A Simple Introduction to Git: a distributed version-control system

CS 5010 Program Design Paradigms

Lesson 0.5

Learning Objectives

- At the end of this lesson you should be able to explain:
  - how git creates a mini-filesystem in your directory
  - what commit, push, pull, and sync do
  - the elements of the basic git workflow
  - how git allows you to work across multiple computers
  - how git allows you and a partner to work together

Git is a distributed version-control system

- You keep your files in a *repository* on your local machine.
- You synchronize your repository with a repository on a server.
- If you move from one machine to another, you can pick up the changes by synchronizing with the server.
- If your partner uploads some changes to your files, you can pick those up by synchronizing with the server.

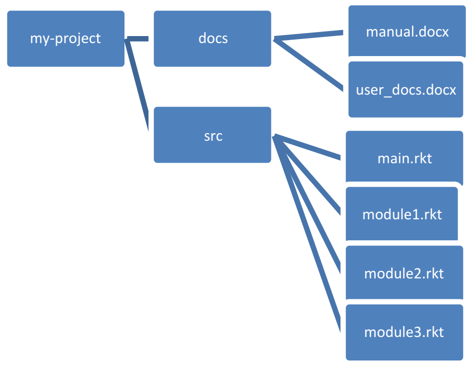
Git is a distributed version-control system

- Terminology: In git-speak, a "version" is called a "commit."
- Git keeps track of the history of your commits, so you can go back and look at earlier versions, or just give up on the current version and go back some earlier version.

A simple model of git

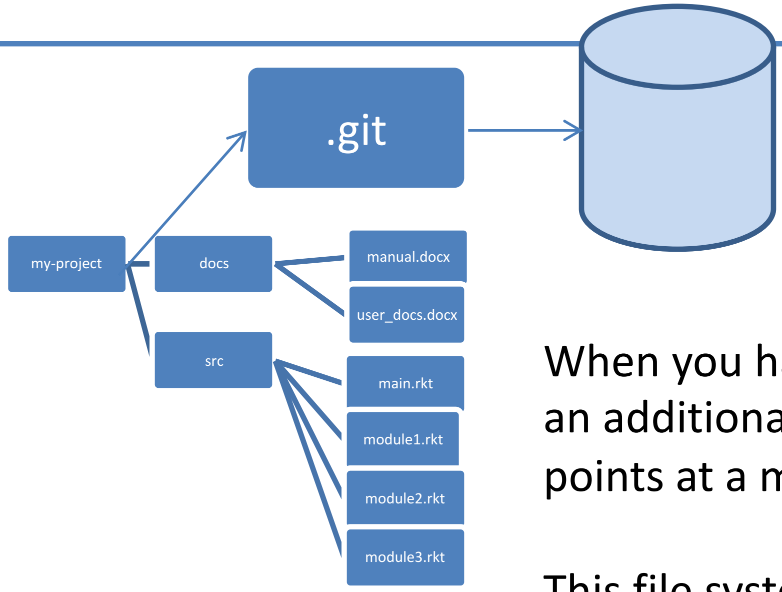
- Most git documentation gets into details very quickly.
- Here’s a very simple model of what’s going on in git.

Your files



Here are your files, sitting in a directory called my-project

Your files in your git repository

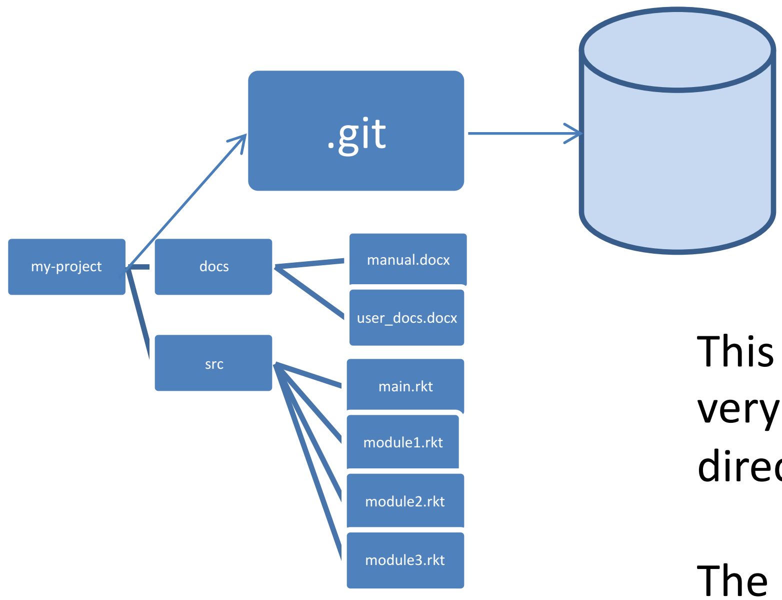


When you have a git repository, you have an additional directory called .git, which points at a mini-filesystem.

This file system keeps all your data, plus the bells and whistles that git needs to do its job.

All this sits on your local machine.

The git client



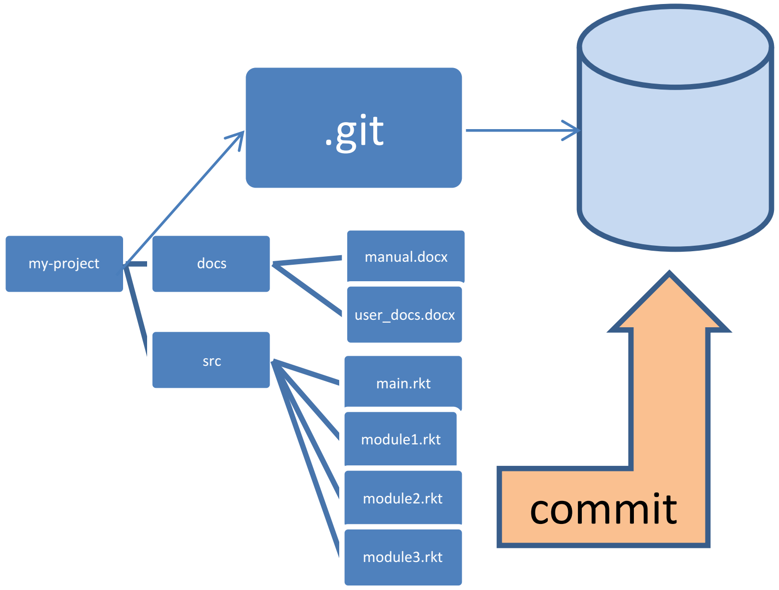
This mini-filesystem is highly optimized and very complicated. Don't try to read it directly.

The job of the git client (either Github for Windows, Github for Mac, or a suite of command-line utilities) is to manage this for you.

Your workflow (part 1)

- You edit your local files directly.
  - You can edit, add files, delete files, etc., using whatever tools you like.
  - This doesn’t change the mini-filesystem, so now your mini-fs is behind.

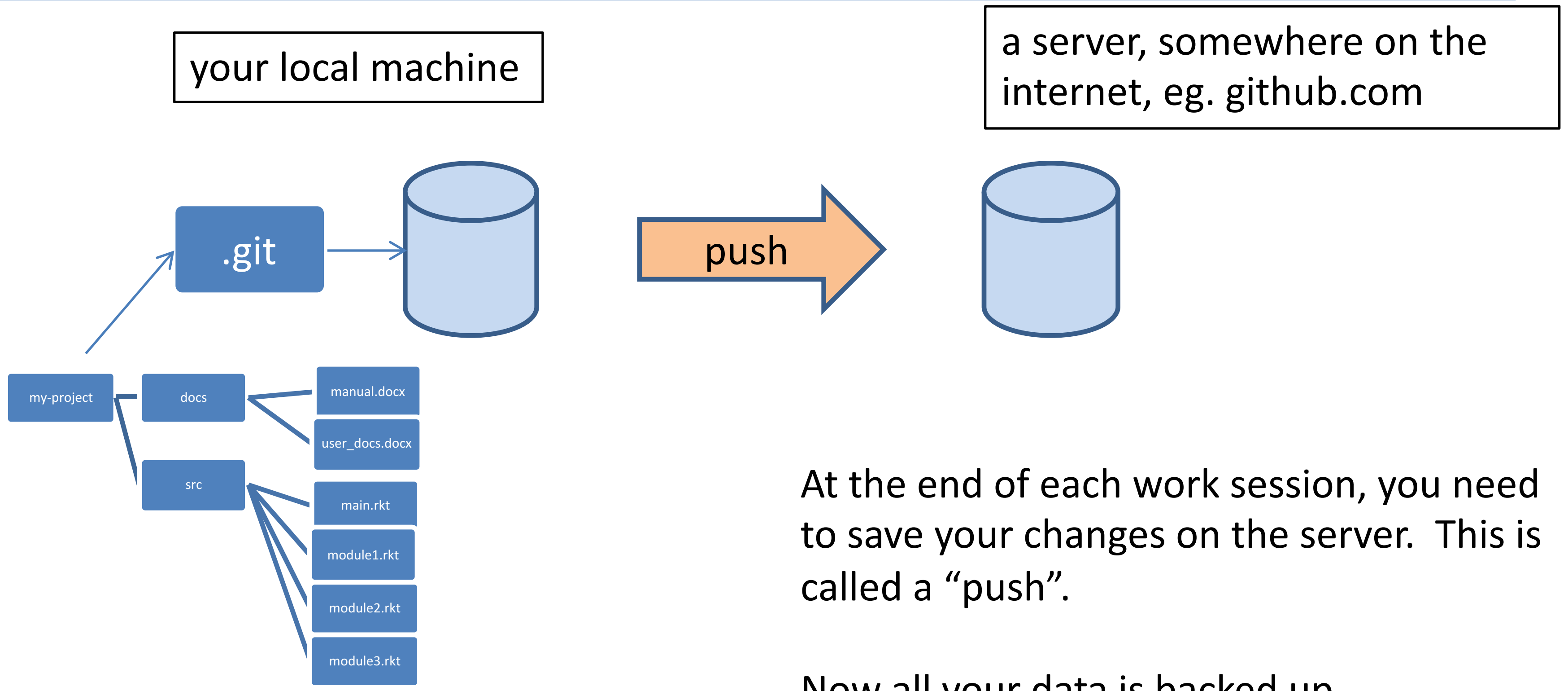
A Commit



When you do a "commit", you record all your local changes into the mini-fs.

The mini-fs is "append-only". Nothing is ever over-written there, so everything you ever commit can be recovered.

Synchronizing with the server (1)

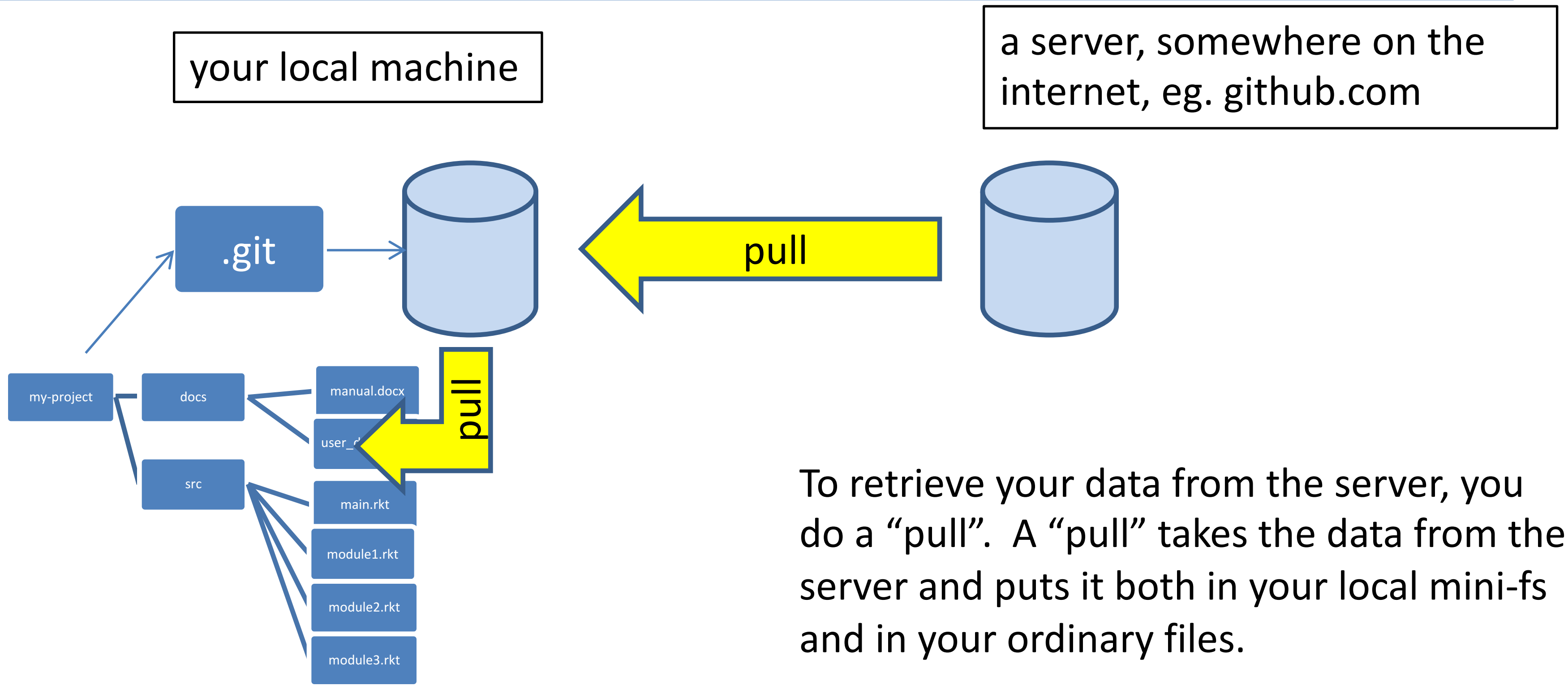


At the end of each work session, you need to save your changes on the server. This is called a "push".

Now all your data is backed up.

- You can retrieve it, on your machine or some other machine.
- We can retrieve it (that's how we collect homework)

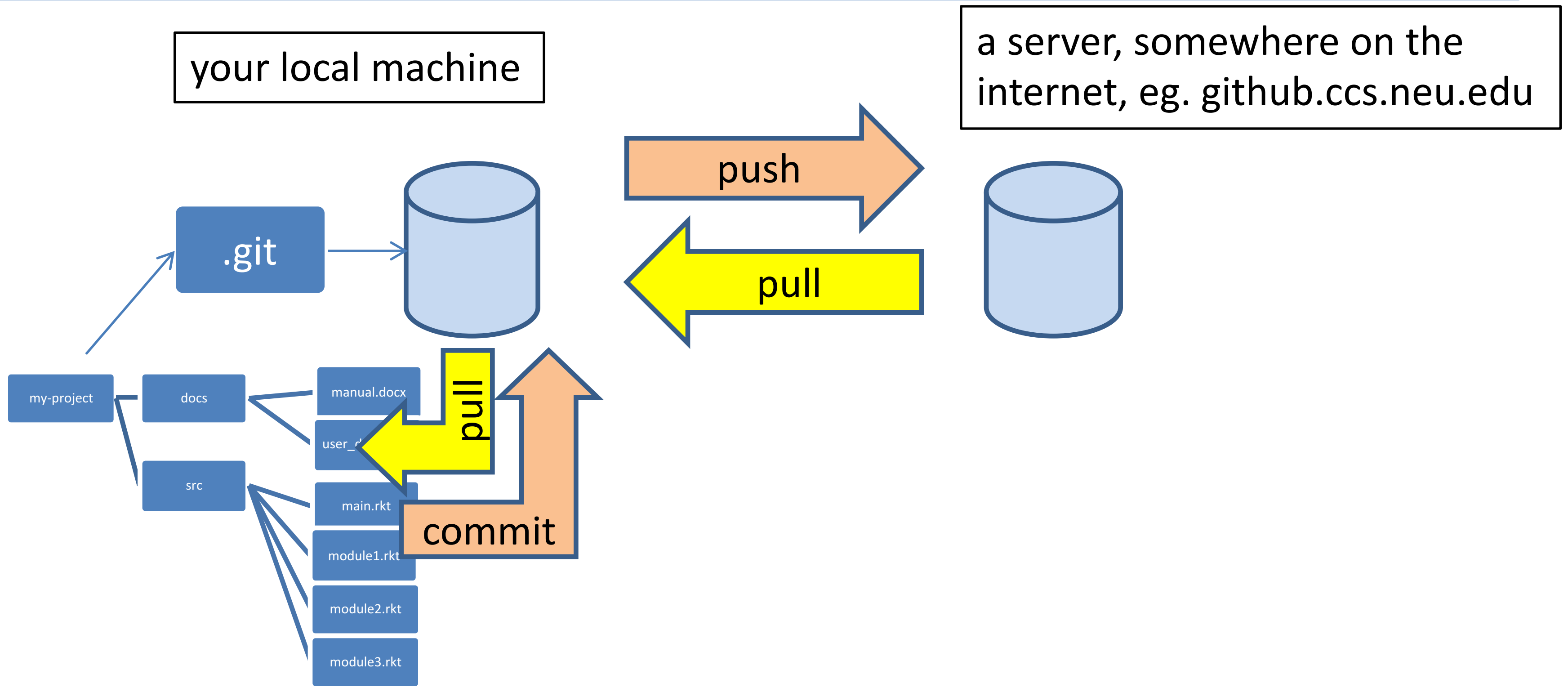
Synchronizing with the server (2)



To retrieve your data from the server, you do a “pull”. A “pull” takes the data from the server and puts it both in your local mini-fs and in your ordinary files.

If your local file has changed, git will merge the changes if possible. If it can’t figure out how to the merge, you will get an error message. We'll learn how to deal with these in the next lesson.

The whole picture

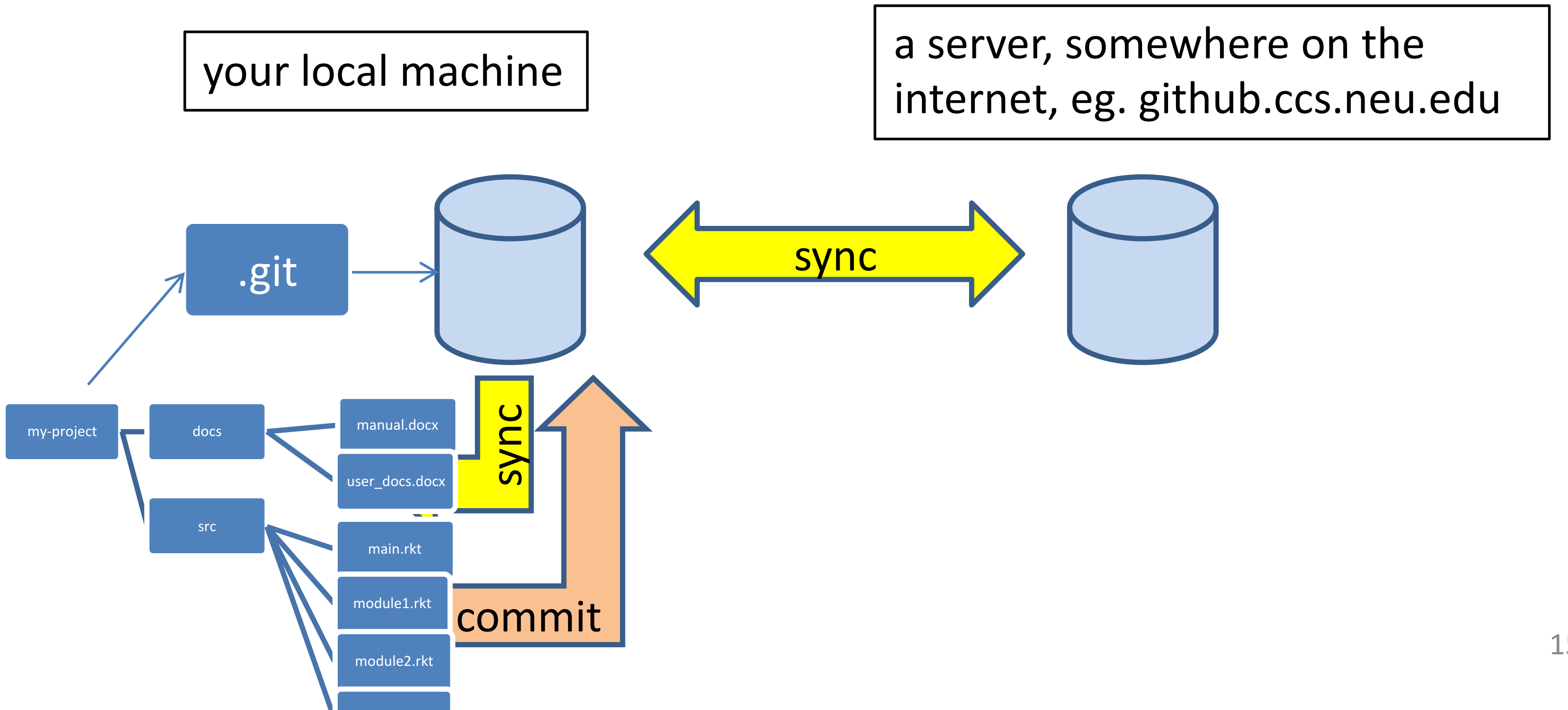


We recommend Github Desktop

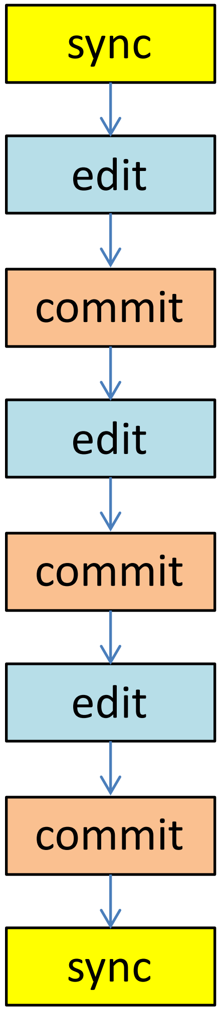
- This is a nice UI for github.
- If your prefer, you can use the command line, or any other git interface you like.
- Point your copy of Github Desktop to use "Github for Enterprise" at https://github.ccs.neu.edu
- We recommend that you set up your repos to "always rebase". (When we set up your repos, we will try to set them up to do this automatically)

Github Desktop uses a simplified git model

- In Github Desktop, “push” and “pull” are combined into a single operation called “sync”. So there are only two steps (“commit” and “sync”) to worry about, not three.



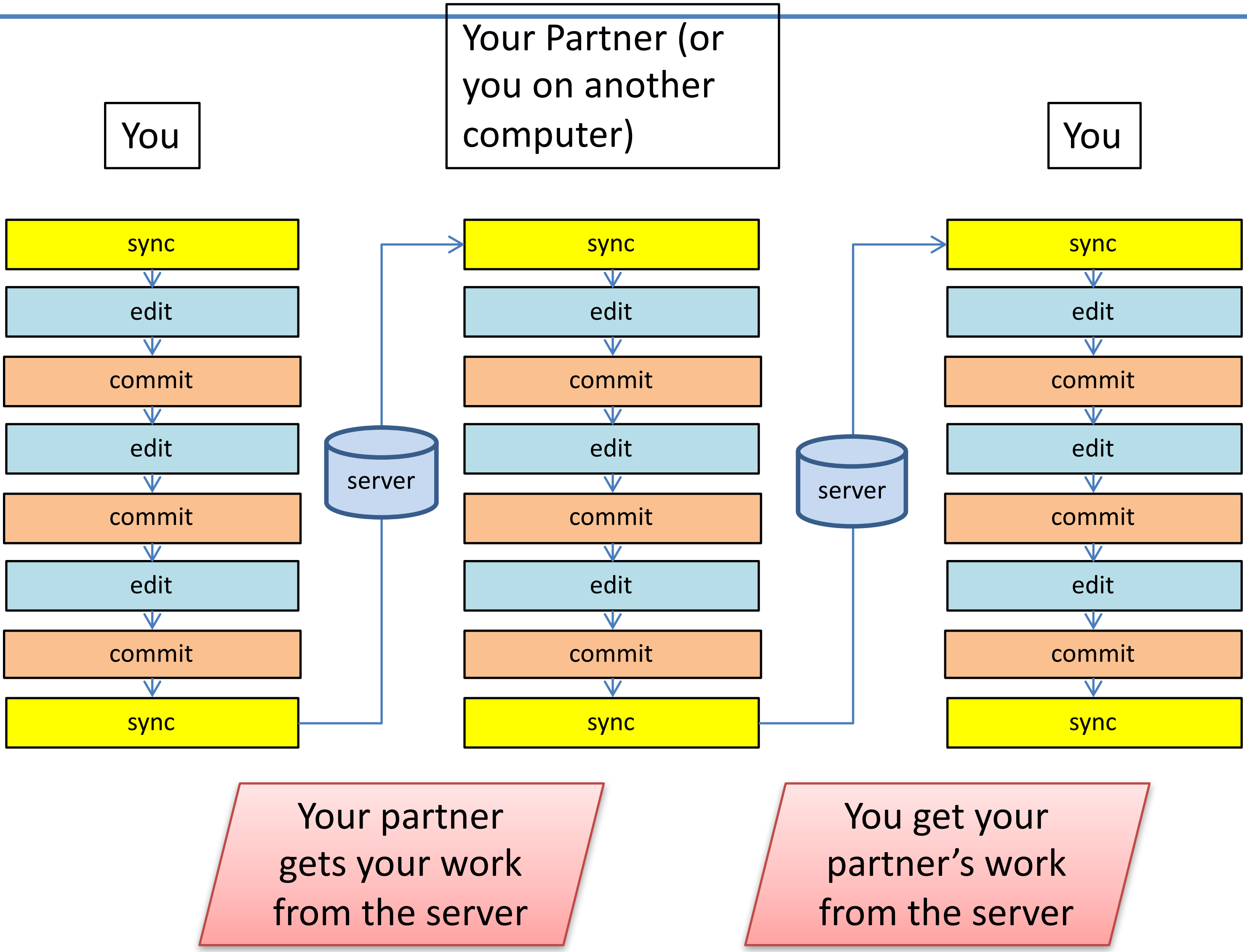
Your workflow with GD



Best practice: commit your work whenever you've gotten one part of your problem working, or before trying something that might fail.

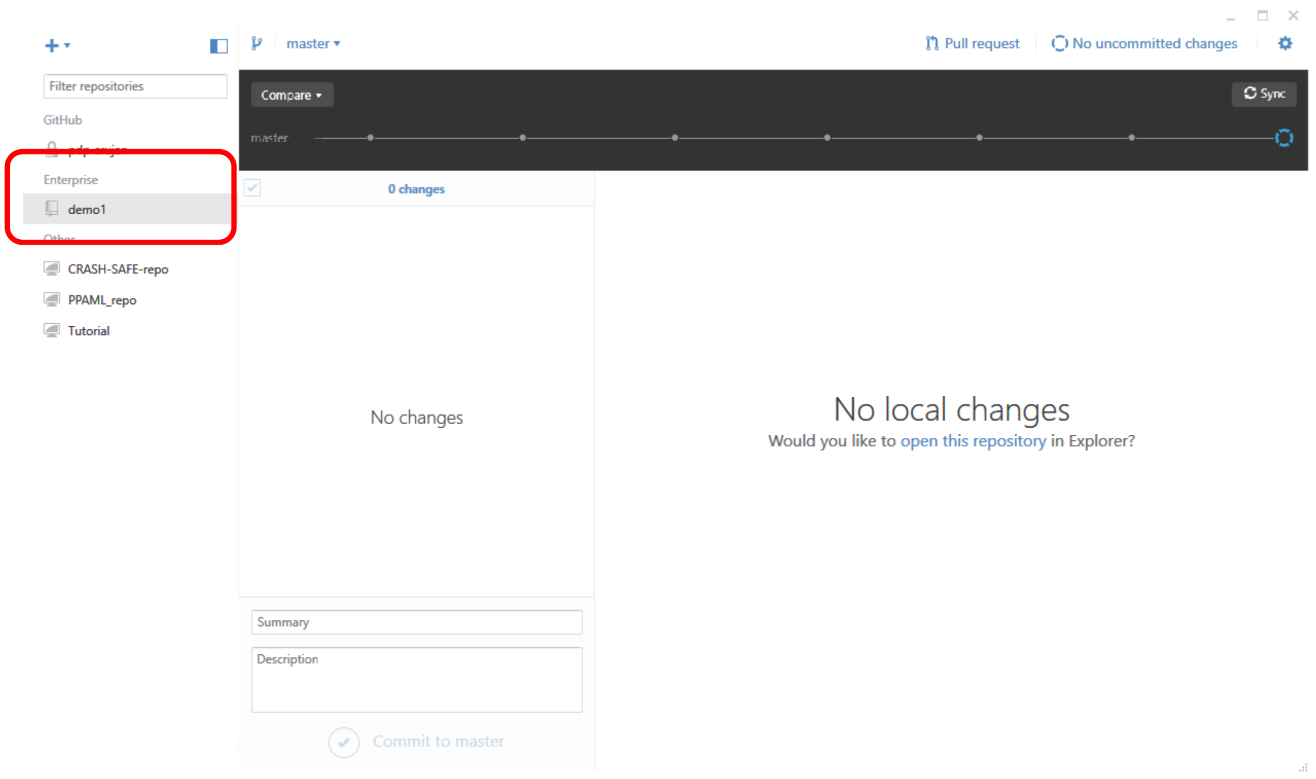
If your new stuff is screwed up, you can always "revert" to your last good commit. (Remember: always "revert", never "roll back")

Your workflow with a partner



Starting your work session

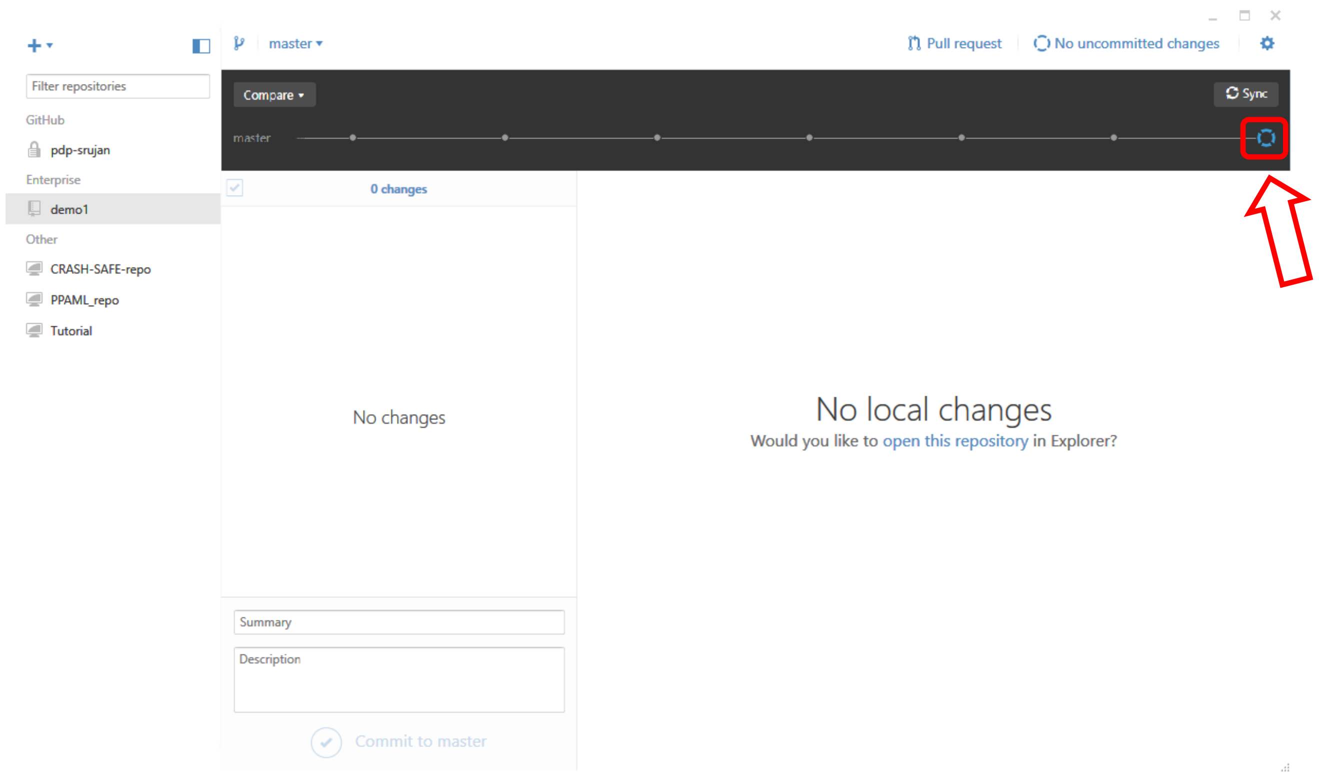
- Here's what your Github Desktop should look like when you open it up. Observe that your repos will be in the section labeled "Enterprise".



No local changes
Would you like to open this repository in Explorer?

Where am I?

- The open blue circle indicates that you are looking at the most recent local files

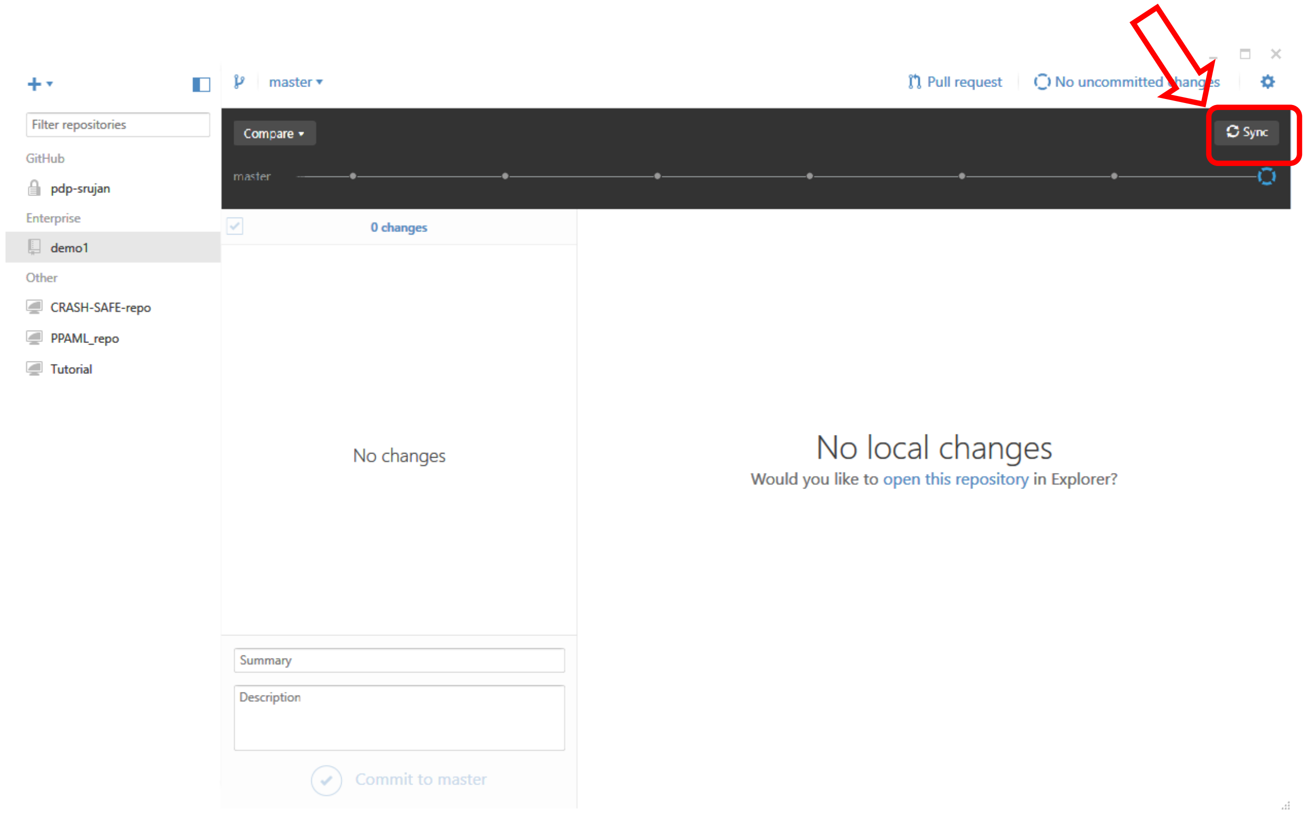


No local changes

Would you like to open this repository in Explorer?

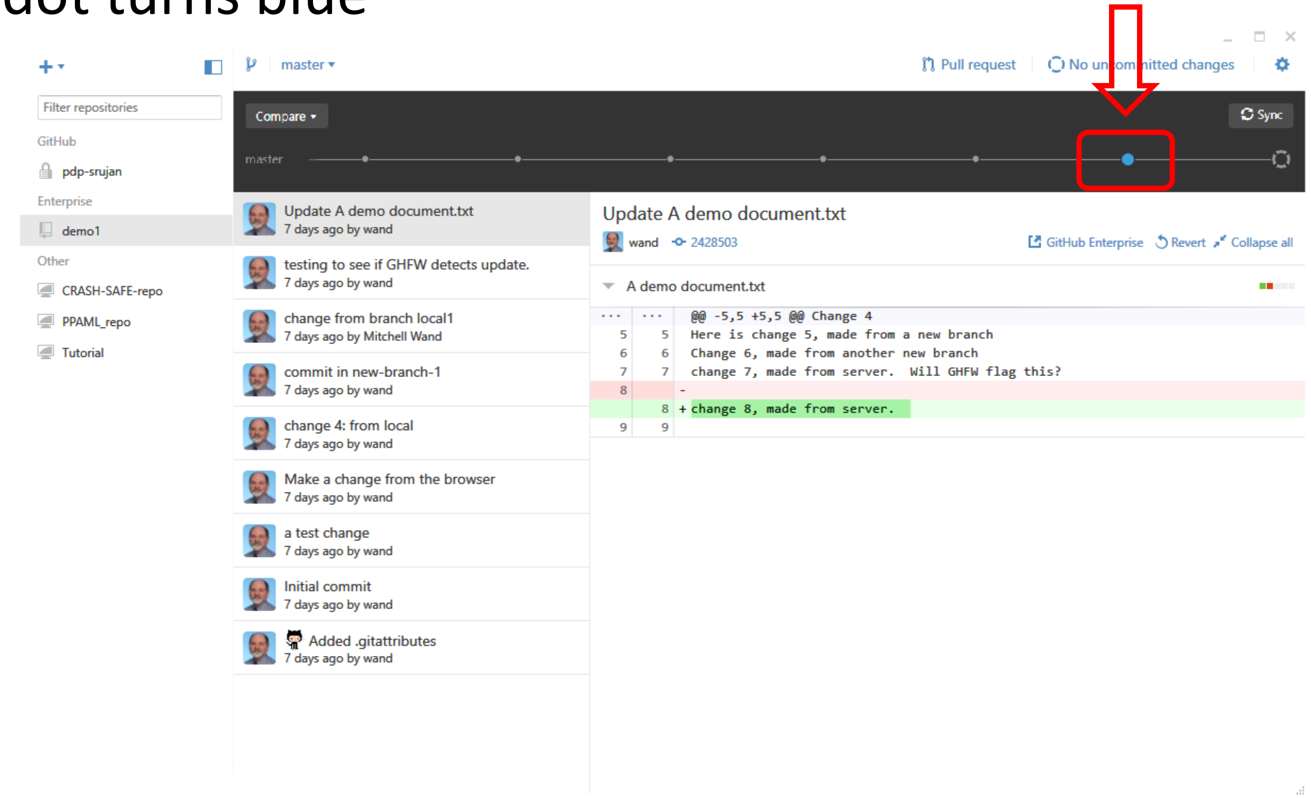
Always start by syncing

- This will download any changes that you or your partner have made on other machines



Click on a dot to see a commit

- Clicking on the last dot will show you what was in your last commit
- The dot turns blue



Update A demo document.txt
7 days ago by wand

testing to see if GHFW detects update.
7 days ago by wand

change from branch local1
7 days ago by Mitchell Wand

commit in new-branch-1
7 days ago by wand

change 4: from local
7 days ago by wand

Make a change from the browser
7 days ago by wand

a test change
7 days ago by wand

Initial commit
7 days ago by wand

Added .gitattributes
7 days ago by wand

Update A demo document.txt

wand 2428503

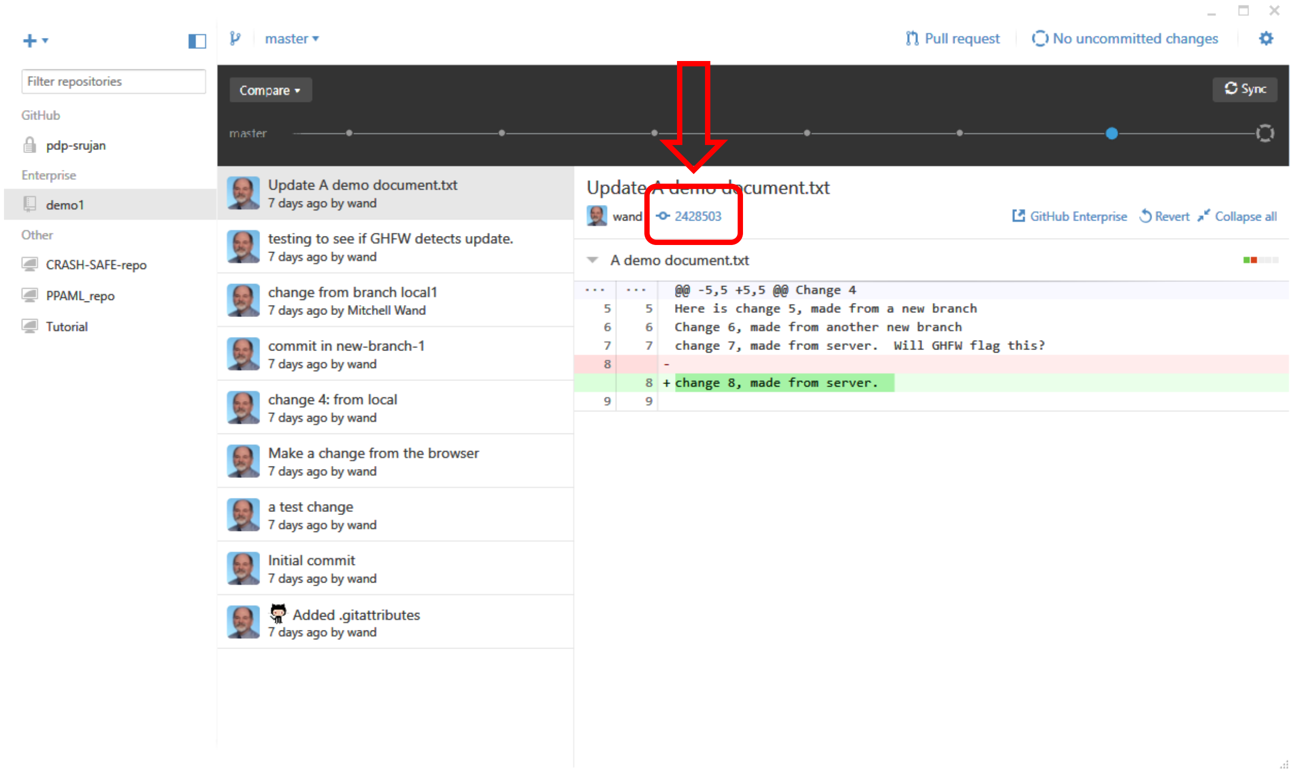
GitHub Enterprise Revert Collapse all

A demo document.txt

```
...  ...  @@ -5,5 +5,5 @@ Change 4
5    5    Here is change 5, made from a new branch
6    6    Change 6, made from another new branch
7    7    change 7, made from server.  Will GHFW flag this?
8         -
     8    +change 8, made from server.
9    9
```

This shows your commit SHA

- In this view, you can see the first 6 characters of the unique identifier ("the SHA") for this commit
- You'll need it for your Worksession Report



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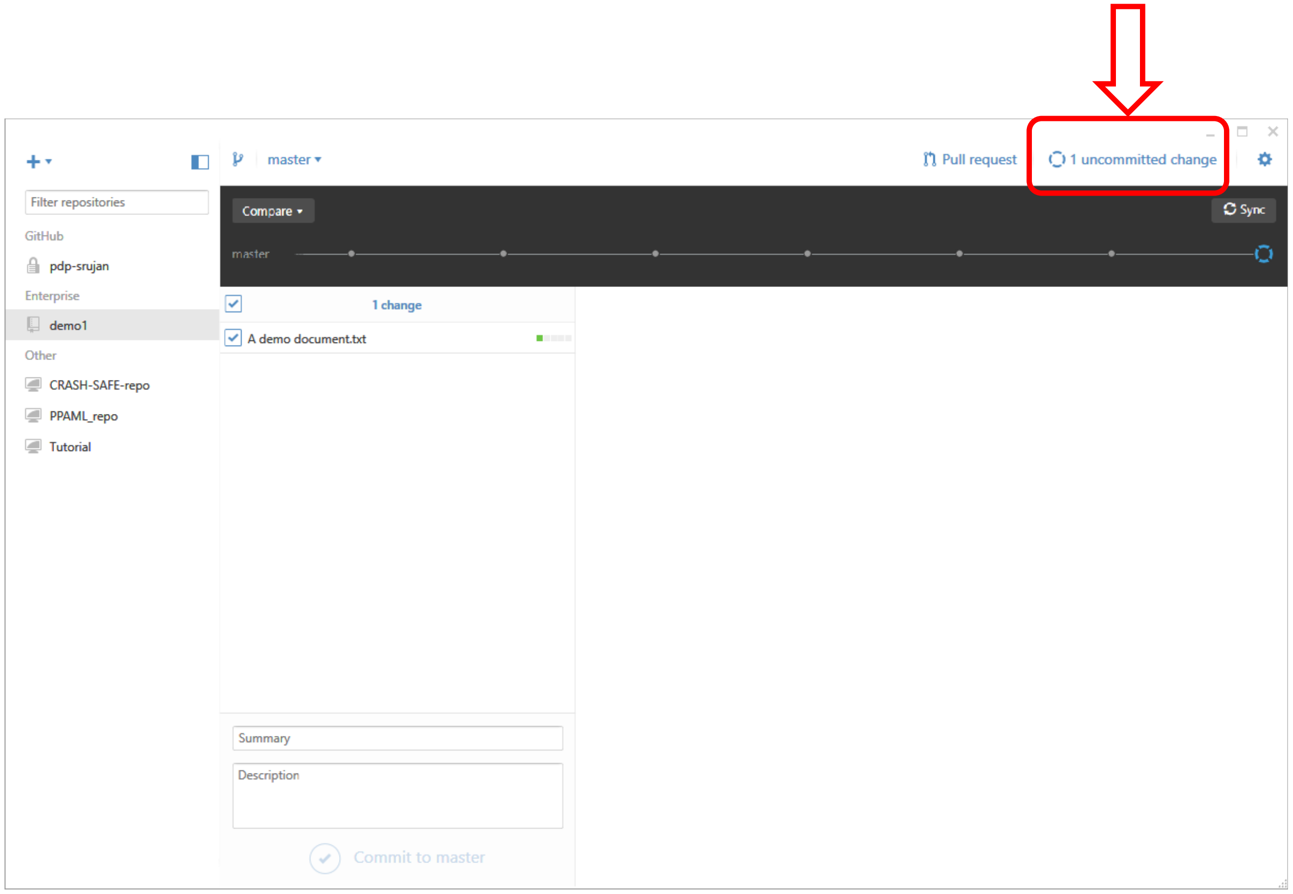
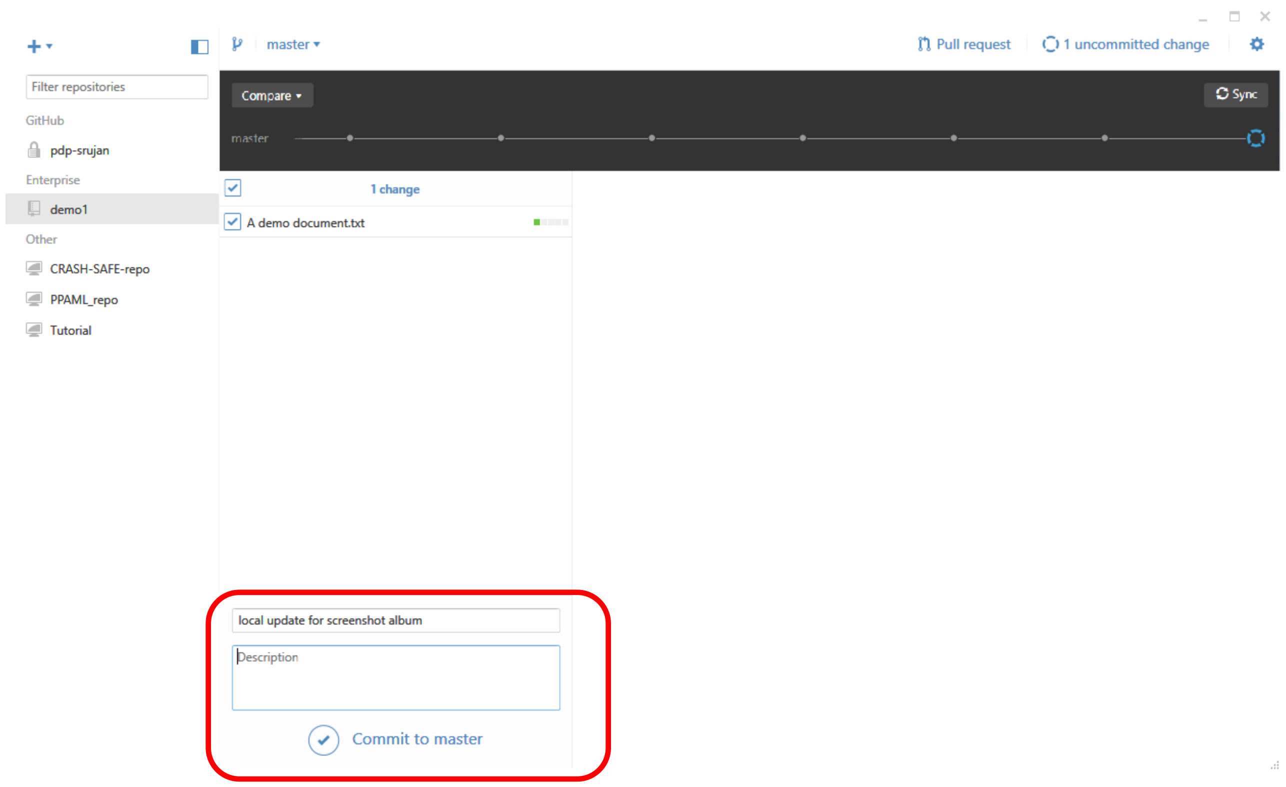
Now let’s work on our file

- Now the screen shows an uncommitted change.



Next, we commit our work

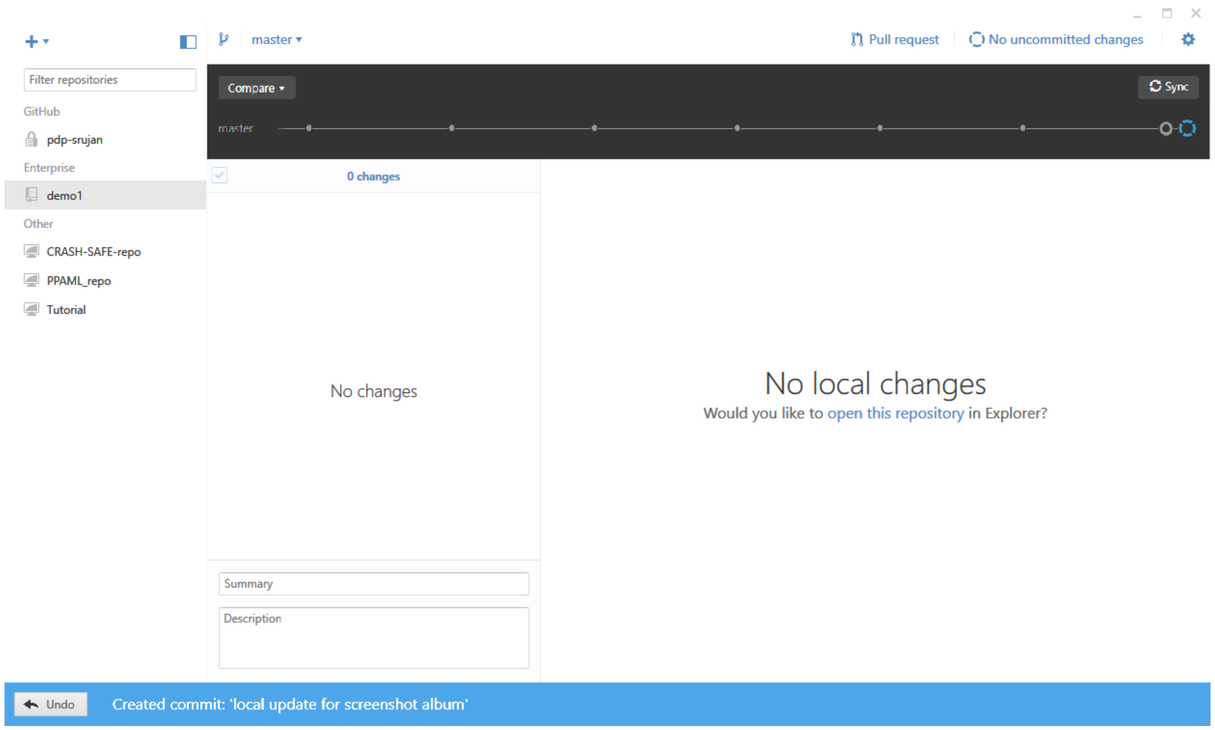
- We write a commit message. Then we'll click on "Commit to Master"



local update for screenshot album

Here's what you'll see after a commit

- Now it says "No uncommitted changes" again.
- You can also undo the commit if you want.



No changes

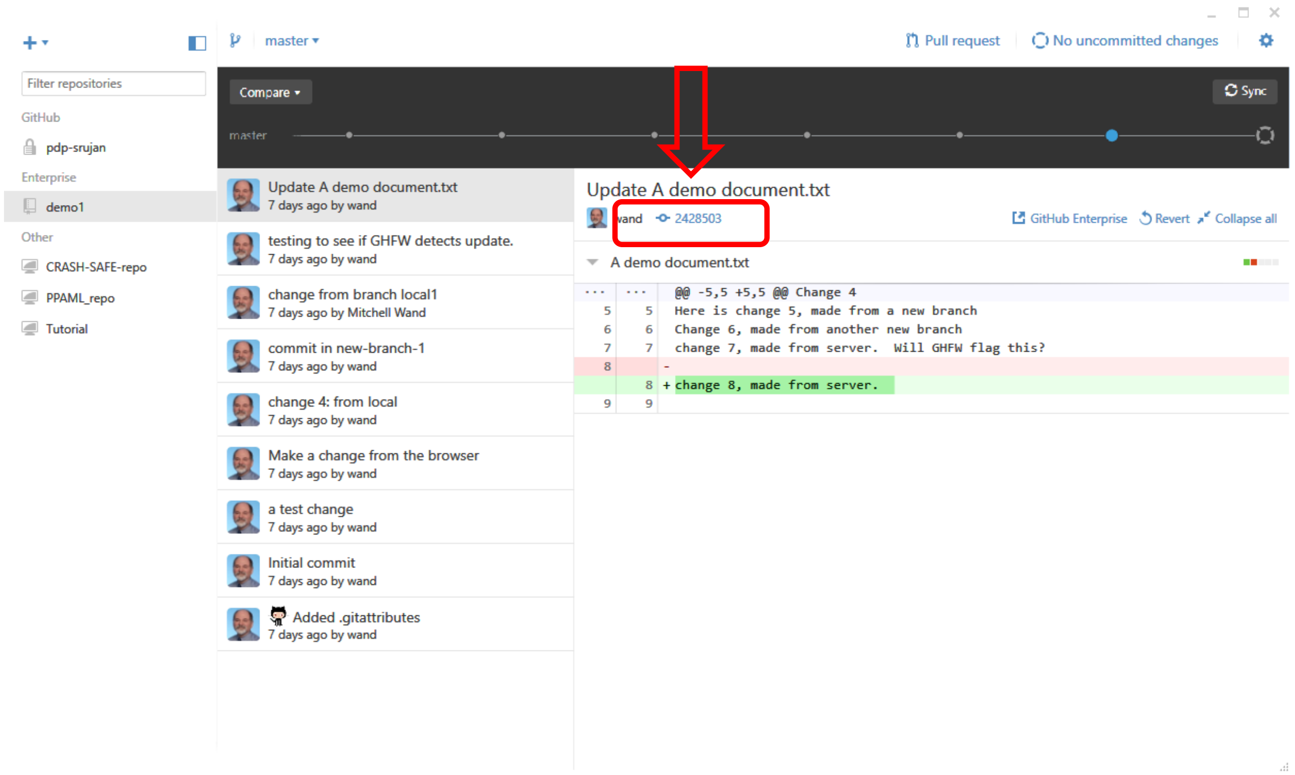
No local changes

Would you like to open this repository in Explorer?

Created commit: 'local update for screenshot album'

Be sure to record the commit SHA

- Click on the open circle to see what was in your commit, and to record the commit SHA. Here's that screen again:



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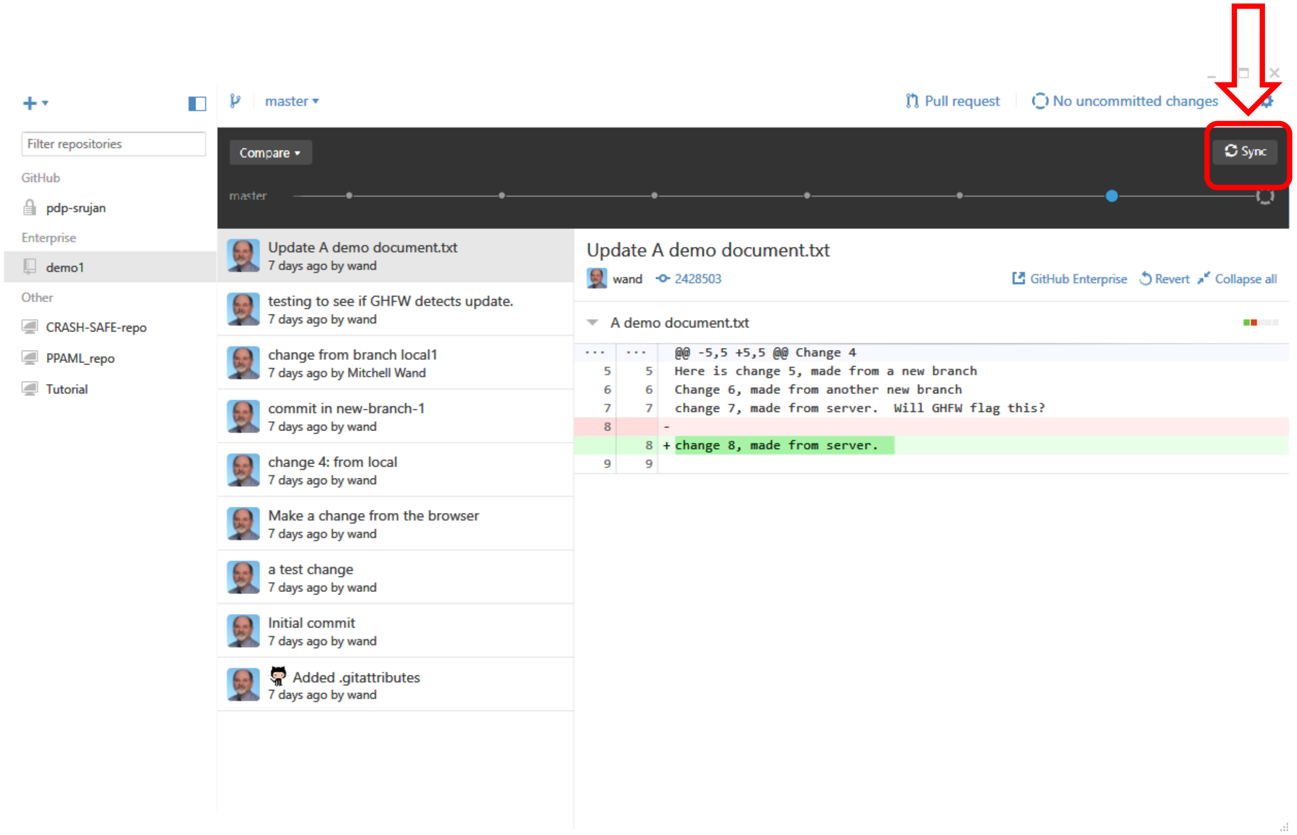
```

Be sure to sync!!!

- Your work is not saved on the server until you sync.



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```
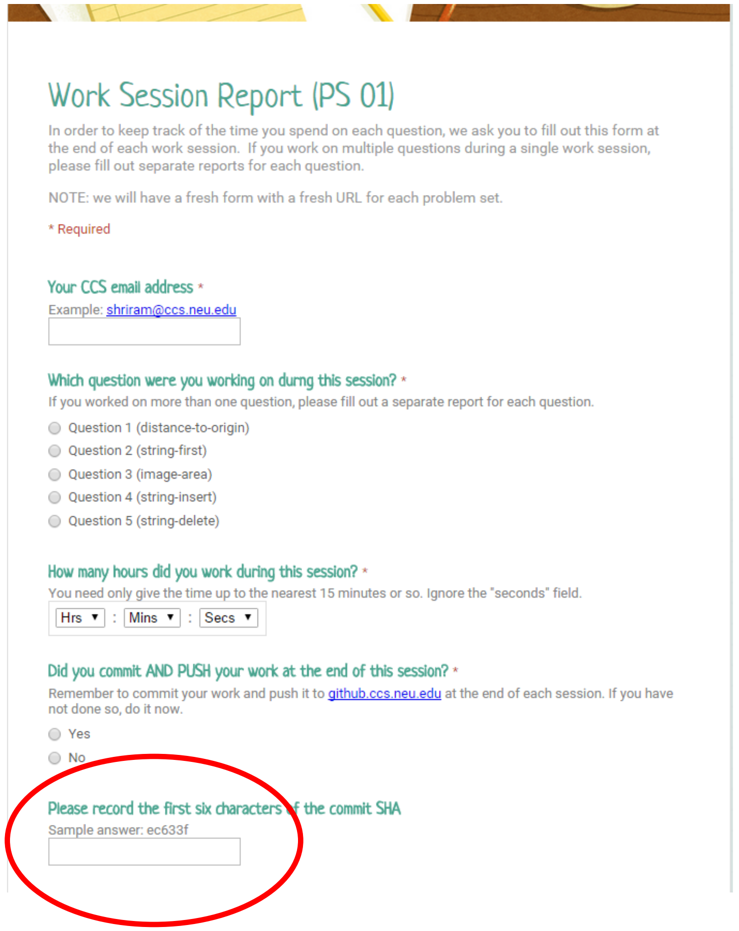

Submit a Work Session Report

- At the end of your work session, submit a work session report via the web.
- The URL for the work session report will appear in each problem set.
- The report will ask for the SHA of your last commit. You can get this from the Github Desktop, as we've shown you.



Work Session Report (PS 01)

In order to keep track of the time you spend on each question, we ask you to fill out this form at the end of each work session. If you work on multiple questions during a single work session, please fill out separate reports for each question.

NOTE: we will have a fresh form with a fresh URL for each problem set.

* Required

Your CCS email address *

Example: shriram@ccs.neu.edu

Which question were you working on durng this session? *

If you worked on more than one question, please fill out a separate report for each question.

- Question 1 (distance-to-origin)
- Question 2 (string-first)
- Question 3 (image-area)
- Question 4 (string-insert)
- Question 5 (string-delete)

How many hours did you work during this session? *

You need only give the time up to the nearest 15 minutes or so. Ignore the "seconds" field.

Hrs : Mins : Secs

Did you commit AND PUSH your work at the end of this session? *

Remember to commit your work and push it to github.ccs.neu.edu at the end of each session. If you have not done so, do it now.

- Yes
- No

Please record the first six characters of the commit SHA

Sample answer: ec633f

Other ways to use git and github

- There are lots of possible ways to use git and github.
- If you and your partner know git well, and you want to do something fancier with multiple branches, merges, and whatnot, feel free to do so.
- But you should be able to get by just fine with just a single master branch.

We believe in the KISS principle:
“Keep It Simple, Stupid!”

Summary

- In this lesson you have learned
  - that git creates a mini-filesystem in your directory
  - what commit, push, pull, and sync do
  - the elements of the basic git workflow
  - how git allows you to work across multiple computers
  - how git allows you and a partner to work together