m 'my first commit'

git status # read what's there NOW
```

If you want this on github

Currently the repository is local to the machine you are working on, if you want to share with your friends and colleagues on `github.com`, follow instructions at:

https://help.github.com/en/articles/adding-an-existing-project-to-github-using-the-command-line

Notes

- Illustrations linked from https://git-scm.com/book/en/v2/ - Creative Commons license CC BY-NC-SA 3.0
- Details on `shasum` (available as a UNIX command):

```
man shasum  # or
info shasum
```