# CSE 403

Software Engineering

**Version control and Git**

# Today

- Version control: why, who, how?
- Git: concepts and terminology

# Why use version control?

Common App
Essay

**11:51pm**

# Why use version control?


Common App Essay


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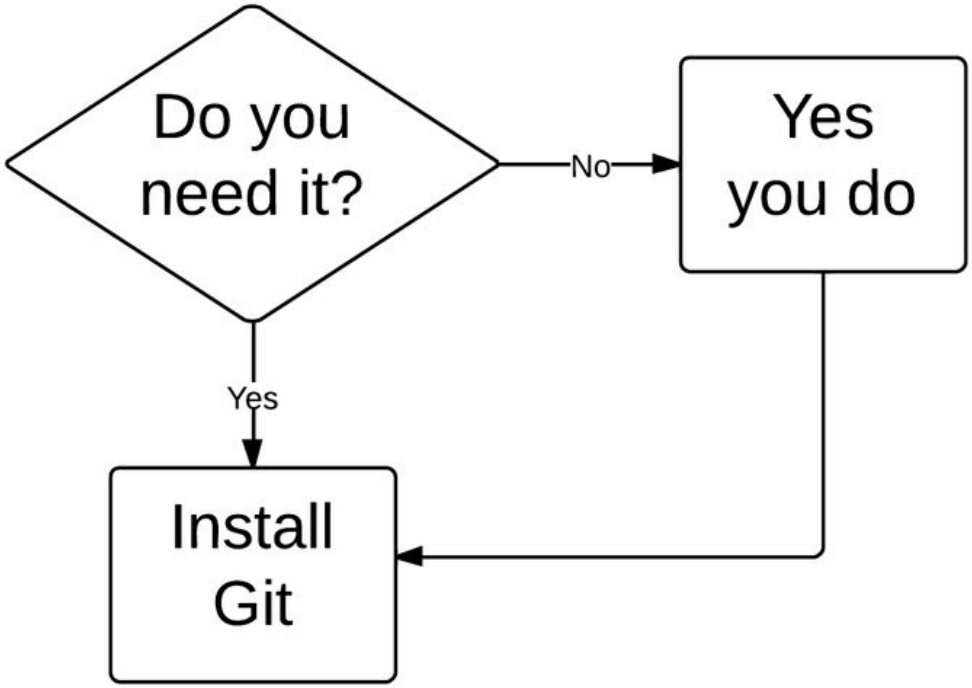
# Version control

Version control records changes to a set of files over time.
This makes it easy to review or obtain a specific version (later).



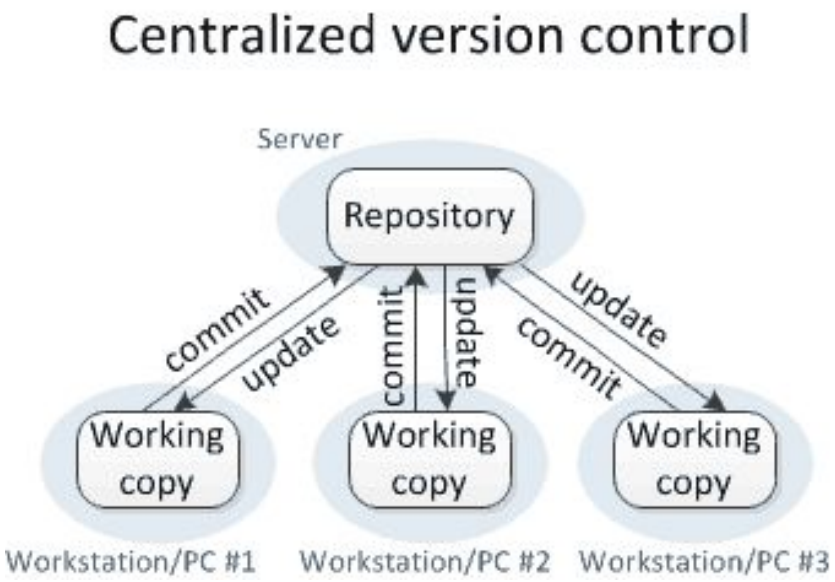
# Who uses version control?

**Example application domains**

- Software development
- Research (infrastructure and data)
- Applications (e.g., (cloud-based) word processors)

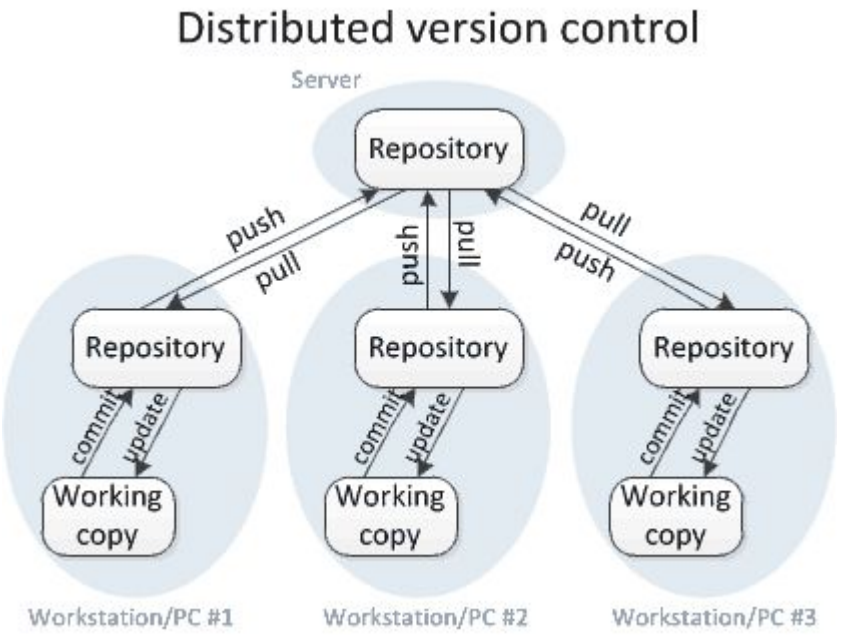
# Centralized version control

- **One central repository.**
- All users **commit** their changes to a **central repository**.
- Each user has a working copy. As soon as they commit, the repository gets updated.
- Examples: SVN (Subversion), CVS.



# Distributed version control

- **Multiple copies of a repository**.
- Each user **commits** to a **local** (private) repository.
- All committed changes remain local unless **pushed** to another repository.
- No external changes are visible unless **pulled** from another repository.
- Examples: Git, Hg (Mercurial).

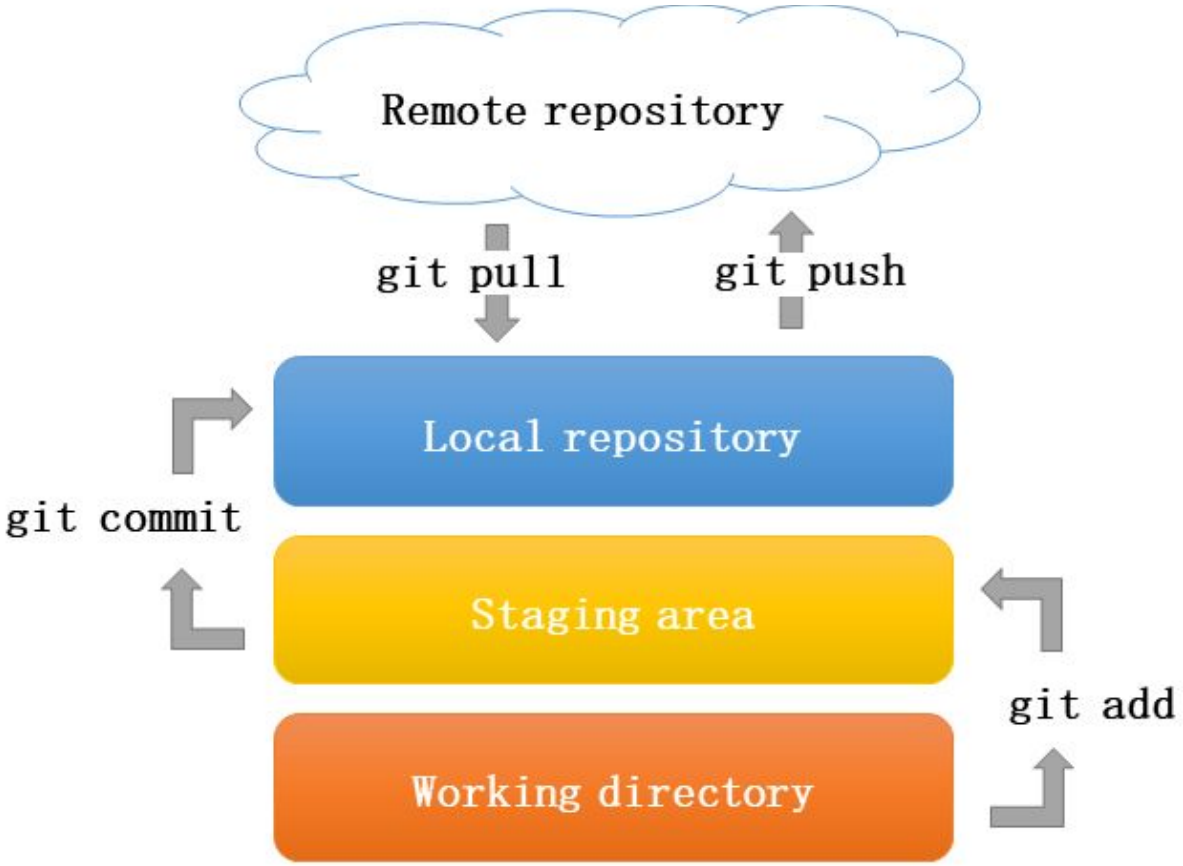


# A Fun Git Quiz

https://forms.gle/vG5yJo5LVAbA8fHQ7

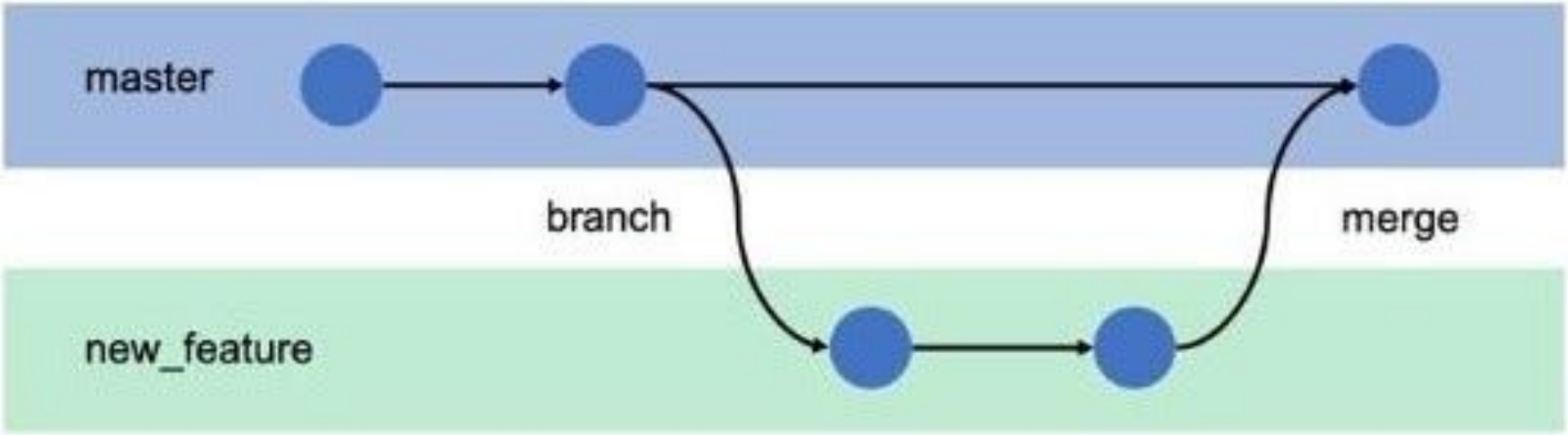
# Git commands [Demo]

- **clone**: linked copy of repo
- **fork**: independent copy of repo
- **add → commit → push**

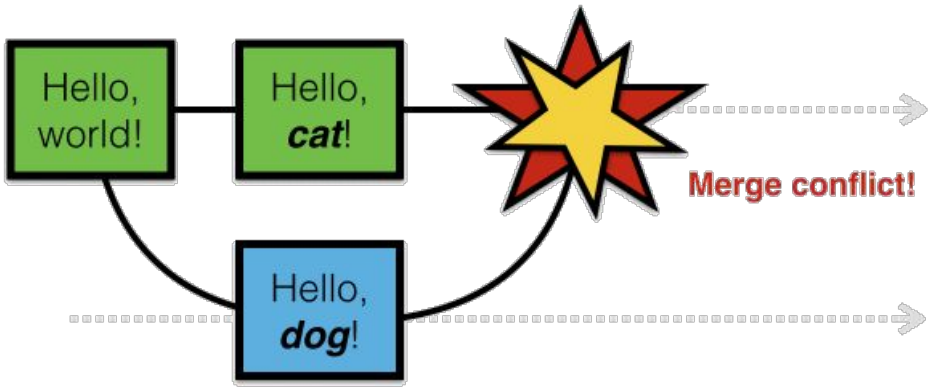


# Branches [Demo]

- **git branch <branch_name>**: create a branch
- **git checkout <branch_name>**: go to branch
- **git checkout -b <branch_name>**: both at same time
- **git merge <branch_name>**: bring all of `branch_name`s changes into current branch
- **Pull Request for main ← <branch_name>**: request to merge `branch_name` into main and see **diff** between them (*GitHub* operation)



# Conflicts




- **Conflicts** arise when two users **change the same line** of a file.
- When a conflict arises, the last committer needs to resolve it.

# Git pull/fetch [Demo]

- **git fetch**: downloads changes from remote repo without modifying working copy
- **git pull = git fetch + git merge**: downloads and merges changes from remote repo into working copy

*How to avoid conflicts?*

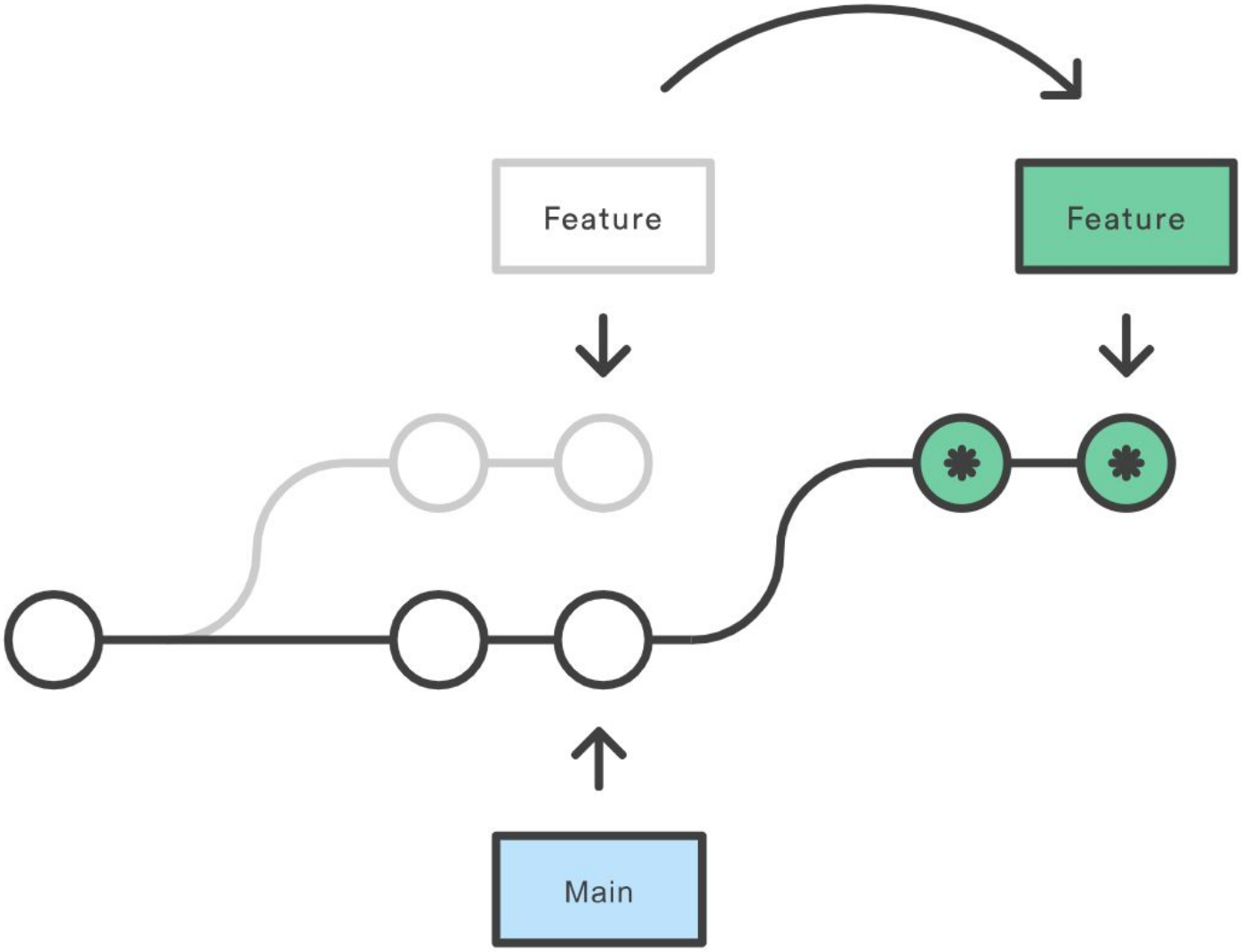
- Do git pull often before pushing
- If you are on a feature branch, do **git pull origin/main** before pushing so that merging feature branch → main is easier
  - Don't have long-running feature branches, otherwise feature branch will get too outdated from main

# Merge vs. Rebase

- Goal of rebase: prepare your work before delivery
  - “Let me clean up my feature branch so it's easier to read and merge.”
  - Action: copies all of feature branch’s commits on top of main (removes old commits)
  - Result: Your feature branch is now based on the latest main, and has a clean linear history.

- Command: On feature-branch, do **git rebase main**

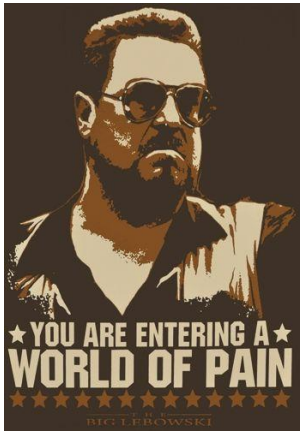
# Git rebase



# Rebase: a powerful tool, but …

- **Changes the commit history!**
- Anyone else on the feature-branch will have the old commits, so it will be **really hard** for them to push to that branch!!


**Do not rebase public branches!**



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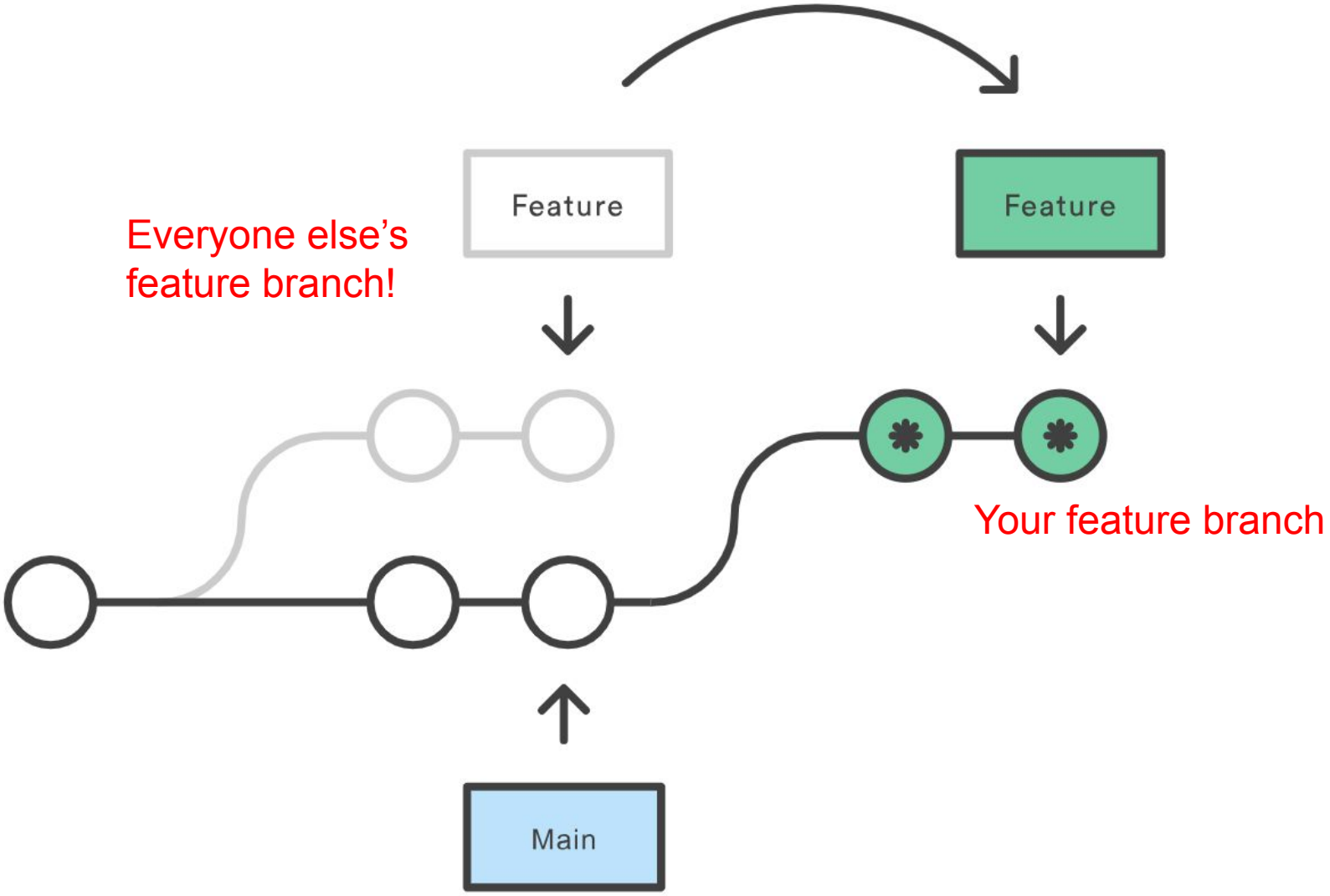
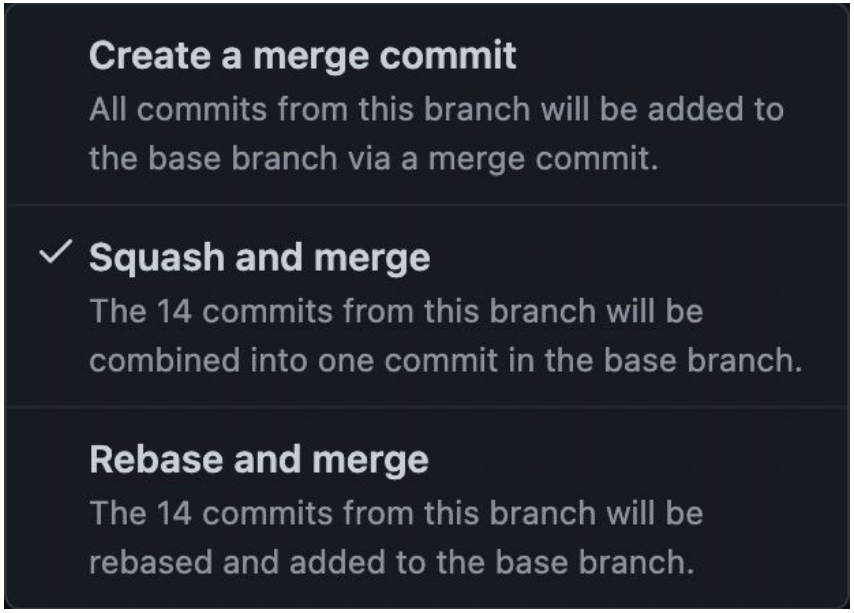


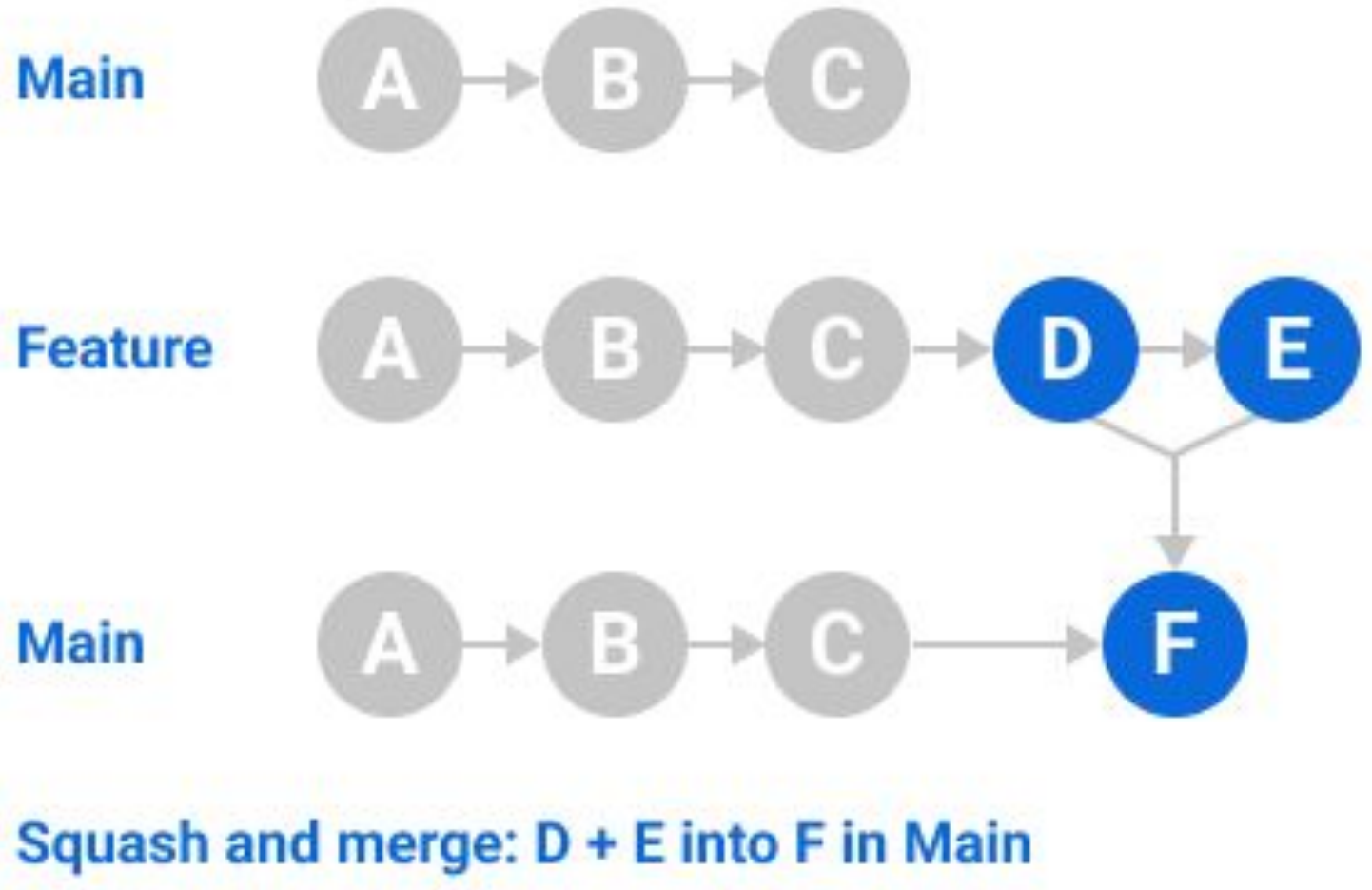
# Merge vs Squash & Merge

- Goal: **want a clean commit history** when merging
  - don’t want to keep history of all of feature branch’s commits!
  - Action: squashes all of feature-branch’s new changes into a single new commit and puts that onto main
  - Result: main has all of feature-branch’s changes with only 1 new commit

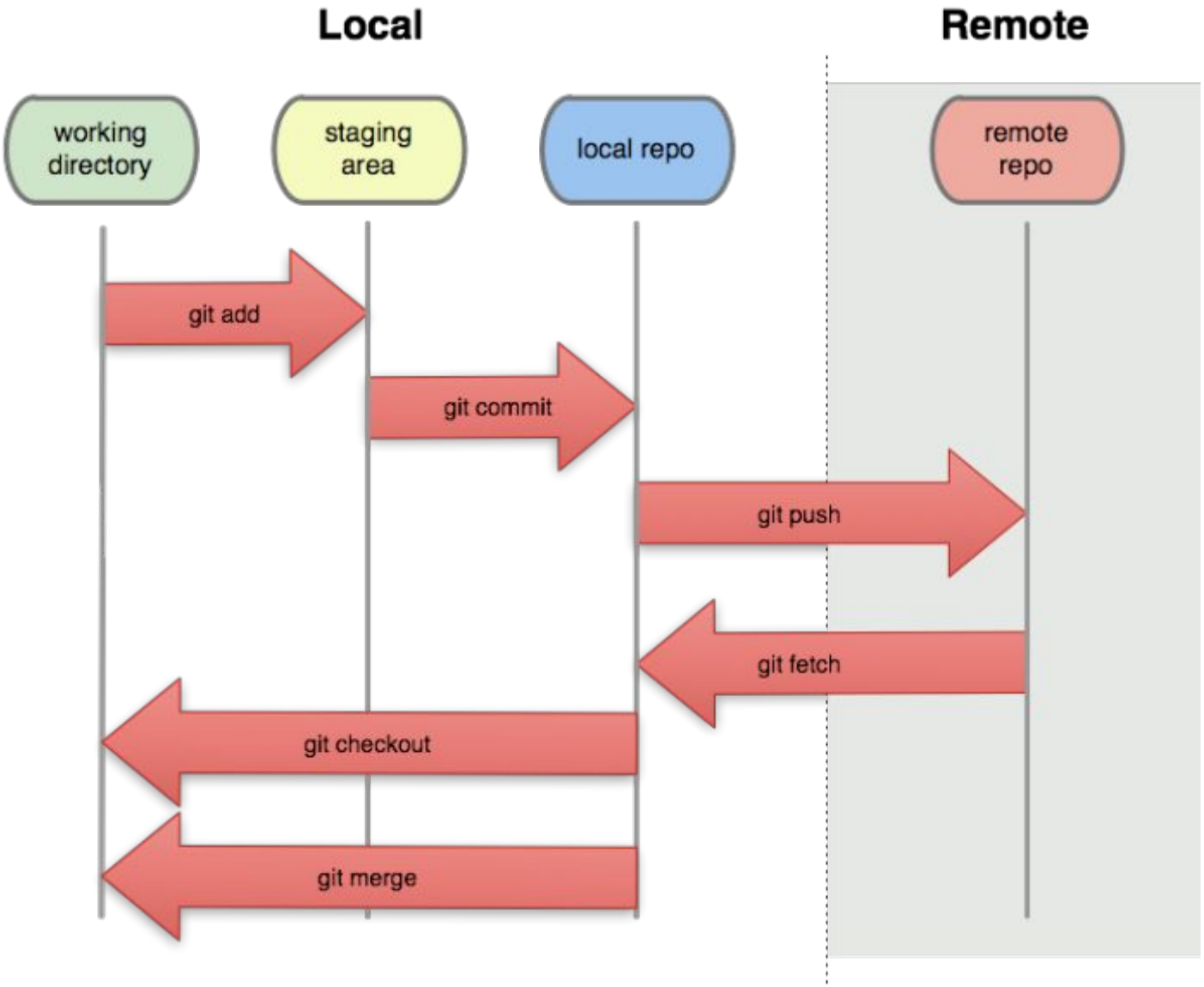
*Not a Git command, only on GitHub*



# Squash & Merge



# Summary of Git concepts



# Conventions when using Git

- Use feature branches, don’t modify main directly
- Don’t merge to main directly: make a PR and request code reviews from colleagues before merging to main
- Commit & push often
- Have good commit messages
- No long-running feature branches
- Do **git pull** often to stay up-to-date with changes
- Have good communication with your colleagues to prevent merge conflicts