Version Control

EECS 2311 - Software Development Project

January 17, 2018

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But first, Screen Readers

- The software you will write for your project must be usable by visually-impaired users
- Such users use screen readers that read out what is shown on the screen
- Your software must work seamlessly with the screen reader
- Screen readers read out windowing information, so they are low-level tools
- As a result, there are different screen readers for different platforms

Popular Screen Readers

- Linux: ORCA (free)
- Windows: JAWS (expensive), NVDA (free)
- Mac: Apple VoiceOver (built-in, must be enabled)
- Download links on course website
- **Requirement**: Your project must support at least 2 of the 3 platforms above

Java Accessibility Support

- Java includes accessibility support for both Swing and JavaFX based GUIs
- Many tutorials online for the GUI framework of your choice
- On Windows, you may have to enable the Java Access Bridge (google it)
- Your code must include calls to the accessibility support framework for every component of your GUI
- Start looking into it now!

Examples

```
rowView.getAccessibleContext().
setAccessibleName("Row Header");

rowView.getAccessibleContext().
setAccessibleDescription("Displays ...");

lblDegrees.setAccessibleText("Enter
temperature in degrees.");
```

And now, back to Version Control…

Scenario 1

- You finished the assignment at home
- You get to York to submit and realize you did not upload it

- Has this ever happened to you?

Scenario 2

- Your program works pretty well
- You make a lot of improvements ...
  - ...but you haven't gotten them to work yet
- You need to demo your program *now*

Scenario 3

- You are working on the 2.0 version of “your great app.” But 2.0 does not quite compile yet… and customer finds a critical bug in 1.0, which must be fixed ASAP.
- If you're smart, you have a copy of your 1.0 source. You make the change and release, but how do you merge your changes into your 2.0 code?
- If you're not so smart, you have NO source code saved. You have no way to track down the bug, and you lose face until 2.0 is ready.

Scenario 4

- You change one part of a program - it works
- Your teammate changes another part - it works
- You put them together - it does not work

- What were all the changes?

Scenario 5

- You make a number of improvements to a class
- Your teammate makes a number of *different* improvements to the *same* class

- How can you merge these changes?

A poor solution

- There are a number of tools that help you spot changes (differences) between two files, such as diff
- Of course, they won't help unless you kept a copy of the older version
- Differencing tools are useful for finding a *small* number of differences in a *few* files
- A better solution…

Version control systems

- Keep multiple (older and newer) versions of everything (not just source code)
- Request comments regarding every change
- Display differences between versions
- Allow merging of changes on the same file

Centralized Version Control

- Traditional version control system
  - Server with database
  - Clients have a working version
- Examples
  - CVS
  - Subversion
- Challenges
  - Multi-developer conflicts
  - Client/server communication

Distributed Version Control

- Authoritative server by convention only
- Every working checkout is a repository
- Get version control even when detached
- Backups are trivial
- Examples
  - Git
  - Bitkeeper

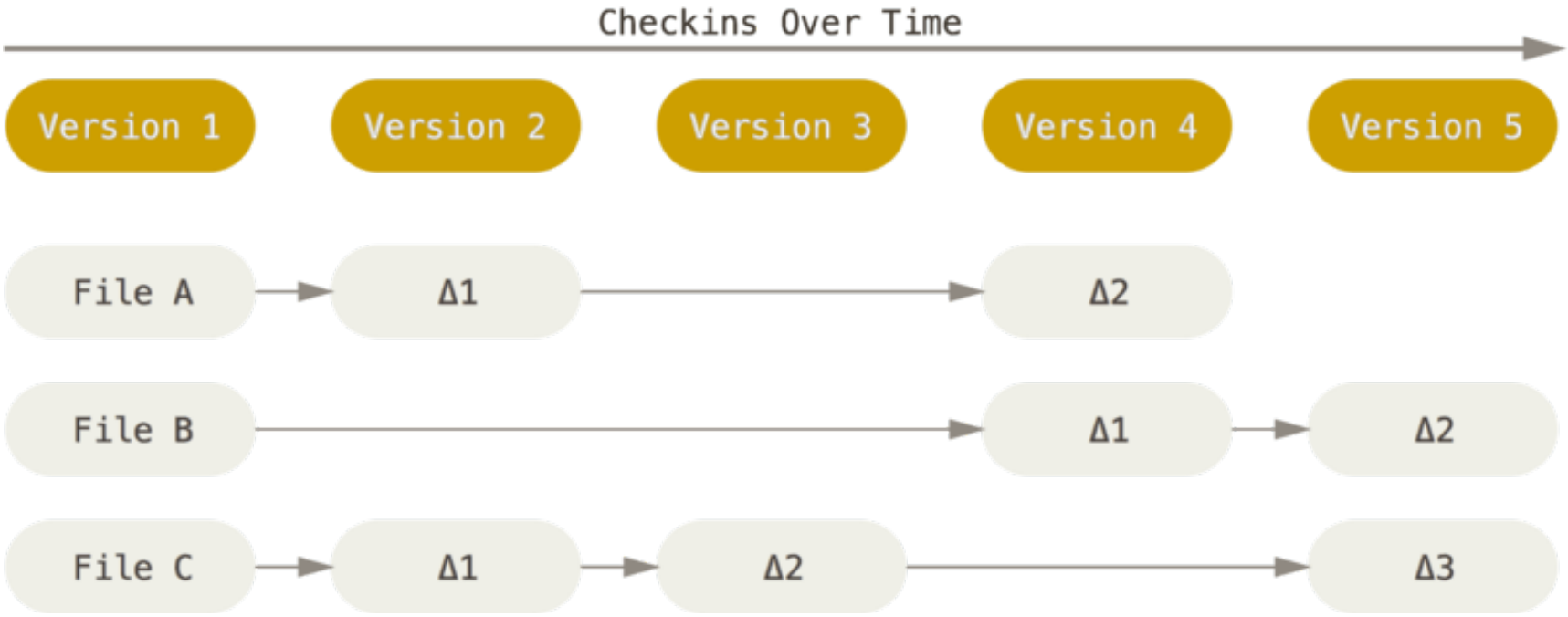
Terminology

- A **repository** contains several branches
- The main branch is called the **master**
- **Branches** break off from the master to try something new, e.g. a new feature, code restructuring etc.
- Branches can be merged with other branches or into the master
- **Tags** are usually official releases that have to be supported

Git

- Developed by Linus Torvalds and the Linux community starting in 2005
- Goals
  - Speed
  - Simple design
  - Strong support for non-linear development (thousands of parallel branches)
  - Fully distributed
  - Can handle large projects like Linux
- The rest of these slides are based on the excellent Pro Git book (link on course website)

Before Git: Delta storage



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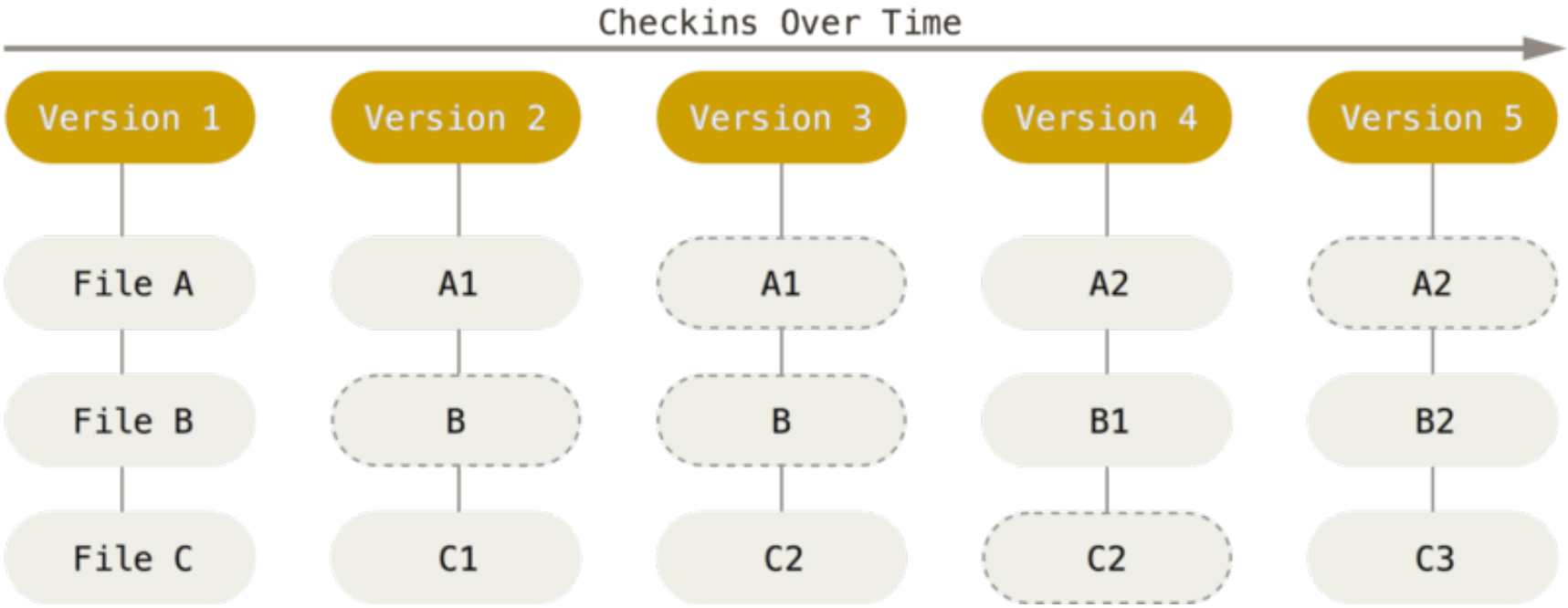
Git: Snapshot storage



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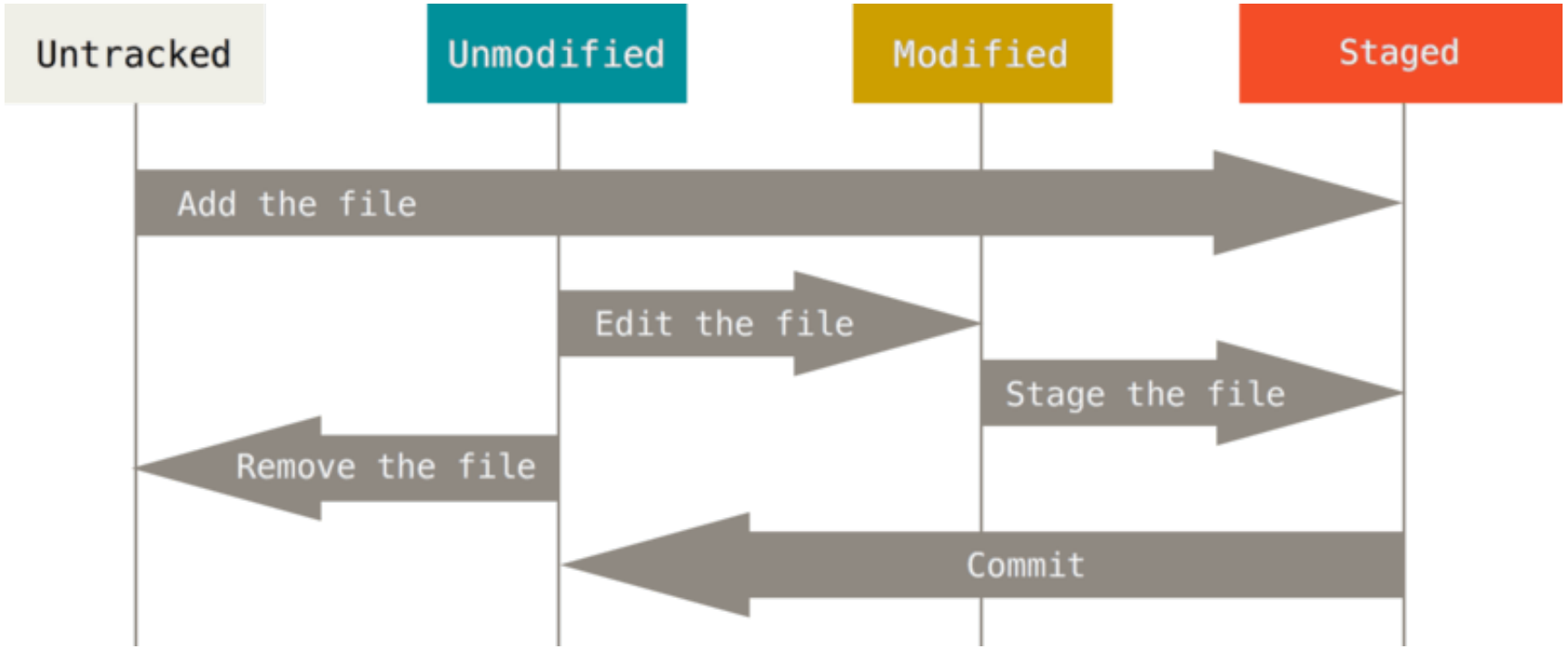
Git storage

- More like a miniature filesystem
- Makes for some very fast operations
- Beneficial when we get to branching

File States in Git

- **Committed** means that the data is safely stored in your local repository. Also called **Unmodified**
- **Modified** means that you have changed the file but have not committed it to your repository yet.
- **Staged** means that you have marked a modified file in its current version to go into your next commit snapshot.
- **Untracked** means that Git will not include the file in any snapshot

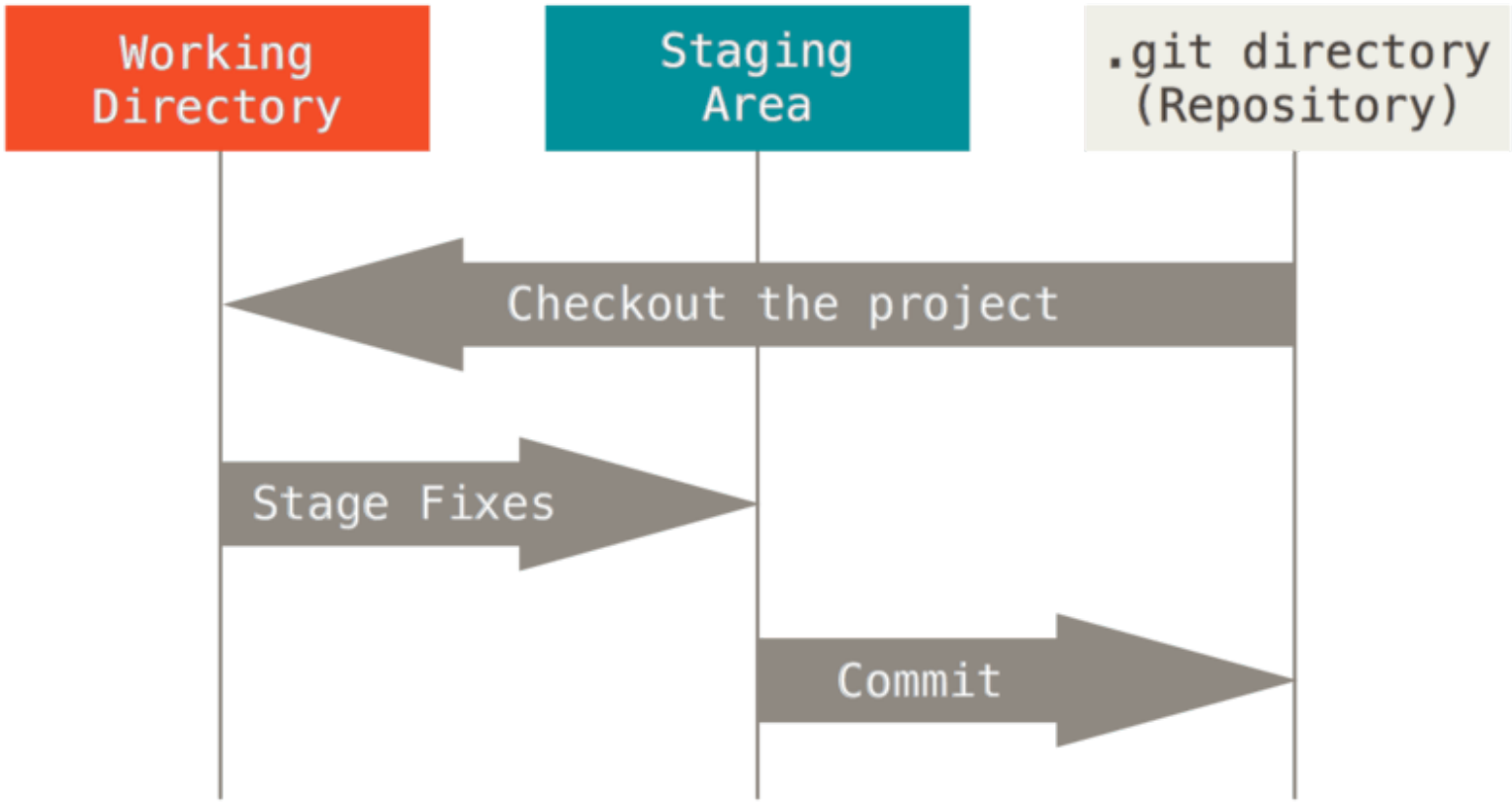
File States in Git



Git terminology

- **Working directory:** a single checkout of one version of the project
- **Staging area**: a file that stores information about what will go into the next commit. Also called **index**
- **.git directory:** The actual repository. Contains metadata and the object database of your project

Basic Git workflow



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Basic Git workflow

- You **modify** files in your working directory.
- You selectively **stage** just those changes you want to be part of your next commit, which adds only those changes to the staging area.
- You do a **commit**, which takes the files as they are in the staging area and stores that snapshot permanently to your .git directory.

Remote Repositories

- So far, everything has been local to your computer
- To collaborate with others (and to ensure backup), you need to set up a **remote repository**
- When we cloned your Github repository in Eclipse, we established one such remote repository
- Your default remote repository is referred to as **origin**
- It's possible to have multiple remote repositories

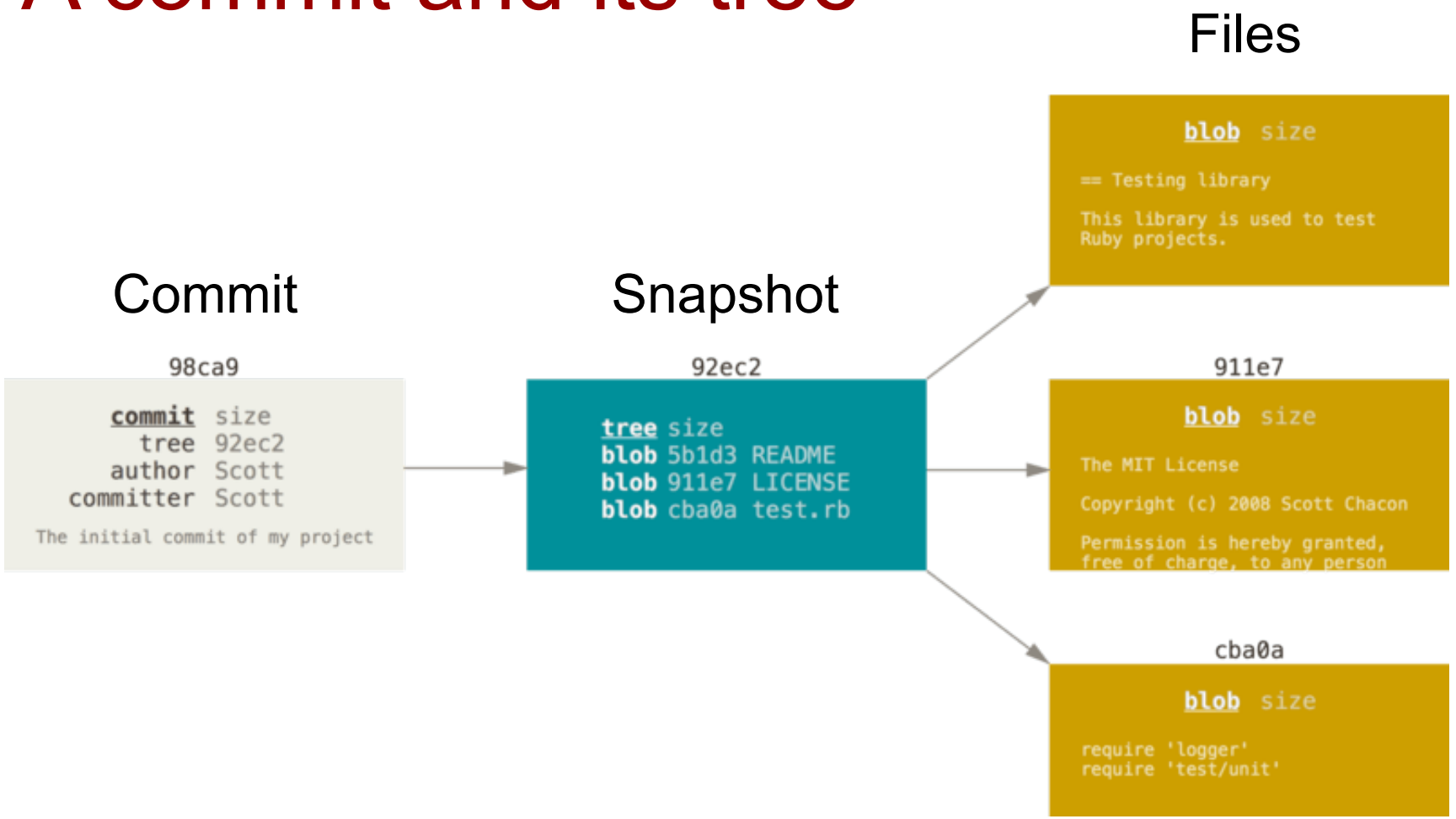
Remote Repository Operations

- **Fetch**: Downloads data from the remote repository, i.e. any changes your teammates have uploaded. Does not merge with your local repository.
- **Pull**: Fetches and then merges with your local repository. In many cases, this is all you need.
- **Push**: When you have a commit in your local repository that you would like to share, use Push to upload your code to the remote repository.

Git branching

- Your main line of development in your project is called the **master** branch
- You can create other branches to try out an idea without affecting your teammates
- If the idea works out, you can **merge** your branch back into the master branch
- Git provides powerful support for this process

A commit and its tree



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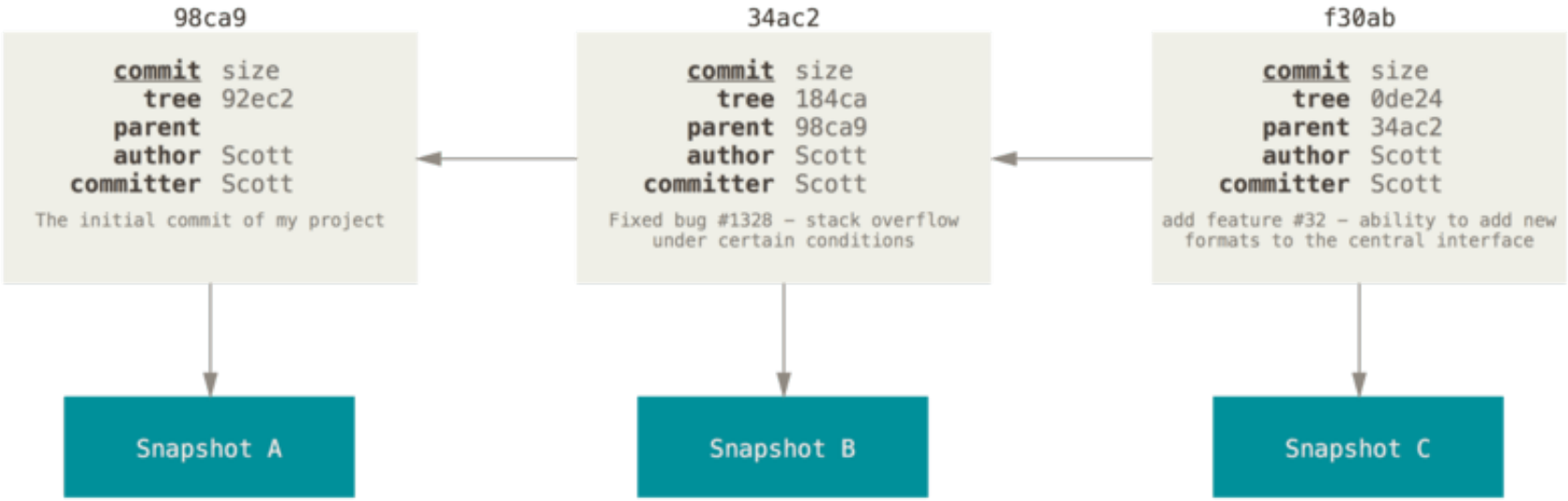
A series of commits



Each commit has a pointer to the previous commit

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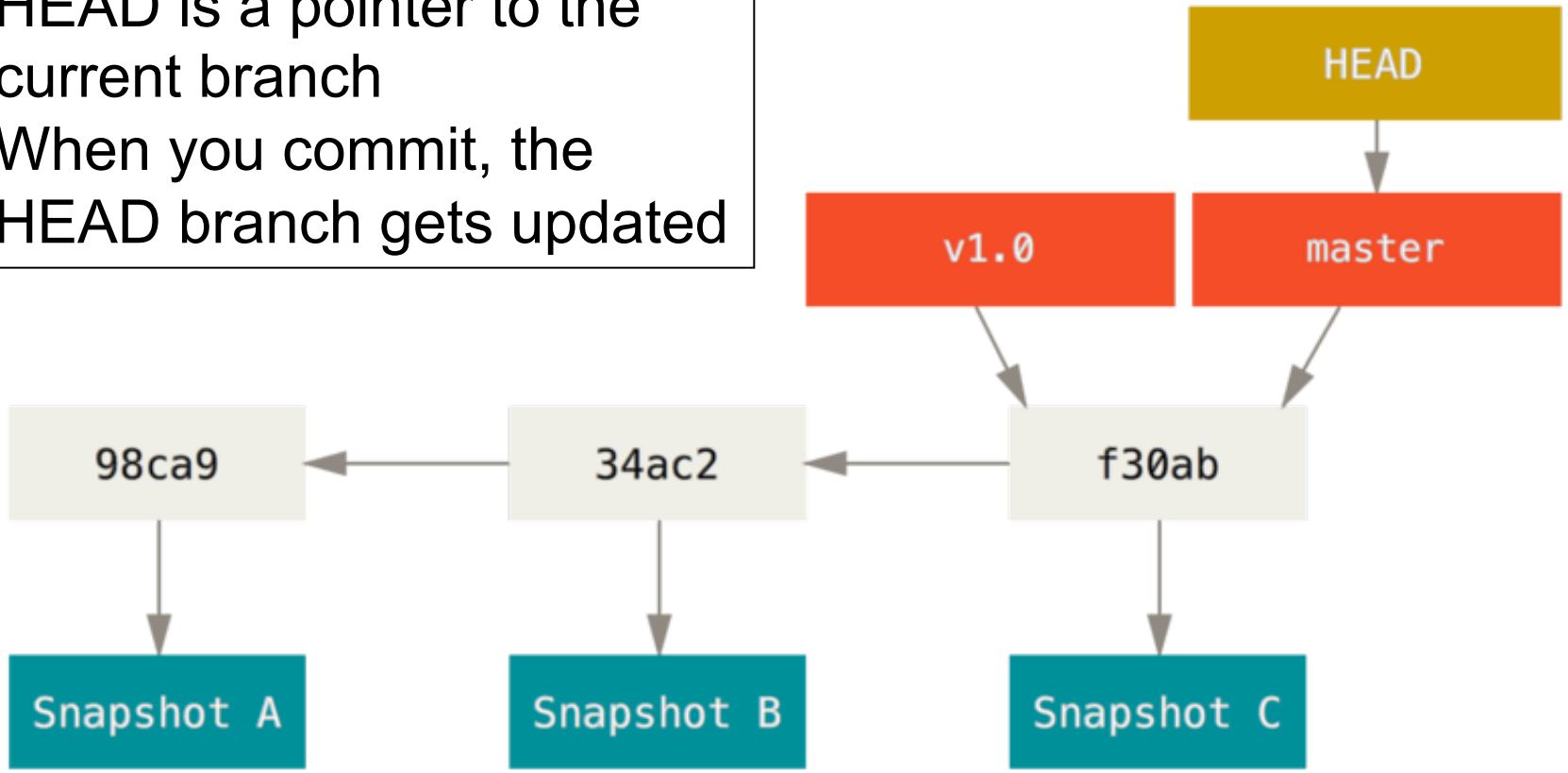
A branch is only a pointer

HEAD is a pointer to the current branch
When you commit, the HEAD branch gets updated



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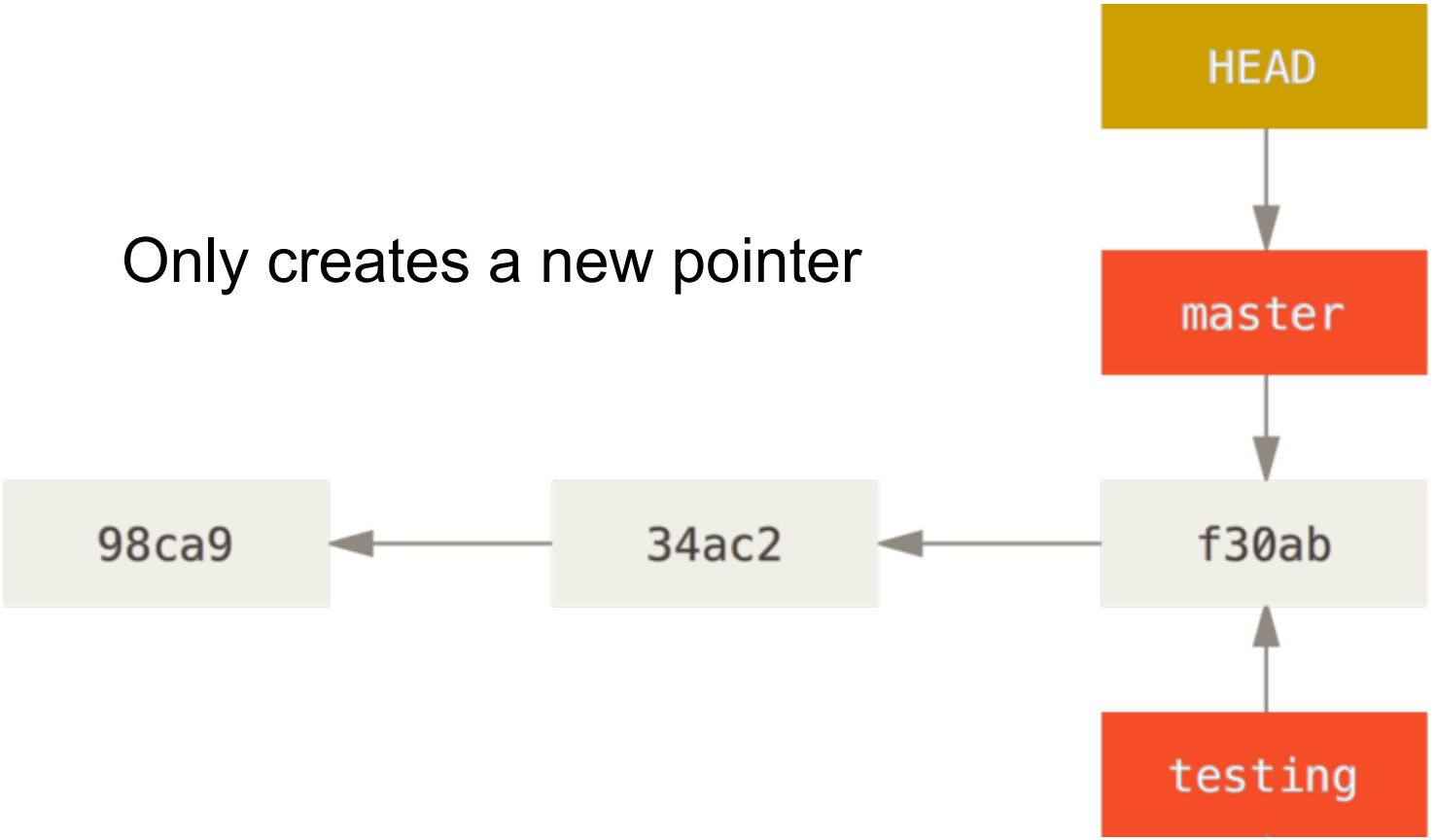
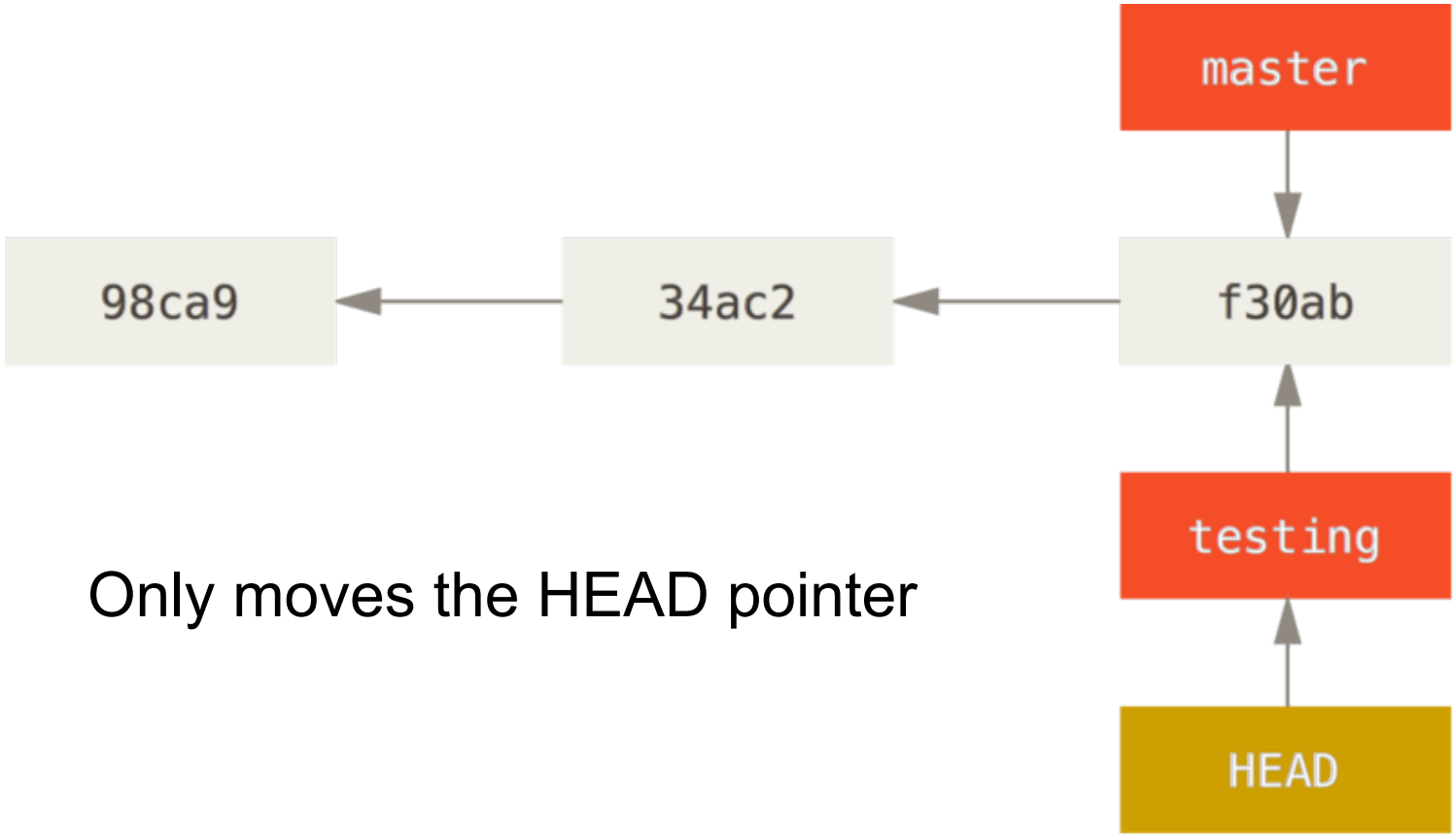
Create a new branch

Only creates a new pointer

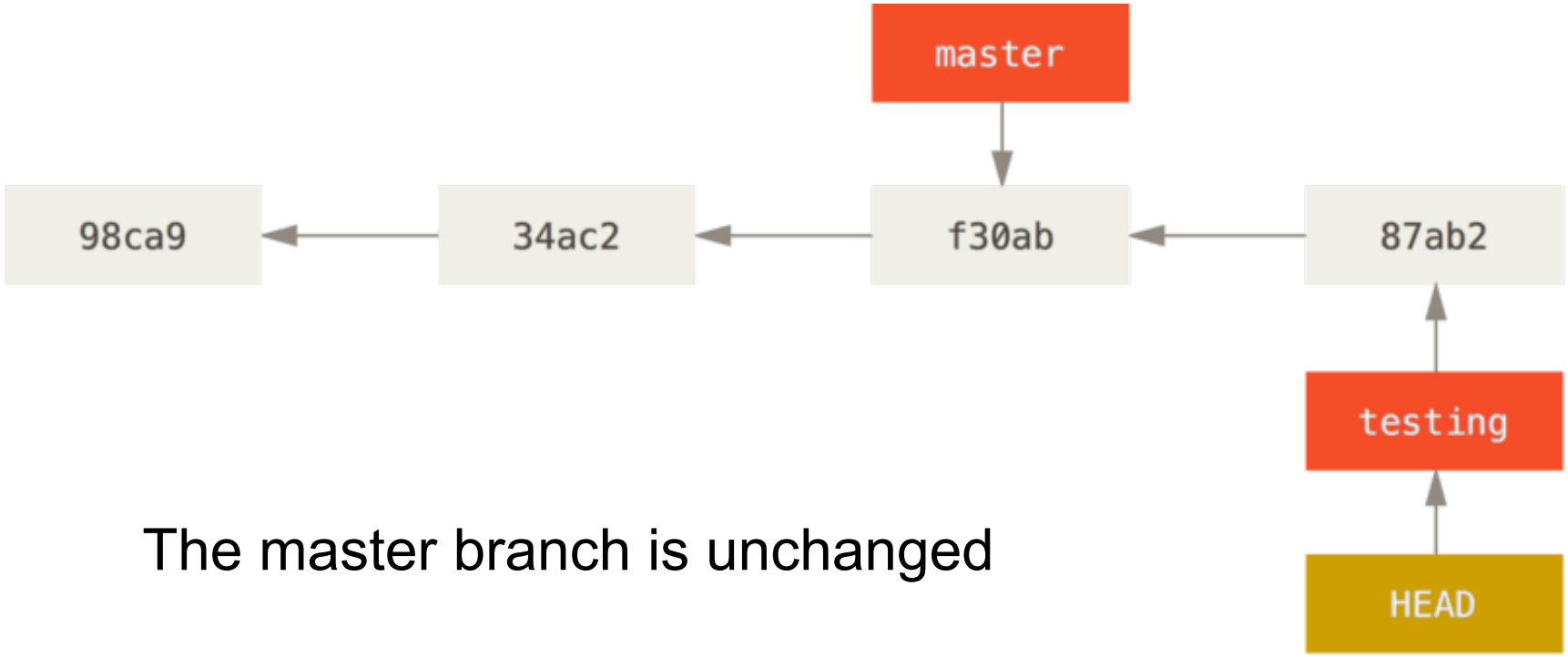


Switch to the new branch



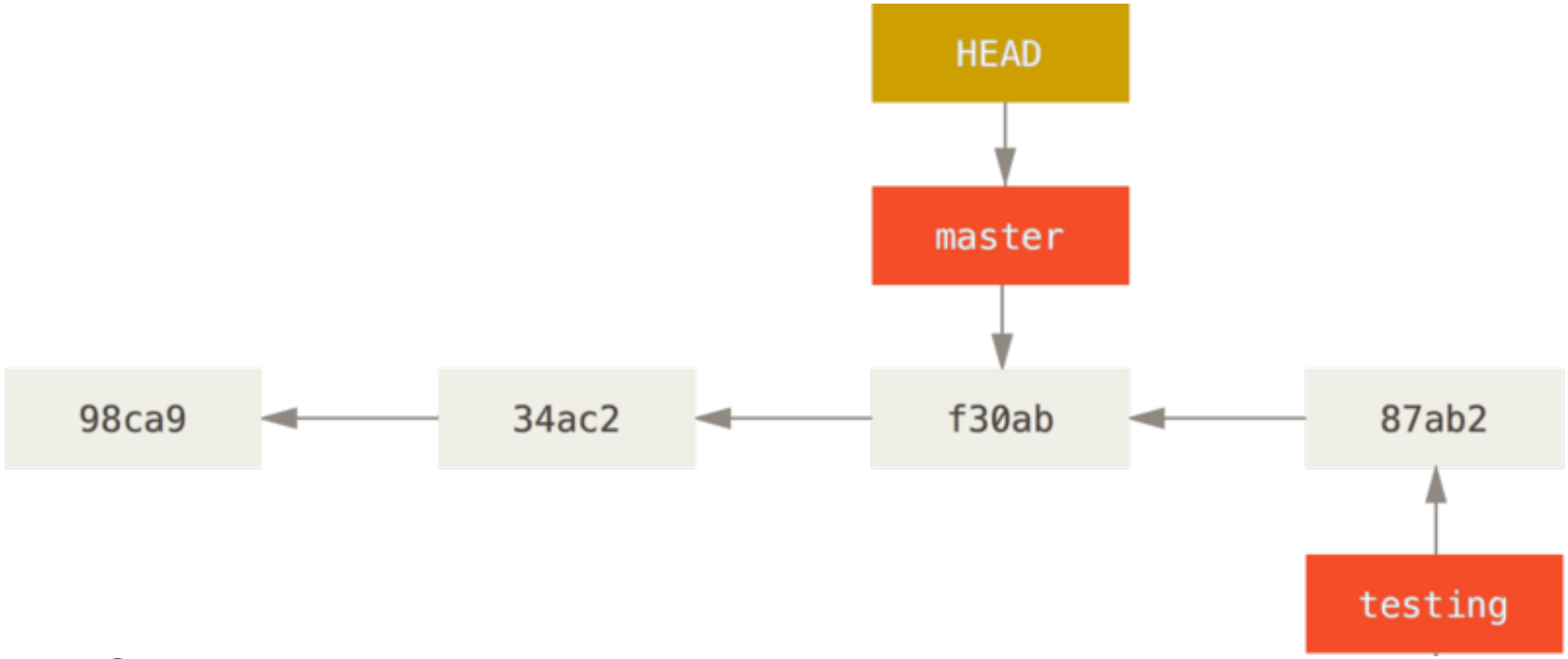
Only moves the HEAD pointer

Commit to the new branch



The master branch is unchanged

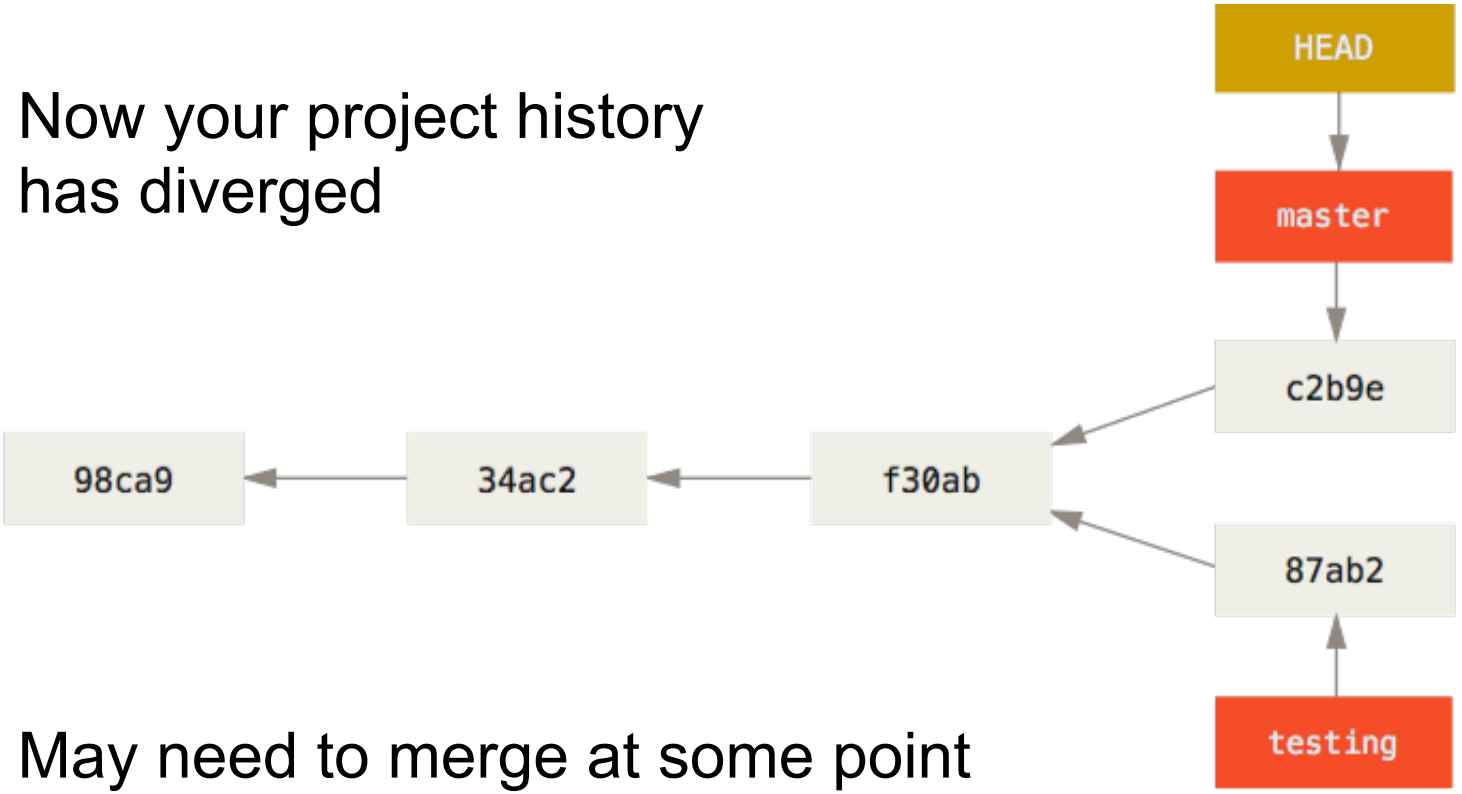
Switch back to the master branch



Only moves the HEAD pointer

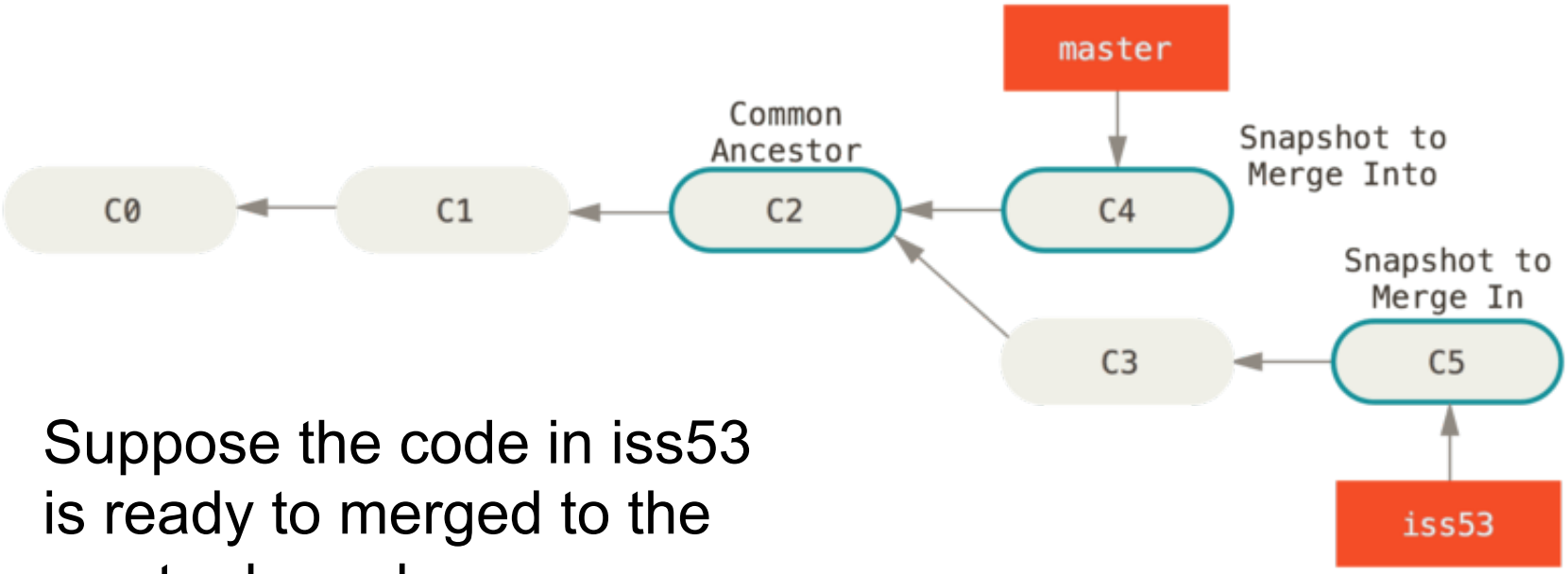
Commit to the master branch

Now your project history has diverged



May need to merge at some point

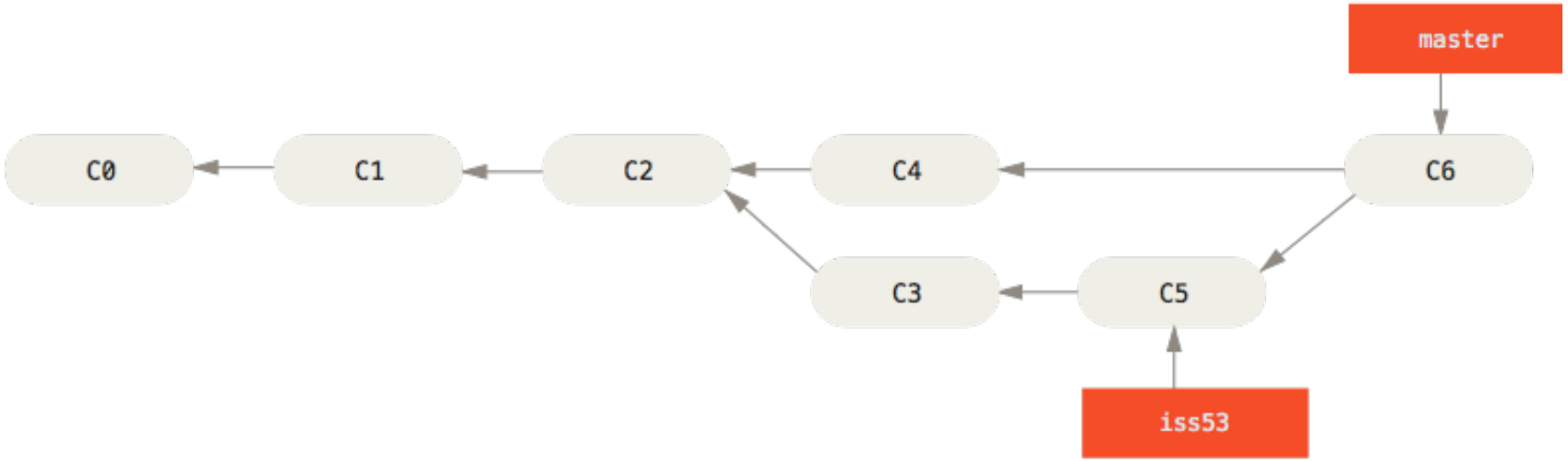
Merging



Suppose the code in iss53 is ready to merged to the master branch

A merge commit

A merge commit has two previous commits

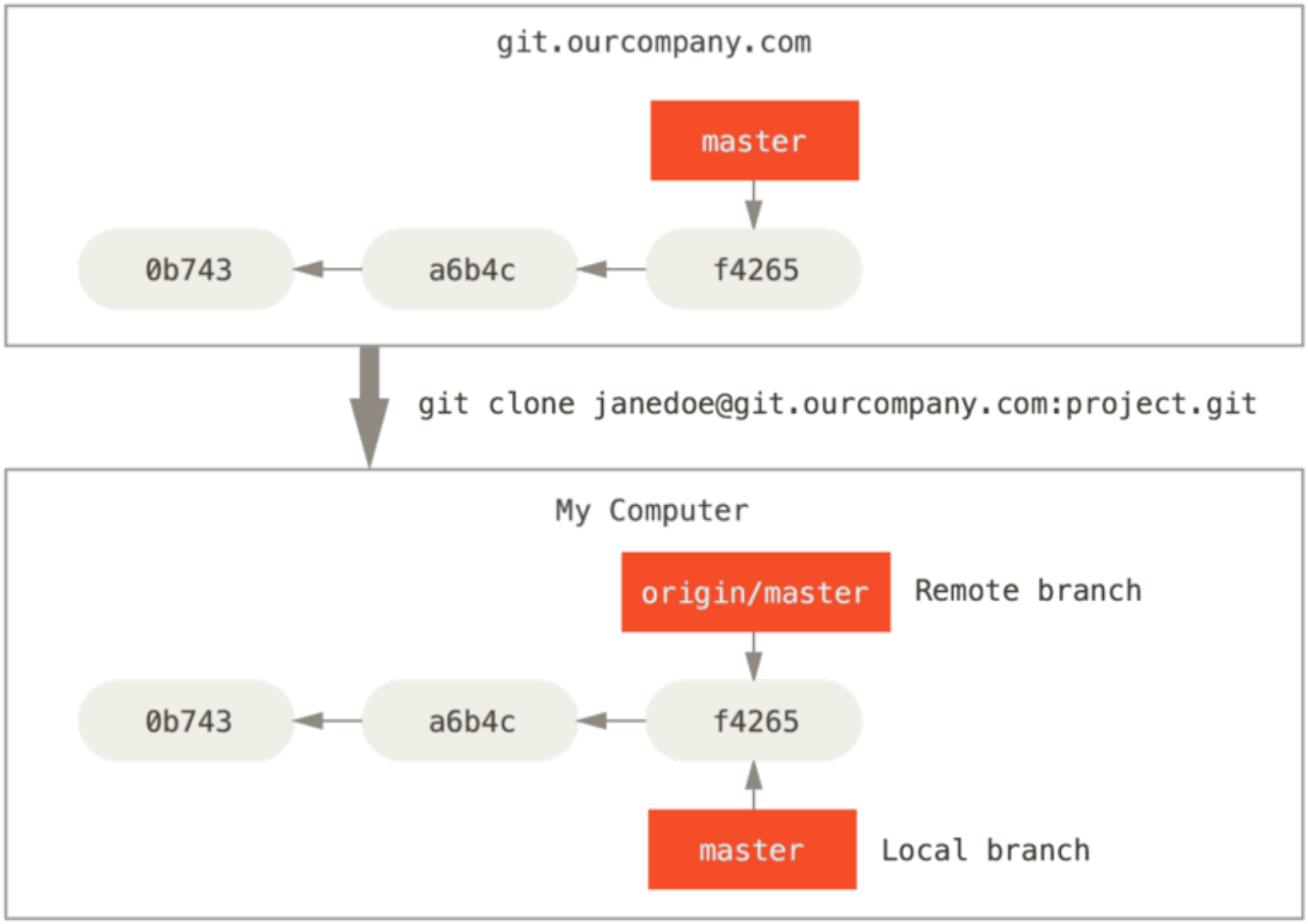


Branch iss53 can now be deleted

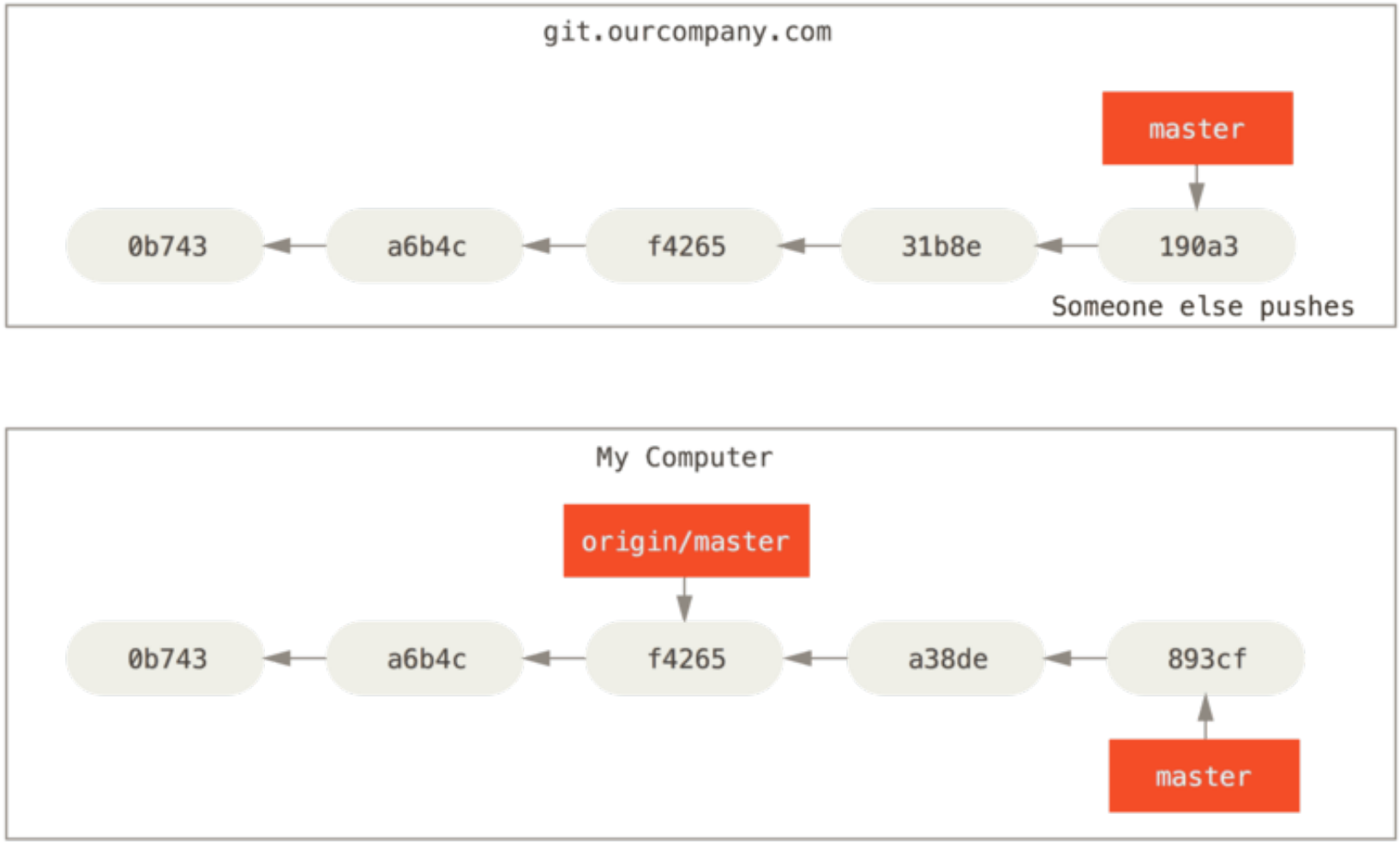
Merge conflicts

- If git cannot merge the two branches because changes have been made to the same part of a file, it will present options to choose one of the two versions or even create a new version on the spot.

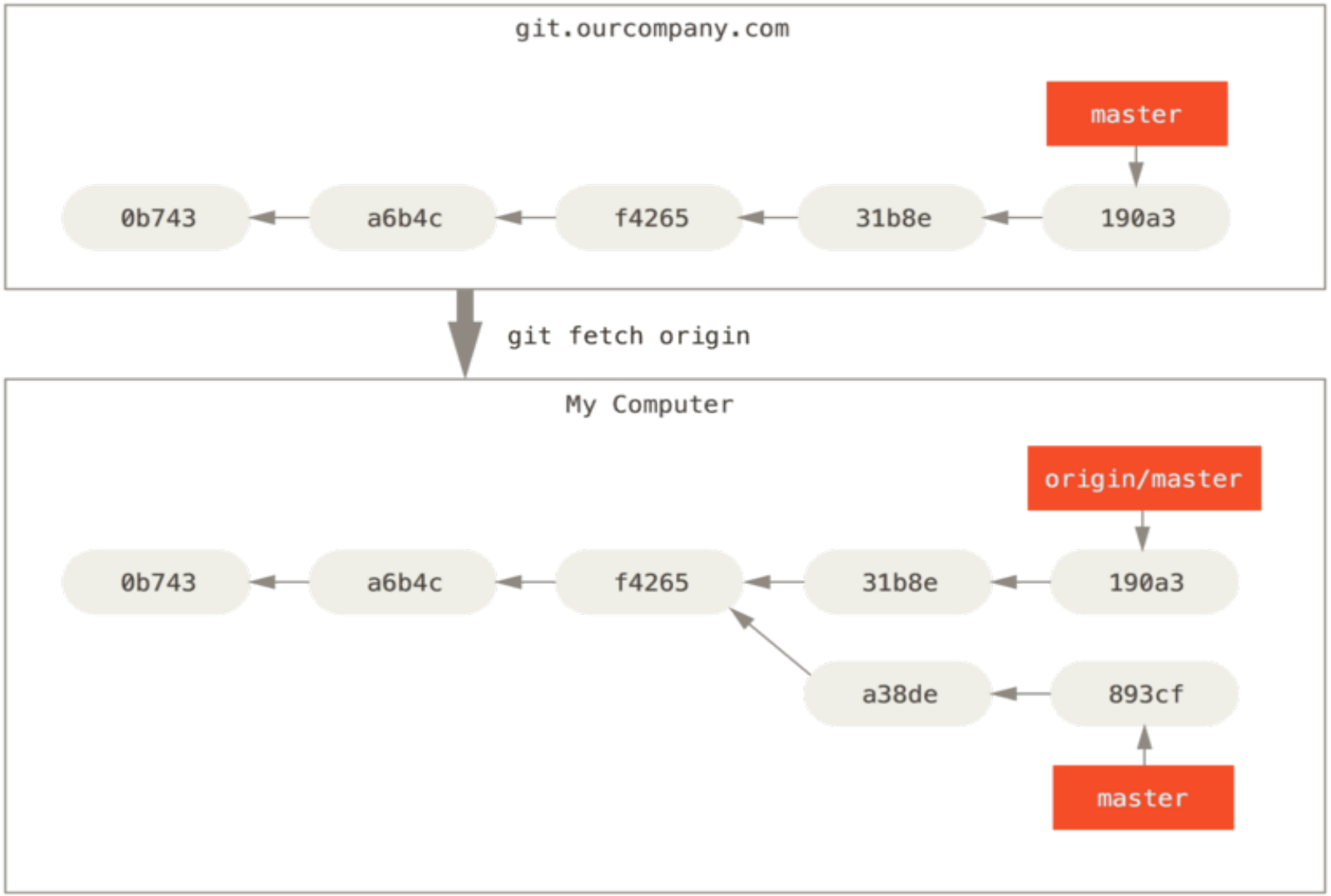
Remote branches



After some local work…



When you fetch…



Git vs. EGit

- Git has a powerful command-line implementation
- Can be used to apply version control to any files, not necessarily code
- Eclipse has EGit, a GUI implementation of git
- Not as powerful, but it provides most of the functionality of git
- See the documentation under Help -> Help Contents
- Tutorial link on Course Website

EGit in-class demo

- See the history of a file
- Compare versions
- Create a new branch and make some changes
- Switch to master branch and make conflicting changes
- Attempt to merge and resolve conflict

Lab Task

- Demonstrate to the TAs that you can create different branches, make changes, and resolve conflicts
- The conflicting versions must be created by two different team members and pushed to the team repository
- You must also demonstrate a first version of the Authoring app with a screen reader running
  - It can be as simple as a JFileChooser to select different scenarios
- Next week I will expect a version that does more than that, so get started!