

ADACS ASTRO HACK WEEK 2020

INTRO TO VERSION CONTROL

WHY USE VERSION CONTROL?

- ▶ Back up your project!

WHY USE VERSION CONTROL?

- ▶ Back up your project!
- ▶ Keep track of changes that have been made

WHY USE VERSION CONTROL?

- ▶ Back up your project!
- ▶ Keep track of changes that have been made
- ▶ Tag stable versions, versions used in particular analyses
 - ▶ good for reproducibility

WHY USE VERSION CONTROL?

- ▶ Back up your project!
- ▶ Keep track of changes that have been made
- ▶ Tag stable versions, versions used in particular analyses
 - ▶ good for reproducibility
- ▶ Code distribution

WHY USE VERSION CONTROL?

- ▶ Back up your project!
- ▶ Keep track of changes that have been made
- ▶ Tag stable versions, versions used in particular analyses
 - ▶ good for reproducibility
- ▶ Code distribution
- ▶ Easy collaboration
 - ▶ Great for things like writing papers

AVAILABLE TOOLS

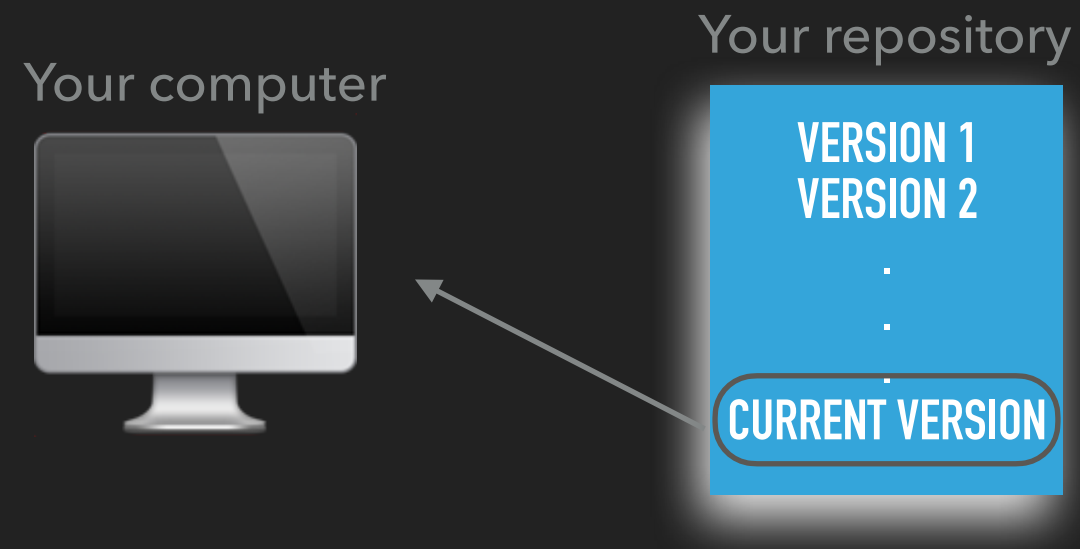
- ▶ **Git**

- ▶ Most common now

- ▶ **Mercurial**

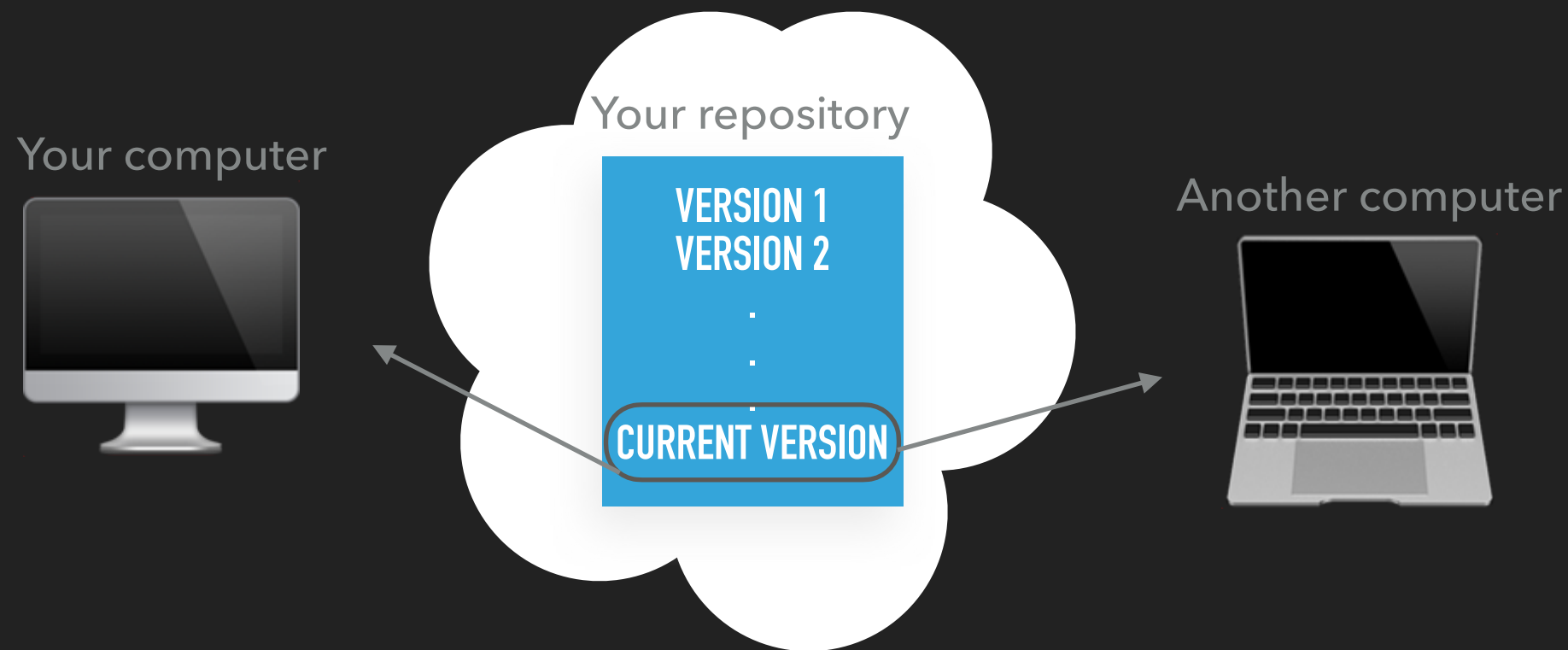
- ▶ **SVN**

REPOSITORY



Repository can be: **Local** (on your own computer)

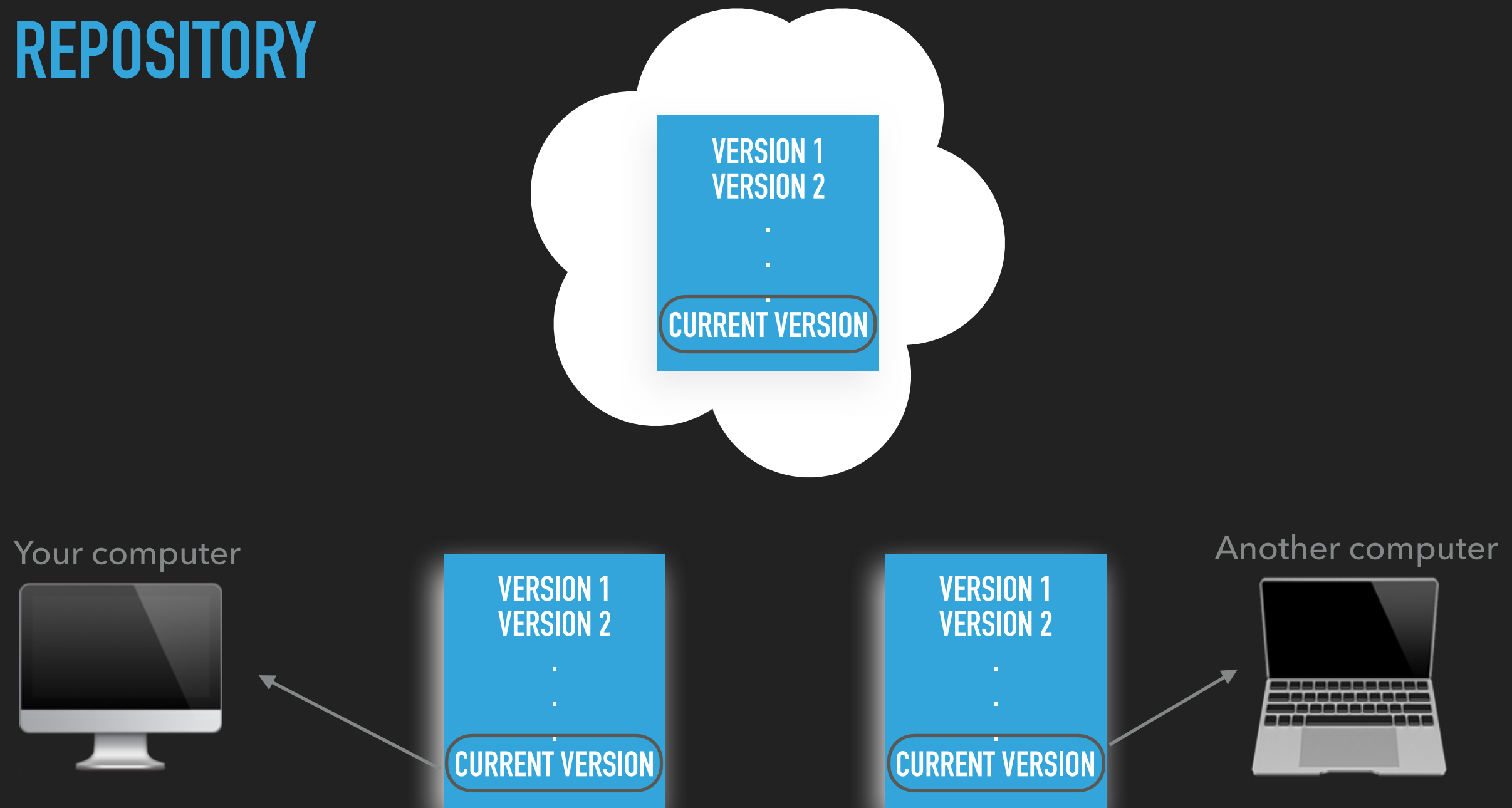
REPOSITORY



Repository can be: **Centralized** (Stored remotely, you only have the current version on local computer)

(Example: SVN)

REPOSITORY



Repository can be: **Distributed** (Repository on every computer)

This is how GitHub works

MAKING A GIT REPOSITORY

```
$ cd <project directory>  
$ git init
```

Think carefully about what goes in each repository

- Generally one repository per project
- (i.e. don't make repository for your whole desktop!)
- Don't nest repositories!

HOW DO I KNOW IT WORKED?

- ▶ Directories under version control will have a **.git** directory

```
$ ls -a
```

- ▶ The **.git** directory has all of the info about change history of your project
 - ▶ Generally a good idea to **not** mess around in that directory yourself

- ▶ Can also check with:

```
$ git status
```

```
On branch master
```

```
No commits yet
```

```
nothing to commit (create/copy files and use "git add" to track)
```

DO IT YOURSELF: MAKE YOUR FIRST REPOSITORY

```
$ mkdir my_first_repository
```

```
$ cd my_first_repository
```

```
$ git init
```

```
$ ls -a
```

```
$ git status
```

DO IT YOURSELF: MAKE YOUR FIRST REPOSITORY

Make a file in your directory:

```
$ echo "this is the first line of text" > my_first_file.txt
```

(can also use your favorite text editor)

```
$ git status
```

What's the output now?

ADDING THINGS TO YOUR REPOSITORY

```
$ git status
```

```
On branch master
```

```
No commits yet
```

```
Untracked files:
```

```
(use "git add <file>..." to include in what will be committed)
```

```
my_fist_file.txt
```

```
nothing added to commit but untracked files present (use "git add" to track)
```

Need to specifically tell git which files to track

```
$ git add <filename>
```

ADDING THINGS TO YOUR REPOSITORY

`git add` stages your commit

On branch master

No commits yet

Changes to be committed:

(use "git rm --cached <file>..." to unstage)

new file: my_fist_file.txt

I.e. tells git that you're ready to add this version of your file to the repository

NOW IT'S TIME TO COMMIT!

```
$ git commit -m "my first commit"
```

“-m” flag is followed by a description of changes made in this commit

(if you don't use “-m” you'll be prompted to add a commit message)

A version of your project now lives in the repository!

DO IT YOURSELF: STAGE AND COMMIT

```
$ git add my_first_file.txt
```

```
$ git status
```

What's the output now?

```
$ git commit -m "my first commit"
```

RECAP AND TIPS

- ▶ Edit your code/paper/etc
- ▶ Stage your commit with git add
 - ▶ `$ git add <filename>`
 - ▶ `$ git add -u` will stage all of the files currently being tracked
 - ▶ Avoid using `$ git add *!!`
- ▶ Commit your changes



THINGS TO NOT ADD TO YOUR REPOSITORY

- ▶ ***LARGE FILES***
- ▶ Raw data
- ▶ Files that are automatically generated

Use a `.gitignore` file

Example file:

```
a_specific_file.txt  
*.dat (e.g. all data products)  
an_entire_directory/
```

SOME COMMON ISSUES AND HOW TO FIX THEM

EXAMPLE 1: I EDITED A FILE BETWEEN STAGING AND COMMITTING!

- ▶ Every time you edit a file you need to re-stage (i.e. run `git add` again)
- ▶ Can check whether file has been modified with `git status`!

On branch master

Changes to be committed:

(use "`git reset HEAD <file>...`" to unstage)

modified: my_first_file.txt

Changes not staged for commit:

(use "`git add <file>...`" to update what will be committed)

(use "`git checkout -- <file>...`" to discard changes in working directory)

modified: my_first_file.txt

EXAMPLE 2: I ADDED SOMETHING I DIDN'T WANT TO ADD!

```
$ rm <filename>
```

EXAMPLE 2: I ADDED SOMETHING I DIDN'T WANT TO ADD!



```
$ rm <filename>
```

Not what you want!!

Does not remove the file from git

EXAMPLE 2: I ADDED SOMETHING I DIDN'T WANT TO ADD!



```
$ rm <filename>
```

Not what you want!!

Does not remove the file from git

```
$ git rm <filename>
```

Remove the file from repository

```
$ git rm --cached <filename>
```

Don't delete it, but stop tracking it

EXAMPLE 3: I CAN'T REMEMBER EXACTLY WHAT I CHANGED

```
$ git diff
```

```
diff --git a/my_first_file.txt b/my_first_file.txt
index 9f26126..a81af58 100644
--- a/my_fist_file.txt
+++ b/my_fist_file.txt
@@ -1,2 +1,3 @@
  This is the first line!
+this is the second line.
```

Tells you what changes you've made since last commit

DO IT YOURSELF: USING GIT DIFF

```
$ echo "a second line of text" >> my_first_file.txt
```

(or use your favorite text editor)

```
$ git diff
```

What's the output?

EXAMPLE 3: I WANT TO GO BACK TO AN OLD VERSION OF THE CODE

Case 1: You made some edits to a file, realize they're garbage, want to go back to most recent version in repo

```
$ git checkout <filename>
```

(Can think of it as pressing ctrl+Z a bunch of times)

EXAMPLE 3: I WANT TO GO BACK TO AN OLD VERSION OF THE CODE

Case 2: You want to go back several commits

```
$ git log
```

```
commit 947fb8e267dcd26f5bf2f2b885185a1e9eed2ed3
Author: megmillhouse <meg.millhouse@gmail.com>
Date:   Wed Feb 5 20:47:48 2020 +1100
```

another new commit

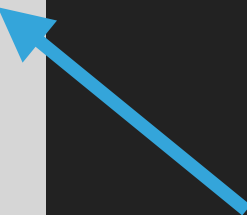
```
commit eeb65b7ec25fe49f144037cec539affe25a5ef97
Author: megmillhouse <meg.millhouse@gmail.com>
Date:   Tue Feb 4 13:06:15 2020 +1100
```

second commit

```
commit ce38b85cec0a2479853487b933ba5a18ce52ade1
Author: megmillhouse <meg.millhouse@gmail.com>
Date:   Tue Feb 4 12:45:50 2020 +1100
```

first commit

Each commit gets a
unique identifier called a
hash



```
$ git checkout eeb65b7 <filename>
```

EXAMPLE 3: I WANT TO GO BACK TO AN OLD VERSION OF THE CODE

WATCHOUT!

```
$ git checkout eeb65b7
```



What happens if you don't specify a file?

End up in a "Detached HEAD" state

Fix via:

```
$ git checkout master
```

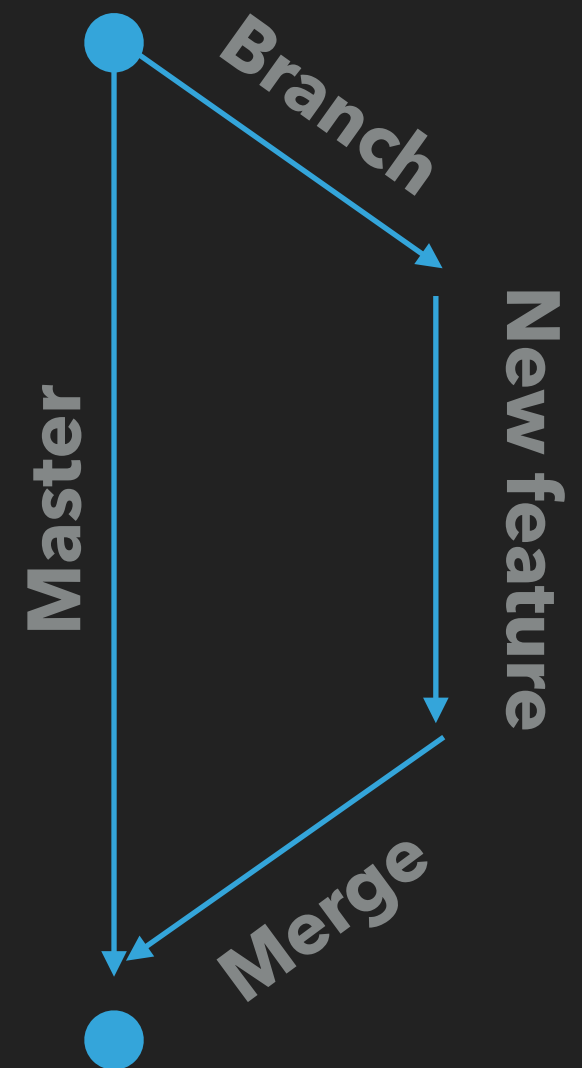
PROJECT MANAGEMENT: BRANCHING

- ▶ For major developments, work on a separate *branch*

```
$ git branch <your-new-branch>  
$ git checkout <your-new-branch>
```

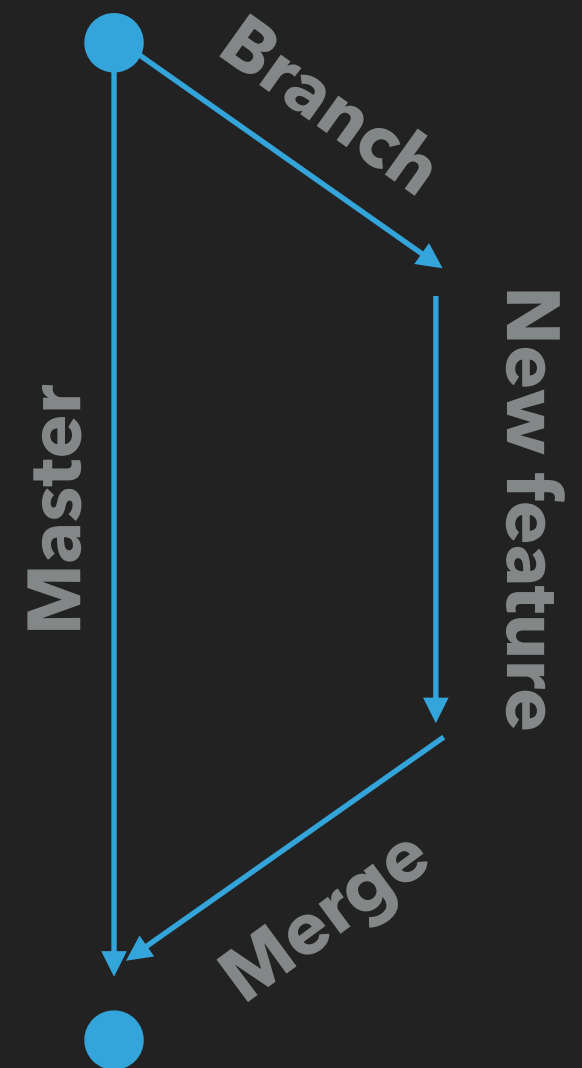
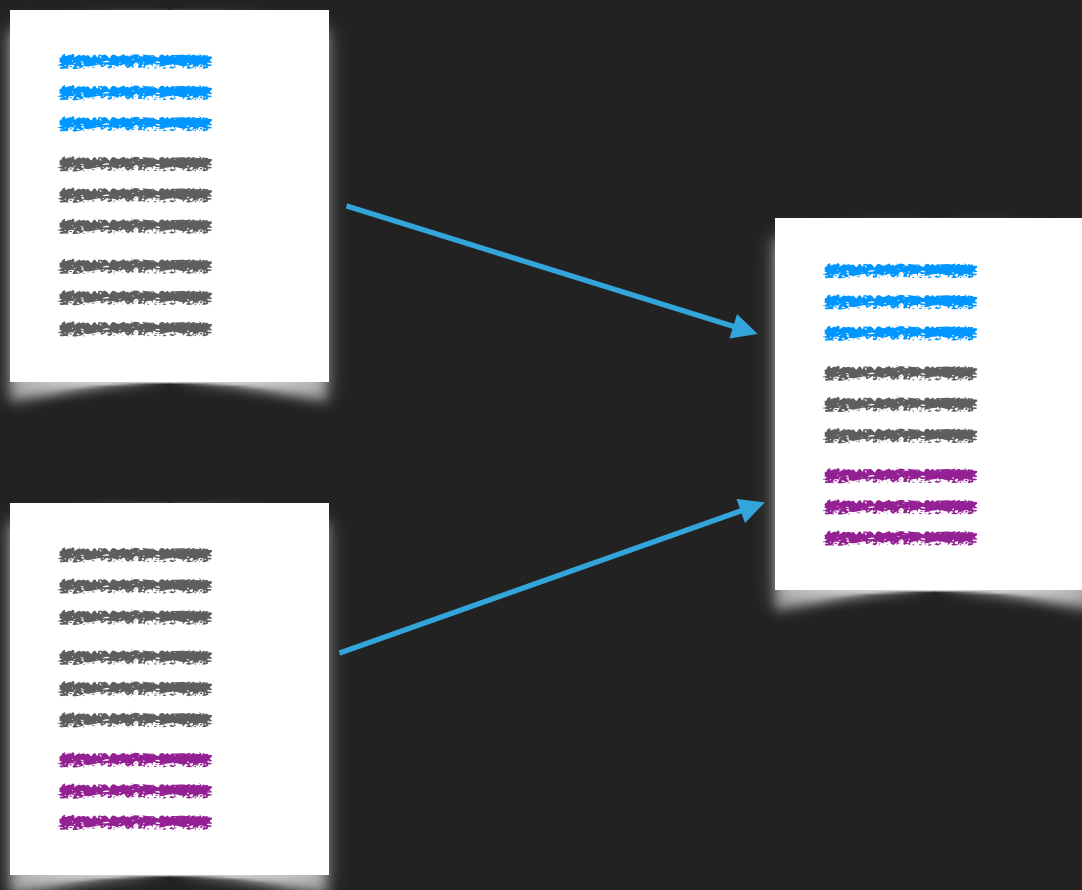
```
$ git checkout master
```

```
$ git merge <your-new-branch>
```



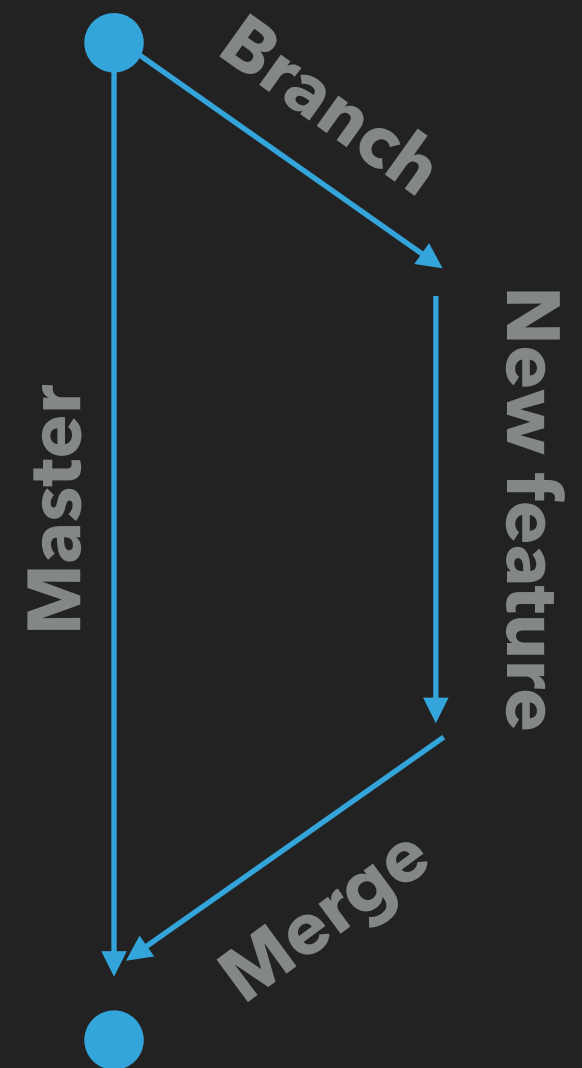
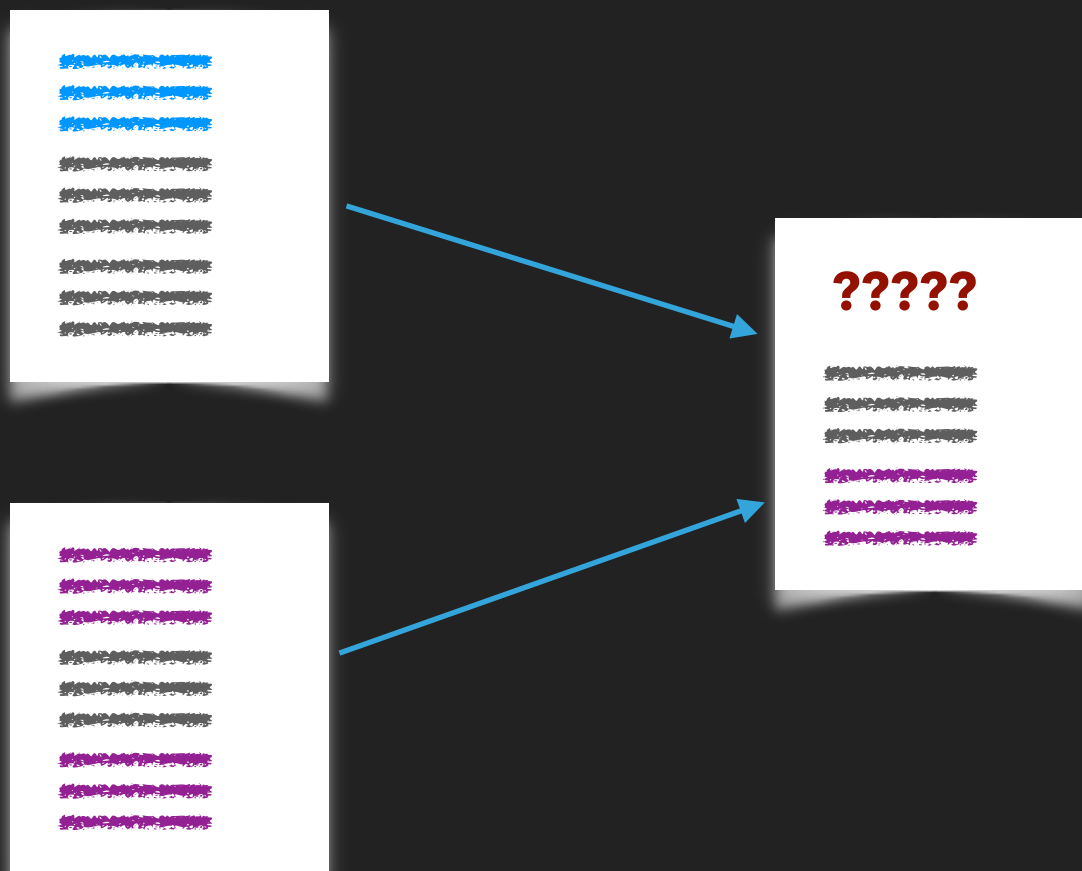
PROJECT MANAGEMENT: BRANCHING

- ▶ Can keep working on new branch and master at the same time
- ▶ Git is good at managing changes itself!



PROJECT MANAGEMENT: BRANCHING

- ▶ Can keep working on new branch and master at the same time
- ▶ Git is good at managing changes itself!



CONFLICTS

- Conflicts arise when the same line of text has been edited in two branches

You will get an error message like:

```
Auto-merging my_fist_file.txt
CONFLICT (content): Merge conflict in my_fist_file.txt
Automatic merge failed; fix conflicts and then commit the result.
```

And the conflicted file will look like:

```
This is the first line
A second line
<<<<<< HEAD
This is the third line
=====
Or maybe THIS is the third line
>>>>>> new_branch
```

DO IT YOURSELF: BRANCH AND MERGE (WITHOUT CONFLICT)

```
$ git branch a_new_branch  
$ git checkout a_new_branch
```

```
$ echo "new text from a branch" >> my_first_file.txt
```

(or use your favorite text editor)

```
$ git checkout master
```

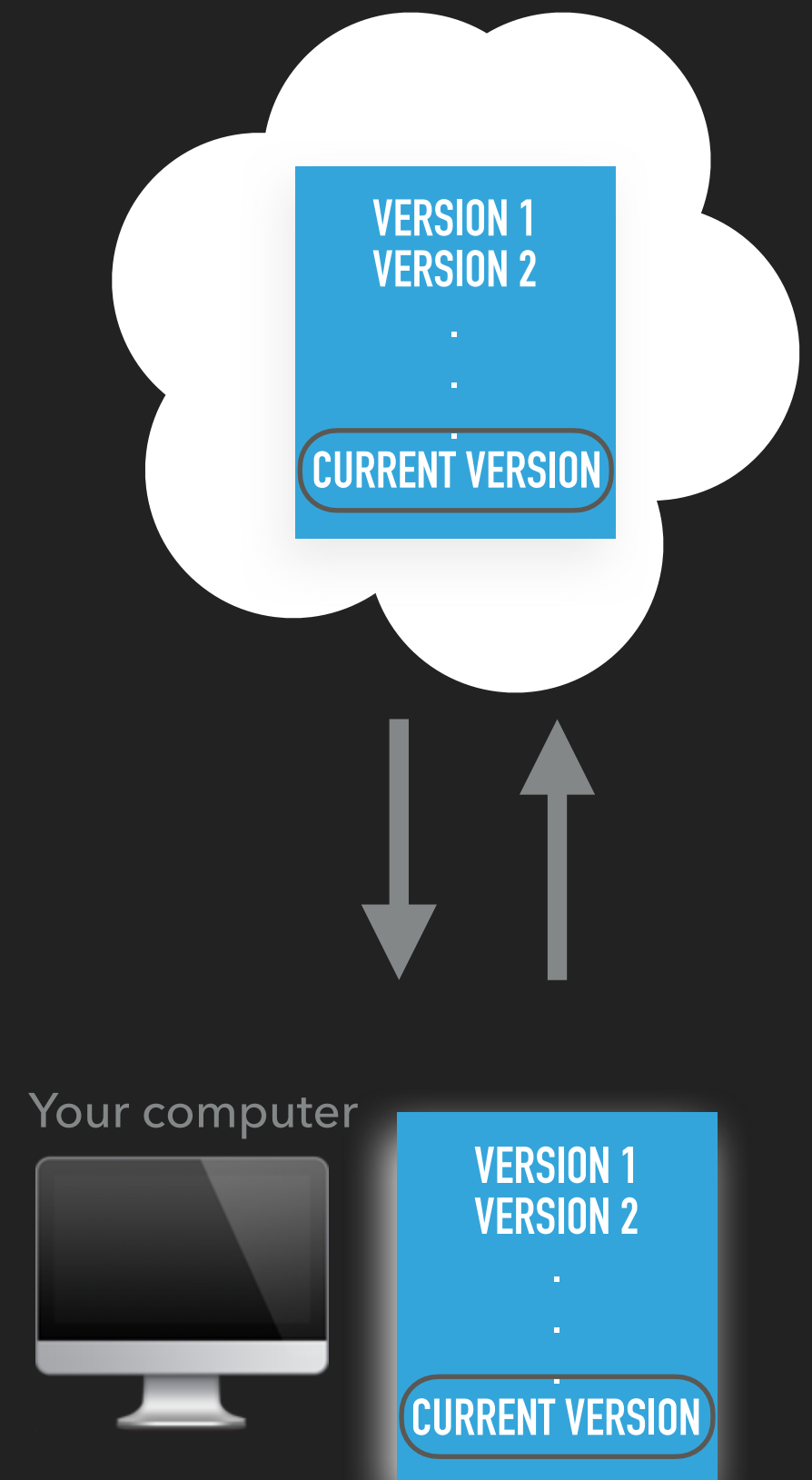
```
$ git merge a_new_branch
```

```
$ git branch -d a_new_branch
```

(delete branch for housekeeping)

PUSHING TO REMOTE REPOSITORIES

- ▶ Staging and committing only updates the local repository on your own computer
 - ▶ Want to edit your code on a different computer
 - ▶ Want to share your code with collaborators
- ▶ Use remote repository hosting like GitHub, GitLab, Bitbucket



SETTING UP A REMOTE REPOSITORY

`https://github.com/new`

Quick setup — if you've done this kind of thing before

 Set up in Desktop or **HTTPS** **SSH** `https://github.com/megmillhouse/example_project.git` 

Get started by [creating a new file](#) or [uploading an existing file](#). We recommend every repository include a [README](#), [LICENSE](#), and [.gitignore](#).

```
$ git remote add origin <url>
```

```
$ git push --set-upstream origin master
```

Only need this part once

PUSHING TO REMOTE REPOSITORIES

Send your current repository to remote location:

```
$ git push origin master
```

Local

Remote

Get the most recent remote repository onto your computer:

```
$ git pull
```

GOOD HABIT OF DAILY WORK FLOW:

```
$ git pull
```

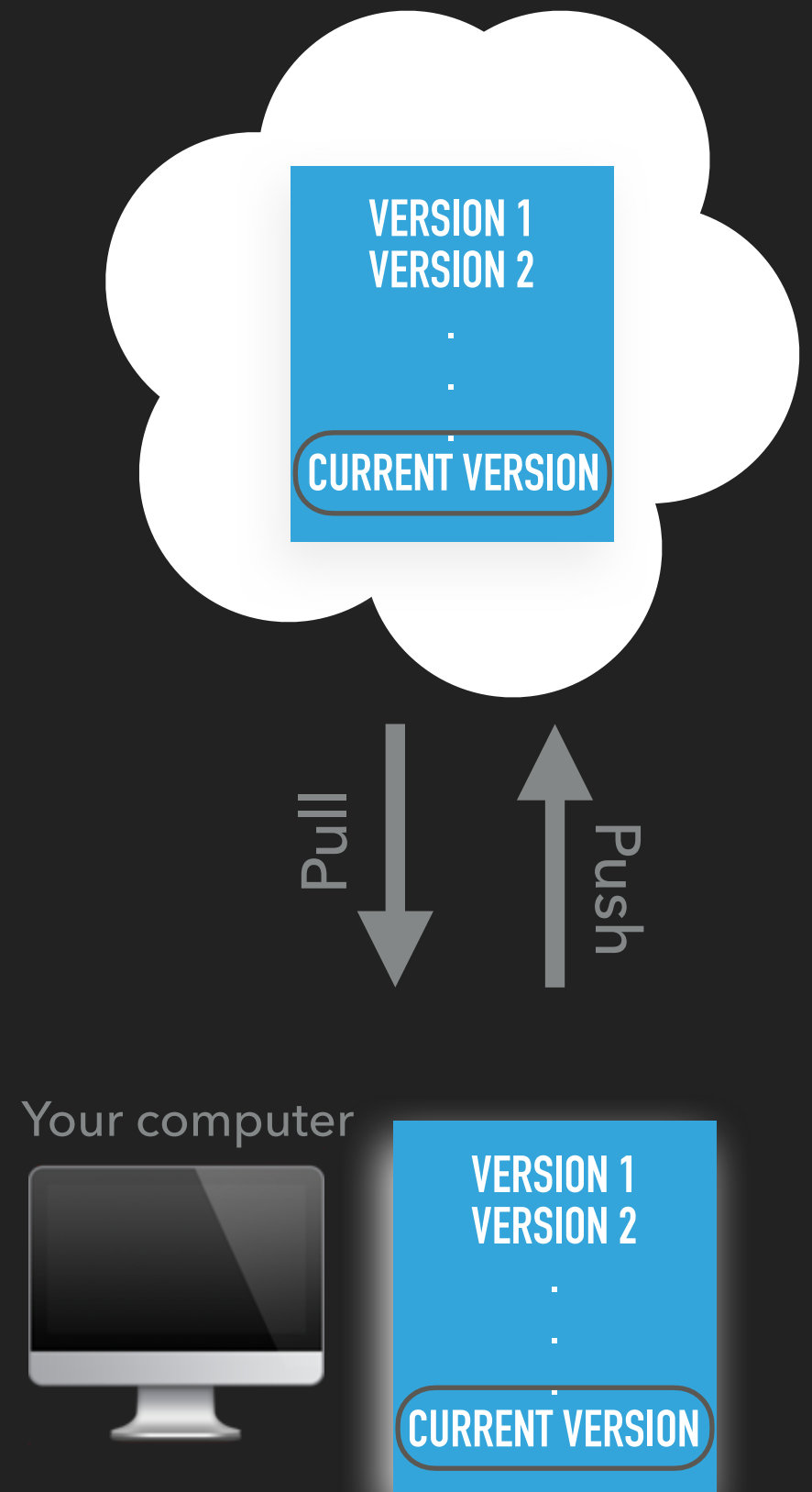
(make your edits)

```
$ git add <updated files>
```

```
$ git commit -m "your commit message"
```

```
$ git pull
```


```
$ git push
```



DO IT YOURSELF: SET UP A REMOTE REPOSITORY

<https://github.com/new>

Quick setup — if you've done this kind of thing before

 Set up in Desktop or ☐ HTTPS ☒ SSH 

Get started by [creating a new file](#) or [uploading an existing file](#). We recommend every repository include a [README](#), [LICENSE](#), and [.gitignore](#).

```
$ git remote add origin <url>
```

```
$ git push --set-upstream origin master
```

```
$ git push --set-upstream origin master
```


COLLABORATION: SHARING CODE WITH OTHER PEOPLE

- ▶ You want to share your code with other people!
- ▶ You want to use or edit someone else's code!

What are the best ways to do that?

COLLABORATION: SHARING CODE WITH OTHER PEOPLE

► Option 1: Invite collaborators to your project

The screenshot shows the GitHub repository settings page for 'megmillhouse / example_project'. The 'Settings' tab is selected in the top navigation bar. On the left sidebar, the 'Manage access' option is highlighted. The main content area is titled 'Who has access' and shows two sections: 'PRIVATE REPOSITORY' and 'DIRECT ACCESS'. The 'PRIVATE REPOSITORY' section states 'Only those with access to this repository can view it.' and has a 'Manage' link. The 'DIRECT ACCESS' section states '0 collaborators have access to this repository. Only you can contribute to this repository.' Below these sections is a 'Manage access' section with a message: 'You haven't invited any collaborators yet'. It also includes a note about GitHub Free limits and a green 'Invite a collaborator' button.

megmillhouse / example_project Private

Unwatch 1 Star 0 Fork 0

Code Issues 0 Pull requests 0 Actions Projects 0 Wiki Security Insights **Settings**

Options **Manage access** Branches Webhooks Notifications Integrations & services Deploy keys Autolink references Secrets Actions

Who has access

[Beta](#) [Learn more or give us feedback](#)

PRIVATE REPOSITORY

Only those with access to this repository can view it.

[Manage](#)

DIRECT ACCESS

0 collaborators have access to this repository. Only you can contribute to this repository.

Manage access

You haven't invited any collaborators yet

If you're using GitHub Free, you can add unlimited collaborators on public repositories, and up to three collaborators on private repositories owned by your personal account. [Learn more](#)

[Invite a collaborator](#)

COLLABORATION: SHARING CODE WITH OTHER PEOPLE

► Option 2: Clone an existing repository

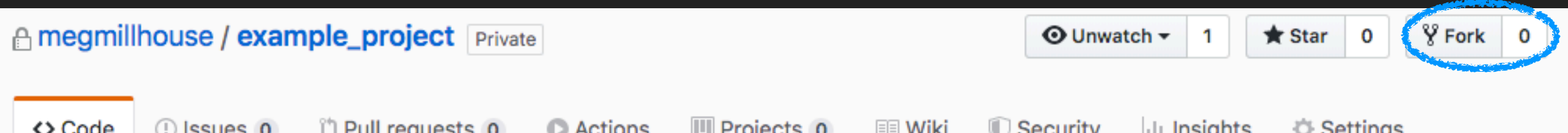
The screenshot shows the GitHub interface for a repository named 'example_project' by user 'megmillhouse'. The repository is marked as 'Private'. At the top right, there are buttons for 'Unwatch' (1), 'Star' (0), and 'Fork' (0). Below this is a navigation bar with tabs for 'Code', 'Issues' (0), 'Pull requests' (0), 'Actions', 'Projects' (0), 'Wiki', 'Security', 'Insights', and 'Settings'. The main content area shows 'No description, website, or topics provided.' with an 'Edit' button. Below this, it says 'Manage topics'. A summary bar displays '6 commits', '1 branch', '0 packages', '0 releases', and '1 contributor'. At the bottom, there are buttons for 'Branch: master', 'New pull request', 'Create new file', 'Upload files', 'Find file', and a green 'Clone or download' button which is circled in blue.

```
$ git clone <URL> <directory>
```

The dropdown menu for 'Clone or download' is open. It shows two options: 'Clone with HTTPS' (selected) and 'Use SSH'. Below these, it says 'Use Git or checkout with SVN using the web URL.' and provides the URL 'https://github.com/megmillhouse/examp' with a copy icon. At the bottom, there are two buttons: 'Open in Desktop' and 'Download ZIP'.

COLLABORATION: SHARING CODE WITH OTHER PEOPLE

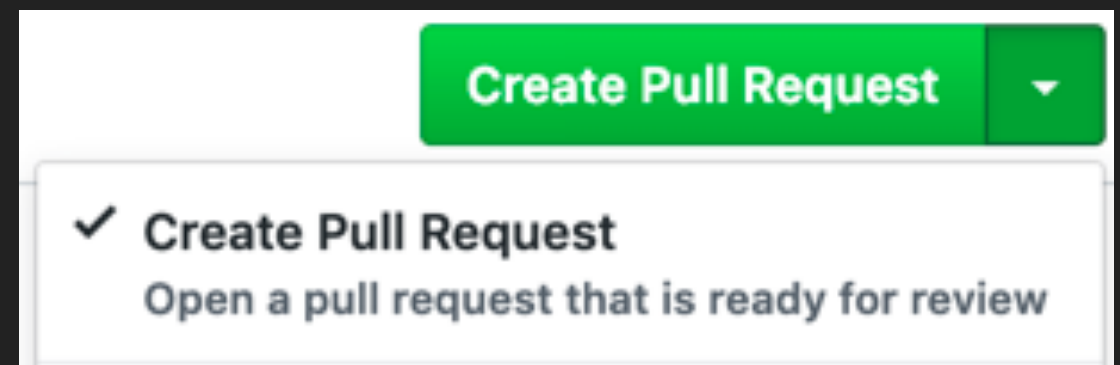
- ▶ Option 3: Fork an existing repository



- ▶ Forking a repository makes an independent copy
- ▶ Clone vs. Fork vs. Branch:
 - ▶ **Clone**: just want to use the code
 - ▶ **Fork**: Your own full version of the repository
 - ▶ **Branch**: temporary, more minor changes. Can have a branch within a fork

FORKING

- ▶ One standard contribution workflow is the fork-branch-merge
 1. Fork a repository
 2. Make new branch in your fork for your particular update/feature
 3. Merge with master from a pull request



GITHUB: WEB INTERFACE

- ▶ Lots of handy things you can do on the GUI
- ▶ (pull up GitHub here)

LICENSING

- ▶ Licensing and best practices for use