

Git and GitHub

What is Git?

- Version Control System
 - Keep careful track of changes in your files
 - Collaborate with others on your projects more easily
 - Test changes without losing the original versions
 - Revert back to older versions when/if needed
- GitHub: web-based hosting service for git
 - Provides a "remote" location for storing your git workspaces
 - Useful if you lose/break your computer, etc.

Using Git

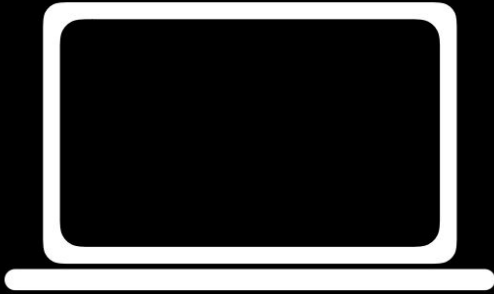
- Installation
 - <https://github.com/join>
 - <https://help.github.com/articles/set-up-git/>
- How it works
 - Create a "repository" (workspace) for your project
 - Add/remove/save/edit files
 - Push local files online to GitHub / pull remote files from GitHub to your local workspace
 - And more!

```
git clone <url>
```

- Downloads an existing repository from GitHub
- Creates a synced, local copy

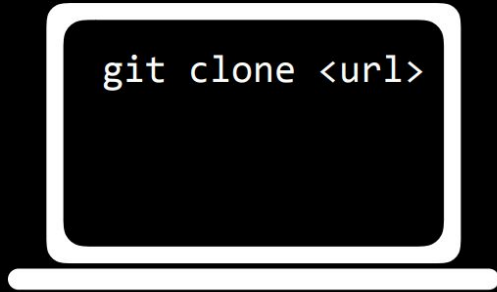
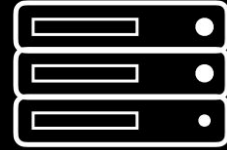
```
git clone <url>
```

```
a = 1  
b = 2  
c = 3  
d = 4
```



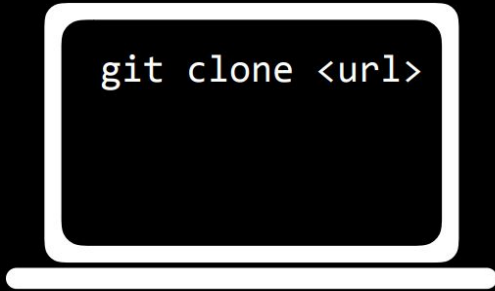
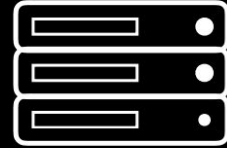
```
git clone <url>
```

```
a = 1  
b = 2  
c = 3  
d = 4
```



```
git clone <url>
```

```
a = 1  
b = 2  
c = 3  
d = 4
```



```
a = 1  
b = 2  
c = 3  
d = 4
```

git add <filename>

- Signals to git that the specified file should be “tracked” for changes
 - Places modified file(s) in the “staging area”
- Files not added in this way are essentially ignored by git
- `git add -A` signals to git that it should track all existing files


```
git add <filename>
```

```
a = 1  
b = 2  
c = 3  
d = 4
```



```
a = 1  
b = 2  
c = 3  
d = 4
```

```
git add <filename>
```

```
a = 1  
b = 2  
c = 3  
d = 4
```



```
a = 1  
b = 2  
c = 3  
d = 4  
e = 5
```

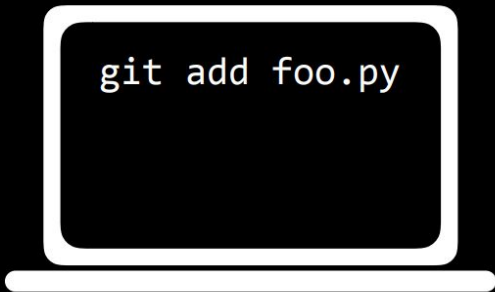
```
git add <filename>
```

```
a = 1  
b = 2  
c = 3  
d = 4
```



```
git add <filename>
```

```
a = 1  
b = 2  
c = 3  
d = 4
```



```
a = 1  
b = 2  
c = 3  
d = 4  
e = 5
```

Changes to be committed:

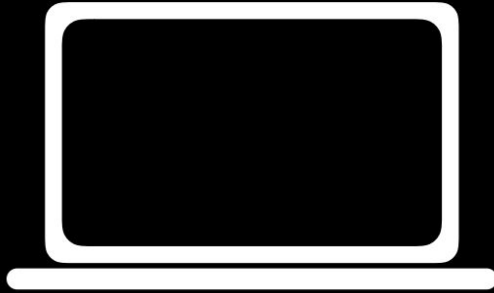
modified: foo.py

```
git commit -m "message"
```

- Takes a "snapshot" of all files currently on the staging area and commits it to git's memory
- The "snapshot" is captioned with the given message as a brief description for the commit

```
git commit -m "message"
```

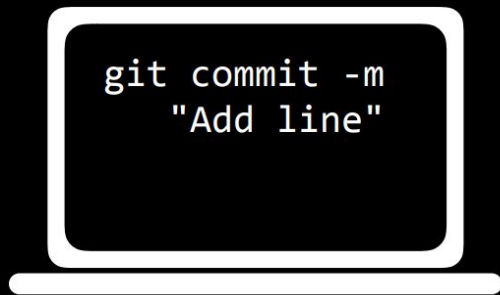
```
a = 1  
b = 2  
c = 3  
d = 4
```



```
a = 1  
b = 2  
c = 3  
d = 4  
e = 5
```

```
git commit -m "message"
```

```
a = 1  
b = 2  
c = 3  
d = 4
```



```
git commit -m  
"Add line"
```

```
a = 1  
b = 2  
c = 3  
d = 4  
e = 5
```

```
git commit -m "message"
```

```
a = 1  
b = 2  
c = 3  
d = 4
```



```
a = 1  
b = 2  
c = 3  
d = 4
```



```
a = 1  
b = 2  
c = 3  
d = 4  
e = 5
```

Add line


```
git commit -am "message"
```

- Nearly identical to previous command, with the added step of applying `git add` to all existing tracked files first
 - Ignores untracked files

git status

- Displays useful information about your repository (e.g., current branch, tracked/untracked files, differences between local and remote versions)

git status

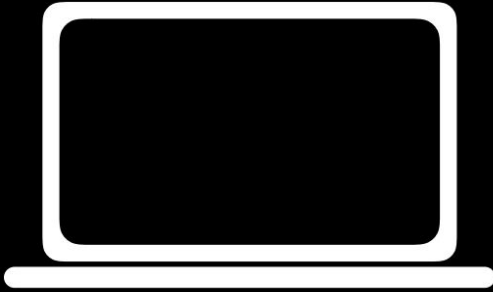
```
a = 1  
b = 2  
c = 3  
d = 4
```



```
a = 1  
b = 2  
c = 3  
d = 4
```

```
a = 1  
b = 2  
c = 3  
d = 4  
e = 5
```

Add line



git status

```
a = 1  
b = 2  
c = 3  
d = 4
```



```
a = 1  
b = 2  
c = 3  
d = 4
```

```
a = 1  
b = 2  
c = 3  
d = 4  
e = 5
```

Add line



git status


```
a = 1  
b = 2  
c = 3  
d = 4
```



```
a = 1  
b = 2  
c = 3  
d = 4
```

```
a = 1  
b = 2  
c = 3  
d = 4  
e = 5
```

Add line



```
git status
```

On branch master

Your branch is ahead of 'origin/master' by 1 commit.
(use "git push" to publish your local commits)

git push

- Uploads local commits to the remote repository (i.e., from your computer to GitHub)

git push

```
a = 1  
b = 2  
c = 3  
d = 4
```



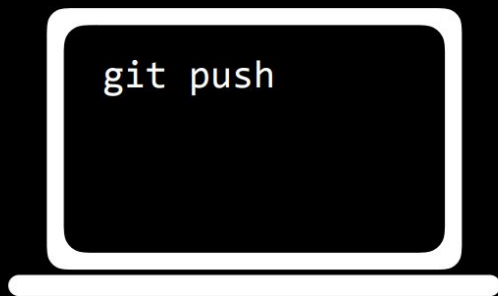
```
a = 1  
b = 2  
c = 3  
d = 4
```

```
a = 1  
b = 2  
c = 3  
d = 4  
e = 5
```

Add line

git push

```
a = 1  
b = 2  
c = 3  
d = 4
```

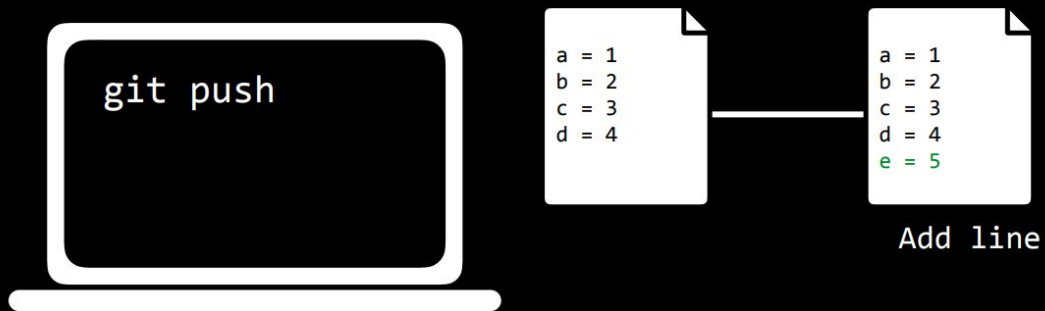


```
a = 1  
b = 2  
c = 3  
d = 4
```

```
a = 1  
b = 2  
c = 3  
d = 4  
e = 5
```

Add line

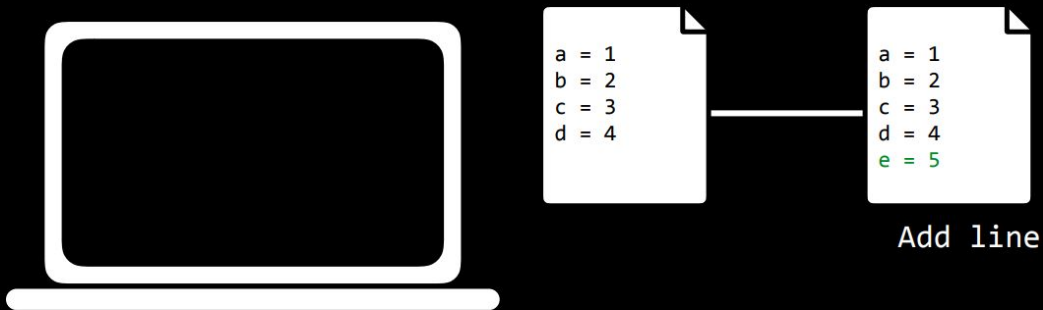
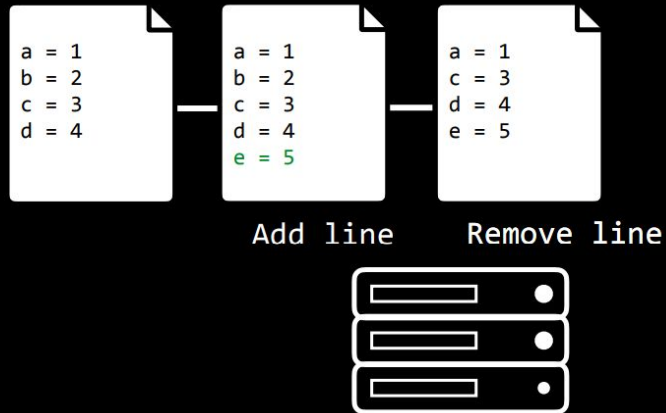
git push



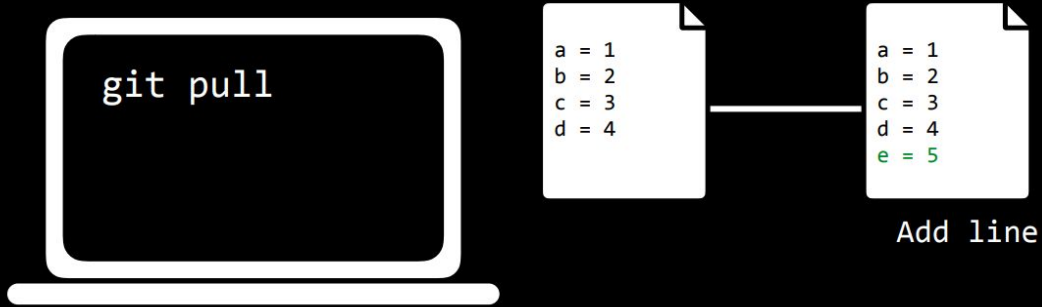
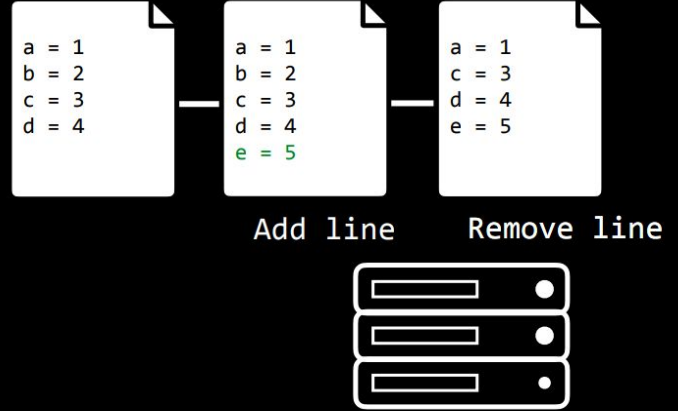
git pull

- Downloads remote commits to the local repository (i.e., from GitHub to your computer)

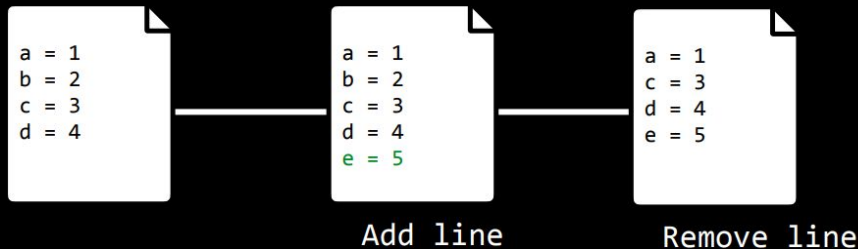
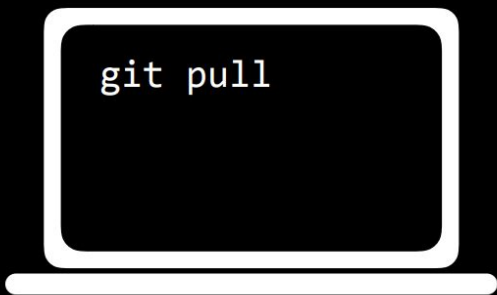
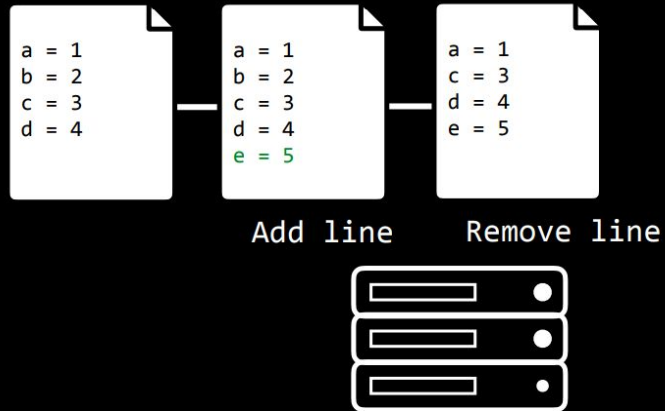
git pull



git pull



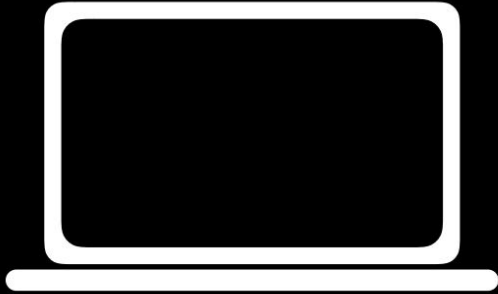
git pull



Merge Conflicts

- When two collaborators make conflicting changes to the same file, a merge conflict may arise
- Git will complain when you attempt to `git pull` and you will need to manually resolve the conflict

Merge Conflicts



Merge Conflicts

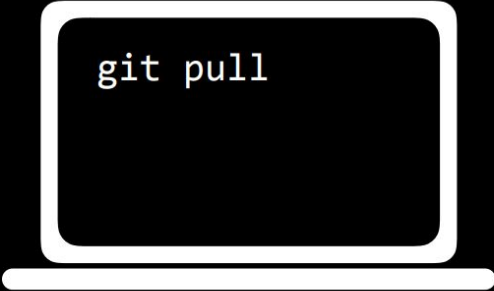


Merge Conflicts



```
CONFLICT (content): Merge conflict in foo.py
Automatic merge failed; fix conflicts and then
commit the result.
```

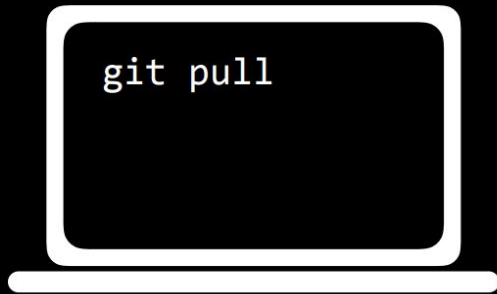
Merge Conflicts



```
git pull
```

```
a = 1
<<<<< HEAD
b = 2
=====
b = 0
>>>>> 57656c636f6d6520746f20576562
c = 3
d = 4
e = 5
```

Merge Conflicts



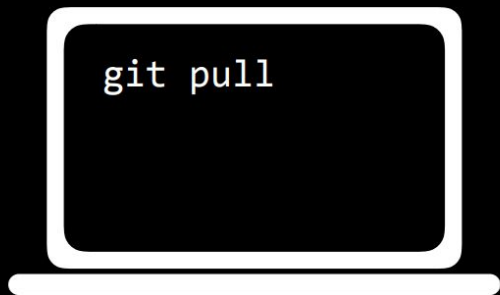
your
changes

remote
changes

```
a = 1
<<<<< HEAD
{ b = 2
  =====
  { b = 0
    >>>> 57656c636f6d6520746f20576562
    c = 3
    d = 4
    e = 5
```

conflicting commit
↓

Merge Conflicts



```
a = 1
<<<<< HEAD
b = 2
=====
b = 0
>>>>> 57656c636f6d6520746f20576562
c = 3
d = 4
e = 5
```

Merge Conflicts



```
a = 1
```

```
b = 2
```

```
c = 3
```

```
d = 4
```

```
e = 5
```

Merge Conflicts



```
a = 1  
b = 2  
c = 3  
d = 4  
e = 5
```

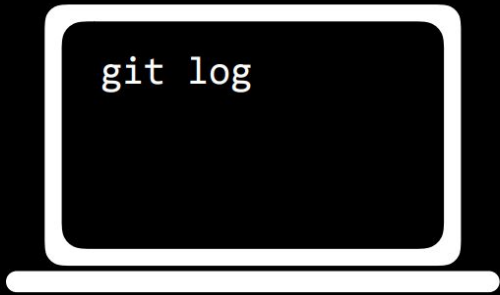
git log

- Displays history of commits made in the repository from newest to oldest

git log



git log



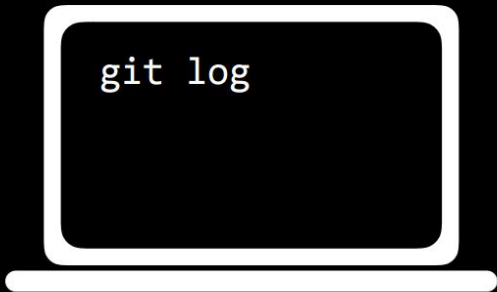
git log

```
commit 436f6d6d6974204d73672048657265
Author: Brian Yu <brian@cs.harvard.edu>
Date:   Mon Jan 22 14:06:28 2018 -0400
```

Remove a line

```
commit 57656c636f6d6520746f20576562
Author: Brian Yu <brian@cs.harvard.edu>
Date:   Mon Jan 22 14:05:28 2018 -0400
```

Add a line



Branching

- Each repository by default has a "master" branch where all your work lives
- Sometimes useful to create separate branches in your repository (to test new features, separate work among collaborators, etc.)



first
commit



first
commit

changes



first
commit

changes

more
changes

start new
feature



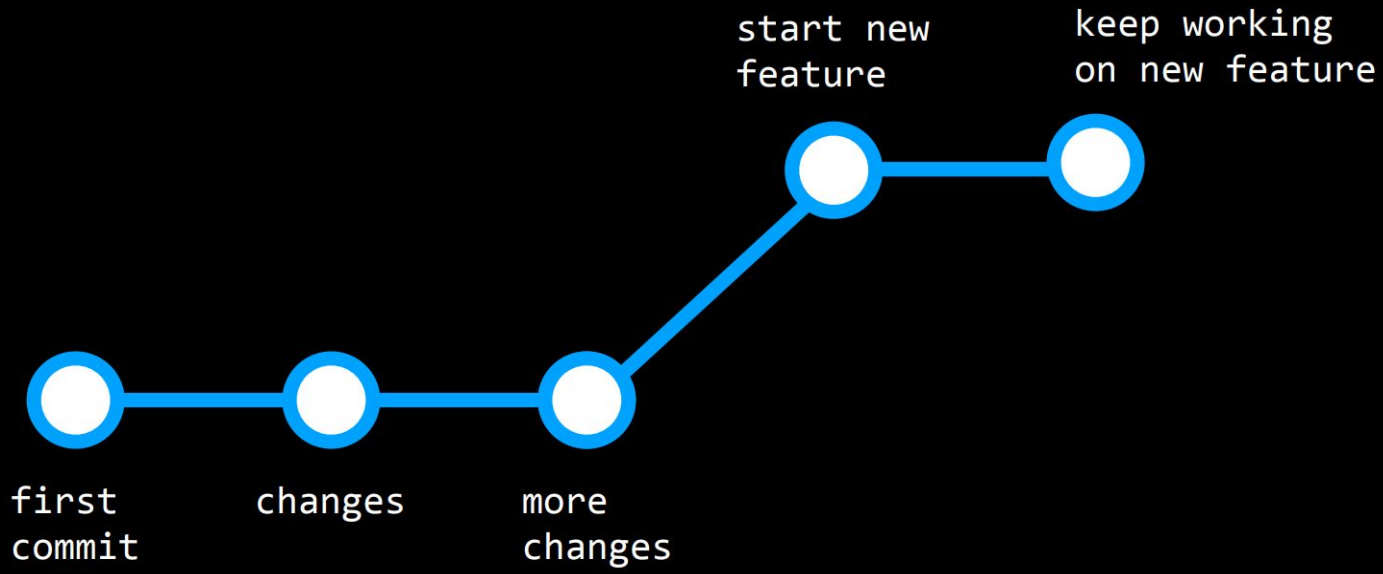
more
changes

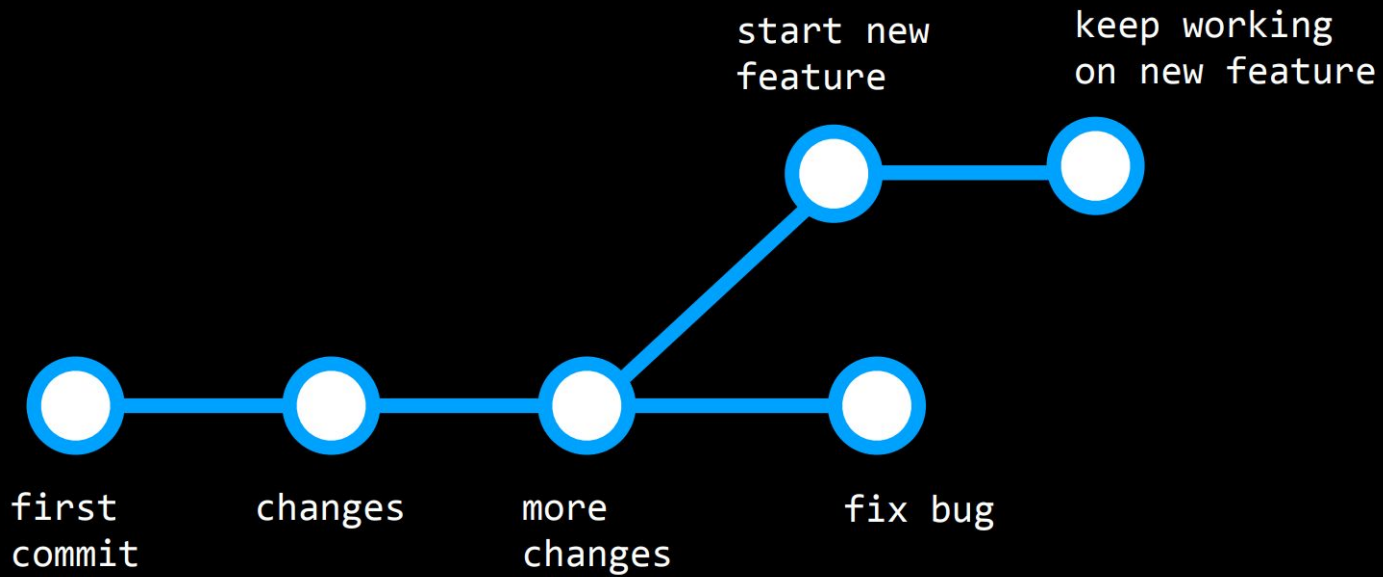


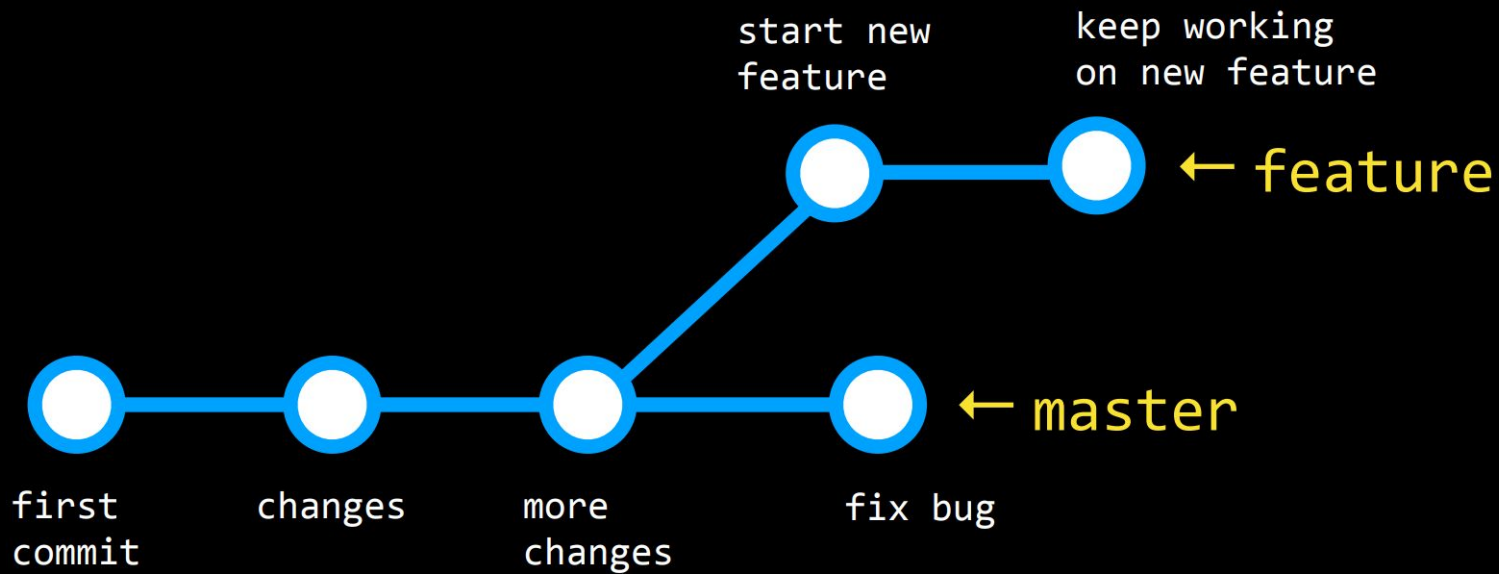
changes

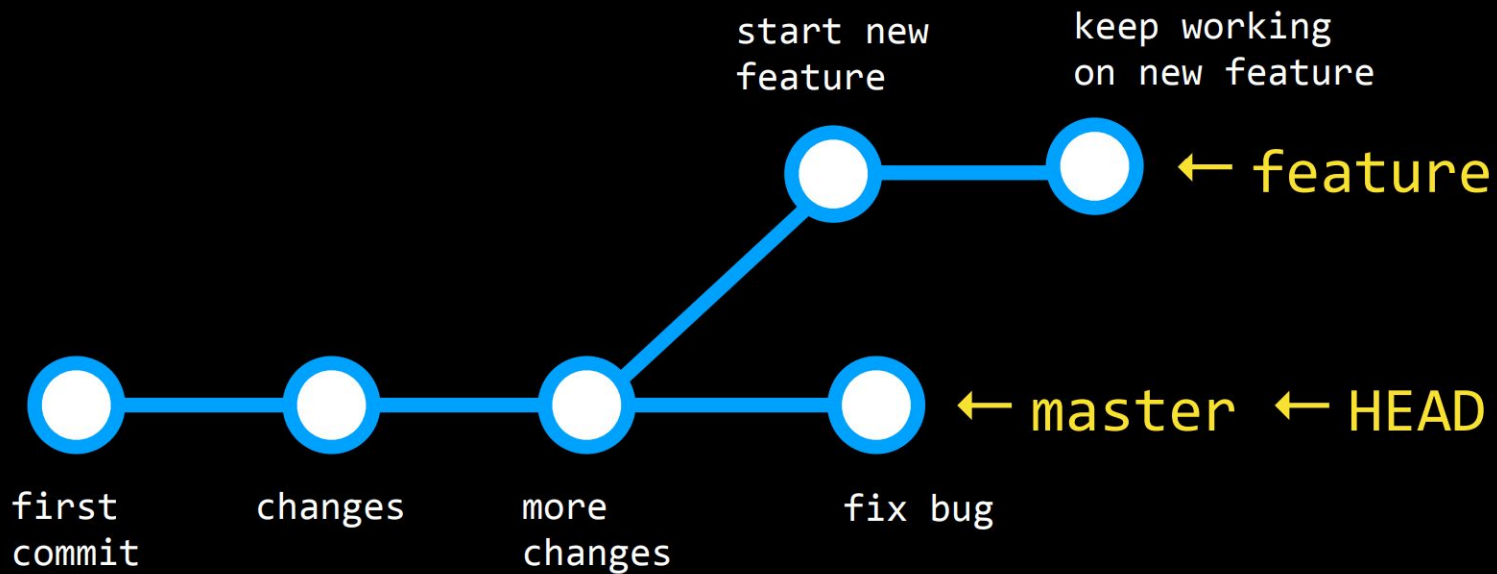


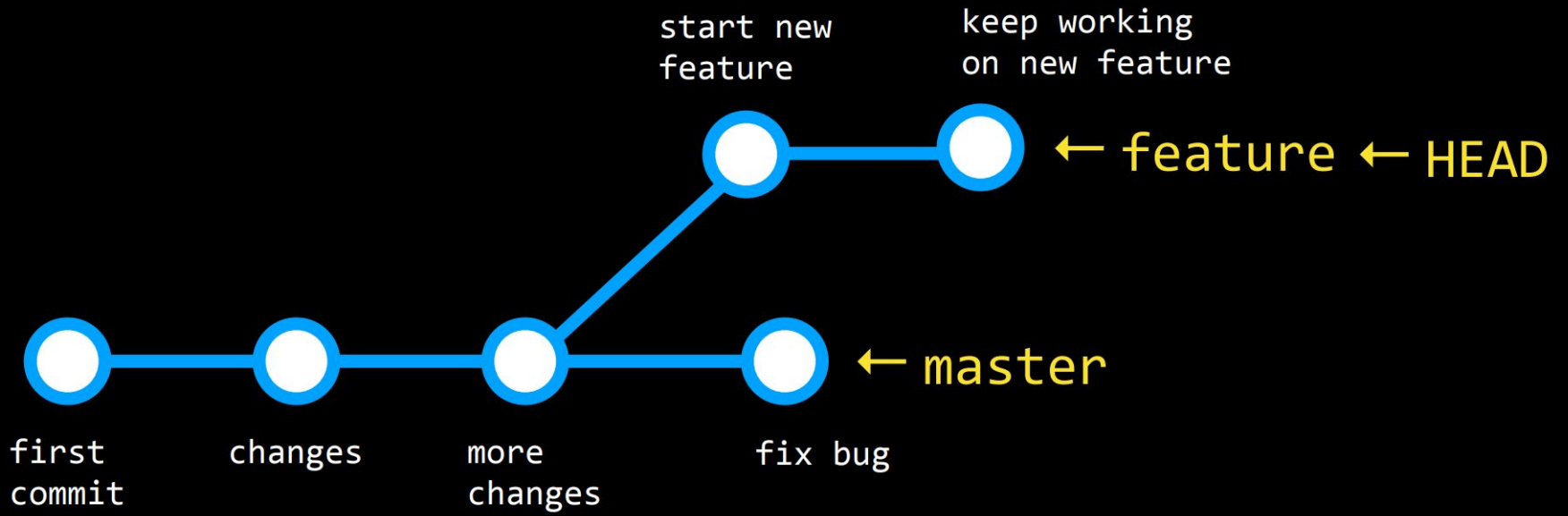
first
commit

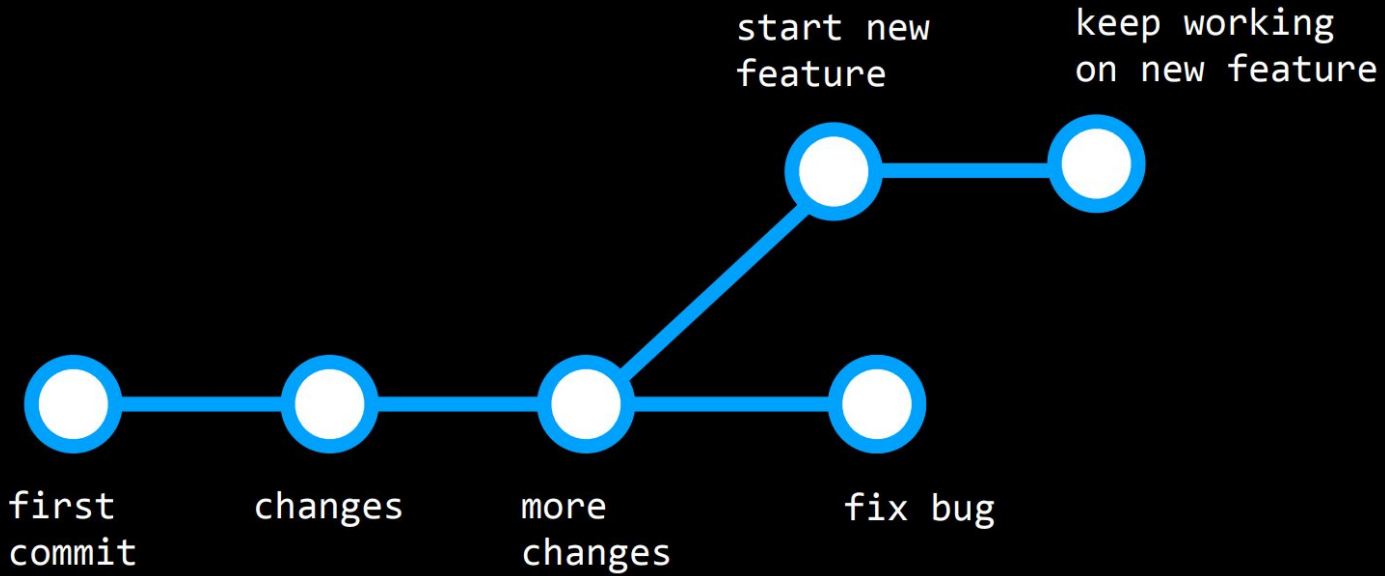


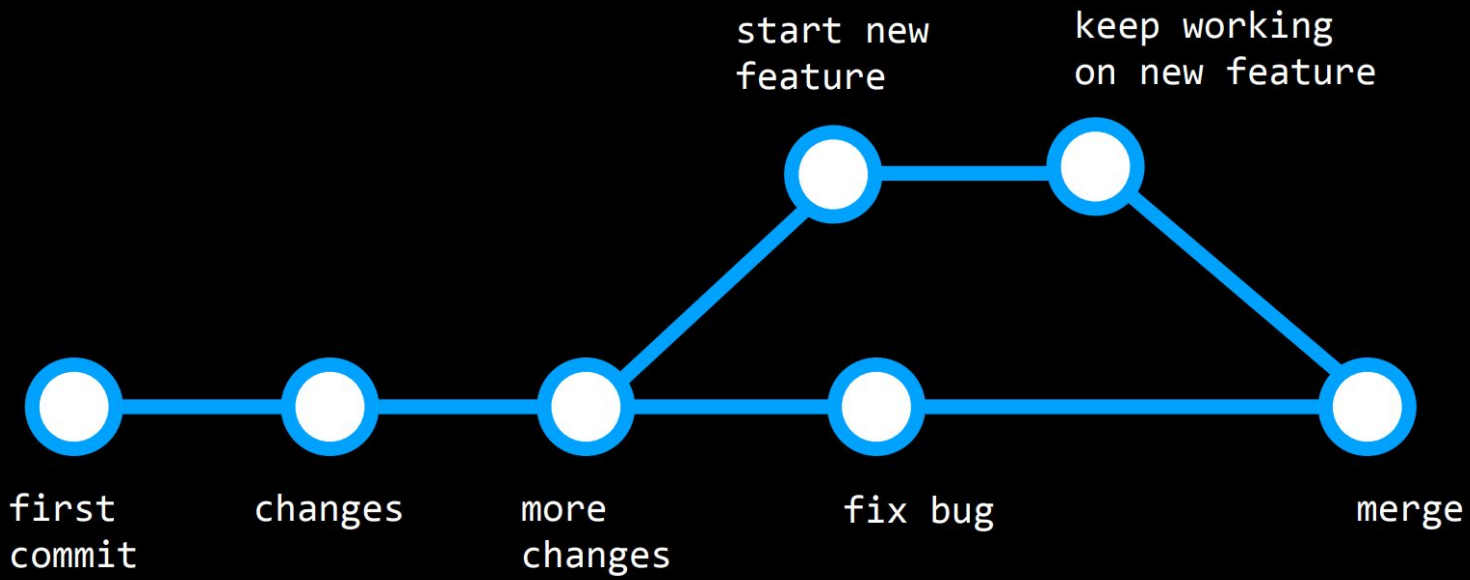












git branch

- By default, lists all of the branches in your repository, but has a few other variations:
- `git branch <branch>`
 - Creates a new branch with the given name
- `git branch -d <branch>`
 - Deletes the specified branch

git checkout <branch>

- Switches from the current branch to the specified branch (must already exist)


```
git checkout -b <branch>
```

- First creates a new branch with the given name, then switches to it

```
git merge <branch>
```

- Merges the specified branch to the current branch

Open Source

- GitHub is a popular home for "open source" projects (i.e., projects whose source code is freely available online and may be redistributed and modified).

Forking

- Create a copy of someone else's repository on your profile so that you can contribute to their project

Final questions?