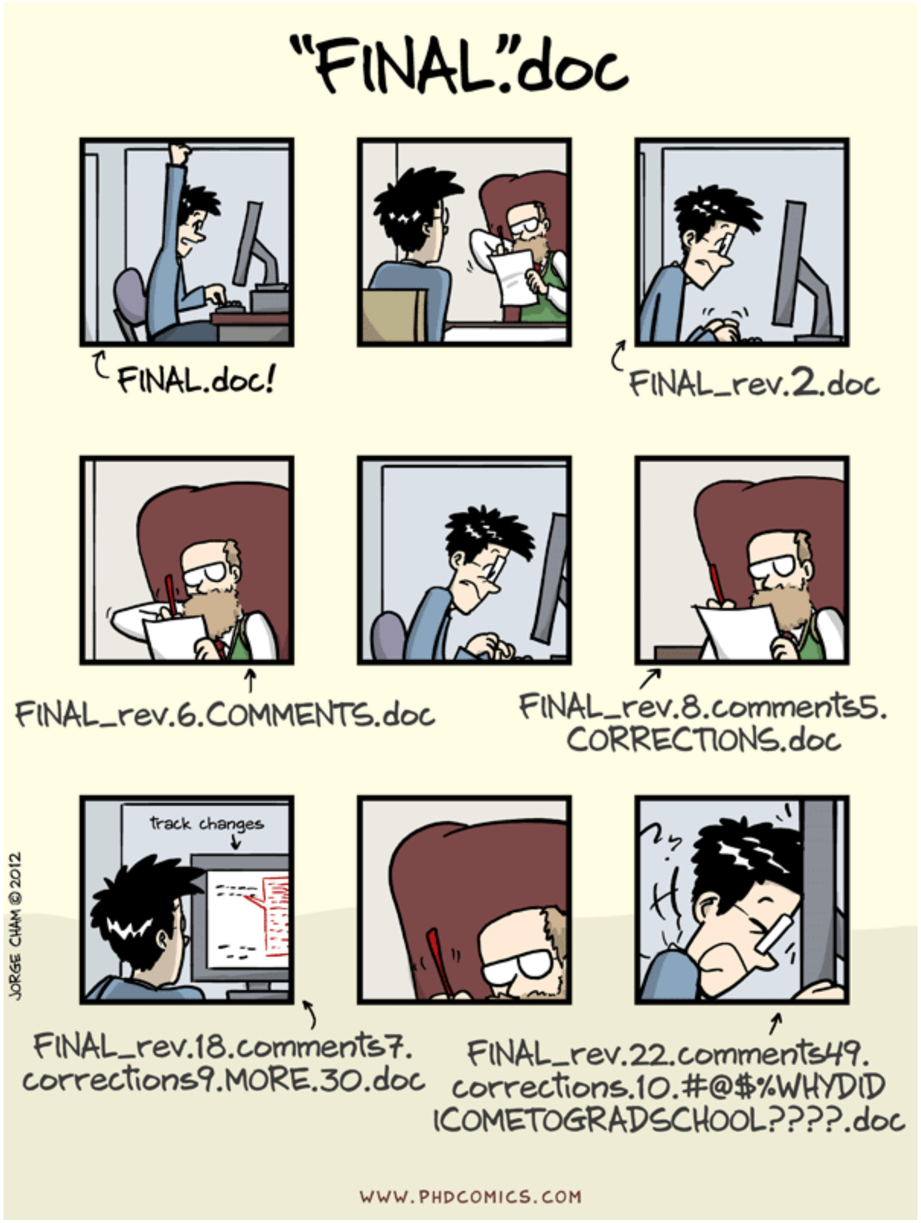
Version Control with Git

Kaylea Nelson

Yale Center for Research Computing

Version Control with Git

- What is Version Control and Git?
- Putting Your Code into Git
- Connecting Your Repository to Bitbucket
- Utilizing Your Repository’s History
- Collaboration: Merging and Conflicts


"FINAL".doc
FINAL.doc!
FINAL_rev.2.doc
FINAL_rev.6.COMMENTS.doc
FINAL_rev.8.comments5.CORRECTIONS.doc
track changes
FINAL_rev.18.comments7.corrections9.MORE.30.doc
FINAL_rev.22.comments49.corrections.10.#@$%WHYDID ICOMETOGRADSCHOOL????.doc
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What is Version Control?

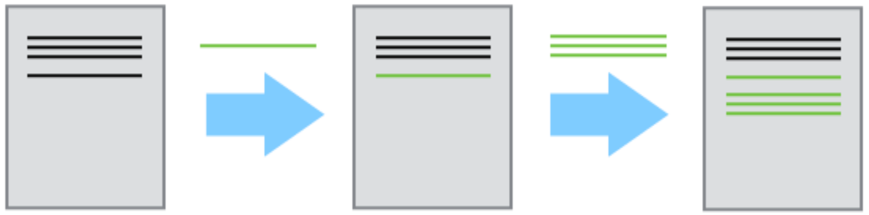
“The whole idea behind any version control system is to store “safe” copies of a project so that you never have to worry about irreparably breaking your code base.”

– Bitbucket.org

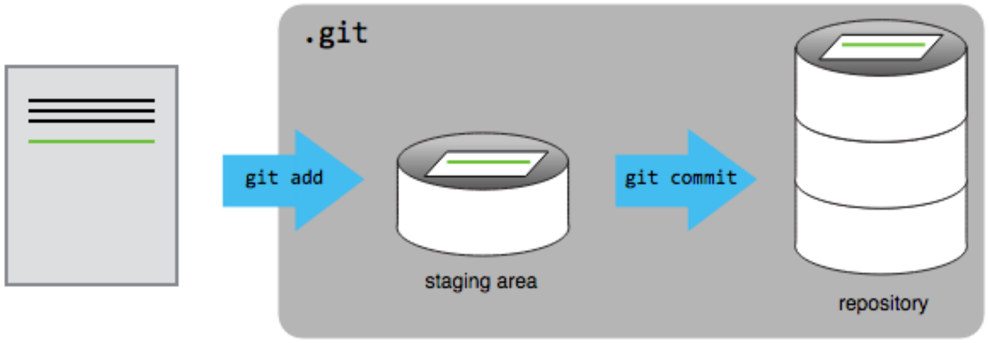
- Easy and powerful way to track changes to your work
- Useful for both writing (if using e.g. LaTeX) and code
- Backups of your work
- General coding safety net

What is Git? How does it work?

Git tracks changes to a file (or set of files) through a series of snapshots called “commits” or “revisions”.



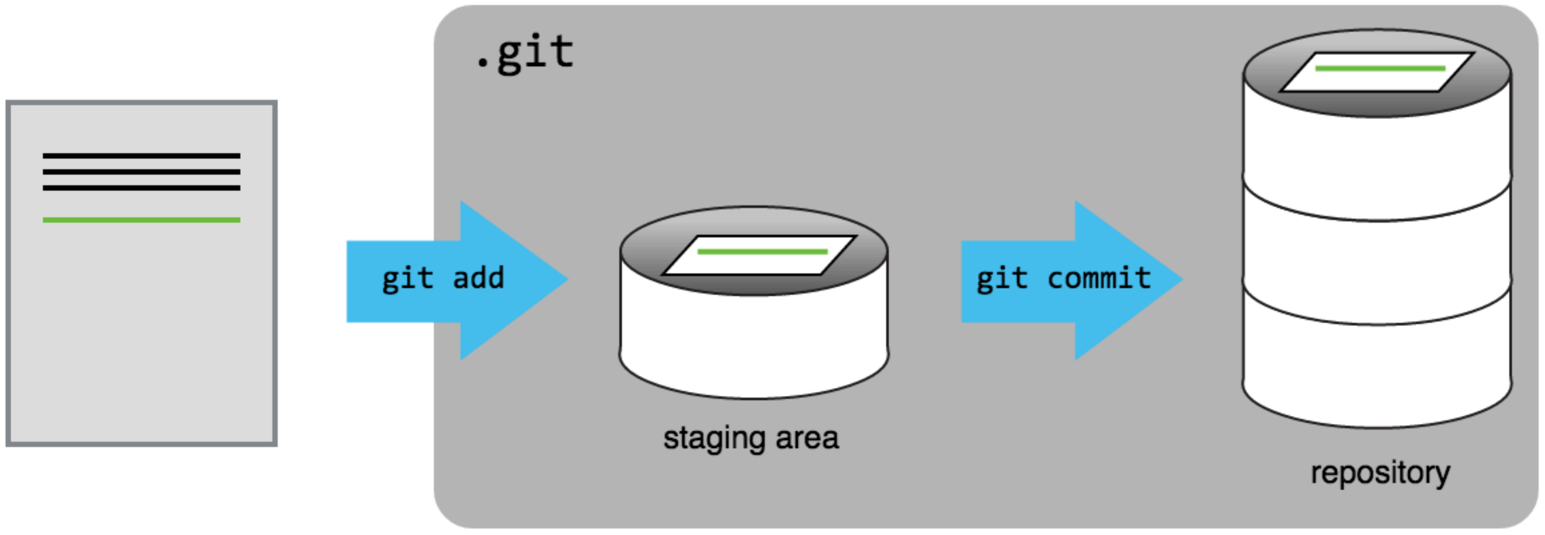
These snapshots are stored in a “repository” which contains a history of all the changes to the files.



How is Git useful to me?

- “Why isn’t it working all of a sudden?”
- Cleaner file system (no more “code, codev2, codev3_test, codev3_test1” directories)
- Record of your edits (and thought process!)
- Check for bugs in inconsistent results
- Unlimited and powerful “undo”
- Collaboration!

Putting Your Code into Git



Configure Git

- Global configurations for Git

```
$ git config --global user.name "Your Name"
$ git config --global user.email "your.email@yale.edu"
```

Setup Repository

- Initialize repository

```
$ git init
```

This create a `.git` directory in your directory that contains all the version control information. DO NOT DELETE!!!

```
$ ls -a
.               ..               .git
```

Add Existing Files to Repository

- The Git repository can be initialized before or after you create any files. To version control existing files, just add them to the repository.

```
$ git add myplot.py
```

Check Status of Repository

```
$ git status
On branch master

Initial commit

Changes to be committed:
  (use "git rm --cached <file>..." to unstage)

    new file:   myplot.py

Untracked files:
  (use "git add <file>..." to include in what will
be committed)

    myfigure.png
```

Make Initial Commit

- Now we want to permanently save the changes to repository, an action called “committing”

```
$ git commit –m "initial commit"
```

Leaving Files Out of Repository

- You don’t want to add every file to your repository. The good rule of thumb is to exclude files if they are a product of your code. Examples of files to exclude:
  - Image files
  - PDFs
  - Compiled code (including .o or .pyc files)
  - System files (e.g., .DS_Store)

Automate Exclusions

- To easily automate exclusions, create a `.gitignore` file.

```
$ cat .gitignaore
.DS_Store
*.png
*.pyc

$ git add .gitignore
$ git commit –m "added .gitignore"
```

- Now these files won’t show up as “untracked” in the `git status` command and can’t accidentally get added to the repository

Make Changes!

- Make changes to the file and then check on the repository

```
$ git status
On branch master
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:   myplot.py

no changes added to commit (use "git add" and/or
"git commit -a")
```

Make Changes!

- Add and commit your changes

```
$ git add myplot.py
$ git commit -m "increased frequency"
[master 21e2dd2] increased frequency
 1 file changed, 1 insertion(+), 1 deletion(-)
```

Review Changes

- You can check to see what has been modified before adding files using `git diff`

```
$ git diff
diff --git a/myplot.py b/myplot.py
index 3c179cc..3eb9a45 100644
--- a/myplot.py
+++ b/myplot.py
@@ -2,7 +2,7 @@ import matplotlib.pyplot as plt
 import numpy as np

 t = np.arange(0.0, 2.0, 0.01)
-s = np.sin(2*np.pi*t)
+s = np.sin(4*np.pi*t)

 plt.plot(t, s)
 plt.xlabel('time (s)')
```

Review Changes

- You can check to see what has been modified before committing using `git diff --staged`

```
$ git diff --staged
diff --git a/myplot.py b/myplot.py
index 3c179cc..3eb9a45 100644
--- a/myplot.py
+++ b/myplot.py
@@ -2,7 +2,7 @@ import matplotlib.pyplot as plt
 import numpy as np

 t = np.arange(0.0, 2.0, 0.01)
-s = np.sin(2*np.pi*t)
+s = np.sin(4*np.pi*t)

 plt.plot(t, s)
 plt.xlabel('time (s)')
```

Writing a Good Commit Message

- The commit message should be a high level explanation of the change
  - Don't be too brief
  - Also, don't exactly quote the change
- Example:
  - Bad: "Changes"
  - Bad: "Changed line 178 in plot_bM_vs_t.py"
  - Better: "Change color of pressure line to red"
- Most important question: If you are looking at this message in 6 months, is it going to make sense and be useful?

Other Useful Commands

- Rename or move a file in the repository

```
$ git mv <old_filename> <new_filename>
```

- Delete a file from the repository

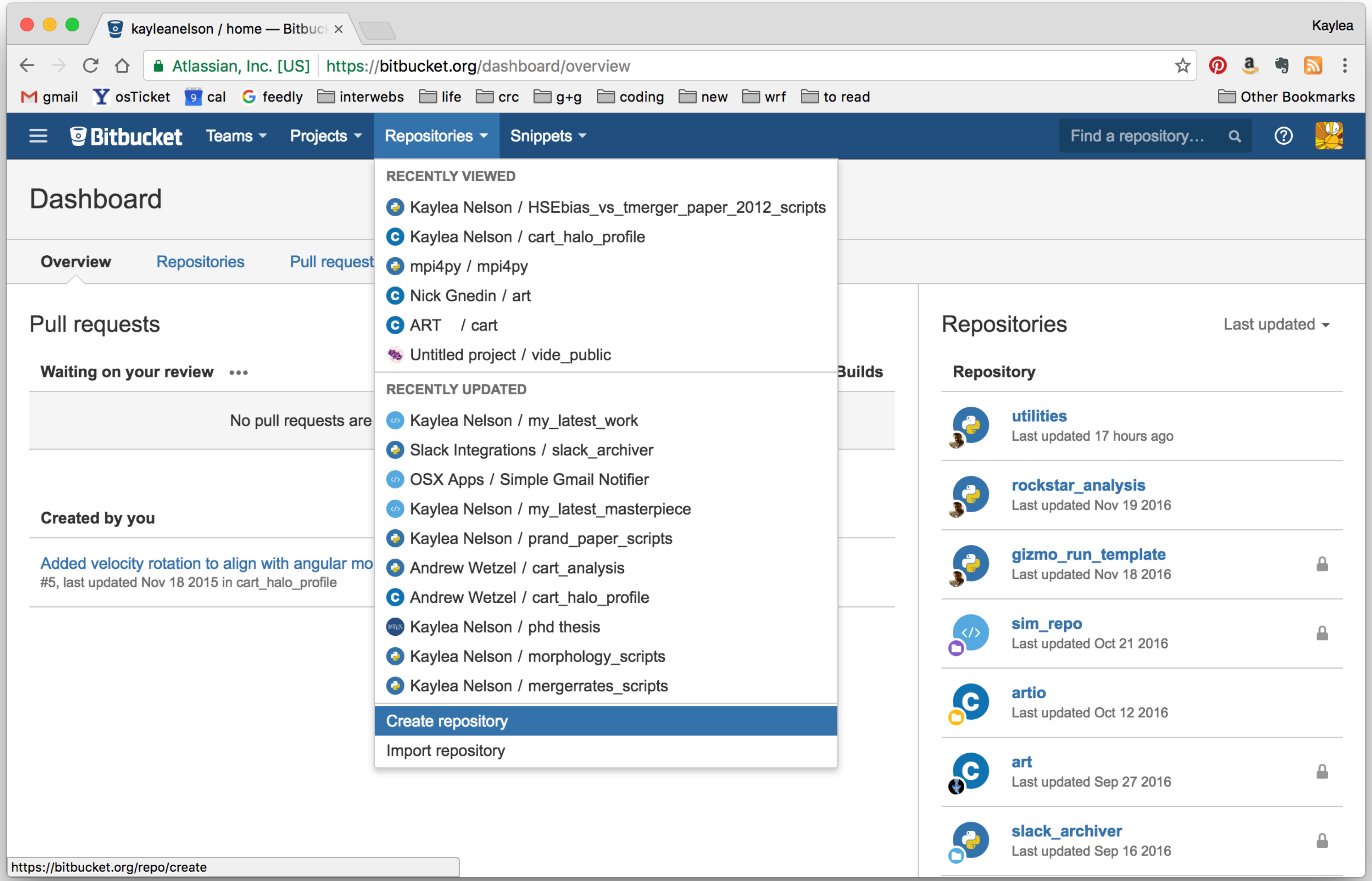
```
$ git rm <filename>
```

Connecting Your Repository to Bitbucket

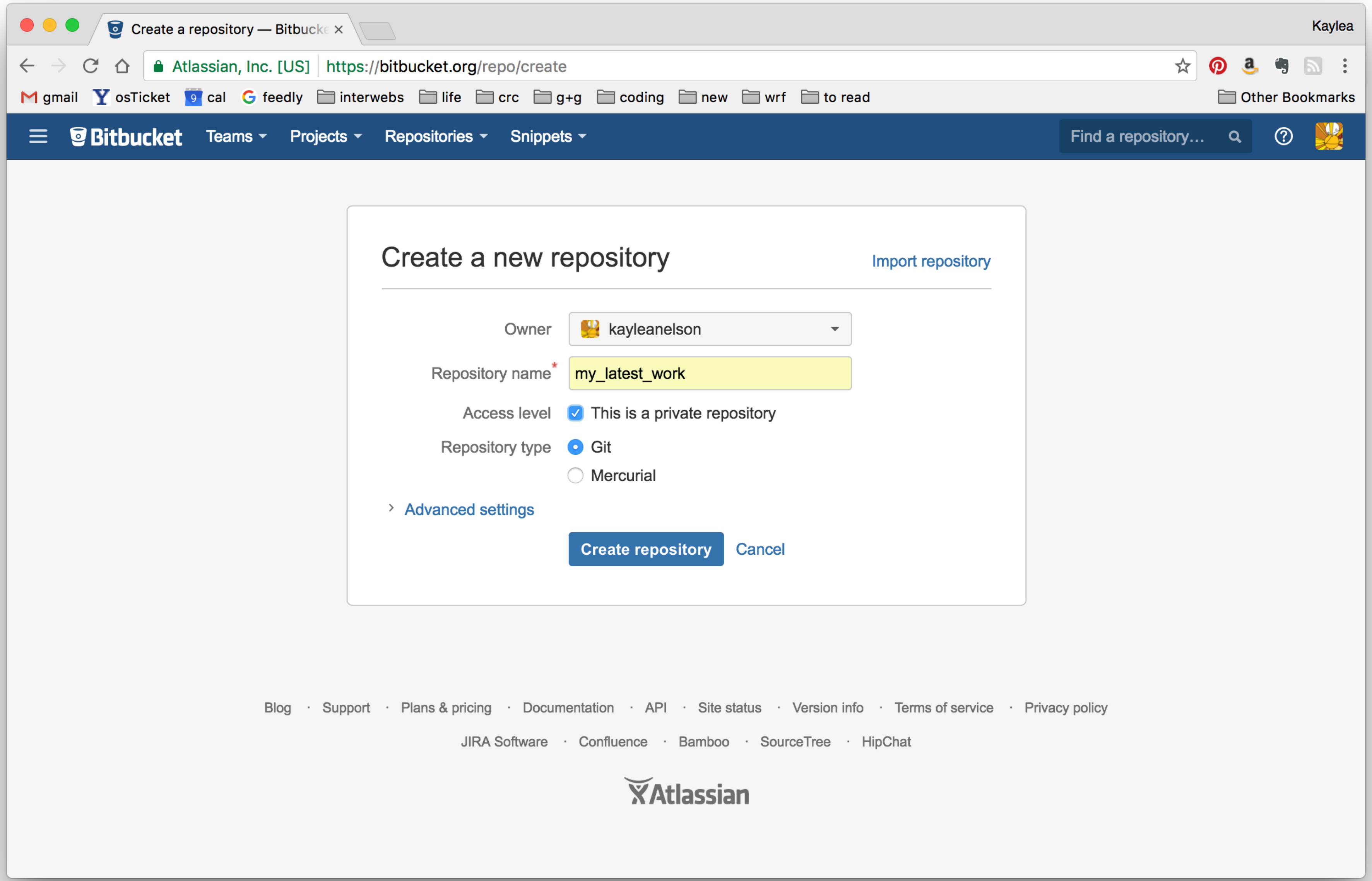
1. Create repository on your online account
2. Follow included instructions to get your local repository connected to your remote repository
3. Push committed changes to the remote repository

```
…
$ git commit -m "<message>"
$ git push
```

Create a New Repository on Bitbucket


kayleanelson / home — Bitbuc
Kaylea
Atlassian, Inc. [US] https://bitbucket.org/dashboard/overview
gmail osTicket cal feedly interwebs life crc g+g coding new wrf to read Other Bookmarks
Bitbucket Teams Projects Repositories Snippets
Find a repository…
Dashboard
Overview Repositories Pull request
Pull requests
Waiting on your review
No pull requests are
Builds
Created by you
Added velocity rotation to align with angular mo
#5, last updated Nov 18 2015 in cart_halo_profile
RECENTLY VIEWED
Kaylea Nelson / HSEbias_vs_tmerger_paper_2012_scripts
Kaylea Nelson / cart_halo_profile
mpi4py / mpi4py
Nick Gnedin / art
ART / cart
Untitled project / vide_public
RECENTLY UPDATED
Kaylea Nelson / my_latest_work
Slack Integrations / slack_archiver
OSX Apps / Simple Gmail Notifier
Kaylea Nelson / my_latest_masterpiece
Kaylea Nelson / prand_paper_scripts
Andrew Wetzel / cart_analysis
Andrew Wetzel / cart_halo_profile
Kaylea Nelson / phd thesis
Kaylea Nelson / morphology_scripts
Kaylea Nelson / mergerrates_scripts
Create repository
Import repository
Repositories
Last updated
Repository
utilities
Last updated 17 hours ago
rockstar_analysis
Last updated Nov 19 2016
gizmo_run_template
Last updated Nov 18 2016
sim_repo
Last updated Oct 21 2016
artio
Last updated Oct 12 2016
art
Last updated Sep 27 2016
slack_archiver
Last updated Sep 16 2016
https://bitbucket.org/repo/create

Create a New Repository on Bitbucket



https://bitbucket.org/repo/create

Create a new repository

Owner: kayleanelson

Repository name*: my_latest_work

Access level: [✓ This is a private repository]

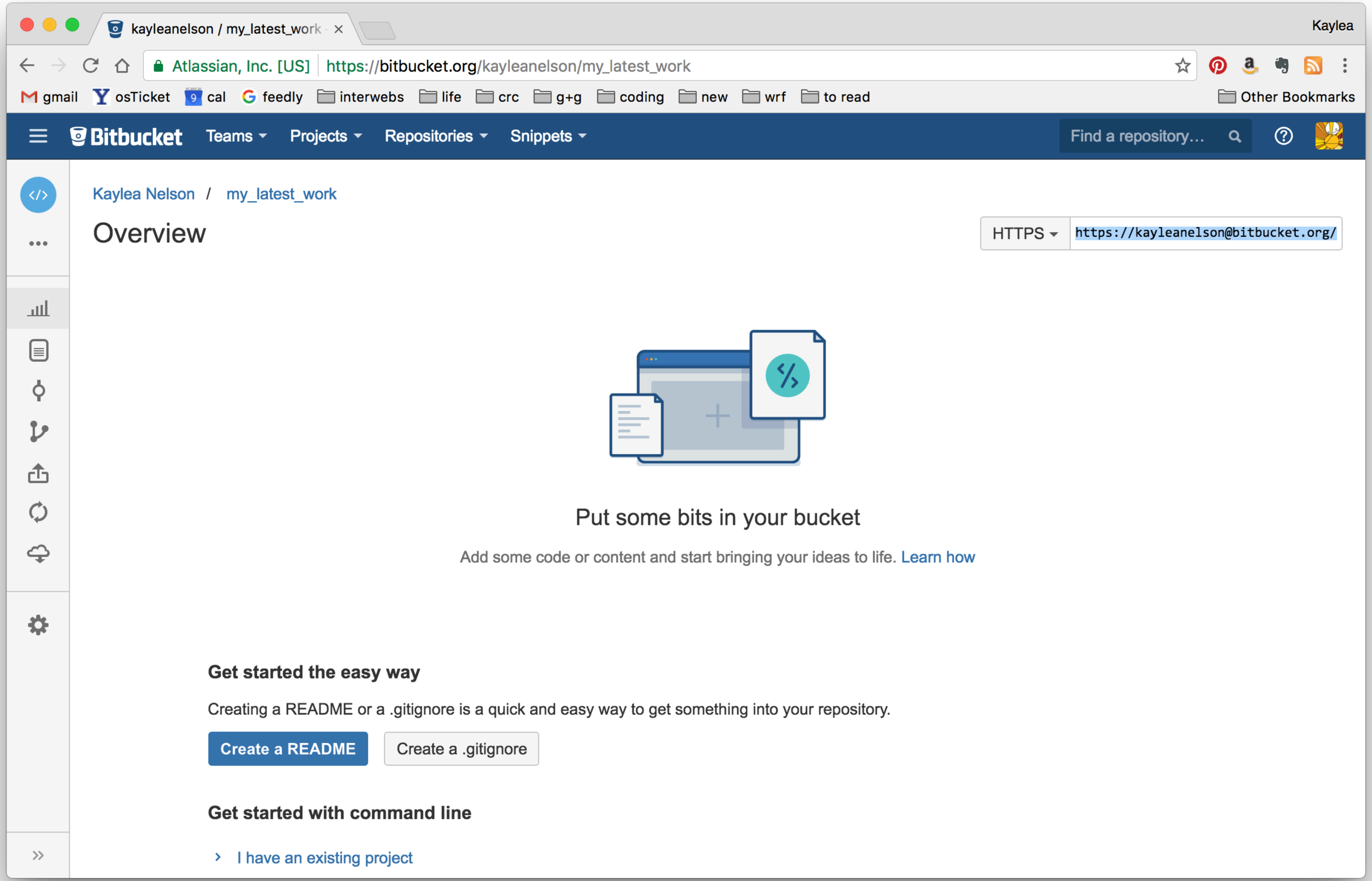
Repository type: [✓ Git] Mercurial

Advanced settings

Create repository · Cancel

Create a repository — Bitbucket
Bitbucket
Teams
Projects
Repositories
Snippets
Find a repository…
Import repository
Blog · Support · Plans & pricing · Documentation · API · Site status · Version info · Terms of service · Privacy policy
JIRA Software · Confluence · Bamboo · SourceTree · HipChat
Atlassian

Create a New Repository on Bitbucket



kayleanelson / my_latest_work
Kaylea
Atlassian, Inc. [US] https://bitbucket.org/kayleanelson/my_latest_work
gmail osTicket cal feedly interwebs life crc g+g coding new wrf to read Other Bookmarks
Bitbucket Teams Projects Repositories Snippets
Find a repository…
Kaylea Nelson / my_latest_work
Overview
HTTPS
https://kayleanelson@bitbucket.org/

Put some bits in your bucket

Add some code or content and start bringing your ideas to life. Learn how

Get started the easy way

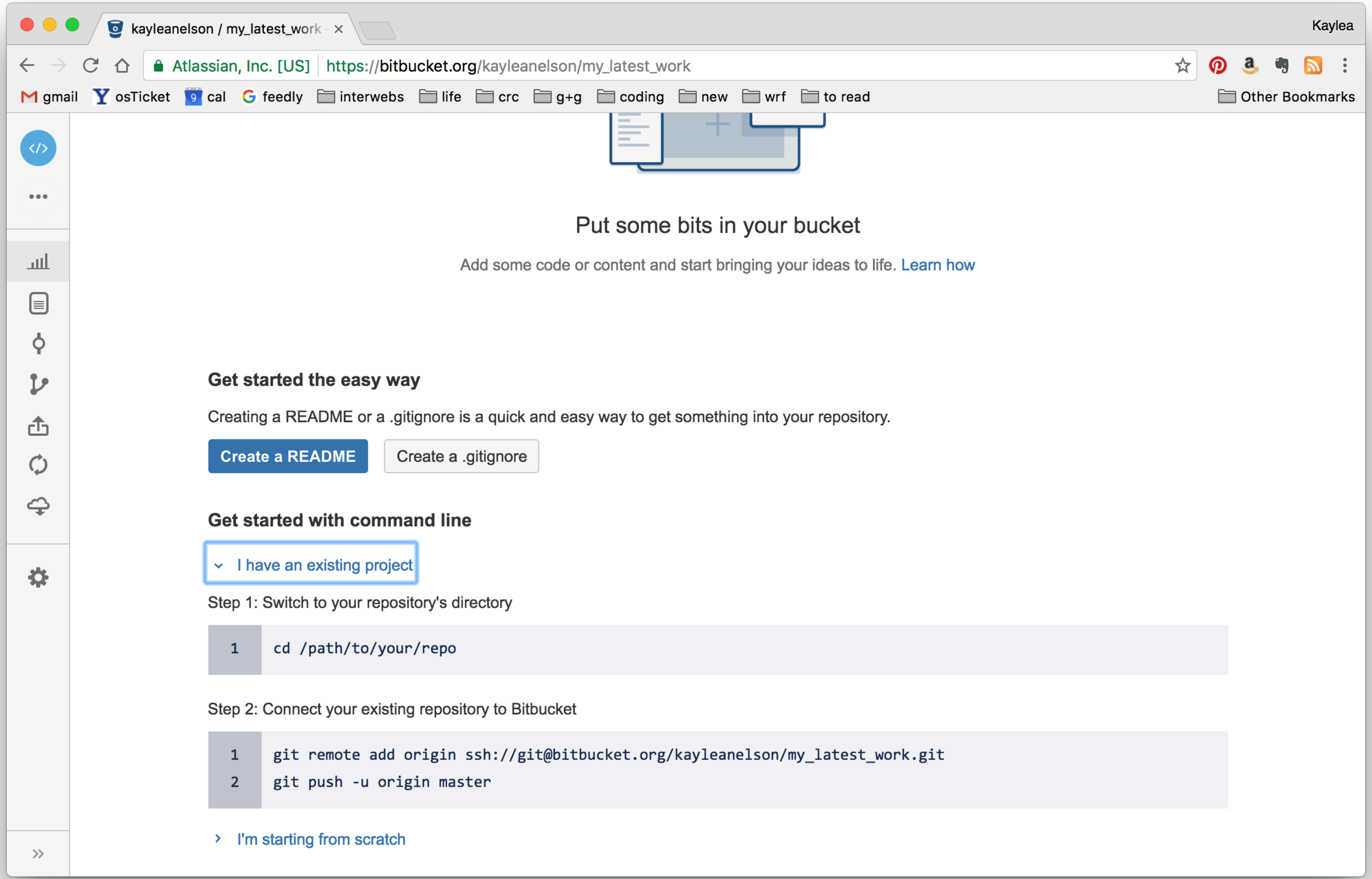
Creating a README or a .gitignore is a quick and easy way to get something into your repository.

Create a README
Create a .gitignore

Get started with command line

I have an existing project

Follow the Instruction to Push



Put some bits in your bucket

Add some code or content and start bringing your ideas to life. Learn how

Get started the easy way

Creating a README or a .gitignore is a quick and easy way to get something into your repository.

Get started with command line

Step 1: Switch to your repository's directory

```
cd /path/to/your/repo
```

Step 2: Connect your existing repository to Bitbucket

```
git remote add origin ssh://git@bitbucket.org/kayleanelson/my_latest_work.git
git push -u origin master
```

Push Future Commits

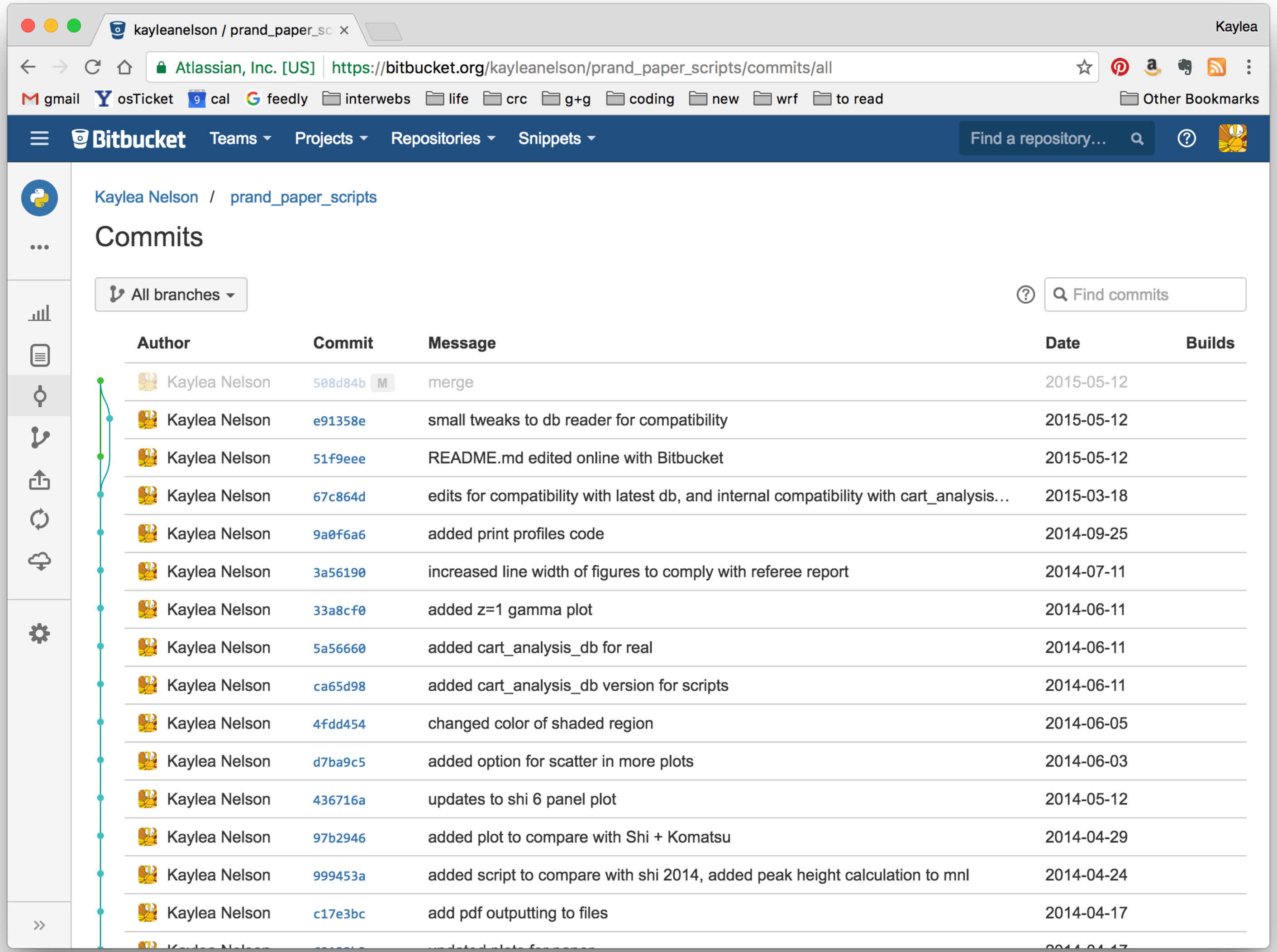
- After the initial “push” to the remote repository, just remember to push any new commits and you will have easy remote backups of your work!

```
…
$ git commit -m "<message>"
$ git push
```

Remote Repository Hosts Options

- Bitbucket.org – unlimited free public and private repos with .edu email address
- github.com – unlimited free PUBLIC repos
- git.yale.edu – free fully featured accounts. Only available on Yale network or VPN and with Yale netid

Utilizing Your Repository's History



kayleanelson / prand_paper_sc
Kaylea
Atlassian, Inc. [US] https://bitbucket.org/kayleanelson/prand_paper_scripts/commits/all
gmail osTicket cal feedly interwebs life crc g+g coding new wrf to read Other Bookmarks
Bitbucket Teams Projects Repositories Snippets
Find a repository...
All branches
Find commits

Kaylea Nelson / prand_paper_scripts

Commits

Author	Commit	Message	Date	Builds
Kaylea Nelson	508d84b M	merge	2015-05-12	
Kaylea Nelson	e91358e	small tweaks to db reader for compatibility	2015-05-12	
Kaylea Nelson	51f9eee	README.md edited online with Bitbucket	2015-05-12	
Kaylea Nelson	67c864d	edits for compatibility with latest db, and internal compatibility with cart_analysis...	2015-03-18	
Kaylea Nelson	9a0f6a6	added print profiles code	2014-09-25	
Kaylea Nelson	3a56190	increased line width of figures to comply with referee report	2014-07-11	
Kaylea Nelson	33a8cf0	added z=1 gamma plot	2014-06-11	
Kaylea Nelson	5a56660	added cart_analysis_db for real	2014-06-11	
Kaylea Nelson	ca65d98	added cart_analysis_db version for scripts	2014-06-11	
Kaylea Nelson	4fdd454	changed color of shaded region	2014-06-05	
Kaylea Nelson	d7ba9c5	added option for scatter in more plots	2014-06-03	
Kaylea Nelson	436716a	updates to shi 6 panel plot	2014-05-12	
Kaylea Nelson	97b2946	added plot to compare with Shi + Komatsu	2014-04-29	
Kaylea Nelson	999453a	added script to compare with shi 2014, added peak height calculation to mnl	2014-04-24	
Kaylea Nelson	c17e3bc	add pdf outputting to files	2014-04-17	

Review History

- You can see a history of all recent commits
  - Detailed Log:

```
$ git log
$ git log -1
```

  - Simplified Log

```
$ git log --oneline
$ git log --oneline --graph --decorate
```

Compare Revisions

- You can compare two revisions to see what changes were made with `git diff`

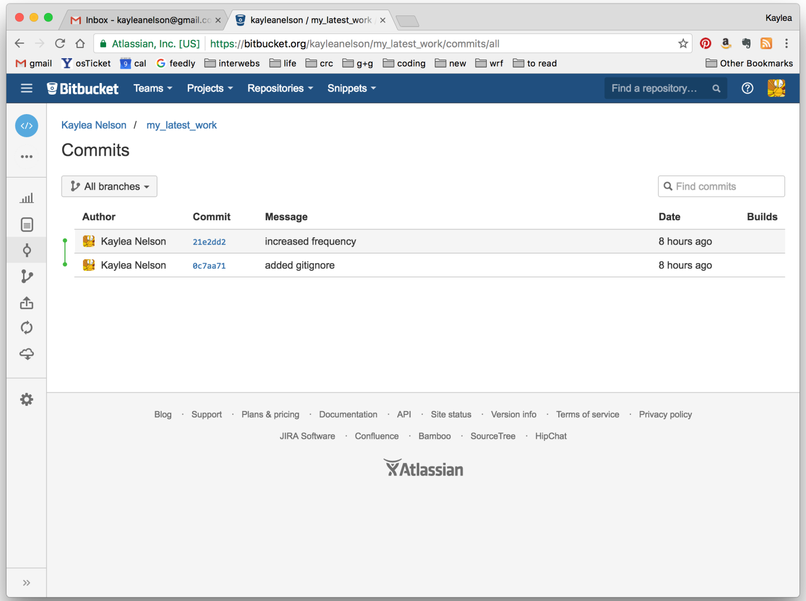
```
$ git diff HEAD 0c7aa71
diff --git a/myplot.py b/myplot.py
index 3c179cc..3eb9a45 100644
--- a/myplot.py
+++ b/myplot.py
@@ -2,7 +2,7 @@ import matplotlib.pyplot as plt
 import numpy as np

 t = np.arange(0.0, 2.0, 0.01)
-s = np.sin(2*np.pi*t)
+s = np.sin(4*np.pi*t)

 plt.plot(t, s)
 plt.xlabel('time (s)')
```

Review History

- The interfaces on Bitbucket and Github are also great for exploring the commit history and tracking changes


Inbox - kayleanelson@gmail.co
kayleanelson / my_latest_work
Atlassian, Inc. [US] https://bitbucket.org/kayleanelson/my_latest_work/commits/all
gmail osTicket cal feedly interwebs life crc g+g coding new wrf to read Other Bookmarks
Bitbucket Teams Projects Repositories Snippets
Find a repository...
All branches
Find commits
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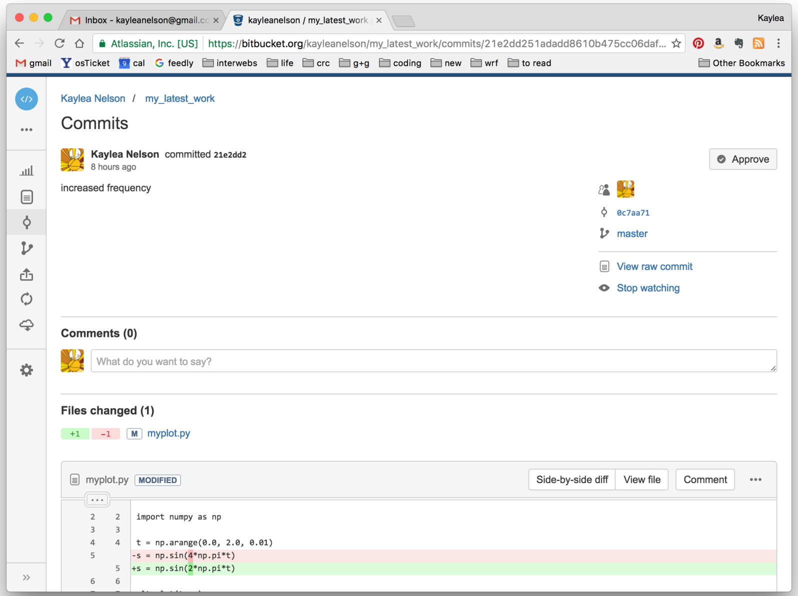
JIRA Software · Confluence · Bamboo · SourceTree · HipChat
Atlassian

Kaylea Nelson / my_latest_work

Commits

Author	Commit	Message	Date	Builds
Kaylea Nelson	21e2dd2	increased frequency	8 hours ago	
Kaylea Nelson	0c7aa71	added gitignore	8 hours ago	


Inbox - kayleanelson@gmail.co
kayleanelson / my_latest_work
Atlassian, Inc. [US] https://bitbucket.org/kayleanelson/my_latest_work/commits/21e2dd251adadd8610b475cc06daf...
gmail osTicket cal feedly interwebs life crc g+g coding new wrf to read Other Bookmarks
Approve
0c7aa71
master
View raw commit
Stop watching
What do you want to say?
Side-by-side diff
View file
Comment

Kaylea Nelson / my_latest_work

Commits

Kaylea Nelson committed 21e2dd2
8 hours ago

increased frequency

Comments (0)

Files changed (1)

+1 -1 M myplot.py

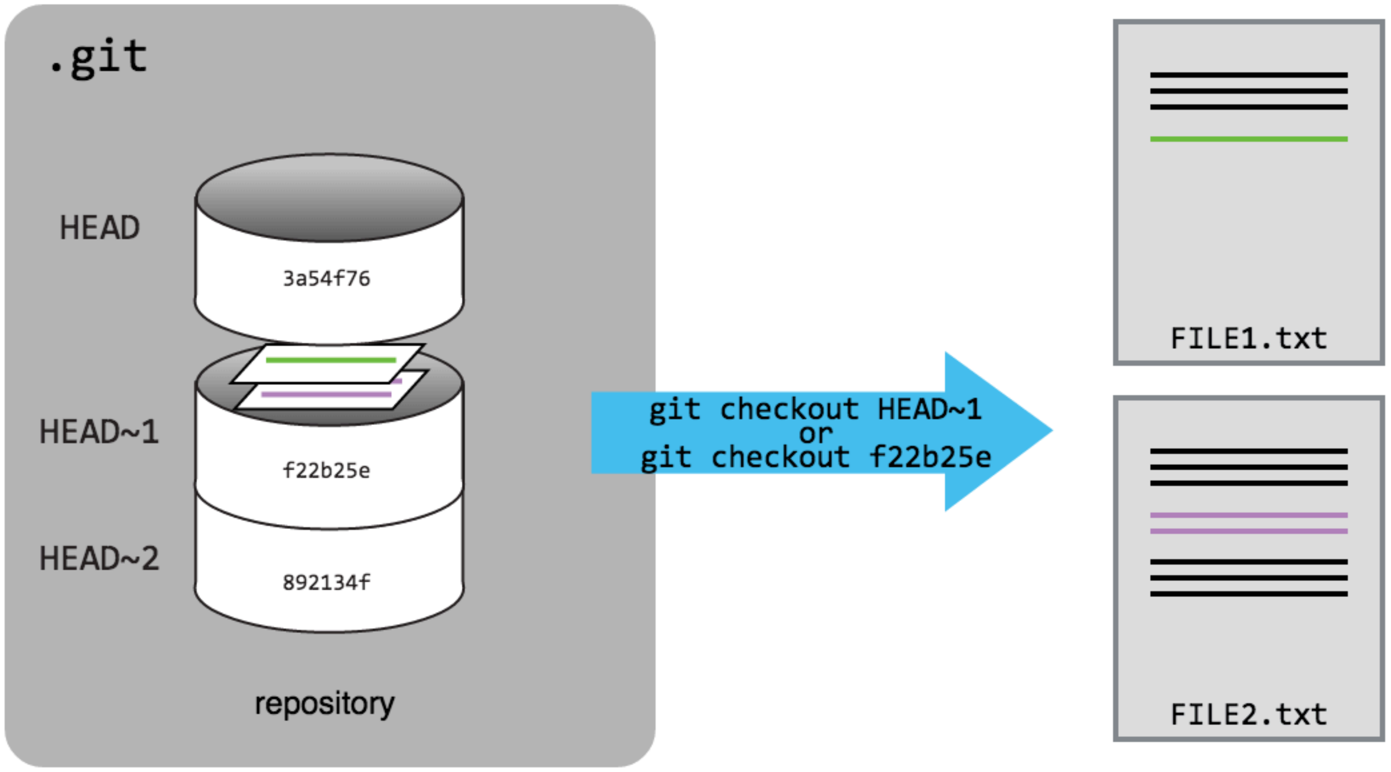
myplot.py MODIFIED

```
 import numpy as np

 t = np.arange(0.0, 2.0, 0.01)
-s = np.sin(4*np.pi*t)
+s = np.sin(2*np.pi*t)

```

Checkout Previous Commits



```
git checkout HEAD~1
or
git checkout f22b25e
```

Checkout Previous Commits

- After, you have identified the revision you need to revert to, “checkout” that revision

```
$ git checkout <revision>
```

- Or just a specific file from that revision

```
$ git checkout <revision> <filename>
```

Warning: If you checkout from an old revision, any uncommitted changes to the project will be lost.

Throwaway All New Changes

- Revert your working directory to the last commit

```
$ git reset --hard
```

Warning: Any uncommitted changes to the project will be lost.

Getting Your Code in a New Location

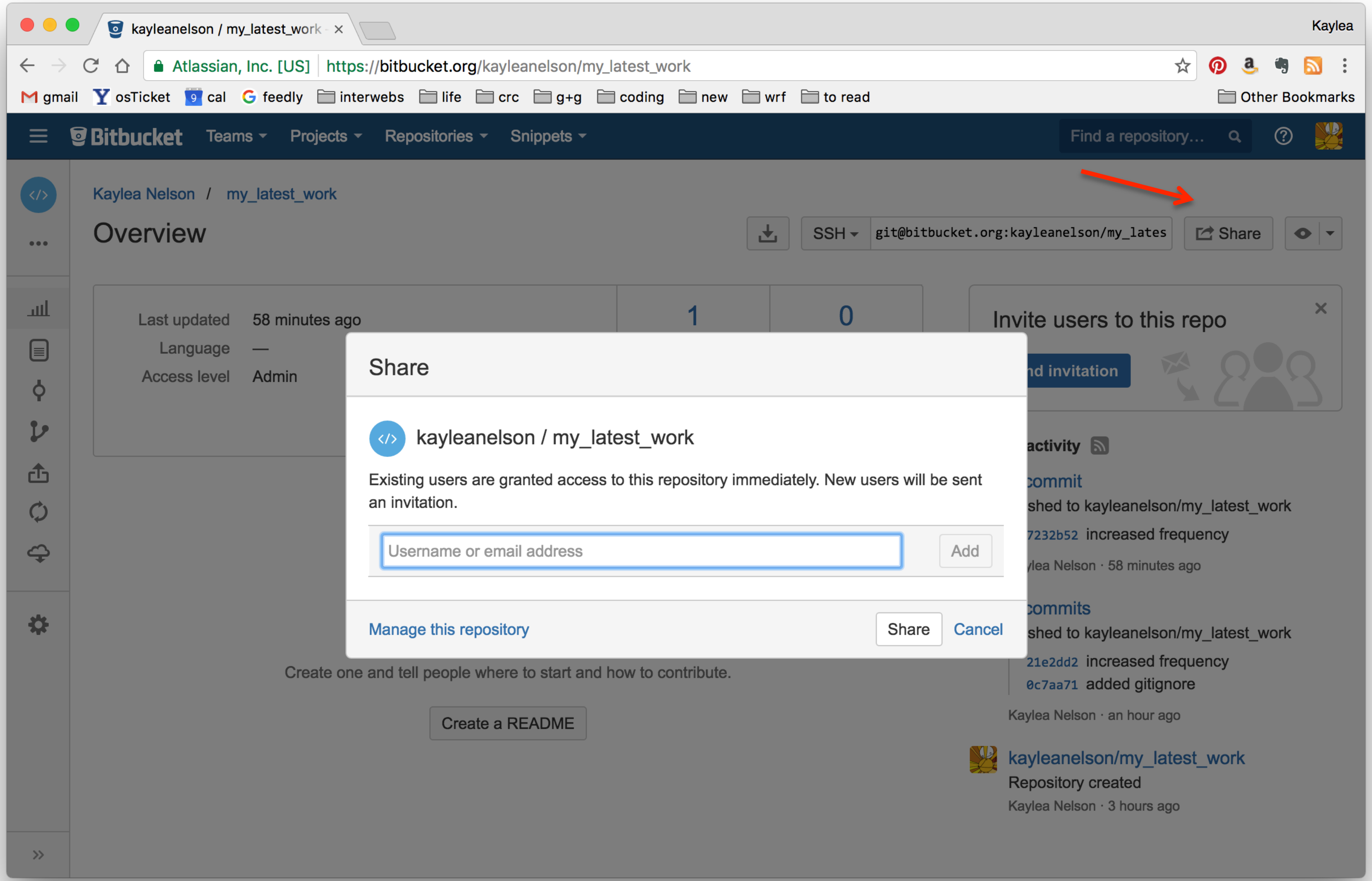
- If you have a remote repository, you can "clone" it to a new location to continue your work (e.g., copying code to the cluster, recovering your code to a new laptop)

```
$ git clone https://kayleanelson@bitbucket.org/
kayleanelson/my_latest_work.git
```

Collaboration

- Once your work is in a remote repository, it is very easy to being to collaborate with others
  - Git has a sophisticated system for managing multiple people editing the same code base through “merging”
- Usage Examples
  - Multiple collaborators on a code
  - LaTeX papers!

Sharing Your Repository



kayleanelson / my_latest_work
Kaylea
Atlassian, Inc. [US] https://bitbucket.org/kayleanelson/my_latest_work
gmail osTicket cal feedly interwebs life crc g+g coding new wrf to read Other Bookmarks
Bitbucket Teams Projects Repositories Snippets
Find a repository…
Kaylea Nelson / my_latest_work
Overview
SSH
git@bitbucket.org:kayleanelson/my_lates
Share
Invite users to this repo
nd invitation
activity
Create a README

Last updated 58 minutes ago
Language —
Access level Admin

Share

kayleanelson / my_latest_work

Existing users are granted access to this repository immediately. New users will be sent an invitation.

Username or email address | Add

Manage this repository | Share | Cancel

Create one and tell people where to start and how to contribute.

commit
shed to kayleanelson/my_latest_work
7232b52 increased frequency
ylea Nelson · 58 minutes ago

commits
shed to kayleanelson/my_latest_work
21e2dd2 increased frequency
0c7aa71 added gitignore
Kaylea Nelson · an hour ago

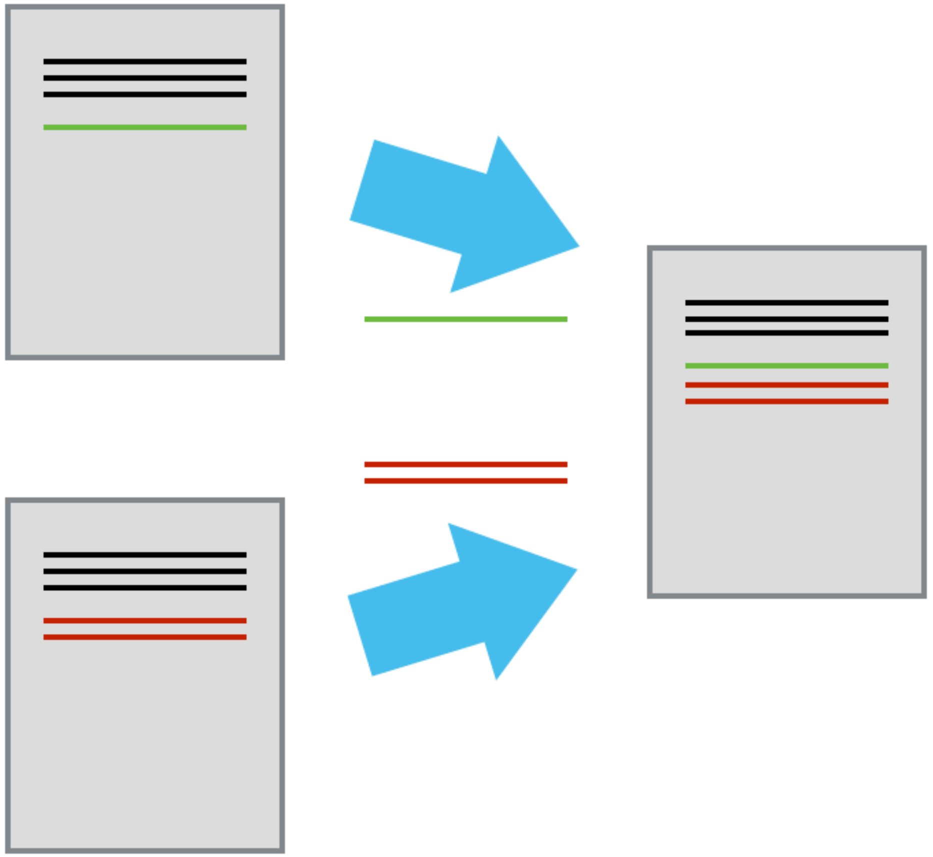
kayleanelson/my_latest_work
Repository created
Kaylea Nelson · 3 hours ago

Basic Collaborative Workflow

- Pull down new commits
- Make your edits
- Add your modified files and commit
- Push commits to remote

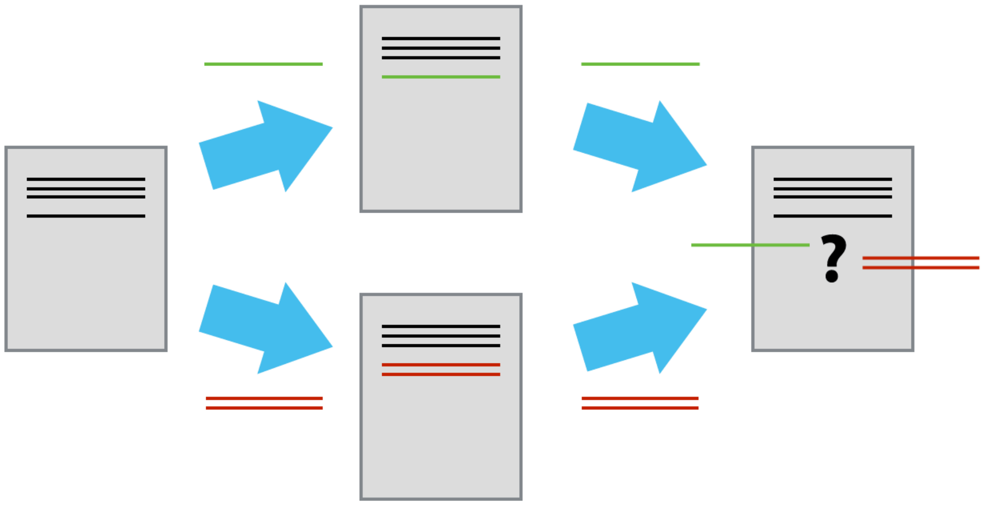
```
$ git pull
…
$ git add <files>
$ git commit –m <message>
$ git push
```

Merging



Conflicts

- Inevitably, you and your collaborator will commit overlapping changes to a file. This will create a "merge conflict".



Resolving Conflicts

- Pull in commits and Oops!

```
$ git pull
Auto-merging myplot.py
CONFLICT (content): Merge conflict in myplot.py
Automatic merge failed; fix conflicts and then
commit the result.
```

Resolving Conflicts

- Git marks the conflicted line in the file

```
$ cat myplot.py
import matplotlib.pyplot as plt
import numpy as np

t = np.arange(0.0, 2.0, 0.01)
<<<<<<< HEAD
s = np.sin(3*np.pi*t)
=======
s = np.sin(4*np.pi*t)
>>>>>>> 7232b521f34cf3deed50f4d8aac6260616683ddf
```

- Manually merge the code in a text editor and commit the changes

Uncommitted Conflicts

- Git will also complain if you pull in changes to a file you have modified but not committed. You have two options.
  - Undo the changes to the file back to last committed revision by checking it out from the HEAD

```
$ git checkout -- <filename>
```

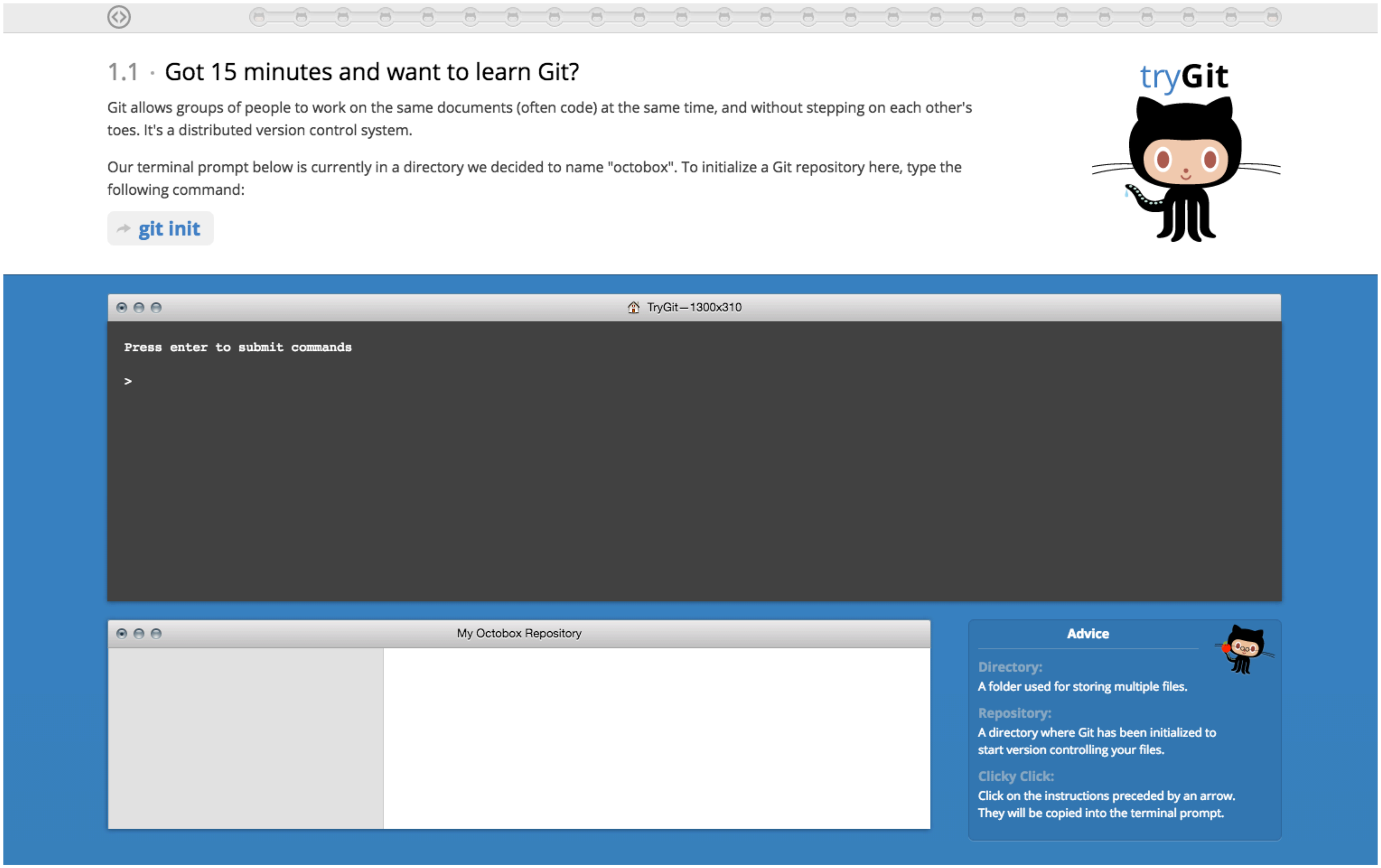
  - Commit your changes and then redo the pull (and potentially merge the changes, if applicable)

Questions?

To summarize, add 3 commands to your daily workflow for unlimited undo and online backups of your code!

```
$ git add <files>
$ git commit –m <message>
$ git push
```

try.github.io



1.1 · Got 15 minutes and want to learn Git?

Git allows groups of people to work on the same documents (often code) at the same time, and without stepping on each other's toes. It's a distributed version control system.

Our terminal prompt below is currently in a directory we decided to name "octobox". To initialize a Git repository here, type the following command:

```
git init
```

```
Press enter to submit commands

>
```

Advice

Directory:
A folder used for storing multiple files.

Repository:
A directory where Git has been initialized to start version controlling your files.

Clicky Click:
Click on the instructions preceded by an arrow. They will be copied into the terminal prompt.

Even more information:

- Great in depth tutorial on all things git:
  - https://www.atlassian.com/git/tutorials
- Software Carpentry (thanks for the images!)
  - https://swcarpentry.github.io/git-novice/01-basics/