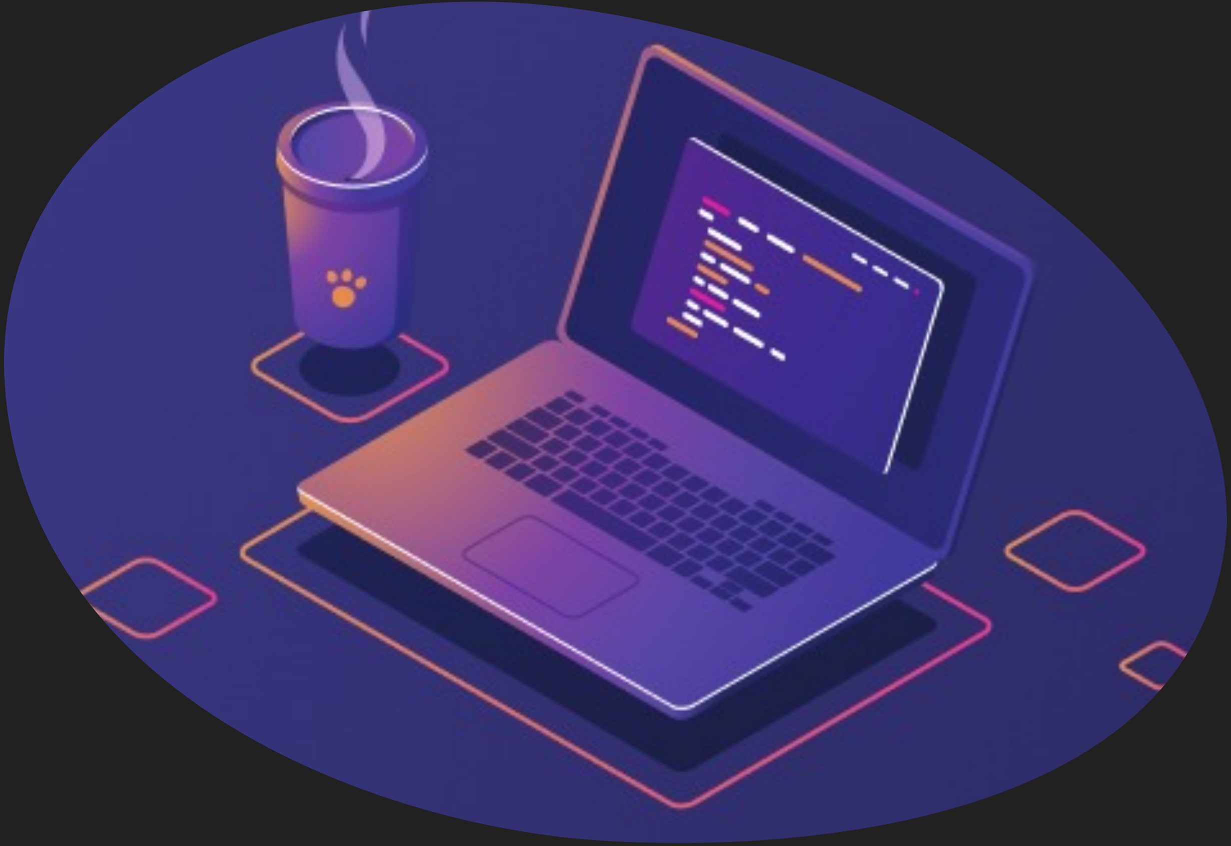


Week 3 : SOFTWARE DEVELOPMENT TOOLS AND ENVIRONMENTS

Week 3
Branches and Working with Others

Week 3 Branches and Working with Others

- **Review:**
  - So far we’ve learned how to create repositories, add changes to the stage, and commit them to the repository.
  - We’ve also learned how to push and pull code back and forth from local machines to remote branches on GitHub.

Week 3 Branches and Working with Others

- **Week 3**
  - Today it’s time to learn about a critical concept in Git: **branches**.
  - Branches allow us to organize a repository and split it apart so multiple people can work on it or so a solo developer can work on different aspects of a project on a separated work.

Week 3 Branches and Working with Others

- **Week 3 Topics:**
  - Master/Main Branch and Branches
  - Understanding HEAD
  - Git Branch Commands:
    - **git branch**, **git switch**, **git checkout**
  - Delete or Rename Branch
  - Merging Branches and Conflicts
  - Using **gif diff**
  - Exercise and Solution

Let’s get started!

Week 3
Branches

Week 3 Branches and Working with Others

- Let’s review what our current commit process looks like…

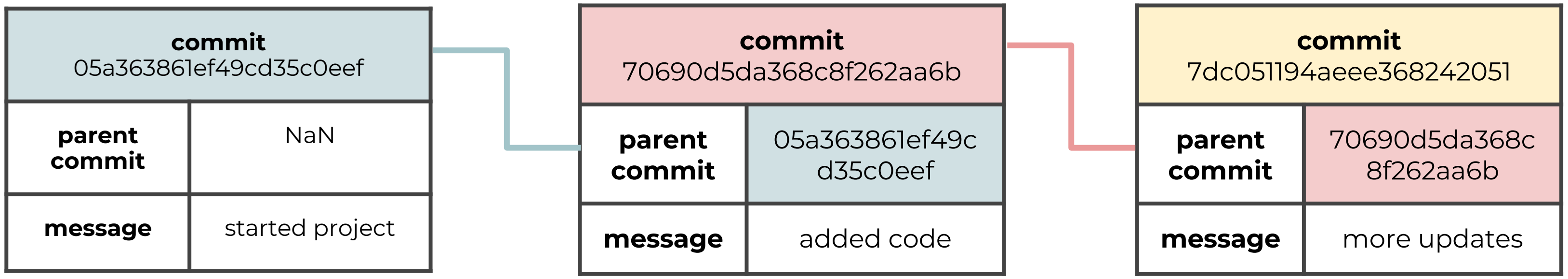
Week 3 Branches and Working with Others

- **Commit Process**
    - As we create commits, we are linking to a parent commit, showing the log of the commit history.

commit 05a363861ef49cd35c0eef	
parent commit	NaN
message	started project

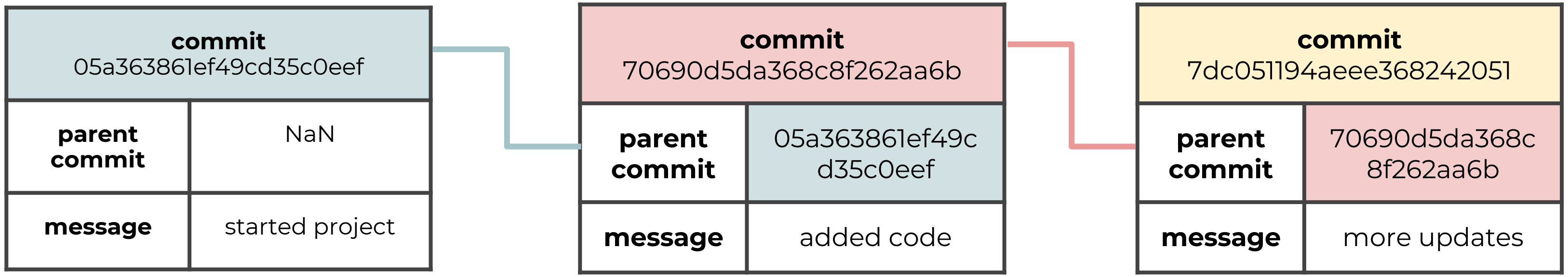
Week 3 Branches and Working with Others

- **Commit Process**
  - As we create commits, we are linking to a parent commit, showing the log of the commit history.



Week 3 Branches and Working with Others

- **Commit Process**
  - As we need incorporate the workflows of others or be able to focus on new updates without breaking old code, we need **branches**.



Week 3 Branches and Working with Others

- **Branches**
  - A branch represents an independent line of development.
  - Branches serve as an abstraction for the edit/stage/commit process.
  - They are a way to request a brand new working directory, staging area, and project history.

Week 3 Branches and Working with Others

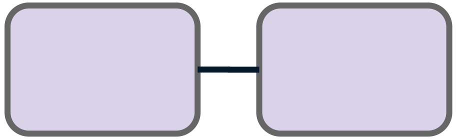
- **Branches**
  - Branches are just pointers to commits.
  - When you create a branch, all Git needs to do is create a new pointer, it doesn’t change the repository in any other way.
  - Let’s explore why branches are useful for workflows…

Week 3 Branches and Working with Others

- **Branches**

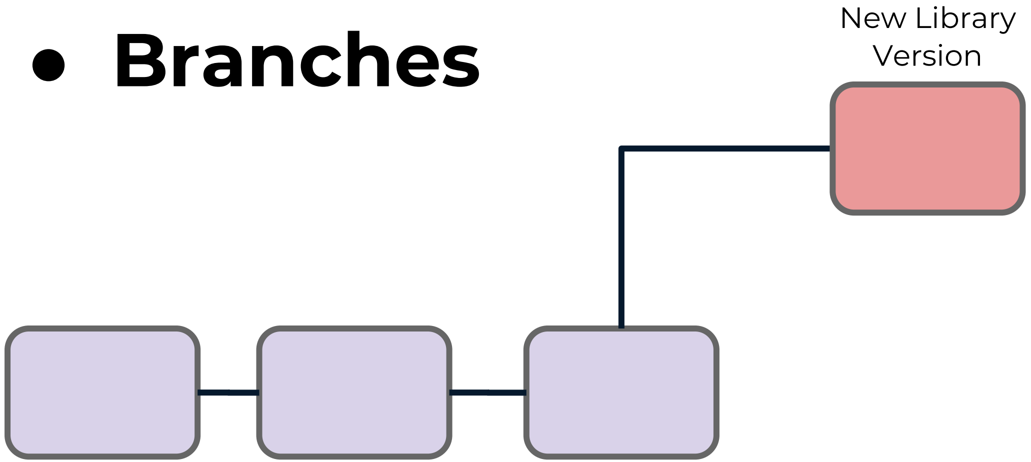
Week 3 Branches and Working with Others

- **Branches**



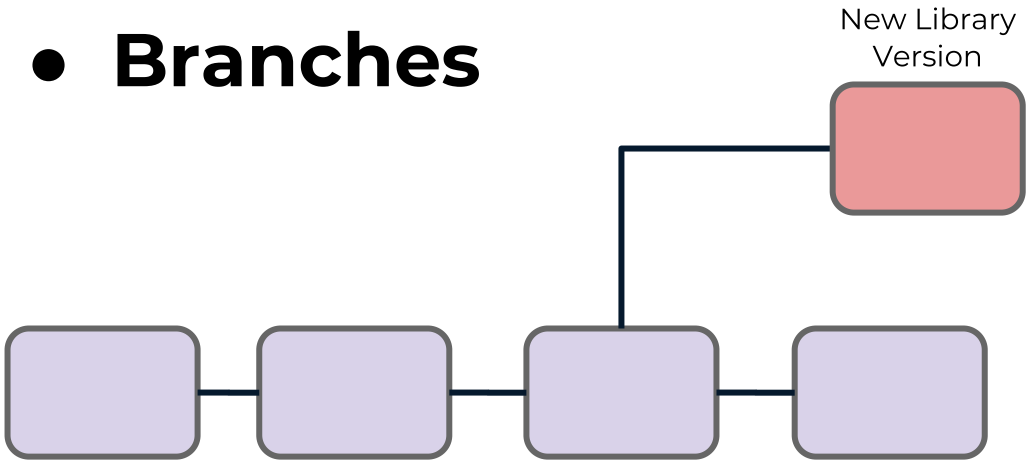
Week 3 Branches and Working with Others

- **Branches**



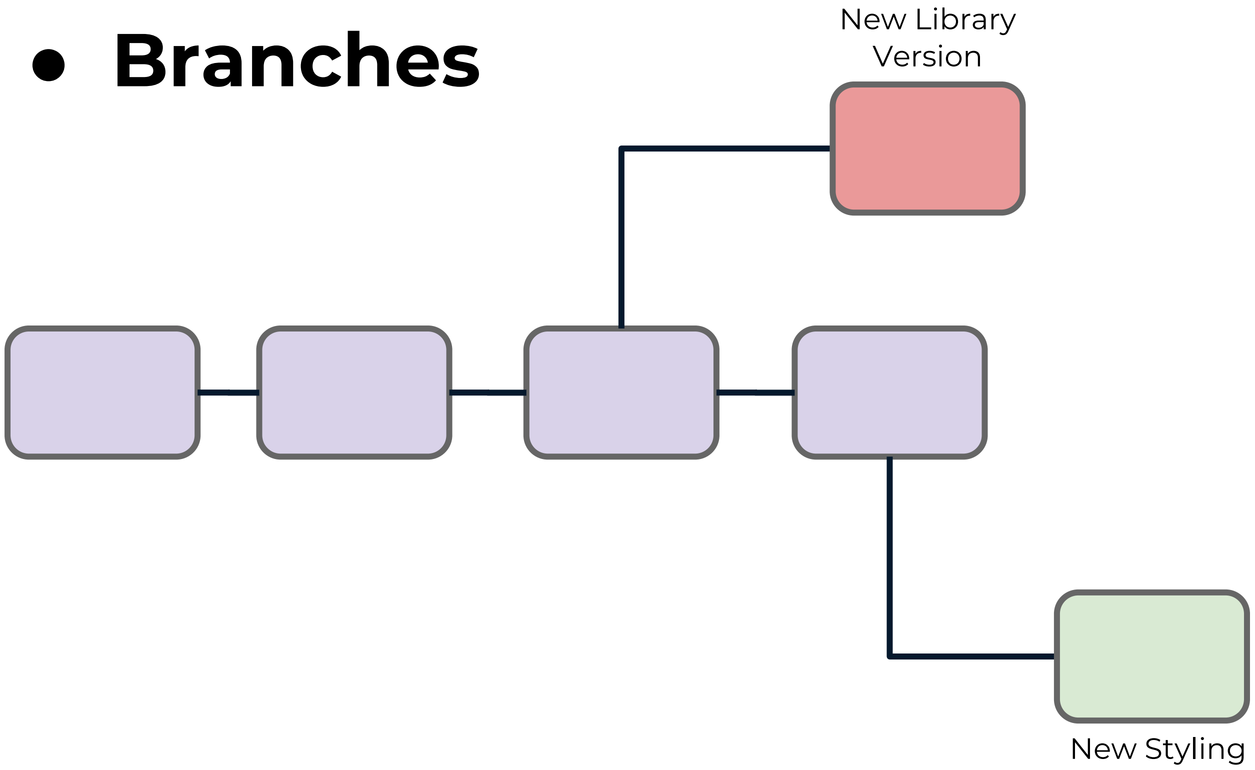
Week 3 Branches and Working with Others

- **Branches**



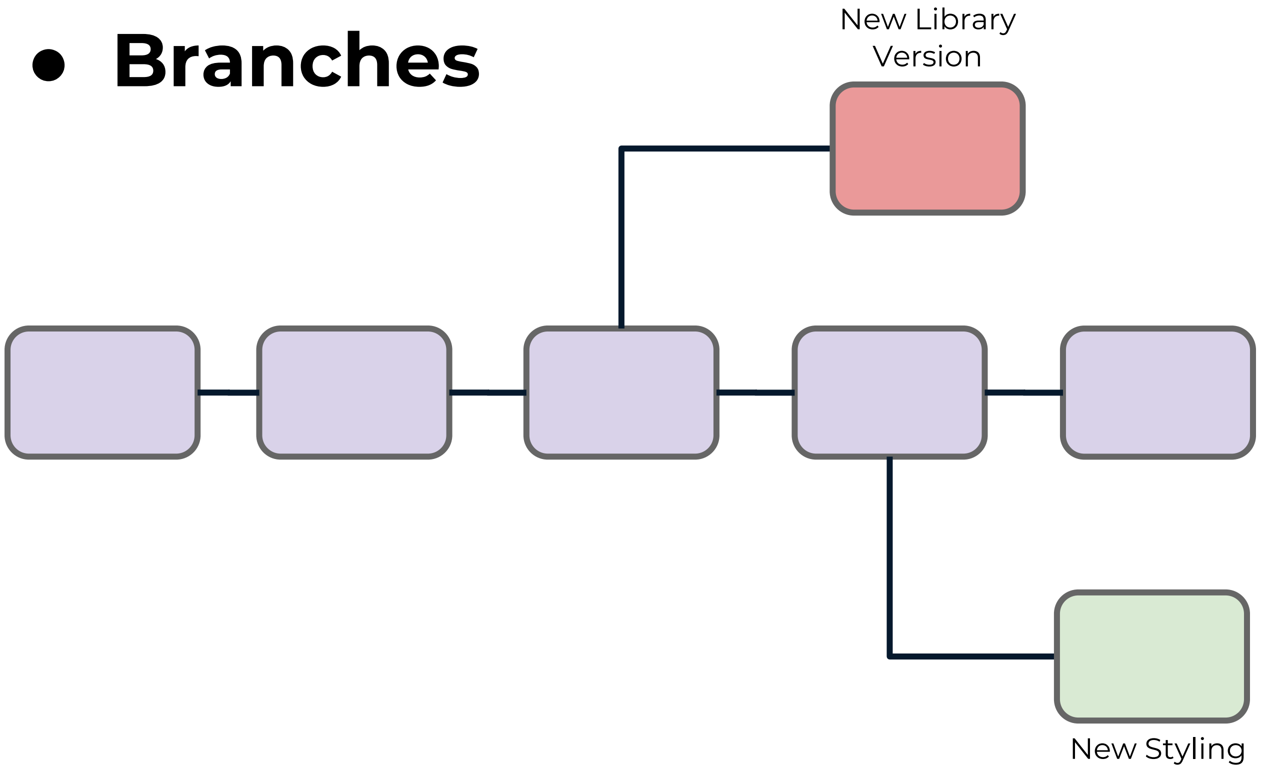
Week 3 Branches and Working with Others

- **Branches**



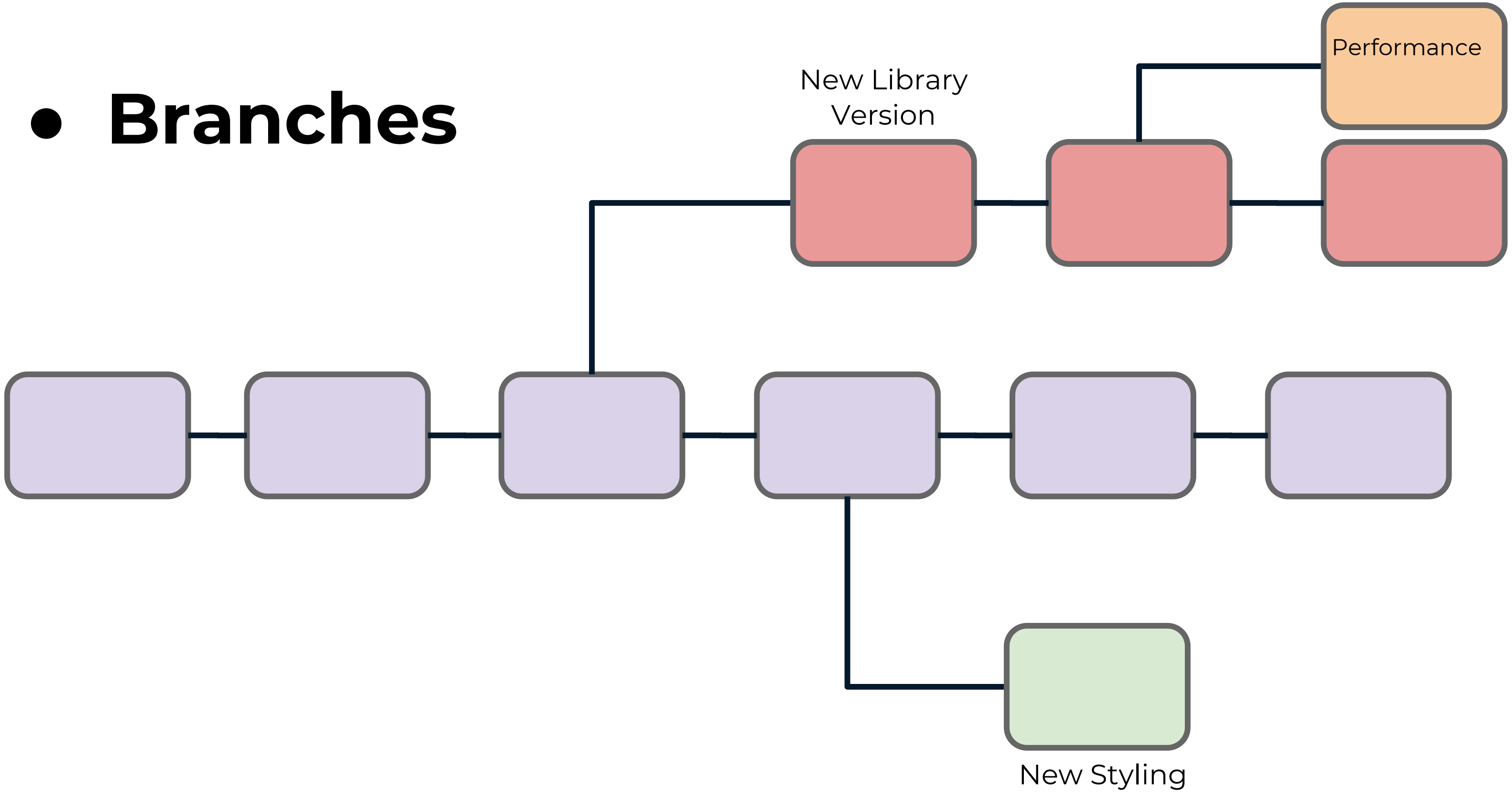
Week 3 Branches and Working with Others

- **Branches**



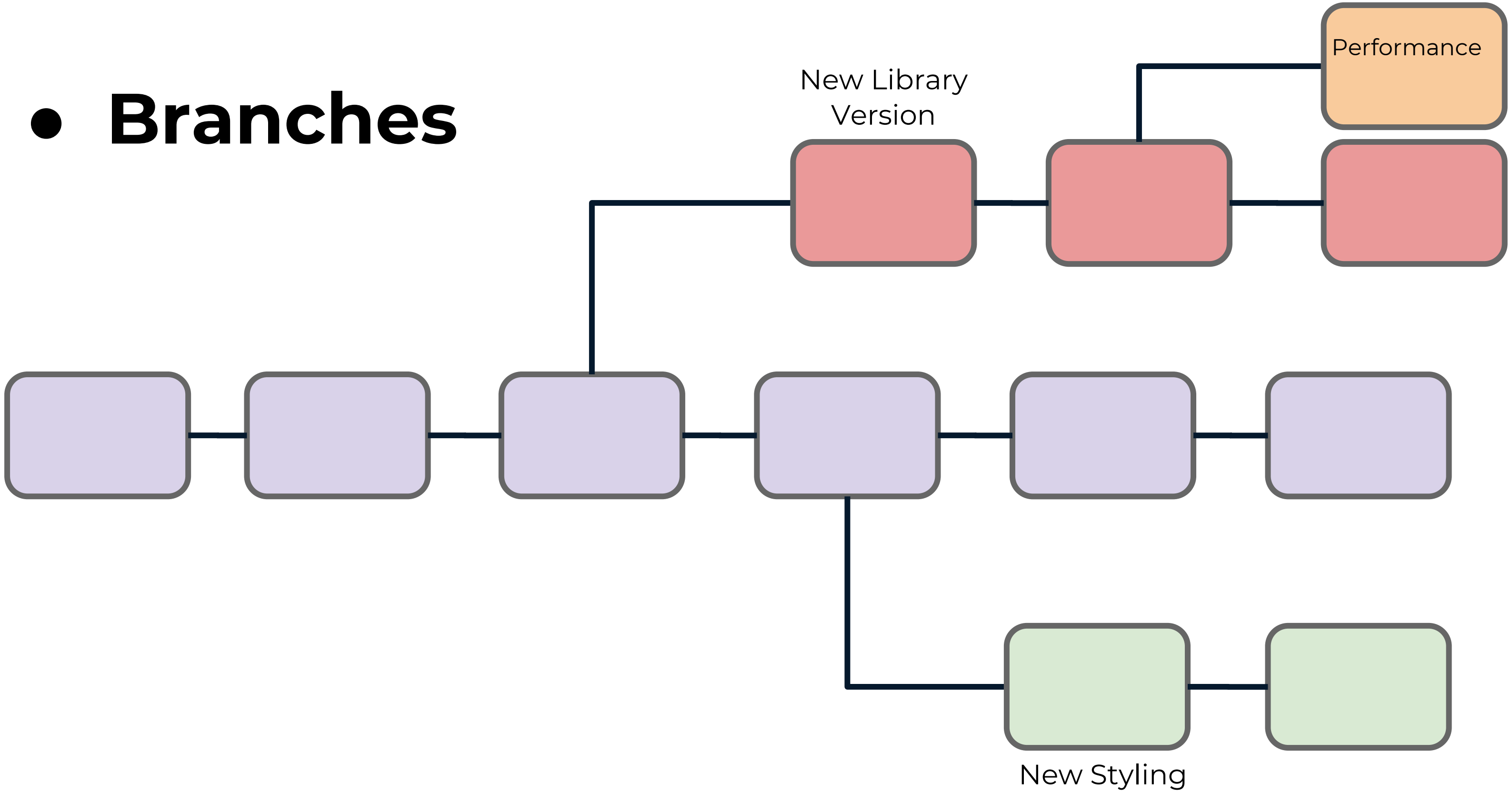
Week 3 Branches and Working with Others

- **Branches**



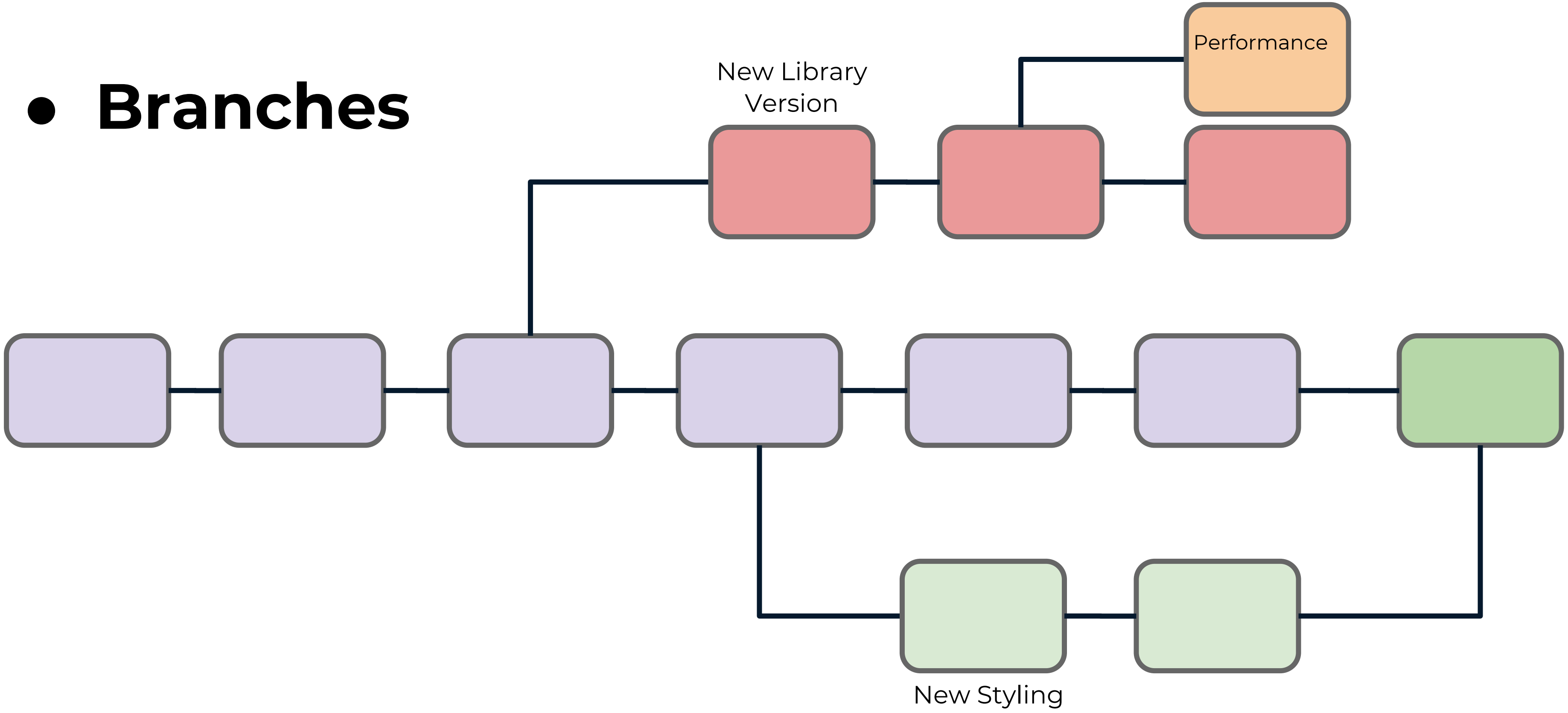
Week 3 Branches and Working with Others

- **Branches**



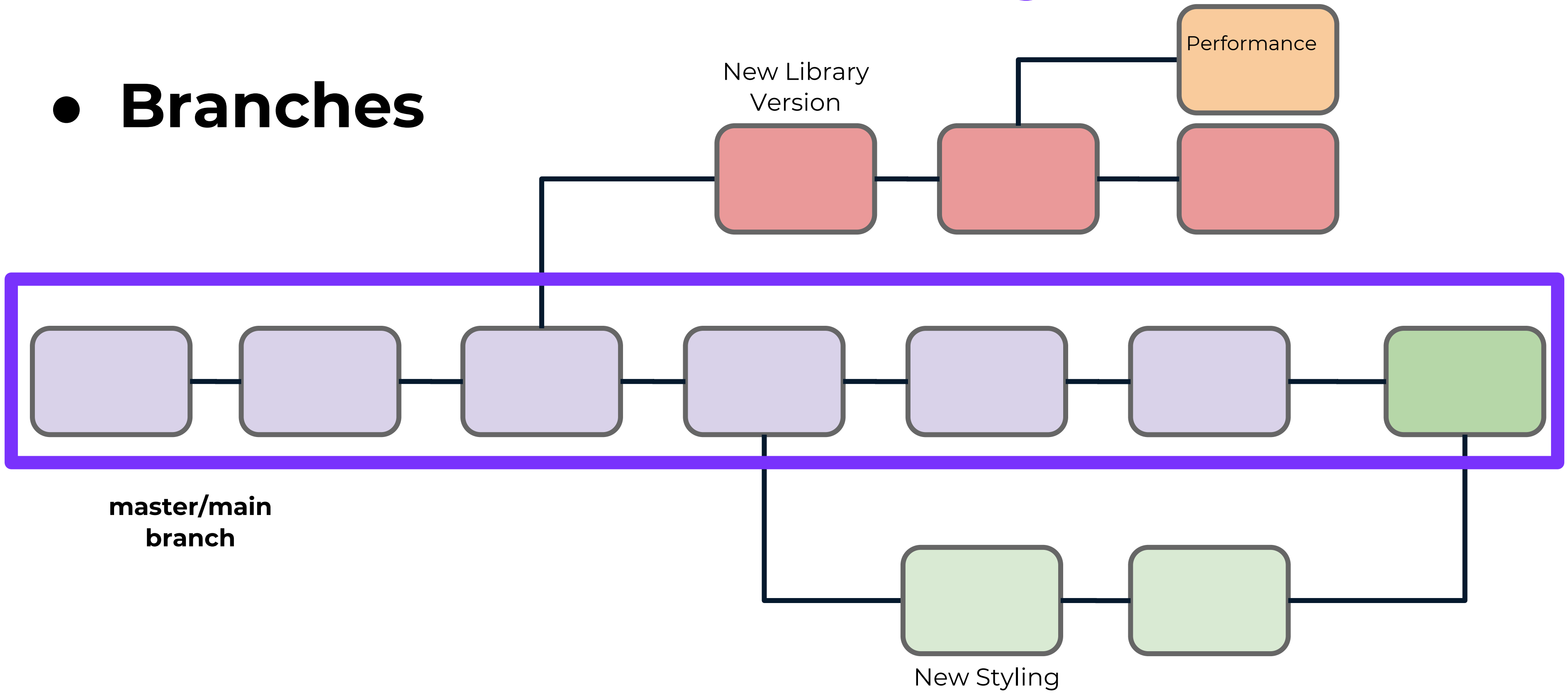
Week 3 Branches and Working with Others

- **Branches**



Week 3 Branches and Working with Others

- **Branches**



Week 3 Branches and Working with Others

- **Branches**
  - Upon creating a new repo with **git init** you create a new branch called the **master branch** (or **main branch**).
  - This is a branch just like any other, but it’s simply the first one created.
    - *Should code pushed to master branch always be in working condition?*

Week 3 Branches and Working with Others

- **Branches**
  - While organizations and developers often treat this master branch as the official branch for things like deployment, this is not a requirement.
  - You can use any branch for code deployment or code that’s actually “in-use”.

Week 3 Branches and Working with Others

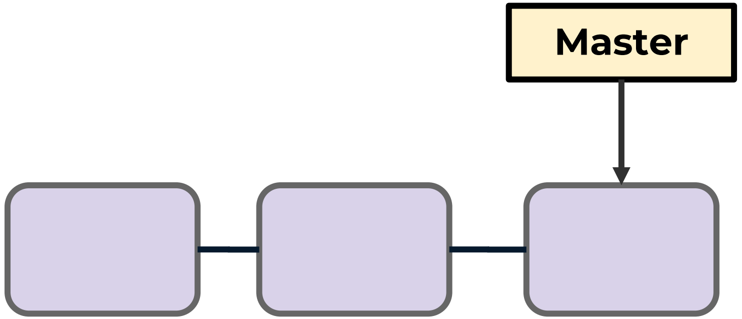
- **Branches**
  - Master vs. Main
    - As we've discussed previously, GitHub has changed the nomenclature for this initial branch to be **main branch** while Git is still using **master branch** (but this may change in the future)**.**
    - You can also rename any branch (**trunk branch**).

Week 3 Branches and Working with Others

- **Creating a New Branch**
    - Before we conclude, let’s quickly go into more detail about what happens when first create a new branch.
    - Branches are just pointers to commits.
    - When you create a branch, all Git needs to do is create a new pointer, it doesn’t change the repository in any other way.

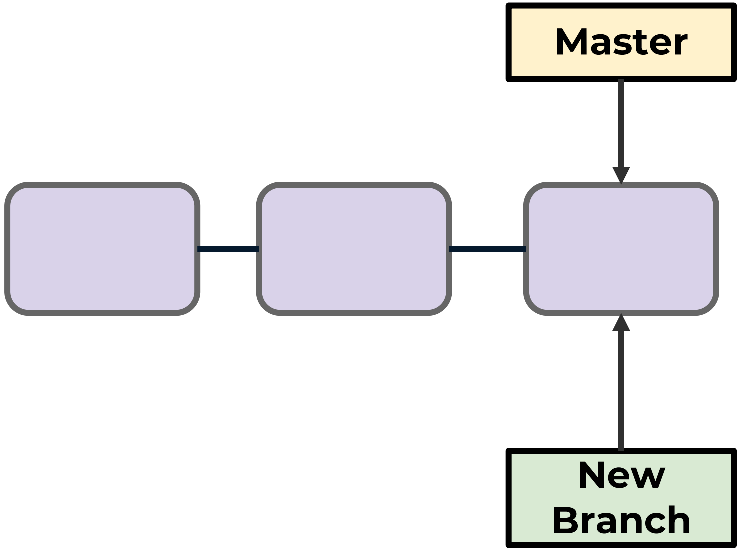
Week 3 Branches and Working with Others

- **Creating a New Branch**



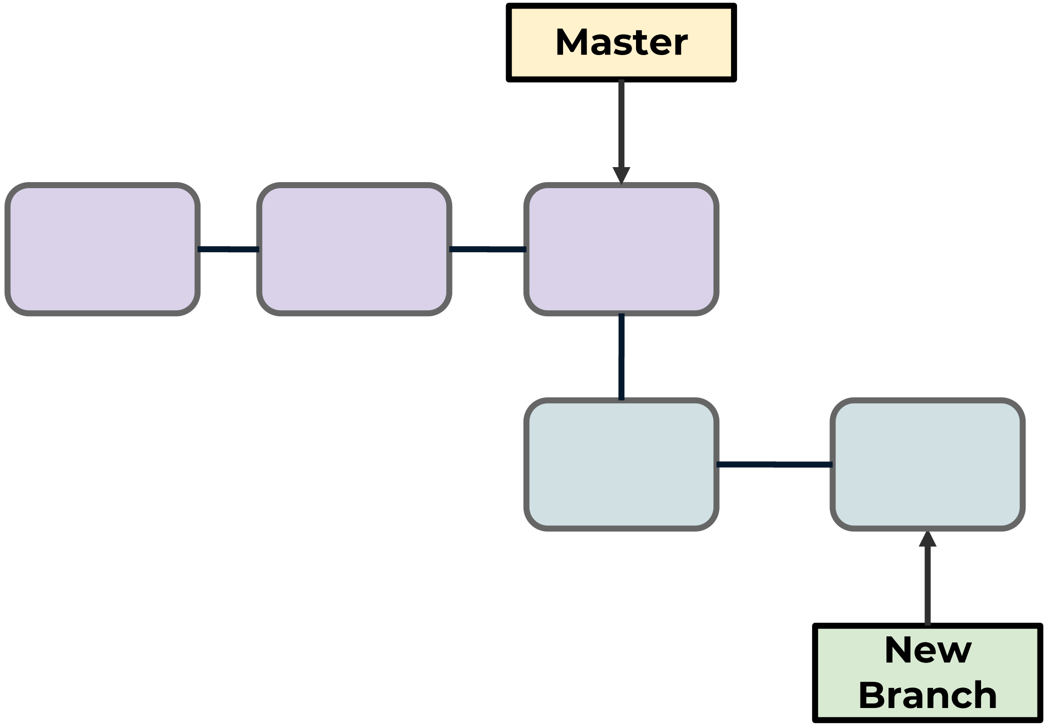
Week 3 Branches and Working with Others

- **Creating a New Branch**



Week 3 Branches and Working with Others

- **Creating a New Branch**



Week 3 Branches and Working with Others

- Now that we’ve seen how branches point to commits, we need to learn about HEAD.
- HEAD will help us understand what we are currently “viewing” or where we are “located” in regards to branches and commits.

Week 3 Branches and Working with Others

- **Up Next:**
  - We’ll explore and visualize specific actions and commands related to branches, including **HEAD, git checkout, git branch, git switch**, and more.

Week 3
Understanding HEAD

Week 3 Branches and Working with Others

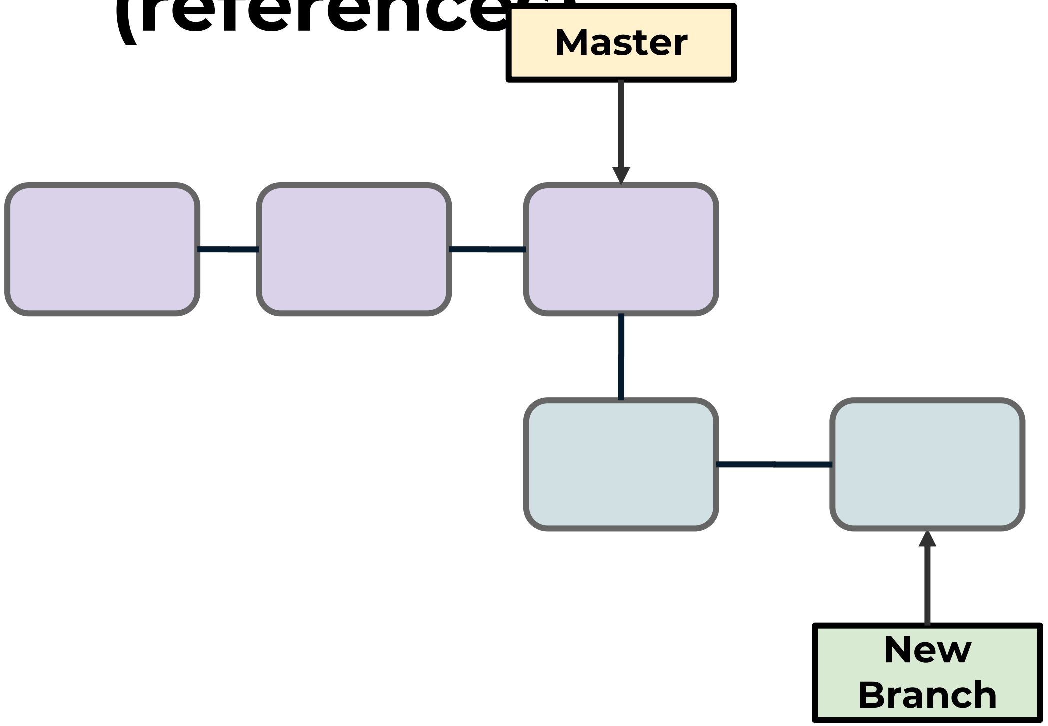
- **Branches**
  - As we work more with branches, you will probably notice a term show up during your commits: **HEAD**.
  - When viewing the most recent commit using **git log** you may see:
    - **commit 05as..3e2 (HEAD -> master)**

Week 3 Branches and Working with Others

- **HEAD**
  - In all of our examples so far, HEAD has always been pointing to the most recent commit in the master branch.
    - **HEAD -> master**

Week 3 Branches and Working with Others

- **Recall we have branch points (references)**



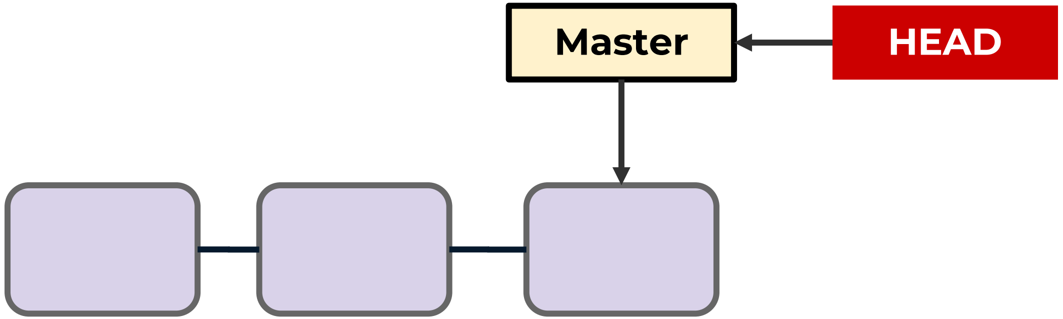
Week 3 Branches and Working with Others

- **Branches and Commits**
  - Git stores a branch as a reference to a commit.
  - In this sense, a branch represents the tip of a series of commits—it's not a container for commits.
  - The history for a branch is extrapolated through the commit relationships.

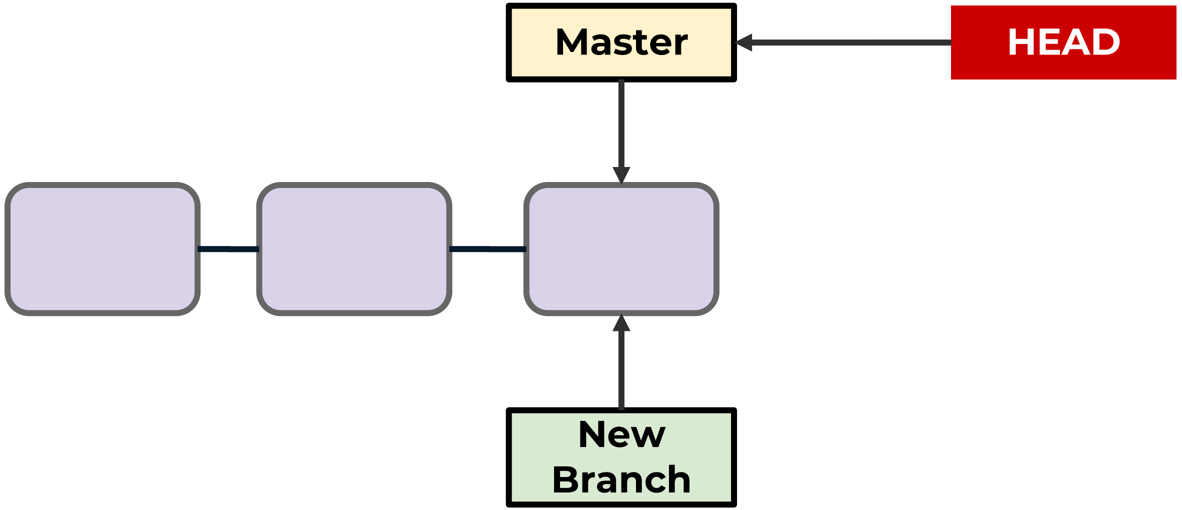
Week 3 Branches and Working with Others

- **HEAD**
  - A HEAD is simply a reference to a commit object.
  - We can think of HEAD as pointing to a specific commit in a branch that we are currently viewing.

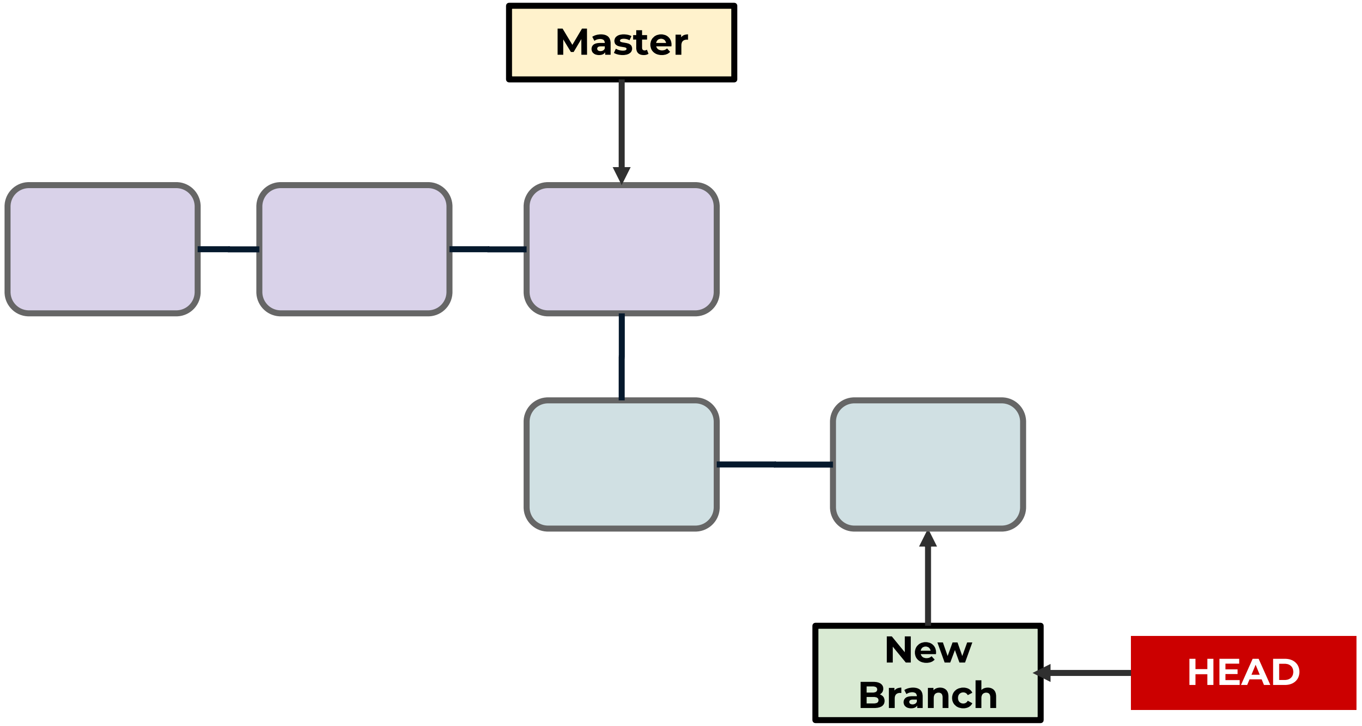
Week 3 Branches and Working with Others



Week 3 Branches and Working with Others



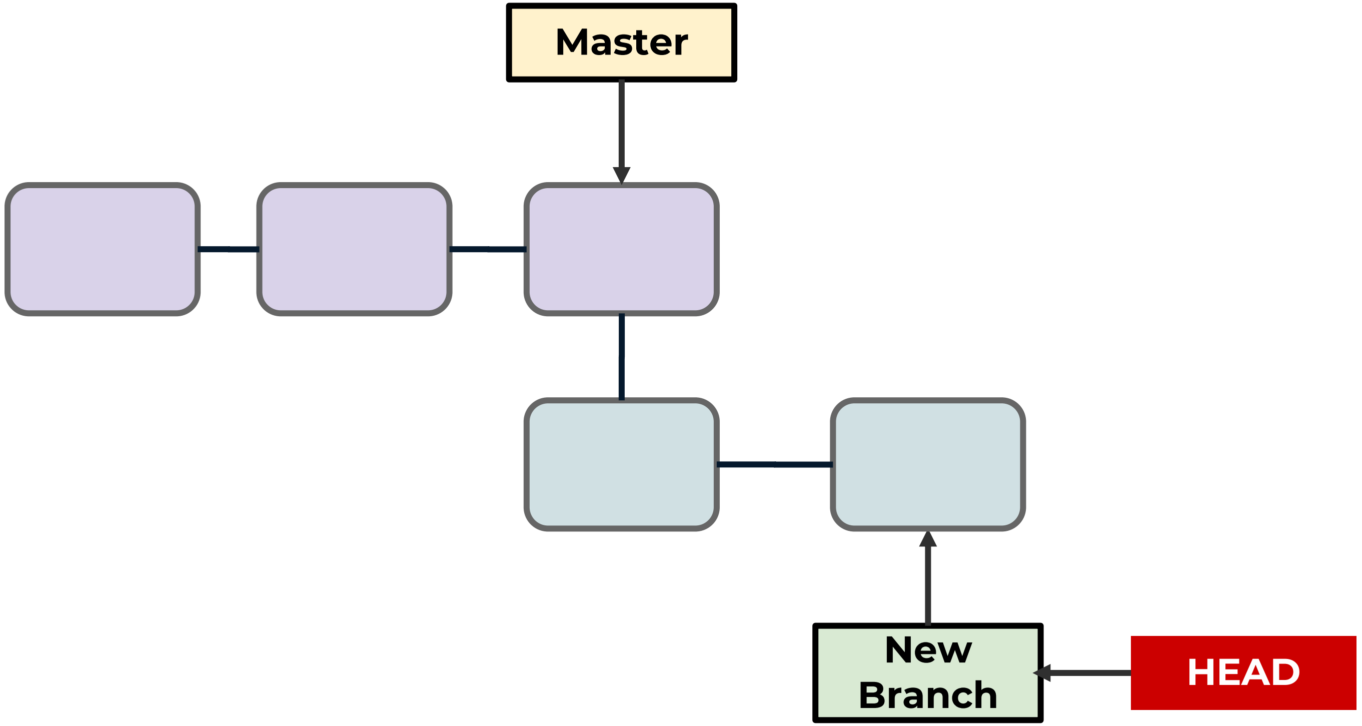
Week 3 Branches and Working with Others



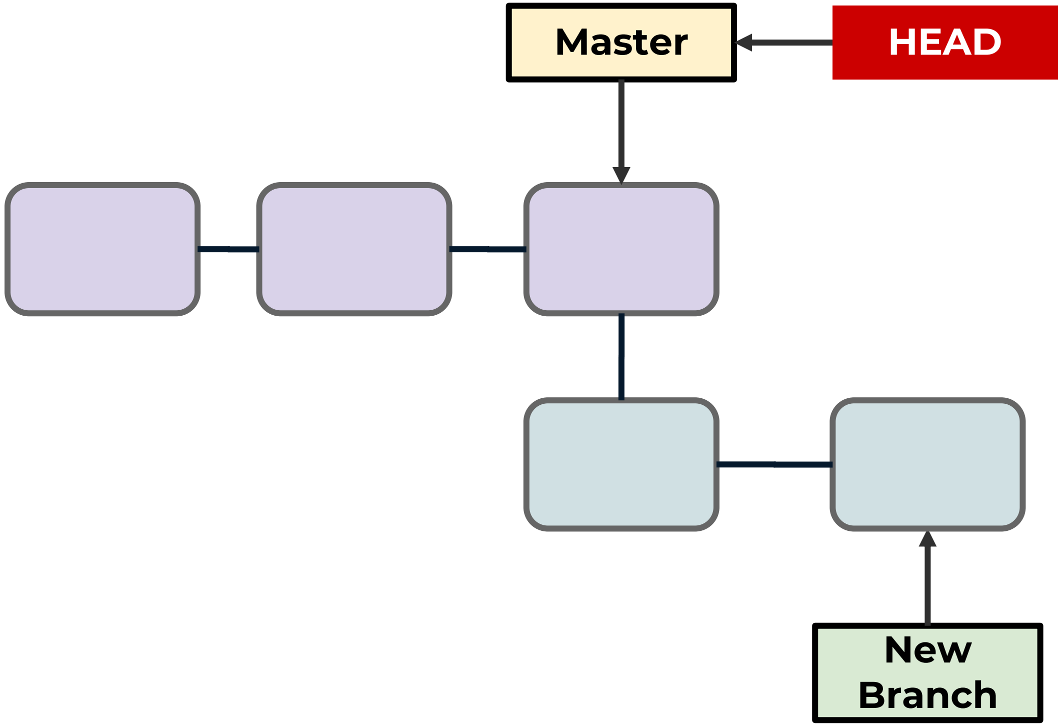
Week 3 Branches and Working with Others

- We can think of these branches as just references to a commit.
- Using HEAD tells us which branch reference we are currently “checking out”.
- We can always switch back out HEAD to some other branch (which is a pointer to a commit reference).

Week 3 Branches and Working with Others



Week 3 Branches and Working with Others



Week 3 Branches and Working with Others

- **Up Next:**
  - Now that we understand the theory behind branches and HEAD, let’s begin to explore the actually commands that let us create branches and navigate between them.

Week 3
Git Branch Commands

Week 3 Branches and Working with Others

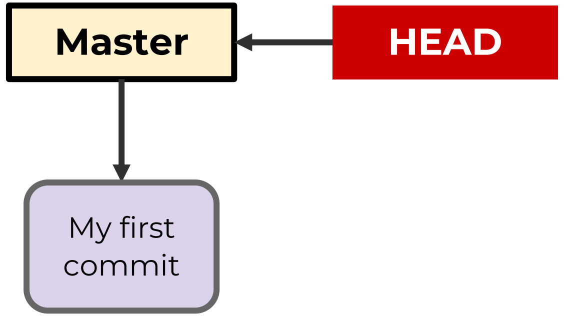
- **Git Branch Commands**
  - Create a New Repo
  - Add File
  - Create a New Branch
    - **git branch <branch_name>**
  - Report Branches
    - **git branch**
  - Switch Branches
    - **git switch**

Week 3 Branches and Working with Others

- **Git Branch Commands**
  - Add and Commit Changes on New Branch
  - Use **git log** and **git switch** to explore differences between branches.

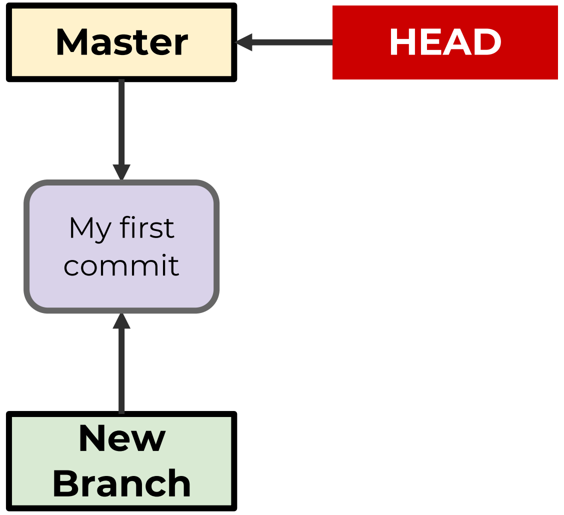
Week 3 Branches and Working with Others

- **git init, git add, git commit**



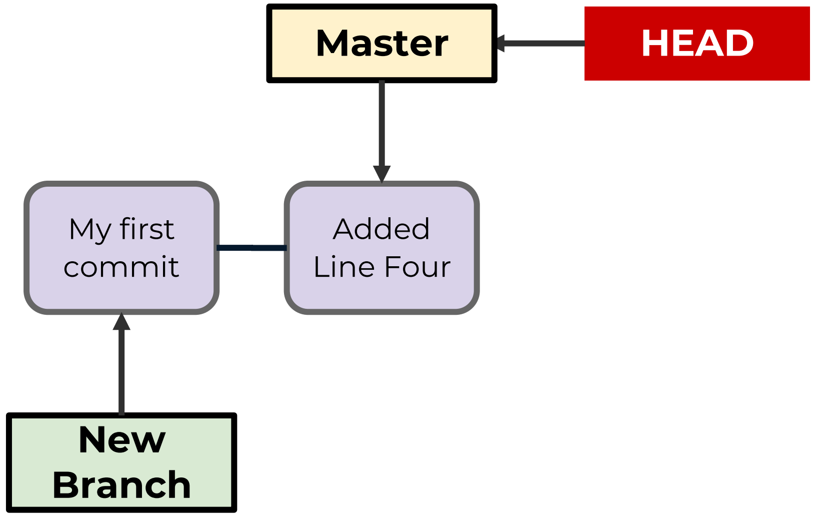
Week 3 Branches and Working with Others

- **git branch new_branch**



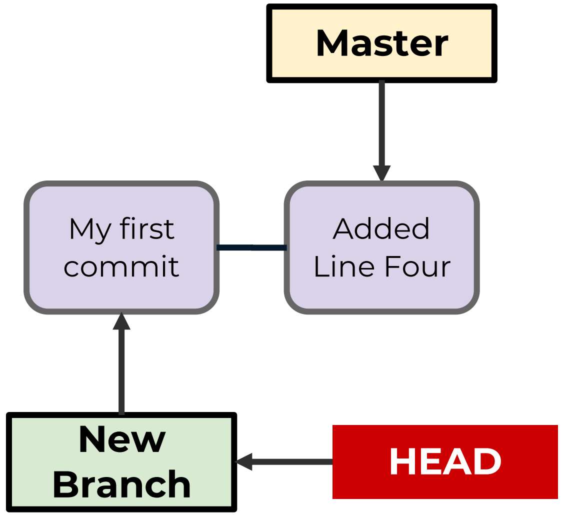
Week 3 Branches and Working with Others

- **git add, git commit, git log**



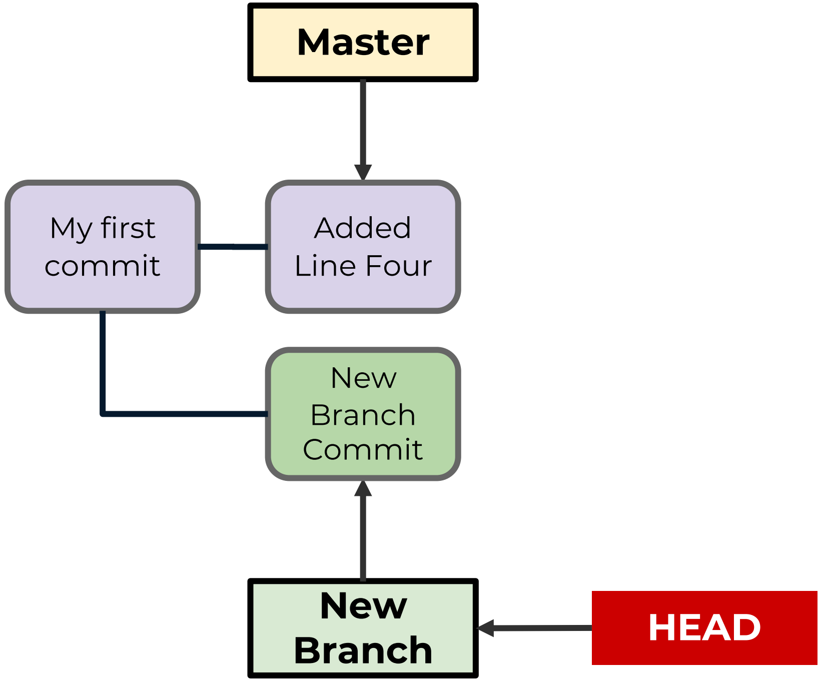
Week 3 Branches and Working with Others

- **git switch new_branch**



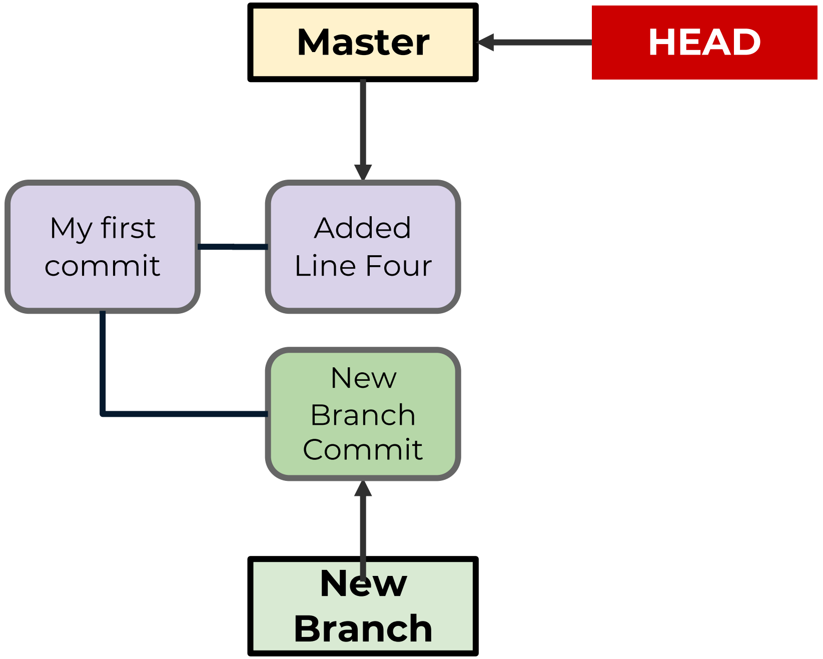
Week 3 Branches and Working with Others

- **git add , git commit, git log**



Week 3 Branches and Working with Others

- **git switch master**



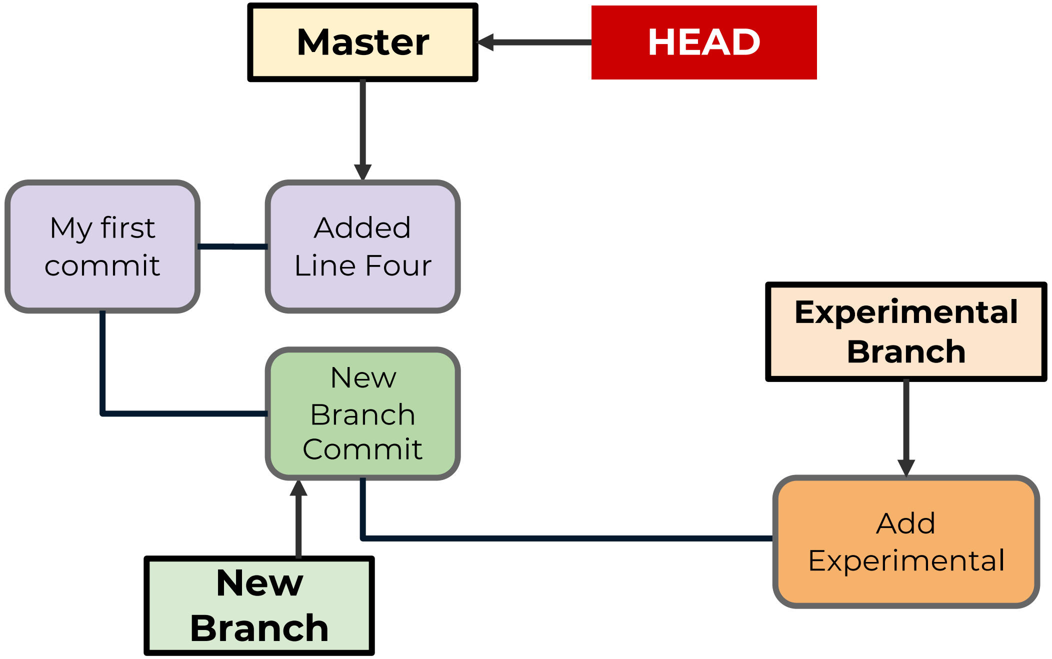
Week 3
Delete and Rename Branches

Week 3 Branches and Working with Others

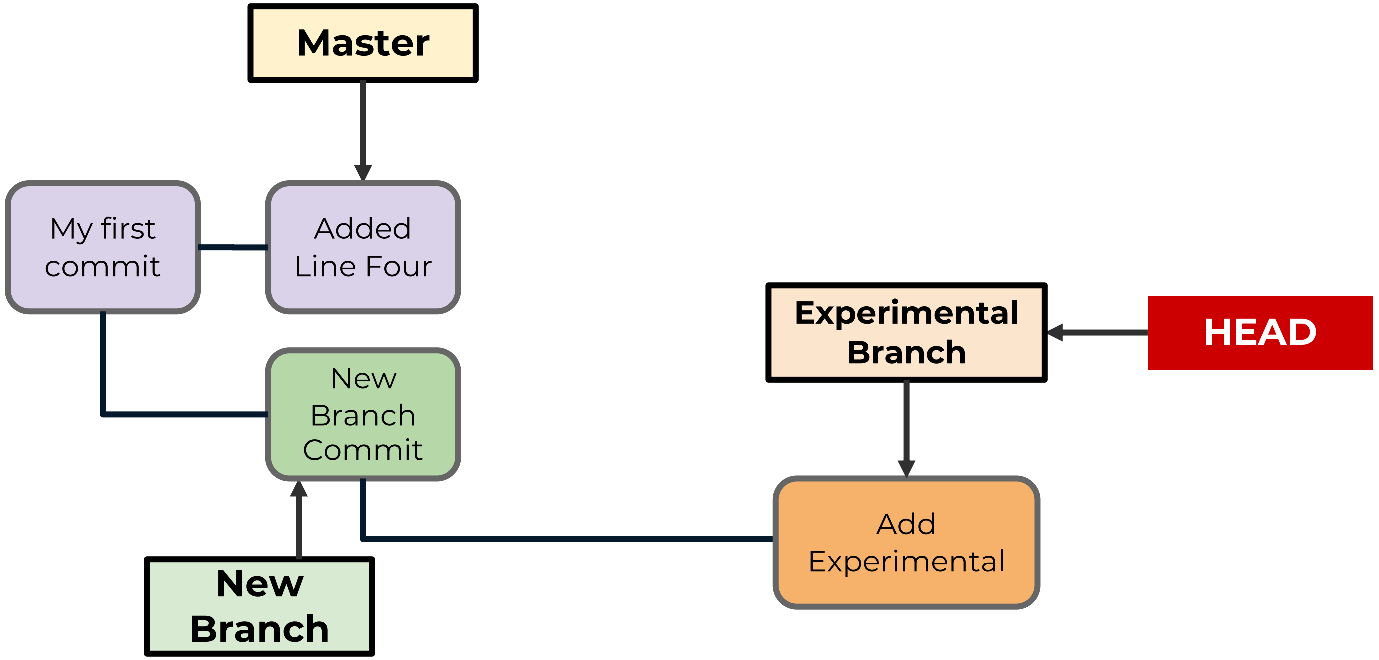
- Let’s quickly explore how to rename and delete branches.
- Keep in mind that we still need to learn how to merge branches together.

Week 3 Branches and Working with Others

- **Previously:**



Week 3 Branches and Working with Others

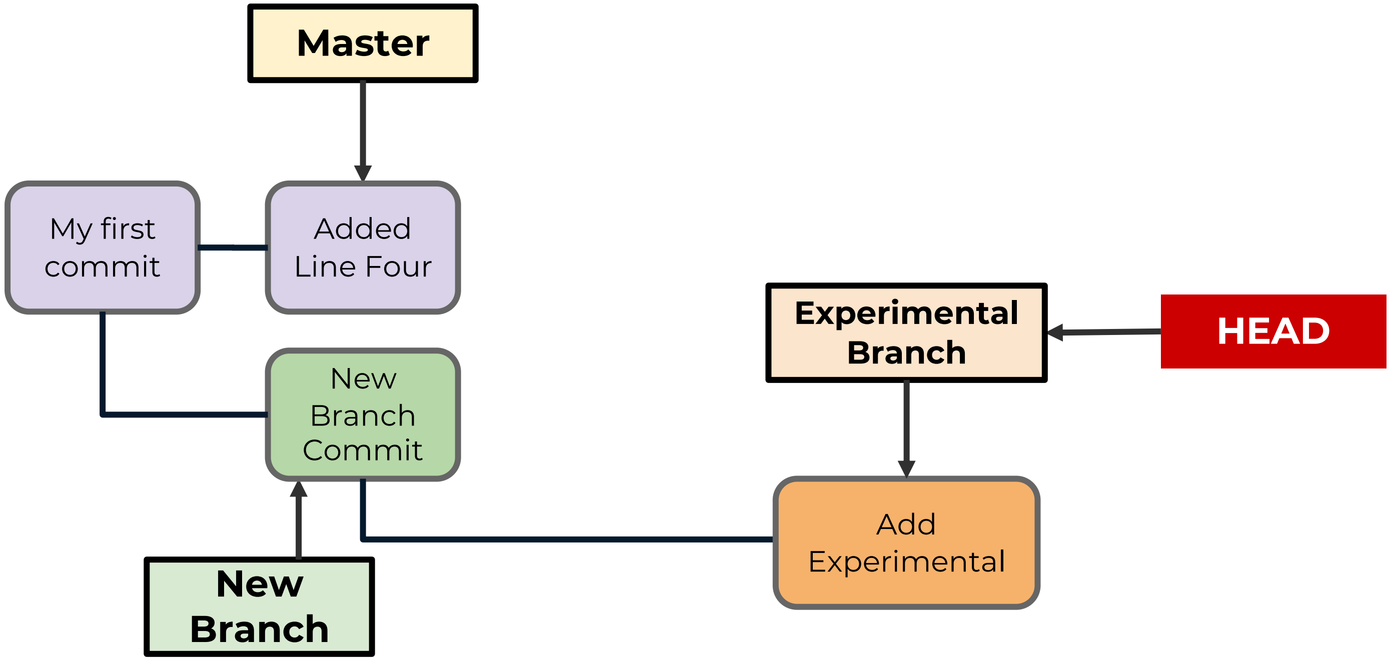


Week 3 Branches and Working with Others

- **Renaming a Branch**
  - **git switch branch_to_rename**
  - **git branch -m new_name**
    - You must be checked out on the branch you will rename.

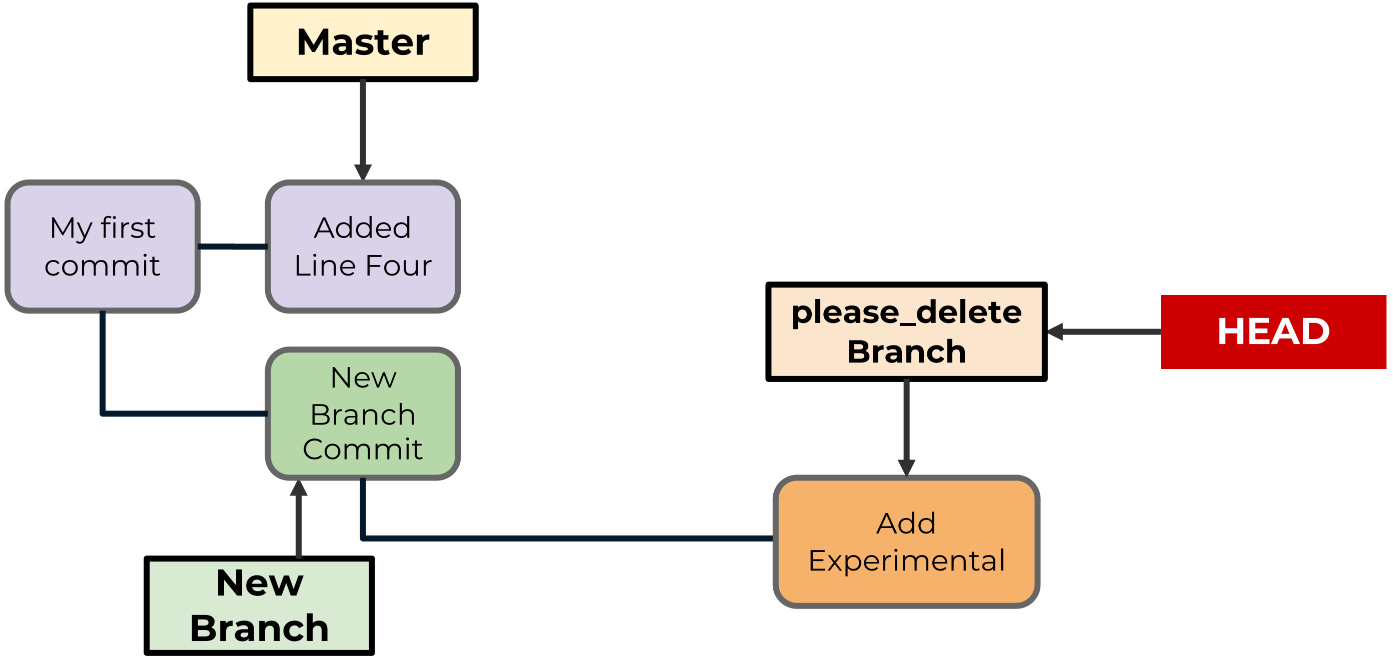
Week 3 Branches and Working with Others

- **git switch experimental**



Week 3 Branches and Working with Others

- **git branch -m please_delete**

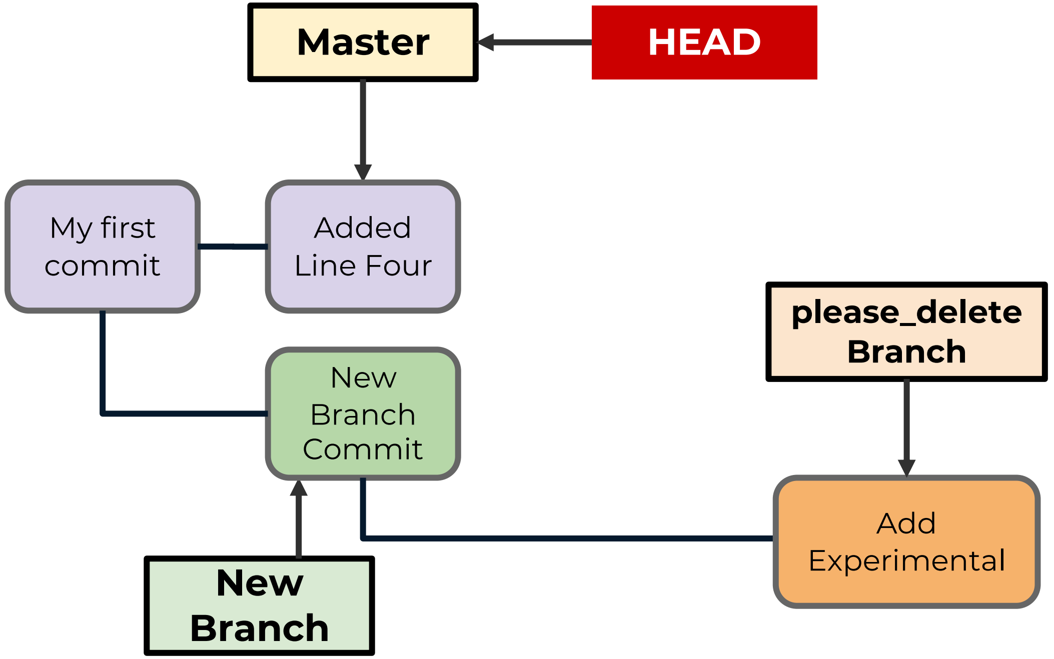


Week 3 Branches and Working with Others

- **Deleting a Branch**
  - **git branch -d branch_to_delete_name**
    - You can not delete a branch you are checked out at.
    - You also will get a warning if the branch is not merged.
      - You can confirm you want to do this anyways with **-D**

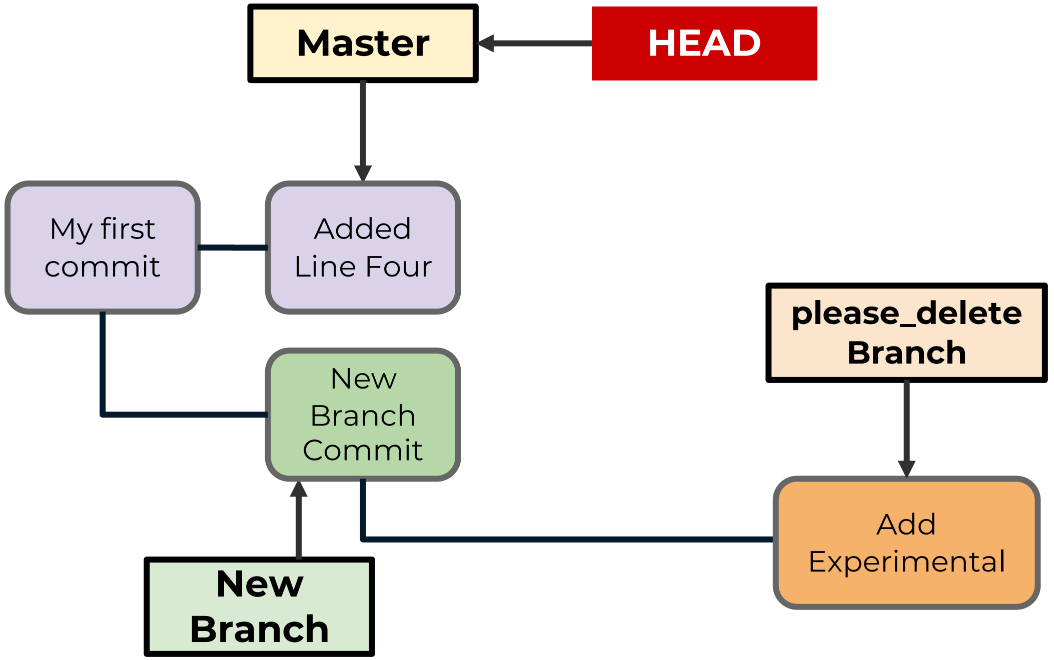
Week 3 Branches and Working with Others

- **git switch master**



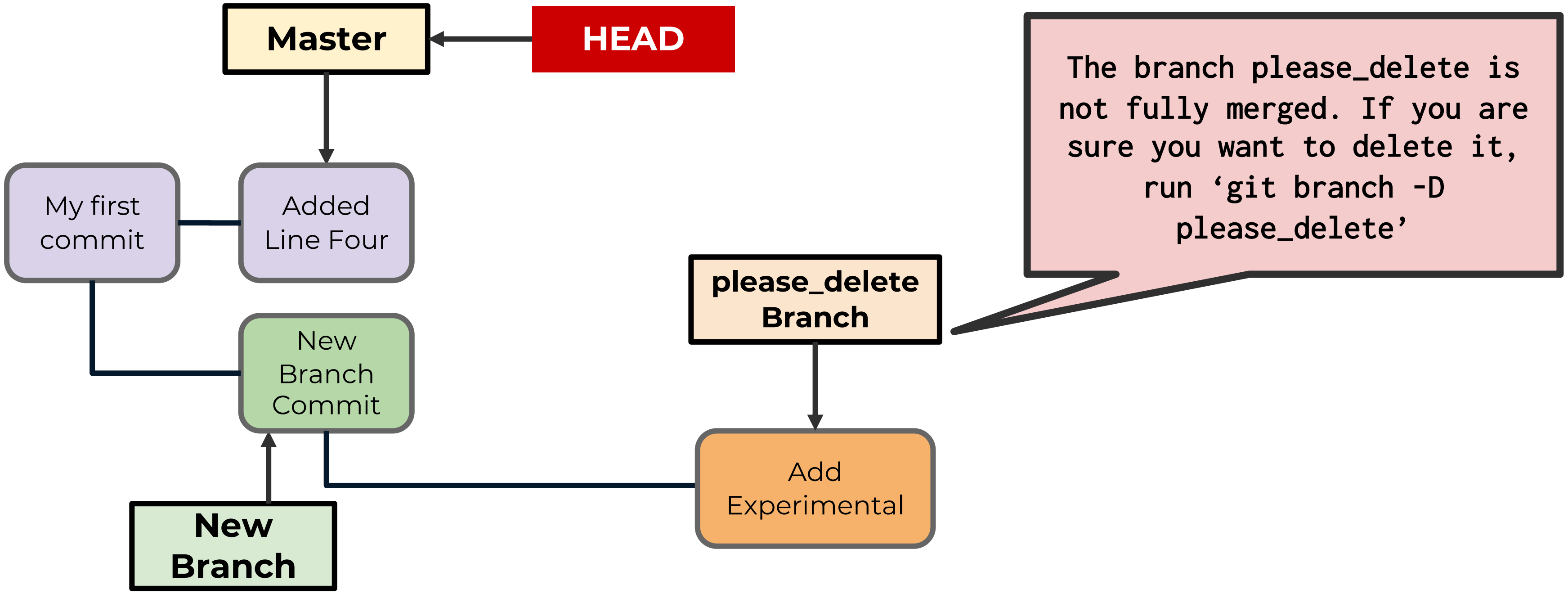
Week 3 Branches and Working with Others

- **git branch -d please_delete**



Week 3 Branches and Working with Others

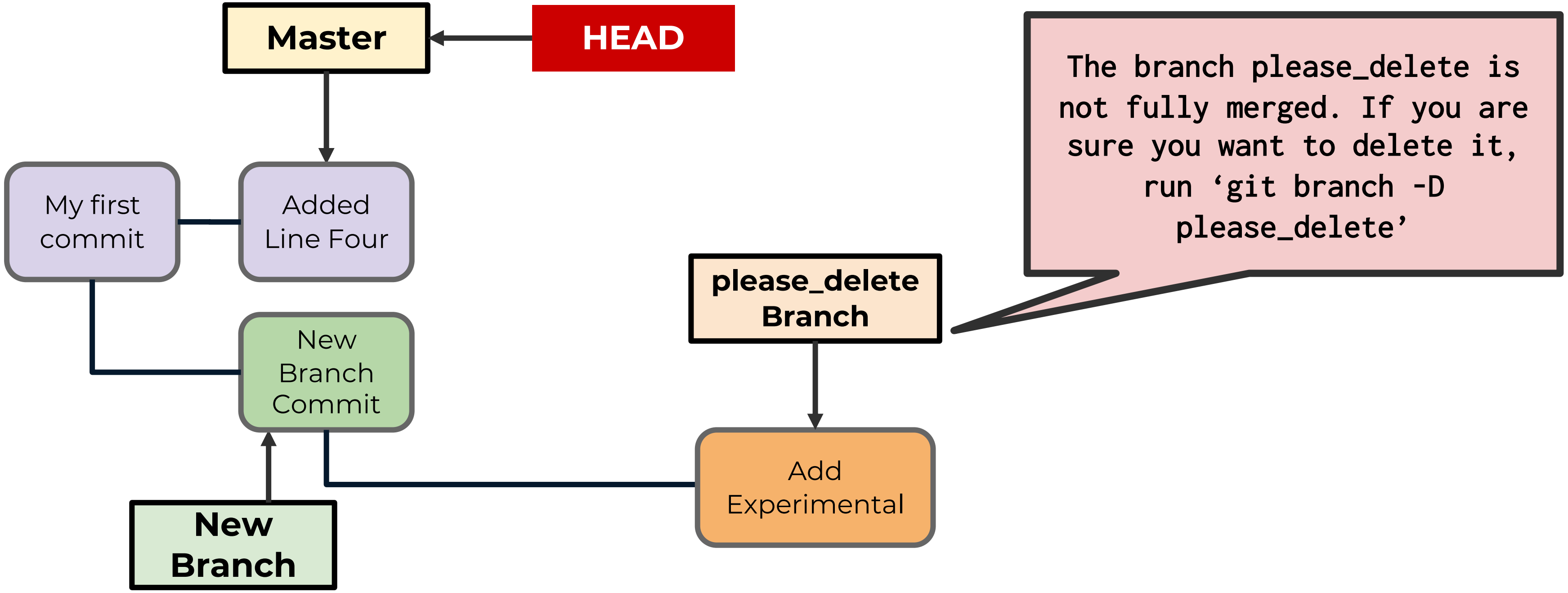
- **git branch -d please_delete**



```
The branch please_delete is
not fully merged. If you are
sure you want to delete it,
run ‘git branch -D
please_delete’
```

Week 3 Branches and Working with Others

- git branch -D please_delete



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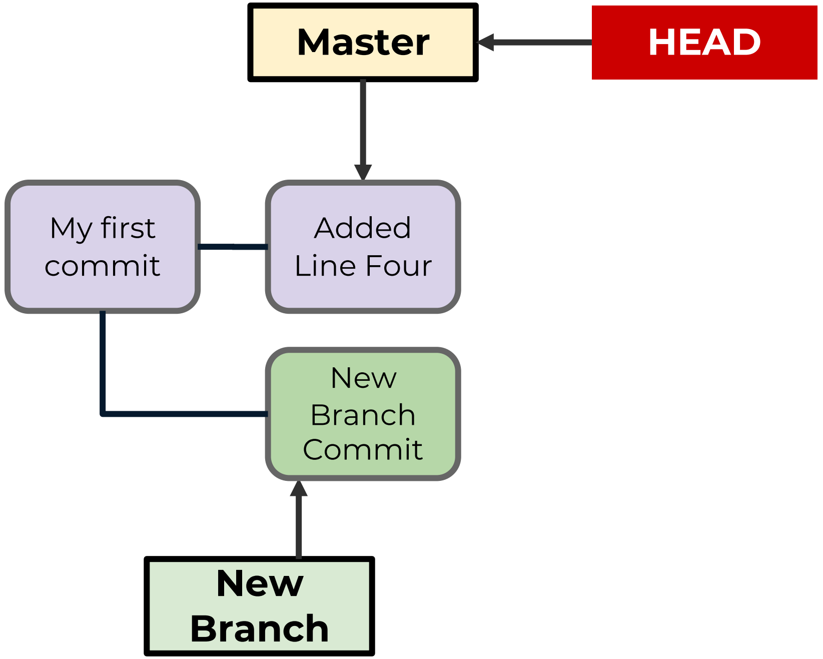
Week 3 Branches and Working with Others

- **git branch -D please_delete**



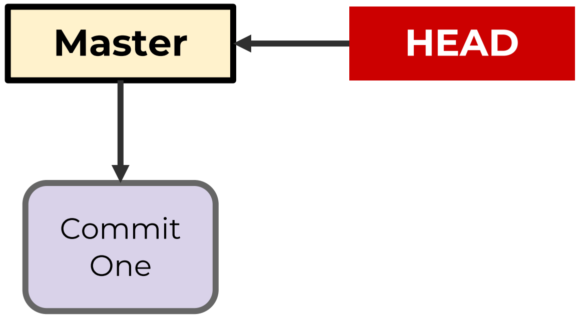
Week 3
Merging Branches and Conflicts

Week 3 Branches and Working with Others

- Now that we understand creating new branches, let's shift focus to merging branches back together.
- Let's explore a simple type of merge, where a new branch is created, but the original branch it stemmed from has no additional commits.
    - This is known as a "fast-forward" merge

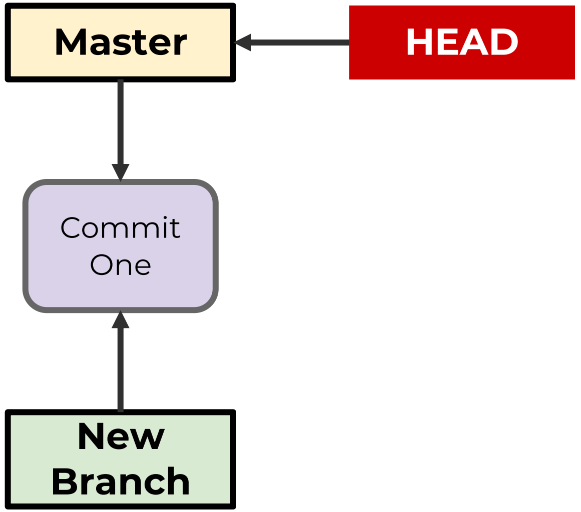
Week 3 Branches and Working with Others

- “Fast Forward” Merge



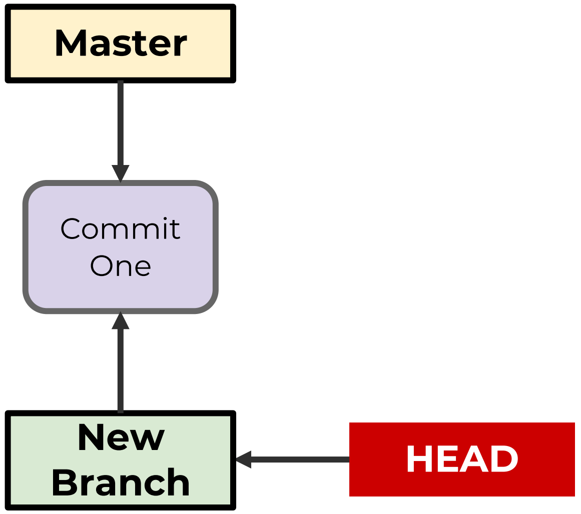
Week 3 Branches and Working with Others

- “Fast Forward” Merge



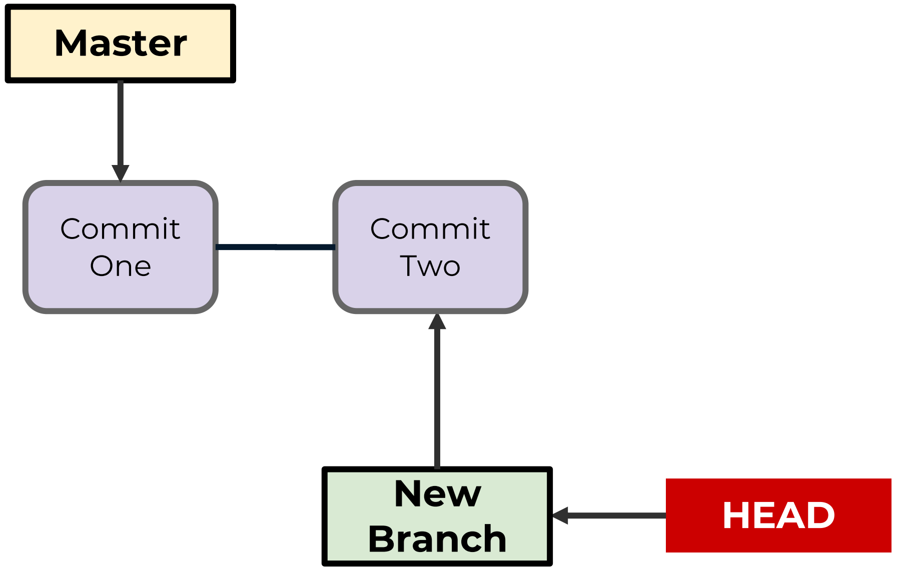
Week 3 Branches and Working with Others

- “Fast Forward” Merge



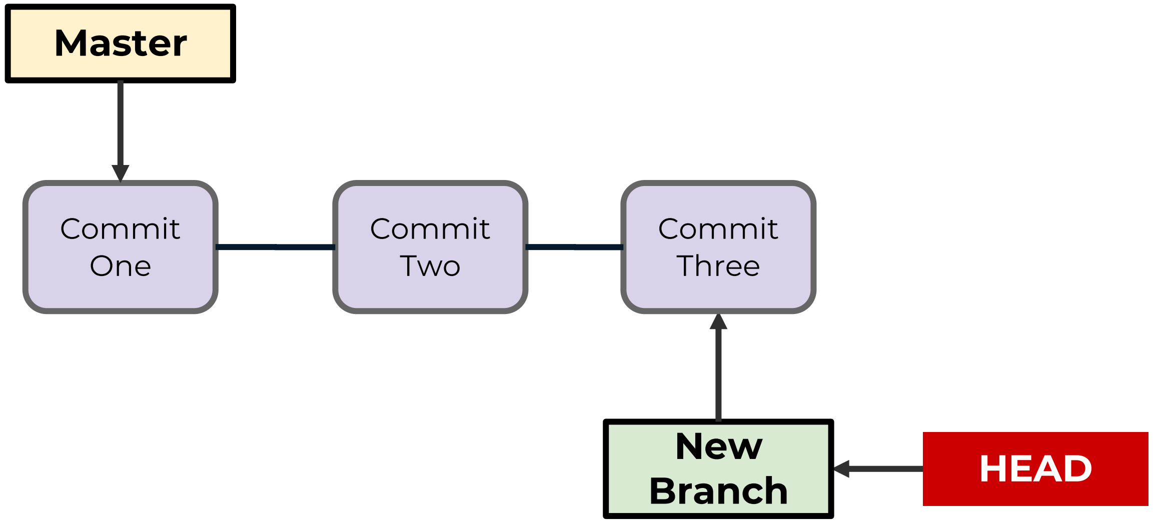
Week 3 Branches and Working with Others

- "Fast Forward" Merge



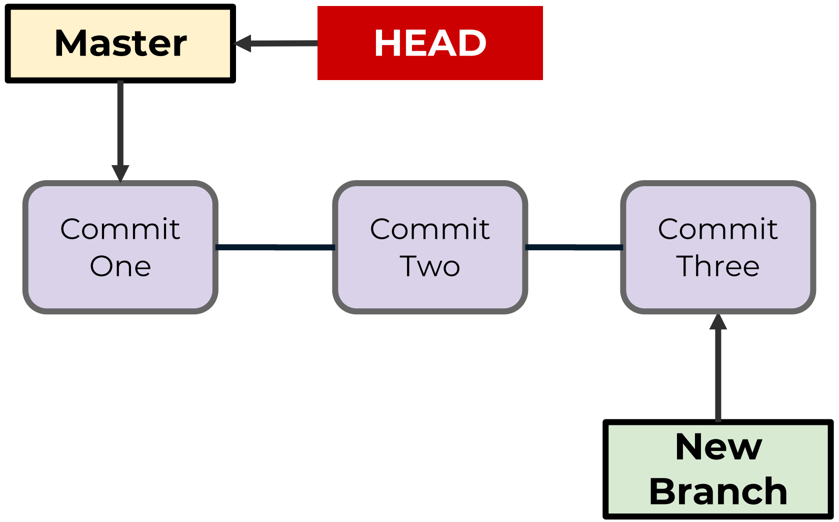
Week 3 Branches and Working with Others

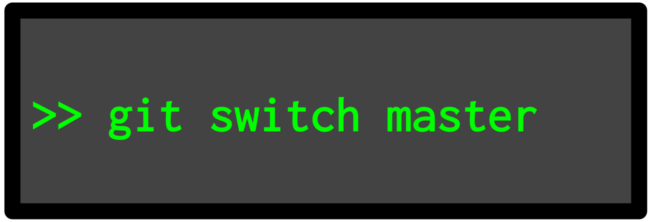
- “Fast Forward” Merge



Week 3 Branches and Working with Others

- “Fast Forward” Merge

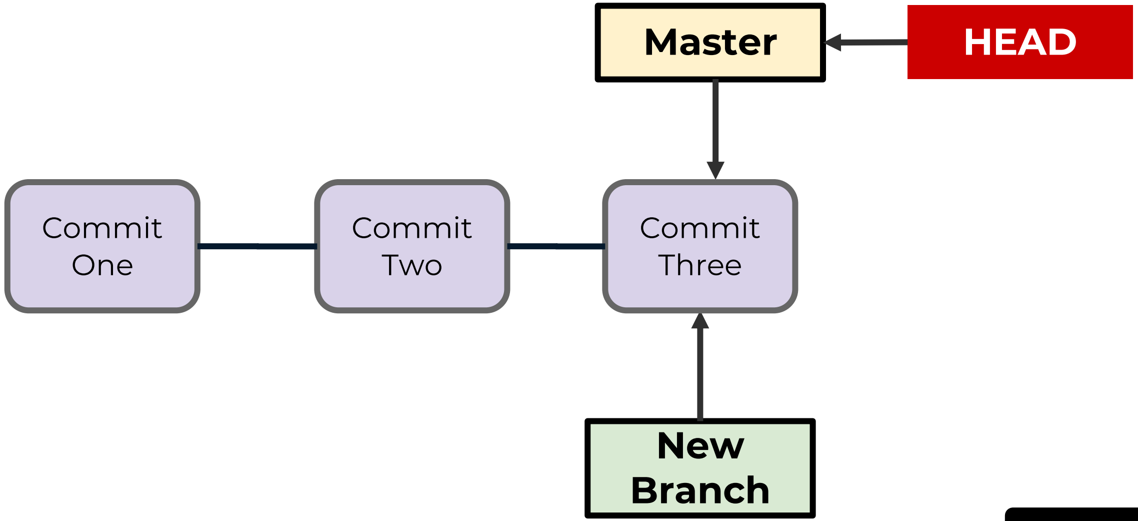




```
>> git switch master
```

Week 3 Branches and Working with Others

- “Fast Forward” Merge



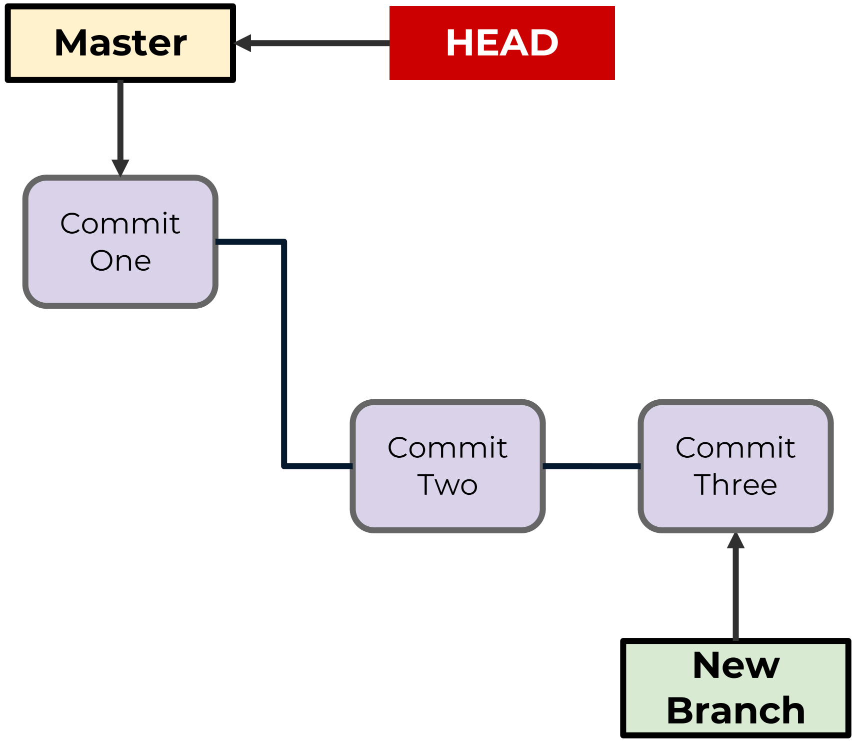
```
>> git merge new_branch
```

Week 3 Branches and Working with Others

- Now let’s explore what happens for a merge where we have different commits in the branches.

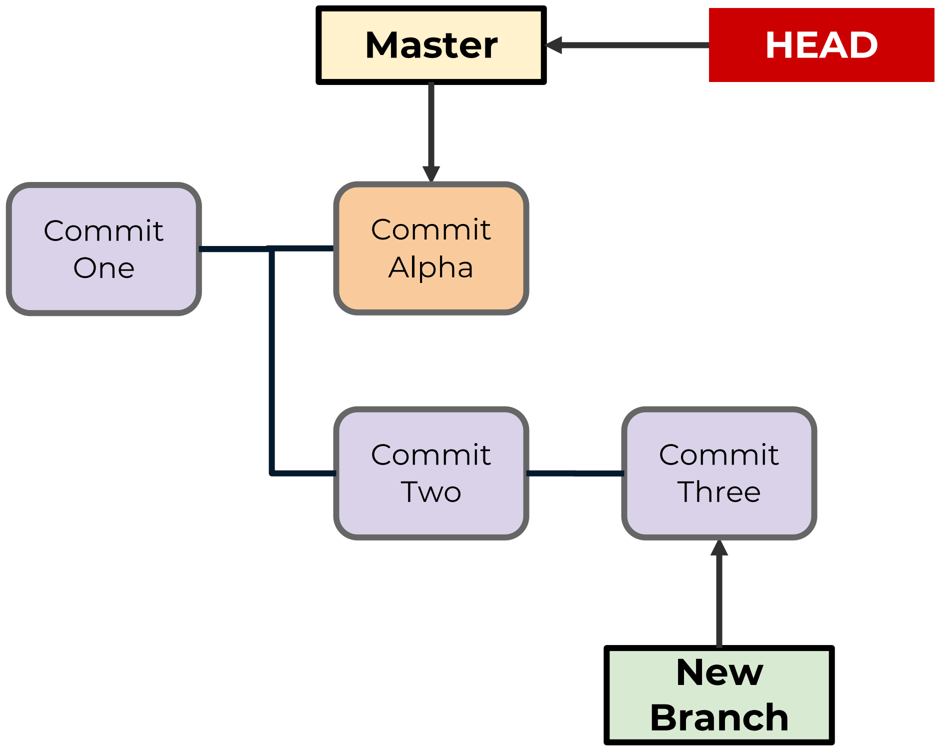
Week 3 Branches and Working with Others

- **Git Merge**



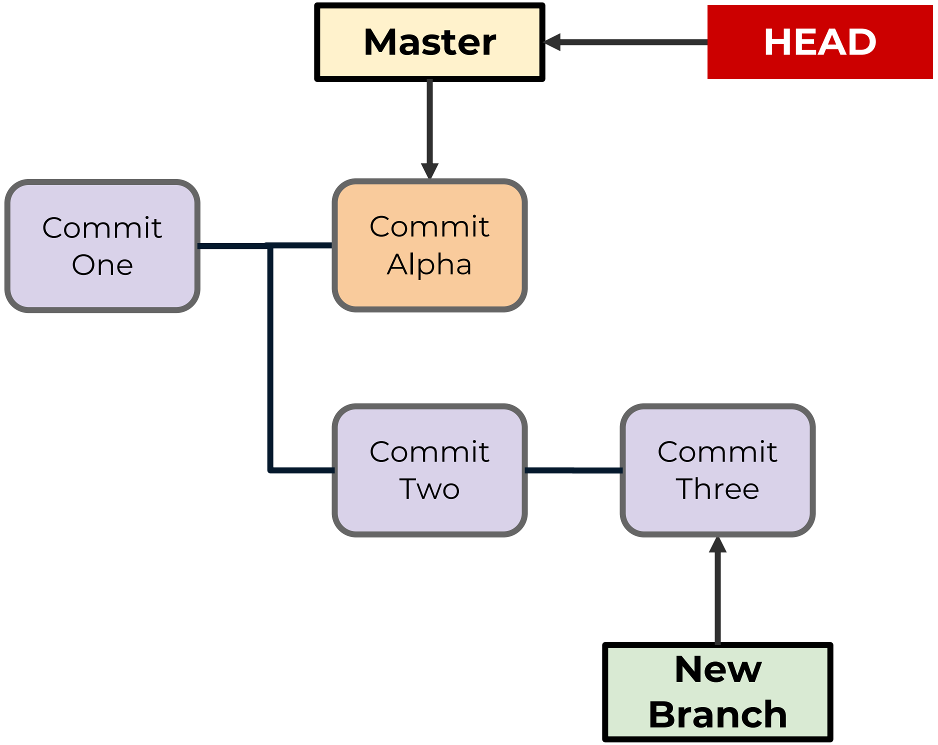
Week 3 Branches and Working with Others

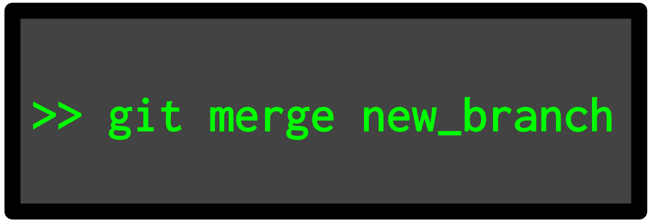
- **Git Merge**



Week 3 Branches and Working with Others

- ## Git Merge

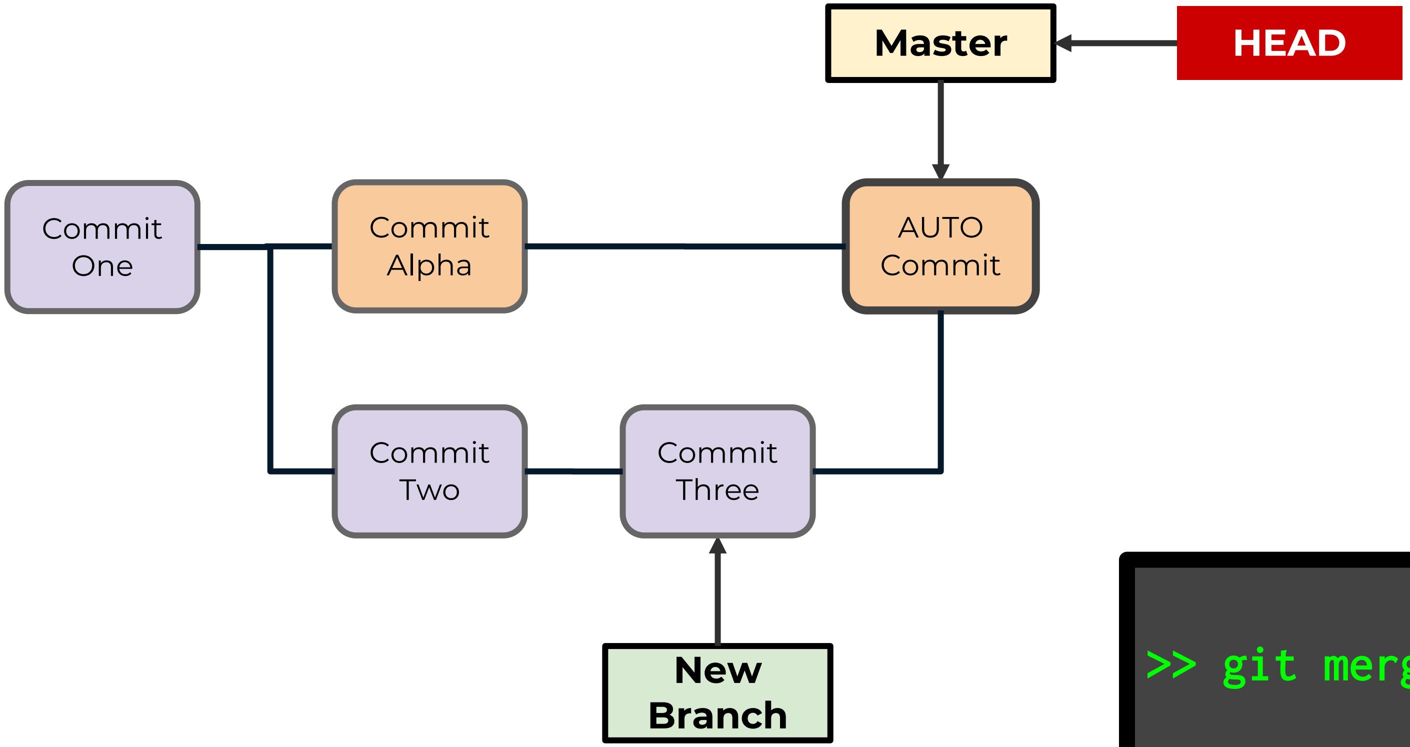


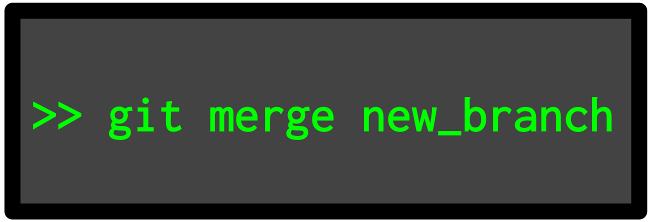


```
>> git merge new_branch
```

Week 3 Branches and Working with Others

- **Git Merge**

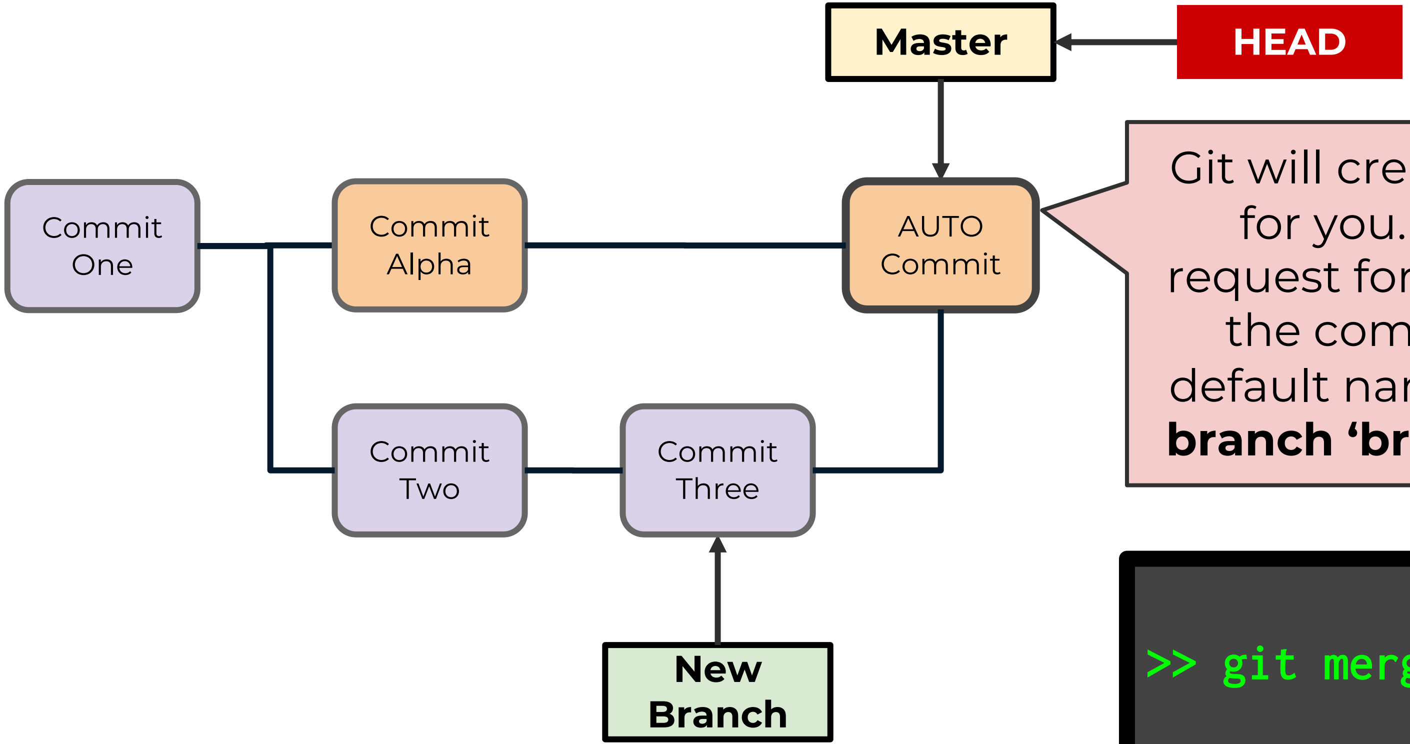




```
>> git merge new_branch
```

Week 3 Branches and Working with Others

- **Git Merge**



Git will create a commit for you. It will also request for you to name the commit, with a default name of “**Merge branch ‘branch_name’**”

```
>> git merge new_branch
```

Week 3 Branches and Working with Others

- Git creates the new commit for us, and will attempt the merge.
- Sometimes there are no conflicts, for example:
  - The branch only focused on files not in the receiving branch, thus the merge simply adds the new files to the receiving branch.

Week 3 Branches and Working with Others

- Git will try to automatically create the merge, and can do so in cases where no information from a specific branch would be lost, for example:

Week 3 Branches and Working with Others

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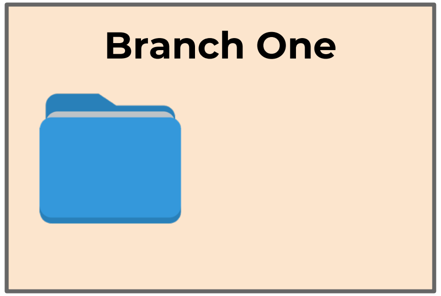

Week 3 Branches and Working with Others

- Git will try to automatically create the merge, and can do so in cases where no information from a specific branch would be lost, for example:

Branch One
Branch Two

Week 3 Branches and Working with Others

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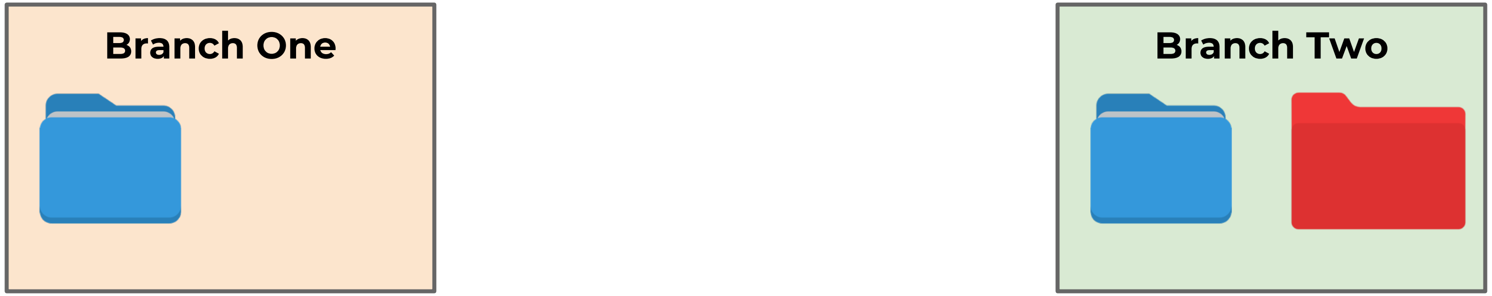
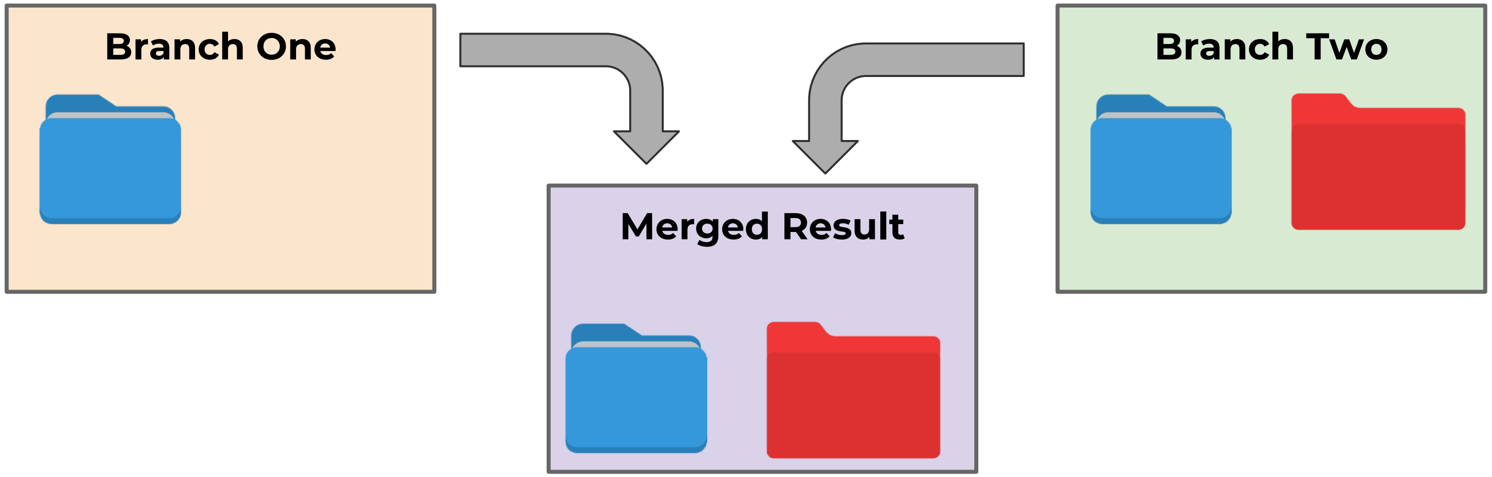


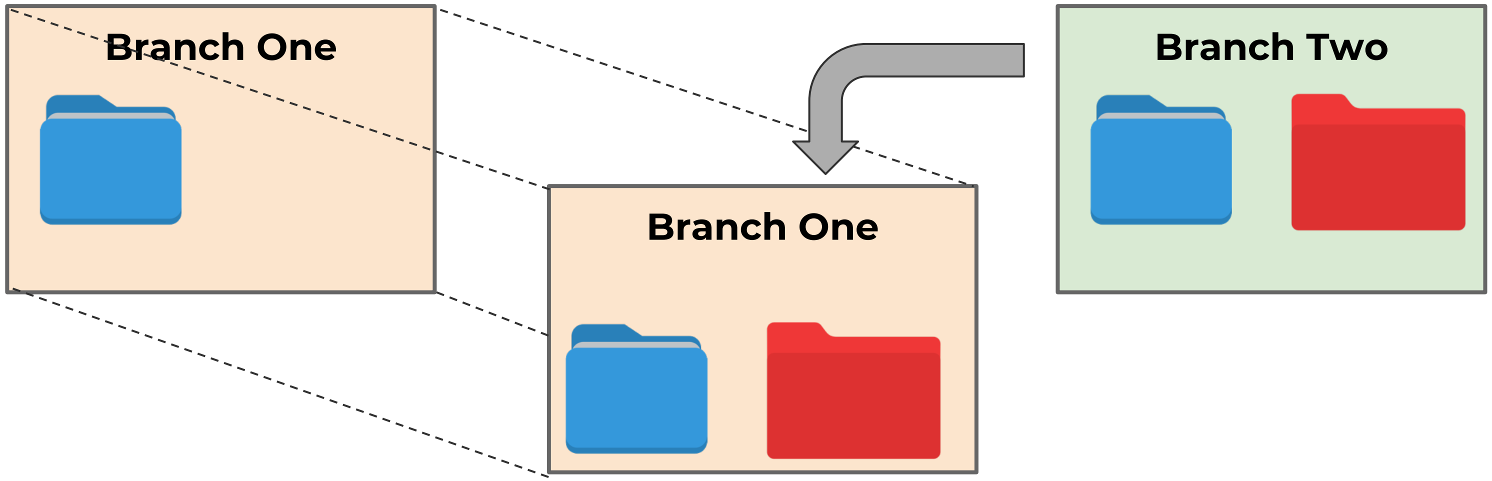
Week 3 Branches and Working with Others

- Git will try to automatically create the merge, and can do so in cases where no information from a specific branch would be lost, for example:



Week 3 Branches and Working with Others

- Git will try to automatically create the merge, and can do so in cases where no information from a specific branch would be lost, for example:



Week 3 Branches and Working with Others

- However, there will be many instances where there are conflicts, for example changes in the file on lines that are different between the branches.
- These are known as **merge conflicts**, and we need to resolve (fix) the conflicts between the branches in order to merge them.

Week 3 Branches and Working with Others

- Git will warn you about files in conflict.
- Then you must edit the files in order to remove the conflicts.
    - Fortunately, Git also provides specialized markdown to indicate the differences between the files and what differences come from which branch.
    - Modern editors (e.g. VS Code) have syntax highlighting to reflect this.

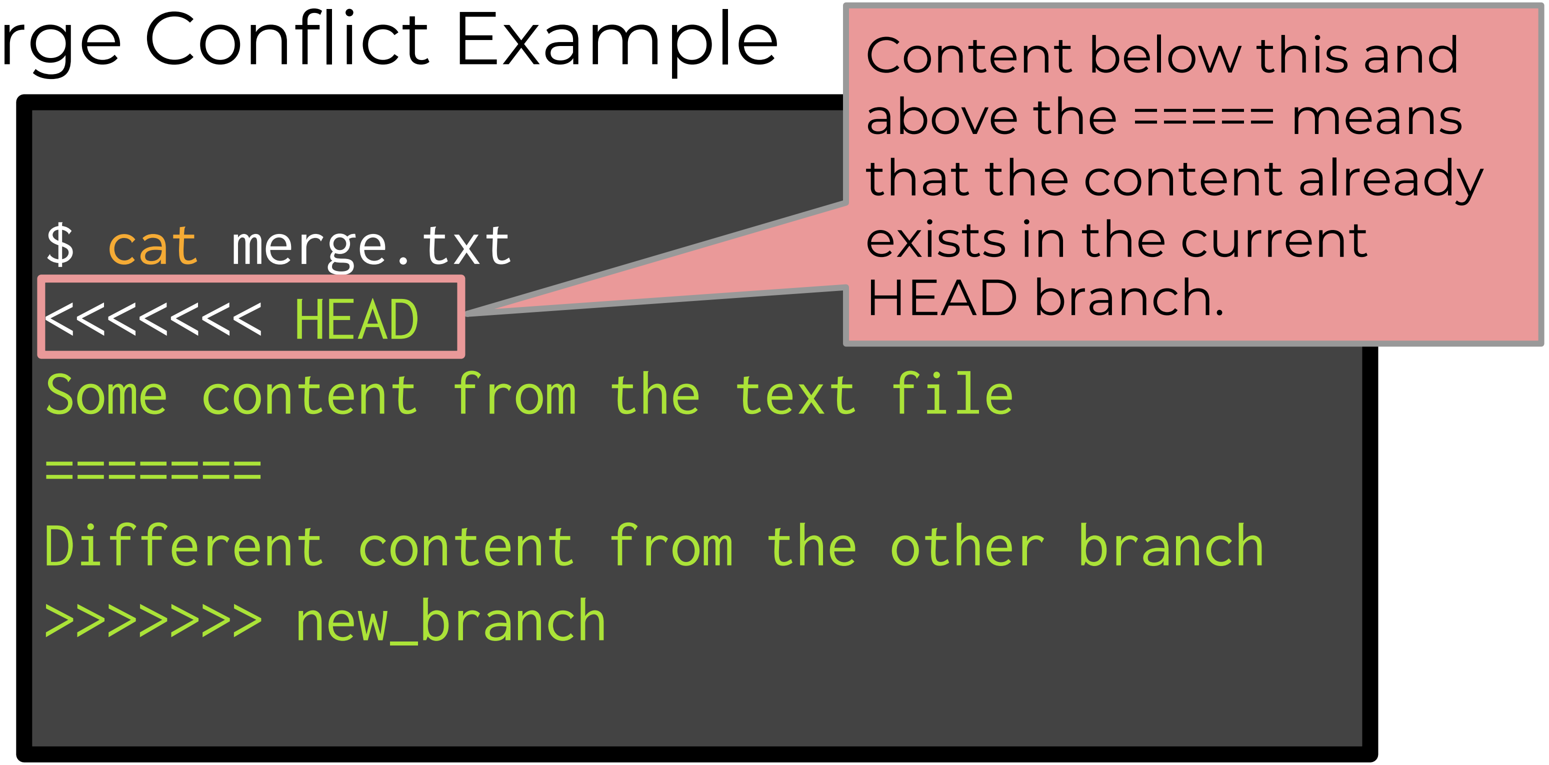
Week 3 Branches and Working with Others

- Merge Conflict Example

```
$ cat merge.txt
<<<<<<< HEAD
Some content from the text file
=======
Different content from the other branch
>>>>>>> new_branch
```

Week 3 Branches and Working with Others

- Merge Conflict Example

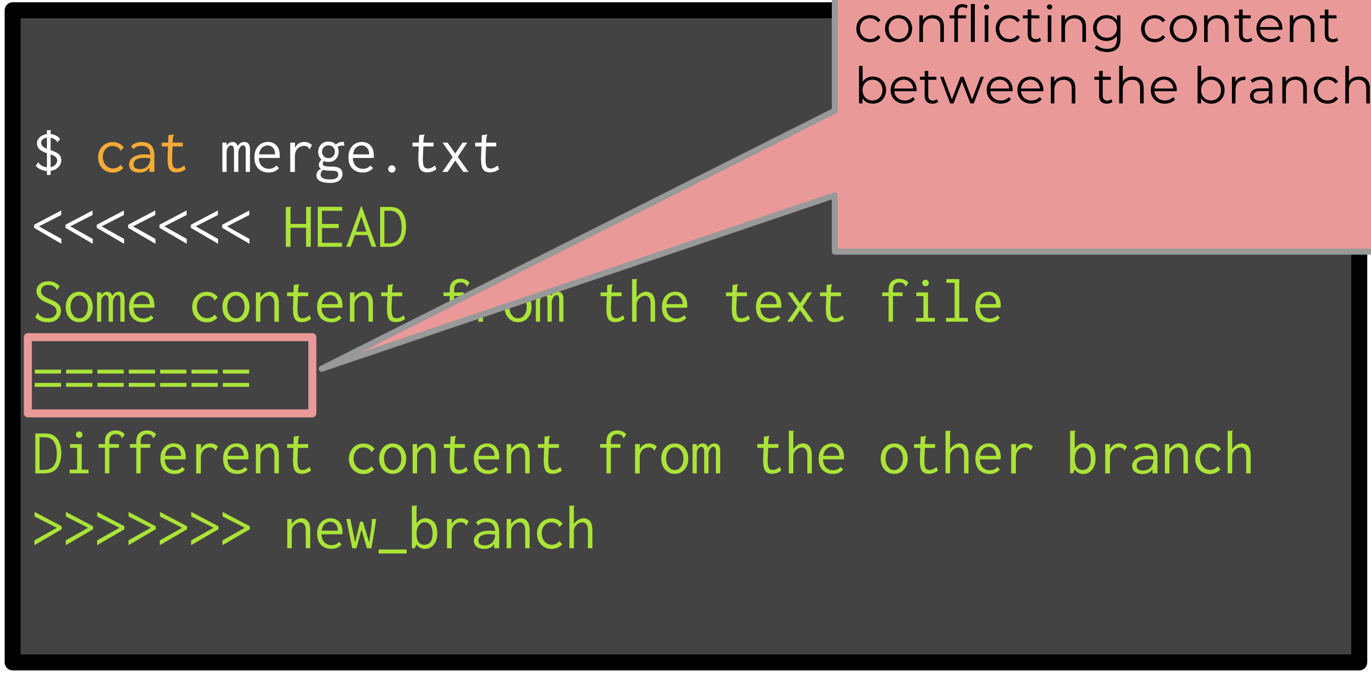


```
$ cat merge.txt
<<<<<<< HEAD
Some content from the text file
=======
Different content from the other branch
>>>>>>> new_branch
```

Content below this and above the ===== means that the content already exists in the current HEAD branch.

Week 3 Branches and Working with Others

- Merge Conflict Example

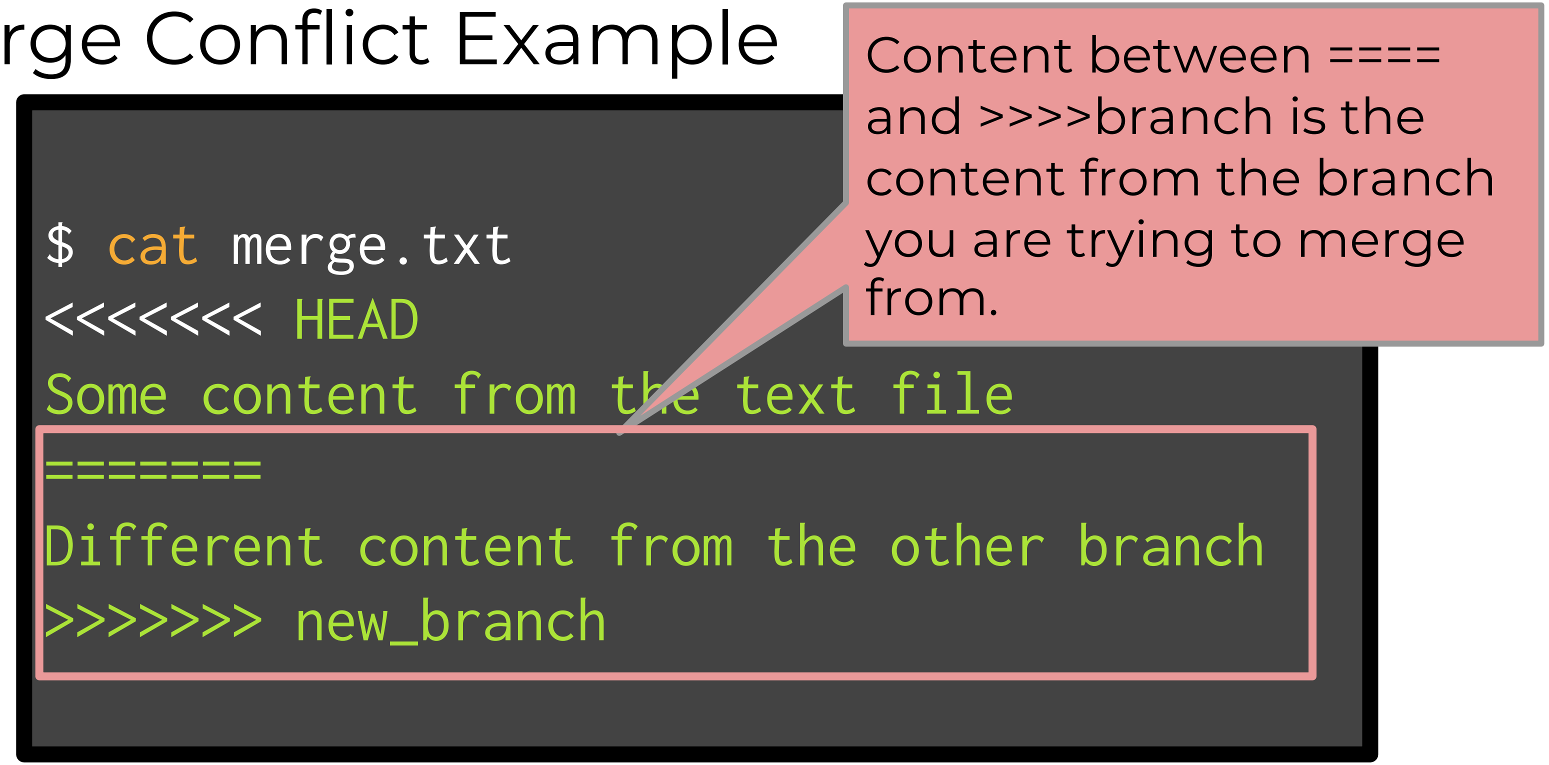


```
$ cat merge.txt
<<<<<<< HEAD
Some content from the text file
=======
Different content from the other branch
>>>>>>> new_branch
```

Division line between the conflicting content between the branches.

Week 3 Branches and Working with Others

- Merge Conflict Example



```
$ cat merge.txt
<<<<<<< HEAD
Some content from the text file
=======
Different content from the other branch
>>>>>>> new_branch
```

Content between ==== and >>>>branch is the content from the branch you are trying to merge from.

Week 3 Branches and Working with Others

- Let’s explore these merge concepts in practice in the next lecture!

Week 3
Merge in Practice

Week 3 Branches and Working with Others

- **Merge in Practice**
  - Fast Forward Merge
  - Multiple Branch Commit Merge with No Conflict
  - Multiple Branch Commit Merge with a Conflict

Week 3
Git Diff

Week 3 Branches and Working with Others

- **Checking differences with git diff**
  - When working with multiple branches or file versions, it is useful to have a tool that can display the differences between versions.
  - **git diff** is a powerful tool that can show the differences between data sets.

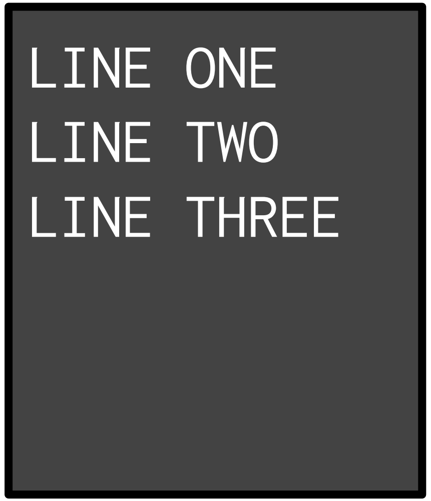
Week 3 Branches and Working with Others

- **Checking differences with git diff**
  - For the scope of this course, we will only be exploring the default behaviour of **git diff** which displays the differences between the original file and unstaged changes.
  - Before we explore this, let’s understand the syntax that git diff uses to display changes.

Week 3 Branches and Working with Others

- **Checking differences with git diff**

myfile.txt



```
LINE ONE
LINE TWO
LINE THREE
```

Week 3 Branches and Working with Others

- **Checking differences with git diff**

myfile.txt

```
LINE ONE
LINE TWO
LINE THREE
```

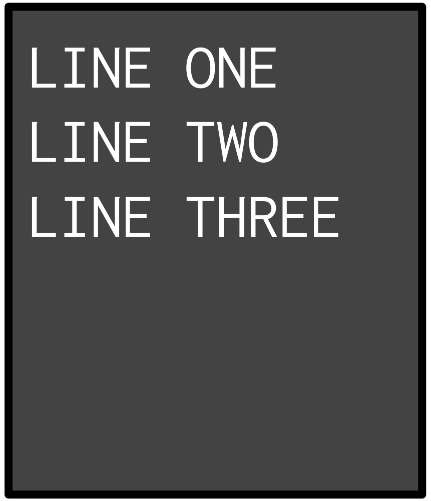
myfile.txt

```
LINE ONE
NEW LINE
LINE THREE
```

Week 3 Branches and Working with Others

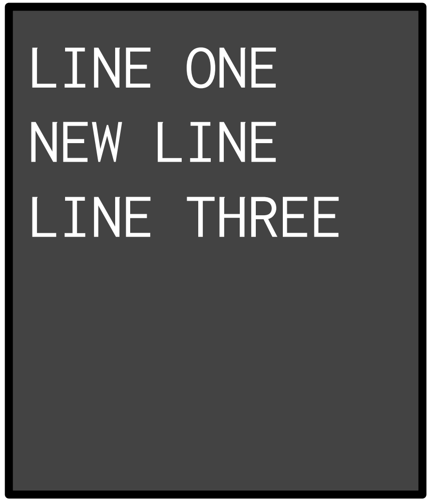
- **Checking differences with git diff**

myfile.txt



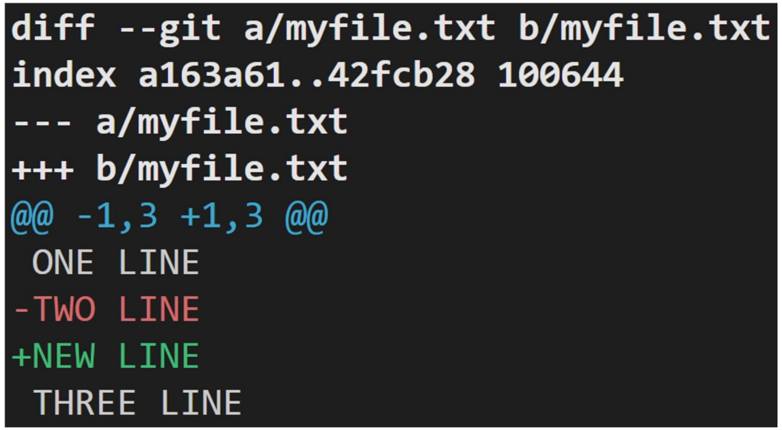
```
LINE ONE
LINE TWO
LINE THREE
```

myfile.txt



```
LINE ONE
NEW LINE
LINE THREE
```

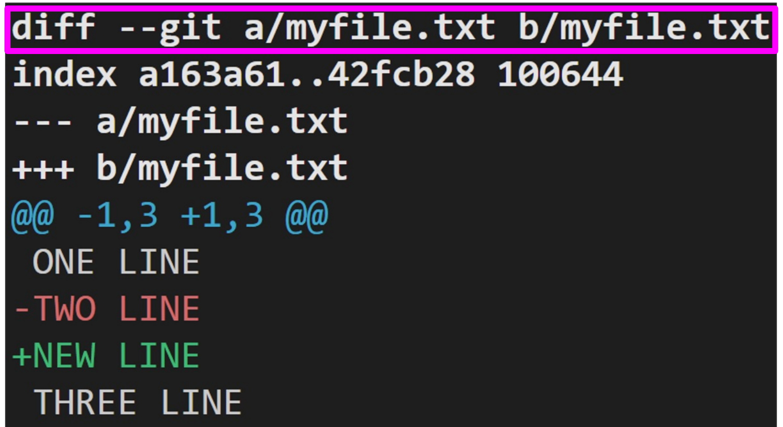
git diff output



```
diff --git a/myfile.txt b/myfile.txt
index a163a61..42fcb28 100644
--- a/myfile.txt
+++ b/myfile.txt
@@ -1,3 +1,3 @@
 ONE LINE
-TWO LINE
+NEW LINE
 THREE LINE
```

Week 3 Branches and Working with Others

- **git diff syntax - comparison input**
    - Comparison input at the first line displays the sources of the diff, notice how it's actually the same file, just versions a and b.



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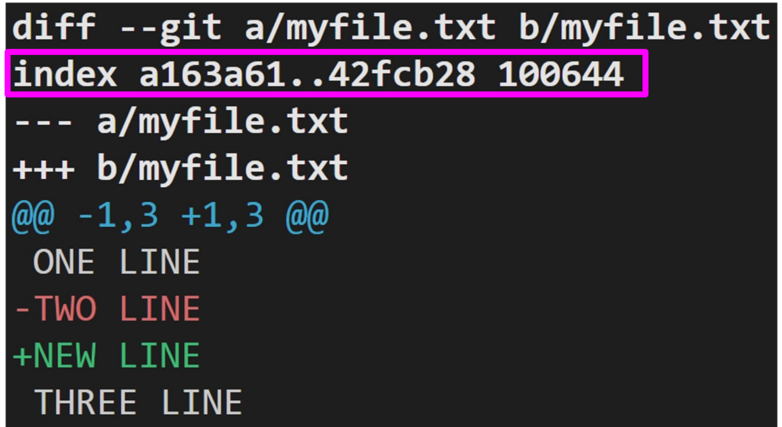
--- a/myfile.txt
+++ b/myfile.txt
@@ -1,3 +1,3 @@
 ONE LINE
-TWO LINE
+NEW LINE
 THREE LINE
```

Week 3 Branches and Working with Others

- **git diff syntax - metadata**
  - Metadata is just internal Git metadata you are unlikely to use, such a some hash information.



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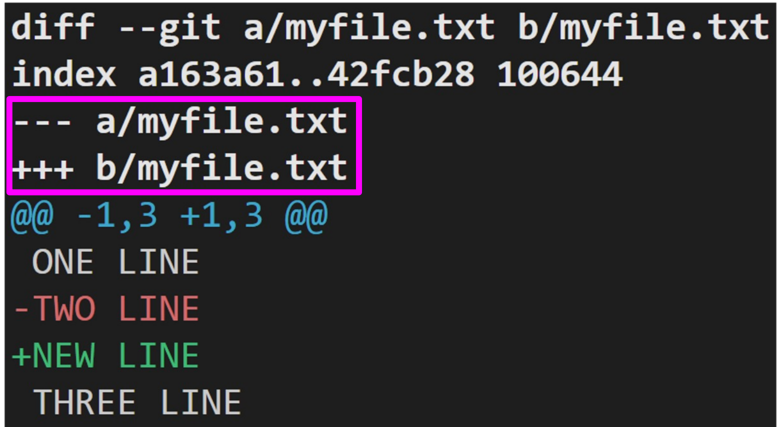
@@ -1,3 +1,3 @@
 ONE LINE
-TWO LINE
+NEW LINE
 THREE LINE
```

Week 3 Branches and Working with Others

- **git diff syntax - markers for changes**
  - Legend that assigns symbols to each diff input source. Changes from a/myfile.txt are marked with **-** and the changes from b/myfile.txt are marked with **+** symbol.



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diff --git a/myfile.txt b/myfile.txt
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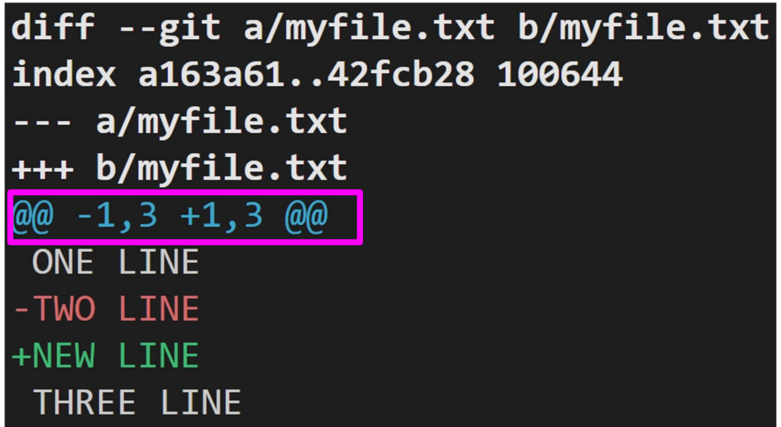
--- a/myfile.txt
+++ b/myfile.txt
@@ -1,3 +1,3 @@
 ONE LINE
-TWO LINE
+NEW LINE
 THREE LINE
```

Week 3 Branches and Working with Others

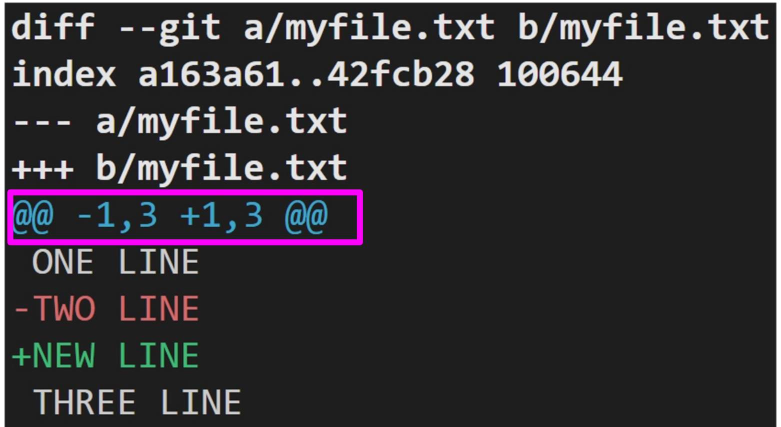
- **git diff syntax - diff chunks**
    - The remaining output will be a list of “chunks” of code, showing the changes as well as a few lines for context above and below the change.



```
diff --git a/myfile.txt b/myfile.txt
index a163a61..42fcb28 100644
--- a/myfile.txt
+++ b/myfile.txt
@@ -1,3 +1,3 @@
 ONE LINE
-TWO LINE
+NEW LINE
 THREE LINE
```

Week 3 Branches and Working with Others

- **git diff syntax - diff chunks**
  - @@ -start_line,num +start_line, num@@



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--- a/myfile.txt
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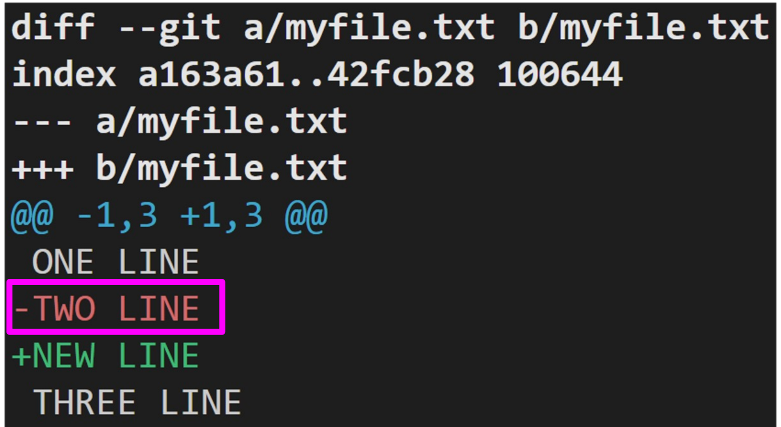
@@ -1,3 +1,3 @@
 ONE LINE
-TWO LINE
+NEW LINE
 THREE LINE
```

Week 3 Branches and Working with Others

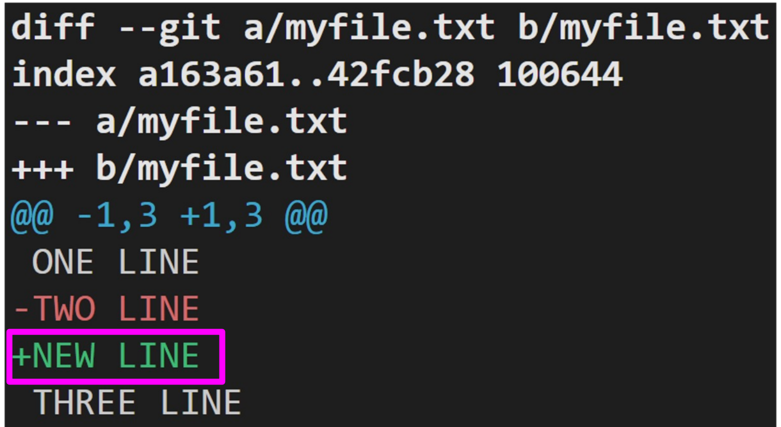
- **git diff syntax - diff chunks**
  - Displays what was in file ---a/myfile.txt



```
diff --git a/myfile.txt b/myfile.txt
index a163a61..42fcb28 100644
--- a/myfile.txt
+++ b/myfile.txt
@@ -1,3 +1,3 @@
 ONE LINE
-TWO LINE
+NEW LINE
 THREE LINE
```

Week 3 Branches and Working with Others

- **git diff syntax - diff chunks**
  - Displays what was in file +++b/myfile.txt



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@@ -1,3 +1,3 @@
 ONE LINE
-TWO LINE
+NEW LINE
 THREE LINE
```

Week 3 Branches and Working with Others

- **Git Diff**
  - This is a very powerful command, and we’ve only scratched the surface of what it can do, let’s explore it in practice, but you can learn more at:
  - **https://git-scm.com/docs/git-diff**

Week 3
Exercise and Solution

Week 3 Branches and Working with Others

- **Perform the following tasks:**
  - Create a new repository
  - Create a text file with the numbers 1-3 written out in english (one,two, three).
  - Add and Commit these Updates
  - Create a new branch called **translation**
  - Switch to the new branch and translate the numbers to another language(uno, dos, tres).

Week 3 Branches and Working with Others

- **Perform the following tasks:**
  - ***Bonus Task:***
    - ***Can you figure out how to use git diff to view the differences between the two branches before a merge?***
  - Merge the **translation** branch back to your initial master branch, it should be a “fast forward” merge since there were no other commits on master.

Week 3 Branches and Working with Others

- Overall this task should be a straight forward review of many of the concepts covered so far.
- Let’s walk you through it!