

Linux and Git Boot Camp

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Connecting Clients

SSH

Windows users: MobaXterm, PuTTY, SSH Tectia

Mac & Linux users: Terminal (Just type `ssh`)

```
ssh andrewid@shark.ics.cs.cmu.edu
```

I Need You To Make A Directory

```
$ ls
$ cd private
$ mkdir 15-213
$ cd 15-213
```

- All work **MUST** be done in private directory or any subfolder within
- For more information on AFS directories and permission see https://www.cs.cmu.edu/~help/afs/afshome.html

File Transfers

- Useful for transferring handins to local machine for submission to Autolab.
- Use MobaXTerm's file transfer dialog if you're on Windows
- On Linux or Mac OS X:

```
$ sftp andrew@shark.ics.cs.cmu.edu:private/15-213
sftp> help
(read help for 'cd', 'lcd', 'pwd, 'lpwd', 'get', 'put', etc.)
$ scp andrew@shark.ics.cs.cmu.edu:private/file.txt /local/folder
$ scp file.txt andrew@shark.ics.cs.cmu.edu:private/folder
```

Also, you can use FileZilla! Here's a detailed guide:
http://cs.cmu.edu/~213/recitations/using_filezilla.pdf

Continue On...

```
$ ls
$ cd private
$ mkdir 15-213
$ cd 15-213
$ cd lab-handout
```

(Once obtained from GitHub!)

Git

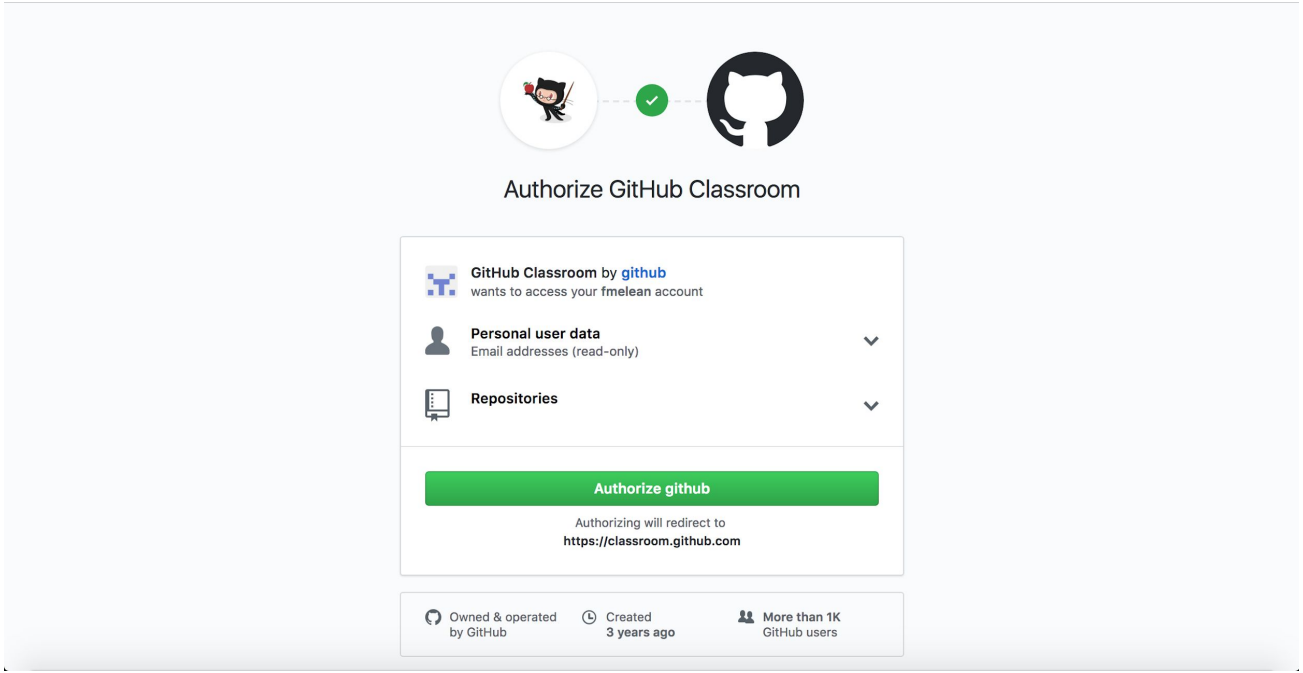

THIS IS GIT. IT TRACKS COLLABORATIVE WORK ON PROJECTS THROUGH A BEAUTIFUL DISTRIBUTED GRAPH THEORY TREE MODEL.
COOL. HOW DO WE USE IT?
NO IDEA. JUST MEMORIZE THESE SHELL COMMANDS AND TYPE THEM TO SYNC UP. IF YOU GET ERRORS, SAVE YOUR WORK ELSEWHERE, DELETE THE PROJECT, AND DOWNLOAD A FRESH COPY.

Git Setup (User Information)

```
$ git config --global user.name "<Your Name>"
$ git config --global user.email <Your email>
$ git config --global push.default simple
```

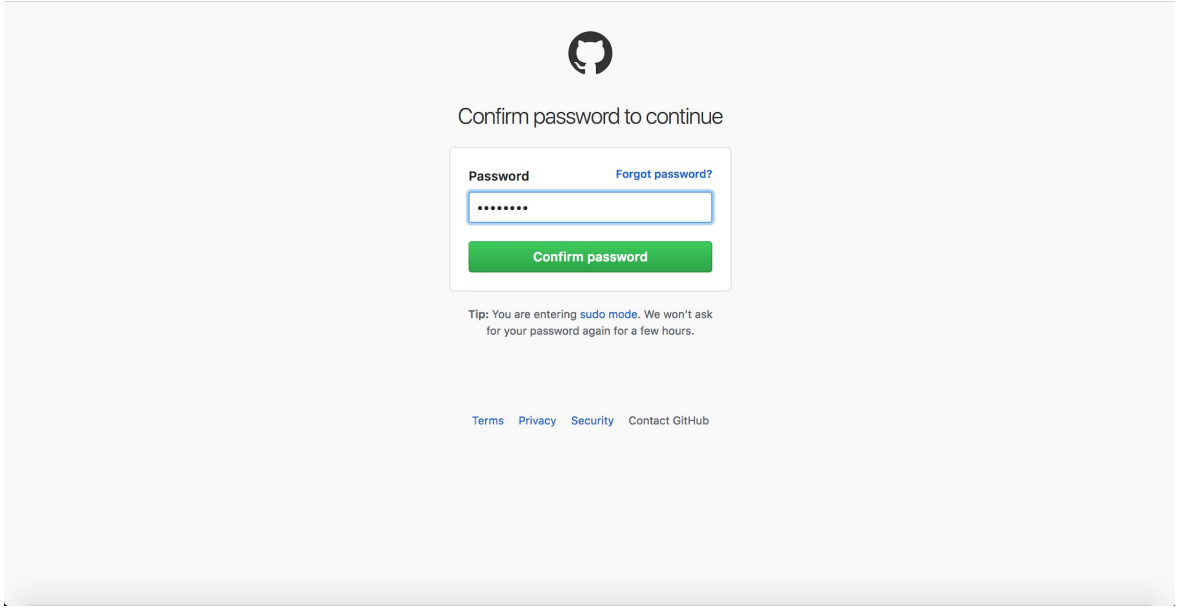
GitHub Setup

Go to link provided. Give access.



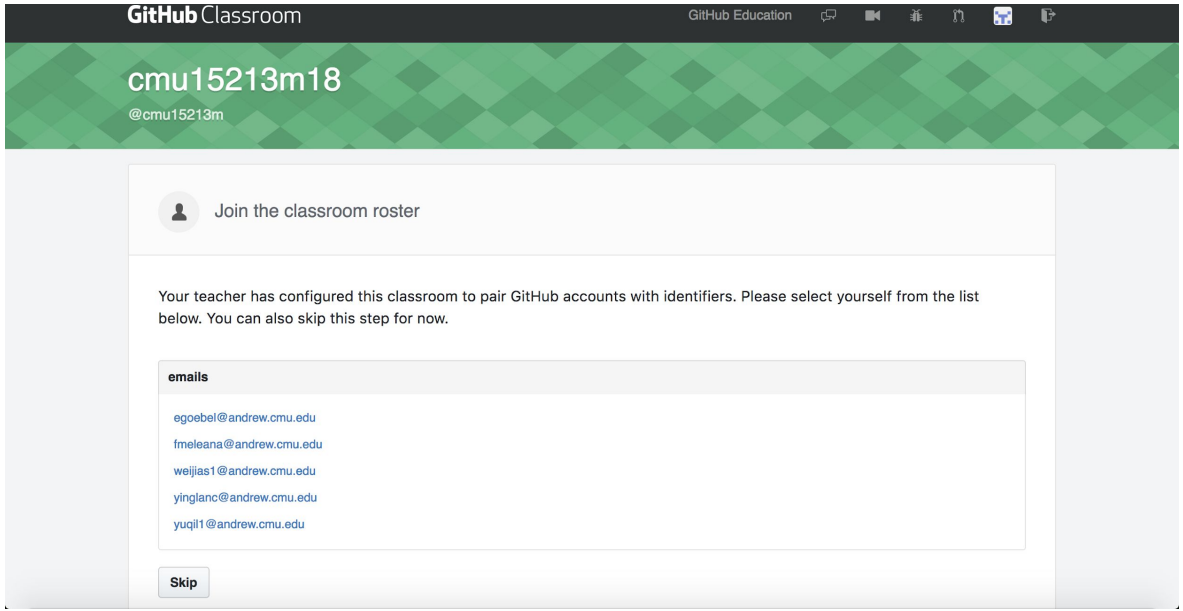
GitHub Setup

Enter GitHub Password.



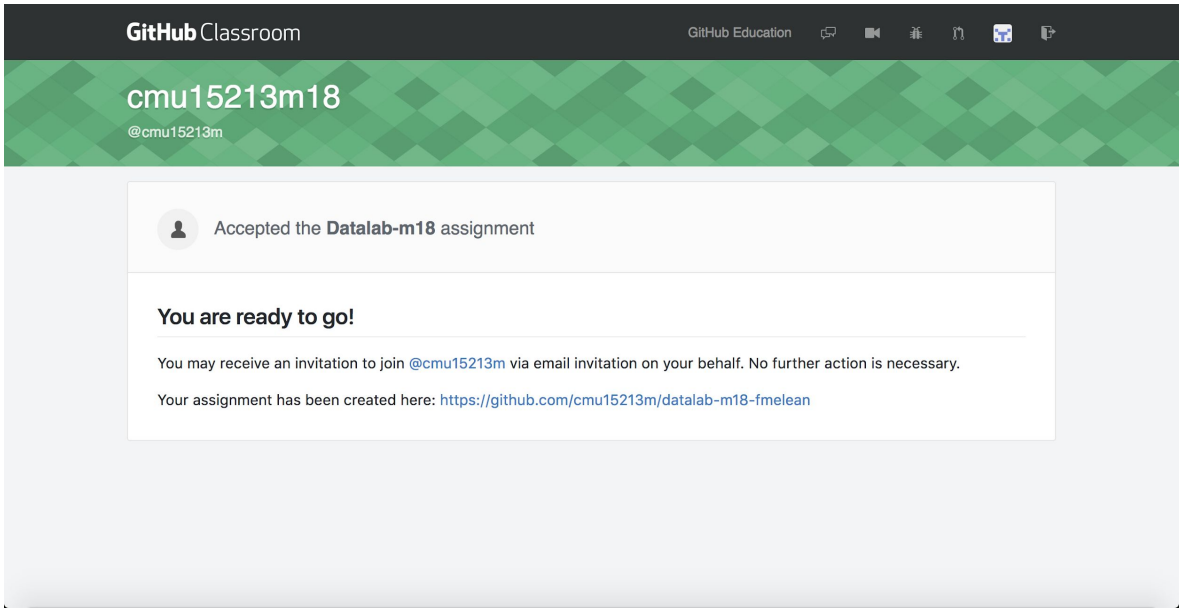
GitHub Setup

Select *YOUR* andrew email.



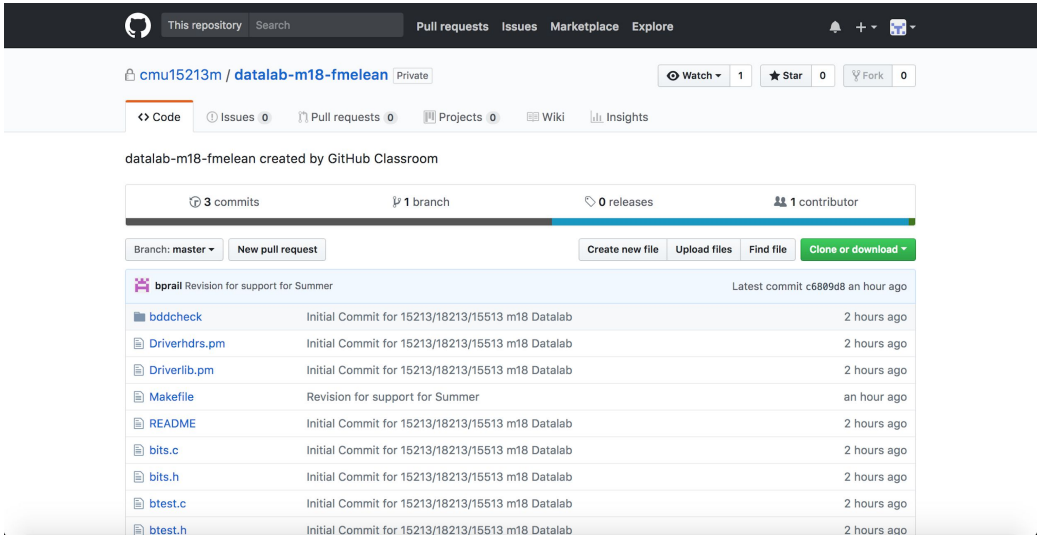
GitHub Setup

Reach this screen. If not, raise hand for help.



GitHub Setup

Now you should have access to a repo like this. Click lower link to get there from previous image.



Set up SSH Keys

First check if you already have an ssh key:

`$ cat ~/.ssh/id_rsa.pub` should print a string

If not:

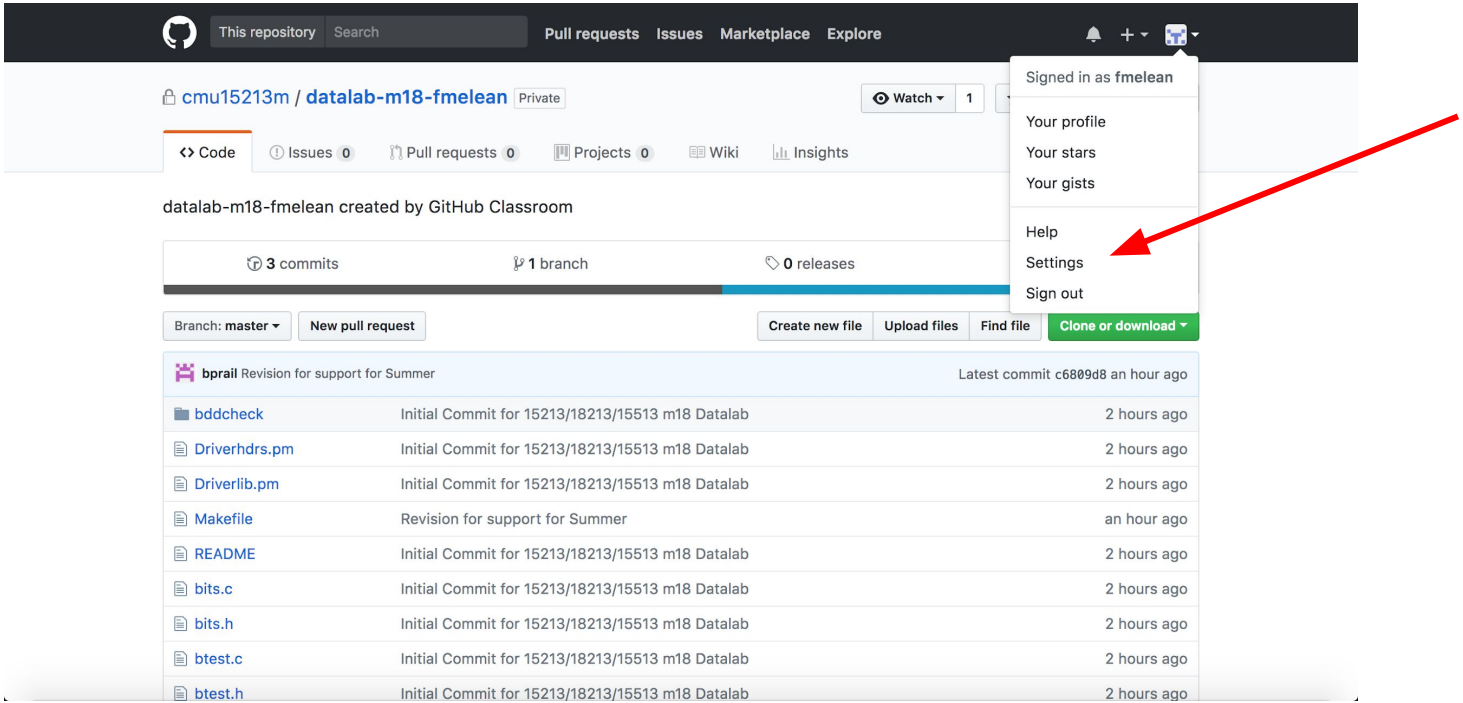
```
$ ssh-keygen -t rsa -C "213GitHub" -b 4096
```

Use the default file path (press Enter).

Optionally type in a password. (press Enter for no password)

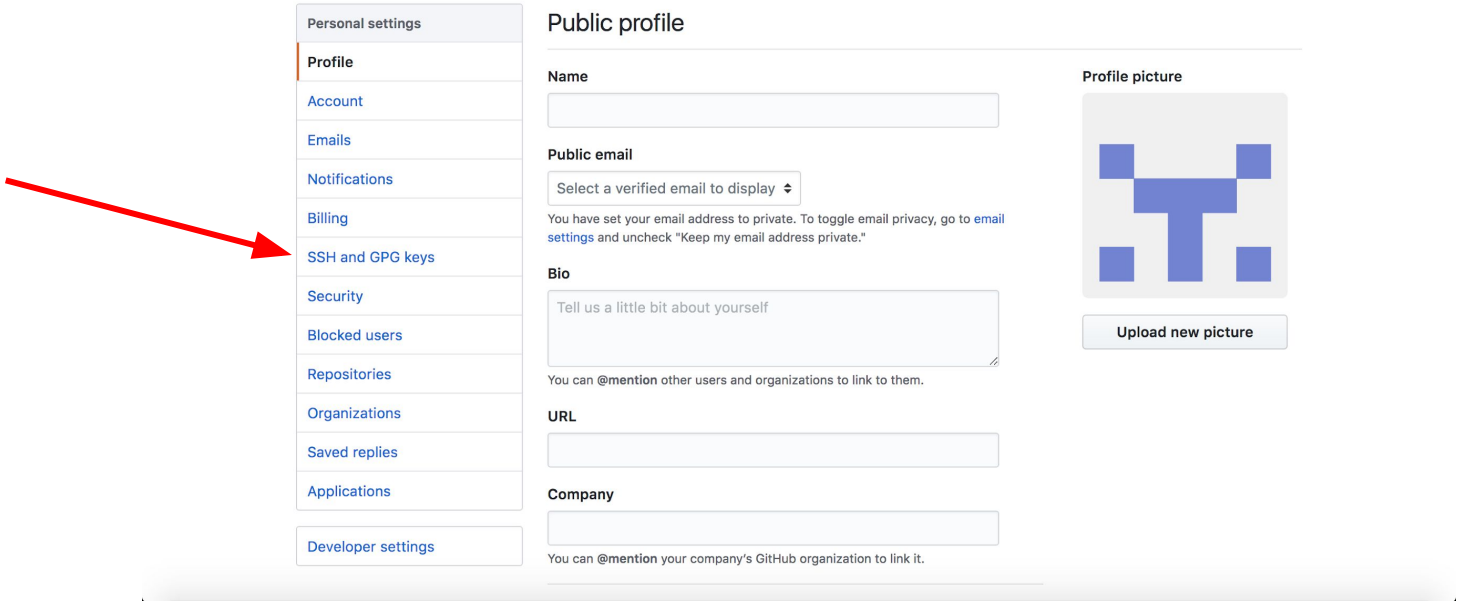
Unlocking Your Github Repo

Enter Github Settings



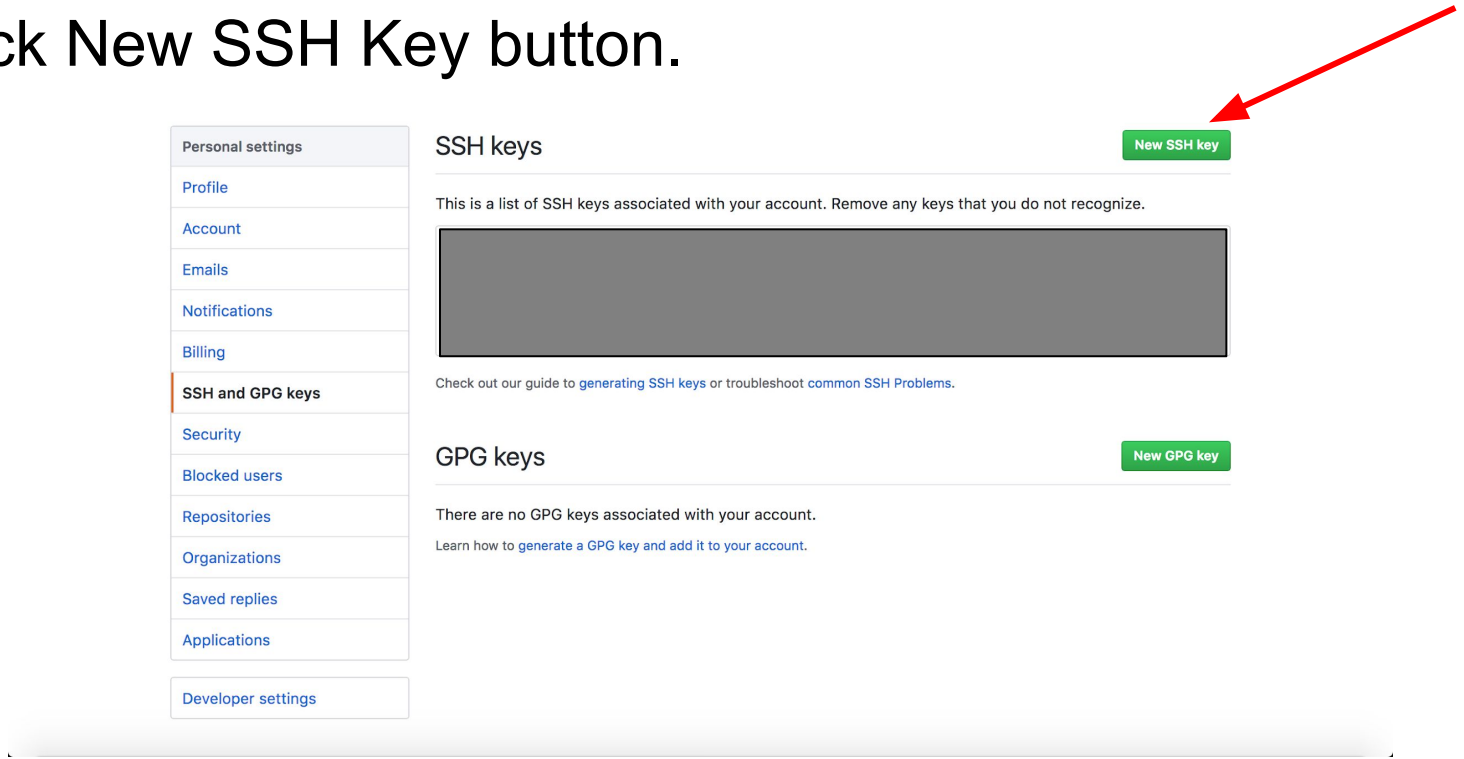
Unlocking Your Github Repo

Select SSH and GPG keys from left-side panel.



Unlocking Your Github Repo

Click New SSH Key button.



Unlocking Your Github Repo

From your terminal, type:

```
$ cat ~/.ssh/id_rsa.pub
```

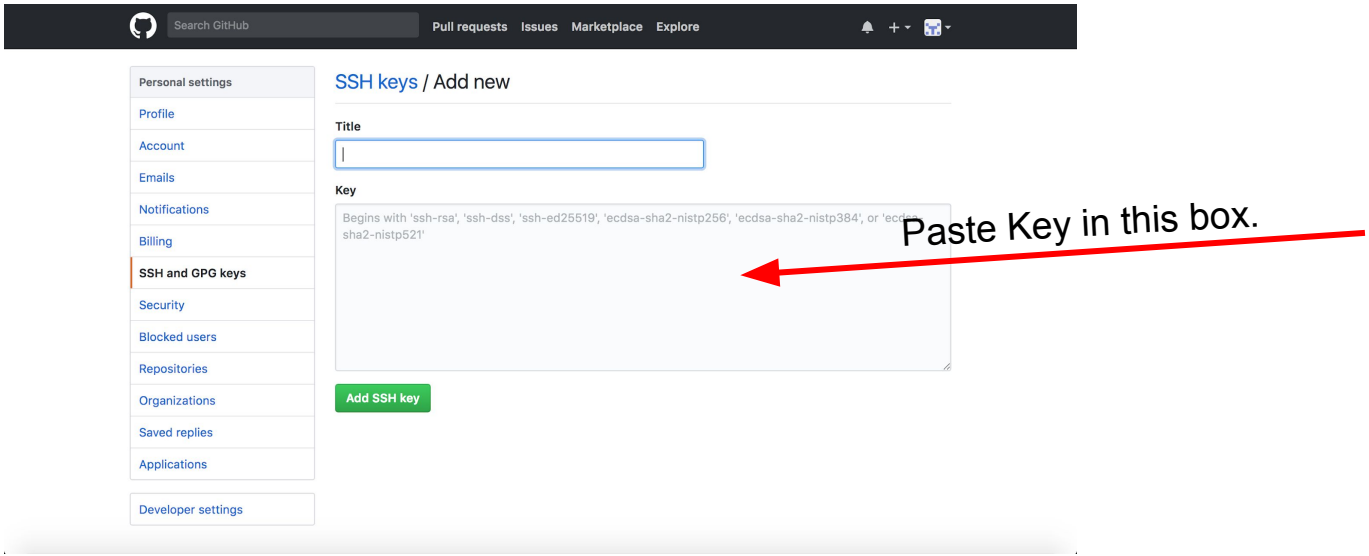
Your public key will be printed.

Highlight it with the mouse and copy

Unlocking Your Github Repo

Give a title and paste *entire* SSH key.

Should start with ‘ssh-rsa’ and end with ‘213Github’.

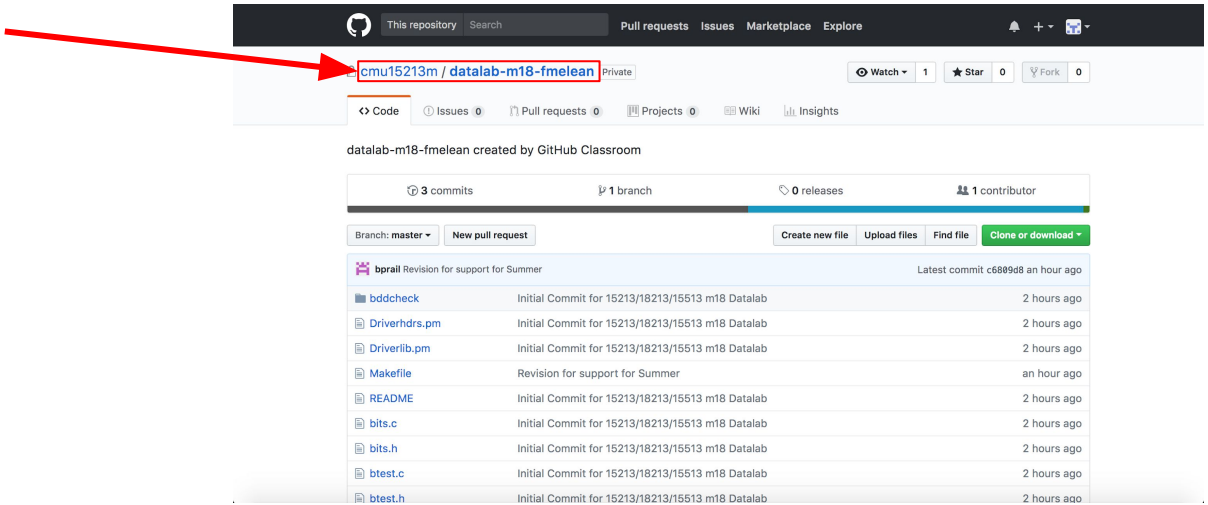


Accessing Your Github Repo

From your **private** 15213 directory, type the following:

$ git clone git@github.com:<directory path>.git

Image below shows where to find <directory path>:



Initial Commit

Enter cloned directory and do following:

$ echo “turtwig” > myteam.txt

$ git add myteam.txt

$ git commit -m “initial commit”

Push your git commit

```
$ git push -u origin master
```

You should now be able to see your updated repo in GitHub

`$ git push` is all that is required for future pushes in the same folder

Git is a distributed version control system

AKA a way to easily save and restore versions of your code

Made a change and now your code doesn't work?
About to start a huge refactor?

Use Git to save your work in case you want to come back to it later!

Git is good practice

Git is (almost) universally used in industry and academia

Committing frequently is excellent software engineering practice

Most importantly, we will use Git commit history to settle academic integrity issues

Staging changes and committing

All changes are by default *unstaged*

When you edit a file , add it to staging area (index):

$ git add <file-name>

To save your staged files in a *commit:*

$ git commit -m “commit message”

When you want to backup your commits in the Git Repo:

$ git push

Unstaging changes and modifying commits

Unstage changes with:
$ git reset <file-name>

Modify last commit by adding (if necessary), then:
$ git commit --amend

[CAUTION] Overwrite remote repo with:
$ git push -f

Undoing commits

First find the commit hash:
$ git log

Then:
$ git revert <commit-hash>

OR go to a previous state (can then create a branch):
$ git checkout <commit-hash>

Git Commands

`add`	Stage new or changed files	`rebase`	Modify, combine, delete, ... previous commits
`commit`	Save current staged files	`merge`	Combine commits from specified branch into current branch
`push/pull`	Push/pull local index to/from the remote server	`checkout`	Examine a different commit/branch/file
`log`	Show history of git commits	`stash`	Temporarily save your current uncommitted changes
`status`	Shows working directory status (added/modified/deleted files)	`stash pop`	Restore previously stashed changes
`show`	Show a file from a different commit or branch	`diff`	Show changes between commits, files, unstaged changes, ...
`branch`	Create a new branch (use a new branch for experimenting safely)	`clone`	Clone a git repository (like a remote GitHub repo)

Git Ignore

For those who want to use

`git add -all` or `git add .`

Do not track .o files or executable files!!!

Create a file `.gitignore` in your git repository and add files that you do not want to track

gitignore rules: https://git-scm.com/docs/gitignore

More Git

Getting help:

- `git help <command>`
- Piazza/Office hours

Google/Stack Overflow + practice!!!

Git tutorials:

- https://www.atlassian.com/git/tutorials (focused tutorials)
- https://try.github.io (basic interactive introduction)

https://rogerdudler.github.io/git-guide (simple guide)

Terminal Shortcuts

The command line operates on one directory at a time (the “working directory”).

You can use these shortcuts whenever a directory or file path is expected.

	Meaning	Example
`~`	Home directory	`cp foo.txt ~`
`.`	Working (current) directory	`cp ~/foo.txt .`
`..`	Parent directory	`cp ~/foo.txt ..`
`-`	Previous directory	`cd -`
`*`	Match as many characters as possible	`cp ~/*.txt` `rm *.c`

- **Be very *very* ***very*** careful with rm!!!**
  - **There is no trash with `rm`. It is gone.**

More Terminal Shortcuts

- Pressing tab will autocomplete file/directory names.
- Use the up+down arrow keys to scroll through your previous commands.
- Control+R lets you search your command history.
- Control+A jumps to the beginning of the line.
- Control+E jumps to the end of the line.
- Control+U clears everything to the left of the cursor.
- Control+C kills your current program.
- Control+D (on a blank line) exits the terminal.
- Control+L clears your screen.

`ls <dir>`

- Lists files in the present working directory, or, if specified, `dir`.
  - `-l` lists ownership and permissions.
  - `-a` shows hidden files (“dotfiles”).
- `pwd` tells you your present working directory.

`cd <directory>`

- Try running `cd -` to return to the previous directory.
- Try running `cd ..` to return to the parent directory.
- Changes your present working directory.

`mkdir <dirname>`

- Makes a directory `dirname` in your present working directory.
- Directories and folders are the **same thing!**

`mv <src> <dest>`

- `cp` works in exactly the same way, but copies instead
  - for copying folders, use `cp -r`
- `dest` can be into an existing folder (preserves name), or a file/folder of a different name
- `src` can be either a file or a folder

`tar <options> <filename>`

- For full list of options, see `man tar`
- `tar` stands for **t**ape **ar**chive. Was used on tapes!
- `x` - extract, `v` - verbose, `f` - file input, `p` - keep perms

`rm <file1> <file2> … <filen>`

- To remove an (empty) directory, use `rmdir`
  - To remove a folder and its contents, use `rm -rf`
    - **Please be careful, don't delete your project.**
    - **There is no "Trash" here. It's gone.**
    - **Contact ugradlabs@cs.cmu.edu to restore.**
    - **Latest restore is up to a day old!**

- **Restore most recent version yourself if you use git!**

pipes and redirects

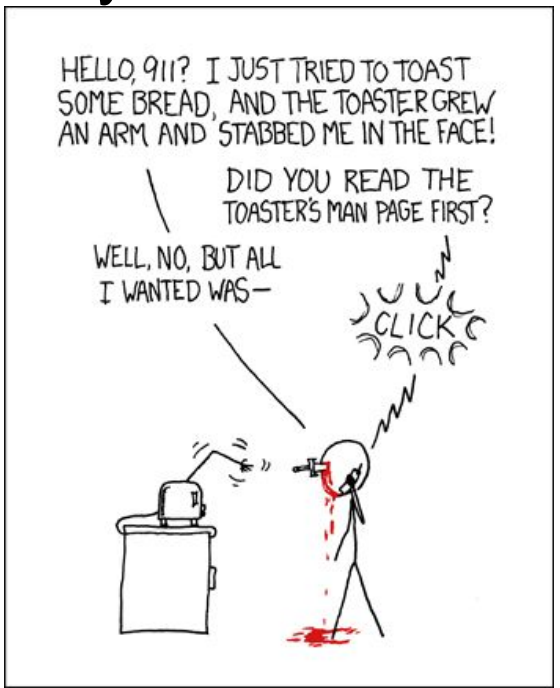
- A *pipe* redirects output from one program as input to another program.
  - Ex1: `cat filename | outputfile`
  - Ex2: `cat filename | grep 15213`
  -
- Can *redirect* output to a file.
  - Ex3: `echo hello >  file.txt`
  - Ex4: `echo hello >> file.txt`

What's in a file? (using `cat`)

- `cat <file1> <file2> … <filen>` lets you display the contents of a file in the terminal window.
  - Use `cat -n` to add line numbers!
- You can *combine* multiple files into one!
  - `cat <file1> … <filen> >> file.txt`
- Good for seeing what's in small files.

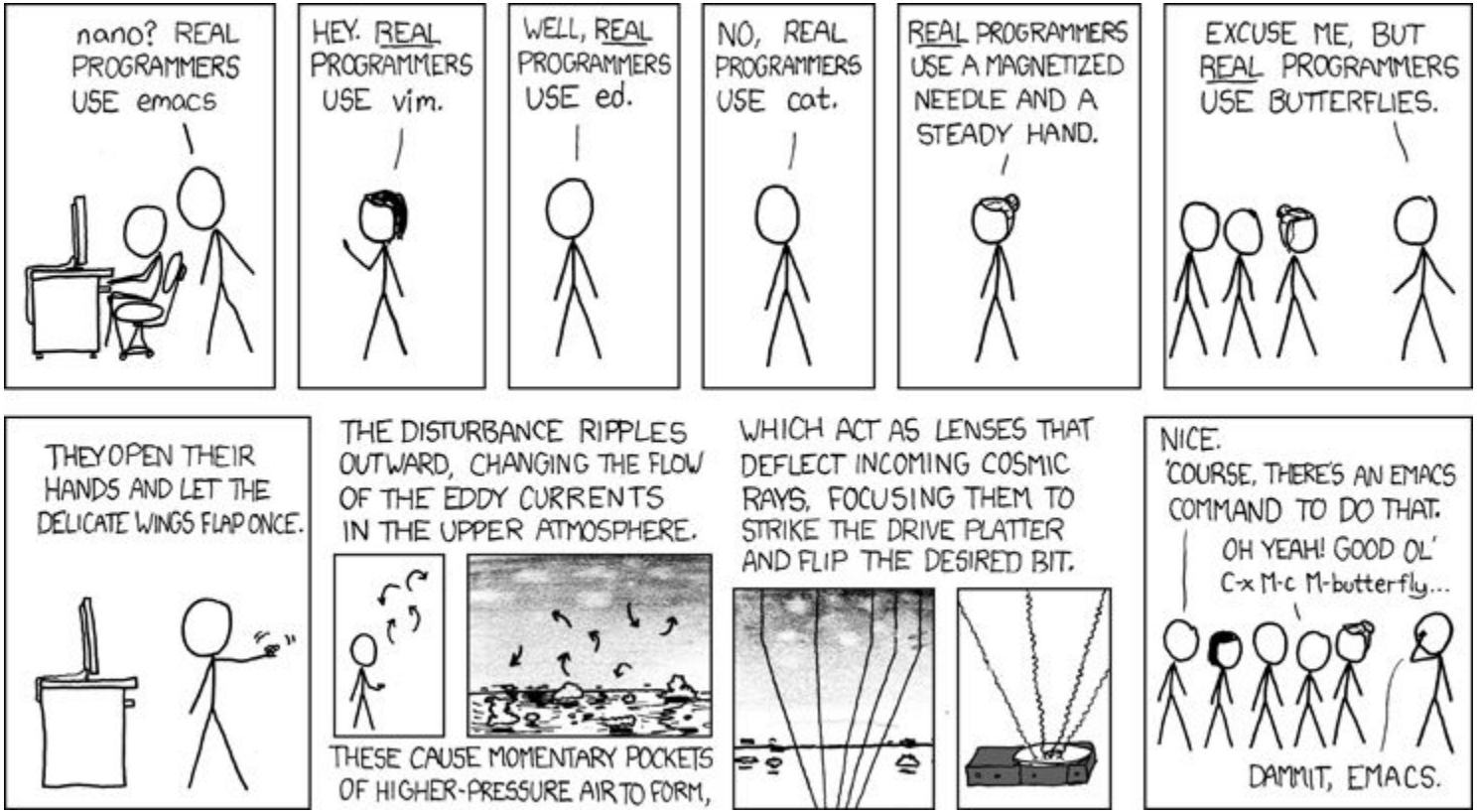
man <thing>

- What is that command? What is this C standard library function? What does this library do?
- Try it!
  - man grep
  - man tar
  - man strlen
  - man 3 printf
  - man stdio.h
  - man man



Appendix

Editors (a touchy subject)



Editors (a touchy subject)

- `vim` is nice, made for very powerful text editing
  - Try running `vimtutor` to get started learning
- `emacs` is nice, made to be more versatile
  - Emacs tutorial in emacs: “Ctrl-h t”
- `gedit` has a GUI
  - Requires X Forwarding: See Appendix
- I **strongly** recommend editing on the terminal.
- **Gist**: Use an editor with auto-indent and line numbers

Configuring bash

The file `~/.bashrc` is run every time you log in.

Put the following code:

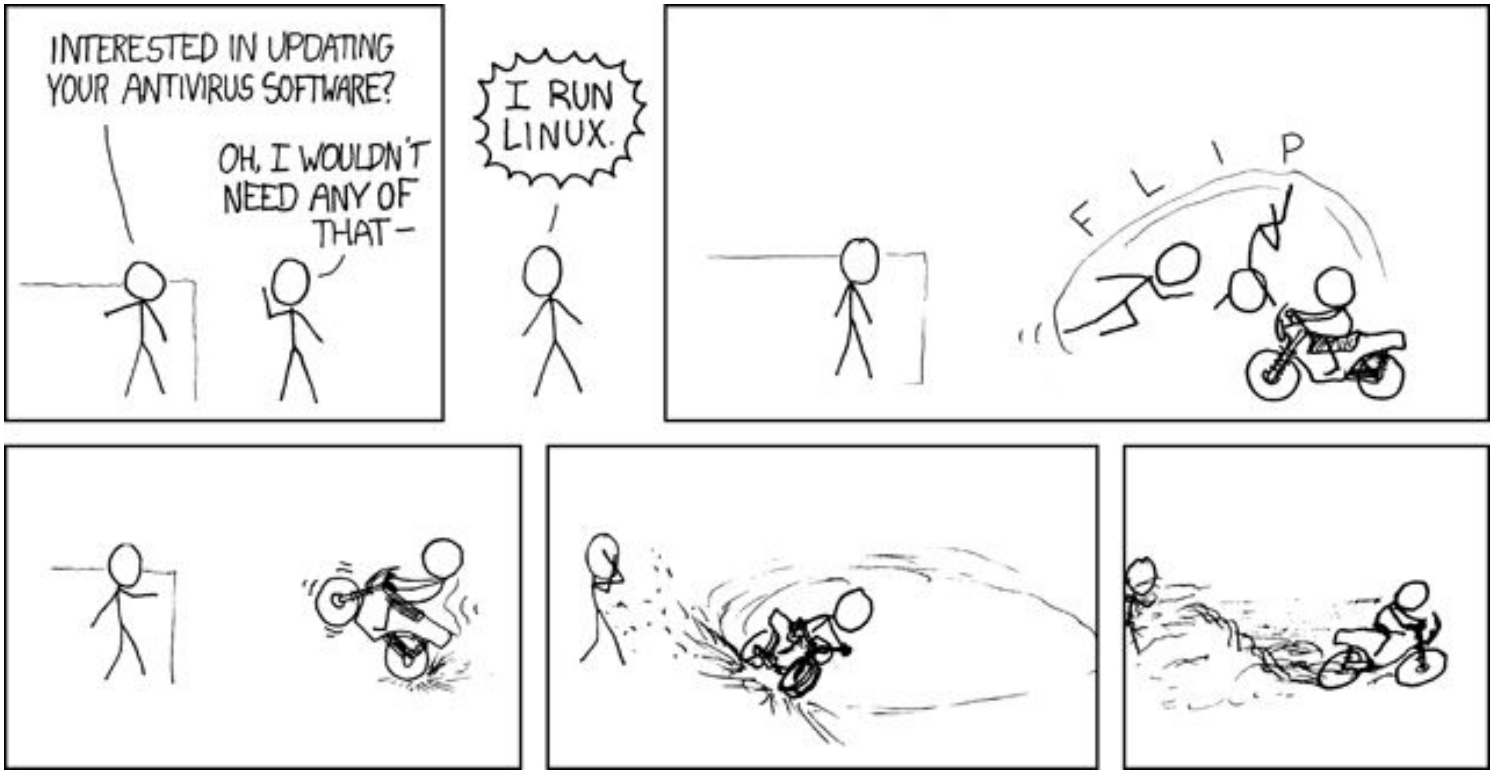
```
PS1="[\u@\h:\w] \$ "
alias ls='ls --color=auto'
```

to change your prompt to look like:

```
[szz@makoshark:~/private/15213] $ ls
attacklab  bomblab  lab-answers
```

Commands related to 15-213

- `gdb`, the **G**NU **Deb**ugger, will be used for bomb lab.
- `objdump` displays the symbols in an executable.
- `gcc` is the **G**NU **C** **C**ompiler.
- `make` is a configurable build system often used for compiling programs.
- We will provide other tools in the handouts as well


INTERESTED IN UPDATING YOUR ANTIVIRUS SOFTWARE?
OH, I WOULDN'T NEED ANY OF THAT-
I RUN LINUX.
F L I P

Vimtutor Walkthrough

- Chapters 1-3
- Cheatsheet: http://bit.ly/2cl0lJ0

Resources

- Quick references: cs.cmu.edu/~213/resources.html
- CMU Computer Club
  - www.contrib.andrew.cmu.edu/~sbaugh/emacs.html
  - club.cc.cmu.edu/talks/fall15/power-vim.html
  - club.cc.cmu.edu/talks/fall15/power-git.html
- Great Practical Ideas
  - www.cs.cmu.edu/~15131/f15/topics/bash/
  - www.cs.cmu.edu/~15131/f15/topics/git/
- Official manuals
  - `info bash`
  - `info emacs`
  - `:help` in Vim

tmux

```
$ tmux
```

Ctrl+b, then c: create a new tab

Ctrl+b, then n: move to next tab

Ctrl+b, then p: move to previous tab

Ctrl+b, then x: kill the current tab

Ctrl+b, then ?: help

Ctrl+b, then ": split horizontal

Ctrl+b, then %: split vertical

Ctrl+b, then arrow keys: move between panes

Fancy Terminal Shortcuts

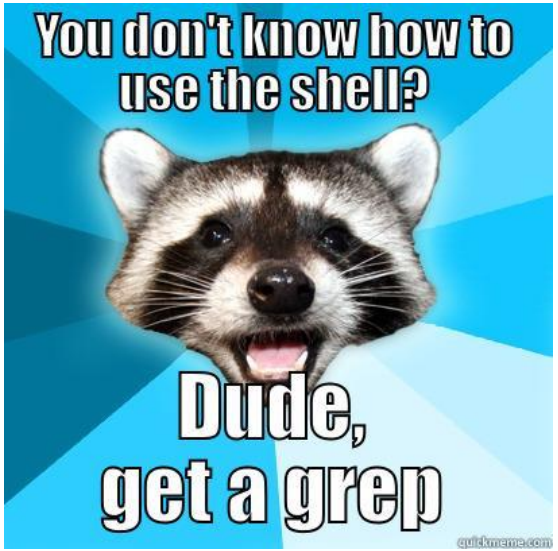
- Bash automatically splits things up in brackets!
  - Ex: `cp foo{1,2}.txt = cp foo1.txt foo2.txt`
  - Ex: `cp foo.txt{,.bak} = cp foo.txt foo.txt.bak`
  - For when typing the same filename gets annoying
- Bash has `for` loops!
  - Ex: Append “15-213” to every file ending in .c

```
for file in *.c; do echo “15-213” >> $file; done
```

- Have fun, but don’t break things or lose track of time

What's in a file? (using `grep`)

- `grep <pattern> <file>` will output any lines of `file` that have `pattern` as a substring
  - `grep -v` will output lines *without* pattern as substring
  - `grep -n` prints line numbers
  - `grep -R` will search *recursively*
- Try it: `grep 'phase' bomb.c`
  - `grep -n 'printf' src.c`
  - `grep -R 'unsigned' .`



Looking for something? `grep -A -B`

```
~/test
✓ $ ls
bar.txt  foo.txt  foobar.txt
~/test
✓ $ ls | grep foo
foo.txt
foobar.txt
~/test
✓ $ ls | grep bar
bar.txt
foobar.txt
~/test
✓ $ ls | grep foo > file.txt
~/test
✓ $ cat file.txt
foo.txt
foobar.txt
```

- `grep -B <x>`: include x lines **B**efore match.
- `grep -A <y>`: include y lines **A**fter match.
- Ex: `objdump -d | grep -A 25 explode_bomb`
- Ex: `grep -B 20 return *.c`