2018-01

E.T.

EFFICIENT TOOLS
for RESEARCH

VERSION CONTROL with GIT

~ *accelerated tutorial for busy academics* ~

Version Control with Git

accelerated tutorial
for busy academics

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CentraleSupélec Rennes, January 24, 2018

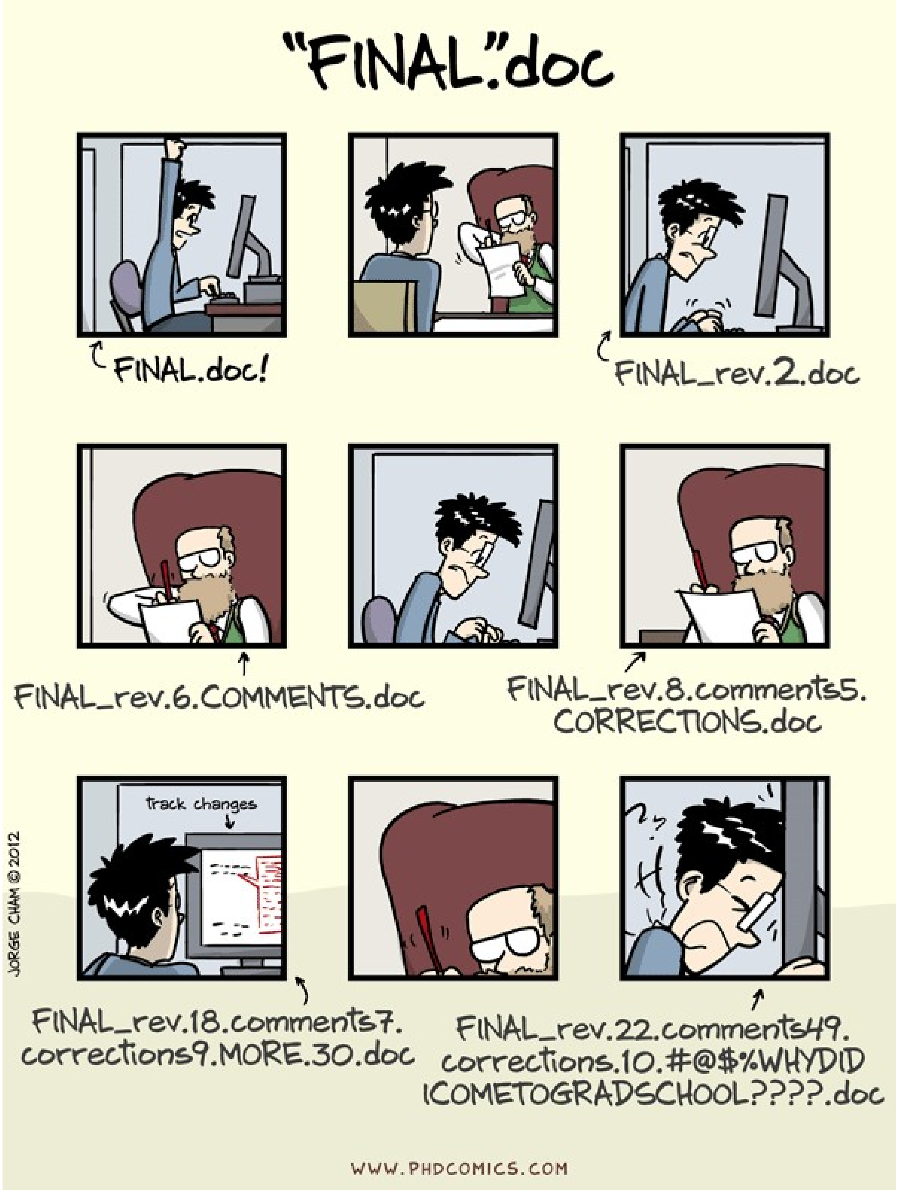
Why Git ?

1) **Version Control** system:
keep track of changes (history)

- Git = most popular VCS since 2010
- Alternatives: Subversion (svn), Mercurial

2) **Collaboration**

- **Publish** and on the web
  - including the history
  - always up-to-date
- **Collaborate**
  manage **asynchronous** contributions, with potential conflicts.


"FINAL".doc
FINAL.doc!
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Outline of the training

1) **Personal work**: single user on its local computer

week-long break

2) **Publish work** on the Internet: hosted Git services (GitHub, GitLab)

3) **Collaborative work**: keep in sync, manage conflicts

1) Personal work

single user on its local computer

(no leaks on a “cloud” ☻,
but no backup either ☹)

Personal work (local computer)

- Setting up Git: install and configure (once per machine)
- Initialize an empty git *repository*,
- **Track changes** : add changes to the *staging area*, create commits
- Compare versions (diff) and explore the history (log)

Practice 1

based on

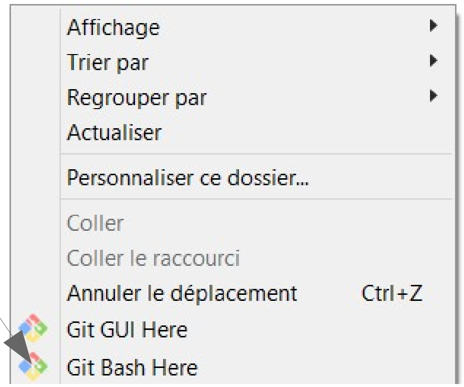
http://swcarpentry.github.io/git-novice/

Practice 1

Setting up Git

(once per machine)

- Install Git. Instructions for Windows:
  1) first, Git for Windows http://gitforwindows.org/ .
     On page https://git-scm.com/download/win , download should start automatically.
  2) then I suggest TortoiseGit as a convenient graphical tool https://tortoisegit.org/
- Create empty folder and open "Git Bash"
- Configure identity: `git config` (name & email)



Practice 1

Creating an (empty) Repository

- `git init`
- $\longrightarrow$ Observe new “.git” directory (unhide hidden files and folders)

http://swcarpentry.github.io/git-novice/03-create/

Practice 1

Tracking changes

Actions:

1) Put changed files to the staging area: `git add`
2) Save staged content as a new commit: `git commit`

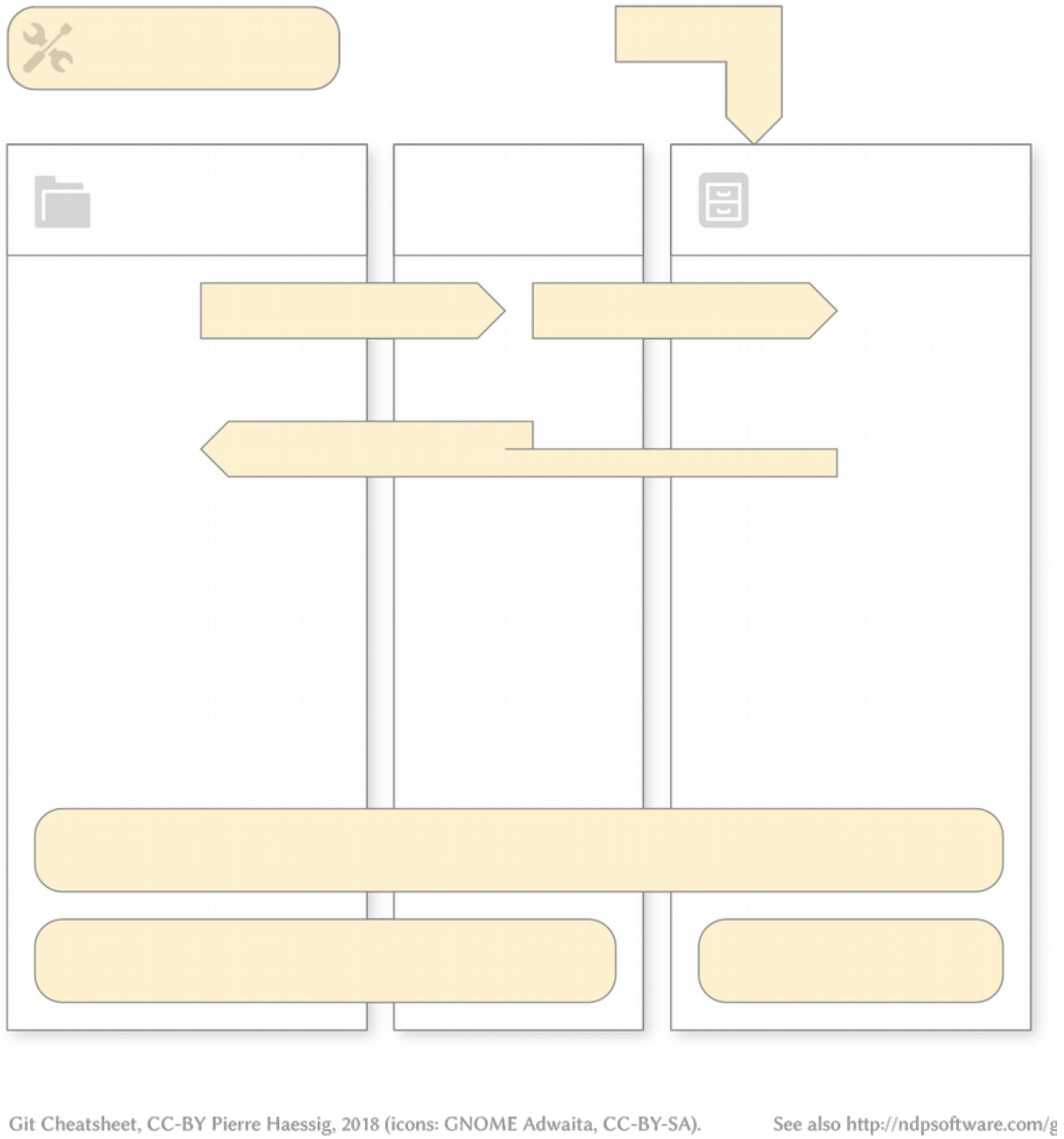
Check the Status of the repository: `git status`

http://swcarpentry.github.io/git-novice/04-changes/

Exploring History

- Compare versions (diff): `git diff`
  - Ex: `git diff HEAD~1 script.m`
- Explore the history (the graph of all commits): `git log`

(Easier with graphical tools, c.f. next)


Git Cheatsheet, CC-BY Pierre Haessig, 2018 (icons: GNOME Adwaita, CC-BY-SA). See also http://ndpsoftware.com/g

Places

Workspace
Index/Staging area
Local Repository

Commands
`git ...`

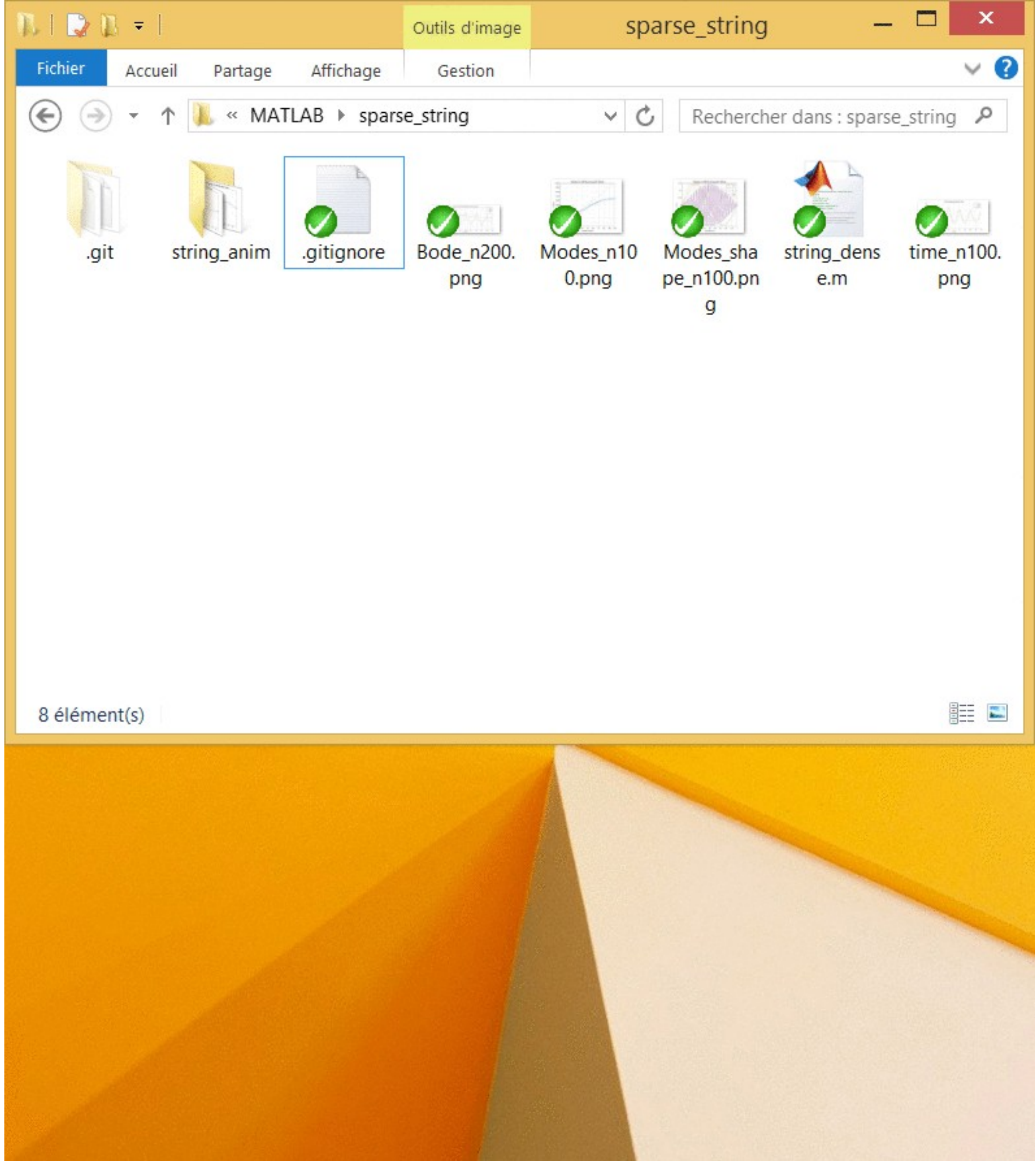
```
config

init

add
commit

status
diff
log

checkout
```

Graphical Git tools

- *(Too) many to choose!*
- Windows shell: TortoiseGit
- IDE integration: e.g. Matlab

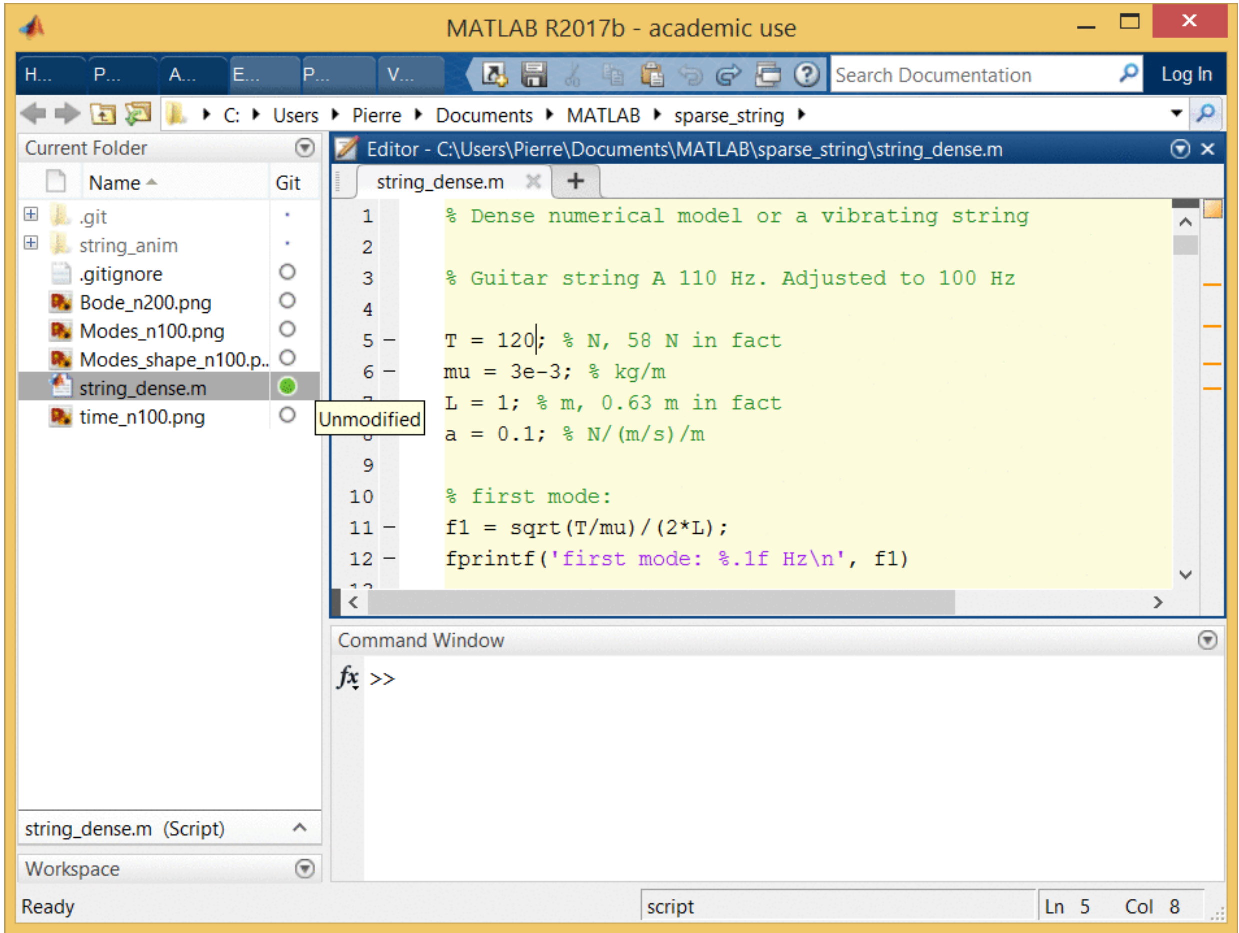
TortoiseGit

- https://tortoisegit.org/
- A "Windows Shell Interface", i.e., in the file explorer: "right click" → **context menu**



Git in Matlab

- Integration in the "Current Folder" panel of Matlab Desktop
- Details in doc
  https://fr.mathworks.com/help/matlab/source-control.html
  - e.g. handling of binary files like Simulink's .slx



MATLAB R2017b - academic use
H... P... A... E... P... V...
Search Documentation
Log In
C: ▸ Users ▸ Pierre ▸ Documents ▸ MATLAB ▸ sparse_string ▸
Current Folder
Name
Git
Editor - C:\Users\Pierre\Documents\MATLAB\sparse_string\string_dense.m
string_dense.m
Unmodified
Command Window
string_dense.m (Script)
Workspace
Ready
script
Ln 5 Col 8

Name	Git
.git	·
string_anim	·
.gitignore	○
Bode_n200.png	○
Modes_n100.png	○
Modes_shape_n100.p..	○
string_dense.m	●
time_n100.png	○

```
% Dense numerical model or a vibrating string

% Guitar string A 110 Hz. Adjusted to 100 Hz

T = 120; % N, 58 N in fact
mu = 3e-3; % kg/m
L = 1; % m, 0.63 m in fact
a = 0.1; % N/(m/s)/m

% first mode:
f1 = sqrt(T/mu)/(2*L);
fprintf('first mode: %.1f Hz\n', f1)
```

```
>>
```

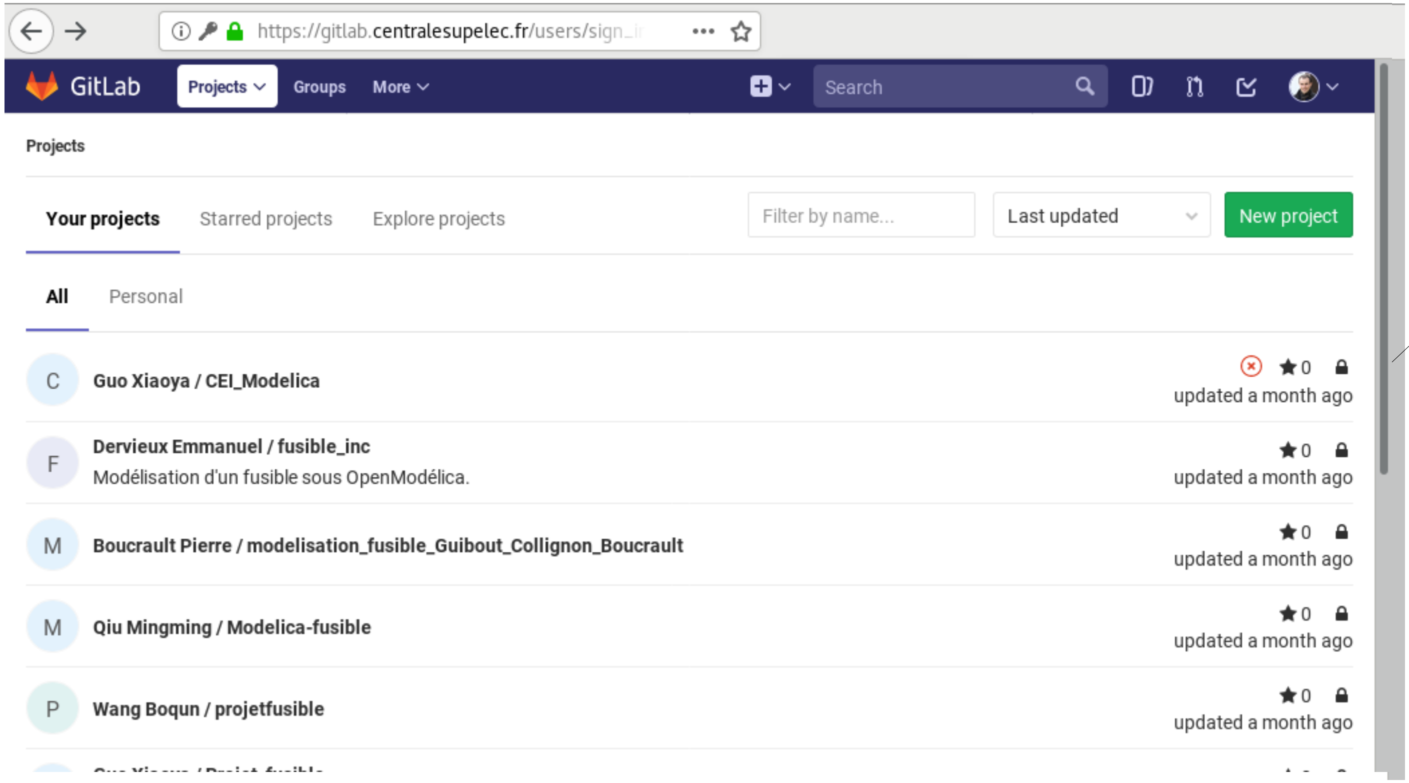
Week-long break

2) **Publish** work on the Internet

Hosted Git services:
GitLab (at CentraleSupélec)
GitHub

GitLab

GitLab *instance* hosted at CS: https://gitlab.centralesupelec.fr/



Guo Xiaoya / CEI_Modelica ★0 updated a month ago

Dervieux Emmanuel / fusible_inc ★0 updated a month ago
Modélisation d'un fusible sous OpenModélica.

Boucrault Pierre / modelisation_fusible_Guibout_Collignon_Boucrault ★0 updated a month ago

Qiu Mingming / Modelica-fusible ★0 updated a month ago

Wang Boqun / projetfusible ★0 updated a month ago

Login with your usual LDAP username

Publish work

Based on the previously created local Git repository (Practice 1)

- On CentraleSupélec GitLab website: create a new repository.
- On local computer, add a remote, then push the local commits.
- On GitLab: explore the web interface, look at the commits.

Practice 2

based on

http://swcarpentry.github.io/git-novice/07-github/ (with GitLab instead)

3) Collaborative work

“How to keep in sync?”

Clone an existing repository

Pull (fetch & merge) fresh changes

Manage potential **conflicts**

Collaborate

Based on the previously created online (GitLab) Git repository (Practice 2)

- ➔ make pairs: “Owner” and “Collaborator”
- ➔ Collab. clones the GL repo of Owner (needs O to give rights to C)
- ➔ Collab. makes local changes, commit and push
- ➔ Owner pulls those changes

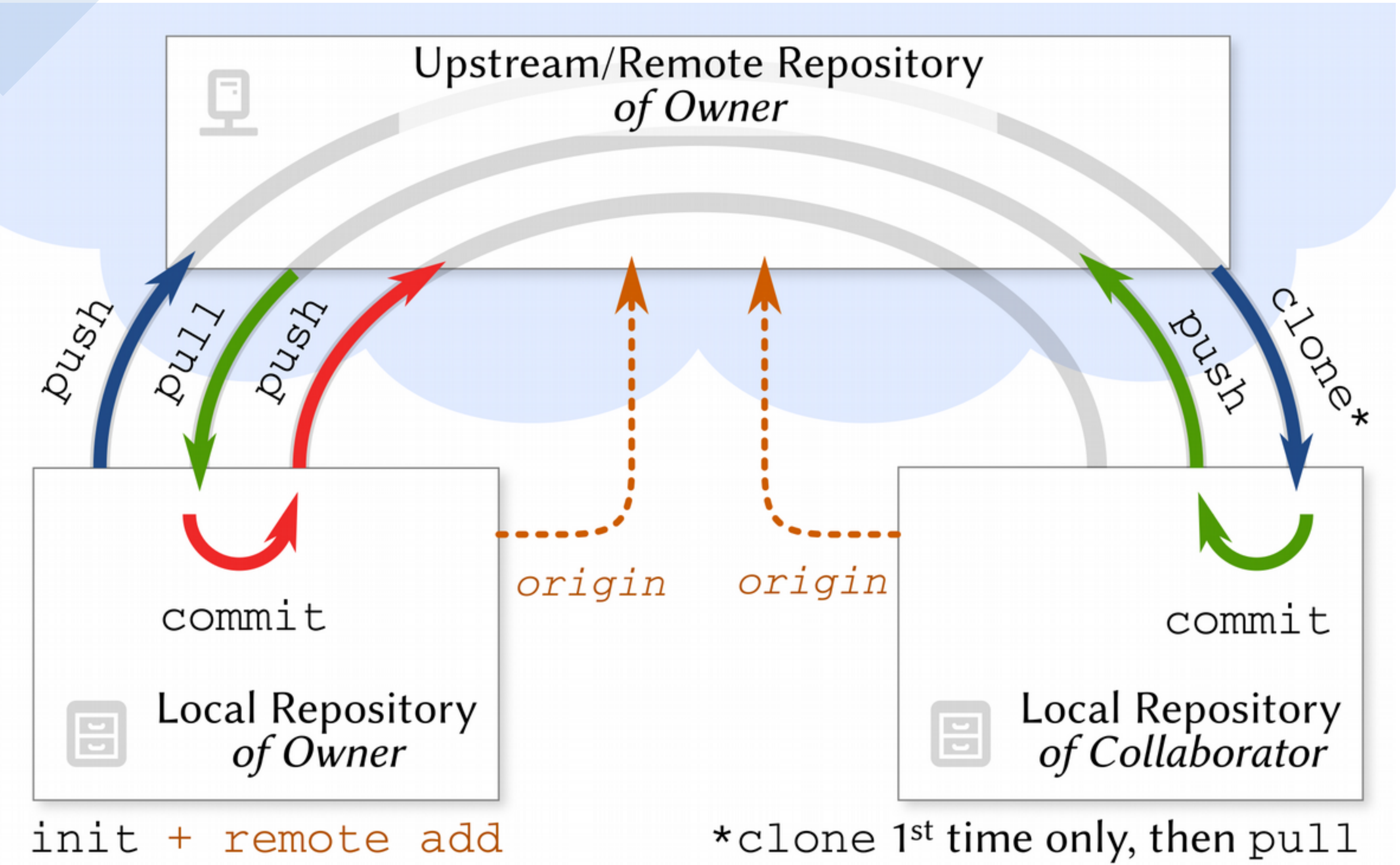
Practice 3

based on

http://swcarpentry.github.io/git-novice/08-collab/

Practice 3

The “ping-pong” Git workflow



Notice: Git provides **no lock mechanism**. Work is asynchronous

No conflicts,
if people work
in very different
time zones 🌐 !

globe with meridians: https://www.emojione.com/emoji/1f310

Practice 3

Manage merge conflicts

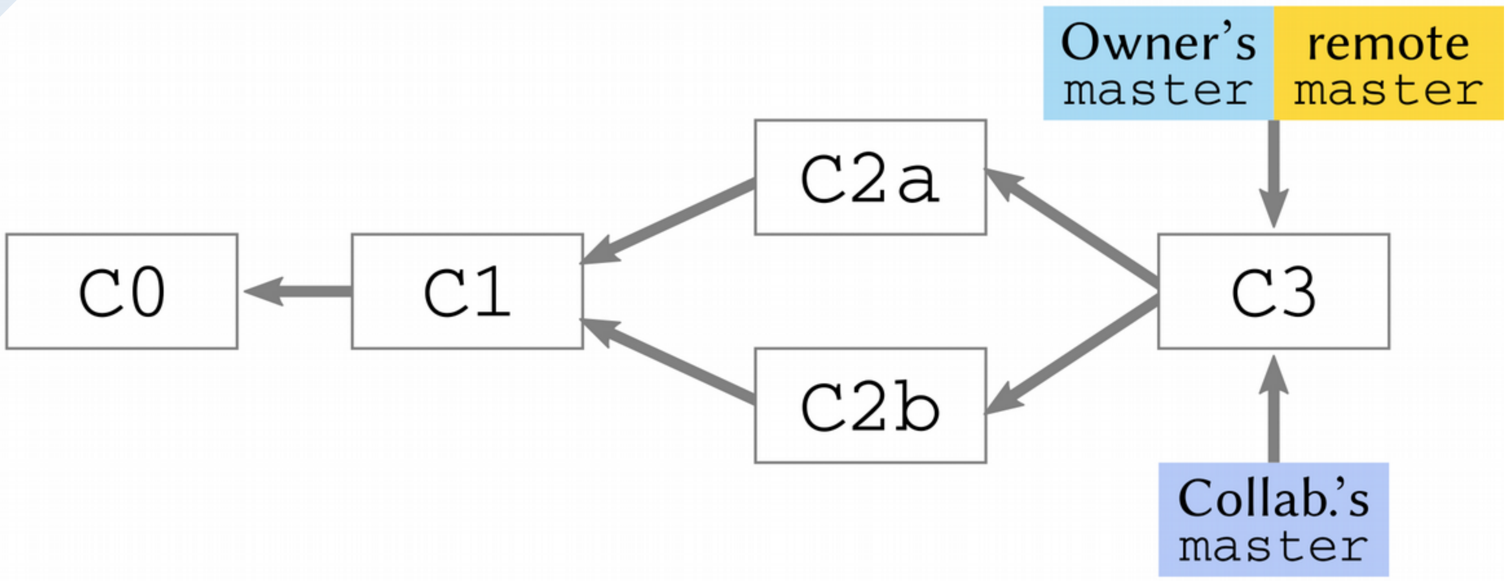
Again in pairs "Owner" and "Collaborator"

- Collab clones the GL repo of Owner (needs O to give rights to C)
- Owner AND Collab make local changes, commit
- Both attempt to push
  - The first to push is fine ☻
  - The second gets an error ("local is behind remote")
    ⟶ needs to pulls the first changes, and merge its own changes (automatic or needs manual conflict resolution)
  - Then second creates a merge commit and finally makes a push

http://swcarpentry.github.io/git-novice/09-conflict/

Practice 3

Merge commit process



1) Everybody synced
2) Local commits
3) Collab pushes first
   $\longrightarrow$ *Owner's view of remote is outdated*
4) Owner pulls and make a merge commit
5) Owner pushes
   Collab is outdated
6) Collab pulls
   $\longrightarrow$ everybody synced

http://swcarpentry.github.io/git-novice/09-conflict/
See also Git Branching - Branches in a Nutshell from "Pro Git" book

Review: typical workflows

- Locally:
  1) make changes
  2) add to staging
  3) commit to local repo
- With a remote:
  1) pull from remote (before making changes if possible)
  2) make local commits
  3) push to remote. If error (local behind remote), pull to merge.

Ressources

Gentle introduction:

- “Version Control with Git” lesson from Software Carpentry
  http://swcarpentry.github.io/git-novice/
- Interactive tutorial https://try.github.io

Comprehensive book:

- “Pro Git” by Chacon & Straub, Apress, 2nd Edition, 2014
  free to read online https://git-scm.com/book/

Quick References (Git “Cheatsheets”)

From Software Carpentry’s lesson Quick Reference page:

- Printable PDF (EN & FR) https://services.github.com/on-demand/resources/cheatsheets/
- Interactive webpage http://ndpsoftware.com/git-cheatsheet.html