Version Control – Agile Workflow with Git/GitHub

15 - 17 November 2022 | Guido Trensch (JSC, Simulation & Data Lab Neuroscience)

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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?

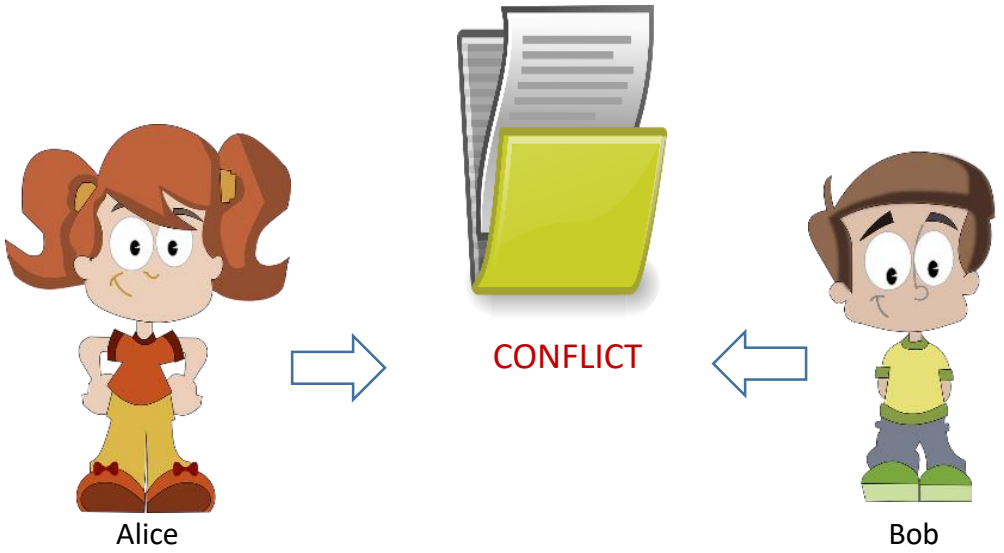
- Keep track of different versions of software components.
- Identify, store, organize and control revisions and access to it.
- Track contributions.
- **Enable independent development in multi-developer projects.**

Introduction

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

and

provide strategies to solve conflicts in independent development!



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Version Control (VCS)

There are two types of version control systems:

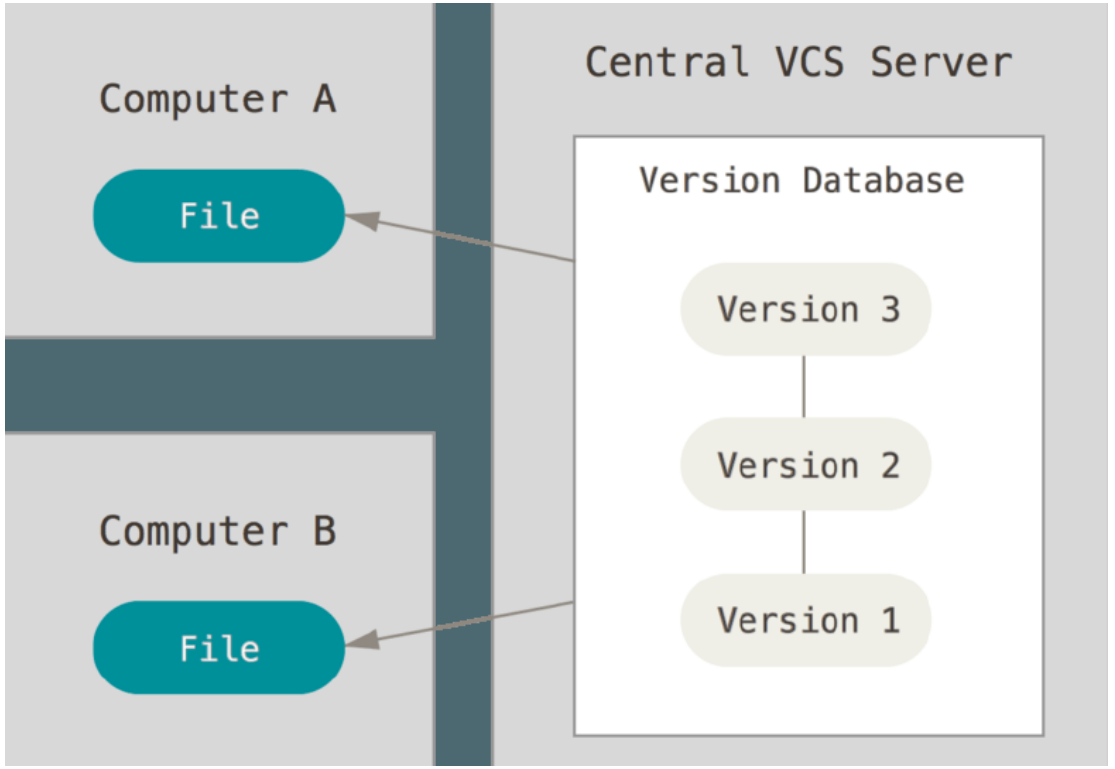
- Centralized systems
- Distributed systems

Version Control (VCS)

Centralized systems

- Maintain a single main (master) repository

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

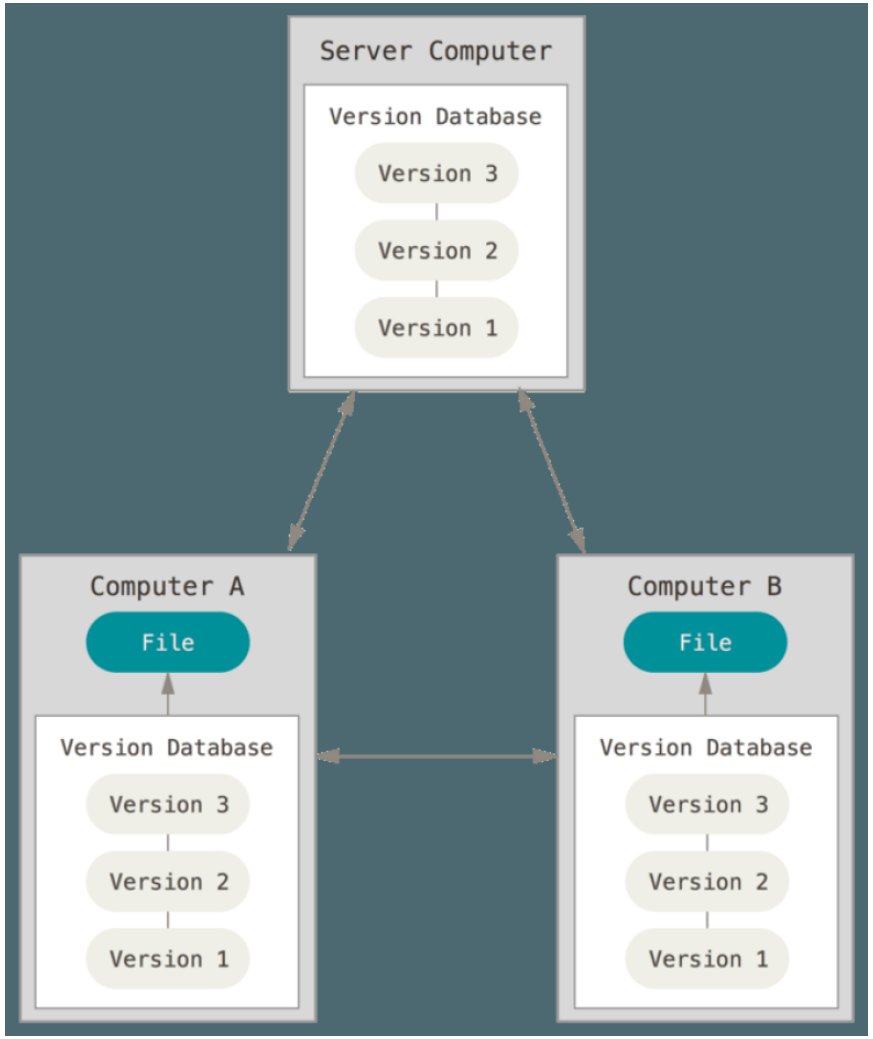


[Scott Chacon and Ben Straub, “Pro Git”]

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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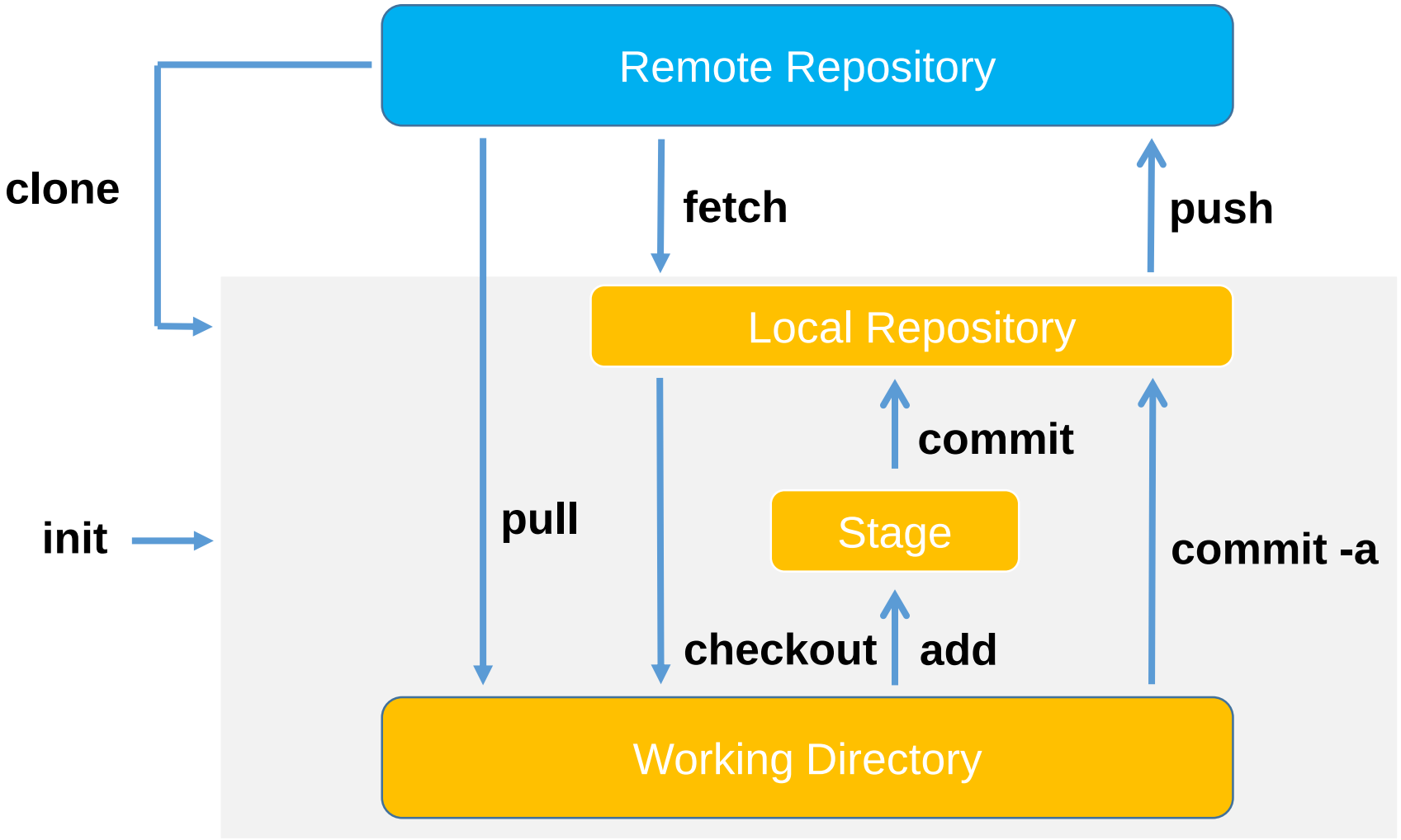
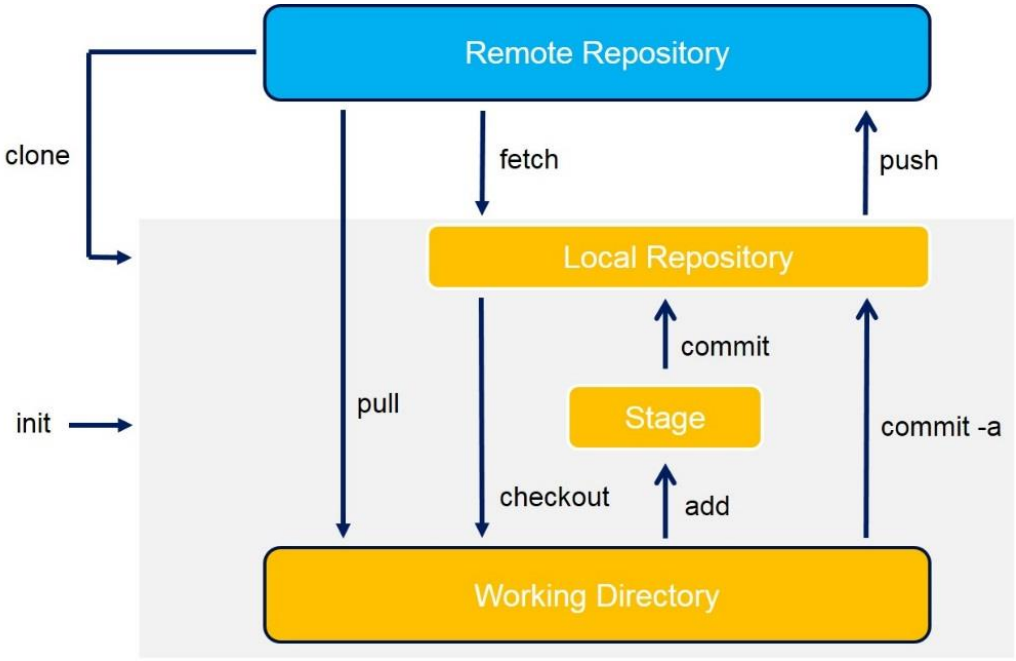
Understanding Git



Understanding Git

Obtain a repository



- **git init**

  Create an empty Git repository or reinitialize an existing one.

- **git clone <repository>**

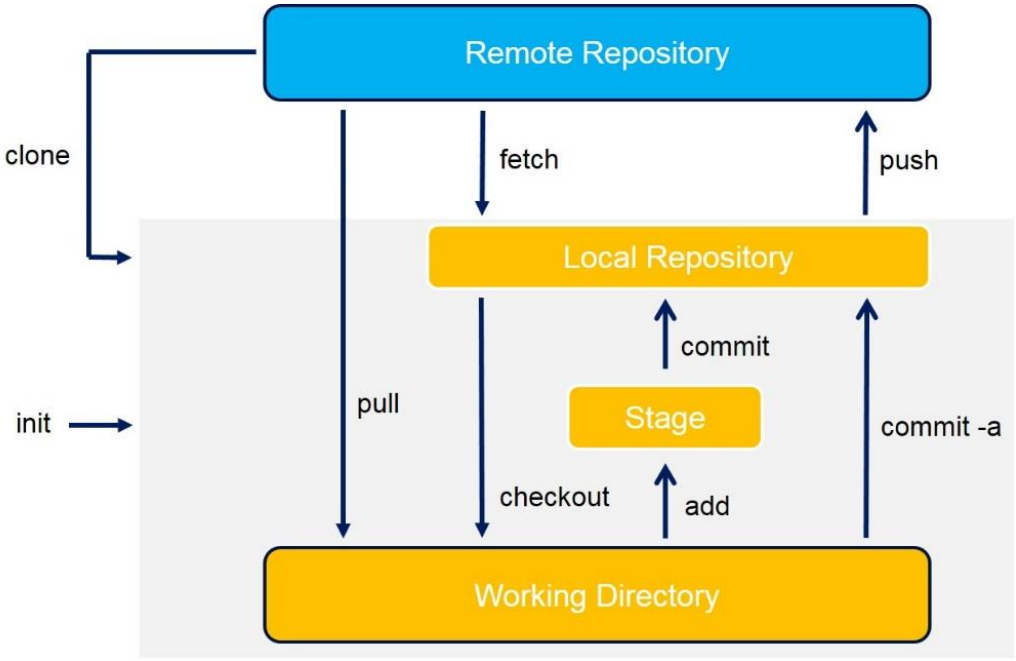
  Clone a repository into a new directory.

Example (SSH URL):

git clone git@github.com/MyGitHubUserName/SoftwareDevInScience.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

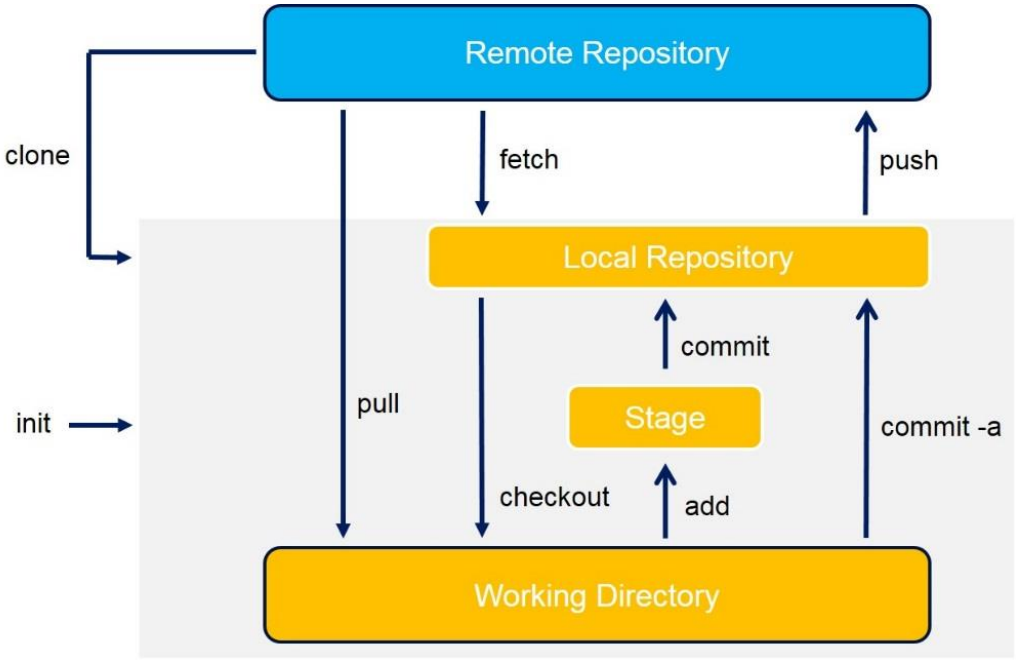
Apply changes to a remote repository

- **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.



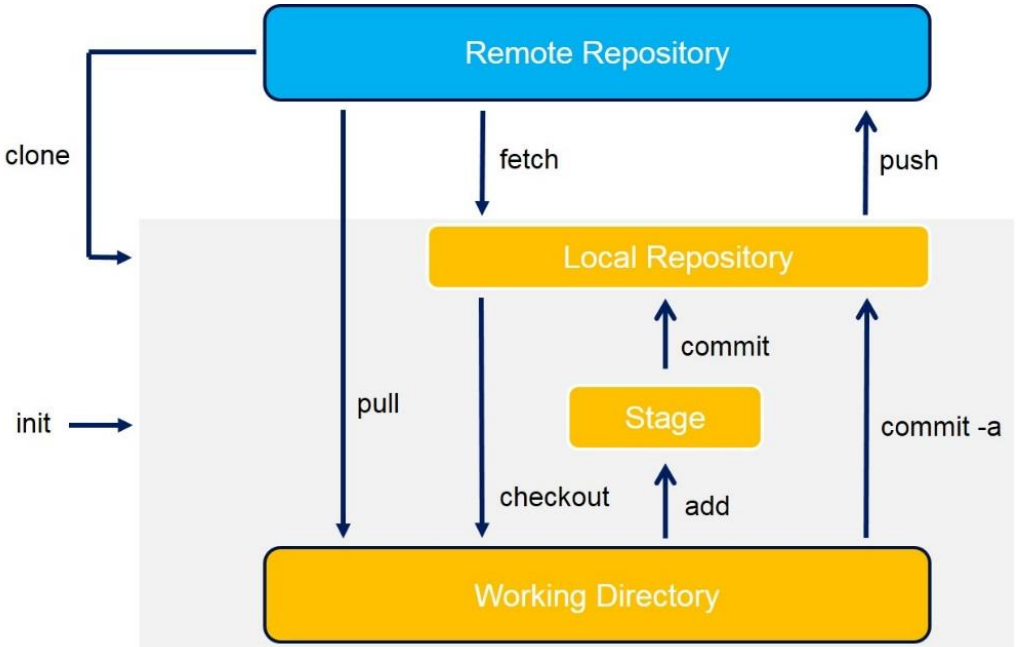
Understanding Git

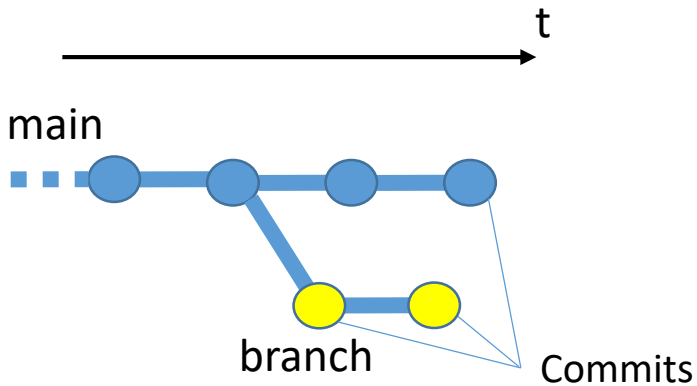
Branching

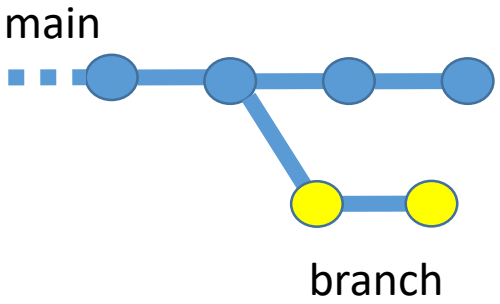
- **git checkout –b <new_branch>**
- **git branch <new_branch>**

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

  Deletes a branch.







Avoid working on your main-branch !

(Except you know what you do.)

Understanding Git

Other 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)

What is GitHub?

- Web-based Git repository hosting service
- Platform to share open-source projects

www.github.com

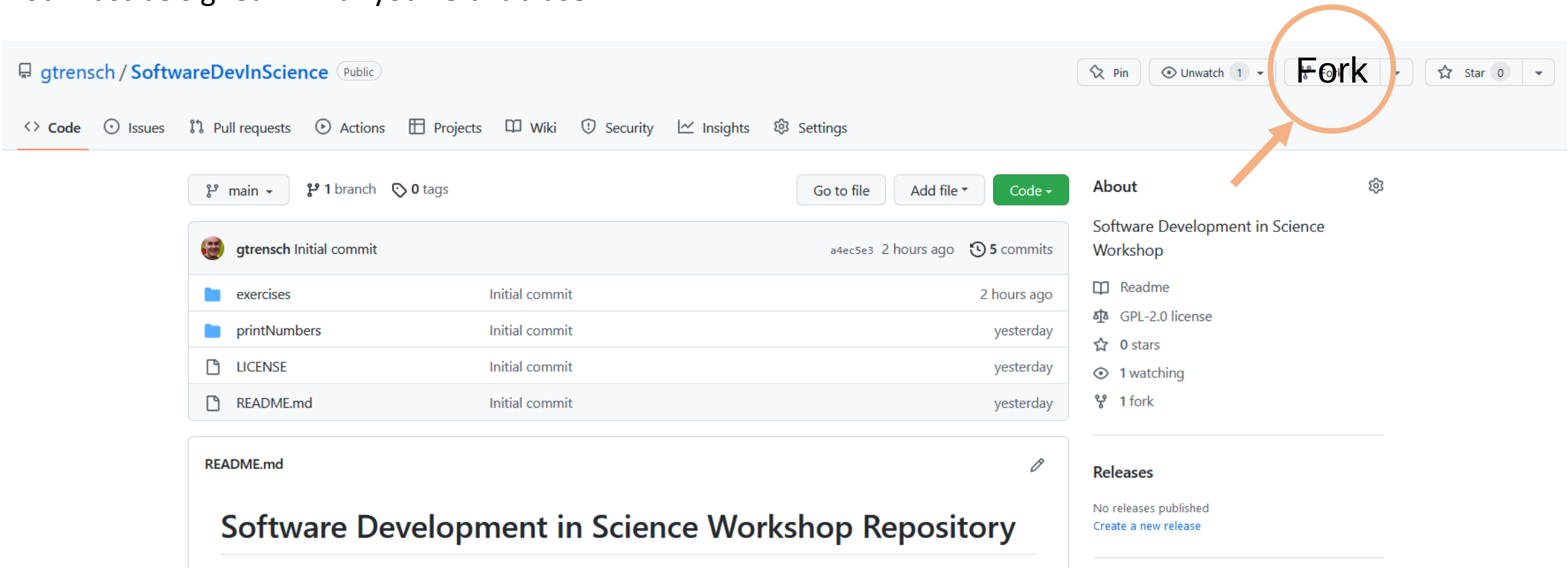
- As of January 2020, GitHub reports having **over 40 million users** and more than 190 million repositories!
- Supports agile practices:
  - Code review workflow
  - Continuous Integration and Delivery (CI/CD)
    - GitHub Actions
  - Lightweight project management

GitHub (Agile Workflow)

- Issue tracker
- Wiki functionality
- 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)

You must be signed in with your GitHub user.

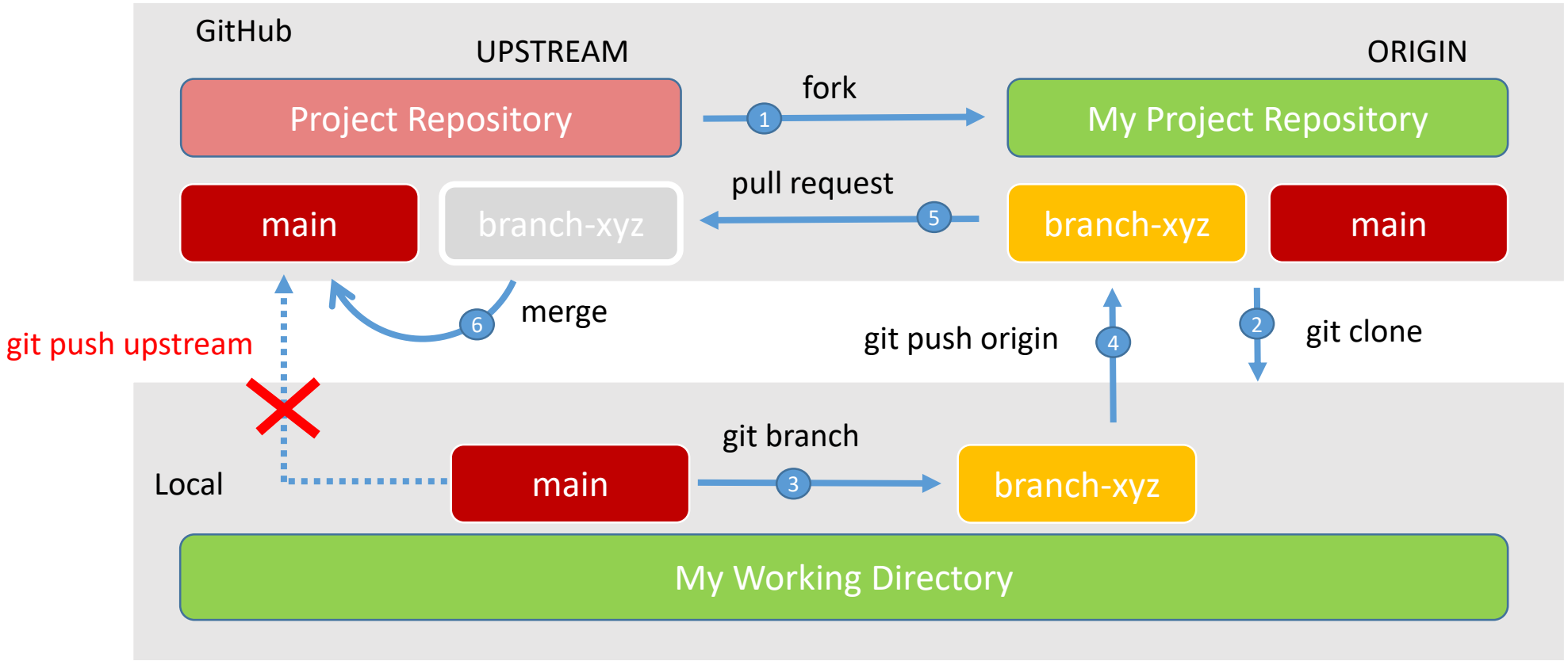


Four common GitHub workflows proven to be useful …

Not rules, rather guidelines and best practices for developers.

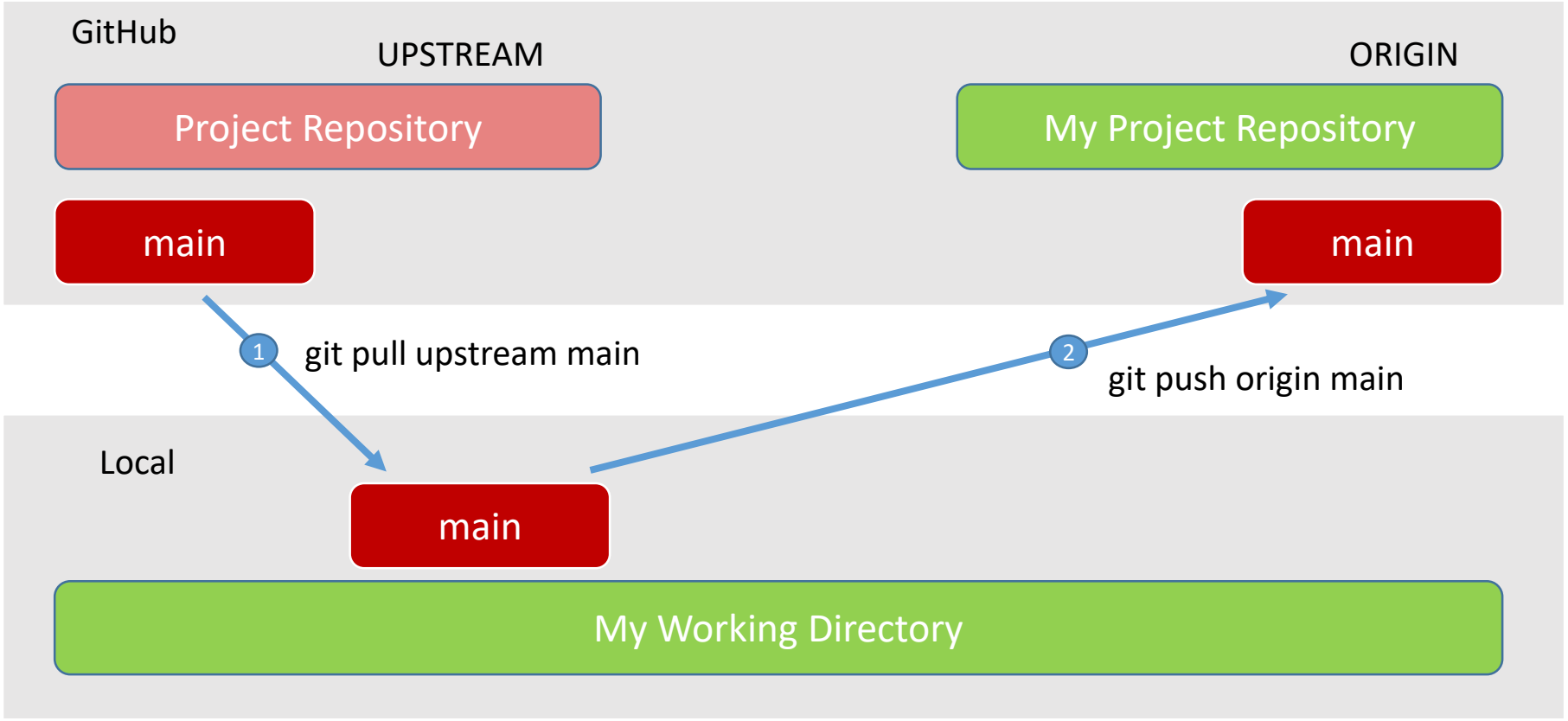
GitHub (Agile Workflow)

Contribute to a project



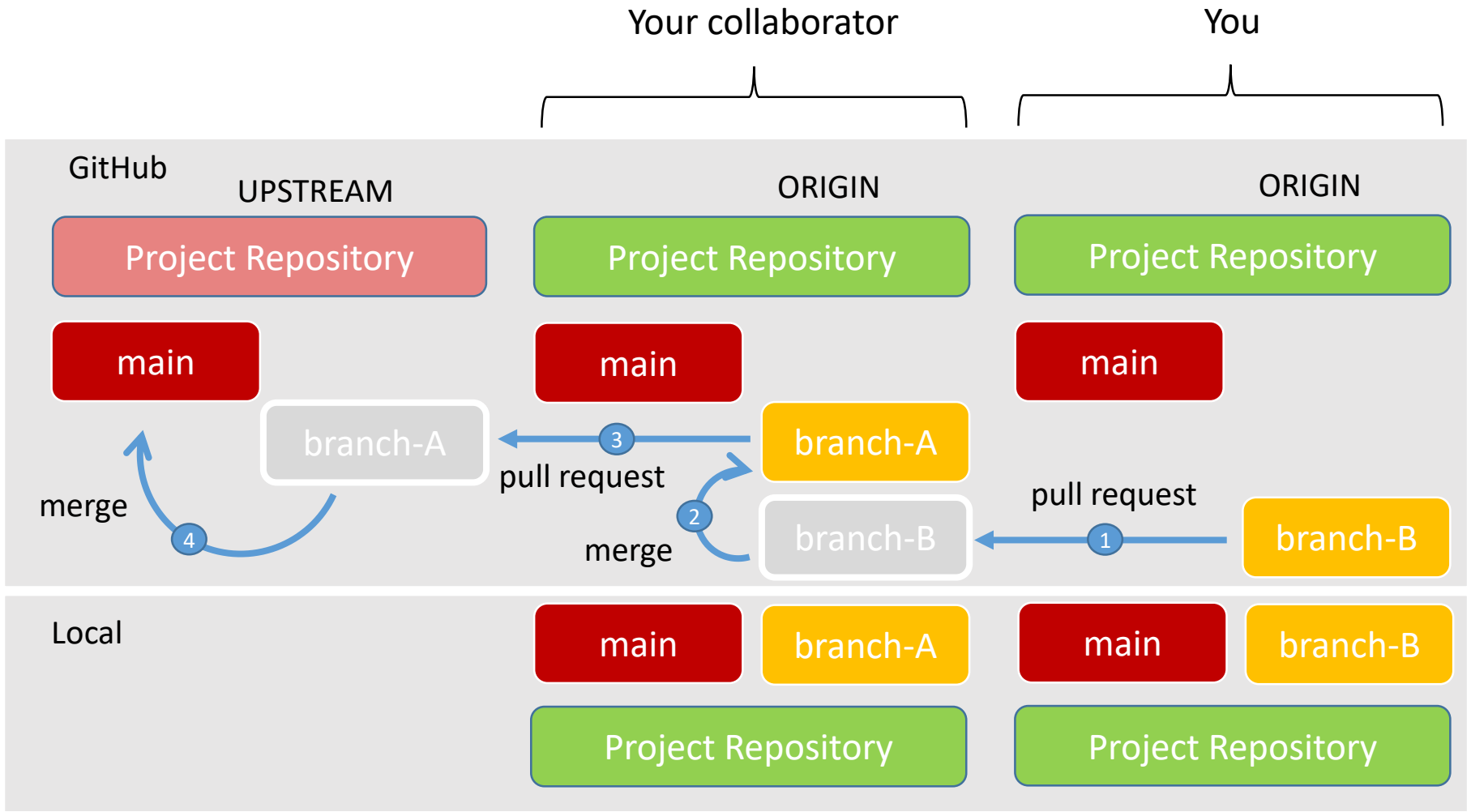
GitHub (Agile Workflow)

Keeping your local repository in sync with GitHub



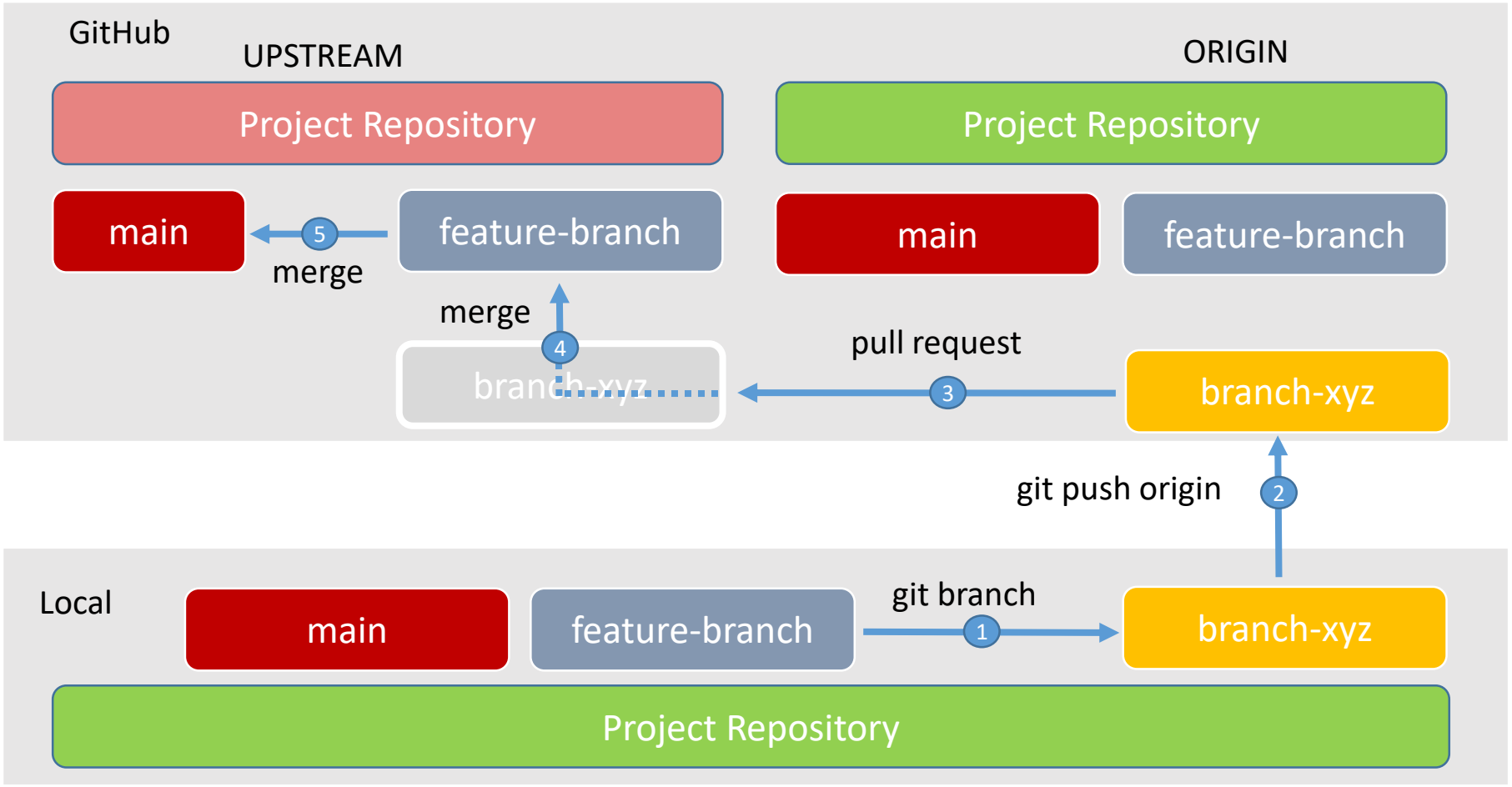
GitHub (Agile Workflow)

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/