

# Git Crash Course

Fearlessly develop!

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# Agenda

- Setup pre-reqs
- Why learn Git?
- Essential Git
- GitHub

# What is Git?

Is it just short for GitHub?

- Answer: No
- Git is a version control system. It's a tool used to manage code history. It's like a programming language... it has a syntax
- GitHub is a website for hosting Git repositories
- An alternative to GitHub is Atlassian's Bitbucket, which also hosts Git repos

# Why learn Git?

# Why use version control?

The "real" question

- Many companies (and some courses @ Berkeley!) use a VCS (Version Control System)
- Git is one possible (and popular) tool

## Companies & Projects Using Git

Google

facebook

Microsoft

twitter

LinkedIn

NETFLIX



Source: [git-scm.com](https://git-scm.com)

File Home Insert Page Layout References Mailings Re

Cut Copy Paste Format Painter Clipboard

Calibri (Body) 11 A<sup>+</sup> A<sup>-</sup> Aa Aa


**B** *I* U ~~abc~~ x<sub>2</sub> x<sup>2</sup> A ab A


Font


Document Recovery

Word has recovered the following files. Save the ones you wish to keep.

**Available files**

 .....\_..w\_v2.docx [Autosav...]  
Version created from the last ...  
14:25 11 мая 2016 г.

 \_ v\_v2.docx [Original]  
Version created last time the ...  
14:17 11 мая 2016 г.

 -ready11.doc [Original]  
Version created last time the ...  
12:26 11 мая 2016 г.  
**Repaired**

## Document Recovery

Word has recovered the following files. Save the ones you wish to keep.

### Available files



.....\_..w\_v2.docx [Autosav...]  
Version created from the last ...  
14:25 11 мая 2016 г.



\_ \_ v\_v2.docx [Original]  
Version created last time the ...  
14:17 11 мая 2016 г.



-ready11.doc [Original]  
Version created last time the ...  
12:26 11 мая 2016 г.

Repaired

## Manage versions

Drive keeps older versions of 'disc11\_sol.pdf' for 30 days. [Learn more](#)

UPLOAD NEW VERSION

	Current version disc11_sol.pdf Nov 30, 12:20 PM JERRY CHEN	
	Version 4 disc11_sol.pdf Nov 27, 7:25 PM JERRY CHEN	
	Version 3 disc11_sol.pdf Nov 26, 9:57 PM JERRY CHEN	
	Version 2 disc11_sol.pdf Nov 26, 9:41 PM JERRY CHEN	

CLOSE

Can use different image





















Past\_Versions

<>

Search

Past\_Versions

Name	^	Date Modified	Size
 Jerry Chen Resum v2.pdf		Jan 4, 2015 at 23:59	55 KB
 Jerry Chen Resum v3		Jan 12, 2015 at 13:02	55 KB
 Jerry Chen Resum v4.pdf		Jan 26, 2015 at 21:35	55 KB
 Jerry-Chen-Resum e-1_26_17.pdf		Aug 27, 2016 at 22:09	89 KB
 Jerry-Chen-Resum e-R-v1.pdf		Jul 31, 2015 at 16:53	67 KB
 Jerry-Chen-Resum e-R-v15.pdf		Oct 12, 2015 at 19:45	85 KB
 Jerry-Chen-Resum e-v5.pdf		Jan 26, 2015 at 21:35	55 KB
 Jerry-Chen-Resum e-v6.pdf		Mar 19, 2015 at 11:19	56 KB
 Jerry-Chen-Resum e-v7.pdf		Apr 16, 2015 at 14:47	55 KB
 Jerry-Chen-Resum e-v8.pdf		Apr 16, 2015 at 14:51	55 KB
 Jerry-Chen-Resum e-v9.pdf		Jul 5, 2015 at 15:44	57 KB
 Jerry-Chen-Resum e-v10.1.pdf		Jul 26, 2015 at 21:50	85 KB
 Jerry-Chen-Resum e-v10.pdf		Jul 6, 2015 at 18:16	57 KB
 Jerry-Chen-Resum e-v11.pdf		Jul 28, 2015 at 21:10	67 KB
 Jerry-Chen-Resum e-v12.pdf		Jul 30, 2015 at 14:56	67 KB
 Jerry-Chen-Resum e-v13.pdf		Sep 4, 2015 at 18:13	84 KB

19 items, 122.67 GB available

Can use different image



# Existing "Version Control"

Many problems!

- Not enough granularity
- *Too much* granularity
- Useless version naming
- Managing many copies of a file

# Git

A bright and beautiful future

- Create "checkpoints" at your **own pace**
- **Custom descriptions** for versions
- Only a single version of a file to **focus** on at a time

Downside: This does take some time to learn...

# Git Essentials

# Let's get started

Please get your computer ready

This part is best if you have a computer to follow along with

If you don't, no worries — you can view the slides & notes later

# Creating a Local Git Repo

- Most of Git is local
- The main difference between this and remote is push + pull



# Vocabulary

- **Repository (Repo)** - a directory of files plus edit history
- **Commit** - a snapshot of the repository state

# Some Non-Git Commands

Basic file manipulation

- `cat` will output contents of a file
- `touch file.txt` creates a empty file
- `echo "TEXT" > file.txt` replaces file with "TEXT"
- `echo "TEXT" >> file.txt` appends "TEXT" to a file

Demo

pangram1.txt

<empty>

pangram2.txt

<empty>

Unmodified

Modified

Staged

pangram1.txt

<empty>

pangram2.txt

<empty>

```
echo "...dog.." > pangram1.txt
```

Unmodified

Modified

Staged

pangram1.txt

...dog...

pangram2.txt

<empty>

```
echo "...Trebek..." > pangram2.txt
```

	Unmodified	Modified	Staged
--	------------	----------	--------

pangram1.txt			
--------------	--	--	--

pangram1.txt		...dog...	
--------------	--	-----------	--

pangram2.txt			
--------------	--	--	--

pangram2.txt		...Trebek...	
--------------	--	--------------	--

```
git add pangram1.txt
```

Unmodified

Modified

Staged

pangram1.txt

...dog...

pangram2.txt

...Trebek...



git commit

Unmodified

Modified

Staged

pangram1.txt

...dog...

pangram2.txt

...Trebek...

# Commit Messages

A brief note

- Good commit messages are hard to come by
- Bad commit messages are worse than useless

758575d Merge pull request #26 from Berkeley-CS162/blargh  
606878f some persistence working again  
ba6af4d (**origin/subdirs**) Revert to the "so far" commit  
b887e6d lol  
85320da tons of tests pass  
06e8ee0 grow-tell-persistence seems to pass  
f6aa390 so far  
748f040 Merge branch 'subdirs' of https://github.com/Berkeley-CS162/group11 into subdirs  
f232868 made some progress on vine  
b549c97 Various fixes (see full commit message for more detail)  
1b4efdd blsggtefd  
8710759 stupid piece of  
971d0ac stuff  
13c2813 Update helper fxn name  
47e930e dir open  
58468d2 Prevent bad access from crashing the program  
402a5ff Deny writes to dirs  
4ae06eb trying to open dirs  
d0f3044 accessing files in subdirs  
ae5cd2b prep for '.' and '..'

f232868	made some progress on vine
b549c97	Various fixes (see full commit message)
1b4efdd	blsggtefd
8710759	stupid piece of
971d0ac	stuff
13c2813	Update helper fxn name
47e930e	dir open

1. Short and descriptive
2. Use imperative mood for the subject line
3. Addl. details (if any) go in the body

# Log

History in depth

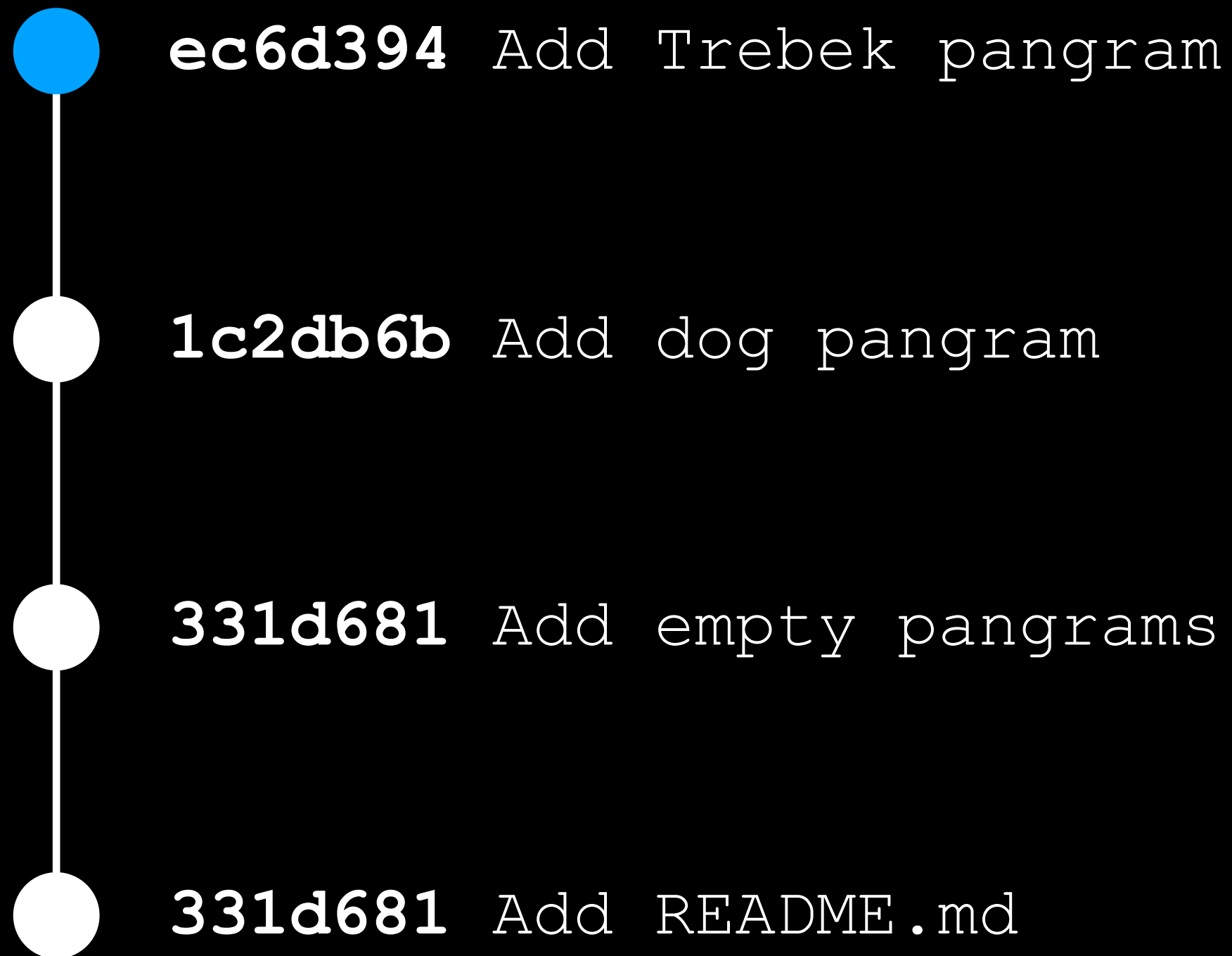
- Let's formalize the concept of the log
- Commits remember their parent

Demo

**ec6d394** Add Trebek pangram



You are here (HEAD)



Beginning of time

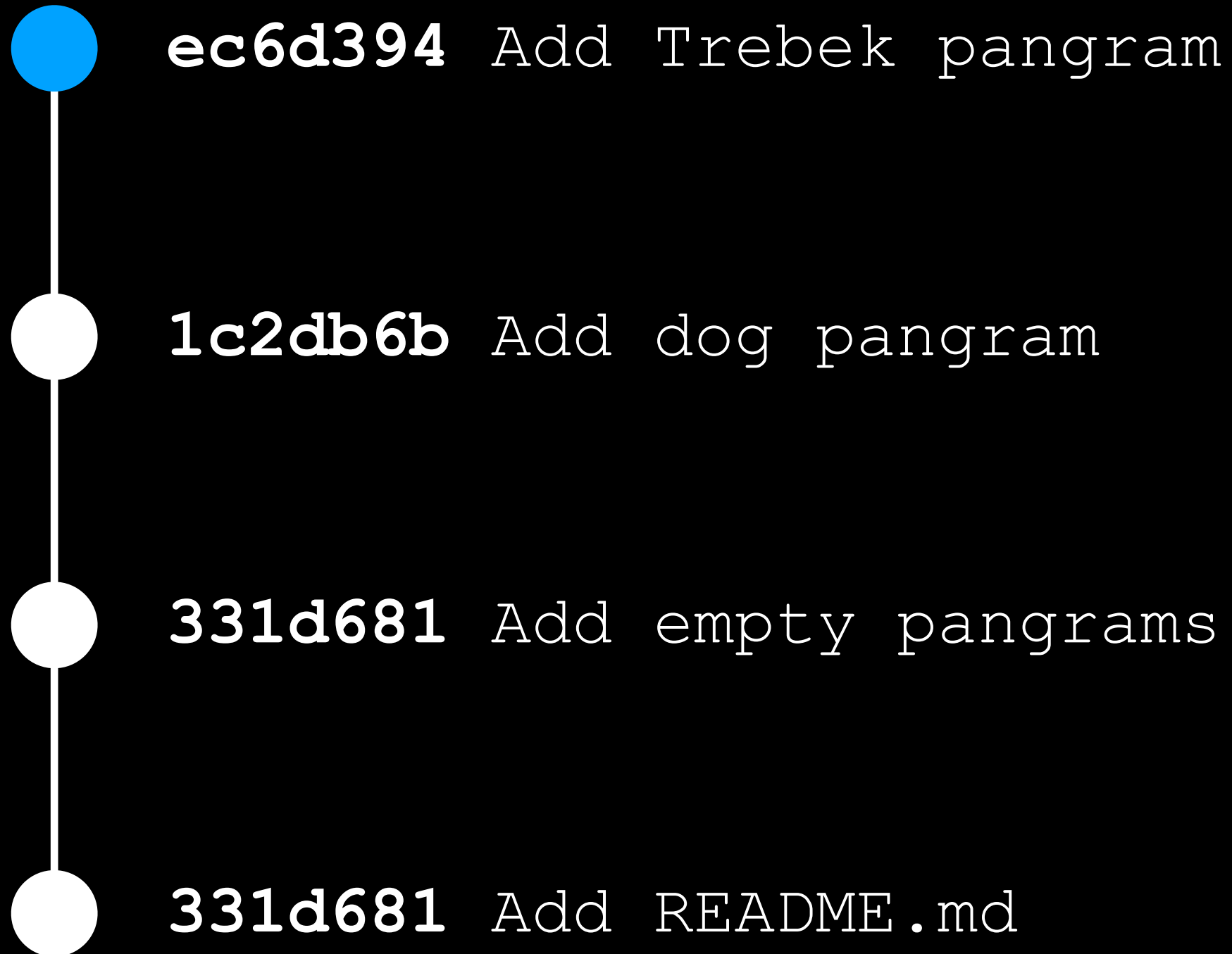
# Branches

An introduction to multiverse theory

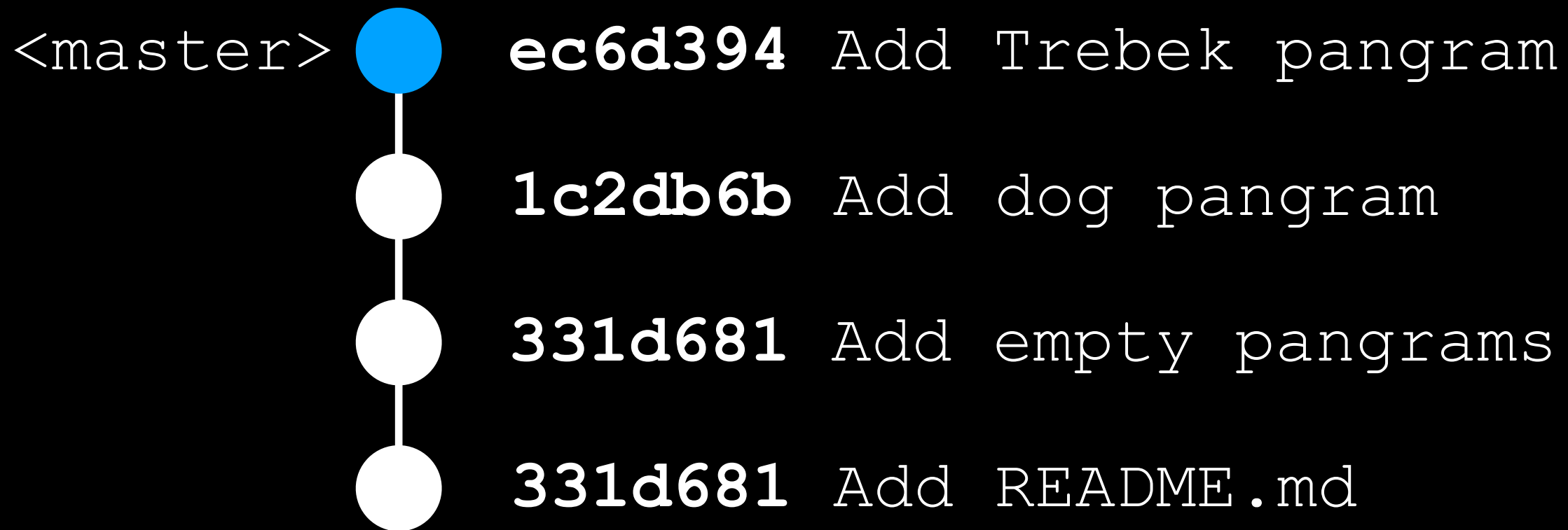
- Branches are labels pointing to specific commits
- "master" is the default starting branch

Demo

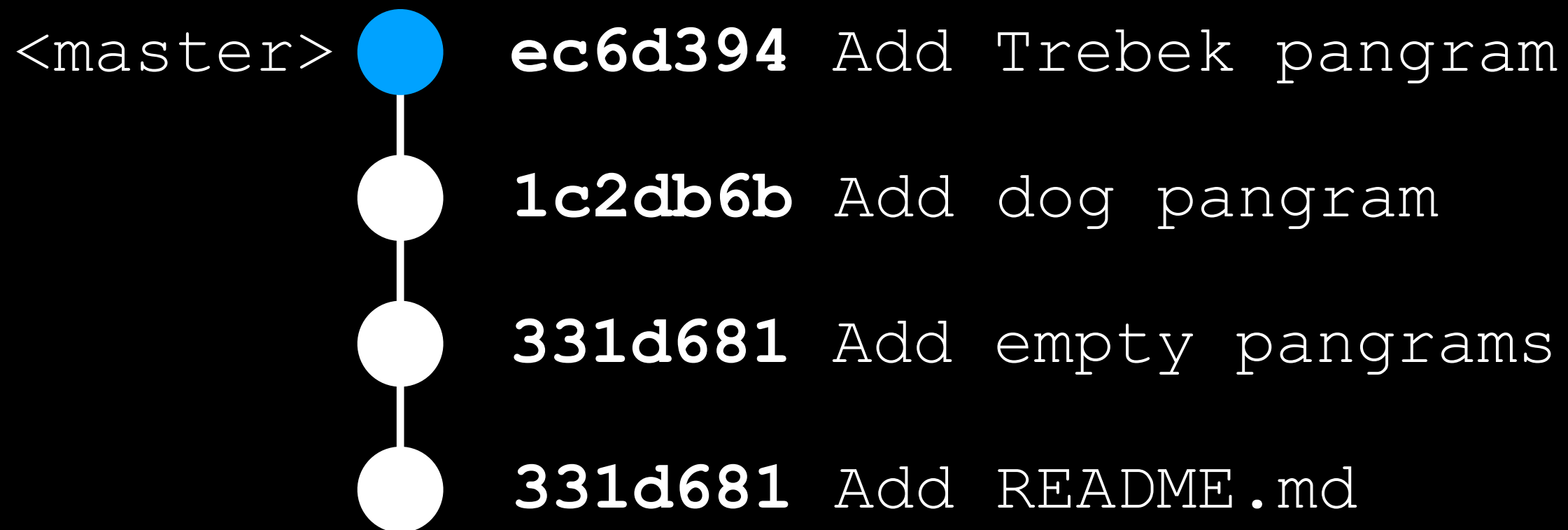
You are here



Beginning of time

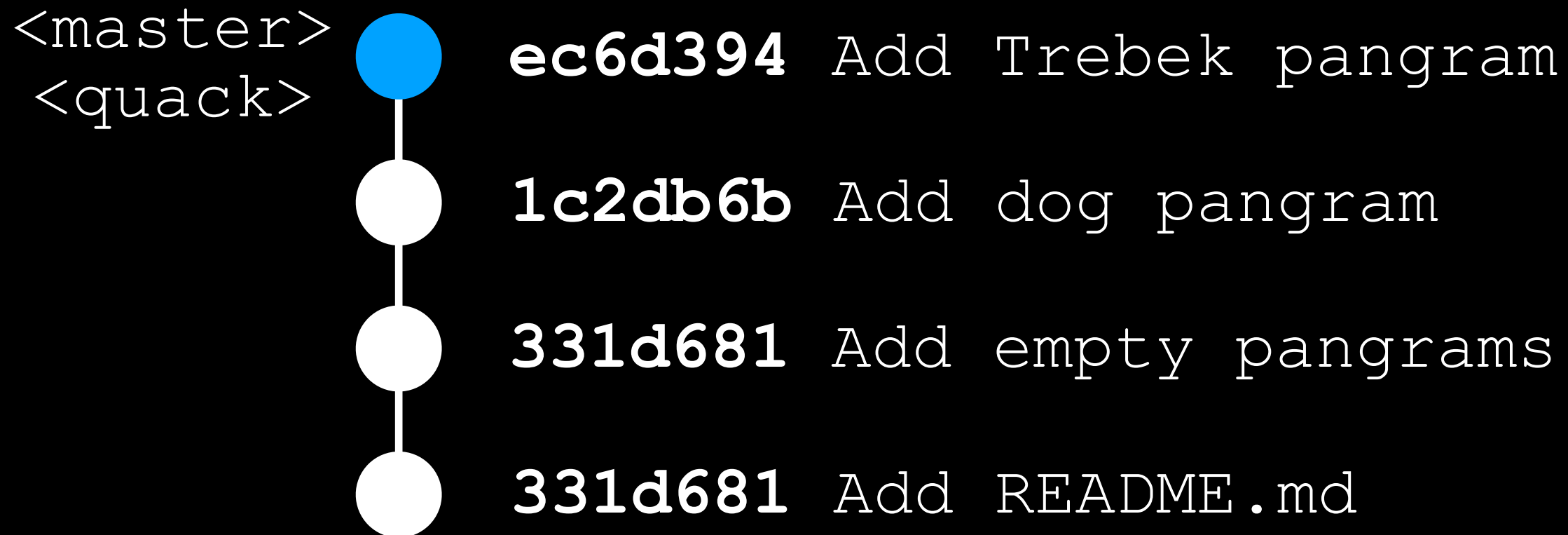


HEAD

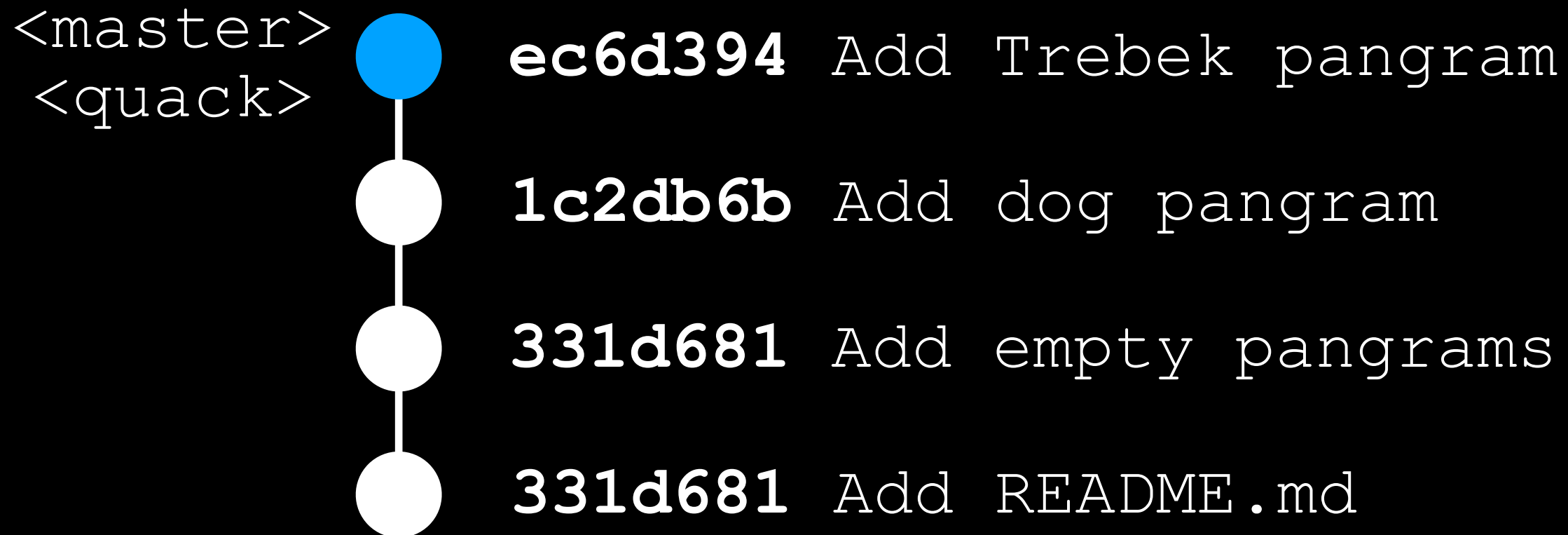


```
git branch quack
```

HEAD



git commit





git commit



git checkout quack



git commit



git commit



git commit



# Merging

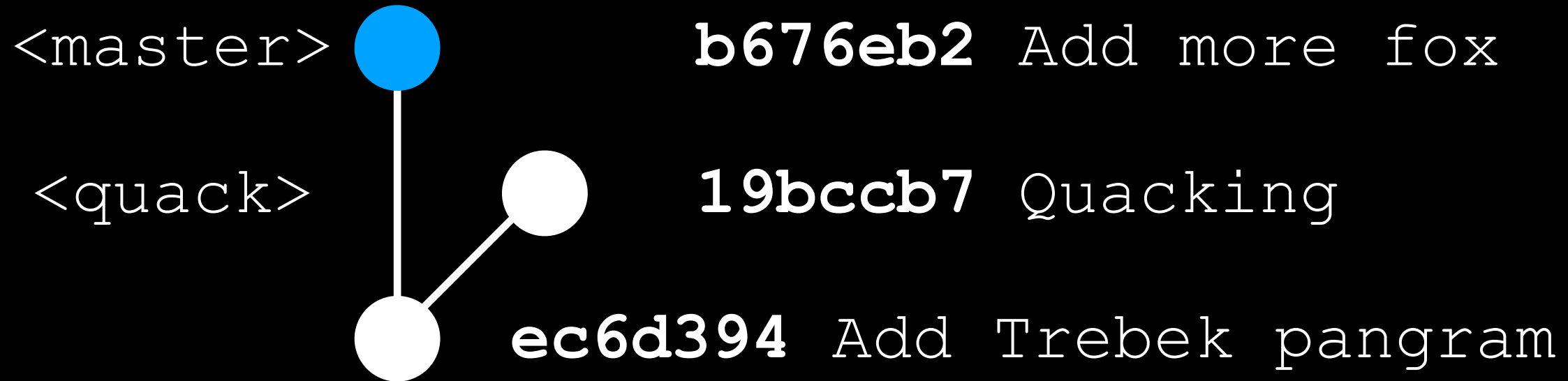
Worlds collide

- Now it's time to combine our work
- Usually this is boring

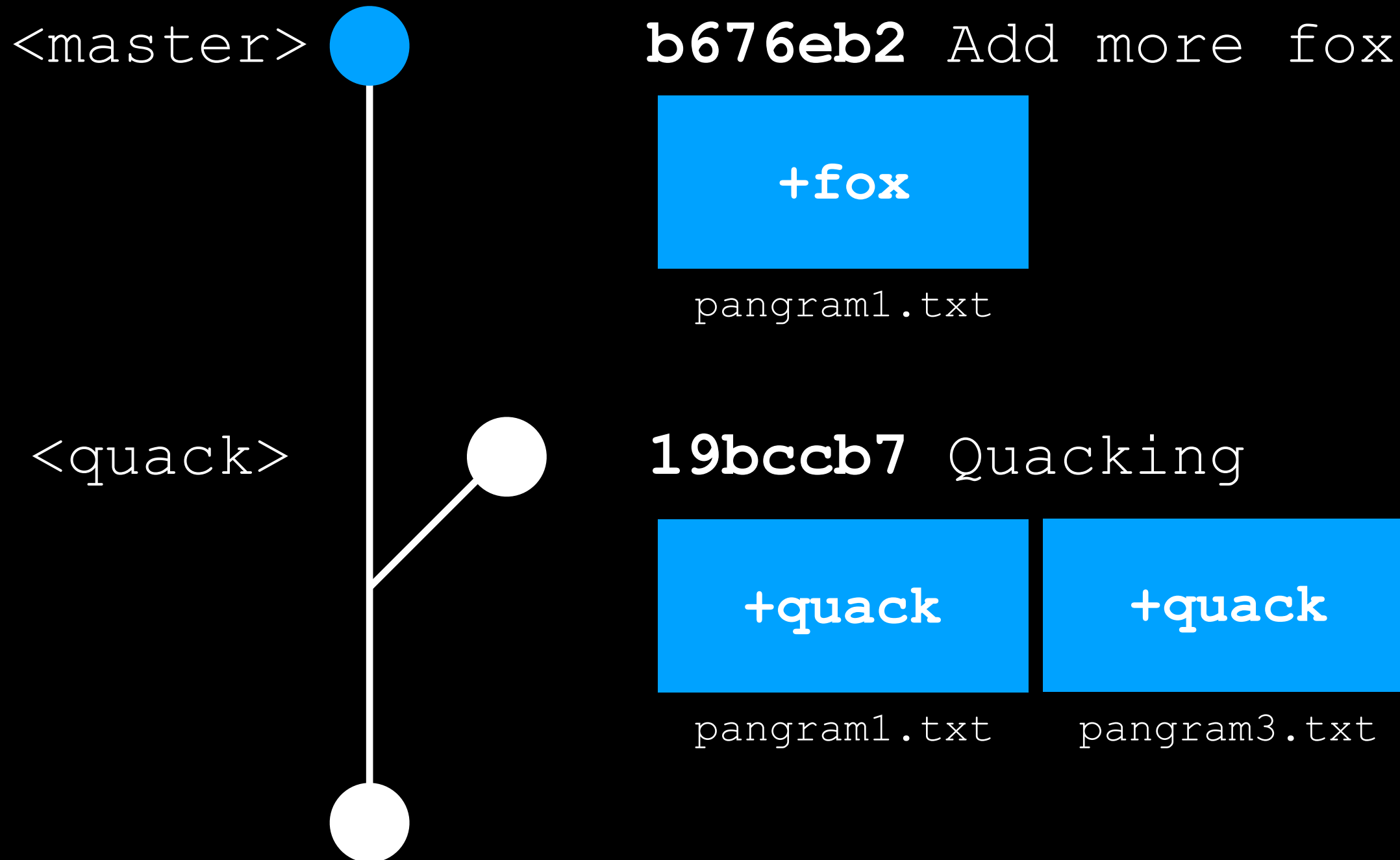
```
git checkout master
```

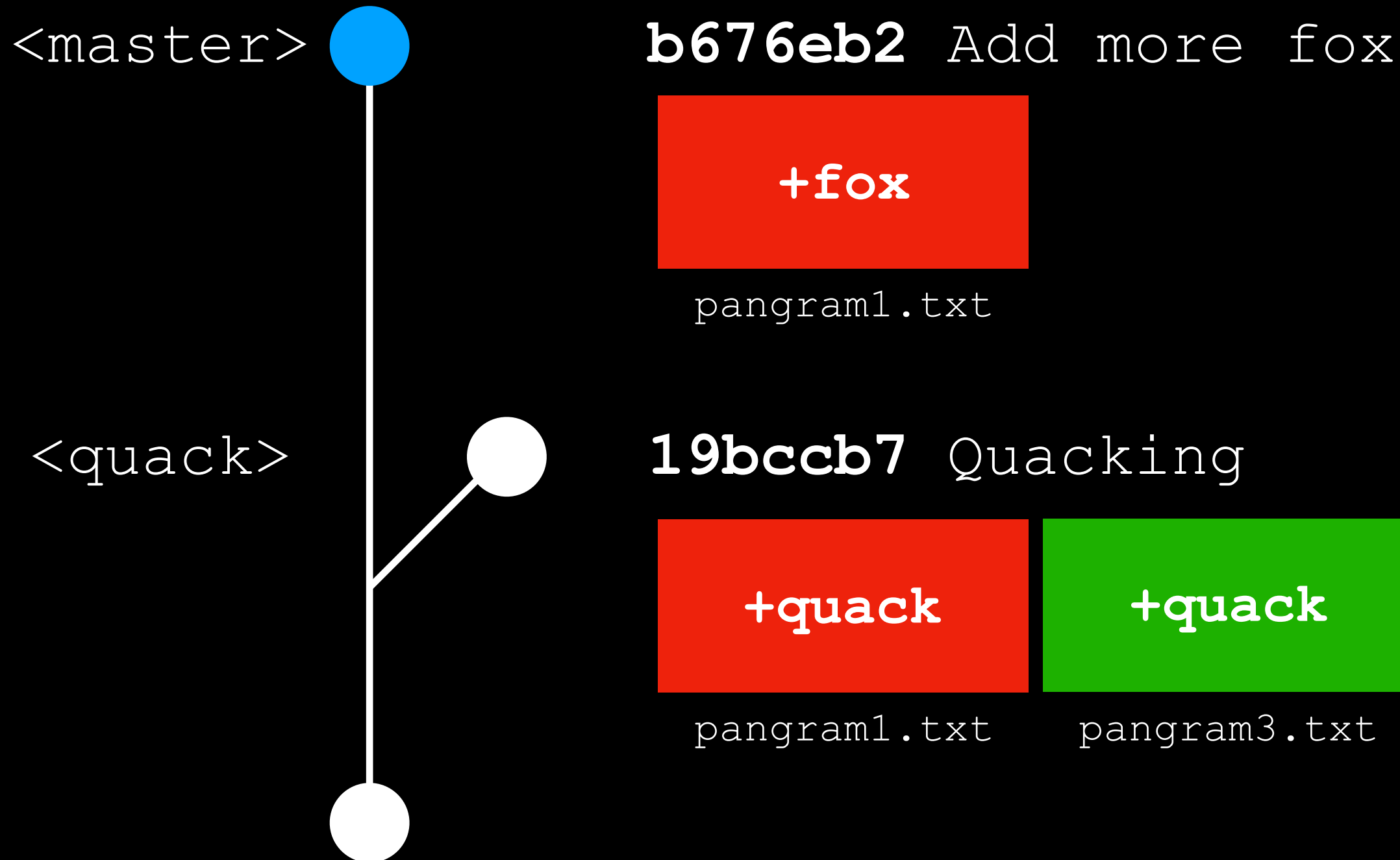


```
git checkout master
```









```
git merge quack
```

<master>

ff2ee03 Merge branch 'quack'

**b676eb2** Add more fox

<quack>

# 19bcb7 Quacking

```
git merge quack
```

<master>

**ff2ee03** Merge branch 'quack'

+fox  
+quack

pangram1.txt

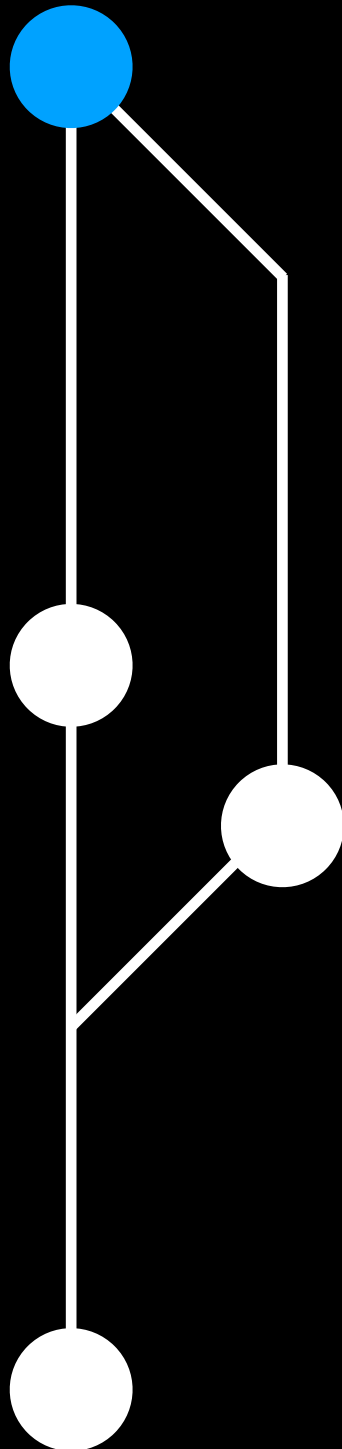
+quack

pangram3.txt

**b676eb2** Add more fox

<quack>

**19bccb7** Quacking



Demo

**Break**

# Restoring

What good is a history if you can't use it?

- This part is dependent on the commits you created earlier
- As before, this works best if you can follow along

# Checkout

One tool, many uses

## Changing position in the commit history

- `git checkout branch_name`
- `git checkout commit_id`

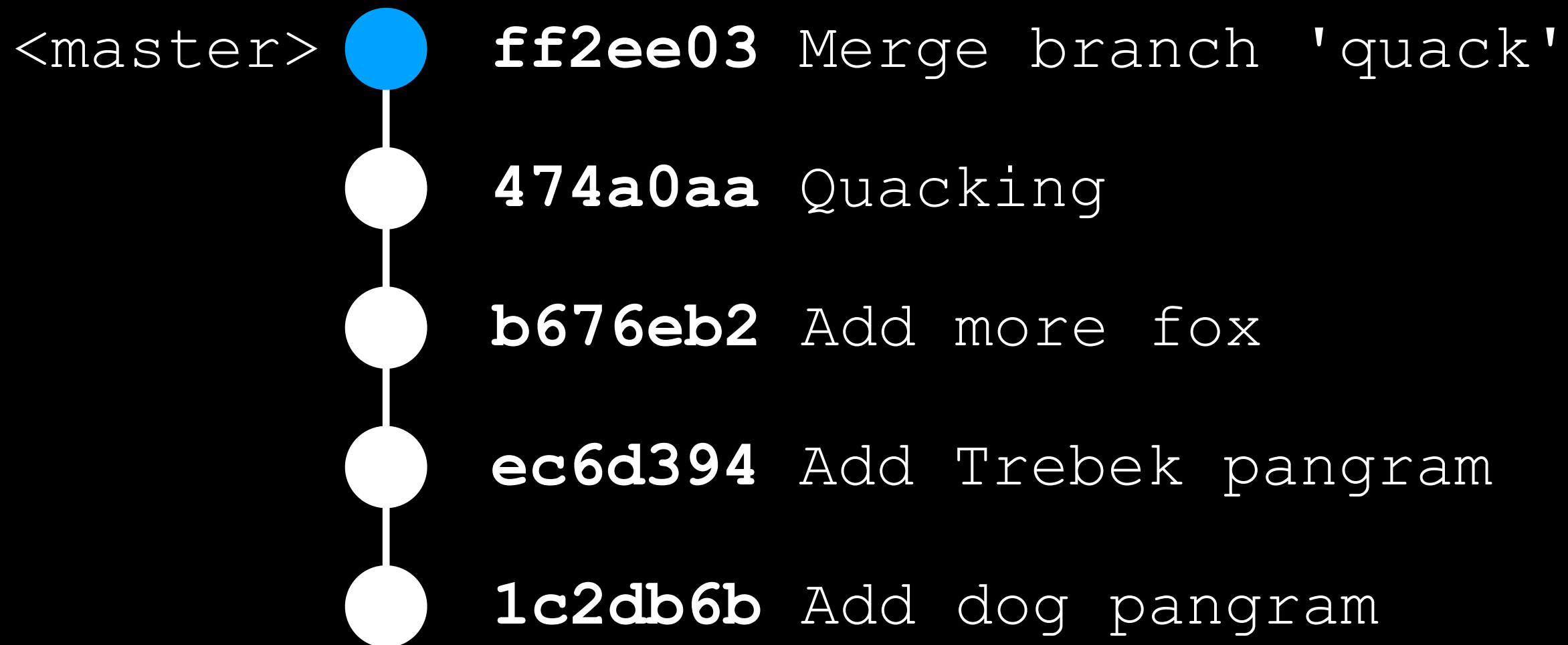
## Changing files only

- `git checkout -- file_name`
- `git checkout commit_id -- file_name`

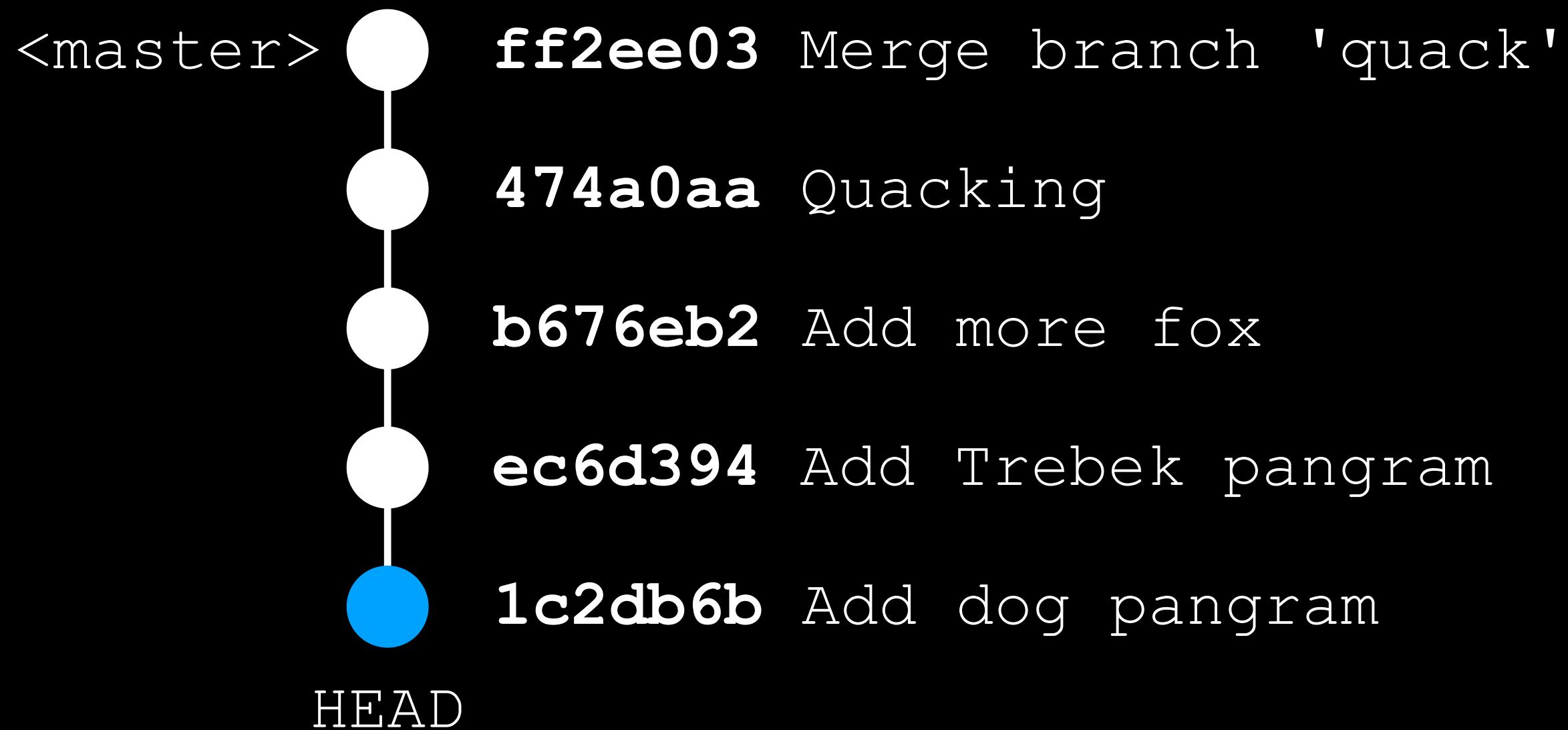


Demo

HEAD

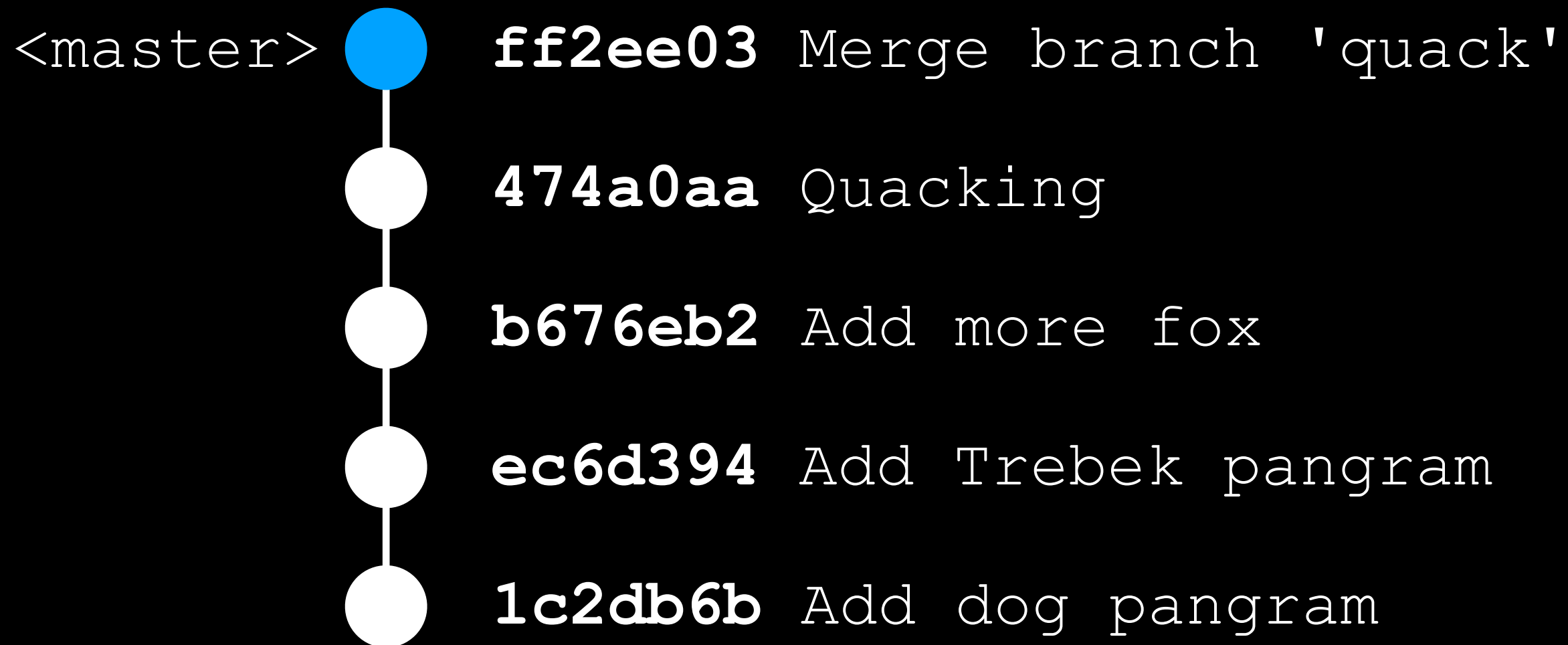


```
git checkout 1c2db6b
```



git checkout master

HEAD



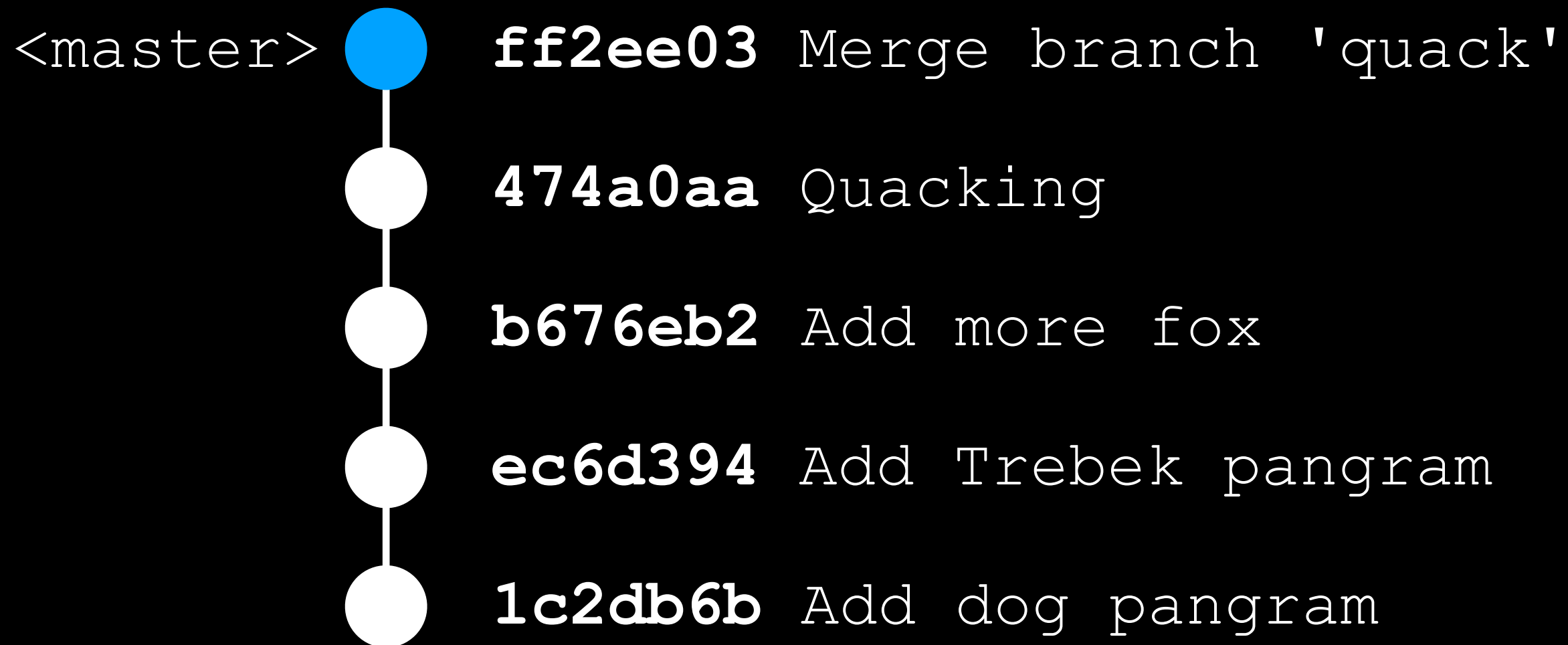
# Reset

Change branches

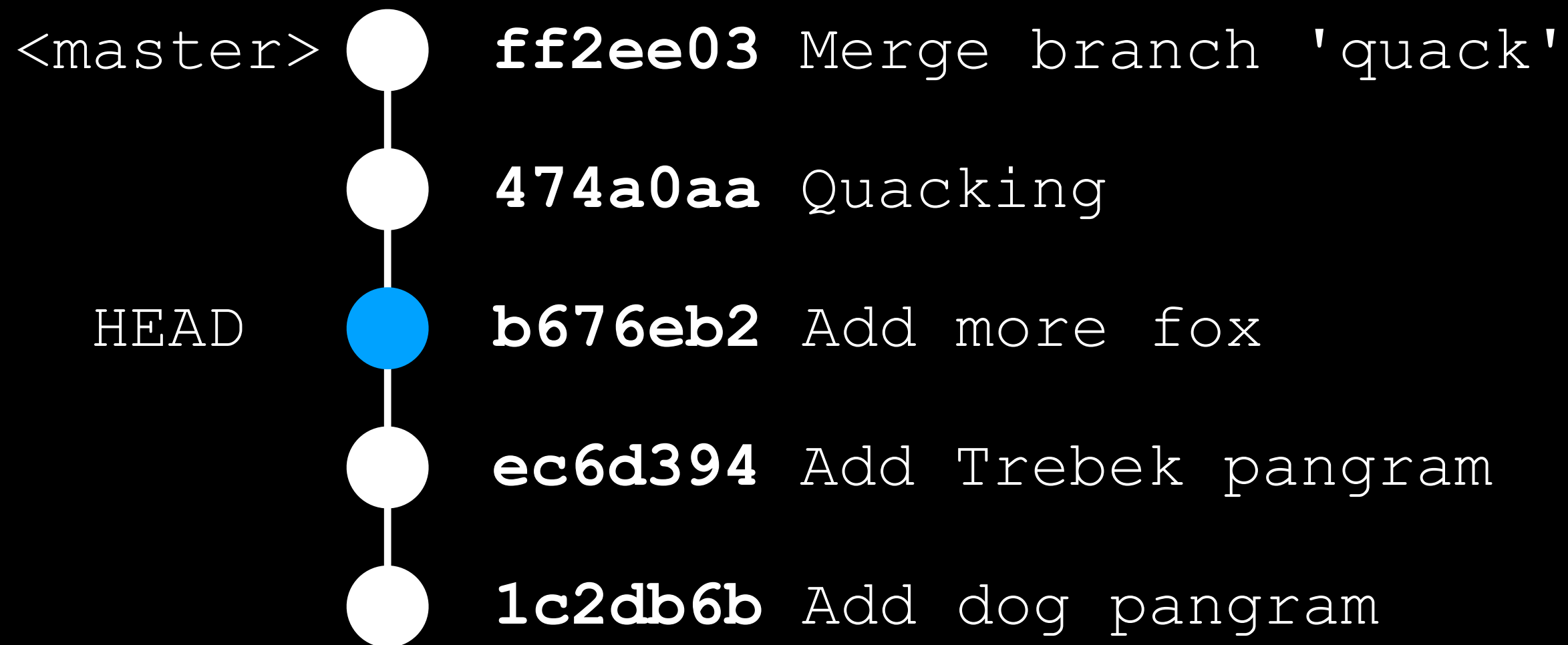
- Update the current head
- Also update the current branch to match (if applicable)

Demo

HEAD



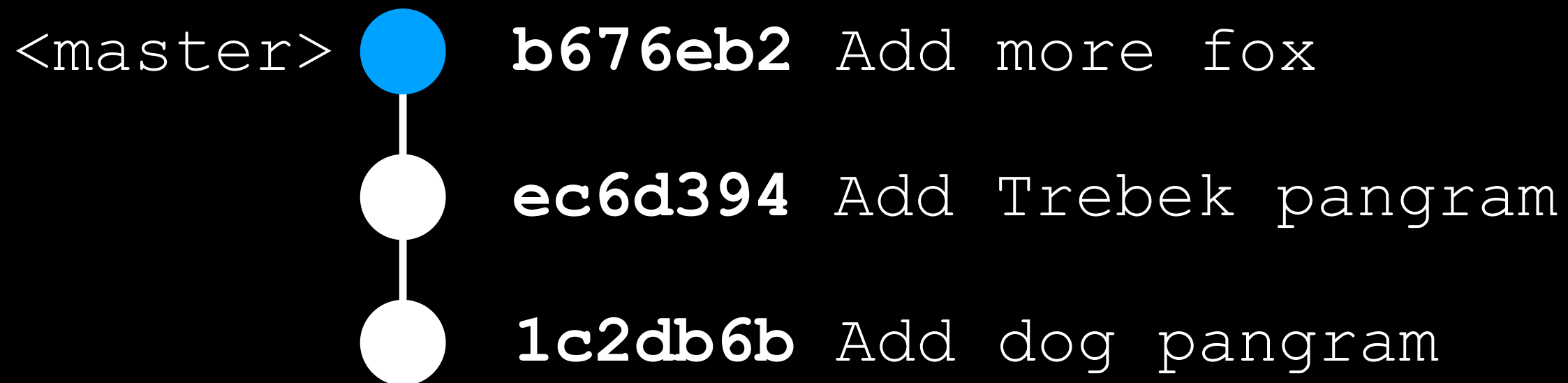
```
git reset b676eb2
```





```
git reset b676eb2
```

HEAD



# Reset vs Checkout

When applied to branches (not files):

- checkout changes the location of HEAD
- reset changes the location of HEAD AND updates branch

# Grab Bag

Three quick and useful tools

- `git diff`
- `git show`
- `git grep`

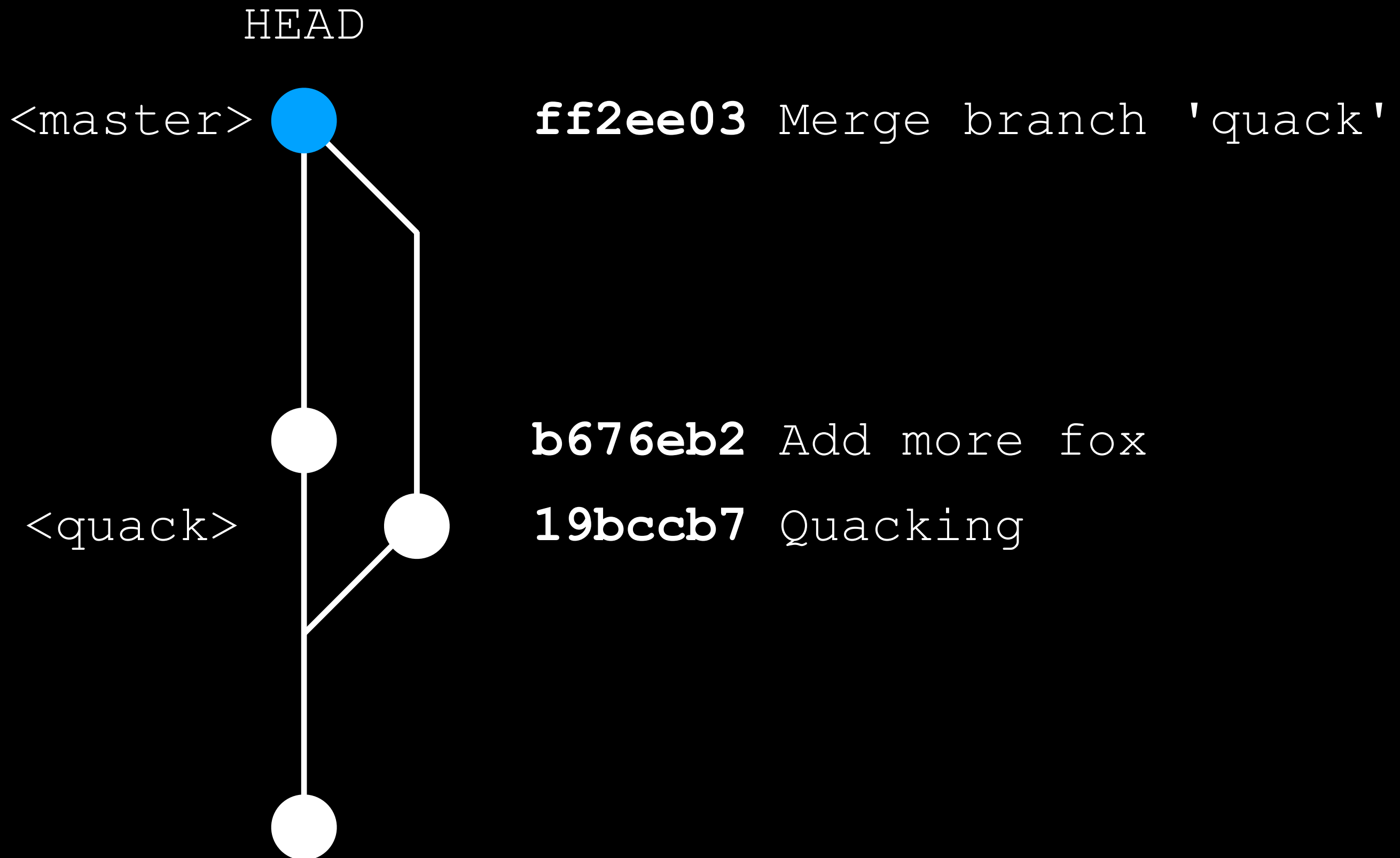
Demo

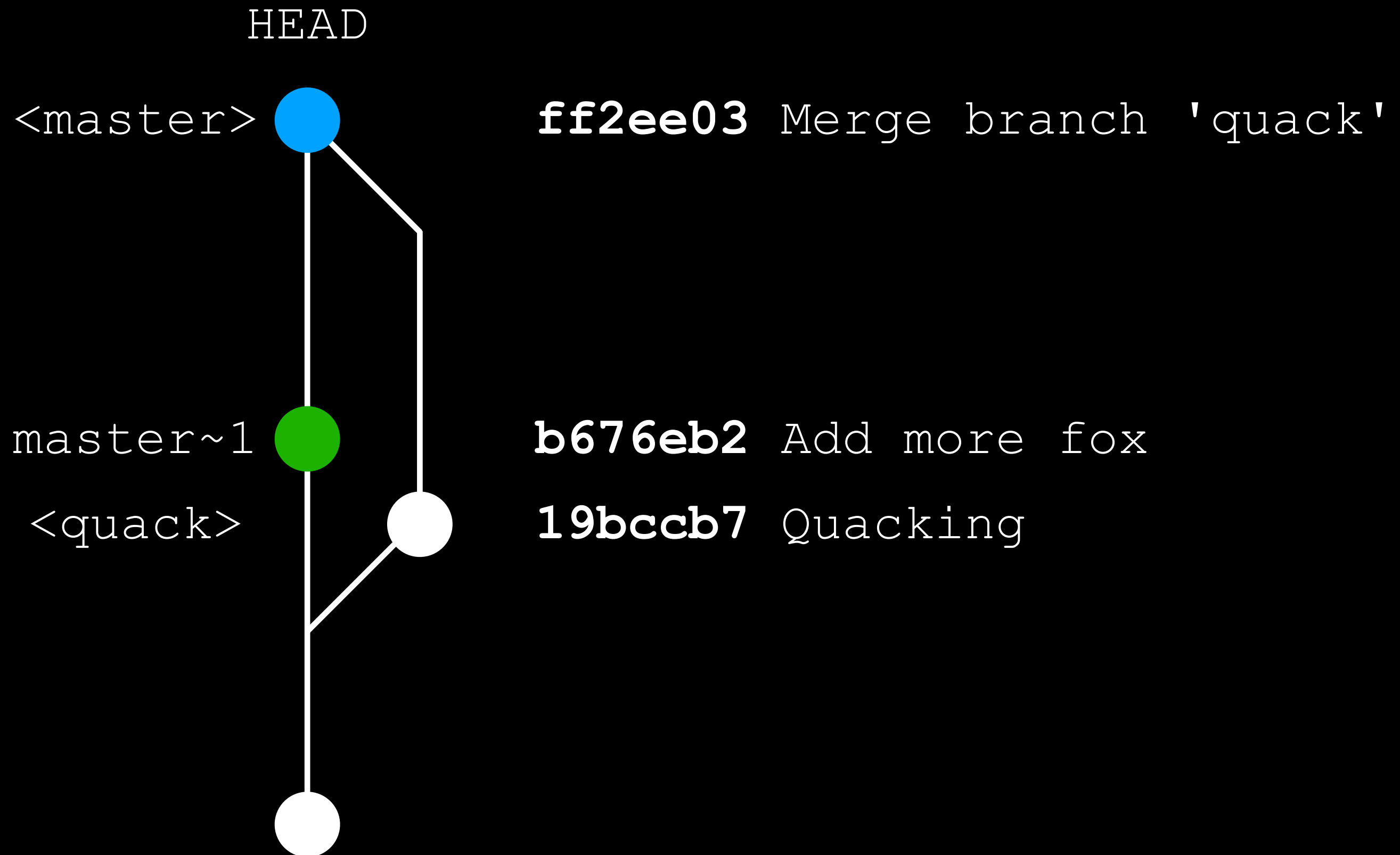
# Grab Bag

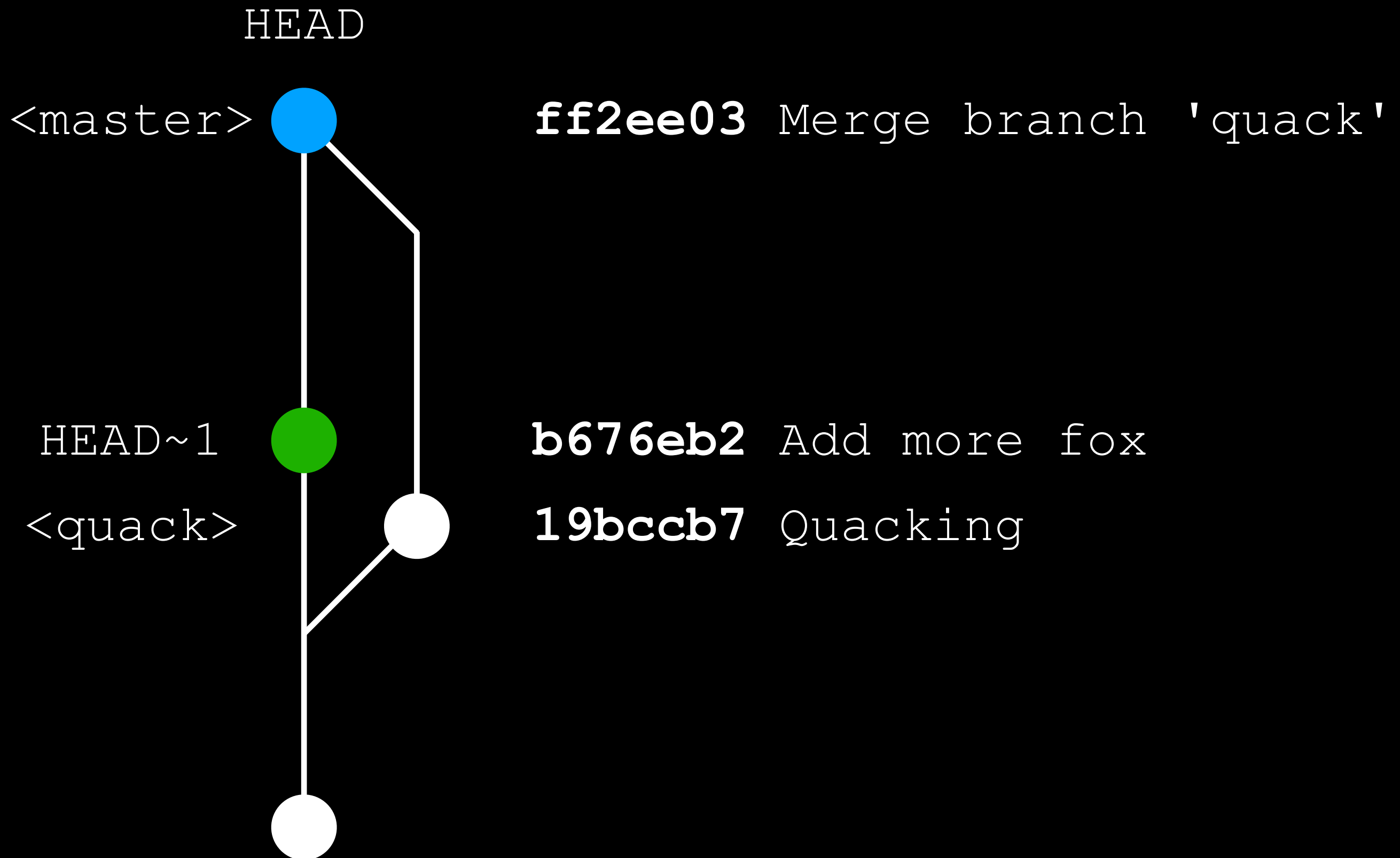
Relative references

Tilde (~) and caret (^)

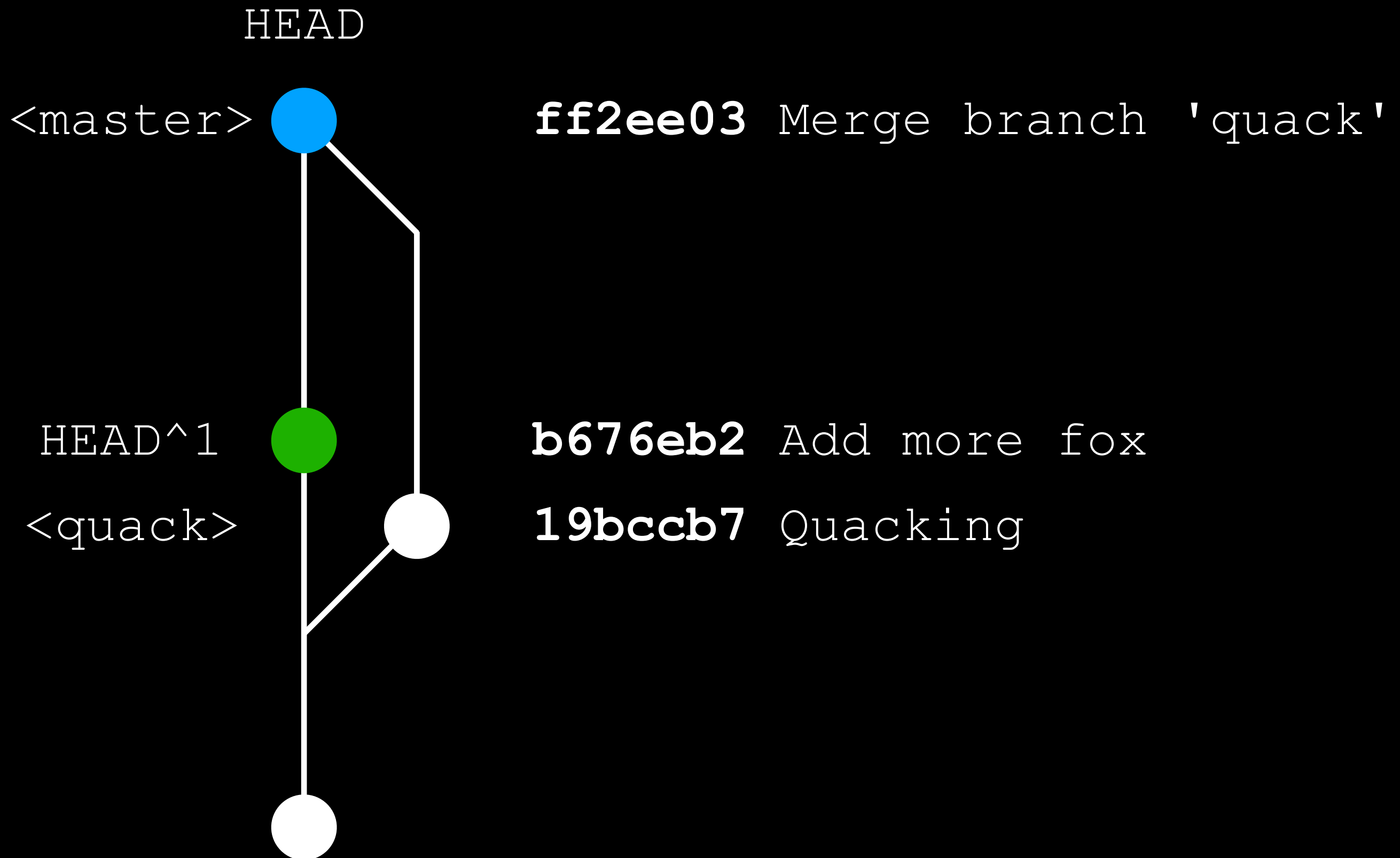
- `master~1`
- `HEAD^2`

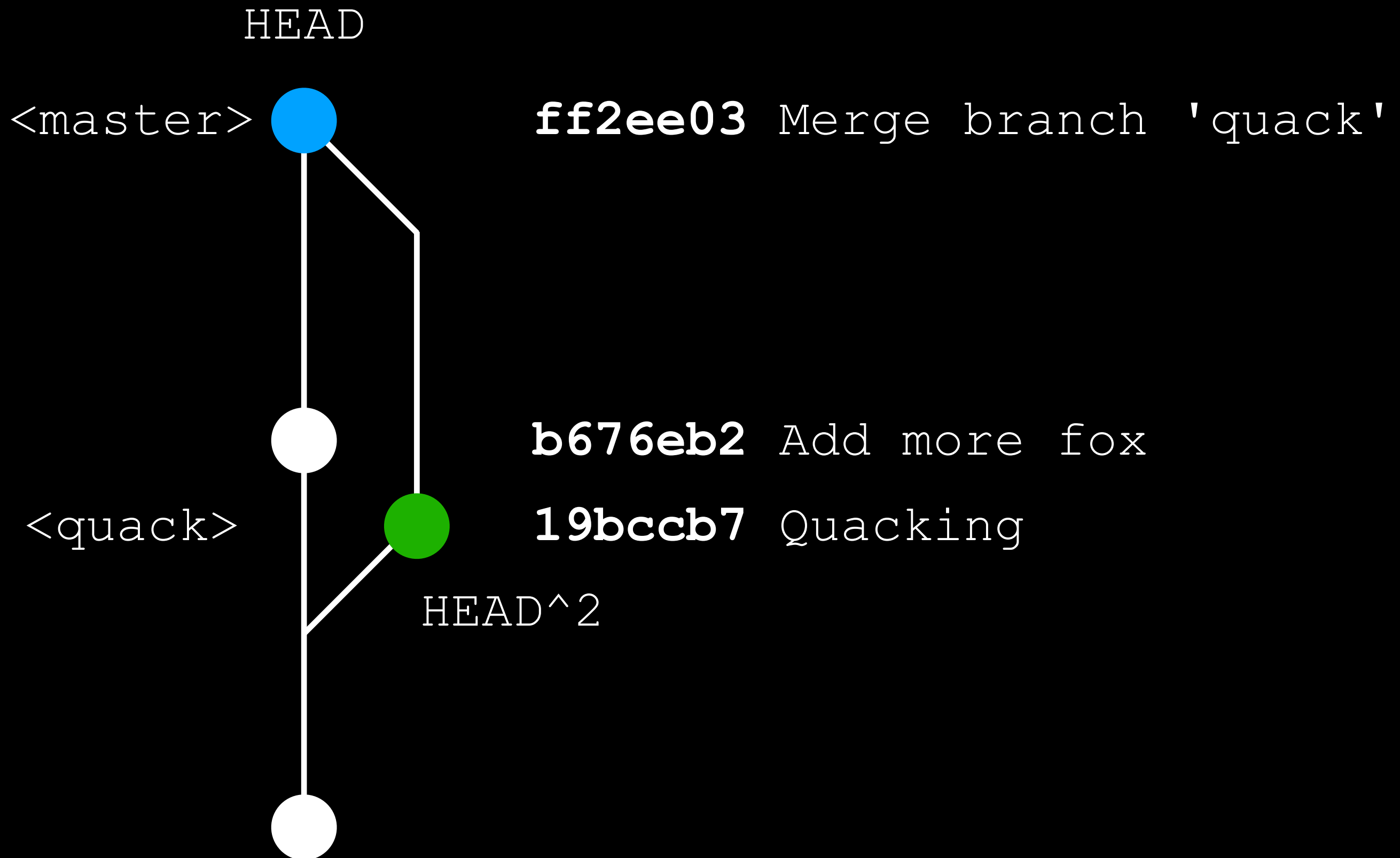












Demo

# In Summary

- `init`
- `add, commit`
- `log`
- `branch`
- `merge`
- `checkout, reset`
- `diff, show, grep`
- `master~1, HEAD^2`

# Congratulations

You now know enough Git to be dangerous

- Too dangerous actually
- You may want to periodically backup your work using more traditional methods until you're more comfortable

There's a lot more to  
learn

Cherry-pick

Interactive rebase

Rebasing a branch

Clean

Bisect

Creating patches

Reflog

.gitignore

Tag

Revert

Stashing changes

Blame

GitHub



# Let's get started

Please get your computer ready

This part is best if you have a computer to follow along with

If you don't, no worries — you can view the slides later

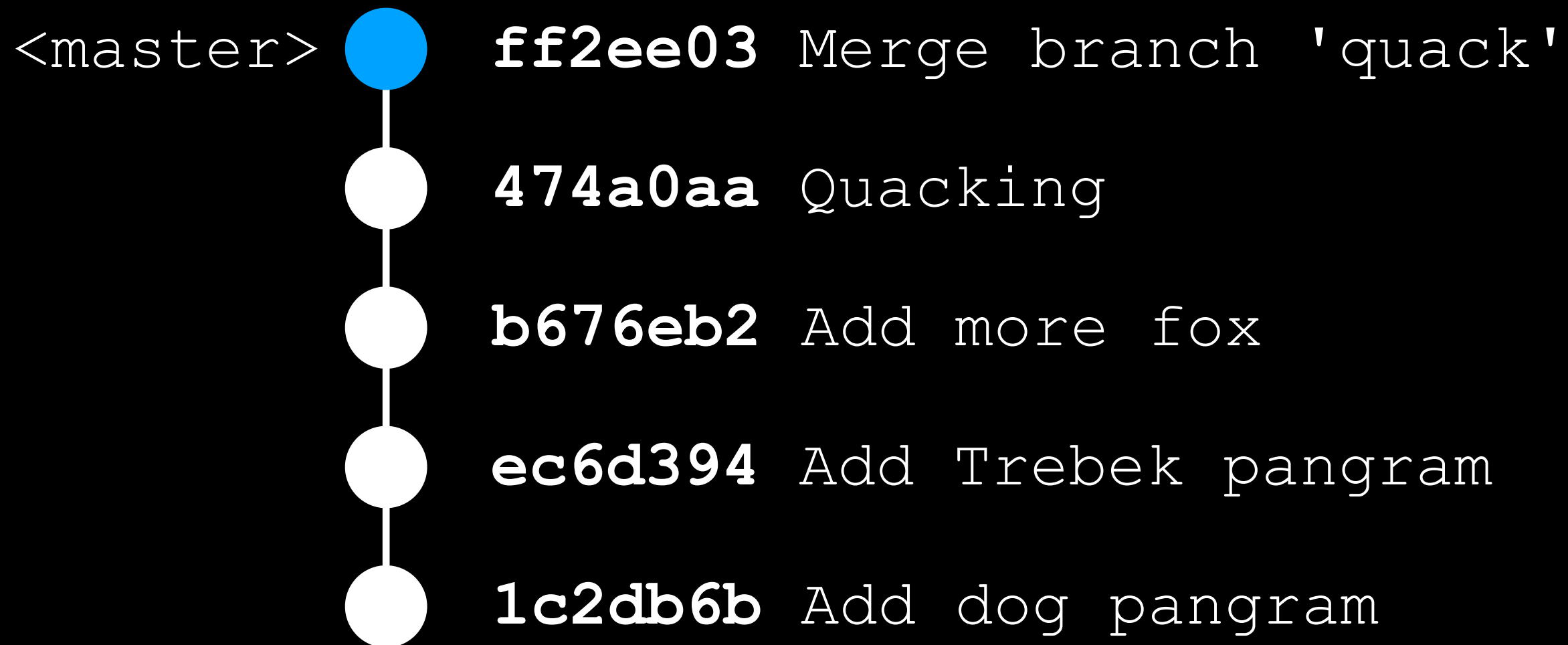
# Push and Pull

Commits will update local repository

Remote repository missing changes? **Push from local**

Updated content on remote repository? **Pull from remote**

HEAD





Local

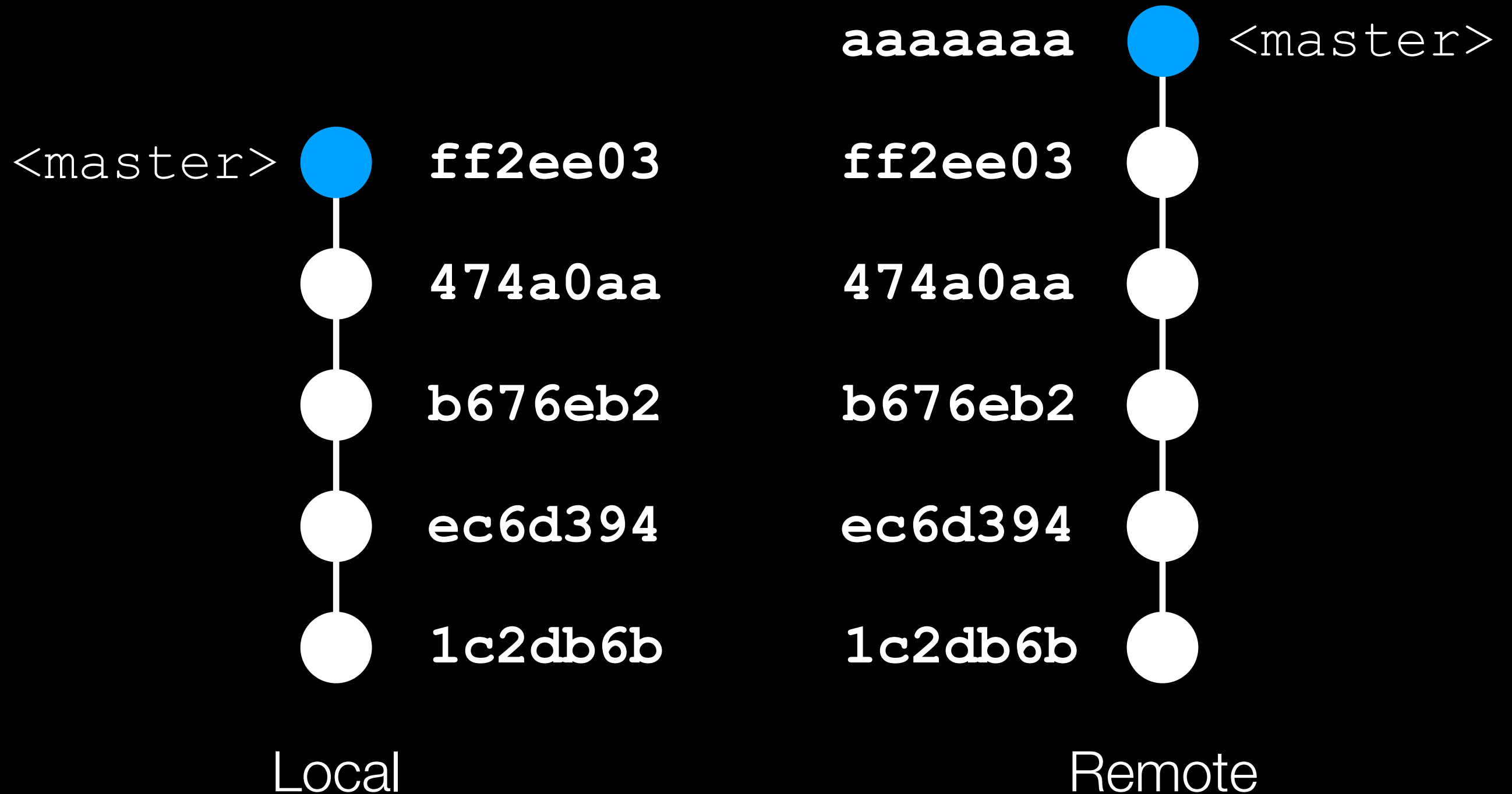
Remote

<master>

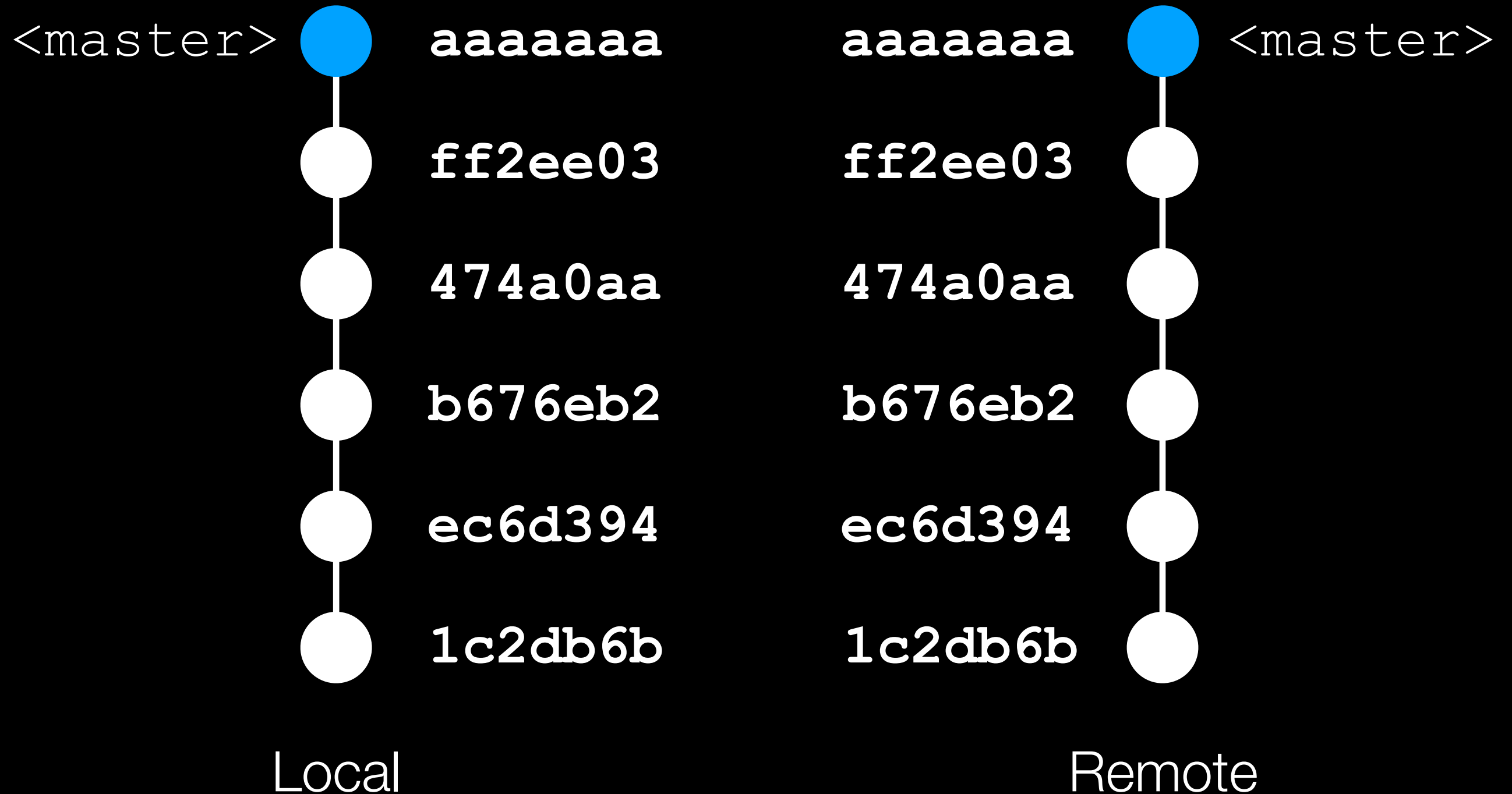
git push origin master



git commit (on another machine)



git pull origin master



Demo



# Putting it all together

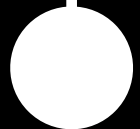
Finally, the real world

- Merge conflict example from before
- Now, different people changing the same branch

Demo



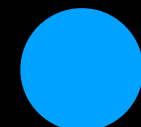
ff2ee03



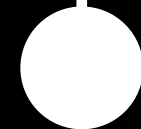
474a0aa

Jerry

Paul



ff2ee03



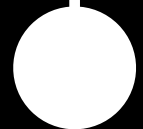
1c2db6b

GitHub

git clone

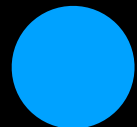


ff2ee03

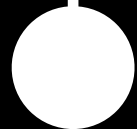


474a0aa

Jerry

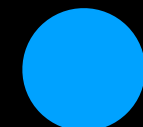


ff2ee03

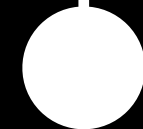


474a0aa

Paul



ff2ee03

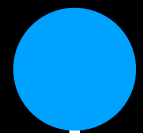


1c2db6b

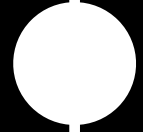
GitHub

git commit

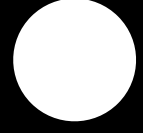
git commit



1111111

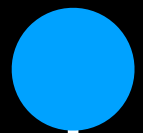


ff2ee03

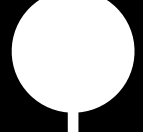


474a0aa

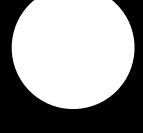
Jerry



aaaaaaaa

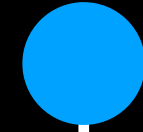


ff2ee03

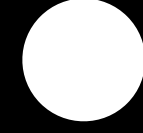


474a0aa

Paul



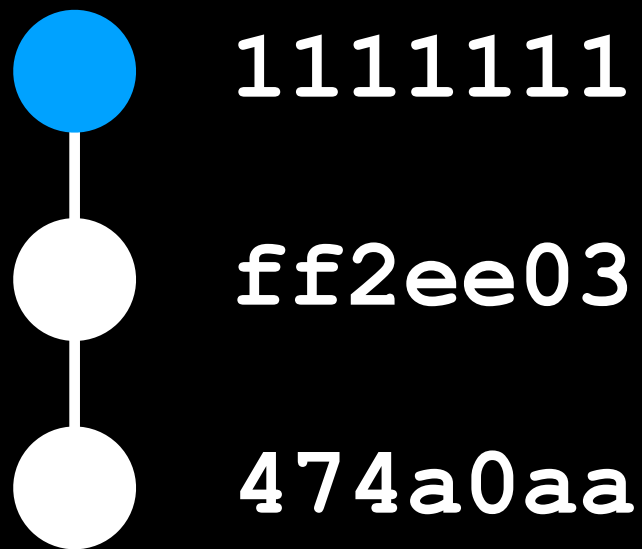
ff2ee03



1c2db6b

GitHub

git push

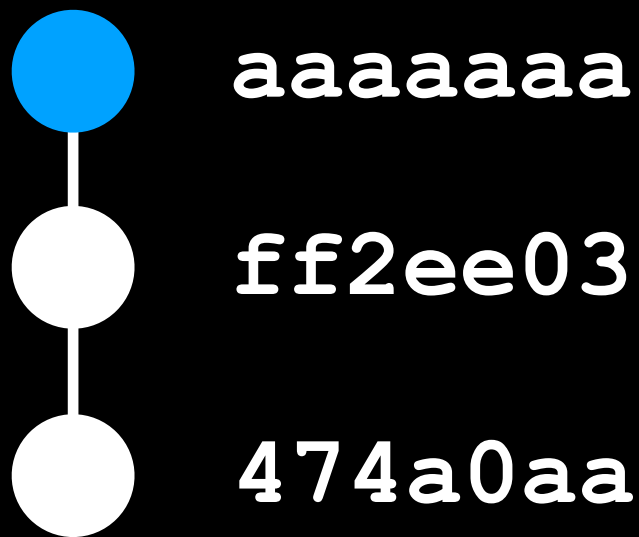


1111111

ff2ee03

474a0aa

Jerry

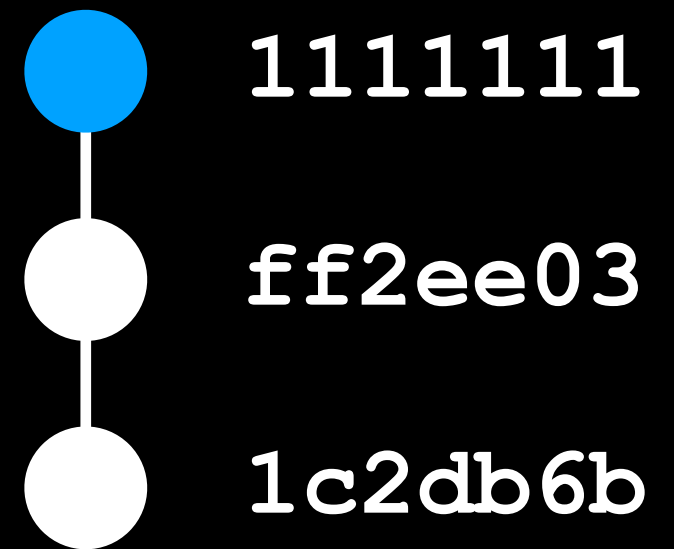


aaaaaaaa

ff2ee03

474a0aa

Paul



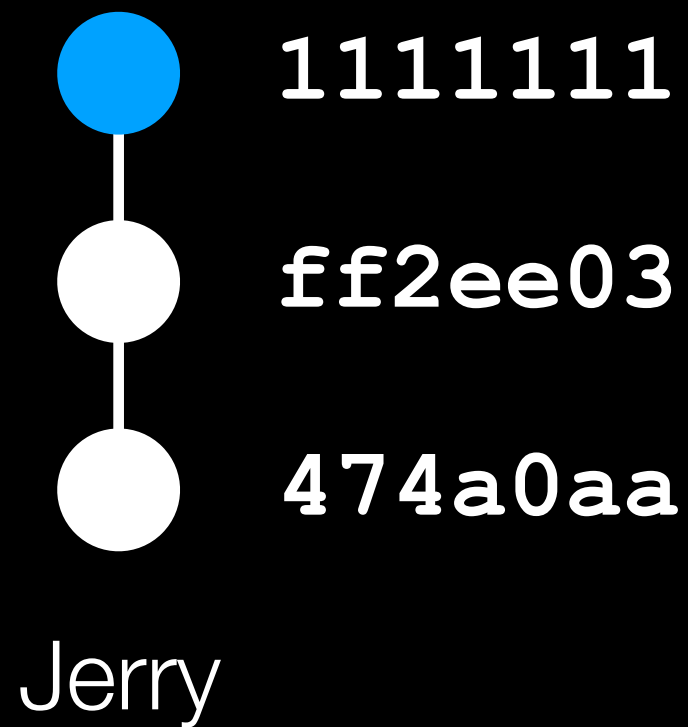
1111111

ff2ee03

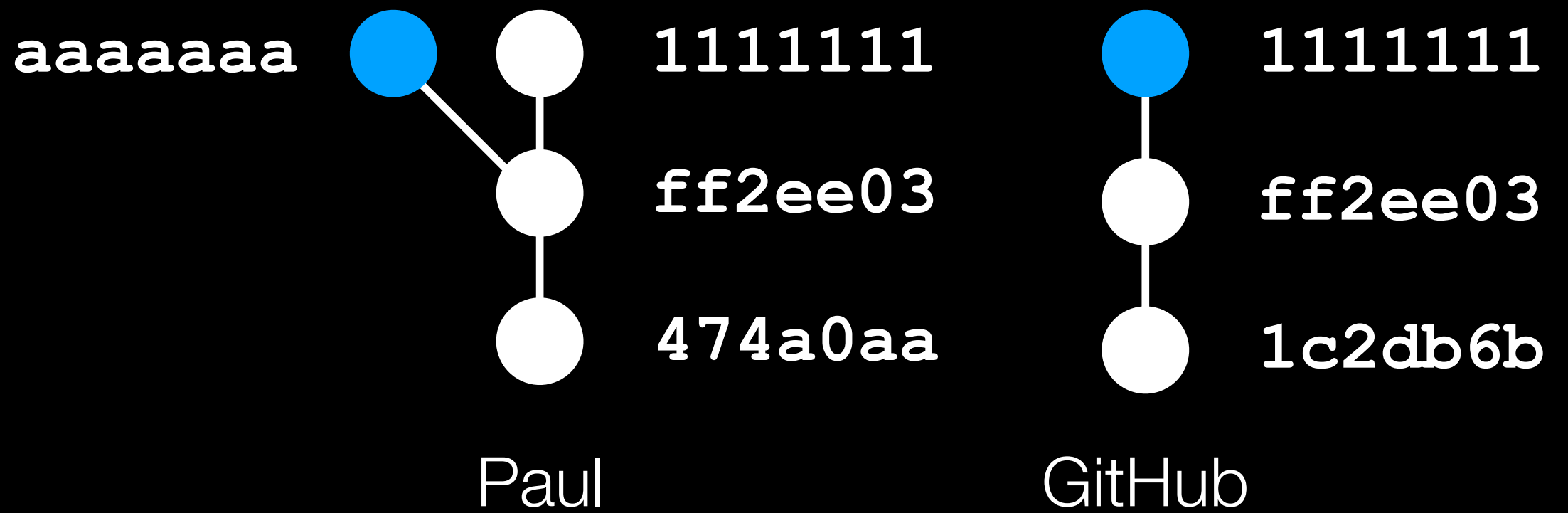
1c2db6b

GitHub

 git push

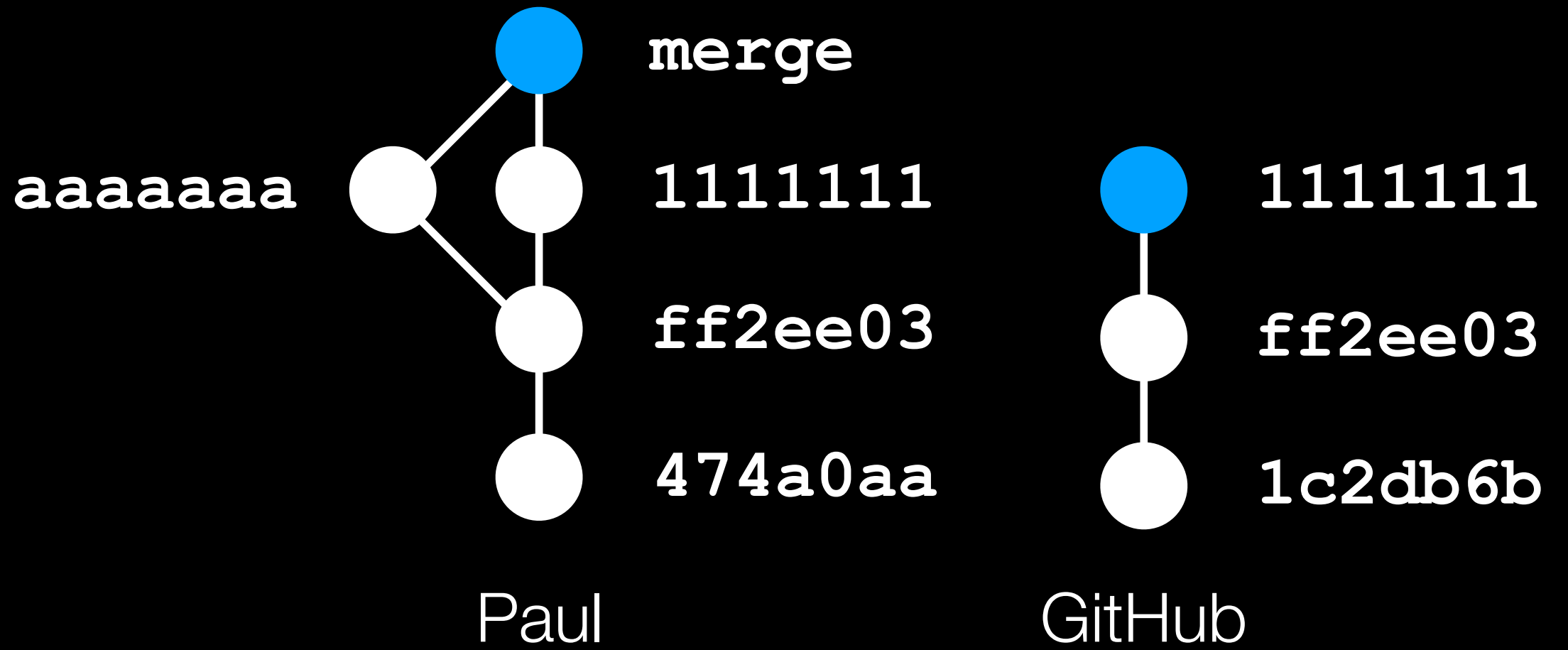


git pull

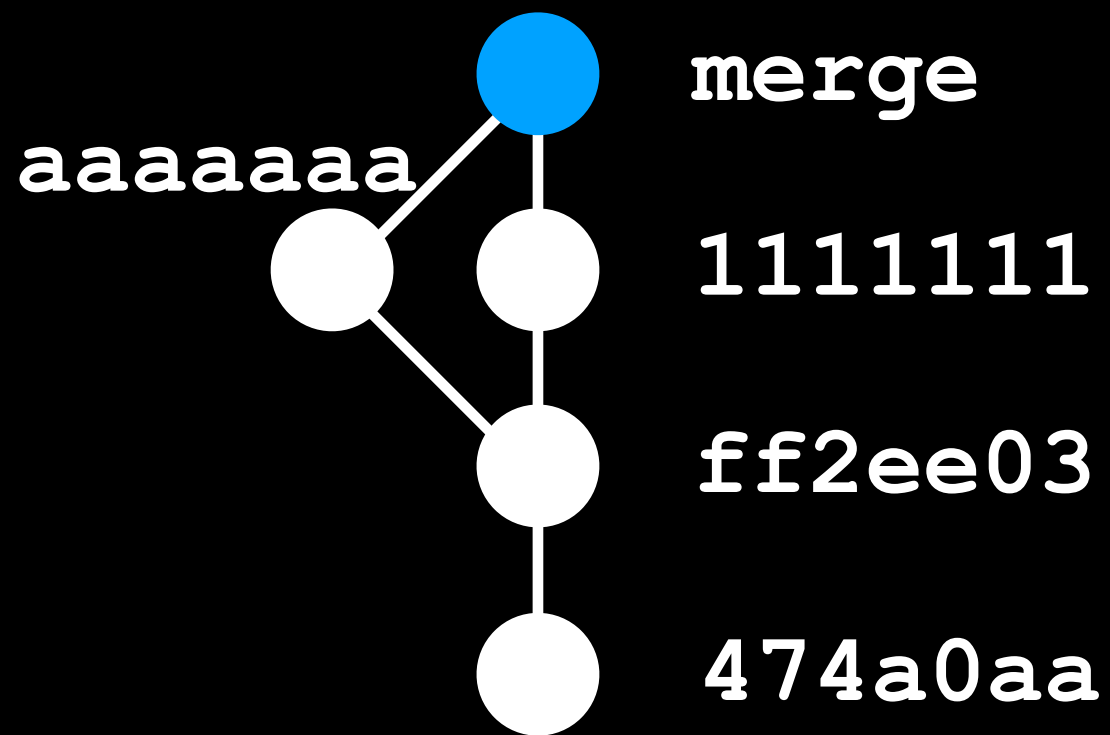




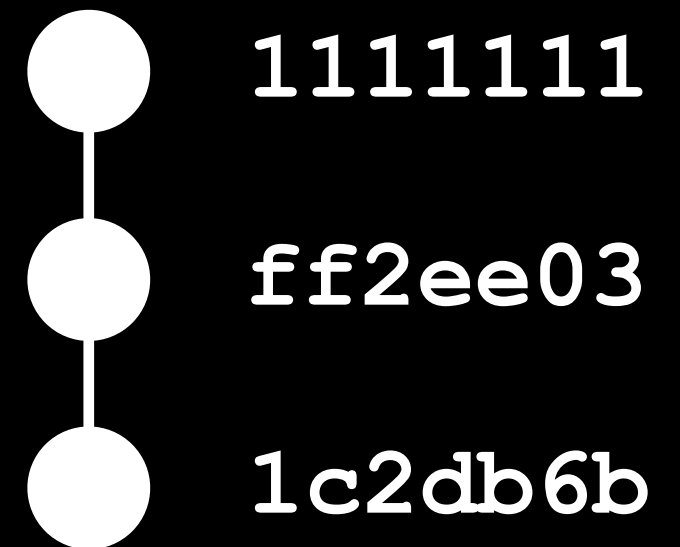
```
git pull
```



git push

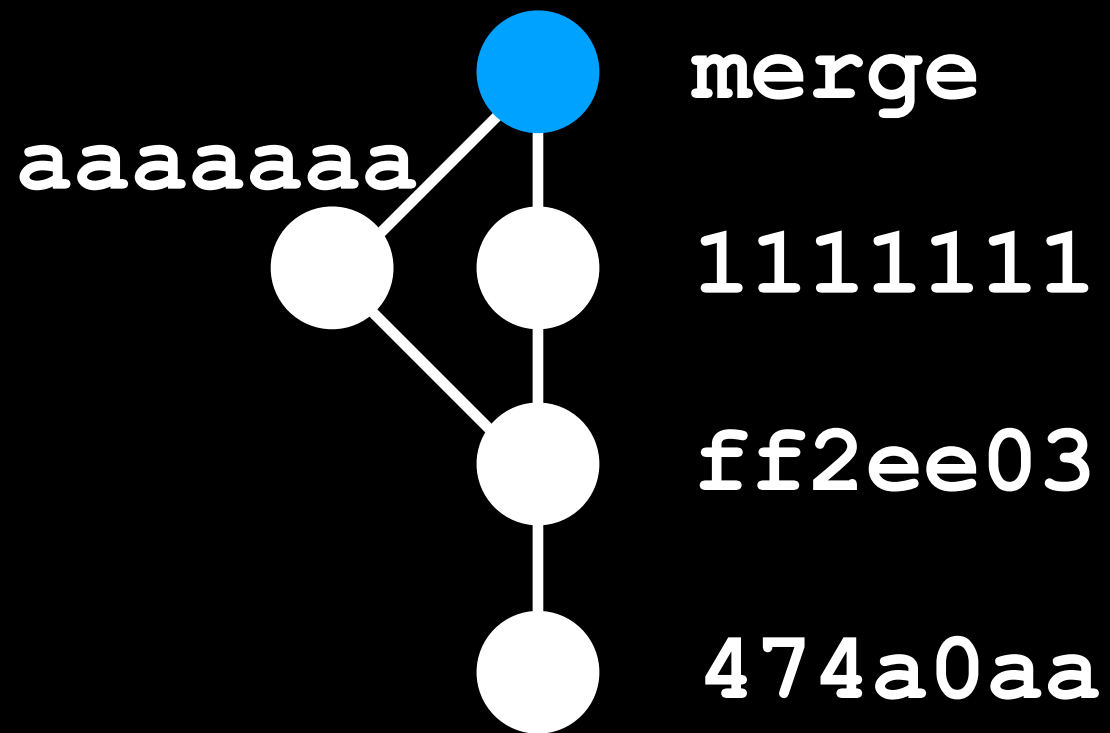


Paul

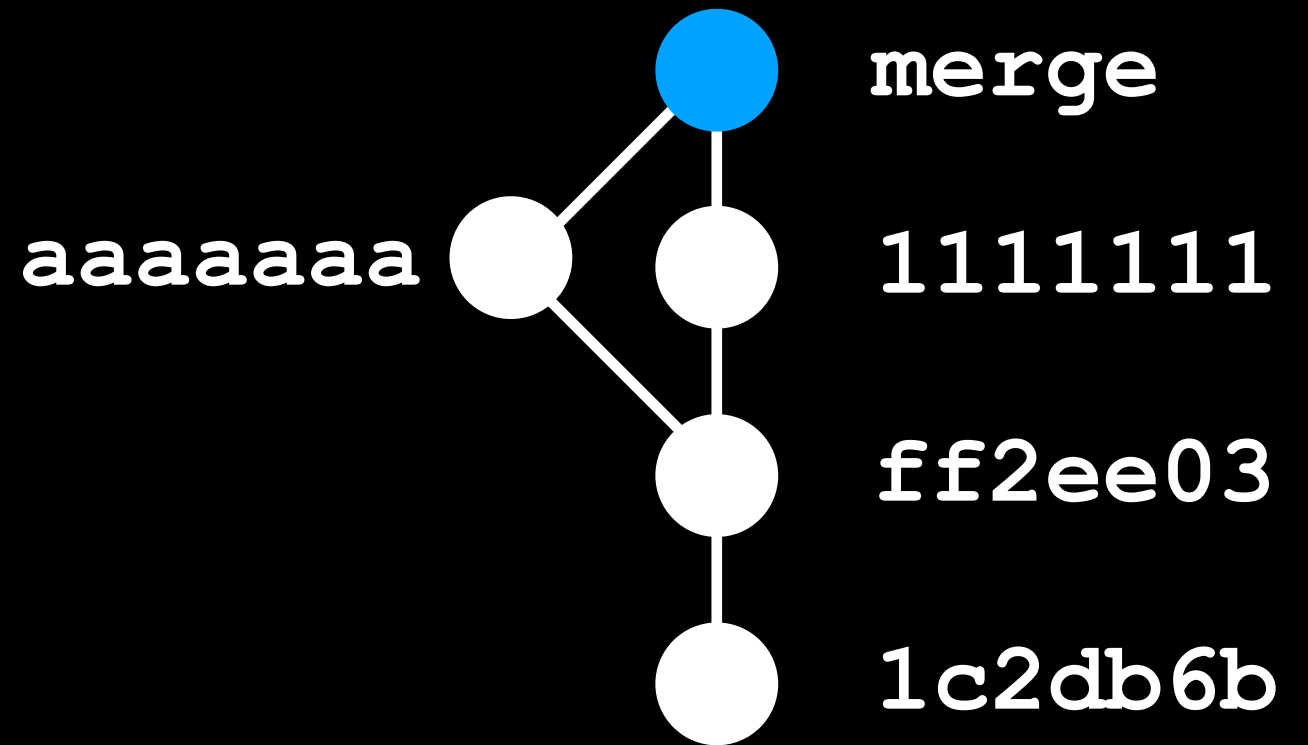


GitHub

git push



Paul



GitHub

Projects

GitLab

Signatures

Pull requests

Fork

Fetch

Issues

Organizations

Customizing remotes

ssh keys

Bitbucket

# Reference Material

# Miscellaneous

## Additional Resources

- GitHub's own tutorial: [guides.github.com/activities/hello-world/](https://guides.github.com/activities/hello-world/)
- Popular Git GUIs:
  - Git Tower: [git-tower.com](https://git-tower.com)
  - SourceTree: [source-treeapp.com](https://source-treeapp.com)
- Digital signatures for commits: <https://help.github.com/articles/signing-commits-using-gpg/>
- Git plugin for ohmyzsh (also install themes with Git goodies): <https://github.com/robbyrussell/oh-my-zsh/blob/master/plugins/git/git.plugin.zsh>
- Writing good commit messages: <https://chris.beams.io/posts/git-commit/>