Version Control – Agile Workflow with Git/GitHub

16 - 18 November 2021 | Guido Trensch (JSC, Simulation & Data Lab Neuroscience)

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Version Control Systems (VCS)

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Introduction

- Version control is one aspect of configuration management (CM) which is concerned with:
  - System building and Release Management
    - *Preparing software for releases and keeping track of system versions.*
  - Change management
    - *Keeping track of requests for changes, working out the costs and impact.*

[Ian Sommerville,*"Software Engineering"*]

Introduction

Why do we need version control?

- Keep track of different versions of software components.
- Identify, store, organize and control revisions and access to it.
- Track contributions.
- Enable independent development in multi-developer projects.

Introduction

Ensure that changes made by different developers do not interfere with each other

and

provide strategies to solve conflicts in independent development!

CONFLICT
Alice
Bob

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Version Control (VCS)

There are two types of version control systems:

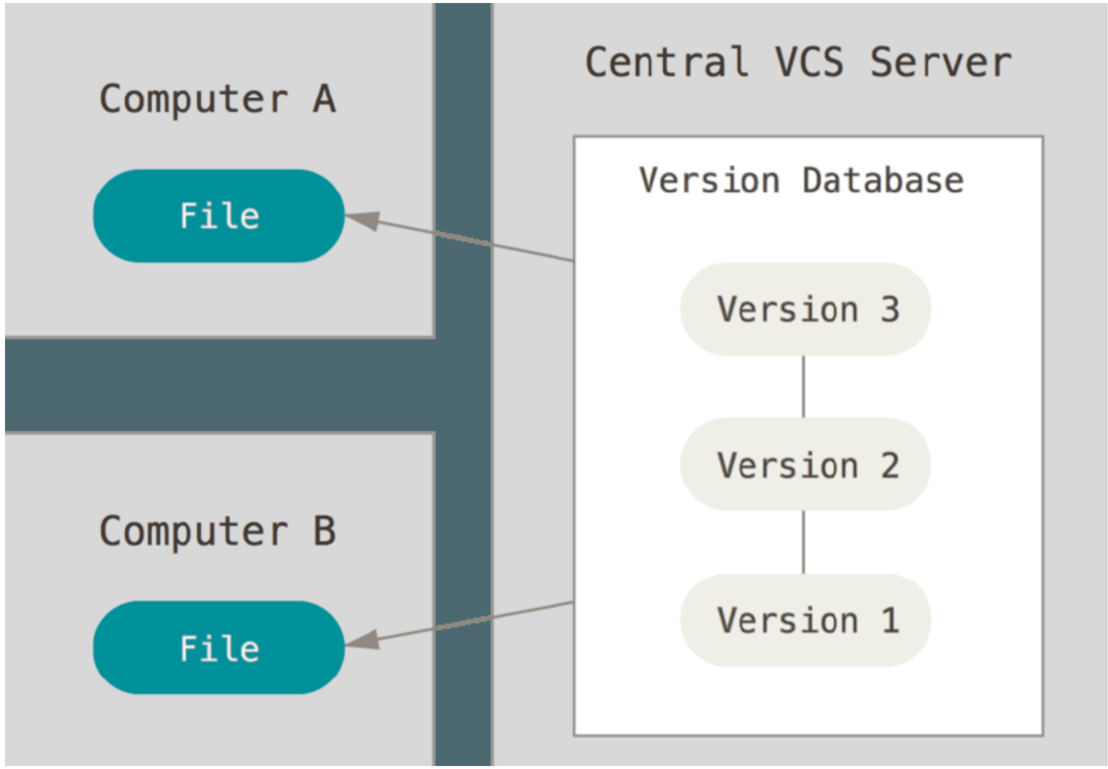
- Centralized systems
- Distributed systems

Version Control (VCS)

Centralized systems

- Maintain a single main (master) repository

- *Revision Control System (RCS, 1982)*
- *Concurrent Versioning System (CVS, 1986)*
- *Subversion (SVN, 2000)*

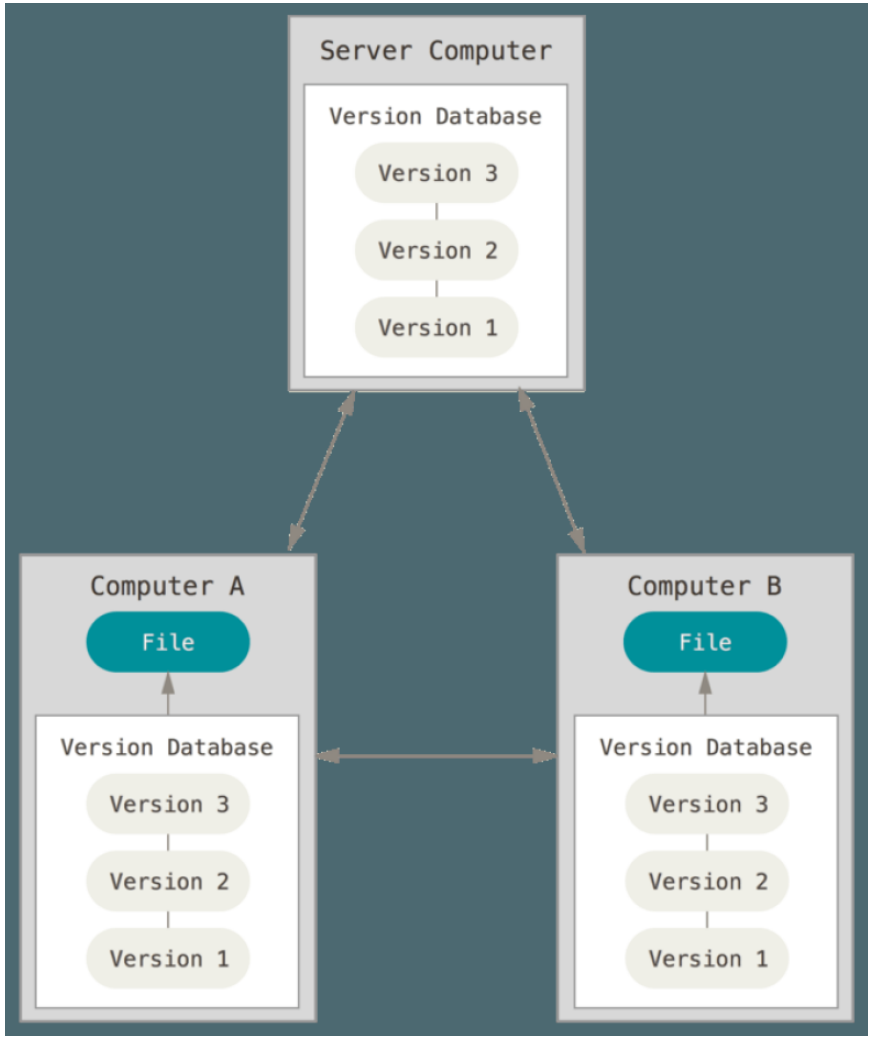


[Scott Chacon and Ben Straub, “Pro Git”]

Version Control (VCS)

Distributed systems

- Multiple versions of the component repository exist at the same time.
- *Git (by Linus Torwalds, 2005)*



[Scott Chacon and Ben Straub, “Pro Git”]

> “**Distributed version control** is essential for open-source development where several people may be working simultaneously on the same system without any central coordination.”

[Ian Sommerville,*“Software Engineering”*]

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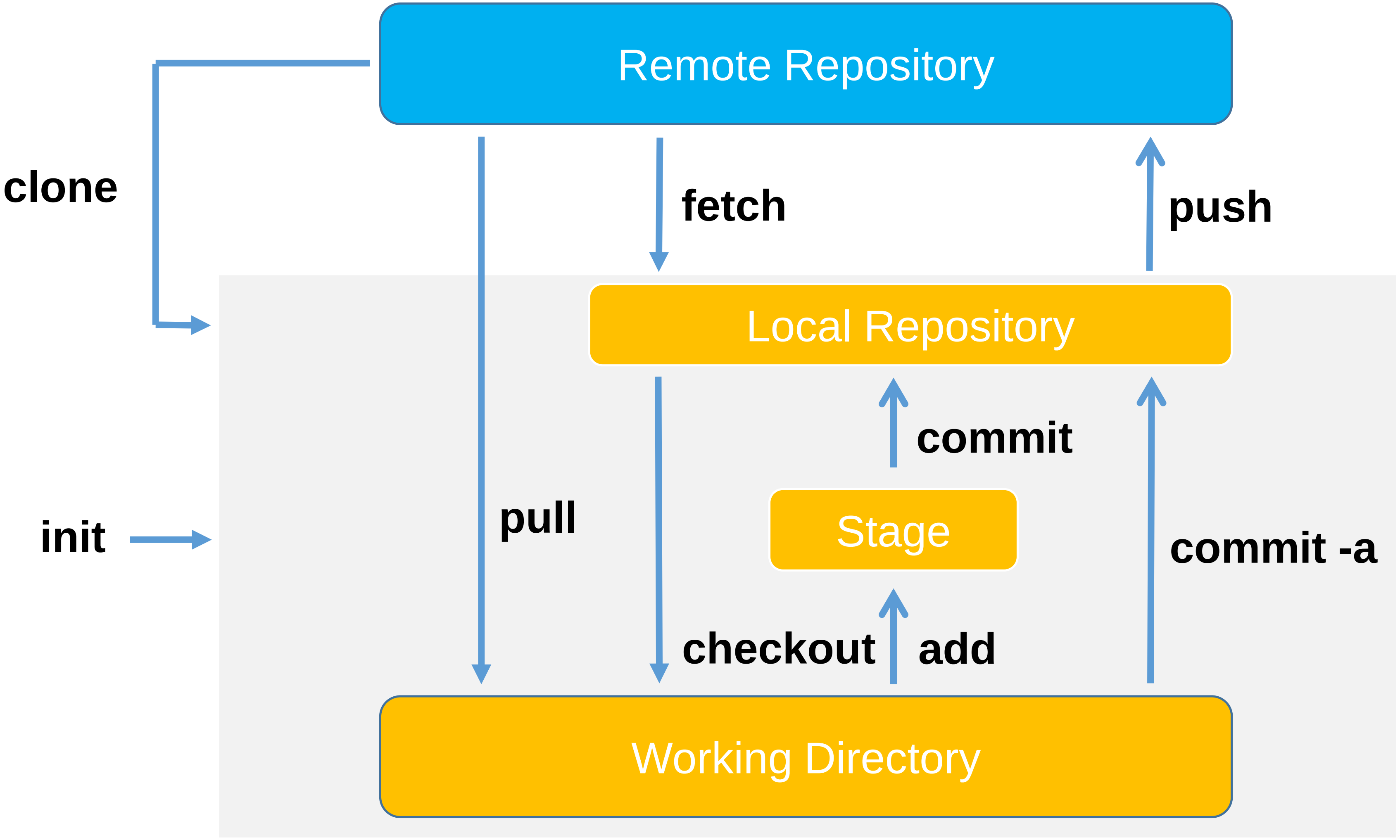


Understanding Git

Obtain a repository

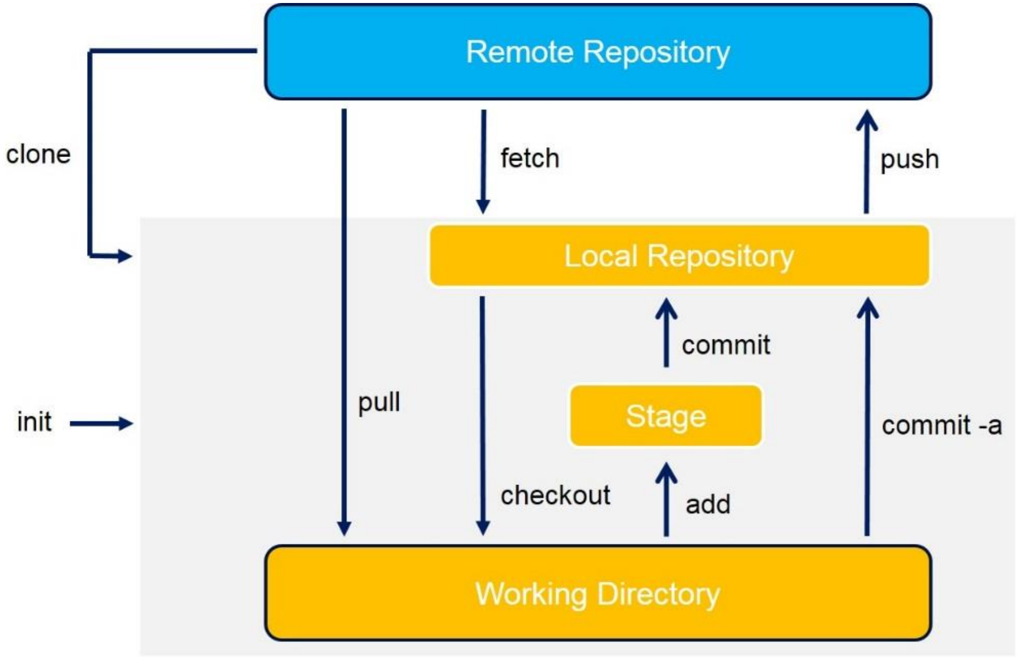
- **git init**

  Create an empty Git repository or reinitialize an existing one.
- **git clone <repository>**

  Clone a repository into a new directory.

Example:

```
git clone https://github.com/gtrensch/SoftwareDevInScience2021.git
```



Understanding Git

Get changes from a remote repository

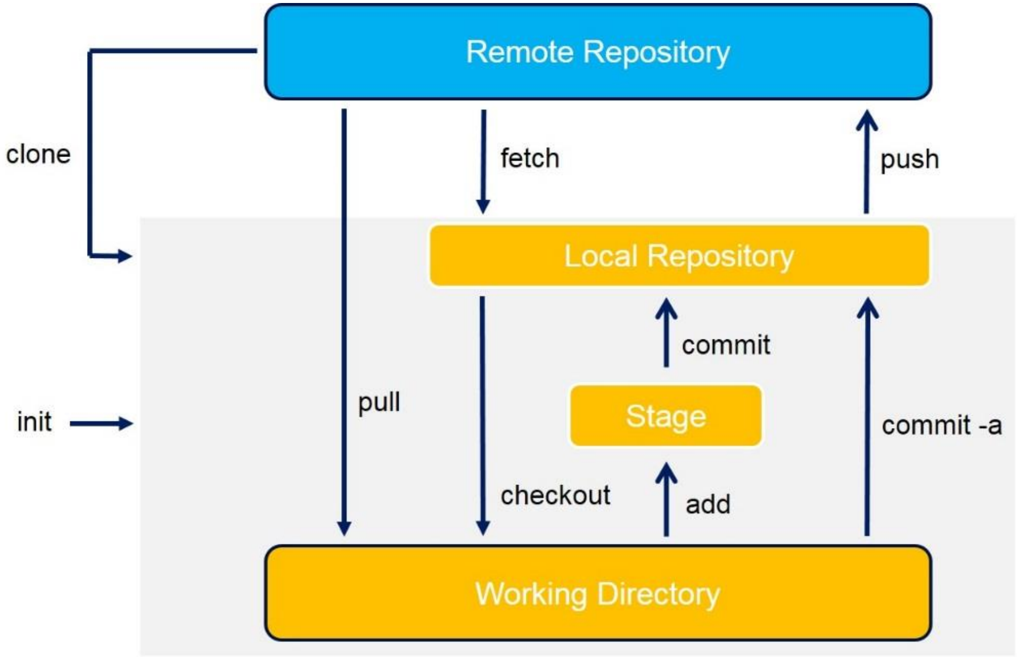
- **git fetch**

  Download objects and refs from another repository.

- **git pull <repository>**

  Fetch from and integrate with another repository or a local branch.

  (shorthand for *git fetch* followed by *git merge FETCH_HEAD*)



Understanding Git

Push changes to a remote repository

- **git add <file_name(s)>**

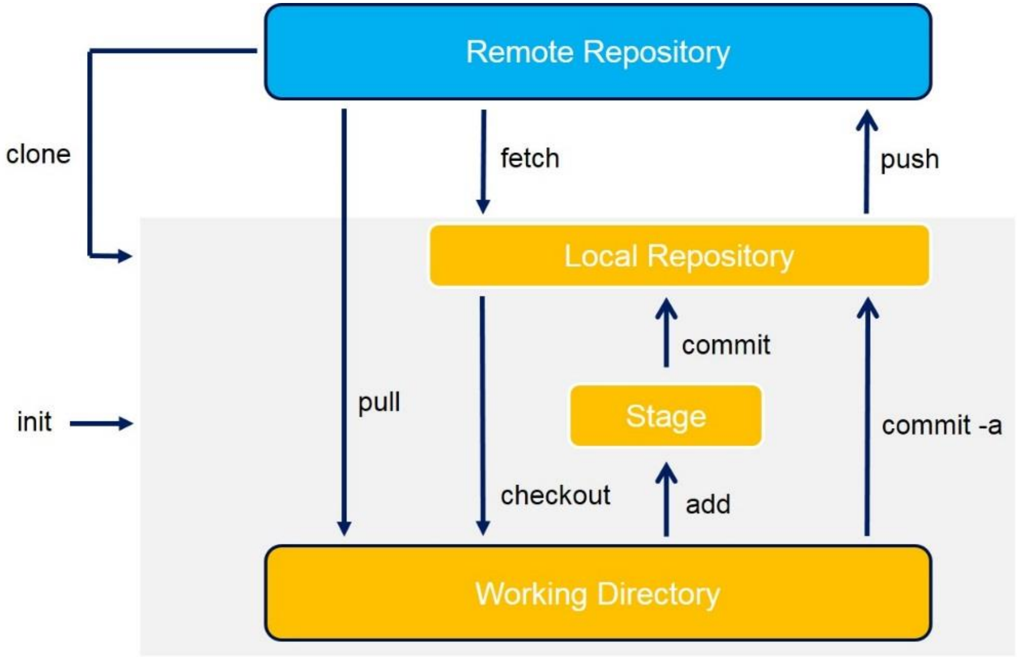
  Add file contents to the index (stage).

- **git commit -m <message>**

  Record changes to the repository.

- **git push <repository>**

  Update remote refs along with associated objects.



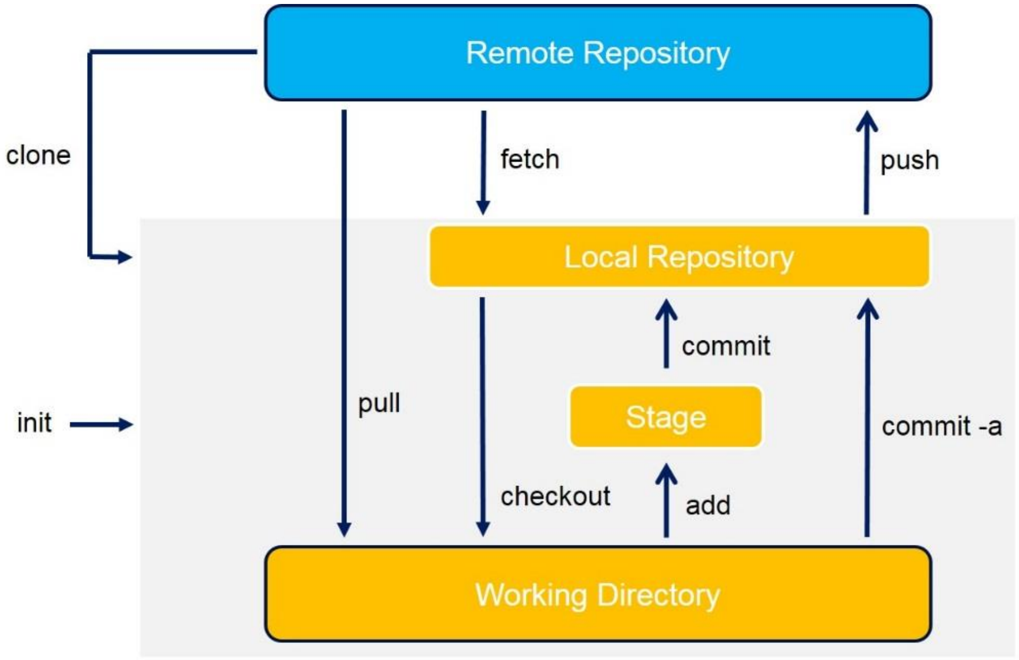
Understanding Git

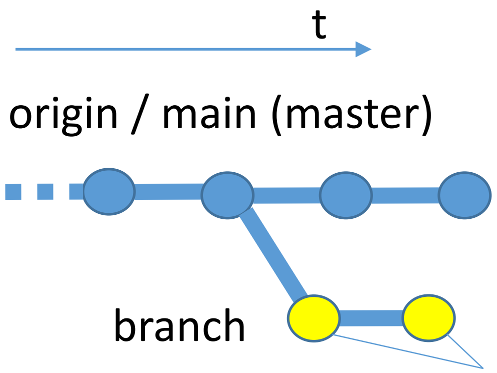
Branching

- **git checkout –b <new_branch>**
- **git branch <new_branch>**

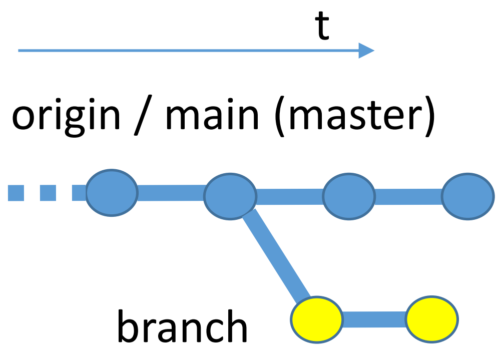
  Both commands creates a new branch.
- **git branch –d <old_branch>**

  Deletes a branch.





Commits waiting for review and merge into main.



Avoid working on your main-branch !

(Except you know what you do.)

Understanding Git

Useful Git commands

- **git status**

  Show the working tree status.

- **git reset**

  Reset current HEAD to the specified state.

- **git diff**

  Show changes between commits, commit and working tree, etc.

- **git merge**

  Join two or more development histories together.

- **git remote**

  Manage set of tracked repositories.

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GitHub (Agile Workflow)

GitHub

www.github.com

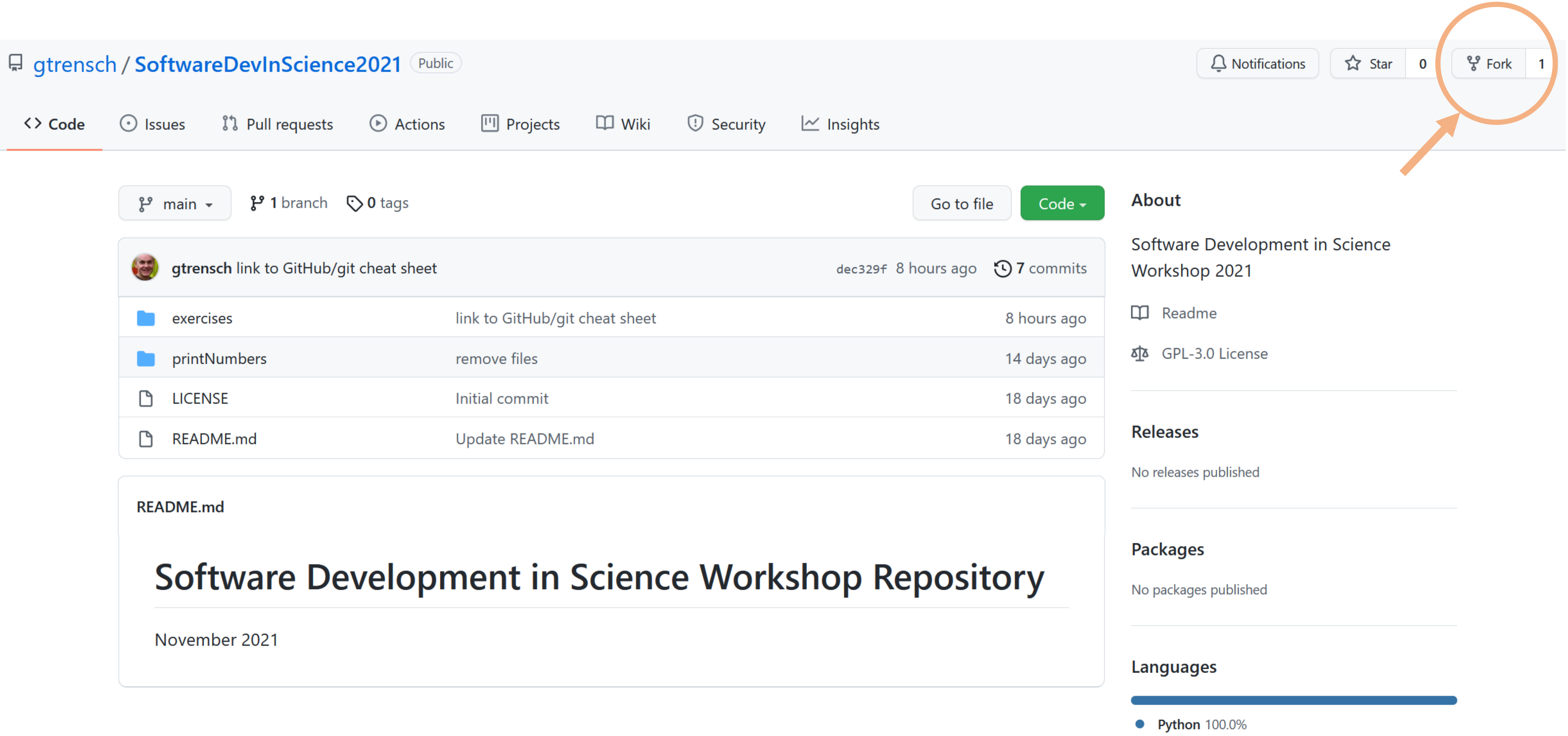
What is GitHub?

- Web-based Git repository hosting service
- Platform to share open-source projects
- As of January 2020, GitHub reports having **over 40 million users** and more than 190 million repositories!
- Supports agile practices:
  - Code review workflow
  - Continuous Integration and Delivery (CI/CD)
    - GitHub Actions
    - (Coupling with Travis CI)
  - Basic project management

GitHub (Agile Workflow)

- Issue tracker
- Wiki
- GitHub **”Fork”**:
  - Enables you to copy a repository from a user‘s account.
  - You can make changes under your own account and share your work by issuing a so-called "pull request".

GitHub (Agile Workflow)



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Notifications · Star 0 · Fork 1

Code · Issues · Pull requests · Actions · Projects · Wiki · Security · Insights

main · 1 branch · 0 tags · Go to file · Code

gtrensch link to GitHub/git cheat sheet · dec329f 8 hours ago · 7 commits

exercises	link to GitHub/git cheat sheet	8 hours ago
printNumbers	remove files	14 days ago
LICENSE	Initial commit	18 days ago
README.md	Update README.md	18 days ago

README.md

Software Development in Science Workshop Repository

November 2021

About

Software Development in Science Workshop 2021

Readme

GPL-3.0 License

Releases

No releases published

Packages

No packages published

Languages

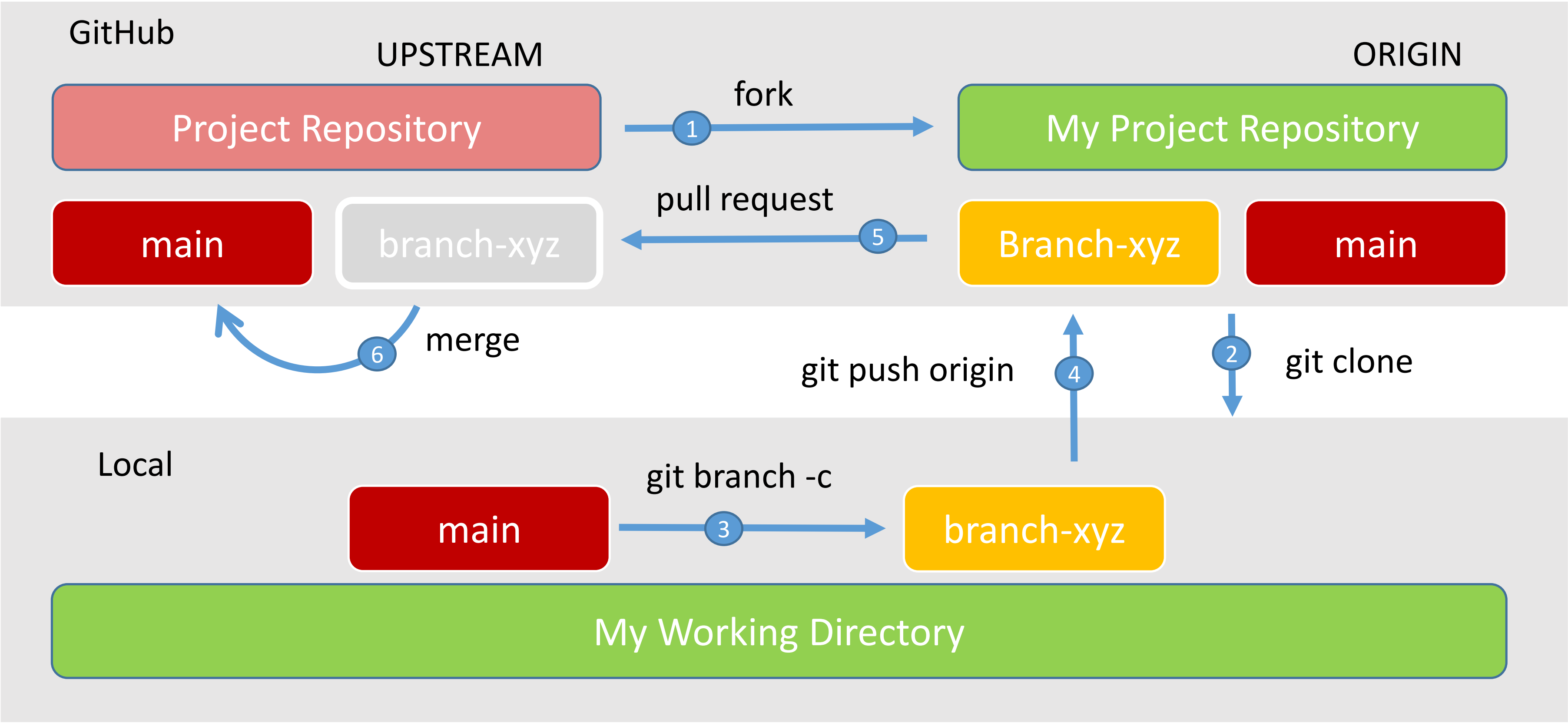
● Python 100.0%

4 Common GitHub/Git Workflows …

GitHub (Agile Workflow)

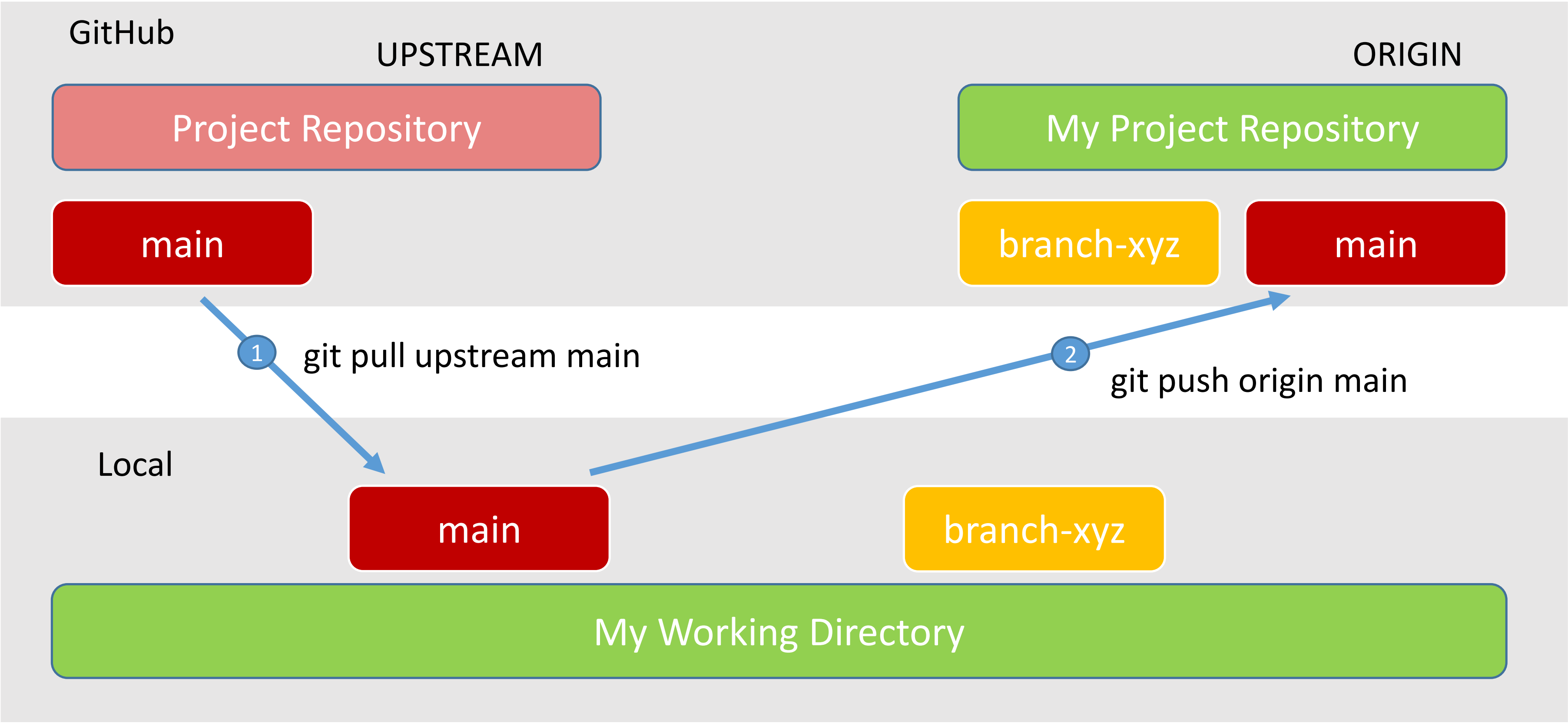
GitHub/Git Workflow: **Contribute to a project**

- Not rules. Guidelines and best practices developers should follow.



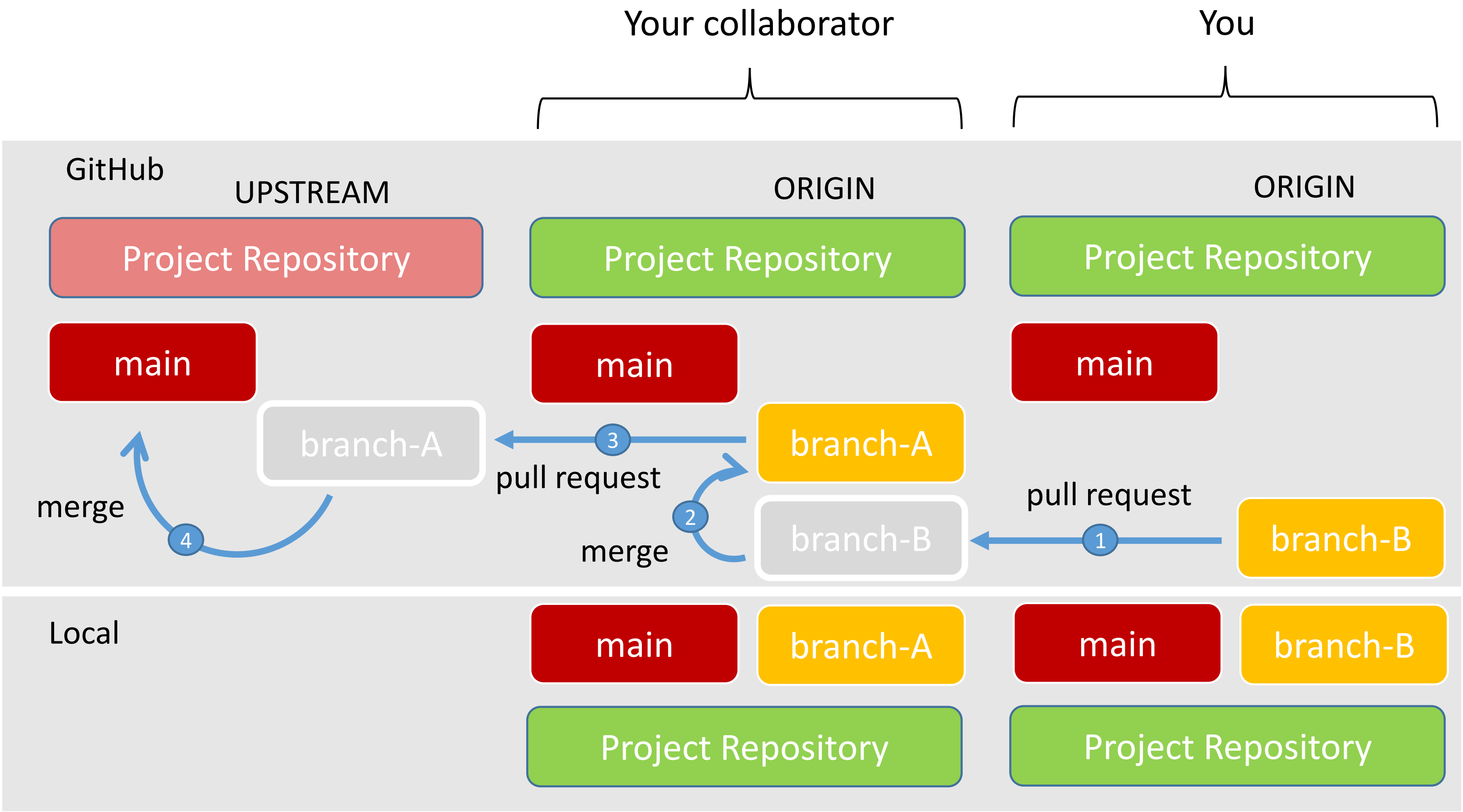
GitHub (Agile Workflow)

Actualize/sync your local repository



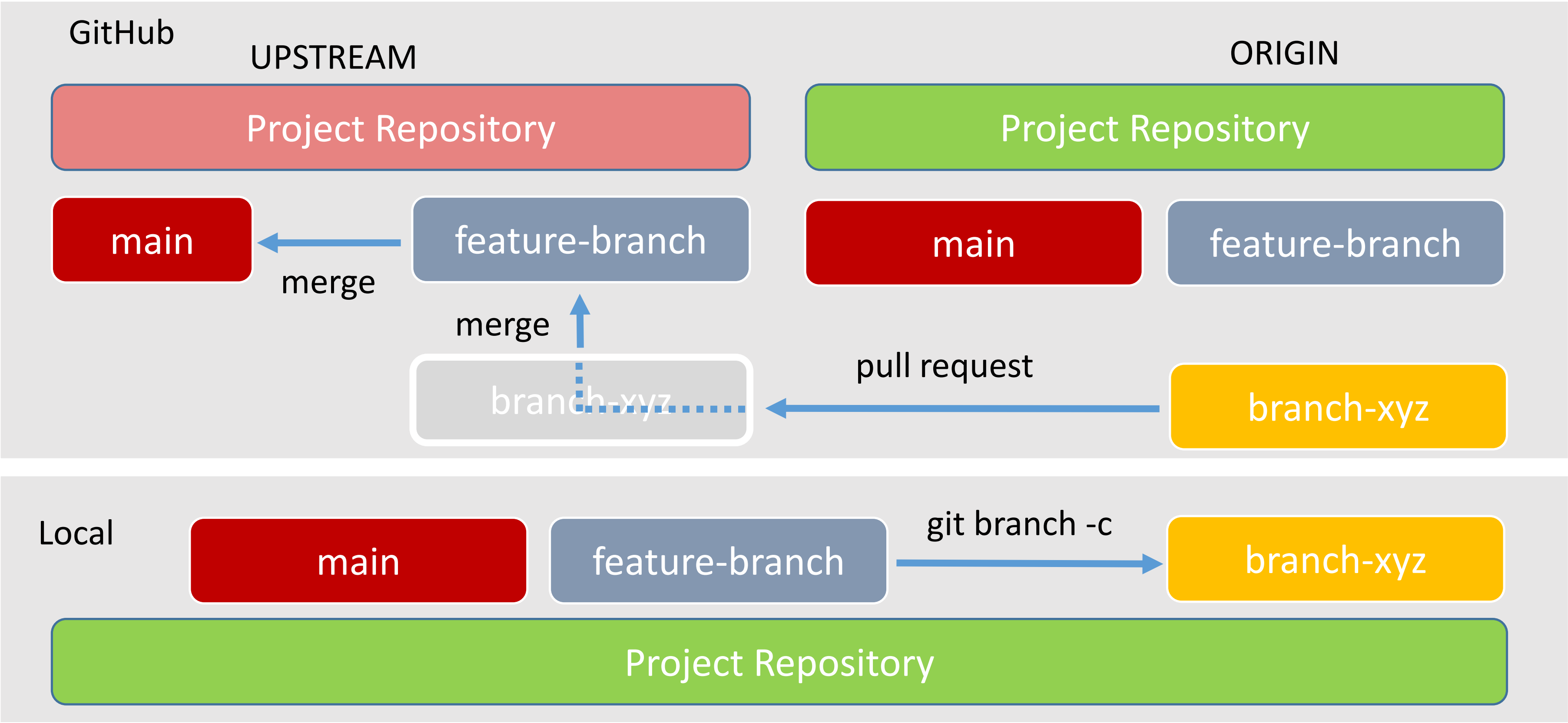
GitHub (Agile Workflow)

Collaborate



GitHub (Agile Workflow)

Feature Branch



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References

- Everything you need to know about Git.

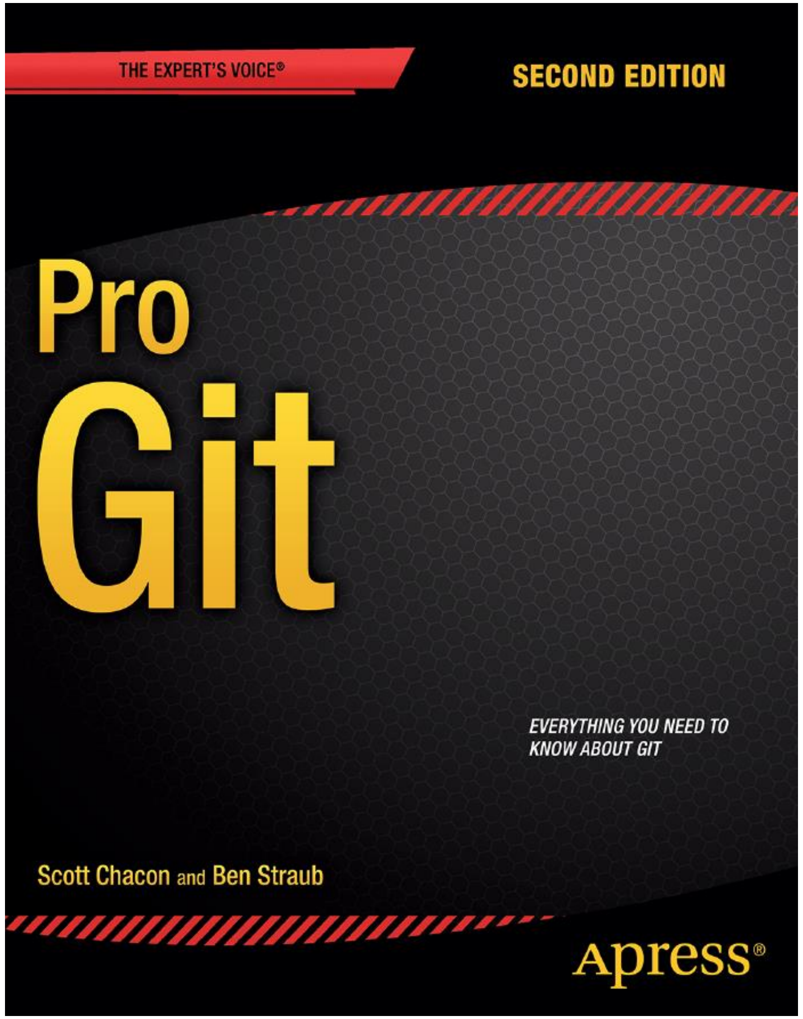
  https://git-scm.com/book/en/v2

- Git Reference

  https://git-scm.com/docs

- GitLab

  https://about.gitlab.com/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