git

## Cheat sheet

git checkout -b myBranch

(make changes)

git checkout master

git pull

git merge myBranch

Fix conflicts

git push

## Overview

- Collaborative development
- Version Control
- Git
- Methods
- Best practices

## Objectives

- Know about different version control systems.
- Understand why git is the best.
- Don’t be a jerk to your group members.

## Collaborative development

- Software development model
- Focus on availability and communication
- Started with the linux kernel in ‘95
- Enables mass peer review
- Facilitates specialization
- Involves users

## Collaborative development

- Not unique to software development.
- **Your chosen profession.**
- How all good things are built.

IF YOU WANT TO GO FAST, GO ALONE
IF YOU WANT TO GO FAR, GO TOGETHER.

## linux runs everything

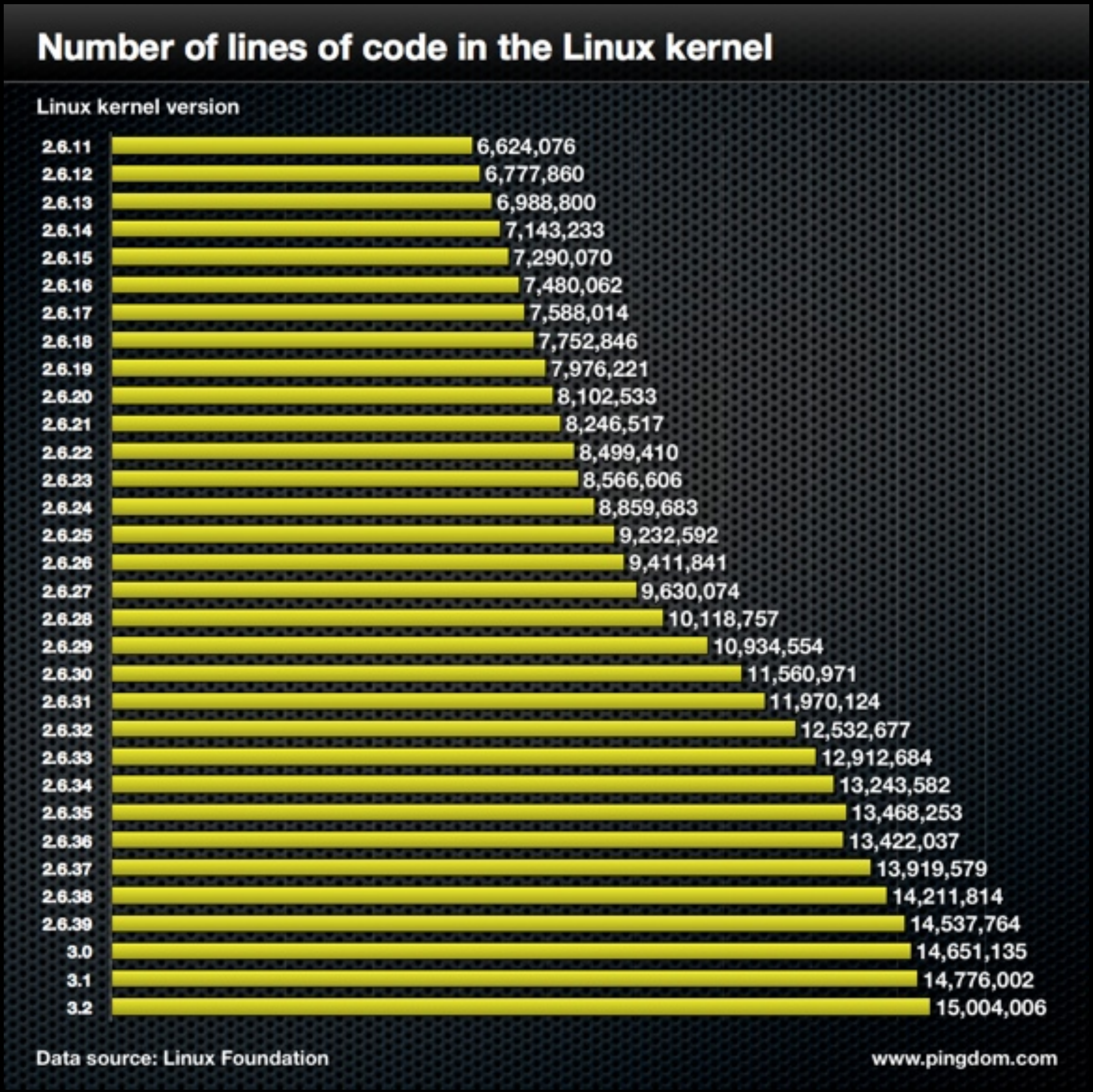
- your tv
- your car
- your bank
- your phone
- air traffic control
- nuclear submarines
- most of the global economy

## seriously…

- 1.3 million smart phones
- 700,000 televisions
- 92% of the worlds high performance computing systems: weather, cern, nasa
- 85% of the global economic trading systems

## ...

- facebook
- google
- amazon
- twitter
- apple


Number of lines of code in the Linux kernel
Linux kernel version
2.6.11 6,624,076
2.6.12 6,777,860
2.6.13 6,988,800
2.6.14 7,143,233
2.6.15 7,290,070
2.6.16 7,480,062
2.6.17 7,588,014
2.6.18 7,752,846
2.6.19 7,976,221
2.6.20 8,102,533
2.6.21 8,246,517
2.6.22 8,499,410
2.6.23 8,566,606
2.6.24 8,859,683
2.6.25 9,232,592
2.6.26 9,411,841
2.6.27 9,630,074
2.6.28 10,118,757
2.6.29 10,934,554
2.6.30 11,560,971
2.6.31 11,970,124
2.6.32 12,532,677
2.6.33 12,912,684
2.6.34 13,243,582
2.6.35 13,468,253
2.6.36 13,422,037
2.6.37 13,919,579
2.6.38 14,211,814
2.6.39 14,537,764
3.0 14,651,135
3.1 14,776,002
3.2 15,004,006
Data source: Linux Foundation
www.pingdom.com

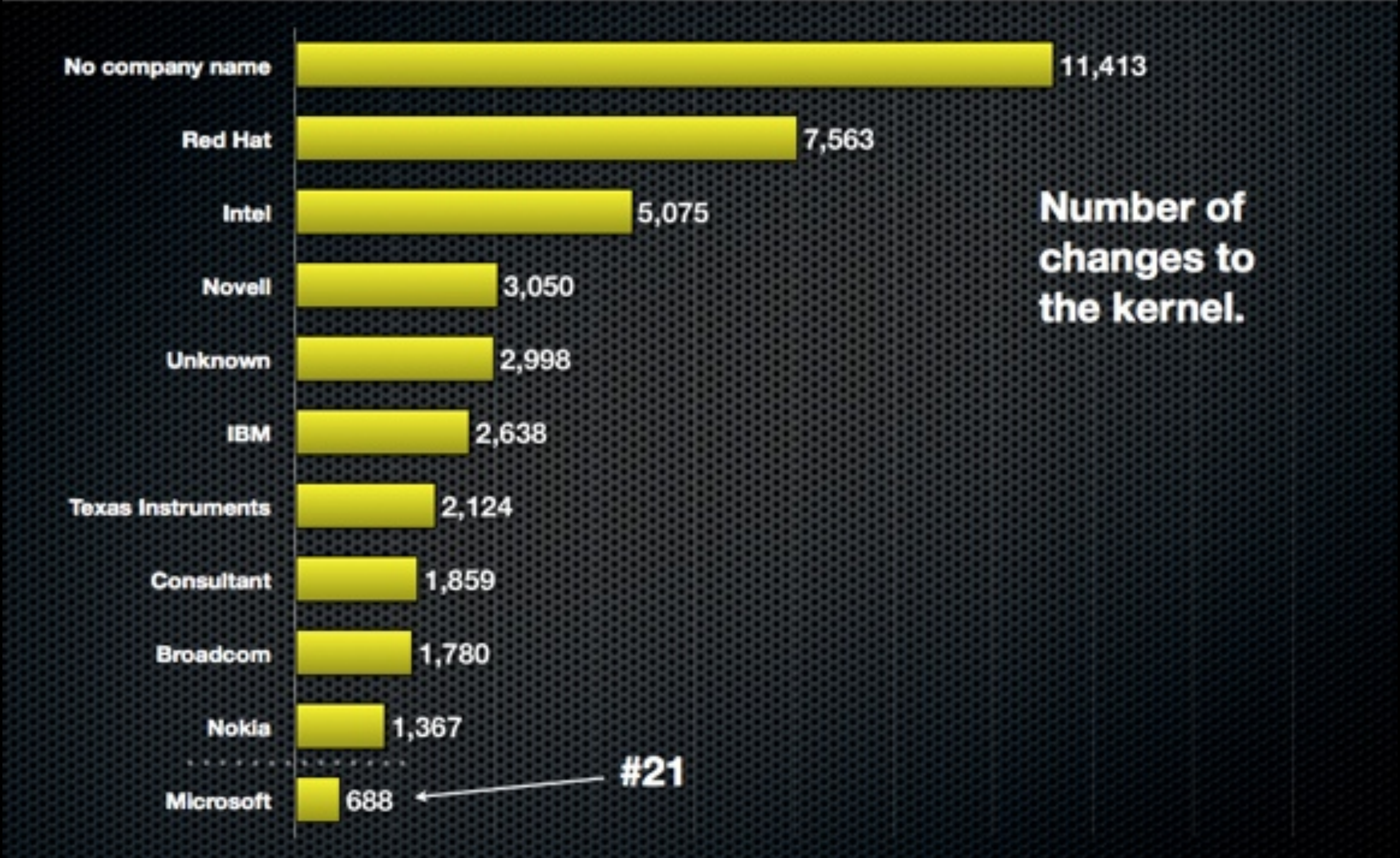
Linux was built gradually and collaboratively.

## kernel version 3.2.

1,316 developers

226 known companies

## Top 10 contributors to the Linux kernel since version 2.6.36



Data source: Linux Foundation

www.pingdom.com

This wouldn’t work without a system.

# Linus Torvalds

- Created the linux kernel.
- Linux kernel maintenance changes to the software were passed around as patches and archived files.
- Used bit keeper (DVCS) for a while.
- Made git
- Today about 6% of the linux kernel is Linus’s code.

Many eyeballs make all bugs shallow

# VCS

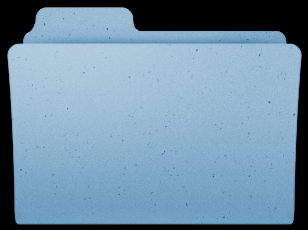
## synonyms

- source control
- revision control
- version control
- source code control systems
- distributed version control systems

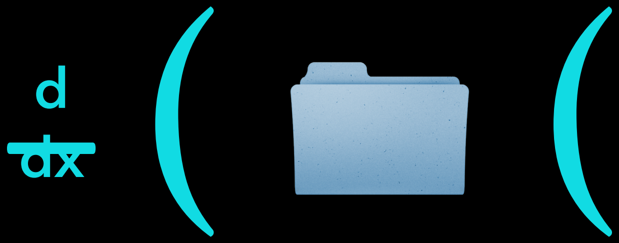
## network types

- none

- centralized



- distributed



## no network

- one file at a time
- locks a file when accessed
- one central development environment
- one shared point of failure

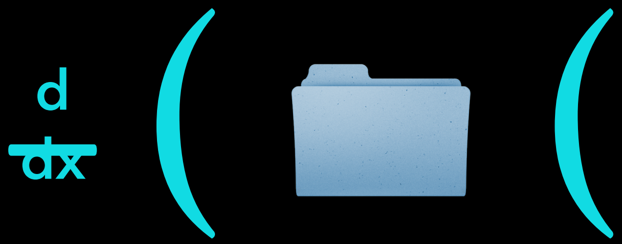
    - RCS, SCCS

## centralized

- multiple files at a time
- stores change sets irrespective of their files
- one central development environment
- one shared point of failure

    - SourceSafe, Subversion, CVS

## distributed



- everyone has the whole repository
- change sets
- independent, local development environments
- available offline

  - Bitkeeper, Bazaar, Git, Mercurial

## branches

- everyone has the whole repository
- safe, independent development environments

## merging branches

- recursive
  - normal merge
- octopus
  - merges multiple heads in one commit as long as it can do it cleanly.
- ours
  - keeps the history of a branch without any of the effects of the branch.
- subtree
  - merge in another project into a subdirectory of your current project.

## git vs. subversion

- Git is much faster
- Subversion allows you to check out just a subtree of a repository; Git requires you to clone the entire repository.
- Git's repositories are ~30x smaller.
- Git branches are simpler and require fewer resources.
- Git branches carry their entire history.
- Subversion's UI is more mature than Git’s.
- Git provides better auditing of branch and merge events.

## git is awesome

- distributed
- flexible
- secure
- simple
- local
- light-weight
- fast

## distributed

- each individual machine is a development environment and has the whole repository
- allows for offline development

## flexible

- Many different work flows.
- Adapts to your needs.
- Various intelligent merge methods.

## secure

- Stores change sets as hashes.
- requires authentication for pushing and pulling.

## simple

- You guys did Homework 1.
- That’s most of it.

## local

- Everyone has their own independent development environment.
- Break the build all day long, your team mates won’t notice.

## light-weight

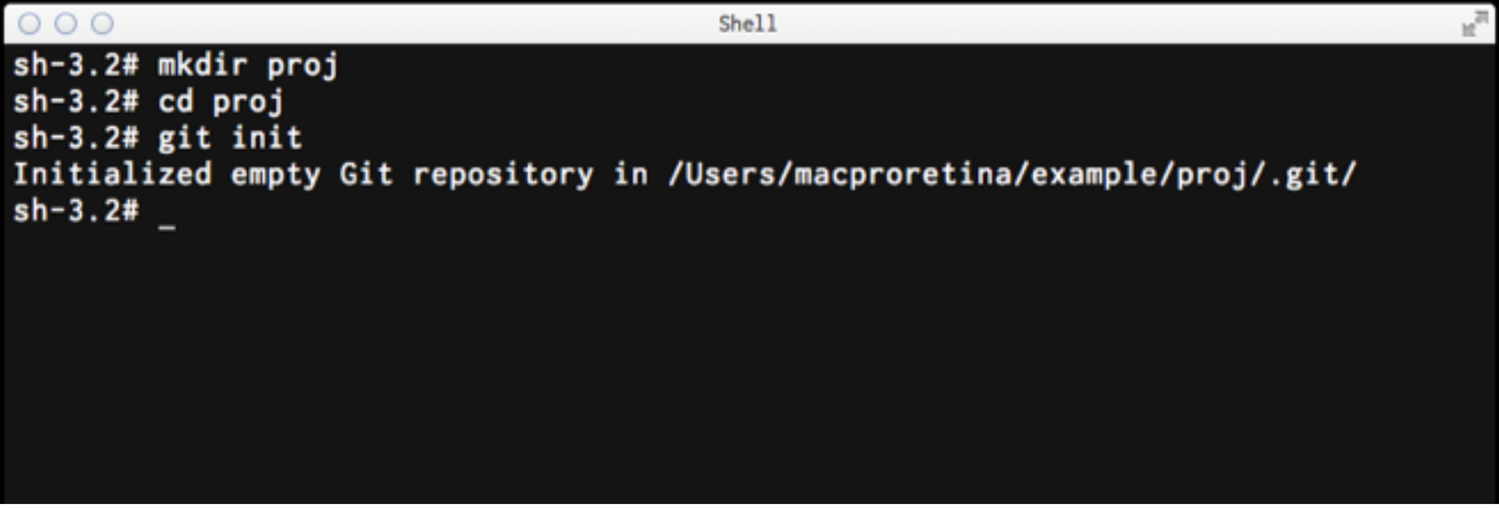
- Mozzila’s git repository is ~30x smaller than the same content in SVN.

## fast

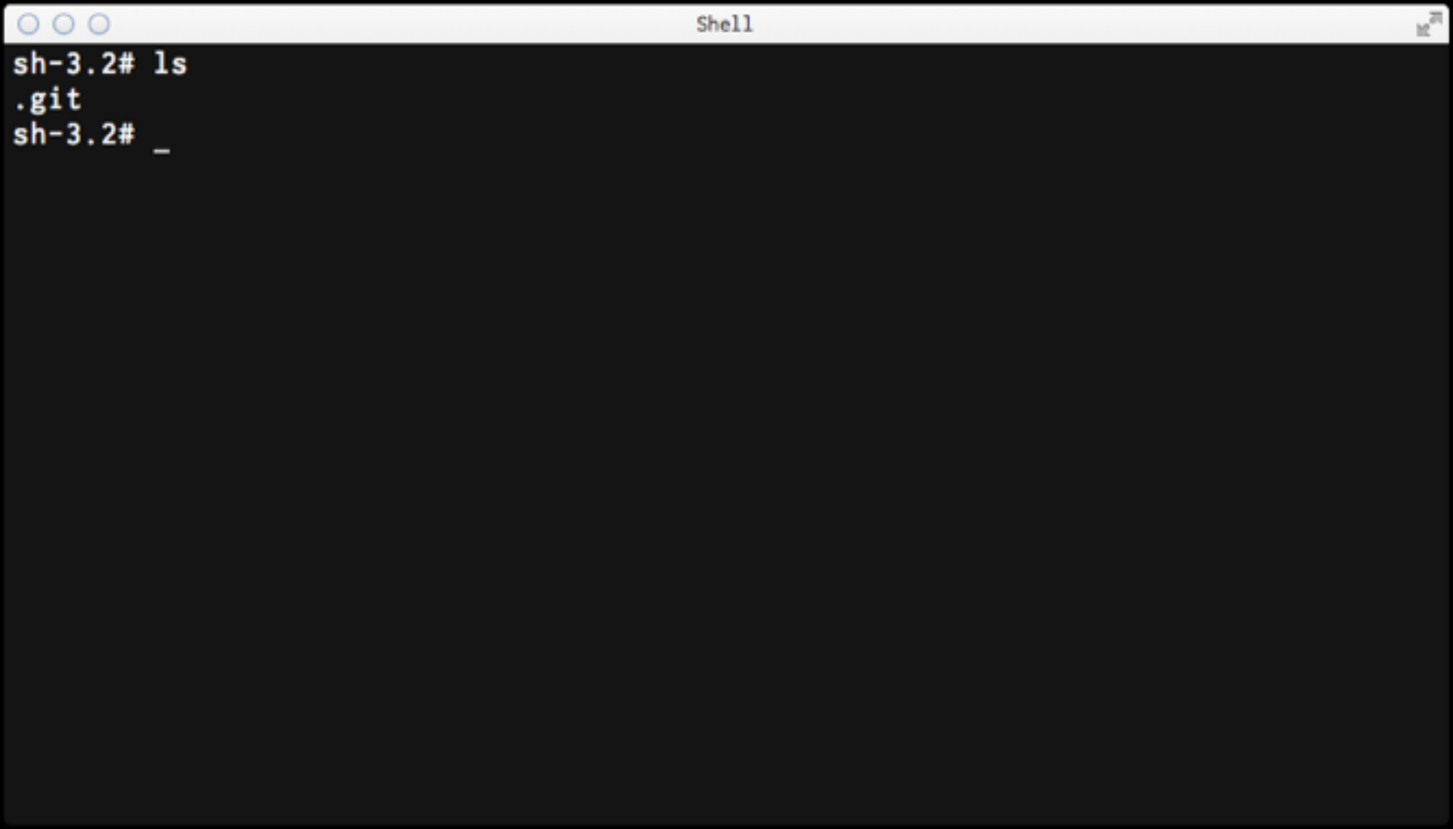
- Nearly every action in git is considerably faster than it’s analogue in other version control systems.
- Change sets are minimized and hashed and packaged before pushing / pulling

## methods

## git init

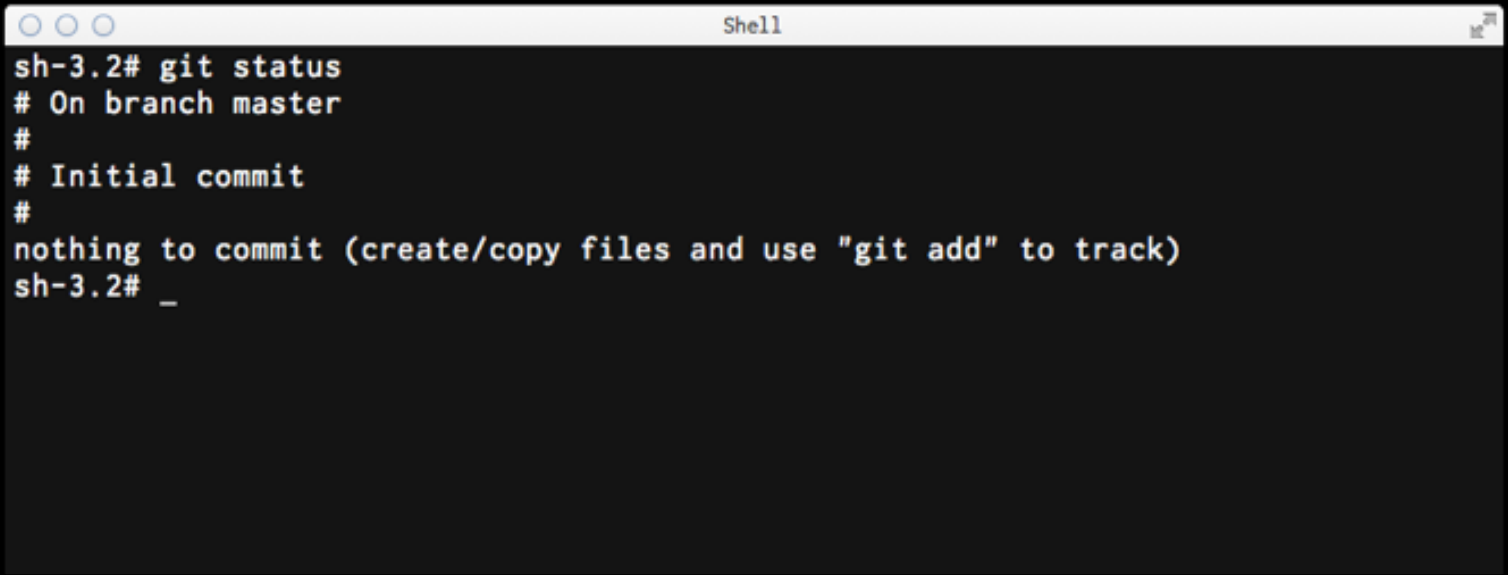


```
sh-3.2# mkdir proj
sh-3.2# cd proj
sh-3.2# git init
Initialized empty Git repository in /Users/macproretina/example/proj/.git/
sh-3.2# _
```



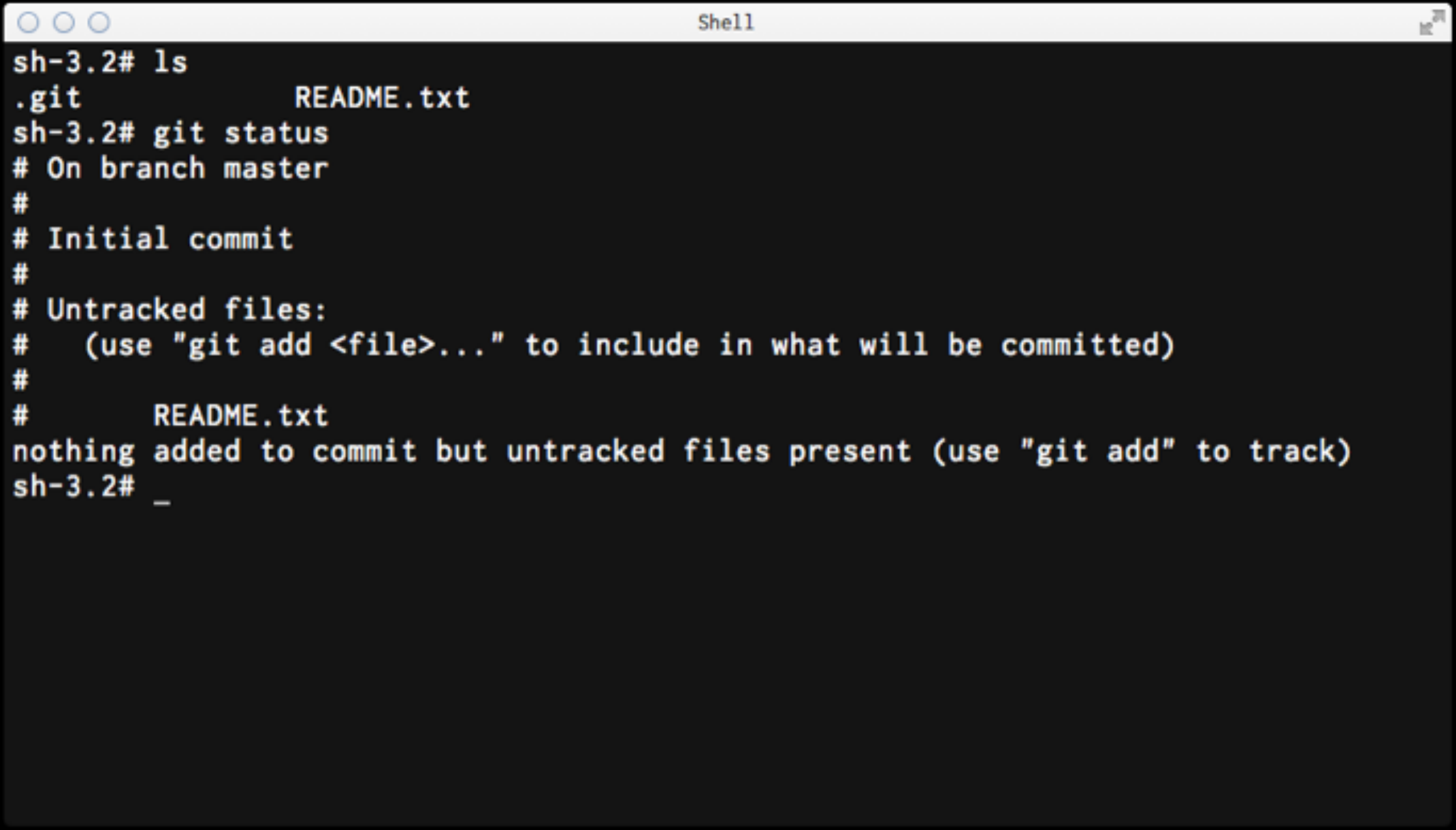
```
sh-3.2# ls
.git
sh-3.2# _
```

## git status



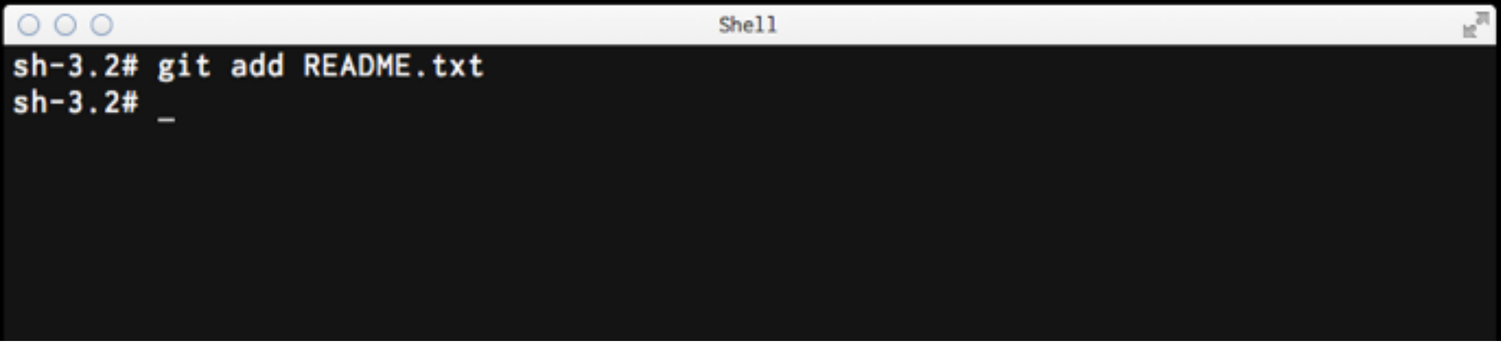
Shell

```
sh-3.2# git status
# On branch master
#
# Initial commit
#
nothing to commit (create/copy files and use "git add" to track)
sh-3.2# _
```

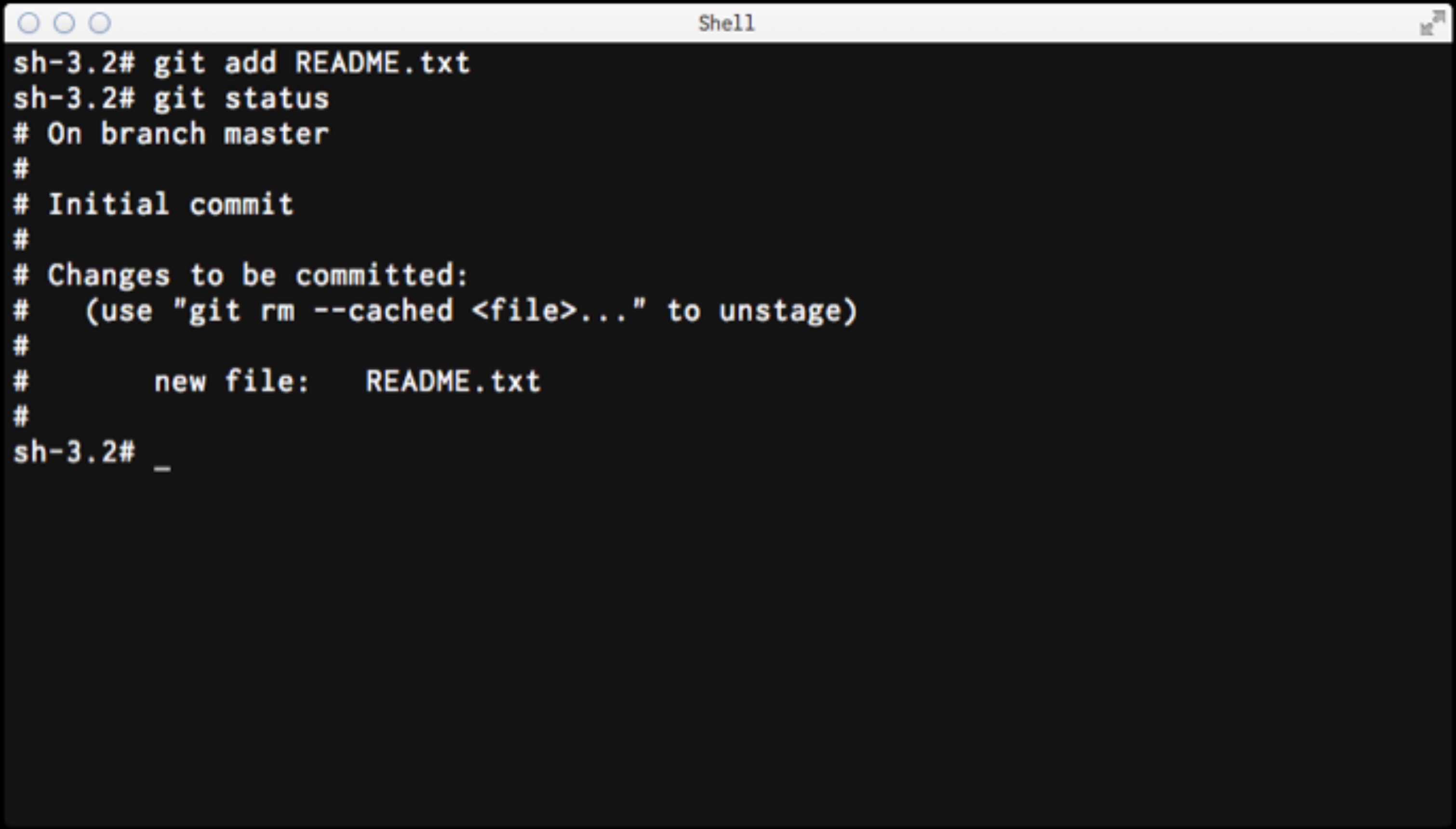


```
sh-3.2# ls
.git            README.txt
sh-3.2# git status
# On branch master
#
# Initial commit
#
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#       README.txt
nothing added to commit but untracked files present (use "git add" to track)
sh-3.2# _
```

## git add

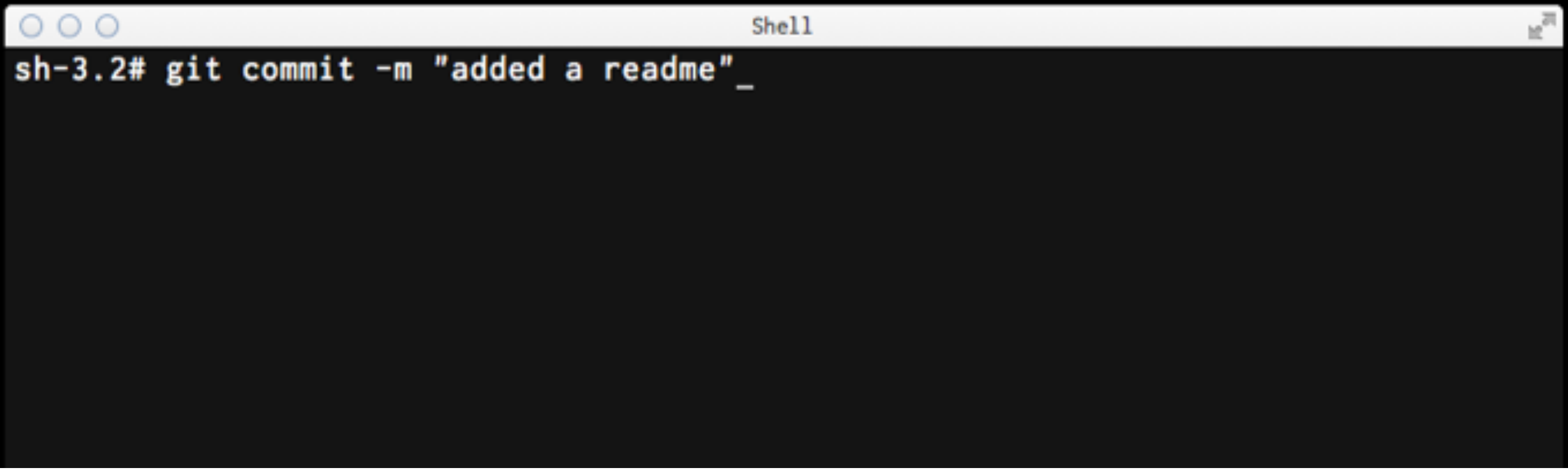


```
sh-3.2# git add README.txt
sh-3.2# _
```

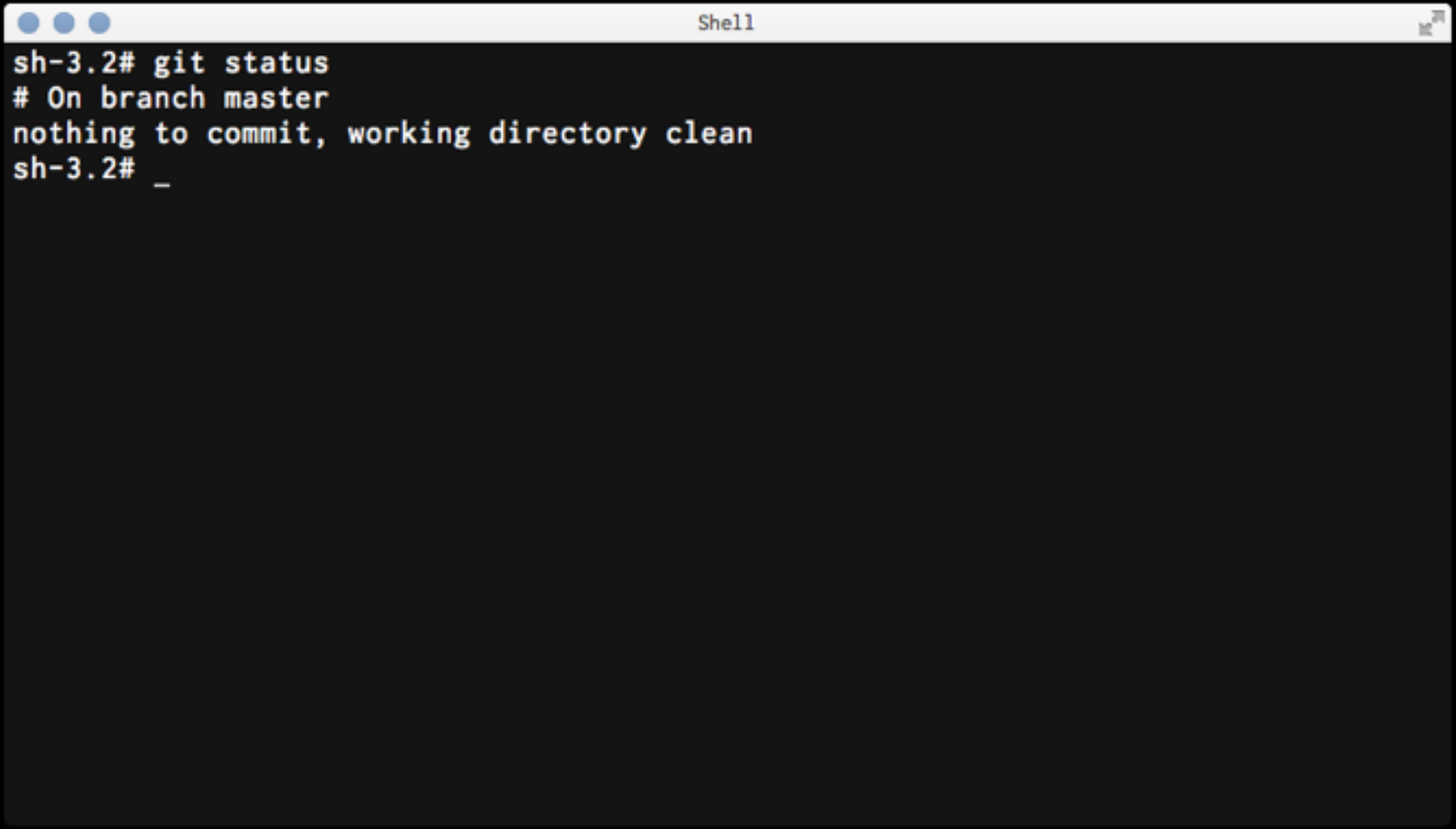


```
sh-3.2# git add README.txt
sh-3.2# git status
# On branch master
#
# Initial commit
#
# Changes to be committed:
#   (use "git rm --cached <file>..." to unstage)
#
#       new file:   README.txt
#
sh-3.2# _
```

# git commit

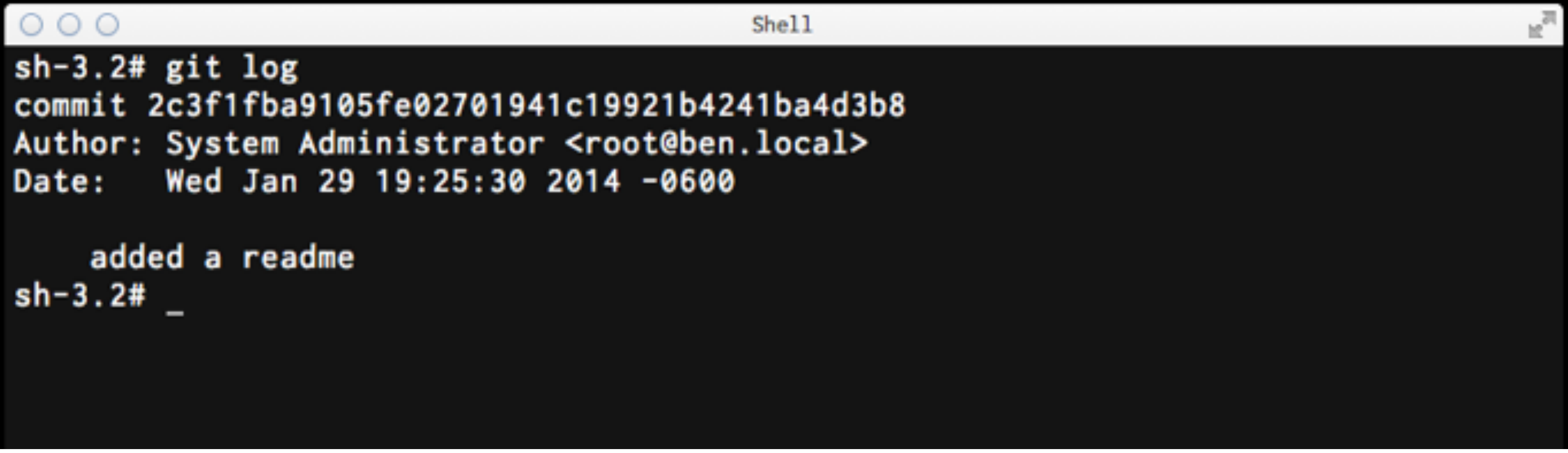


```
sh-3.2# git commit -m "added a readme"_
```

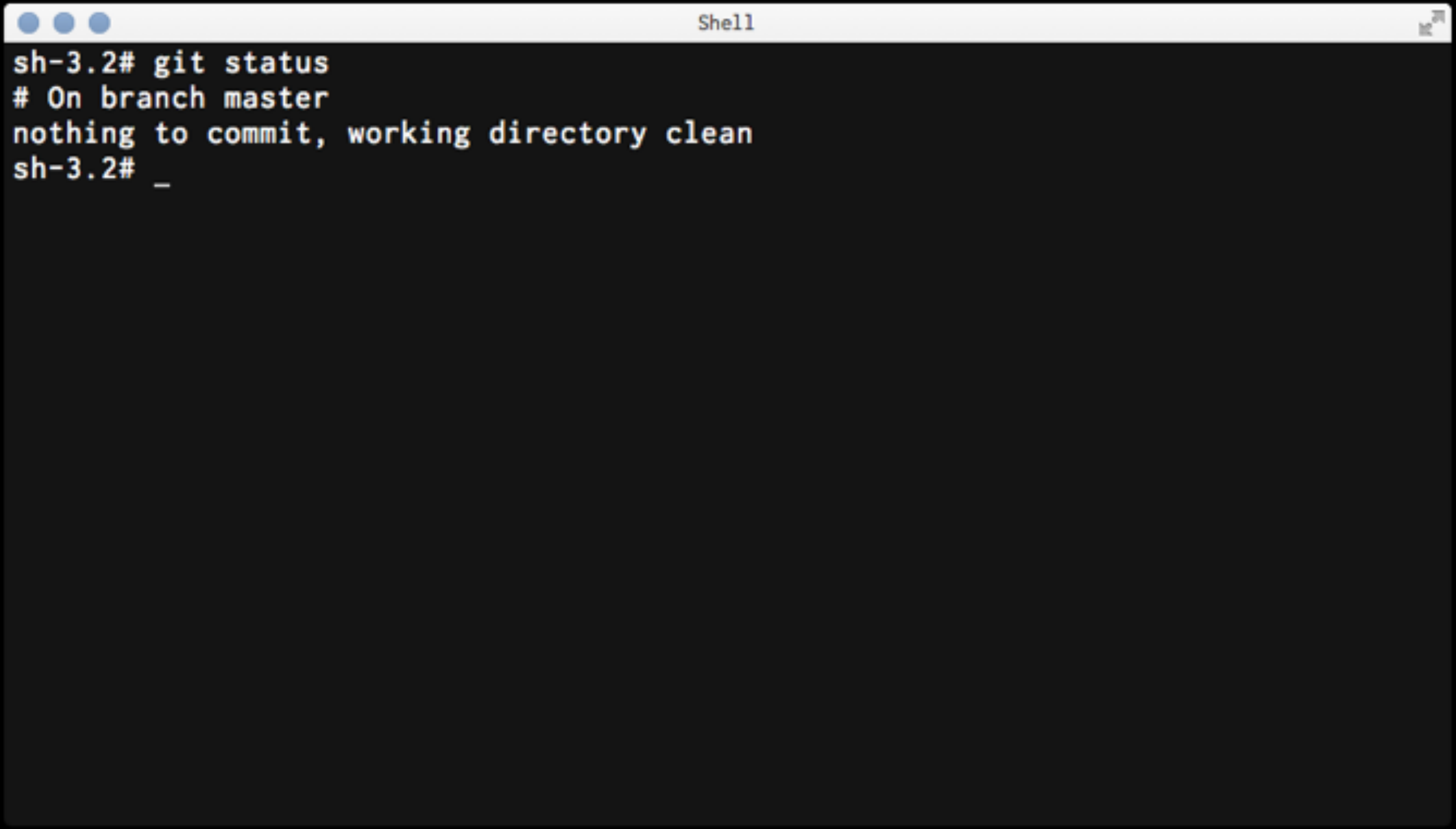


```
sh-3.2# git status
# On branch master
nothing to commit, working directory clean
sh-3.2# _
```

## git log

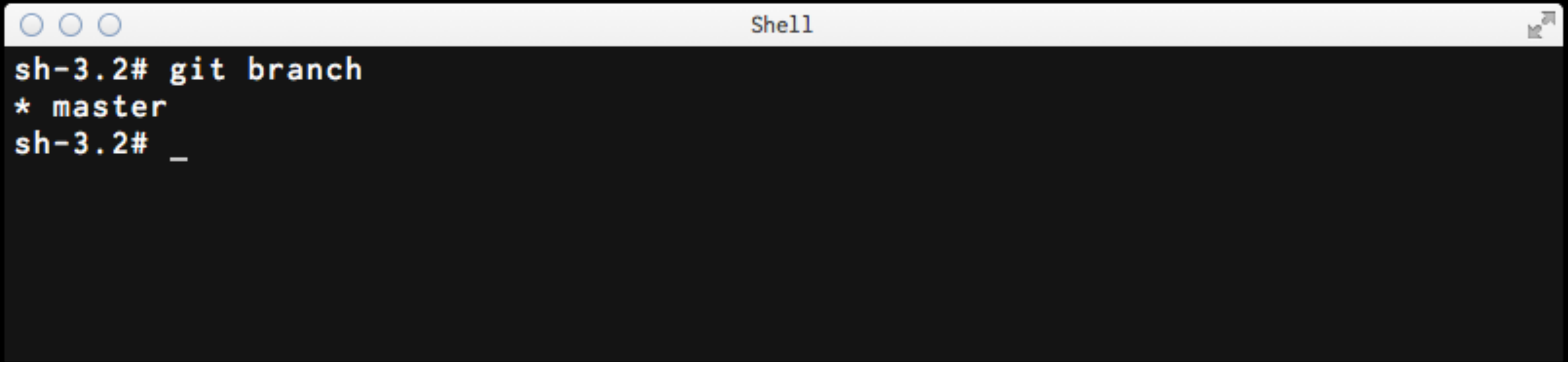


```
sh-3.2# git log
commit 2c3f1fba9105fe02701941c19921b4241ba4d3b8
Author: System Administrator <root@ben.local>
Date:   Wed Jan 29 19:25:30 2014 -0600

    added a readme
sh-3.2# _
```



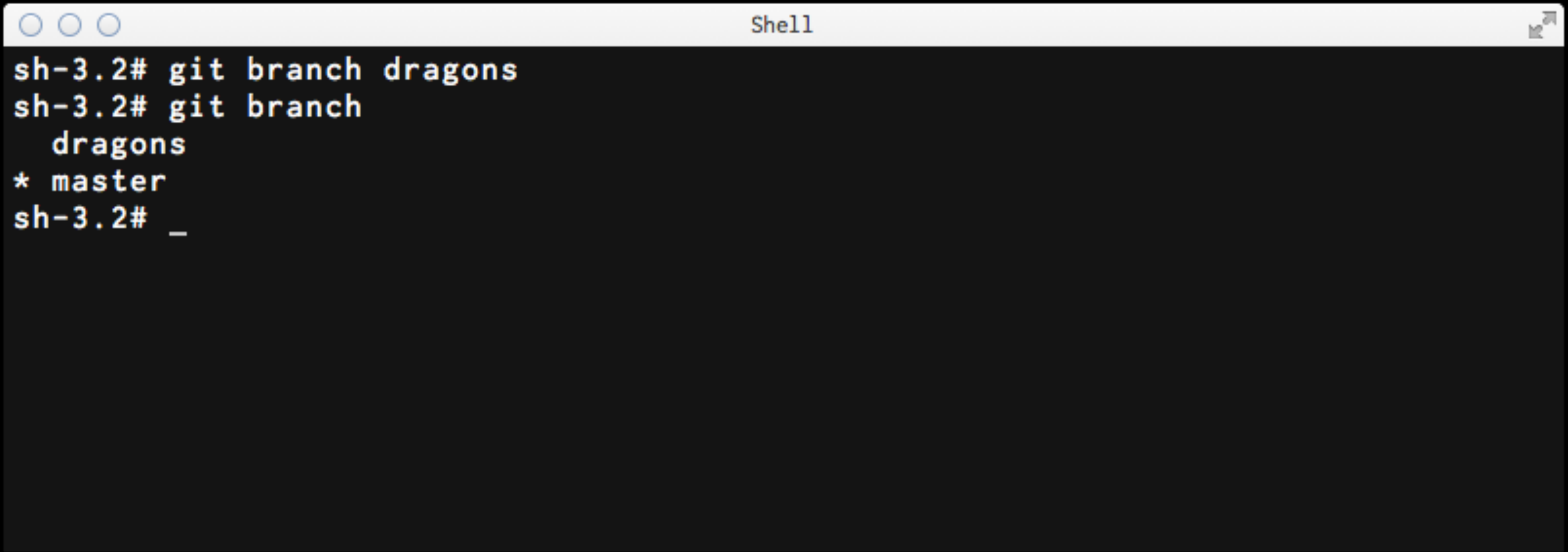
```
sh-3.2# git status
# On branch master
nothing to commit, working directory clean
sh-3.2# _
```

# git branch



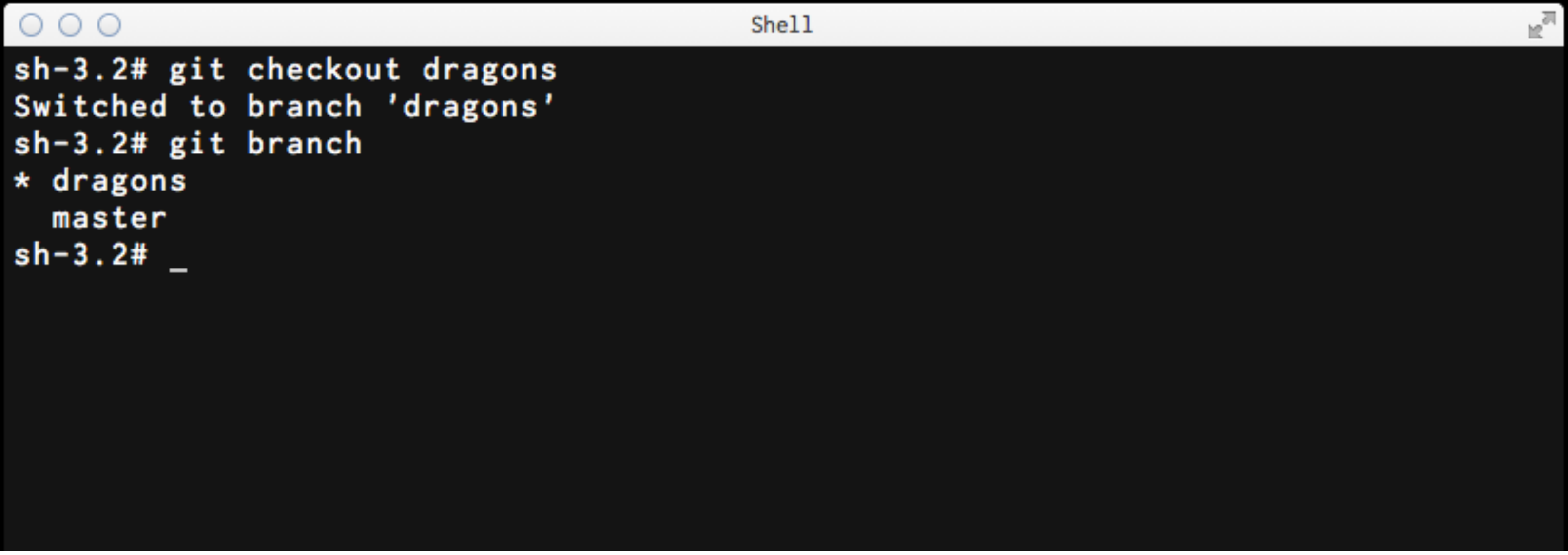
```
sh-3.2# git branch
* master
sh-3.2# _
```

# git branch dragons



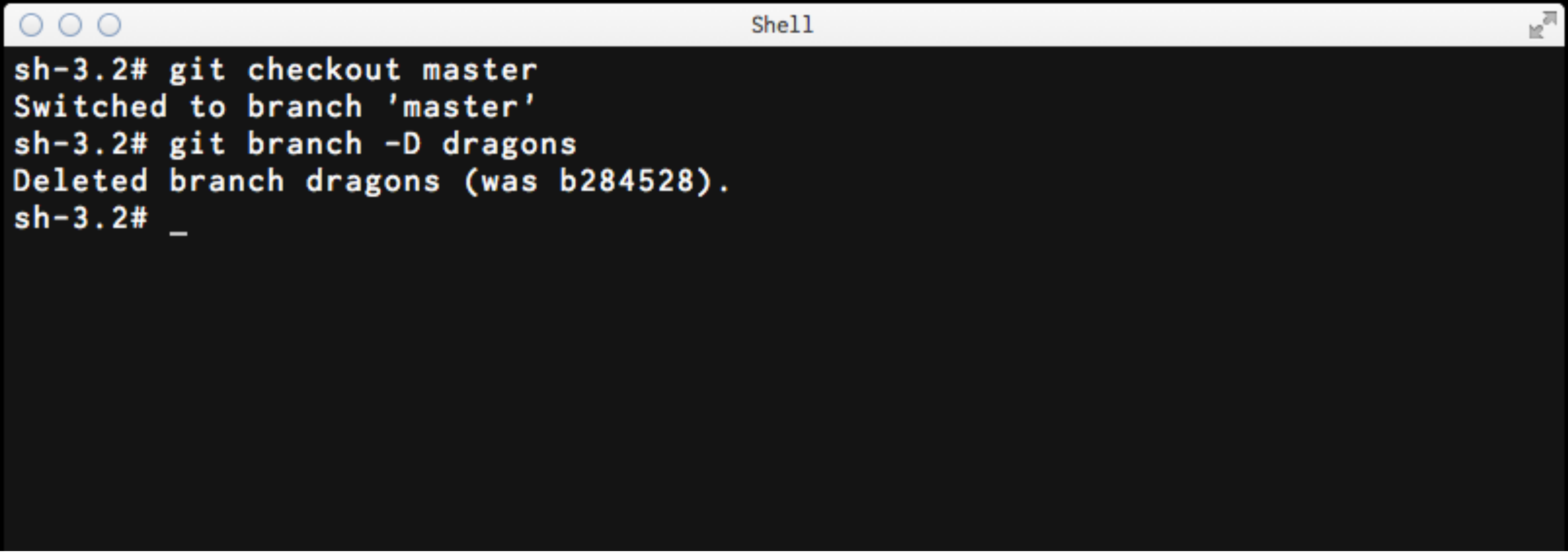
```
sh-3.2# git branch dragons
sh-3.2# git branch
  dragons
* master
sh-3.2# _
```

## git checkout dragons

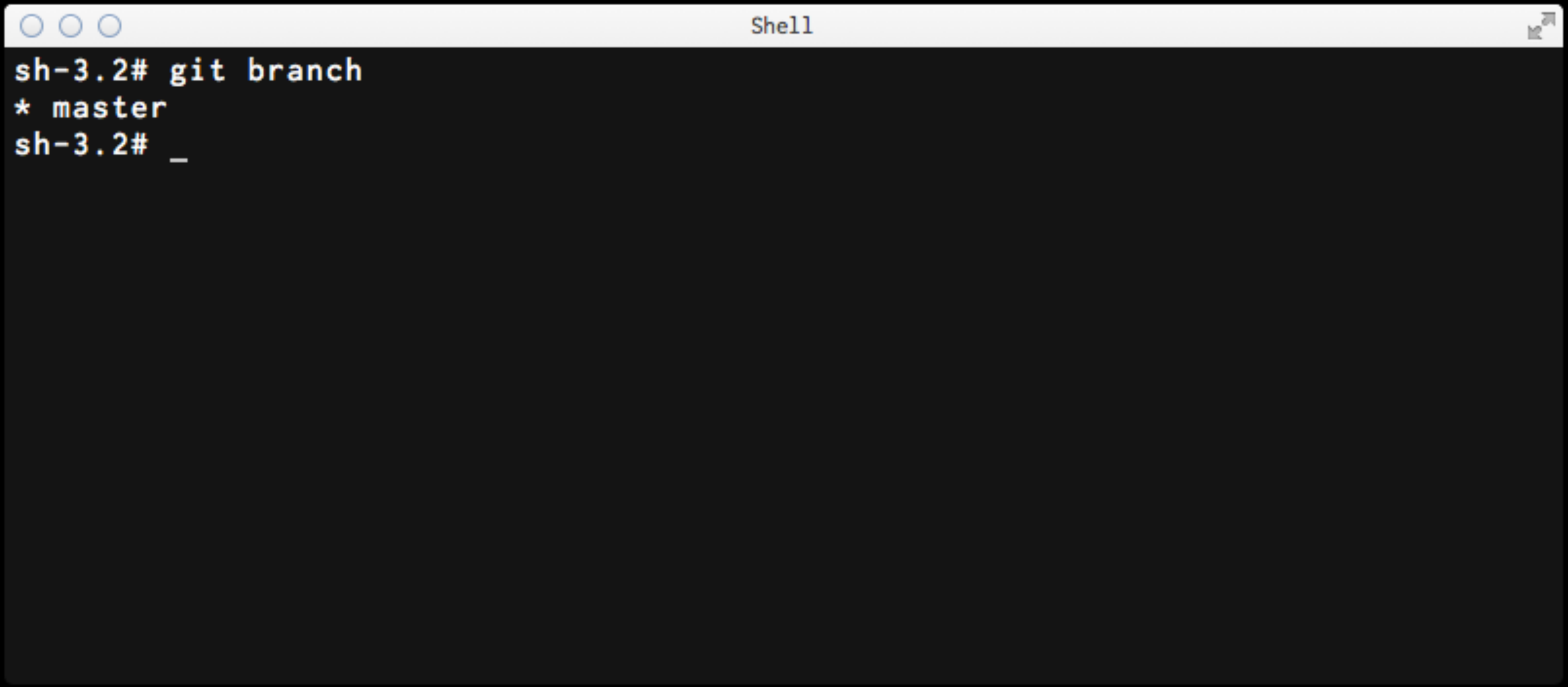


```
sh-3.2# git checkout dragons
Switched to branch 'dragons'
sh-3.2# git branch
* dragons
  master
sh-3.2# _
```

## git branch -D dragons

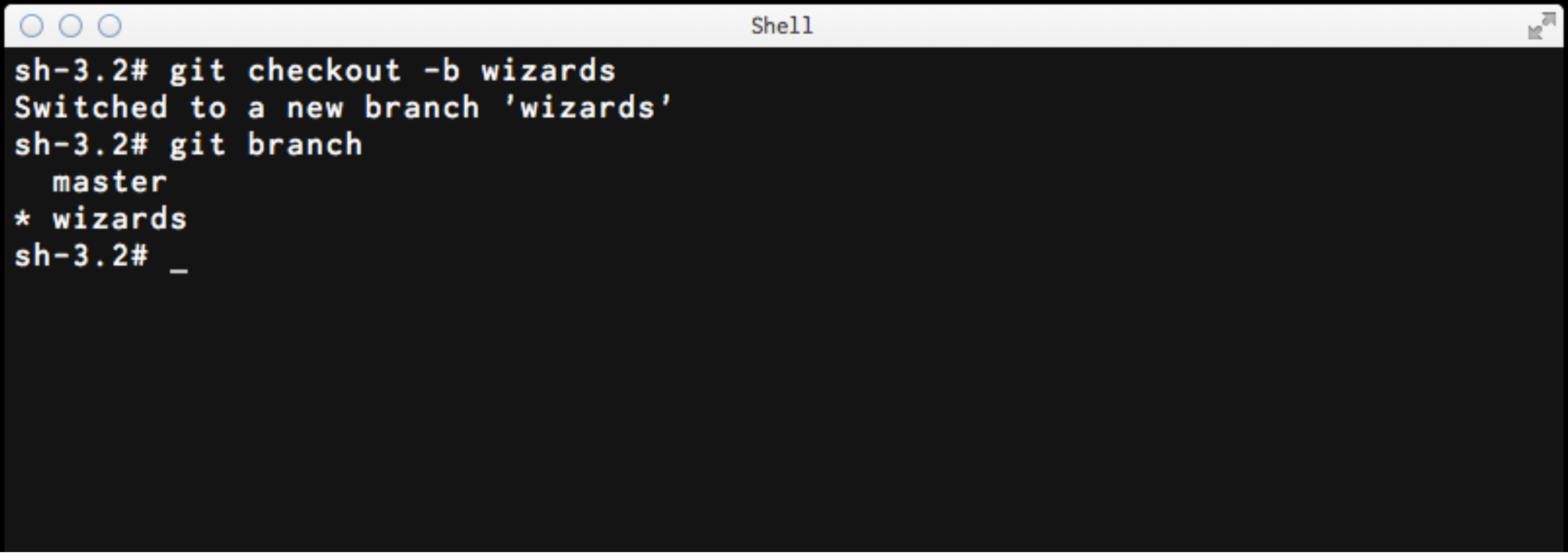


```
sh-3.2# git checkout master
Switched to branch 'master'
sh-3.2# git branch -D dragons
Deleted branch dragons (was b284528).
sh-3.2# _
```



```
sh-3.2# git branch
* master
sh-3.2# _
```

## git checkout -b wizards

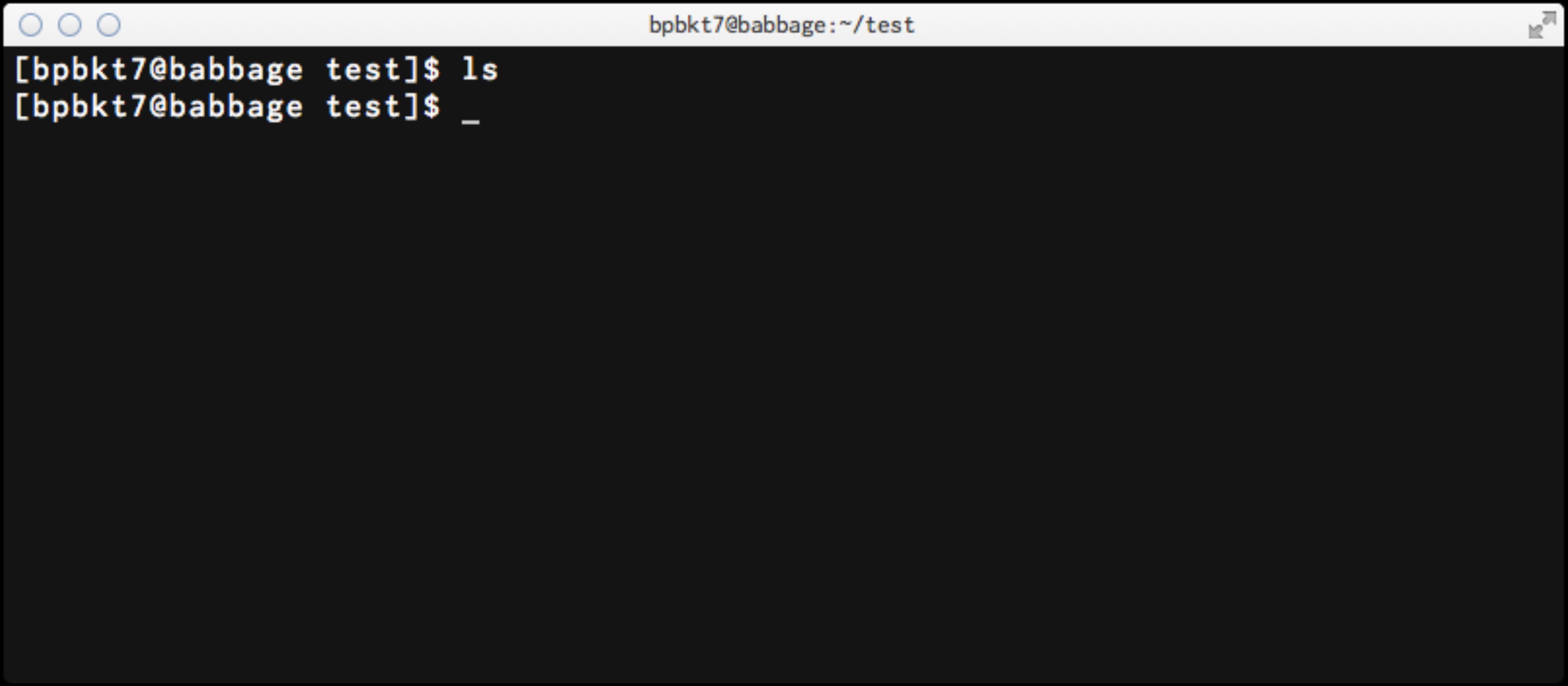


```
sh-3.2# git checkout -b wizards
Switched to a new branch 'wizards'
sh-3.2# git branch
  master
* wizards
sh-3.2# _
```

## best practices

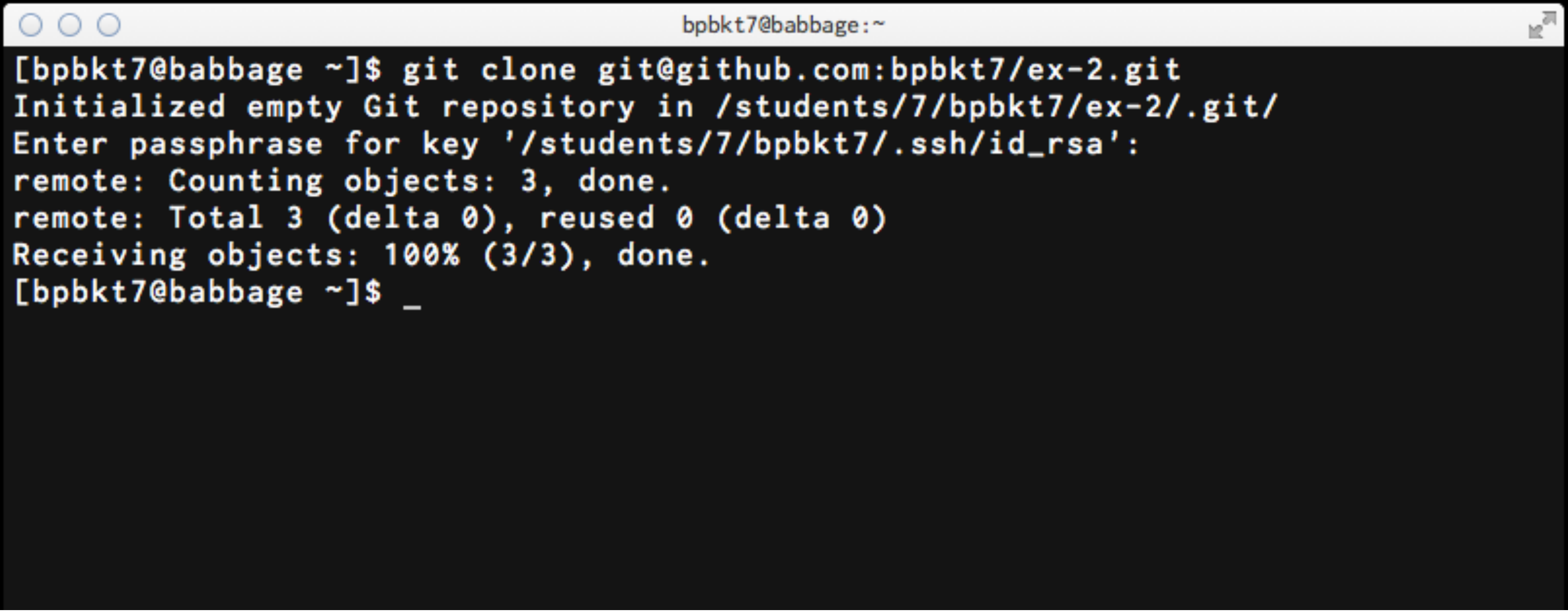
```
git checkout -b myBranch

(make your changes)

git checkout master

git pull origin master

git merge myBranch

(fix conflicts if they exist)

git push origin master
```

- Split up your development to avoid merge conflicts.
- Don’t commit a broken build.
- Work in branches.
- Comment your commits.

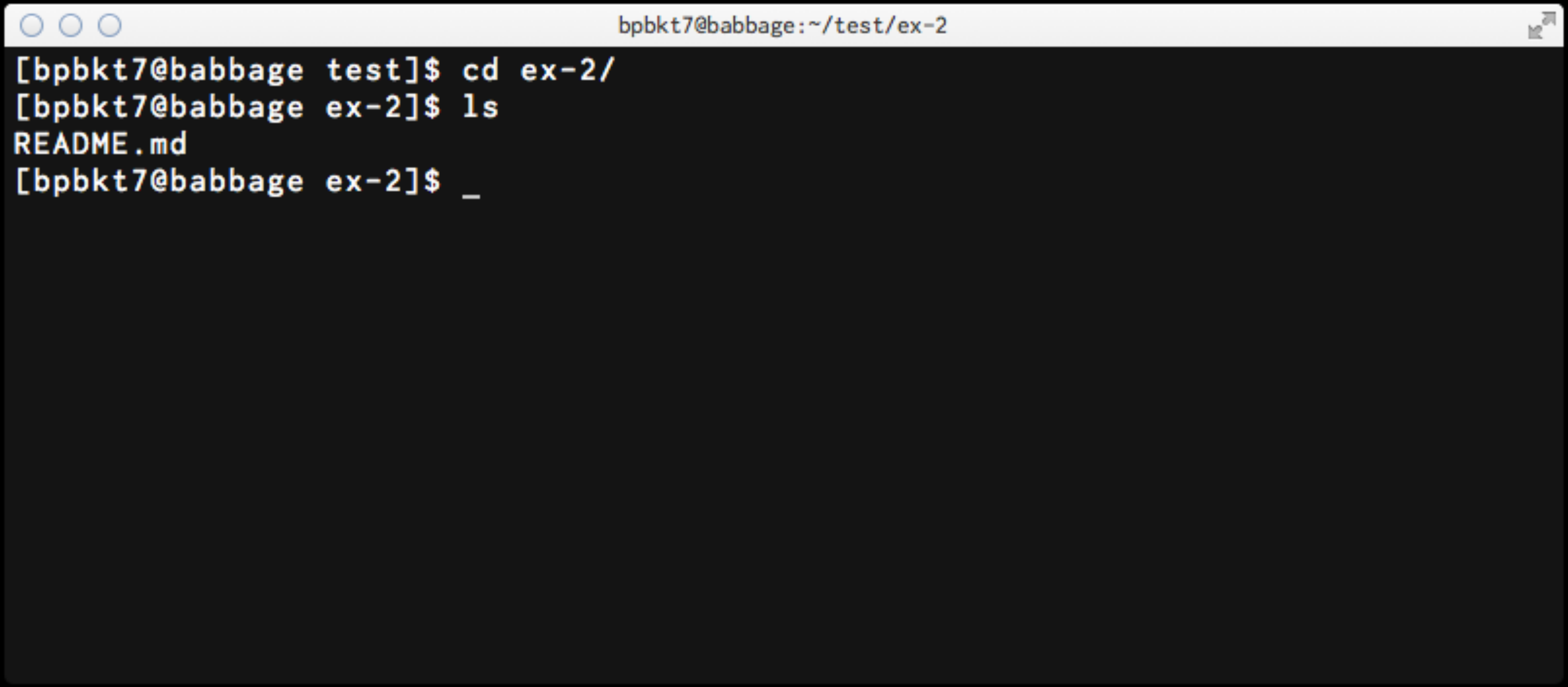


```
[bpbkt7@babbage test]$ ls
[bpbkt7@babbage test]$ _
```

## git clone

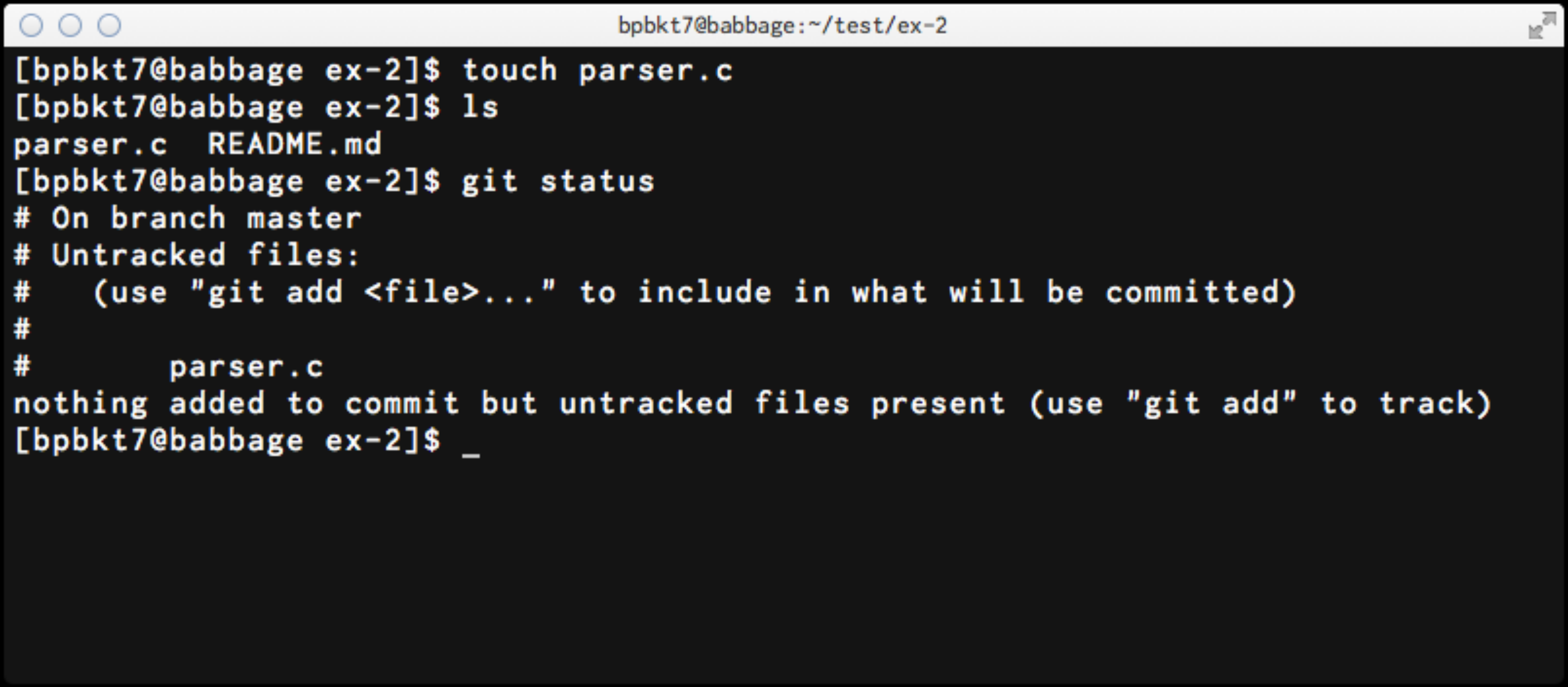


```
[bpbkt7@babbage ~]$ git clone git@github.com:bpbkt7/ex-2.git
Initialized empty Git repository in /students/7/bpbkt7/ex-2/.git/
Enter passphrase for key '/students/7/bpbkt7/.ssh/id_rsa':
remote: Counting objects: 3, done.
remote: Total 3 (delta 0), reused 0 (delta 0)
Receiving objects: 100% (3/3), done.
[bpbkt7@babbage ~]$ _
```



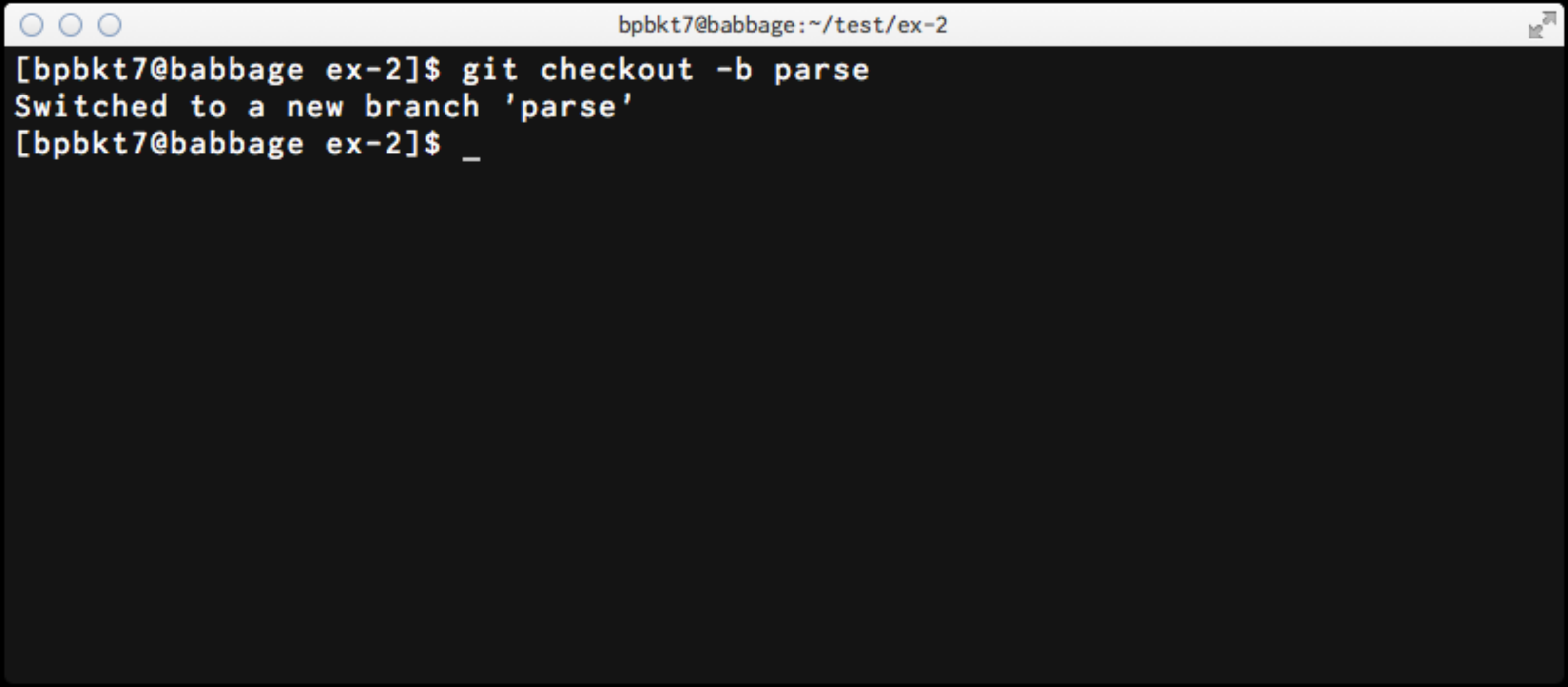
bpbkt7@babbage:~/test/ex-2

```
[bpbkt7@babbage test]$ cd ex-2/
[bpbkt7@babbage ex-2]$ ls
README.md
[bpbkt7@babbage ex-2]$ _
```

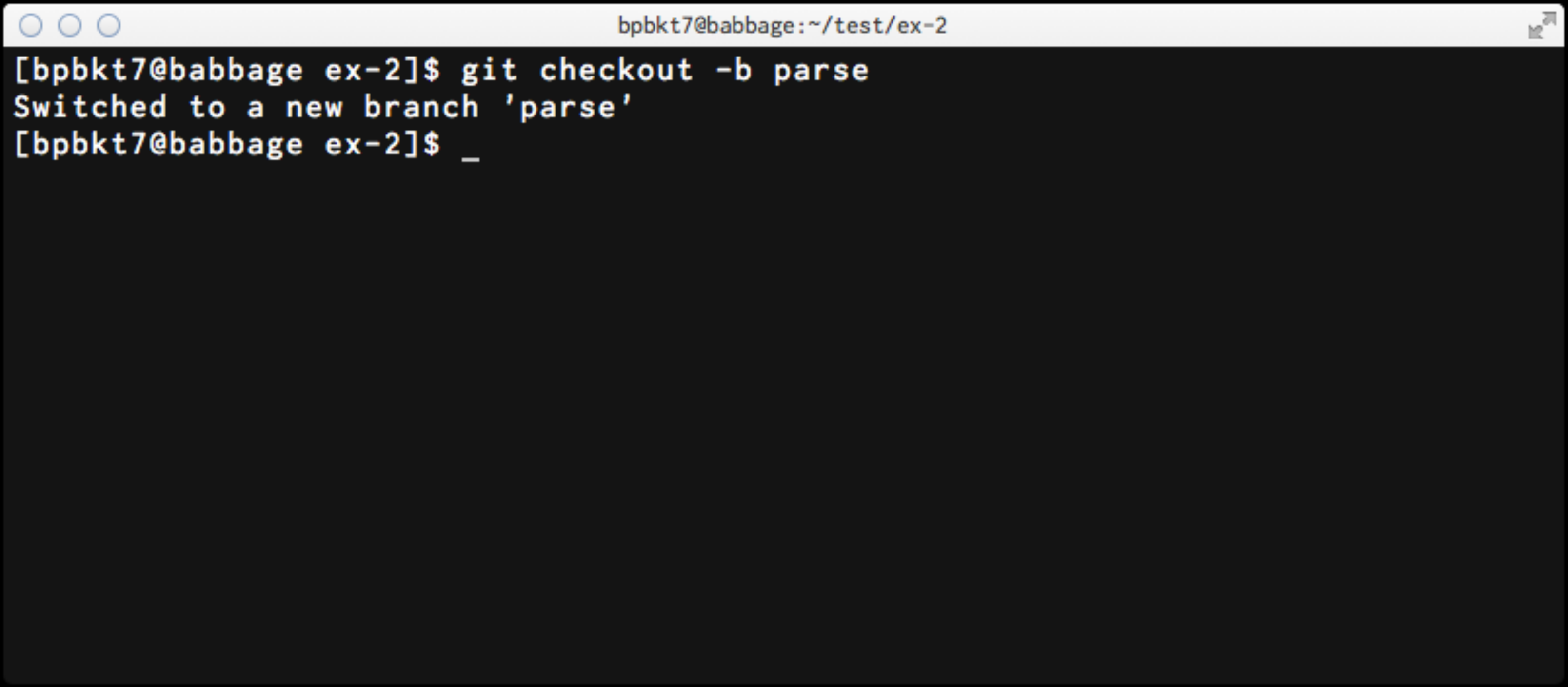


bpbkt7@babbage:~/test/ex-2

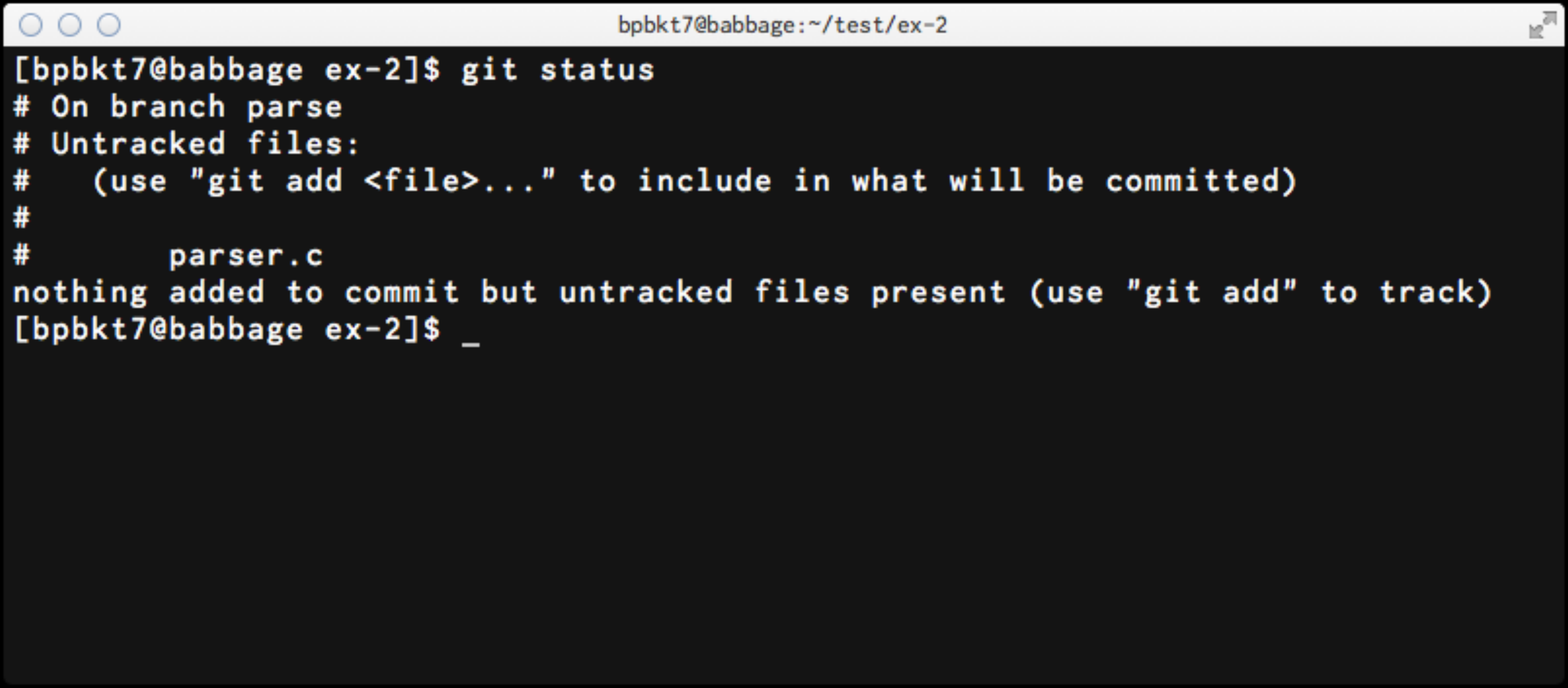
```
[bpbkt7@babbage ex-2]$ touch parser.c
[bpbkt7@babbage ex-2]$ ls
parser.c  README.md
[bpbkt7@babbage ex-2]$ git status
# On branch master
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#       parser.c
nothing added to commit but untracked files present (use "git add" to track)
[bpbkt7@babbage ex-2]$ _
```



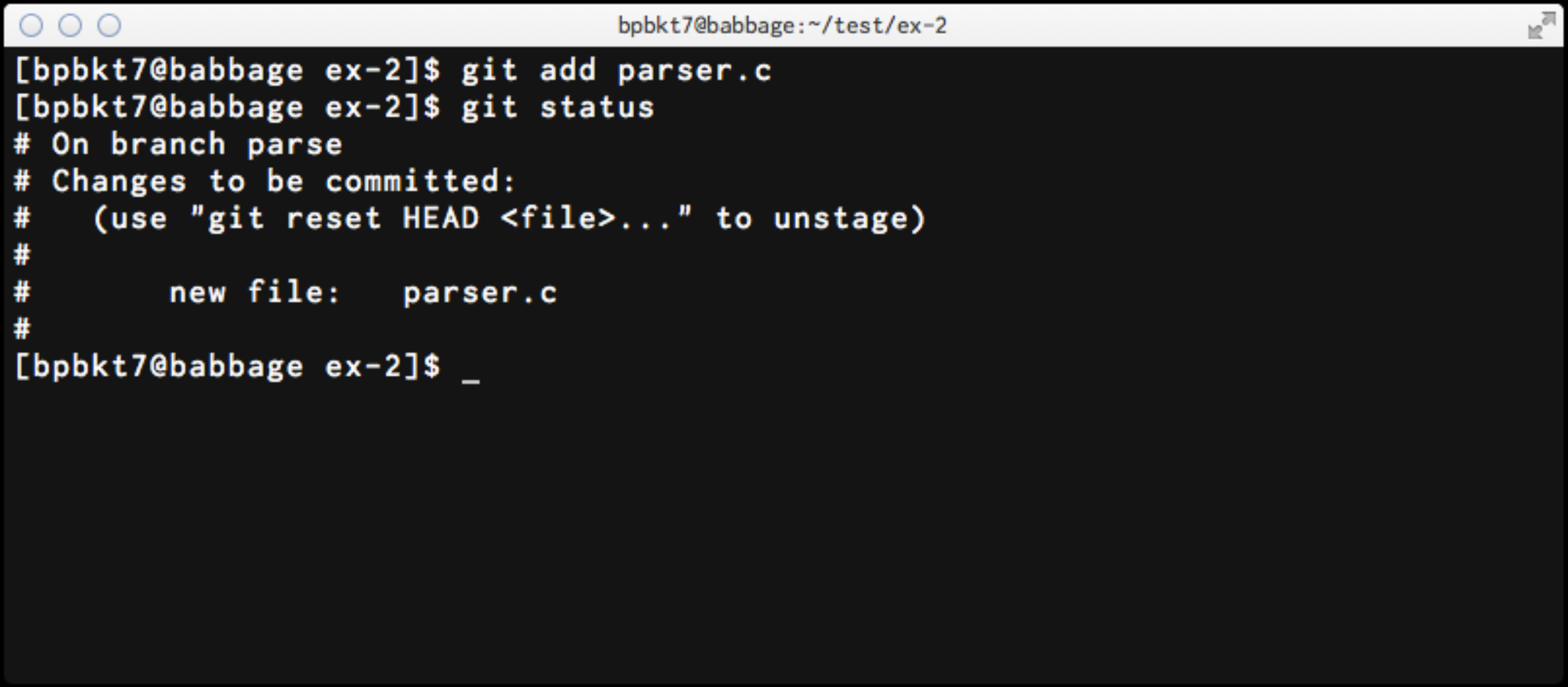
```
[bpbkt7@babbage ex-2]$ git checkout -b parse
Switched to a new branch 'parse'
[bpbkt7@babbage ex-2]$ _
```


bpbkt7@babbage:~/test/ex-2

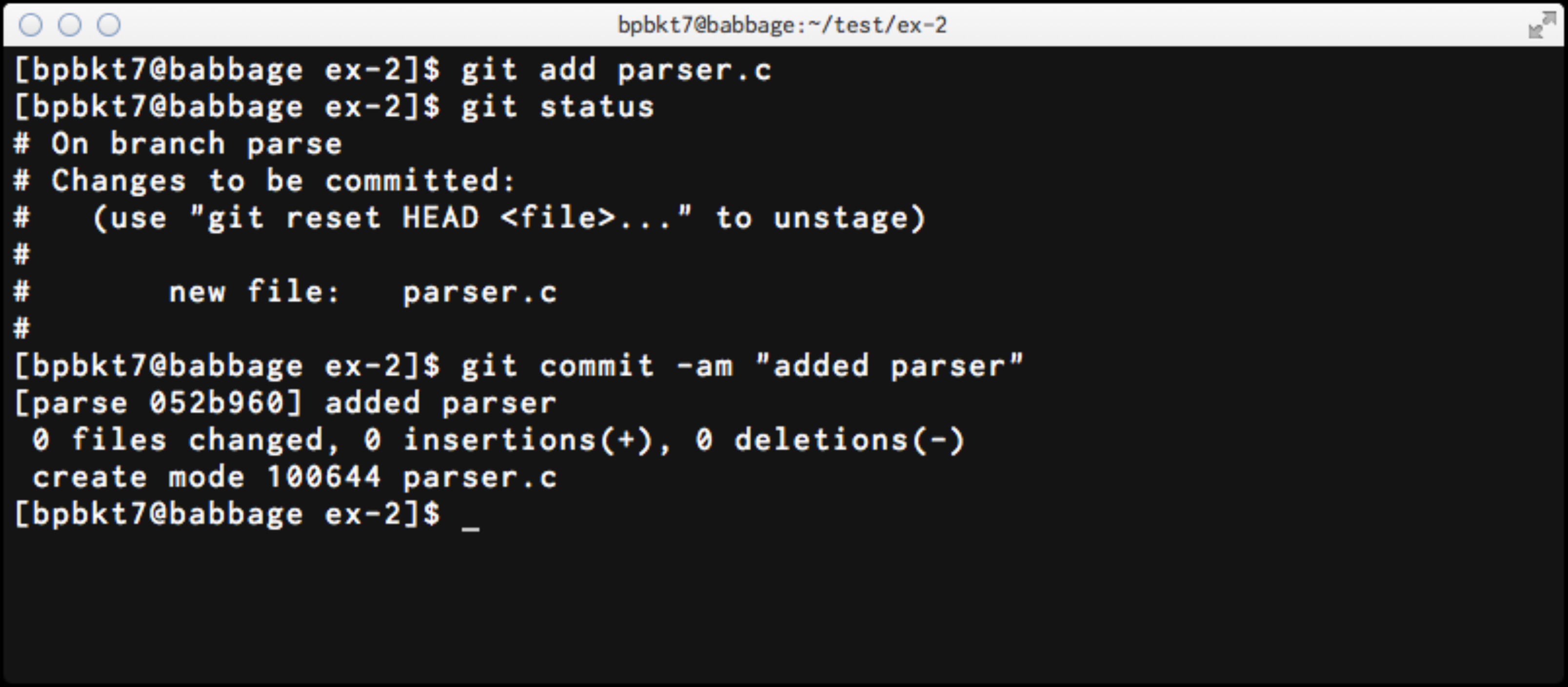
```
[bpbkt7@babbage ex-2]$ git checkout -b parse
Switched to a new branch 'parse'
[bpbkt7@babbage ex-2]$ _
```



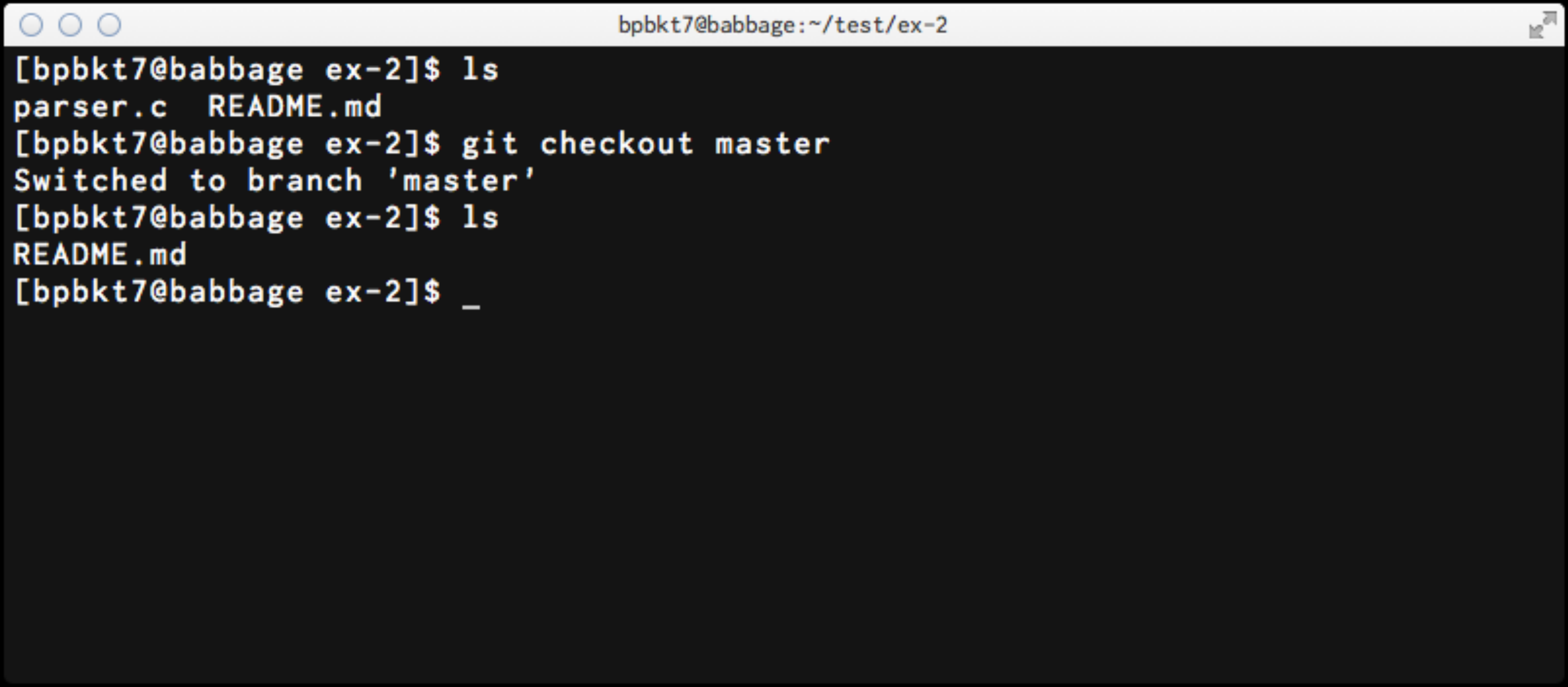
```
[bpbkt7@babbage ex-2]$ git status
# On branch parse
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#       parser.c
nothing added to commit but untracked files present (use "git add" to track)
[bpbkt7@babbage ex-2]$ _
```


bpbkt7@babbage:~/test/ex-2

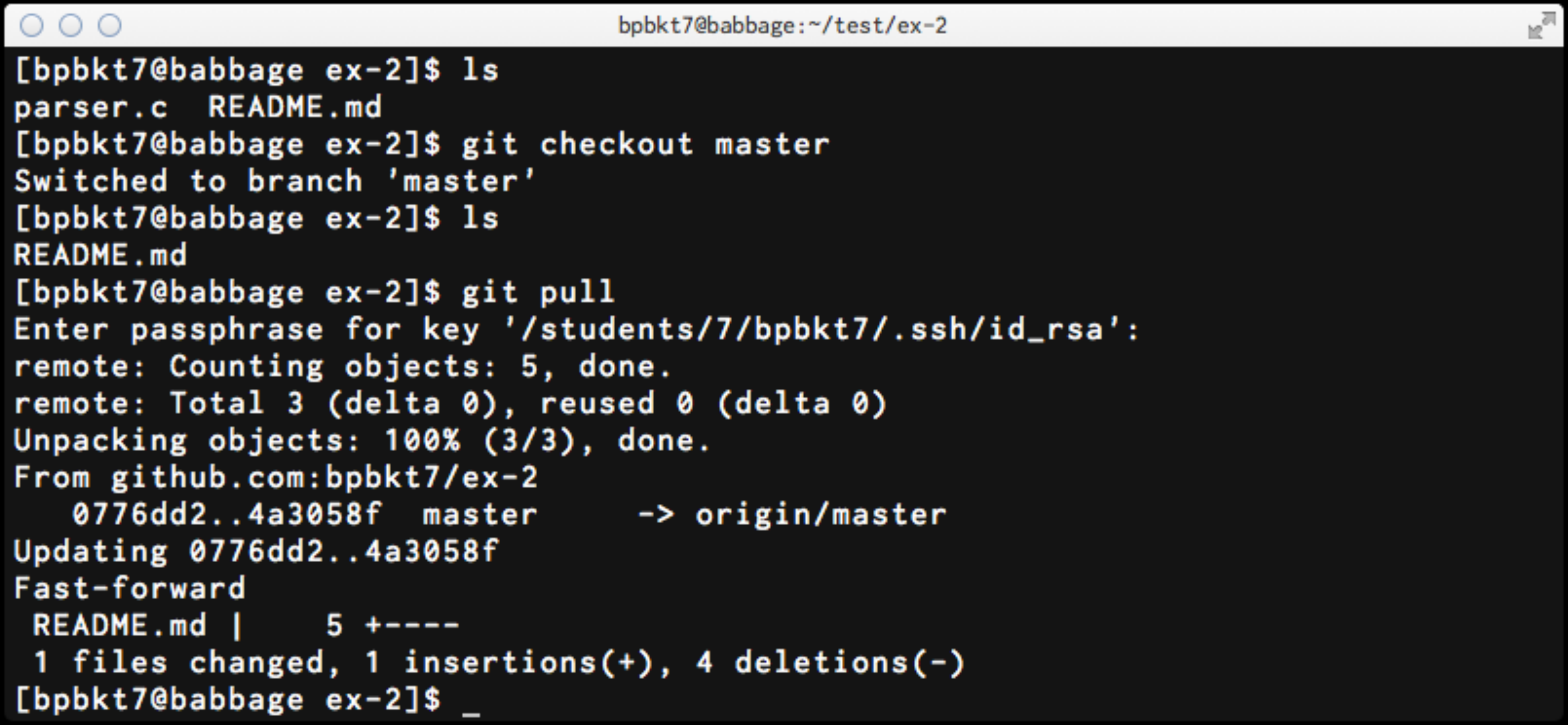
```
[bpbkt7@babbage ex-2]$ git add parser.c
[bpbkt7@babbage ex-2]$ git status
# On branch parse
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#       new file:   parser.c
#
[bpbkt7@babbage ex-2]$ _
```



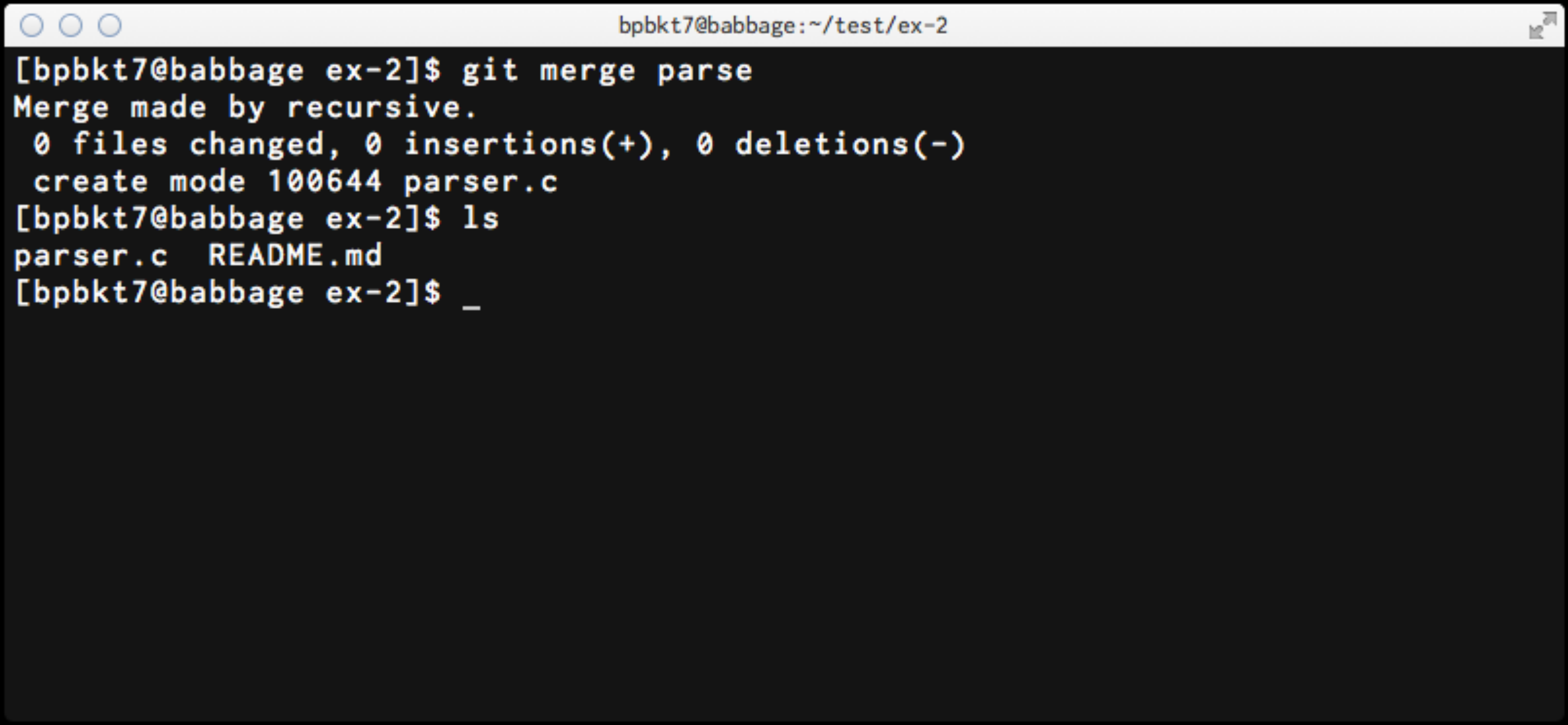
```
[bpbkt7@babbage ex-2]$ git add parser.c
[bpbkt7@babbage ex-2]$ git status
# On branch parse
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#       new file:   parser.c
#
[bpbkt7@babbage ex-2]$ git commit -am "added parser"
[parse 052b960] added parser
 0 files changed, 0 insertions(+), 0 deletions(-)
 create mode 100644 parser.c
[bpbkt7@babbage ex-2]$ _
```


bpbkt7@babbage:~/test/ex-2

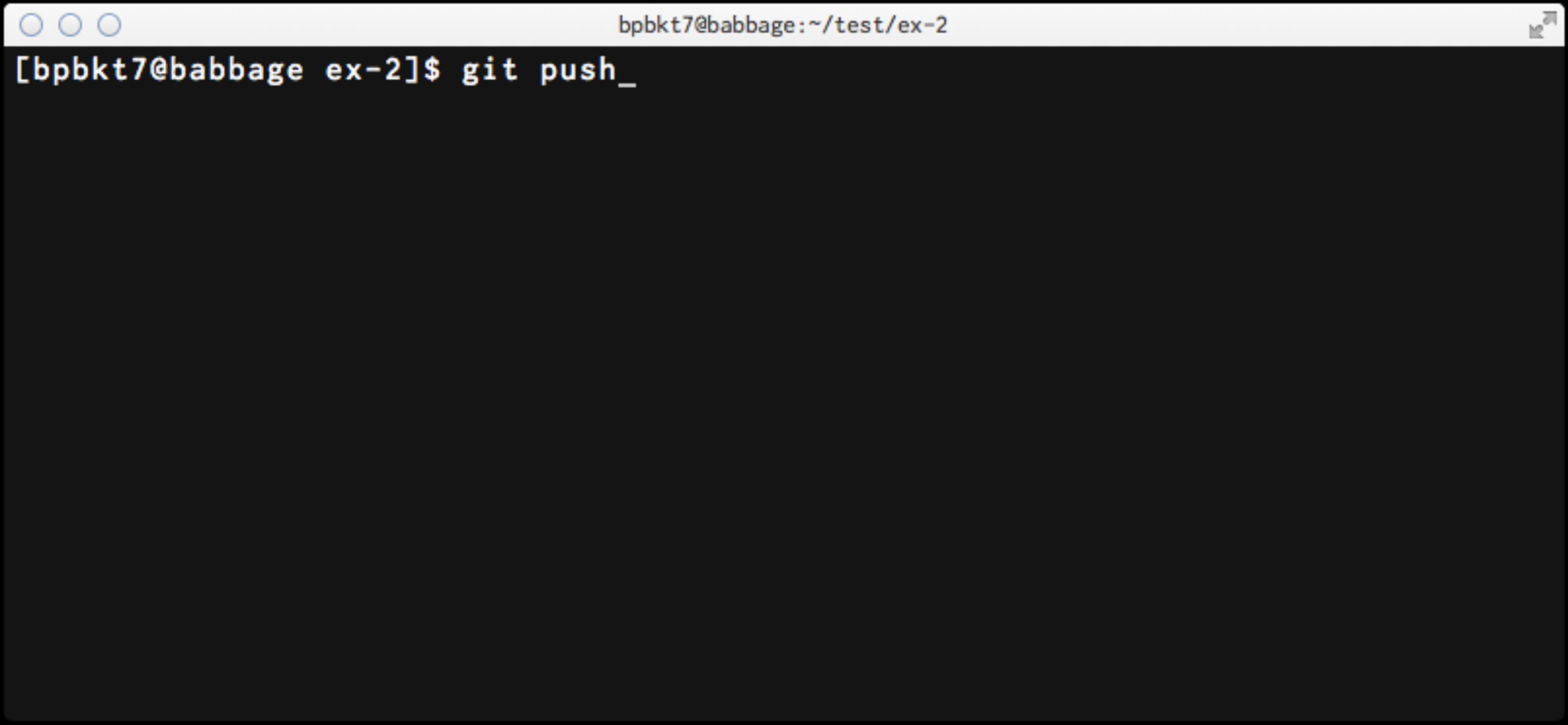
```
[bpbkt7@babbage ex-2]$ ls
parser.c  README.md
[bpbkt7@babbage ex-2]$ git checkout master
Switched to branch 'master'
[bpbkt7@babbage ex-2]$ ls
README.md
[bpbkt7@babbage ex-2]$ _
```


bpbkt7@babbage:~/test/ex-2

```
[bpbkt7@babbage ex-2]$ ls
parser.c  README.md
[bpbkt7@babbage ex-2]$ git checkout master
Switched to branch 'master'
[bpbkt7@babbage ex-2]$ ls
README.md
[bpbkt7@babbage ex-2]$ git pull
Enter passphrase for key '/students/7/bpbkt7/.ssh/id_rsa':
remote: Counting objects: 5, done.
remote: Total 3 (delta 0), reused 0 (delta 0)
Unpacking objects: 100% (3/3), done.
From github.com:bpbkt7/ex-2
   0776dd2..4a3058f  master     -> origin/master
Updating 0776dd2..4a3058f
Fast-forward
 README.md |    5 +----
 1 files changed, 1 insertions(+), 4 deletions(-)
[bpbkt7@babbage ex-2]$ _
```



```
[bpbkt7@babbage ex-2]$ git merge parse
Merge made by recursive.
 0 files changed, 0 insertions(+), 0 deletions(-)
 create mode 100644 parser.c
[bpbkt7@babbage ex-2]$ ls
parser.c  README.md
[bpbkt7@babbage ex-2]$ _
```



bpbkt7@babbage:~/test/ex-2

```
[bpbkt7@babbage ex-2]$ git push_
```

Design your dev habits to minimize merge conflicts.

## merge conflicts

- Changes on the same file
- Different branches.
- Git handles it gracefully.

## fixing merge conflicts

- git mergetool
- git checkout —theirs
- git checkout —ours

## fixing merge conflicts

```
# # You have unmerged paths.
# #   (fix conflicts and run "git commit")
# #
# # Unmerged paths:
# #   (use "git add ..." to mark resolution)
# #
# # both modified:      README.md
# #
# no changes added to commit (use "git add" and/or "git commit -a")
```

## fixing merge conflicts

```
<<<<<<< HEAD
We like cats.
=======
We like dogs.
>>>>>>> branch-a
We like cats & dogs.
```

## fixing merge conflicts

We like cats & dogs.

## fixing merge conflicts

add & commit

- Split up your development to avoid merge conflicts.
- Don’t commit a broken build.
- Work in branches.
- Comment your commits.

```
git checkout -b myBranch

(make your changes)

git checkout master

git pull origin master

git merge myBranch

(fix conflicts if they exist)

git push origin master
```