Git

Crawford Kesy Moderegger

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Literature

Title: Pro Git
Author: Scott Chacon and Ben Straub
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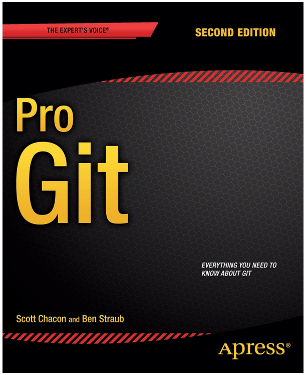
THE EXPERT'S VOICE®
SECOND EDITION
Pro Git
EVERYTHING YOU NEED TO KNOW ABOUT GIT
Scott Chacon and Ben Straub
Apress®

Version Control Systems

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Version Control Systems

- What is a Version Control System (VCS)?
    - Tracks changes to files
- Centralized vs. Distributed VCS
    - Centralized: All clients depend on a single server
    - Distributed: Every client has a full copy of the repository
- Advantages of a VCS
    - Recover lost or overwritten data by reverting to previous versions
    - Enables collaboration

Git

- A Distributed VCS

The Git logo

Git

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- Created by Linus Torvalds in 2005

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- A Distributed VCS
- Created by Linus Torvalds in 2005
- Creates/stores snapshots of your project
- Goals of Git
  - Speed
  - Simple design
  - Strong support for non-linear development
  - Fully distributed
  - Able to handle large projects

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Git Basics - Get a Repository

- To create a new repository, run:

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$ git init
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- To create a new repository, run:

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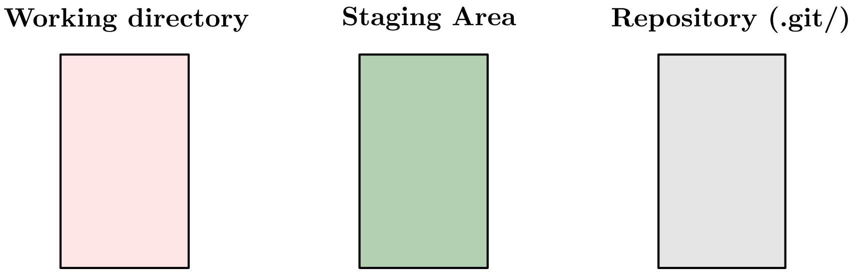
- This creates a new .git/ directory in the root of your project
  - Stores all the data and metadata Git needs to manage the repository
  - Losing or corrupting this directory means losing the repository's version history

```
.git/
  | config
  | description
  | HEAD
  | hooks/
  | info/
  | objects/
  | refs/
```

Newly created Git directory

Git Workflow

- A basic Git workflow looks like this:



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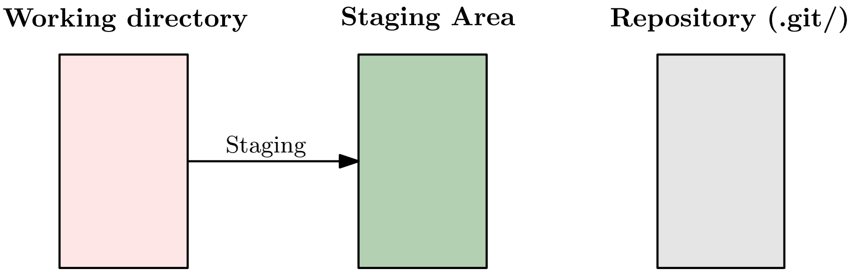

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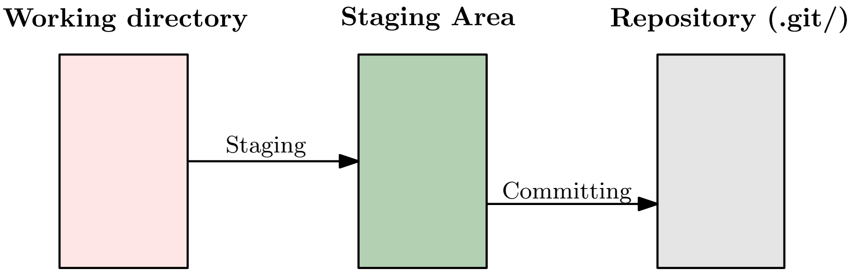

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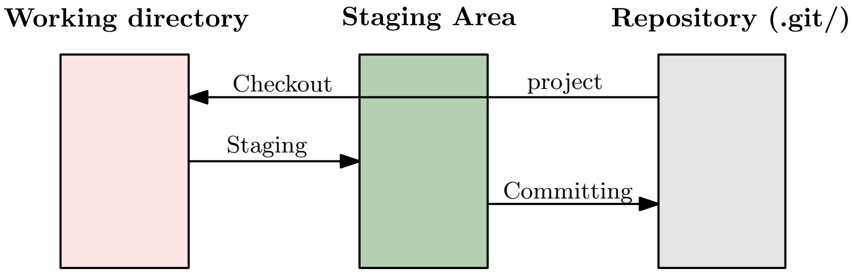
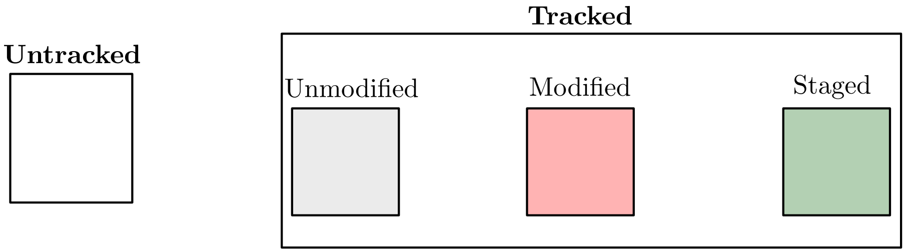


The different File States in Git



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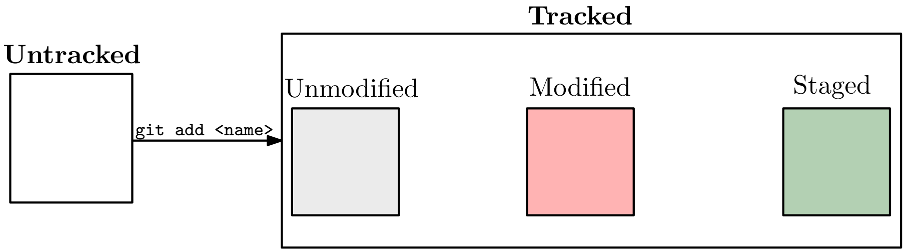

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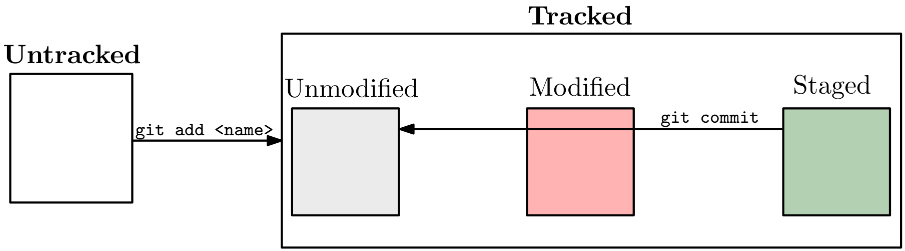

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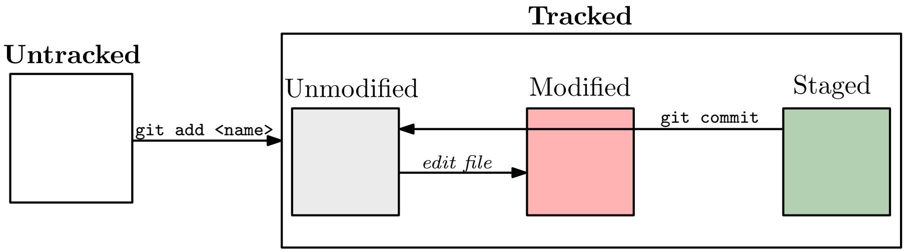

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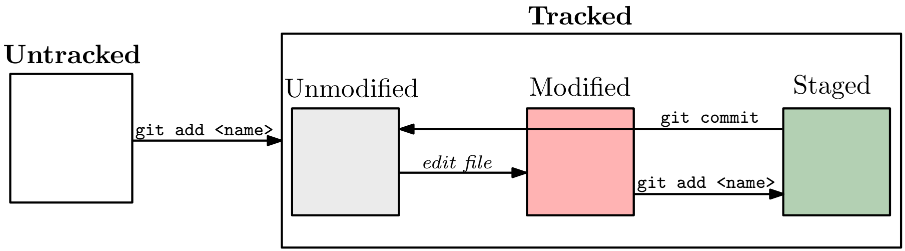

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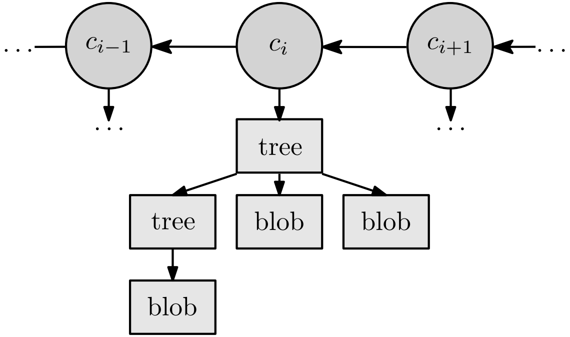

Object hierarchy

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- `git commit`
  1. Writes a new tree object based on the contents in the index
  2. The new commit object points to this tree

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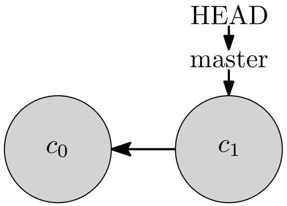
- To move `HEAD` to another branch (switching branches):

```
$ git checkout <branch>
```

Git Branches - An example



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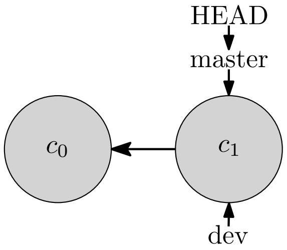

```
$ git branch dev
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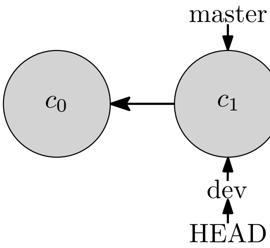

```
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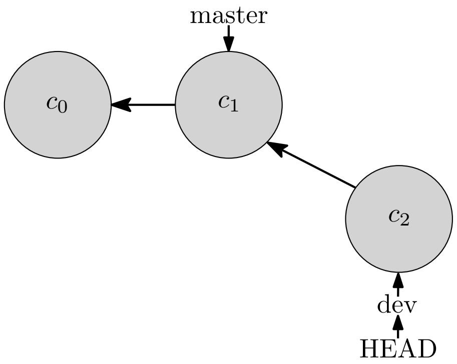

```
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```

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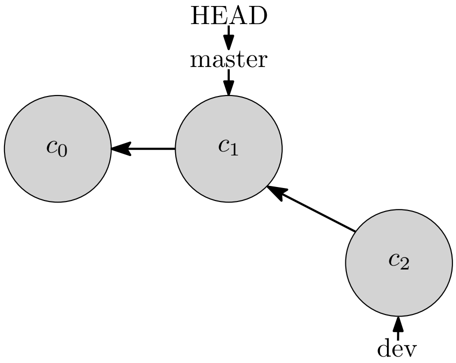
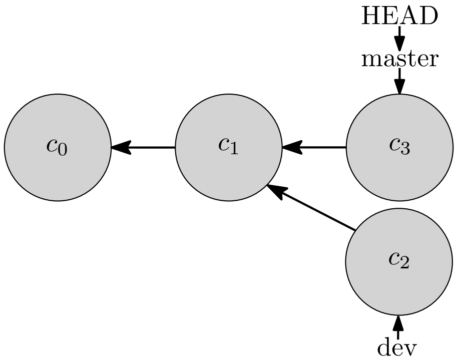


```
$ git checkout master
```

Git Branches - An example



```
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```

Merging branches

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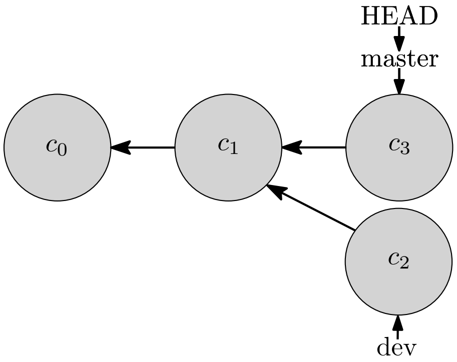
  2. The tips of the branches are compared with the base to determine the new changes on each branch
  3. Non-conflicting changes are applied
  4. Conflicting changes result in a merge conflict, which must be resolved manually

True Merge



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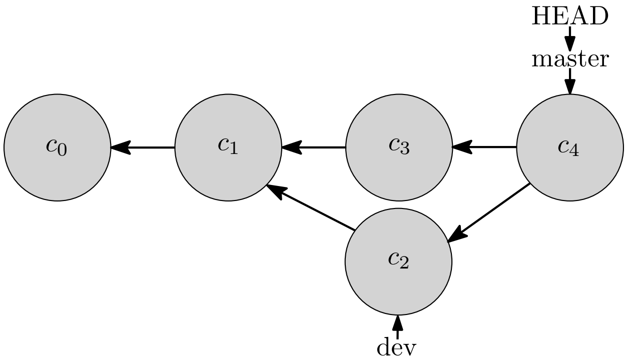

```
$ git merge dev
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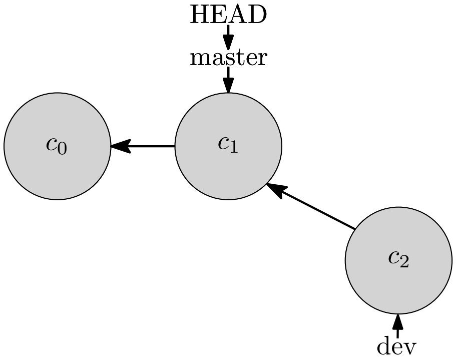
Fast-forward Merge



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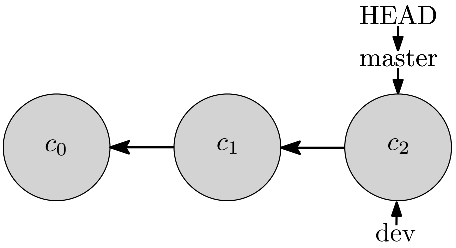

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```
.git/refs/
  | heads/
  |   | master
  |   | dev
  | remotes/
```

```
$ cat .git/refs/heads/master
98c7705f...
$ git log master | head -1
commit 98c7705f...
```

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```

```
$ cat .git/refs/heads/master
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$ git log master | head -1
commit 98c7705f...
```

- While `.git/HEAD` is not under `.git/refs/`, it is a symbolic reference to another reference

```
$ cat .git/HEAD
ref: refs/heads/master
```

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  - Stored under `.git/refs/remotes`
- Adding a Remote:

```
$ git remote add <name> <url>
```

Git Remotes - Pushing and Pulling

- **Pushing** changes to a remote:

```
$ git push <remote> <branch>
```

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- **Pulling** in changes from a remote:

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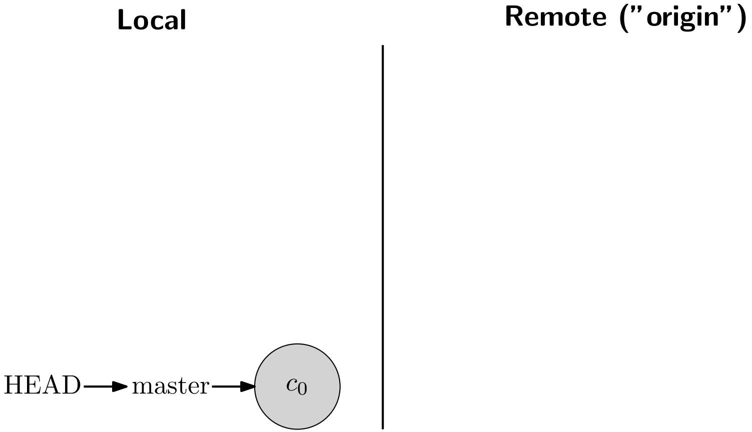
  - To integrate the changes, merge a remote branch into the current branch:

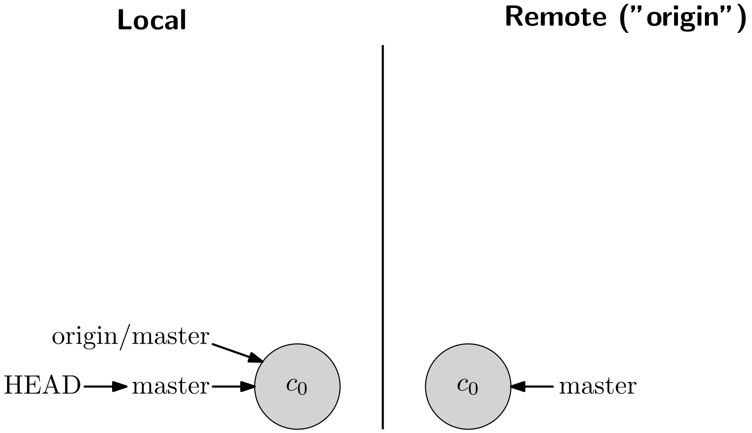
```
$ git merge <remote>/<branch>
```

Remotes - An Example



```
$ git remote add origin git@github.com:johnsmith/myrepo.git
```

Remotes - An Example



```
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```
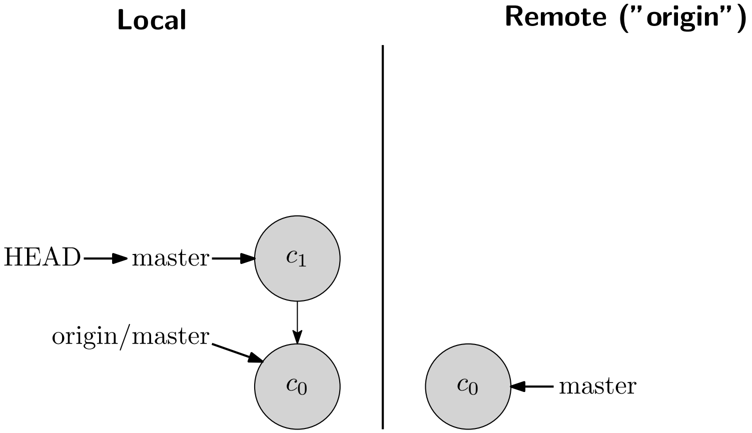

Remotes - An Example



```
...
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```
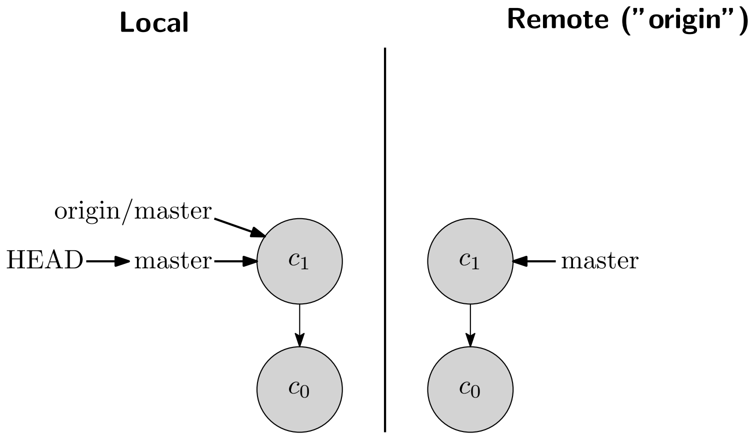

Remotes - An Example



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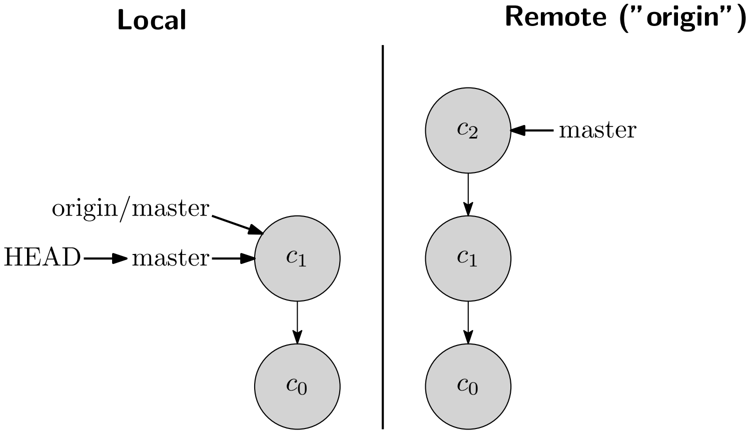

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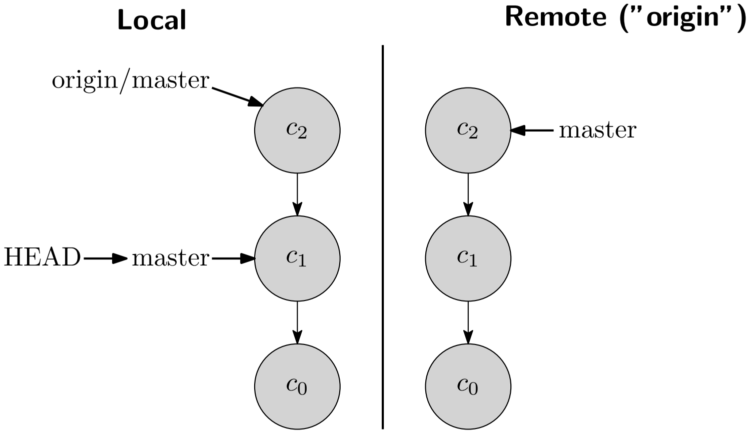

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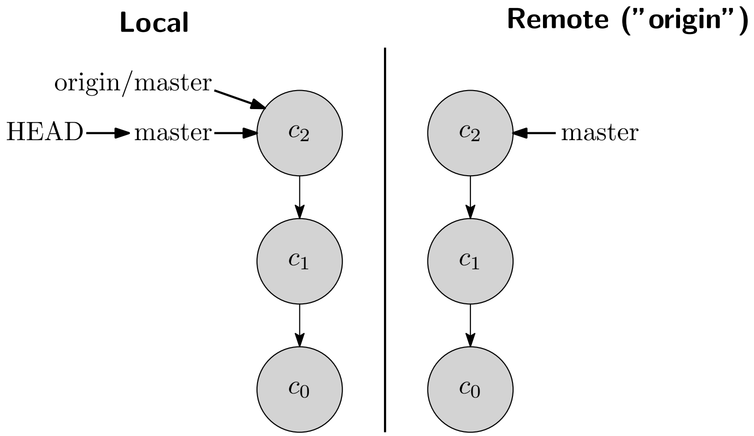

```
$ git merge origin/master
```

Undo Operations

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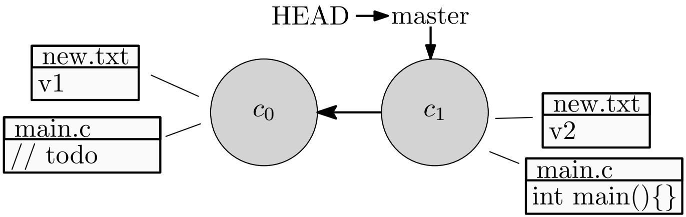
- `git reset` can cause partial loss of history

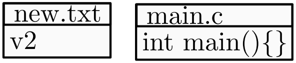
Undo Operations - An example

- **Goal:** Revert back to state of c_0, but keep contents of `main.c`



```
$ git log
commit 4b76761cd4...
...
commit 52cbc76923...
...
```

Working directory:



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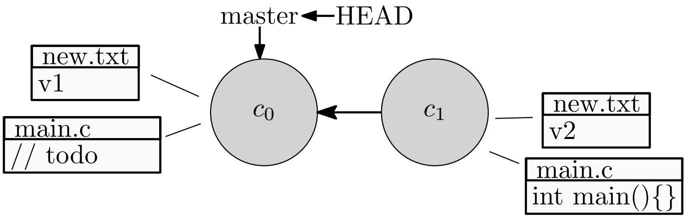

```
$ git reset 52cb
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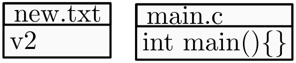

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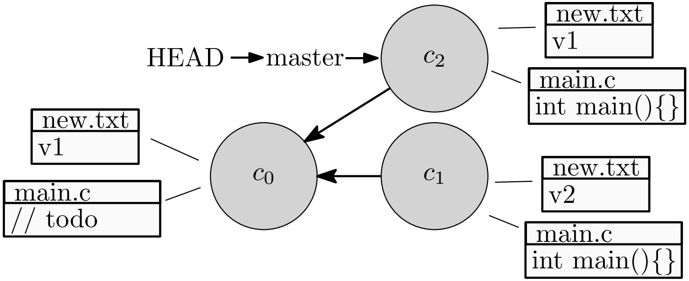
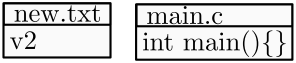


```
$ git add main.c
$ git commit
```

Working directory:



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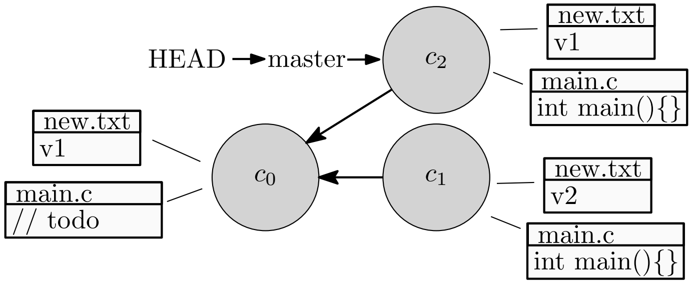
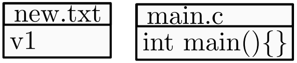


```
$ git restore new.txt
```

Working directory:



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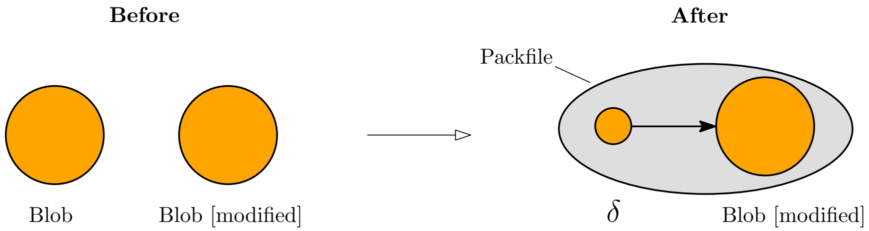

Packfile example

The Git Directory - Summary

```
.git/
  | config
  | description
  | HEAD
  | index
  | hooks/
  | info/
  | logs/
  | objects/
  | refs/
```

Git directory

The Git Directory - Summary

- `config` and `description` are self-explanatory

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Git directory

The Git Directory - Summary

- config and description are self-explanatory
- HEAD: Reference to a branch

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Git directory

The Git Directory - Summary

- `config` and `description` are self-explanatory
- `HEAD`: Reference to a branch
- `index`: The staging area

```
.git/
  | config
  | description
  | HEAD
  | index
  | hooks/
  | info/
  | logs/
  | objects/
  | refs/
```

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Git directory

The Git Directory - Summary

- config and description are self-explanatory
- HEAD: Reference to a branch
- index: The staging area
- hooks/: Scripts triggered by certain commands
- info/: Local configurations
- logs/: Records changes made to refs
- objects/: All objects
- refs/: (Remote) branches

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   | description
   | HEAD
   | index
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   | logs/
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   | refs/
```

Git directory