Git

What it is, how it works, and how to use it

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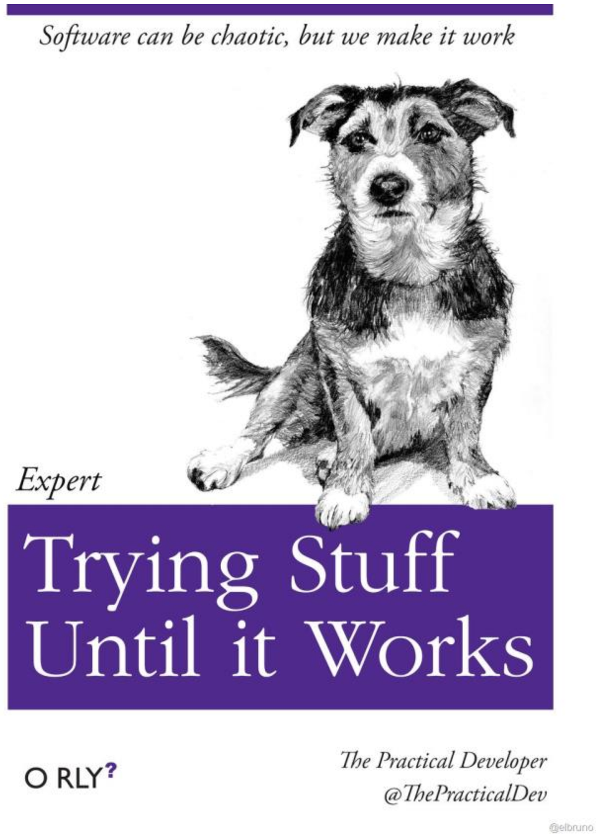
THE OHIO STATE UNIVERSITY

Overview

Git is a very useful tool, but it has a bit of learning curve

This brief workshop should give you the groundwork to get started

When all else fails, consult these valuable resources


Software can be chaotic, but we make it work
Expert
Trying Stuff Until it Works
O RLY?
The Practical Developer
@ThePracticalDev
@elbruno

+

What is it?

“Git is software for tracking changes in any set of files, usually used for coordinating work among programmers collaboratively developing source code during software development. Its goals include speed, data integrity, and support for distributed, non-linear workflows.”
https://en.wikipedia.org/wiki/Git

Git is a version control system which allows for:

- Tracking changes
- Collaborating with others
- Parallel development

THIS IS GIT. IT TRACKS COLLABORATIVE WORK ON PROJECTS THROUGH A BEAUTIFUL DISTRIBUTED GRAPH THEORY TREE MODEL.
COOL. HOW DO WE USE IT?
NO IDEA. JUST MEMORIZE THESE SHELL COMMANDS AND TYPE THEM TO SYNC UP. IF YOU GET ERRORS, SAVE YOUR WORK ELSEWHERE, DELETE THE PROJECT, AND DOWNLOAD A FRESH COPY.

How it works

The gory details are beyond the scope of this talk (see e.g. StackOverflow)

The basics of git are:

- Create/clone a repo
- Add/modify code
- Commit changes
- Push commit(s) (optional, for collaborating with others)

Git vs GitHub vs GitLab etc

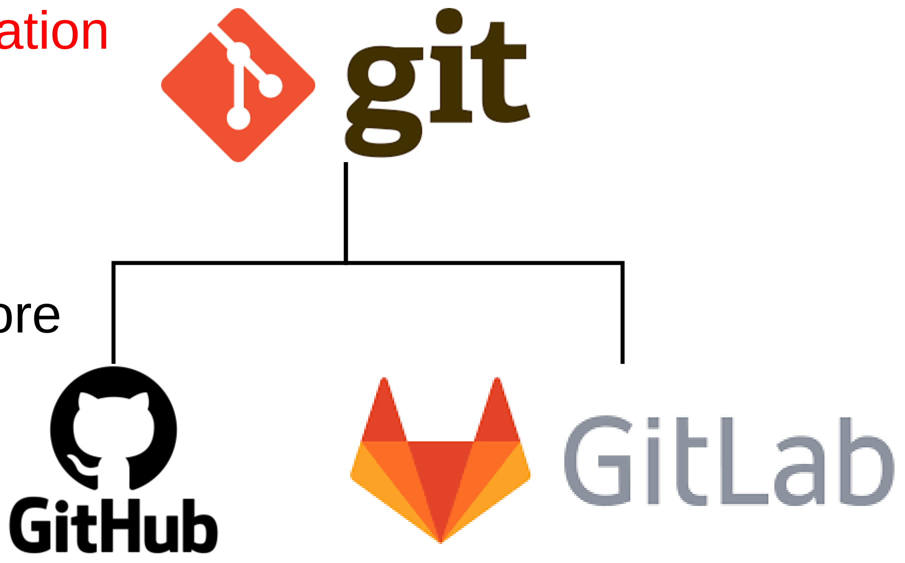
Git is the base protocol for storing information

Sites like GitHub and GitLab are git based tools for collaboration

For example, on GitHub one can push/pull commits,
open a pull request (PR), view changes,
enable continuous integration (CI), add contributors, and more

GitHub and GitLab are very similar

- It just depends on who started the repo and where



How to use it

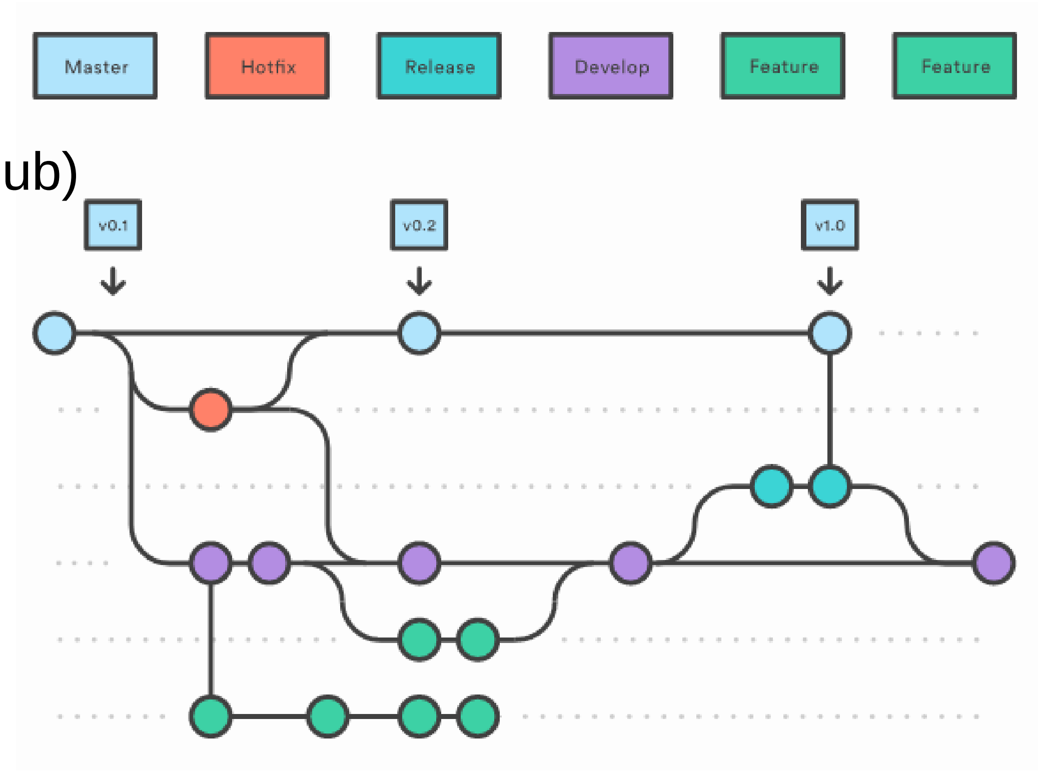
This section will be broken up into different parts:

Part I – How to set up a git repo (manually and with GitHub)

Part II – How to add files and make simple commits

Part III – Pushing to a remote repo

Part IV – Collaborating with others (via GitHub)



Part I

HOW TO SET UP A GIT REPO

Terminology

Repo – Repository in git

Remote – Link to the internet version (on GitHub, GitLab, etc.)

Origin – Shorthand for the remote repo where the project was originally cloned from

Upstream – Default remote branch where all pushes go

How to set up a git repo

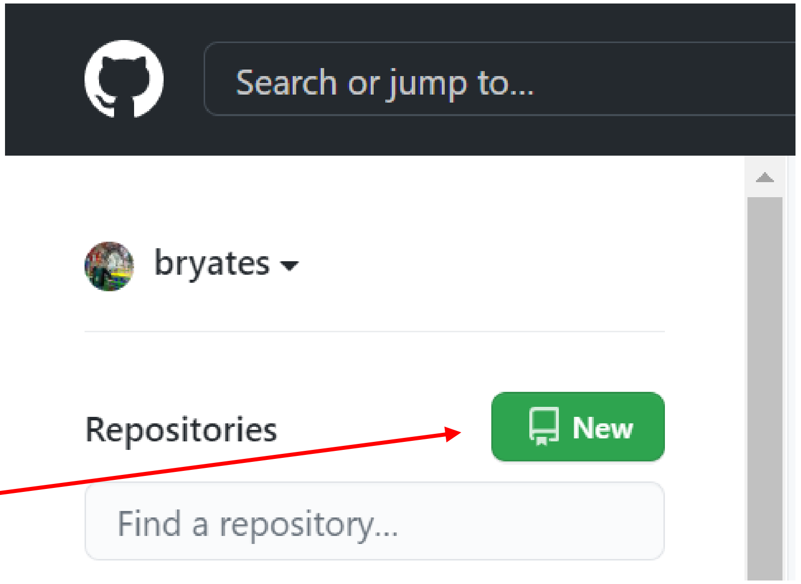
This can be done two different ways:

For local repos only, you can simply run `git init` in a new folder

- This can only be done once
- Git will create .git and other files/folders
- Trying another `init` will just throw an error

For collaborating, I prefer to create the repo online

- Go to github.com and create a new repo
- Clone the repo on any machine(s) used for development



Creating a GitHub repo

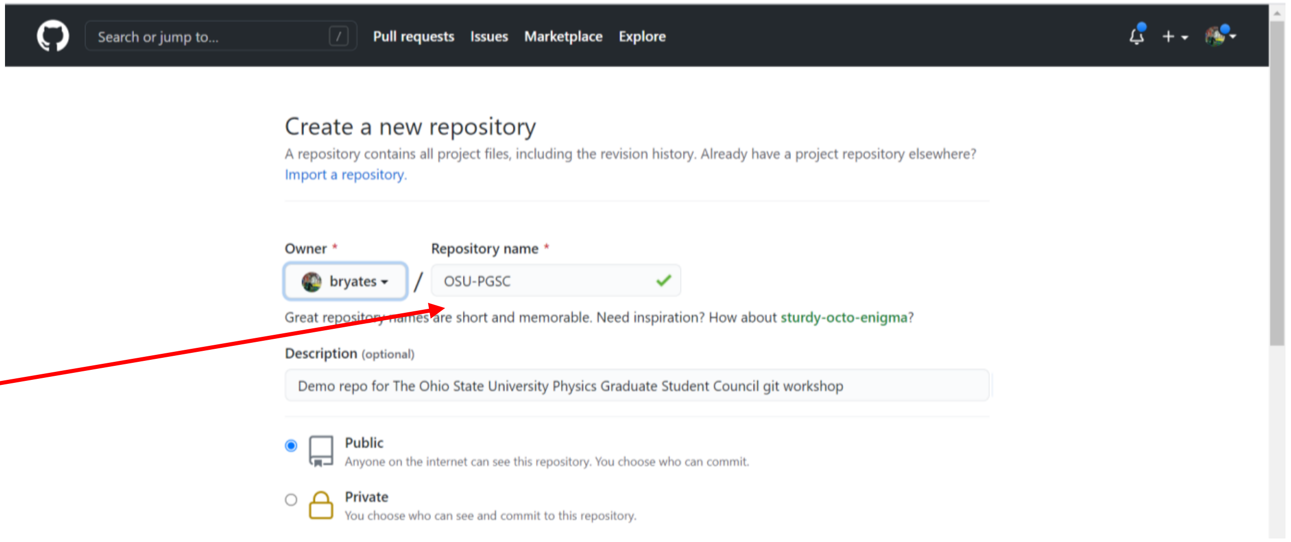
Clicking the new link opens this page

Here I've picked the name `OSU-PGSC`

The next page is unique to a fresh repo, and will change once anything is uploaded

To begin, clone the repo by copying the address

- I prefer the SSH version for security, but it takes additional steps to [add your own SSH key]()
- Today we'll just use HTTPS
- I clicked on the README part to have GitHub generate a README



Create a new repository

A repository contains all project files, including the revision history. Already have a project repository elsewhere? Import a repository.

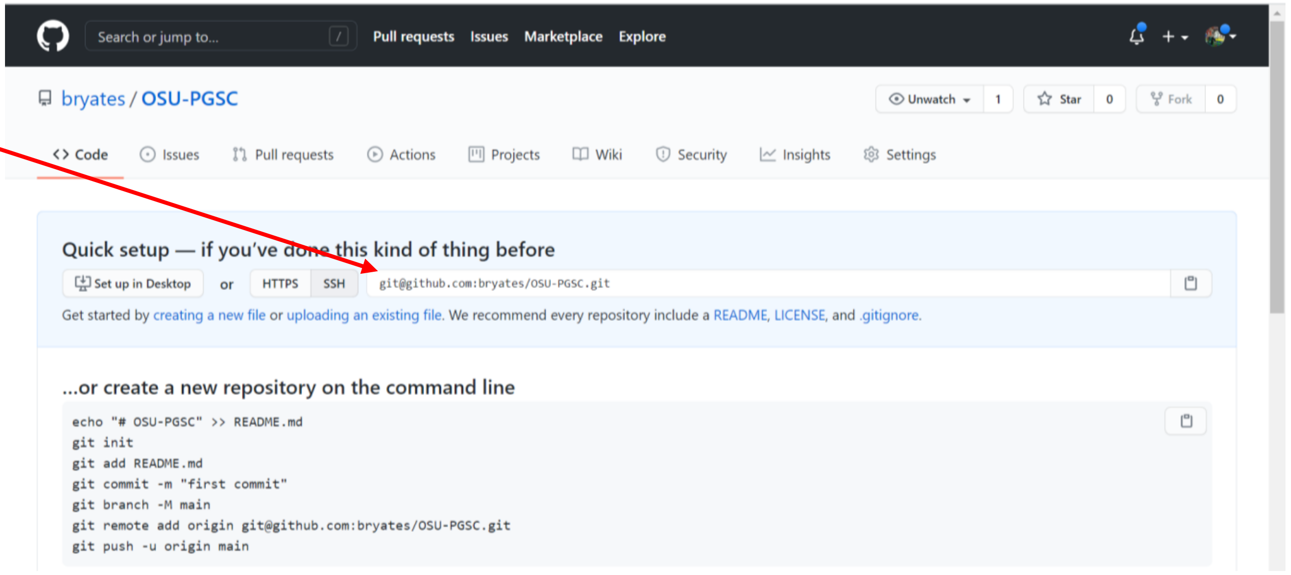
Owner * : bryates
Repository name * : OSU-PGSC

Great repository names are short and memorable. Need inspiration? How about sturdy-octo-enigma?

Description (optional): Demo repo for The Ohio State University Physics Graduate Student Council git workshop

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

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



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

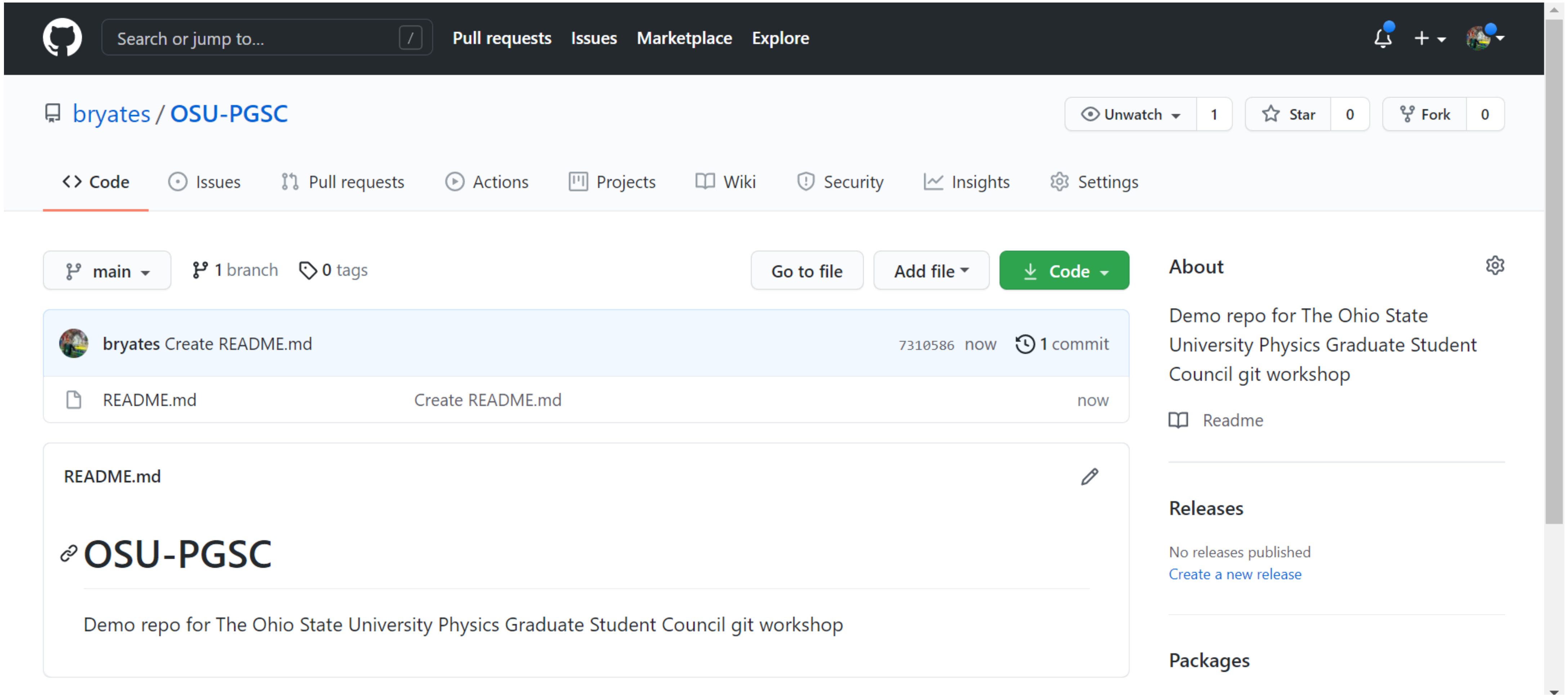
Set up in Desktop or HTTPS SSH `git@github.com:bryates/OSU-PGSC.git`

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

...or create a new repository on the command line

```
echo "# OSU-PGSC" >> README.md
git init
git add README.md
git commit -m "first commit"
git branch -M main
git remote add origin git@github.com:bryates/OSU-PGSC.git
git push -u origin main
```

Our new repo on GitHub



bryates Create README.md 7310586 now 1 commit

README.md Create README.md now

README.md

OSU-PGSC

Demo repo for The Ohio State University Physics Graduate Student Council git workshop

About

Demo repo for The Ohio State University Physics Graduate Student Council git workshop

Readme

Releases

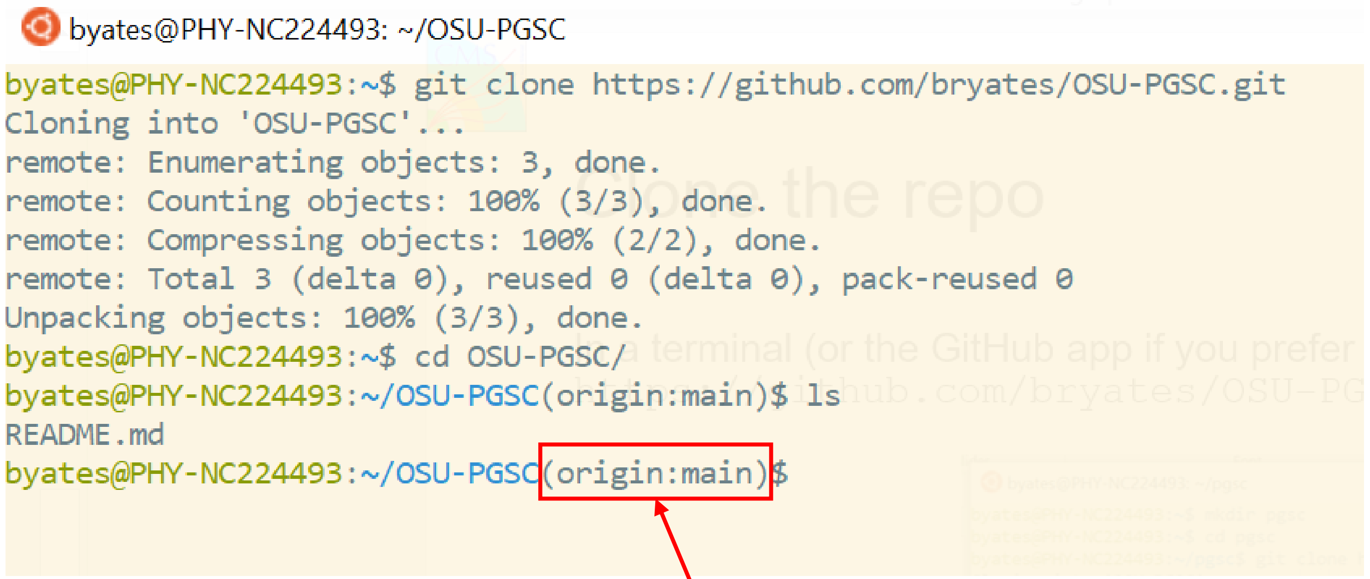
No releases published
Create a new release

Packages

Clone the repo

In a terminal (or the GitHub app if you prefer an interactive screen) clone the repo at `https://github.com/bryates/OSU-PGSC.git`

E.g. `git clone https://github.com/bryates/OSU-PGSC.git`



```
byates@PHY-NC224493: ~/OSU-PGSC
byates@PHY-NC224493:~$ git clone https://github.com/bryates/OSU-PGSC.git
Cloning into 'OSU-PGSC'...
remote: Enumerating objects: 3, done.
remote: Counting objects: 100% (3/3), done.
remote: Compressing objects: 100% (2/2), done.
remote: Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
Unpacking objects: 100% (3/3), done.
byates@PHY-NC224493:~$ cd OSU-PGSC/
byates@PHY-NC224493:~/OSU-PGSC(origin:main)$ ls
README.md
byates@PHY-NC224493:~/OSU-PGSC(origin:main)$
```

I wrote a custom shell script in my `.bashrc` to display the remote repo name and branch name in the command line.
You won't normally see this.

A quick word on branch names

GitHub allows for any branch name you want, and any branch can be the primary branch

By default, GitHub now uses `main` as the primary branch

- If you've used GitHub before, you might be used to the `master` branch
- GitHub is encouraging groups to voluntarily avoid this wording
  https://github.com/github/renaming

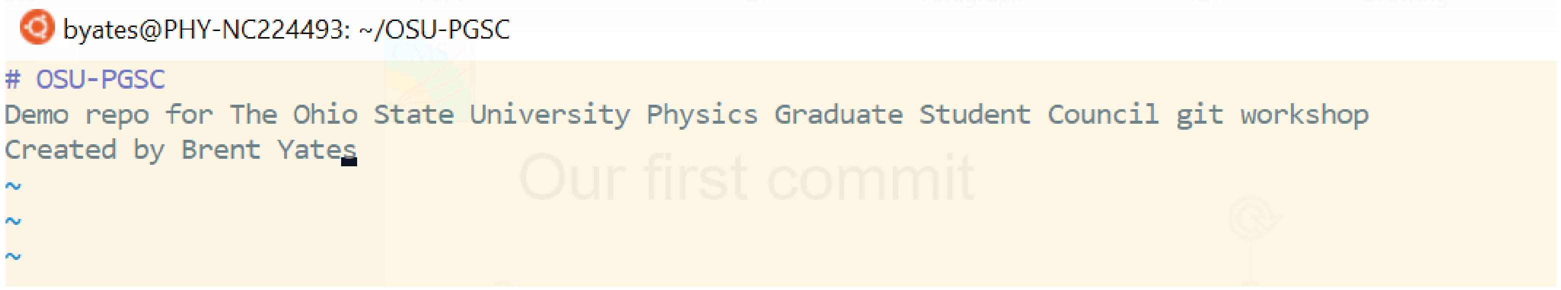
Part II

HOW TO ADD FILES AND MAKE SIMPLE COMMITS

Our first commit

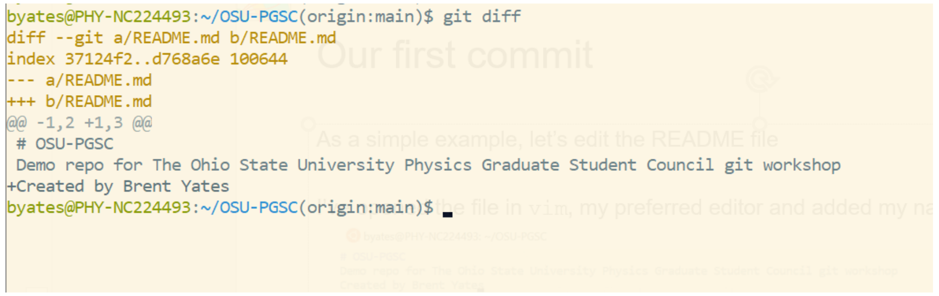
As a simple example, let’s edit the README file

I’ve opened the file in `vim`, my preferred editor and added my name to the bottom



```
byates@PHY-NC224493: ~/OSU-PGSC
# OSU-PGSC
Demo repo for The Ohio State University Physics Graduate Student Council git workshop
Created by Brent Yates
~
~
~
```

After saving the file, it is now different from the repo’s version



```
byates@PHY-NC224493:~/OSU-PGSC(origin:main)$ git diff
diff --git a/README.md b/README.md
index 37124f2..d768a6e 100644
--- a/README.md
+++ b/README.md
@@ -1,2 +1,3 @@
 # OSU-PGSC
 Demo repo for The Ohio State University Physics Graduate Student Council git workshop
+Created by Brent Yates
byates@PHY-NC224493:~/OSU-PGSC(origin:main)$
```

Our first commit (continued)

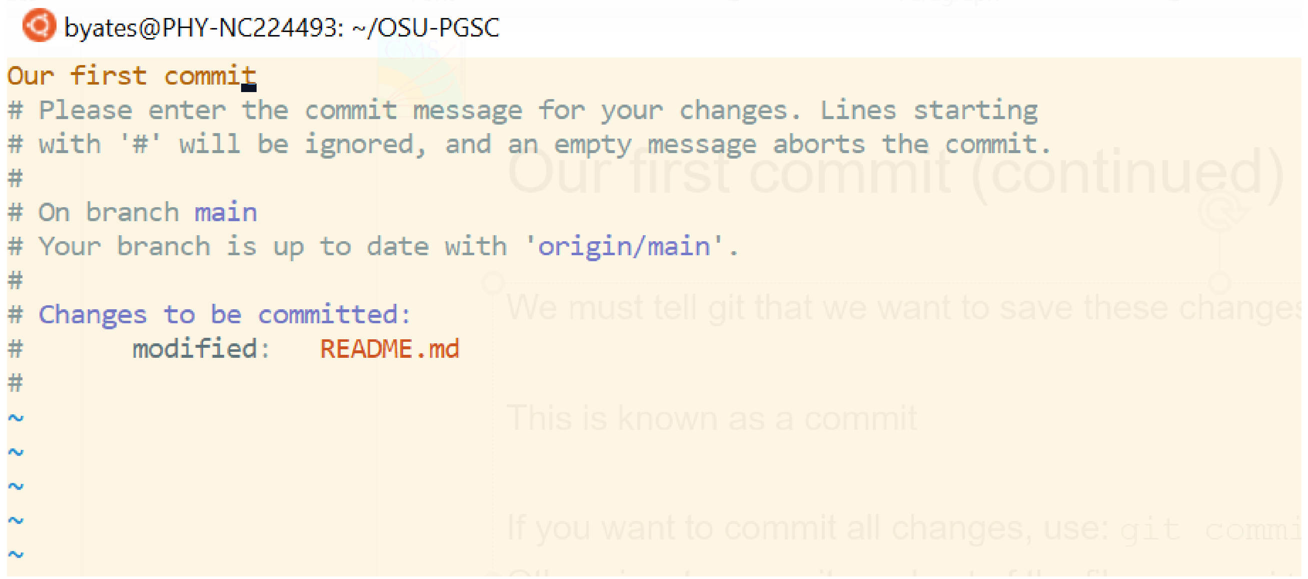
We must tell git that we want to save these changes

This is known as a commit

New files must be added first
`git add file1 file2 …`

If you want to commit all changes, use:
`git commit -a`

To commit a subset of the files, use:
`git commit file1 file2 …`

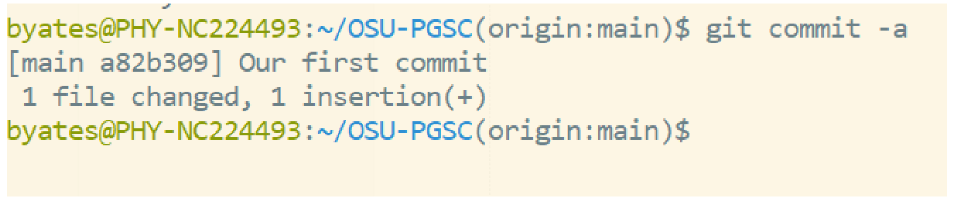


byates@PHY-NC224493: ~/OSU-PGSC

```
Our first commit
# Please enter the commit message for your changes. Lines starting
# with '#' will be ignored, and an empty message aborts the commit.
#
# On branch main
# Your branch is up to date with 'origin/main'.
#
# Changes to be committed:
#       modified:   README.md
#
~
~
~
~
~
```

This will open your default editor (`vim` in my case) where you can add a short message about the commit

- After saving and closing this, the file(s) will be committed



```
byates@PHY-NC224493:~/OSU-PGSC(origin:main)$ git commit -a
[main a82b309] Our first commit
 1 file changed, 1 insertion(+)
byates@PHY-NC224493:~/OSU-PGSC(origin:main)$
```

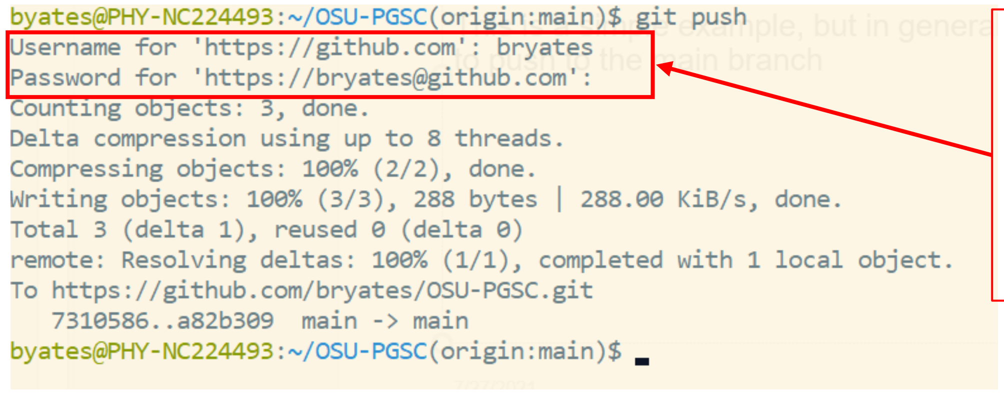
Part III

PUSHING TO A REMOTE REPO

What next?

Now that we've committed our files locally, we must tell GitHub about the changes

This is done by using: `git push`



```
byates@PHY-NC224493:~/OSU-PGSC(origin:main)$ git push
Username for 'https://github.com': bryates
Password for 'https://bryates@github.com':
Counting objects: 3, done.
Delta compression using up to 8 threads.
Compressing objects: 100% (2/2), done.
Writing objects: 100% (3/3), 288 bytes | 288.00 KiB/s, done.
Total 3 (delta 1), reused 0 (delta 0)
remote: Resolving deltas: 100% (1/1), completed with 1 local object.
To https://github.com/bryates/OSU-PGSC.git
   7310586..a82b309  main -> main
byates@PHY-NC224493:~/OSU-PGSC(origin:main)$
```

This is why I prefer using SSH keys

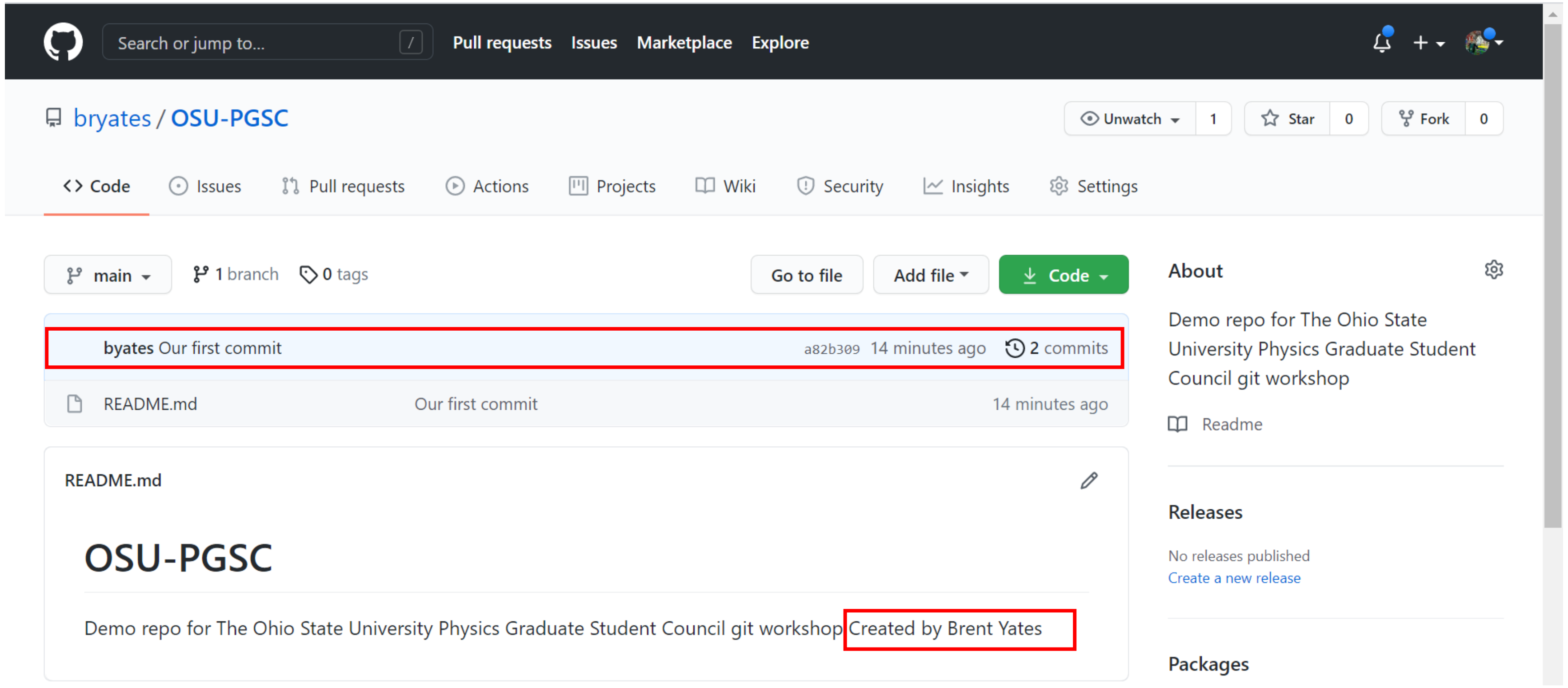
You can store your username and password in git, but it is not as secure

This is a simple example, but in general if you are collaborating with others, you should avoid pushing to the `main` branch

Instead, push to a new development branch (or one you're in the processes of updating), and open a pull request (more on this later)

After pushing

The repo on GitHub is now up to date with our changes



bryates / OSU-PGSC

byates Our first commit a82b309 14 minutes ago 2 commits

README.md Our first commit 14 minutes ago

README.md

OSU-PGSC

Demo repo for The Ohio State University Physics Graduate Student Council git workshop Created by Brent Yates

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Demo repo for The Ohio State University Physics Graduate Student Council git workshop

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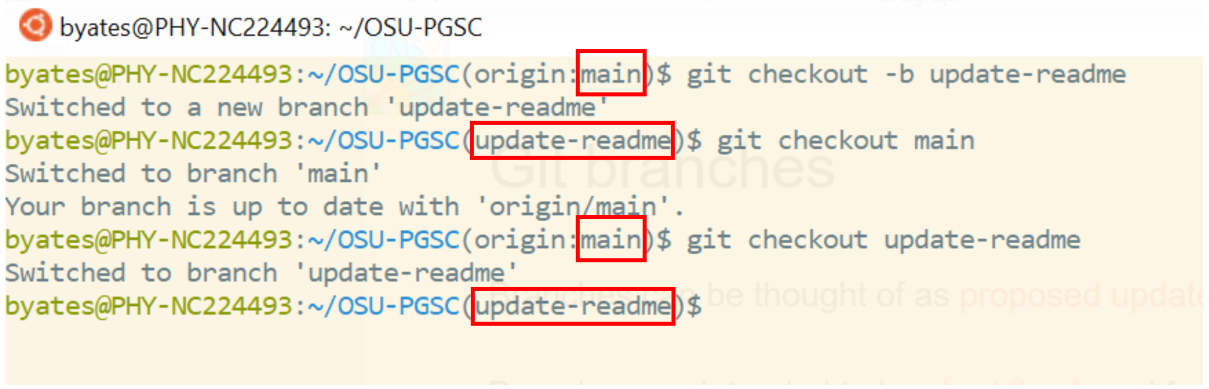
Git branches

Branches can be thought of as proposed updates to a git repo

Branches are intended to be short lived, and for one feature

- E.g. fix a bug, confirm it works, merge into the main branch, and delete the development branch

- Quite often people will not follow this rule, resulting in more complicated (but sometimes necessary) merging



byates@PHY-NC224493: ~/OSU-PGSC

```
byates@PHY-NC224493:~/OSU-PGSC(origin:main)$ git checkout -b update-readme
Switched to a new branch 'update-readme'
byates@PHY-NC224493:~/OSU-PGSC(update-readme)$ git checkout main
Switched to branch 'main'
Your branch is up to date with 'origin/main'.
byates@PHY-NC224493:~/OSU-PGSC(origin:main)$ git checkout update-readme
Switched to branch 'update-readme'
byates@PHY-NC224493:~/OSU-PGSC(update-readme)$
```

- A branch is created with: `git branch -b name`

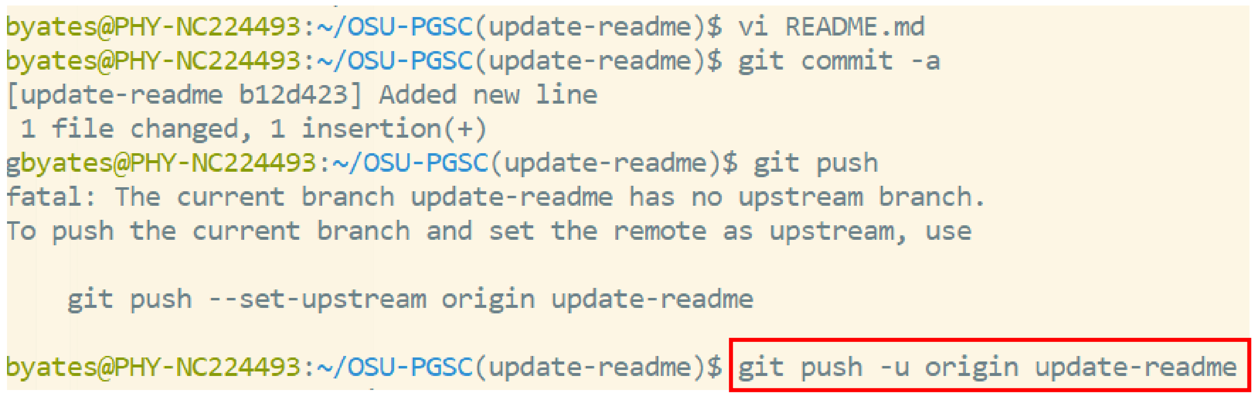
- To switch between branches, use: `git checkout name`

Pushing branches

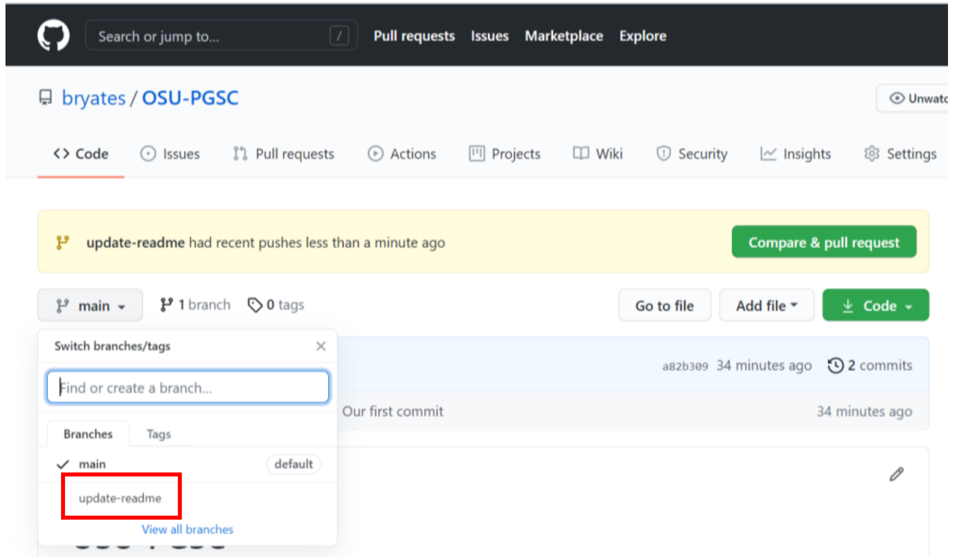
The first time a branch is pushed, it must be assigned to an upstream branch

`git push --set-upstream origin name` or `git push –u origin name`

This tells GitHub the new branch exists



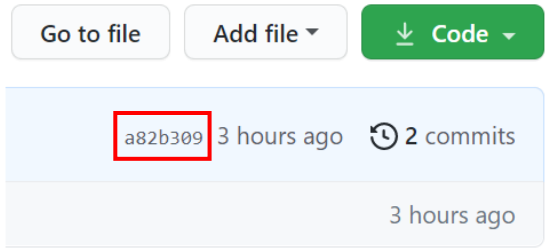
```
byates@PHY-NC224493:~/OSU-PGSC(update-readme)$ vi README.md
byates@PHY-NC224493:~/OSU-PGSC(update-readme)$ git commit -a
[update-readme b12d423] Added new line
 1 file changed, 1 insertion(+)
gbyates@PHY-NC224493:~/OSU-PGSC(update-readme)$ git push
fatal: The current branch update-readme has no upstream branch.
To push the current branch and set the remote as upstream, use

    git push --set-upstream origin update-readme

byates@PHY-NC224493:~/OSU-PGSC(update-readme)$ git push -u origin update-readme
```



Subsequent pushes are done with `git push`

Commit hash

You might have noticed these hash codes in the terminal and on the GitHub website



When a commit is made, git computes the SHA hash of all the files in the commit

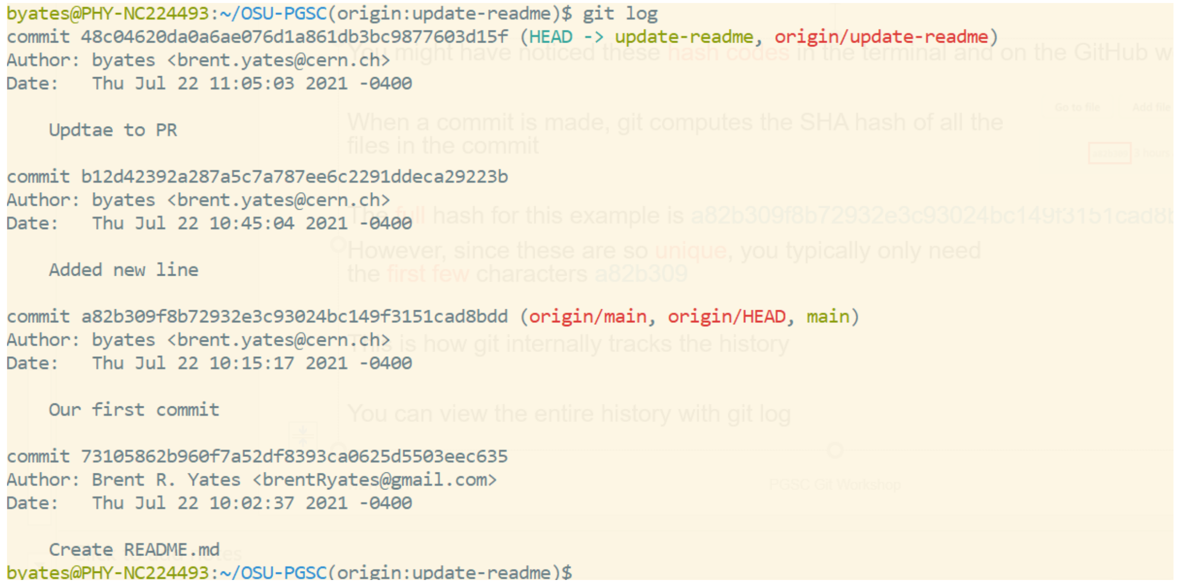
The full hash for this example is a82b309f8b72932e3c93024bc149f3151cad8bdd

However, since these are so unique, you typically only need the first few characters a82b309

This is how git internally tracks the history

You can view the entire history with `git log`

If you need to temporarily look at an older version of the code, use `git checkout sha`, or `git checkout sha -b name` if you want to make a new branch with this version



```
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git log
commit 48c04620da0a6ae076d1a861db3bc9877603d15f (HEAD -> update-readme, origin/update-readme)
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 11:05:03 2021 -0400

    Updtae to PR

commit b12d42392a287a5c7a787ee6c2291ddeca29223b
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 10:45:04 2021 -0400

    Added new line

commit a82b309f8b72932e3c93024bc149f3151cad8bdd (origin/main, origin/HEAD, main)
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 10:15:17 2021 -0400

    Our first commit

commit 73105862b960f7a52df8393ca0625d5503eec635
Author: Brent R. Yates <brentRyates@gmail.com>
Date:   Thu Jul 22 10:02:37 2021 -0400

    Create README.md
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$
```

Part IV

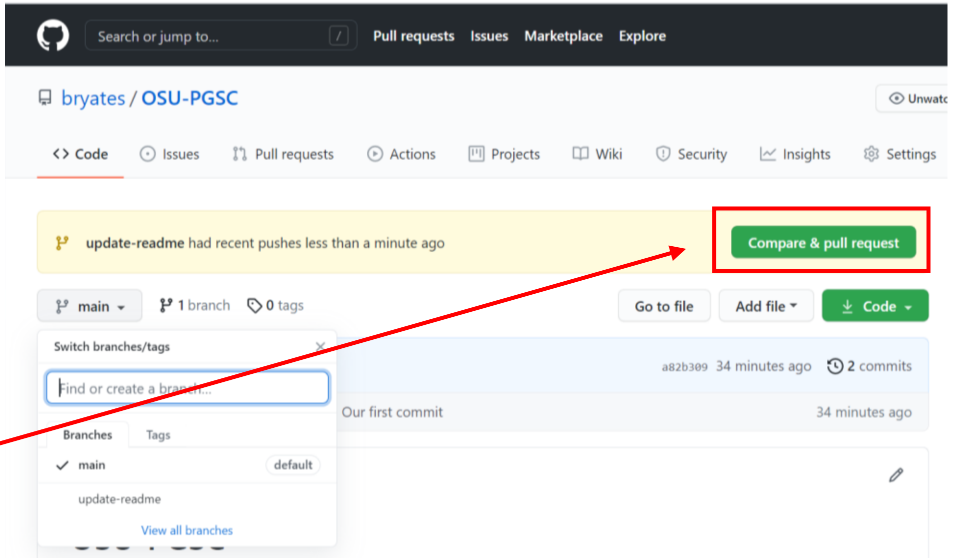
COLLABORATING WITH OTHERS

Pull request

A pull request (PR) is a way of letting others know your branch is ready for review and merging into the `main` branch

This is done on the GitHub webpage, not on the command line

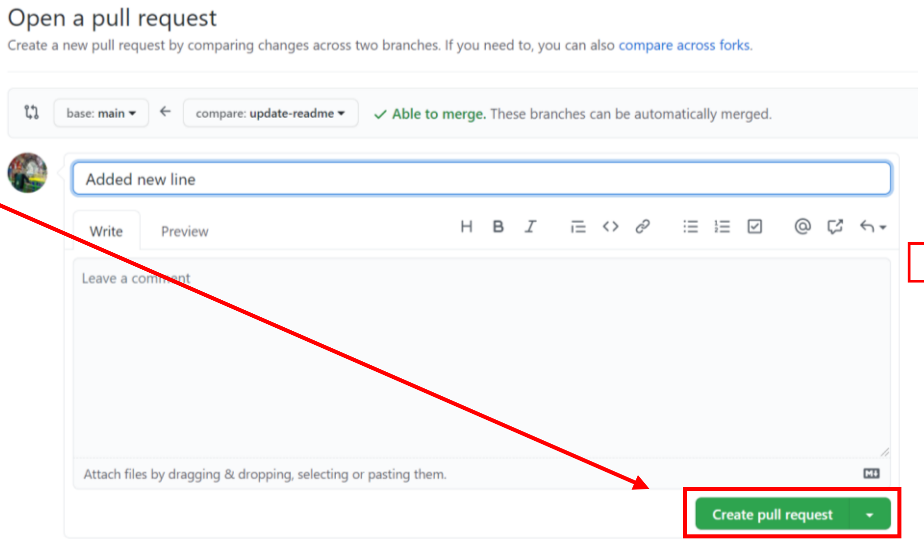
- Click Compare & pull request
- Fill in any information you desire
- Click Create pull request
- PRs can be updated and/or merged



update-readme had recent pushes less than a minute ago

a82b309 34 minutes ago 2 commits

Our first commit 34 minutes ago



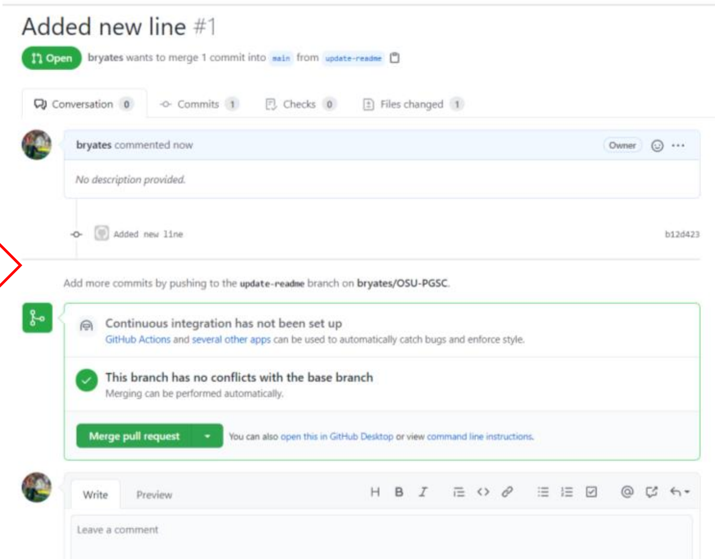
Open a pull request

Create a new pull request by comparing changes across two branches. If you need to, you can also compare across forks.

base: main ← compare: update-readme ✓ Able to merge. These branches can be automatically merged.

Added new line

Write
Preview
H B I
Leave a comment
Attach files by dragging & dropping, selecting or pasting them.
Create pull request



Added new line #1

Open bryates wants to merge 1 commit into `main` from `update-readme`

bryates commented now

No description provided.

Added new line b12d423

Add more commits by pushing to the **update-readme** branch on **bryates/OSU-PGSC**.

Continuous integration has not been set up
GitHub Actions and several other apps can be used to automatically catch bugs and enforce style.

This branch has no conflicts with the base branch
Merging can be performed automatically.

Merge pull request
You can also open this in GitHub Desktop or view command line instructions.

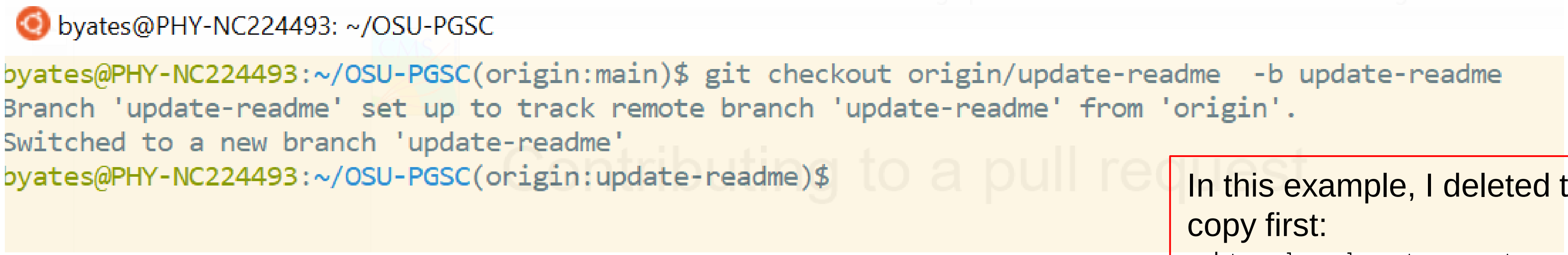
Contributing to a pull request

Anyone can update a the PR by pulling, making changes, and pushing to the same branch

To checkout a new branch from GitHub (e.g. one someone else created) use:

```
git checkout origin/name -b name
```

Where `origin/name` refers to the upstream branch, and `-b name` creates a local copy of the branch with the corresponding `name`



byates@PHY-NC224493: ~/OSU-PGSC

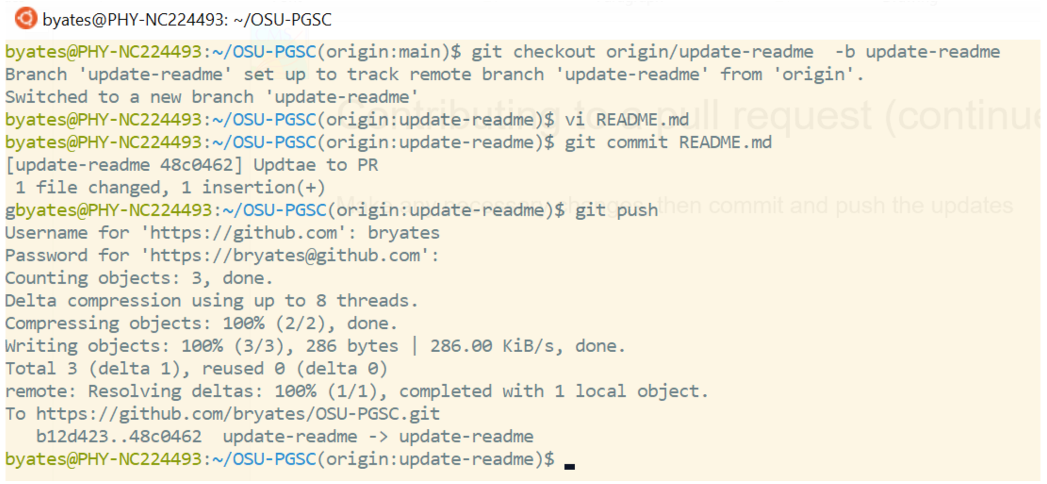
```
byates@PHY-NC224493:~/OSU-PGSC(origin:main)$ git checkout origin/update-readme  -b update-readme
Branch 'update-readme' set up to track remote branch 'update-readme' from 'origin'.
Switched to a new branch 'update-readme'
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$
```

In this example, I deleted the local copy first:

```
git checkout master
git branch -d update-readme
```

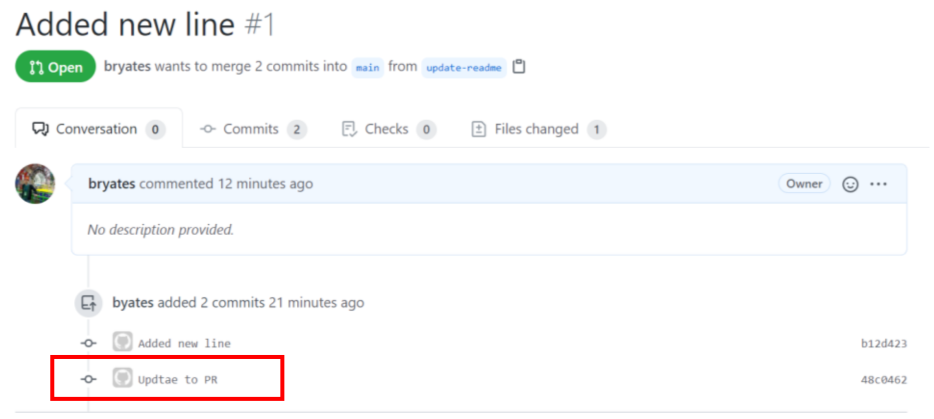
Contributing to a pull request (continued)

Make any necessary changes, then commit and push the updates



byates@PHY-NC224493: ~/OSU-PGSC

```
byates@PHY-NC224493:~/OSU-PGSC(origin:main)$ git checkout origin/update-readme  -b update-readme
Branch 'update-readme' set up to track remote branch 'update-readme' from 'origin'.
Switched to a new branch 'update-readme'
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ vi README.md
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git commit README.md
[update-readme 48c0462] Updtae to PR
 1 file changed, 1 insertion(+)
gbyates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git push
Username for 'https://github.com': bryates
Password for 'https://bryates@github.com':
Counting objects: 3, done.
Delta compression using up to 8 threads.
Compressing objects: 100% (2/2), done.
Writing objects: 100% (3/3), 286 bytes | 286.00 KiB/s, done.
Total 3 (delta 1), reused 0 (delta 0)
remote: Resolving deltas: 100% (1/1), completed with 1 local object.
To https://github.com/bryates/OSU-PGSC.git
   b12d423..48c0462  update-readme -> update-readme
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$
```



Added new line #1

Open bryates wants to merge 2 commits into main from update-readme

bryates commented 12 minutes ago

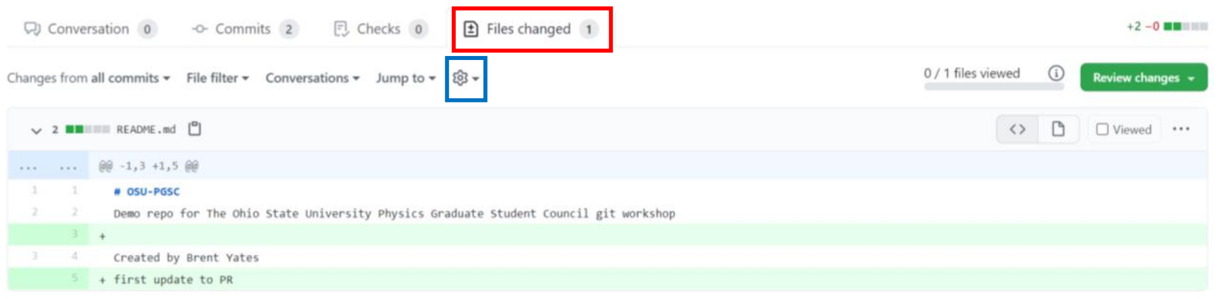
No description provided.

bryates added 2 commits 21 minutes ago

```
Added new line    b12d423
Updtae to PR      48c0462
```

Changes can be viewed online

By default white spaces count as changes; click the gear box to see more options

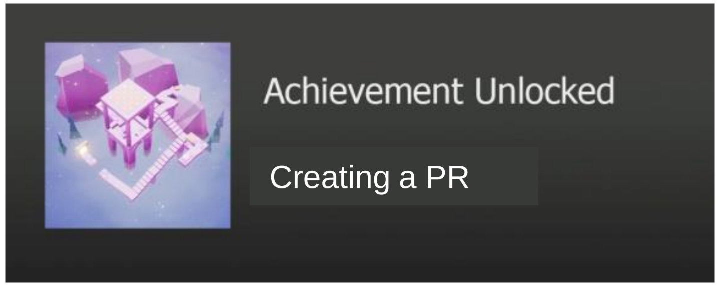


2 README.md

```
...  ...  @@ -1,3 +1,5 @@
1    1     # OSU-PGSC
2    2     Demo repo for The Ohio State University Physics Graduate Student Council git workshop
     3   +
3    4     Created by Brent Yates
     5   + first update to PR
```

Interactive session

Interactive exercise I – Your first PR

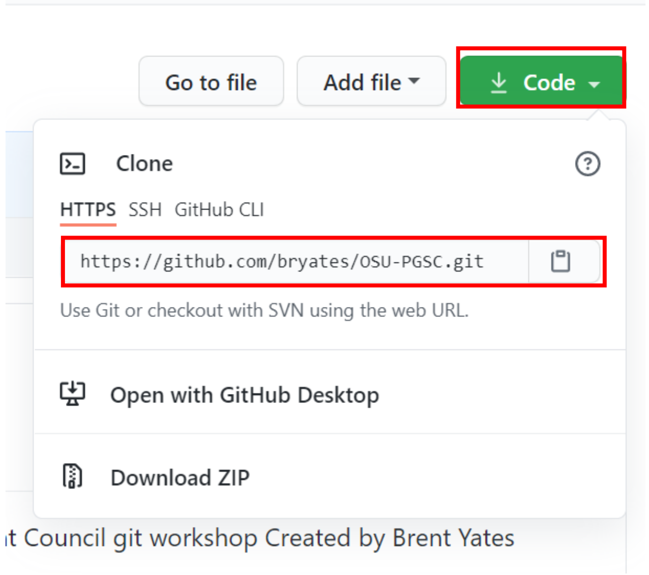


Everyone clone the repo: https://github.com/bryates/OSU-PGSC

Create a new branch (with a unique name)

Add your name to the README

Push to the repo and open a PR



```
https://github.com/bryates/OSU-PGSC.git
```

Use Git or checkout with SVN using the web URL.

ıt Council git workshop Created by Brent Yates

Interactive exercise II – Working with others

Pushing to the same branch at the same time causes issues

Git will prevent this by refusing to push

To avoid this for now, split into groups of two

Steps to participate:

- Checkout your partner’s branch
- Pull the latest changes with `git pull`
- Add your namb below theirs
- Commit and push your changes to their PR

Advanced topics

MERGING AND REBASING

Merging and rebasing

What happens if two branches need to be synced?

- E.g. you forgot to pull before committing
- If you do `git pull`, it will initiate a merge

Git will try its best to reconcile the differences

- If not, you'll have to manually fix any merge issues

Alternative is to rebase one branch to the other with `git rebase name`

Rebasing will allow git to:

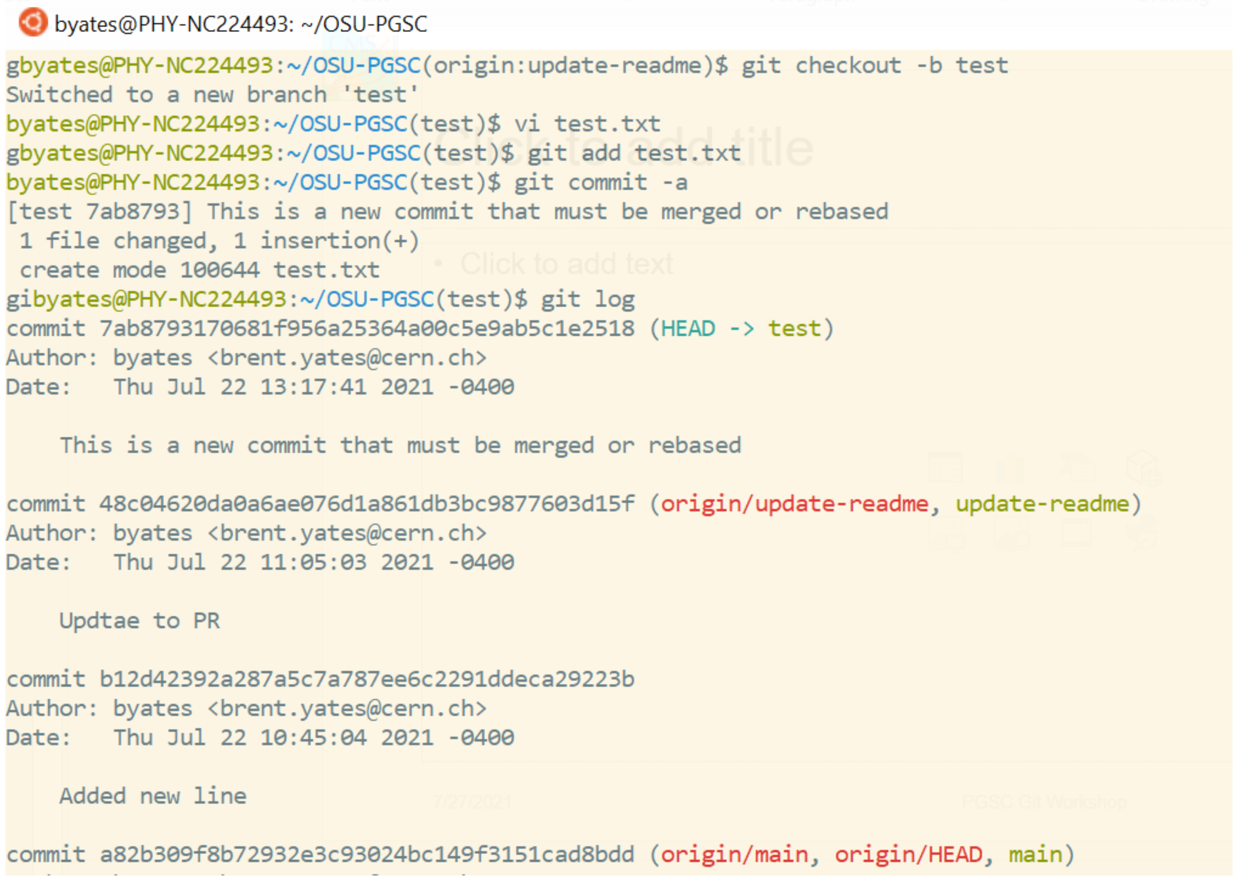
- Rewind the commit history of both branches to a common ancestor
- Apply the commits one-by-one
- Rewriting the history along the way

Merging and rebasing

I created a new branch called `test` based on the `update-readme` branch

I made a new file called `test.txt`, added and committed it to the branch

The two branches now differ, and must be handled



byates@PHY-NC224493: ~/OSU-PGSC

```
gbyates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git checkout -b test
Switched to a new branch 'test'
byates@PHY-NC224493:~/OSU-PGSC(test)$ vi test.txt
gbyates@PHY-NC224493:~/OSU-PGSC(test)$ git add test.txt
byates@PHY-NC224493:~/OSU-PGSC(test)$ git commit -a
[test 7ab8793] This is a new commit that must be merged or rebased
 1 file changed, 1 insertion(+)
 create mode 100644 test.txt
gibyates@PHY-NC224493:~/OSU-PGSC(test)$ git log
commit 7ab8793170681f956a25364a00c5e9ab5c1e2518 (HEAD -> test)
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 13:17:41 2021 -0400

    This is a new commit that must be merged or rebased

commit 48c04620da0a6ae076d1a861db3bc9877603d15f (origin/update-readme, update-readme)
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 11:05:03 2021 -0400

    Updtae to PR

commit b12d42392a287a5c7a787ee6c2291ddeca29223b
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 10:45:04 2021 -0400

    Added new line

commit a82b309f8b72932e3c93024bc149f3151cad8bdd (origin/main, origin/HEAD, main)
```

Merging

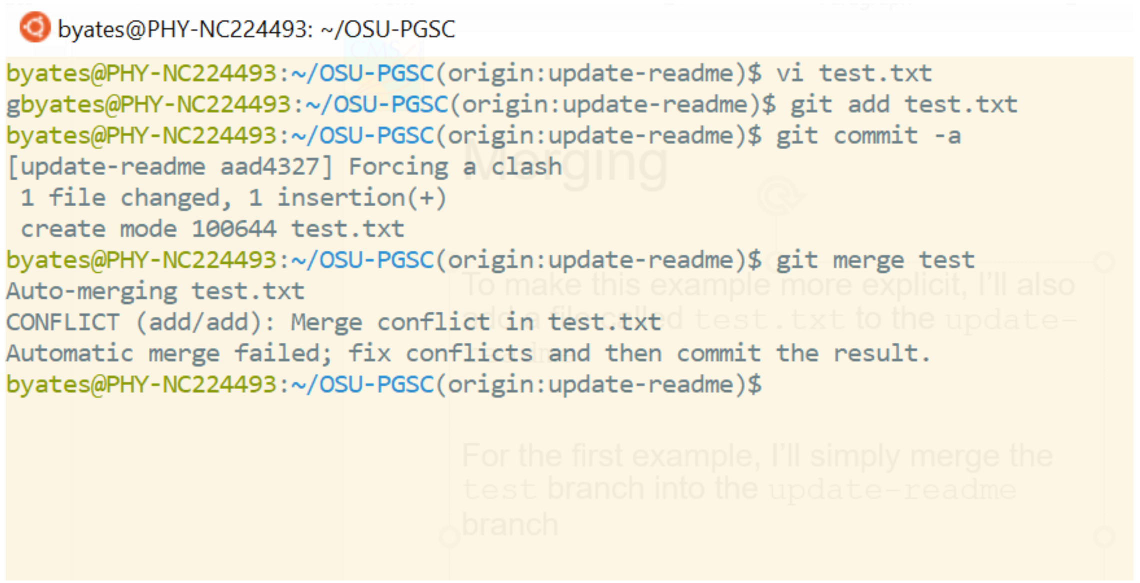
Also added `test.txt` to the `update-readme` branch

Try to merge the `test` branch into the `update-readme` branch

A merge conflict occurred

Resolve by hand or using `git mergetool`

A merge tool must be set, in my case
`git config --global merge.tool vimdiff`


byates@PHY-NC224493: ~/OSU-PGSC

```
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ vi test.txt
gbyates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git add test.txt
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git commit -a
[update-readme aad4327] Forcing a clash
 1 file changed, 1 insertion(+)
 create mode 100644 test.txt
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git merge test
Auto-merging test.txt
CONFLICT (add/add): Merge conflict in test.txt
Automatic merge failed; fix conflicts and then commit the result.
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$
```

Merge conflict

Simple enough to do in `vim`

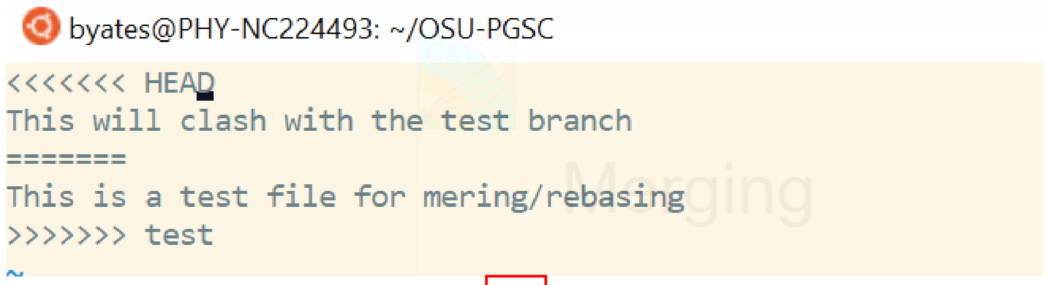
Notice the file has been split

`<<<<<<< HEAD` is where the current branch sit and `=======` is where the merging branch (`test` in this case) commits sit

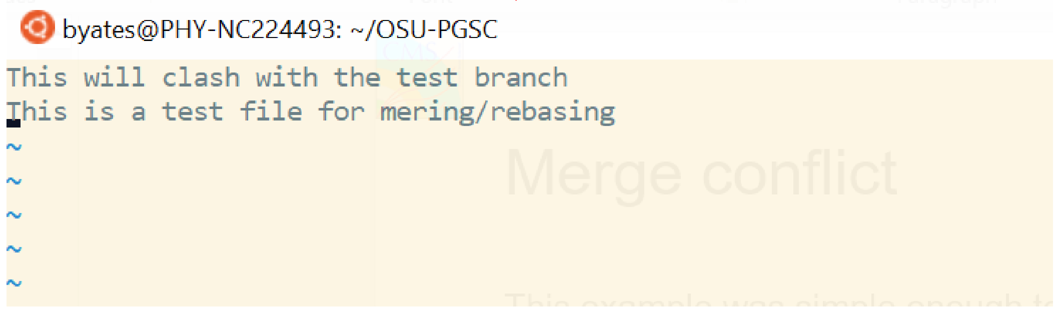
I would like the file to contain both versions, so I'll just remove the markings

Finally, we must commit this new change with `git commit -a`

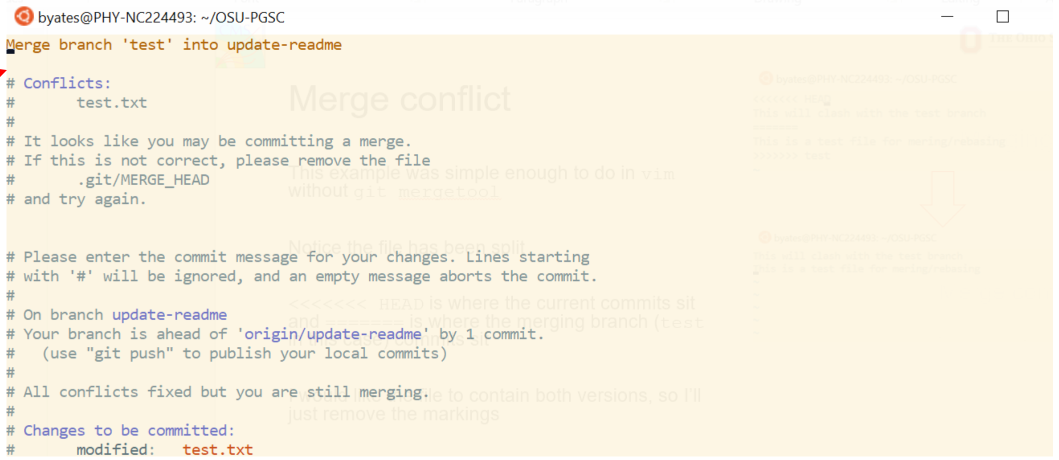
Result new commit stating we merged the two branches


byates@PHY-NC224493: ~/OSU-PGSC

```
<<<<<<< HEAD
This will clash with the test branch
=======
This is a test file for mering/rebasing
>>>>>>> test
~
```


byates@PHY-NC224493: ~/OSU-PGSC

```
This will clash with the test branch
This is a test file for mering/rebasing
~
~
~
~
~
```


byates@PHY-NC224493: ~/OSU-PGSC

```
Merge branch 'test' into update-readme

# Conflicts:
#       test.txt
#
# It looks like you may be committing a merge.
# If this is not correct, please remove the file
#       .git/MERGE_HEAD
# and try again.


# Please enter the commit message for your changes. Lines starting
# with '#' will be ignored, and an empty message aborts the commit.
#
# On branch update-readme
# Your branch is ahead of 'origin/update-readme' by 1 commit.
#   (use "git push" to publish your local commits)
#
# All conflicts fixed but you are still merging.
#
# Changes to be committed:
#       modified:   test.txt
```

Rebasing

Using `git rebase` from the test branch instead

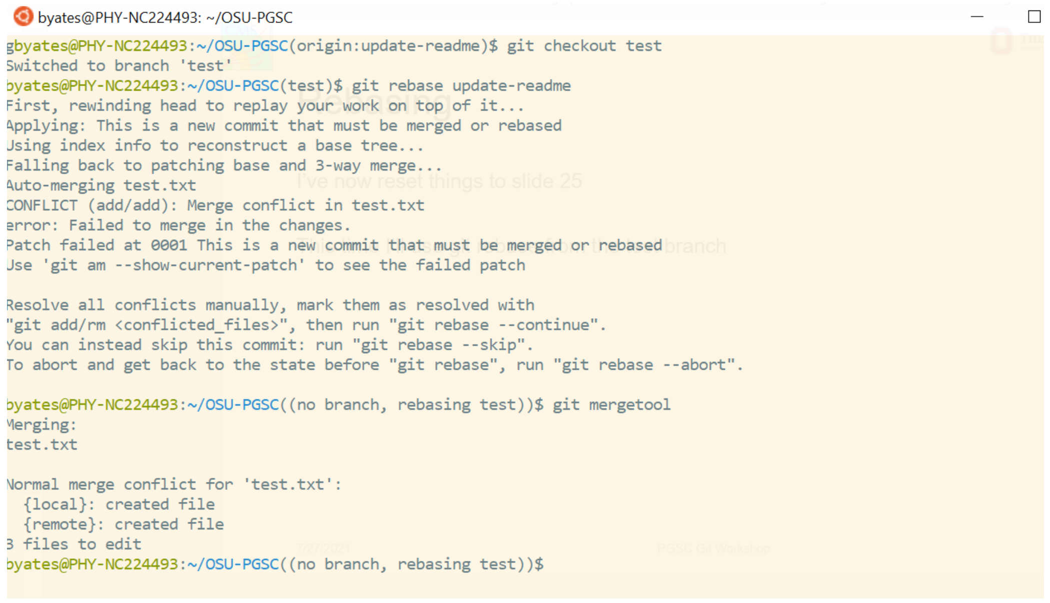
Still have a merge conflict, resolve with `git mergetool` this time

- Might look different

Fix file, save, and close the tool

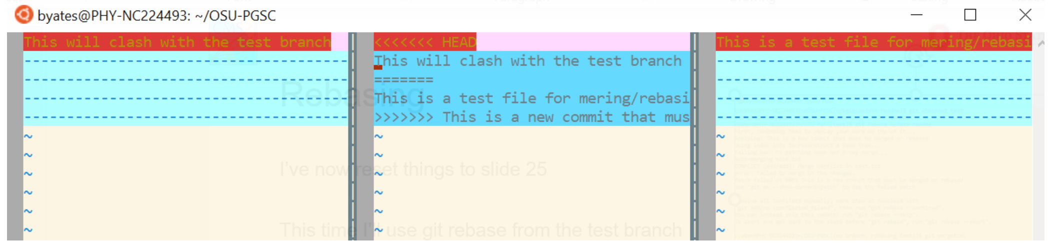
Resume rebase with `git rebase –continue`

Switch back to `update-readme`, merge `test` with no issues



byates@PHY-NC224493: ~/OSU-PGSC

```
gbyates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git checkout test
Switched to branch 'test'
byates@PHY-NC224493:~/OSU-PGSC(test)$ git rebase update-readme
First, rewinding head to replay your work on top of it...
Applying: This is a new commit that must be merged or rebased
Using index info to reconstruct a base tree...
Falling back to patching base and 3-way merge...
Auto-merging test.txt
CONFLICT (add/add): Merge conflict in test.txt
error: Failed to merge in the changes.
Patch failed at 0001 This is a new commit that must be merged or rebased
Use 'git am --show-current-patch' to see the failed patch

Resolve all conflicts manually, mark them as resolved with
"git add/rm <conflicted_files>", then run "git rebase --continue".
You can instead skip this commit: run "git rebase --skip".
To abort and get back to the state before "git rebase", run "git rebase --abort".

byates@PHY-NC224493:~/OSU-PGSC((no branch, rebasing test))$ git mergetool
Merging:
test.txt

Normal merge conflict for 'test.txt':
  {local}: created file
  {remote}: created file
3 files to edit
byates@PHY-NC224493:~/OSU-PGSC((no branch, rebasing test))$
```



byates@PHY-NC224493: ~/OSU-PGSC

```
This will clash with the test branch   | <<<<<<< HEAD                          | This is a test file for mering/rebasi
---------------------------------------| This will clash with the test branch  | -------------------------------------
---------------------------------------| =======                               | -------------------------------------
---------------------------------------| This is a test file for mering/rebasi | -------------------------------------
---------------------------------------| >>>>>>> This is a new commit that mus | -------------------------------------
~                                      | ~                                     | ~
~                                      | ~                                     | ~
~                                      | ~                                     | ~
~                                      | ~                                     | ~
~                                      | ~                                     | ~
~                                      | ~                                     | ~
```

The middle pane is the one to fix
Usually, `vimdiff` will open a fourth, larger window at the bottom, with the one to fix

Merge vs rebase

So, what was the point?

If you compare the git log for each case, it becomes apparent

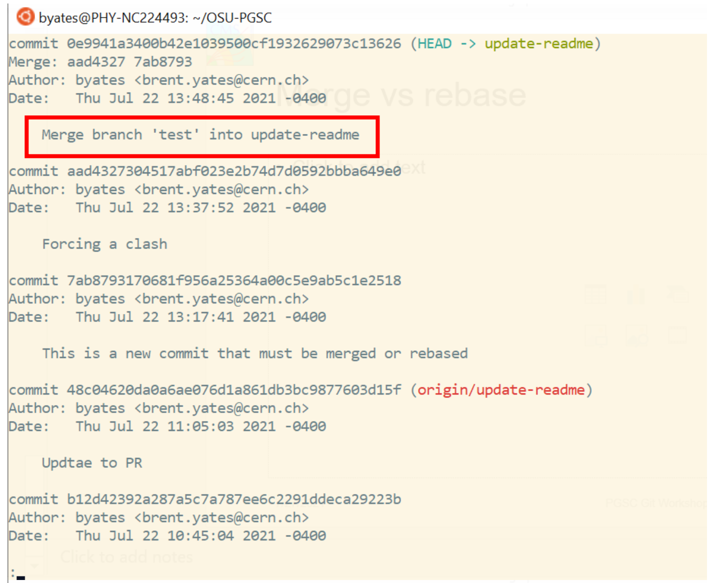
`git merge` ⇒ new commit for the merge
`git rebase` stitched the histories together

The benefit of one over the other is mostly a matter of taste

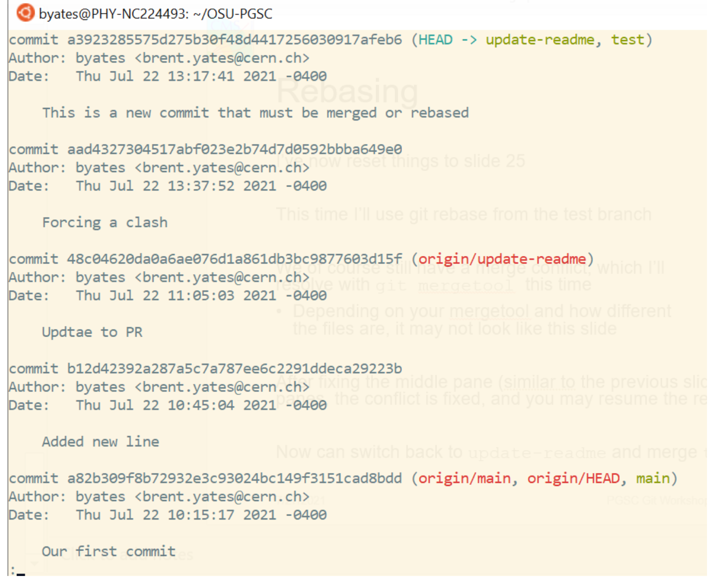
I personally don't like seeing `Merge` in the log

However, keep in mind that if you `pull` someone else's branch, do a `rebase`, and `force push`, they *must* pull these changes before any other updates, or they'll have to do their own merge/rebase again later

- This is why some people prefer not to rebase once a branch is shared


byates@PHY-NC224493: ~/OSU-PGSC

```
commit 0e9941a3400b42e1039500cf1932629073c13626 (HEAD -> update-readme)
Merge: aad4327 7ab8793
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 13:48:45 2021 -0400

    Merge branch 'test' into update-readme

commit aad4327304517abf023e2b74d7d0592bbba649e0
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 13:37:52 2021 -0400

    Forcing a clash

commit 7ab8793170681f956a25364a00c5e9ab5c1e2518
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 13:17:41 2021 -0400

    This is a new commit that must be merged or rebased

commit 48c04620da0a6ae076d1a861db3bc9877603d15f (origin/update-readme)
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 11:05:03 2021 -0400

    Updtae to PR

commit b12d42392a287a5c7a787ee6c2291ddeca29223b
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 10:45:04 2021 -0400

:
```


byates@PHY-NC224493: ~/OSU-PGSC

```
commit a3923285575d275b30f48d4417256030917afeb6 (HEAD -> update-readme, test)
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 13:17:41 2021 -0400

    This is a new commit that must be merged or rebased

commit aad4327304517abf023e2b74d7d0592bbba649e0
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 13:37:52 2021 -0400

    Forcing a clash

commit 48c04620da0a6ae076d1a861db3bc9877603d15f (origin/update-readme)
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 11:05:03 2021 -0400

    Updtae to PR

commit b12d42392a287a5c7a787ee6c2291ddeca29223b
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 10:45:04 2021 -0400

    Added new line

commit a82b309f8b72932e3c93024bc149f3151cad8bdd (origin/main, origin/HEAD, main)
Author: byates <brent.yates@cern.ch>
Date:   Thu Jul 22 10:15:17 2021 -0400

    Our first commit
:
```

Advanced topics

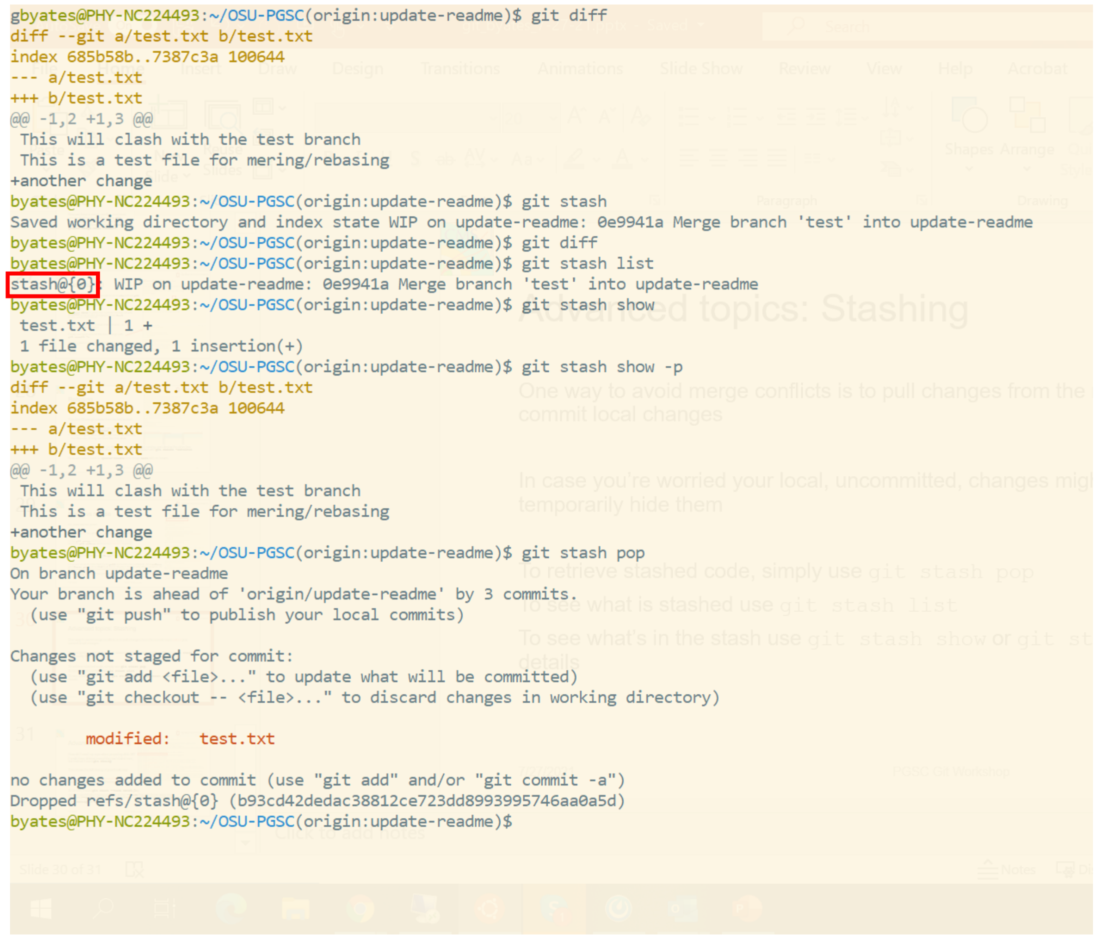
STASHING CHANGES

Stashing unsaved changes

Try to pull before you making local changes

Hide local uncommitted changes with: `git stash`

- To retrieve stashed code, simply use `git stash pop`
- To see what is stashed use `git stash list`
- Have multiple stashes and need an older one? Use `git stash pop stash@{n}` where `n` is the version you want from the list
- To see what's in the stash use `git stash show` or `git stash show -p` to see the details
- Delete all stashes with `git stash clear`



```
gbyates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git diff
diff --git a/test.txt b/test.txt
index 685b58b..7387c3a 100644
--- a/test.txt
+++ b/test.txt
@@ -1,2 +1,3 @@
 This will clash with the test branch
 This is a test file for mering/rebasing
+another change
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git stash
Saved working directory and index state WIP on update-readme: 0e9941a Merge branch 'test' into update-readme
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git diff
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git stash list
stash@{0}: WIP on update-readme: 0e9941a Merge branch 'test' into update-readme
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git stash show
 test.txt | 1 +
 1 file changed, 1 insertion(+)
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git stash show -p
diff --git a/test.txt b/test.txt
index 685b58b..7387c3a 100644
--- a/test.txt
+++ b/test.txt
@@ -1,2 +1,3 @@
 This will clash with the test branch
 This is a test file for mering/rebasing
+another change
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$ git stash pop
On branch update-readme
Your branch is ahead of 'origin/update-readme' by 3 commits.
  (use "git push" to publish your local commits)

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:   test.txt

no changes added to commit (use "git add" and/or "git commit -a")
Dropped refs/stash@{0} (b93cd42dedac38812ce723dd8993995746aa0a5d)
byates@PHY-NC224493:~/OSU-PGSC(origin:update-readme)$
```

Advanced topics

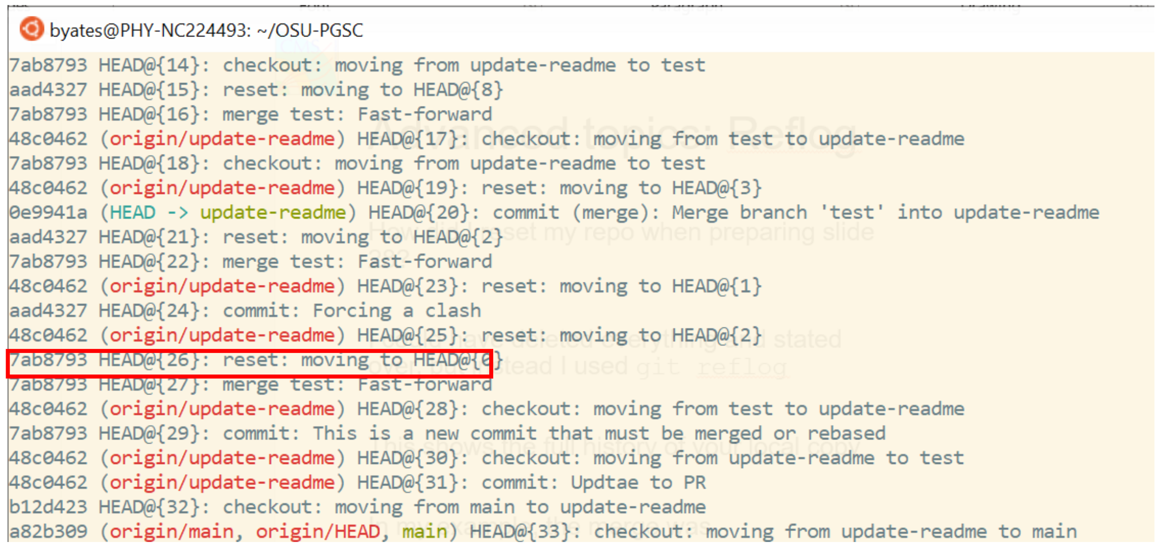
REFLOG

Reflog

How did I reset my repo when preparing slide 35?

I used `git reflog`

This shows the full history of your local copy



```
byates@PHY-NC224493: ~/OSU-PGSC
7ab8793 HEAD@{14}: checkout: moving from update-readme to test
aad4327 HEAD@{15}: reset: moving to HEAD@{8}
7ab8793 HEAD@{16}: merge test: Fast-forward
48c0462 (origin/update-readme) HEAD@{17}: checkout: moving from test to update-readme
7ab8793 HEAD@{18}: checkout: moving from update-readme to test
48c0462 (origin/update-readme) HEAD@{19}: reset: moving to HEAD@{3}
0e9941a (HEAD -> update-readme) HEAD@{20}: commit (merge): Merge branch 'test' into update-readme
aad4327 HEAD@{21}: reset: moving to HEAD@{2}
7ab8793 HEAD@{22}: merge test: Fast-forward
48c0462 (origin/update-readme) HEAD@{23}: reset: moving to HEAD@{1}
aad4327 HEAD@{24}: commit: Forcing a clash
48c0462 (origin/update-readme) HEAD@{25}: reset: moving to HEAD@{2}
7ab8793 HEAD@{26}: reset: moving to HEAD@{0}
7ab8793 HEAD@{27}: merge test: Fast-forward
48c0462 (origin/update-readme) HEAD@{28}: checkout: moving from test to update-readme
7ab8793 HEAD@{29}: commit: This is a new commit that must be merged or rebased
48c0462 (origin/update-readme) HEAD@{30}: checkout: moving from update-readme to test
48c0462 (origin/update-readme) HEAD@{31}: commit: Updtae to PR
b12d423 HEAD@{32}: checkout: moving from main to update-readme
a82b309 (origin/main, origin/HEAD, main) HEAD@{33}: checkout: moving from update-readme to main
```

Revert back to the commit with the message "Forcing clash", which is at `HEAD@{24}`

To do this, I used `git reset --hard HEAD@{24}`

Be careful using git reset, as the `--hard` flag will throw away all changes

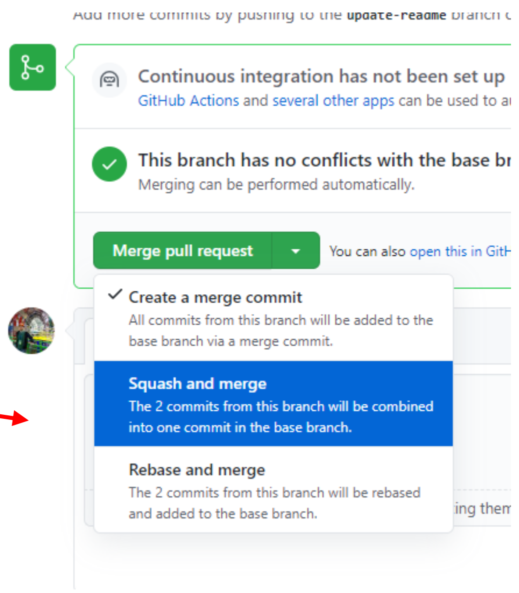
Use `--soft` to treat all changes as new, to be committed again

- Treat `reflog` and `reset` as a last resort

Bonus topics

Squashing

- Remove/merge multiple commits
- `git rebse -i` or use the interactive panel on a PR



Add more commits by pushing to the **update-readme** branch

Continuous integration has not been set up
GitHub Actions and several other apps can be used to a

This branch has no conflicts with the base br
Merging can be performed automatically.

Merge pull request ▾ You can also open this in GitH

✓ Create a merge commit
All commits from this branch will be added to the base branch via a merge commit.

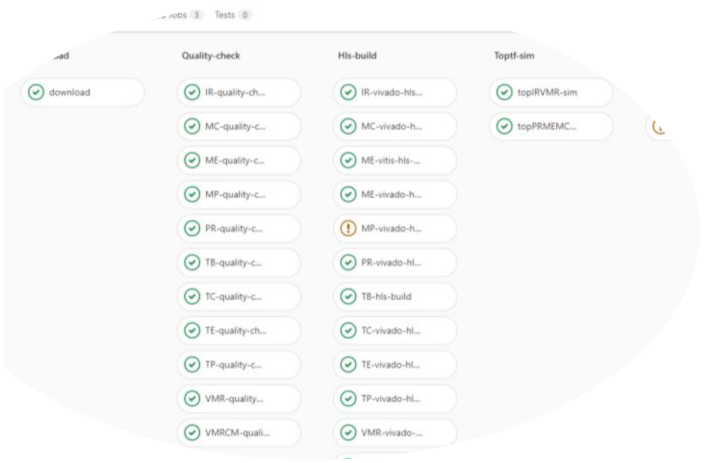
Squash and merge
The 2 commits from this branch will be combined into one commit in the base branch.

Rebase and merge
The 2 commits from this branch will be rebased and added to the base branch.

ing them

Continuous integration (CI)

- Trigger specific actions on GitHub, GitLab, etc.
- E.g. run unit tests whenever someone pushes to the repo
  Compile code every night, so users can download patches in the morning



Conclusion

Git is an excellent tool for version control and collaboration including:

- Push/pull changes to a code base
- Open pull requests for review and to update the main branch
- View a complete history of commits

Many more advanced topics not covered in this talk

Remember, if it breaks, all is not lost!

- Check the logs, checkout past commits, reset changes
- Check StackOverflow; we all make the same mistakes!