ENSF 381
Full Stack Web Development

Lecture 31: Git

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Outline

- Overview of Git.
- Key features.
- Basic concepts.
- Discussion

What is Git?

- Git is a distributed version control system designed to handle everything from small to very large projects with speed and efficiency.
- It was created by Linus Torvalds in 2005 for the development of the Linux kernel.
- Enable multiple developers to work on the same project simultaneously.

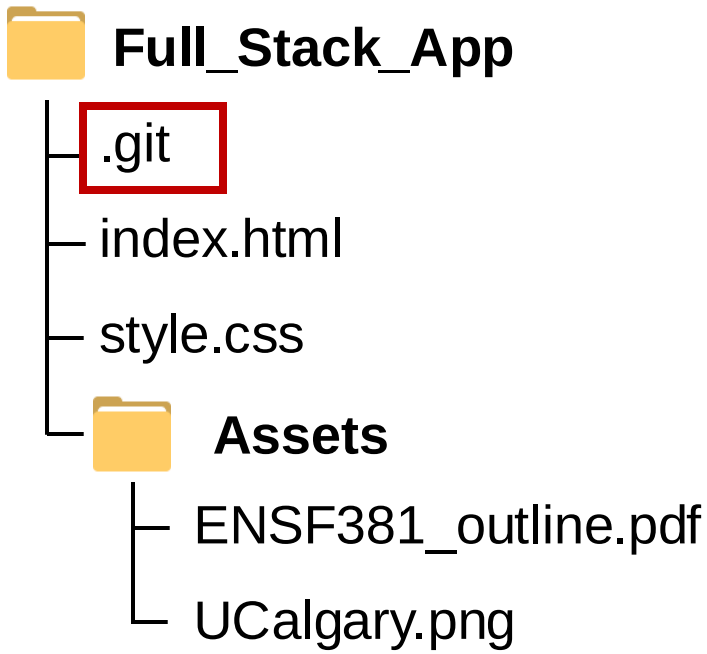
Key features of Git

- **Distributed system**: each developer can work on their local copy of the project, make changes, and then synchronize those changes with others.
- **Branching and merging**: makes it easy to create branches for separate lines of development. Changes can be made in isolation, tested, and then merged back into the main project.
- **Commit history**: maintains a detailed record of every change made to the project, providing a comprehensive history. Each change is recorded as a commit.
- **Fast and efficient**: designed to be fast and efficient, making it suitable for both small projects and large-scale, complex software development.
- **Compatibility**: compatible with various operating systems, including Windows, macOS, and Linux.

Basic concepts

- **Repository (Repo)**: is a directory or storage space where your projects can live. It can be local (on your computer) or remote (on a server).

Repository



.git is a crucial component/file that stores the entire repository, including its history, configuration settings, and other important data. It is responsible for tracking and managing changes in your Git repository.

Basic concepts

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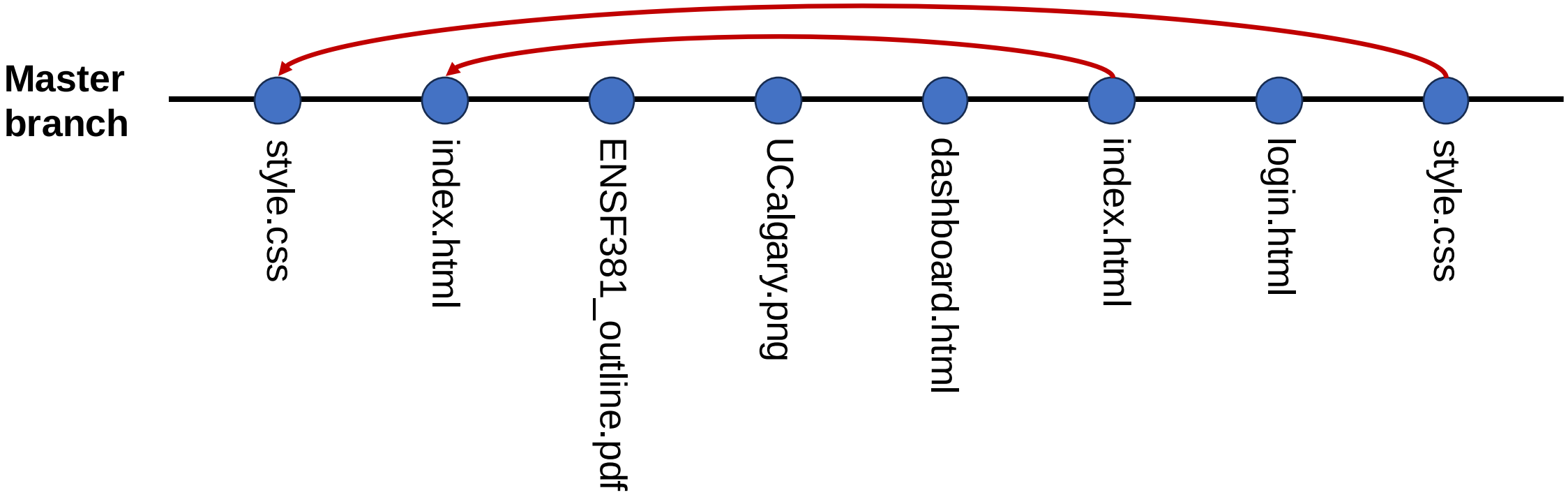
- **Commit**: is a snapshot of changes at a specific point in time. It includes modifications, additions, or deletions of files.

Commits


Master branch
style.css
index.html
ENSF381_outline.pdf
UCalgary.png
dashboard.html
index.html
login.html
style.css

Commit - Stages

- **Working Directory (Modified)**: the current state of the project on your local machine.
- **Staging Area (Index)**: a place to stage changes before committing them to the repository.
- **Repository (Committed)**: the .git directory that stores the committed changes and project history.

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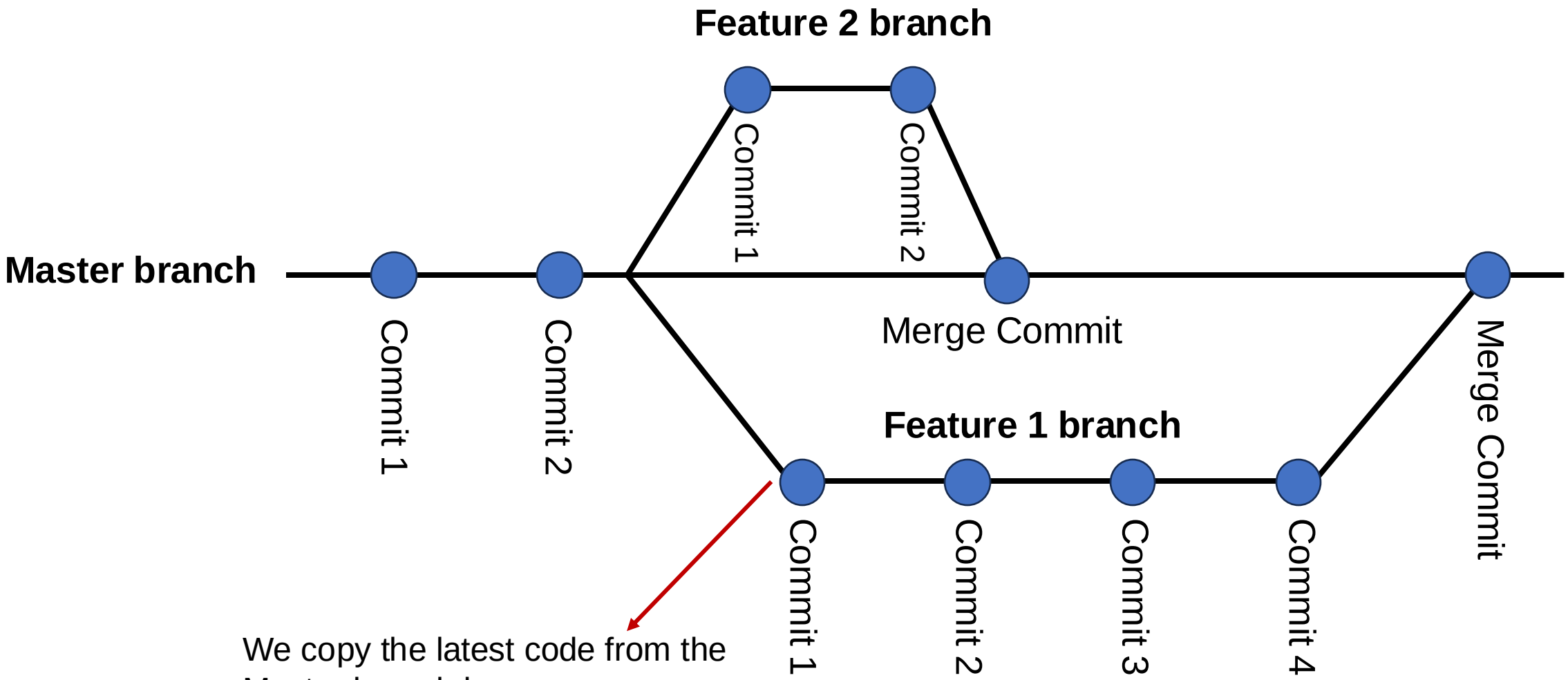
- **Branch**: is an independent line of development. It allows for the creation of isolated environments to work on specific features or fixes without affecting the main project.

Branches

- Allows for the creation of independent lines of development within a Git repository.
- It allows for the creation of isolated environments to work on specific features or fixes without affecting the main project.
- Branching enables parallel development and experimentation.

Branches


Feature 2 branch
Commit 1
Commit 2
Master branch
Commit 1
Commit 2
Merge Commit
Merge Commit
Feature 1 branch
Commit 1
Commit 2
Commit 3
Commit 4
We copy the latest code from the Master branch here, so we can start coding with.

Branching strategies

- **Feature branching**: each feature or task gets its own branch.
- **Release branching**: separate branches for preparing, testing, and deploying releases.
- **Hotfix branching**: immediate branches for fixing critical issues in production.

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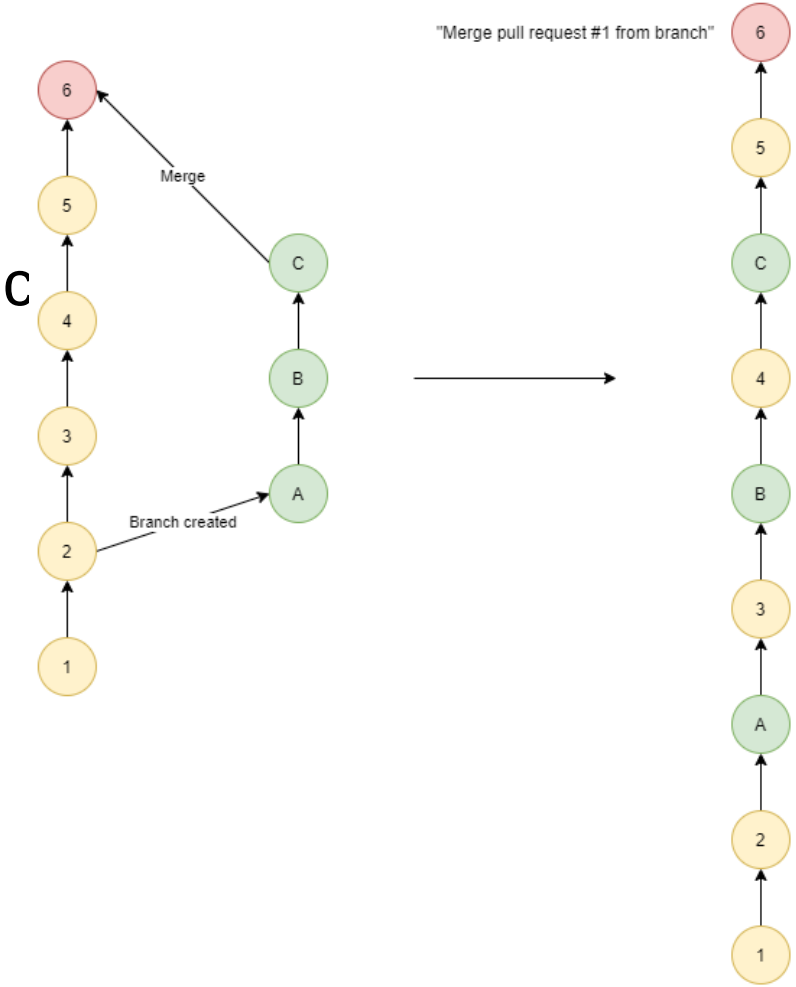
- **Merge**: combines changes from different branches into a single branch, often the main branch.

Different types of merges

There are several ways to merge changes from one branch into another:

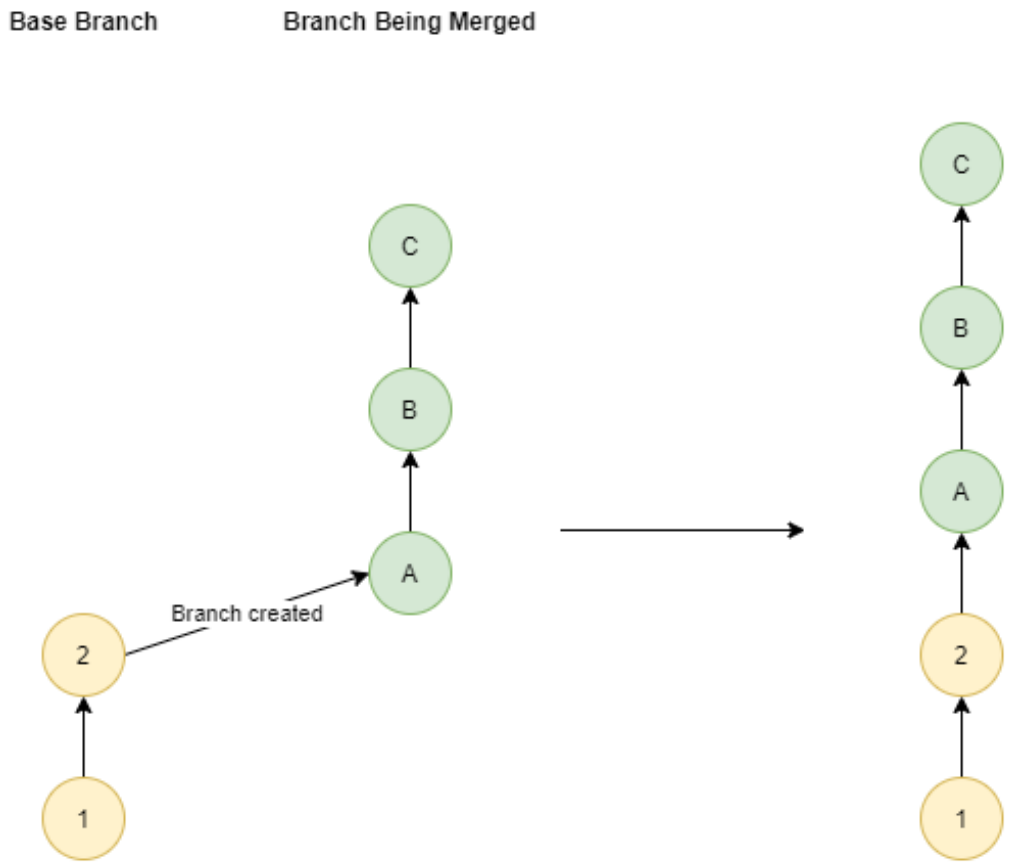
- Merge: This is the default merge strategy in Git. It creates a new commit that combines the changes from two branches. If changes in both branches do not conflic Git automatically performs the merge.



https://lukemerrett.com/different-merge-types-in-git/

Different types of merges

Fast-Forward Merge: occurs when the branch being merged into has not diverged since the branch was created. The branch pointer is simply moved forward to include the changes from the source branch.



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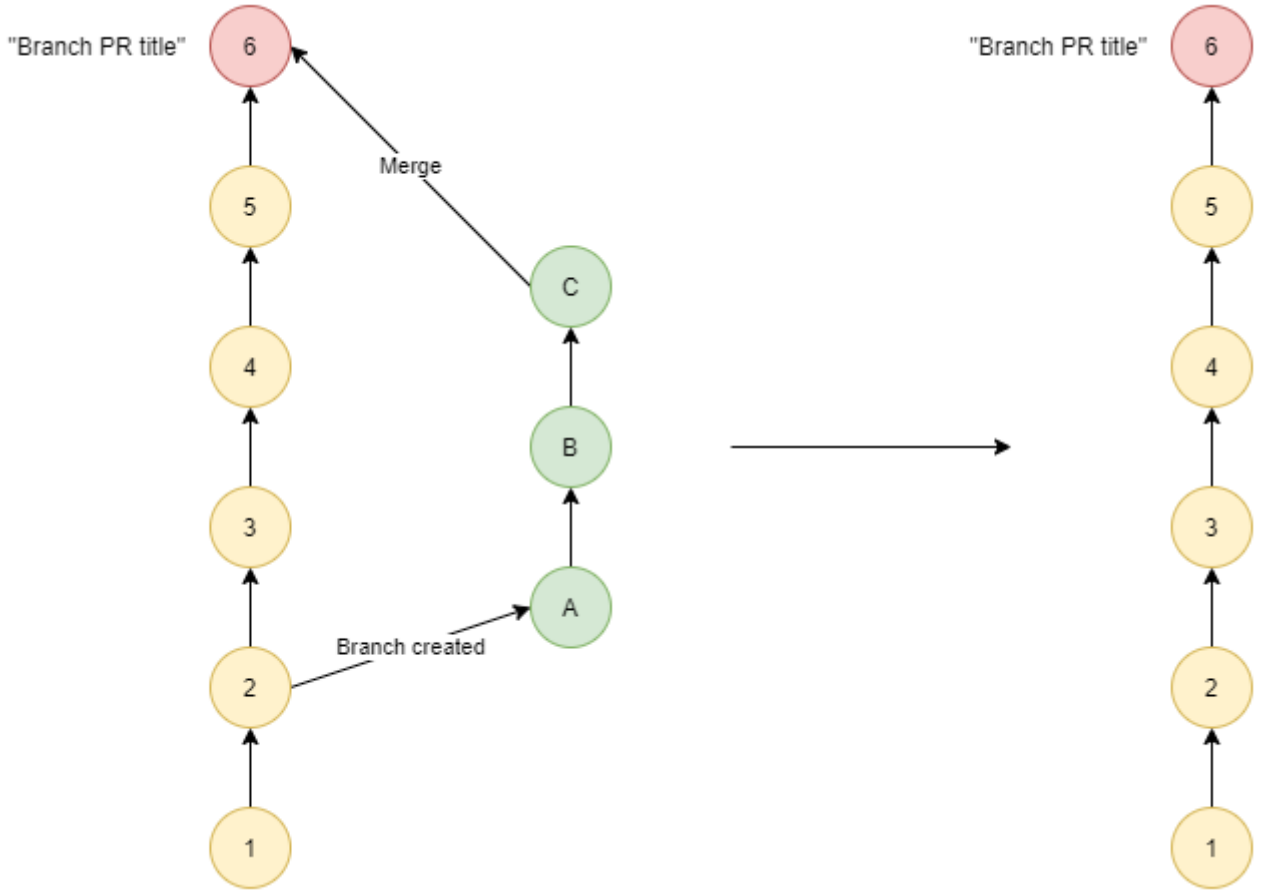
Different types of merges

Squash Merge: Squashing combines all the changes from a feature branch into a single commit before merging. This results in a clean, linear history on the main branch.



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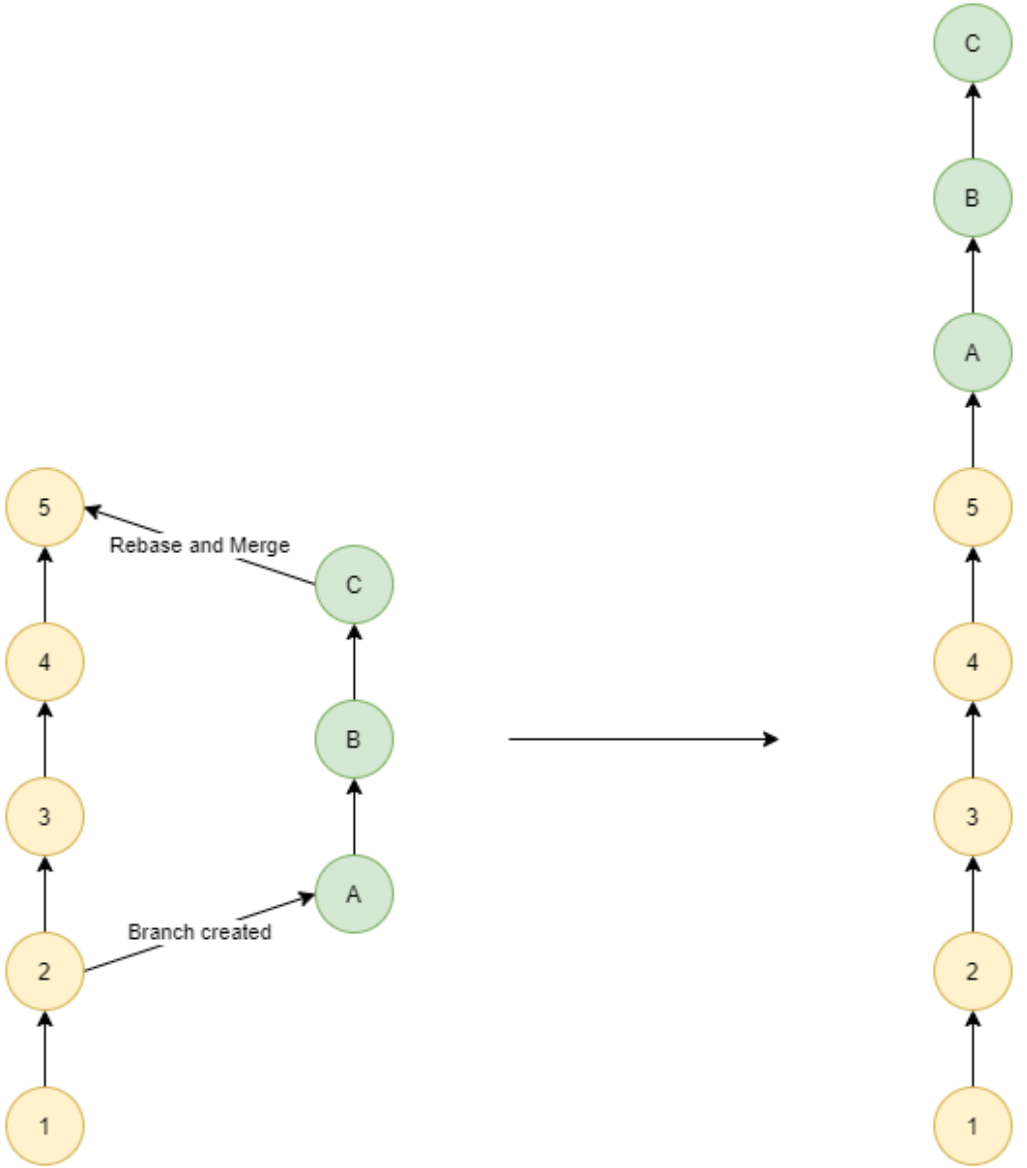
Different types of merges

Rebase and Merge: Rebasing involves moving or combining a sequence of commits to a new base commit.



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Shall we **separate the frontend and backend** into distinct repositories, or is it more convenient to **house them** within the same repository?

Advantages of distinct repositories

- Clear separation allows for modular development. Frontend and backend can evolve independently, making it easier to maintain and update each component.
- Different technology stacks for frontend and backend can be easily accommodated without cluttering a single repository.
- If different teams or individuals are responsible for frontend and backend, separate repositories offer more autonomy.
- Easier scalability as you can scale frontend and backend independently based on requirements.

Advantages of same repository

- A single repository provides a clear, unified history of changes, making it easier to track the evolution of the entire application.
- Versioning is simplified, and it is easier to ensure that frontend and backend versions are compatible.
- Changes that span both frontend and backend can be managed in a more coordinated manner.
- Developers can clone a single repository and have everything they need to work on the project.

Things to consider…

- **Project Size and Complexity:**
  - For small to medium-sized projects with a single team, a single repository might be more convenient.
  - For larger or more complex projects with separate teams or technologies, consider separate repositories.

- **Team Structure:**
  - If the same team works on both frontend and backend, a single repository might be more streamlined.
  - If different teams are responsible for frontend and backend, separate repositories might provide clearer ownership.

- **Development Workflow:**
  - Consider the development workflow and how changes are typically coordinated between frontend and backend.

- **Technology Stack:**
  - If frontend and backend share similar or tightly integrated technology stacks, a single repository could be more suitable.

Version Control beyond code

- Just as code evolves, data undergoes changes. Versioning data enables tracking changes, ensuring reproducibility, and facilitating collaboration among data scientists.
- Tools like DVC (Data Version Control) offers features tailored for versioning large datasets, managing metadata, and enabling data lineage.
- Versioning ML models allows tracking model changes, comparing performance across iterations, and rolling back to previous versions if necessary.
- Frameworks like MLflow provide comprehensive solutions for versioning models, managing experiments, and deploying models at scale.

Questions

Reminder: The deadline for Assignment 4 is **today at 11:59 PM**.