Git Background—Distributed Version Control

Scalable Software Engineering
WS 2021/22

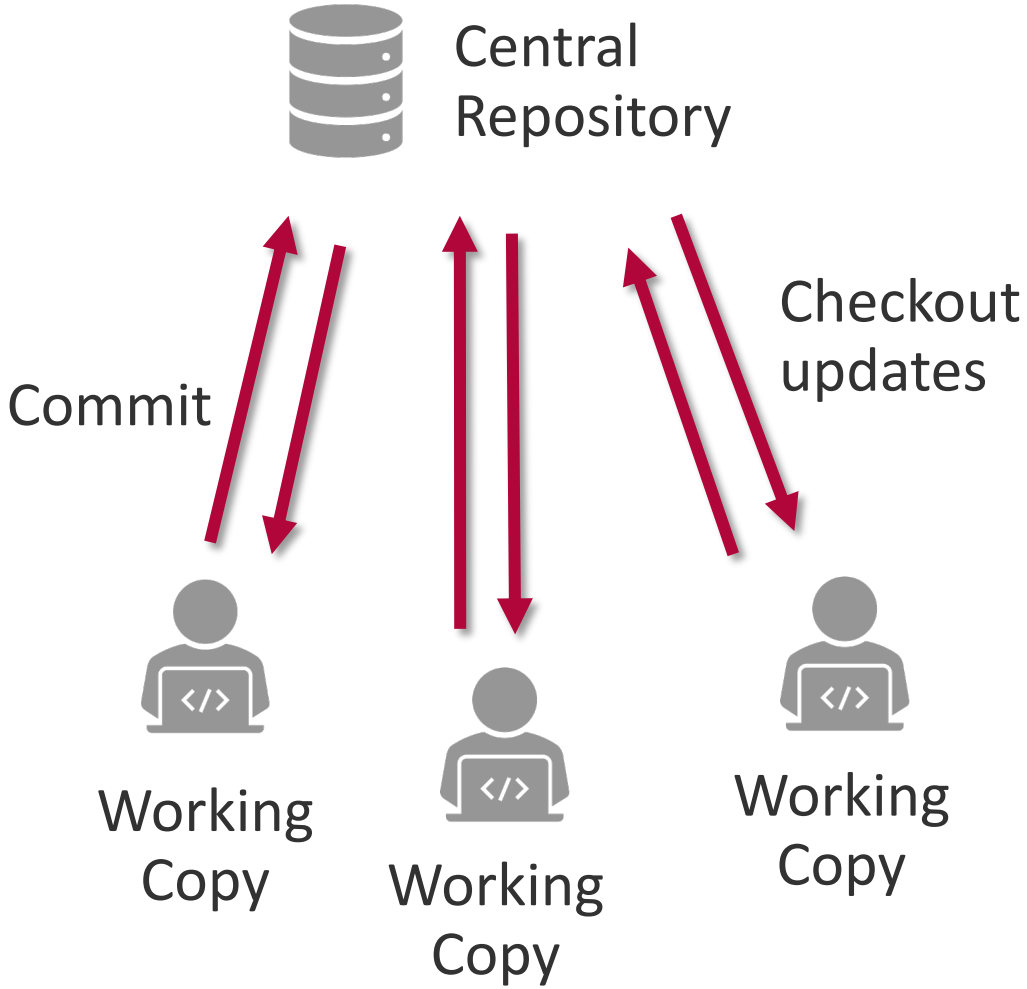
Enterprise Platform and Integration Concepts

Outline

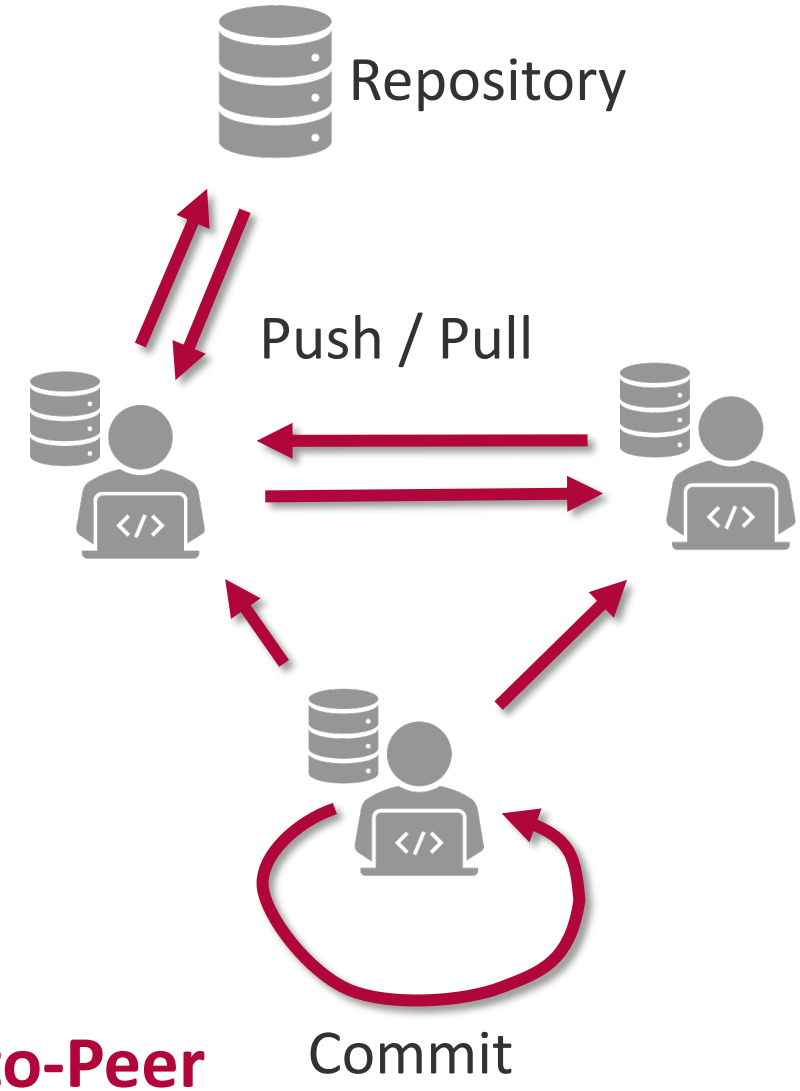
- Design of VCS
- What happens under the hood?
- Collaboration in teams

https://xkcd.com/1597/

Centralized vs Distributed VCS



VS.



Client-Server

Peer-to-Peer

Centralized vs Distributed VCS

Using Version Control Systems

- **Distributed VCS mostly used like centralized ones**
  - One peer who is always online and acts as central (git)hub
- Local commits are blessing and curse
  - Commits can be made while offline
  - Higher chances of code diverging

Git Objects

Blob

- Content of a file
- Nothing else

Tree

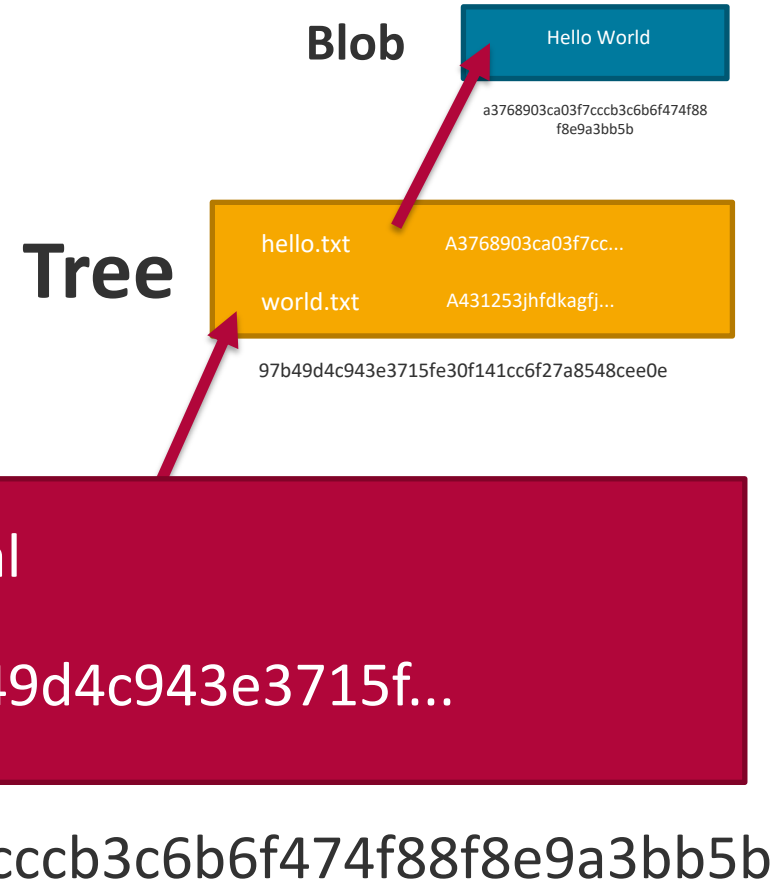
- Folder structure, file names
- References Blobs

Commit

- References Tree object
- Metadata
- 0..* parent commits

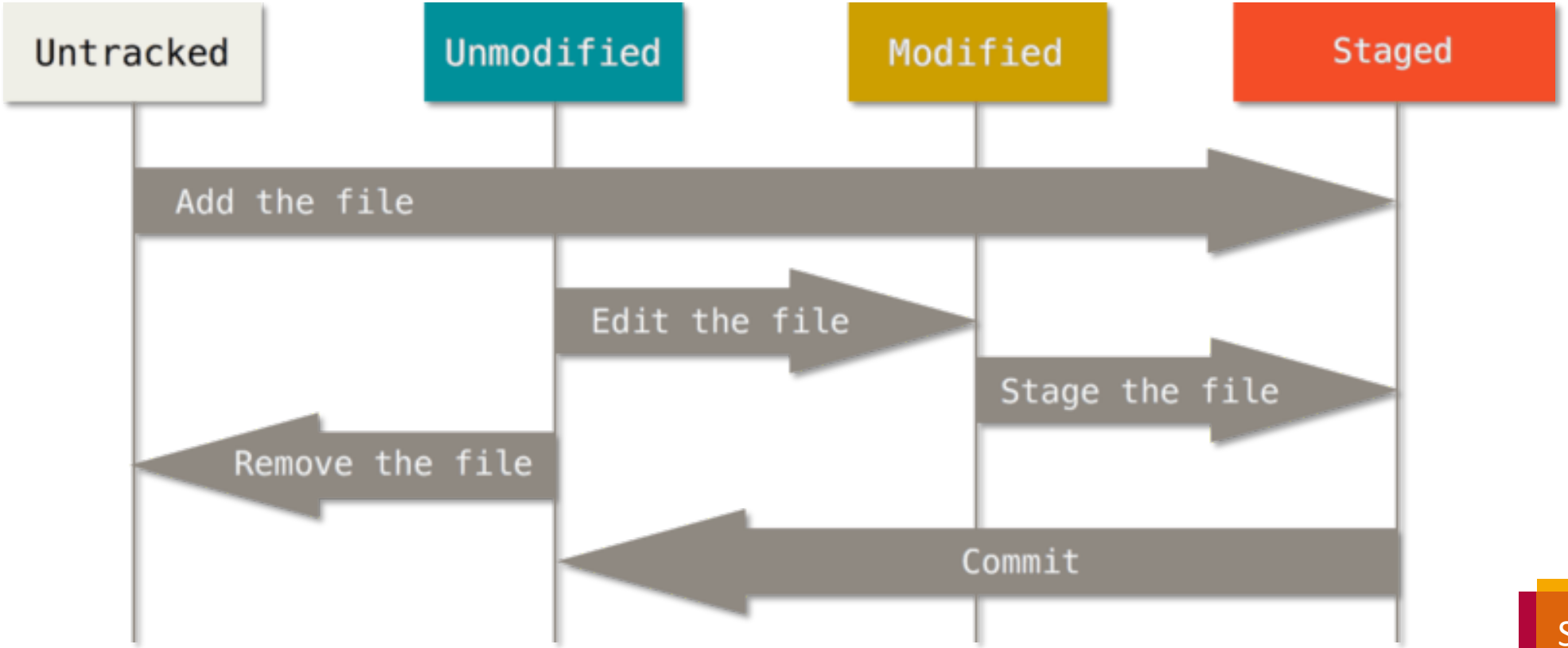
Tag

- Reference to other object



https://git-scm.com/book/en/v2/Git-Internals-Git-Objects

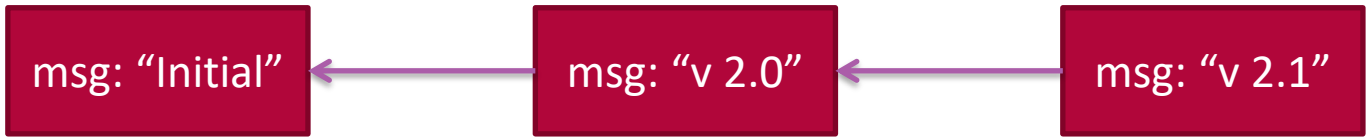
Git Local File Status Lifecycle



Short git status:
`git status -s`

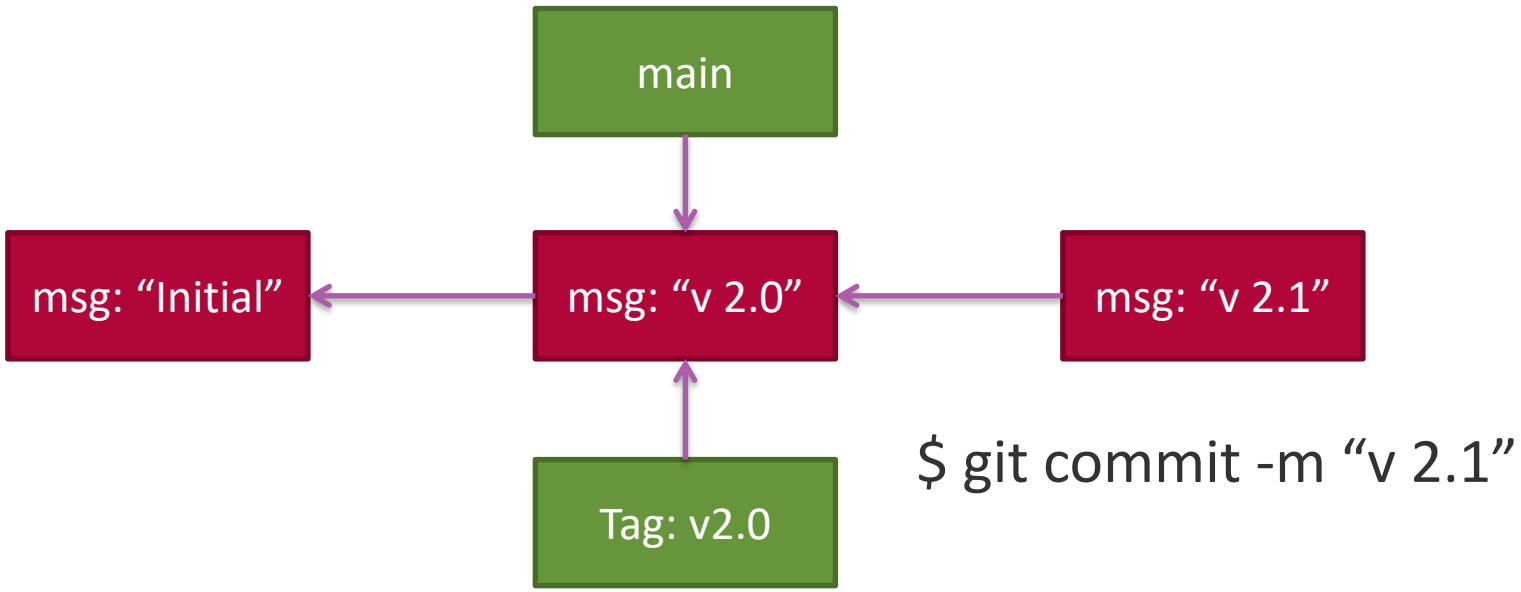
https://git-scm.com/book/en/v2/Git-Basics-Recording-Changes-to-the-Repository

Commit Parent



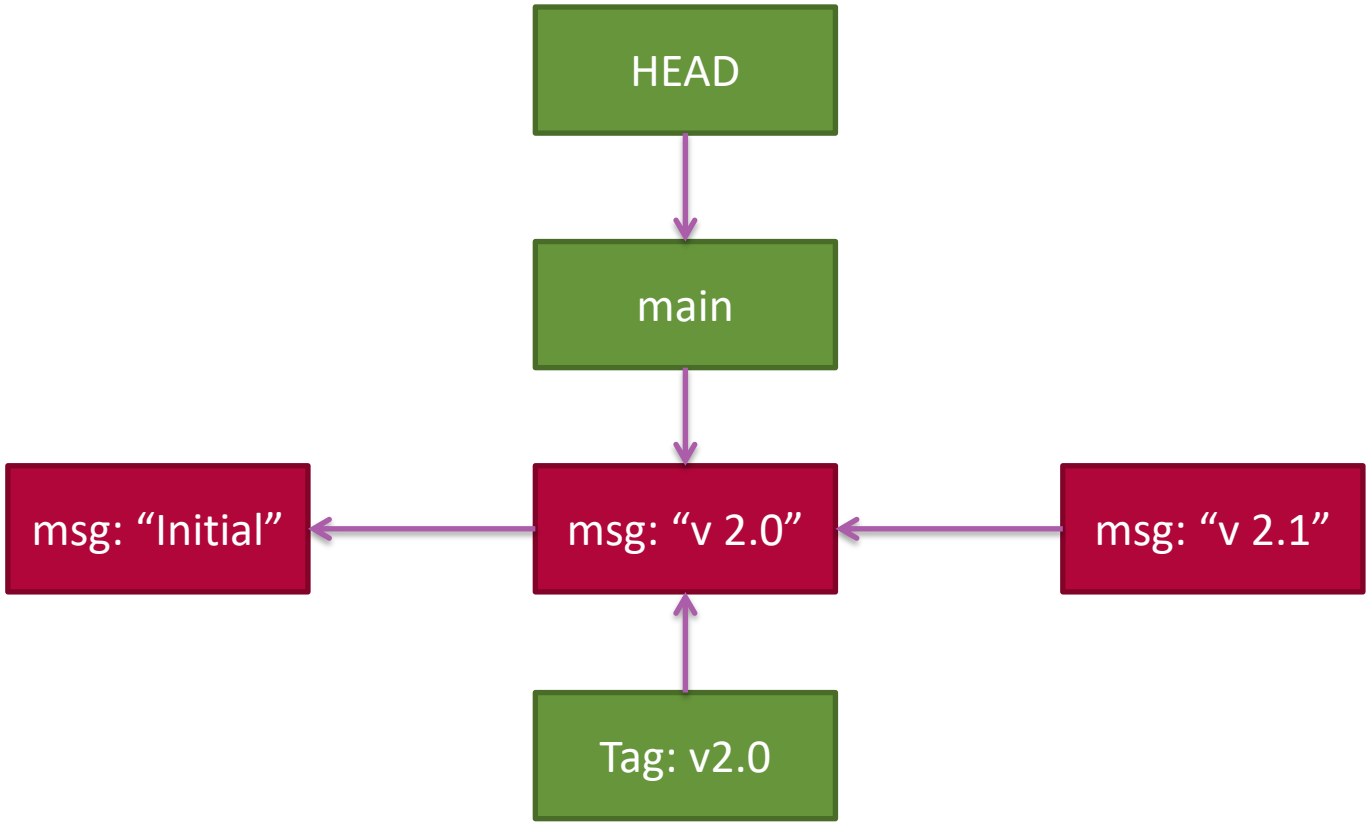
$ git commit -m “v 2.1”

Branches & Tags



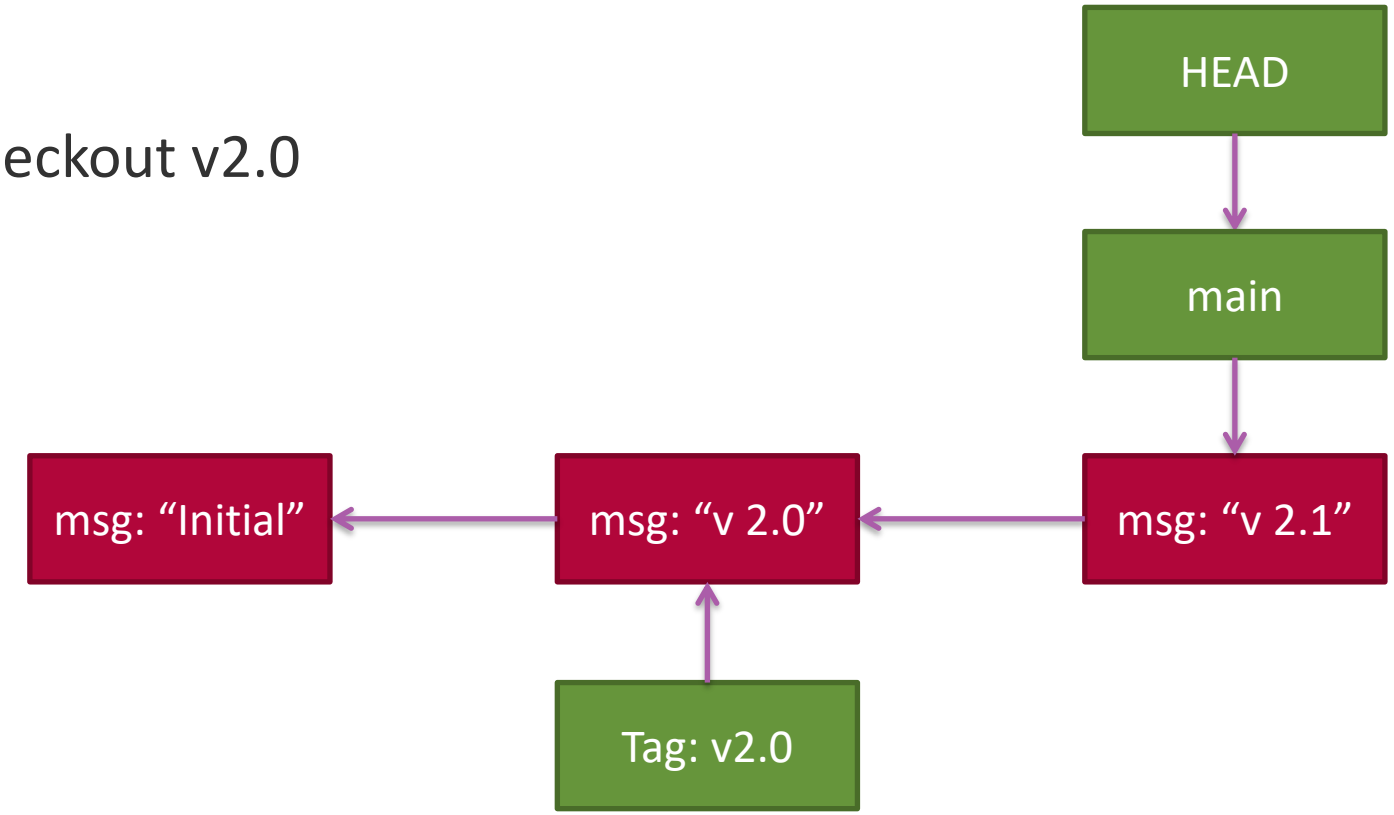
$ git commit -m “v 2.1”

Head

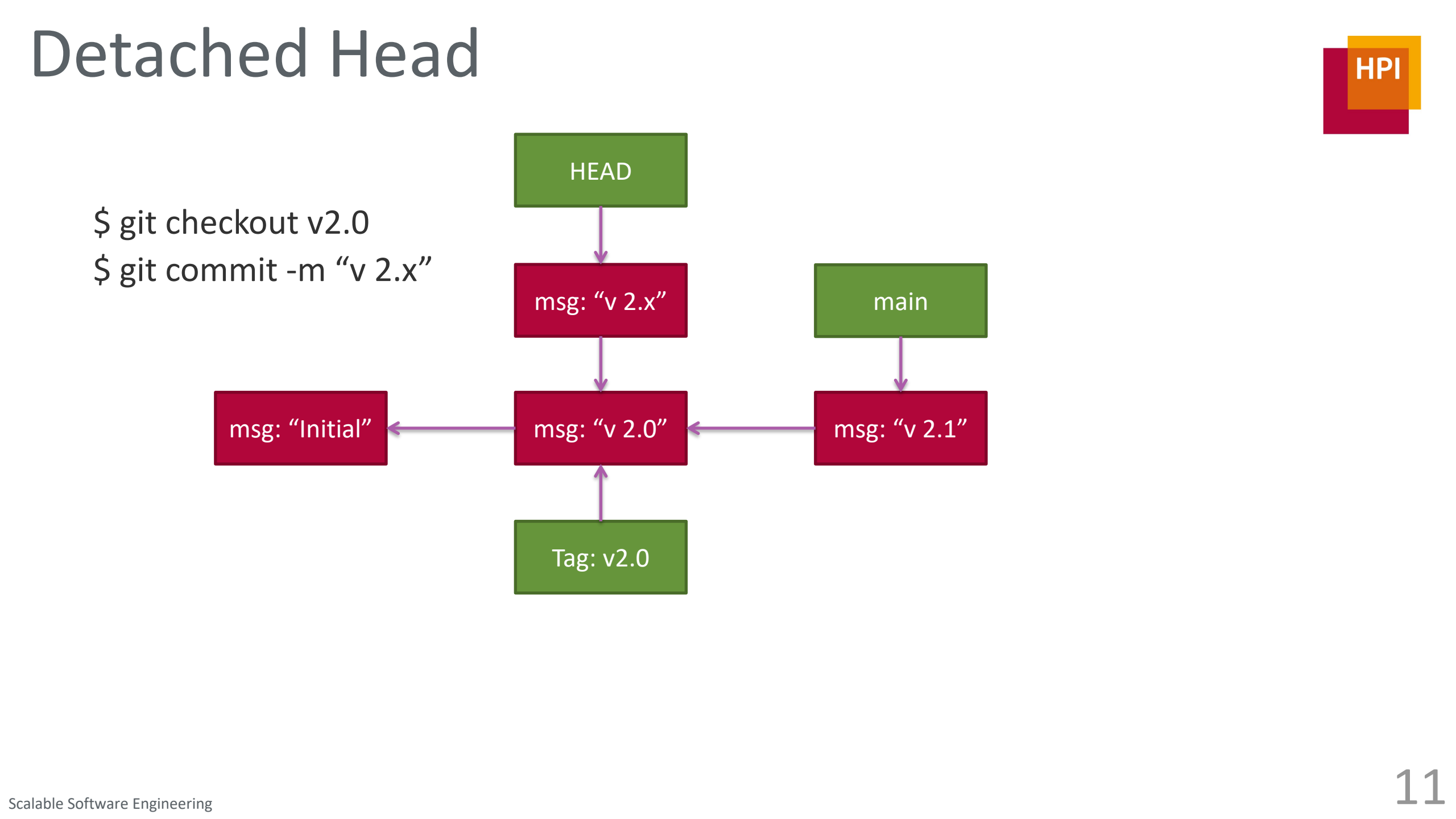


Detached Head

$ git checkout v2.0



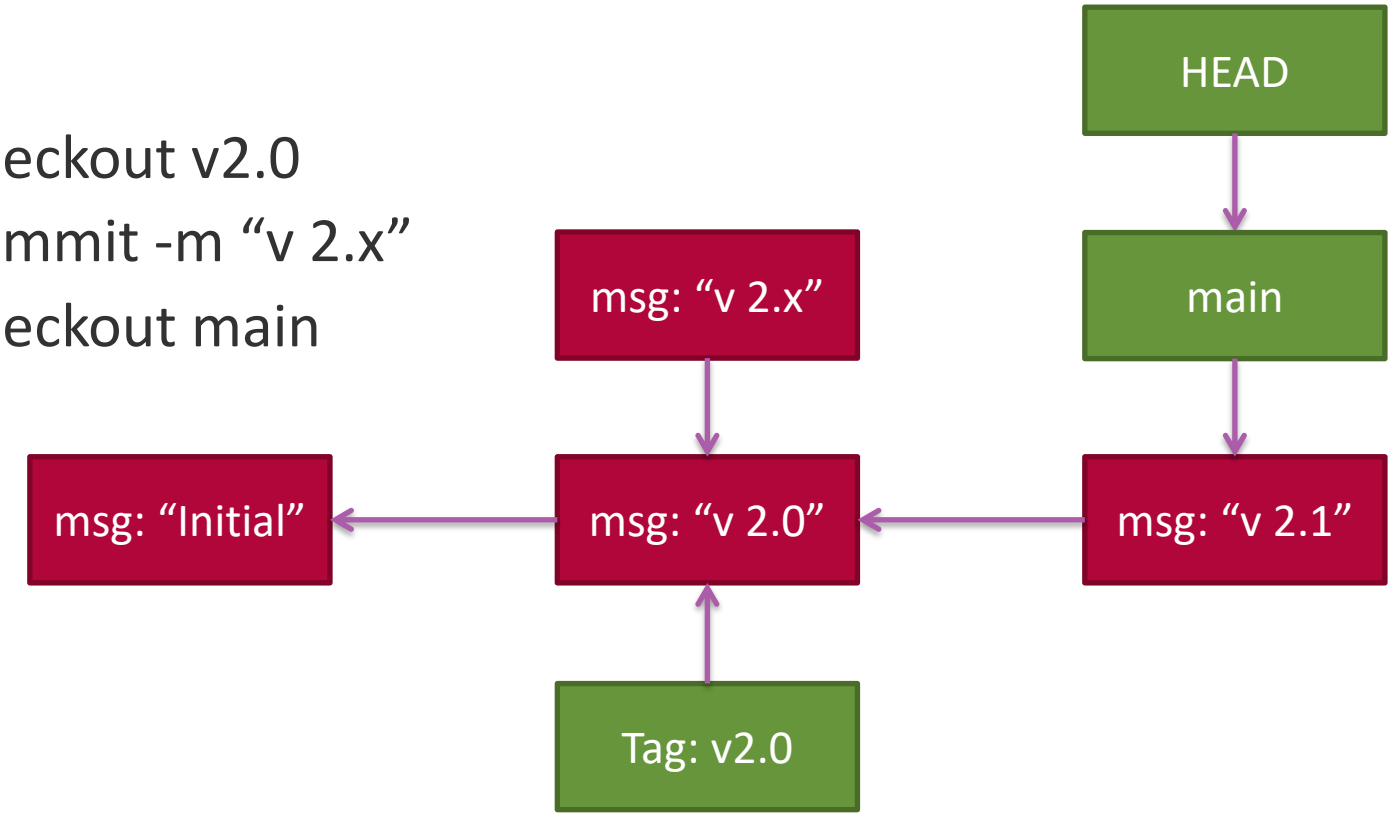
Detached Head



$ git checkout v2.0
$ git commit -m “v 2.x”

Detached Head

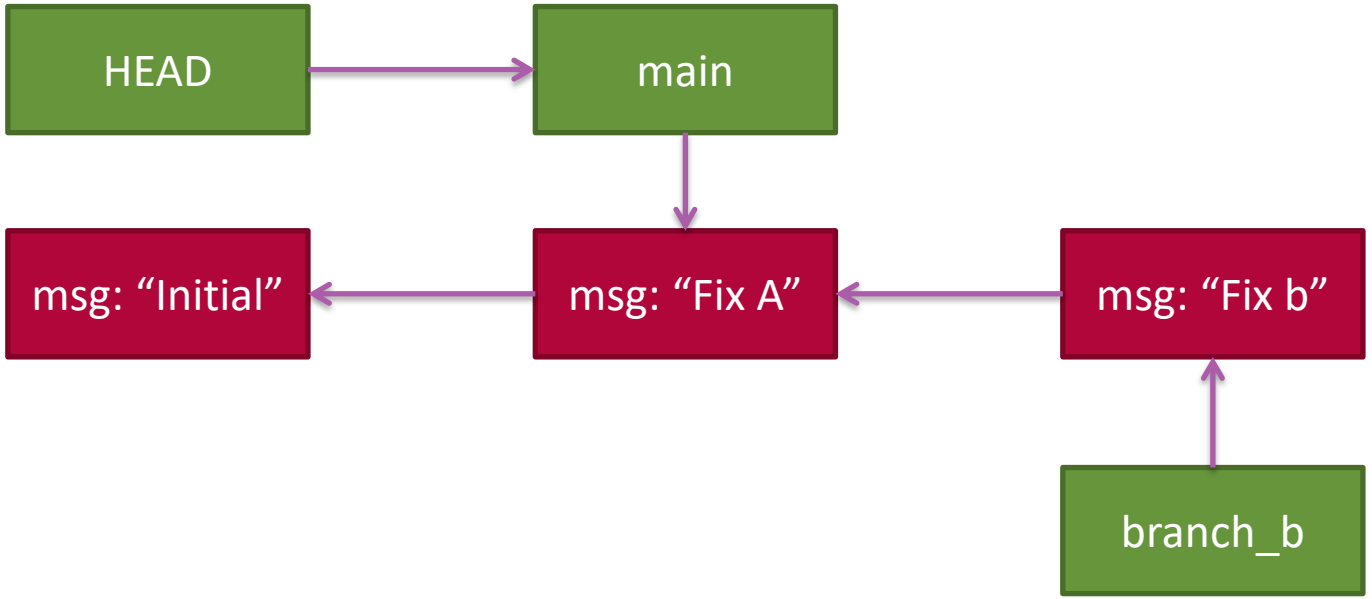
$ git checkout v2.0
$ git commit -m “v 2.x”
$ git checkout main



List all commits:
`git reflog`

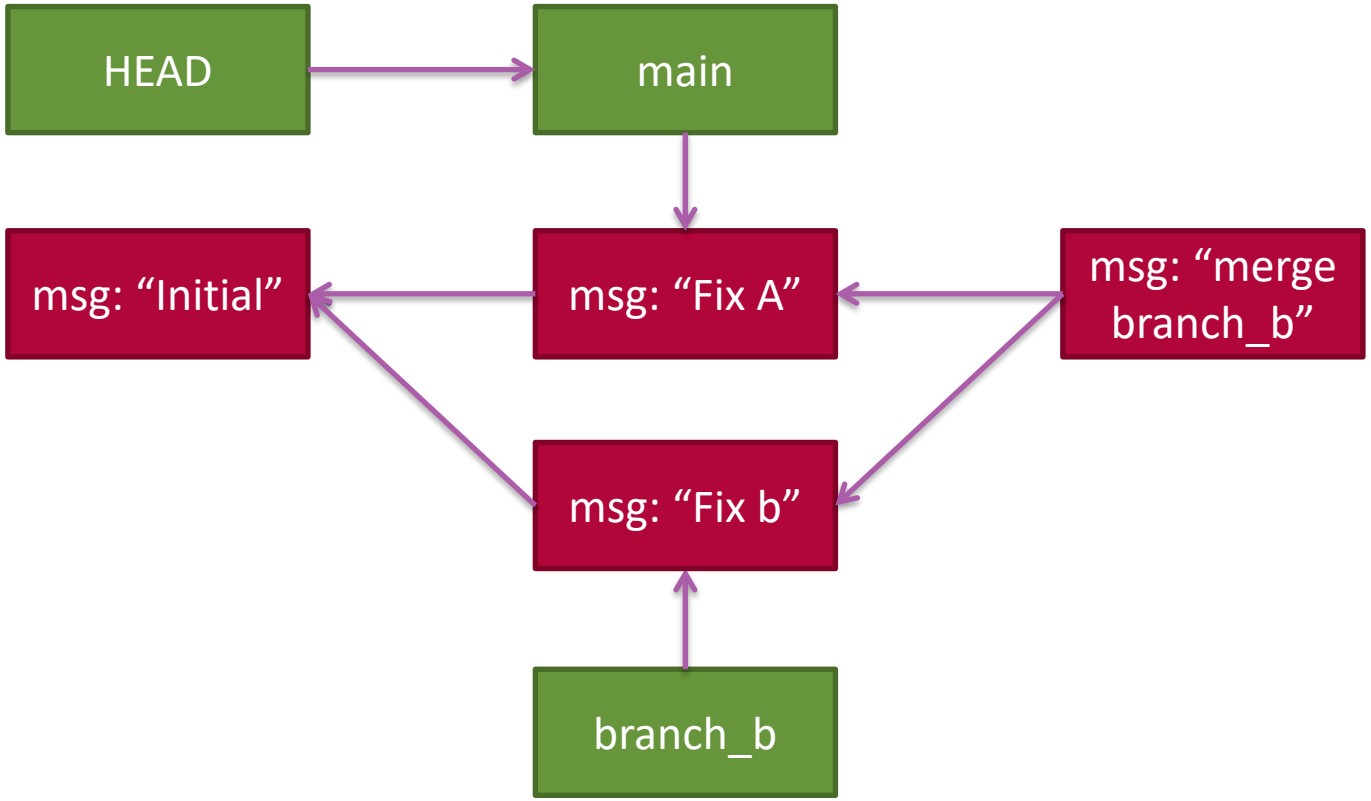
Fast-forward

$ git merge branch_b



Merge

$ git merge branch_b



Collaboration using Git

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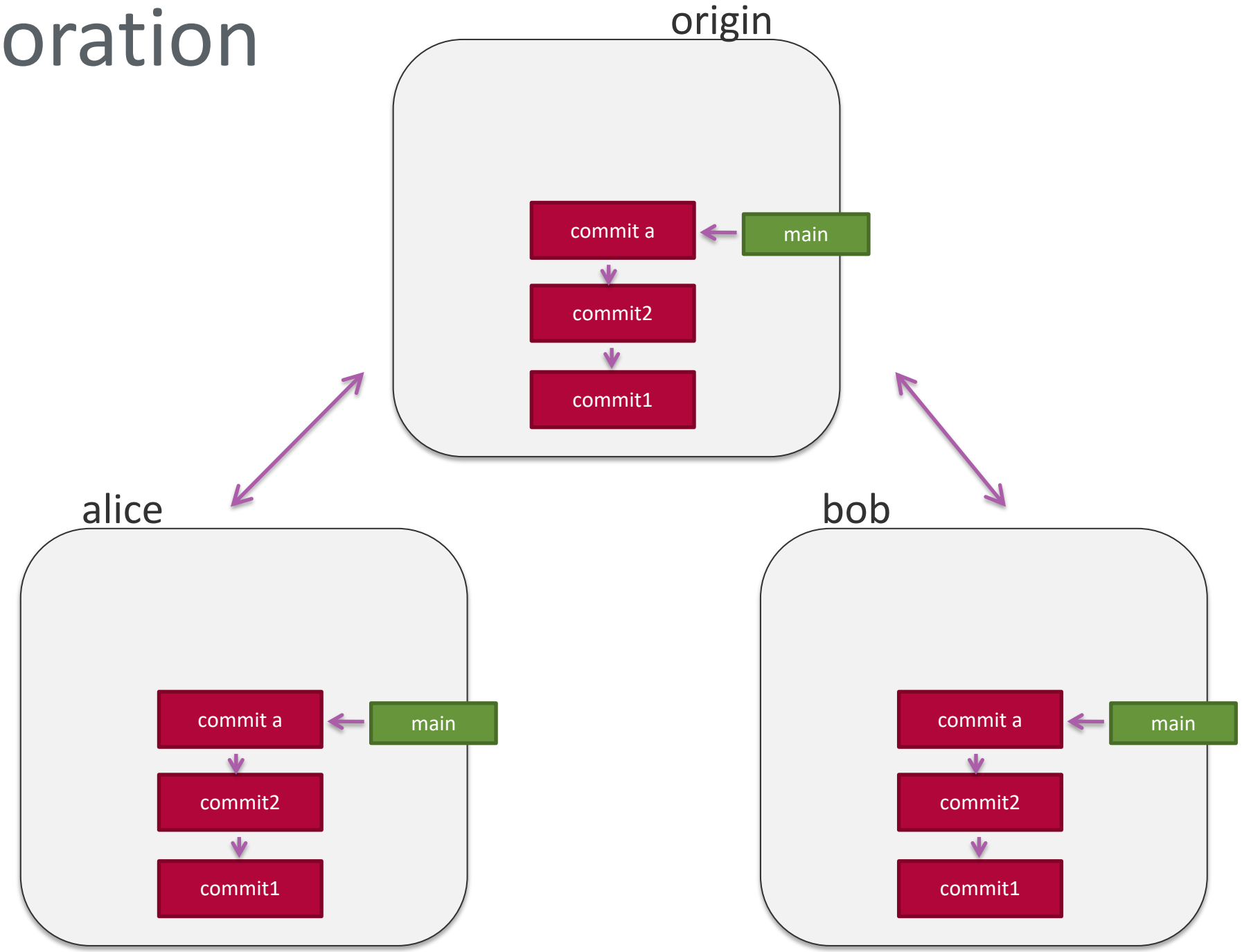
Enterprise Platform and Integration Concepts

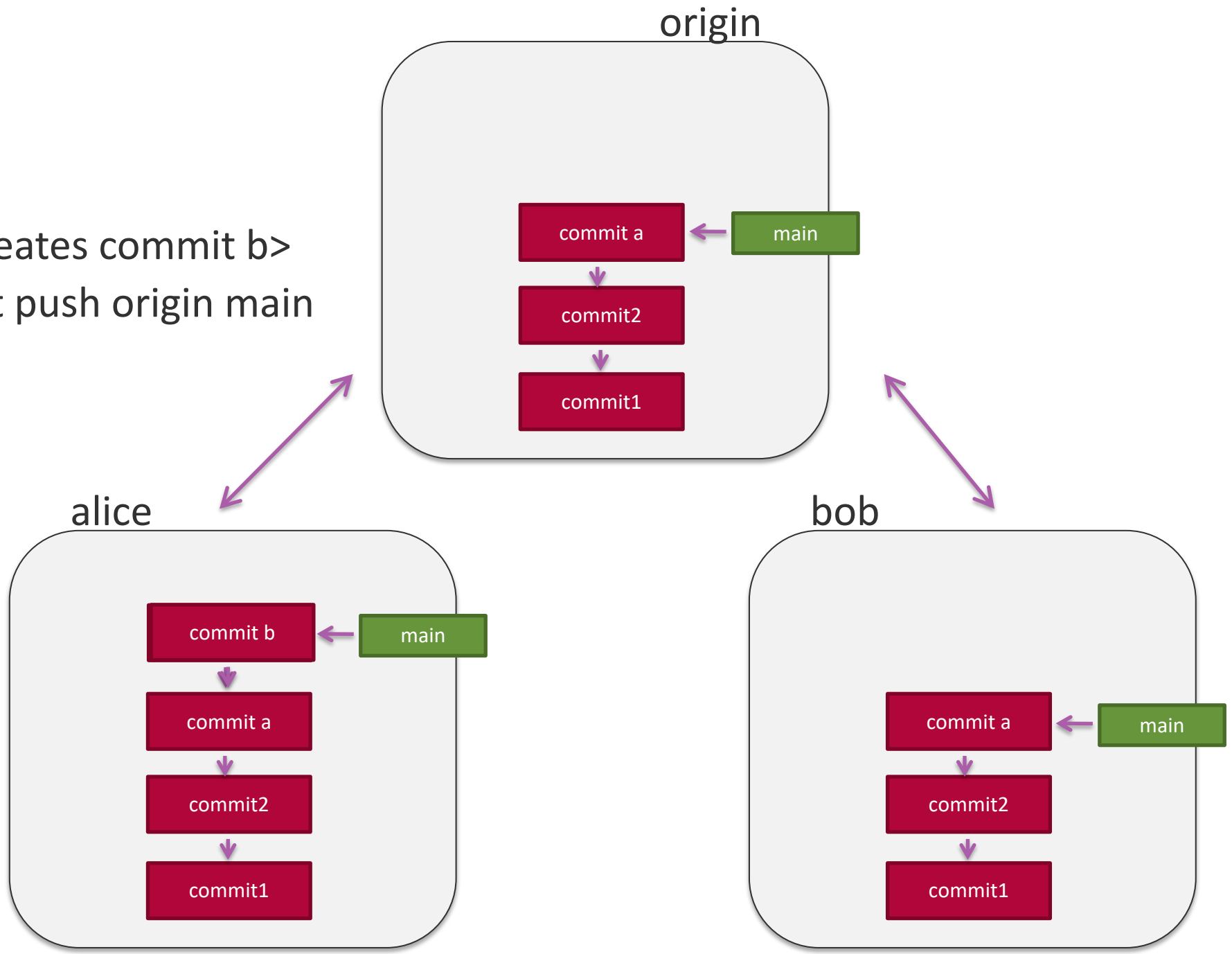
Collaboration



Push

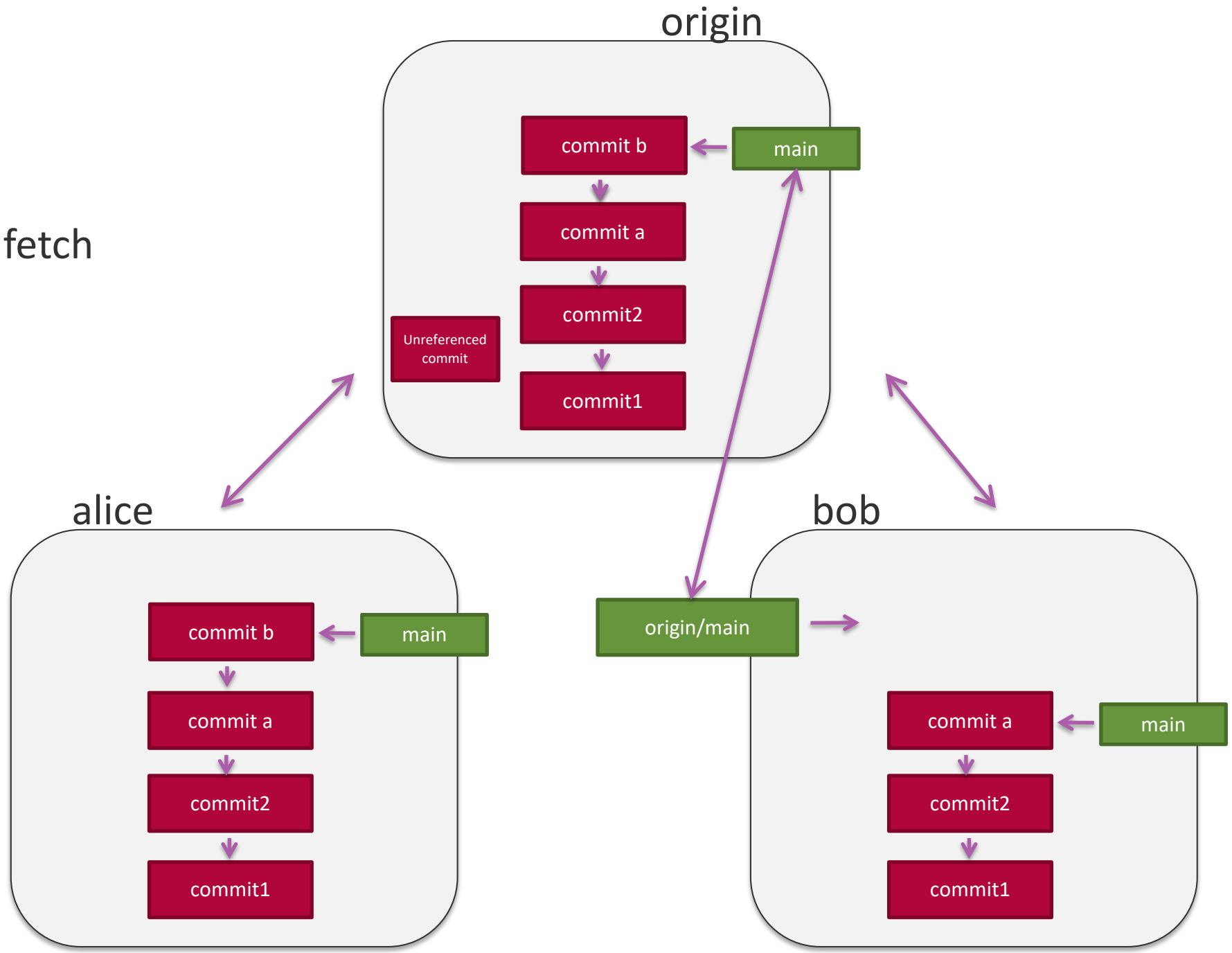
<alice creates commit b>

alice$ git push origin main



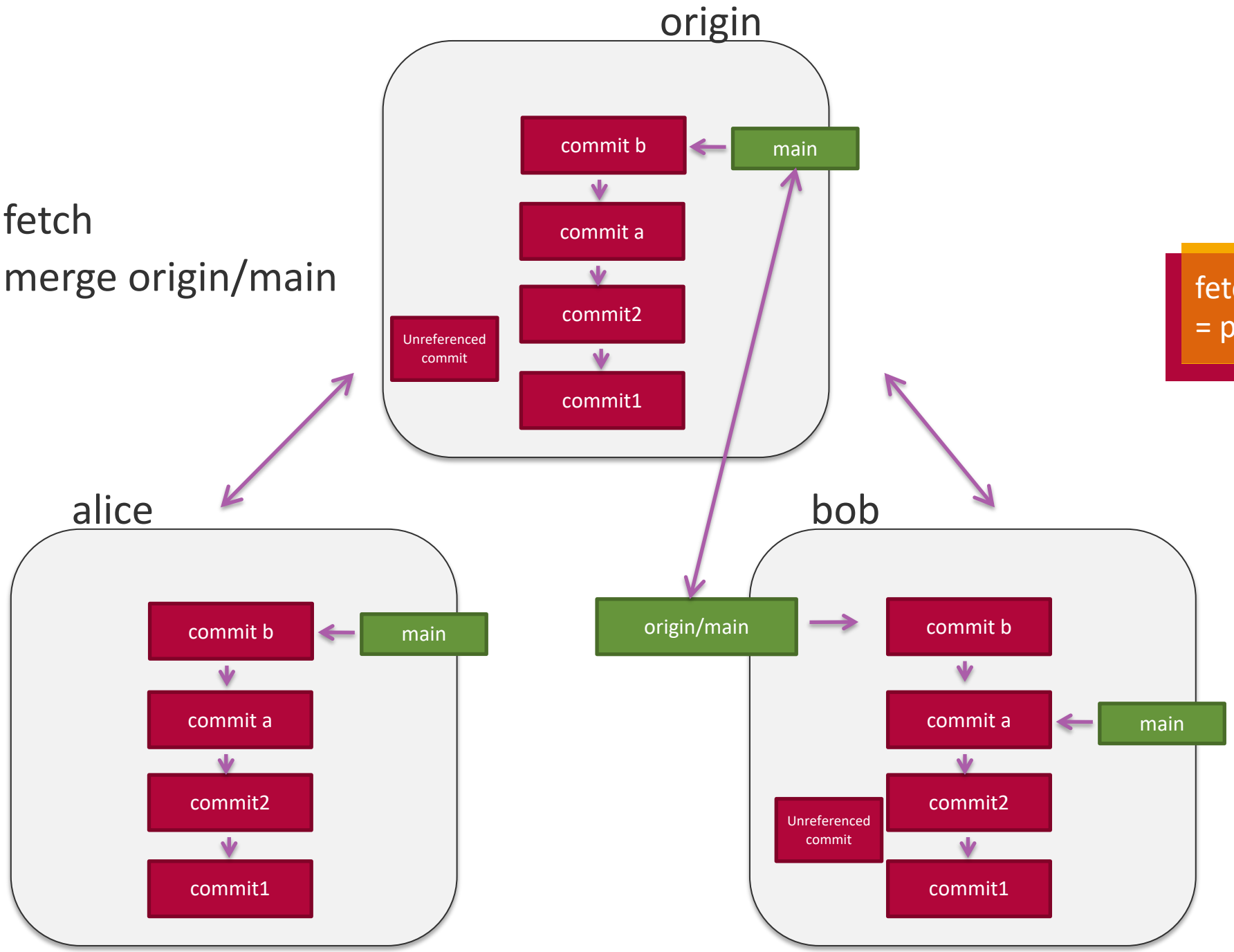
Fetch

bob$ git fetch



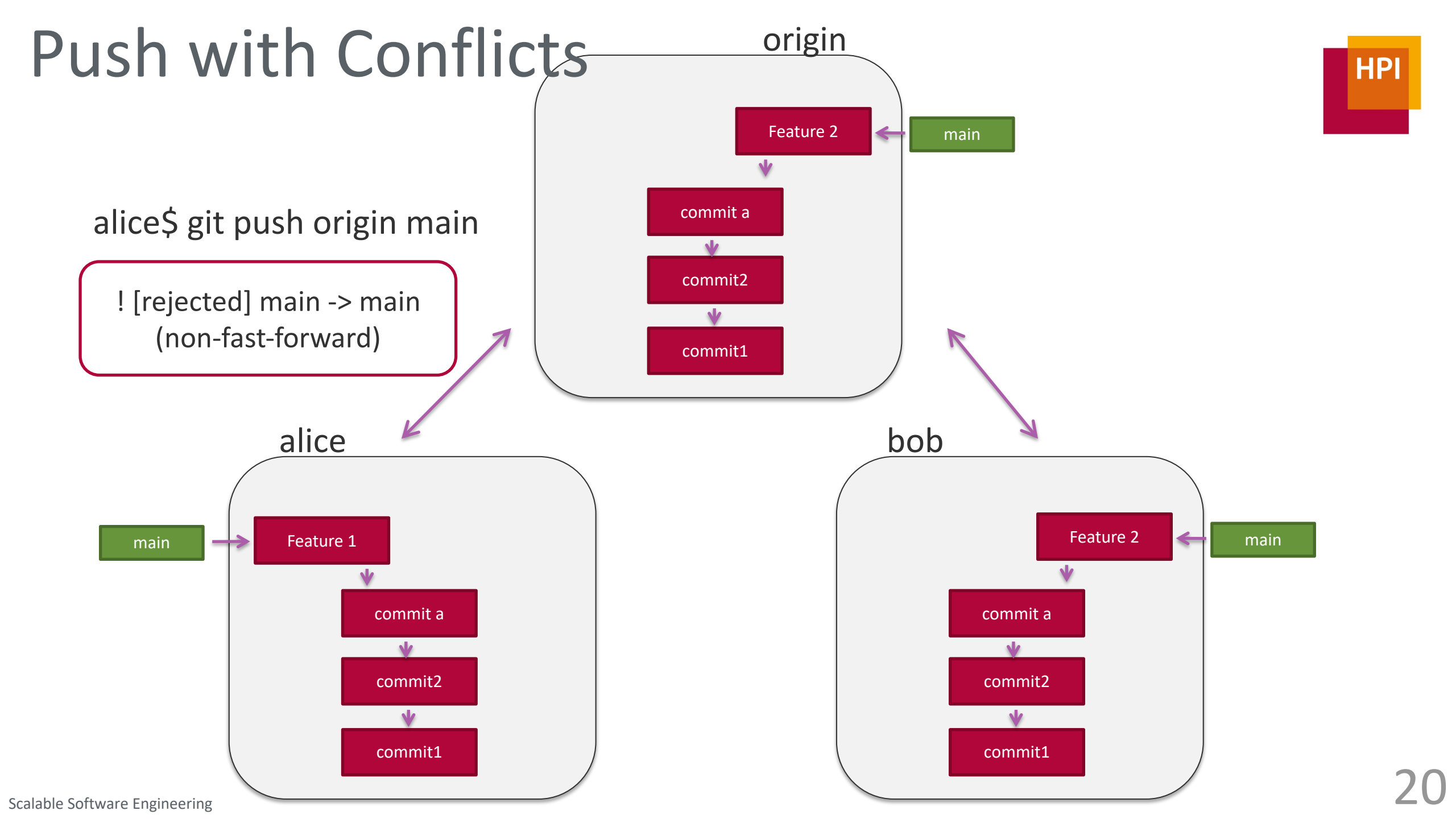
Pull

bob$ git fetch
bob$ git merge origin/main

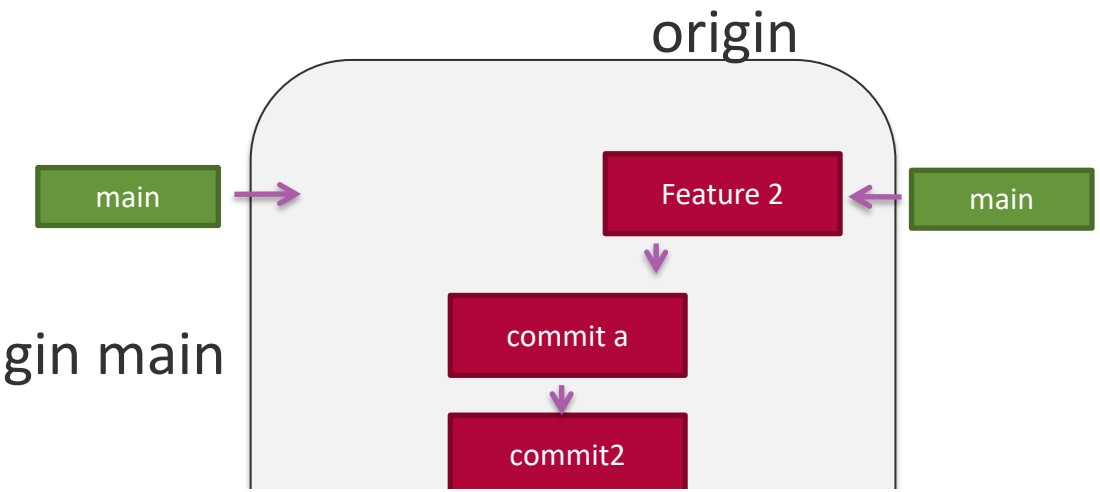


fetch + merge
= pull

Push with Conflicts

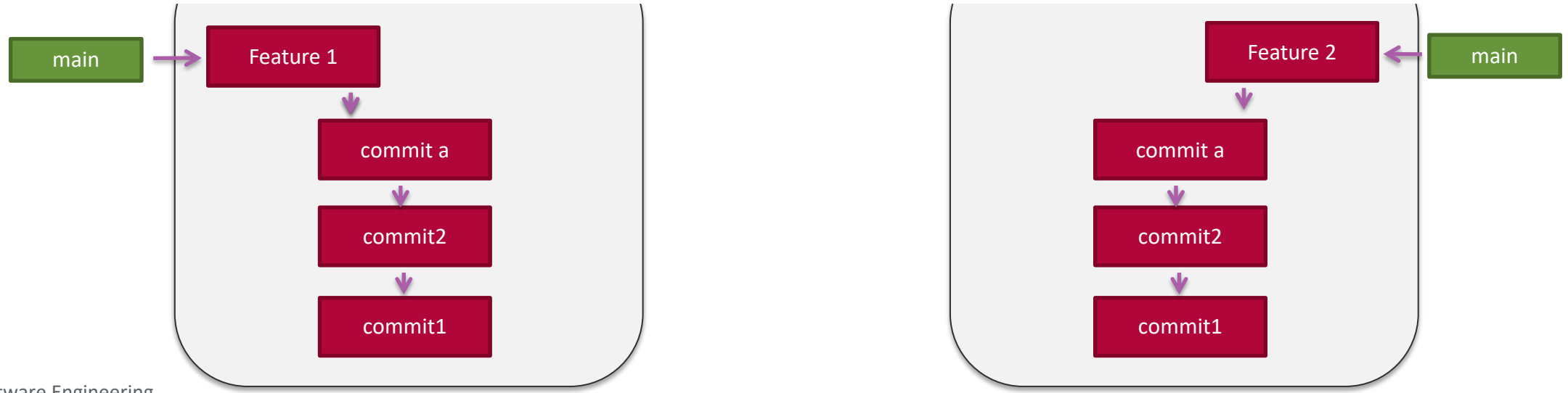


Push --force



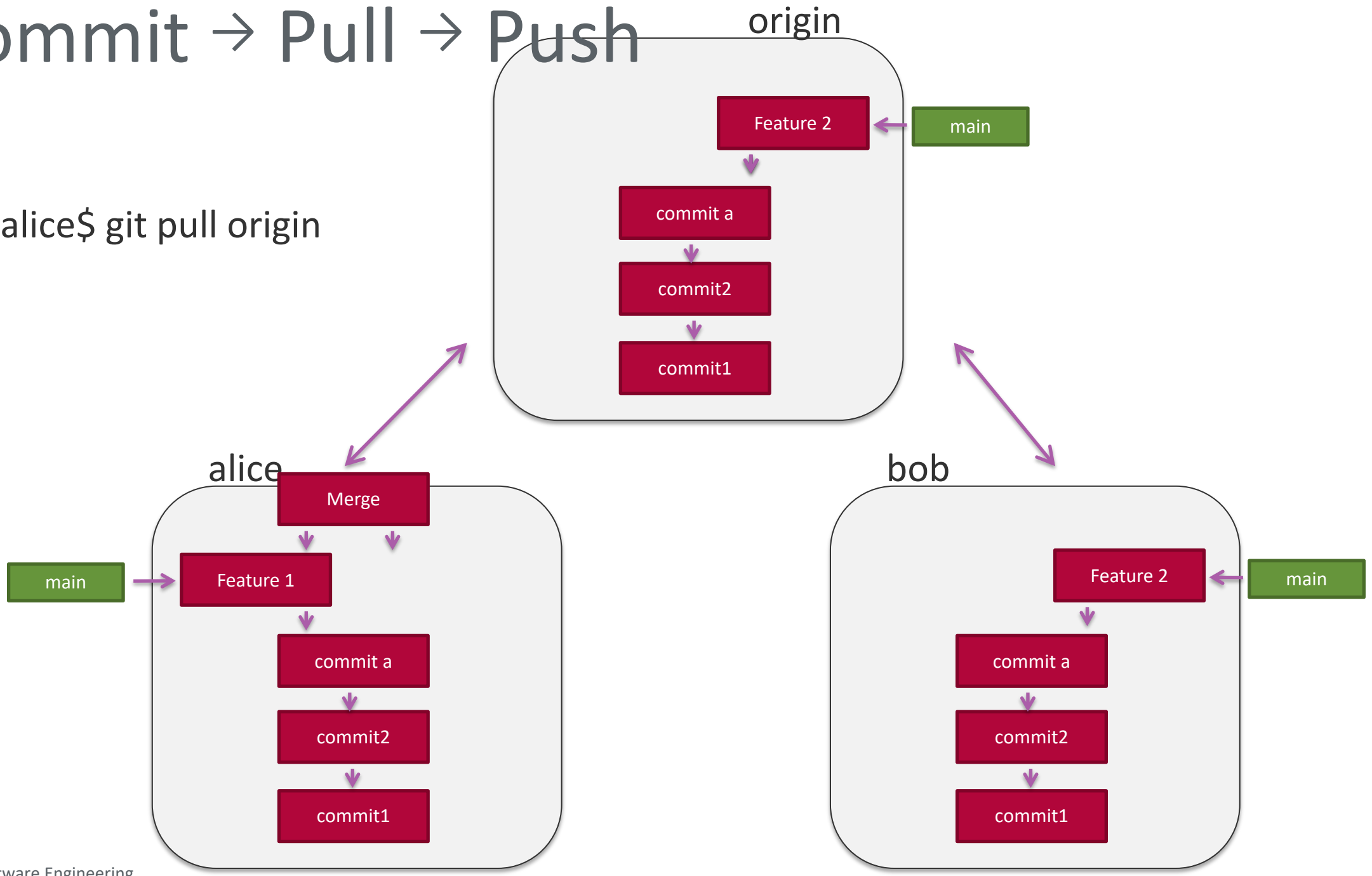
alice$ git push --f origin main

Never push --force

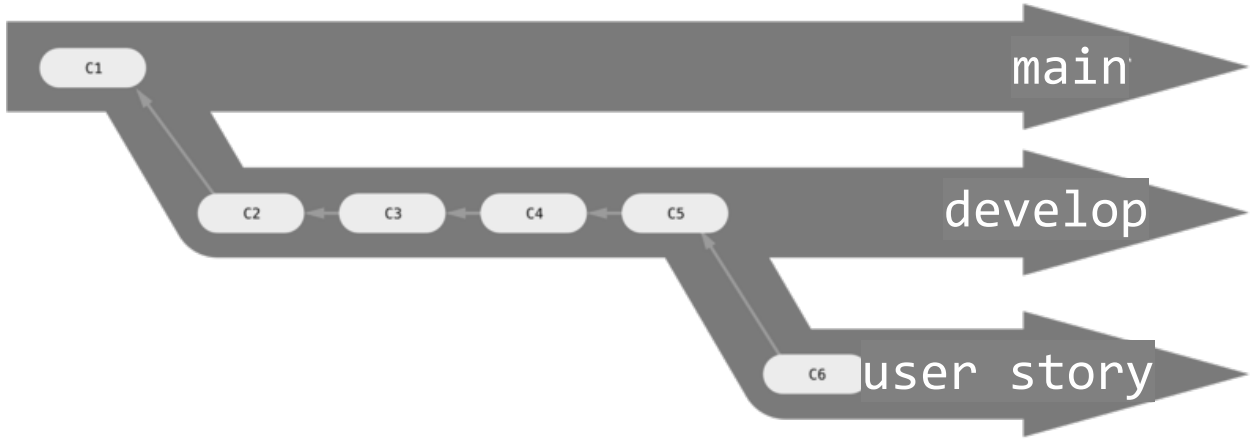


Commit → Pull → Push

alice$ git pull origin



Branching Models



Structuring your code and development

- Many ways to structure branches
- Branching model should be agreed upon by participants
- **Merging efforts increase with increased code divergence**

Recommendations:

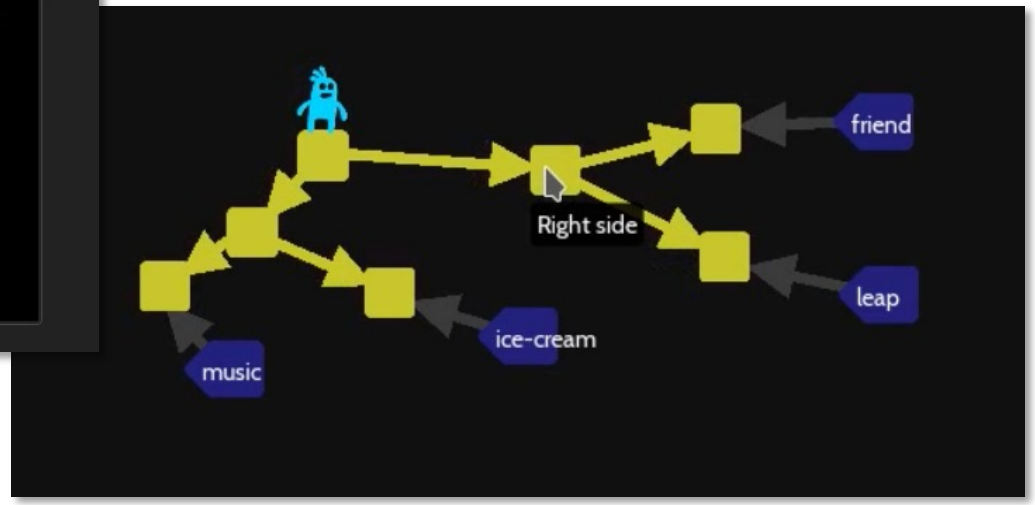
- Never merge in main or release branches
- Try to not commit unfinished/broken code in shared branches

https://git-scm.com/book/en/v2/Git-Branching-Branching-Workflows

Understanding Changes

- **git log**
  - List commits reachable by following the parent links from the current commit
  - Make it visual: `git log --graph --decorate --oneline`
- **git diff**
  - Show line changes between commits
  - Show changes in staged files: `git diff --cached`
- **git blame**
  - Show what revision and author last modified each line of a file

Learn some more



Interactive git exercises and training (go find some more), e.g.

- https://gitexercises.fracz.com/
- https://github.com/benthayer/git-gud
- https://ohmygit.org
- https://learngitbranching.js.org/?locale=de_DE

Summary

Types of VCS

- (De)centralized
- Usage
- (Dis)advantages

Git internals

- Git Objects
- File Lifecycle
- Detached Head
- Fetching & Merging

Collaboration

- Synchronizing repos
- Push –force
- Branching models
- Tracing Changes