METIS

INTRODUCTION TO GIT & GITHUB

GIT != GITHUB

- Git and Github are two separate tools that accomplish two separate goals
- They interface with one another to make a nice pipeline for team coding that is less likely to catastrophically fail

Let’s see how git can help us out

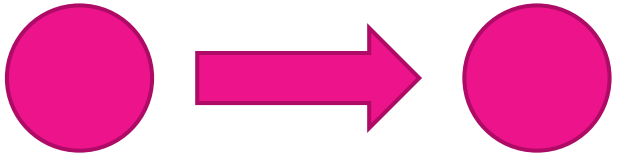
```
def main():
    query = “SELECT * FROM customers”
    table = sql.read(query)
    customer_records = pd.DataFrame(table)
    users = customer_records[‘username’]
    print(users.value_counts())

if __name__ == “__main__”:
    main()
```

Let’s imagine that Janice sets out to write some code to generate a report.

```
def main():
    query = “SELECT * FROM customers”
    table = sql.read(query)
    customer_records = pd.DataFrame(table)
    users = customer_records[‘username’]
    print(users.value_counts())

if __name__ == “__main__”:
    main()
```

Hooray, Janice!
You did a thing!

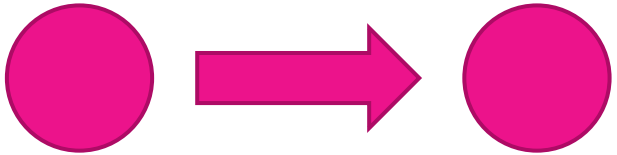
CODE DEVELOPMENT TIMELINE



Janice writes code.

Code put into production. It's ugly code.

CODE DEVELOPMENT TIMELINE



Janice writes code.

Code put into production. It's ugly code.

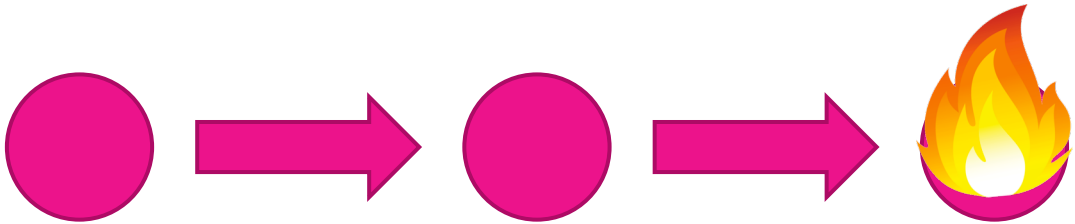
Hey Janice. Fix your ugly code now.

```
def get_data(query):
    """
    Get's the data from the database
    and returns it in dataframe format
    """
    table_data = sql.read(query)
    return pd.DataFrame(table_data)

def print_user_report():
    query = "SELECT * FROM customers"
    customer_records = get_data(query)
    users = customer_records['username']
    print(customer_records.value_counts())

if __name__ == "__main__":
    print_user_report()
```

Janice now sets out to functionalize her code and make it reusable and clear.

Janice breaks things.

CODE DEVELOPMENT TIMELINE



Idea for what the code should do.

The code is ugly, but it works.

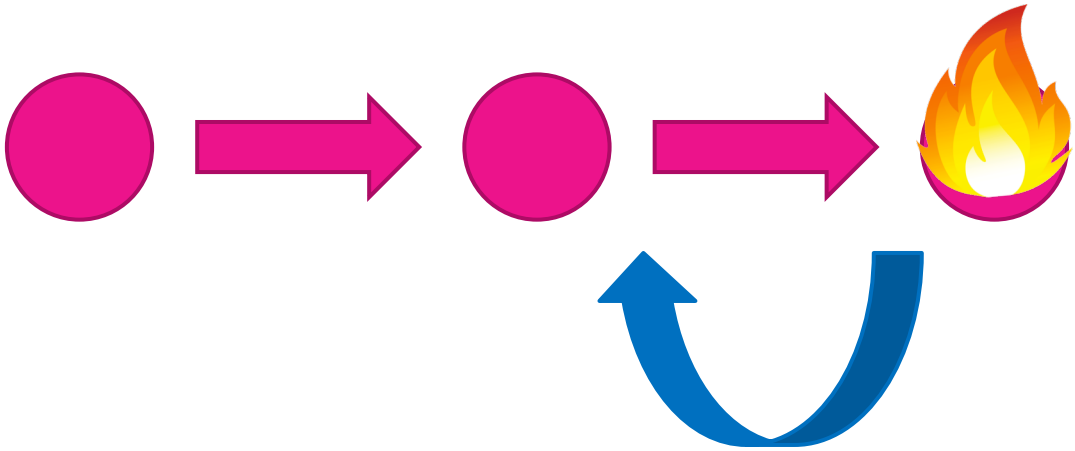
Attempted changes break the code

We broke our code, now what?

With the code broken, we have two options.

1. Figure out how to fix the code
2. Reset to the last time the code worked

CODE DEVELOPMENT TIMELINE

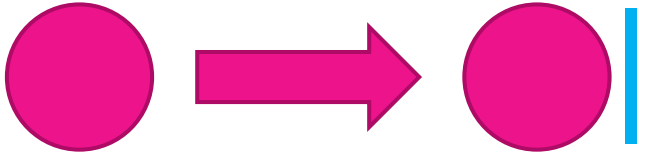


Doing this can be very time consuming if you haven’t prepared for this eventuality. Let’s use git to prepare ourselves.

What does Git do?

- Allows us to introduce a checkpointing system
- Keeps track of each file's evolution over time
- Keeps a history of those changes and allows us to return to a version of our code at any time
- Allows for multiple versions of the same code to exist simultaneously (we'll come back to this one)

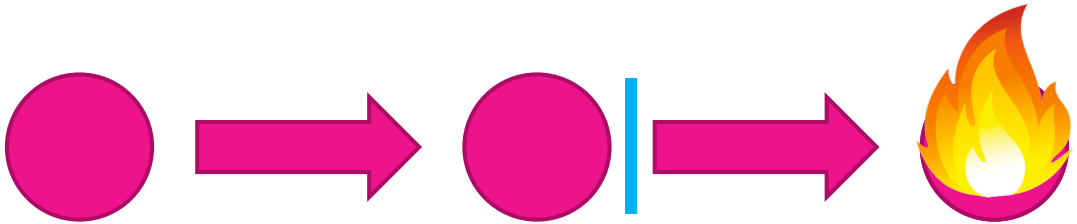
CODE DEVELOPMENT TIMELINE



Checkpoint!

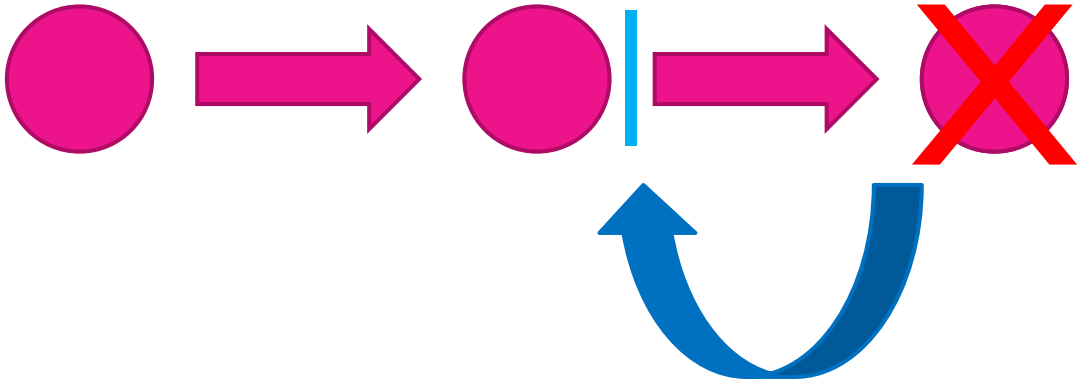
CODE DEVELOPMENT TIMELINE

CODE DEVELOPMENT TIMELINE

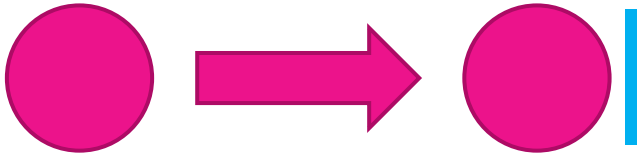


OOPS. REVERT.

CODE DEVELOPMENT TIMELINE



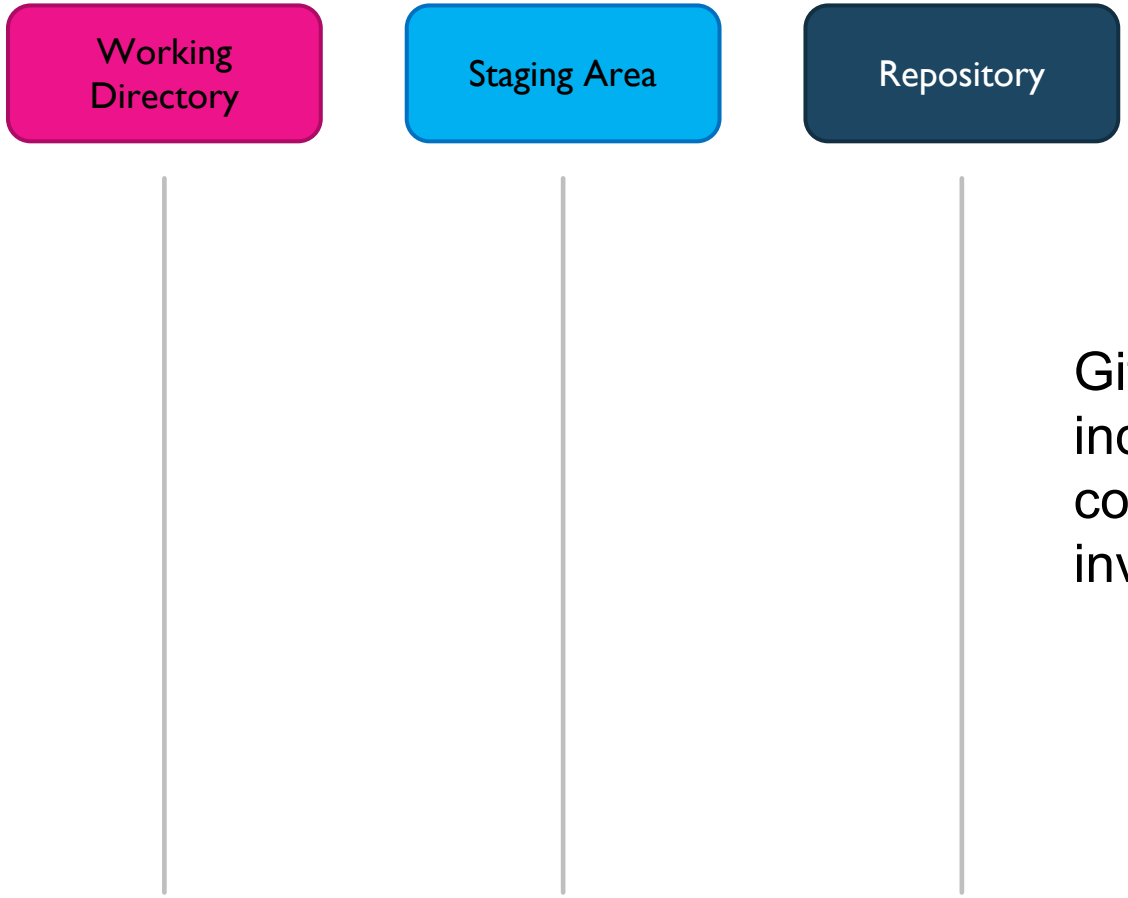
CODE DEVELOPMENT TIMELINE



Git Checkpointing

This checkpointing system is made up of things called “**commits**.” A **commit** is essentially a time stamp where git knows what all the files in the project look like. It remembers the code in each file so we can always get back to that version. Hence why git is called “version control.”

To actually make a **commit**, we need to understand the 3 phases of git.



Git is made up of three independent “phases” of code tracking. Let’s investigate each section.

Working Directory

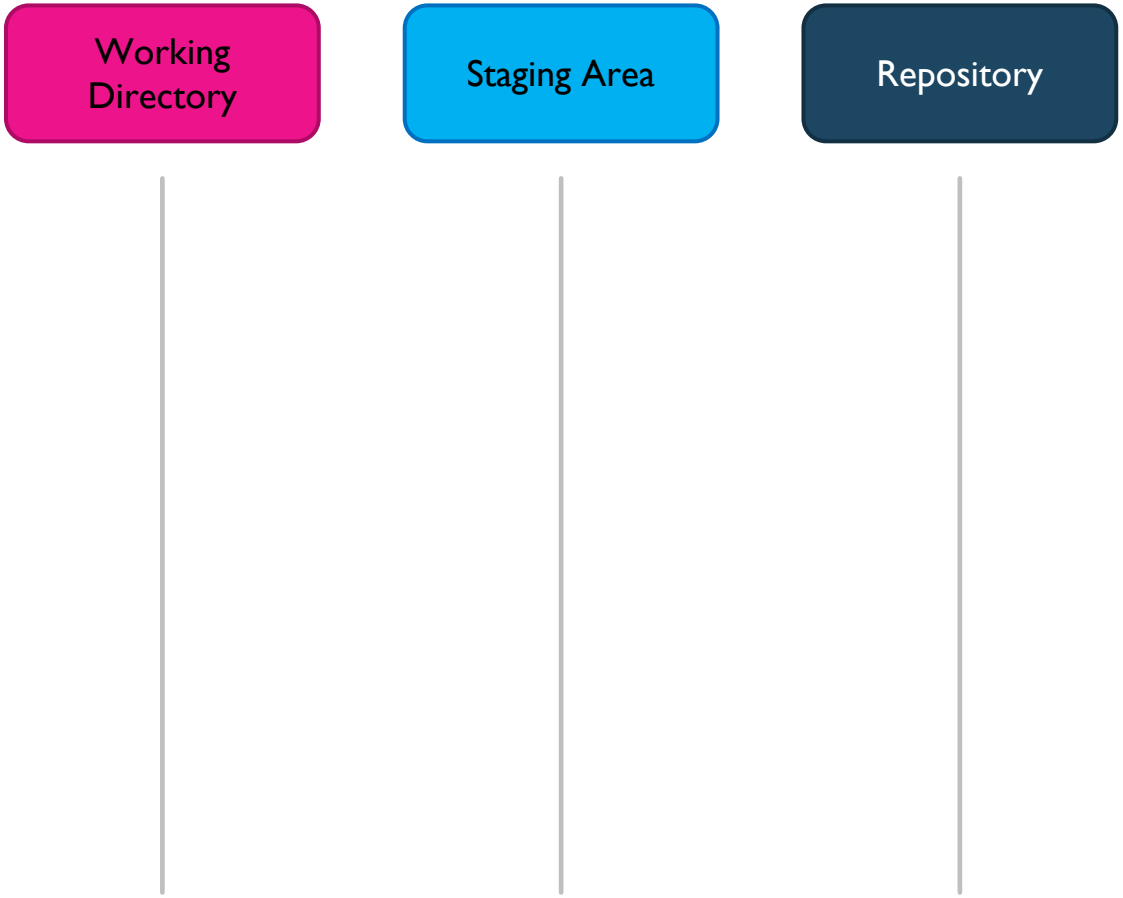
The working directory area is our “normal” file system. This tracks the code as it exists on our computer right now. If we’ve made changes, then the working directory sees all of those changes. It doesn’t track any history. It just says, “this is how my code looks right now.”

Working Directory

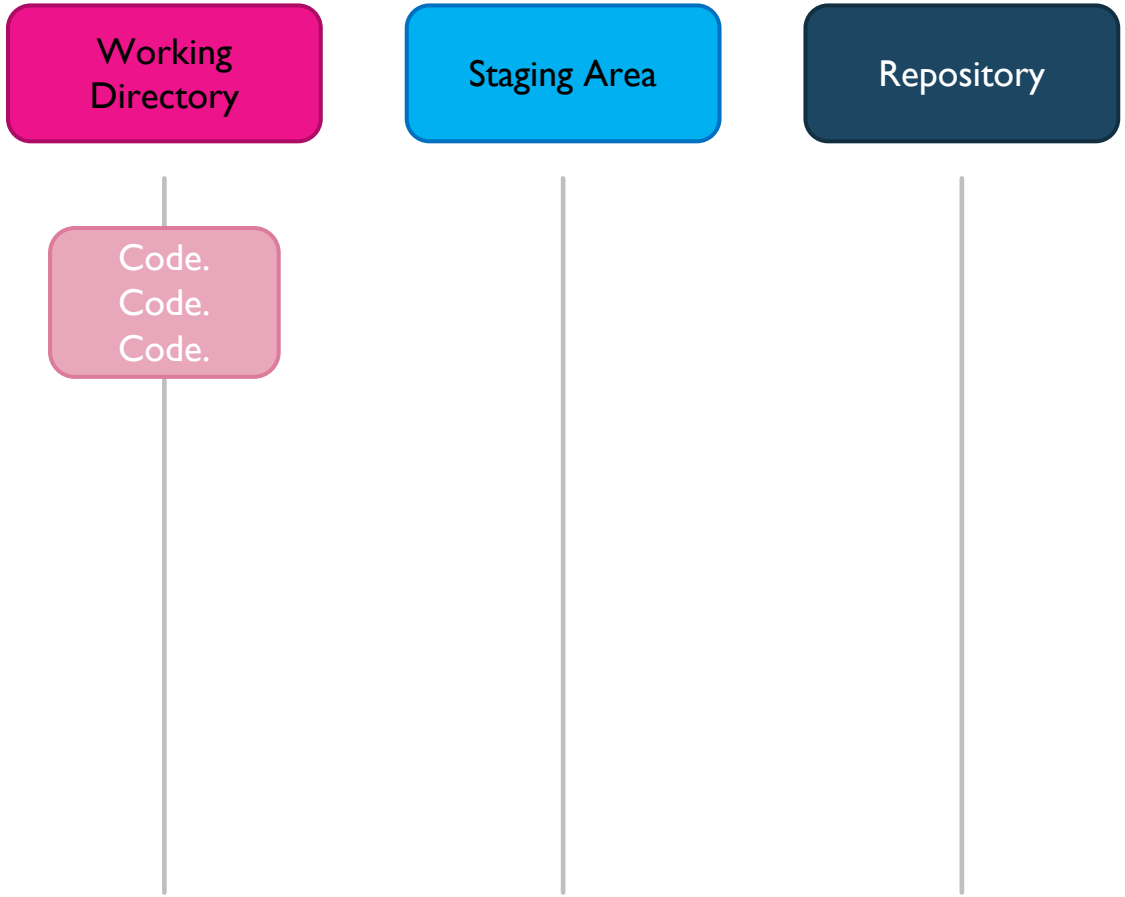
Staging Area

The staging area is how we prepare for a **commit**. Before making a commit, we'll tell git that we want certain files to be "staged" for the **commit** (in non-git terms, we're telling git that we want it to check this file to see if it's changed since the last checkpoint).

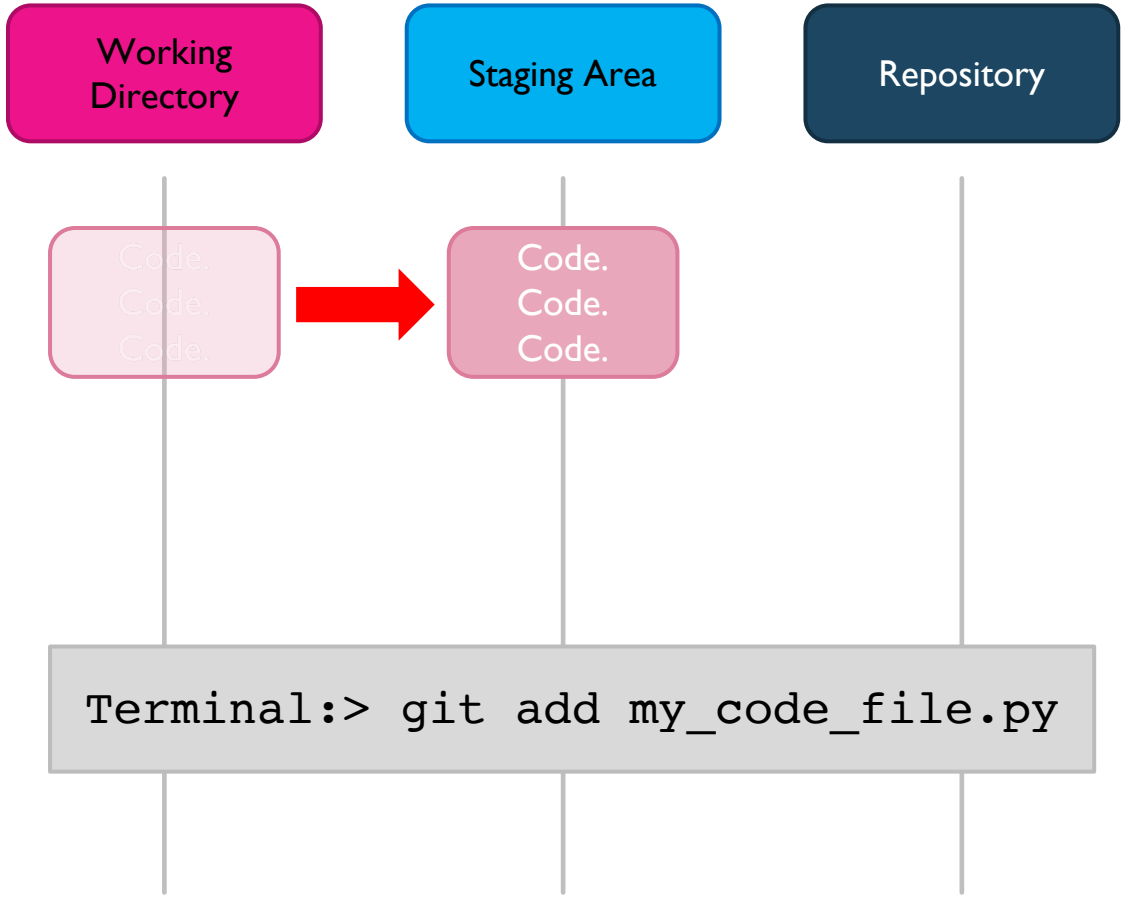
The repository is where all of our checkpoints live. Every time we make a **commit**, all of those changes are pushed into the repository. The repository is the holder of all knowledge about each version of a project. Until the code is **committed** to the repository, no checkpoints have been made.



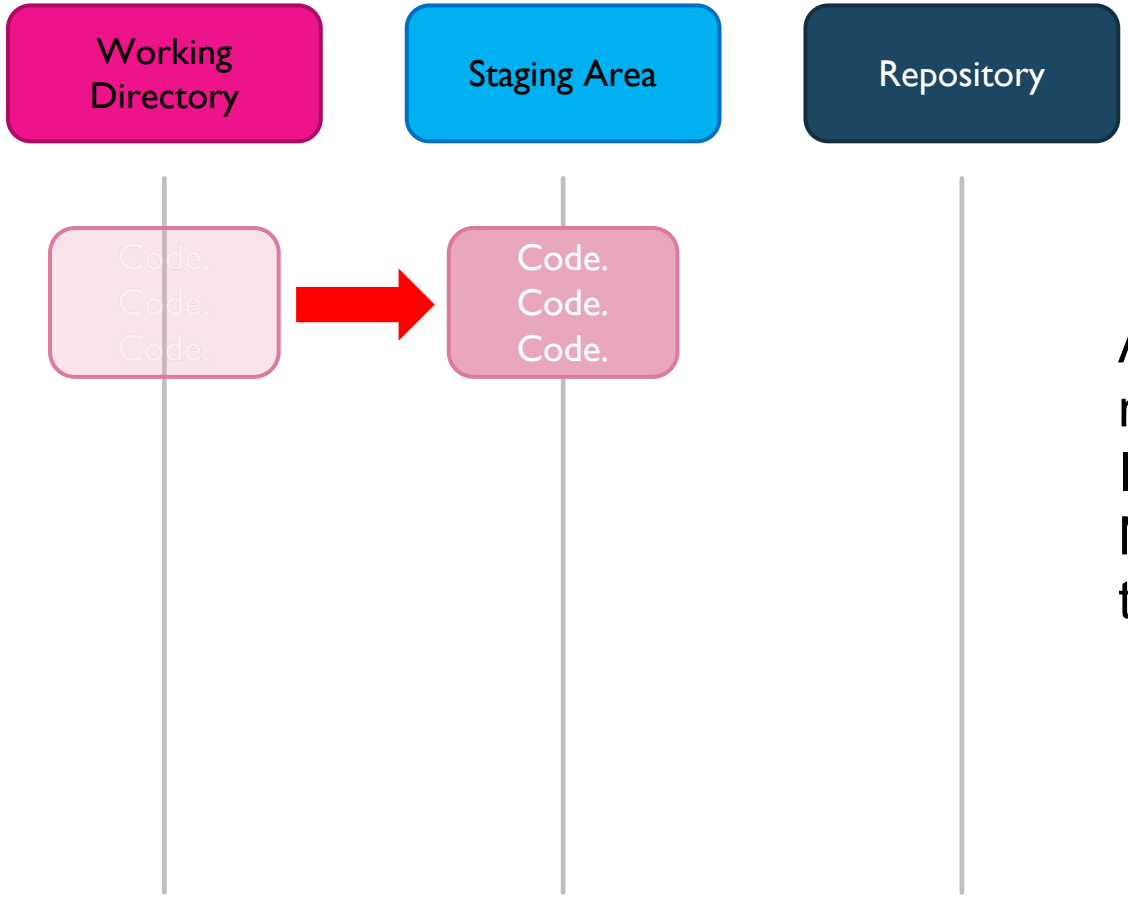
The flow of using Git



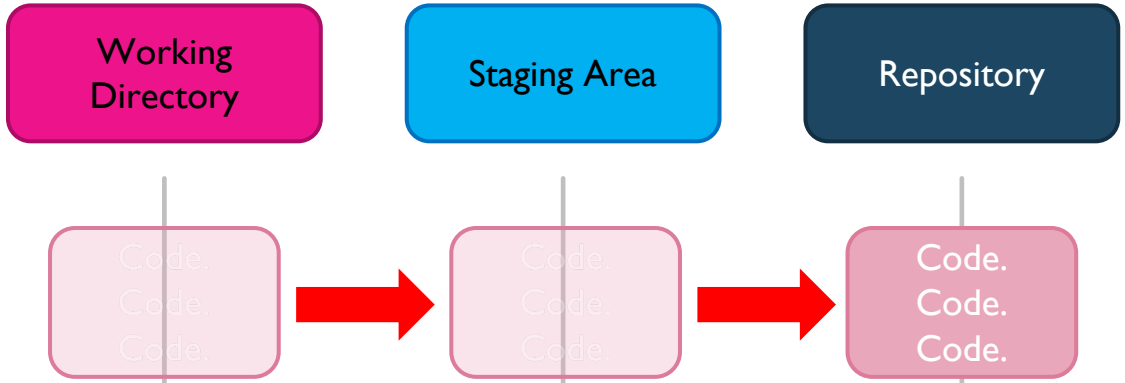
I work on my code in the working directory.



Now let's get it ready for a checkpoint. I need to tell git to 'add' it to the staging area.

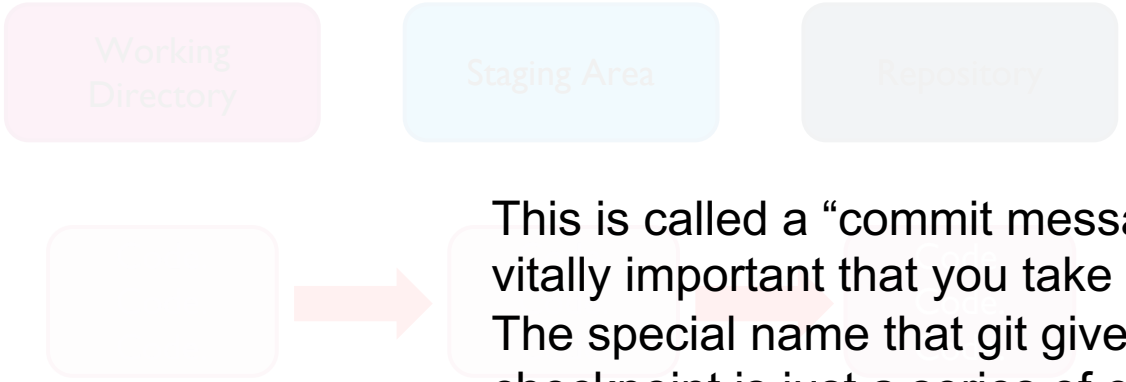


At this point, I haven't made the checkpoint, I've just prepared for it. Now let's actually make the commit.



Now we've actually made a commit. All the things in the staging area are added to the repository and a special name is given to this version of the code to represent the checkpoint.

```
Terminal:> git commit –m "making my first checkpoint"
```



This is called a “commit message” and it’s vitally important that you take it seriously. The special name that git gives to each checkpoint is just a series of characters like “d9rgy6431abql”. If you ever need to go back in time to a certain bit of code, you need to have a message that clearly identifies the commit’s purpose.

```
Terminal:> git commit –m “making my first checkpoint”
```

Commit Message Guide

Commit messages should:

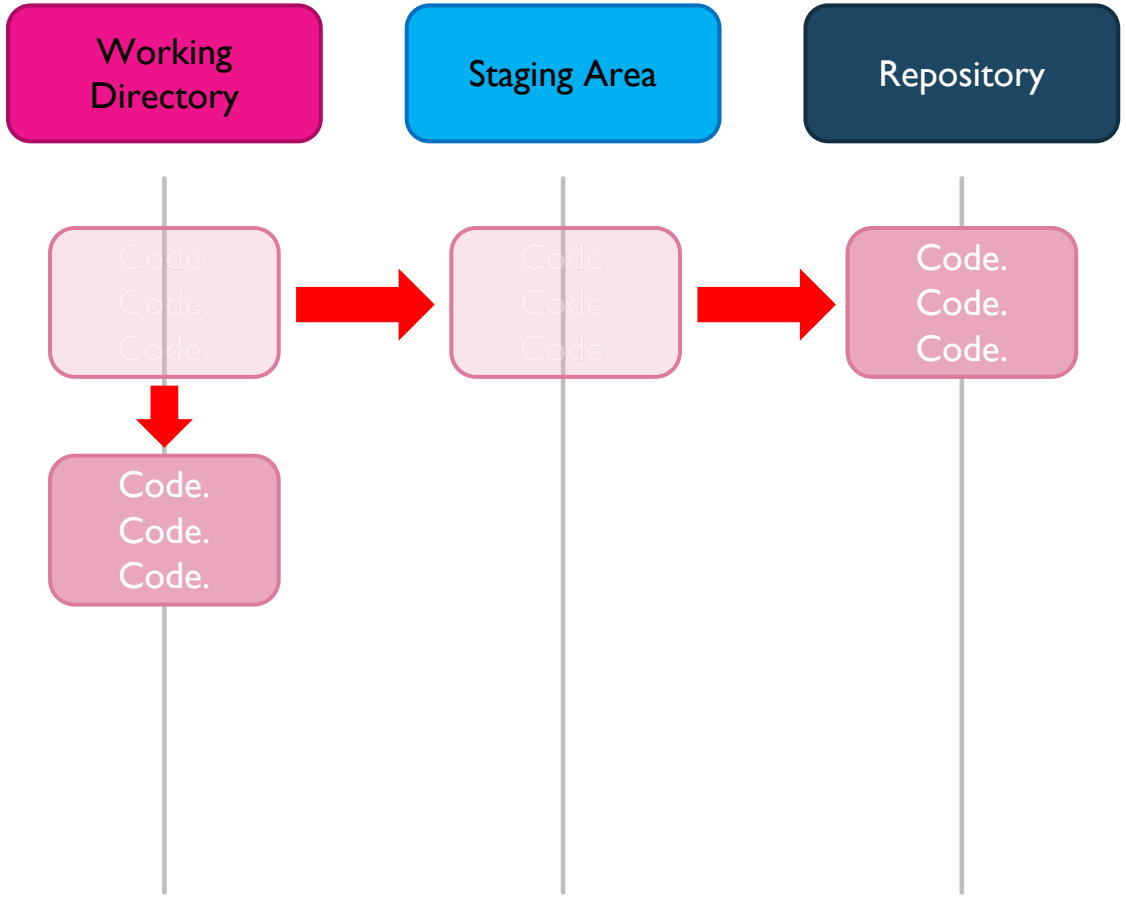
- Clearly state what's changed since the last commit
- Tell us what bugs were fixed, and what new code was added

If we remove the `-m "message here"` part from the previous example, we will be taken to a text editor to make our commit messages instead and can make it more specific.

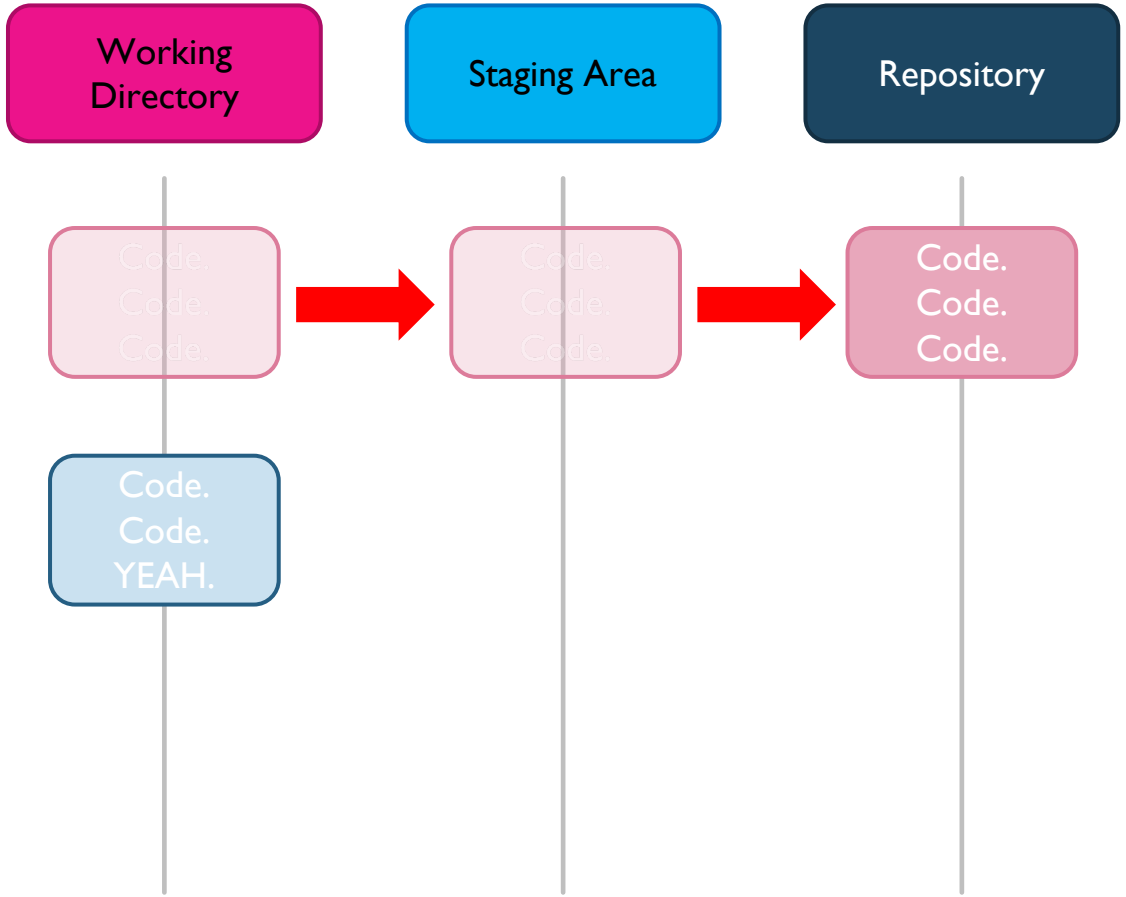
Commit Message Guide

People opine at length about good commit messages. Here are some great blogs on the topic:

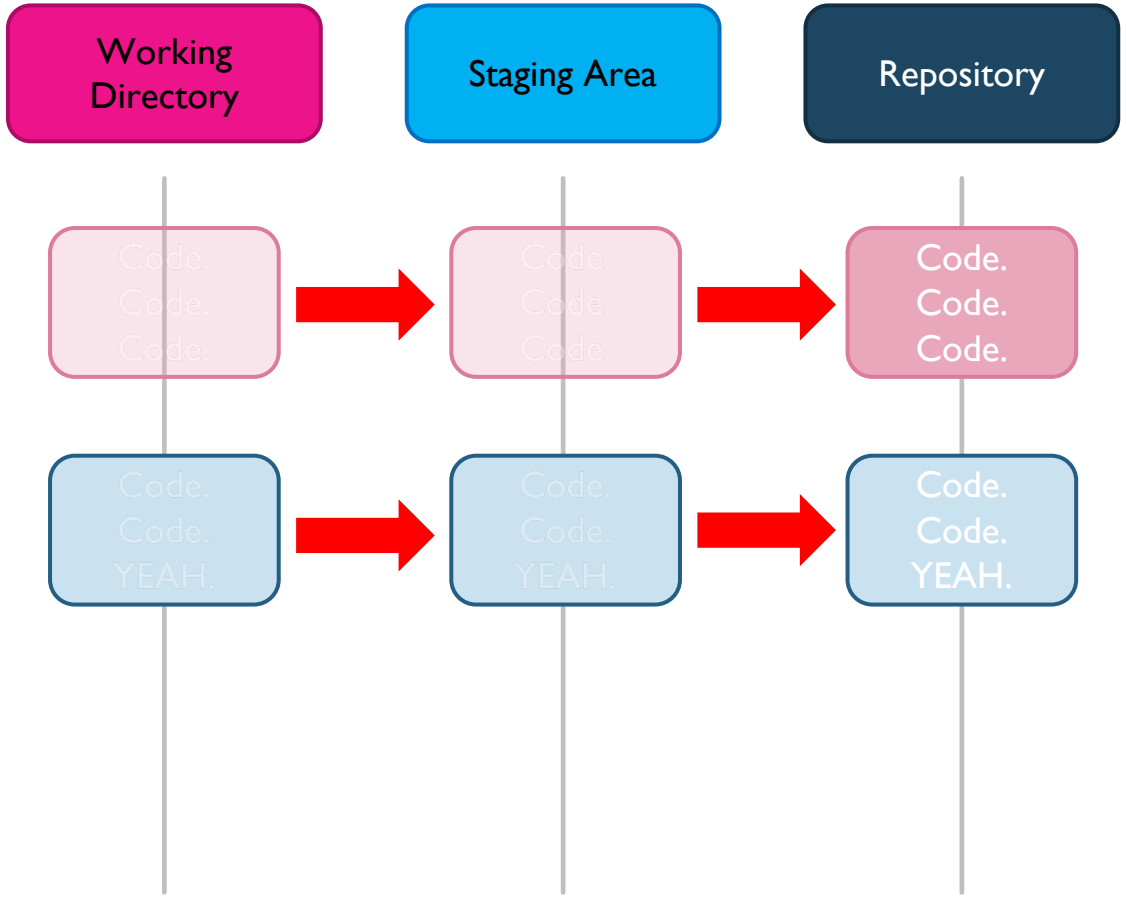
- https://hackernoon.com/what-makes-a-good-commit-message-995d23687ad
- https://chris.beams.io/posts/git-commit/



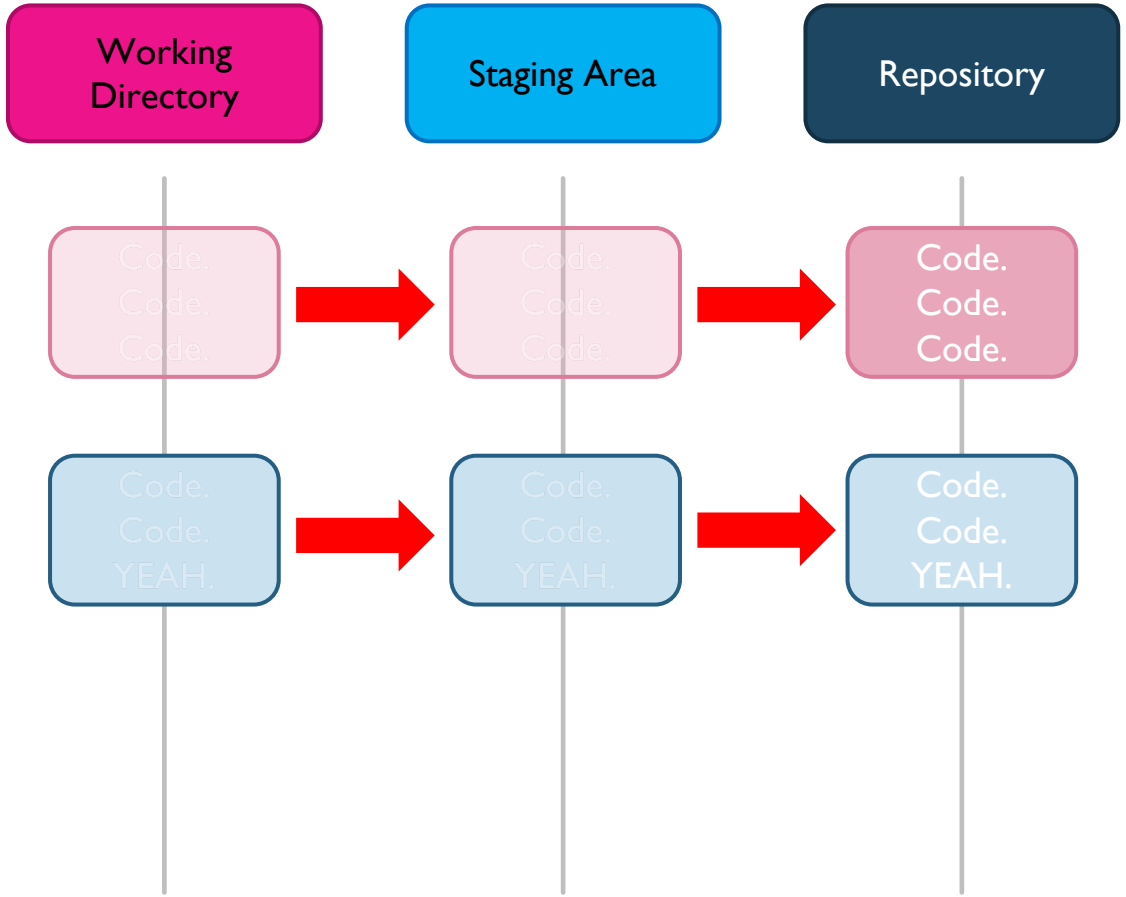
At this point our repository and our working directory match.



If we go through the process again, we can see that we'll add a new commit that also lives in the repository.



If we go through the process again, we can see that we'll add a new commit that also lives in the repository.



What if I want to revert to the original commit?

Git Log

- There’s a command underneath git called **git log**. It displays a list of all the previous commits and information about them.

```
zachariahmiller@metis-zachariahmiller~/Documents/PythonProjects$ git log
commit 8861cc02c62df5946d760a0618d349f6b4481f64 (HEAD -> master, origin/master)
Author: zwmiller <za[redacted].com>
Date:   Sun Sep 2 11:29:57 2018 -0500

    breakout network analysis to own repo

commit 128fc8819d8433971302cc94f5f3db7af08d4c51
Author: zwmiller <za[redacted].com>
Date:   Sun Sep 2 11:23:46 2018 -0500

    refactor code, fix sorting bug, redraw demo, add testing and test data

commit f27dbf83405f876643ffef270f11a1a21ab672a9
Author: zwmiller <za[redacted].com>
Date:   Fri Aug 31 14:30:39 2018 -0500

    add docstrings

commit 1dcaad09c98c3f8db2732db134b2e2a7a65ec681
Author: zwmiller <za[redacted].com>
Date:   Fri Aug 31 14:22:11 2018 -0500

    refactor plot making code
```

```
zachariahmiller@metis-zachariahmiller~/Documents/PythonProjects$ git log
commit 8861cc02c62df5946d760a0618d349f6b4481f64 (HEAD -> master, origin/master)
Author: zwmiller <za[redacted].com>
Date:   Sun Sep 2 11:29:57 2018 -0500

    breakout network analysis to own repo

commit 128fc8819d8433971302cc94f5f3db7af08d4c51
Author: zwmiller <za[redacted].com>
Date:   Sun Sep 2 11:23:46 2018 -0500

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zachariahmiller@metis-zachariahmiller~/Documents/PythonProjects$ git log
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Author: zwmiller <za[redacted].com>
Date:   Fri Aug 31 14:22:11 2018 -0500

    refactor plot making code
```
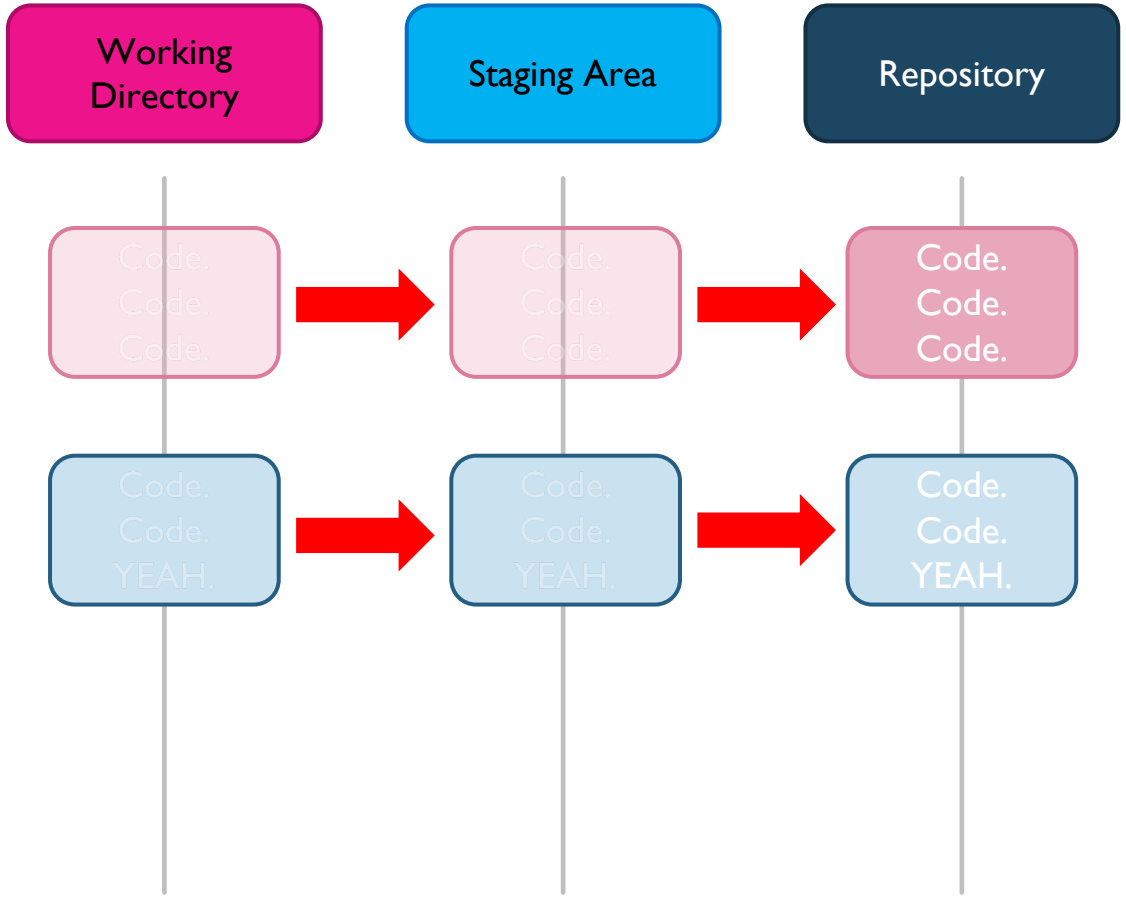

Commit Messages

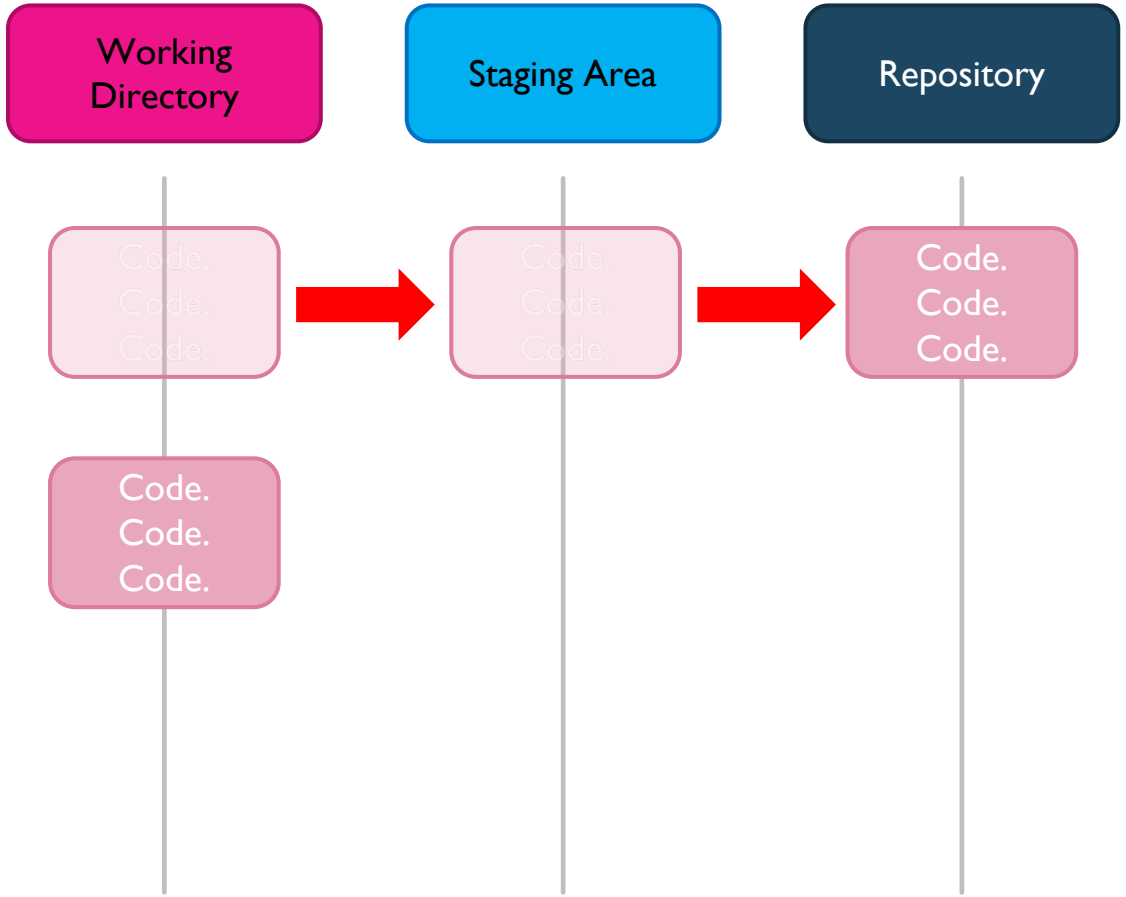
Git Reset

- So if I want to return to a previous state of code, I can just find the correct **commit id** then tell git to reset to that state.

```
Terminal:> git reset 128fc8819d8433971302cc94f5f3db7af08d4c51
```



Before reset.

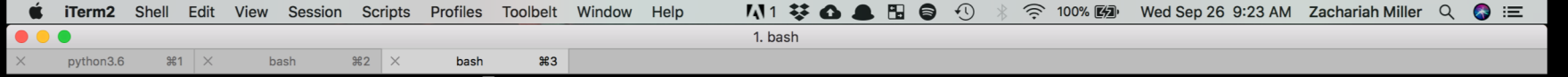

Working Directory
Staging Area
Repository
Code.
Code.
Code.
Code.
Code.
Code.
Code.
Code.
Code.

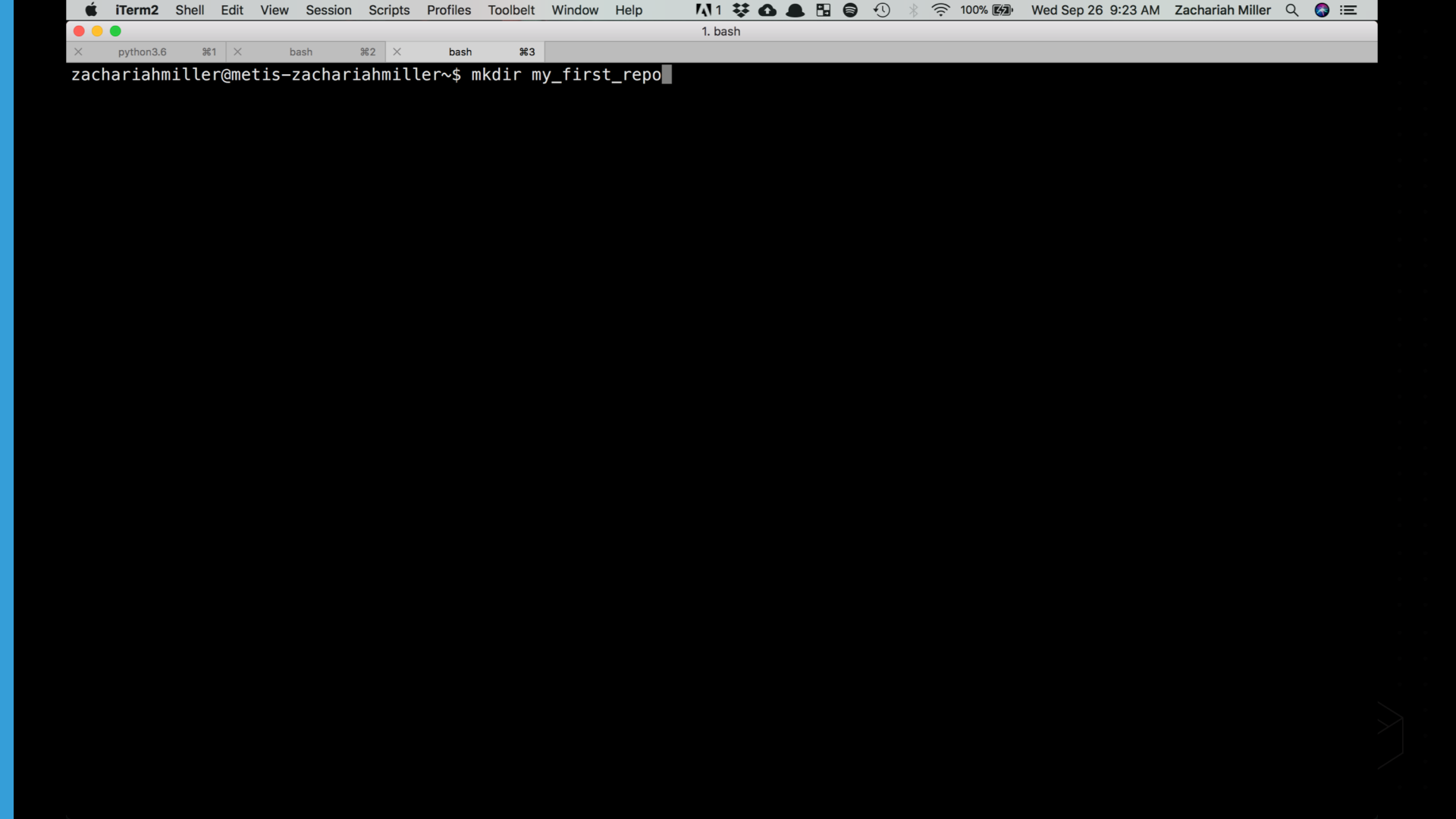
After reset.

Git: A quick review

- Git gives us the ability to track our code over time
- It gives us the history of our code, and the ability to reset to a previous status
- It provides a flexible interface for making checkpoints (called commits)

Exercise: Building your first repo


iTerm2 Shell Edit View Session Scripts Profiles Toolbelt Window Help
100% Wed Sep 26 9:23 AM Zachariah Miller
1. bash
python3.6 ⌘1
bash ⌘2
bash ⌘3
zachariahmiller@metis-zachariahmiller~$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python3.6 ⌘1
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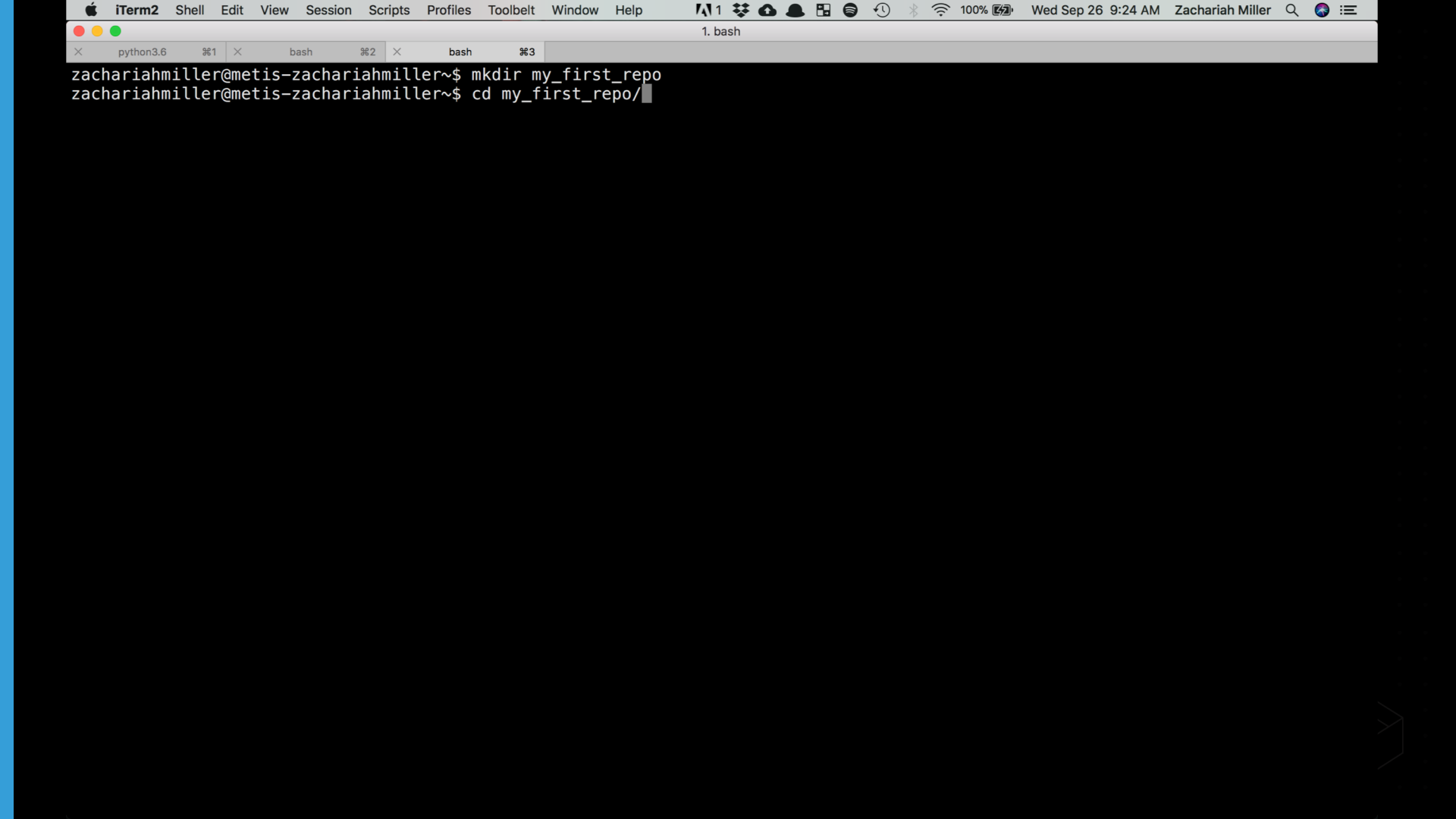
zachariahmiller@metis-zachariahmiller~$ mkdir my_first_repo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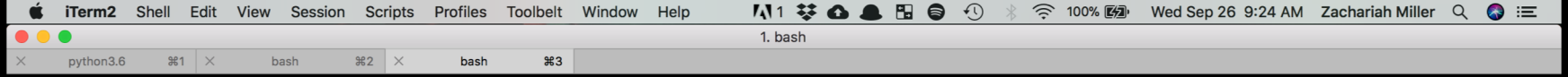
zachariahmiller@metis-zachariahmiller~$ mkdir my_first_repo
zachariahmiller@metis-zachariahmiller~$ cd my_first_repo/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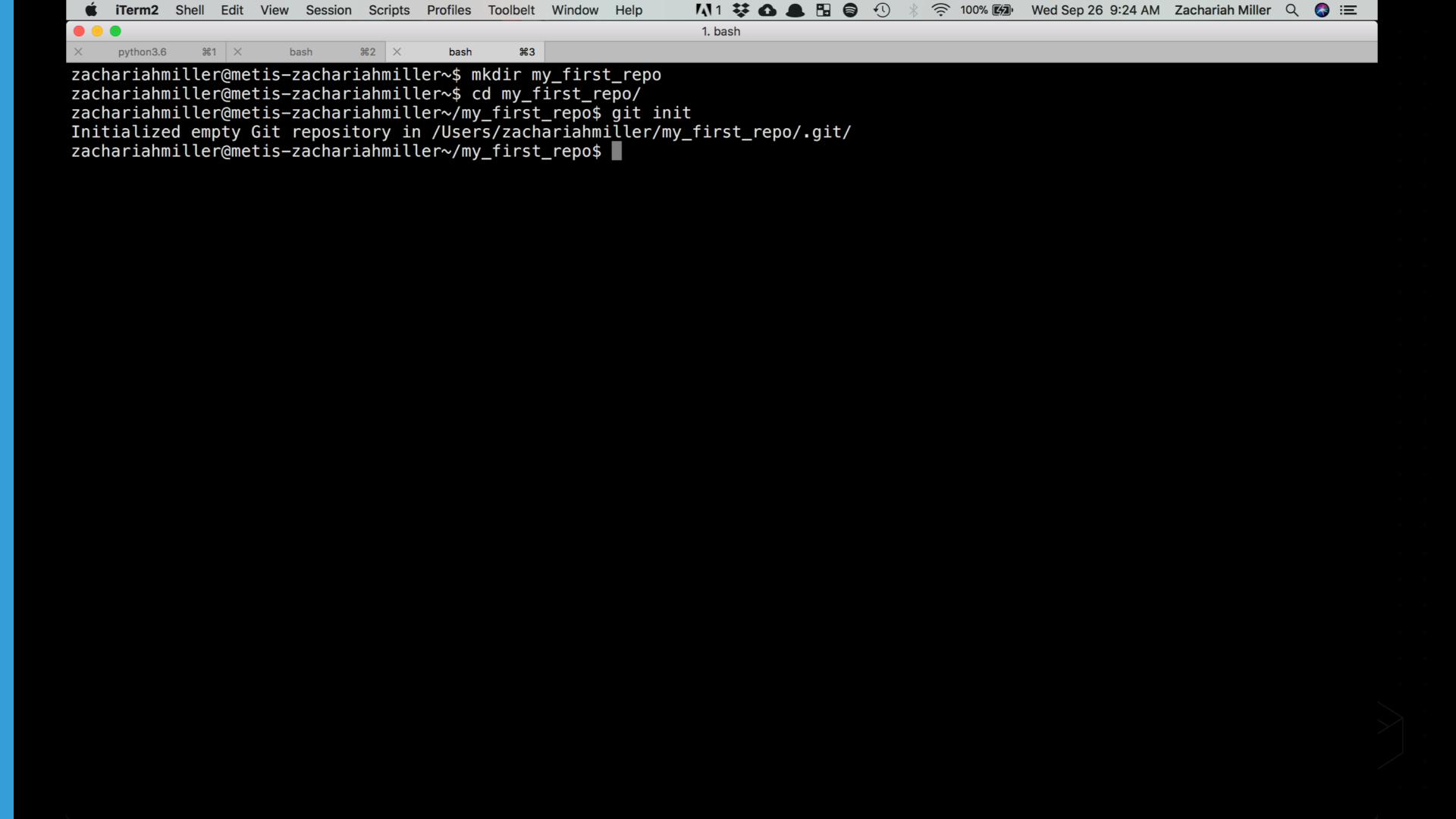
zachariahmiller@metis-zachariahmiller~$ cd my_first_repo/
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git init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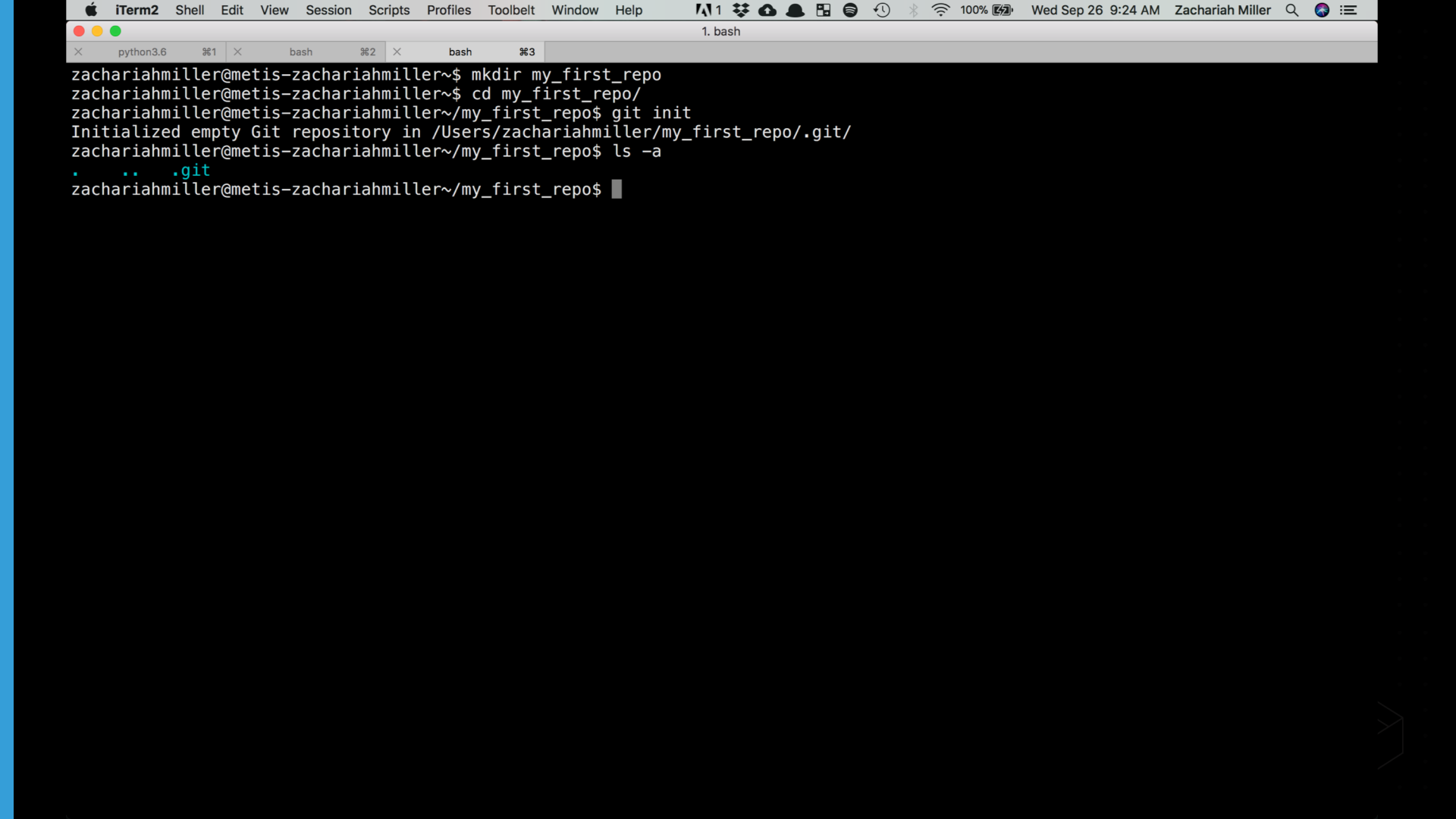
zachariahmiller@metis-zachariahmiller~$ cd my_first_repo/
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git init
Initialized empty Git repository in /Users/zachariahmiller/my_first_repo/.git/
zachariahmiller@metis-zachariahmiller~/my_first_repo$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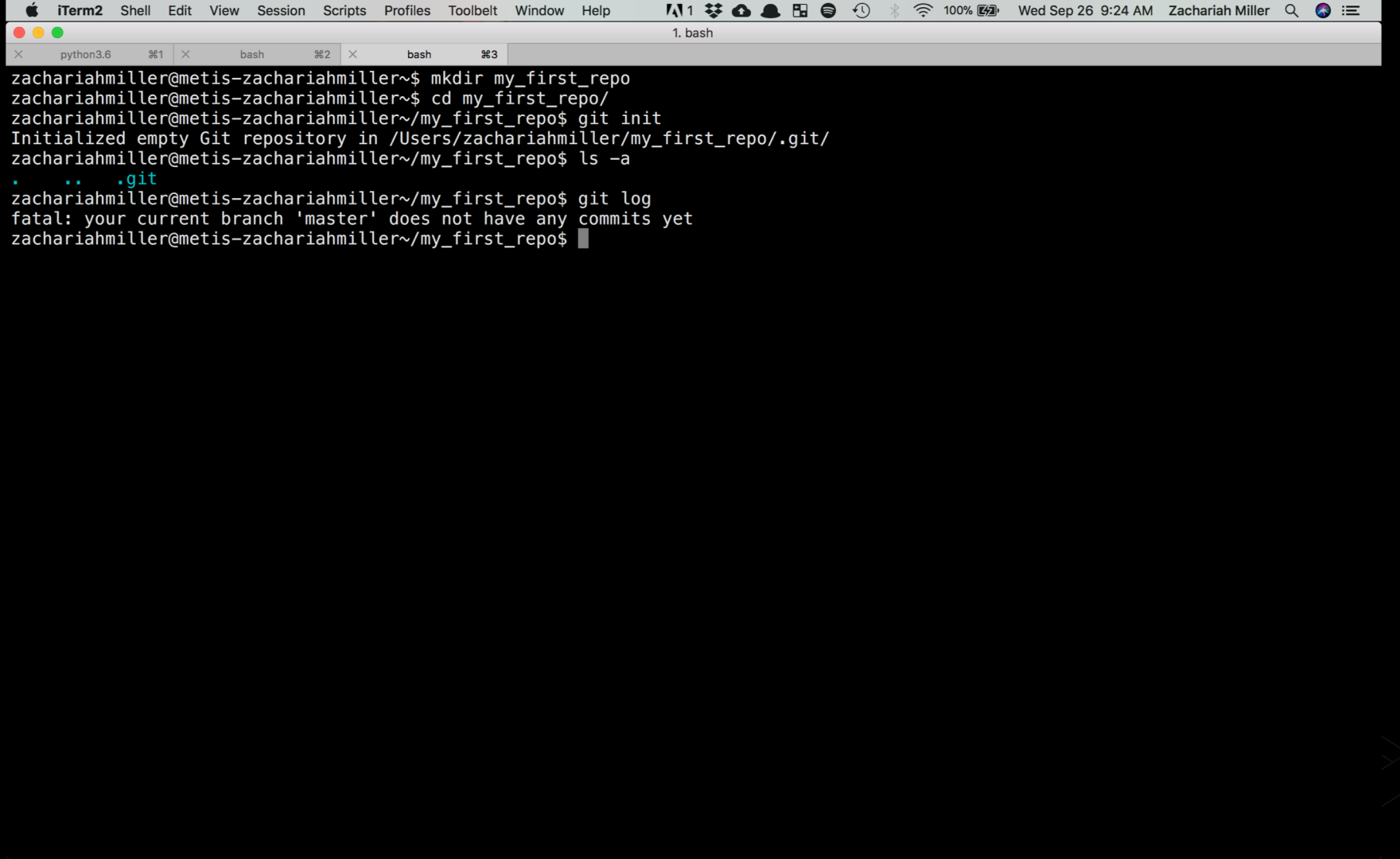
zachariahmiller@metis-zachariahmiller~$ cd my_first_repo/
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git init
Initialized empty Git repository in /Users/zachariahmiller/my_first_repo/.git/
zachariahmiller@metis-zachariahmiller~/my_first_repo$ ls -a
. .. .git
zachariahmiller@metis-zachariahmiller~/my_first_repo$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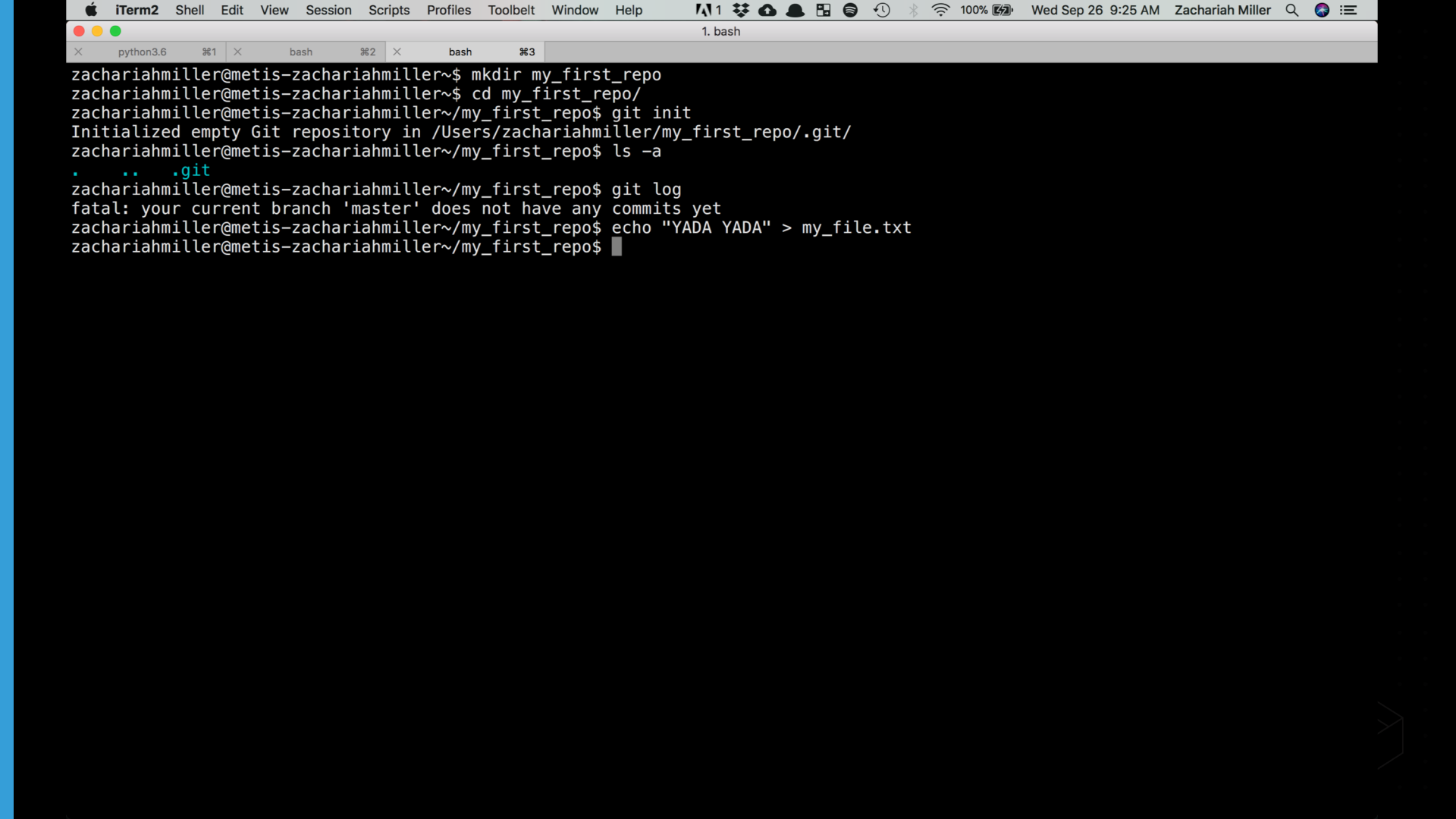
zachariahmiller@metis-zachariahmiller~$ cd my_first_repo/
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git init
Initialized empty Git repository in /Users/zachariahmiller/my_first_repo/.git/
zachariahmiller@metis-zachariahmiller~/my_first_repo$ ls -a
. .. .git
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git log
fatal: your current branch 'master' does not have any commits yet
zachariahmiller@metis-zachariahmiller~/my_first_repo$


iTerm2 Shell Edit View Session Scripts Profiles Toolbelt Window Help
100% Wed Sep 26 9:25 AM Zachariah Miller
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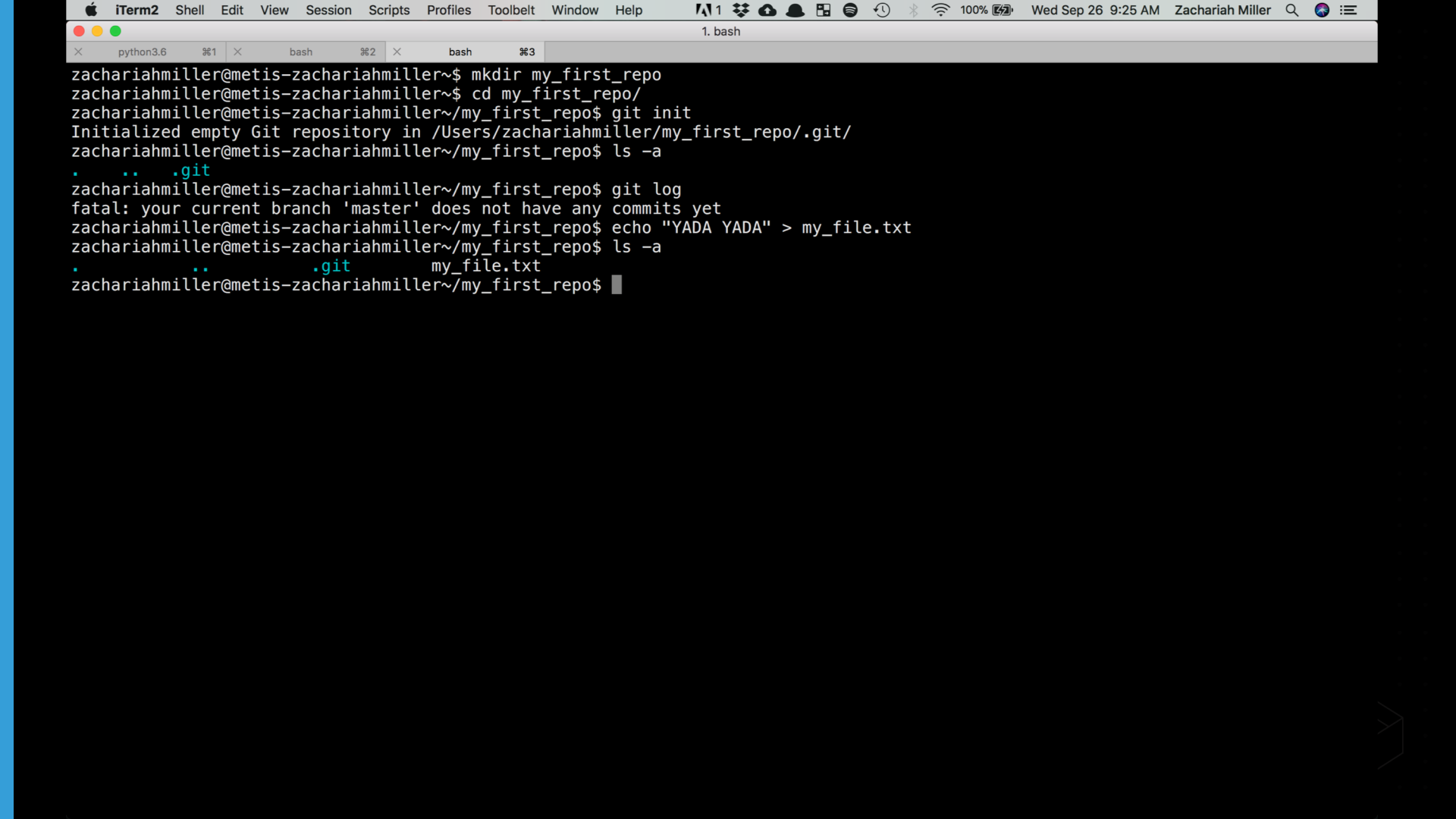
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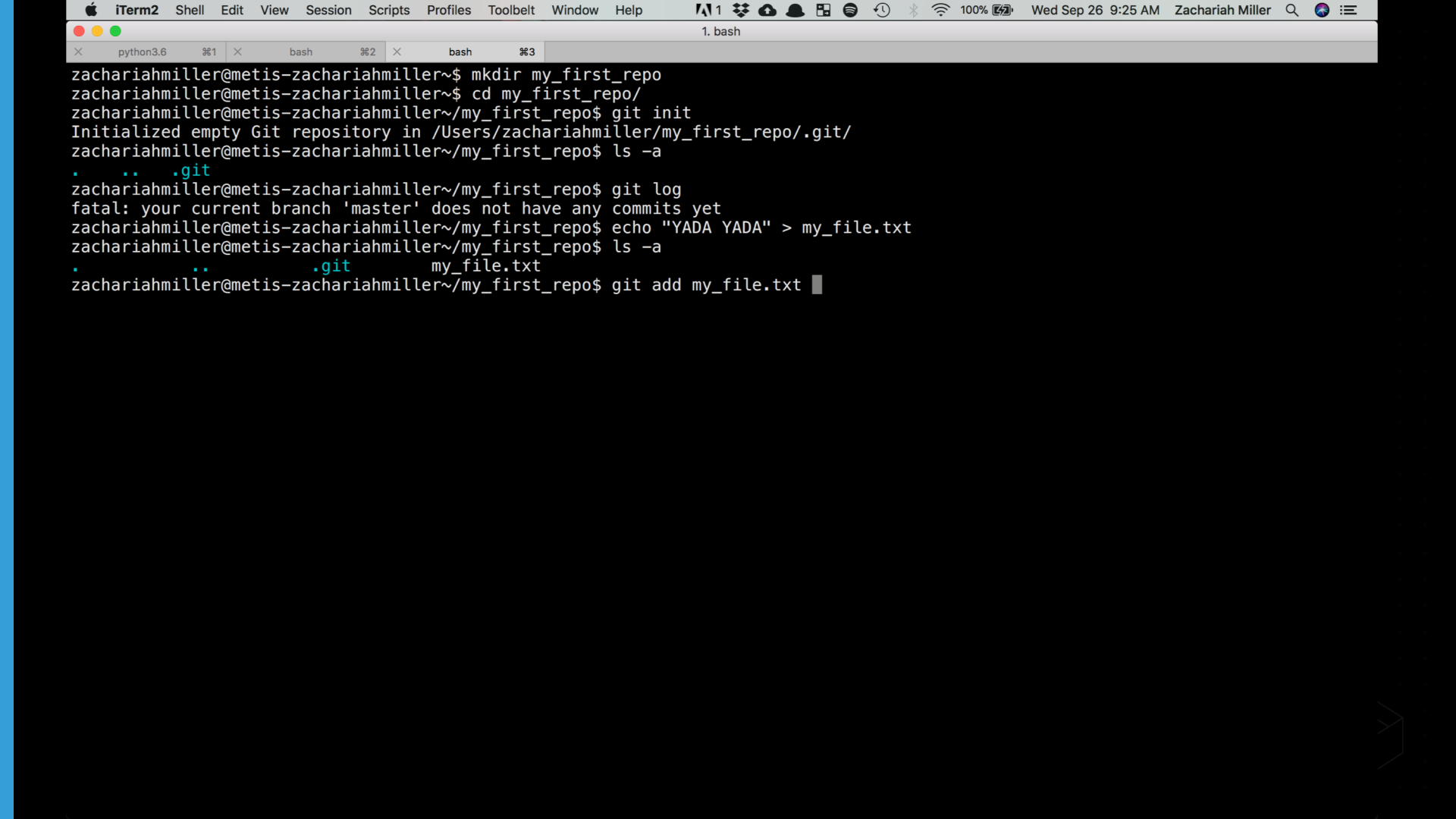
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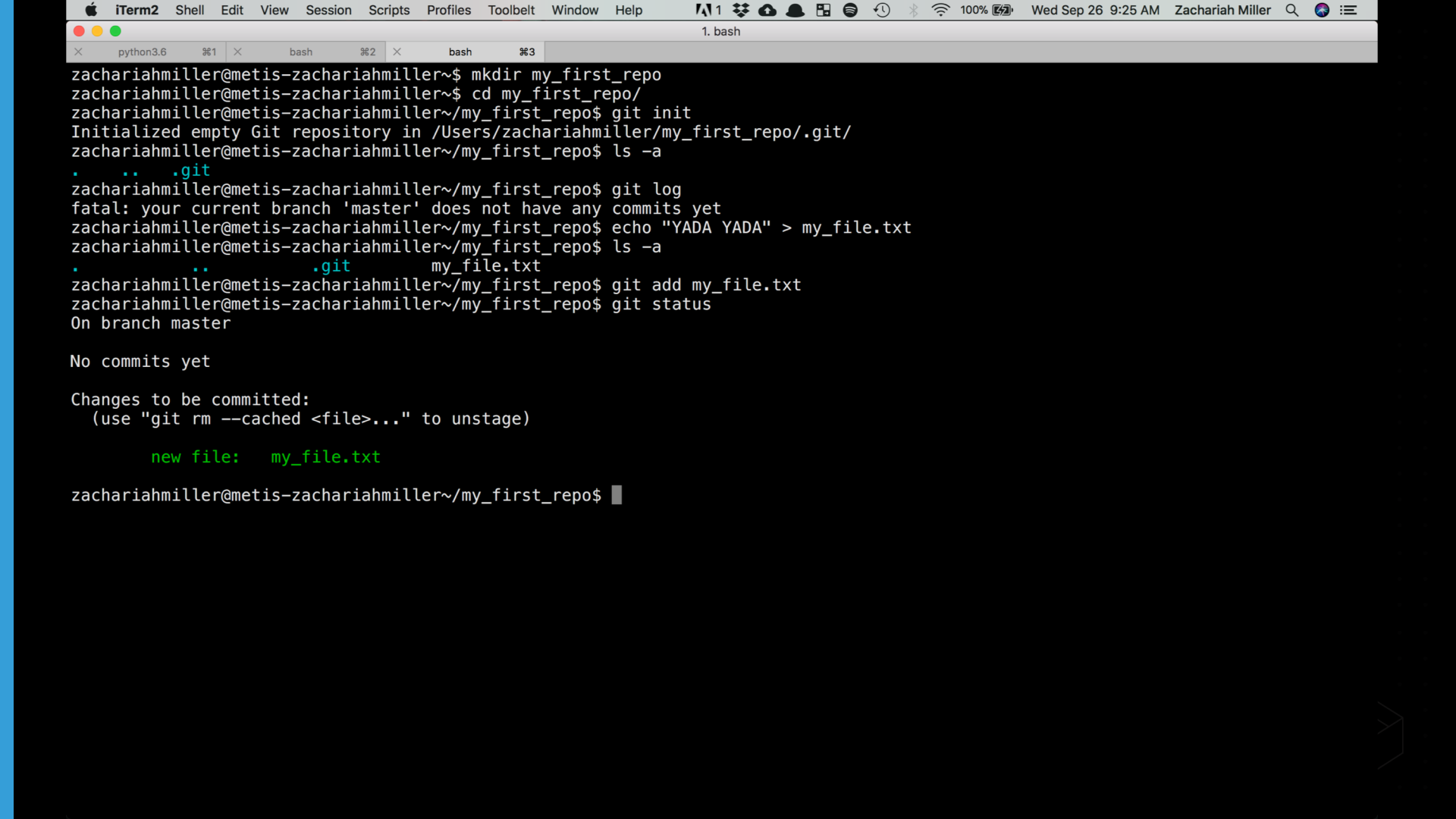
. .. .git my_file.txt
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git add my_file.txt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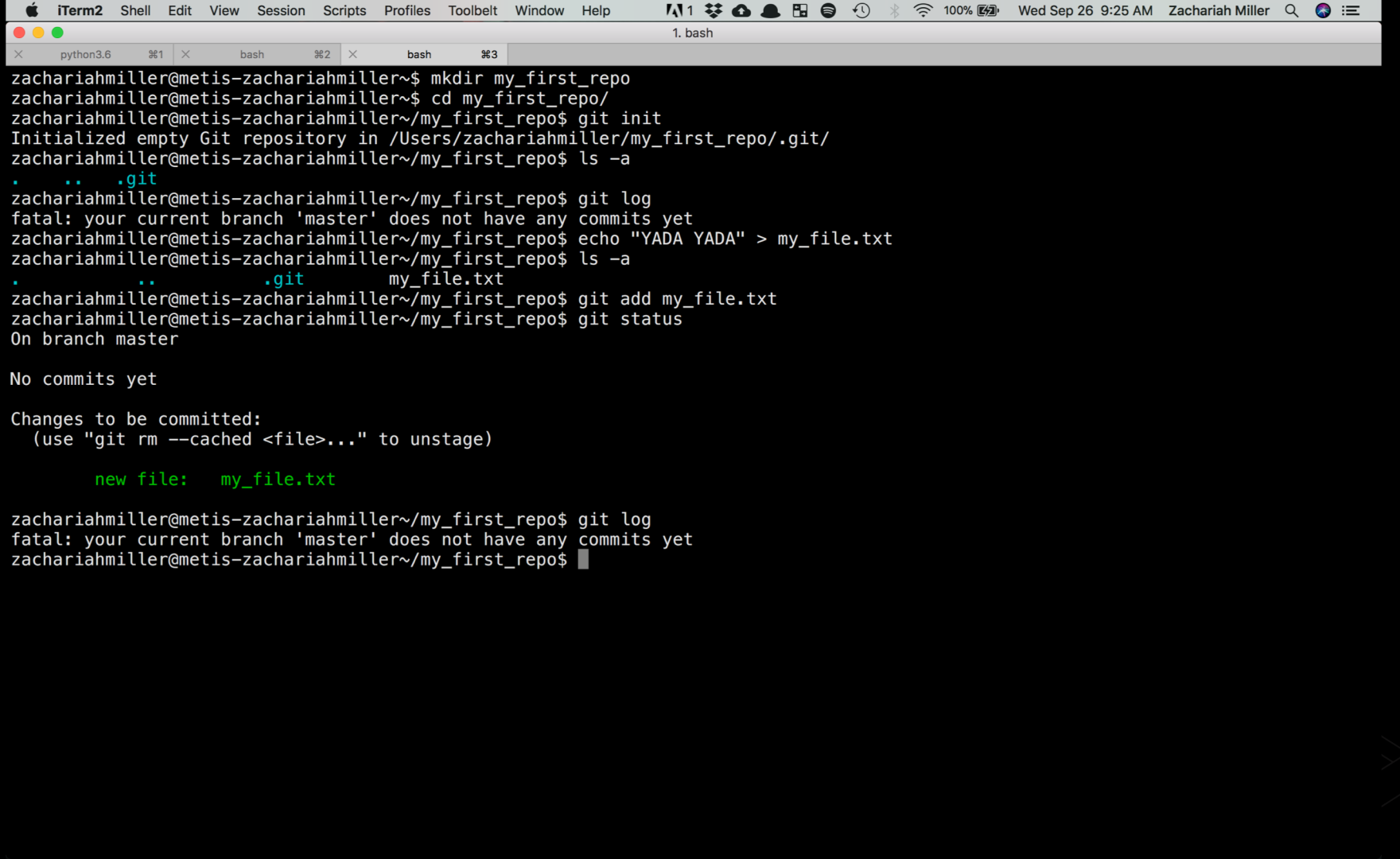
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git status
On branch master
No commits yet
Changes to be committed:
(use "git rm --cached <file>..." to unstage)
new file: my_file.txt
zachariahmiller@metis-zachariahmiller~/my_first_repo$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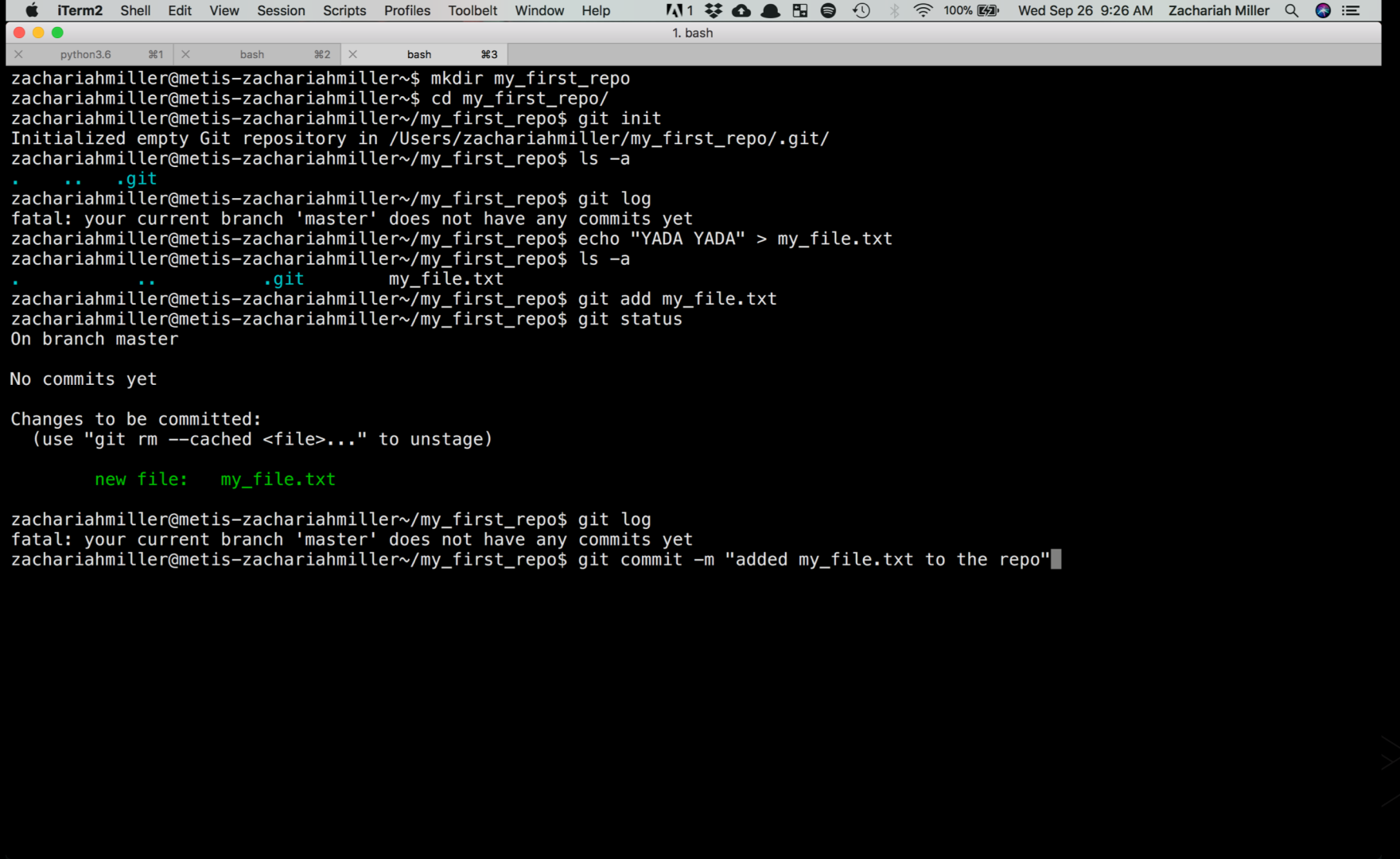
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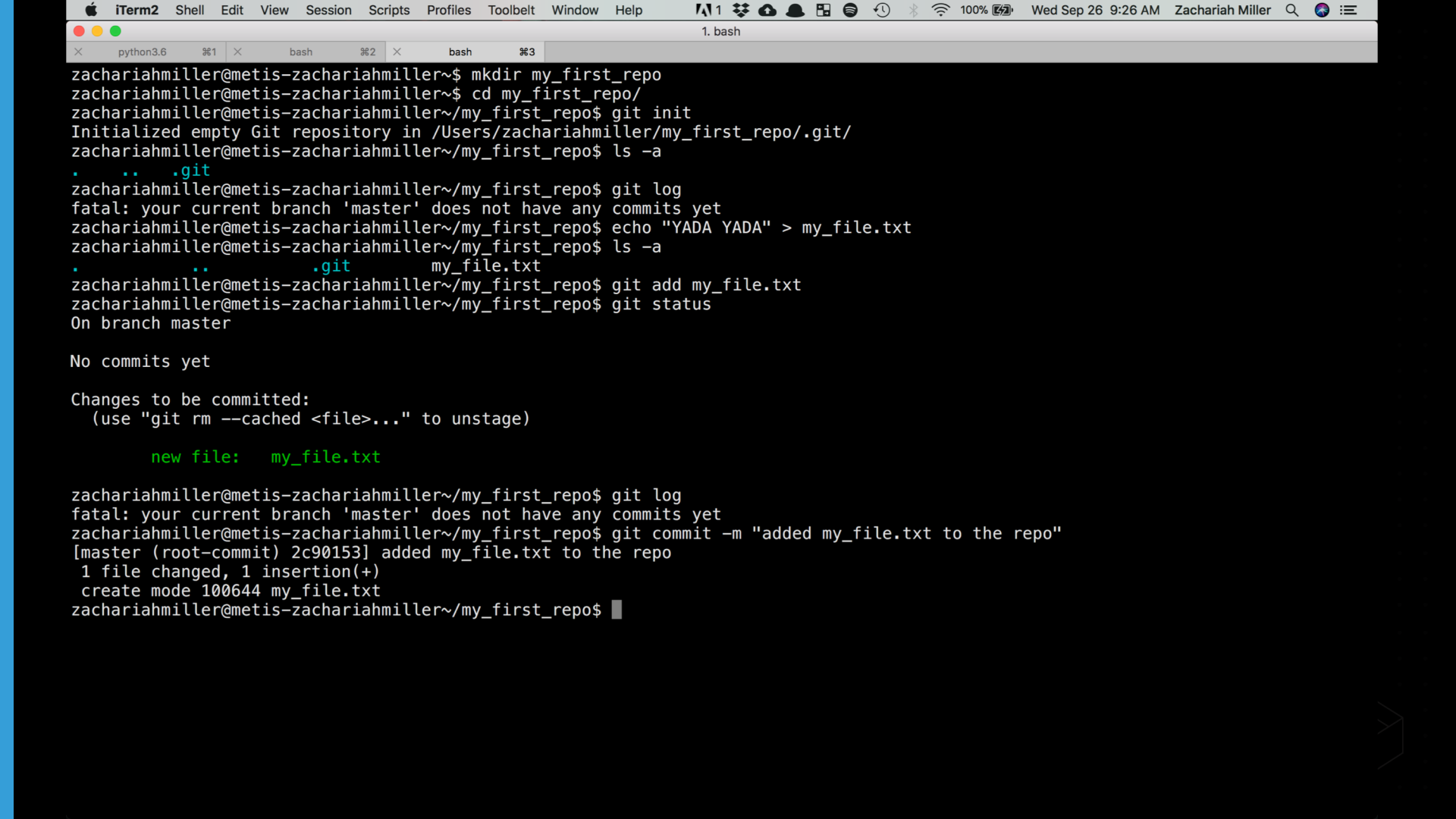
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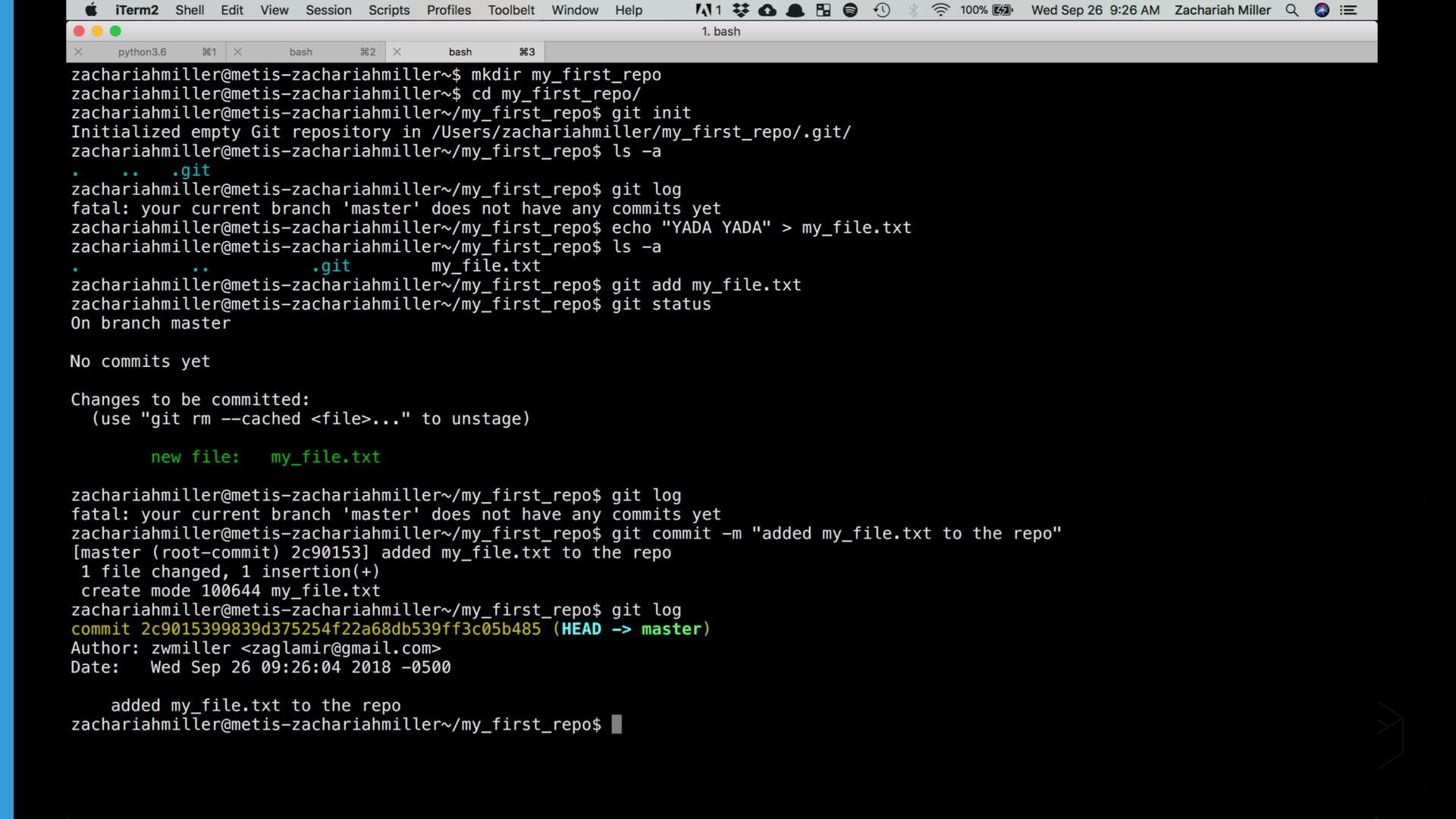
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git status
On branch master
No commits yet
Changes to be committed:
(use "git rm --cached <file>..." to unstage)
new file: my_file.txt
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git log
fatal: your current branch 'master' does not have any commits yet
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git commit -m "added my_file.txt to the repo"
[master (root-commit) 2c90153] added my_file.txt to the repo
1 file changed, 1 insertion(+)
create mode 100644 my_file.txt
zachariahmiller@metis-zachariahmiller~/my_first_repo$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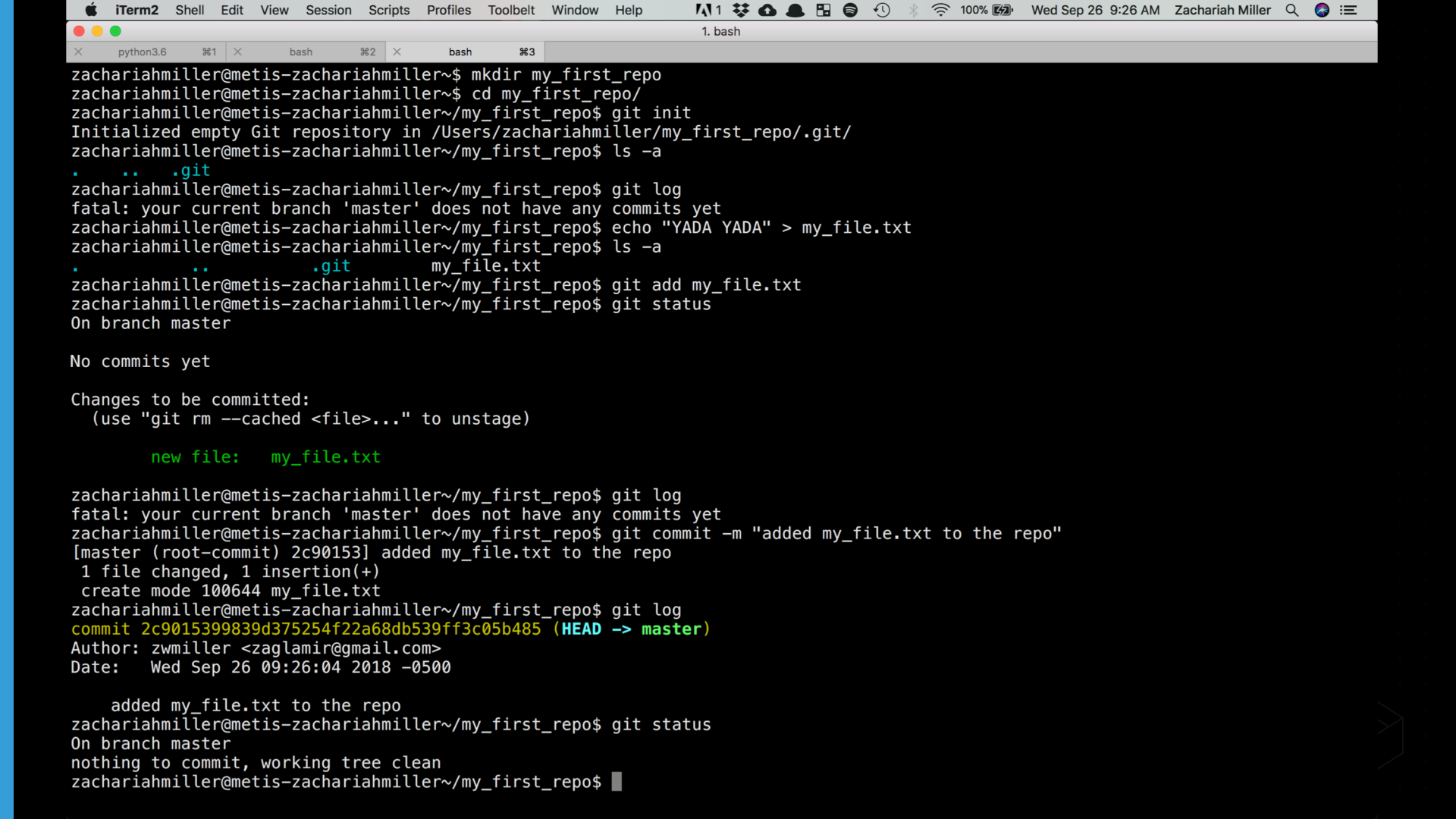
[master (root-commit) 2c90153] added my_file.txt to the repo
1 file changed, 1 insertion(+)
create mode 100644 my_file.txt
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git log
commit 2c9015399839d375254f22a68db539ff3c05b485 (HEAD -> master)
Author: zwmiller <zaglamir@gmail.com>
Date: Wed Sep 26 09:26:04 2018 -0500
added my_file.txt to the repo
zachariahmiller@metis-zachariahmiller~/my_first_repo$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zachariahmiller@metis-zachariahmiller~/my_first_repo$ git status
On branch master
No commits yet
Changes to be committed:
(use "git rm --cached <file>..." to unstage)
new file: my_file.txt
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fatal: your current branch 'master' does not have any commits yet
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[master (root-commit) 2c90153] added my_file.txt to the repo
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create mode 100644 my_file.txt
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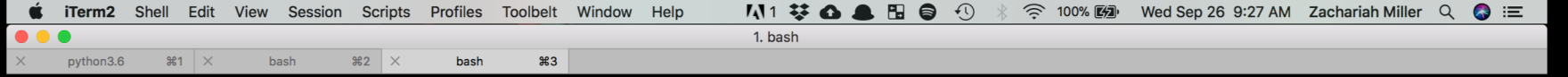
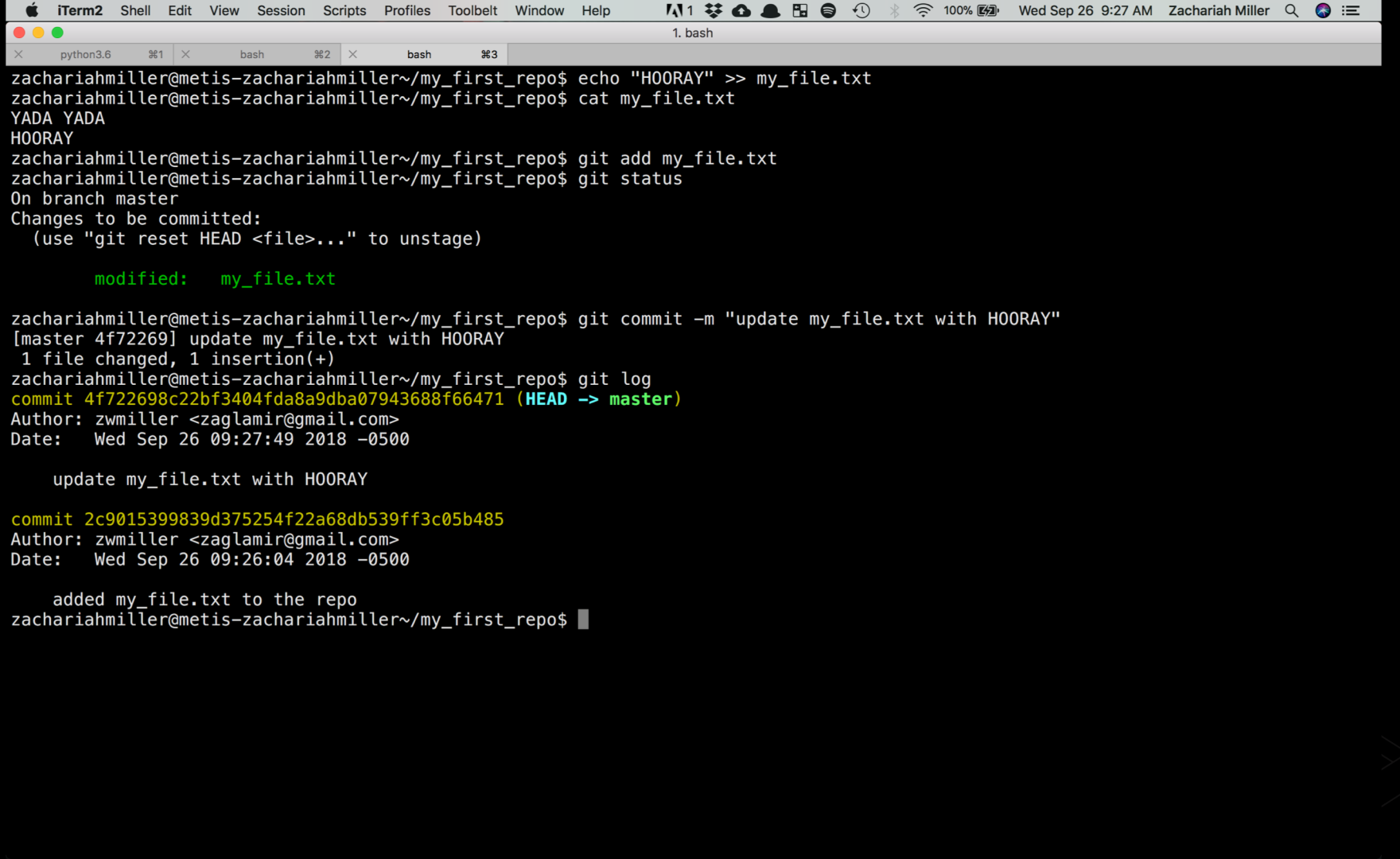
commit 2c9015399839d375254f22a68db539ff3c05b485 (HEAD -> master)
Author: zwmiller <zaglamir@gmail.com>
Date: Wed Sep 26 09:26:04 2018 -0500
added my_file.txt to the repo
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git status
On branch master
nothing to commit, working tree clean
zachariahmiller@metis-zachariahmiller~/my_first_repo$




```
zachariahmiller@metis-zachariahmiller~/my_first_repo$ echo "HOORAY" >> my_file.txt
zachariahmiller@metis-zachariahmiller~/my_first_repo$ cat my_file.txt
YADA YADA
HOORAY
zachariahmiller@metis-zachariahmiller~/my_first_repo$
```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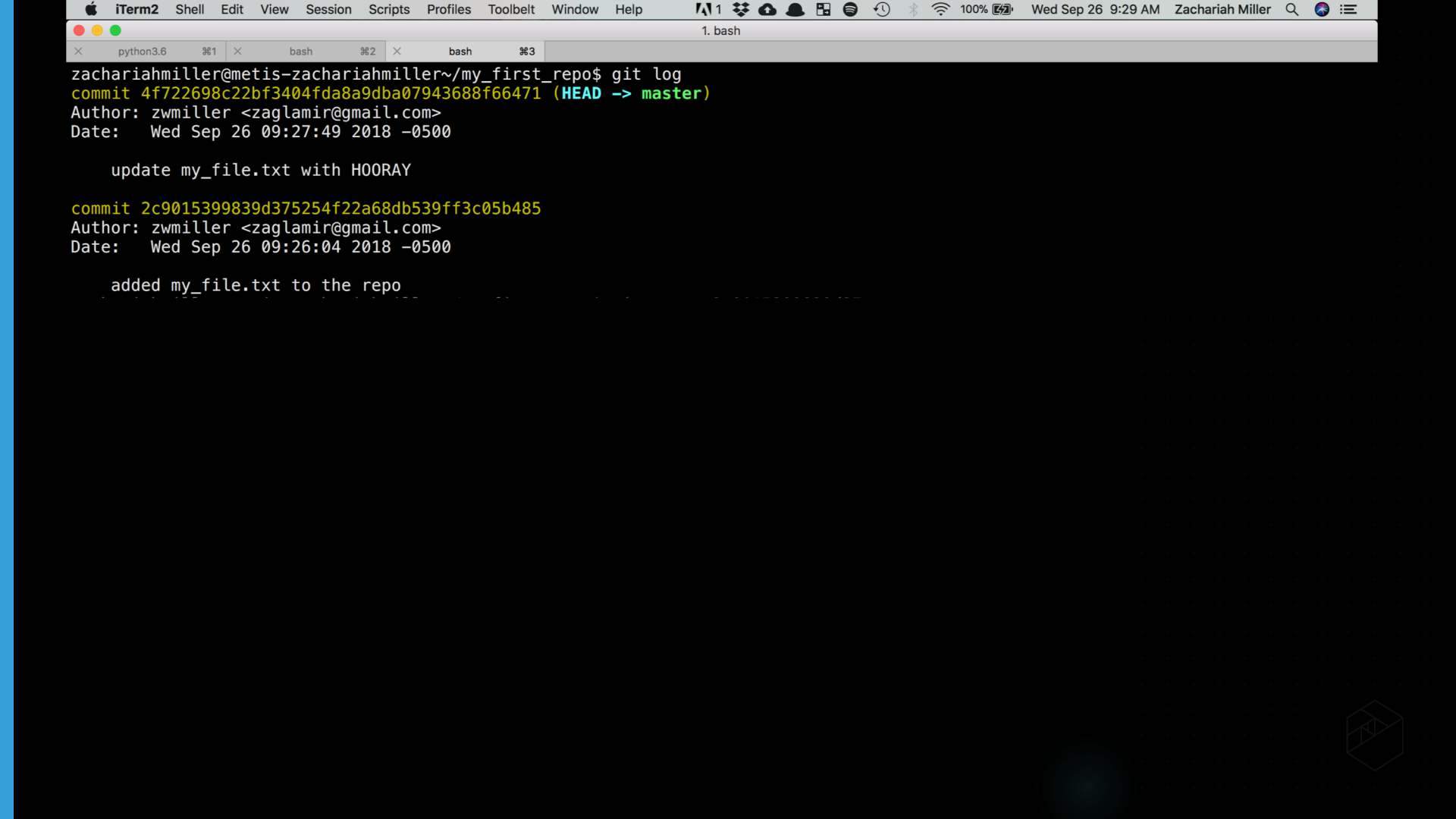
zachariahmiller@metis-zachariahmiller~/my_first_repo$ cat my_file.txt
YADA YADA
HOORAY
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git add my_file.txt
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git status
On branch master
Changes to be committed:
(use "git reset HEAD <file>..." to unstage)
modified: my_file.txt
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git commit -m "update my_file.txt with HOORAY"
[master 4f72269] update my_file.txt with HOORAY
1 file changed, 1 insertion(+)
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git log
commit 4f722698c22bf3404fda8a9dba07943688f66471 (HEAD -> master)
Author: zwmiller <zaglamir@gmail.com>
Date: Wed Sep 26 09:27:49 2018 -0500
update my_file.txt with HOORAY
commit 2c9015399839d375254f22a68db539ff3c05b485
Author: zwmiller <zaglamir@gmail.com>
Date: Wed Sep 26 09:26:04 2018 -0500
added my_file.txt to the repo
zachariahmiller@metis-zachariahmiller~/my_first_repo$

Reverting to a previous point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Author: zwmiller <zaglamir@gmail.com>
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added my_file.txt to the repo

1. bash

python3.6 ⌘1 | bash ⌘2 | bash ⌘3

```
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git log
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Author: zwmiller <zaglamir@gmail.com>
Date:   Wed Sep 26 09:27:49 2018 -0500

    update my_file.txt with HOORAY

commit 2c9015399839d375254f22a68db539ff3c05b485
Author: zwmiller <zaglamir@gmail.com>
Date:   Wed Sep 26 09:26:04 2018 -0500

    added my_file.txt to the repo
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git reset 2c9015399839d37
Unstaged changes after reset:
M       my_file.txt
zachariahmiller@metis-zachariahmiller~/my_first_repo$ cat my_file.txt
YADA YADA
HOORAY
```

1. bash

python3.6 ⌘1 | bash ⌘2 | bash ⌘3

```
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git log
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python3.6 ⌘1 | bash ⌘2 | bash ⌘3

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    added my_file.txt to the repo
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Unstaged changes after reset:
M       my_file.txt
zachariahmiller@metis-zachariahmiller~/my_first_repo$ cat my_file.txt
YADA YADA
HOORAY
zachariahmiller@metis-zachariahmiller~/my_first_repo$ git reset --hard 2c9015399839d37
HEAD is now at 2c90153 added my_file.txt to the repo
zachariahmiller@metis-zachariahmiller~/my_first_repo$ cat my_file.txt
YADA YADA
zachariahmiller@metis-zachariahmiller~/my_first_repo$
```

GitHub: Managing Coding Teams

GitHub

GitHub looks at what git does and asks the question, “what if I want lots of people to be sharing code?”

- It adds an online component of code sharing
- It adds a new phase to our “3 phases of Git”
- It allows the repo to live somewhere other than your computer, so your backups are backed up.

scikit-learn / scikit-learn

scikit-learn: machine learning in Python http://scikit-learn.org

machine-learning python statistics data-science data-analysis

23,273 commits **18** branches **89** releases **1,164** contributors

ogrisel Dedicate the release to Raghav — Latest commit 86931ad 4 hours ago

.circleci	[MRG] Fix FutureWarnings in logistic regression examples (#12114)	2 days ago
benchmarks	FIX: enfore backward compatibility of decision function in Iforest (#...	2 months ago
build_tools	[MRG] MNT Re-enable PyPy CI (#12039)	8 days ago
doc	Dedicate the release to Raghav	4 hours ago
examples	MNT Unused import in plot_gpr_co2.py	7 hours ago
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.coveragerc	coverall added	5 years ago
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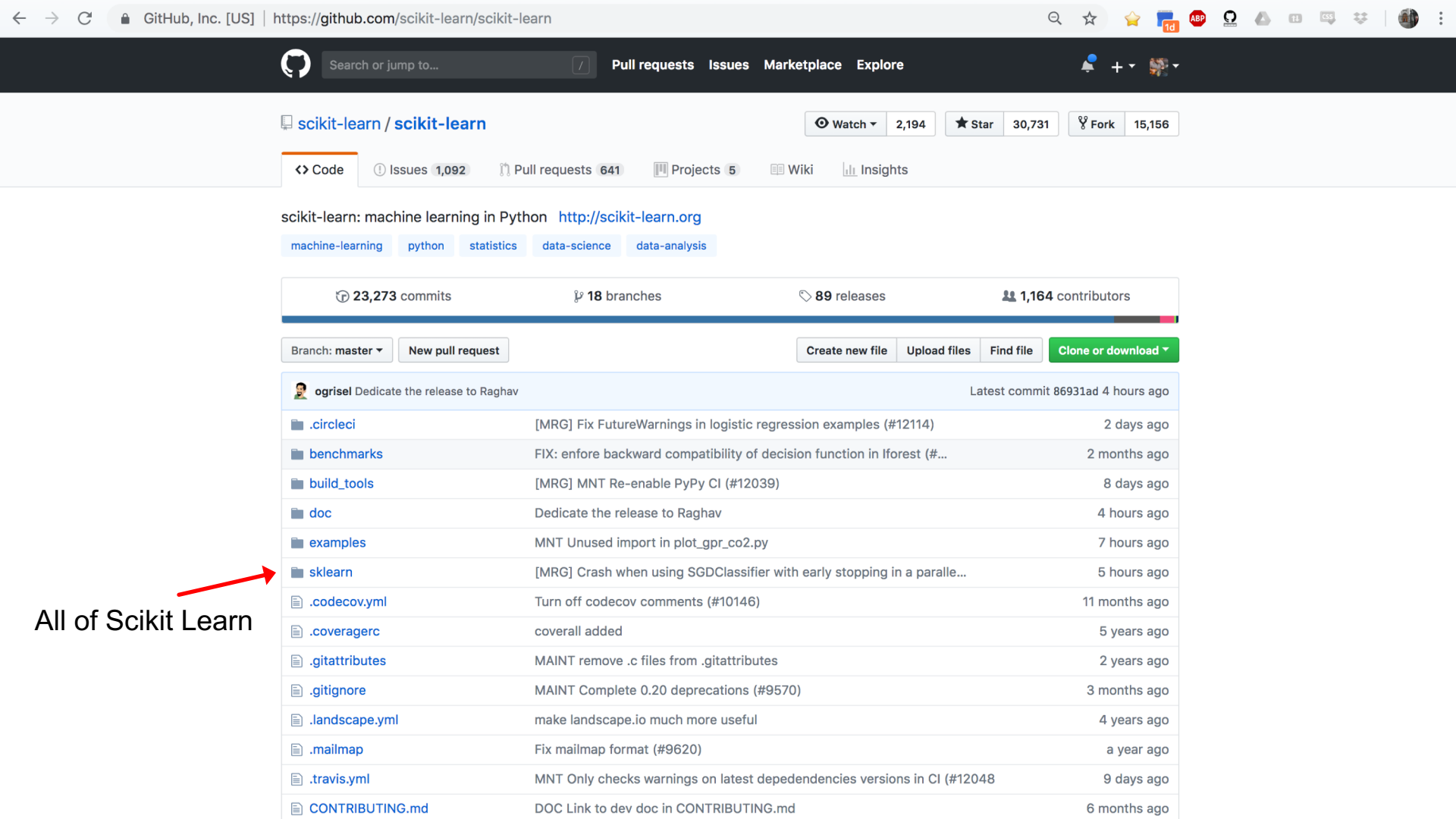

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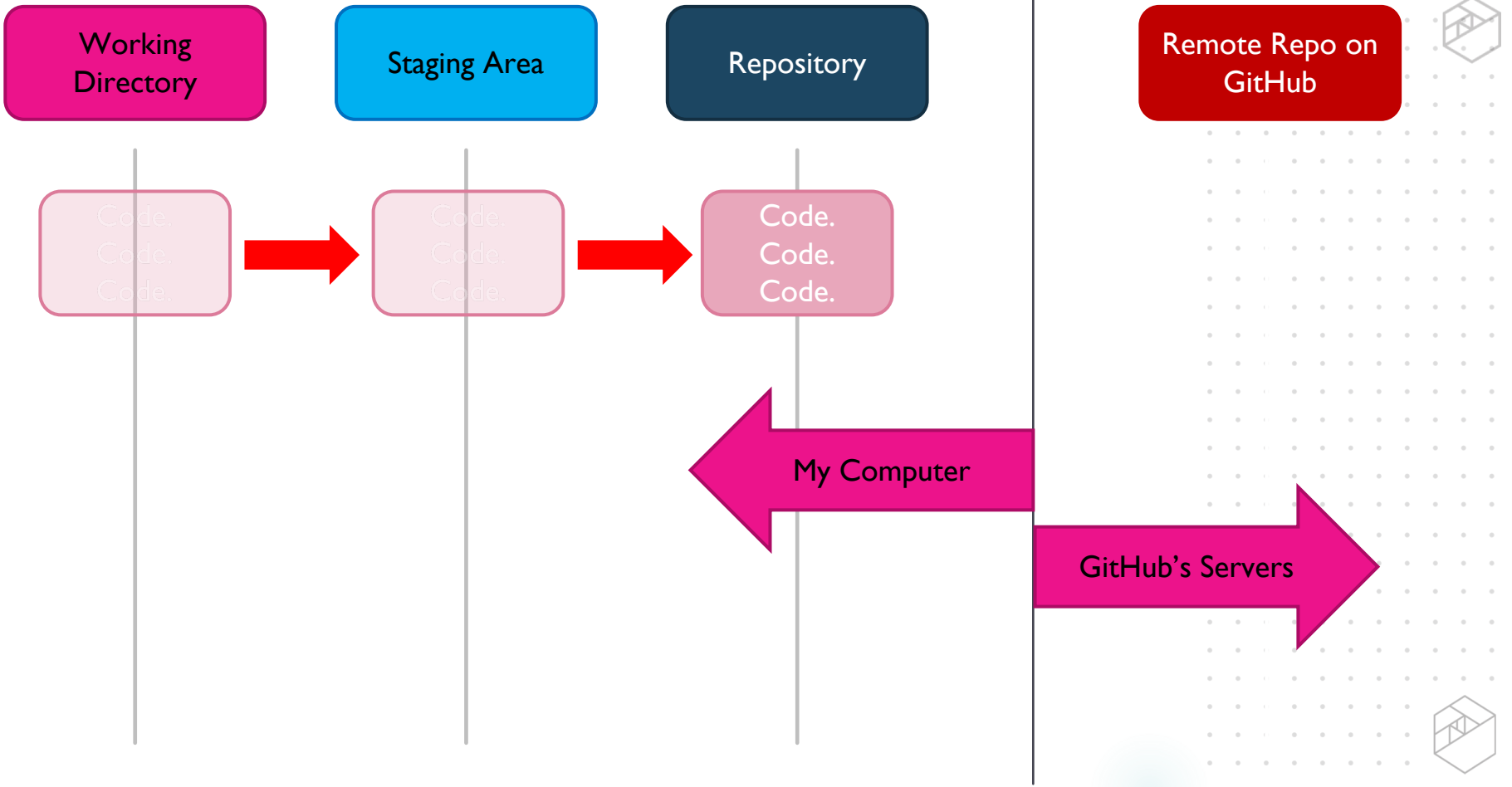
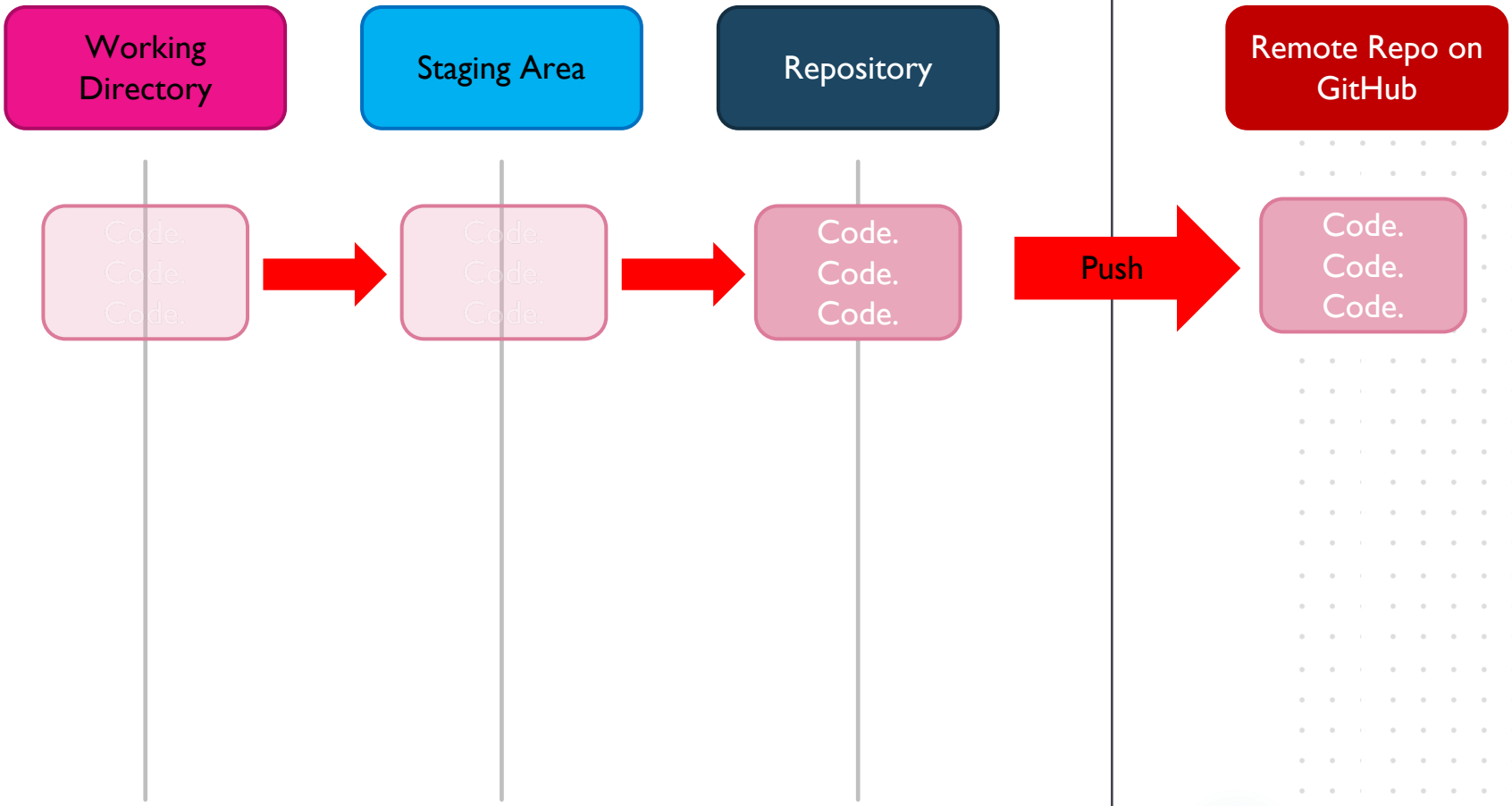

Working Directory
Staging Area
Repository
Remote Repo on GitHub
Code.
Code.
Code.
My Computer
GitHub's Servers

GitHub: Remote vs Local

- We use pushes and pulls to move the current version of our repo between our computer and a “remote” version of the repo.
  - A push says, “make the remote version look like my code” and in particular it updates any files that changed in the last commits.
  - A pull says, “bring in any changes that have occurred on the remote version of the repo and make my code match those”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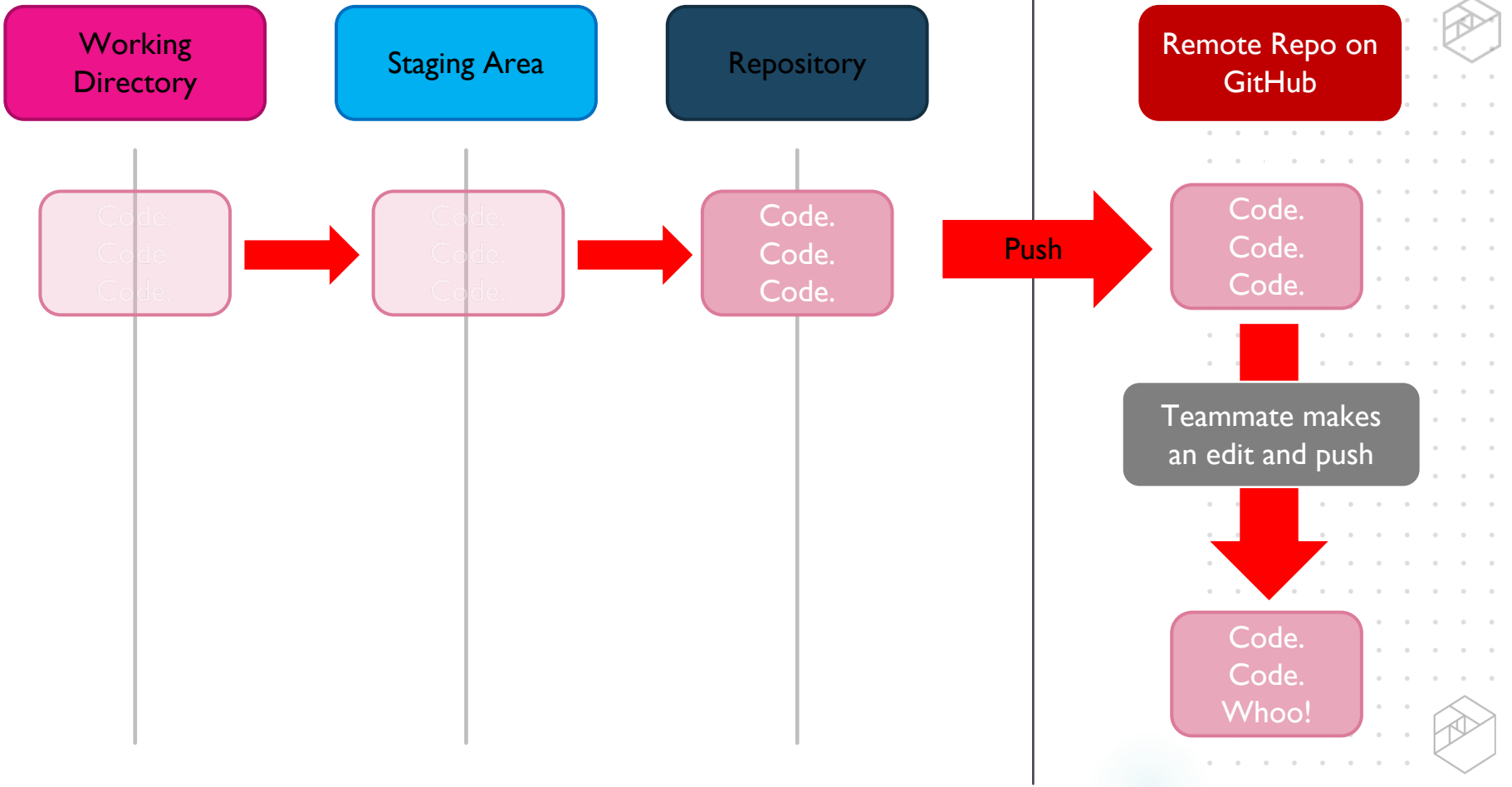
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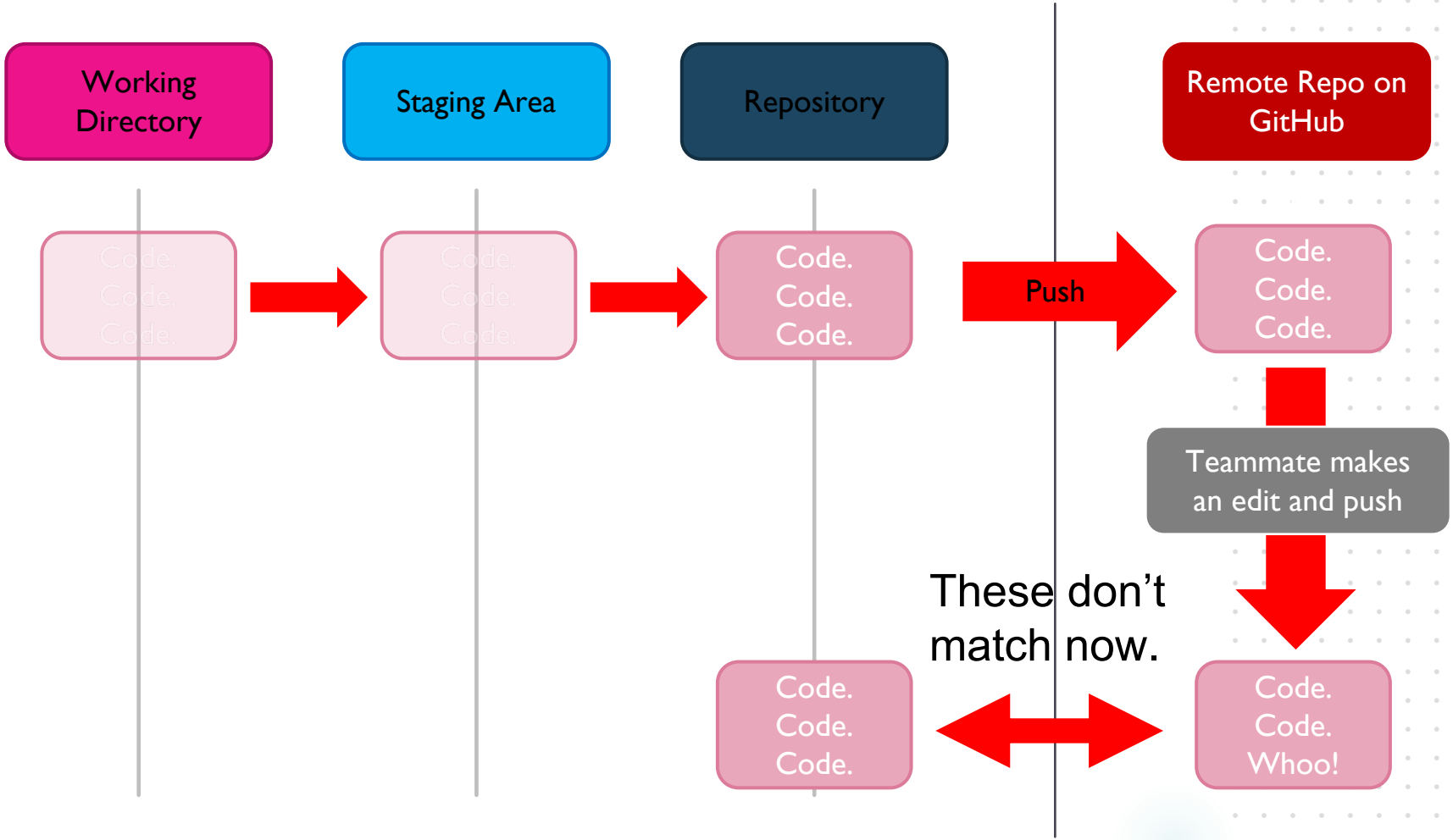
Whoo!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Teammate makes an edit and push
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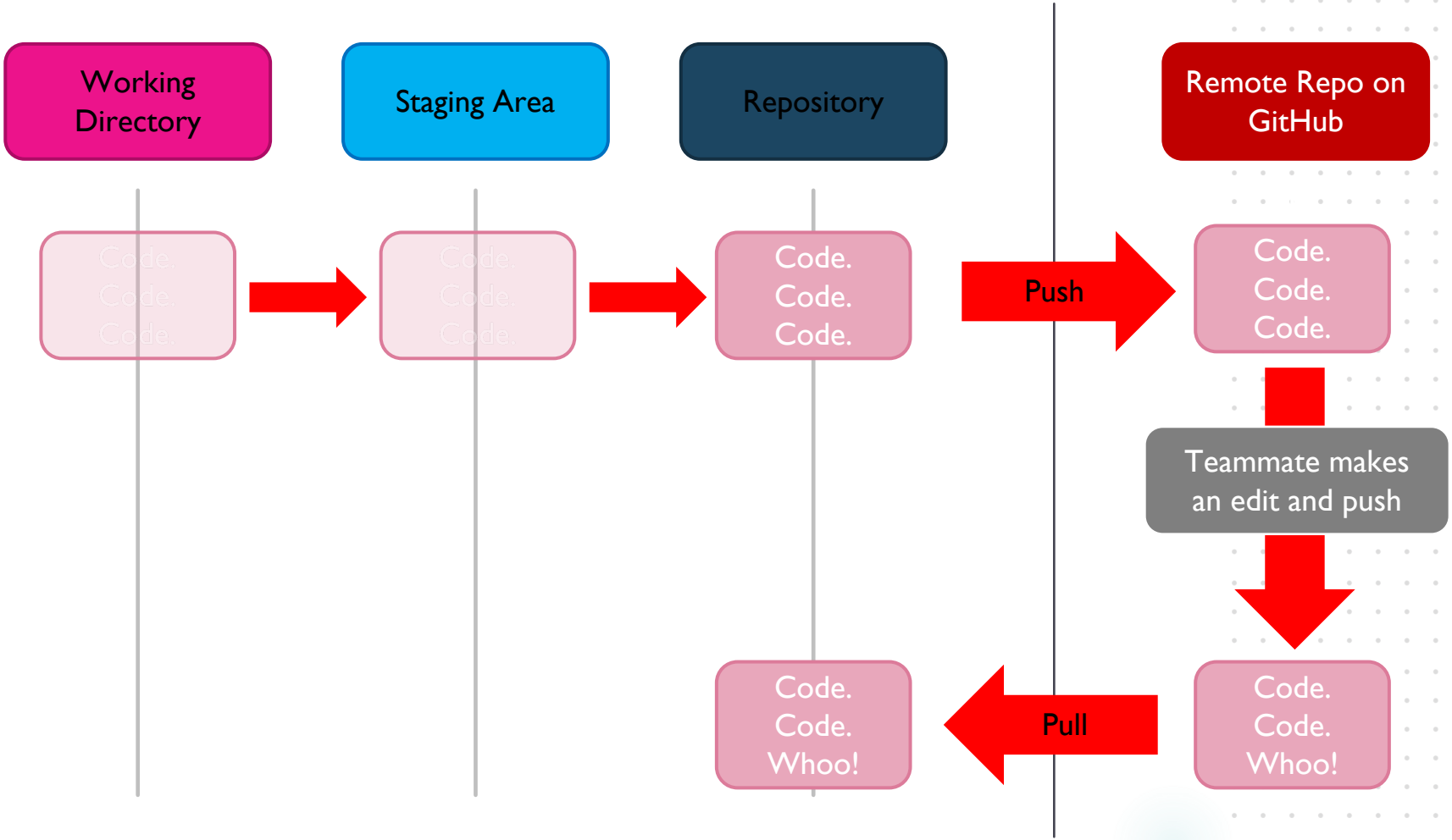
Whoo!


Working Directory
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Code.
Code.
Code.
Push
Teammate makes an edit and push
Pull
Code.
Code.
Whoo!

GitHub: Remote vs Local

- One subtlety: GitHub only modifies files that have CHANGED since the last time you asked Git to track them. So if I never asked Git to track a certain file (by making an add-commit), even if I push my code, it won't go to the remote version).

Exercise: Making your repo remote

Let’s start by creating a repo on GitHub called “Test”

Connecting GitHub to our Local Repo

- We now have a remote repo (on GitHub) and the local one where we put our test files. Let's link those together.

First, in the terminal, move to the repo we started earlier. You need to be in the folder where we did the `git init` earlier. (or any directory below that)

Connecting GitHub to our Local Repo

- We now have a remote repo (on GitHub) and the local one where we put our test files. Let's link those together.

```
Terminal:> git remote add origin URL_FROM_GITHUB
```

This tells git are about to tell it about the non-local version of the repo

Connecting GitHub to our Local Repo

- We now have a remote repo (on GitHub) and the local one where we put our test files. Let's link those together.

```
Terminal:> git remote add origin URL_FROM_GITHUB
```

This tells git we're adding a new remote place to interface with

Connecting GitHub to our Local Repo

- We now have a remote repo (on GitHub) and the local one where we put our test files. Let's link those together.

```
Terminal:> git remote add origin URL_FROM_GITHUB
```

This tells git that we're going to call this remote place "origin" (it's convention)

Connecting GitHub to our Local Repo

- We now have a remote repo (on GitHub) and the local one where we put our test files. Let's link those together.

```
Terminal:> git remote add origin URL_FROM_GITHUB
```

This is specific to your repo and tells git where the remote repo lives.

Connecting GitHub to our Local Repo

- Make sure it worked by testing your remote locations using:

```
Terminal:> git remote -v
```

I see an output like this:

```
origin https://github.com/ZWMiller/test (fetch)
origin https://github.com/ZWMiller/test (push)
```

Connecting GitHub to our Local Repo

- Now let’s move our code to GitHub

```
Terminal:> git push origin master
```

- When we go back to our GitHub and refresh, we should see out files there!

Connecting GitHub to our Local Repo

- Now let's move our code to GitHub

```
Terminal:> git push origin master
```

This told git we wanted to move our commit history up to GitHub

Connecting GitHub to our Local Repo

- Now let's move our code to GitHub

```
Terminal:> git push origin master
```

This told git to use the remote place we just created called "origin"

Connecting GitHub to our Local Repo

- Now let's move our code to GitHub

```
Terminal:> git push origin master
```

This told git to put those changes on the "master" branch. We'll talk about branches later, but master is the most important one.

Summary

- Git and GitHub are powerful tools for maintaining good code.
- They allow us to checkpoint via commits, and give us the power to move back in time if we break our code.
- GitHub allows us to share our code with others and allows multiple people to make changes to the code.

Best Practice

- A smart person would keep a GitHub repo for all of their projects. They would create one right after this lecture for project 1. That way, if they happen to spill coffee on their laptop, their code is backed up.
- It’s a good idea to commit/push often. I usually do so after every completed “point” in my code. Finished a few functions that now work together? Commit. Updated comments in the code? Commit.

QUESTIONS?