Version Control
git + GitHub

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GR5069
Topics in Applied Data Science
for Social Scientists

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Columbia University

Before we begin...

Housekeeping (I): ISO a note-taker for this class

- CU is looking for a **note-taker** for this course
  - **notes** should be **well-organized** and **detailed**
  - note-taker will be **compensated** ($250 for the semester)
- **interested?** submit a sample of your notes to **Emma Johnson** (edj2115@columbia.edu), Assistant Dean of Student Life and Well-being
- **further details**: see posting on **Slack**

Housekeeping (II): use **Slack**!

- **Slack** is the **preferred method of communication** for this class!
  - **sign up** if you haven't already! You should have received an invite in your @columbia email
- **Slack** will be used for all:
  - **class announcements**
  - **questions and comments**
  - **discussions**
  - you'll get a quicker answer there

Housekeeping (II): questions on **Slack**!

- **is it possible that others have a similar question?** post your question in the appropriate channel using the **@channel** handle (we'll all chime in!)
- **is it only relevant to you?** create a **private channel** including instructors and TAs (you'll get a quicker answer!)
- **email** will be reserved for **official communications** only!

Housekeeping (III): timely use of **Slack**!

- we're seeking to generate **collaborative discussions** through Slack **before our live sessions**
- that requires students and instructors to have **enough time to respond**
- please:
  - check **annotated materials, lecture recordings, assignments** for the coming week **immediately after class**
  - do your readings, assignments and exercises **early in the week** (do not leave them to the last minute)
  - **post questions and comments** with **sufficent anticipation** to allow for meaningful interactions (i.e. not a few hours before class)

Housekeeping (IV): GitHub handles for GitHub classroom

- please fill out the Google sheet — link in **Slack** with your GitHub handle
- students registered for the course will be added to GitHub classroom this weekend!
- **Homework #1** will be available on Monday and due next Monday

Now, let's get started!

A Data Science project...

Three **aims** of a Data Science project

a) **reproducibility**

- anyone should be able to arrive to your **same results**

b) **portability**

- anyone should be able to **pick up where you left off** on any machine

c) **scalability**

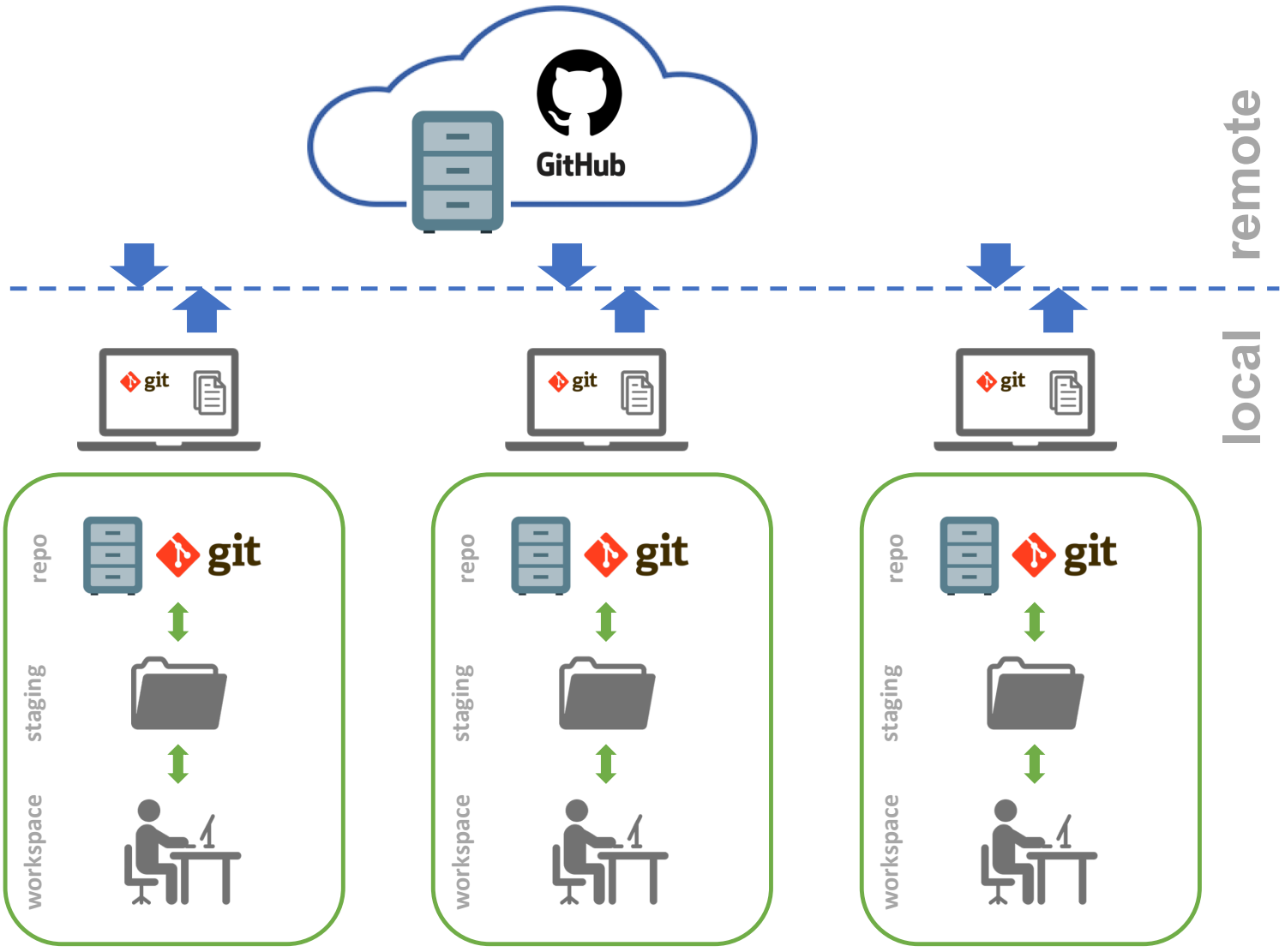
- your project should also work for **larger data sets** and/or be on the path of **automation**

a) and b) crucial for **collaborative work**

Why version control?

- **version control** allows you to keep track of changes / progress in your code
  - keeps “**snapshots**” of your code over time
  - helpful to **debug**, and to enhance **reproducibility**
  - also great for **team collaboration** (everyone can see who changed what!) and **portability**
- **git** is a version control software
- **GitHub** is an online open source repository

An ideal version control setup for collaboration

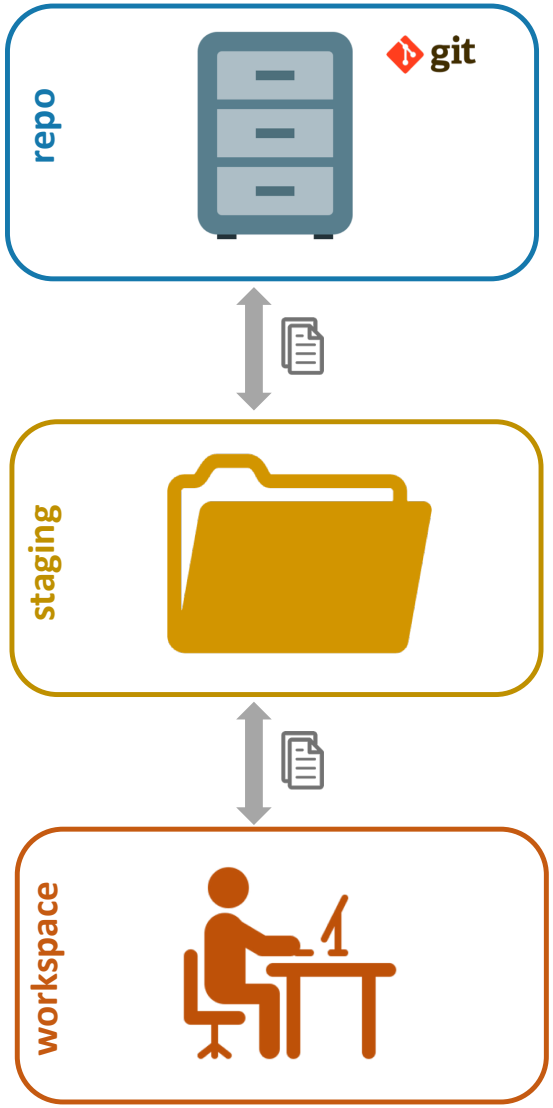


git locally

recap: what was this **git** thing?

- **git** is a version control software
  - installed “locally” on your computer (or virtual machine)
  - keeps snapshots of your (coding) work
- helps with
  - “time travel” (insert your favorite “Back to the future” gif here)
  - keep collaboration organized when multiple people are working on the same project
- a vehicle to be nice to your fellow collaborators (and to the you of the future)

git: a mental model



Introduce yourselves: git, meet your new user!

from the command line:

- set your **user name** and **email address**

```
$ git config --global user.name "John Doe"
```

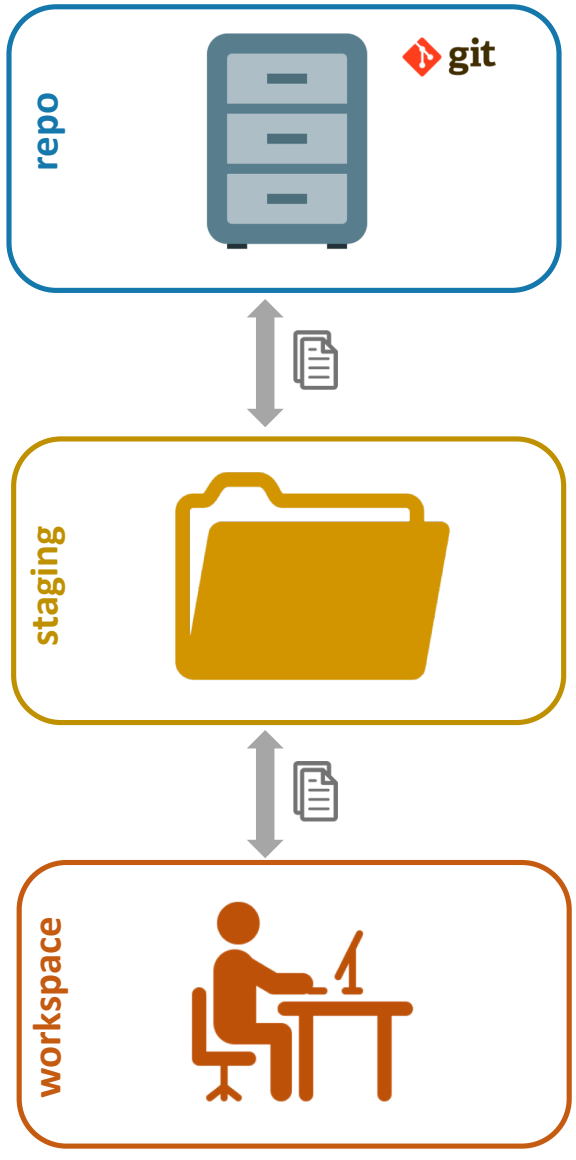
```
$ git config --global user.email johndoe@example.com
```

- **verify** that information was successfully entered

```
$ git config --list
```

- this information gets baked in your commits
- ***ProTip:*** other useful information (e.g. proxy settings) also goes on `git config`

now, turn your folder structure into a git repo



now, turn your folder structure into a git repo

from the command line:

- go to the **root** of your project and **initialize** the repo

```
$ git init
```

- there are **files you never want tracked** by git (e.g. log files, access keys), even by mistake
- from the root of your local repository, create a `.gitignore` file

```
$ touch .gitignore
```
(Mac)

```
$ echo > .gitignore
```
(Windows)

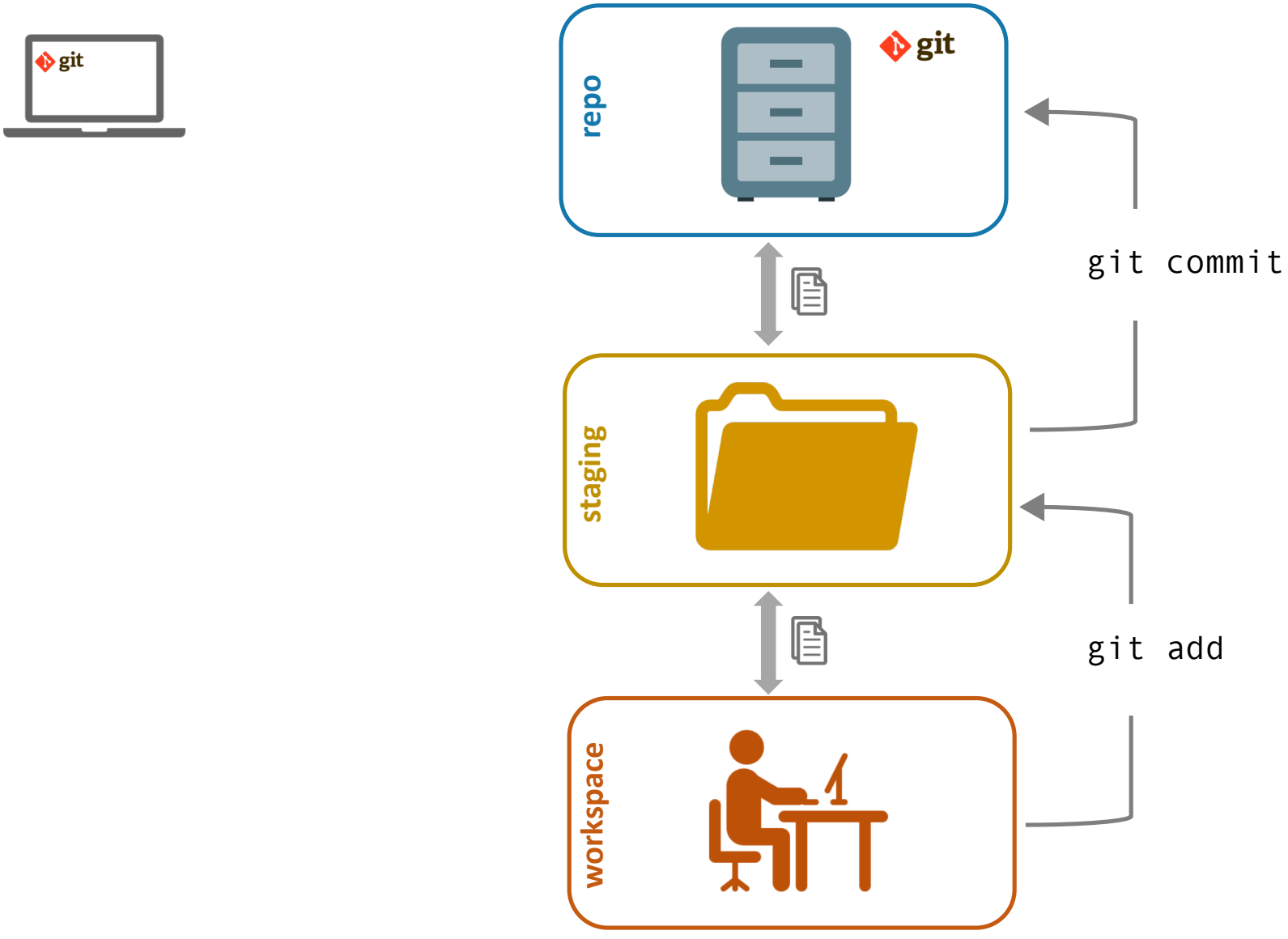
- add files you want git to ignore in the `.gitignore` file

what could go into a `.gitignore` file ?

```
# OS generated files #
*.DS_Store

# Jupyter Notebook
.ipynb_checkpoints

# RStudio files
*.Rproj.user/

# all data folders
data/
```

- ***ProTip:*** further info/templates: https://github.com/github/gitignore

your basic git workflow



your basic git workflow

from the command line:

- indicate a file to be tracked by git

```
$ git add samplefile.R
```

- verify what's being tracked

```
$ git status
```

- commit your tracked files (with an informative message)

```
$ git commit -m "Commit initial files"
```

a few confusing things about git

- a file will be committed **exactly** as it was when you `git add`-ed it
- if you change the file **after** you `git add` it, and want to commit the new changes, you need to `git add` again before the `git commit`
- use `git status` to assess what's being staged and will be commited

git workflow **ProTips**

- **NEVER** use `git add .`
- use `git status` often as **validation**
- only `add` and `commit` **source files**
  - omit files you can reproduce using source files
- `commit` **small chunks of logically grouped changes**
  - you may want to undo a change, and only that change
- `commit` with **informative** (imperative mood) **messages**
  - [*this commit will*] `Rename income variable`

git workflow **ProTips**

A quick detour: `master` vs `main` branch

- ***Pro Tip:*** current best practice is to use `main` for your default branch; used to be `master`
- by default, git will create a `main` branch after your first `commit`
- easy tor rename your branch to `main`

```
$ git branch -M main
```

- for a permanent solution (in git >= 2.28)

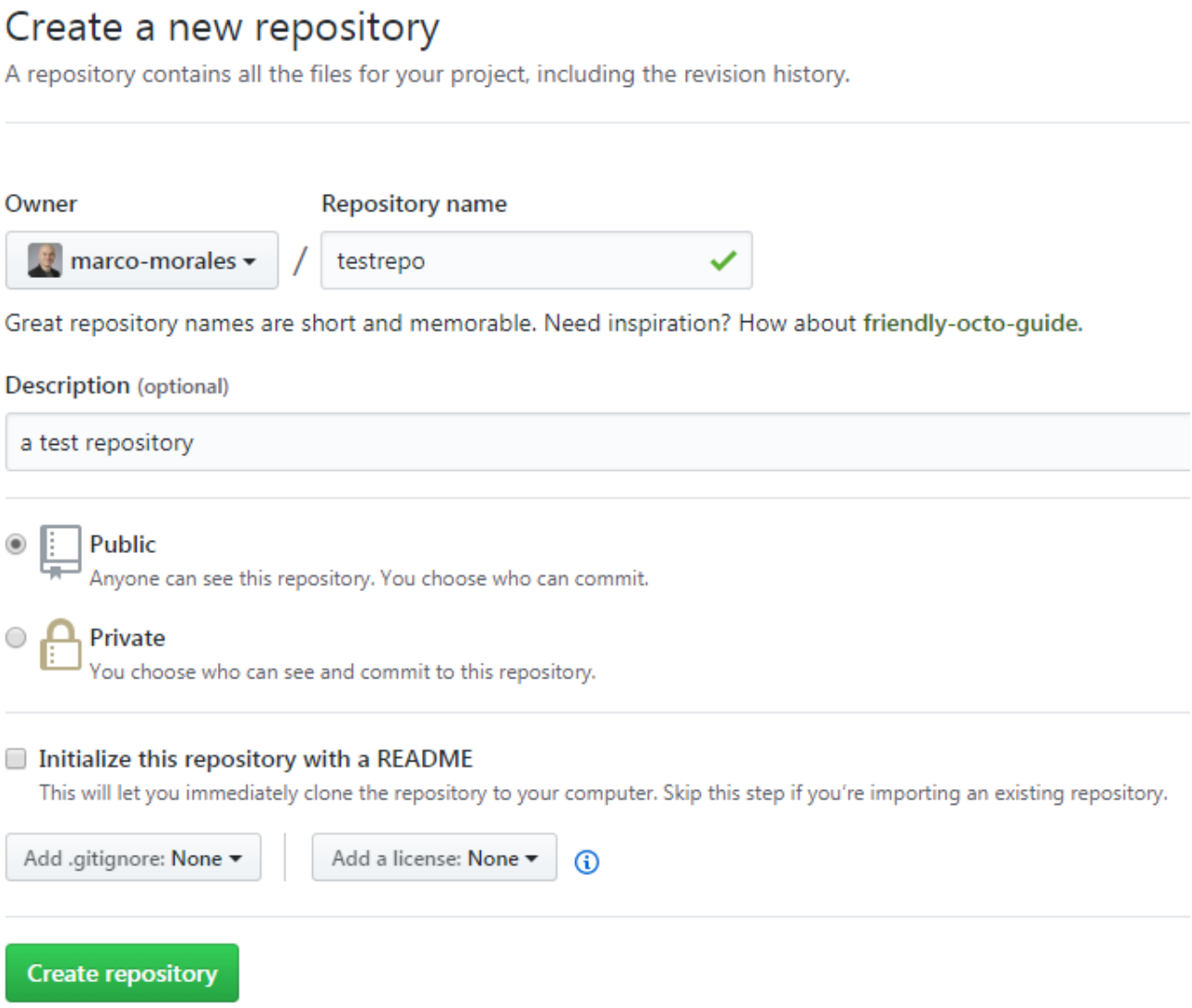
```
$ git config -global init.defaultBranch main
```

push globally
(to GitHub)

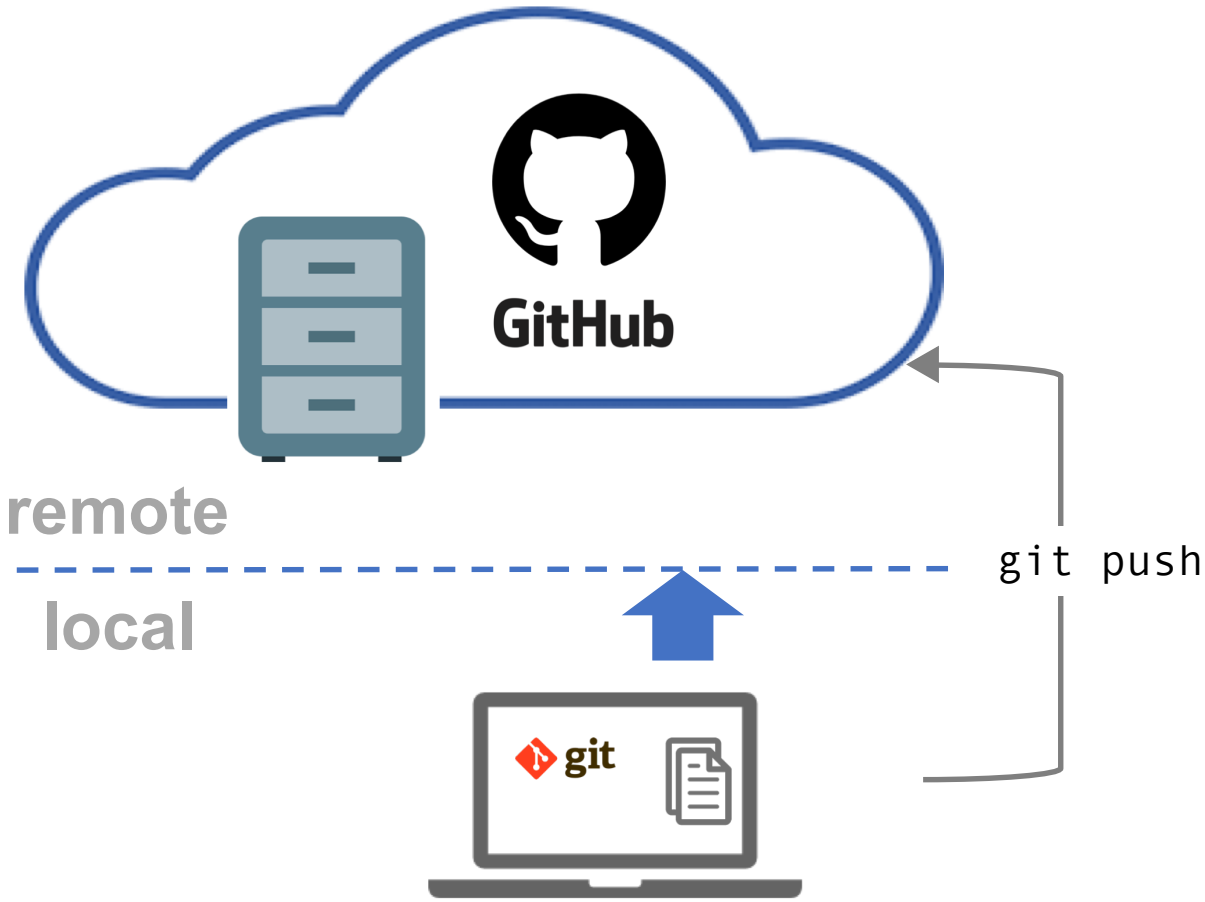
recap: what was this **GitHub** thing?

- **GitHub** is a cloud service that hosts **git** repositories
  - lives in the cloud
  - understands the git dialect!
  - can speak with multiple git users simultaneously
- helps with
  - persisting repository storage (your dog cannot eat your repo!)
  - synchronizing work
  - minimizing risk of people stepping on each other's toes (while working on the same project)
  - seamless transition between environments (dev > staging > prod)

first, create a GitHub repo to store/share in the cloud



then, `push` to that GitHub repo



then, `push` to that GitHub repo

from the command line:

- tell git the **location** of the remote GitHub repo you just created (typically nicknamed “origin”)

```
$ git remote add origin
https://github.com/marco-morales/testrepo.git
```

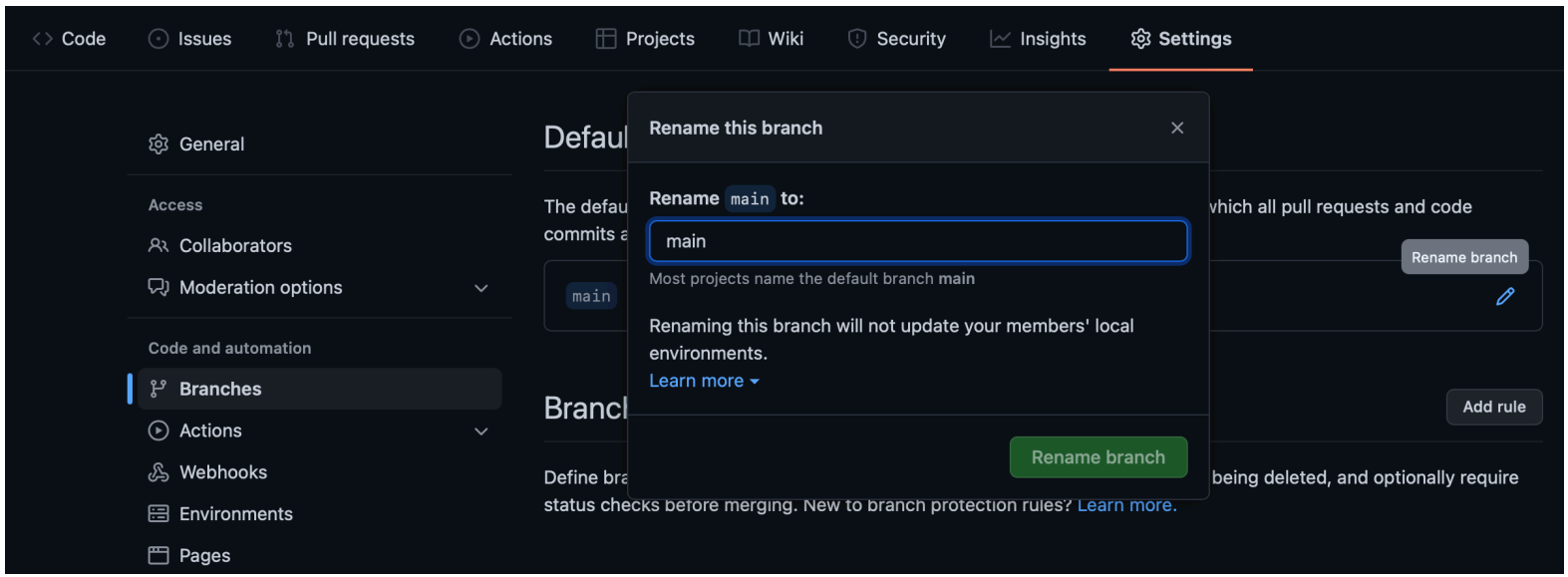
- send **commited files** to your GitHub (“origin”) repo from your local git branch (“main”)

```
$ git push -u origin main
```

GitHub workflow **ProTips**

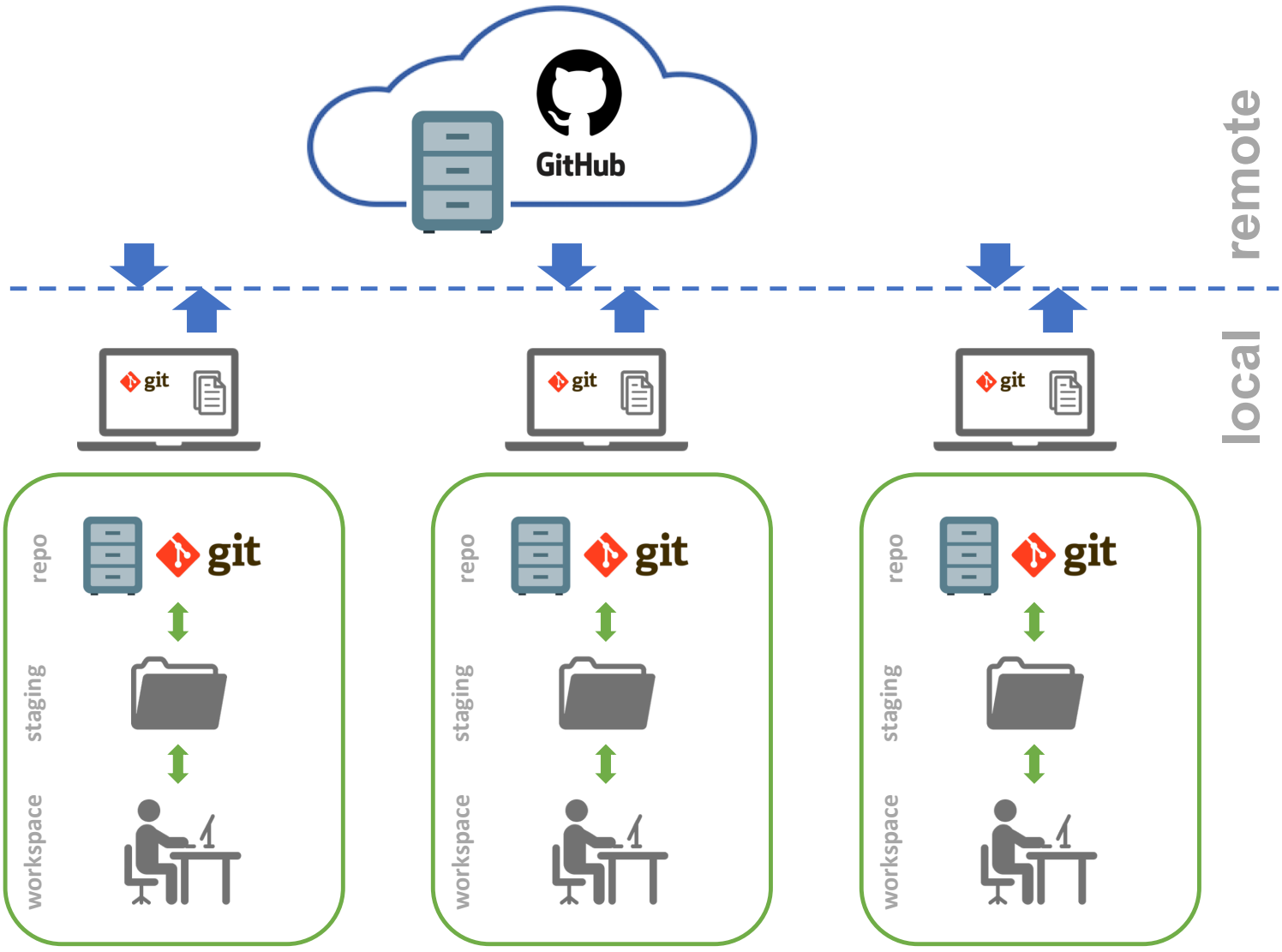
A quick detour: `master` vs `main` branch

- ***Pro Tip:*** current best practice is to use `main` for your default branch; used to be `master`
- by default, GitHub will create a `master` branch after your first create a repo if you do not change defaults
- easy to change permanently in your GitHub settings

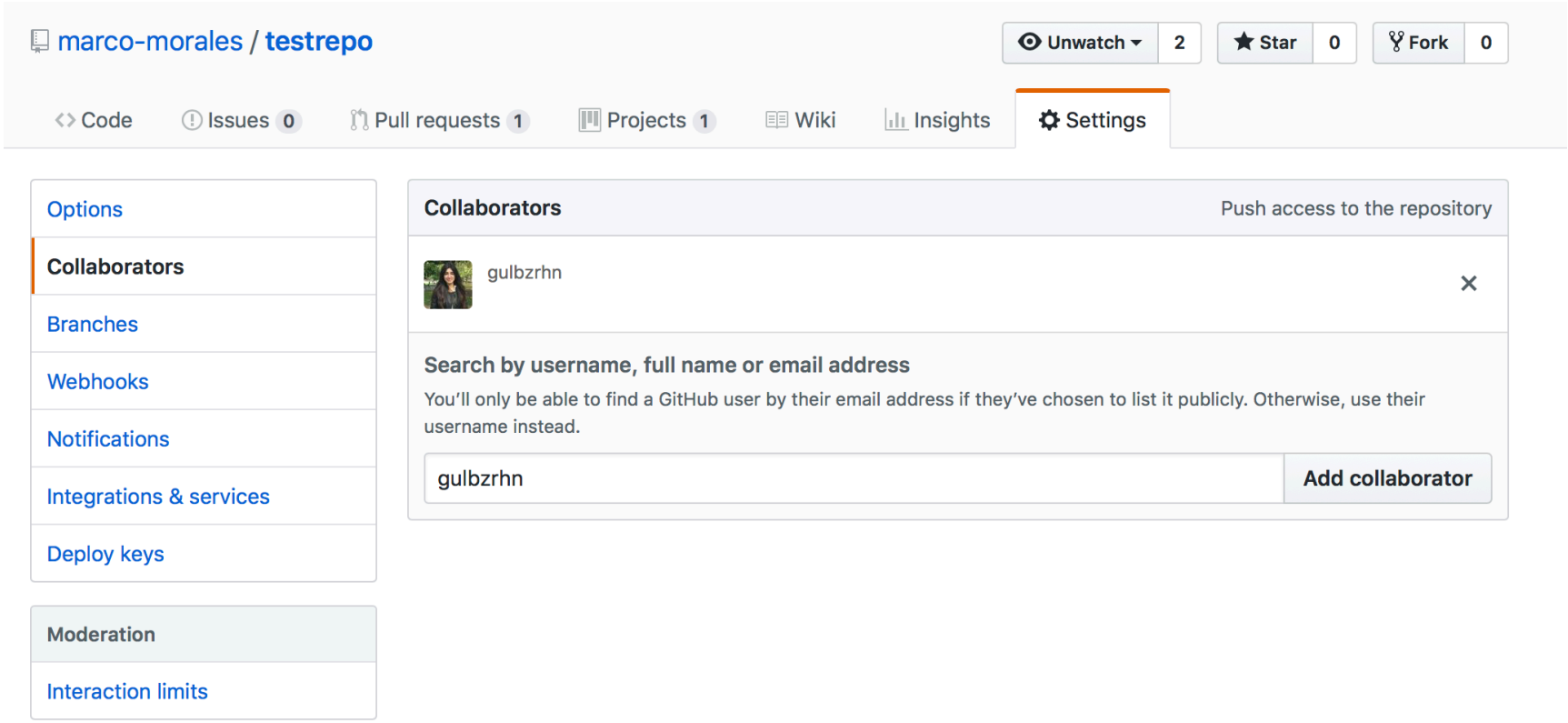


git+GitHub for team collaboration

all the building blocks are now in place



now, enable collaborators in your GitHub repo



important to know what each role can do

- add **collaborators** to your repo
  - as a repo **owner** you have control over what gets changed
  - **collaborators** will be able to `push` to the repo

a) **Collaborators:**

- work on a branch on the repo and create code
- send a `pull` request to add that code to the master repo

b) **Owner:**

- comment on the `pull` request
- accept the `pull` request and/or `merge` the code

(1) a collaborator creates a branch to work on, that will eventually be merged back to the main branch

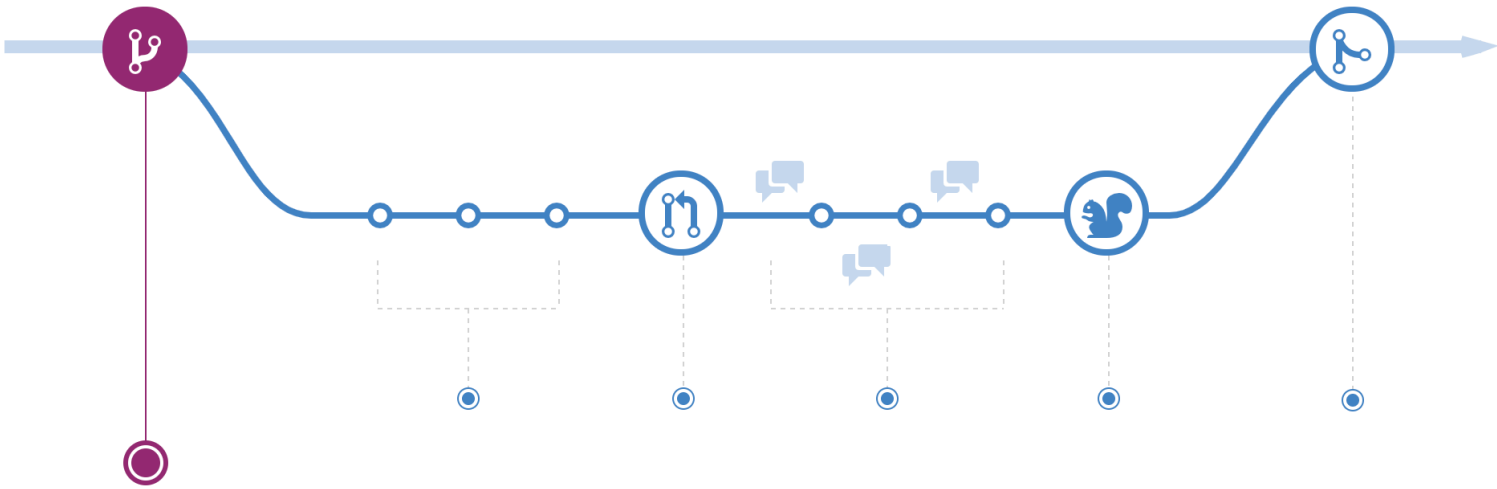


Figure: Understanding the GitHub flow

- changes in a branch do not affect the `master` branch
- ***ProTips***
  - anything in the `main` branch is deployment-ready
  - the branch should always be created off of the `main` branch

(2) a collaborator works and `commit`s on that branch

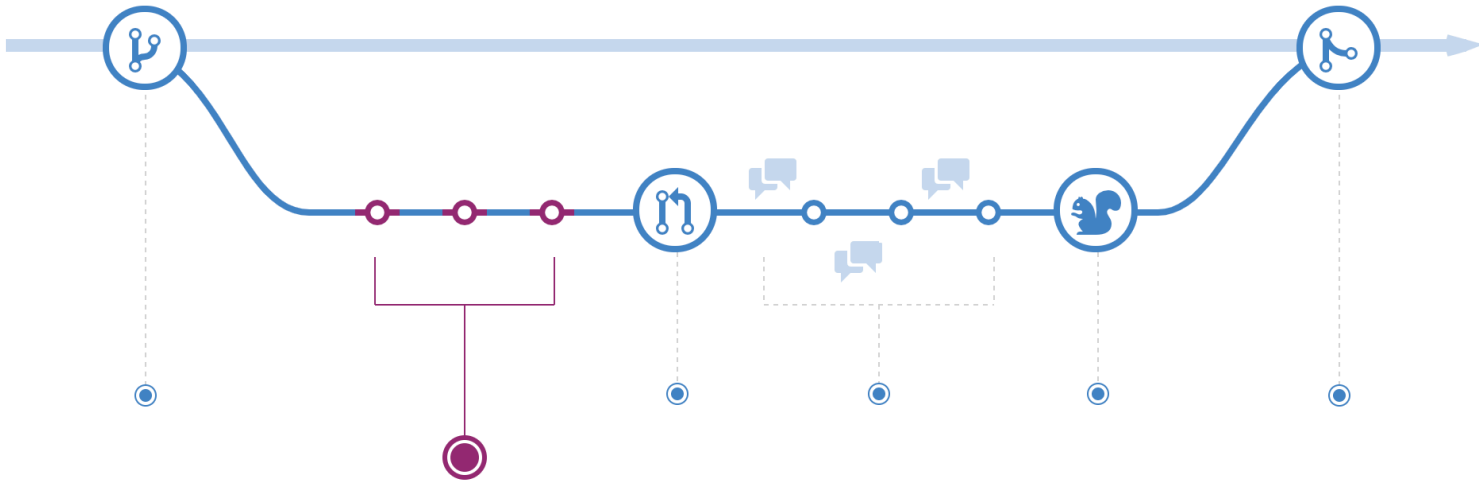


Figure: Understanding the GitHub flow

- use the same workflow in a branch: `git add`, `git status`, `git commit`
- ***ProTip***
  - use informative messages in your branch `commit`s

(3) a collaborator `push`es to create a pull request

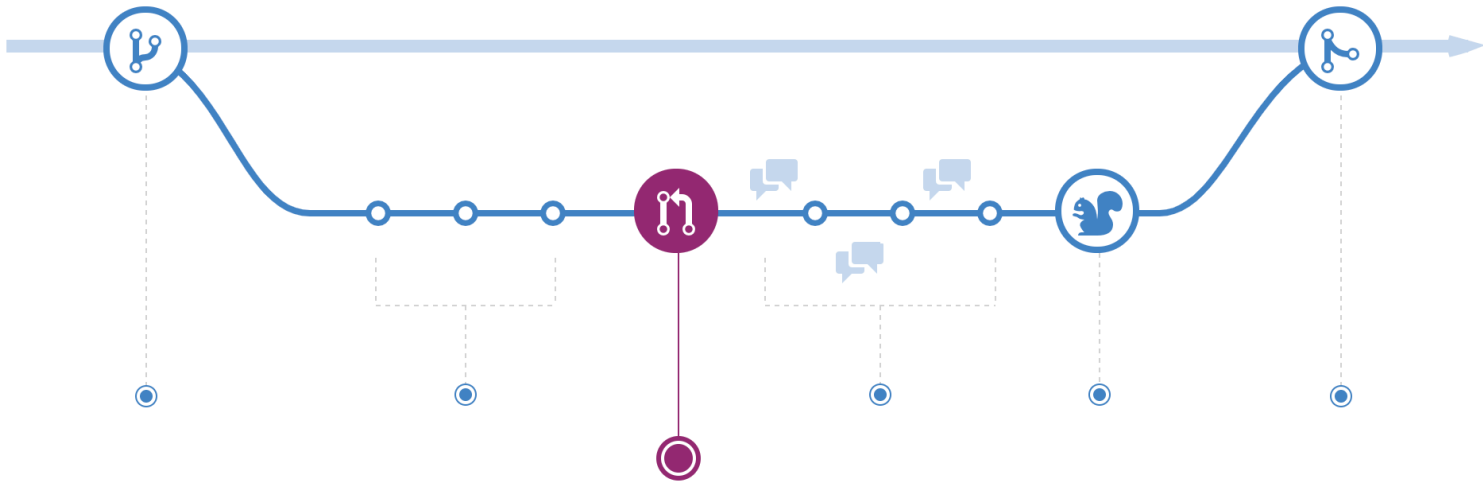
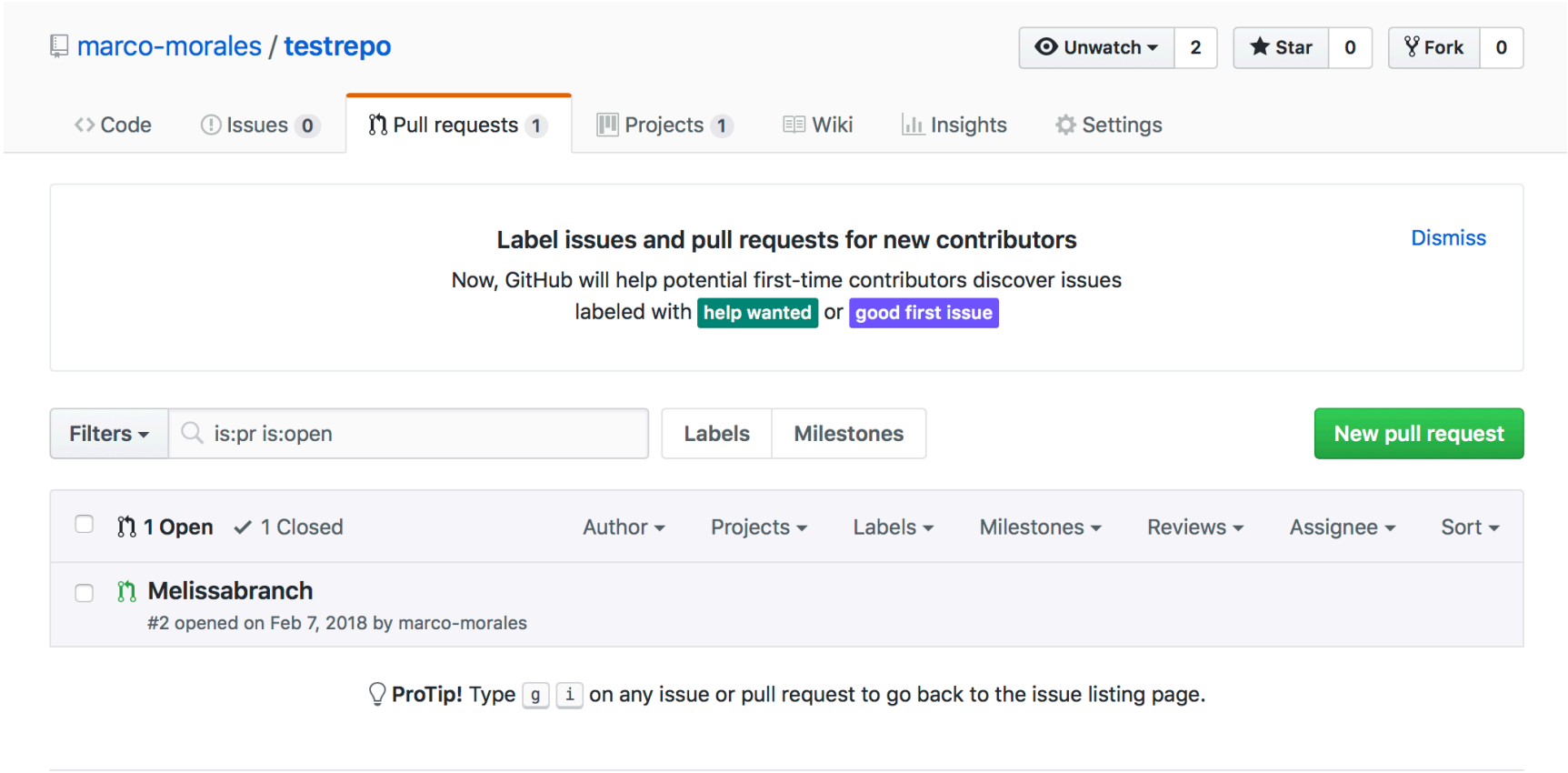


Figure: Understanding the GitHub flow

- a pull request notifies that your changes are ready to be reviewed and merged back to the `main` branch
- the review will validate that the changes do not create problems in the `main` branch and incoporate other members' comments

(3) a collaborator `push`es to create a pull request



(4) an owner reviews changes, resolves conflicts, and approves the merge

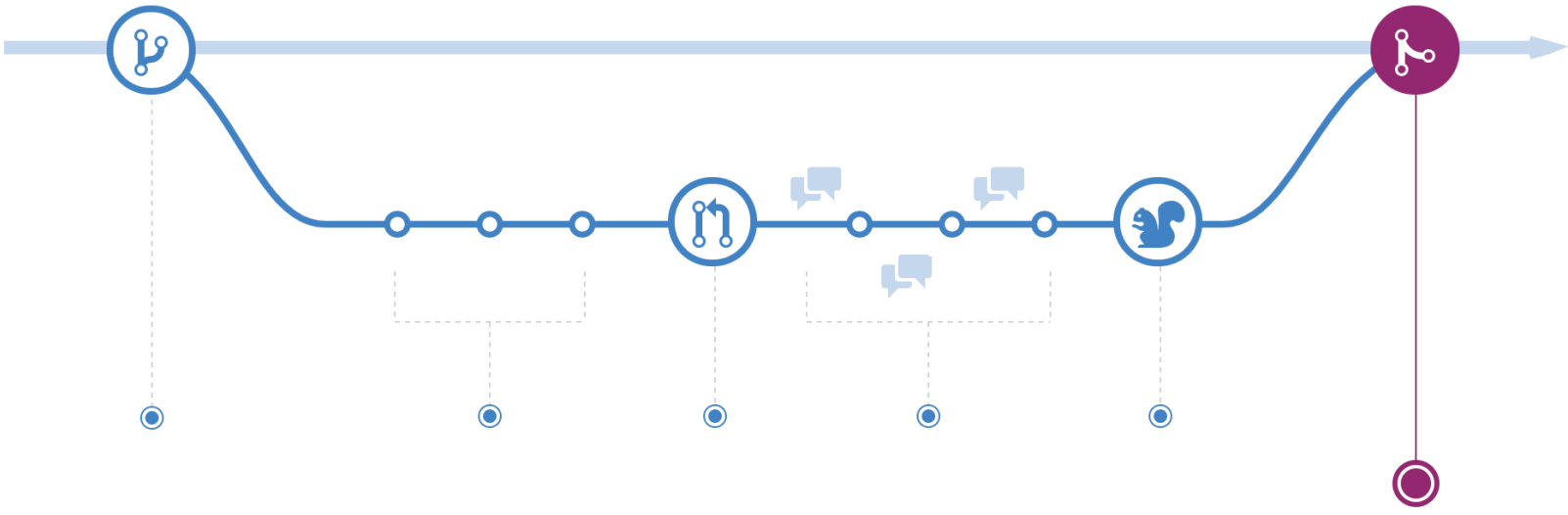
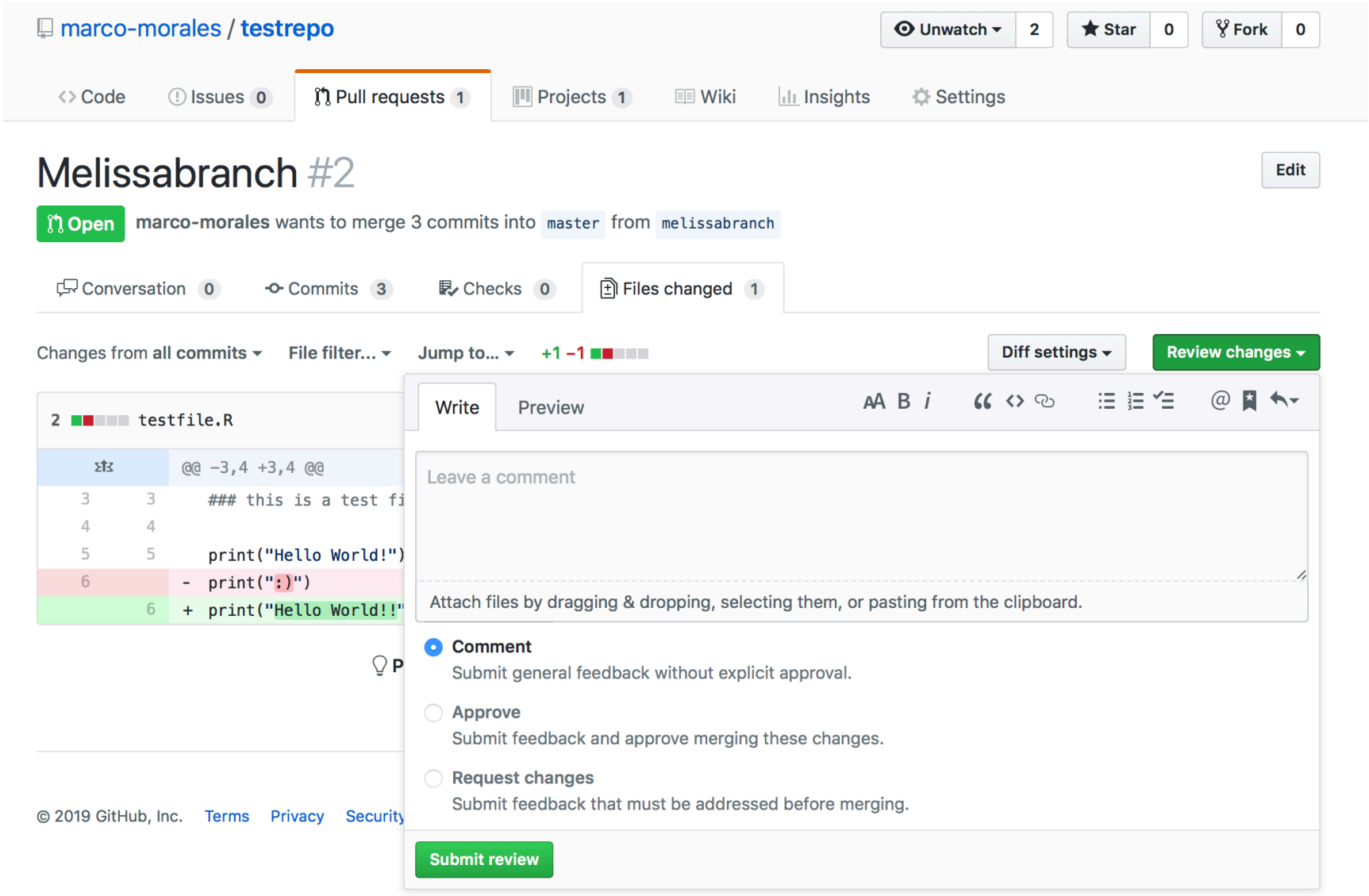


Figure: Understanding the GitHub flow

- once the proposed changes have been validated they are merged back into the `main` branch
- the merge preserves records of changes made on the branch

(4) an owner reviews changes, resolves conflicts, and approves the merge



rinse and repeat

a quick exercise

a quick exercise

from the command line:

- go to a brand new location
- clone somebody else's remote repo

```
$ git clone
https://github.com/marco-morales/testrepo.git
```

- (checkout and) create a branch

```
$ git checkout -b mytestbranch-myname
```

- make a change in your code file
- go on, verify that git is tracking the change

```
$ git status
```

a quick exercise

from the command line:

- do your usual git routine

```
$ git add testfile.R
```

```
$ git commit -m "Add hubris to the code"
```

- now, you'll create a pull request

```
$ git push origin mytestbranch-myname
```

- time for the repo owner to intervene!

Version Control
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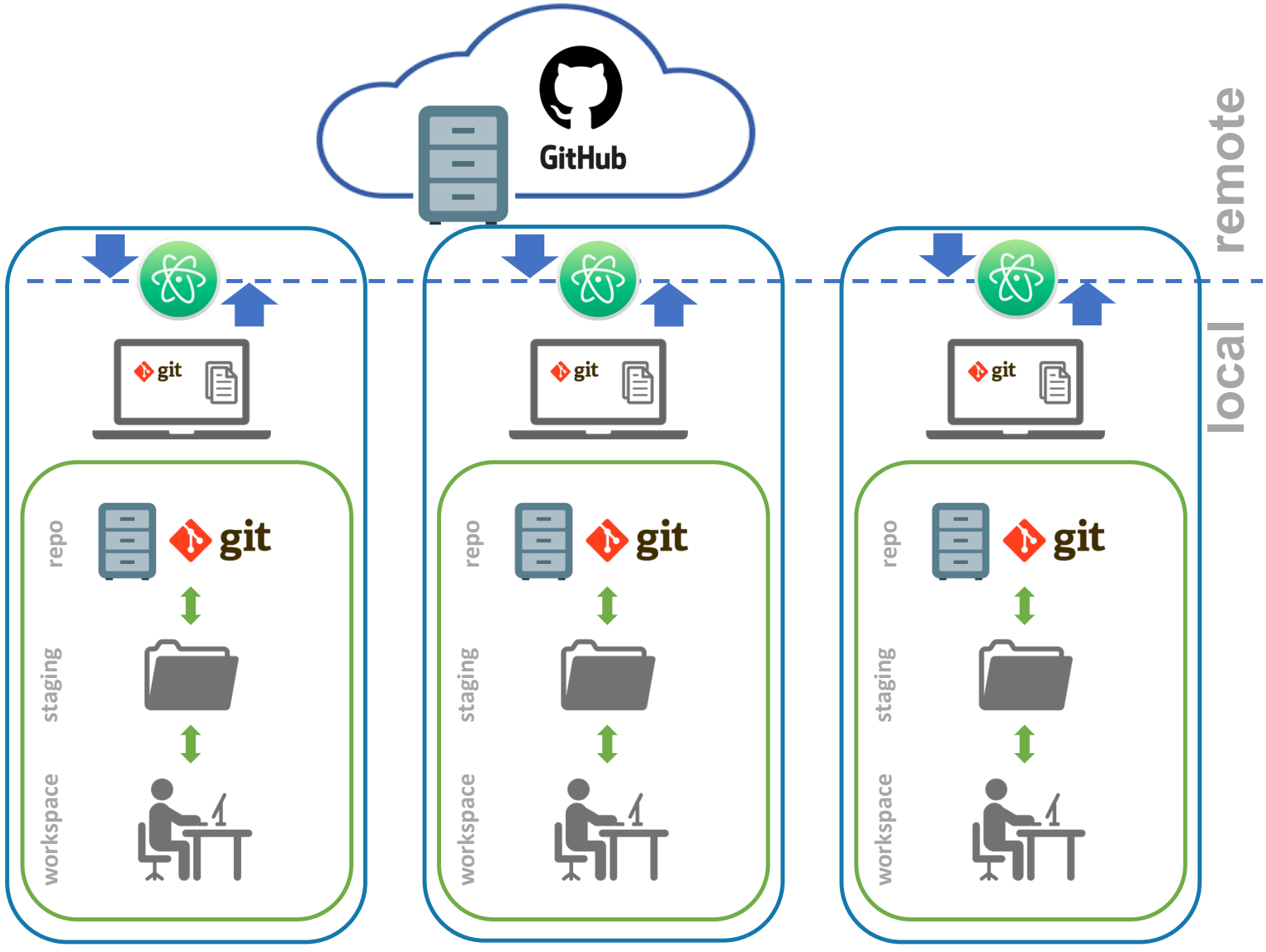
Your Friendly Neighborhood Atom

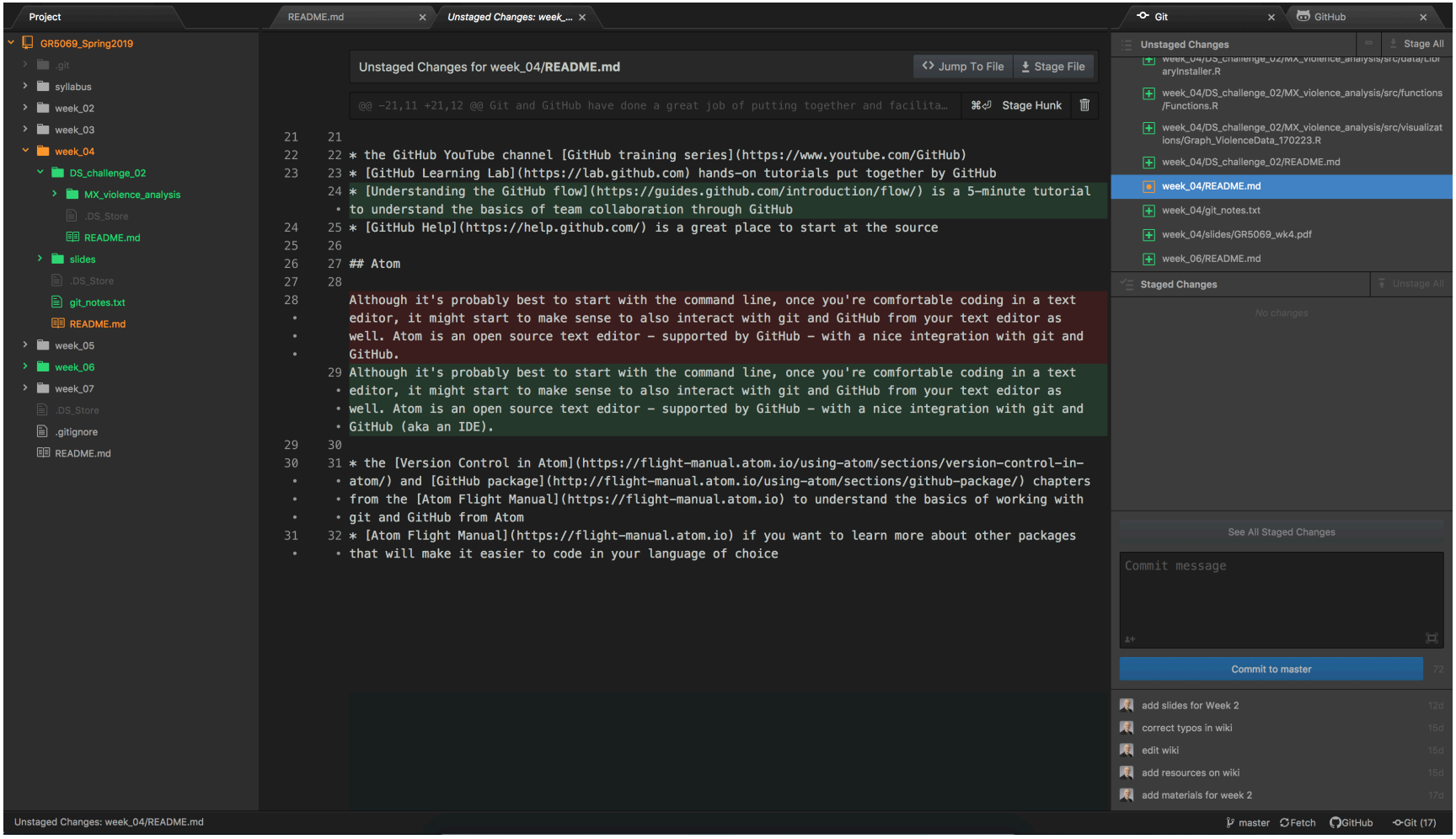
a simpler workflow is possible

- we've been working with git+GitHub from the **command line**
  - it can get confusing and harder that necessary at times
- now that you understand the flow, we can make our lives easier with an **IDE** (Integrated Development Environment)
- our preferred IDE today $\rightarrow$ **Atom**
  - it can seamlessly handle git + GitHub interaction, and coding needs

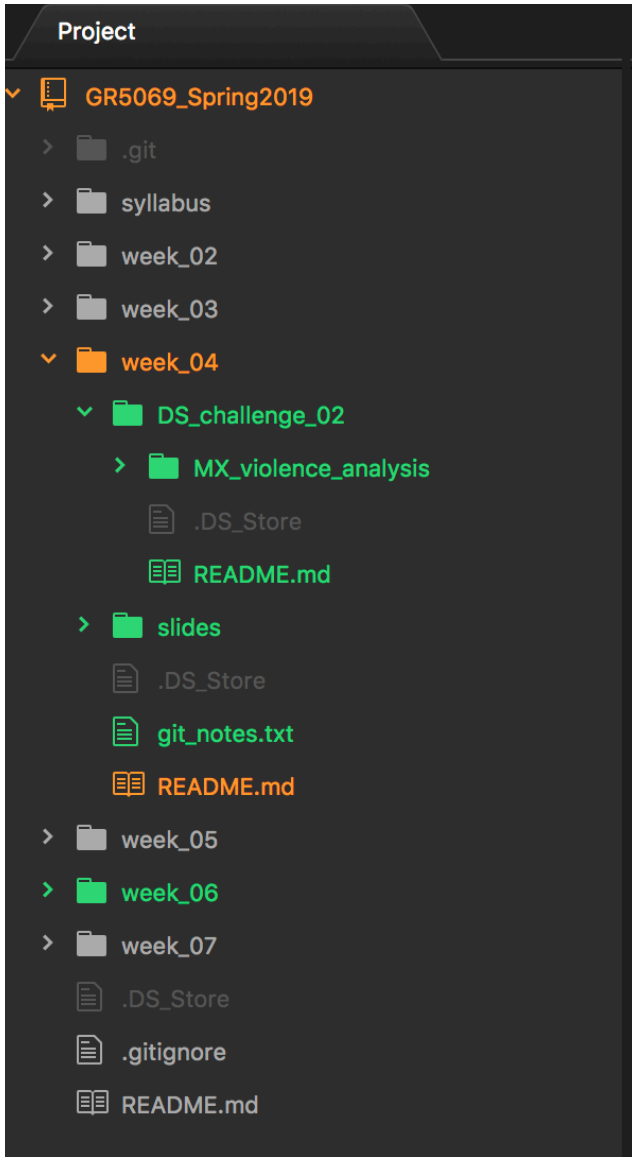
a git+GitHub workflow through an IDE



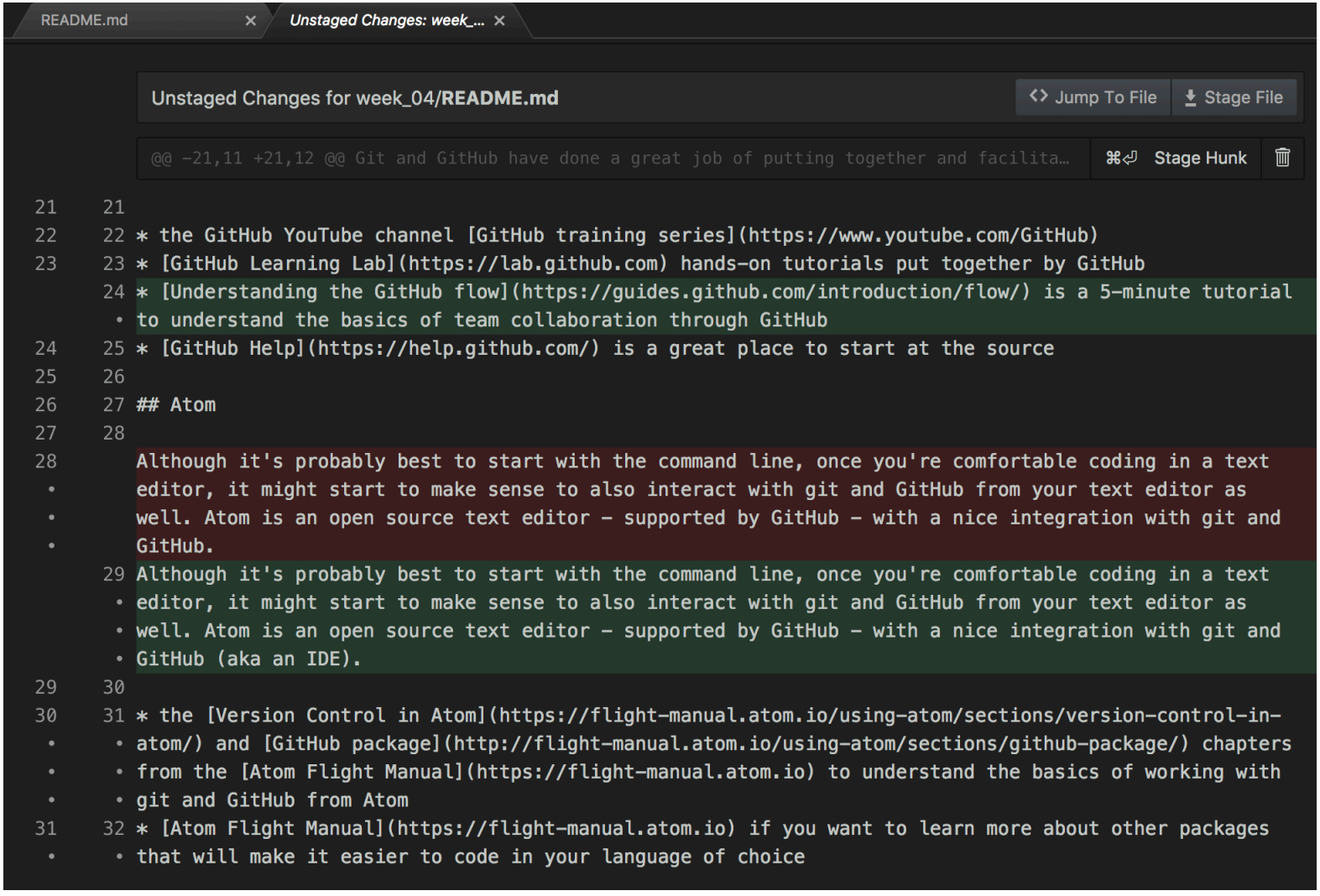
a git+GitHub workflow through an IDE



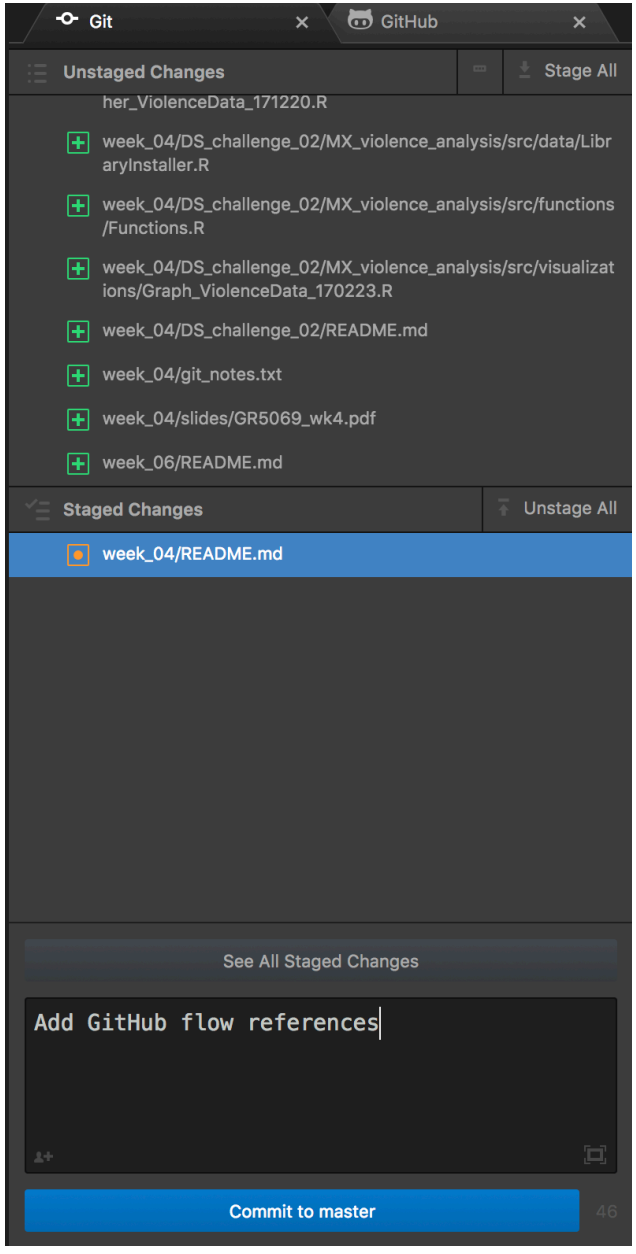
a simple way to identify the `git status` of each file



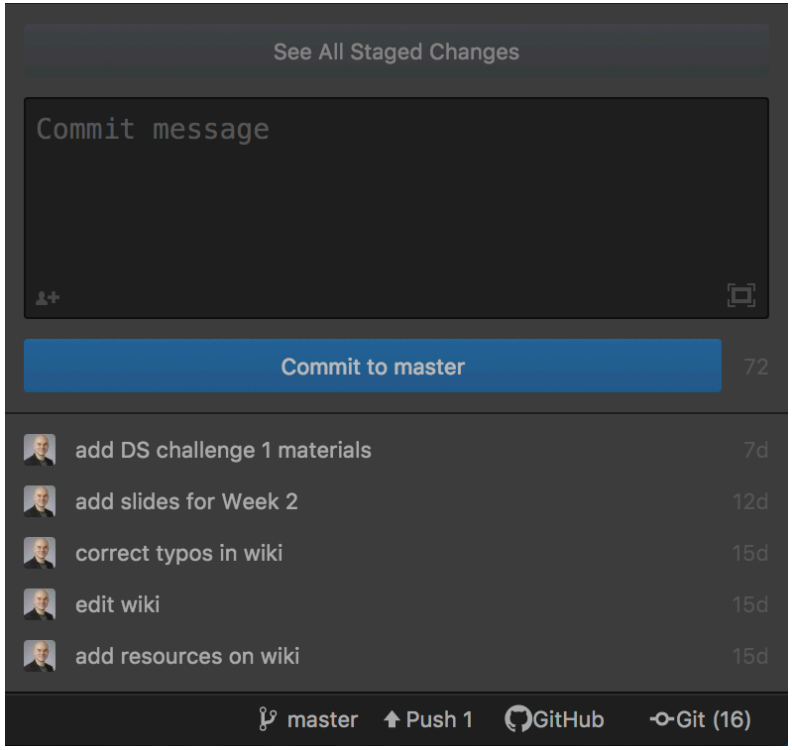
a simple way to `git diff` on a file



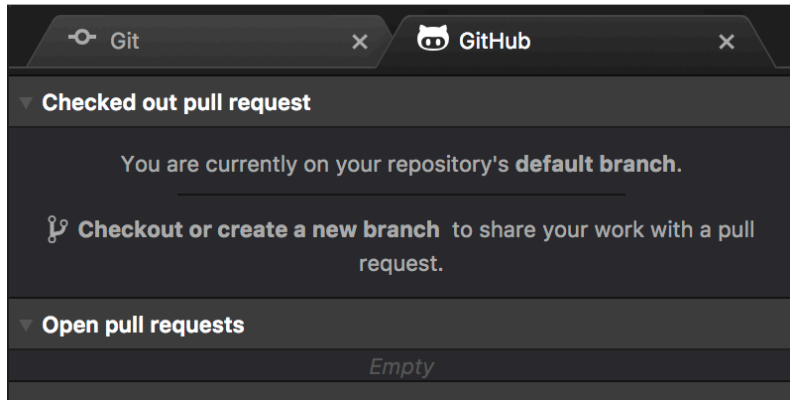
all your git workflow (`add`, `commit`) on a single screen



all your git workflow (`push`) on a single screen



all your GitHub workflow on a single screen



Though this be madness, yet there's method in't

Recap: the method to this version control madness...

- basic **actions** to master in git
  - `git init`: initializes git, and indicates that the folder should be tracked
  - `git add`: brings new files to the attention of git to be tracked as well
  - `git commit`: takes a snapshot of alerted files
  - `git push`: sends changes commited in your branch (of your local repo) to the remote branch (of the GitHub repo)

Recap: the method to this version control madness...

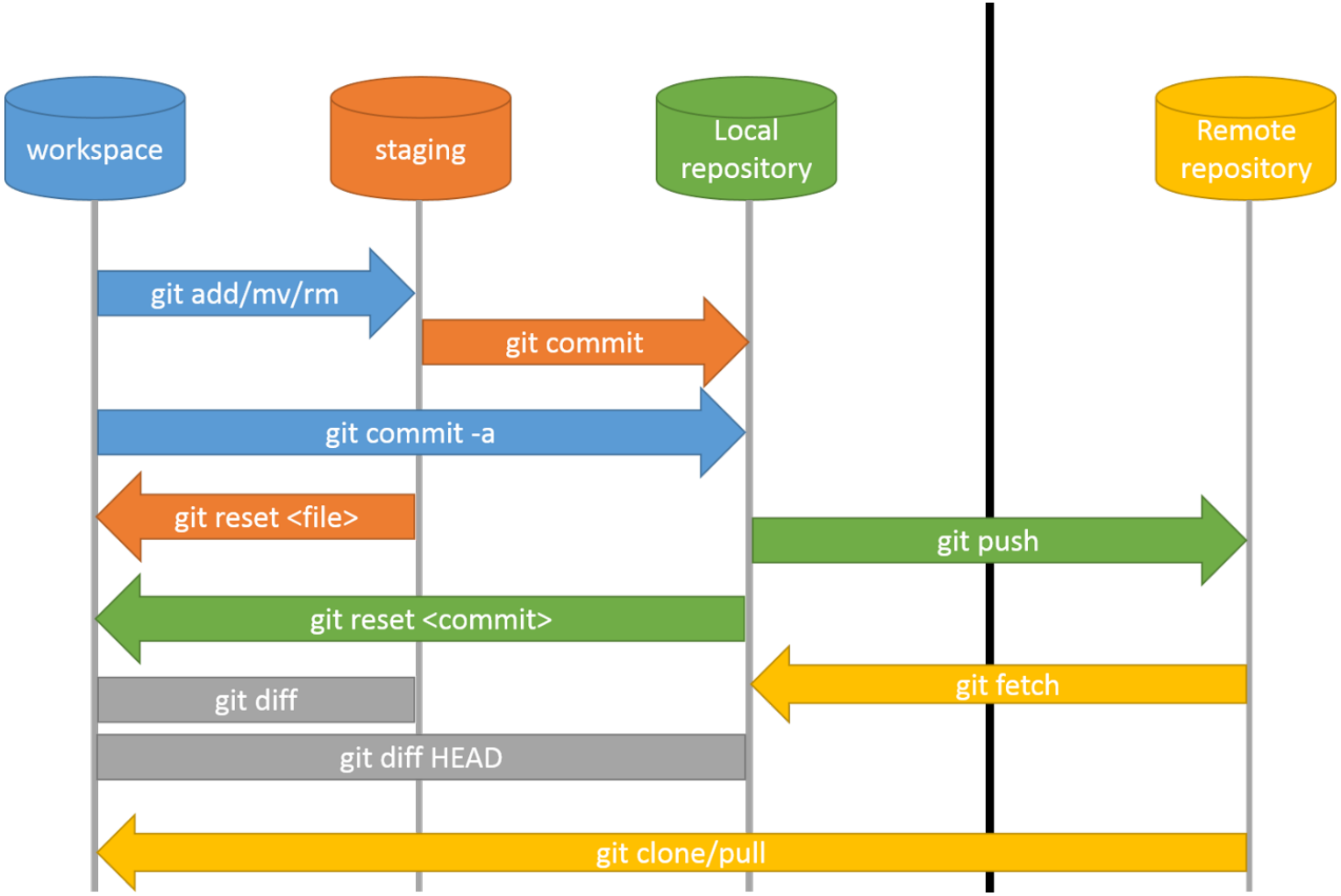


Figure: Pro Git, 2nd Edition

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git + GitHub

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