

Git

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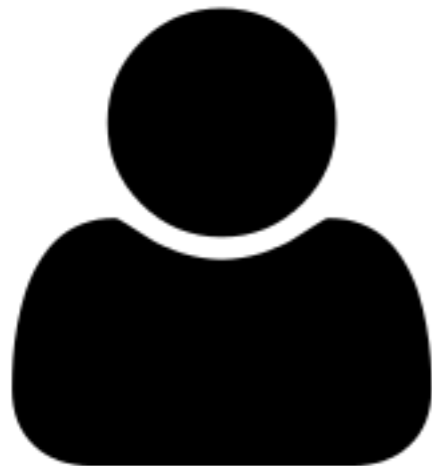
Productivity Tools for Developers

- Editors
- Debuggers
- Build automation tools
- Integrated development environment
- Modeling tools
- Source code analyzers / testing tools
- Version control tools ← *git*

File Changes

How to revert to a previous version?

backup

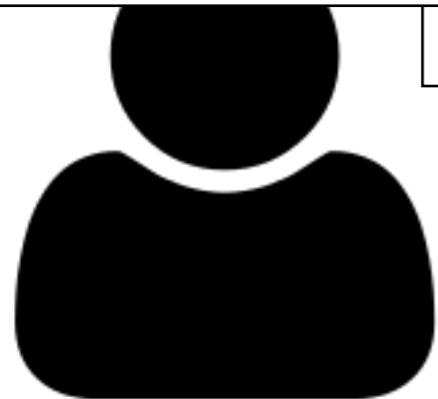


Project Backup

201 What has been done in a version?

Version Control Systems (VCS)

Merge two versions:





diff3

```
if (orient == HORIZONTAL)
  if (orient == HORIZONTAL)
    if (orient == HORIZONTAL)
      }
    }
  }
  return props;
}
```

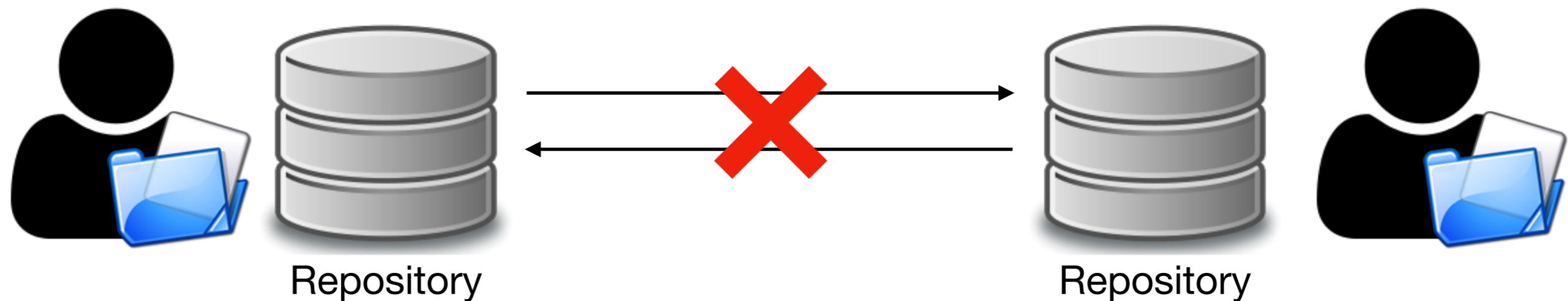
```
    n.width)
    n.width;
    if (height < min.height)
      height = min.height;
    c.setBounds(x, y, width, height);
    if (orient == HORIZONTAL)
      if (orient == HORIZONTAL)
        if (orient == HORIZONTAL)
          if (orient == HORIZONTAL)
            move=> m s x.
            rewrite (acc_ssa_state_eq _ (eqxx (get_index x m))).
            reflexivity.
          Qed.
```

Version Control System

- The developer needs a system that can
 - **store** files in different versions with **log** messages,
 - **compare** files between different versions,
 - **restore** files from specific versions,
 - ...
- All versions are stored in a **repository**  
- A version is checked out to a **working area** for editing

Local Version Control

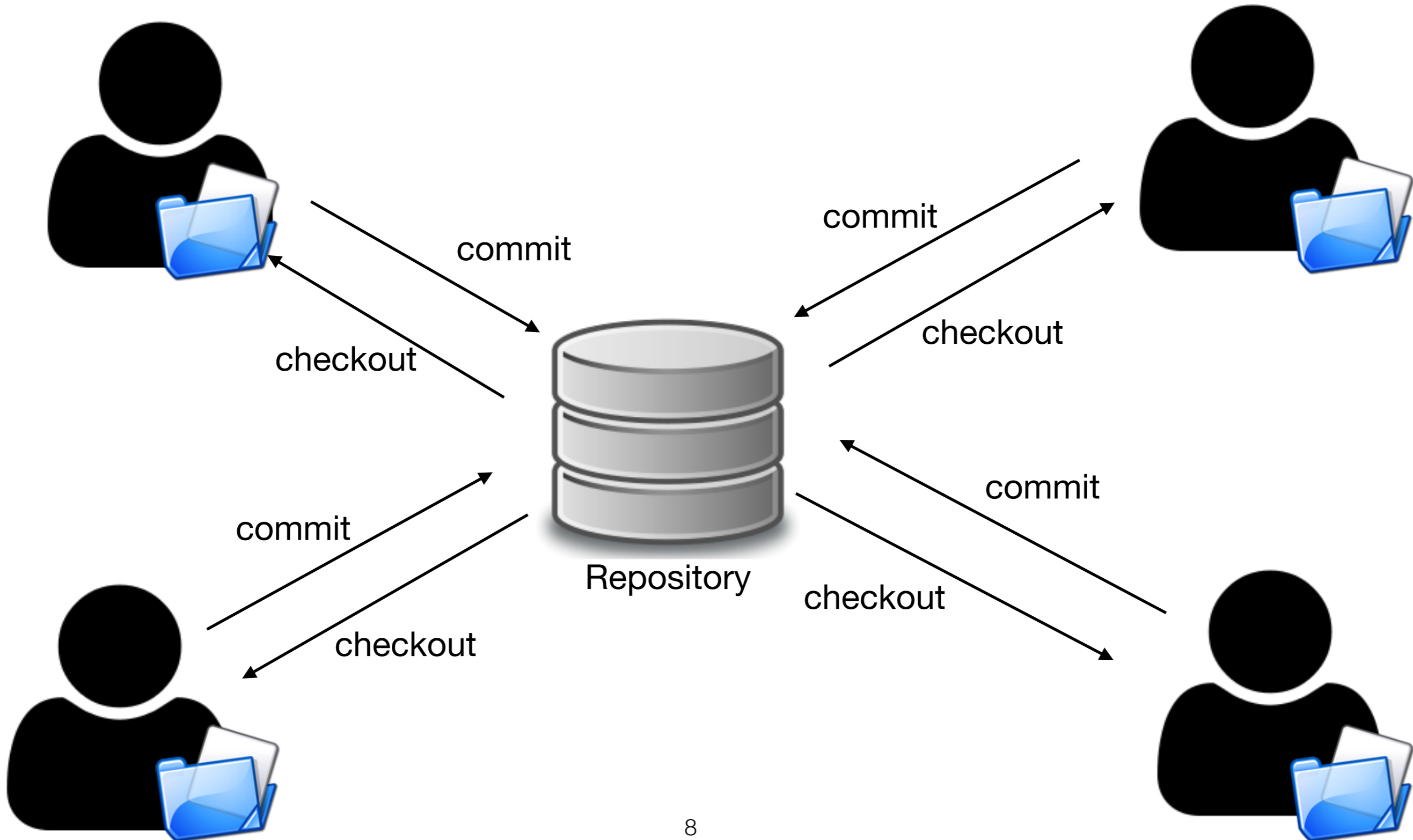
- SCCS (Source Code Control System, 1972)
- RCS (Revision Control System, 1982)



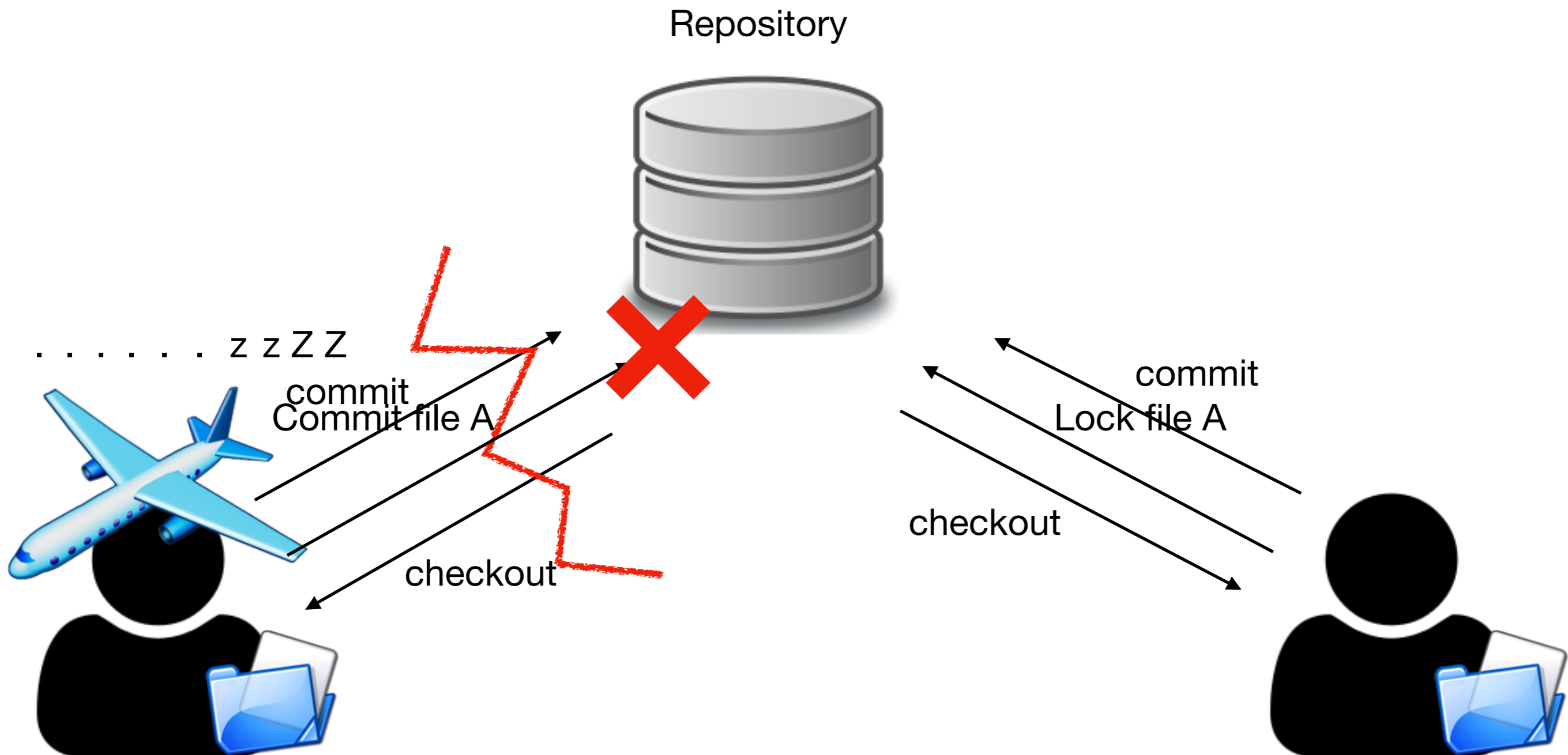
Centralized Version Control

- CVS (Concurrent Versions System, 1990)
- SVN (Subversion, 2000)
- ClearCase
- Visual SourceSafe

Multiple Developers



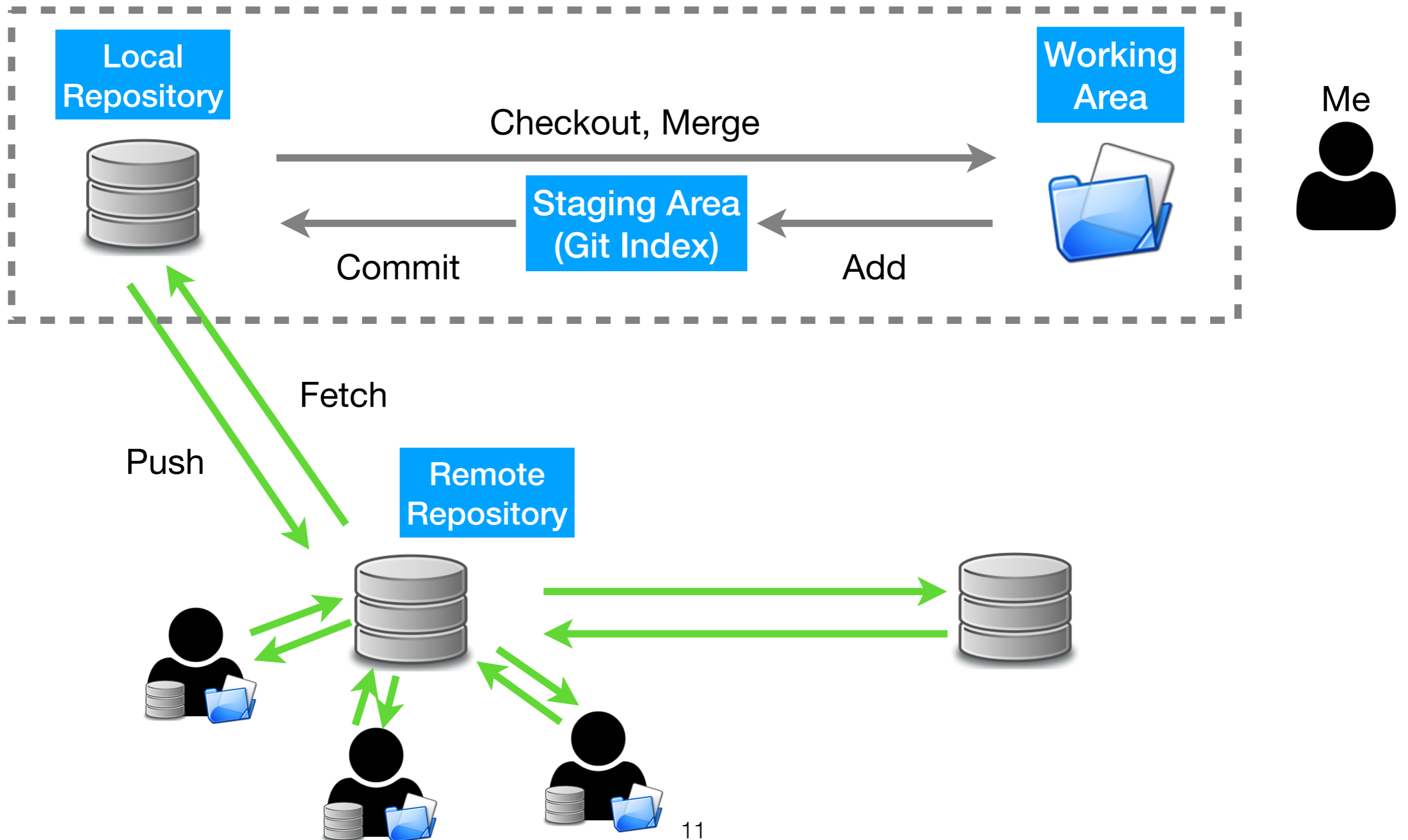
Problems



Distributed Version Control

- BitKeeper
- Git (2005)
- Mercurial (2005)

Distributed Approach (Git)



Create a Repository

```
DHCP-22126 project $ git init
Initialized empty Git repository in /Users/mht208/project/.git/
DHCP-22126 project $ ls
DHCP-22126 project $ ls -a
.  ..  .git
DHCP-22126 project $
```

repository

working area (working tree)

Files in the “project” folder can be added to the repository



Bare Repository

```
~/project
```

```
▶ git init --bare --shared
```

```
Initialized empty shared Git repository in /Users/mht208/project/
```

```
~/project master ✓
```

```
▶ ls -a
```

```
.          HEAD          description info          refs
..         config         hooks         objects
```

```
~/project master ✓
```

```
▶ █
```

no working area in a bare repository

Clone

Supported protocols: ssh, git, http, and https

```
DHCP-22126 demo $ ls
DHCP-22126 demo $ git clone https://github.com/atom/atom.git
Cloning into 'atom'...
remote: Counting objects: 179291, done.
remote: Compressing objects: 100% (16/16), done.
remote: Total 179291 (delta 13), reused 13 (delta 10), pack-reused 179265
Receiving objects: 100% (179291/179291), 285.63 MiB | 4.65 MiB/s, done.
Resolving deltas: 100% (127760/127760), done.
DHCP-22126 demo $ ls
atom
DHCP-22126 demo $ █
```



Add and Commit

the short version number

```
2. git
DHCP-22126 project $ git add README.md
DHCP-22126 project $ git commit
[master (root-commit) d05fe5d] Add README.md.
1 file changed, 1 insertion(+)
create mode 100644 README.md
DHCP-22126 project $ █
```

```
[ Read 10 lines ]
^G Get Help   ^O Write Out  ^W Where Is   ^K Cut Text   ^J Justify    ^C Cur Pos
^X Exit       ^R Read File  ^\ Replace    ^U Uncut Text ^T To Spell   ^_ Go To Line
```



README.md

```
Convert a DSL state to an SSA state. *)
definition ssa_state (m : vmap) (s : State.t) : bv64SSA.State.t :=
  fun m =>
    if (sidx v) == get_index (svor v) m
    then State.acc (svor v) s
    else State.acc (svor v) state.empty,
    ...

ssa_state_equiv :
  forall m s, state_equiv m s (ssa_state m s).
proof.
move m s x.
rewrite (acc_ssa_state_eq _ (eqxx (get_index x m))).
reflexivity.
ed.
```

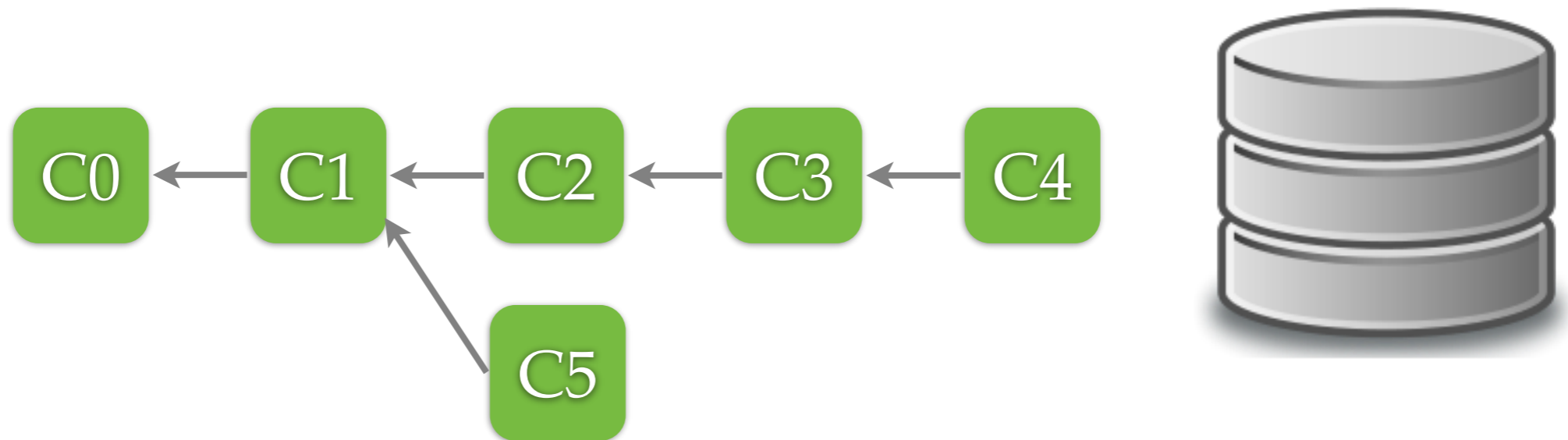


Add VS Commit

- git add
 - Add files to the staging area
 - The files may be new or modified
- git commit
 - Add files in the staging area to the repository as a new version



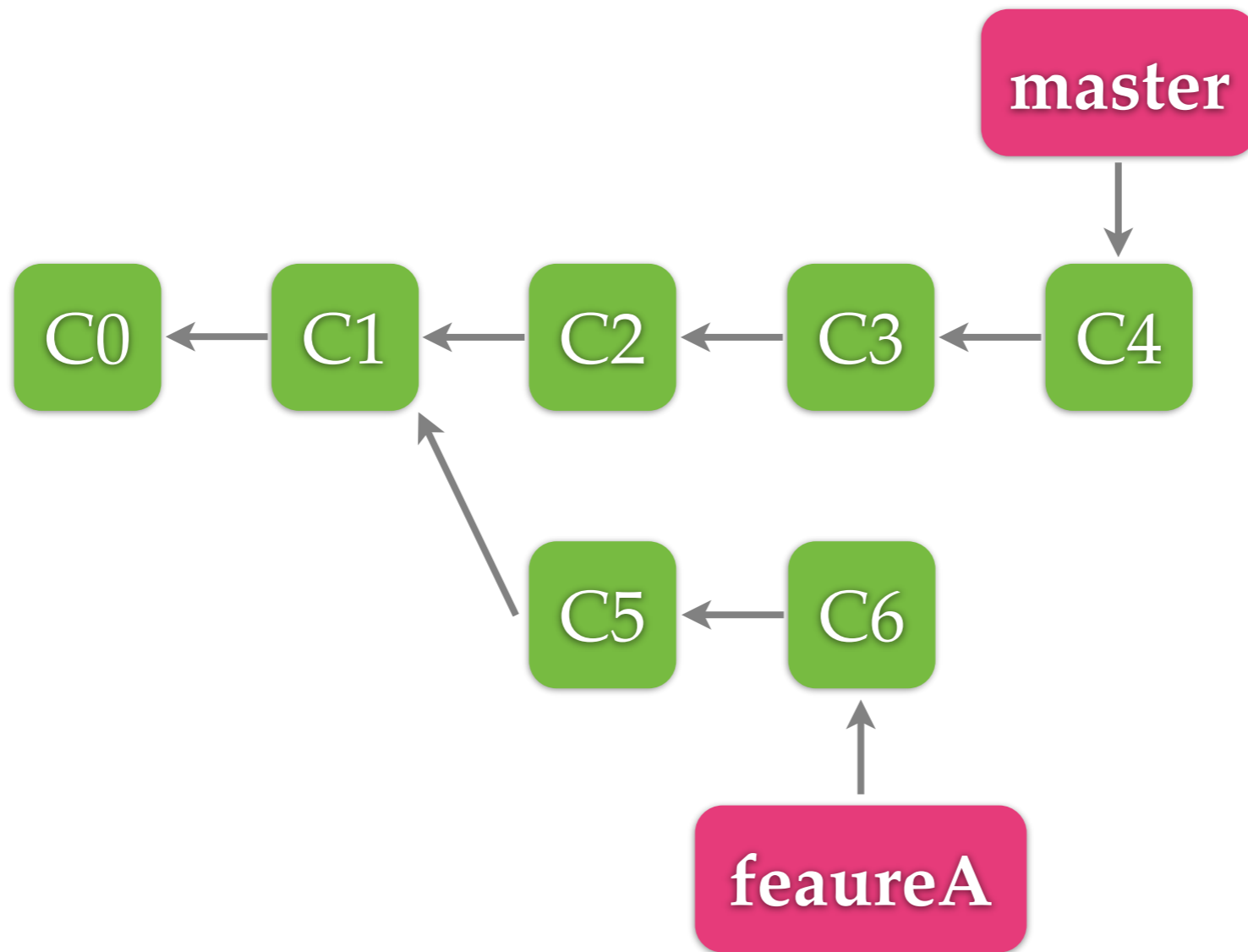
Add More Commits



**Check out C1, do some changes, and then add a new commit.
What will happen?**

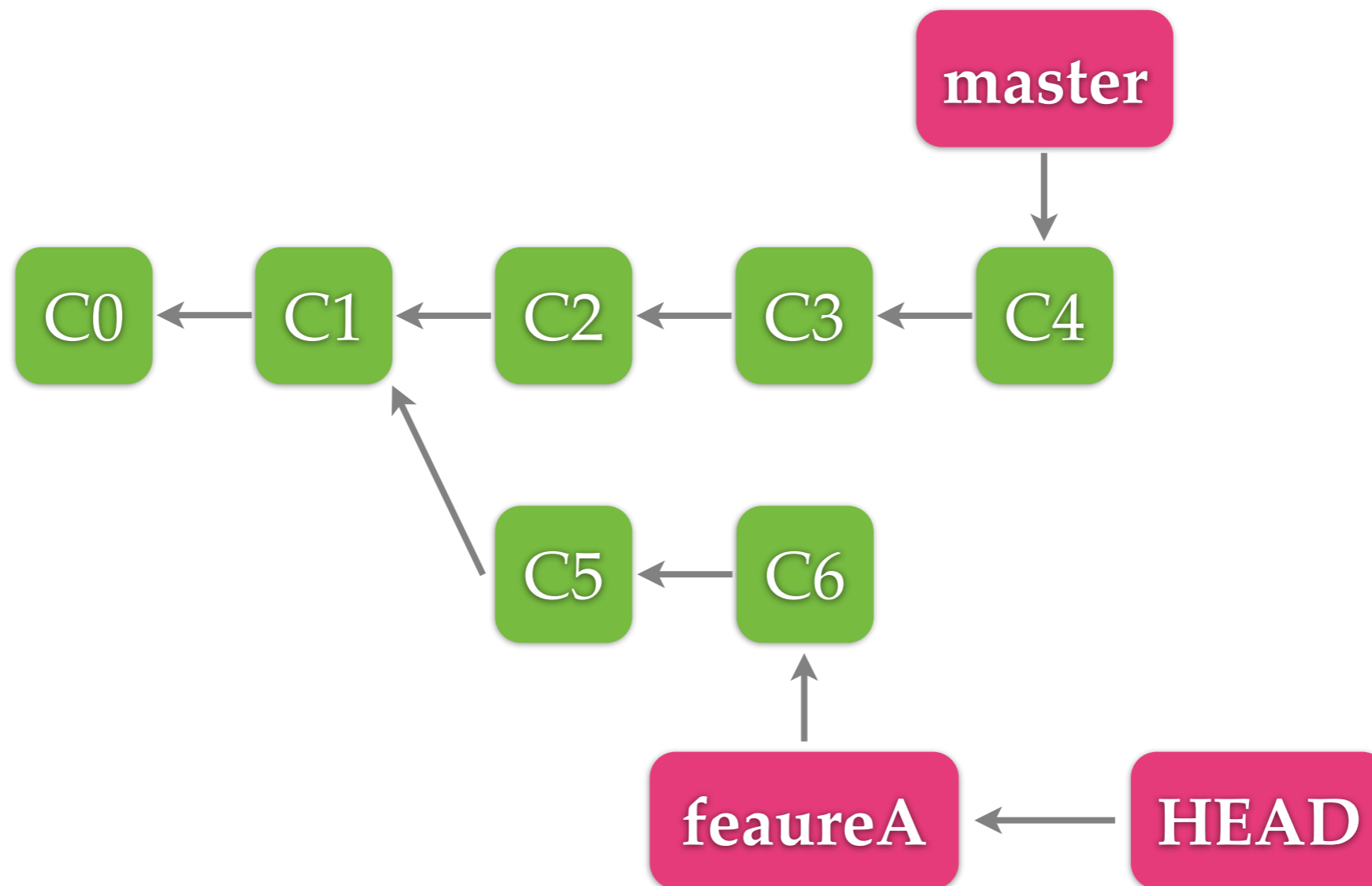
A commit has pointers back to its parents

Branches



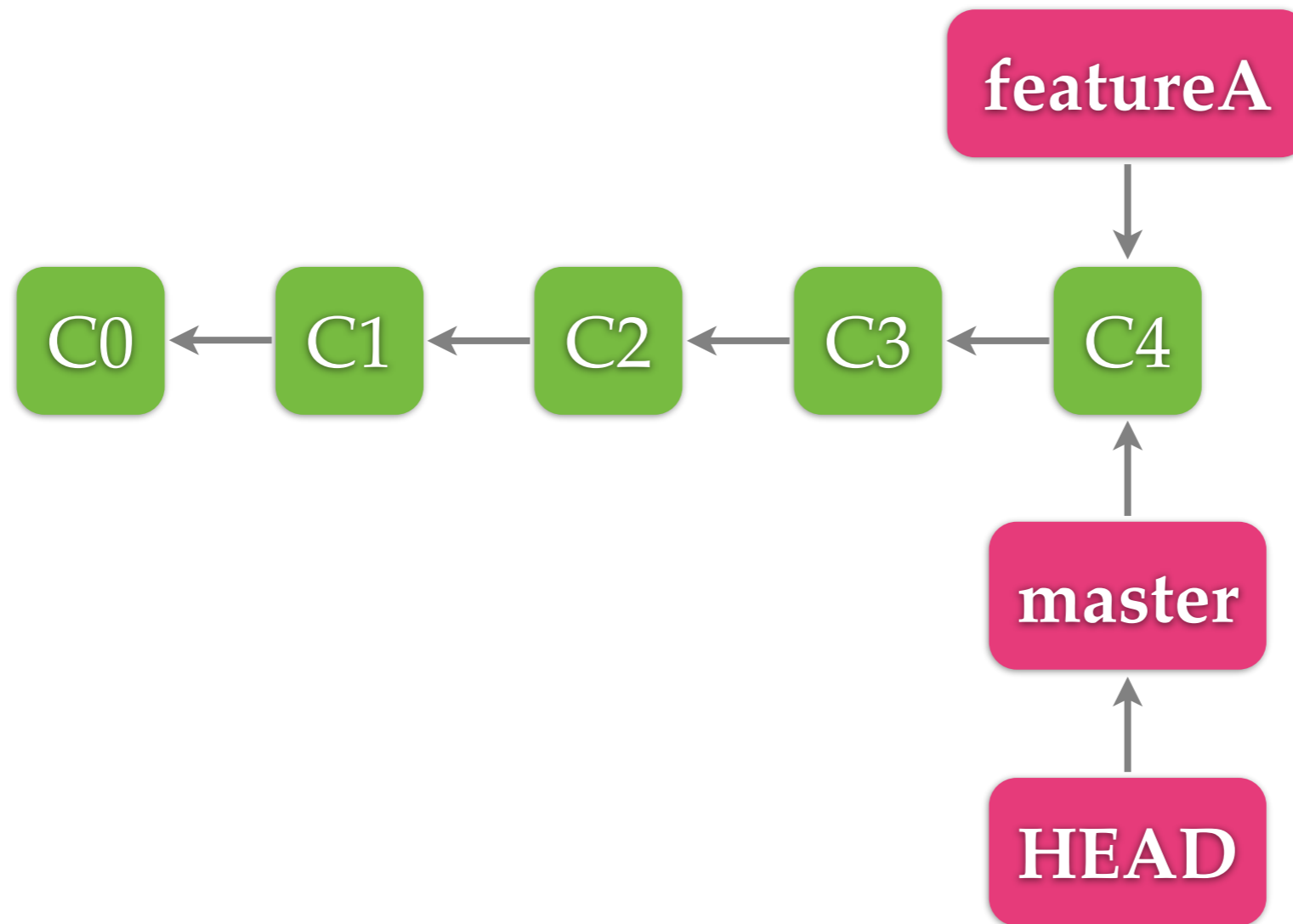
A branch is used to track a line of development
master (main) is the default branch

Head



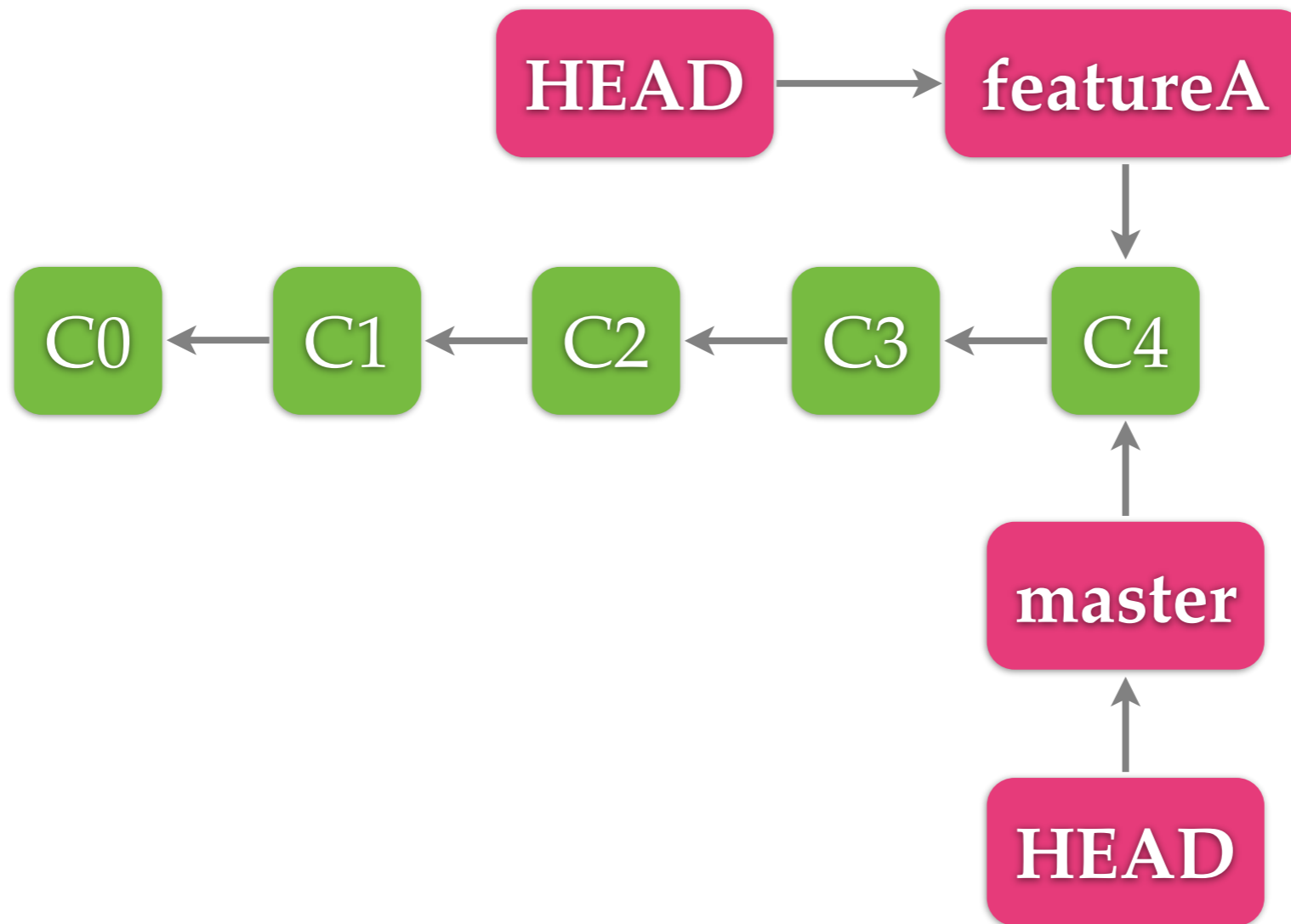
HEAD points to the branch or the commit of the working area

Create Branches



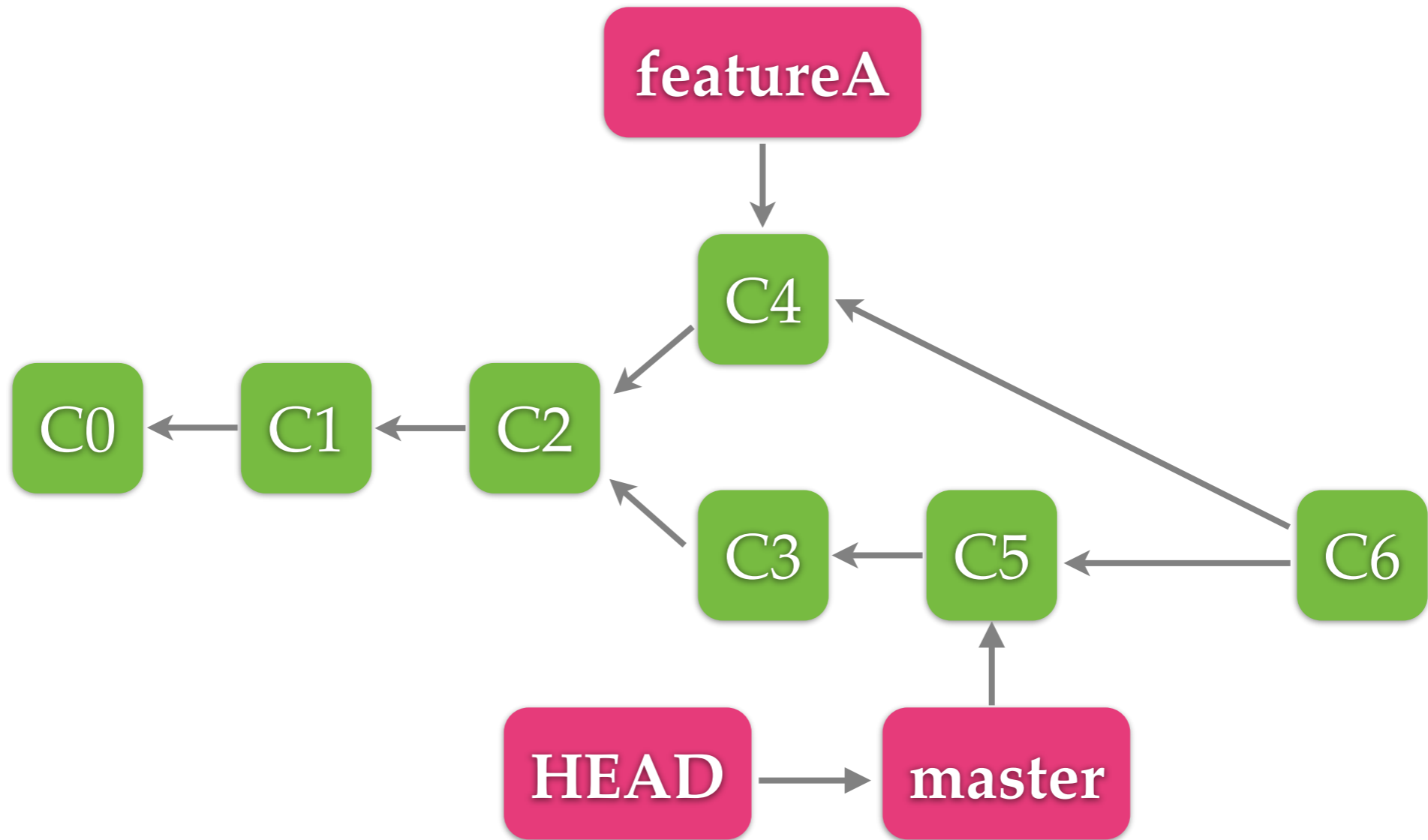
➔ \$ git branch featureA

Switch Branches



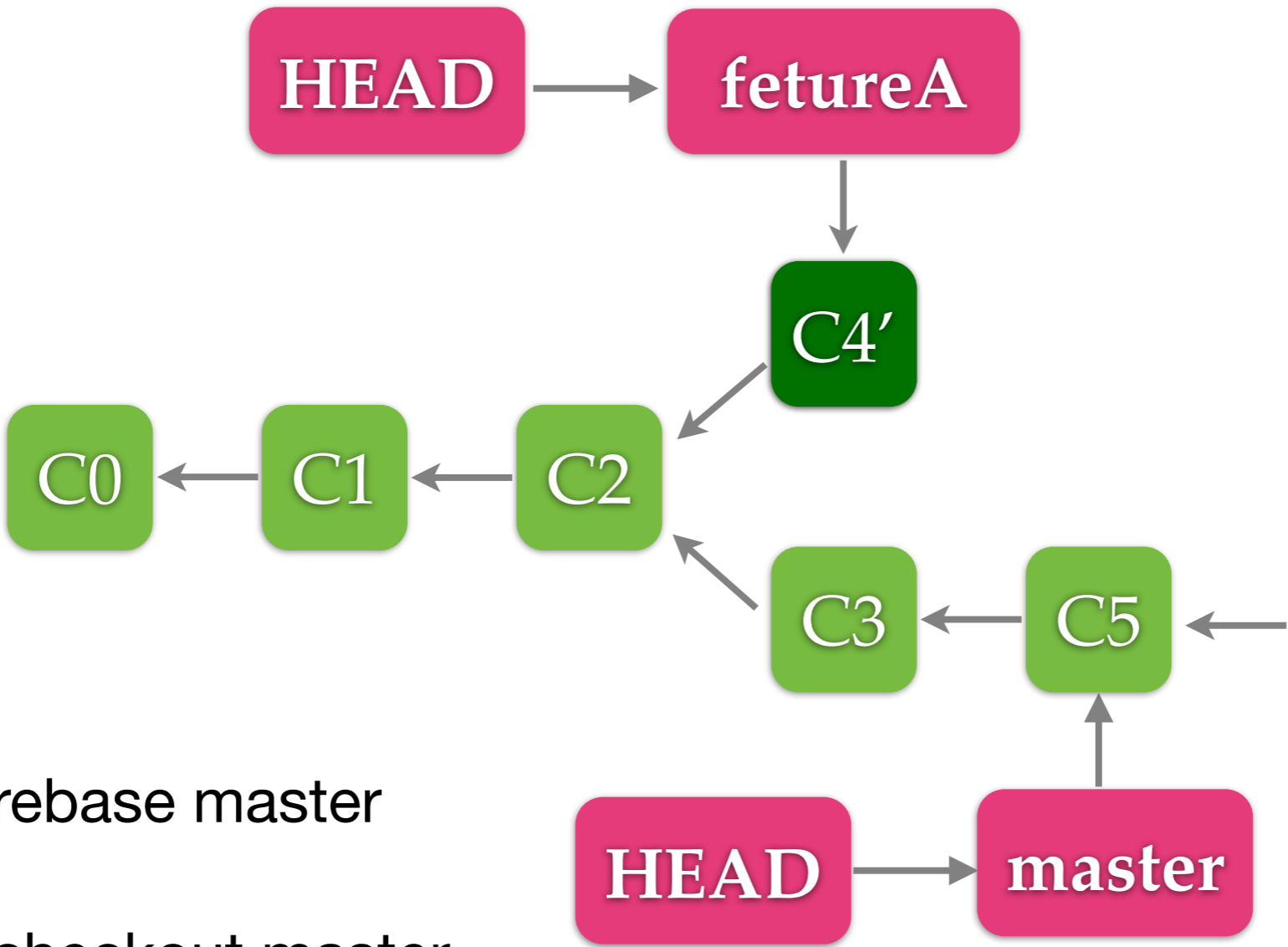
➔ \$ git checkout featureA

Merge



➔ \$ git merge featureA

Rebase



➔ \$ git rebase master

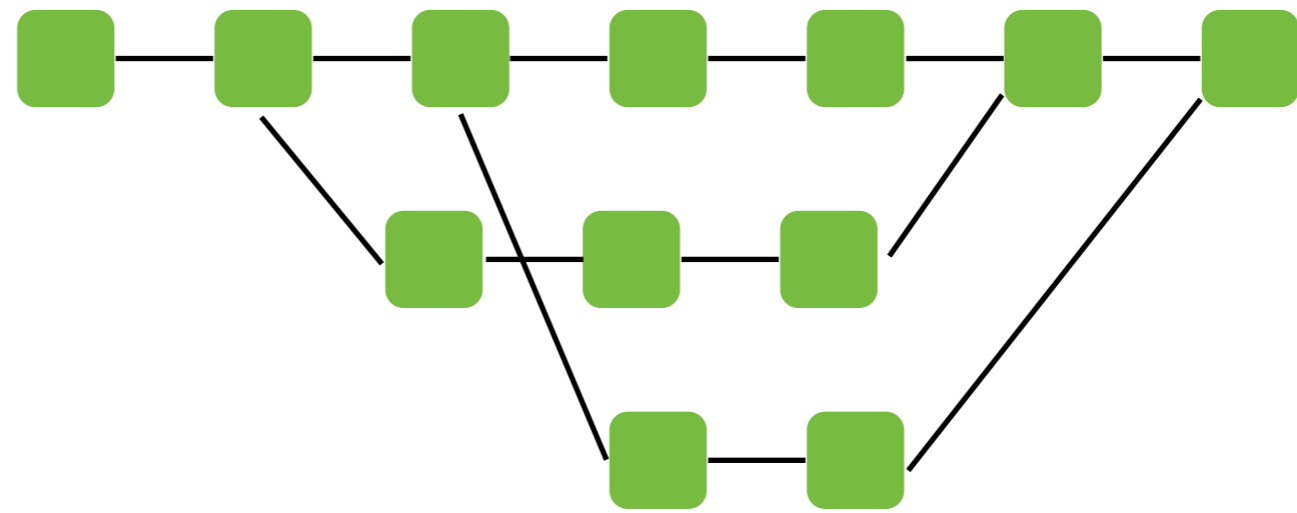
\$ git checkout master

\$ git rebase featureA

Fast Forward

Merge VS Rebase

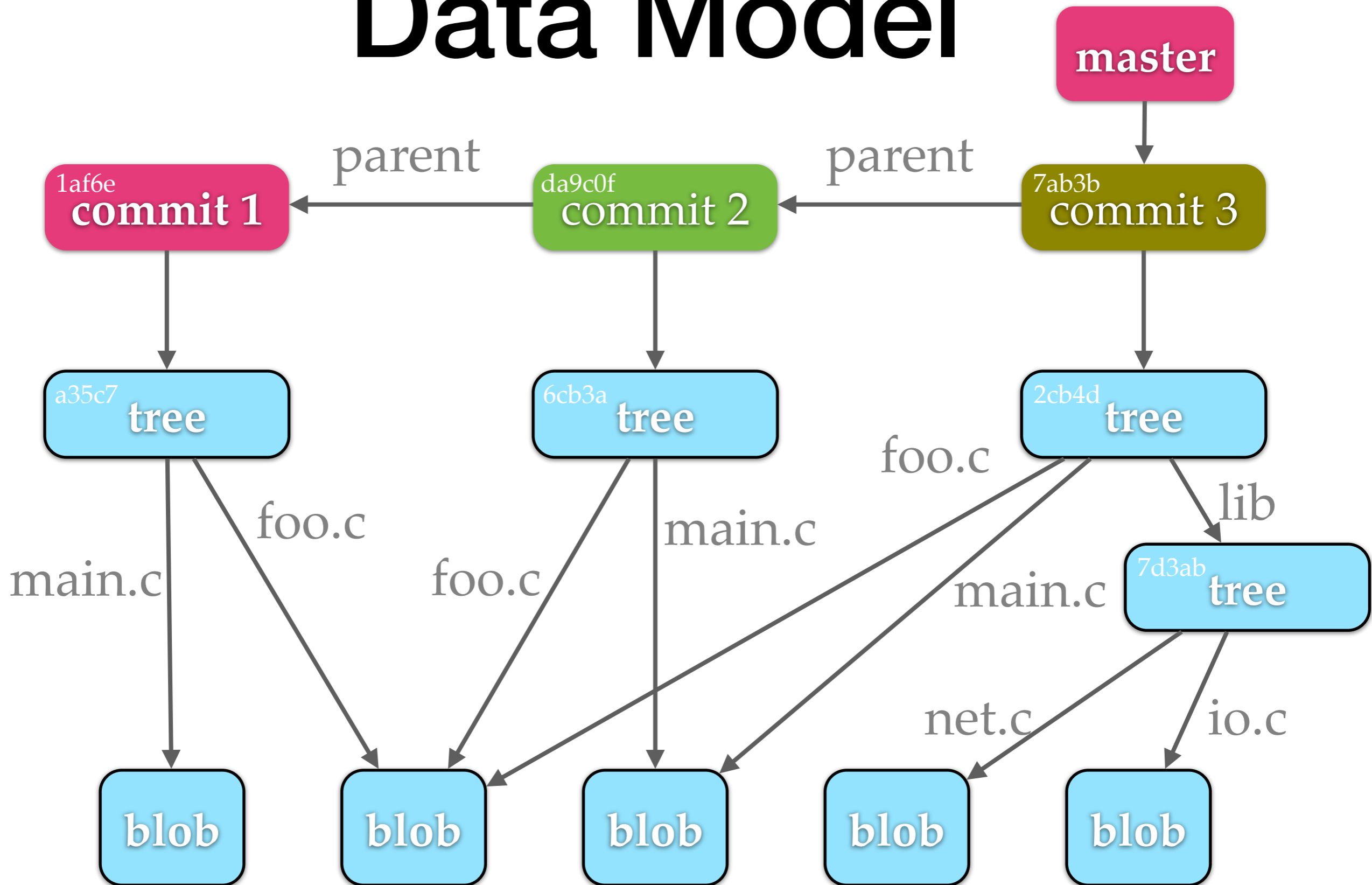
Merge



Rebase



Data Model



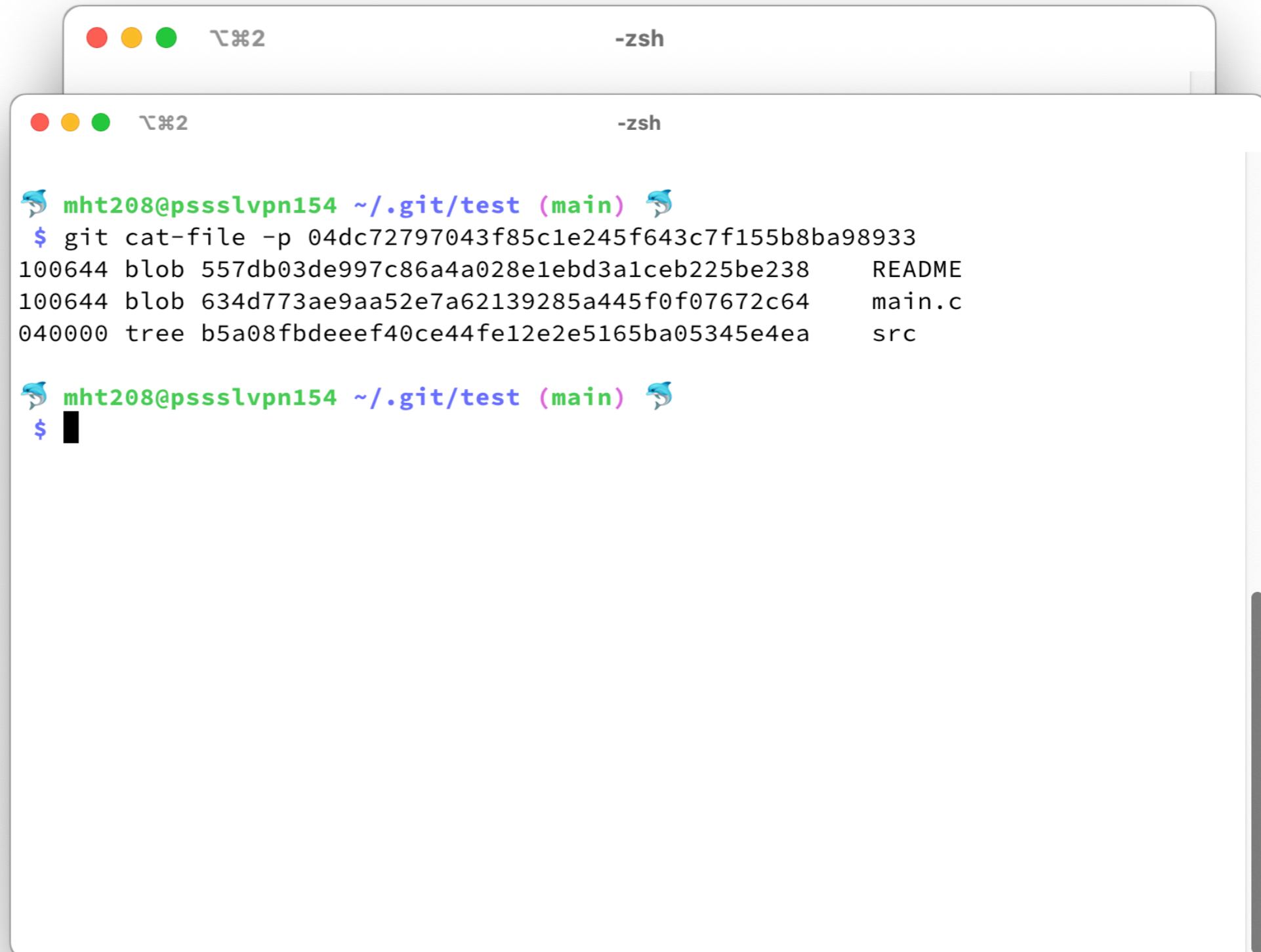
Data compressed by ZLIB

25

SHA1 hash of data and header as file name

Git Objects

- Git objects:
 - Commit
 - Tree
 - Blob



```
mht208@pssslvpn154 ~/.git/test (main)
$ git cat-file -p 04dc72797043f85c1e245f643c7f155b8ba98933
100644 blob 557db03de997c86a4a028e1ebd3a1ceb225be238    README
100644 blob 634d773ae9aa52e7a62139285a445f0f07672c64    main.c
040000 tree b5a08fbdeef40ce44fe12e2e5165ba05345e4ea    src
mht208@pssslvpn154 ~/.git/test (main)
$
```

History

```
4. git
commit 0119516da8f2d96da0695ed9c1a0045616fca9ca
Author: Ming-Hsien Tsai <mhtsai208@gmail.com>
Date: Tue Jun 27 16:58:41 2017 +0800

    Add bvSubC, bvSbb, and bvSbbC.

commit f5313f6f9174e781e544198fd7ccbb0be4e502f9
Author: Bow-Yaw <bowyaw@bitbucket.org>
Date: Thu Jun 22 13:31:10 2017 +0800

    add succ_instr and succ_program

commit 886c57392c65723e2741dbe61f79b25e68aa04a1
Author: Bow-Yaw <bowyaw@bitbucket.org>
Date: Fri Jun 16 08:57:55 2017 +0800

    a script to identify addition chains

commit 0e25d1e7d7ca1c45ce9270c8681056f649865705
Author: Ming-Hsien Tsai <mhtsai208@gmail.com>
Date: Tue Jun 13 11:54:35 2017 +0800

    Fix a bug where ule in Coq becomes ult in OCaml.

commit c9d360dc5609bb9bca06c3dfd0018a59ef59ca08
Author: Bow-Yaw <bowyaw@bitbucket.org>
Date: Tue Jun 13 11:10:07 2017 +0800

    return exit code from verification

commit 7228396b0dc5e7c71722716cbf52a2b28988bf9e
Merge: c1009c5 372c29a
Author: Bow-Yaw Wang <bywang@iis.sinica.edu.tw>
:
```

```
4. less
* f6fbbf4 (HEAD -> nondet) Add value type as an argument of store functors.
* 3cdda6c Move conversion between VS and SSAVS to DSL2SSACommons.
* 5be9e28 Add bvDSLRel.
* a479a2a (origin/nondet) Simplify some proofs.
* 4ea01b5 Improve dp_mem and dp_subset.
* a6b4a99 Add SsrFSet to avoid redundant declarations of variable sets.
* 4136533 Remove useless code in bvDSL. Simplify some proofs in bvDSL.
* 73cbe0b Add Equal to Store.
* a73c784 Merge branch 'master' into nondet
|\
| * 1b7952e Add a buggy implementation of fe25519_mul with radix 2^64 representa
tion.
| * 34b2c45 Add simple decision procedures for mem and subset.
| * 0119516 (subtraction) Add bvSubC, bvSbb, and bvSbbC.
* | f5313f6 add succ_instr and succ_program
|/
* 886c573 (origin/ccs17) a script to identify addition chains
* 0e25d1e Fix a bug where ule in Coq becomes ult in OCaml.
* c9d360d return exit code from verification
* 7228396 Merge branch 'master' of fm1.iis.sinica.edu.tw:/home/git/certified_q
hasm_vcg
|\
| * 372c29a Remove unused admitted lemmas in bvSSA2QFBV.
| * 4de5f10 Proved admitted lemmas in bvSSA2zSSA.
| * ca71d71 Add more lemmas.
* | c1009c5 refer to modified gbarith
|/
* c4e55f6 add to_bvdsl.py and rename to_dsl.py
* a5e23c4 allow configurations in comments
* b78c849 Fix a typo.
* 5fd989f Fix a problem in rewrite_zpower_nat.
* 5092d34 Update specifications.
* e7159cd Use Z for equality assertions.
* af5e257 Fix a bug in rewrite_assign2_with.
: 27
```

File Difference

```
DHCP-22126 project $ git diff
diff --git a/README.md b/README.md
index 52cb6cd..eb99592 100644
--- a/README.md
+++ b/README.md
@@ -1,3 @@
+==== About ====
+
  This is readme.
DHCP-22126 project $ █
```

File Restore (Checkout)

```
DHCP-22126 project $ cat README.md  
===== About =====
```

This is readme.

```
DHCP-22126 project $ git checkout README.md
```

```
DHCP-22126 project $ cat README.md
```

This is readme.

```
DHCP-22126 project $ █
```



README.md

```
** Convert a DSL state to an SSA state. **  
definition ssa_state (m : vmmap) (s : State.t) : bv64SSA.State.t :=  
  fun v =>  
    if (sidx v) == get_index (svor v) m  
    then State.occ (svor v) s  
    else State.occ (svor v) State.empty.
```

```
lemma ssa_state_equiv :  
  forall! m s, state_equiv m s (ssa_state m s).  
  proof.  
    intros m s s'.  
    rewrite (occ_ssa_state_eq _ (exact (get_index x m))).  
    reflexivity.  
  qed.
```



File Status

```
DHCP-22126 project1 $ git status
```

```
On branch master
```

```
Your branch is ahead of 'origin/master' by 3 commits.
```

```
(use "git push" to publish your local commits)
```

```
Changes to be committed:
```

```
(use "git reset HEAD <file>..." to unstage)
```

```
    modified:   B.c
```

```
Changes not staged for commit:
```

```
(use "git add <file>..." to update what will be committed)
```

```
(use "git checkout -- <file>..." to discard changes in working directory)
```

```
    modified:   A.c
```

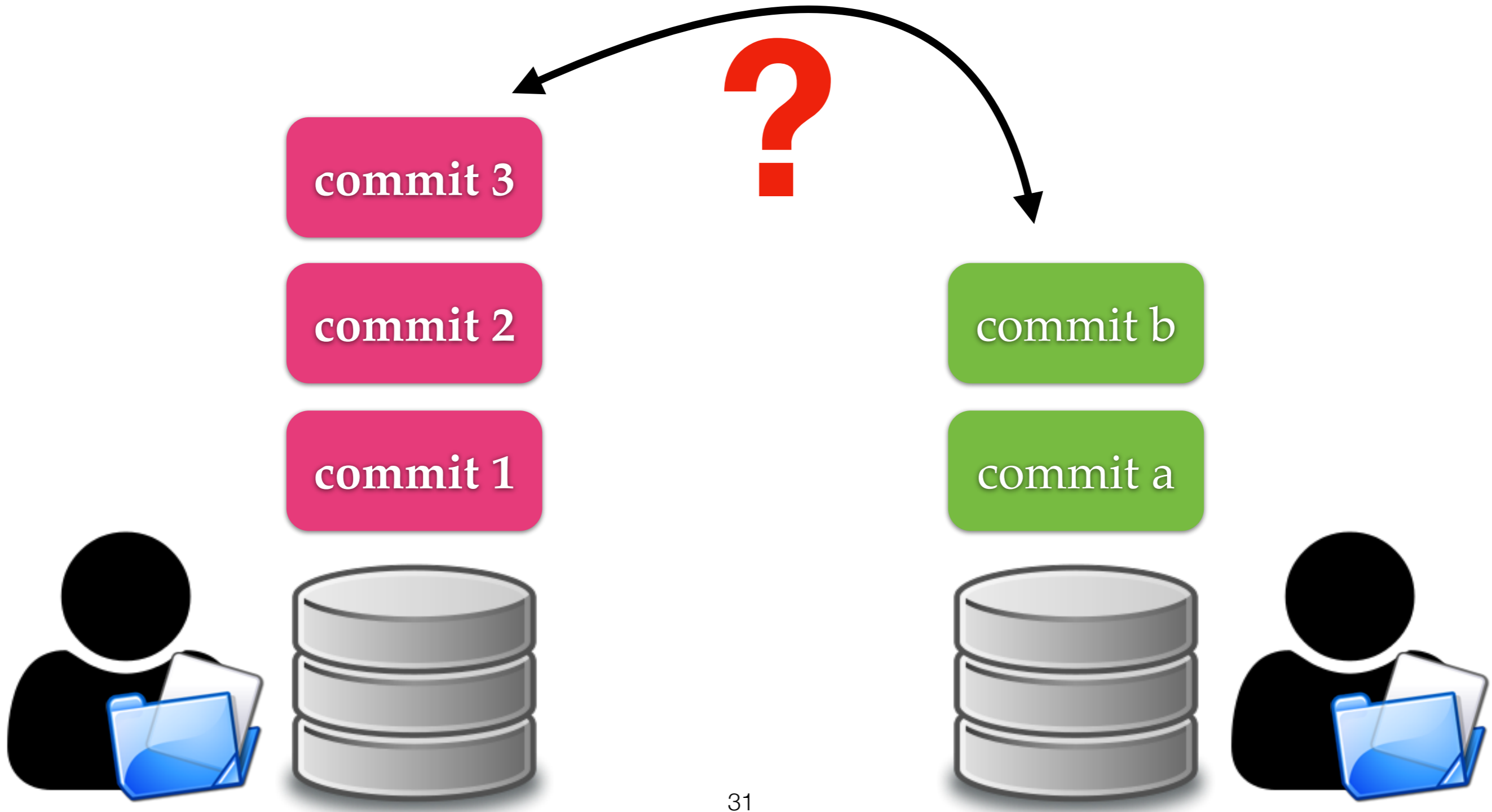
```
    modified:   README.md
```

```
Untracked files:
```

```
(use "git add <file>..." to include in what will be committed)
```

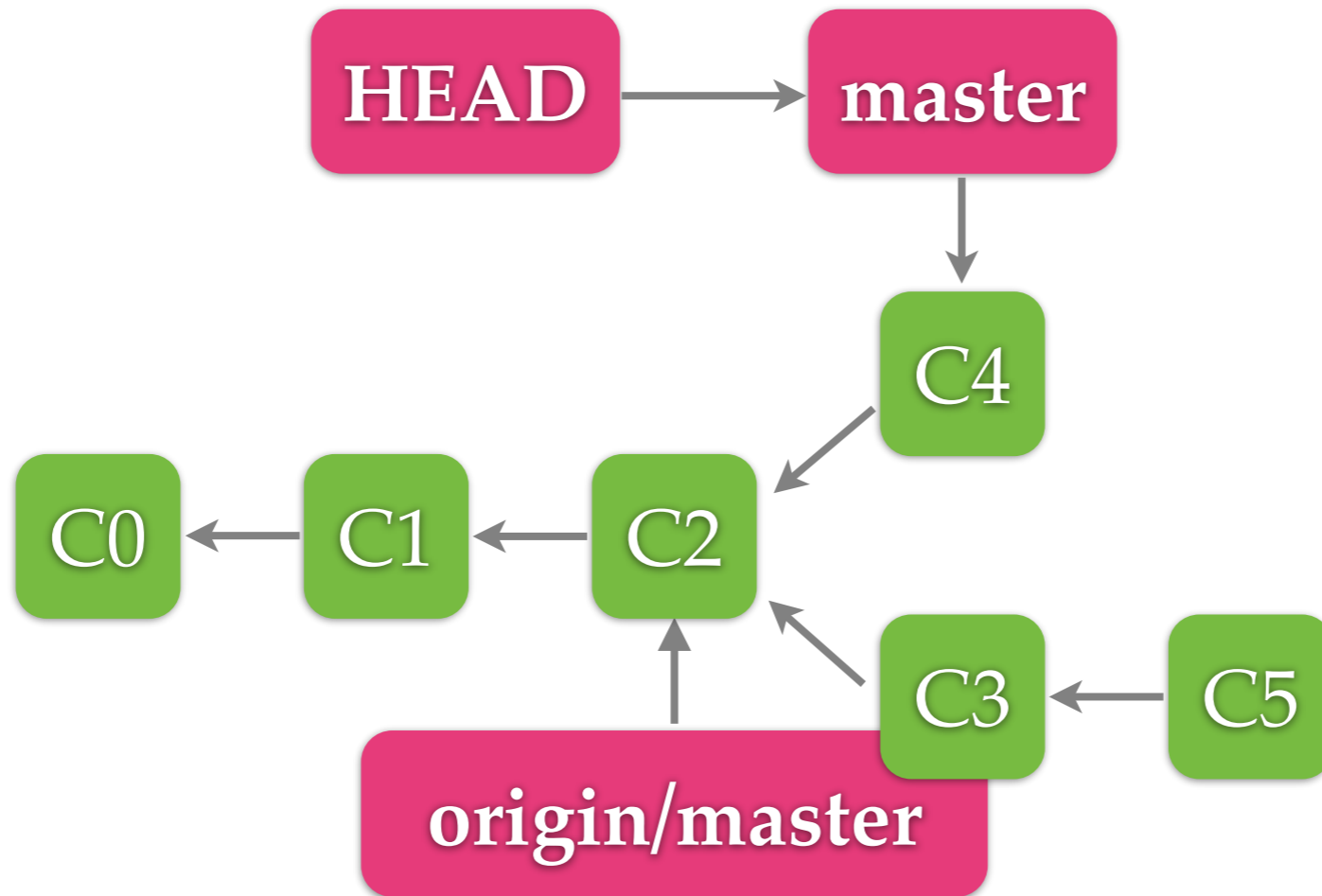
```
    D.java
```

Synchronization



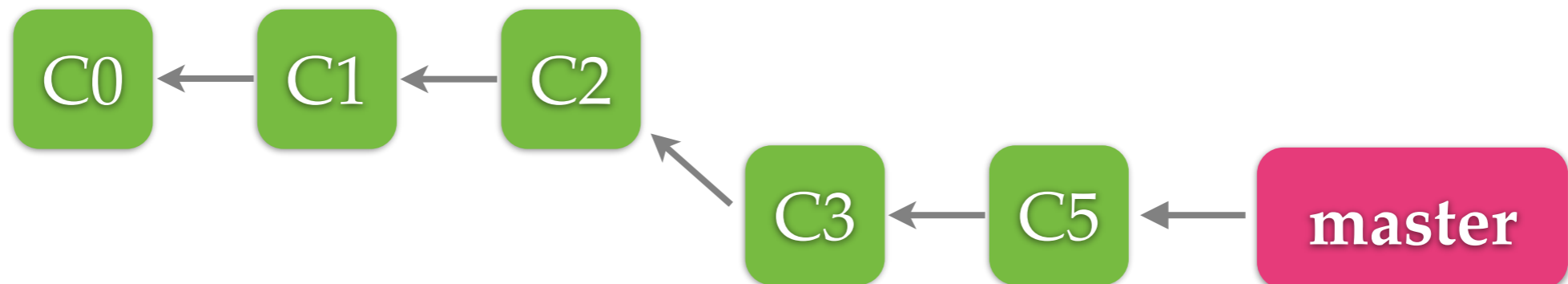
Fetch

Local



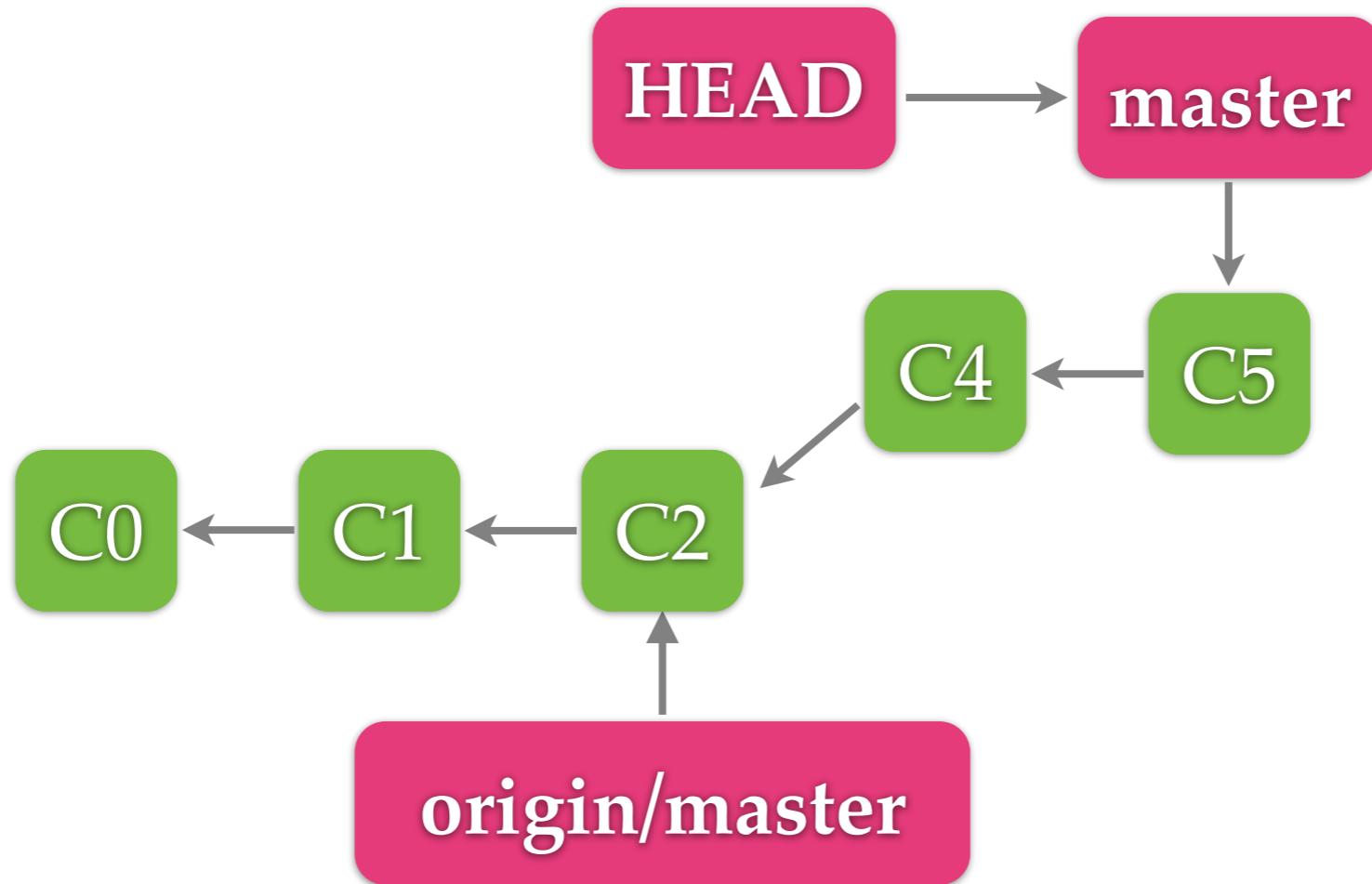
➔ \$ git fetch

Remote (origin)

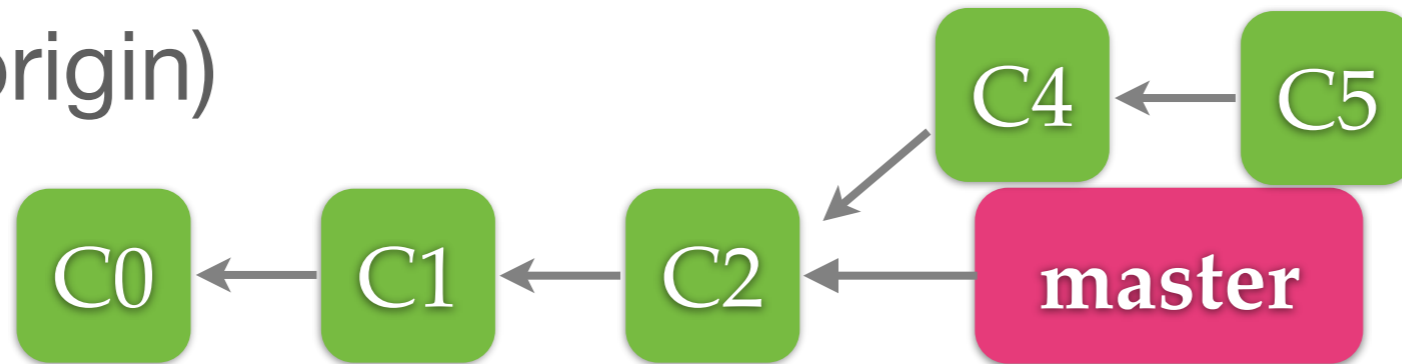


Push

Local



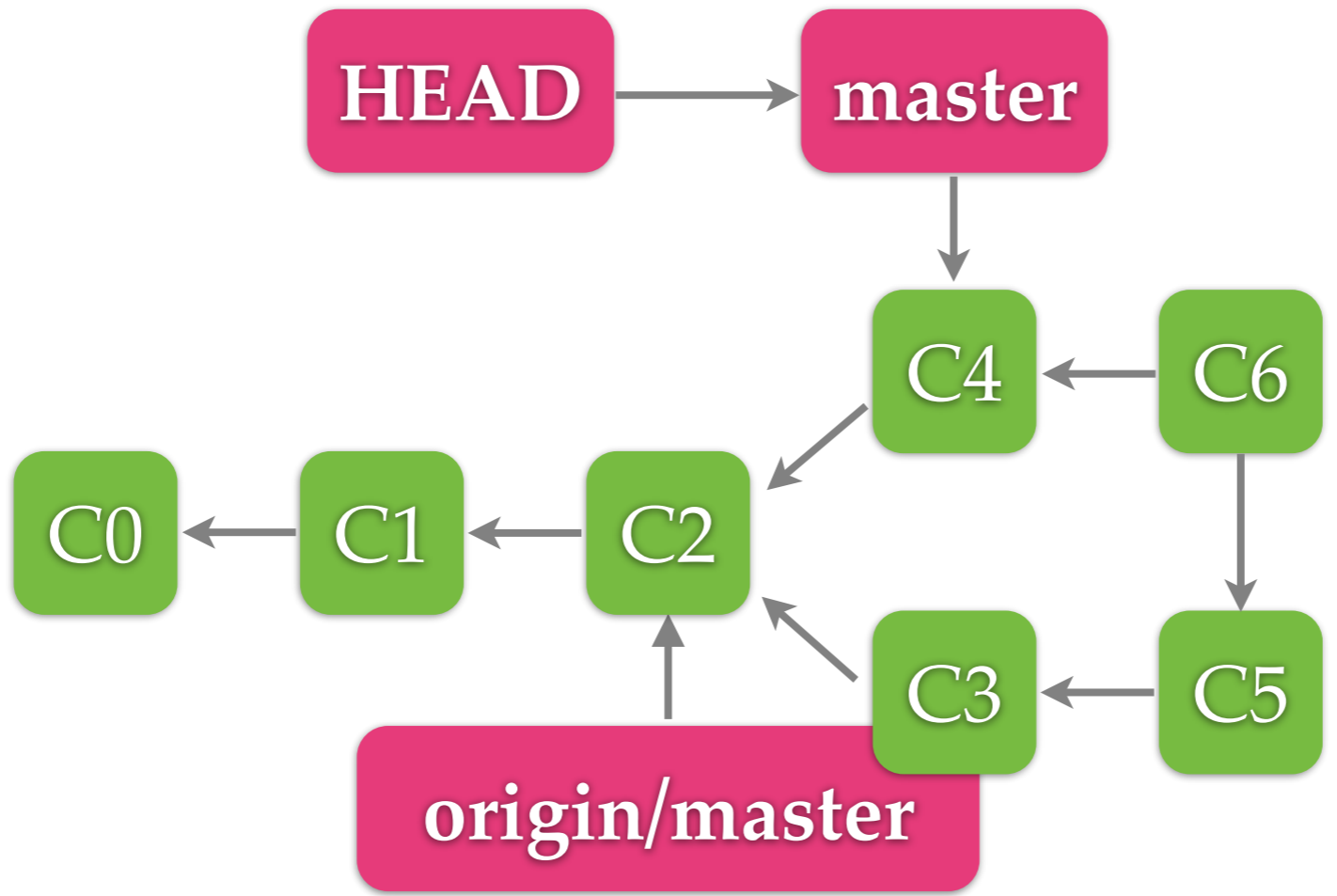
Remote (origin)



➔ \$ git push origin master

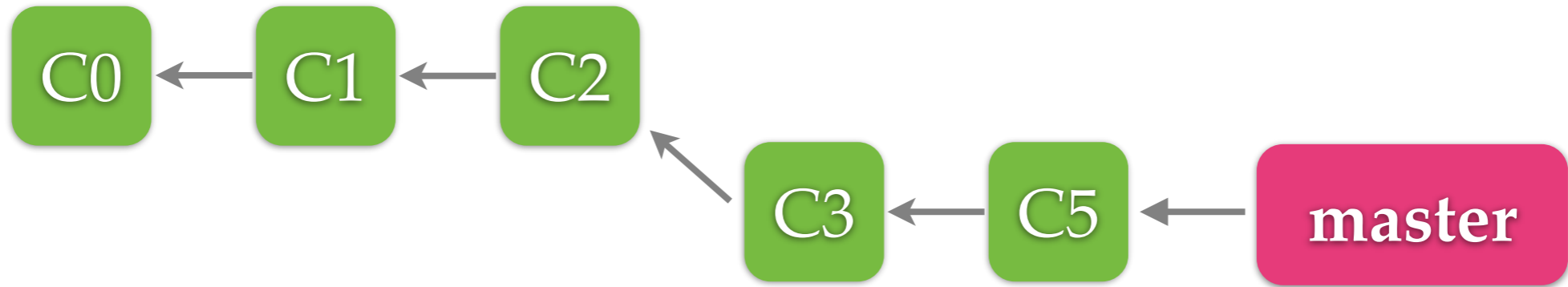
Pull

Local



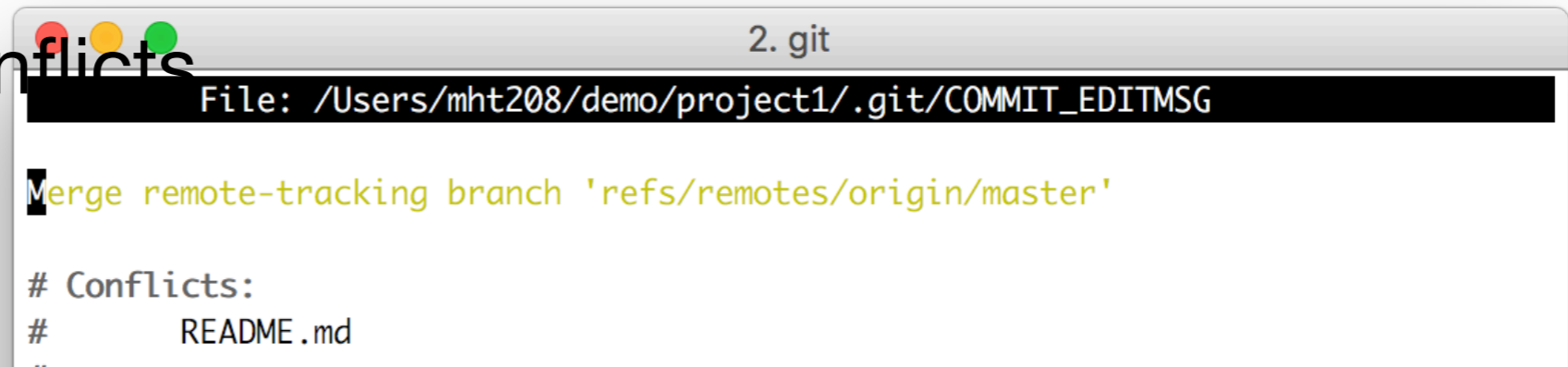
➔ \$ git pull
= fetch + merge

Remote (origin)



Resolve Conflicts

1. Edit files with conflicts
2. git add
3. git commit

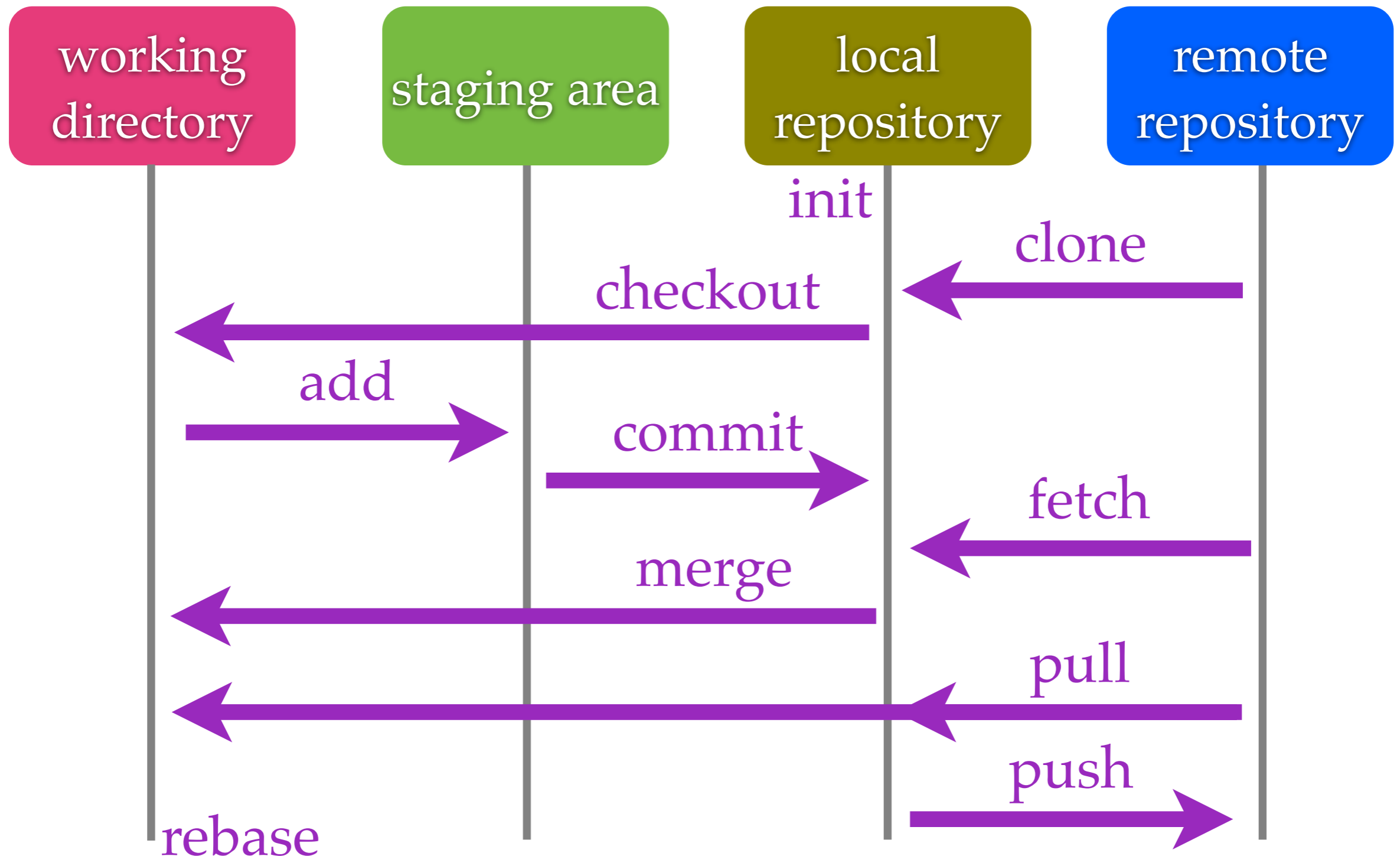


```
2. git
File: /Users/mht208/demo/project1/.git/COMMIT_EDITMSG
Merge remote-tracking branch 'refs/remotes/origin/master'

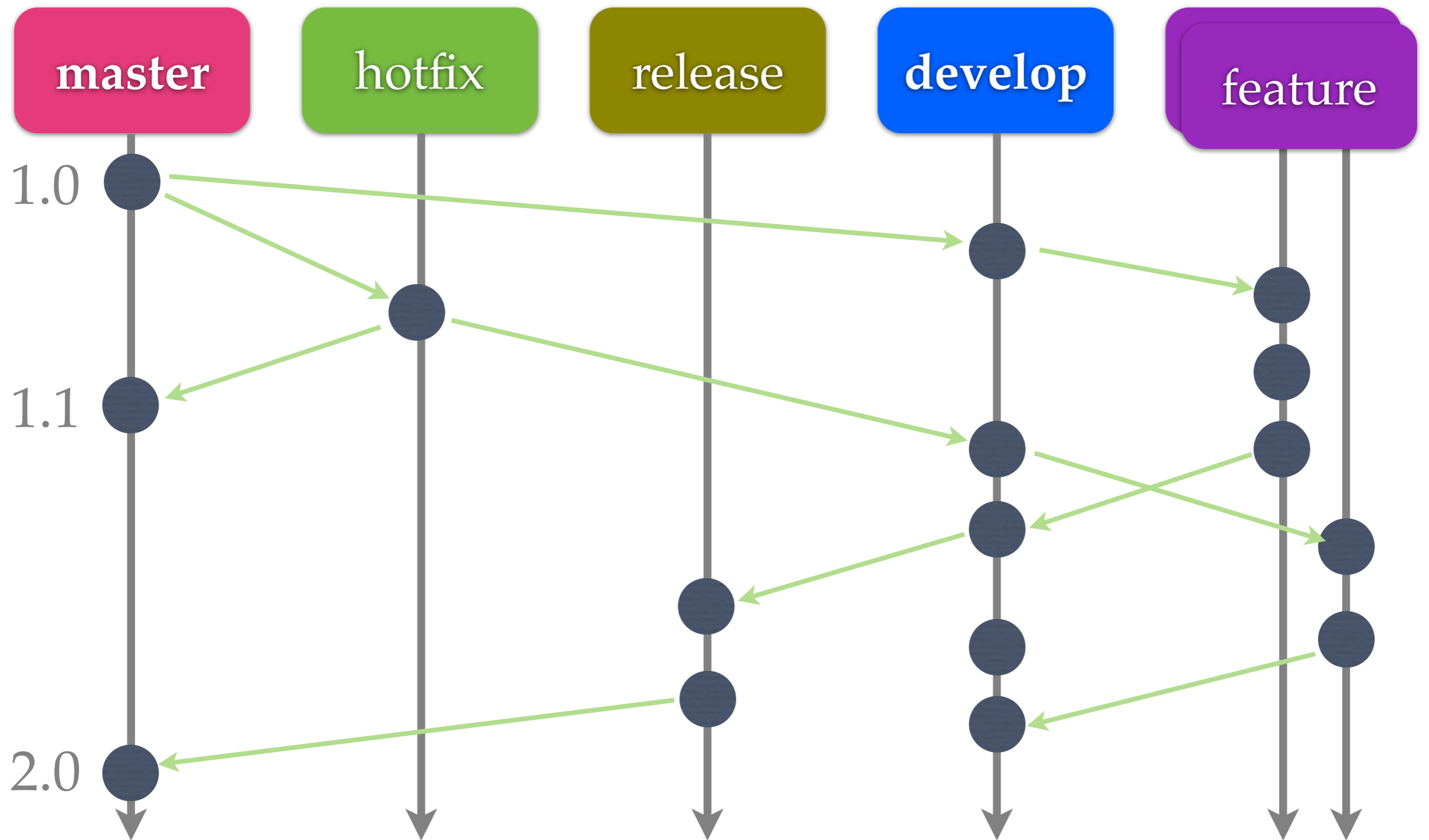
# Conflicts:
#   README.md
"
```

```
DHCP-22126 project1 $ git add README.md
DHCP-22126 project1 $ git commit
[master 3e5947f] Merge remote-tracking branch 'refs/remotes/origin/master'
DHCP-22126 project1 $
From /Users/mht208/demo/server
* 3e5947f (HEAD -> master) Merge remote-tracking branch 'refs/remotes/origin/master'
|\
| * 57d4f6e (origin/master) Modify README.md.
| * | 22804d8 Modify README.md.
|/
* 3691b0d Add README.md.
```

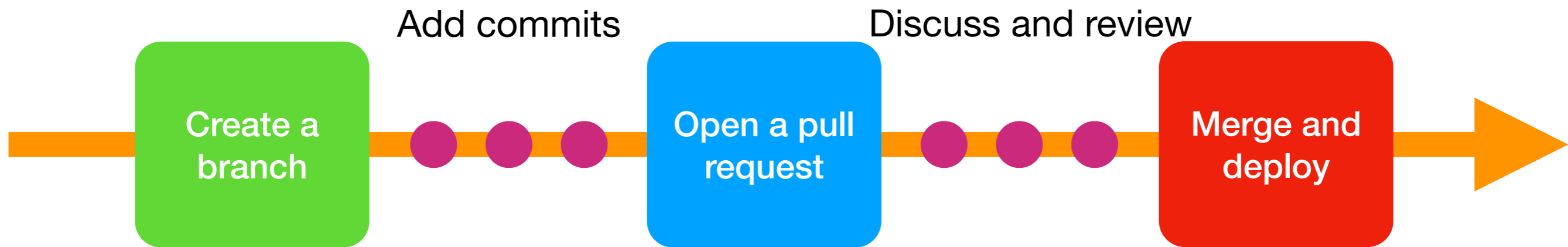
Summary



Git Flow



GitHub Flow



Stash



fix a bug, right now!



Squash

```
GNU nano 2.8.5 File: /Users/mht208/demos/squash/.git/COMMIT_EDITMSG
DHCP-22126 squash $ git rebase -i HEAD~6
# T [detached HEAD 4baf53e] Add feature A.
GNU nano 2.8.5 File: /Users/mht208/demos/squash/.git/COMMIT_EDITMSG Date: Wed Sep 13 09:36:38 2017 +0800
Add feature A 1 file changed, 12 insertions(+)
Successfully rebased and updated refs/heads/master.
# Please use the following format for the commit message:
# with * 4baf53e (HEAD -> master) Add feature A.
# Date: * aaa944b Add main.c.
# DHCP-22126 squash $ █
# interactive rebase in progress; once ready, you can fix up
# Last commands done (6 commands done):
#   squash e5abbde Fix a bug in function
#   squash 5718716 Improve performance.
# No commands remaining.
# This is the commit message #5:
```

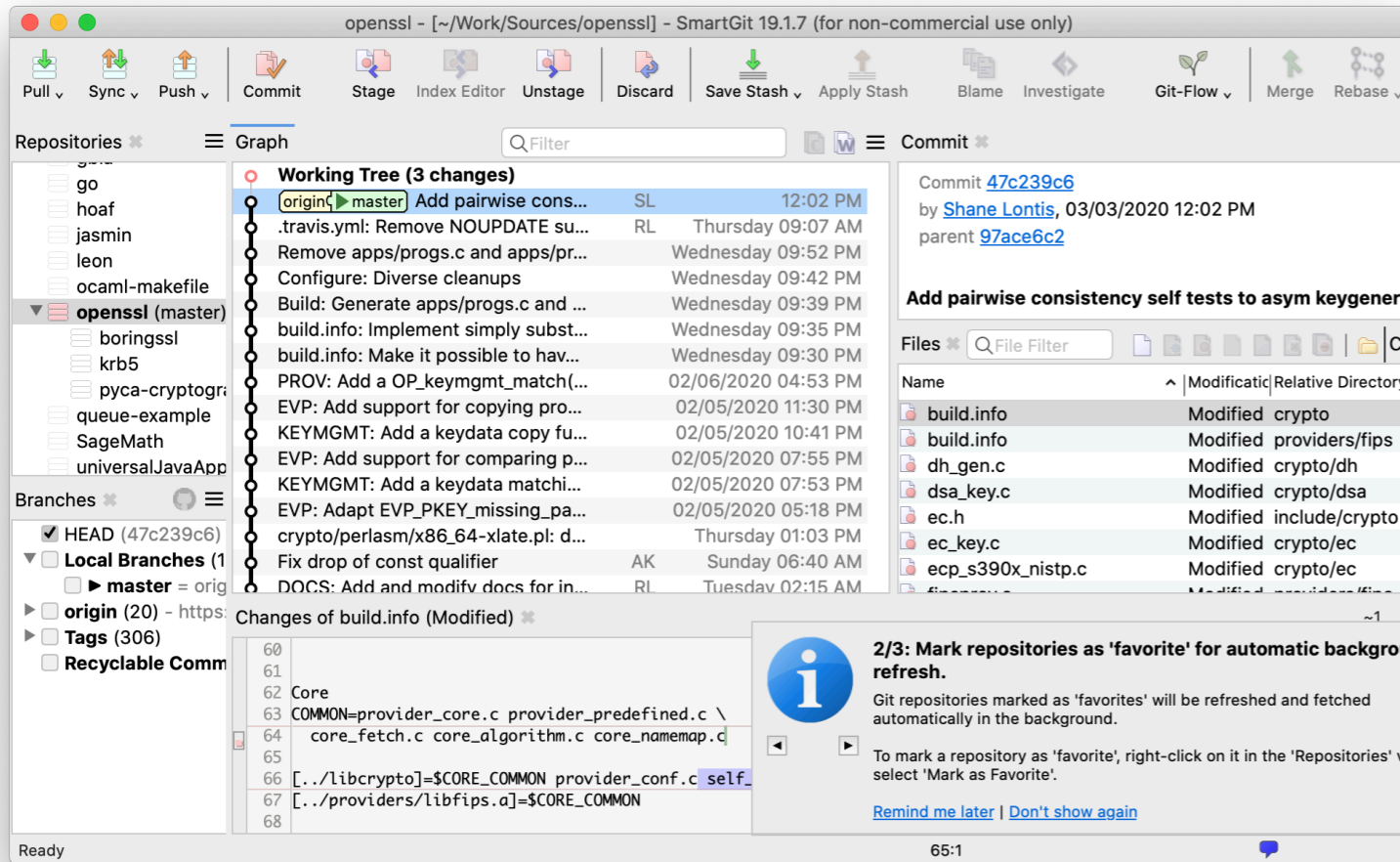
glog is an alias of “log --graph --decorate --pretty=oneline --abbrev-commit”

HEAD: the version of the working tree

Git Hooks

- Git offers the following hooks:
 - Client-side: pre-commit, pre-push, post-merge, ...
 - Server-side: pre-receive, update, post-receive
- Can be used to notify a continuous integration server, update a ticket-tracking system, etc.

GUI Clients

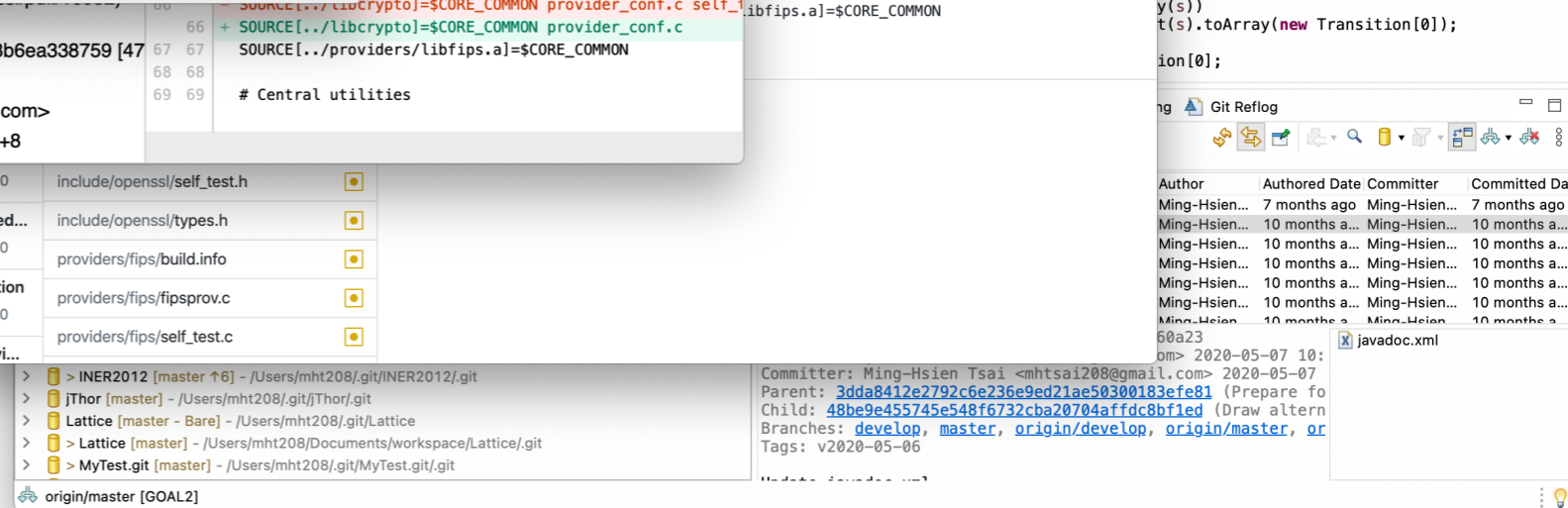


SmartGit

GitHub Desktop

Eclipse EGit

SourceTree



References

- <http://git-scm.com/book>
- <http://git-scm.com/docs>