Version Control
git + GitHub

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Modern Data Structures

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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

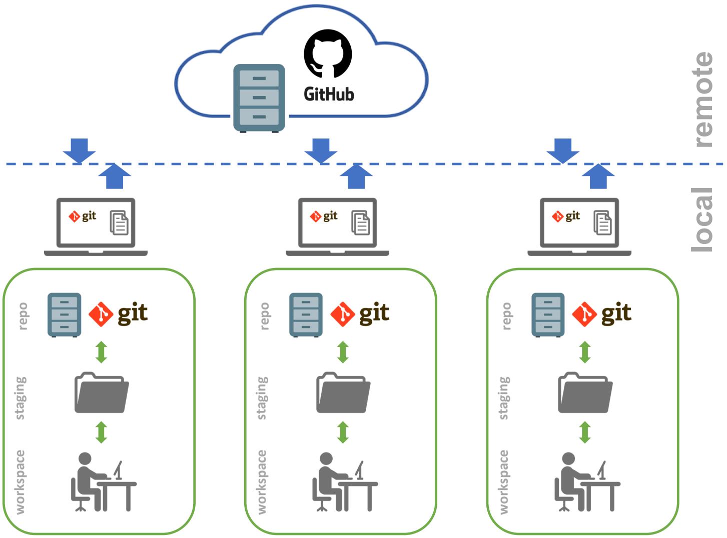
c) **scalability**
   - your project should also work for **larger data sets** and/or be on the path of **automation**

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

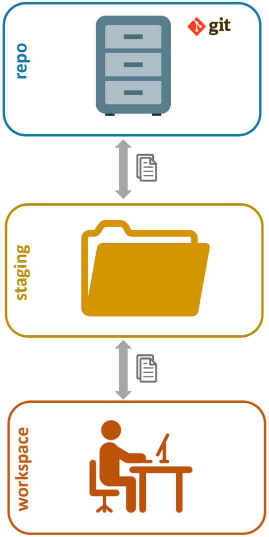


git locally

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**

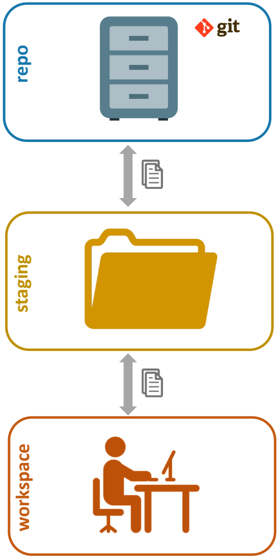
```
$ git config --global user.name "John Doe"
$ git config --global user.email johndoe@example.com
```

- **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)

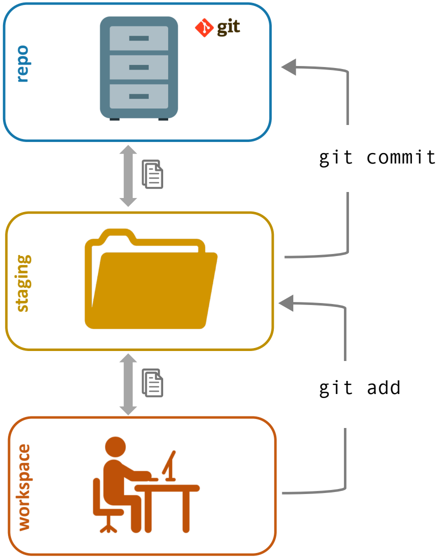
- add files you want git to ignore in the `.gitignore` file

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 `master` branch after your first `commit`
- easy tor rename your branch to `main`

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

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

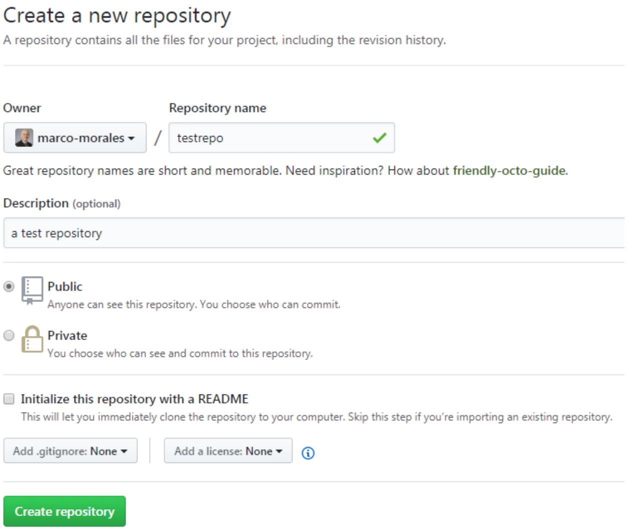
```
$ git config -global init.defaultBranch main
```

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



Create a new repository

A repository contains all the files for your project, including the revision history.

Owner: marco-morales / Repository name: testrepo ✓

Great repository names are short and memorable. Need inspiration? How about friendly-octo-guide.

Description (optional): a test repository

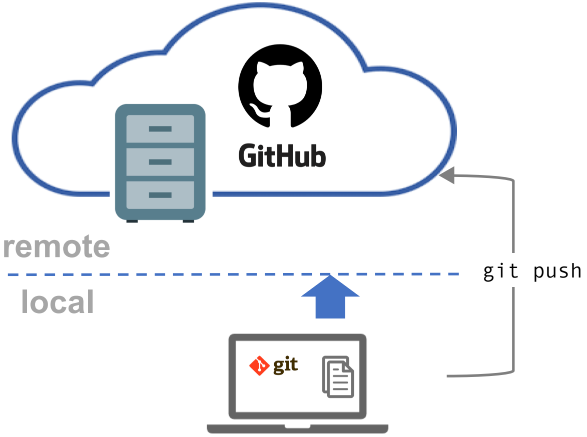
[✓ Public] Anyone can see this repository. You choose who can commit.

Private: You choose who can see and commit to this repository.

☐ Initialize this repository with a README
This will let you immediately clone the repository to your computer. Skip this step if you're importing an existing repository.

Add .gitignore: None
Add a license: None

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")

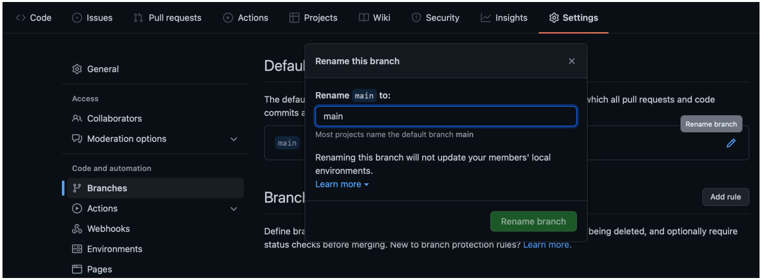
```
$ git push -u origin main
```

- ***ProTip:*** current best practice is to use `main` for your default branch. Default used to be `master`

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



Rename this branch

Rename `main` to:

main

Most projects name the default branch **main**

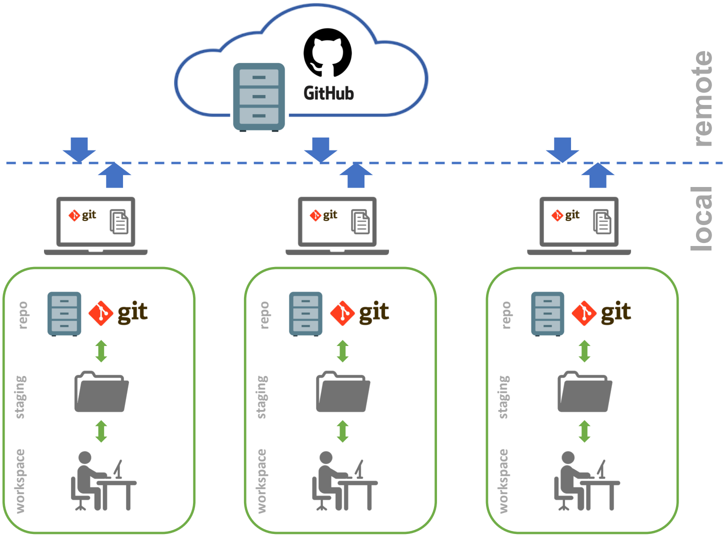
Renaming this branch will not update your members' local environments.

Learn more

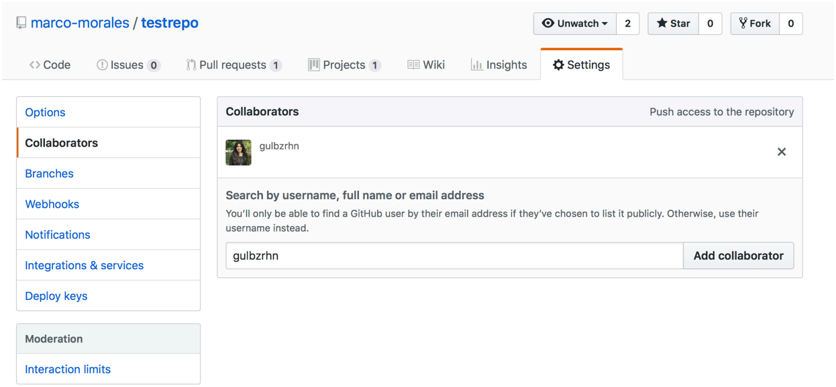
Rename branch

git+GitHub for team collaboration

all the building blocks are now in place



now, enable collaborators in your GitHub repo


marco-morales / testrepo

Collaborators Push access to the repository

gulbzrhn

Search by username, full name or email address

You'll only be able to find a GitHub user by their email address if they've chosen to list it publicly. Otherwise, use their username instead.

gulbzrhn | **Add collaborator**

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

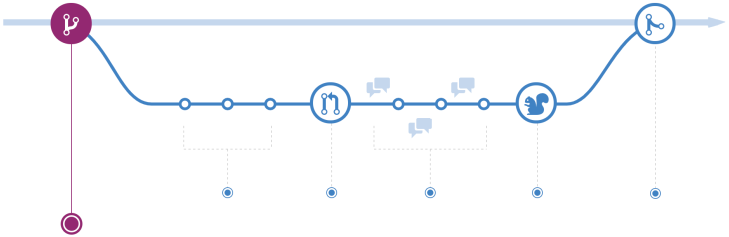


Figure: Understanding the GitHub flow

- 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

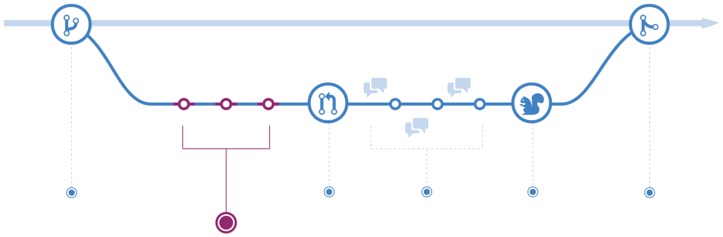


Figure: Understanding the GitHub flow

- 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

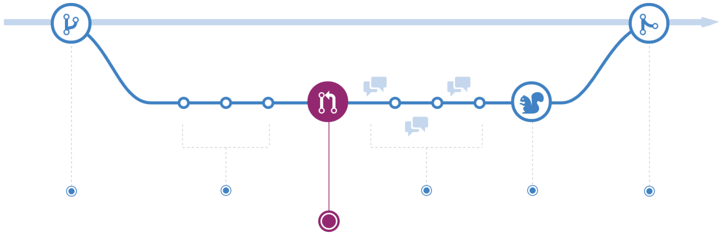
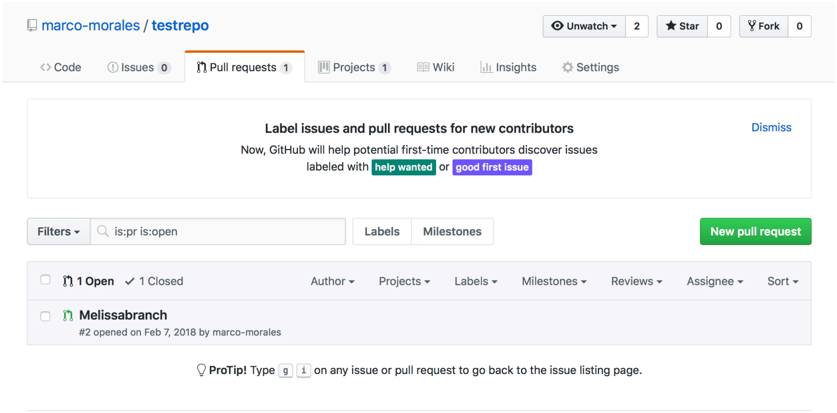


Figure: Understanding the GitHub flow

- 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


marco-morales / testrepo

Unwatch 2 | Star 0 | Fork 0

Code | Issues 0 | Pull requests 1 | Projects 1 | Wiki | Insights | Settings

Label issues and pull requests for new contributors

Now, GitHub will help potential first-time contributors discover issues labeled with help wanted or good first issue

Dismiss

Filters | is:pr is:open | Labels | Milestones | New pull request

1 Open ✓ 1 Closed | Author | Projects | Labels | Milestones | Reviews | Assignee | Sort

Melissabranch
#2 opened on Feb 7, 2018 by marco-morales

ProTip! Type `g` `i` on any issue or pull request to go back to the issue listing page.

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

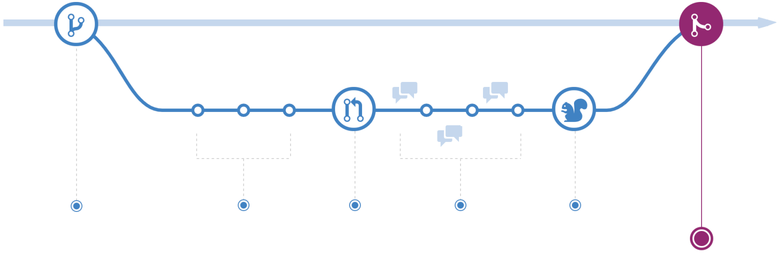
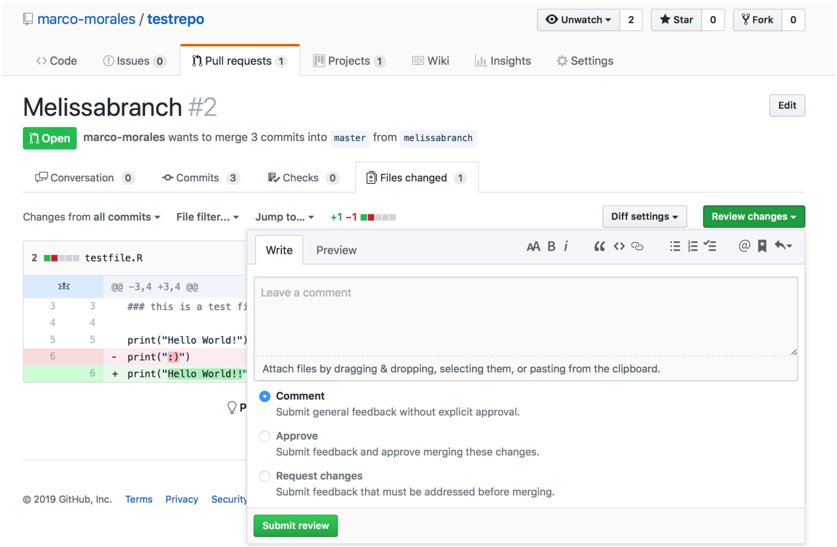


Figure: Understanding the GitHub flow

- 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



marco-morales / testrepo

Unwatch 2 | Star 0 | Fork 0

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Melissabranch #2

Edit

Open **marco-morales** wants to merge 3 commits into `master` from `melissabranch`

Conversation 0 | Commits 3 | Checks 0 | Files changed 1

Changes from **all commits** | File filter... | Jump to... | +1 −1

Diff settings | Review changes

```
2 testfile.R
@@ -3,4 +3,4 @@
3   3      ### this is a test fi
4   4
5   5      print("Hello World!")
6       -  print(":)")
    6   +  print("Hello World!!"
```

Write | Preview

Leave a comment

Attach files by dragging & dropping, selecting them, or pasting from the clipboard.

[✓ **Comment**]
Submit general feedback without explicit approval.

Approve
Submit feedback and approve merging these changes.

Request changes
Submit feedback that must be addressed before merging.

Submit review

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rinse and repeat

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...

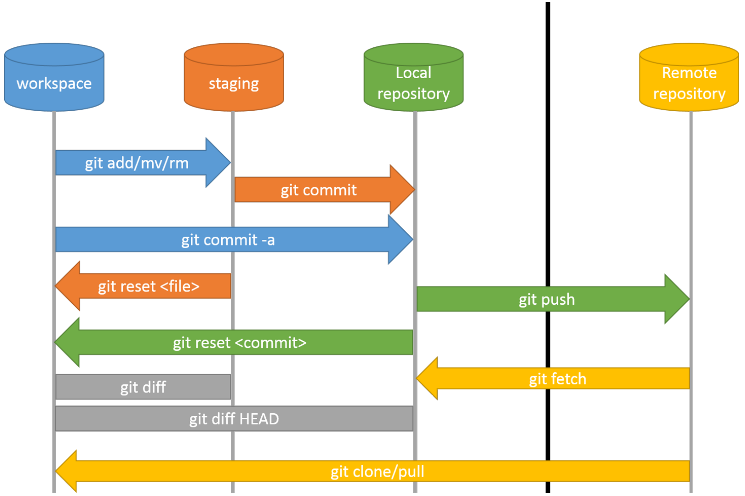

Figure: Pro Git, 2nd Edition

Homework instructions

1. use the **link** to generate your **GitHub classroom** repo
2. select a location in your laptop where you'll clone this repo

   ```
   $ cd <your selected location here>
   ```

3. copy the **url** for your homework repo, and `clone` the repo to the current location

   ```
   $ git clone <paste-your-url>.git
   ```

4. do your usual `add` / `commit` routine
5. `push` back to your homework repo

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

6. submit the link to your repo in **Canvas**

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