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 | Common App Essay EDITED FINAL | Common App Essay FINAL FINAL | Common App Essay FINAL REVISED | Common App Essay FINAL | Common App Essay OKAY THIS IS THE FINAL ONE | Common App Essay REVISED FINAL | Common App Essay REVISED
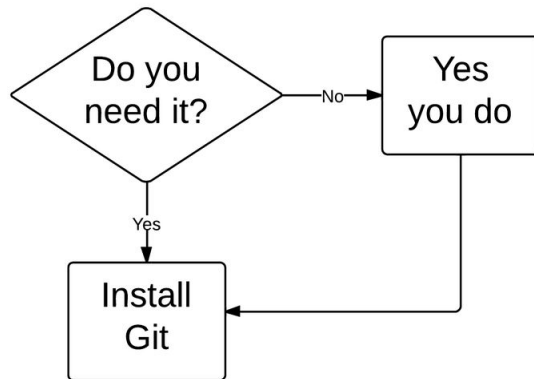
Version control

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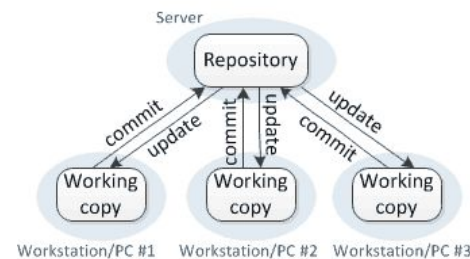

Who uses version control?

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.
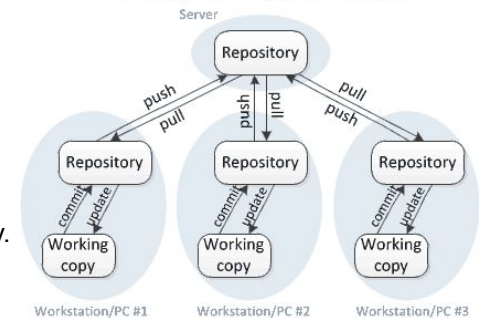
- Examples: SVN (Subversion), CVS.

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.
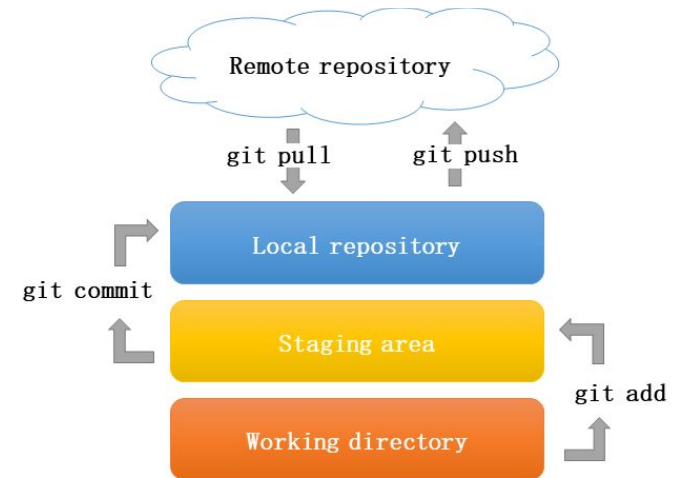
- Examples: Git, Hg (Mercurial).

A Fun Git Quiz

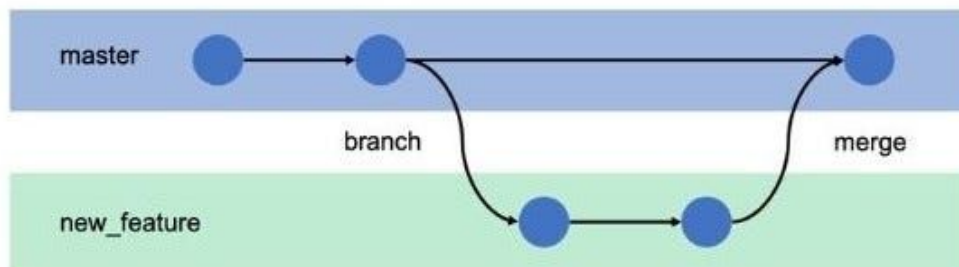## Git commands [Demo]

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

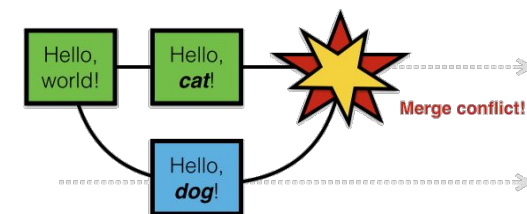
Branches [Demo]

- **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**
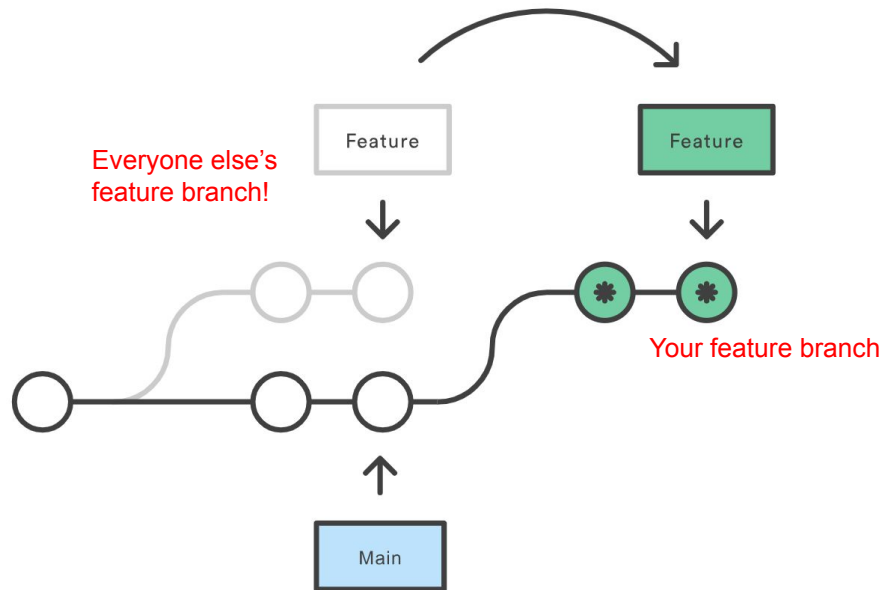
Git rebase
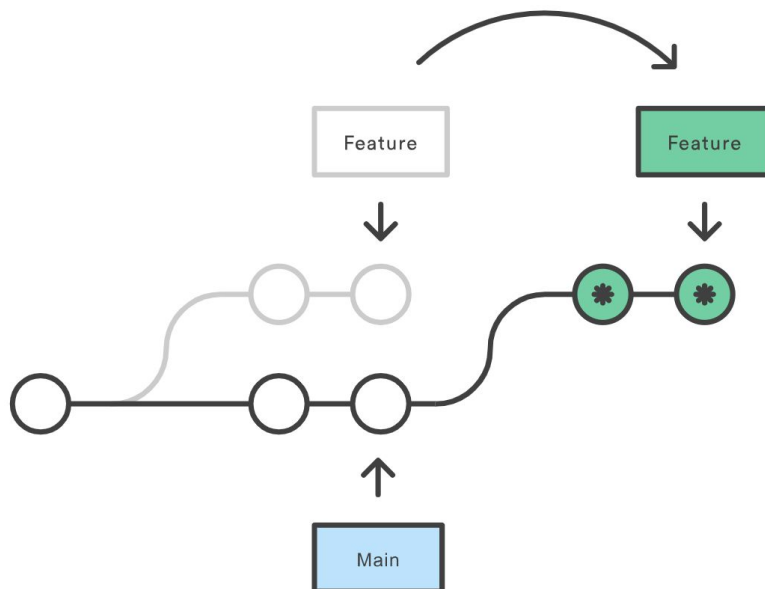
Rebase: a powerful tool, but …

- **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!

Rebase: a powerful tool, but …

Everyone else's feature branch!

Your feature branch

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

Create a merge commit
All commits from this branch will be added to the base branch via a merge commit.
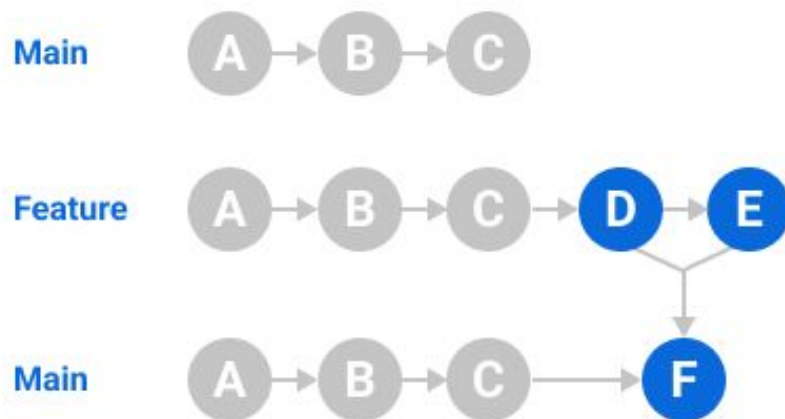
✓ **Squash and merge**
The 14 commits from this branch will be combined into one commit in the base branch.

Rebase and merge
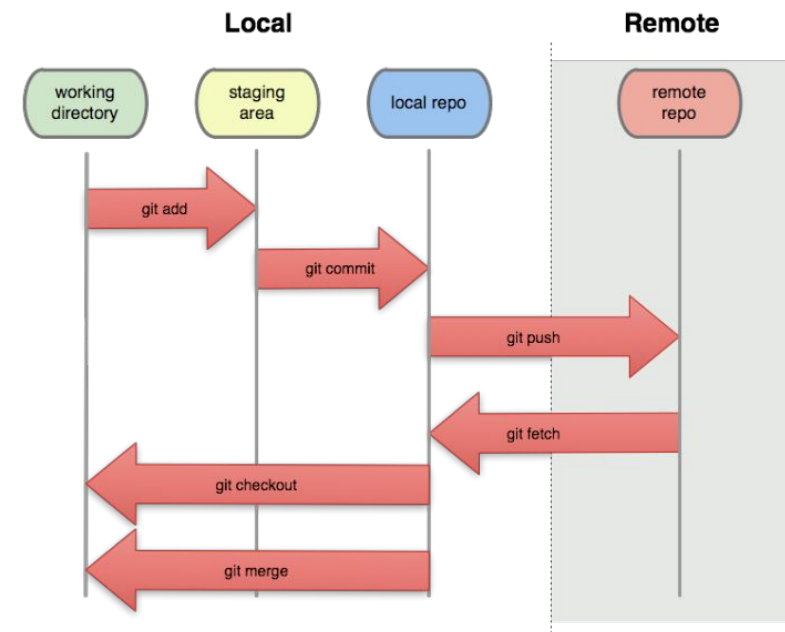The 14 commits from this branch will be rebased and added to the base branch.

Squash & Merge

Squash and merge: D + E into F in Main

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