Deep dive into { git }

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Xpirit

Agenda

- Getting started
- The 3 principles
  - Hash / SHA
  - Snapshots
  - Trees (DAG)
- Branches and tags
- Referencing commits
- Diffs and patches
- Merging
- Resolving merge conflicts
- Remotes
- Branching workflows
- Git aliases
- Reverting changes
- Ammending changes
- Resetting your repository
- Rebase
- Cherry-picking and the reflog
- The stash

Getting started

Getting started

- Local git configs

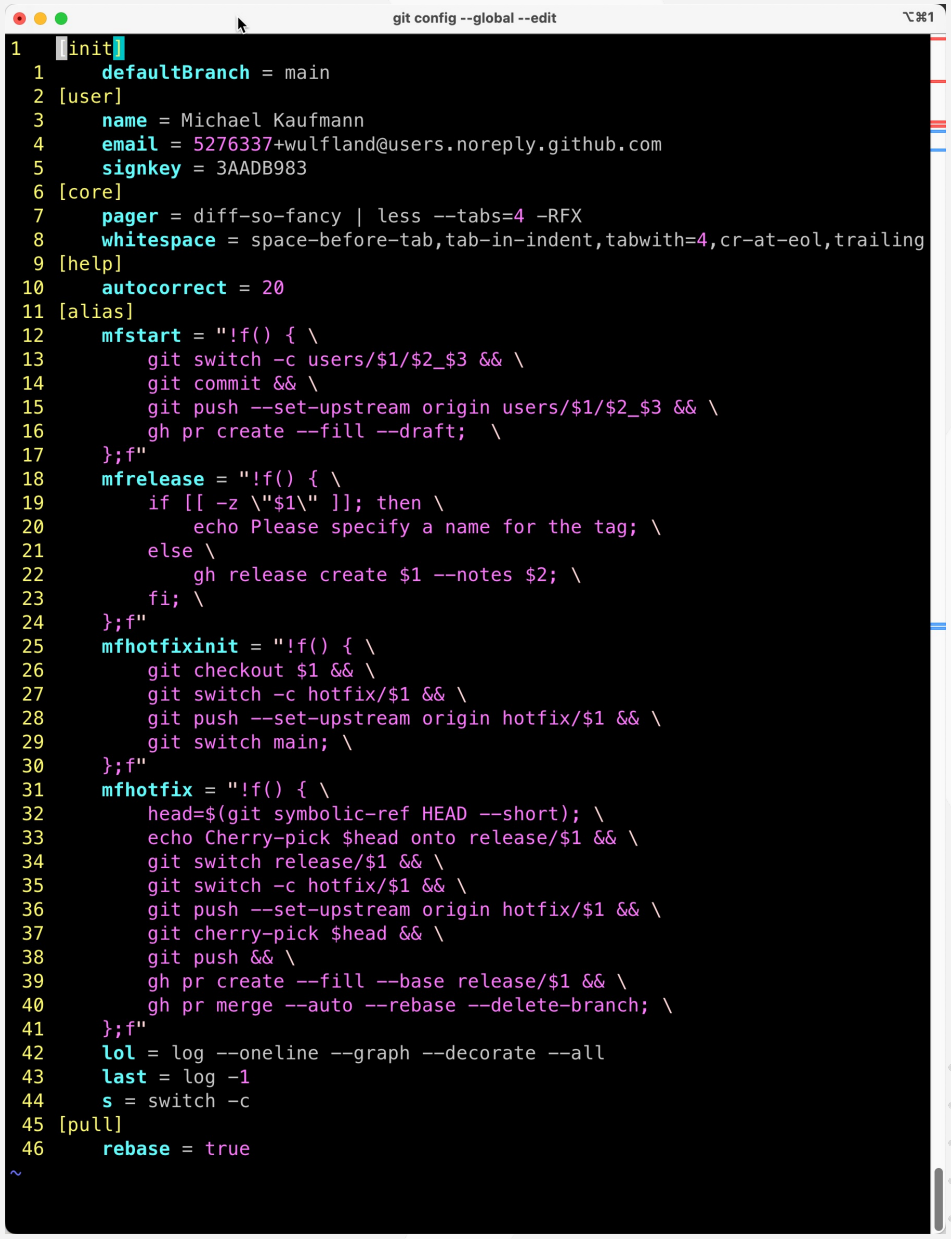

--system


--global

-- local

```
$ git config --global user.email foo@bar
$ git config --global user.name "Foo Bar"
$ git config --global init.defaultBranch main
$ git config --global help.autocorrect 20
$ git config --global core.editor "code --wait"
$ git config --global alias.last "log -1"
$ git config --global --edit
```

- Functions "!f(){ ... };f "
- $1, $2, $3, ... $@
- Line endings: \
- && or ; to separate commands



The 3 principles

The 3 principles

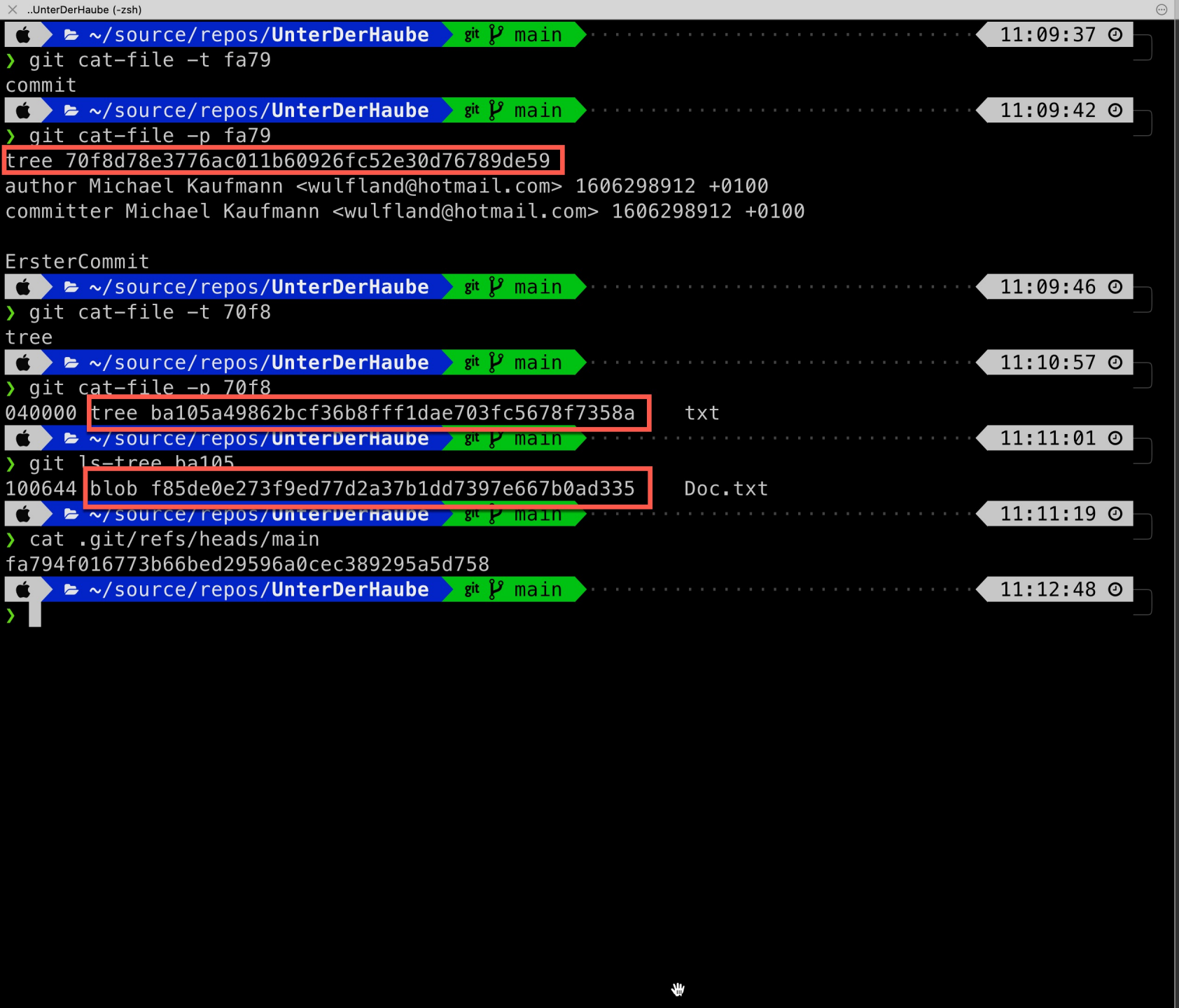
- Everything in git is a file – and changes are tracked using SHA hash values (SHA-1 or SHA-256)
- Git saves snapshots – and not deltas
- Everything is a rooted tree
  - Commits
  - Files and folders

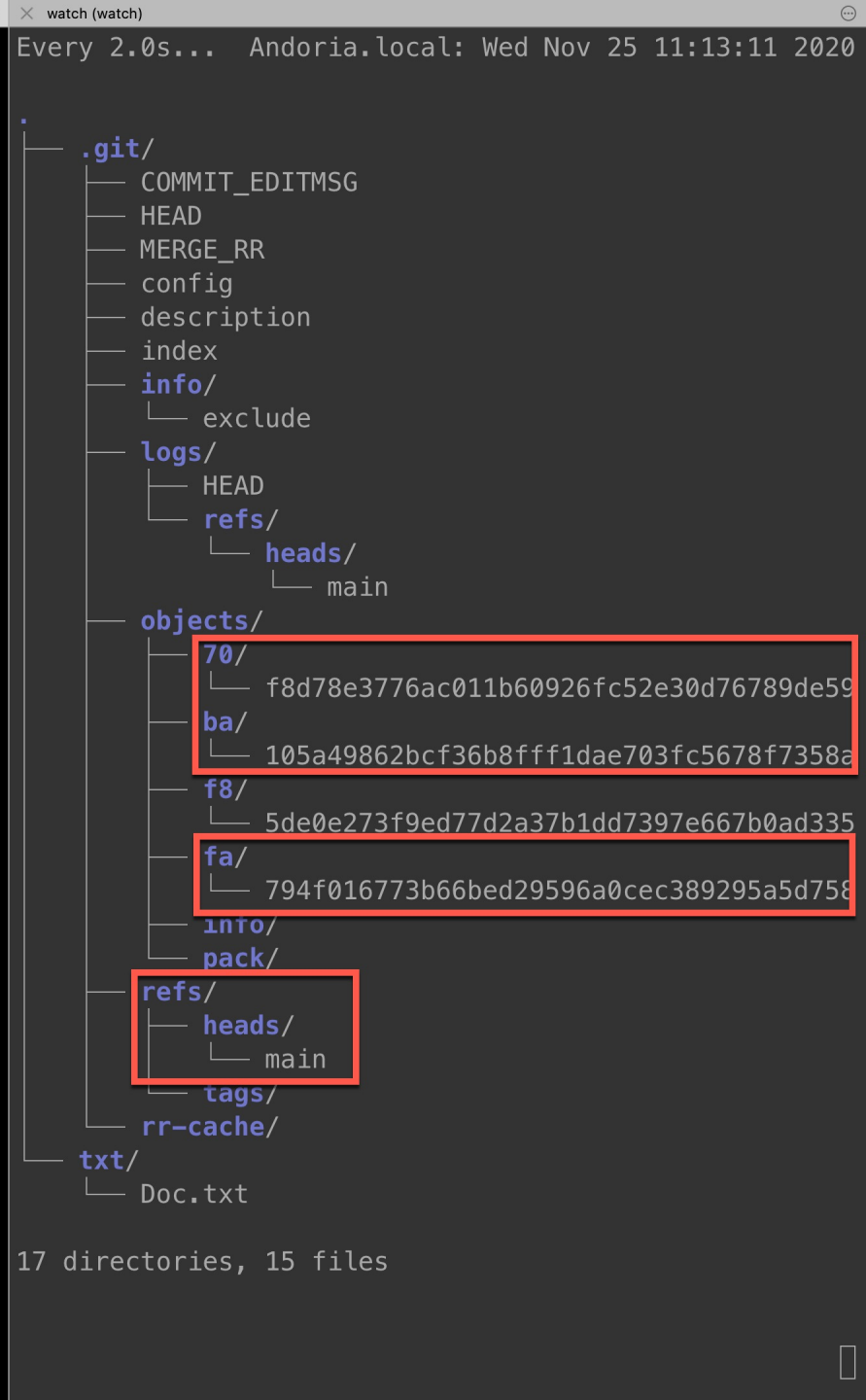
..UnterDerHaube (-zsh)

```
~/source/repos/UnterDerHaube                                                    10:56:10
❯ git init
Initialized empty Git repository in /Users/m.kaufmann/source/repos/UnterDerHaube/.git/
~/source/repos/UnterDerHaube  git main ?1                                       10:56:36
❯ git hash-object txt/Doc.txt
f20acb769ad757b2058c8c3c96e7eac2e1258503
~/source/repos/UnterDerHaube  git main ?1                                       10:57:58
❯ vim txt/Doc.txt
~/source/repos/UnterDerHaube  git main ?1                          14s          10:58:21
❯ git hash-object txt/Doc.txt
f85de0e273f9ed77d2a37b1dd7397e667b0ad335
~/source/repos/UnterDerHaube  git main ?1                                       10:58:24
❯ git add txt/Doc.txt
~/source/repos/UnterDerHaube  git main +1                                       10:59:03
❯ cat .git/HEAD
ref: refs/heads/main
~/source/repos/UnterDerHaube  git main +1                                       11:00:27
❯ cat .git/Index
DIRC_@*@@
@_@*@g@@@@@@@>@]@@s@@wH{@9~f{
@5
  txt/Doc.txt@({@7@@@3@>@pC@k@J@%
~/source/repos/UnterDerHaube  git main +1                                       11:00:43
❯ git ls-files --stage
100644 f85de0e273f9ed77d2a37b1dd7397e667b0ad335 0       txt/Doc.txt
~/source/repos/UnterDerHaube  git main +1                                       11:01:05
❯ cat .git/objects/f8/5de0e273f9ed77d2a37b1dd7397e667b0ad335
xK@@OR03b@K@M@Rp)@Sp@@M-QPr@OVRp*@/@@@/@L@@K@Q(@)2@@0@@@L@â@@O@@@%
~/source/repos/UnterDerHaube  git main +1                                       11:03:05
❯ git cat-file -t f85de
blob
~/source/repos/UnterDerHaube  git main +1                                       11:05:52
❯ git cat-file -p f85de
Name: Dr. Emmet "Doc" Brown
Original time: 1985
Nichname: Doc
~/source/repos/UnterDerHaube  git main +1                                       11:05:57
❯
```

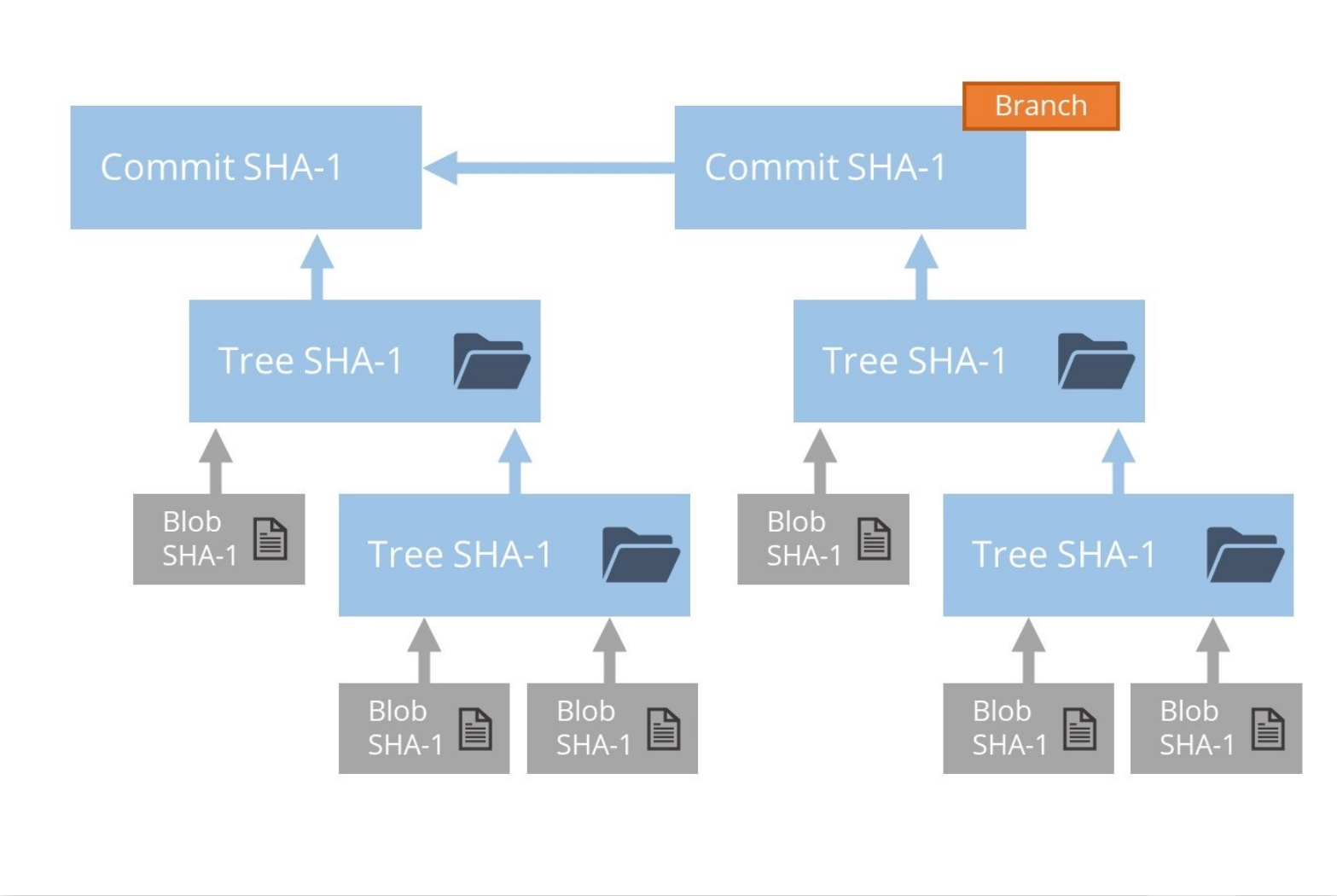
watch (watch)

```
Andoria.local: Wed Nov 25 11:06:00 2020

.
├── .git/
│   ├── HEAD
│   ├── config
│   ├── description
│   ├── index
│   ├── info/
│   │   └── exclude
│   ├── objects/
│   │   ├── f8/
│   │   │   └── 5de0e273f9ed77d2a37b1dd7397e667b
0ad335
│   │   ├── info/
│   │   └── pack/
│   └── refs/
│       ├── heads/
│       └── tags/
└── txt/
    └── Doc.txt

10 directories, 7 files
```


..UnterDerHaube (-zsh)
~/source/repos/UnterDerHaube git main 11:09:37
git cat-file -t fa79
commit
~/source/repos/UnterDerHaube git main 11:09:42
git cat-file -p fa79
tree 70f8d78e3776ac011b60926fc52e30d76789de59
author Michael Kaufmann <wulfland@hotmail.com> 1606298912 +0100
committer Michael Kaufmann <wulfland@hotmail.com> 1606298912 +0100
ErsterCommit
~/source/repos/UnterDerHaube git main 11:09:46
git cat-file -t 70f8
tree
~/source/repos/UnterDerHaube git main 11:10:57
git cat-file -p 70f8
040000 tree ba105a49862bcf36b8fff1dae703fc5678f7358a txt
~/source/repos/UnterDerHaube git main 11:11:01
git ls-tree ba105
100644 blob f85de0e273f9ed77d2a37b1dd7397e667b0ad335 Doc.txt
~/source/repos/UnterDerHaube git main 11:11:19
cat .git/refs/heads/main
fa794f016773b66bed29596a0cec389295a5d758
~/source/repos/UnterDerHaube git main 11:12:48


watch (watch)
Every 2.0s... Andoria.local: Wed Nov 25 11:13:11 2020
.
.git/
COMMIT_EDITMSG
HEAD
MERGE_RR
config
description
index
info/
exclude
logs/
HEAD
refs/
heads/
main
objects/
70/
f8d78e3776ac011b60926fc52e30d76789de59
ba/
105a49862bcf36b8fff1dae703fc5678f7358a
f8/
5de0e273f9ed77d2a37b1dd7397e667b0ad335
fa/
794f016773b66bed29596a0cec389295a5d758
info/
pack/
refs/
heads/
main
tags/
rr-cache/
txt/
Doc.txt
17 directories, 15 files

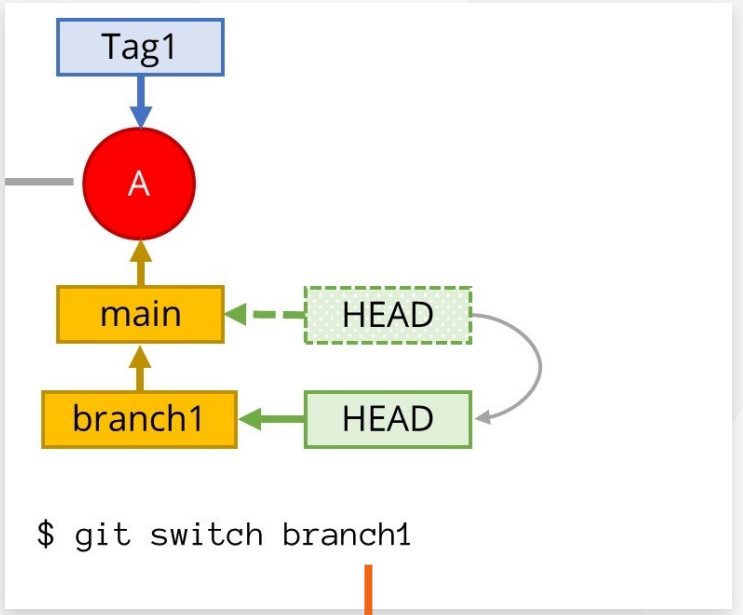
Everything is a rooted tree

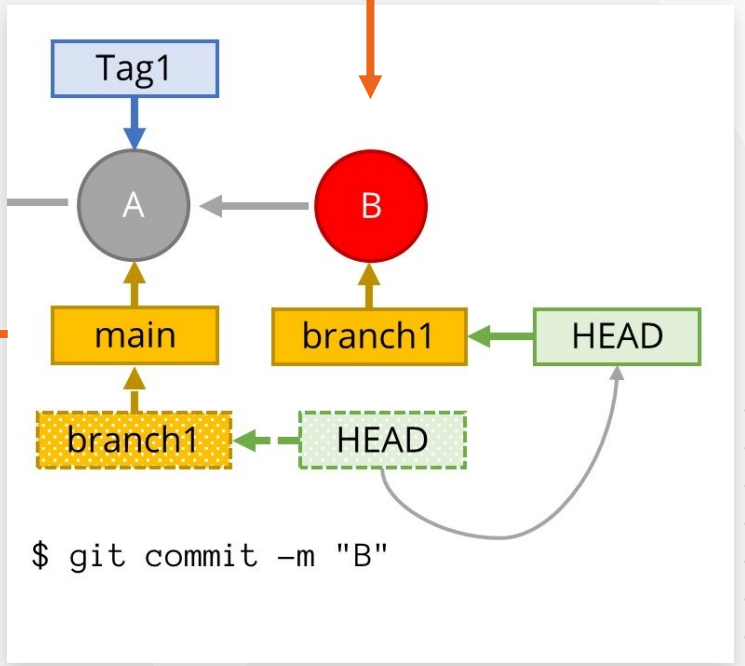


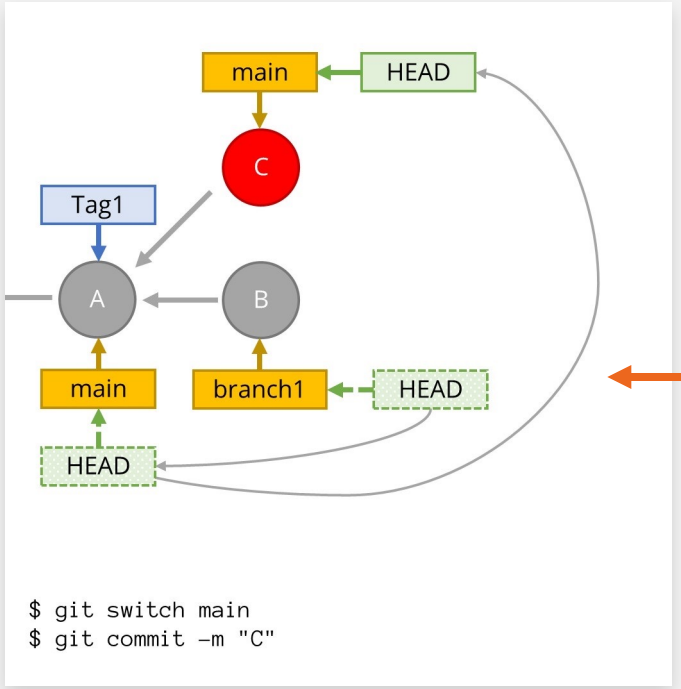
Branches and tags

Branches

- Pointers to a commit
- The branch that HEAD points to
  - will be the parent commit for a new commit
  - Will point to the new commit (git update-ref)

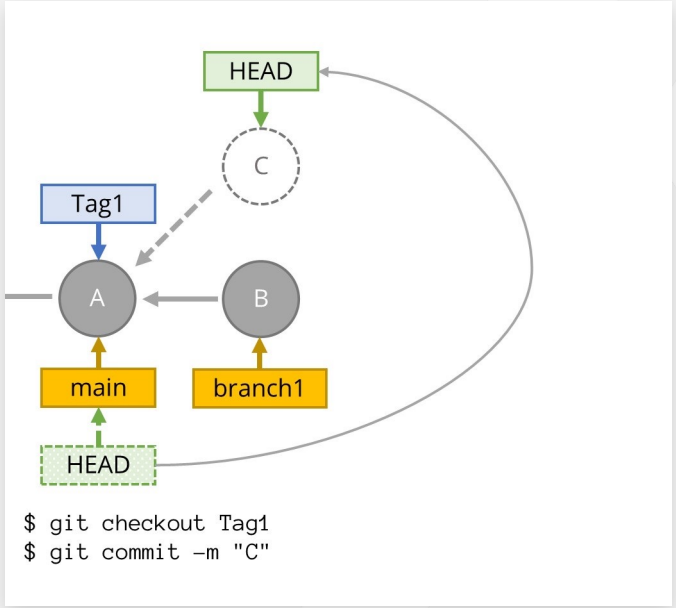






Tags

- Fix pointers to a commit
- Annotated tags – object of type tag that points to a commit (git tag -a)
- Detached HEAD mode



Referencing commits

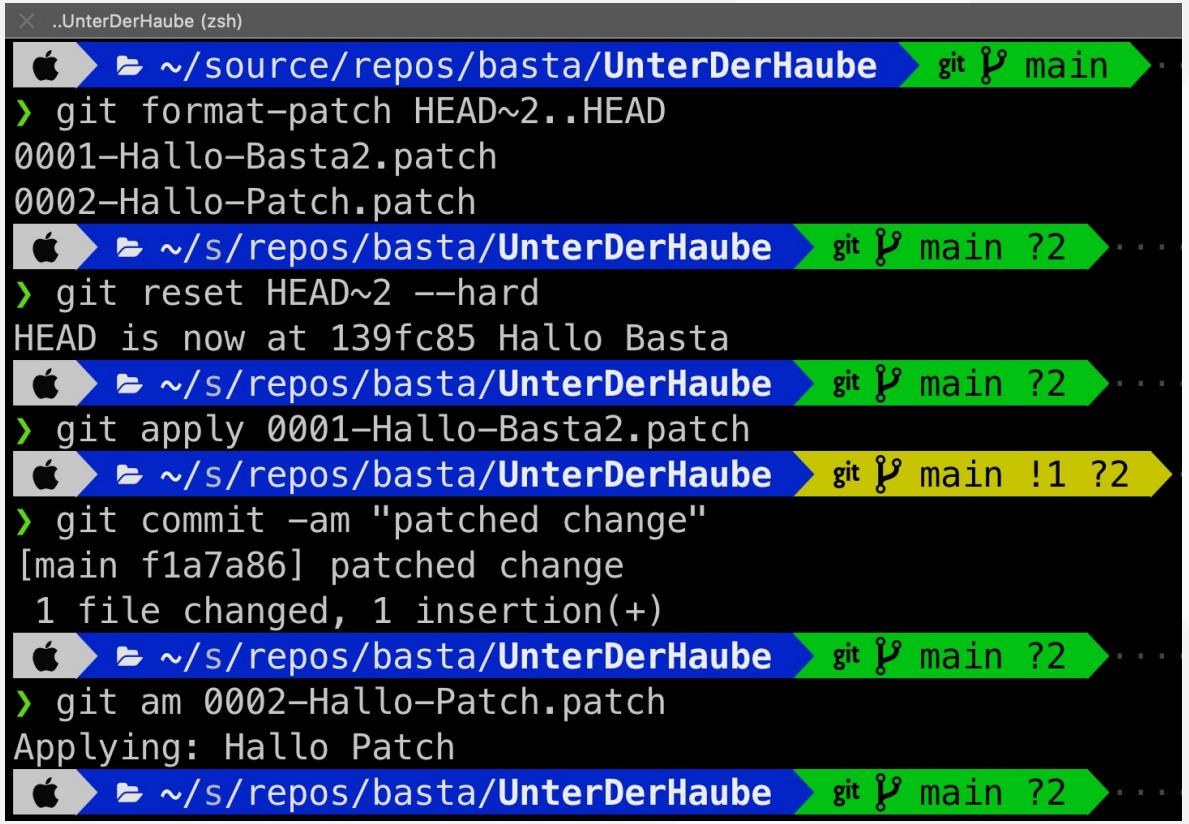
Referencing commits

- **Absolute references**
  - The SHA-1 value **c36554656ee78362ced084e5114b0a51001e2f57**
  - The first part (at least 4 – must be unique) **c365**
  - **HEAD**
  - **Tag**
  - **Branch**
- **Relative in time**
  - **HEAD@{3}**
  - **main@{two.weeks.ago}**
  - **HEAD@{last.month}**
  - **main@{yesterday}**
- **Relative to another reference**
  - **^** = points to the parent commit
  - **^^** = points to the parent of the parent
  - **^2** = points to the second parent of the same commit (merge commits)
  - **~** = points to the first parent of the commit
  - **~2** = ~~ = points to the parent of the parent
- **Ranges**
  - Double dot: **main..experiment** (reachable from experiment but not main)
  - **experiment..main**
  - Tripple dot: **main...experiment** (either of the two references but not both **--left-right**)

Diffs and patches

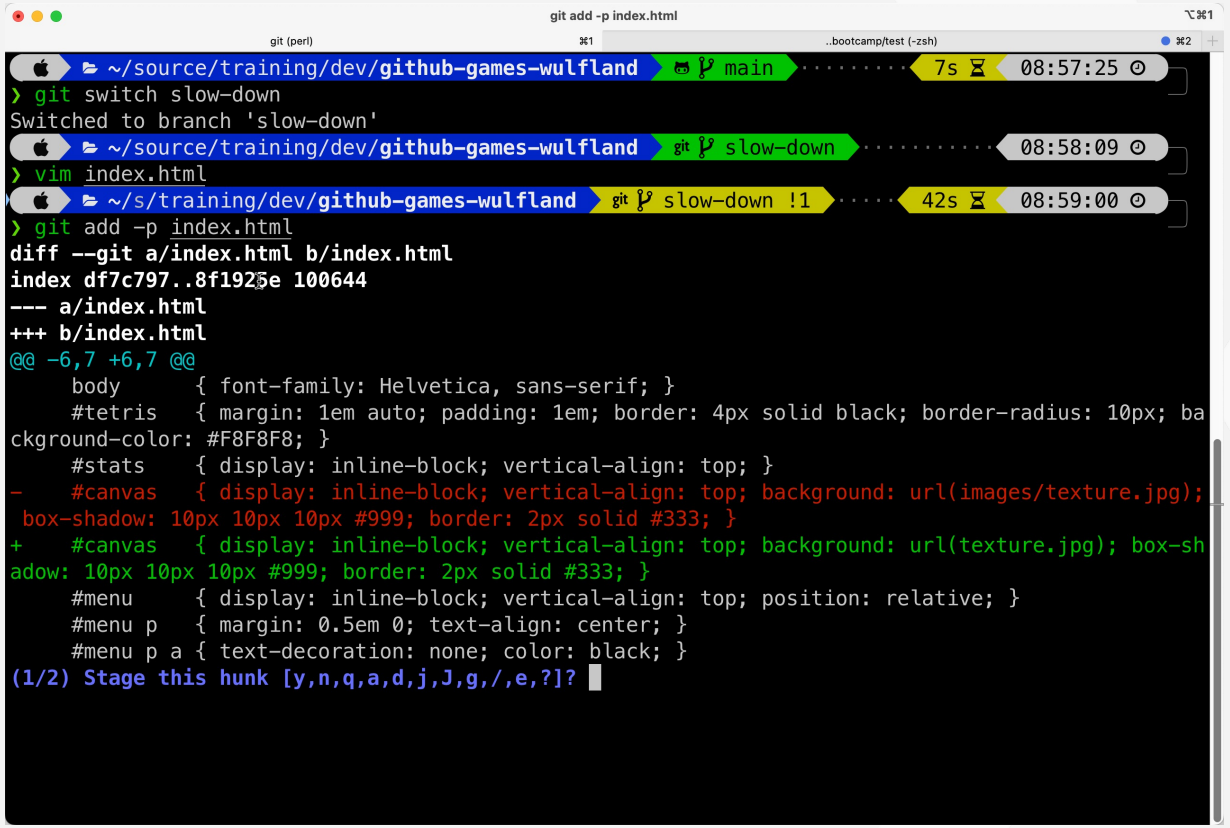
Diffs and patches

```
$ git diff
$ git diff --staged
$ git diff <REF-1> <REF-2>
$ git diff HEAD^!

$ git format-patch HEAD~2..HEAD
$ git reset --hard HEAD~2

$ git apply 0001*.patch

$ git commit -am
$ git am 0002*.patch
```



Diffs and patches

```
$ git add -p | --patch
```

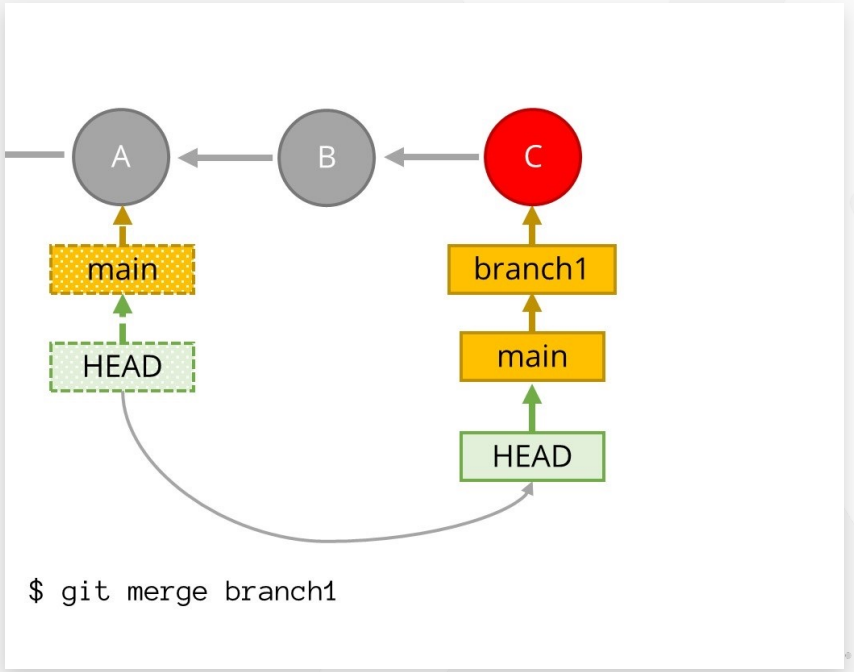


Merging

Fast-forward merge

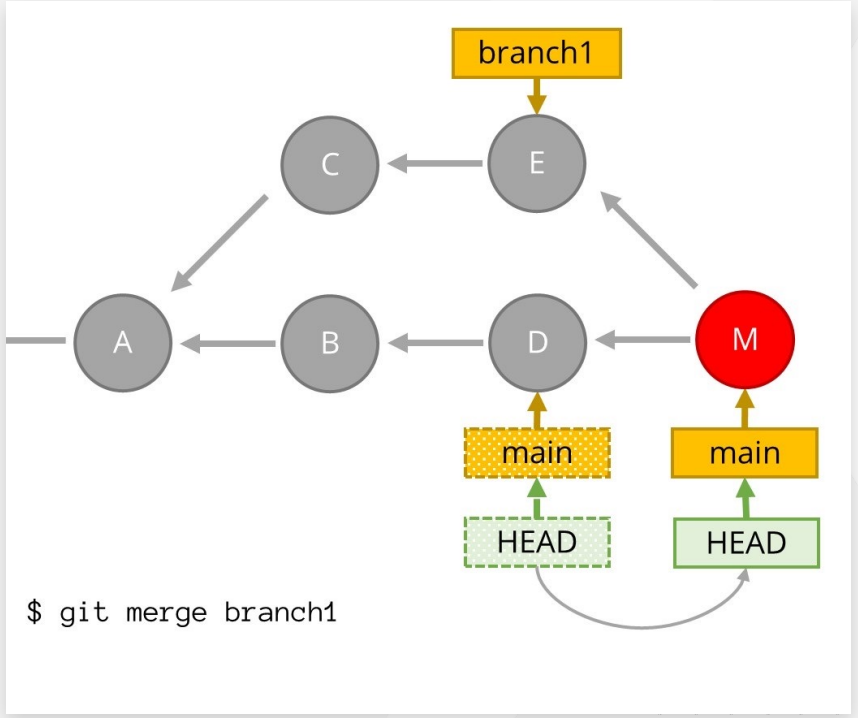
```
$ git switch main
$ git merge [--ff] branch1
> Updating 5efe25f..02fdfff
> Fast-forward
> C.txt | 1 +
> 1 file changed, 1 insertion(+)
> create mode 100644 C.txt
```

```
$ git merge --ff-only
$ git merge --no-ff
```



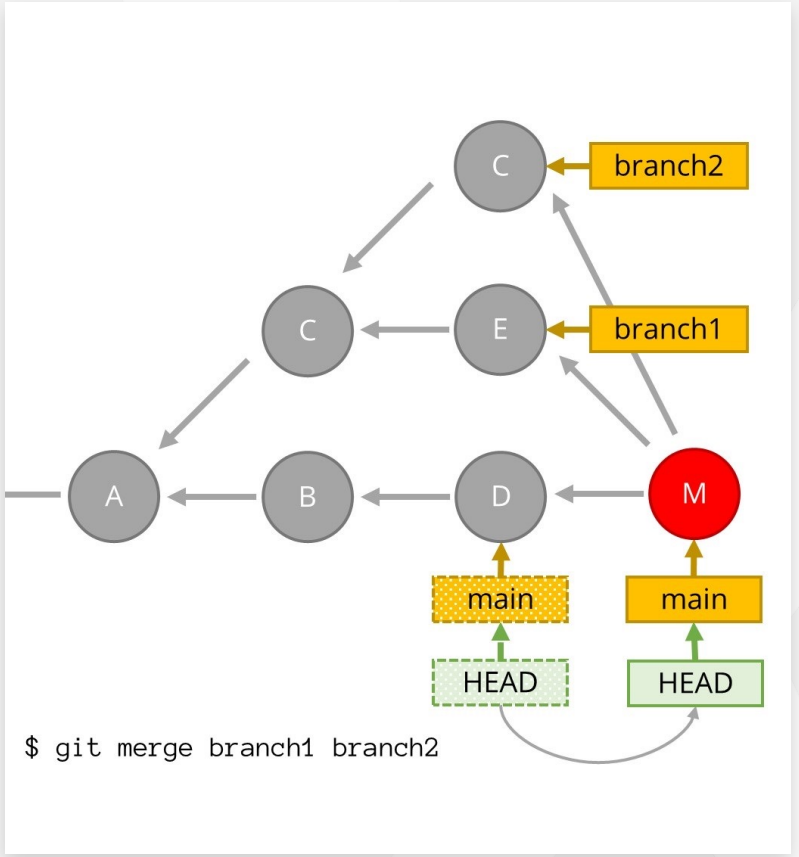
Merge commit

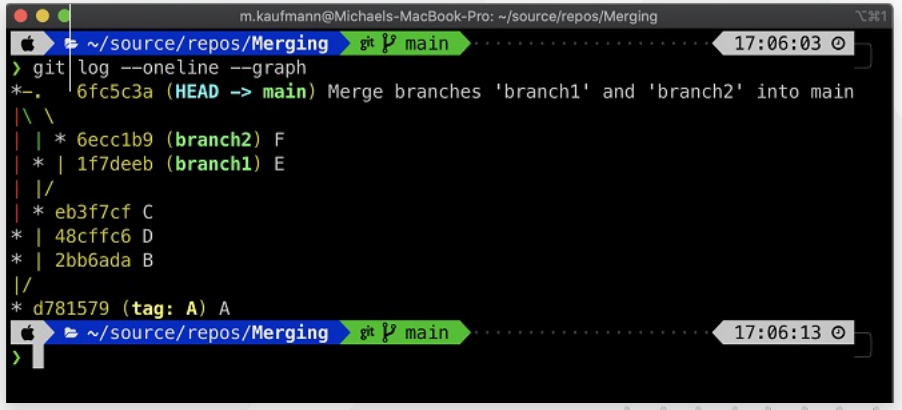
```
$ git merge branch1
> Merge made by the 'recursive' strategy.
> C.txt | 2 ++
> 1 file changed, 2 insertions(+)
> create mode 100644 C.txt
```



Octopus merge

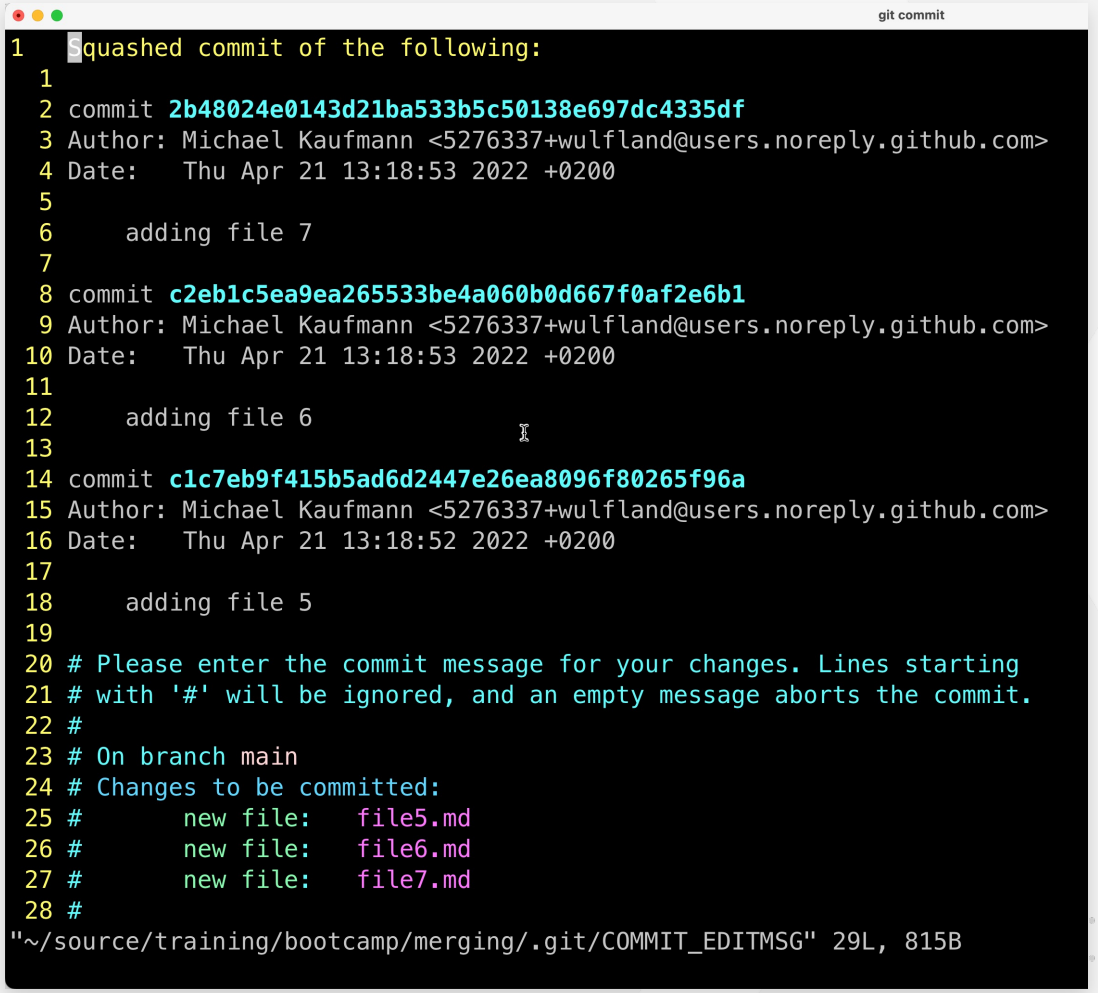
```
$ git merge branch1 branch2
> Trying simple merge with branch1
> Trying simple merge with branch2
> Merge made by the 'octopus' strategy.
>  C.txt | 2 ++
>  F.txt | 1 +
>  2 files changed, 3 insertions(+)
>  create mode 100644 C.txt
>  create mode 100644 F.txt
```





Squash merge

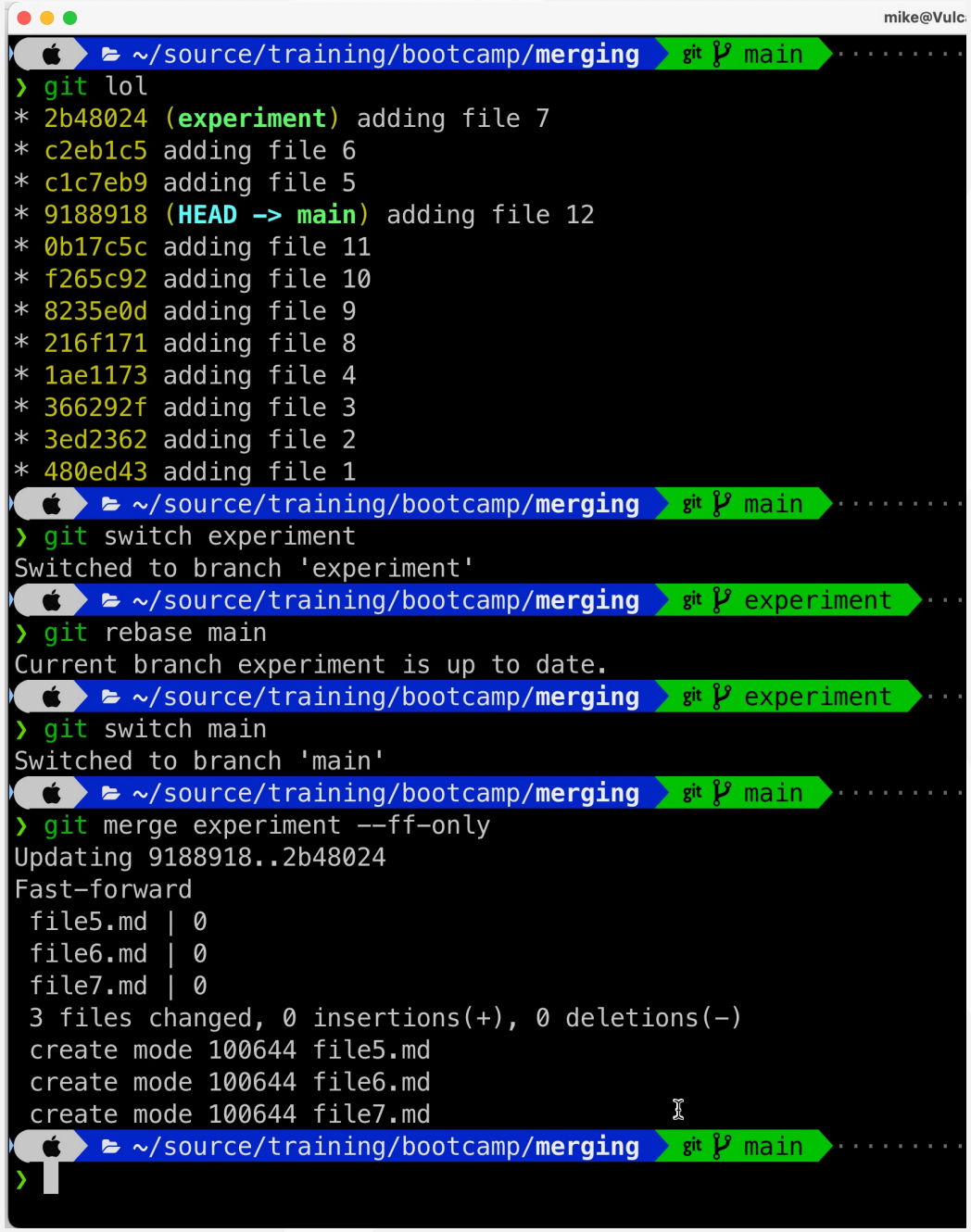
```
$ git merge --squash <branch>
$ git commit
```



Rebase and fast-forward merge

```
$ git switch experiment
$ git rebase main
$ git switch main
$ git merge experiment --ff-only
```

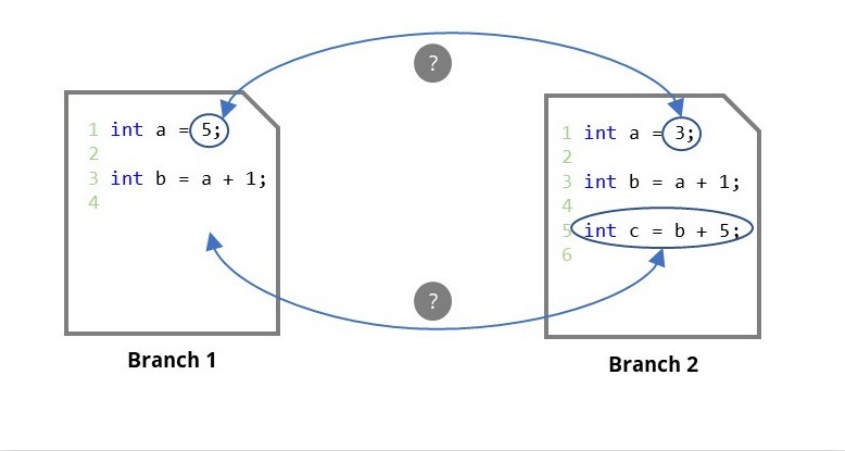
```
$ git pull --rebase
```

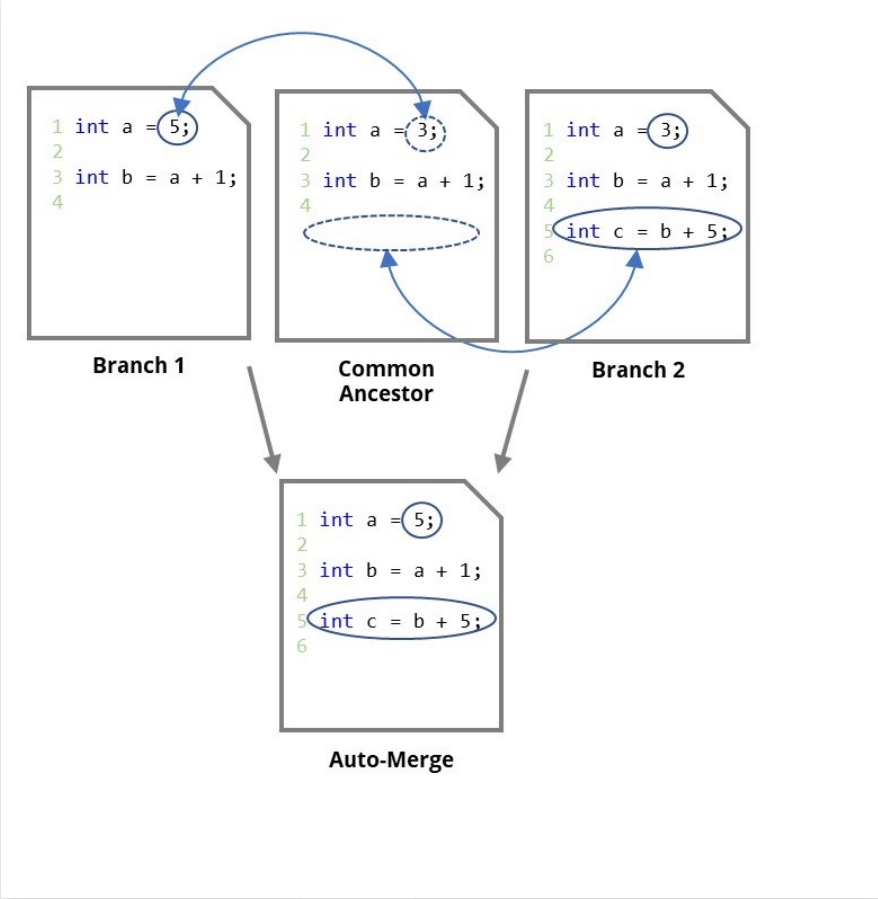


Resolving merge conflicts

Three-way merge

- Three-way merge = using the common anchestor



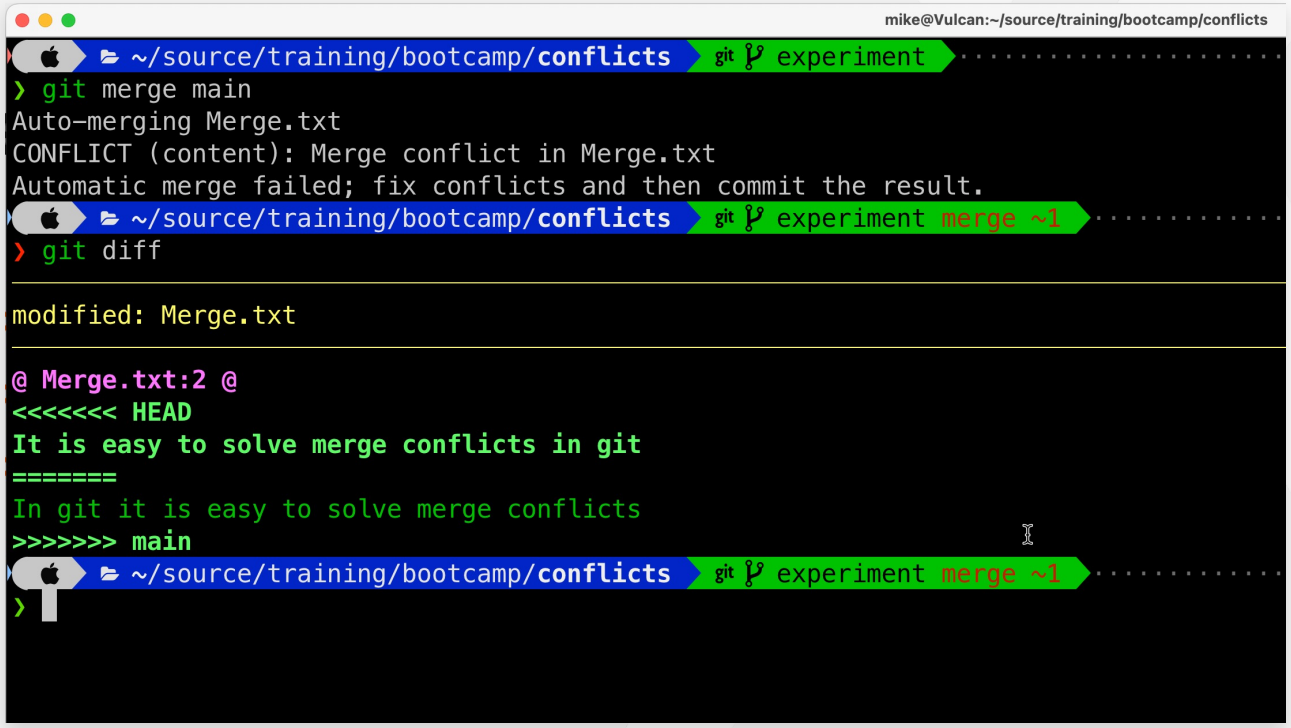


Resolving merge conflicts

```
> Auto-merging Merge.txt
> CONFLICT (content): Merge conflict in Merge.txt
> Automatic merge failed; fix conflicts and then commit the result.
```

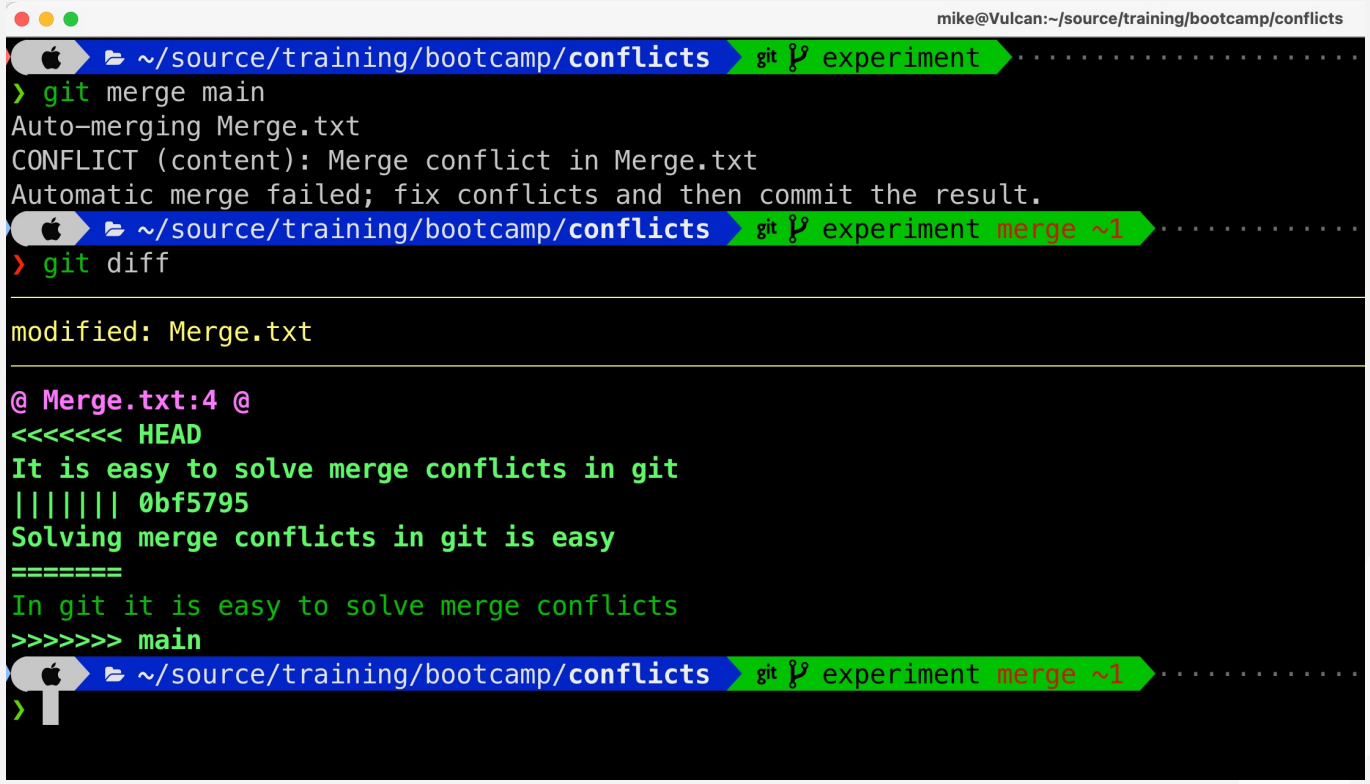
- `<<<<<<<`, `=======`, and `>>>>>>>`

```
<<<<<<<
HEAD (ours)
=======
MERGE_HEAD (incoming, theirs)
>>>>>>>
```



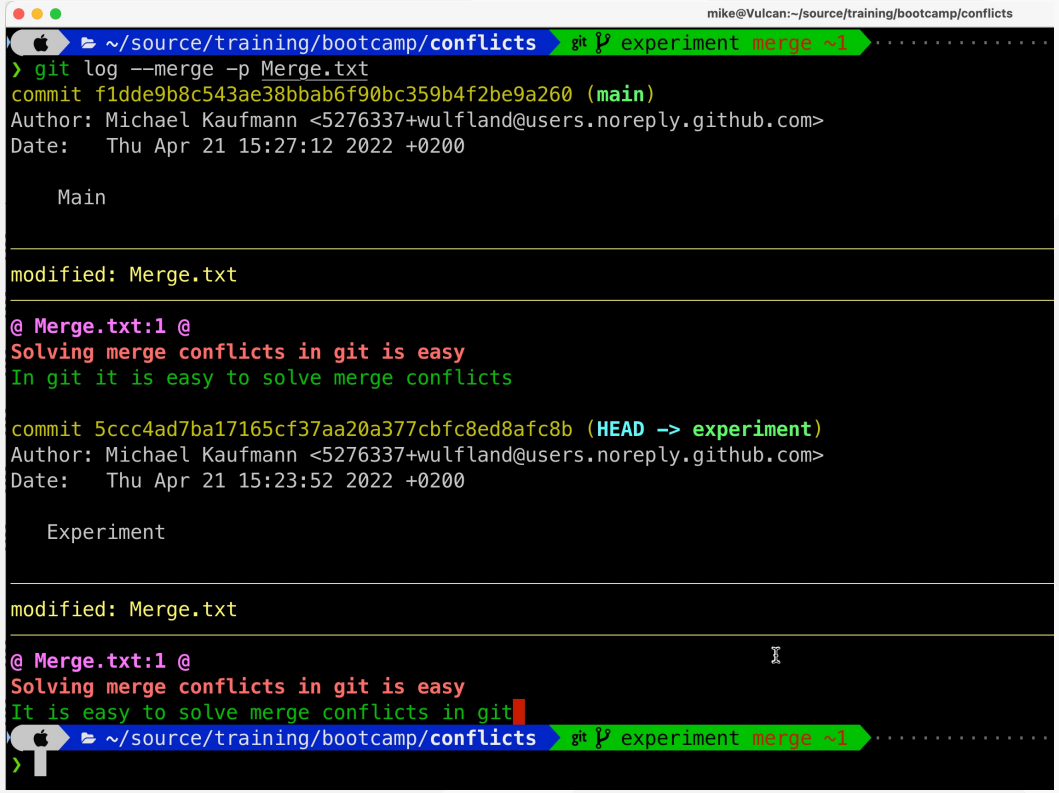
Resolving merge conflicts

```
$ git config --global merge.conflictStyle diff3
```



Resolving merge conflicts

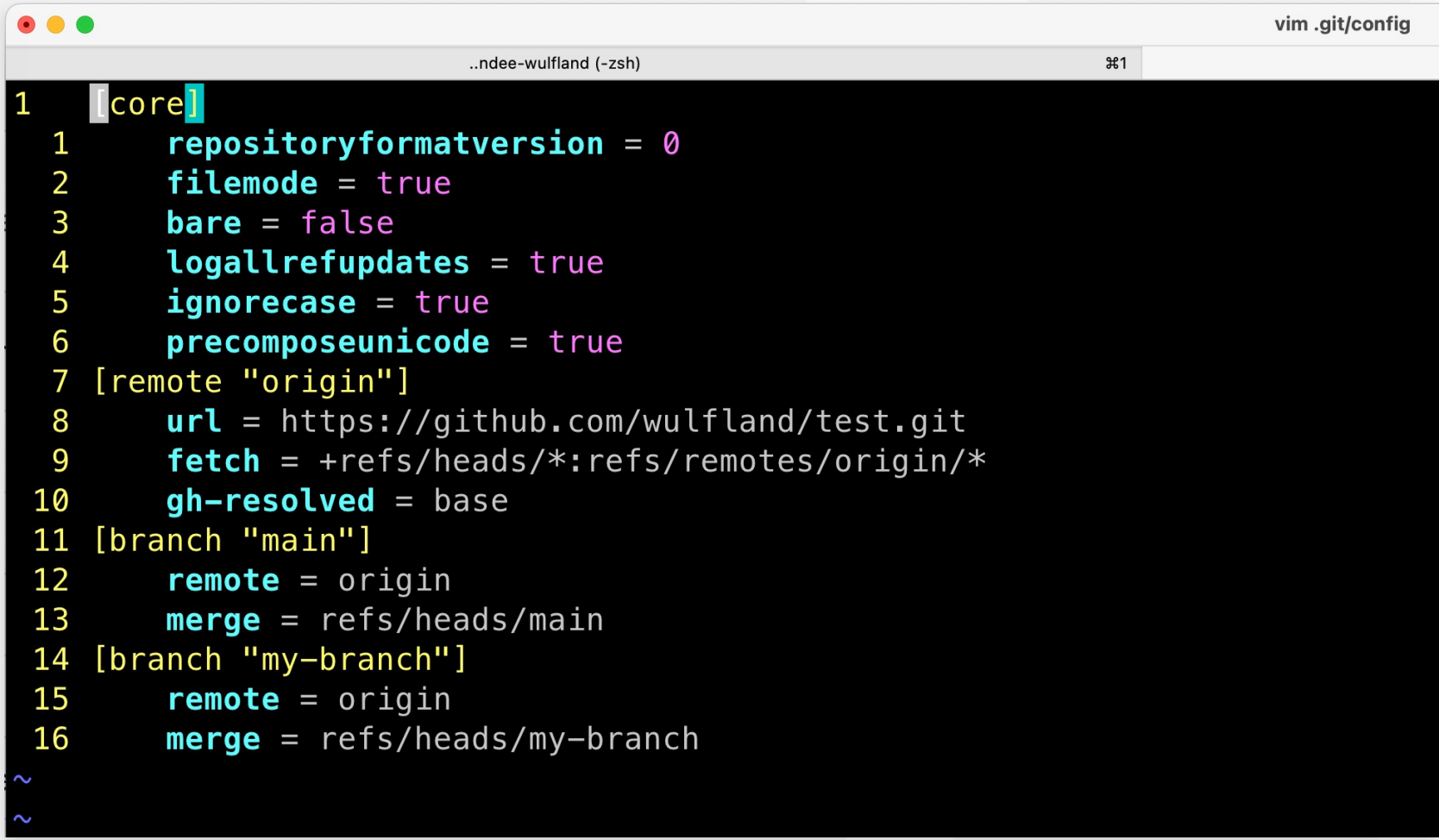
```
$ git merge --abort
$ git diff
$ git log --merge -p <filename>
$ git show :1:<filename> (common anchestor)
$ git show :2:<filename> (HEAD)
$ git show :3:<filename> (MERGE_HEAD)

$ git add <filename>
$ git merge --continue
```



Remotes

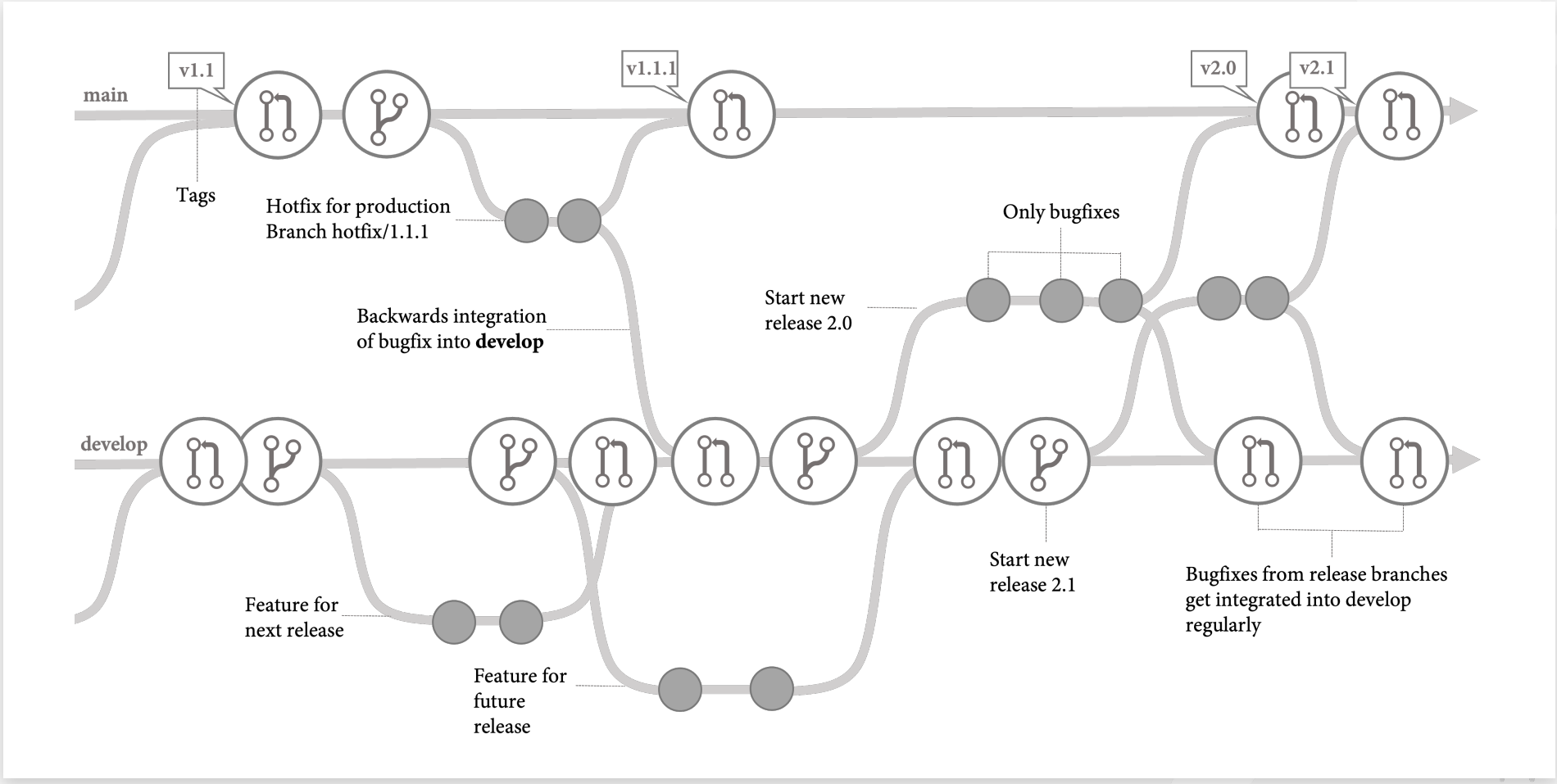
Remotes

```
$ git remote add
$ git push -u
$ git branch -vv
```



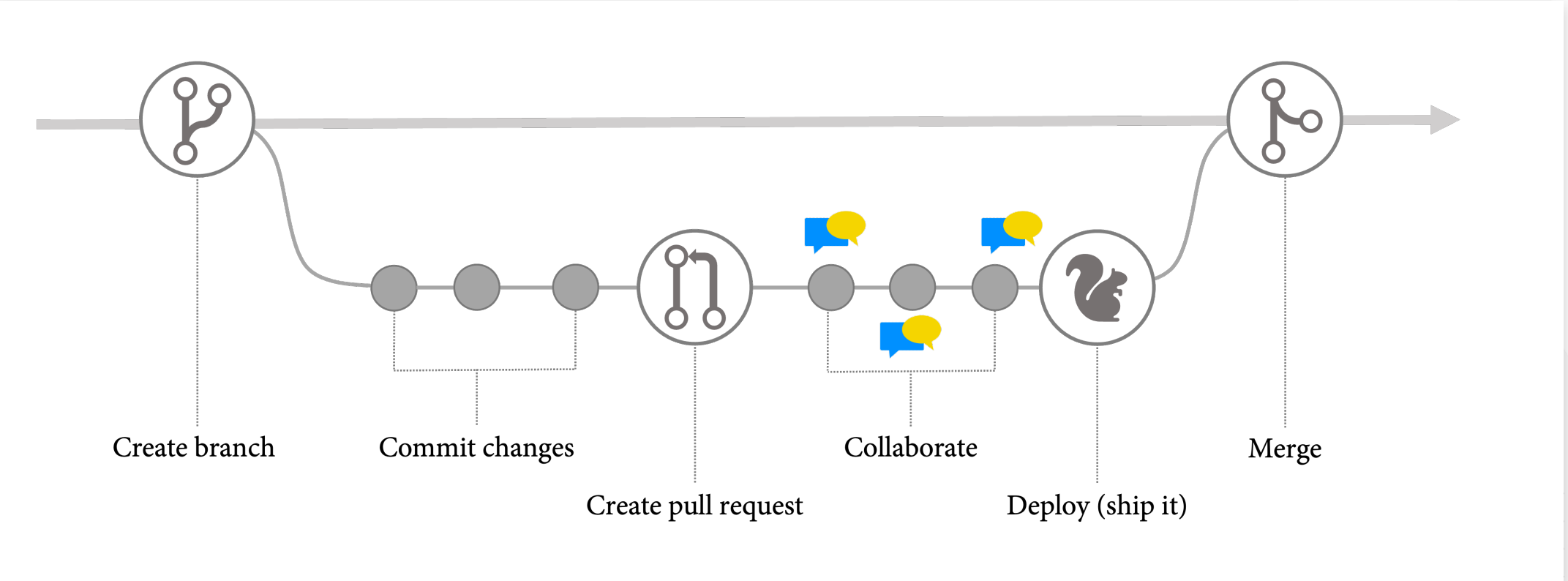
Branching workflows

- **Git flow** (https://nvie.com/posts/a-successful-git-branching-model)



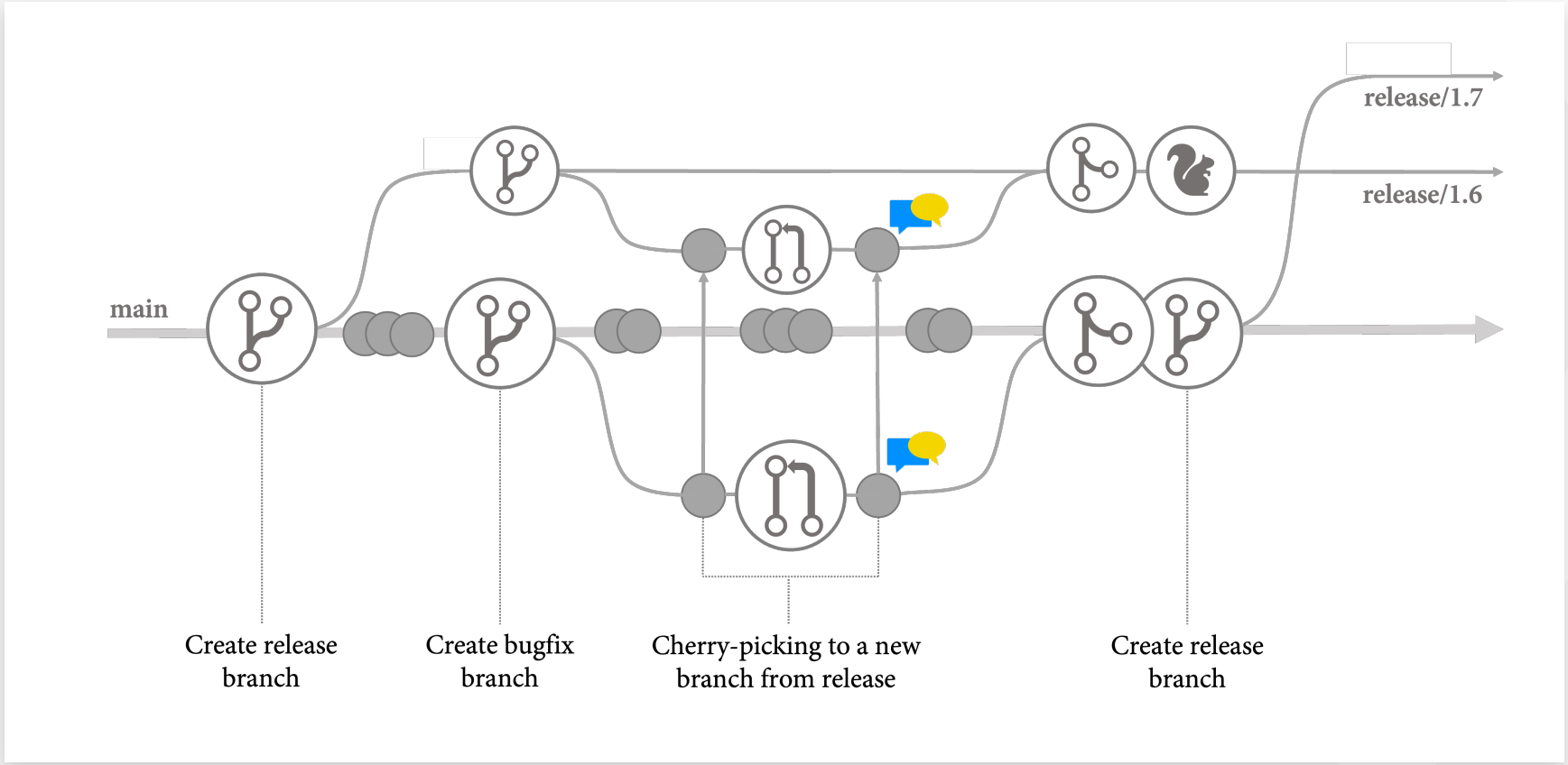
Branching workflows

- **GitHub flow** (trunk-based workflow, https://docs.github.com/en/get-started/quickstart/github-flow)



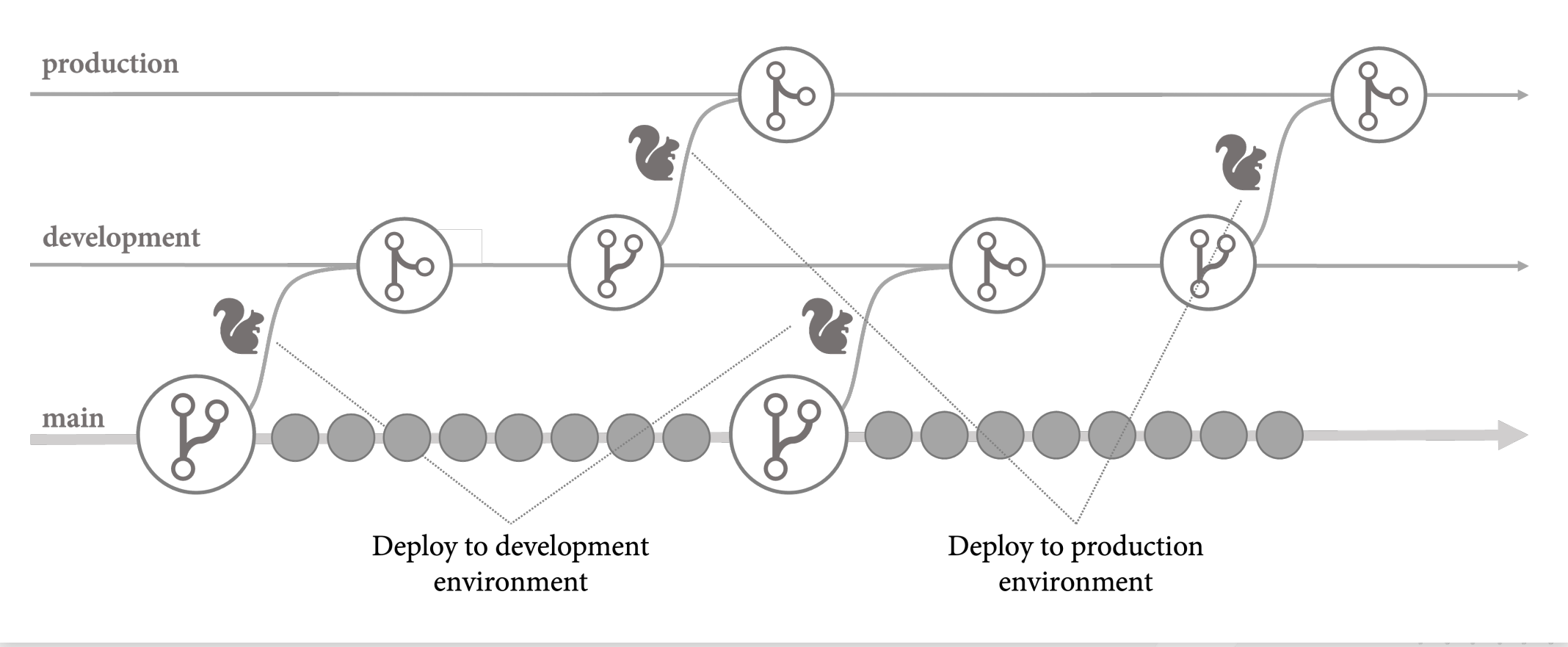
Branching workflows

- **Release flow** (https://devblogs.microsoft.com/devops/release-flow-how-we-do-branching-on-the-vsts-team/)



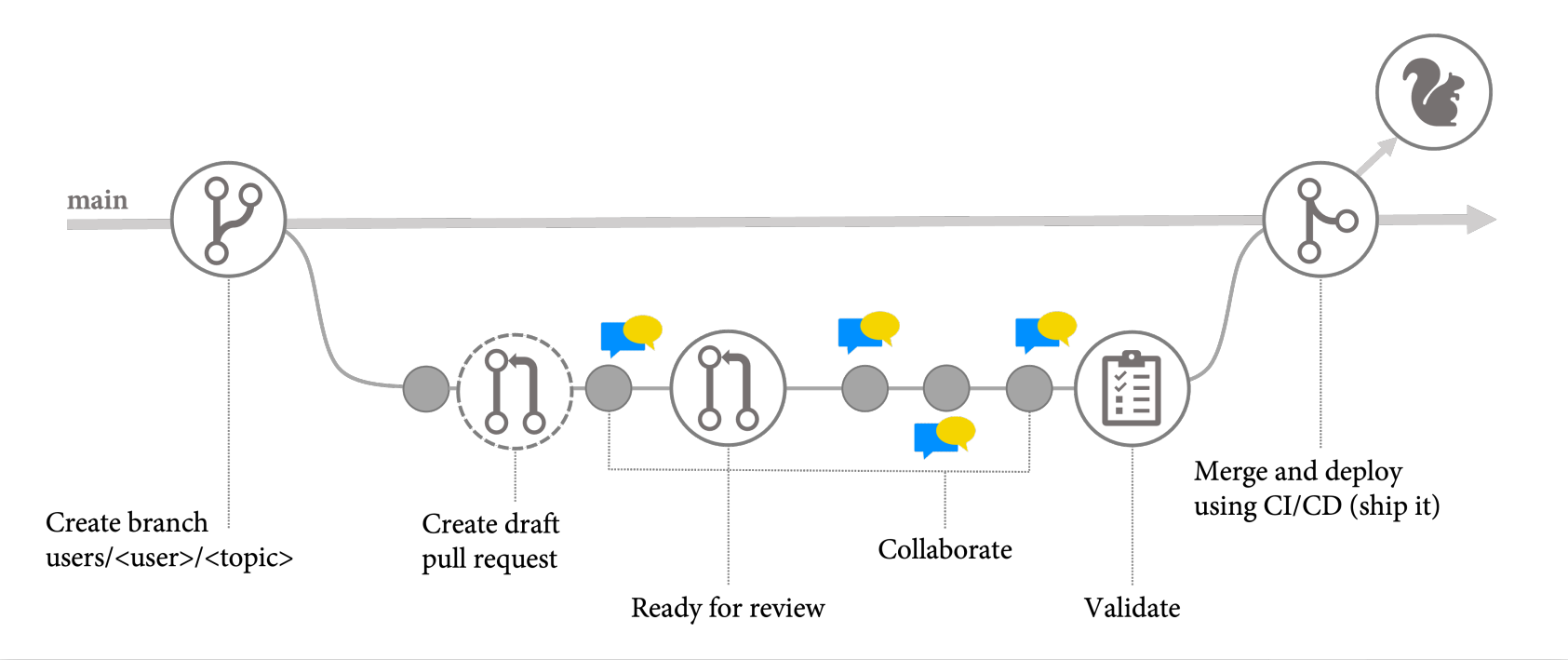
Branching workflows

- **GitLab flow** [https://docs.gitlab.com/ee/topics/gitlab_flow.html]



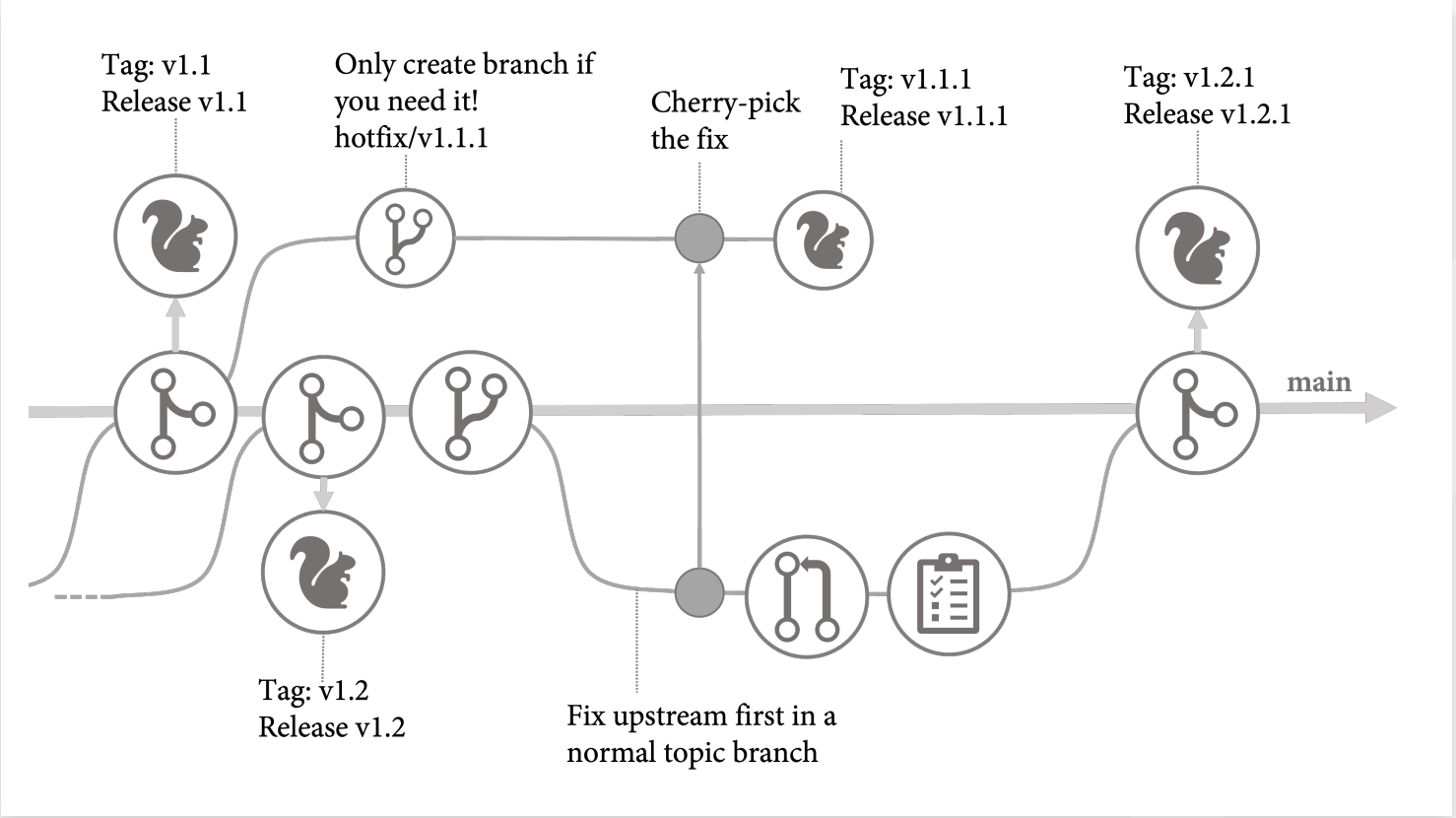
Branching workflows

- **MyFlow** (https://wulfland.github.io/MyFlow/)
  - Trunk-based (main, branch protection, CODEOWNERS)
  - Private topic branches (`users/<username>/<id>_<topic>`)
  - (Draft) pull requests, auto merge, `git push -f` / `git push origin +<branch-name>`



Branching workflows

- **MyFlow** (https://wulfland.github.io/MyFlow/)
  - Releases / Tags / cherry-pick

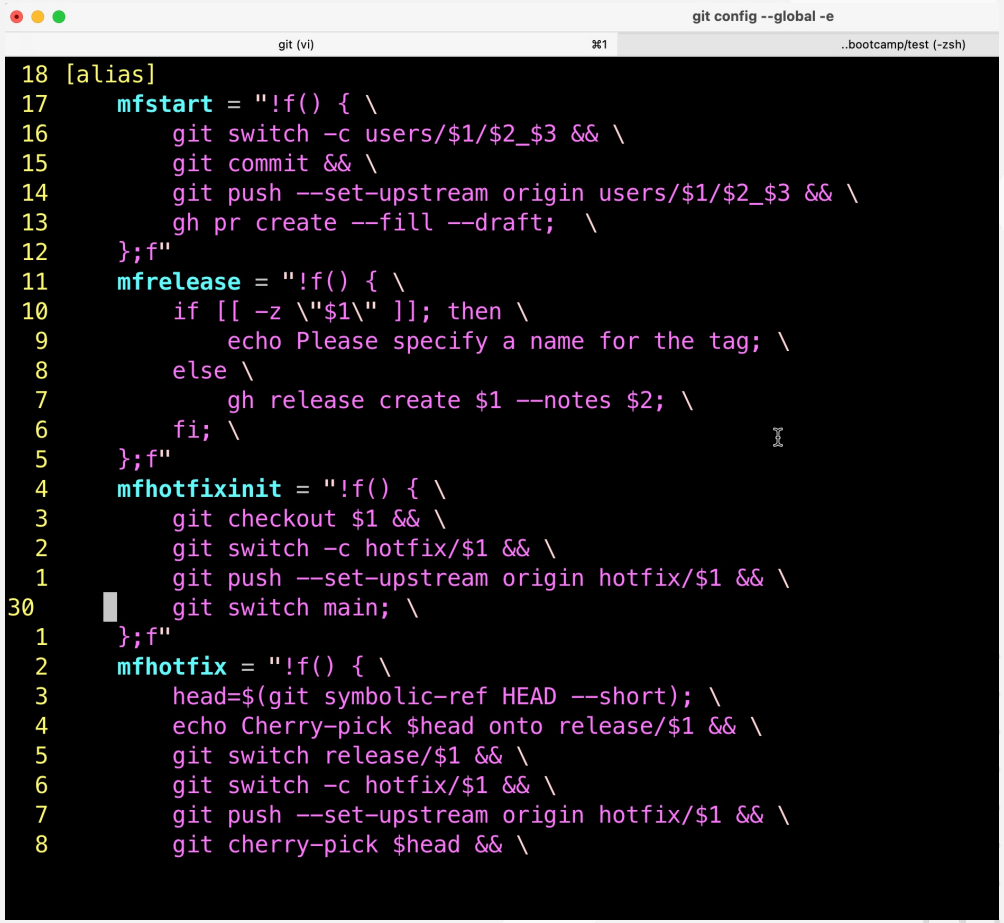


Git aliases

Git aliases

```
$ git config --global alias.last "log -1"
$ git config --global alias.lol "log --oneline --graph --decorate --all"
$ git config --global -e
```

- Functions "!f(){ … };f "
- $1, $2, $3, … $@
- Line endings: \
- && or ; to separate commands

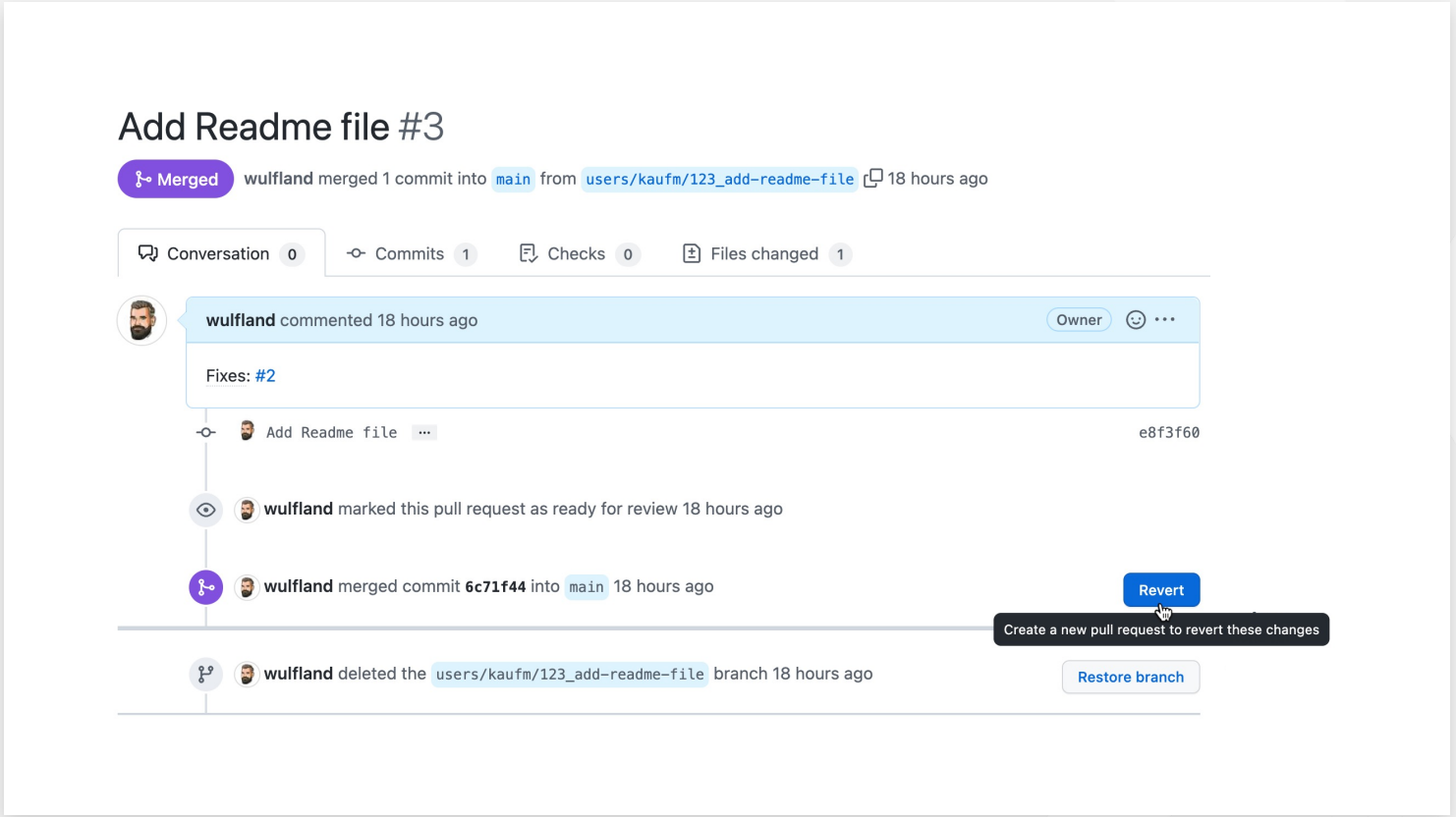


Reverting changes

Reverting changes

Undo changes in a safe way

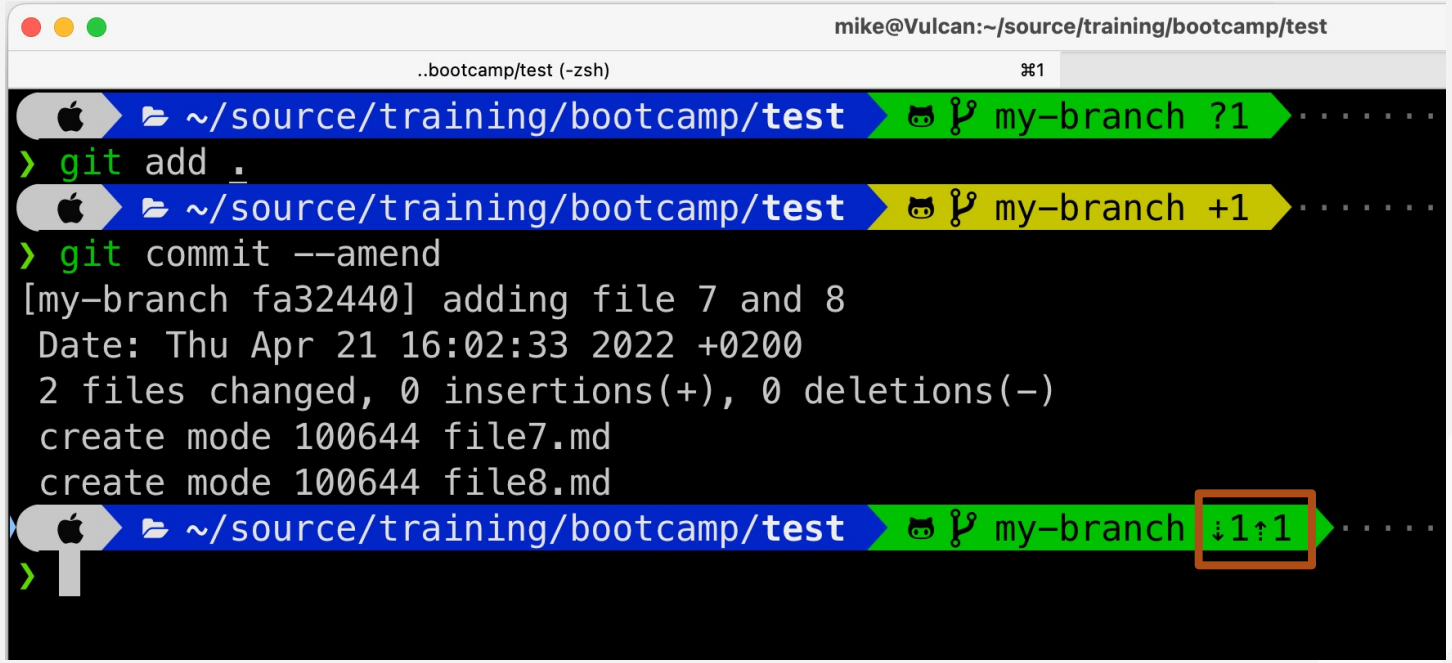
```
$ git revert <REF>
```



Ammending changes

Ammending changes

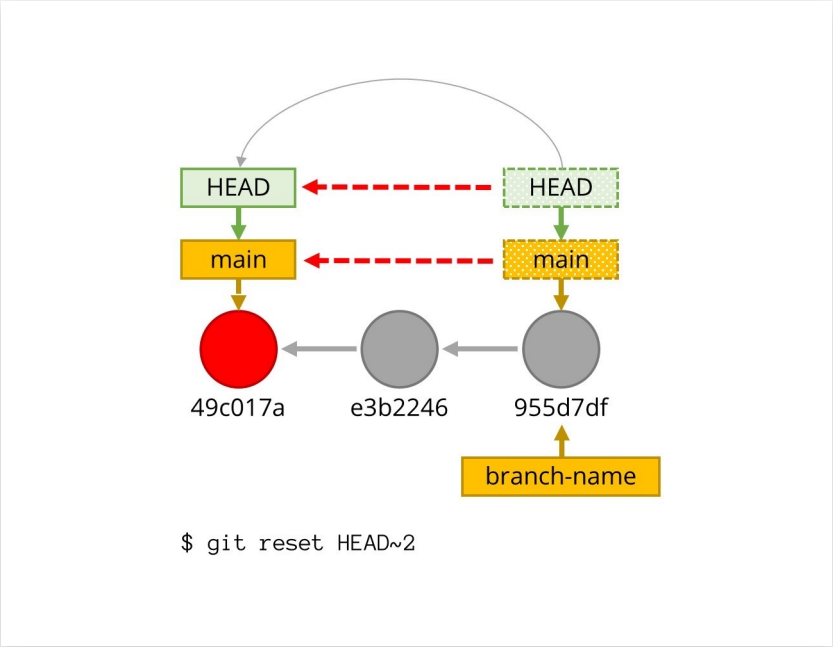
```
$ git commit --amend
$ git push --force
```



Reseting your repository

Resetting your repository

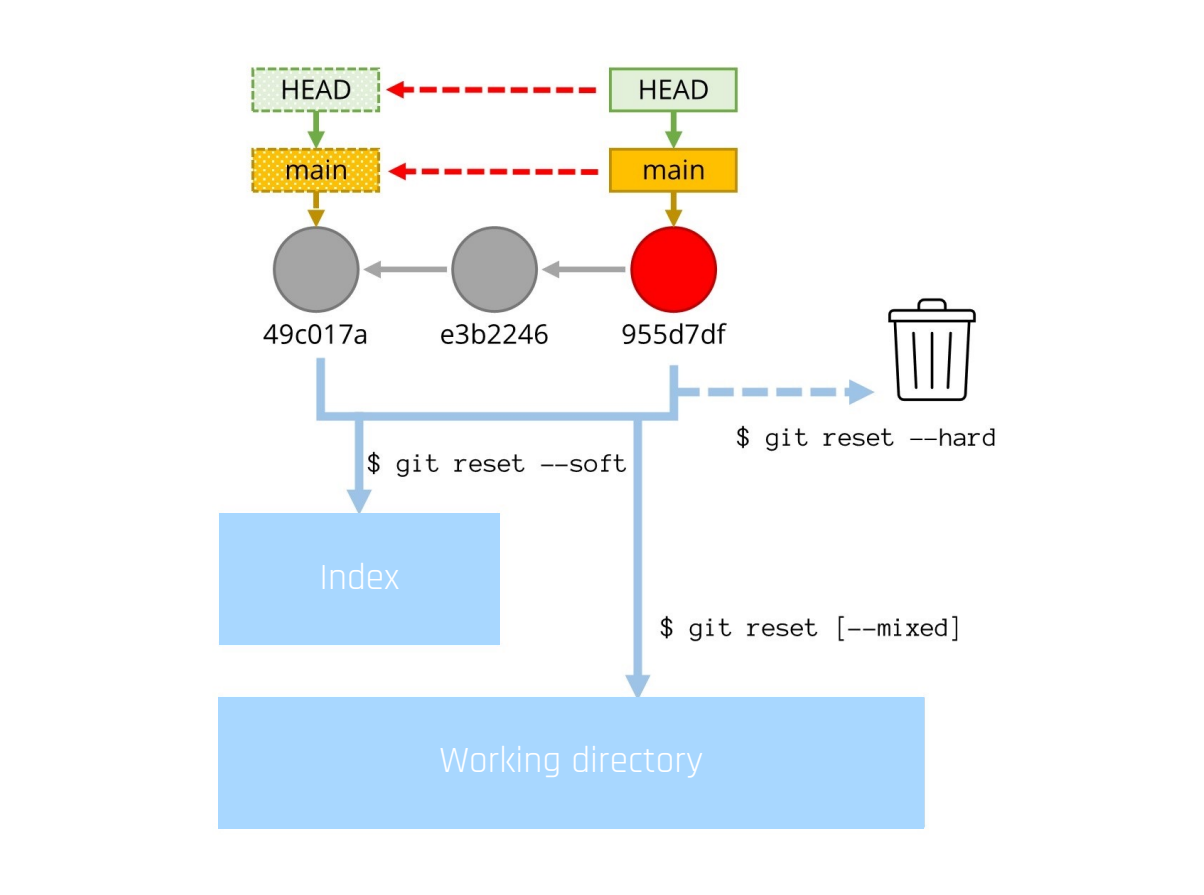
- Moving the current branch to another position



Resetting your repository

- What happens with the changes?

```
$ git reset [--mixed]
$ git reset --hard

$ git reset --soft
$ git reset --merge | --keep
```

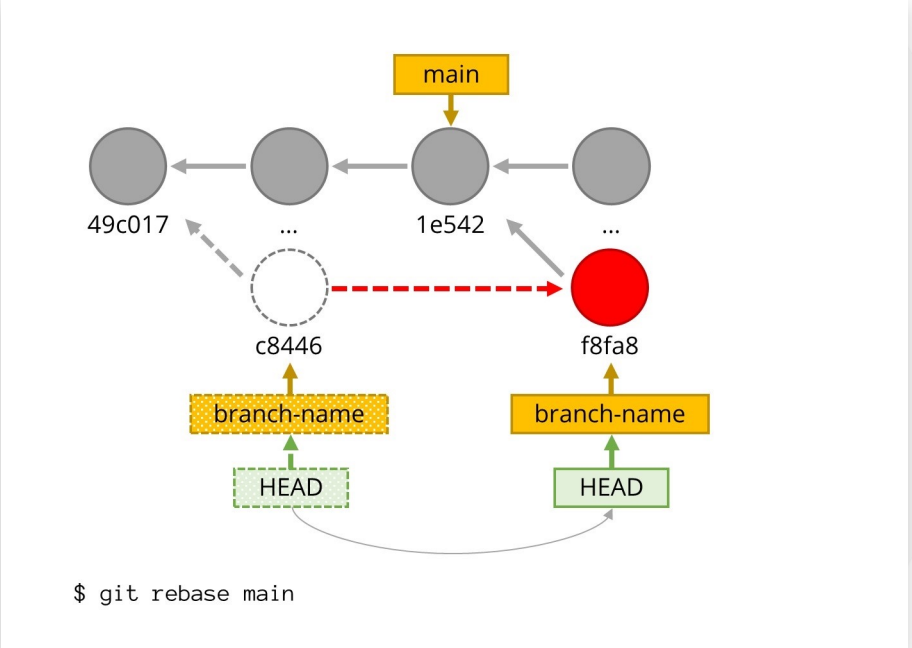


Rebase

Rebase

- Rebase

```
$ git rebase <REF>
$ git rebase -I
$ git commit --amend
$ git rebase --continue
$ git rebase --abort
```

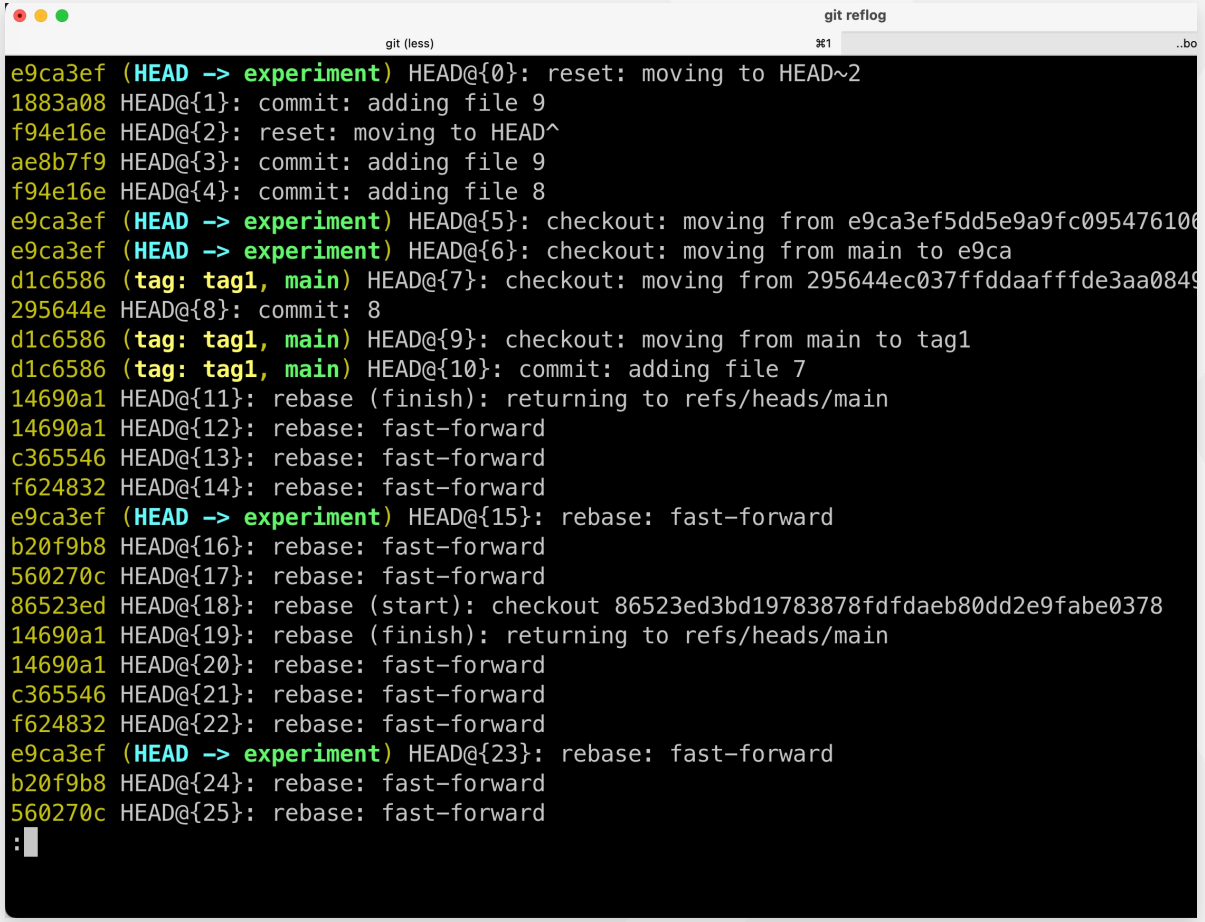


Cherry-picking and the reflog

Git RefLog

- The RefLog is **local**!
- Expires:
  - gc.reflogExpireUnreachable (default 30 days)
  - gc.reflogExpire (default 90 days)

```
$ git reflog [show]

$ git cherry-pick <REF>
$ git cherry-pick --edit <REF>
$ git cherry-pick –no-commit <REF>
```

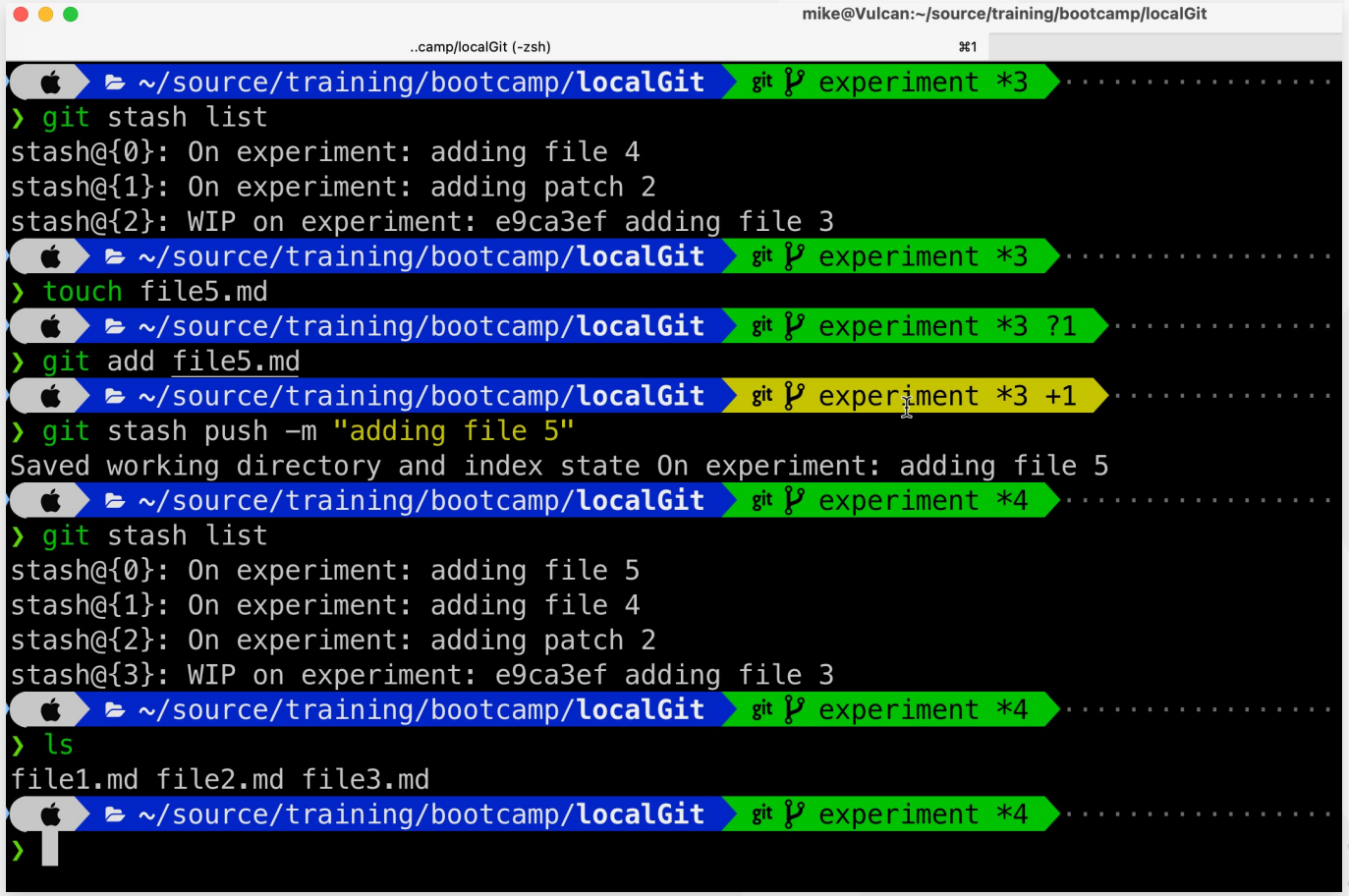


The stash

The stash

- LIFO: Last In – First Out

```
$ git stash [push]
$ git stash push –m "<message>"
$ git stash list
$ git stash pop [--index]
$ git stash branch <name>
```



Let's connect

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