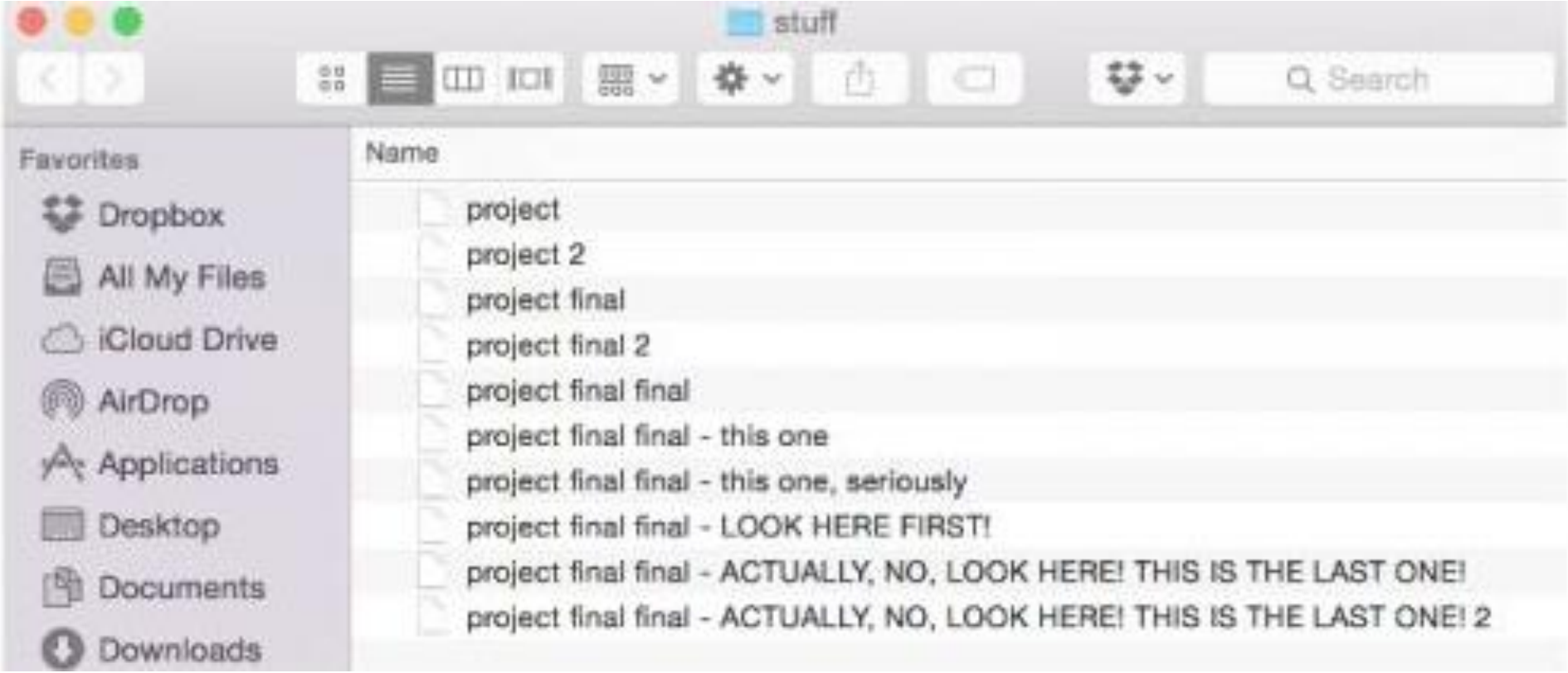
Git

Boston University CS 506 - Lance Galletti


stuff
Search
Favorites
Dropbox
All My Files
iCloud Drive
AirDrop
Applications
Desktop
Documents
Downloads
Name
project
project 2
project final
project final 2
project final final
project final final - this one
project final final - this one, seriously
project final final - LOOK HERE FIRST!
project final final - ACTUALLY, NO, LOOK HERE! THIS IS THE LAST ONE!
project final final - ACTUALLY, NO, LOOK HERE! THIS IS THE LAST ONE! 2

Git

A tool to help us manage the **timeline(s)** of a project (also called repository).

Formally called a **Version Control System** or **Source Control Management**

Fundamental Workflow

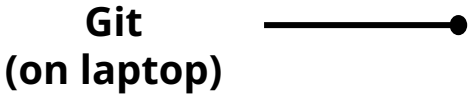
As we change the project over time

Create save points (called **commits**) that track the timeline of the project's evolution

Git
(on laptop)

Fundamental Workflow

Create save points (called **commits**)



Fundamental Workflow

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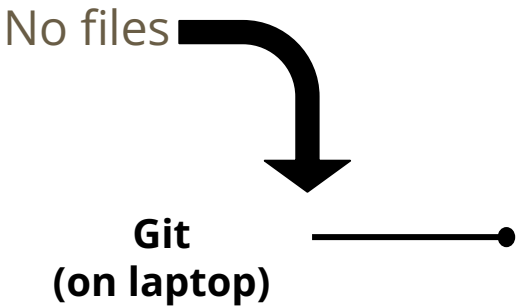

Fundamental Workflow

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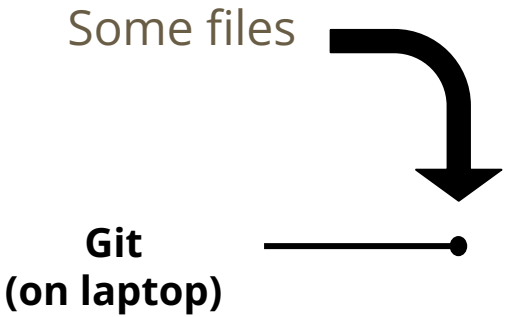
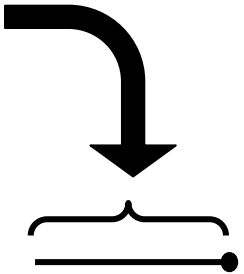


Fundamental Workflow

Create save points (called **commits**)

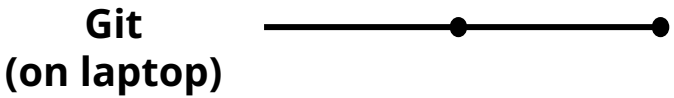
The addition of some files



Git (on laptop)

Fundamental Workflow

Create save points (called **commits**)



Fundamental Workflow

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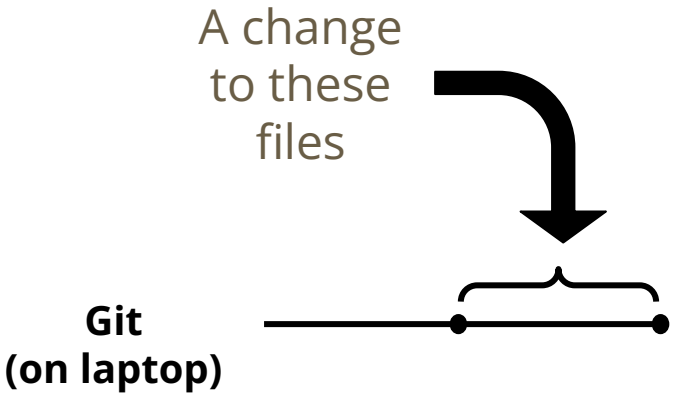
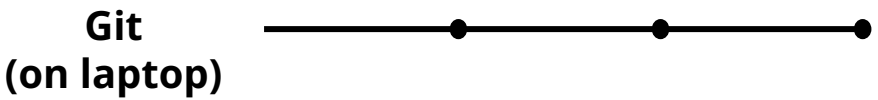


Fundamental Workflow

Creates a timeline of your code / files



Fundamental Workflow

Creates a timeline of your code / files

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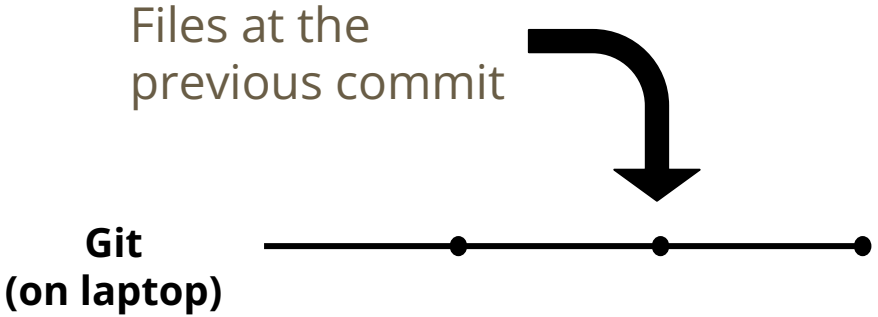

Demo

GitHub vs Git

Git --> [terminal] a **version control system**

GitHub --> [browser] a **website** to **backup and host** the **timeline(s)** of your project

Fundamental Workflow

Create save points (called **commits**)

Push the updates to GitHub (from your laptop) to back up your work

GitHub
(online)

Git
(on laptop)

Fundamental Workflow

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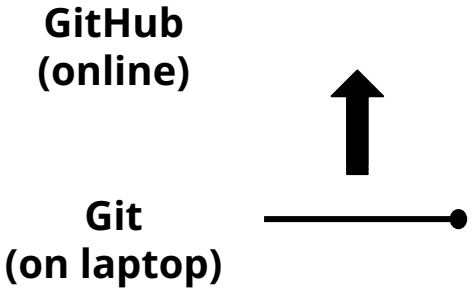

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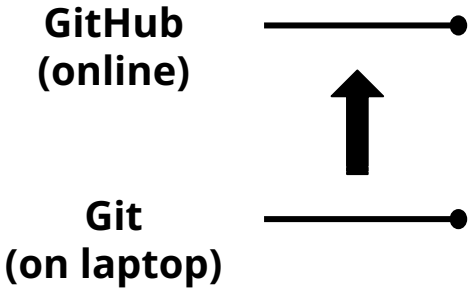

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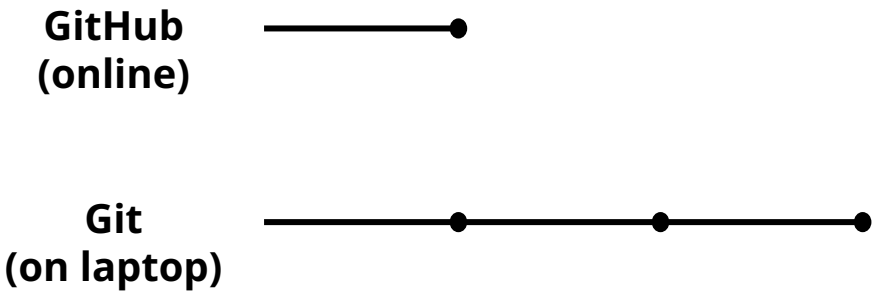

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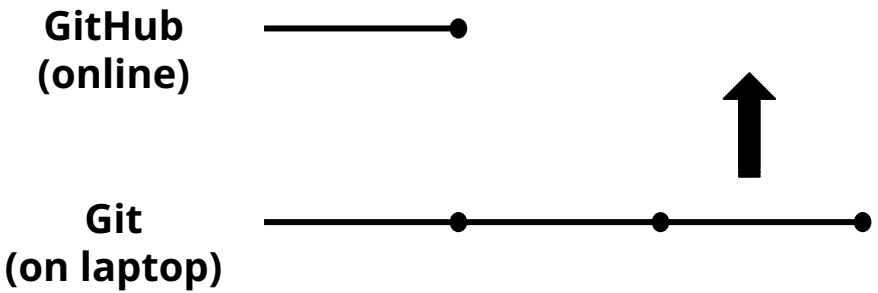

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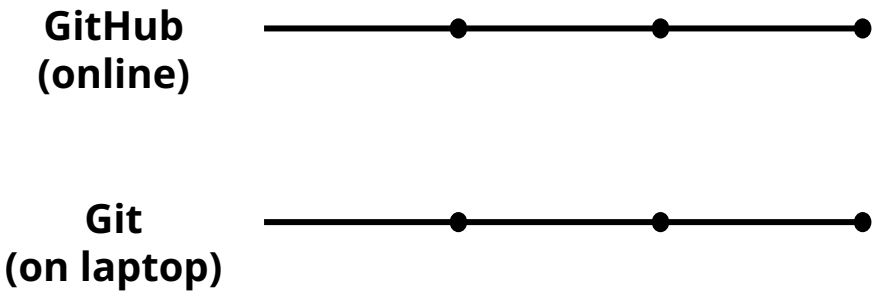

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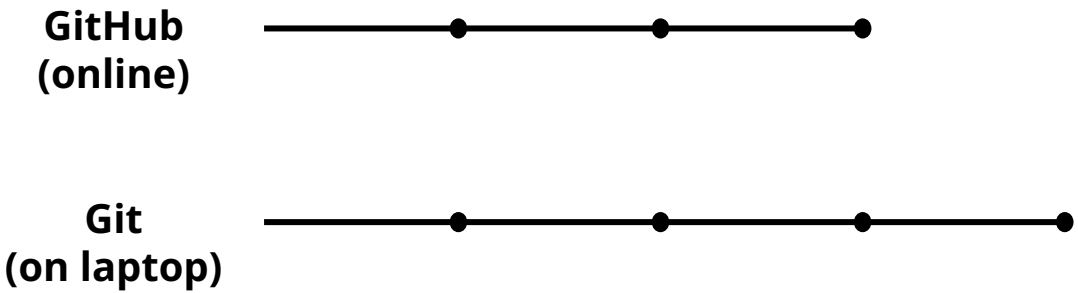

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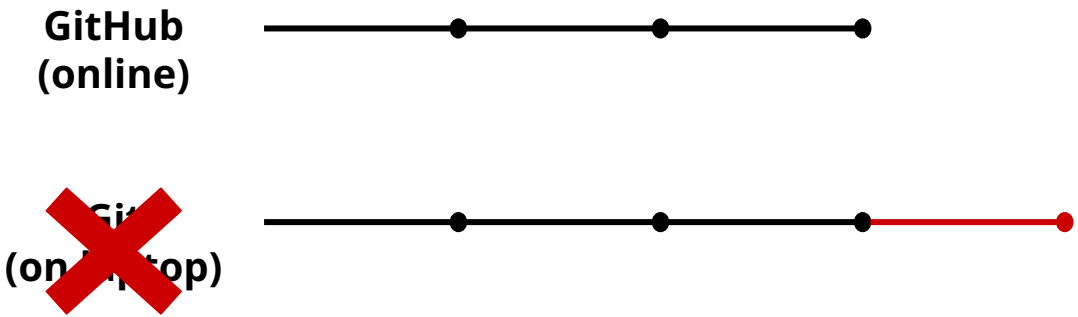

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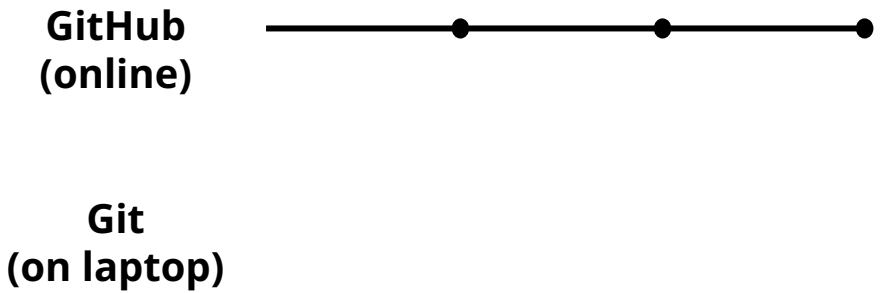

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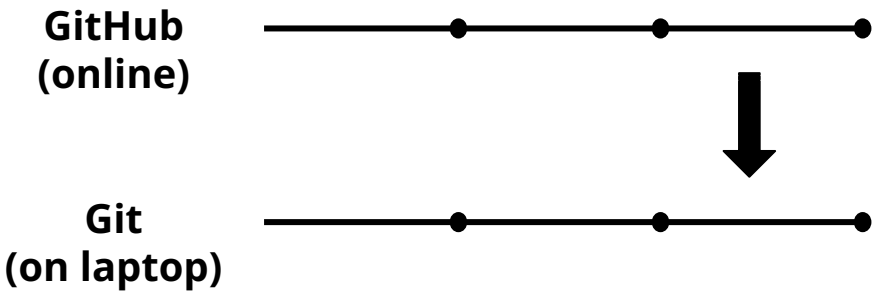
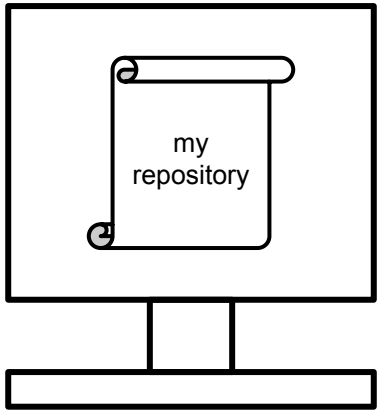


Initialize a repository

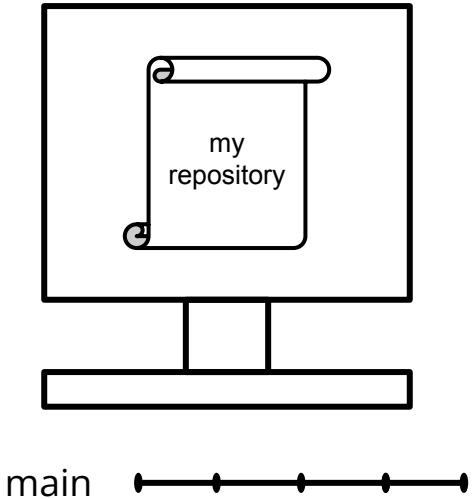
```
git init
```



main

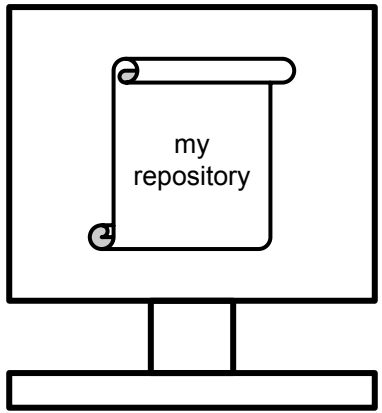
Add and Commit changes

```
git add <files>
git commit -m “some message”
```



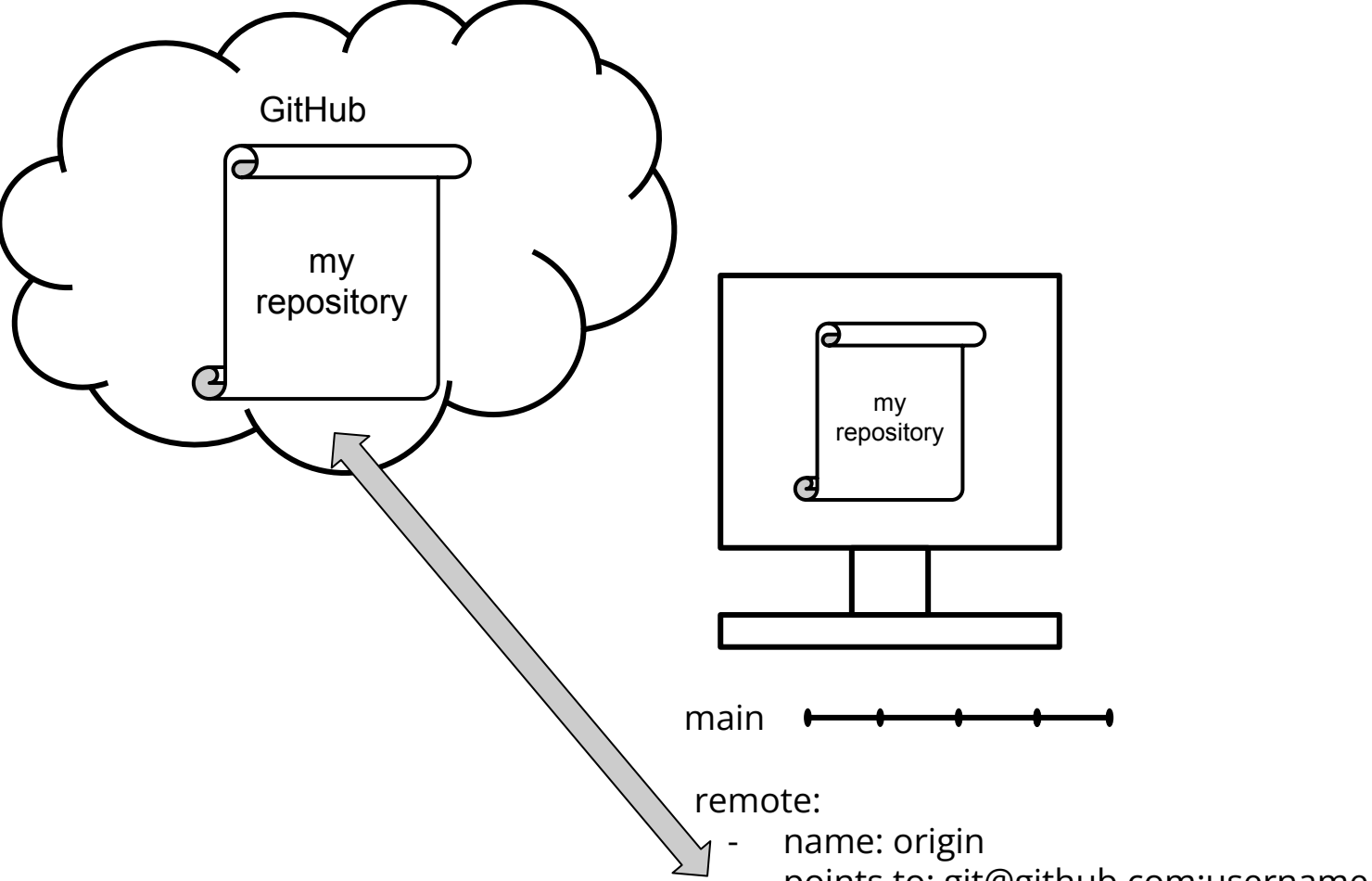
Add a remote that points to GitHub

```
git remote add origin <link>
```



main

remote:
- name: origin
- points to: git@github.com:username



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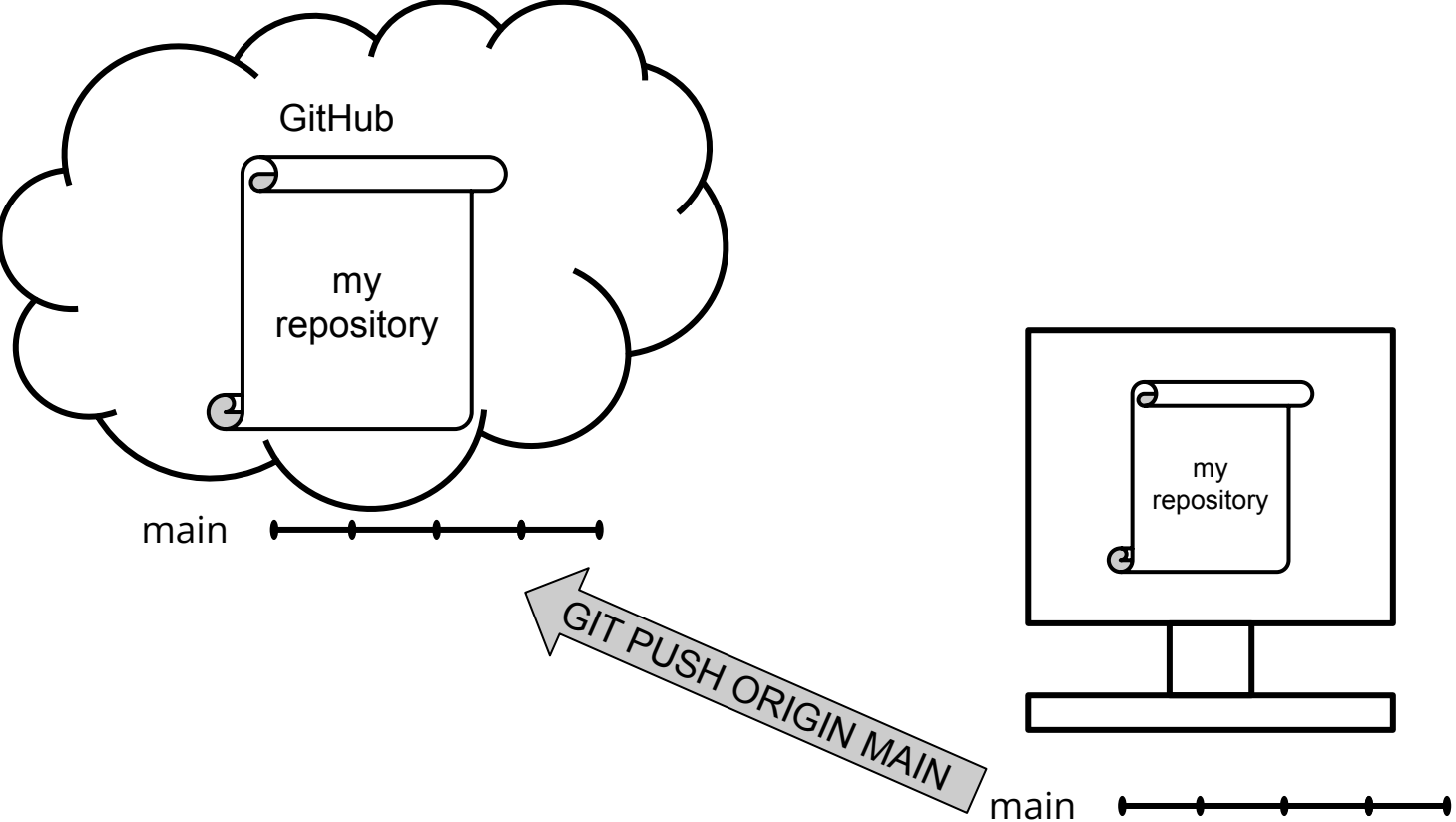

remote:

- name: origin
- points to: git@github.com:username

Demo

Motivation

For each project (repository) I own, I want to write code where:

1. Iterating on (+ keeping track of) different versions of the code is easy
2. Work is backed up to and hosted on the cloud
3. Collaboration is productive

Iterating on Different Versions

The ease or difficulty of adding a new feature to the code base may depend on the state / version of the codebase.

It may be easiest to add this feature at a specific commit.

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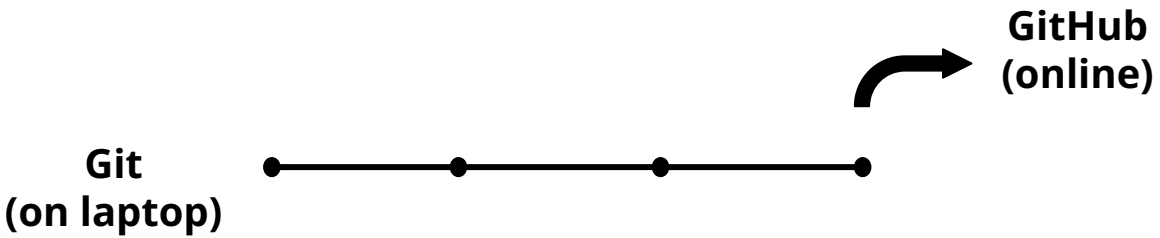

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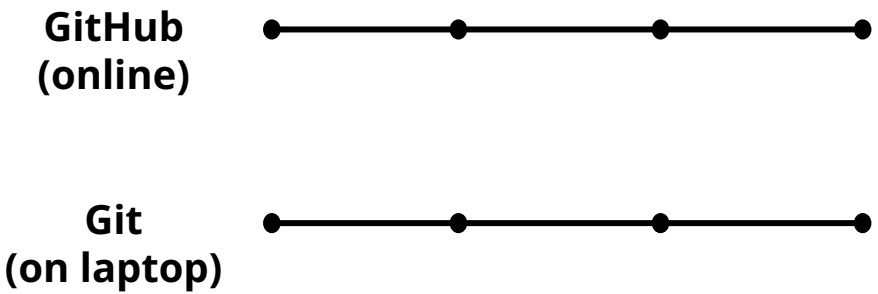

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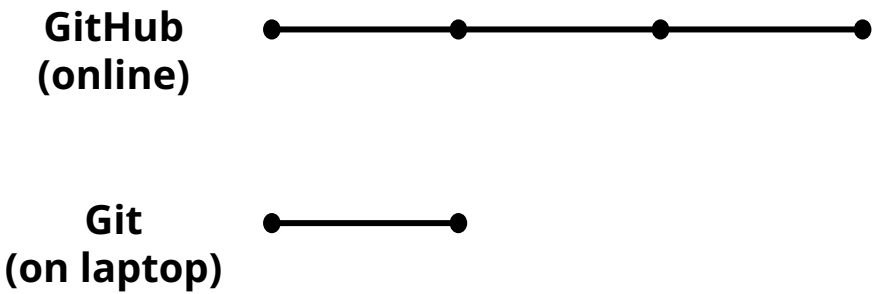

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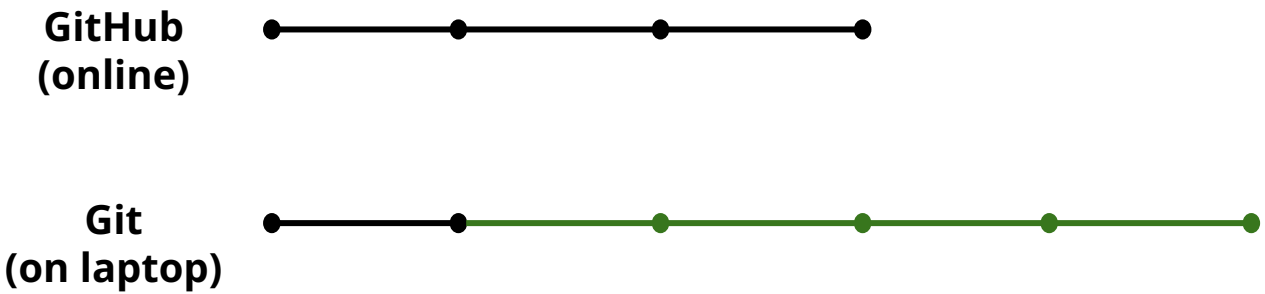
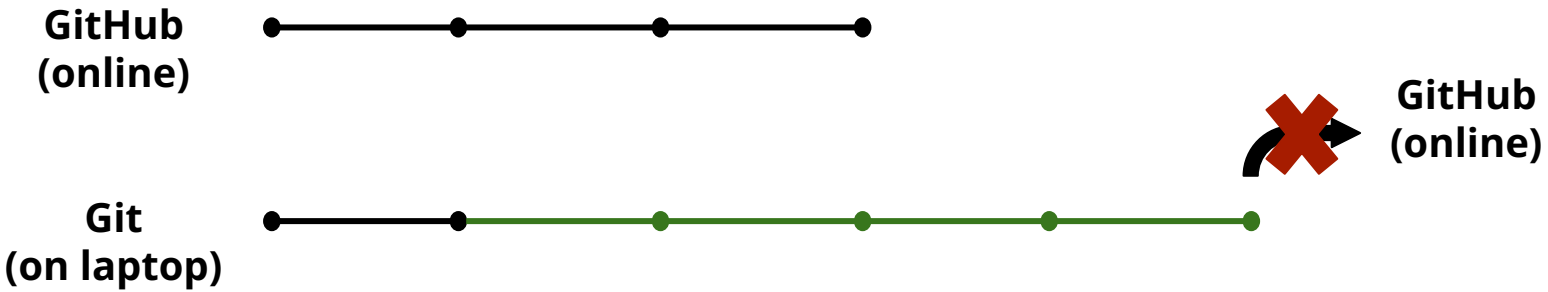


Iterating on Different Versions

What happens now?



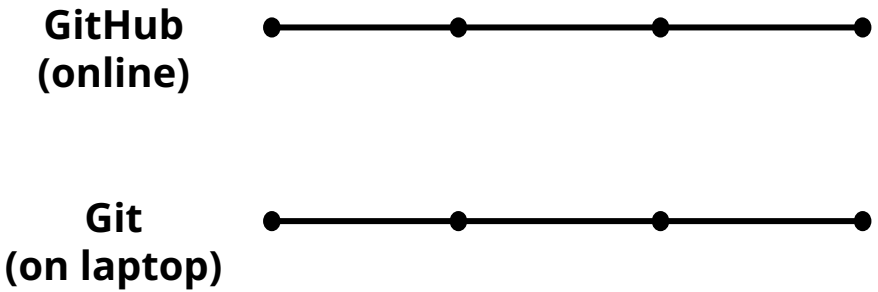
Iterating on Different Versions

Looks like we need:

1. A way to preserve both versions of history
2. A way to overwrite history if we choose (this is dangerous as we will lose that history)

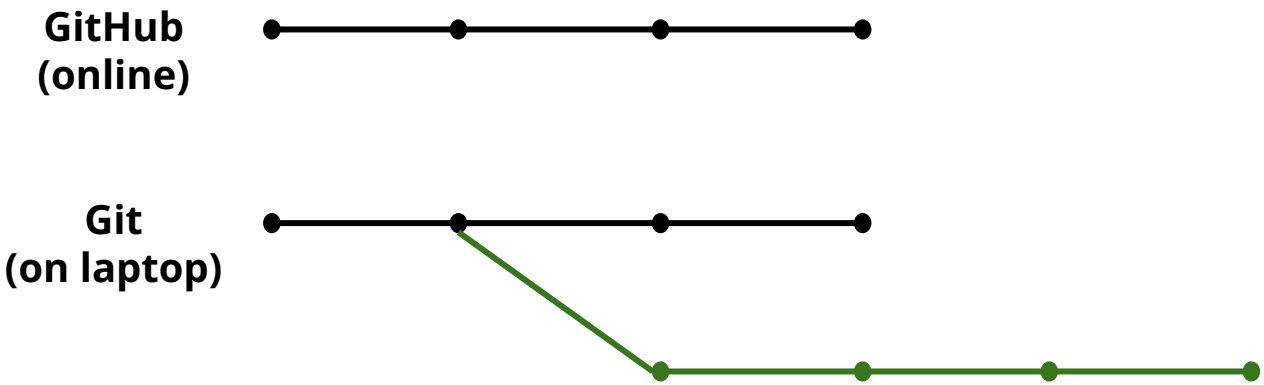
Iterating on Different Versions

Let’s try that again!



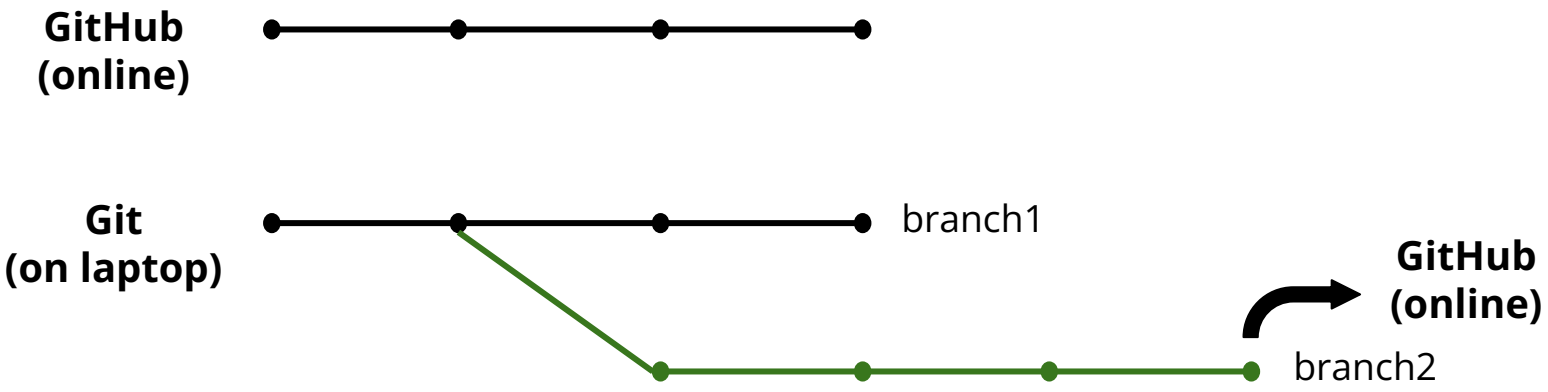
Iterating on Different Versions

We will **branch** off of that particular commit **to create a new timeline**



Iterating on Different Versions

We can push **commits** per **branch**



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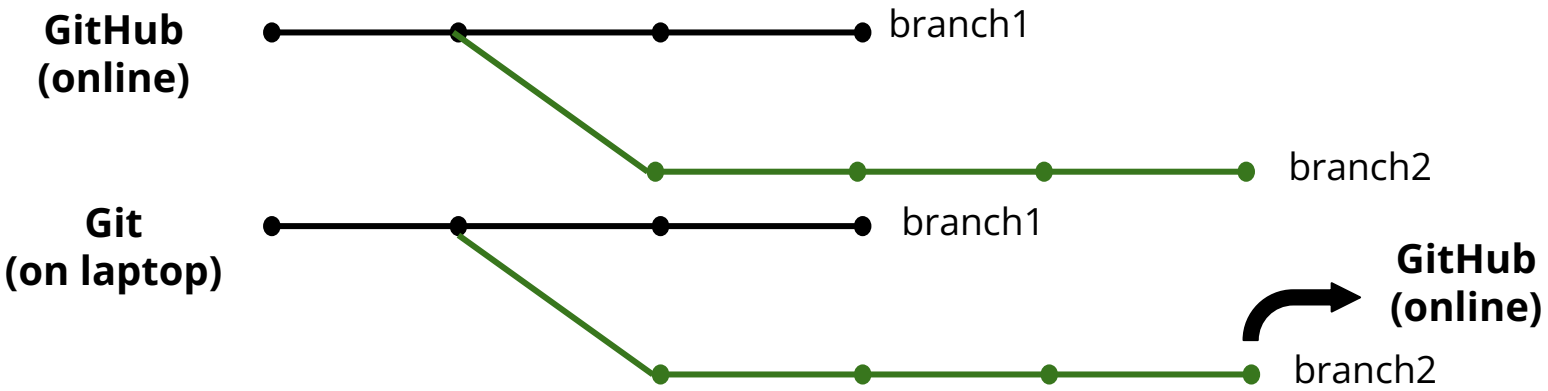

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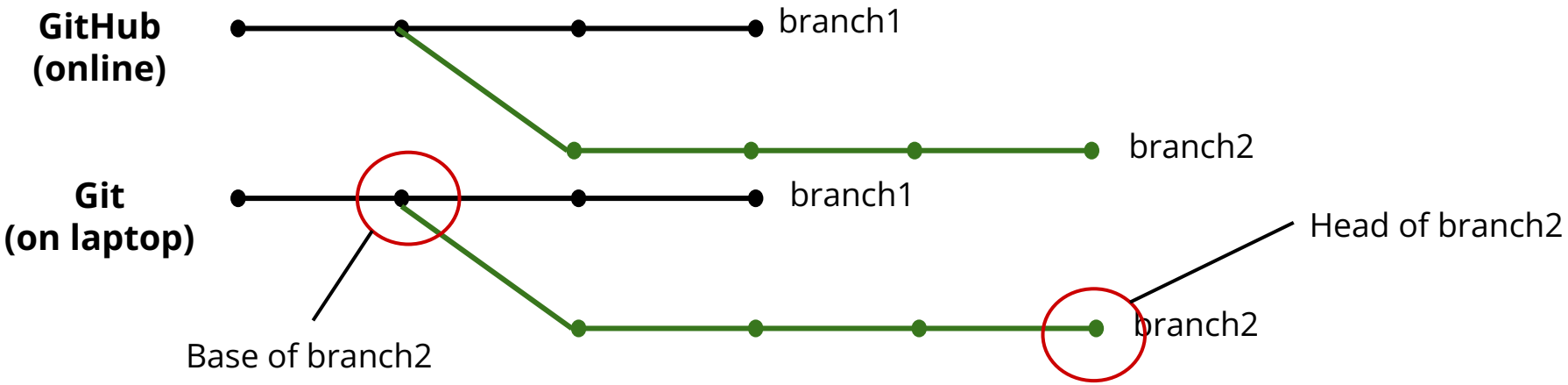
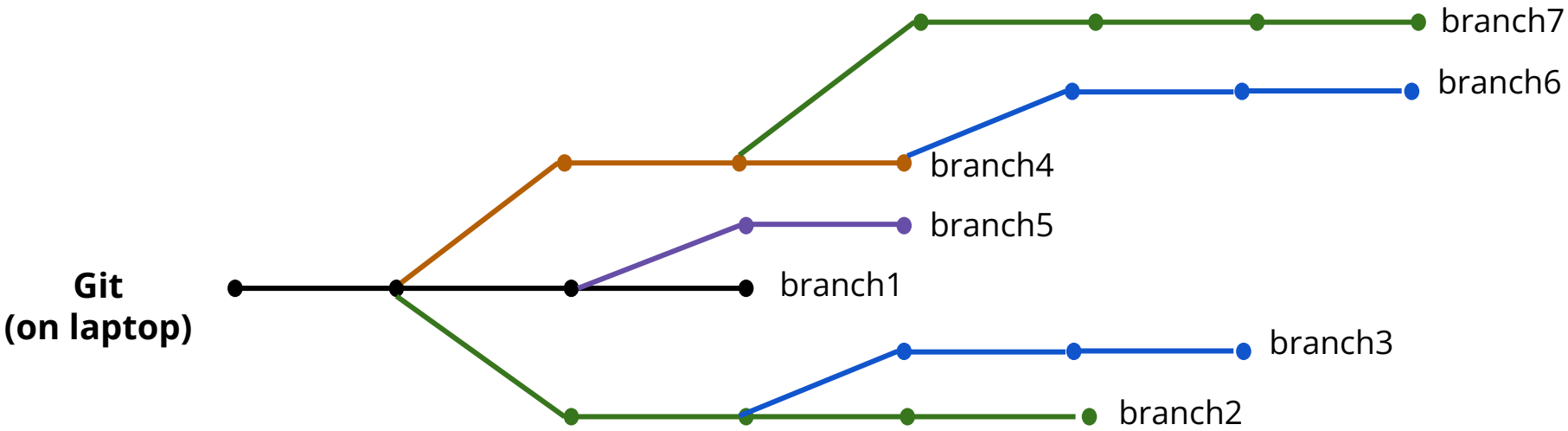


Iterating on Different Versions

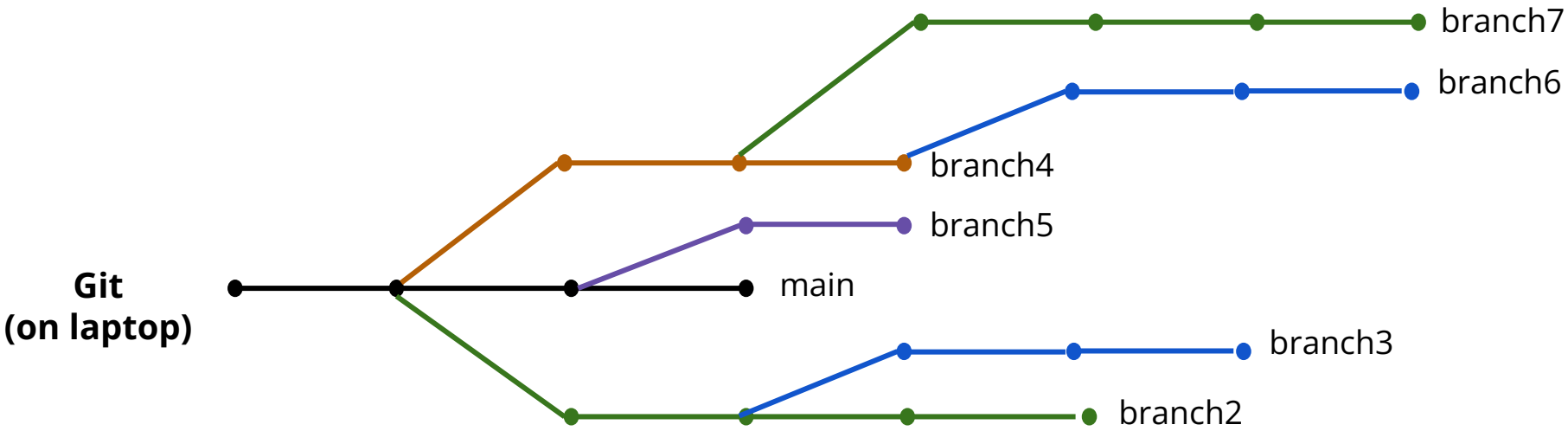
We can create lots of **branches**



Iterating on Different Versions

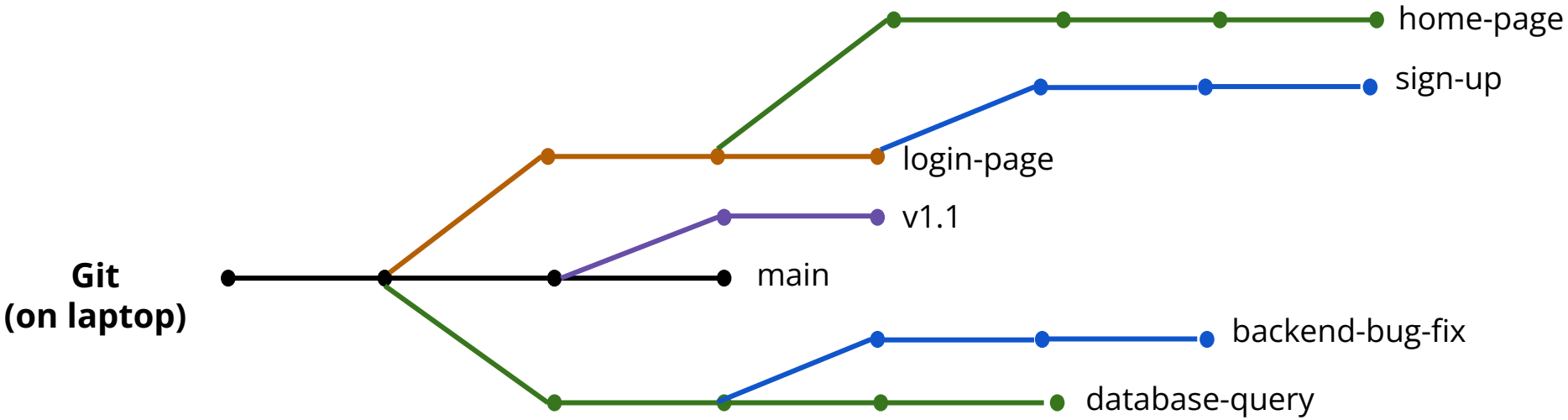
But one branch needs to chosen as the primary, stable branch

This branch is typically called the “main” branch



Iterating on Different Versions

Other branches are usually named after either the feature that is being developed on or the major or minor version of the software / product



Iterating on Different Versions

At some point we will want to clean up certain branches by **merging** them with the master / main branch or with each other.

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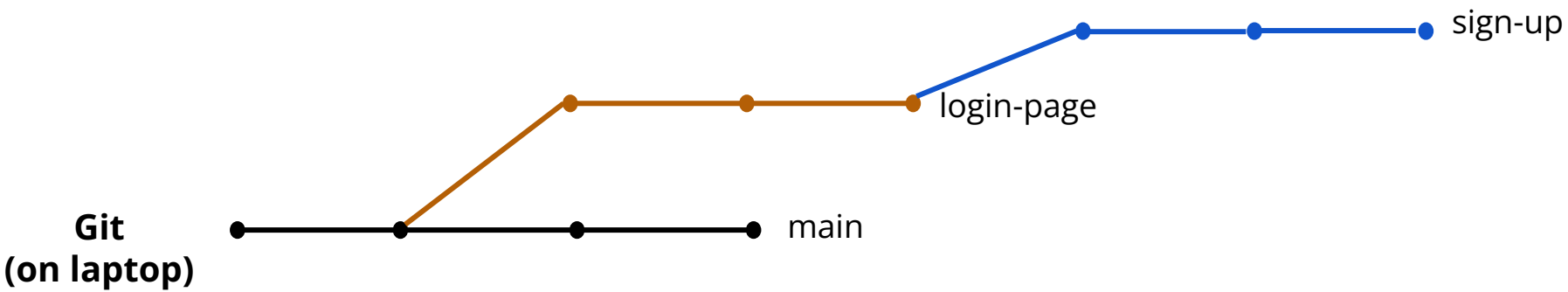
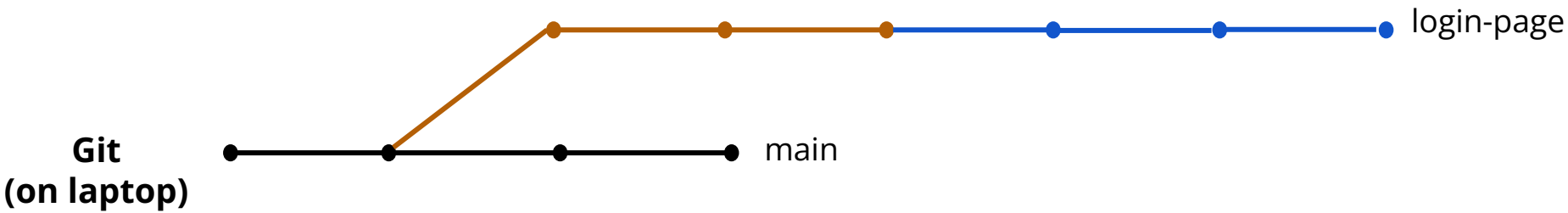


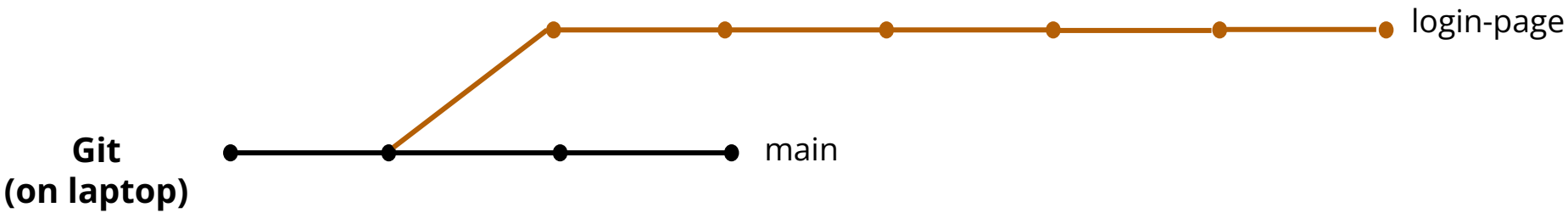
Iterating on Different Versions

Merging is trivial if the **base** of one branch is the **head** of the other - the changes are “simply” appended.



Iterating on Different Versions

When this is not the case, commits can conflict with each other



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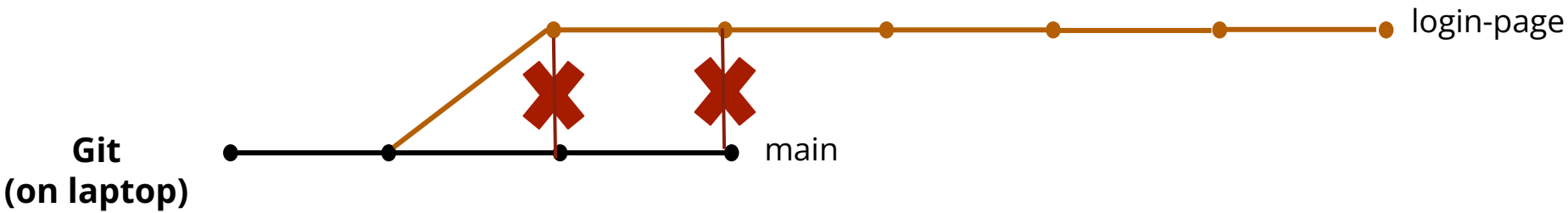

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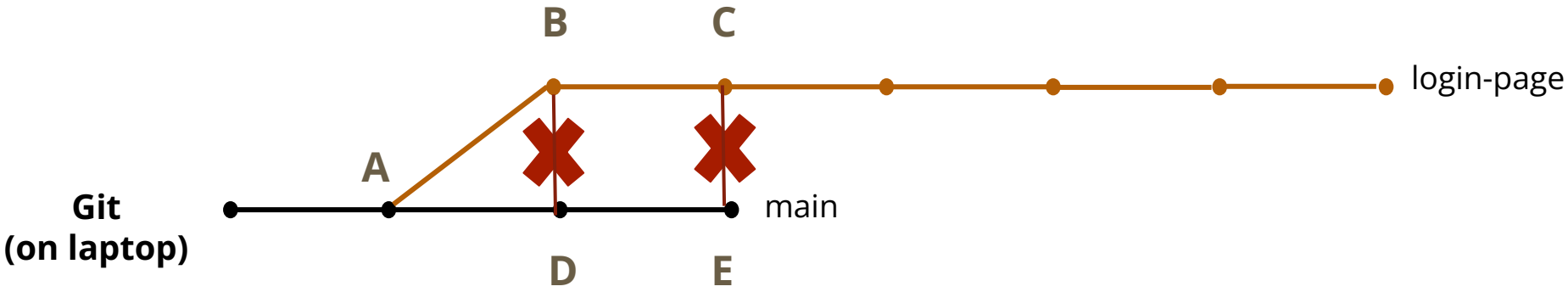
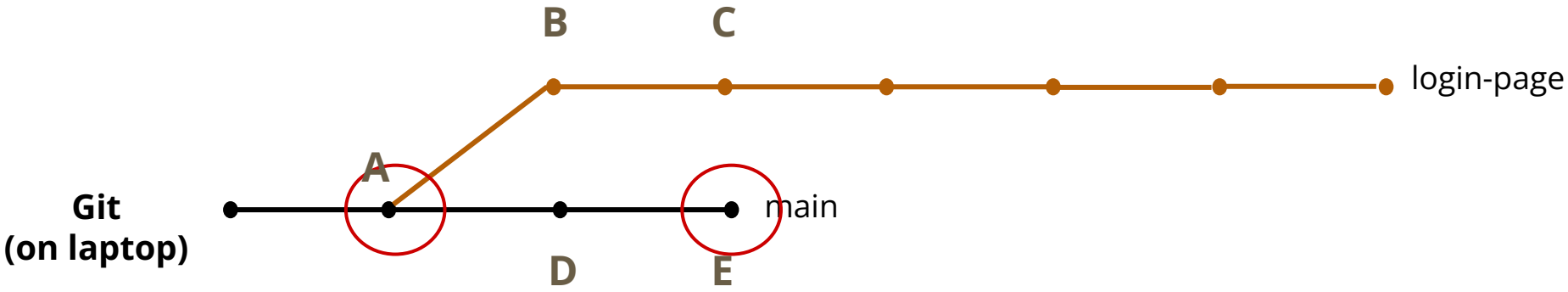


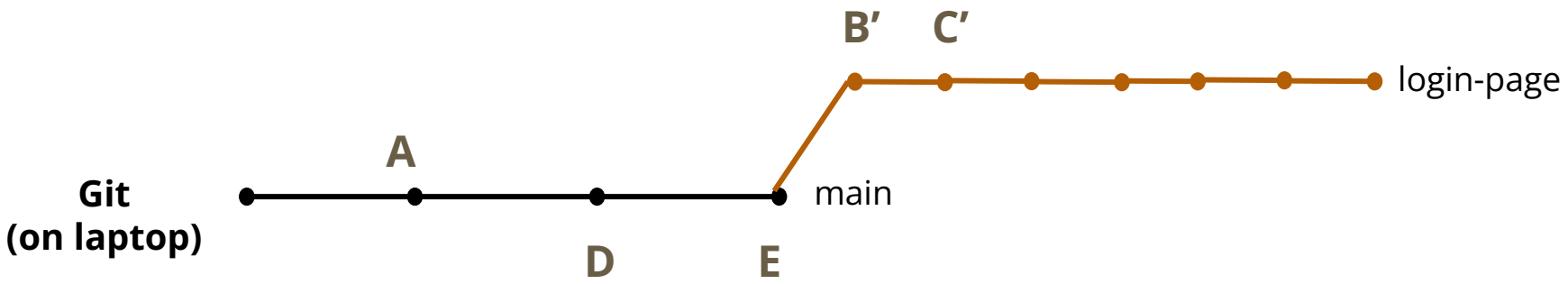
Iterating on Different Versions

We need to change the **base** of the login-page branch (**rebase**) to be at the **head** of the master branch



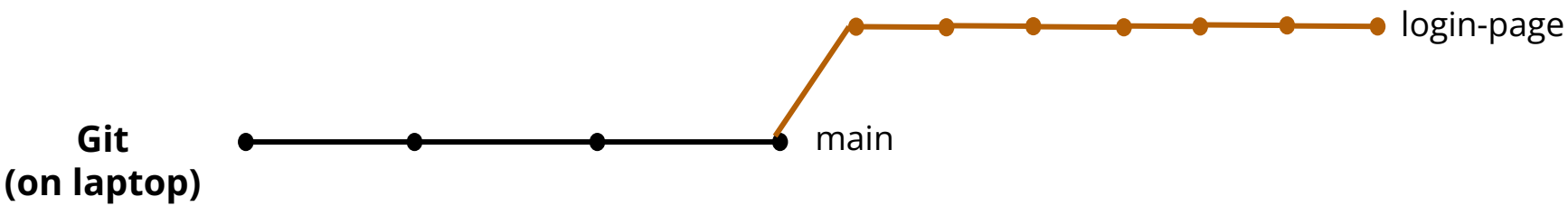
Iterating on Different Versions

We need to change the base of the login-page branch (**rebase**) to be at the head of the master branch



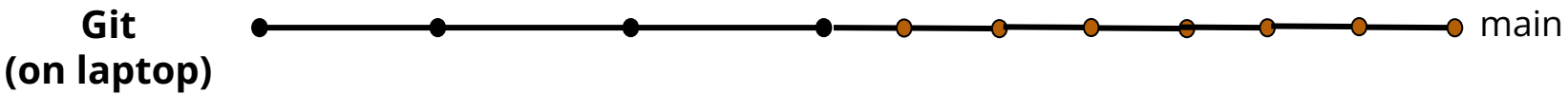
Iterating on Different Versions

This is not a simple operation! It will often require **manual intervention** to resolve the conflicts.



Iterating on Different Versions

This is not a simple operation! It will often require **manual intervention** to resolve the conflicts.



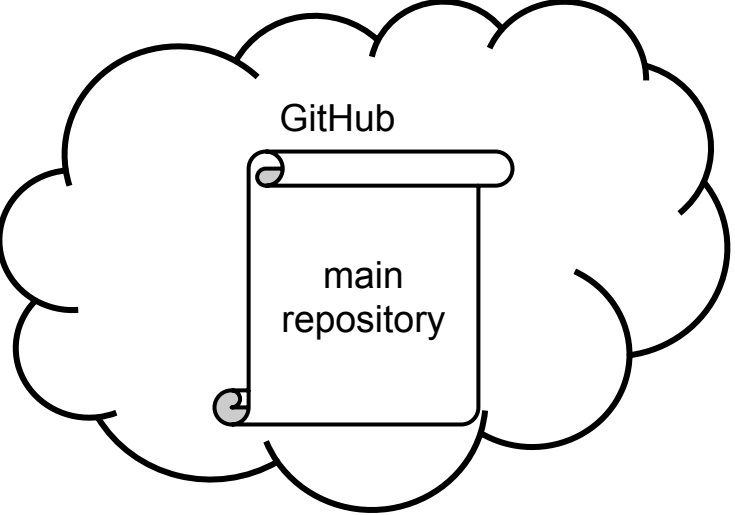
Collaboration
(need volunteer)

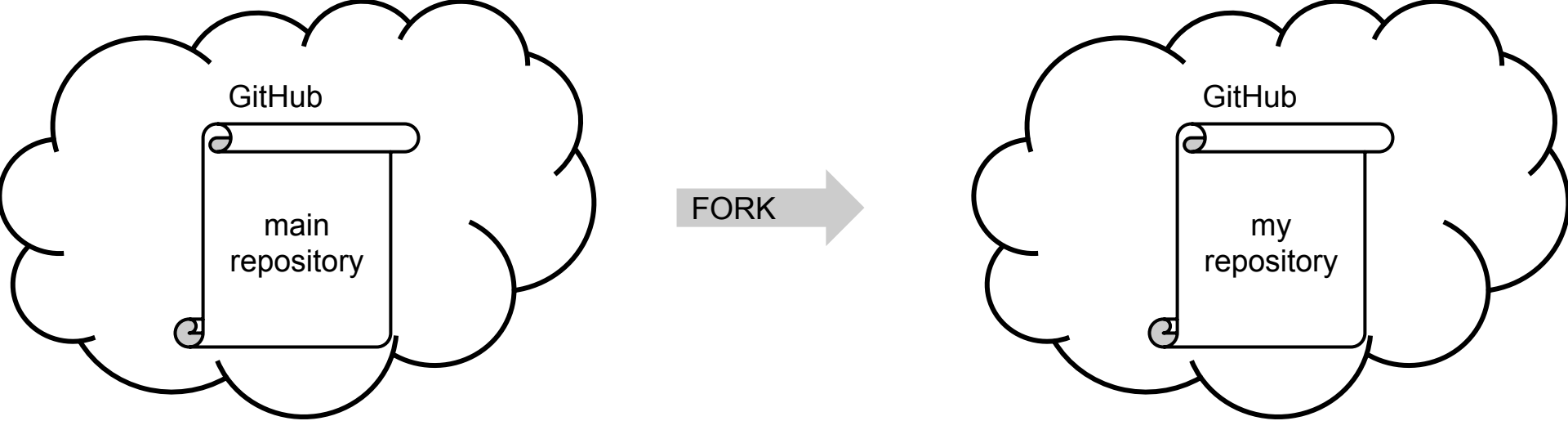
Collaboration

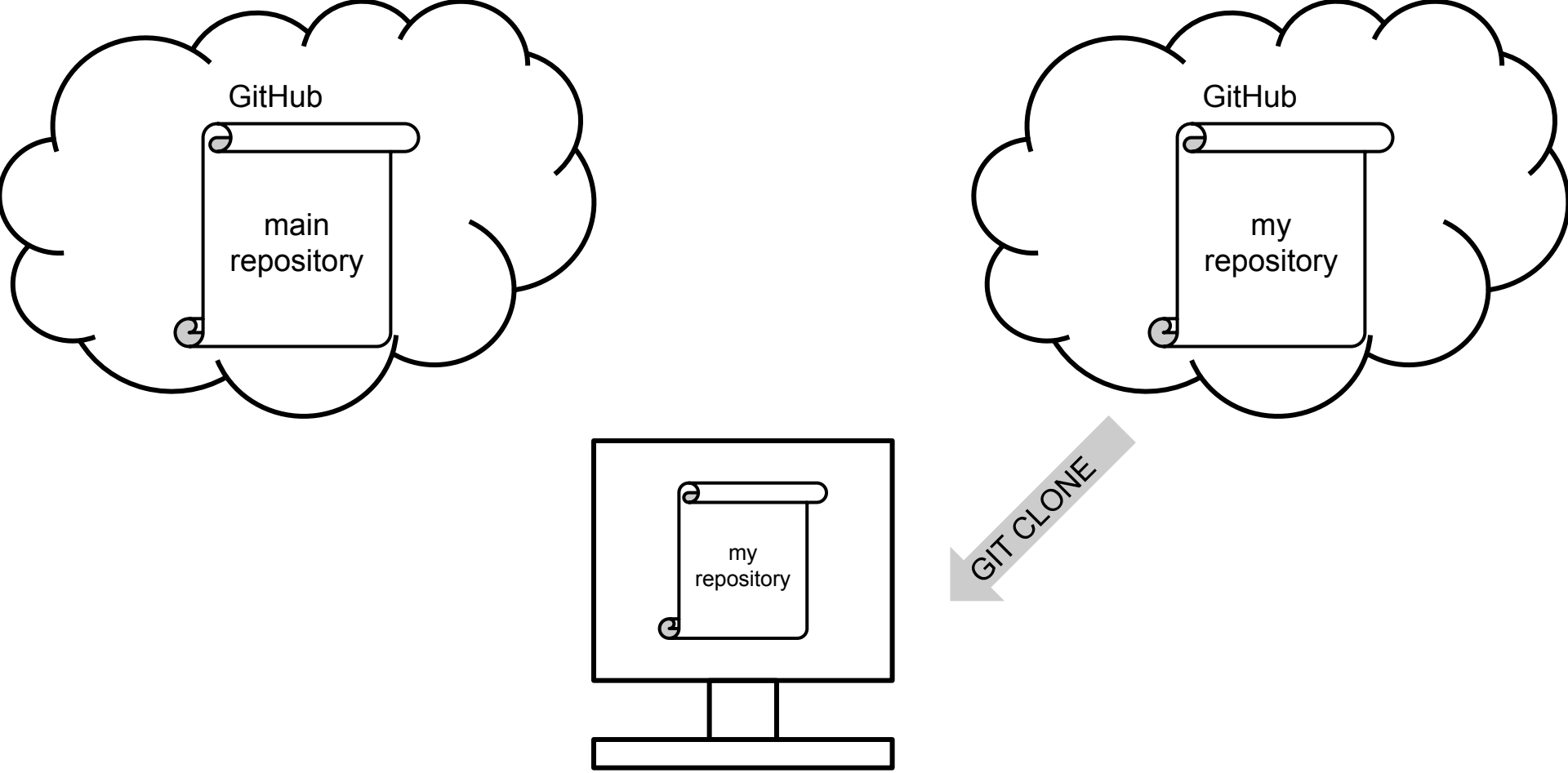
Other repos can be thought of as other branches.

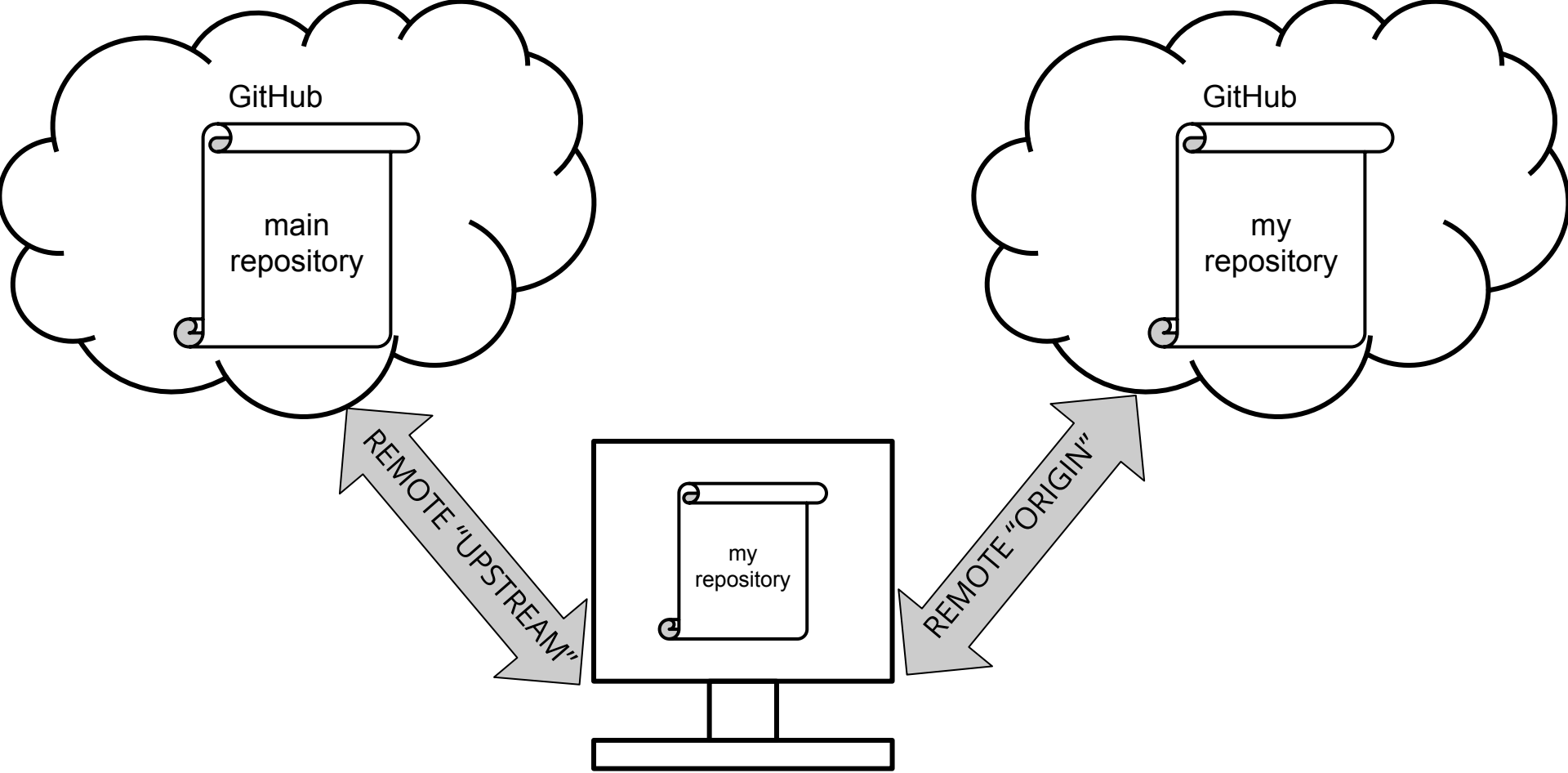
In order to contribute code, collaborators must:

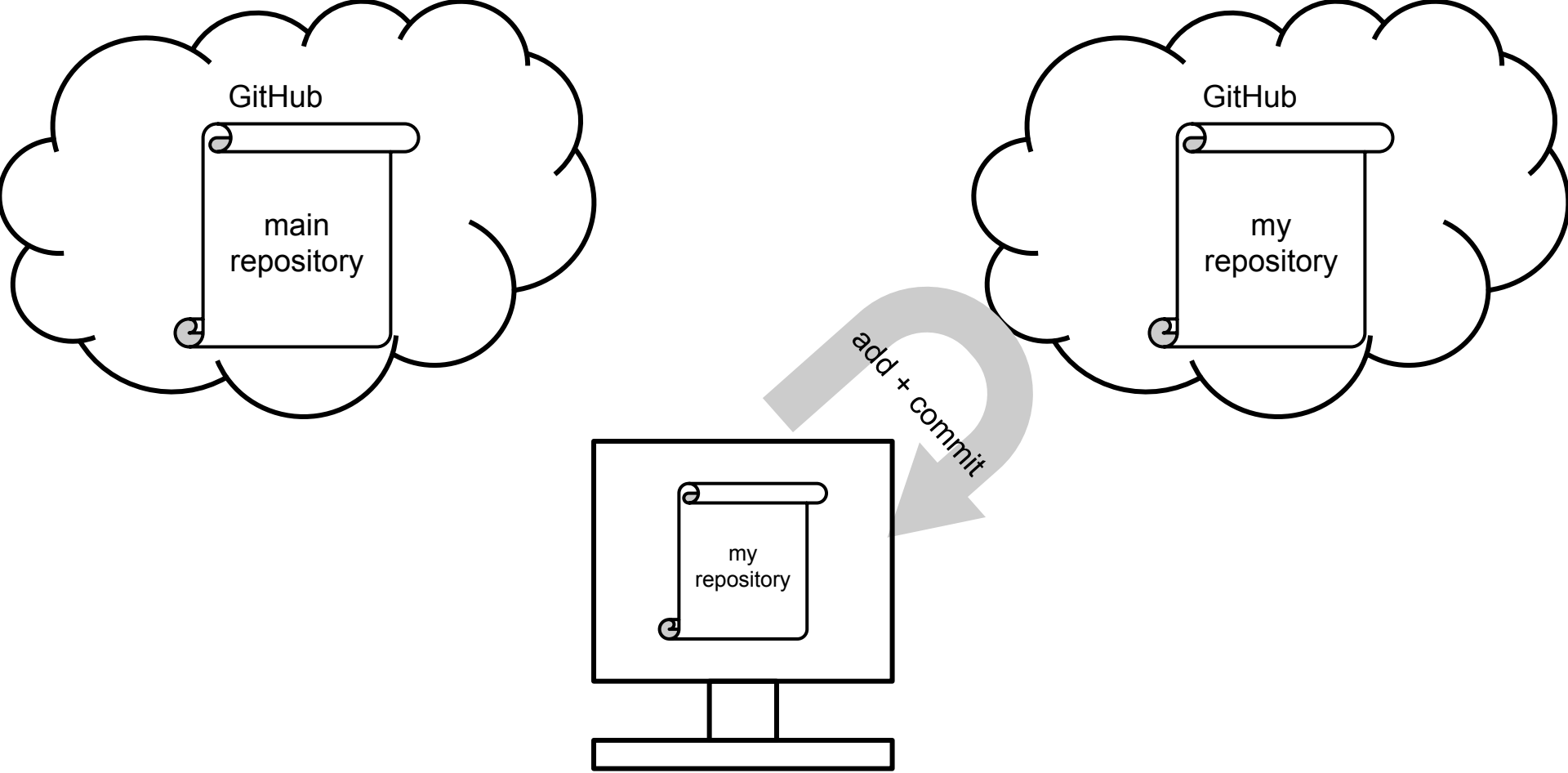
1. Make a copy (**fork**) of the main repository
2. Make all the changes they want to this copy
3. Request that part of their copy be merged into the main repository via a **Pull Request** (PR)

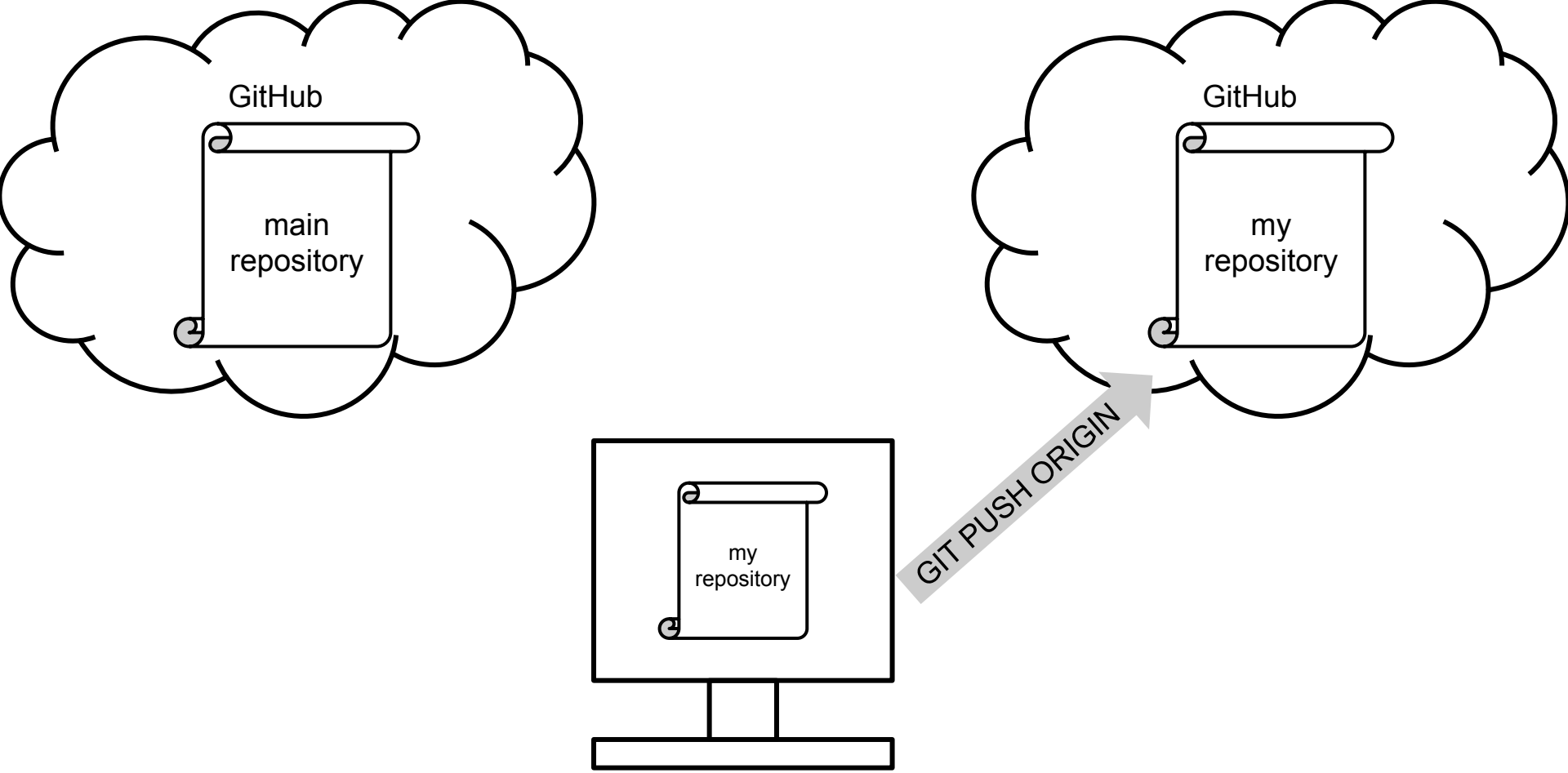

GitHub
main
repository

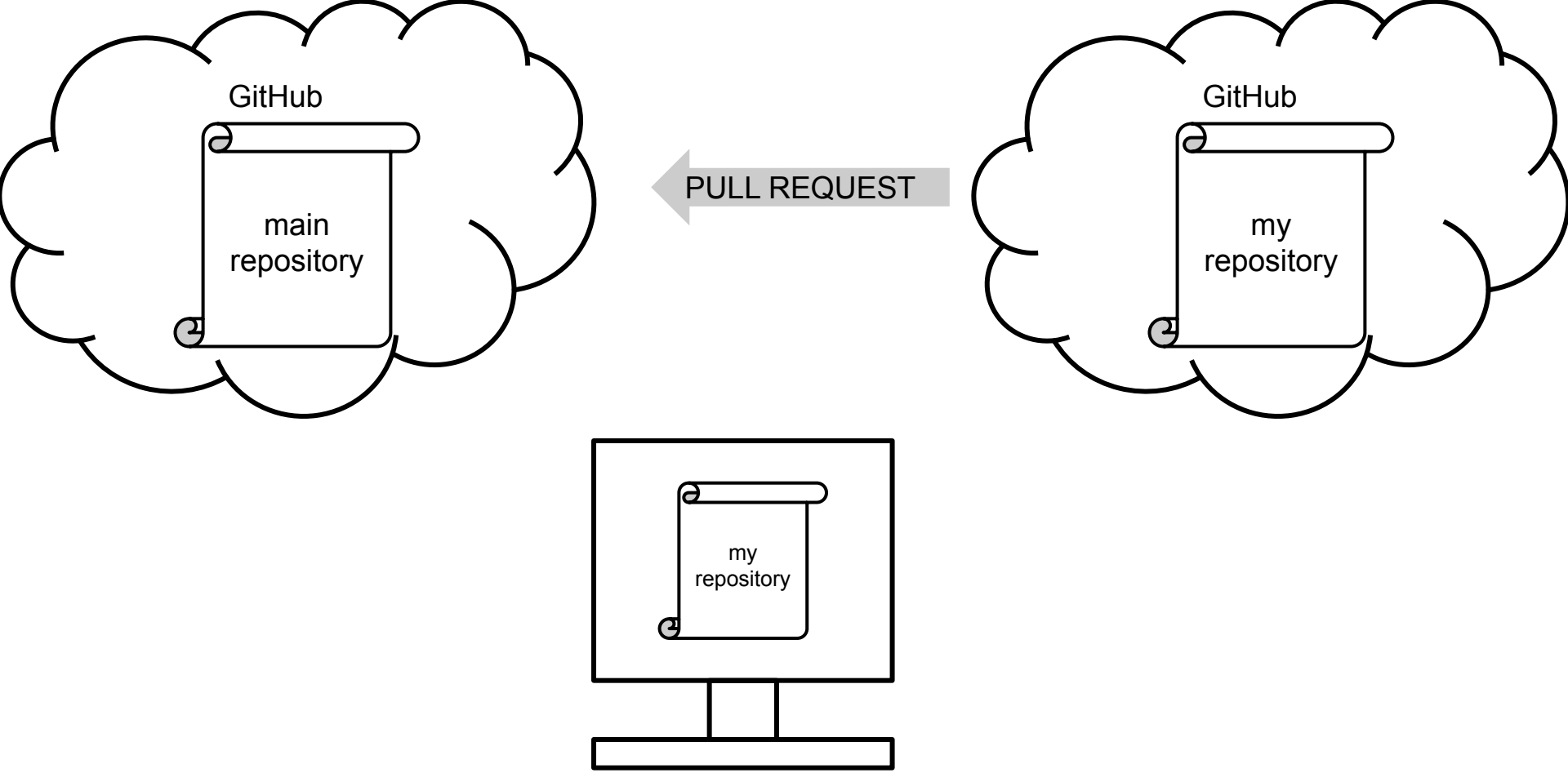

GitHub
main
repository
FORK
GitHub
my
repository


GitHub
main
repository
GitHub
my
repository
my
repository
GIT CLONE


GitHub
main
repository
GitHub
my
repository
REMOTE "UPSTREAM"
my
repository
REMOTE "ORIGIN"

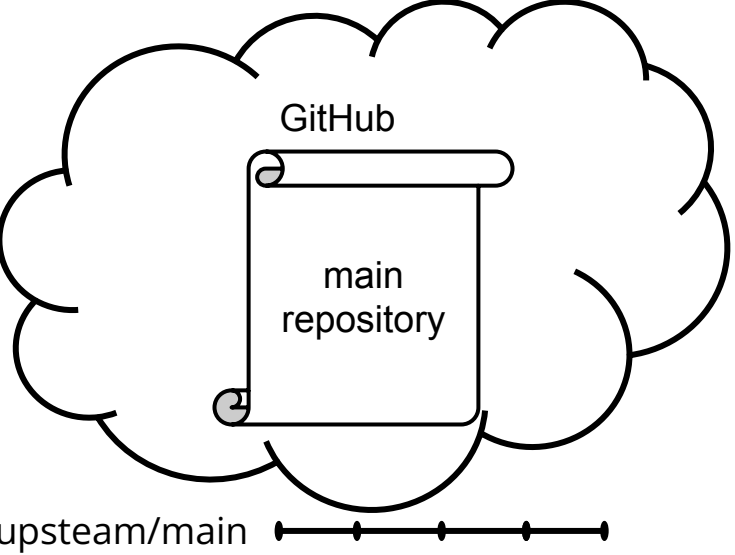

GitHub
main
repository
GitHub
my
repository
add + commit
my
repository

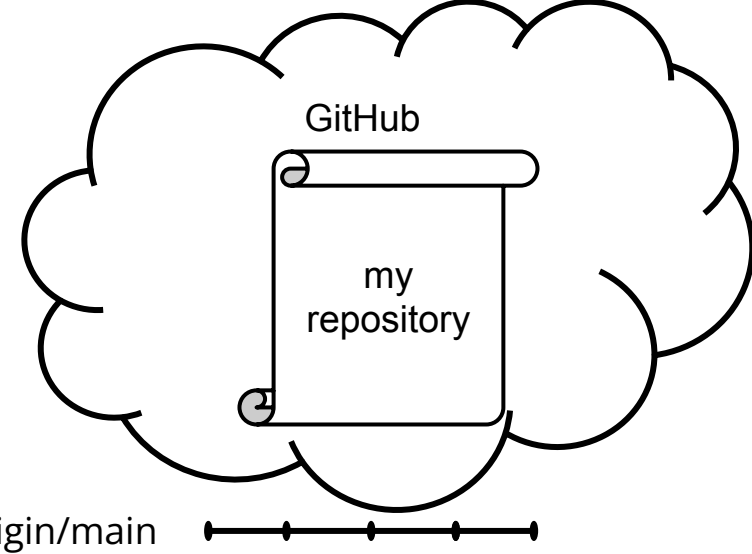

GitHub
main
repository
GitHub
my
repository
my
repository
GIT PUSH ORIGIN

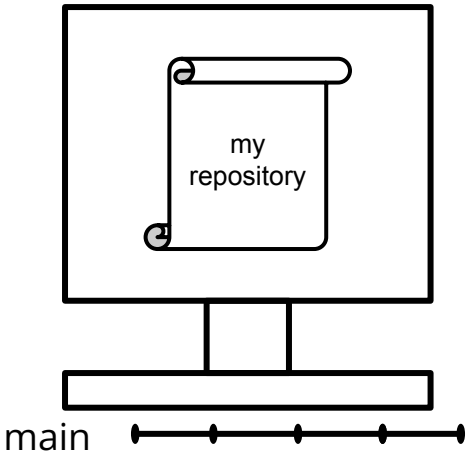

GitHub
main
repository
PULL REQUEST
GitHub
my
repository
my
repository

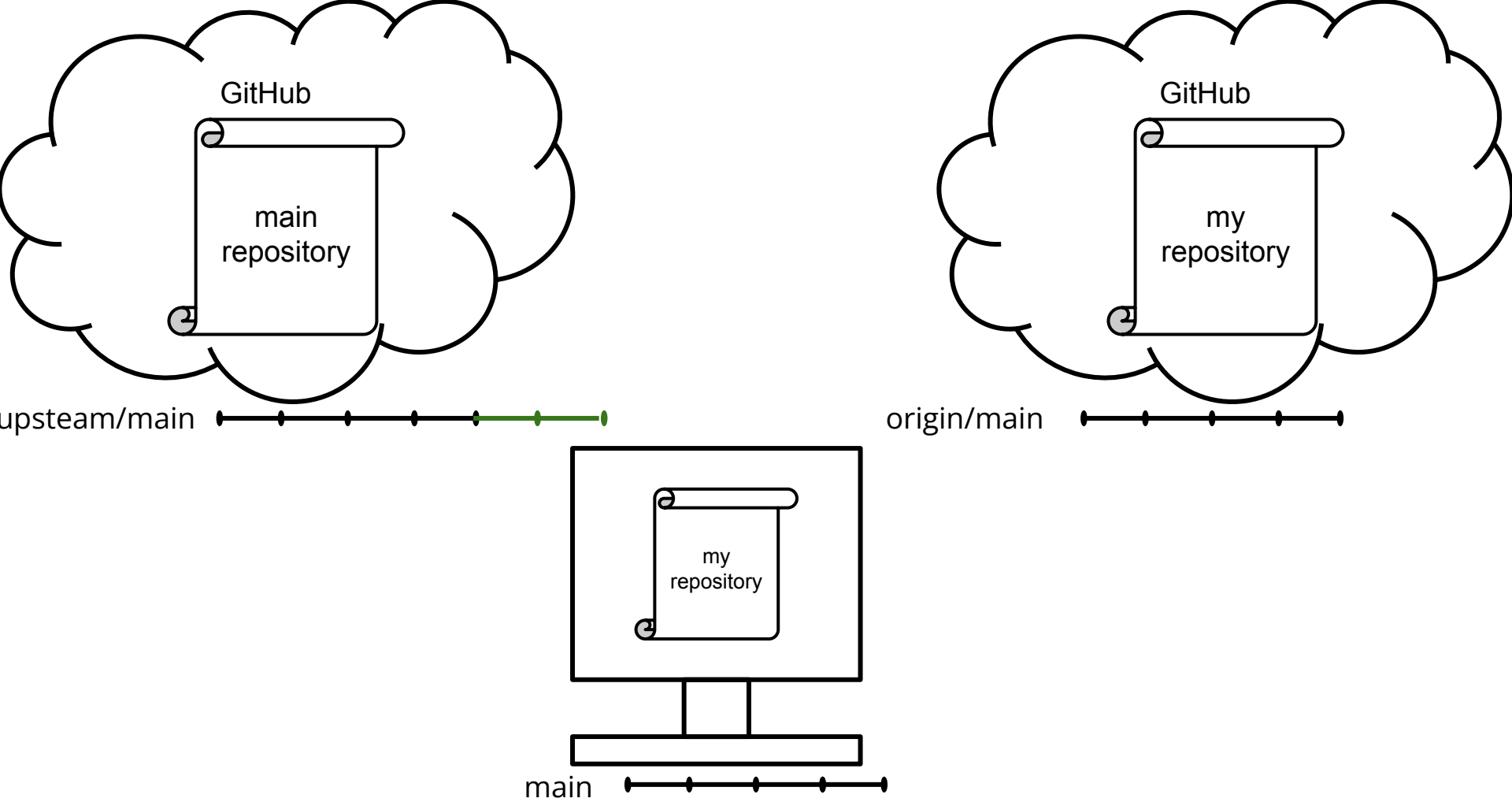
Contributing DEMO

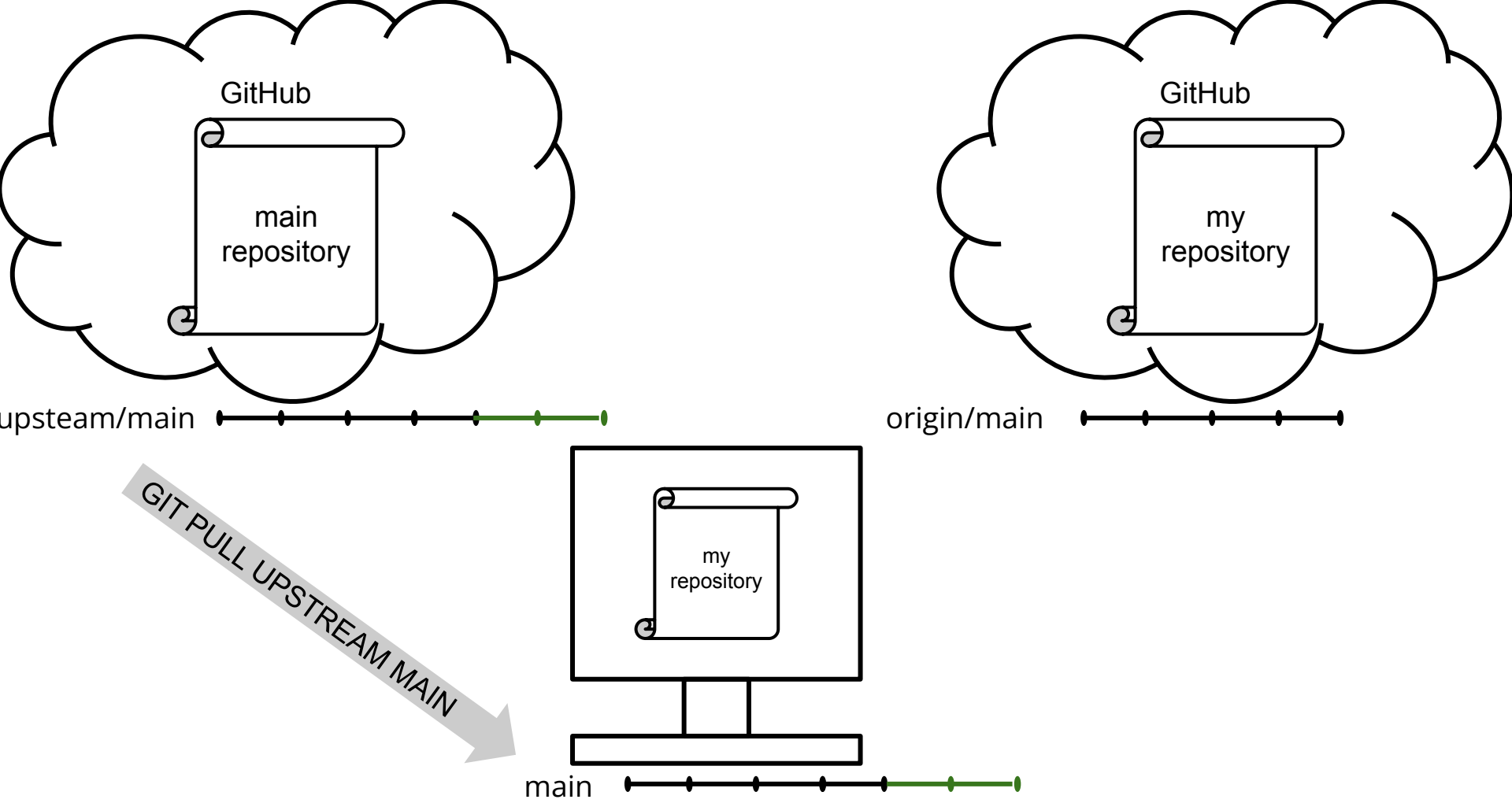
Keeping your fork updated

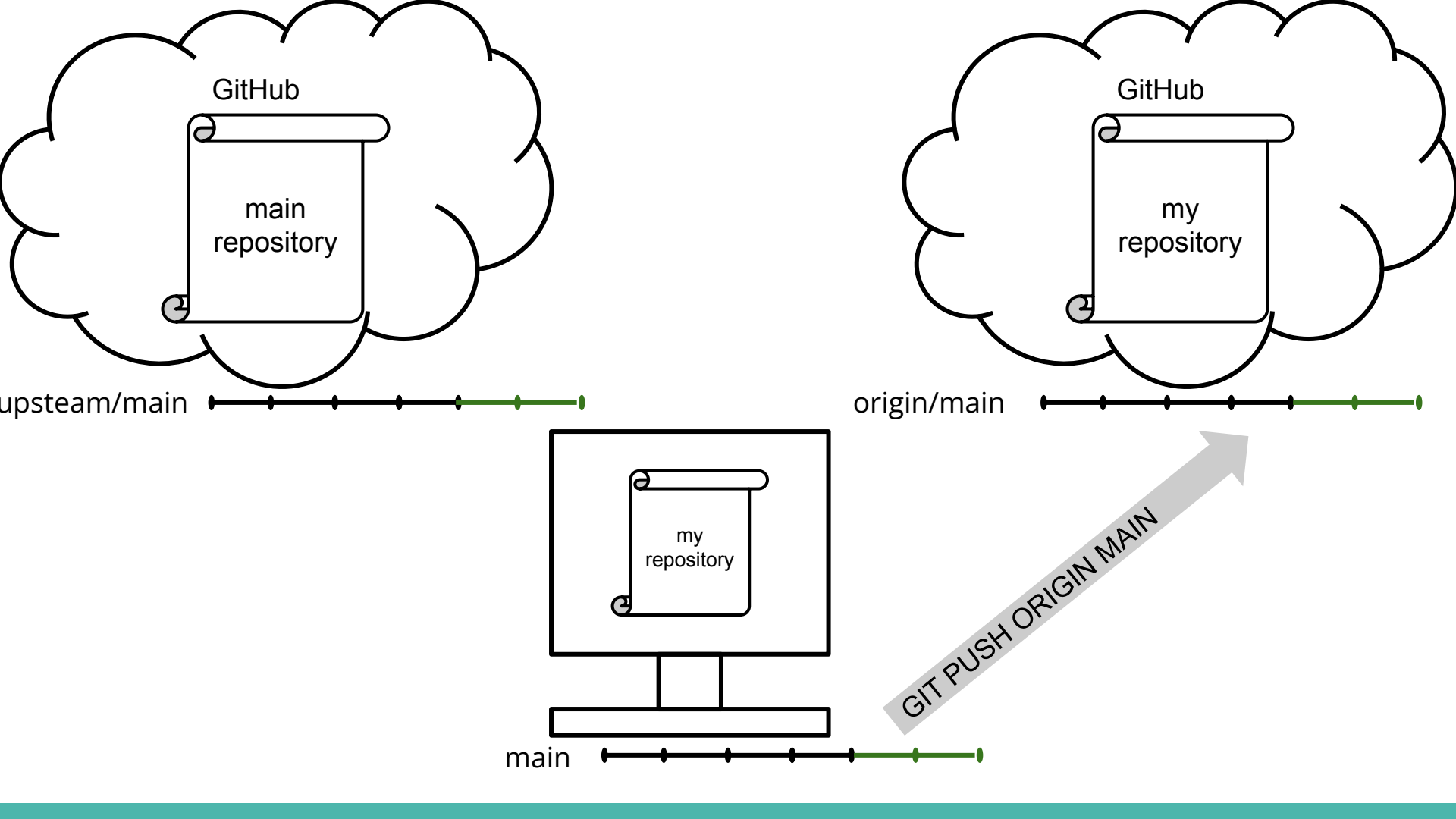

GitHub
main
repository
upsteam/main


GitHub
my
repository
origin/main


my
repository
main


GitHub
main
repository
upsteam/main
GitHub
my
repository
origin/main
my
repository
main

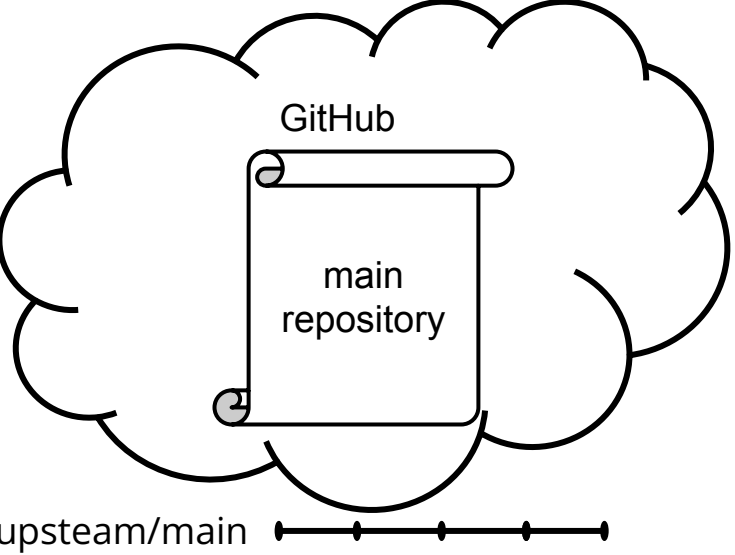

GitHub
main
repository
upsteam/main
GitHub
my
repository
origin/main
GIT PULL UPSTREAM MAIN
my
repository
main

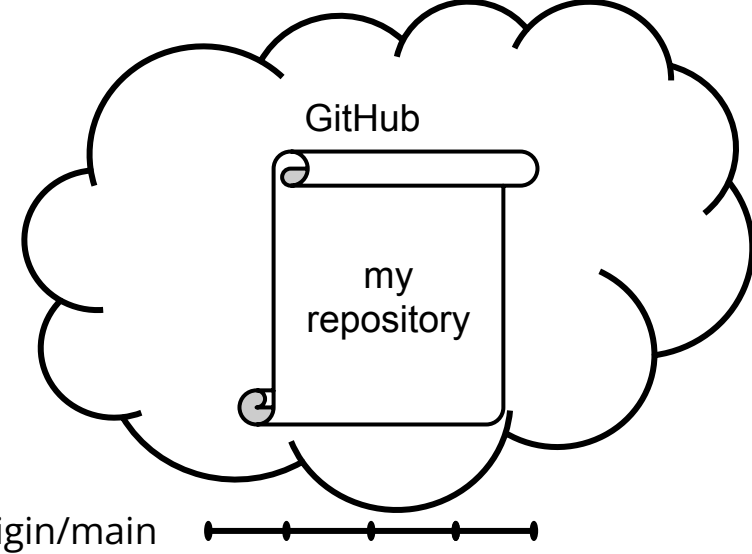

GitHub
main
repository
upsteam/main
GitHub
my
repository
origin/main
my
repository
main
GIT PUSH ORIGIN MAIN

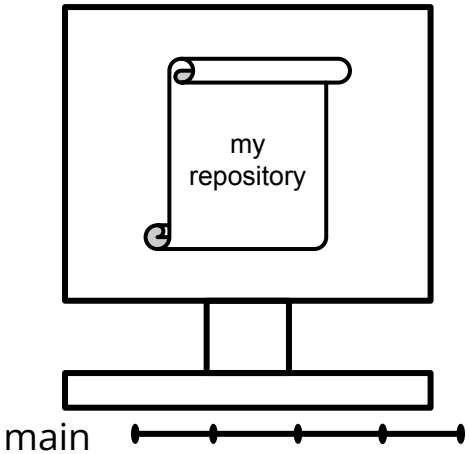
Best Practices

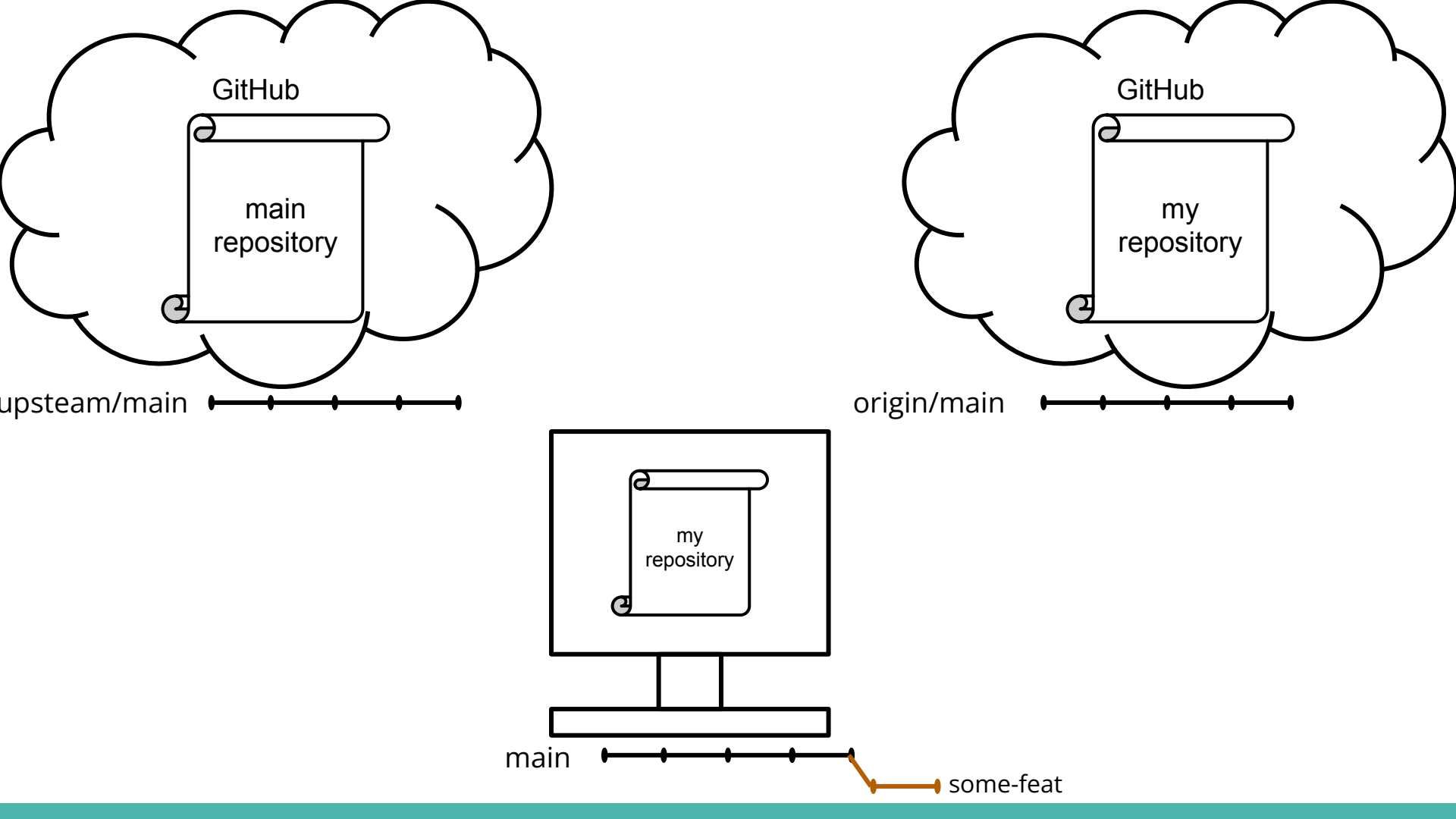
If you **never commit anything to your main branch**, keeping your main branch in sync with the main repository's is easy!

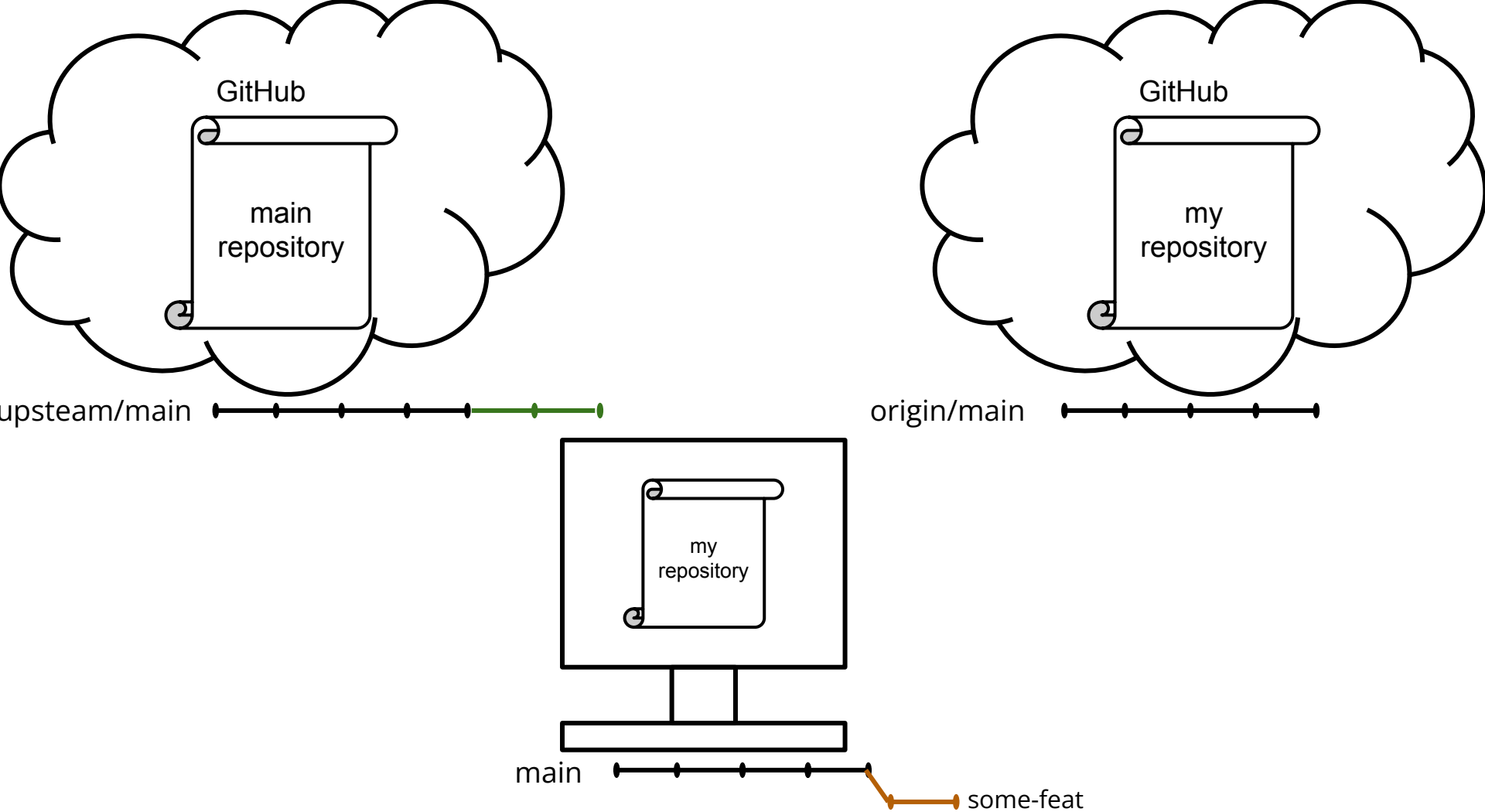
As a rule, always create a new branch when developing - **never commit directly to the main branch**

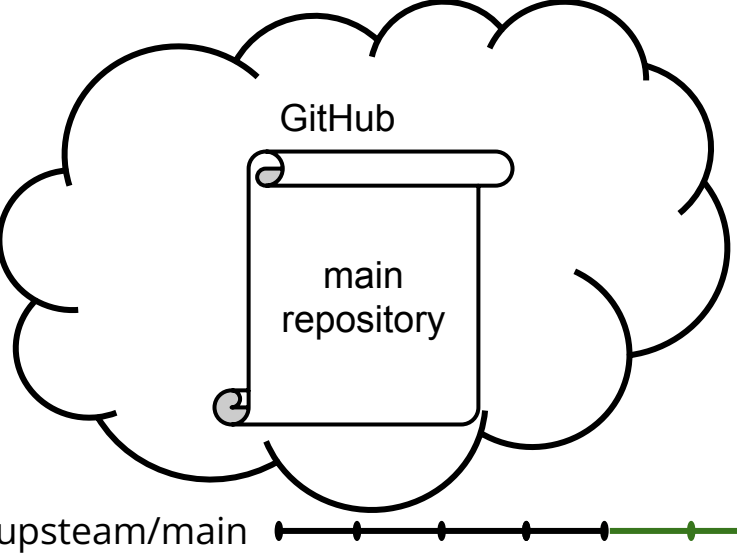

GitHub
main
repository
upsteam/main

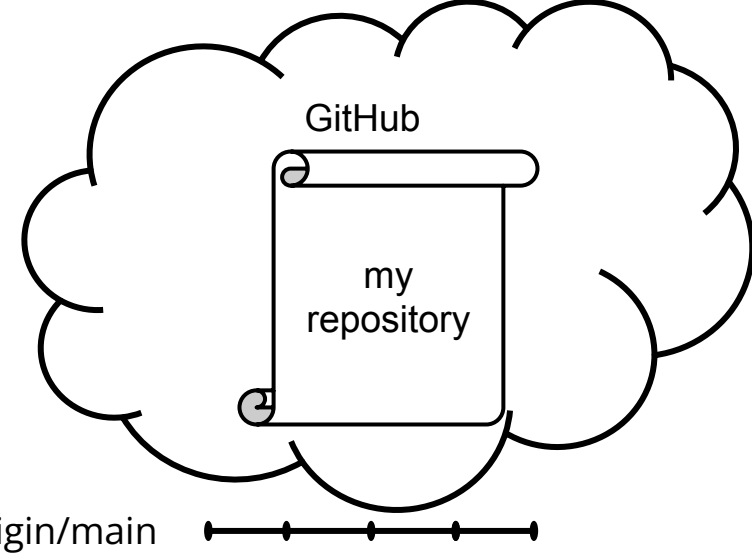

GitHub
my
repository
origin/main


my
repository
main

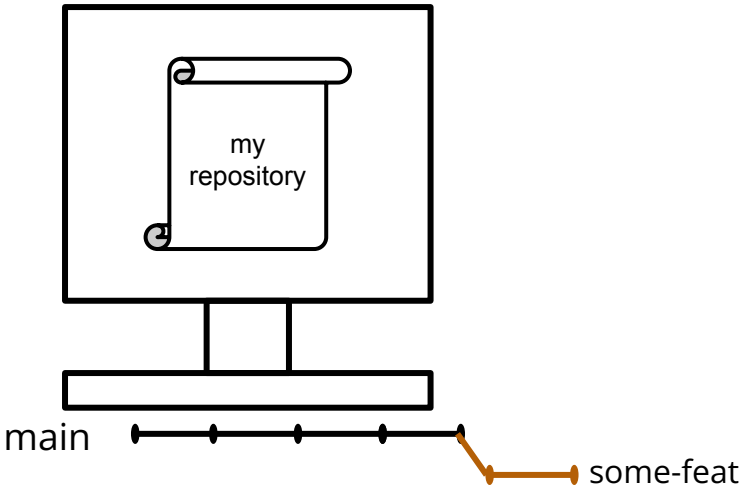

GitHub
main
repository
upsteam/main
GitHub
my
repository
origin/main
my
repository
main
some-feat

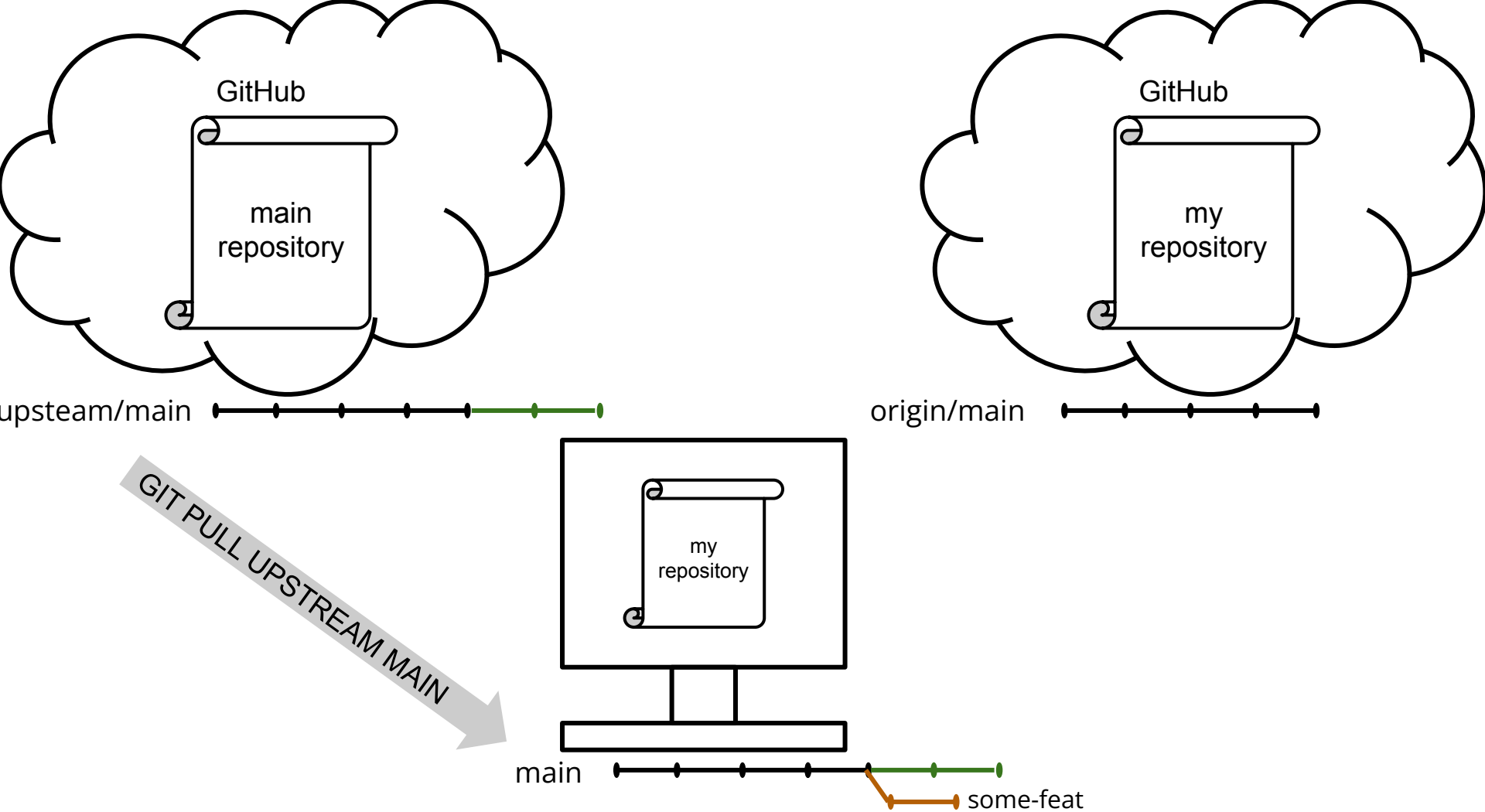

GitHub
main
repository
upsteam/main
GitHub
my
repository
origin/main
my
repository
main
some-feat

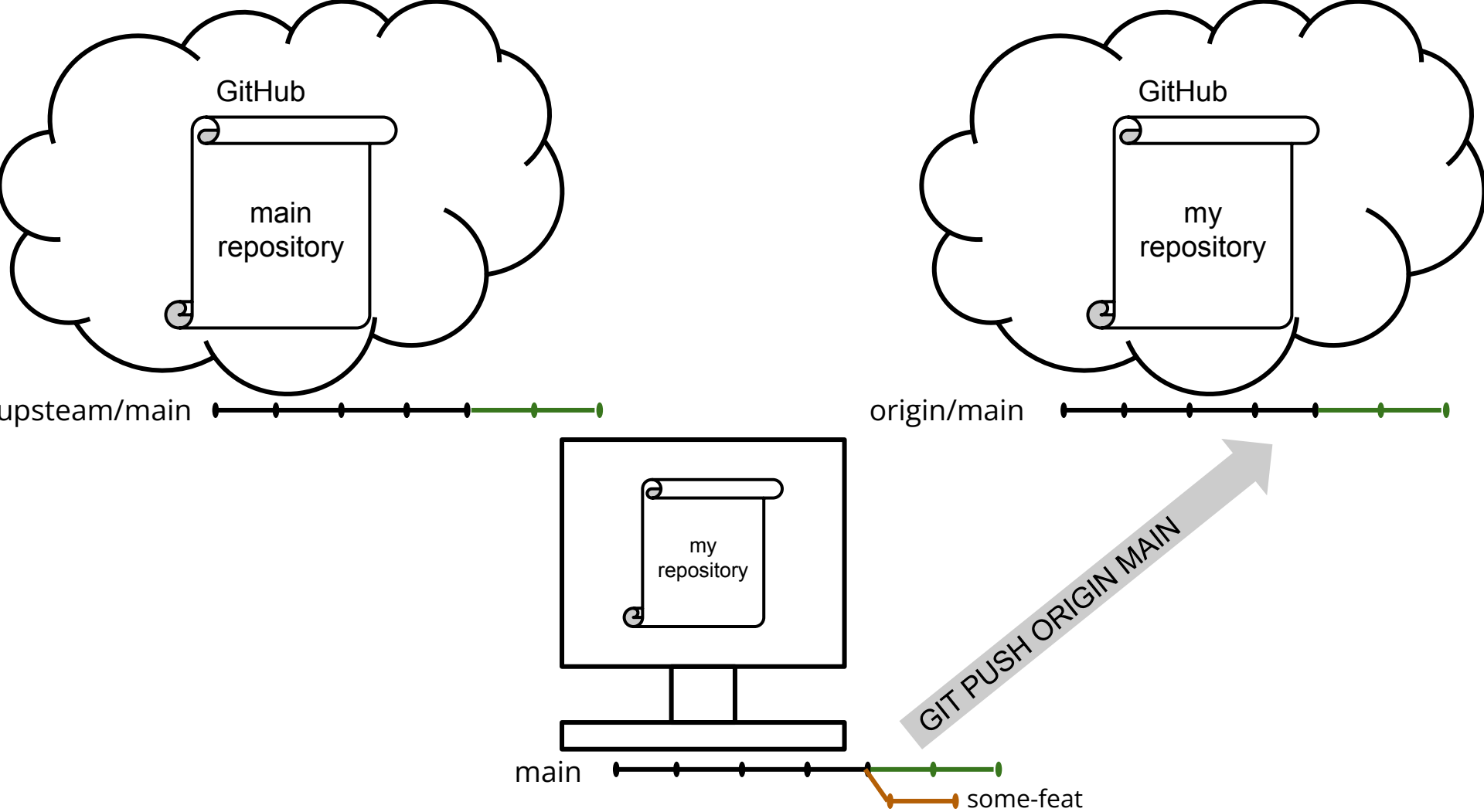


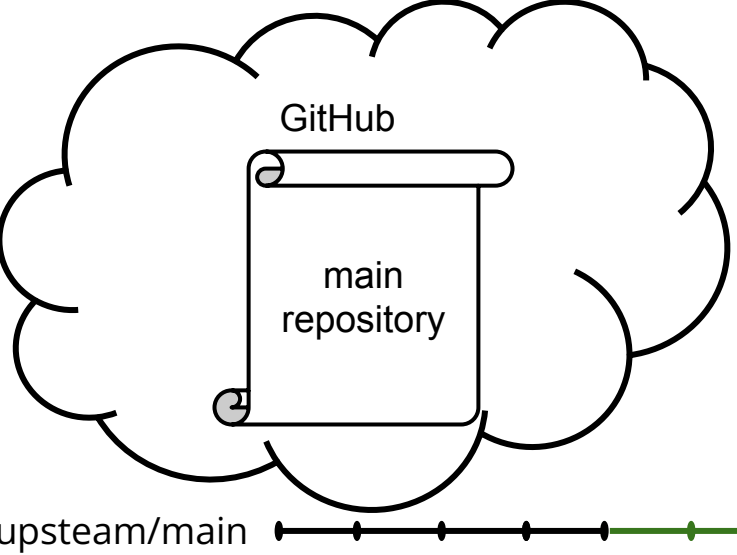


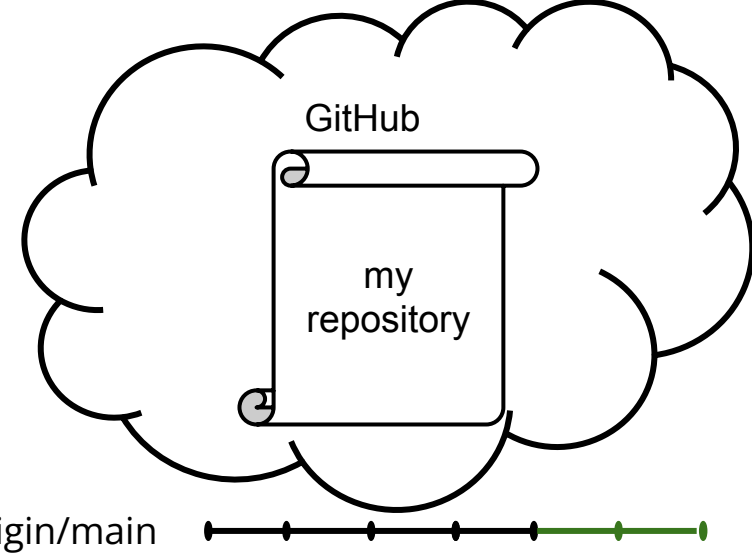
Go back to the main branch



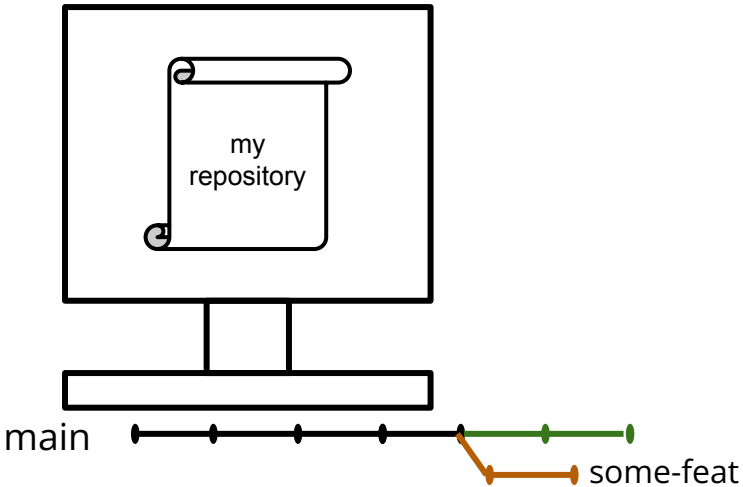

GitHub
main
repository
GitHub
my
repository
upsteam/main
origin/main
GIT PULL UPSTREAM MAIN
my
repository
main
some-feat

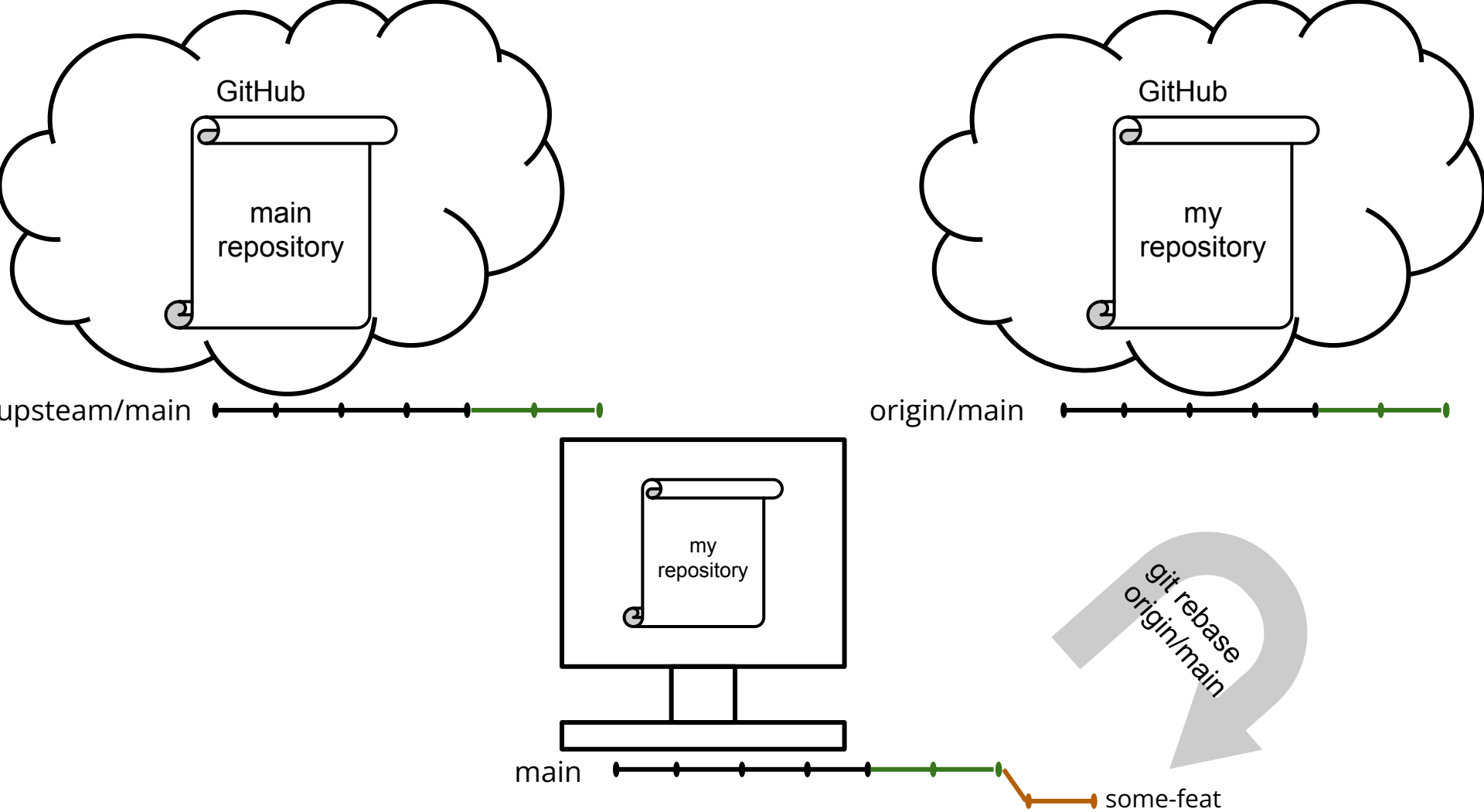

GitHub
main
repository
upsteam/main
GitHub
my
repository
origin/main
my
repository
GIT PUSH ORIGIN MAIN
main
some-feat





Go back to the some-feat branch

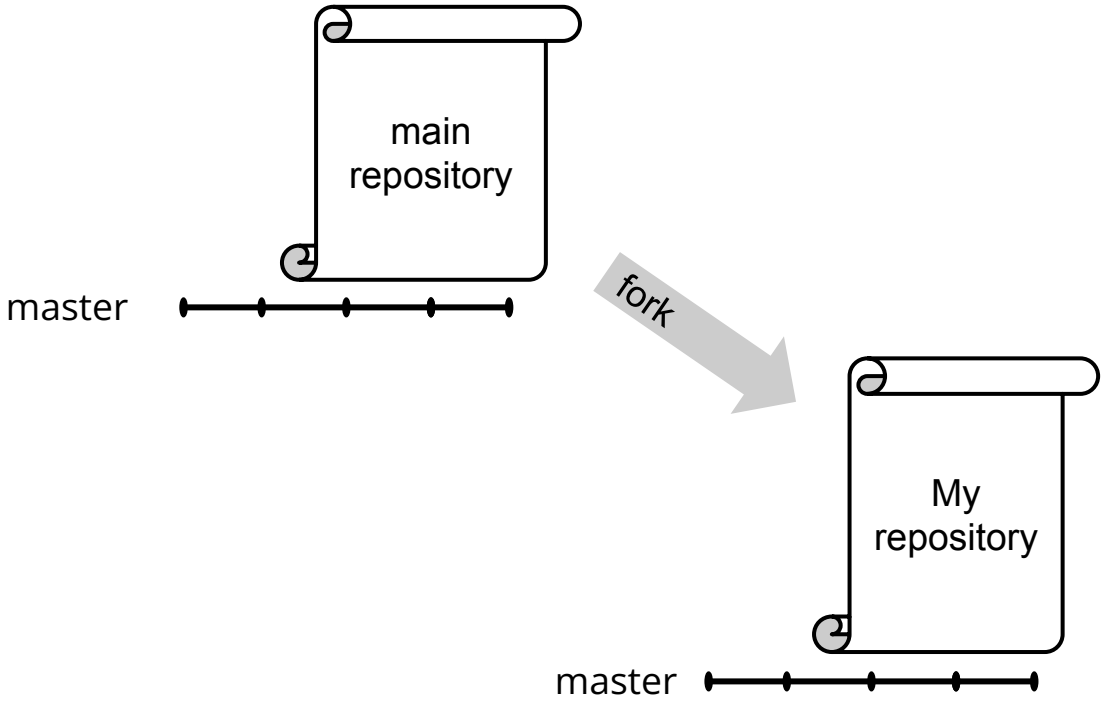


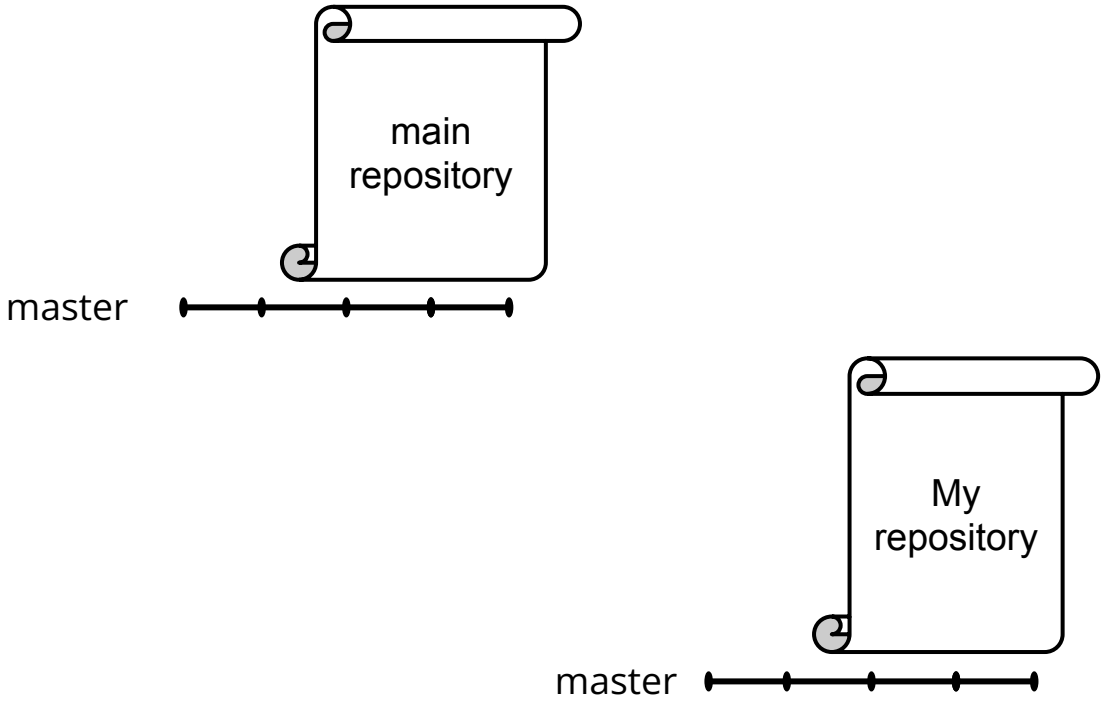

GitHub
main
repository
upsteam/main
GitHub
my
repository
origin/main
my
repository
git rebase
origin/main
main
some-feat

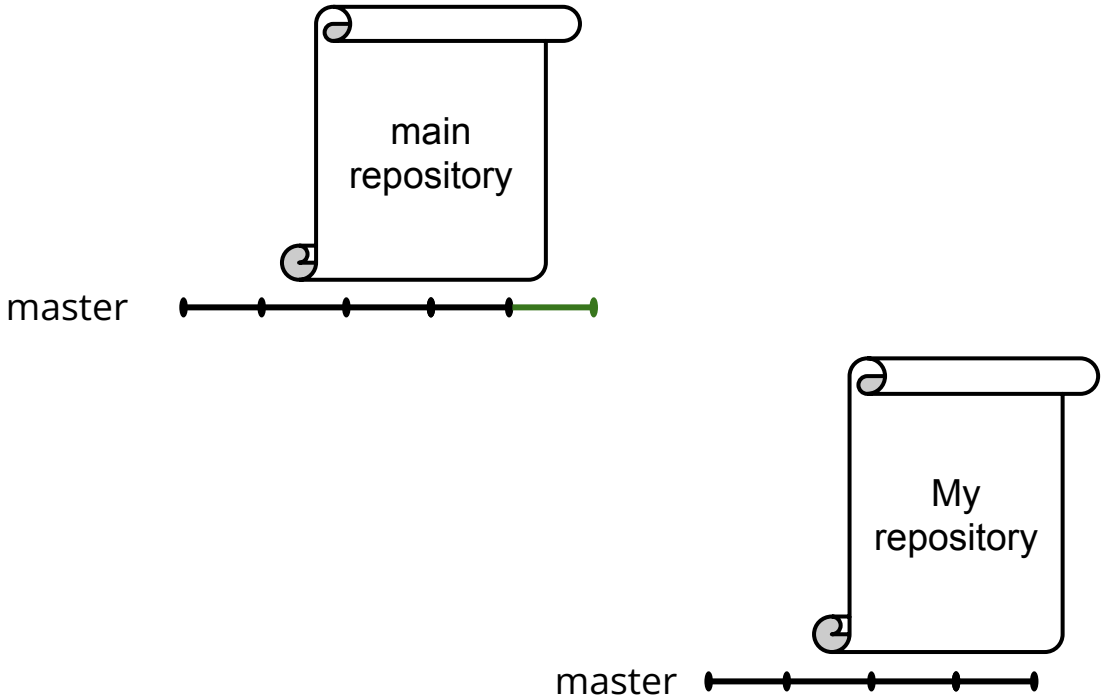
EXTRA

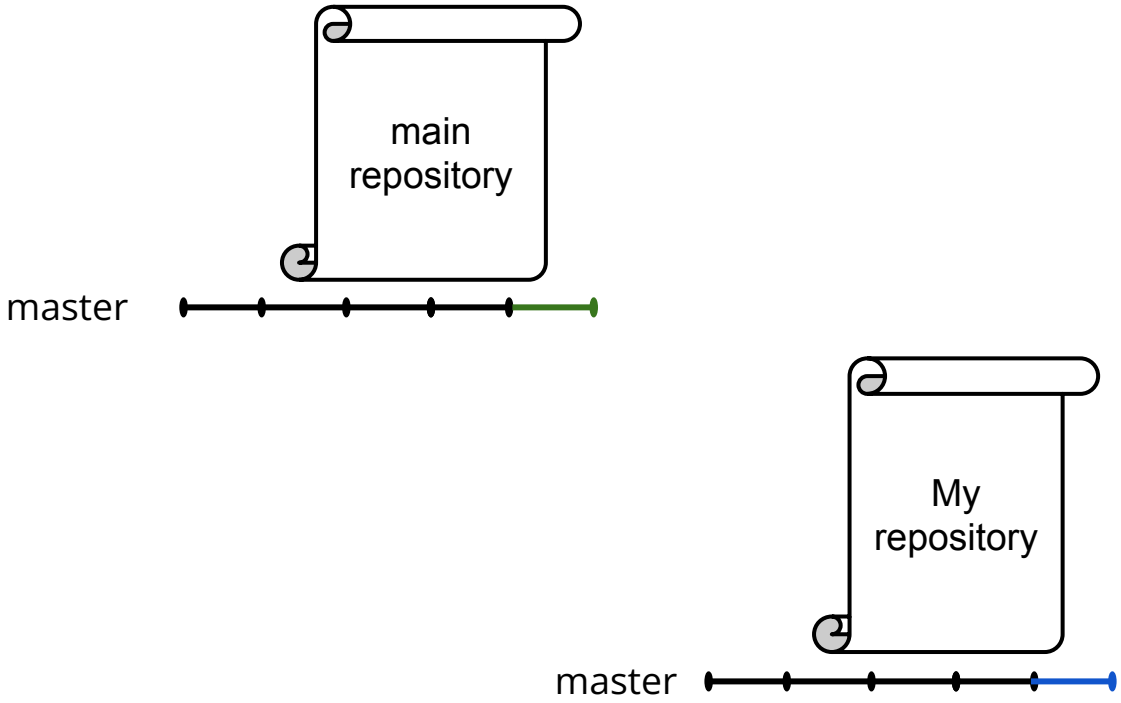
EXTRA

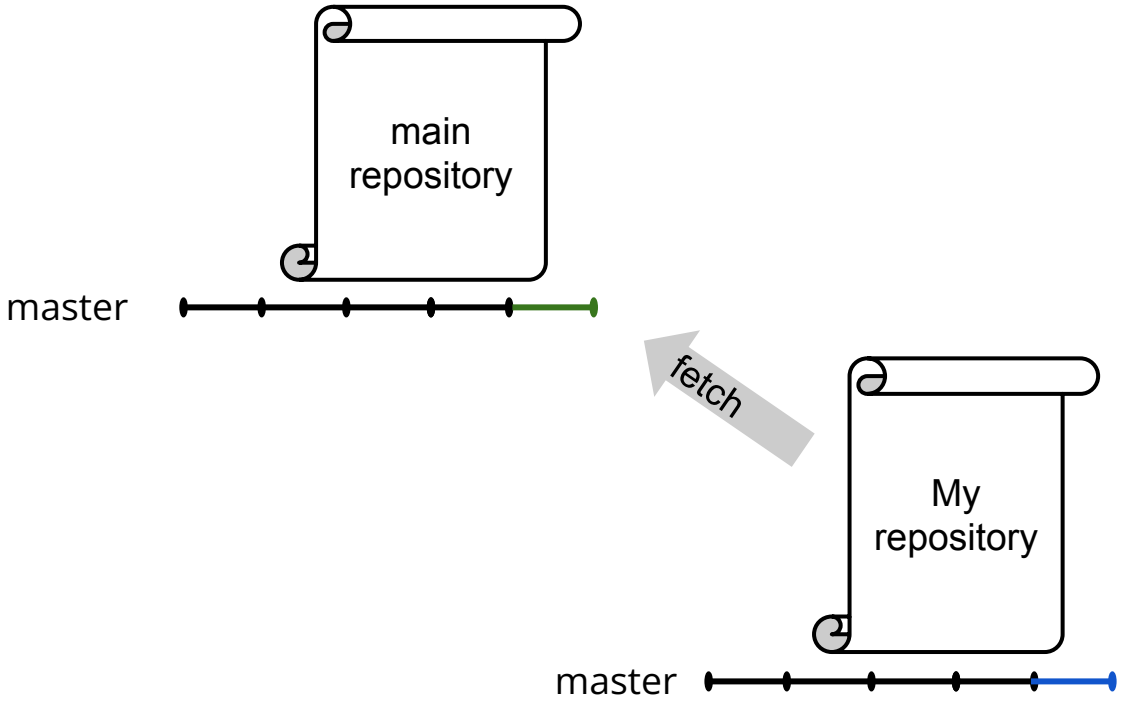
This is trivial when the **base** of one branch matches the **head** of the other.

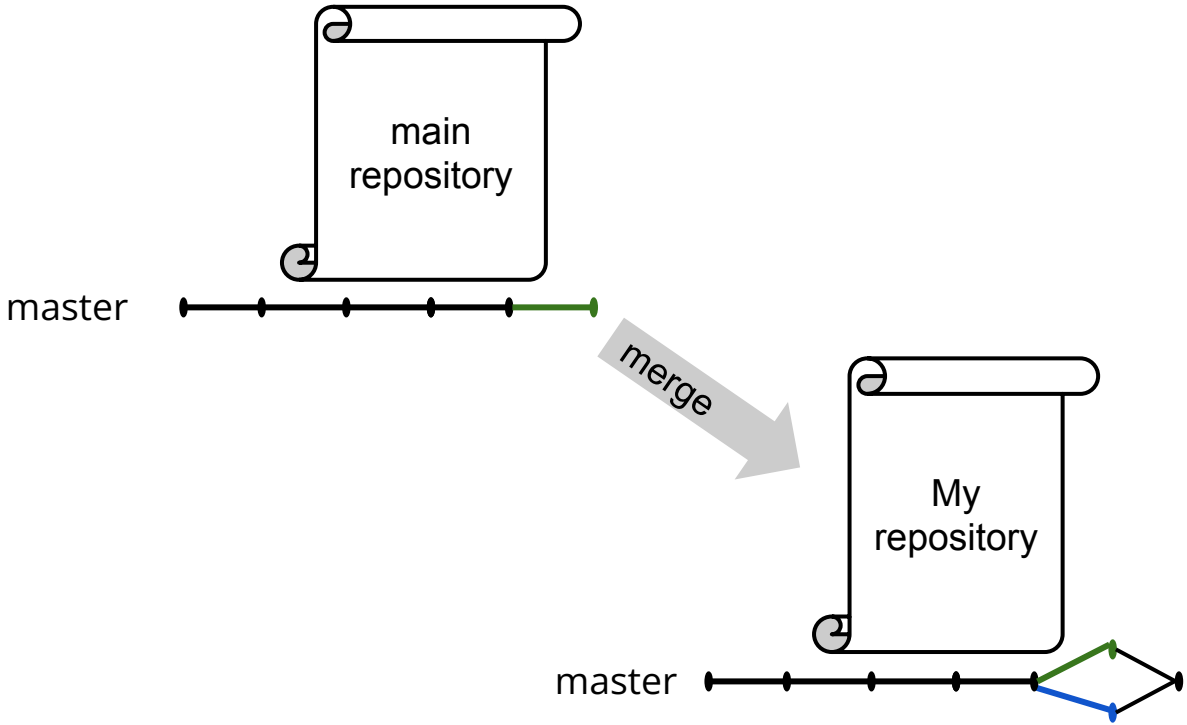

main
repository
master
fork
My
repository
master

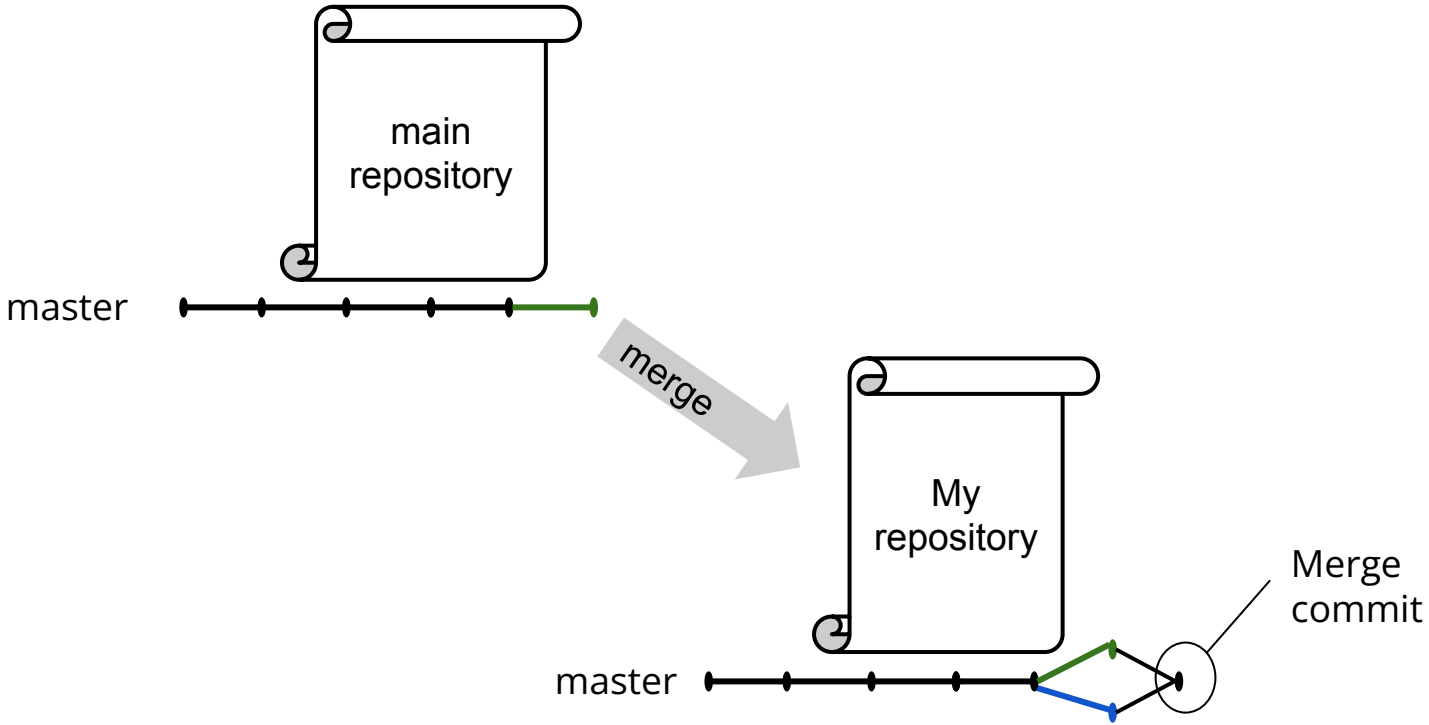

main
repository
master
My
repository
master


main
repository
master
My
repository
master


main
repository
master
My
repository
master

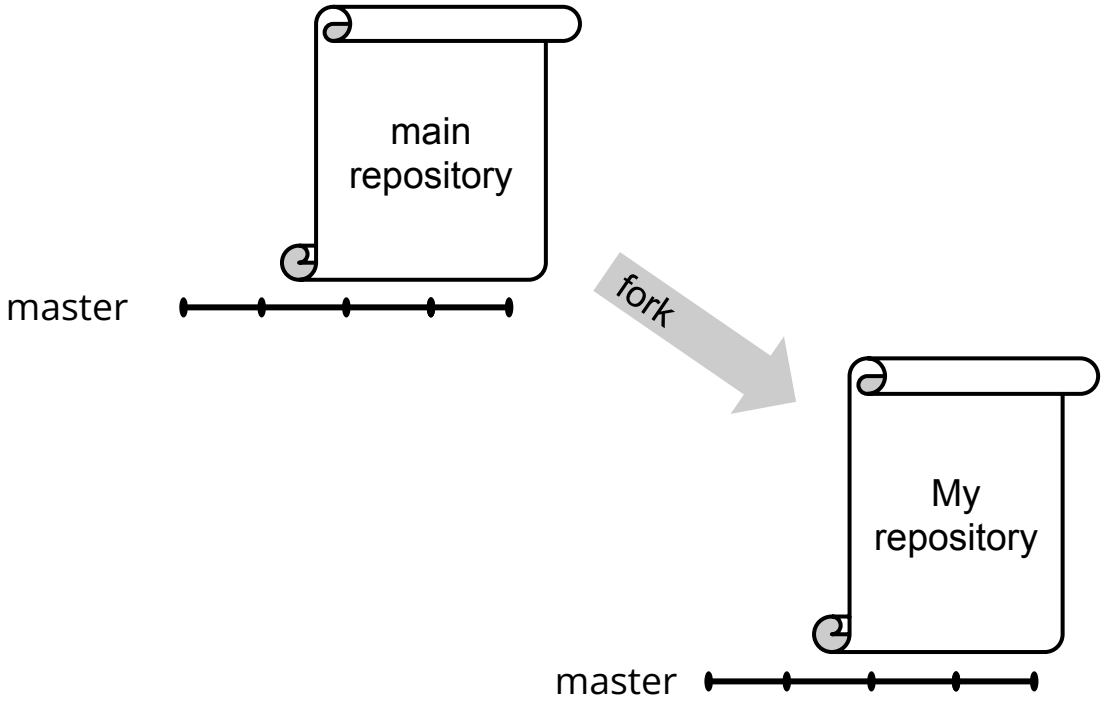

main
repository
master
fetch
My
repository
master

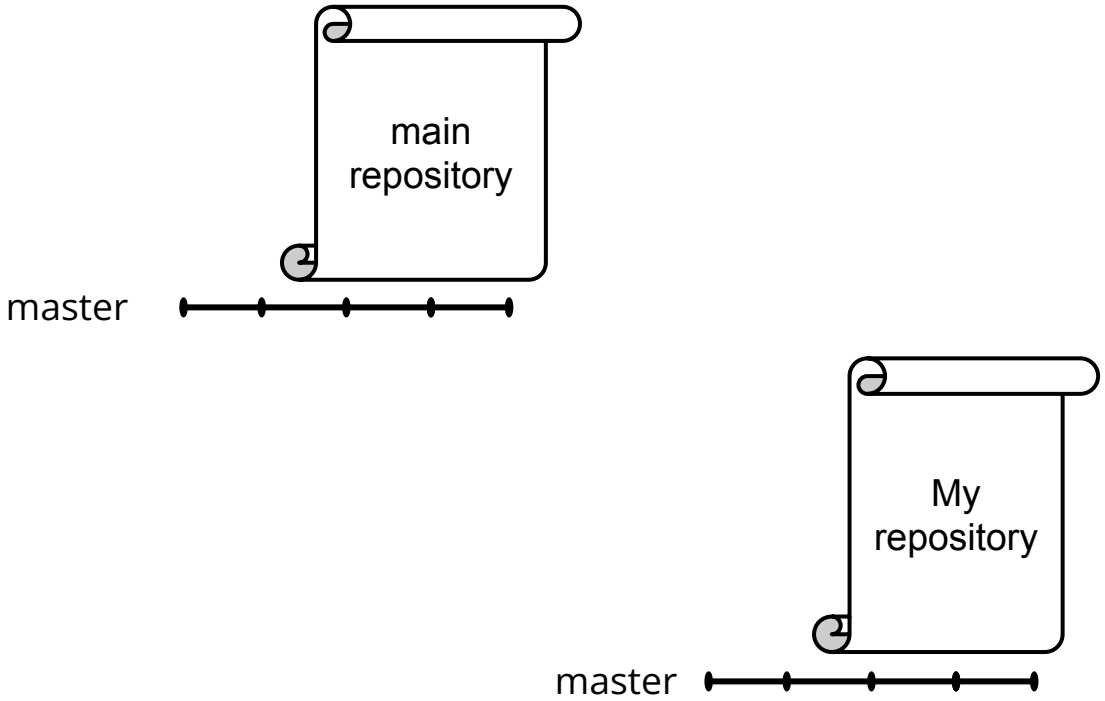

main
repository
master
merge
My
repository
master

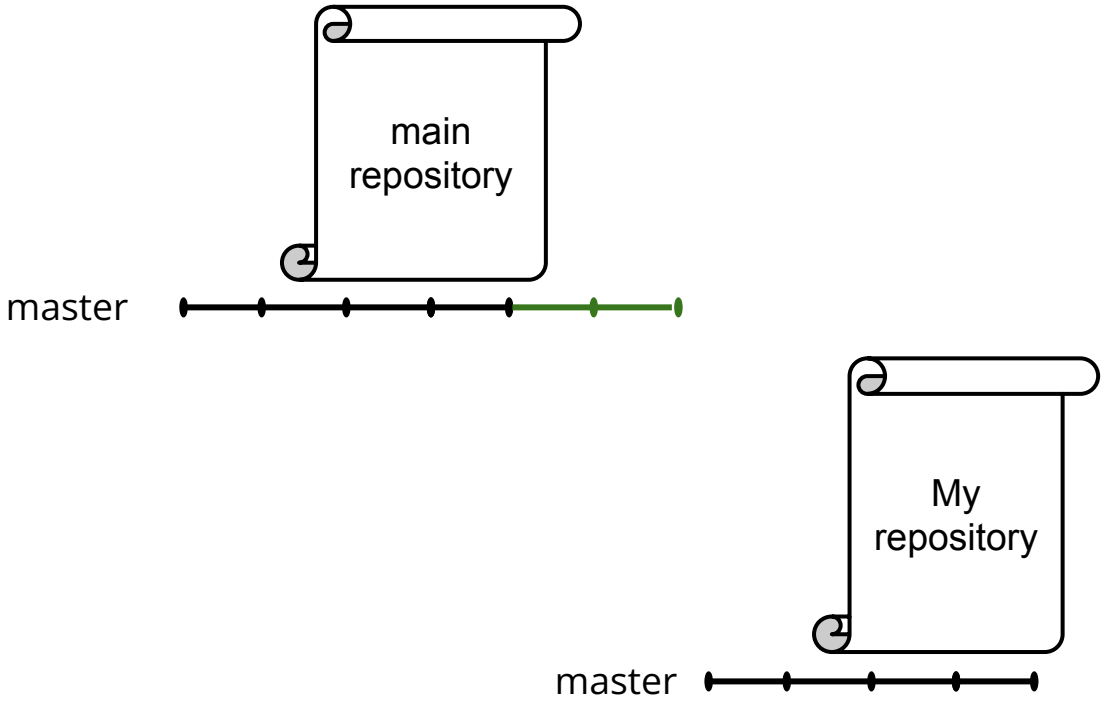

main
repository
master
merge
My
repository
Merge
commit
master

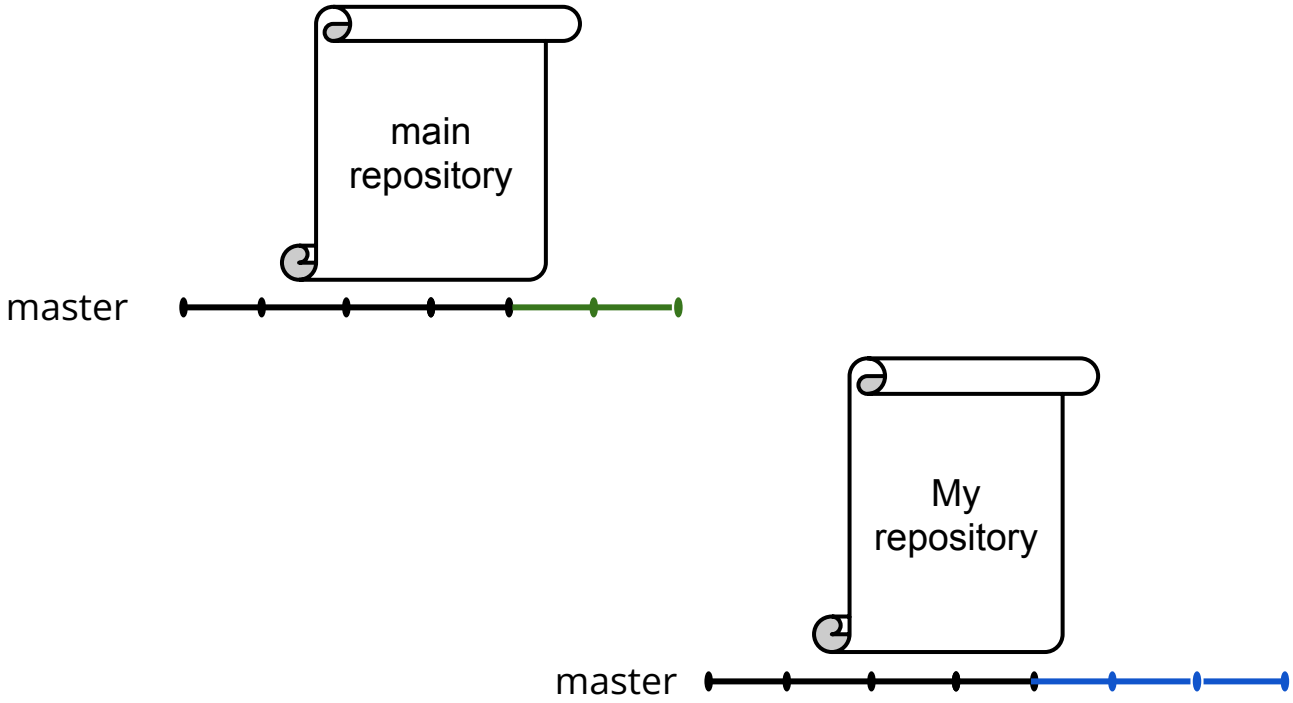
EXTRA

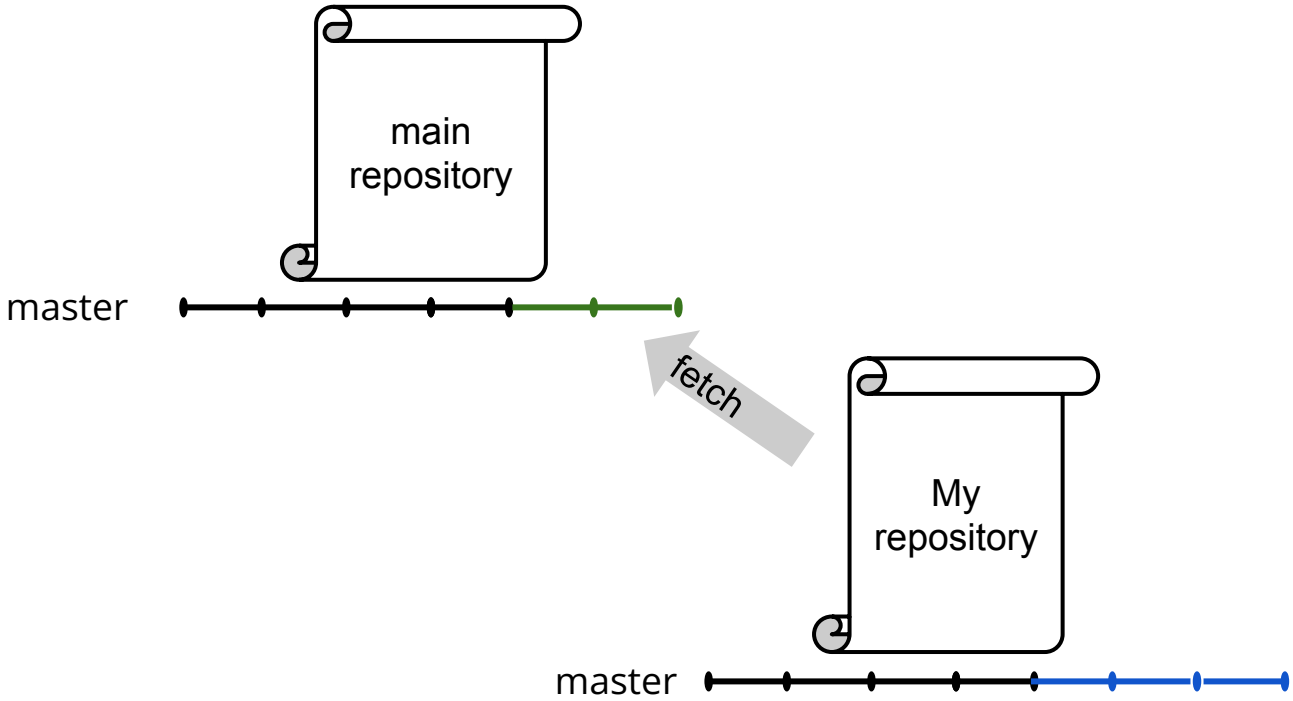
- Having merge commits and diamond shapes in the version history is confusing
- But it preserves both versions exactly as they are so it’s handy for public branches that others depend on (they won’t get conflicts)
- Commits should be logical steps in the creation of a code base. A merge commit on your local development branch for the time that you decided to keep it in sync does not align with that philosophy.
- Try rebasing instead

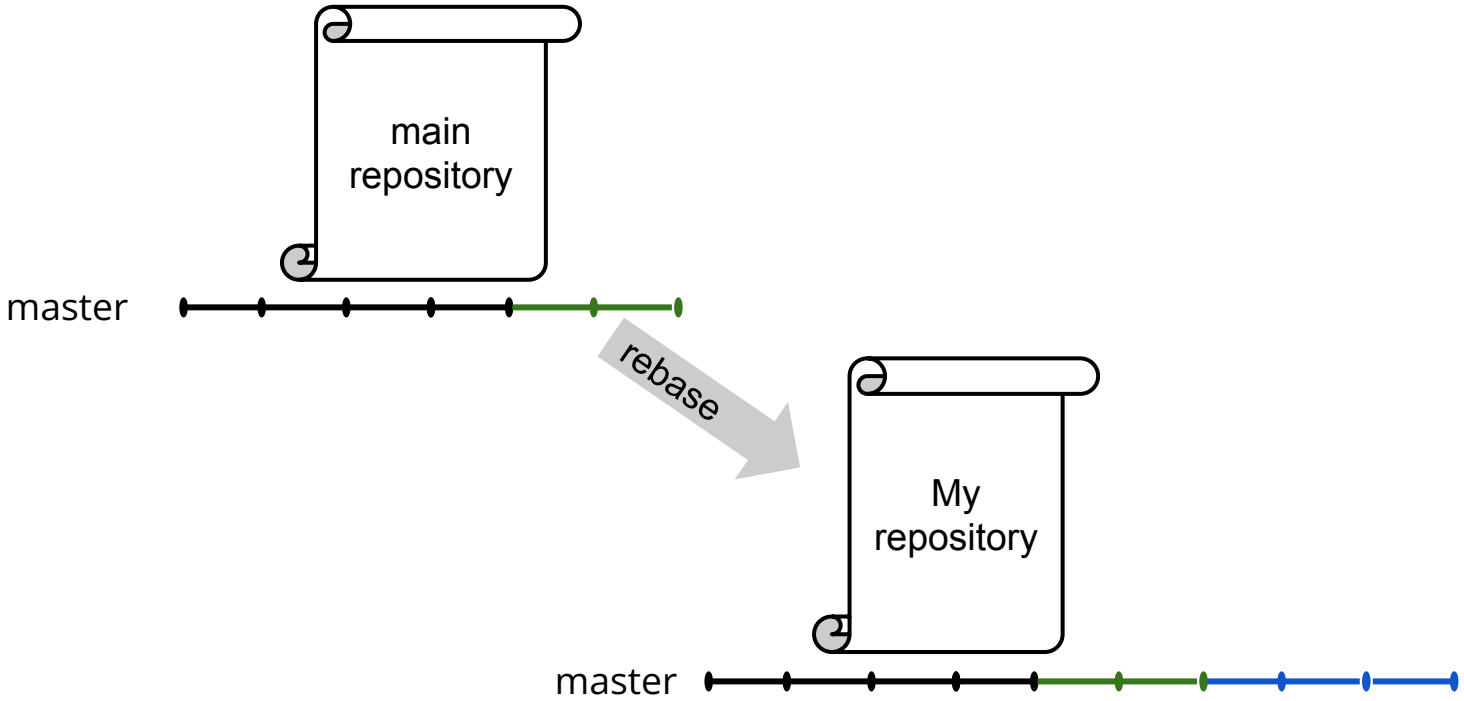

main
repository
master
fork
My
repository
master


main
repository
master
My
repository
master


main
repository
master
My
repository
master

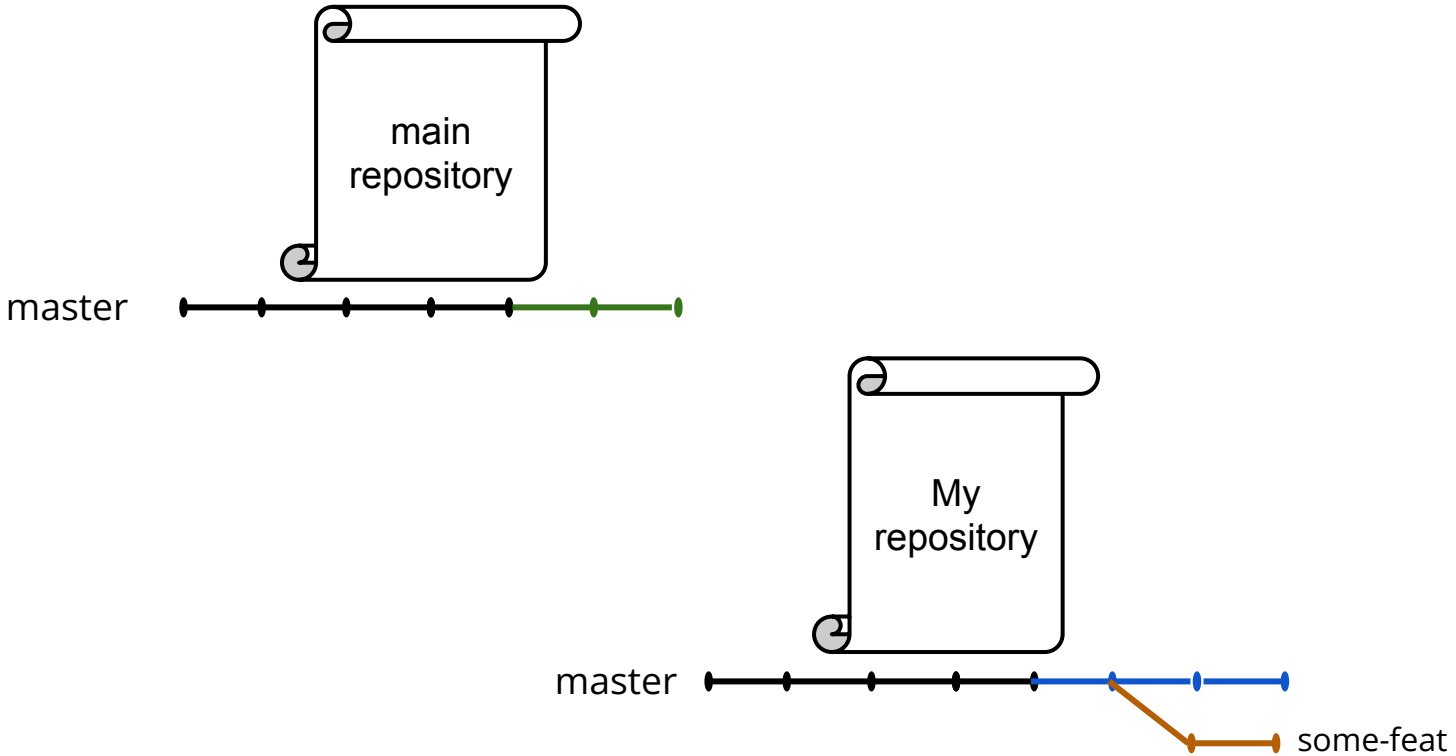

main
repository
master
My
repository
master

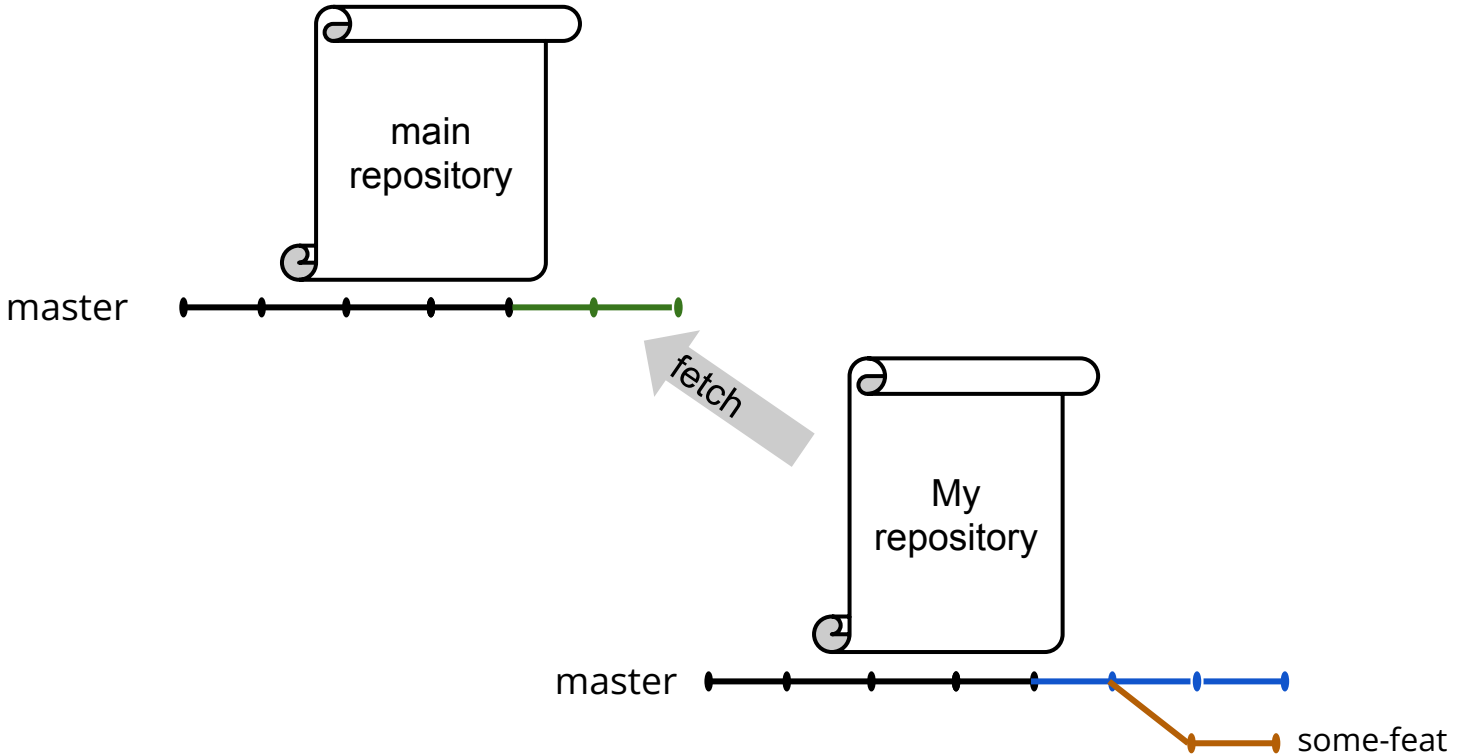

main
repository
master
fetch
My
repository
master

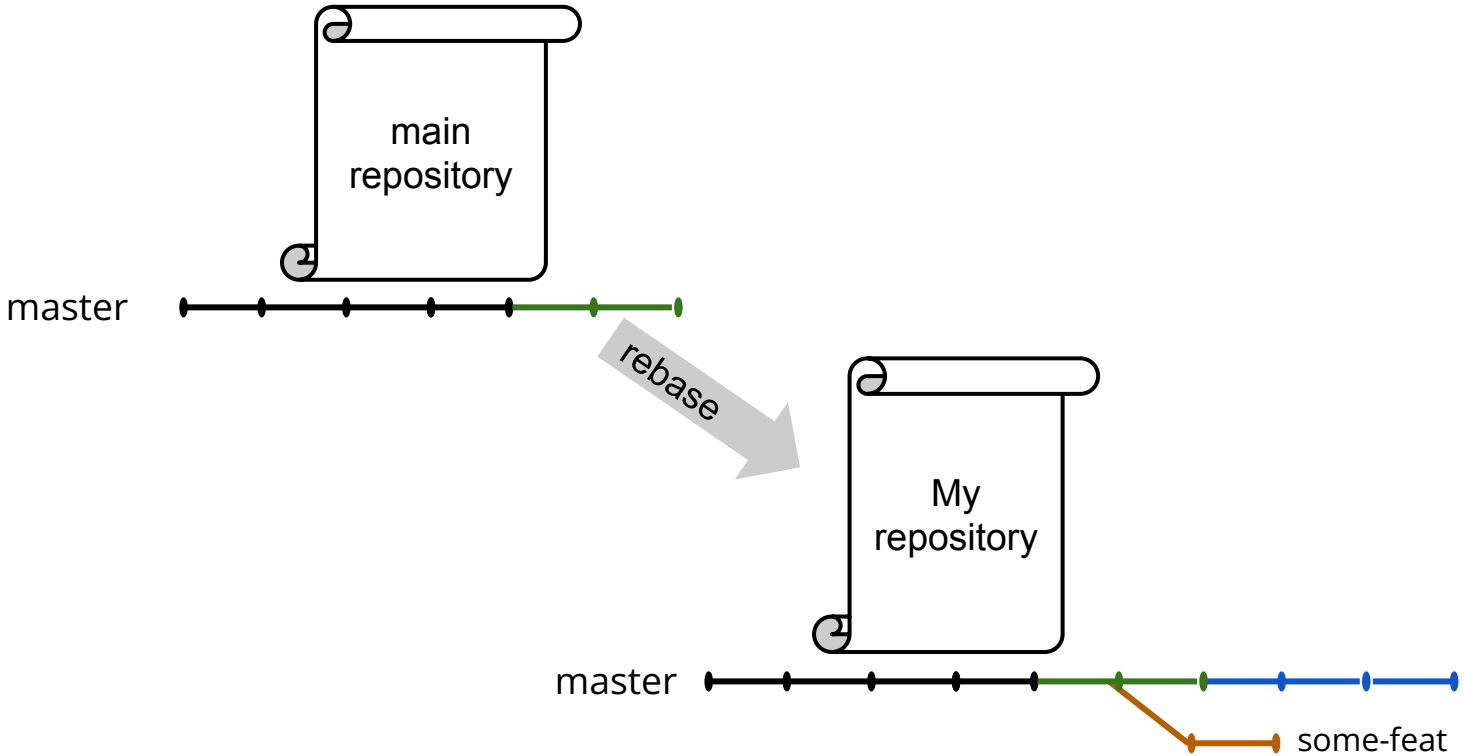

main
repository
master
rebase
My
repository
master

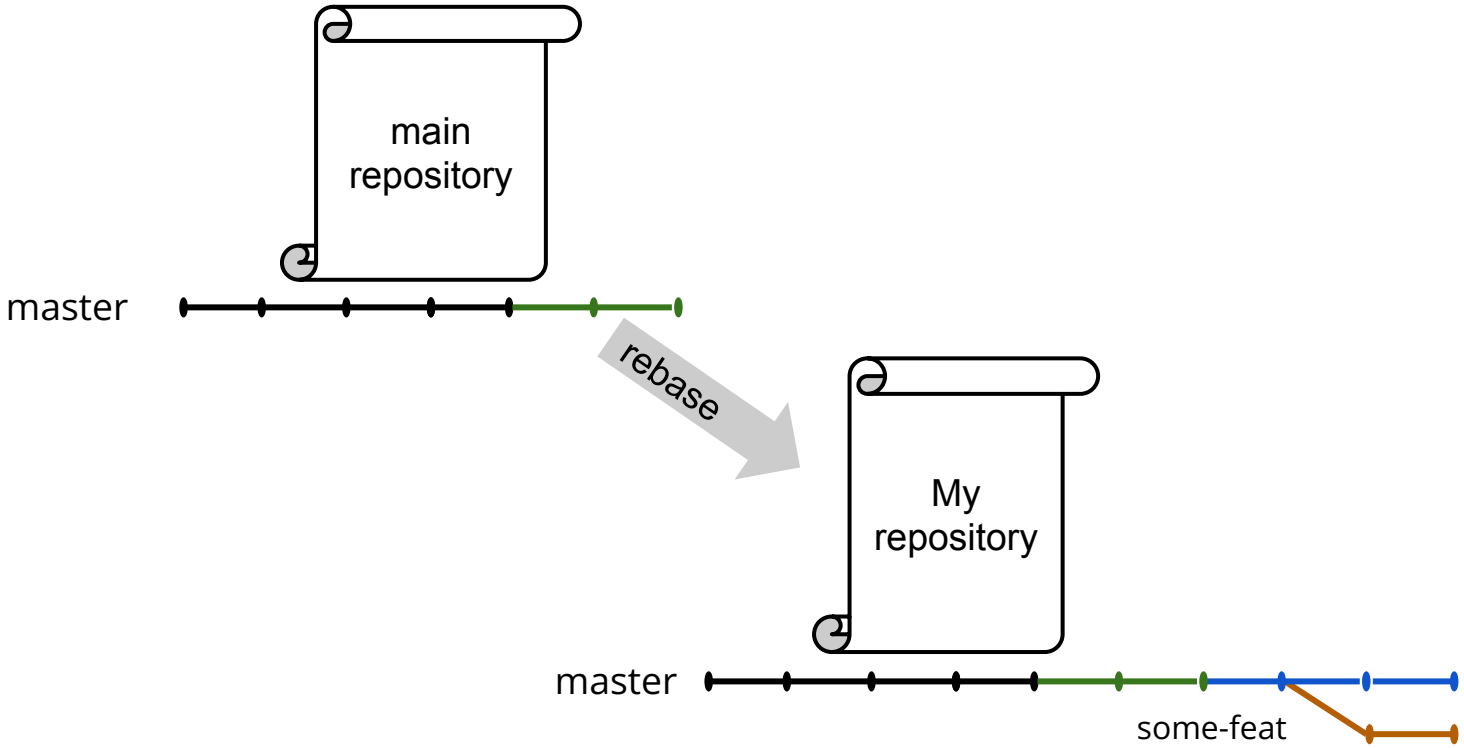
EXTRA

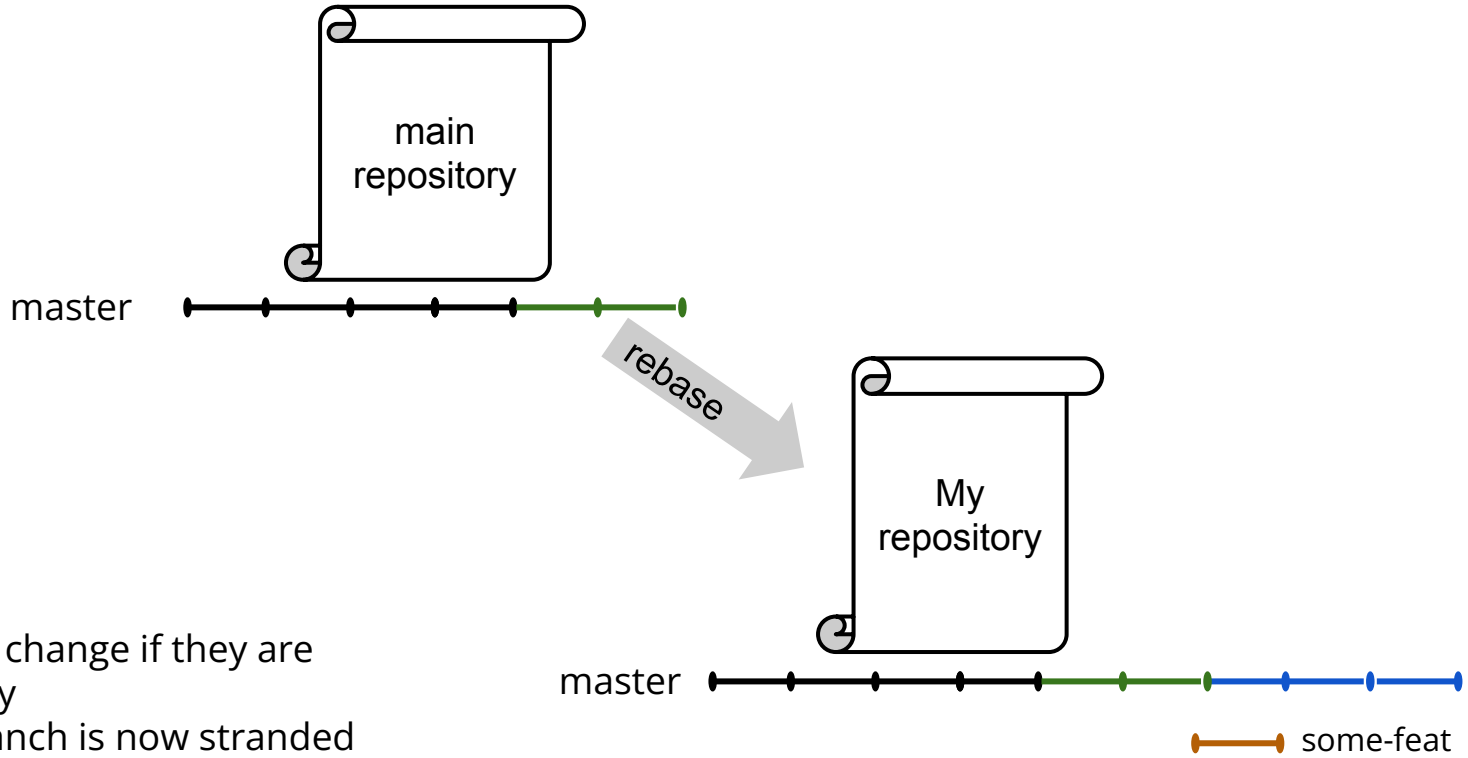
What happens to other branches?


main
repository
master
My
repository
master
some-feat


main
repository
master
fetch
My
repository
master
some-feat


main
repository
master
rebase
My
repository
master
some-feat


main
repository
master
rebase
My
repository
master
some-feat



commit IDs (shas) change if they are ordered differently
The some-feat branch is now stranded