- Free, open source **distributed version control system**
- **Record changes** to a set of files over time
- Promotes **rapid experimentation**
- **Collaborate** with other developers

# Who uses git?


**https://git-scm.com/**

# The Working Directory

Our project is a set of files in a **directory** that contains:

- Text files (code)
- Sub-directories

We'd like to be able to store **versions** (snapshots) of our code

```
my_project
├── Makefile
├── cstart.c
├── libmypi
│   ├── Makefile
│   ├── backtrace.c
│   ├── console.c
│   ├── fb.c
│   ├── gl.c
│   ├── gpio.c
│   ├── keyboard.c
│   ├── malloc.c
│   ├── printf.c
│   ├── shell.c
│   ├── strings.c
│   └── timer.c
├── main.c
├── memmap
└── start.s

1 directory, 17 files
```

# Recording Changes

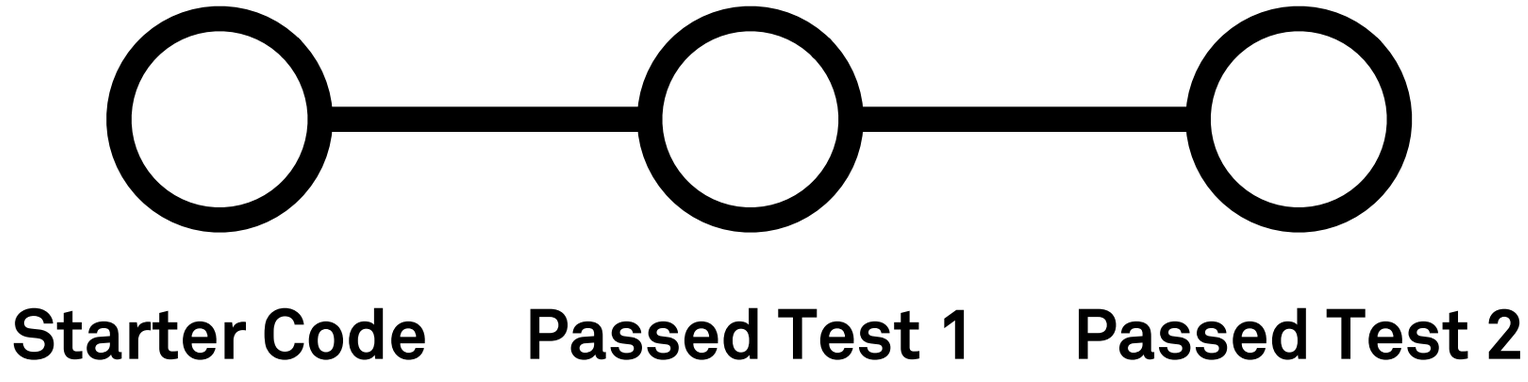
Save a snapshot of your working directory at any time

```
❯ git add <file>
❯ git commit -m "Passed Test 1"
```

# Recording Changes

**Strategy**: Save a snapshot whenever you pass a new test

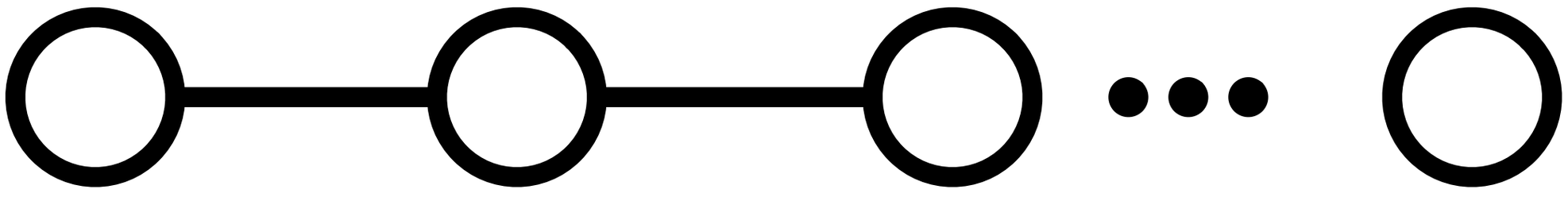
```
❯ git add <file>
❯ git commit -m "Passed Test 2”
```



# Recording Changes

**Strategy**: Save a snapshot whenever you pass a new test

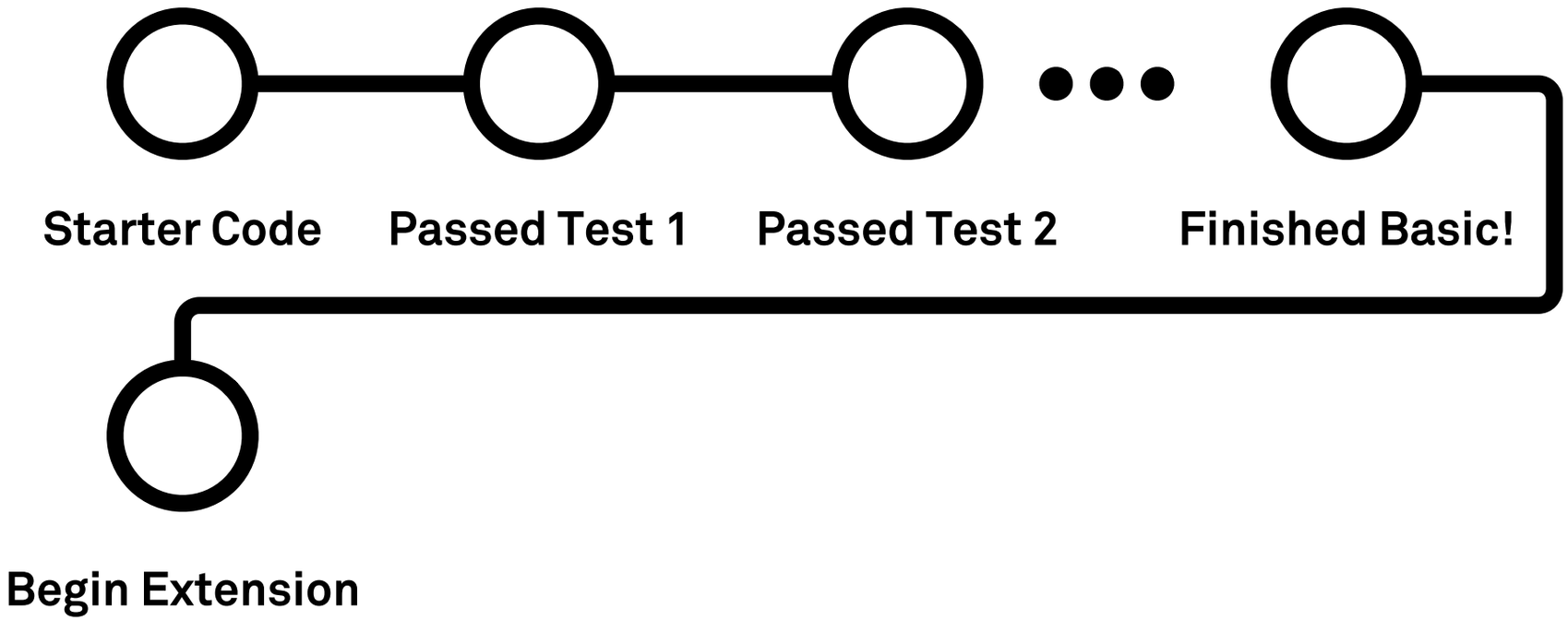
```
❯ git add <file>
❯ git commit -m “Finished Basic!”
```



# Recording Changes

Begin working on your extension

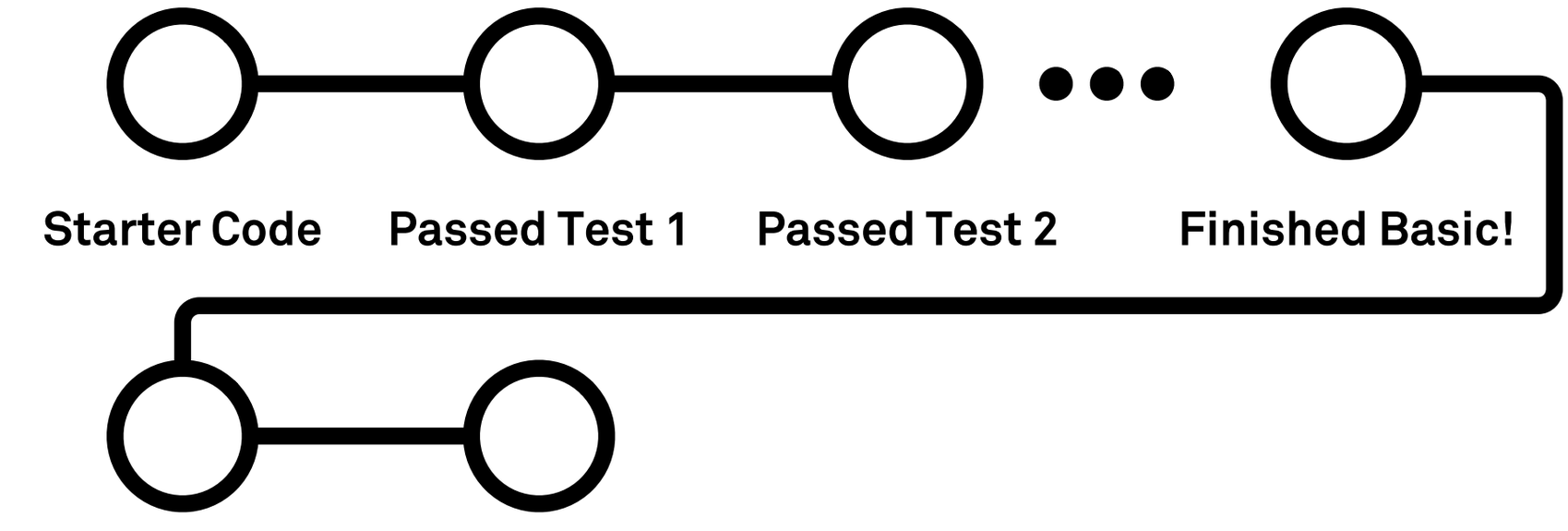
```
❯ git add <file>
❯ git commit -m “Begin Extension”
```



# Recording Changes

Still isn’t working

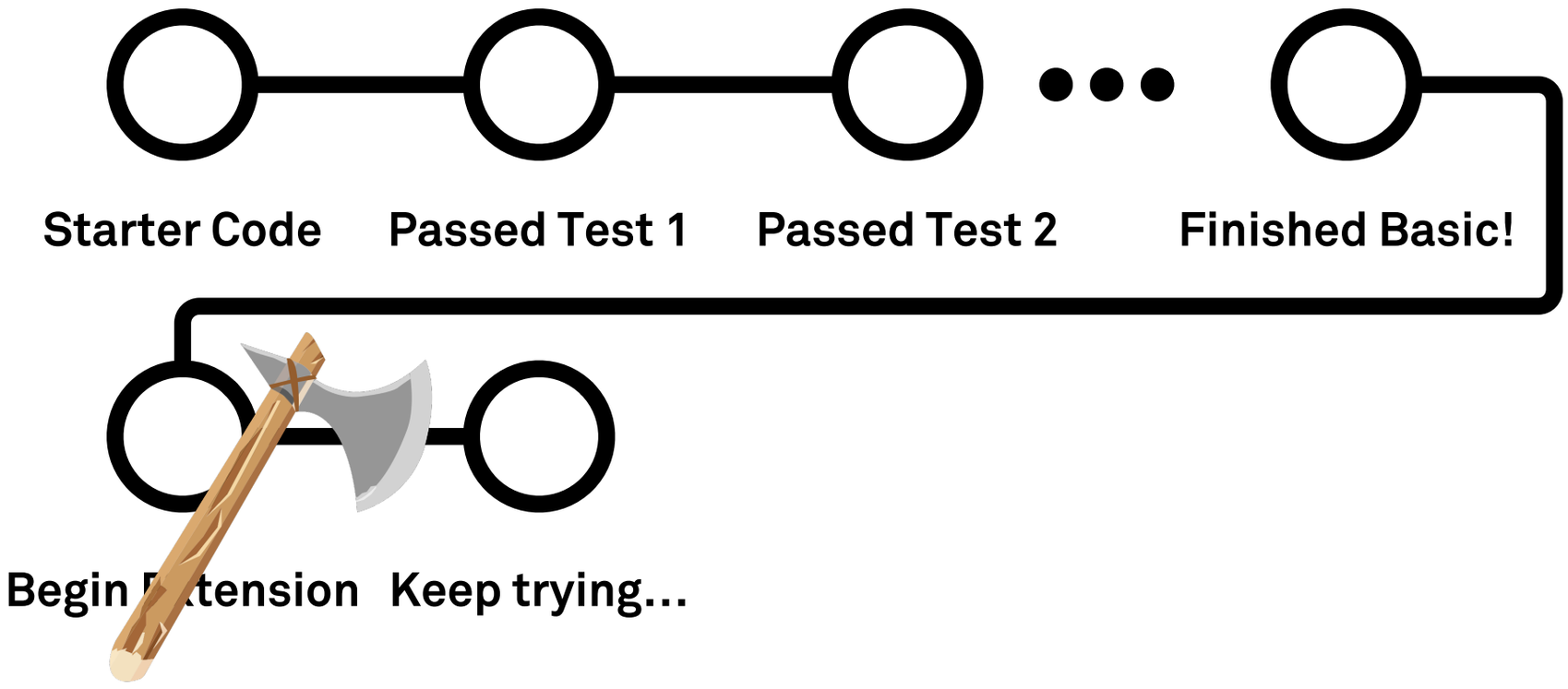
```
❯ git add <file>
❯ git commit -m “Keep trying...”
```



# Recording Changes

Tuesday at 4:30pm

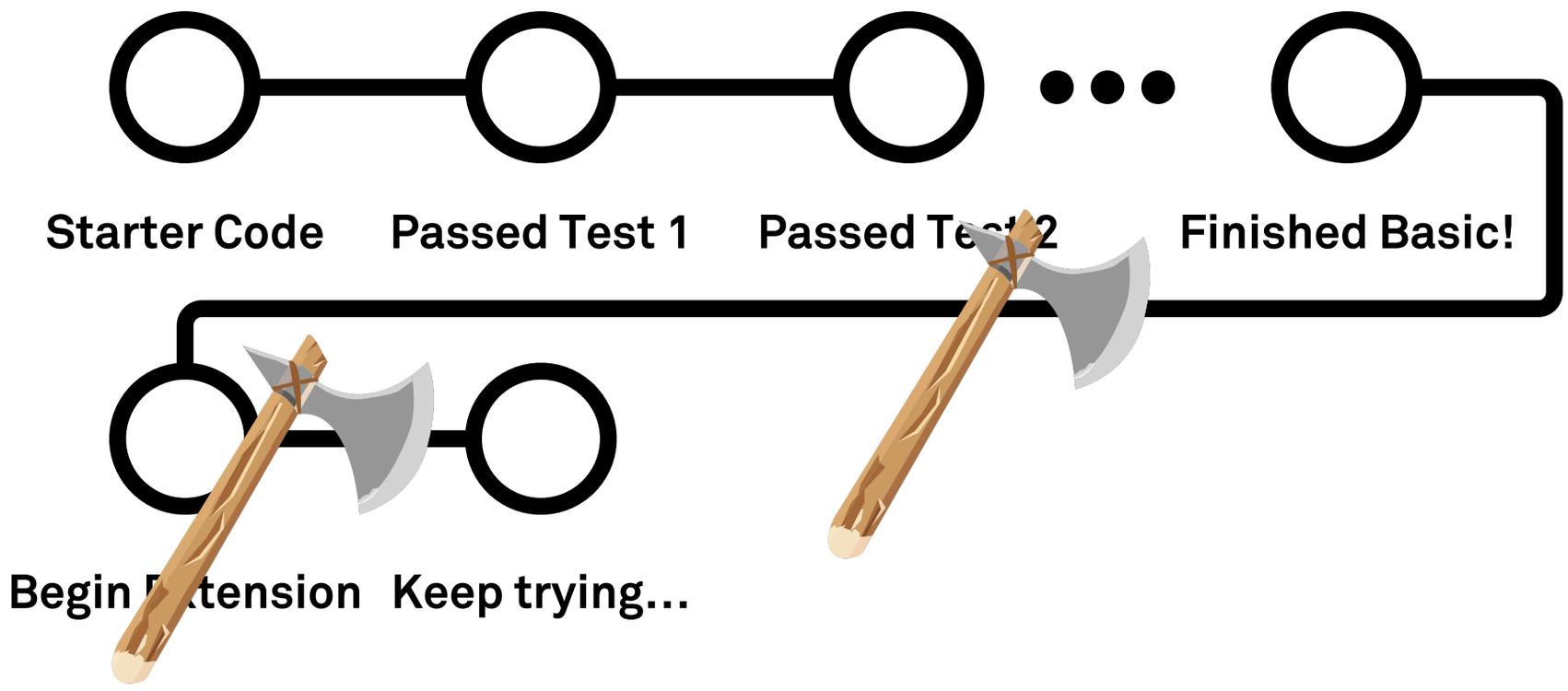
```
❯ git revert <commit1>
```



# Recording Changes

Tuesday at 4:30pm

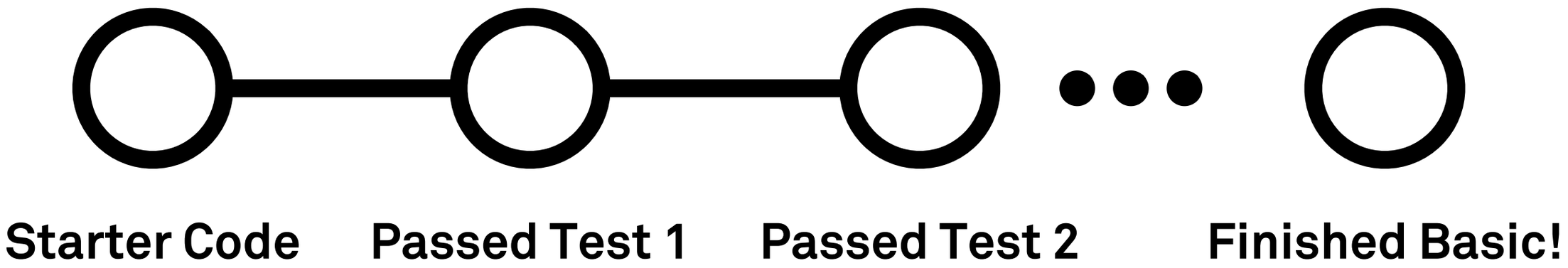
```
❯ git revert <commit1>
❯ git revert <commit2>
```



# Recording Changes

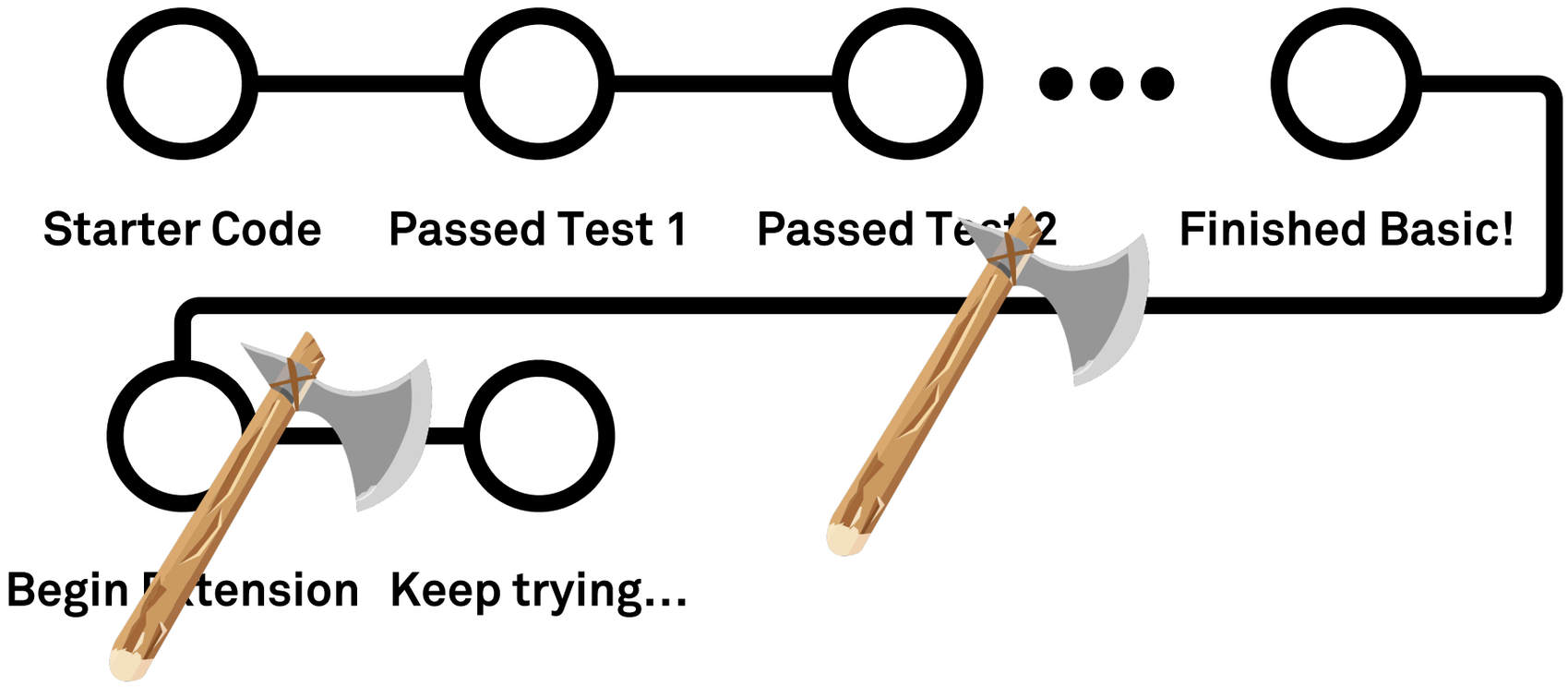
Tuesday at 4:31pm

```
❯ git push
```



# Recording Changes

- Keeping a change history enables experimentation
- You can always revert to a good state!
- What are some problems with this approach?



## Revert .gitignore changes as they didn't work

Browse files

master (#30)

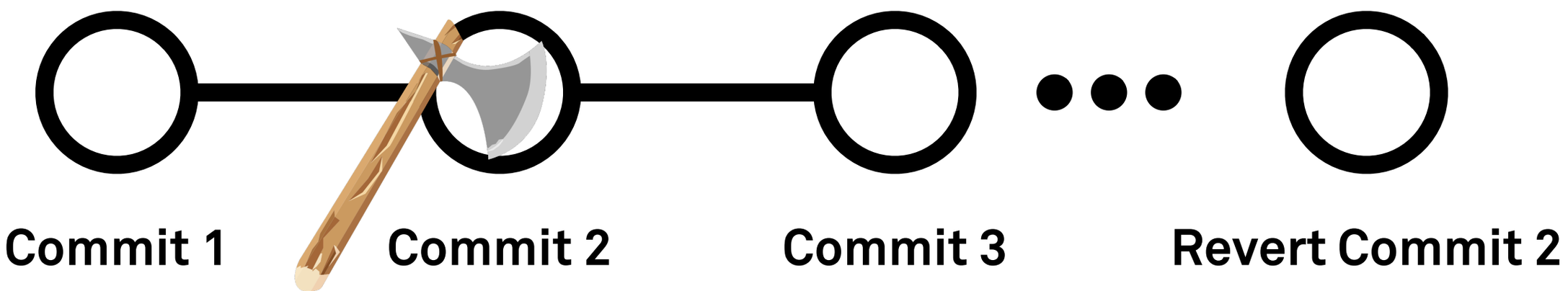
**leonardt** committed on Jul 27, 2017 — 1 parent e979765 — commit 6234bffa7f54fcfa796f7ab23ce9bb353f31fdfe

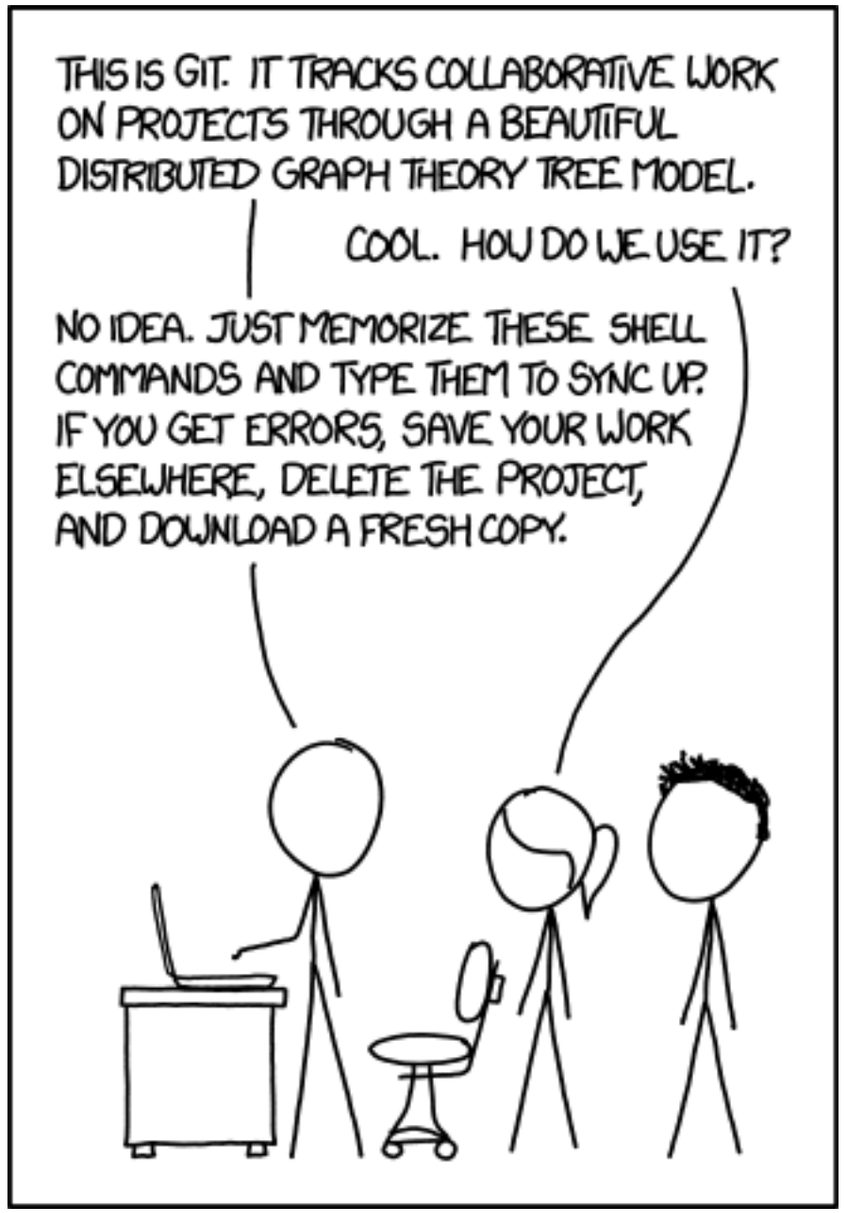
Showing 1 changed file with **1 addition** and **3 deletions.**

Unified | Split

4 .gitignore — View

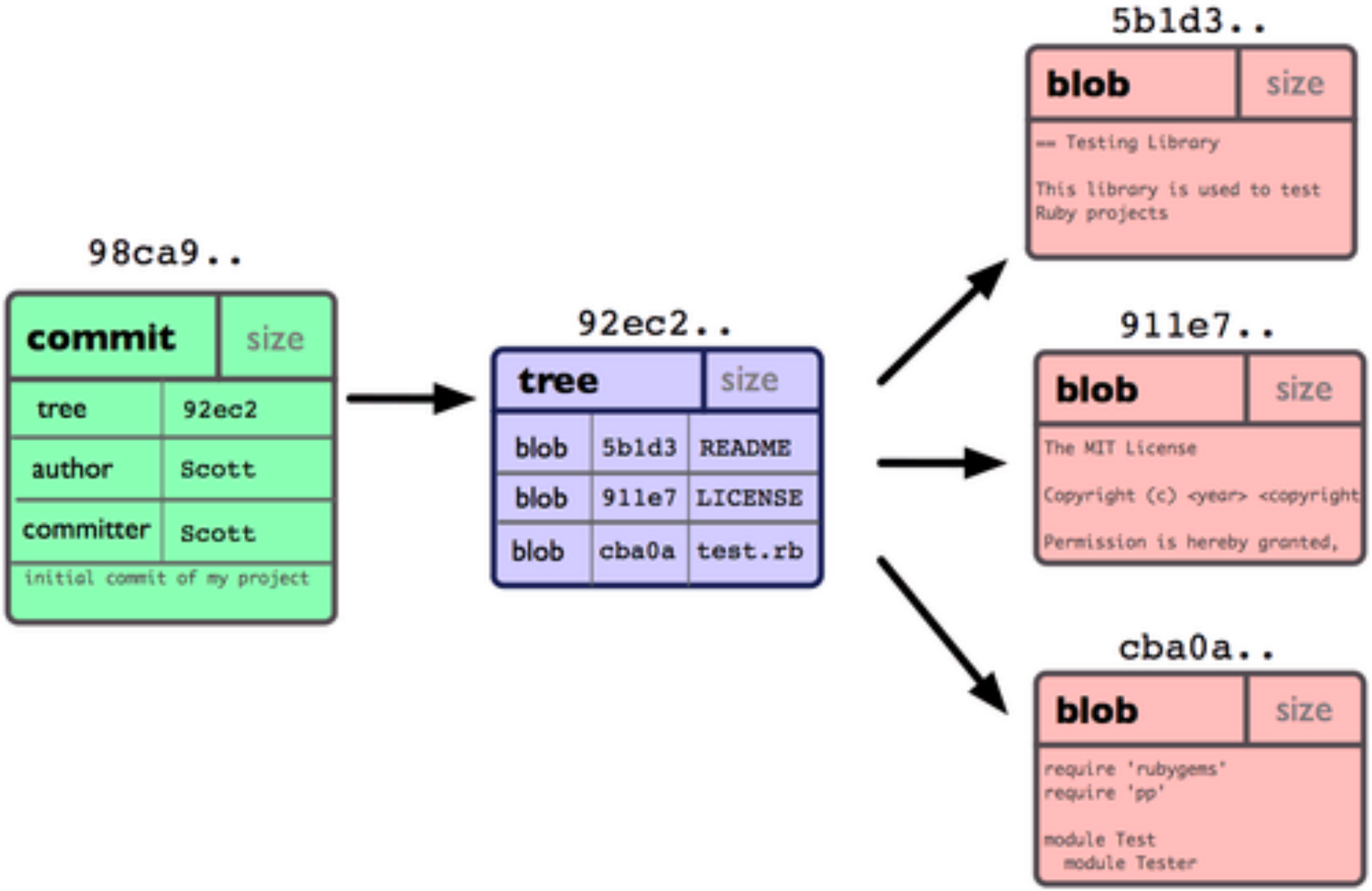
```
@@ -9,9 +9,7 @@ __pycache__/
 # Distribution / packaging
 .Python
 env/
-**/build/*
-!**/build/.gitignore
-!**/build/Makefile
+build/

 develop-eggs/
 dist/
```



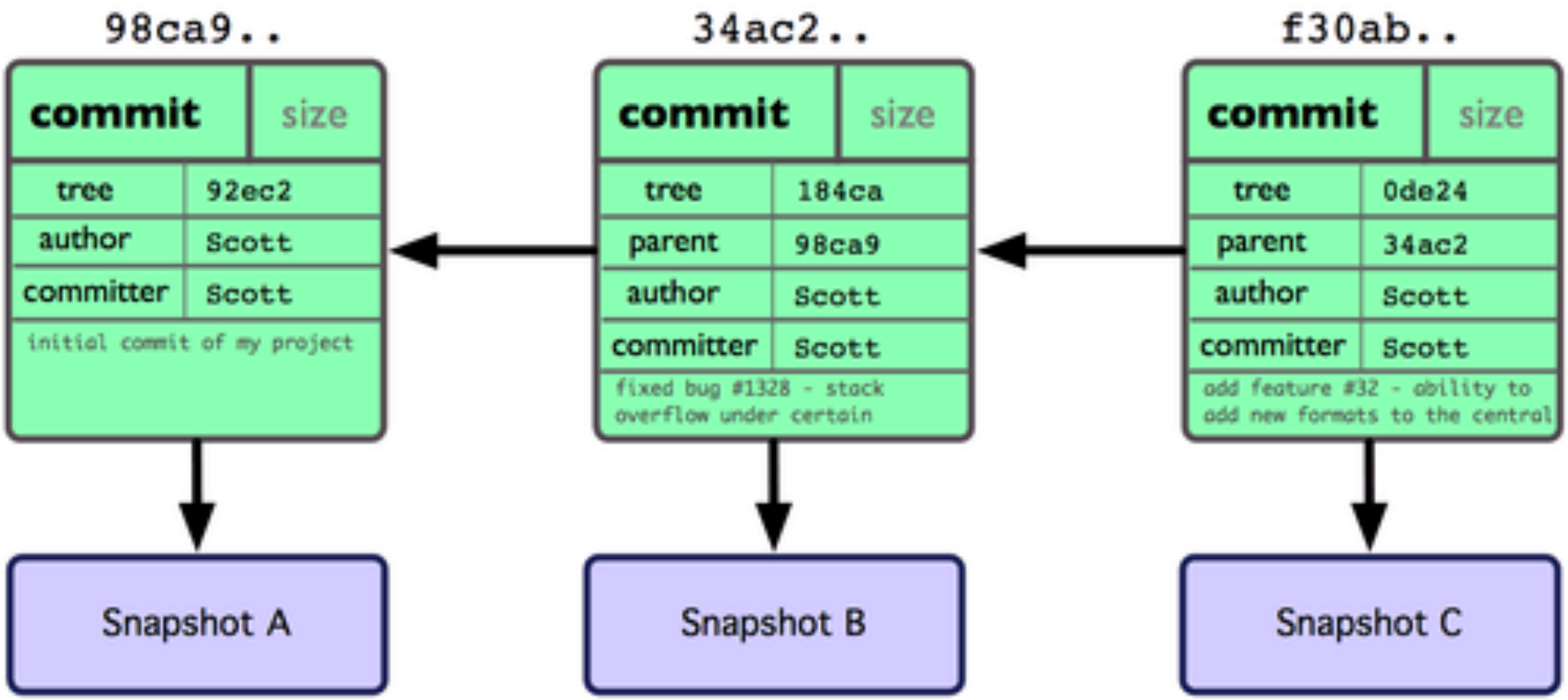



https://xkcd.com/1597/

# The Force Awakens in You

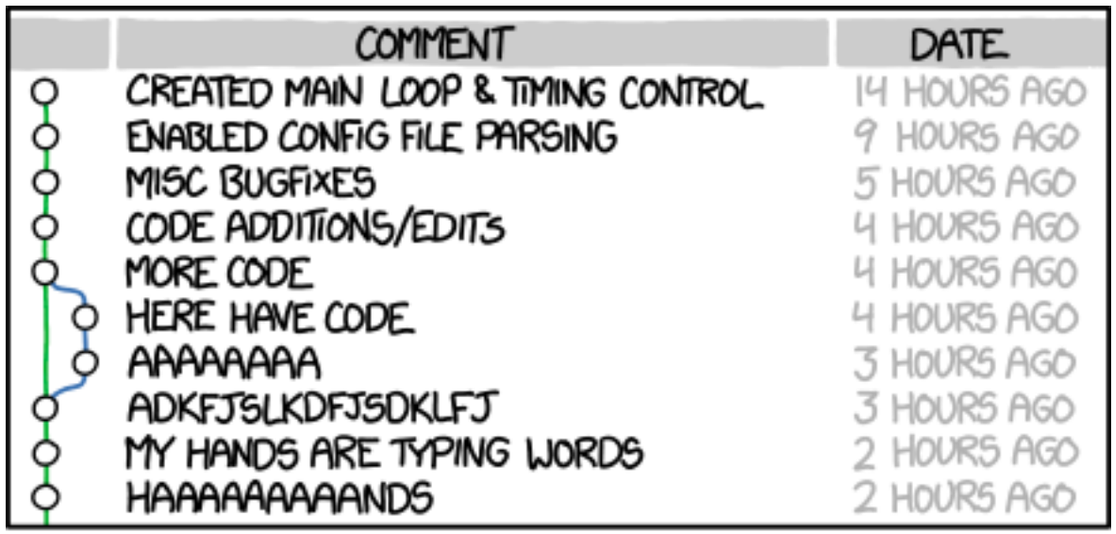



https://git-scm.com/book/en/v1/Git-Branching-What-a-Branch-Is

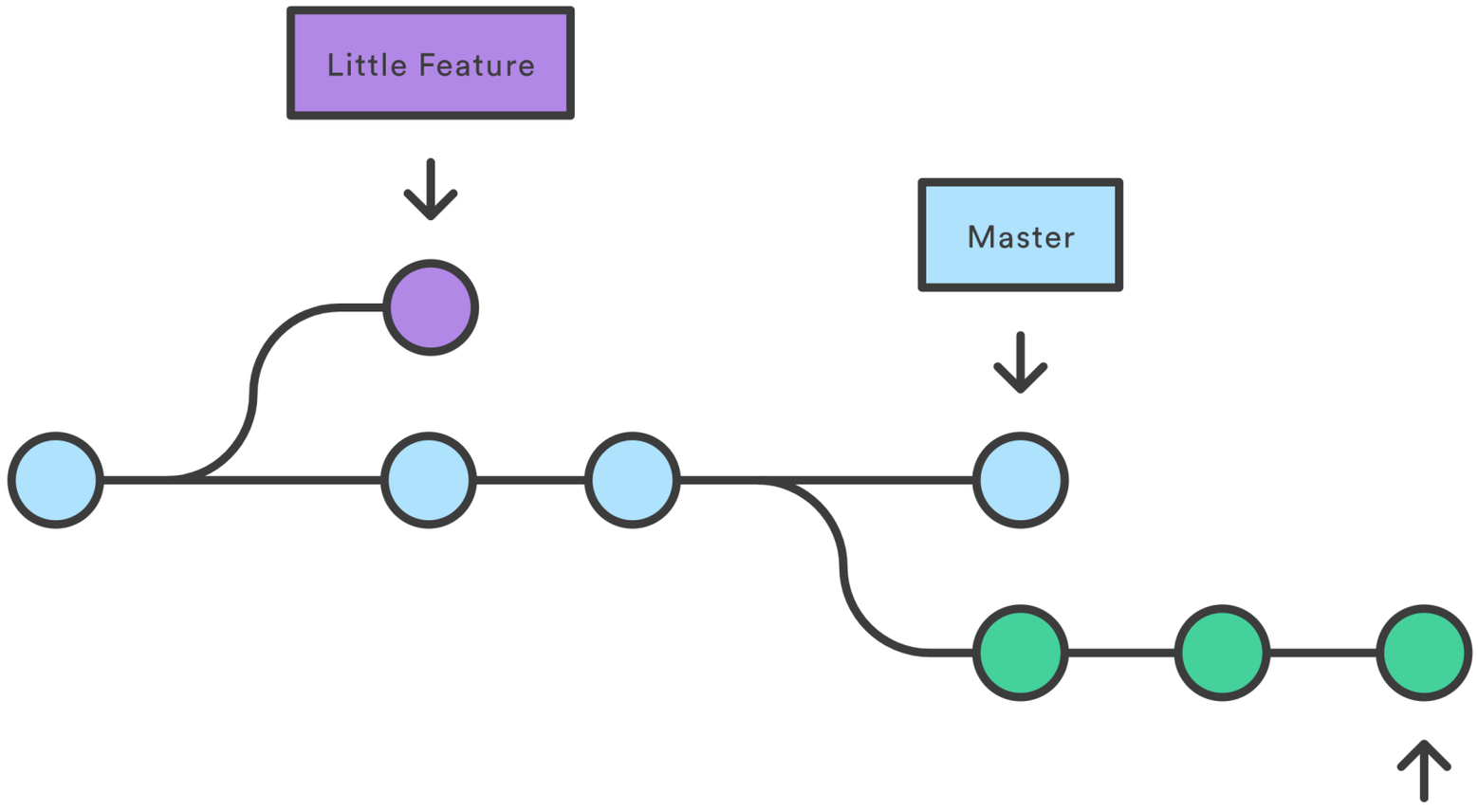



https://git-scm.com/book/en/v1/Git-Branching-What-a-Branch-Is

# Commit Messages




https://xkcd.com/1296/




- Git branches are lightweight, encouraging branch based workflows

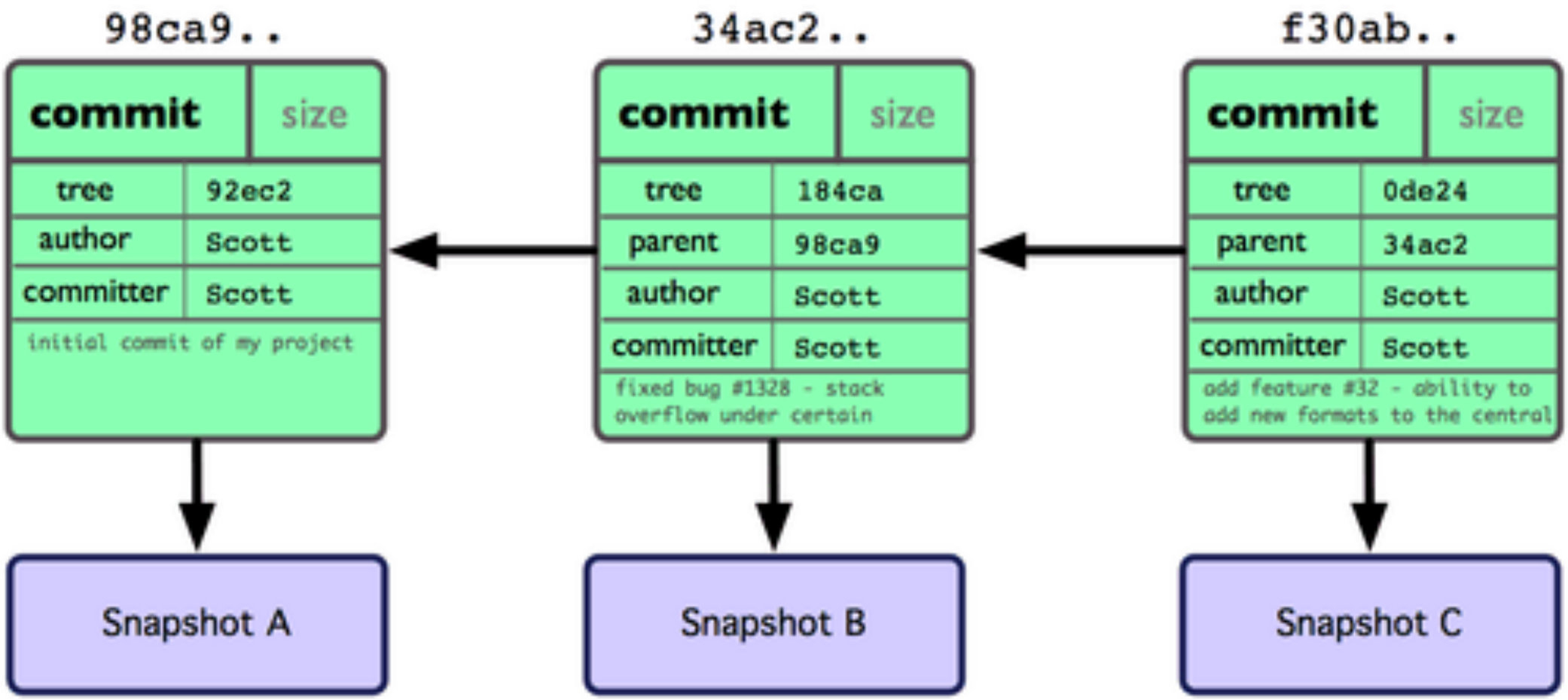
- Compare to other version control systems that use a heavyweight approach such as copying directories

**https://www.atlassian.com/git/tutorials/using-branches**

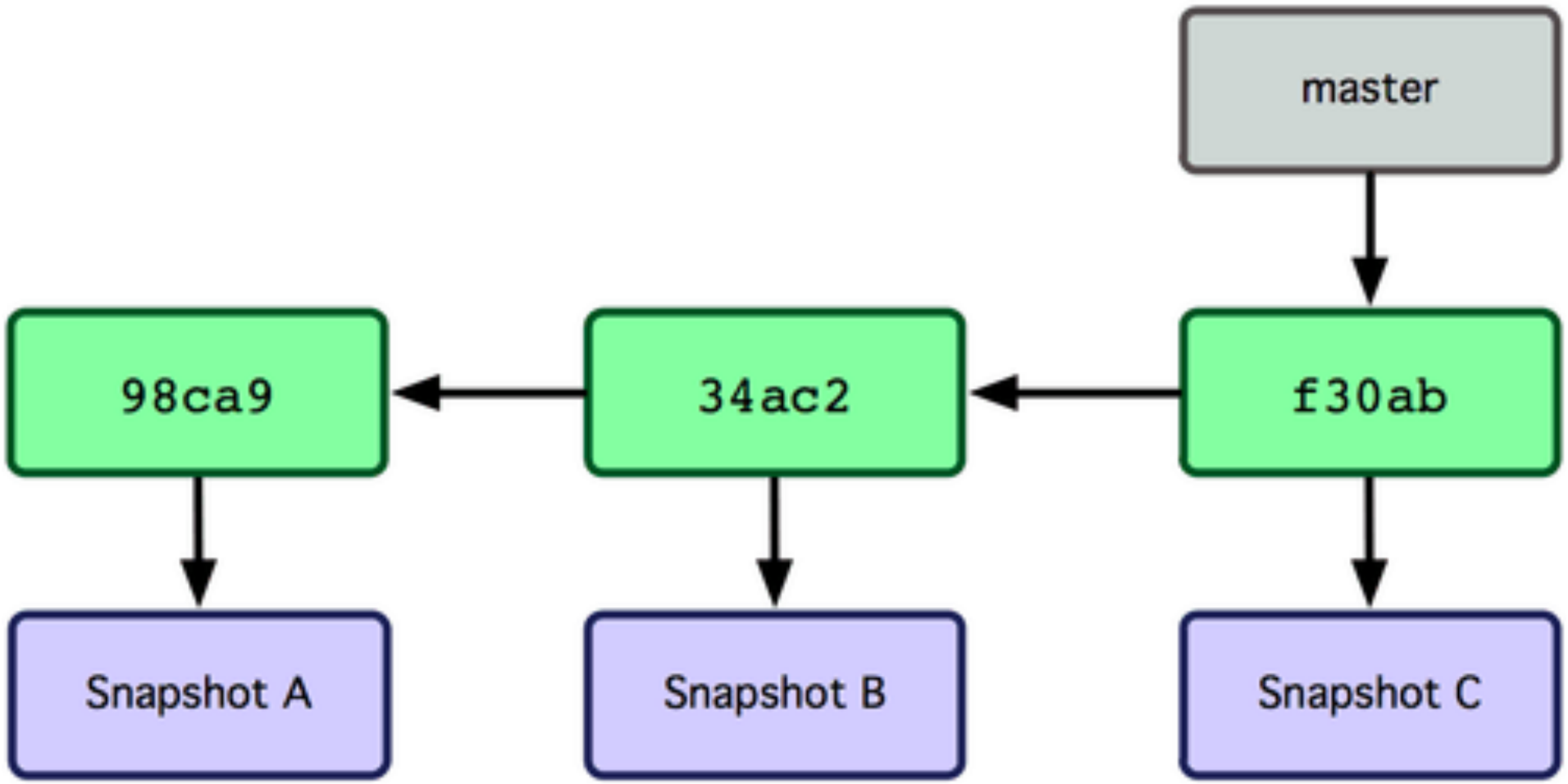
# Frictionless Context Switching

- Create a branch, try out an idea
- Switch back to another branch, fix a bug for your teammate
- Switch back to your branch, merge in the bug fix
- Disposable experimentation

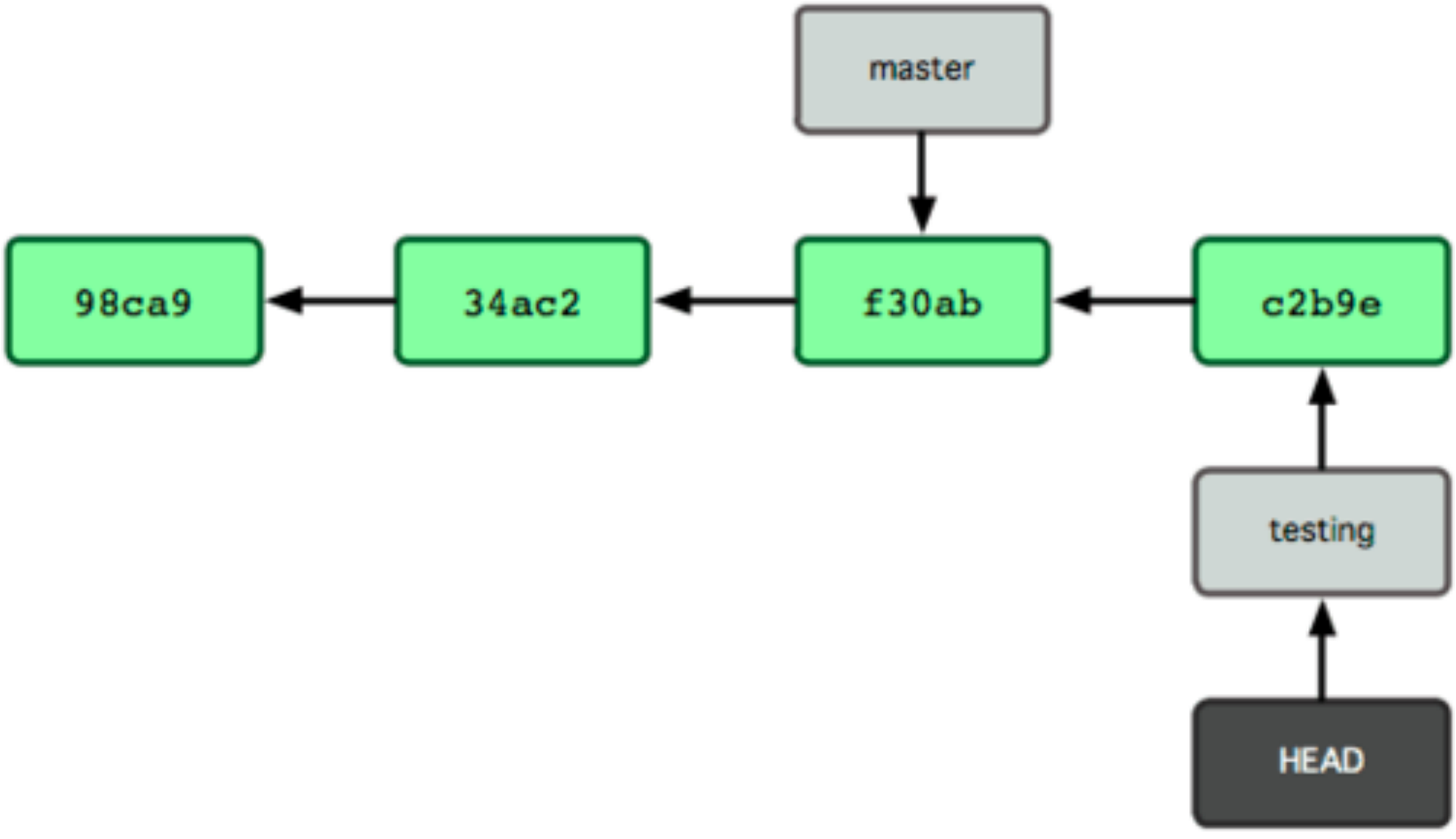
**https://git-scm.com/about/branching-and-merging**



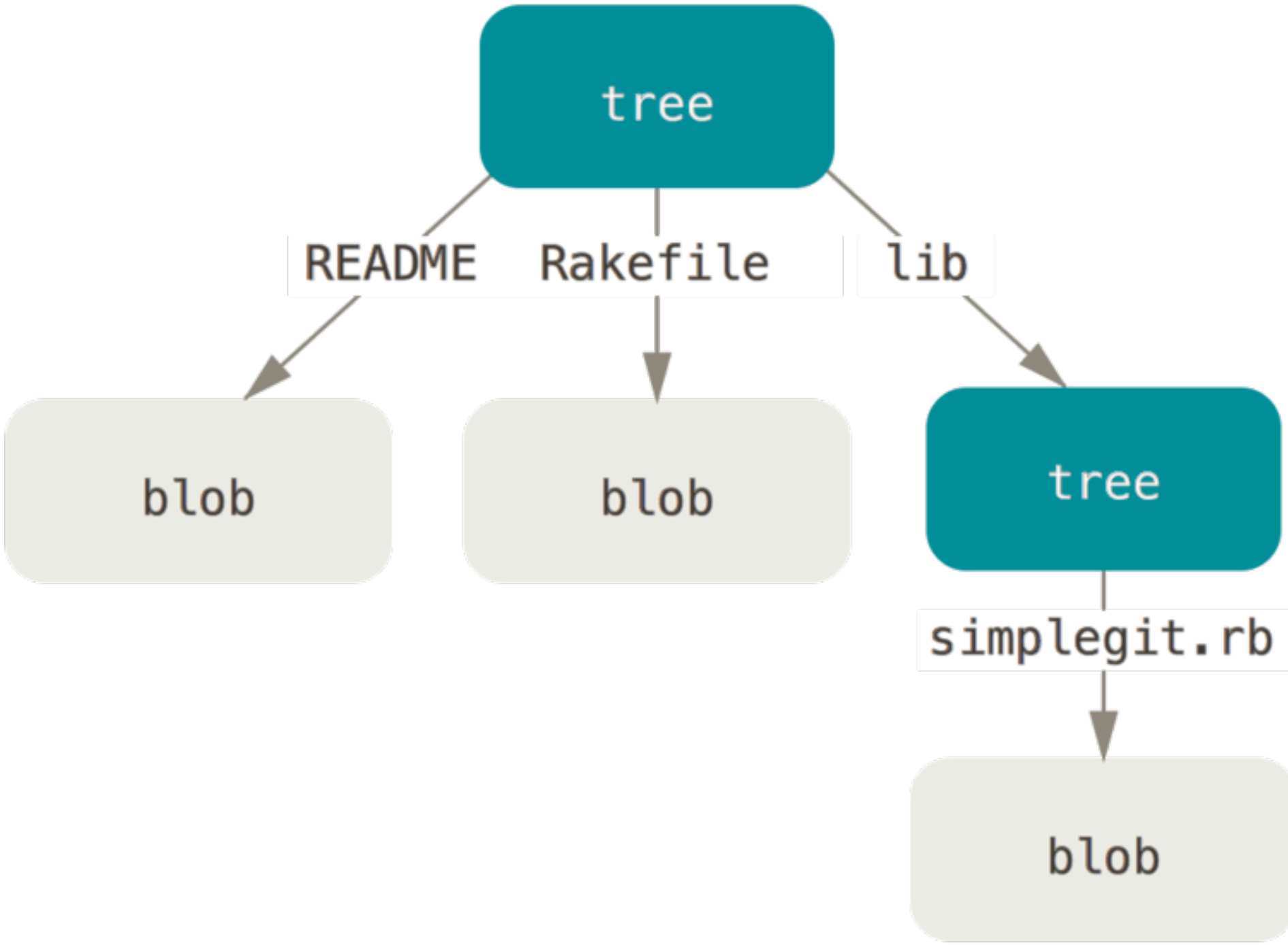

https://git-scm.com/book/en/v1/Git-Branching-What-a-Branch-Is



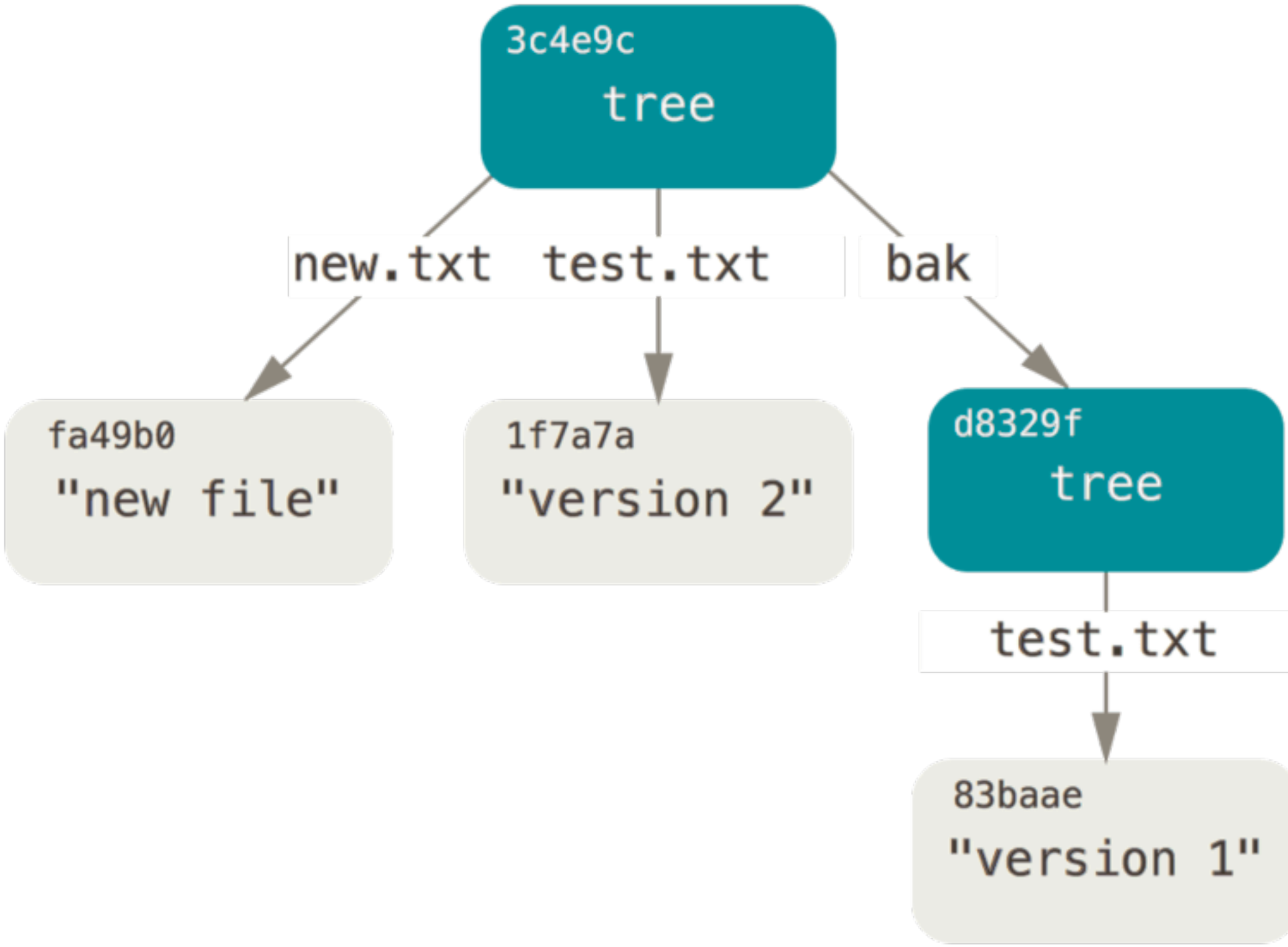

https://git-scm.com/book/en/v1/Git-Branching-What-a-Branch-Is



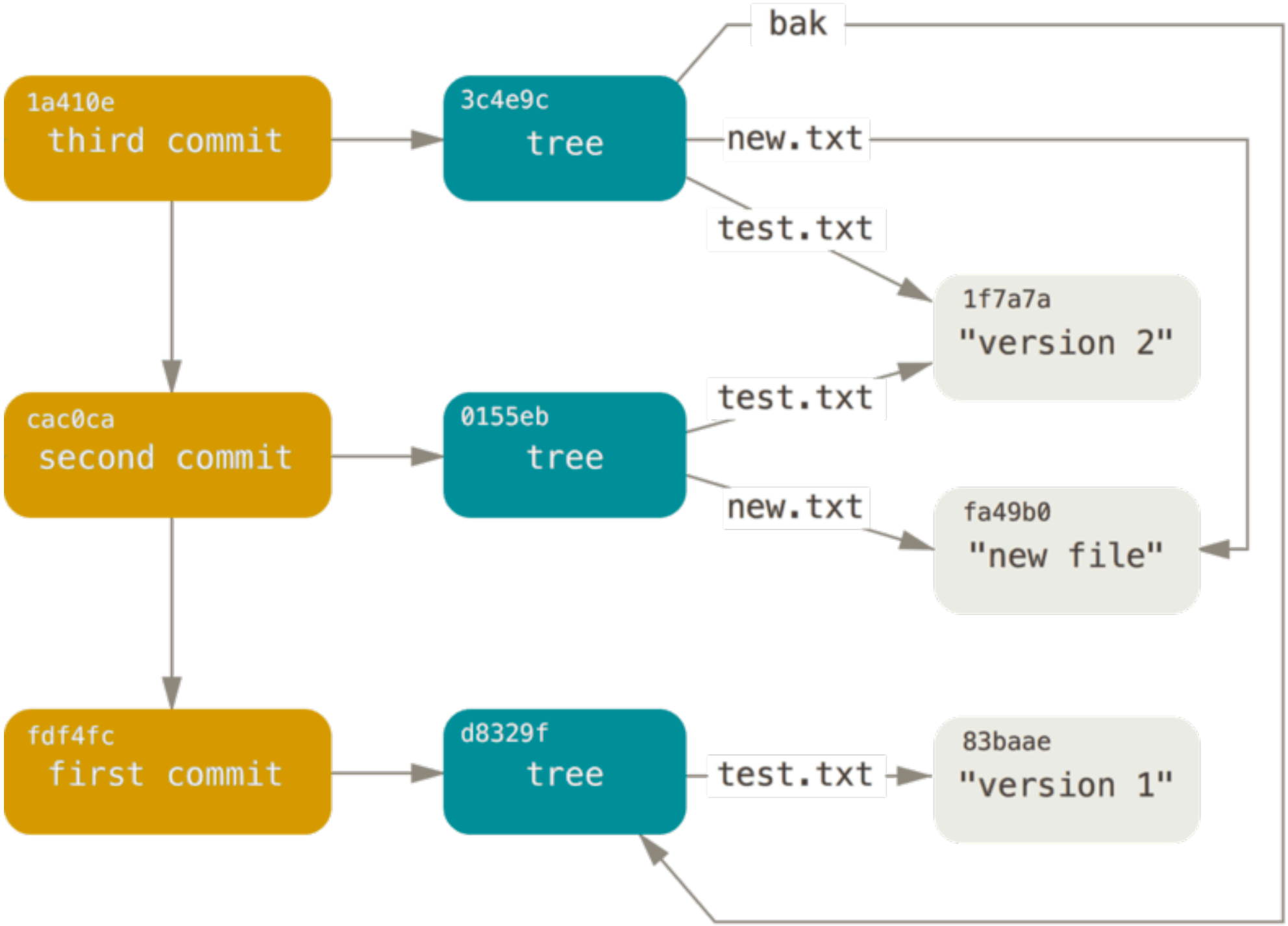

https://git-scm.com/book/en/v1/Git-Branching-What-a-Branch-Is



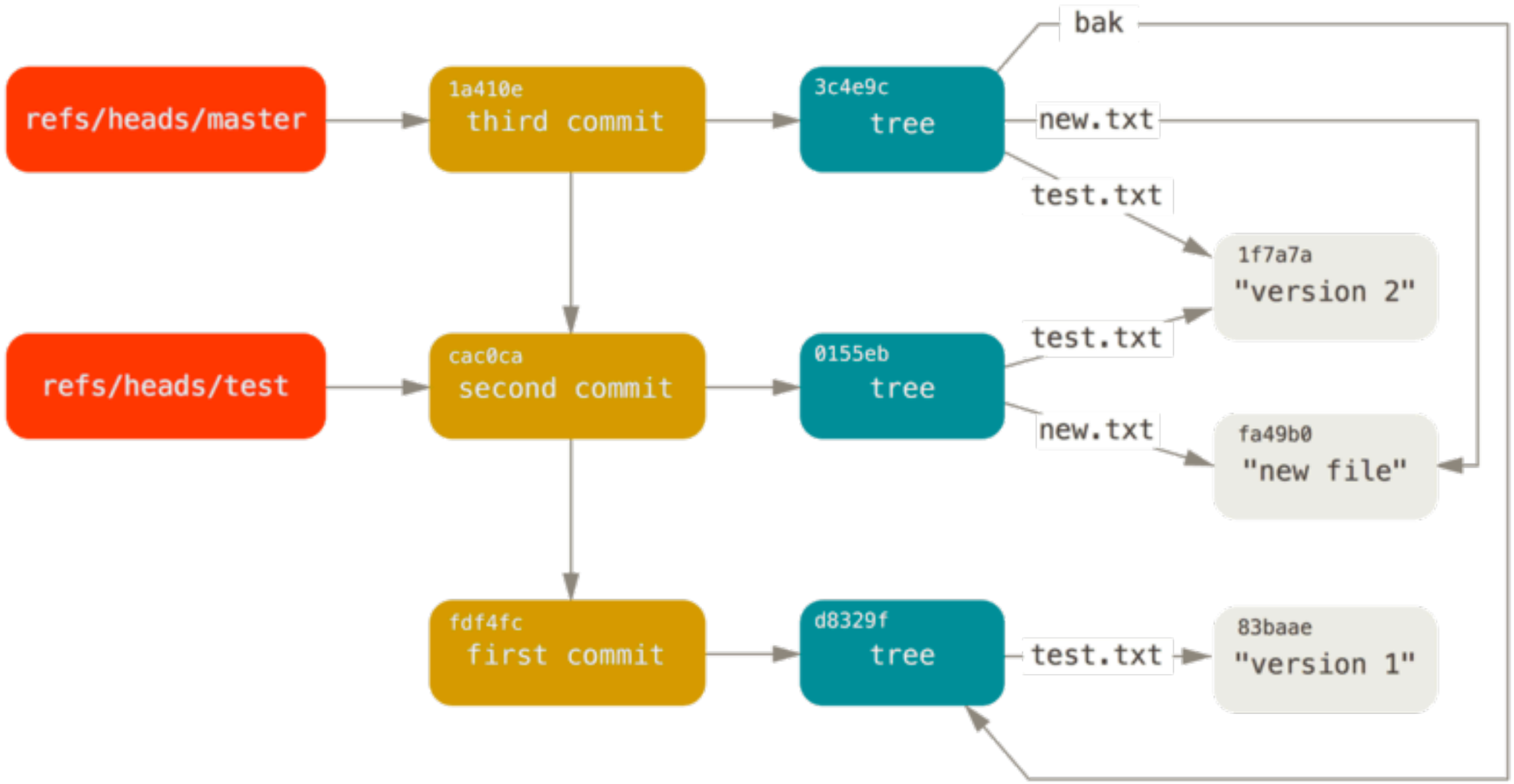

**https://git-scm.com/book/en/v2/Git-Internals-Git-Objects**




**https://git-scm.com/book/en/v2/Git-Internals-Git-Objects**




**https://git-scm.com/book/en/v2/Git-Internals-Git-Objects**




https://git-scm.com/book/en/v2/Git-Internals-Git-References

Make each program do one thing well. To do a new job, build afresh rather than complicate old programs by adding new "features".

*Doug McIlroy, 1978 Bell Labs*

# Unix Philosophy

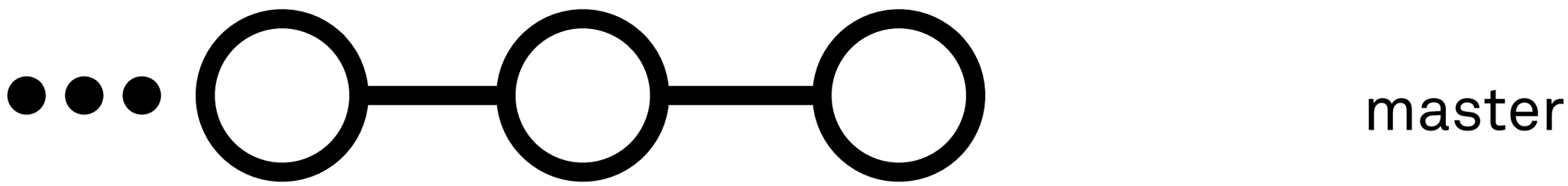
- Compose git commands to build a workflow
  - `git hash-object` (hash a file)
  - `git write-tree` (create a tree)
  - `git commit-tree` (create a commit)
  - `git update-ref` (create a branch)
  - Many, many more

# Feature Branch Workflow

- All feature development should occur in a dedicated branch (not master!)
- Master branch never contains broken code
- Encapsulating feature development makes it possible to leverage pull requests
    - Get reviews and help from your team

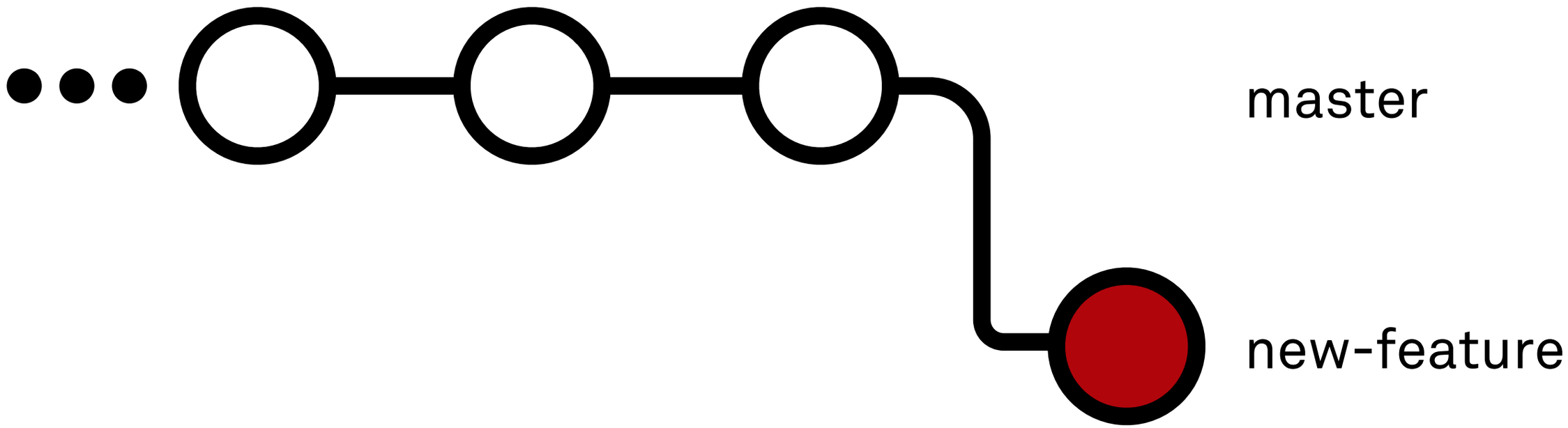
**https://www.atlassian.com/git/tutorials/comparing-workflows/feature-branch-workflow**

# Get the Latest Master



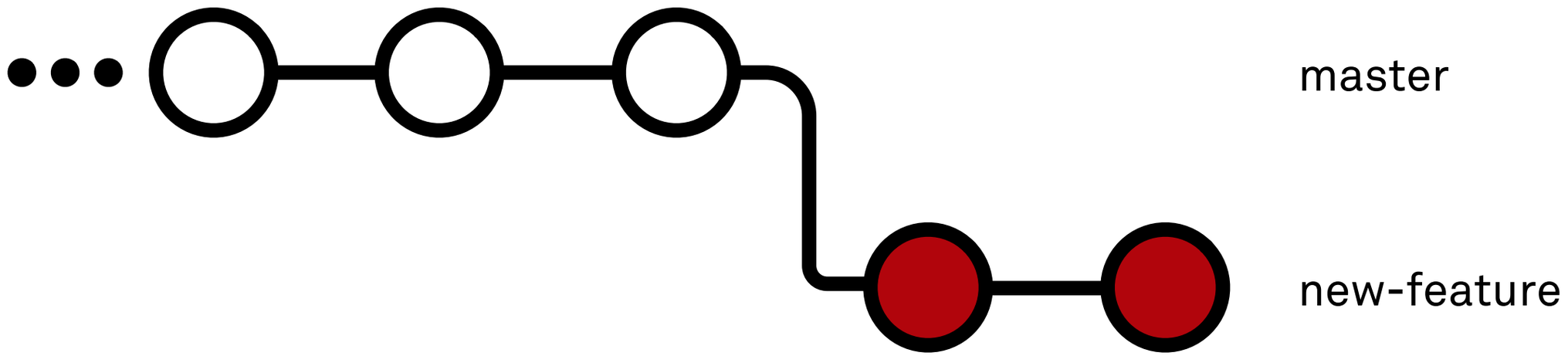

```
❯ cd repo
❯ git checkout master
❯ git fetch origin
❯ git reset --hard origin/master
```

# New Feature = New Branch



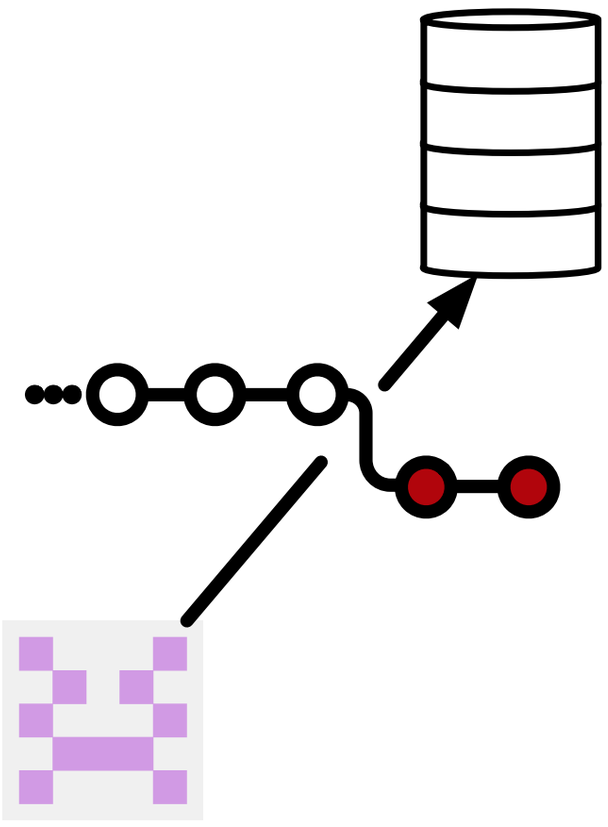

```
› git checkout -b new-feature master
```

# Update, add, commit, and push changes



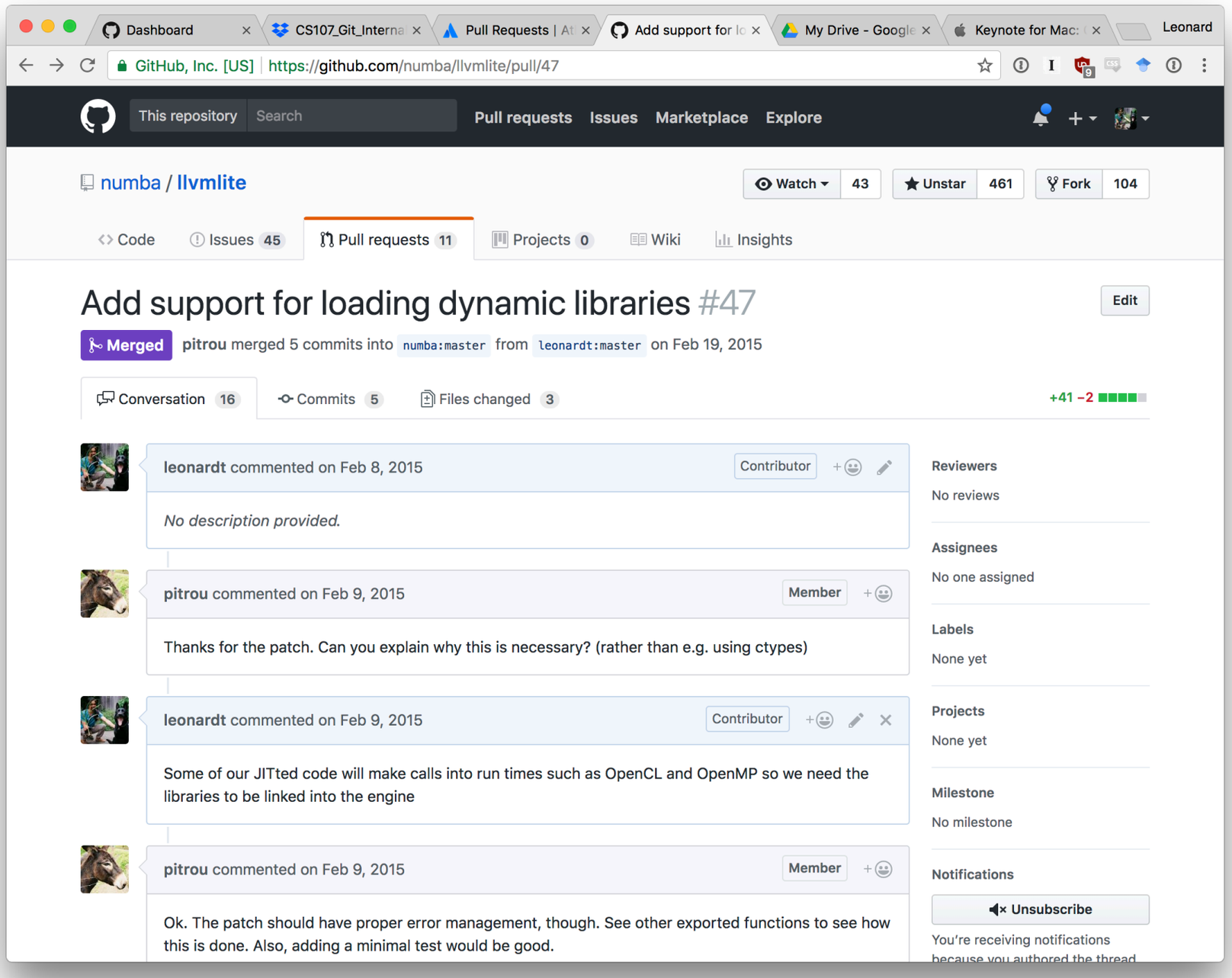

```
❯ git status
❯ git add <file>
❯ git commit
❯ git push -u origin new-feature
```

# Push feature branch to remote



```
❯ git push -u origin new-feature
```

# Pull Request




**https://github.com/numba/llvmlite/pull/47**

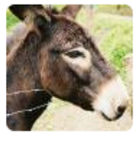
# Discuss the changes

**pitrou** commented on Feb 9, 2015 — Member

Thanks for the patch. Can you explain why this is necessary? (rather than e.g. using ctypes)

**leonardt** commented on Feb 9, 2015 — Contributor

Some of our JITted code will make calls into run times such as OpenCL and OpenMP so we need the libraries to be linked into the engine



**pitrou** commented on Feb 9, 2015 — Member

Ok. The patch should have proper error management, though. See other exported functions to see how this is done. Also, adding a minimal test would be good.

**https://github.com/numba/llvmlite/pull/47**

# Resolve Feedback

**pitrou** reviewed on Feb 12, 2015 — View changes

`llvmlite/tests/test_dylib.py` — Hide outdated

```
6  +from ctypes.util import find_library
7  +import unittest
8  +
9  +@unittest.skipUnless(platform.system() in ["Linux", "Darwin"], "Unsupport
```

**pitrou** on Feb 12, 2015 **Member**

Actually, test_bad_library would probably work under Windows.

**leonardt** on Feb 12, 2015 Contributor

not sure what the error message should look like, okay to just assert that an exception is raised?

**pitrou** on Feb 12, 2015 **Member**

Yes, that's ok.

Reply...

**pitrou** reviewed on Feb 12, 2015 — View changes

`llvmlite/tests/test_dylib.py` — Hide outdated

```
31 +            elif self.system == "Darwin":
32 +                libm = find_library("libm")
33 +            dylib.load_library_permanently(libm)
34 +        except Exception:
```

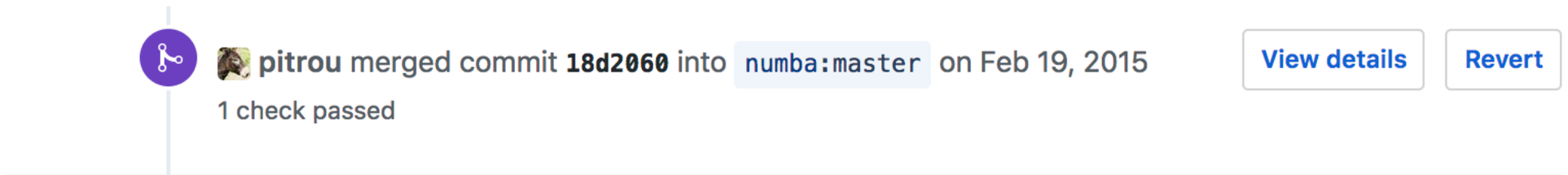
**pitrou** on Feb 12, 2015 **Member**

No need to catch the exception.

Reply...

**https://github.com/numba/llvmlite/pull/47**

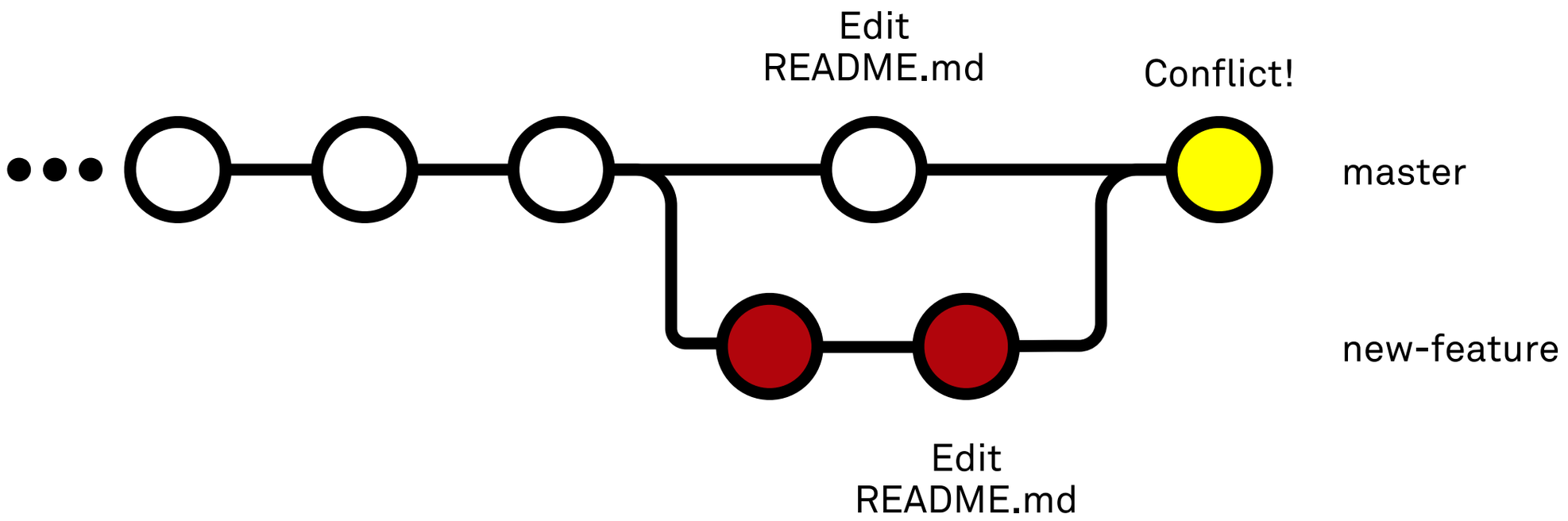
# Merge!





**https://github.com/numba/llvmlite/pull/47**

# Merge Conflicts



# Merge Conflicts

```
› git status
# On branch master
# You have unmerged paths.
#   (fix conflicts and run "git commit")
#
# Unmerged paths:
#   (use "git add ..." to mark resolution)
#
# both modified:      README.md
```

# Merge Conflicts

```
❯ cat README.md
This is a README
<<<<<<< HEAD
Added another line in master.
=======
Added another line in new-feature.
>>>>>>> new-feature
```

# Merge Conflicts

```
❯ cat README.md
This is a README

Added another line in master.

Added another line in new-feature.
❯ git add README.md
❯ git commit
```

# Continuous Integration

- Strive to “continuously” (multiple times a day) merge new code into the master branch
- The smaller the changes, the easier to integrate (less merge conflicts)
- Leverage testing and automation to integrate quickly and with confidence

# Decentralized

- Everyone has a **full copy** of the repository
- **Massive** impact in the open source world
- Erase barriers to contribution
- No need to manage **access control** between users
- Anyone can participate!

# Sites to Know

- Git Repository Hosting

GitHub

GitLab

Bitbucket

- Continuous Integration

Travis CI

circleci

# In case of fire

1. git commit

2. git push

3. leave building

https://github.com/louim/in-case-of-fire