

# Embedded Software Essentials

*Version Control*

C1 M1 V9

# Version Control Systems (VCS)

- Software package that allows users to track changes
- Many different types
  - Concurrent Versions System (CVS)
  - Subversion (SVN)
  - Mercurial
  - IBM Rational ClearCase
  - **Git**

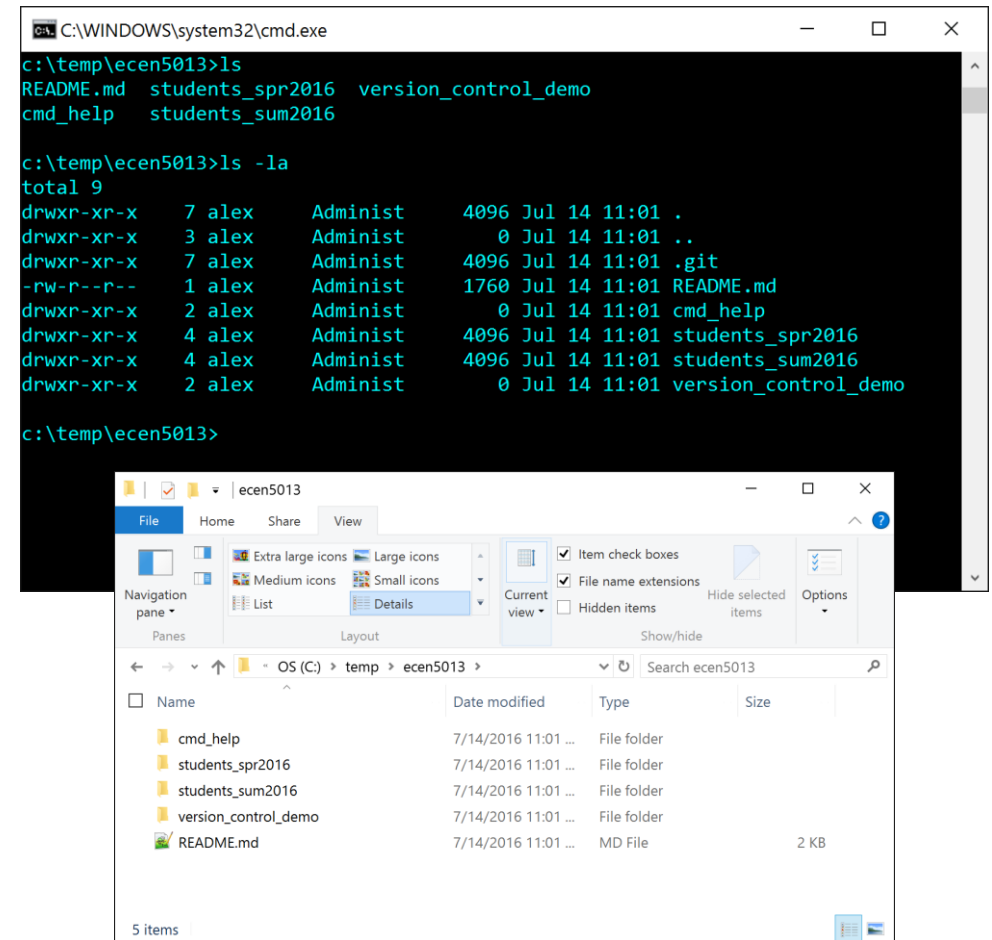


Used by:

- Linux Kernel
- Google's Android
- Twitter
- GNU Toolchain

# VCS Features

- Allows you to track:
  - Software
  - Documents
  - Build information
  - Software configuration information
- **Repository**: Collection of tracked files
  - Acts like a normal file system

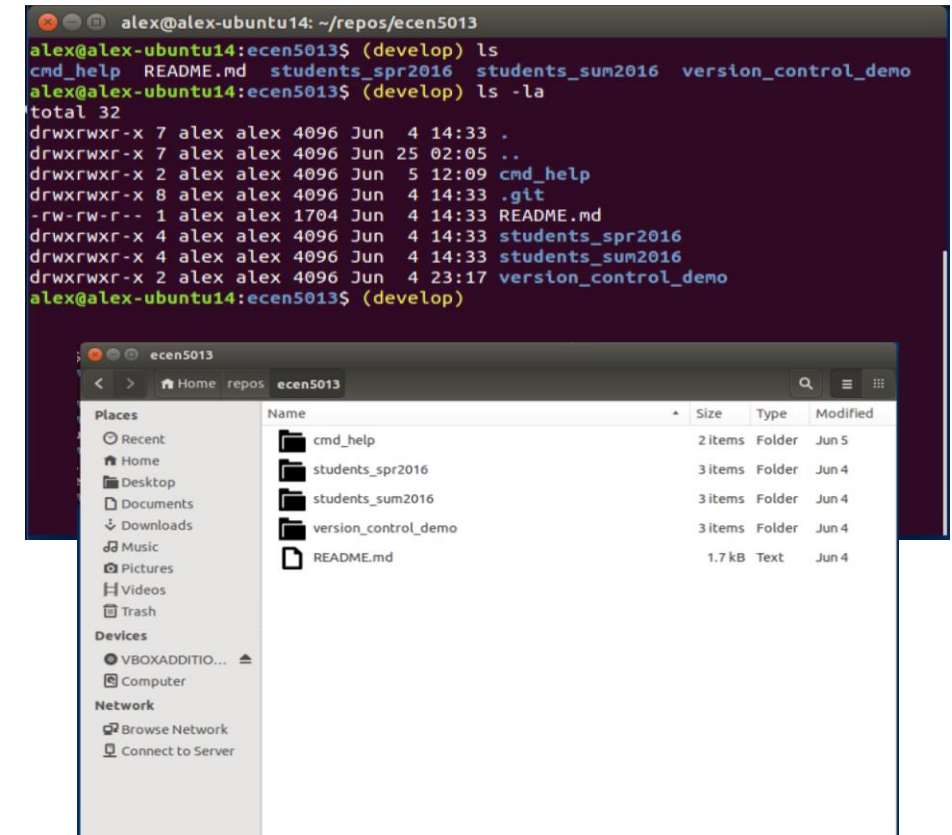


## Windows Perspective

# VCS Features

- Allows you to track:
  - Software
  - Documents
  - Build information
  - Software configuration information
- **Repository**: Collection of tracked files
  - Acts like a normal file system
- Has extra hidden configuration files  
(DO NOT EDIT THIS FOLDER)

 **.git folder**



The image shows a terminal window and a file manager window. The terminal window displays the output of the `ls` and `ls -la` commands in a Git repository. The file manager window shows the contents of the repository, including the `cmd_help`, `students_spr2016`, `students_sum2016`, `version_control_demo`, and `README.md` files.

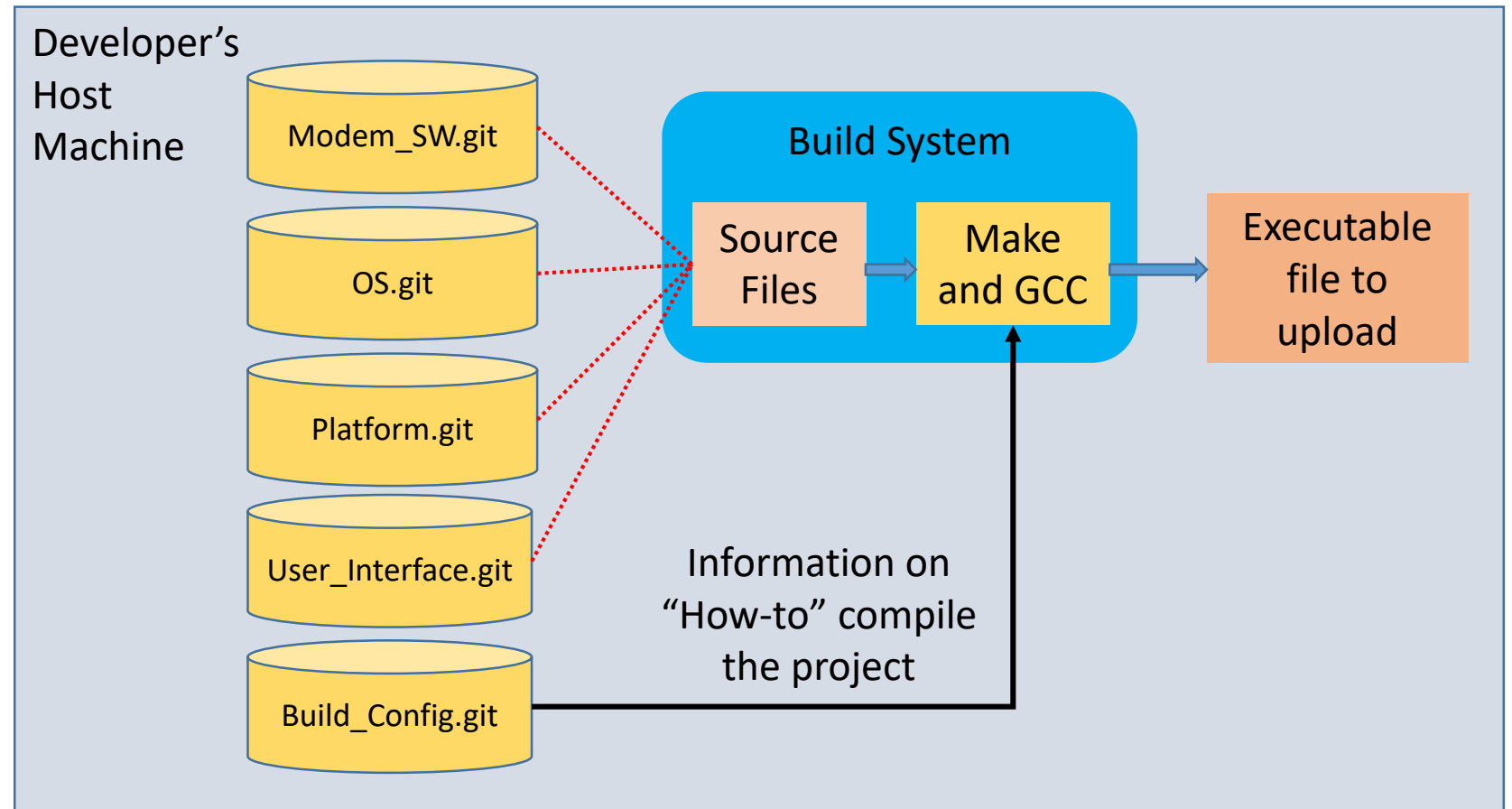
```
alex@alex-ubuntu14: ~/repos/ecen5013
alex@alex-ubuntu14:ecen5013$ (develop) ls
cmd_help  README.md  students_spr2016  students_sum2016  version_control_demo
alex@alex-ubuntu14:ecen5013$ (develop) ls -la
total 32
drwxrwxr-x 7 alex alex 4096 Jun  4 14:33 .
drwxrwxr-x 7 alex alex 4096 Jun 25 02:05 ..
drwxrwxr-x 2 alex alex 4096 Jun  5 12:09 cmd_help
drwxrwxr-x 8 alex alex 4096 Jun  4 14:33 .git
-rw-rw-r-- 1 alex alex 1704 Jun  4 14:33 README.md
drwxrwxr-x 4 alex alex 4096 Jun  4 14:33 students_spr2016
drwxrwxr-x 4 alex alex 4096 Jun  4 14:33 students_sum2016
drwxrwxr-x 2 alex alex 4096 Jun  4 23:17 version_control_demo
alex@alex-ubuntu14:ecen5013$ (develop)
```

Name	Size	Type	Modified
cmd_help	2 items	Folder	Jun 5
students_spr2016	3 items	Folder	Jun 4
students_sum2016	3 items	Folder	Jun 4
version_control_demo	3 items	Folder	Jun 4
README.md	1.7 kB	Text	Jun 4

**Linux Perspective**

# Multiple Repositories (Repos)

- You can have many repositories contribute to a single software product
- Each individually managed in a separate git repo



**Example Project for an Android phone**

# Commits

- Tracked changes, in logical groupings
  - Single/Multiple file changes
  - New or Removed files
- Commits have metadata
  - Extra information with regards to tracking the changes made
- Metadata includes info like
  - Author of Change-set
  - Data of Change
  - File Change List
  - Commit Comment
  - SHA-1 Commit ID
  - Parent commit

```
alex@ubuntu: ~/repos/ese-coursera
alex@ubuntu:ese-coursera$ (demo) git show 4a382ee89 --stat
commit 4a382ee89dc8b15b1f60c584d8e10eb50663f4ac
Author: Alex Fosdick <fosdick@colorado.edu>
Date:   Sun Aug 7 19:37:27 2016 -0600

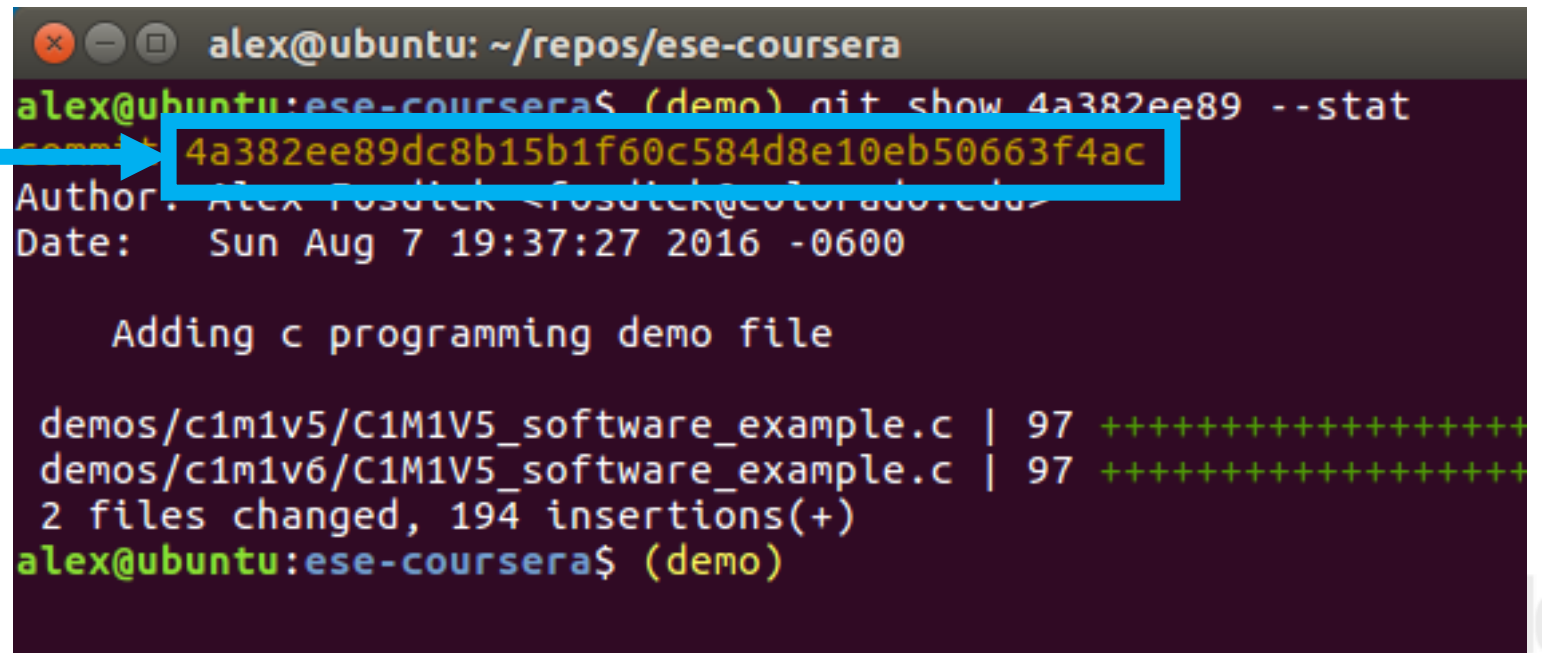
    Adding c programming demo file

demos/c1m1v5/C1M1V5_software_example.c | 97 +++++
demos/c1m1v6/C1M1V5_software_example.c | 97 +++++
2 files changed, 194 insertions(+)
alex@ubuntu:ese-coursera$ (demo)
```

# Commits

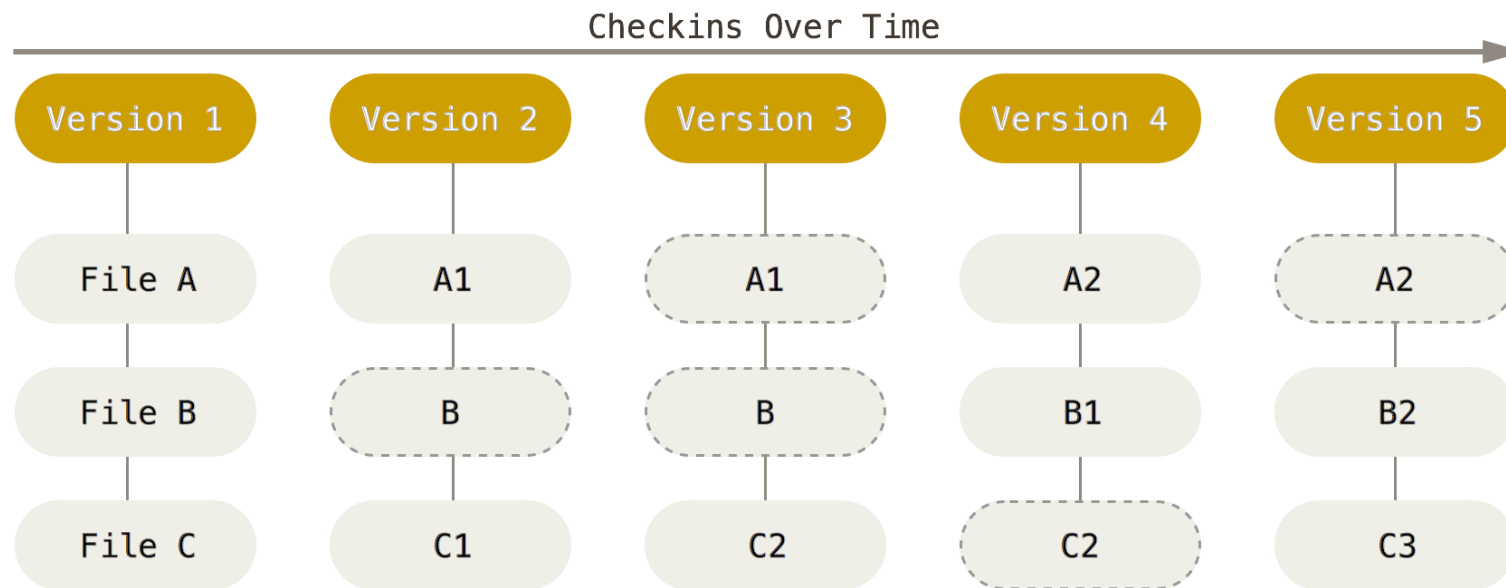
- Commit SHA - A 40 Character Unique ID
  - Reference point for your change set

SHA-1 Commit ID

A terminal window titled 'alex@ubuntu: ~/repos/ease-coursera' shows the command 'alex@ubuntu:ease-coursera\$ (demo) git show 4a382ee89 --stat' being executed. The output displays the commit details, including the author 'Alex Fosdtek <fosdtek@colorado.edu>' and the date 'Sun Aug 7 19:37:27 2016 -0600'. The commit message is 'Adding c programming demo file'. The diff shows two files changed: 'demos/c1m1v5/C1M1V5\_software\_example.c' and 'demos/c1m1v6/C1M1V5\_software\_example.c', both with 97 insertions. The total changes are '2 files changed, 194 insertions(+)'.

# Commits

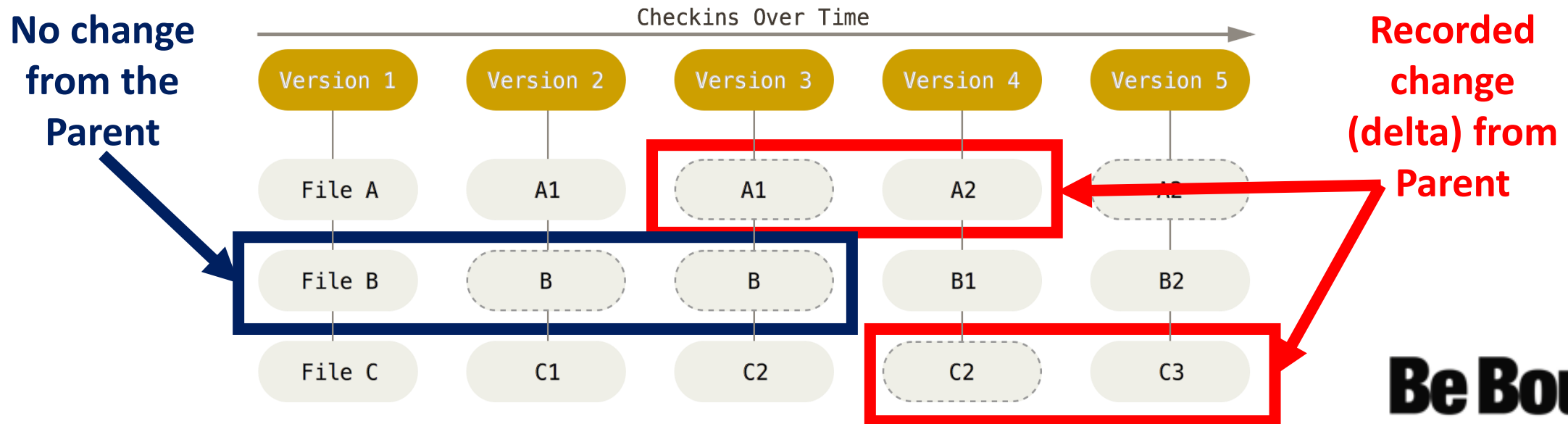
- Commits (Checkins) contain info about the **Parent commit**
  - The commit before the current changes





# Commits

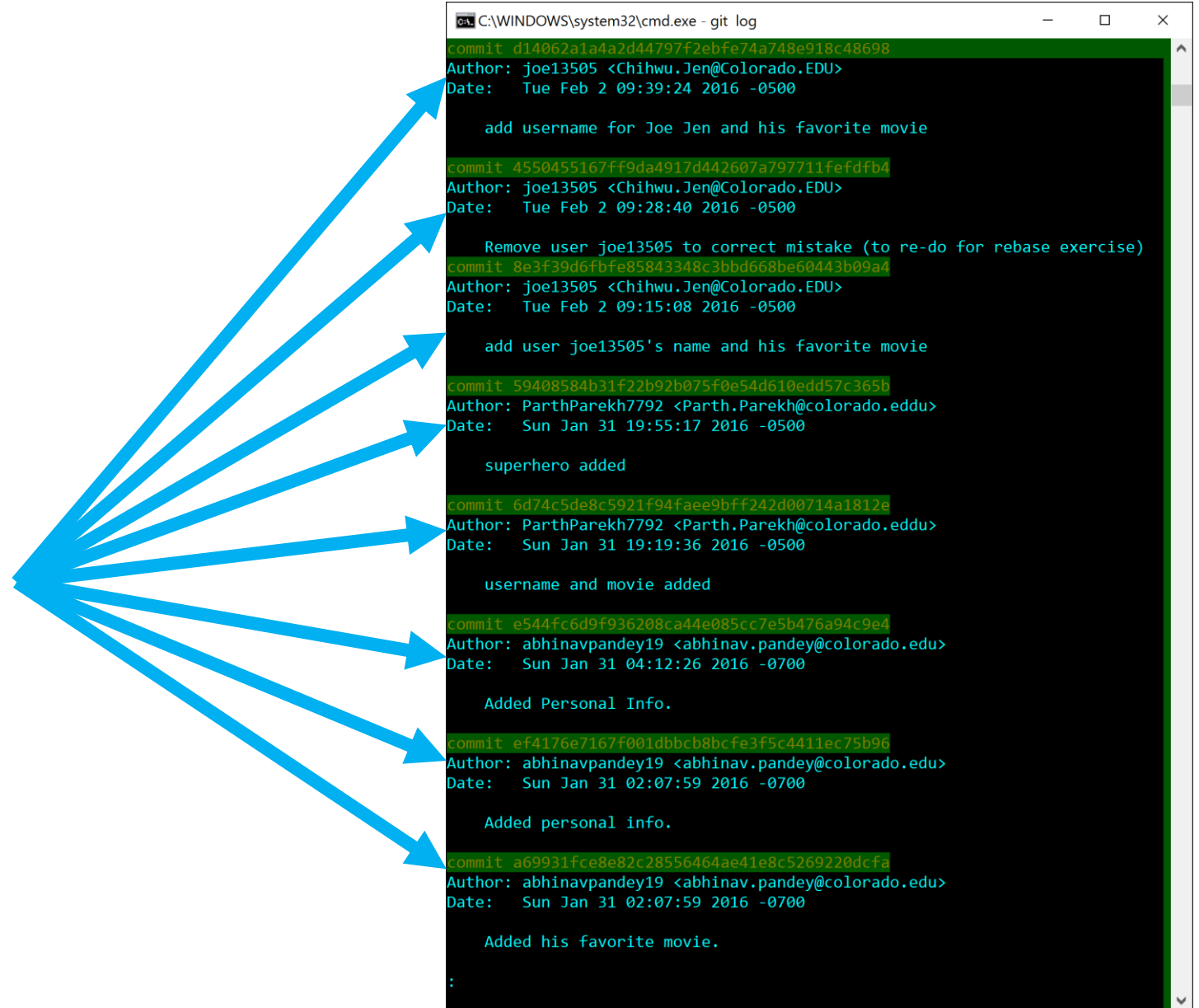
- Commits track the “changes” from the current commit and the **Parent commit**
  - Not all files have changes from the parent



# Git Log

```
$ git log
```

**Different Commits  
with a list of some of  
the commit metadata  
information**



```
C:\WINDOWS\system32\cmd.exe - git log
commit d14062a1a4a2d44797f2ebfe74a748e918c48698
Author: joe13505 <Chihwu.Jen@Colorado.EDU>
Date: Tue Feb 2 09:39:24 2016 -0500

    add username for Joe Jen and his favorite movie

commit 4550455167ff9da4917d442607a797711fefdfb4
Author: joe13505 <Chihwu.Jen@Colorado.EDU>
Date: Tue Feb 2 09:28:40 2016 -0500

    Remove user joe13505 to correct mistake (to re-do for rebase exercise)

commit 8e3f39d6fbfe85843348c3bbd668be60443b09a4
Author: joe13505 <Chihwu.Jen@Colorado.EDU>
Date: Tue Feb 2 09:15:08 2016 -0500

    add user joe13505's name and his favorite movie

commit 59408584b31f22b92b075f0e54d610edd57c365b
Author: ParthParekh7792 <Parth.Parekh@colorado.eddu>
Date: Sun Jan 31 19:55:17 2016 -0500

    superhero added

commit 6d74c5de8c5921f94faee9bfff242d00714a1812e
Author: ParthParekh7792 <Parth.Parekh@colorado.eddu>
Date: Sun Jan 31 19:19:36 2016 -0500

    username and movie added

commit e544fc6d9f936208ca44e085cc7e5b476a94c9e4
Author: abhinavpandey19 <abhinav.pandey@colorado.edu>
Date: Sun Jan 31 04:12:26 2016 -0700

    Added Personal Info.

commit ef4176e7167f001dbbcb8bcbfe3f5c4411ec75b96
Author: abhinavpandey19 <abhinav.pandey@colorado.edu>
Date: Sun Jan 31 02:07:59 2016 -0700

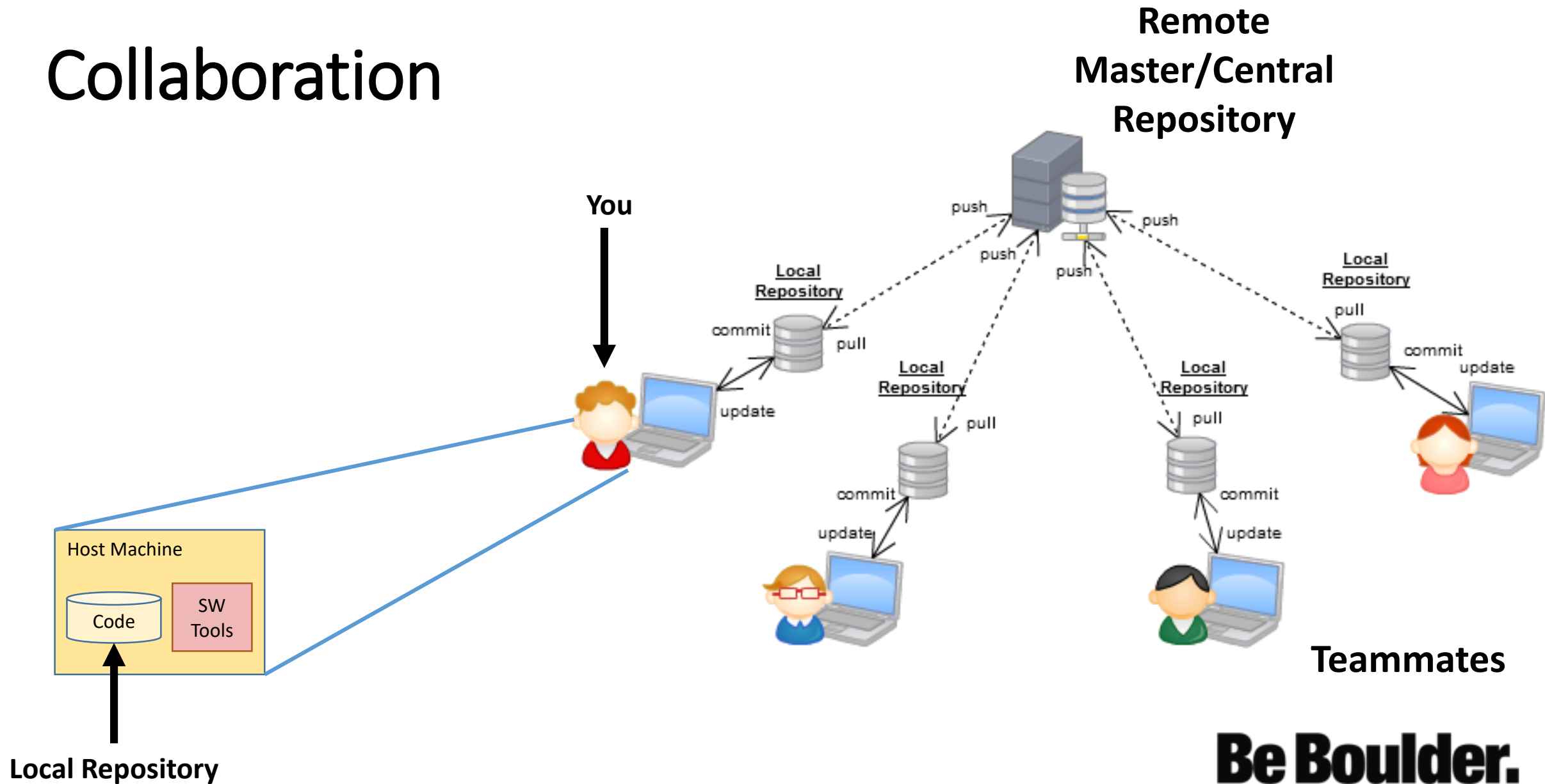
    Added personal info.

commit a69931fce8e82c28556464ae41e8c5269220dcfa
Author: abhinavpandey19 <abhinav.pandey@colorado.edu>
Date: Sun Jan 31 02:07:59 2016 -0700

    Added his favorite movie.

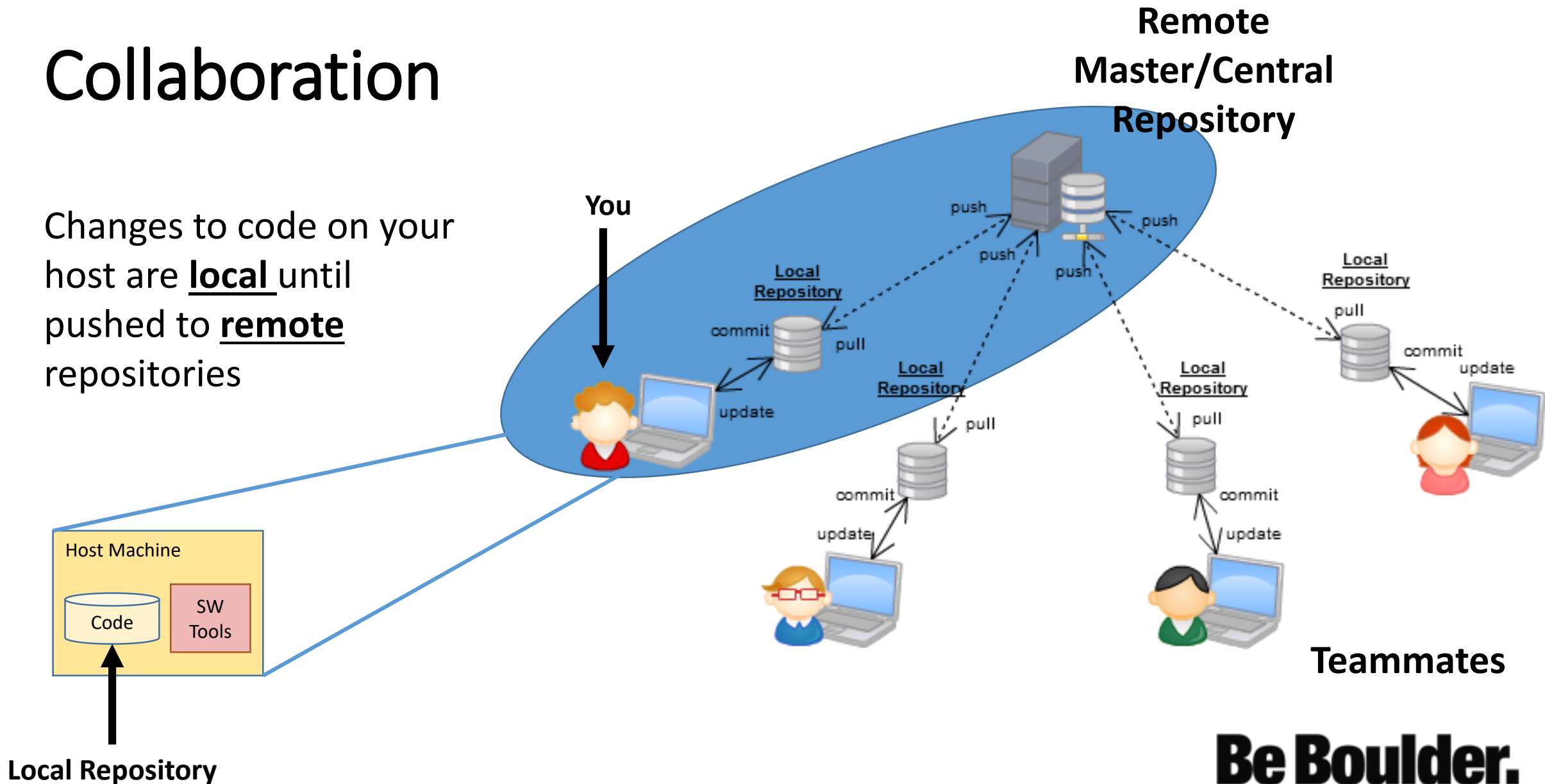
:
```

# Collaboration



# Collaboration

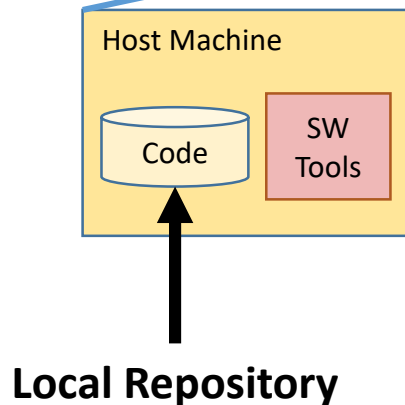
Changes to code on your host are **local** until pushed to **remote** repositories



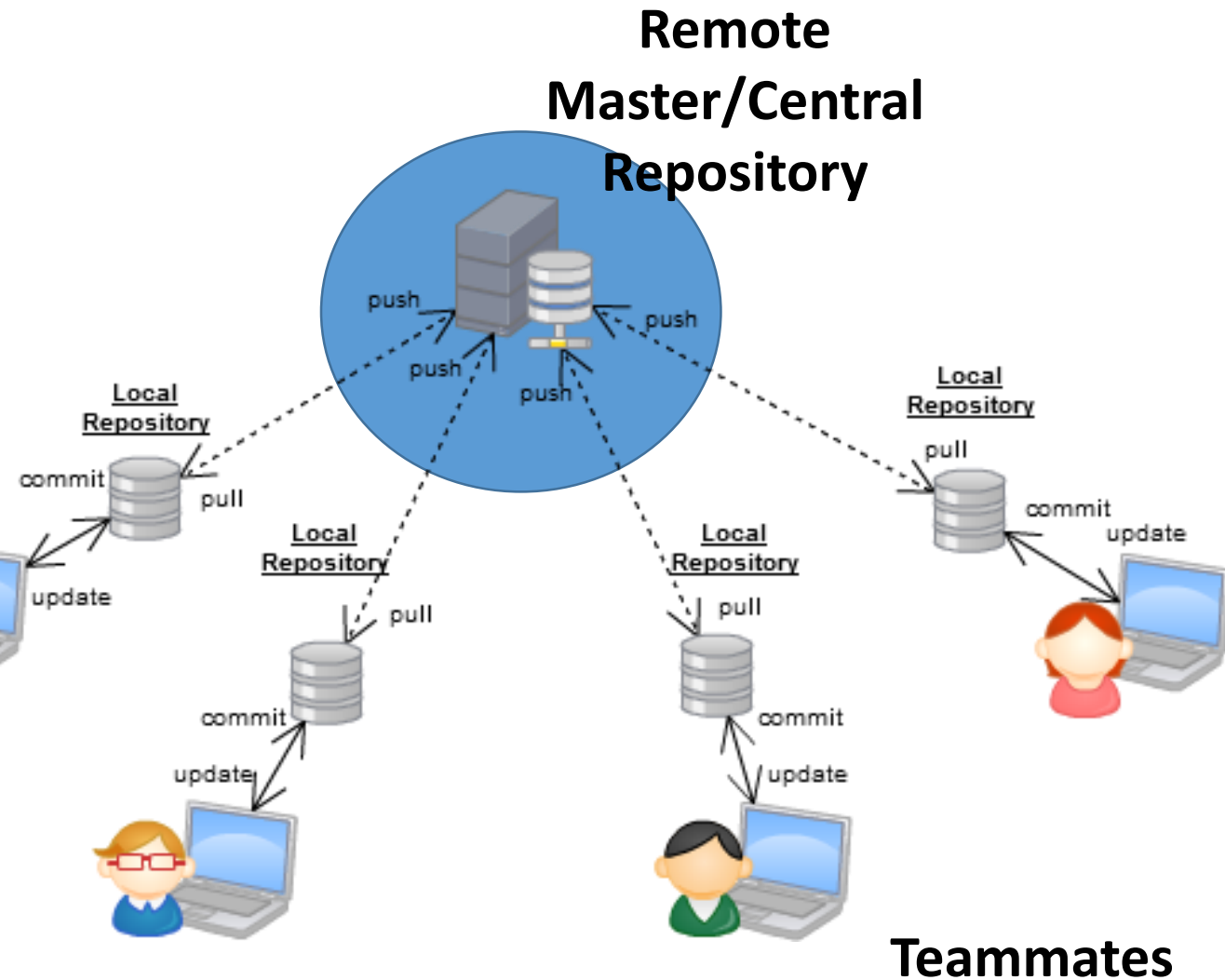
# Collaboration

Everyone has a copy of the master repository on their machine

Referred to as the remote “origin”



You

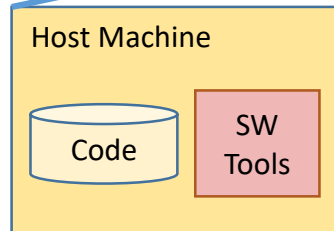


```
$ git remote show origin
```

# Collaboration

Other team members are also **Remote** repositories

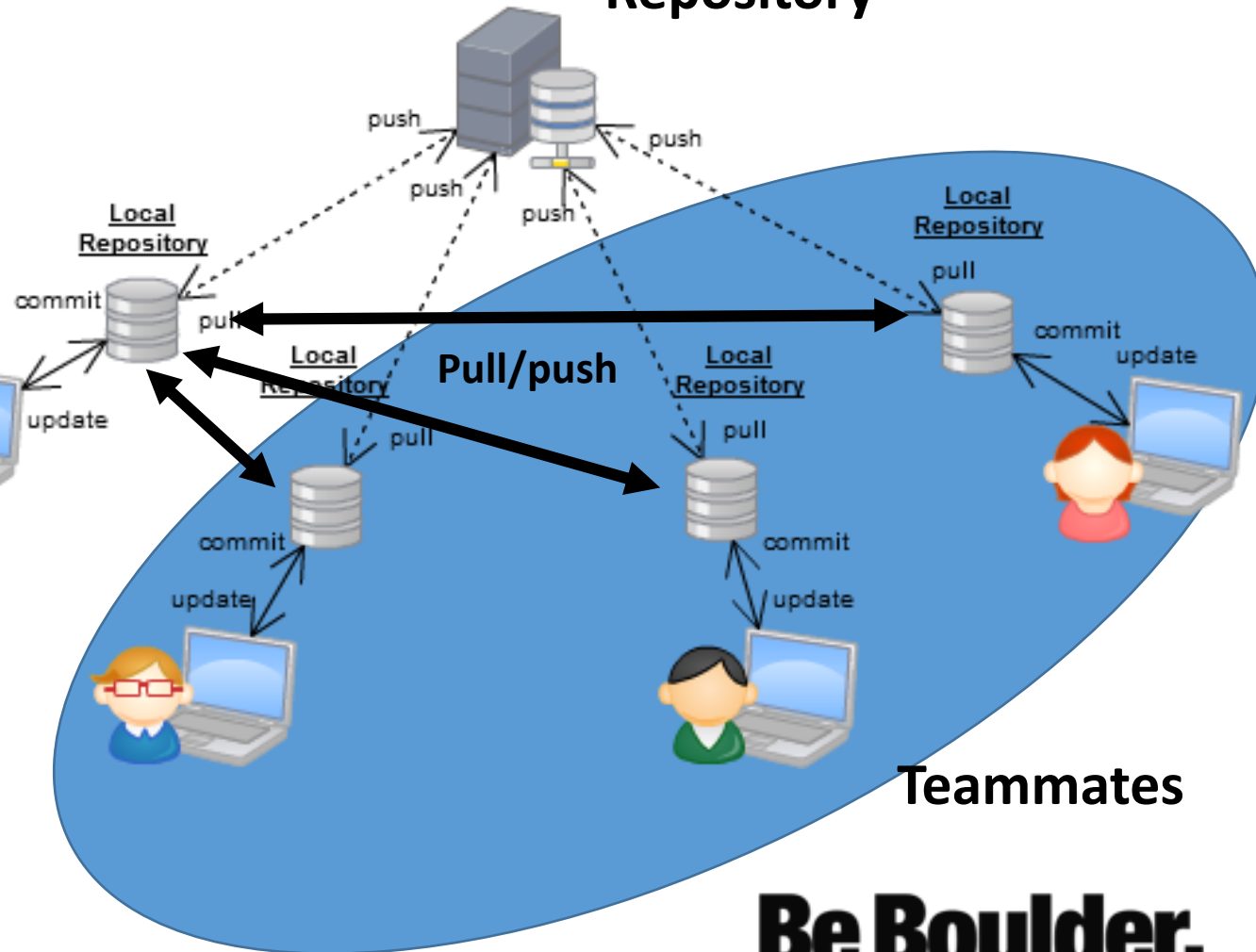
You can keep local copies of their repositories too



You



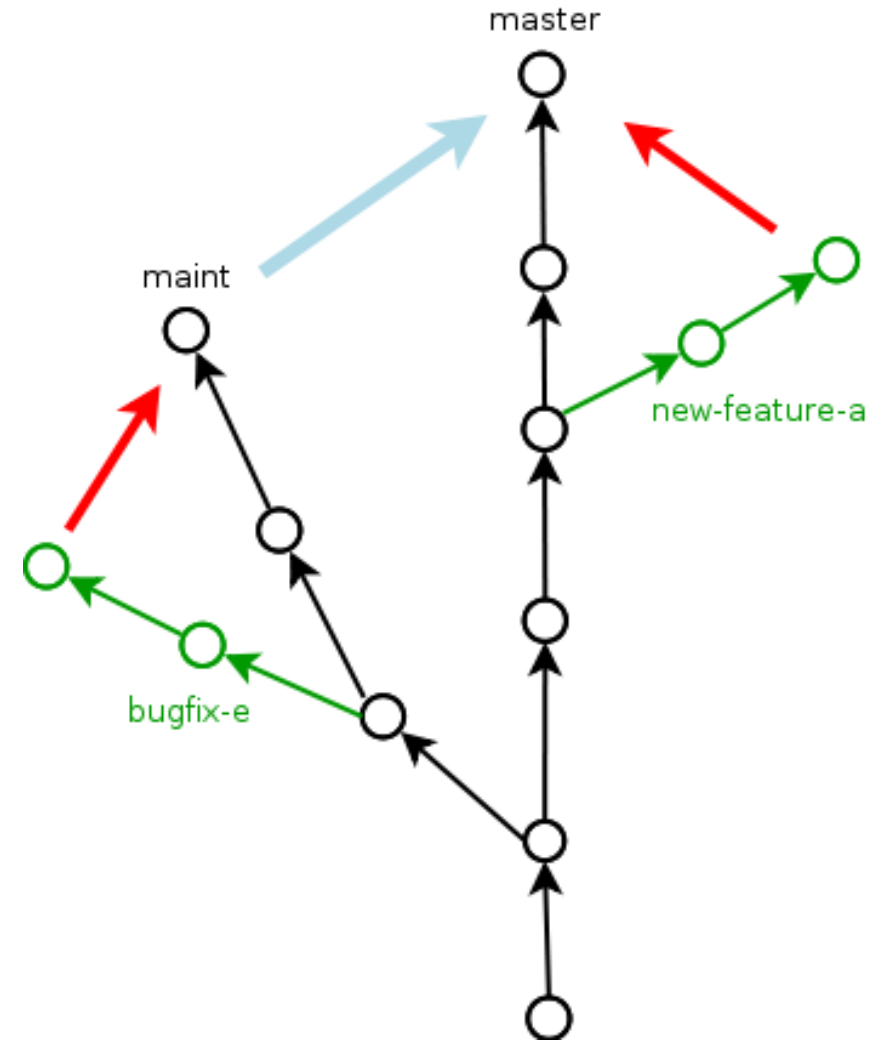
Remote  
Master/Central  
Repository



# Workflow

## 1. Create a **development branch**

**Branch**: Helps organize a change set from others



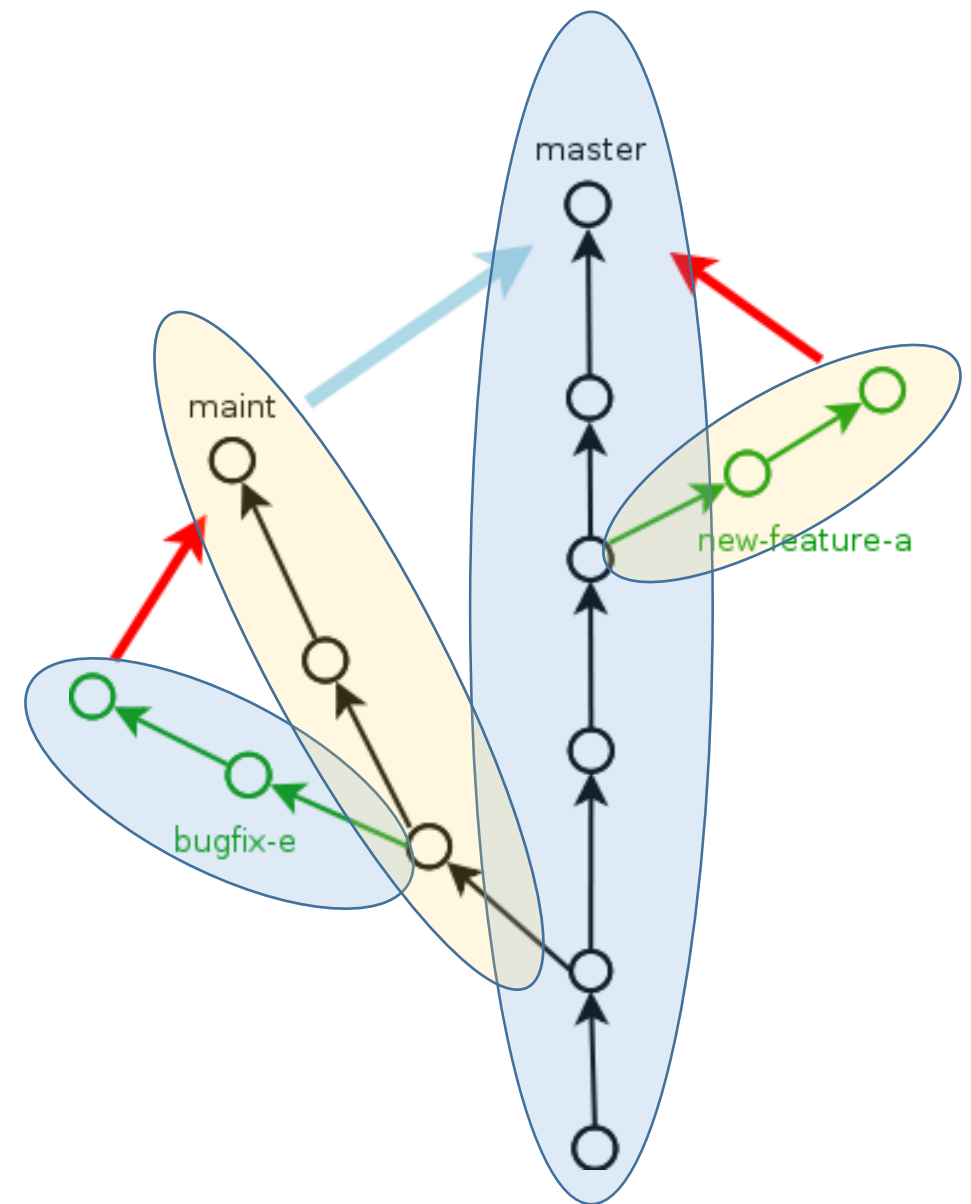
# Workflow

## 1. Create a **development branch**

**Branch**: Helps organize a change set from others

Four Branches each with many commits

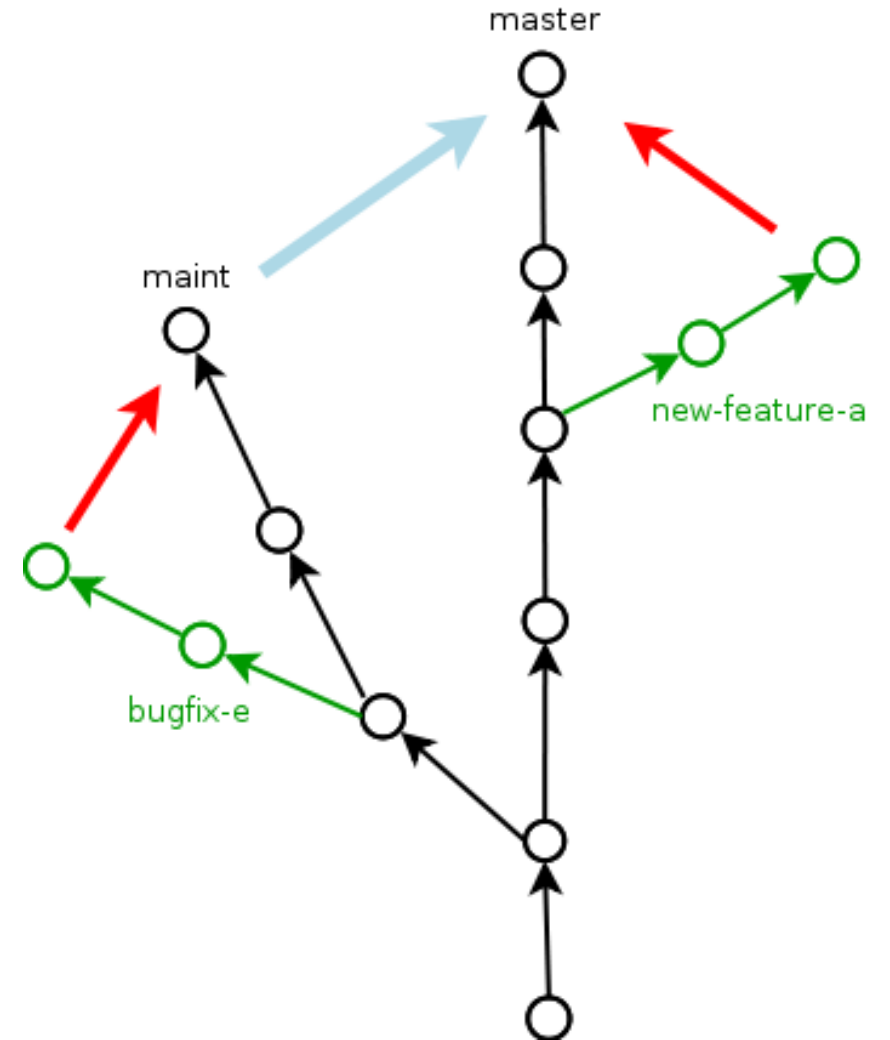
- master, maint, new-feature-a, bugfix-e
- Some branches use other branches as a parent





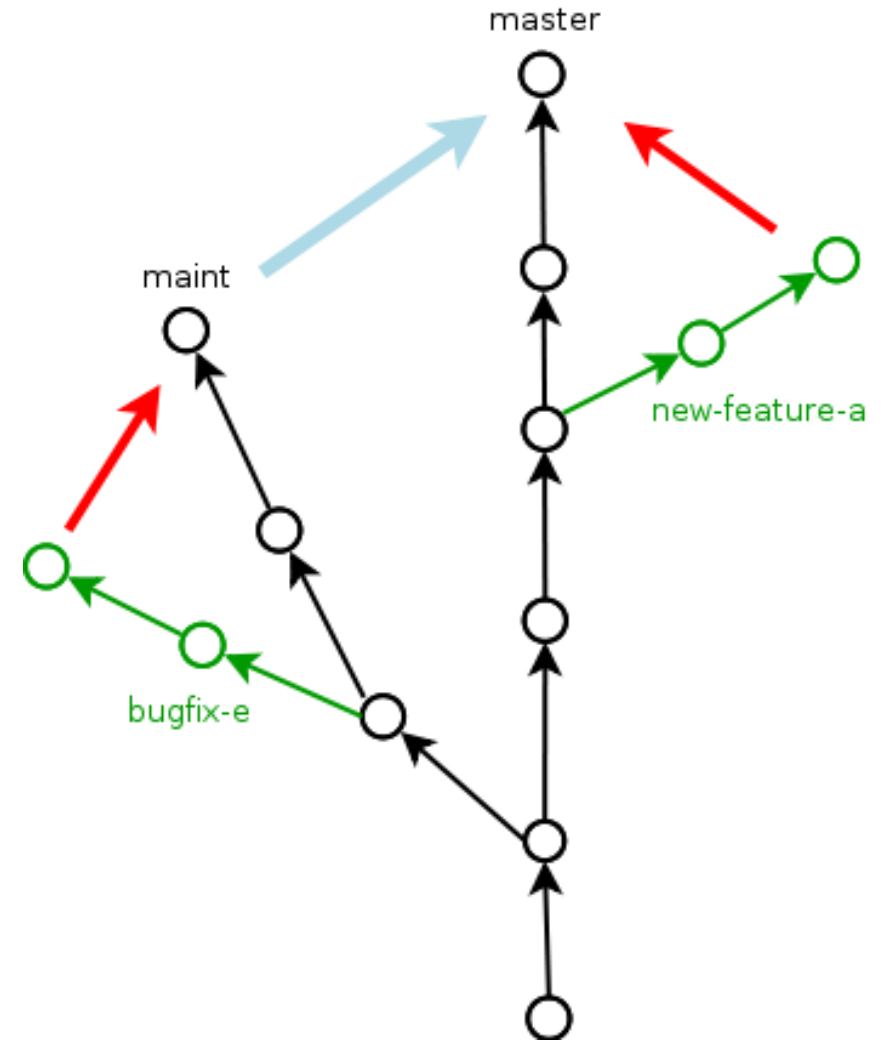
# Workflow

1. Create a **development branch**
2. Make Changes



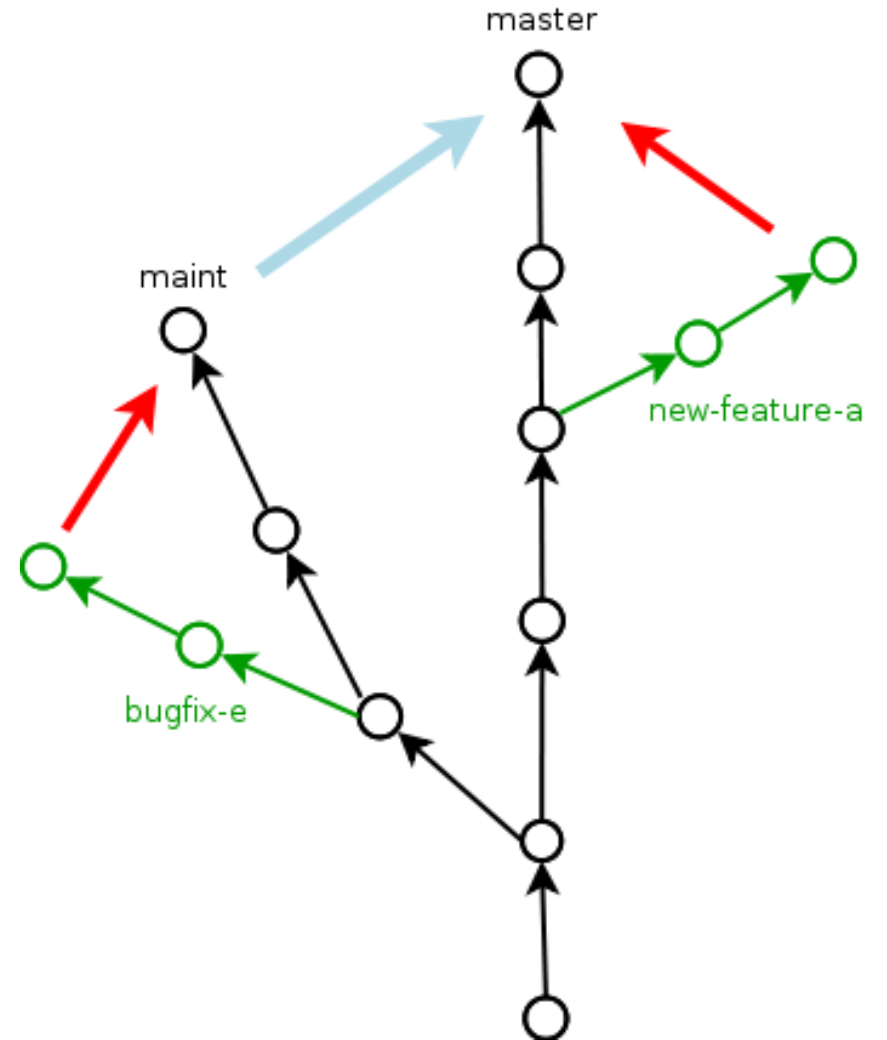
# Workflow

1. Create a **development branch**
2. Make Changes
3. Stage File for Commit



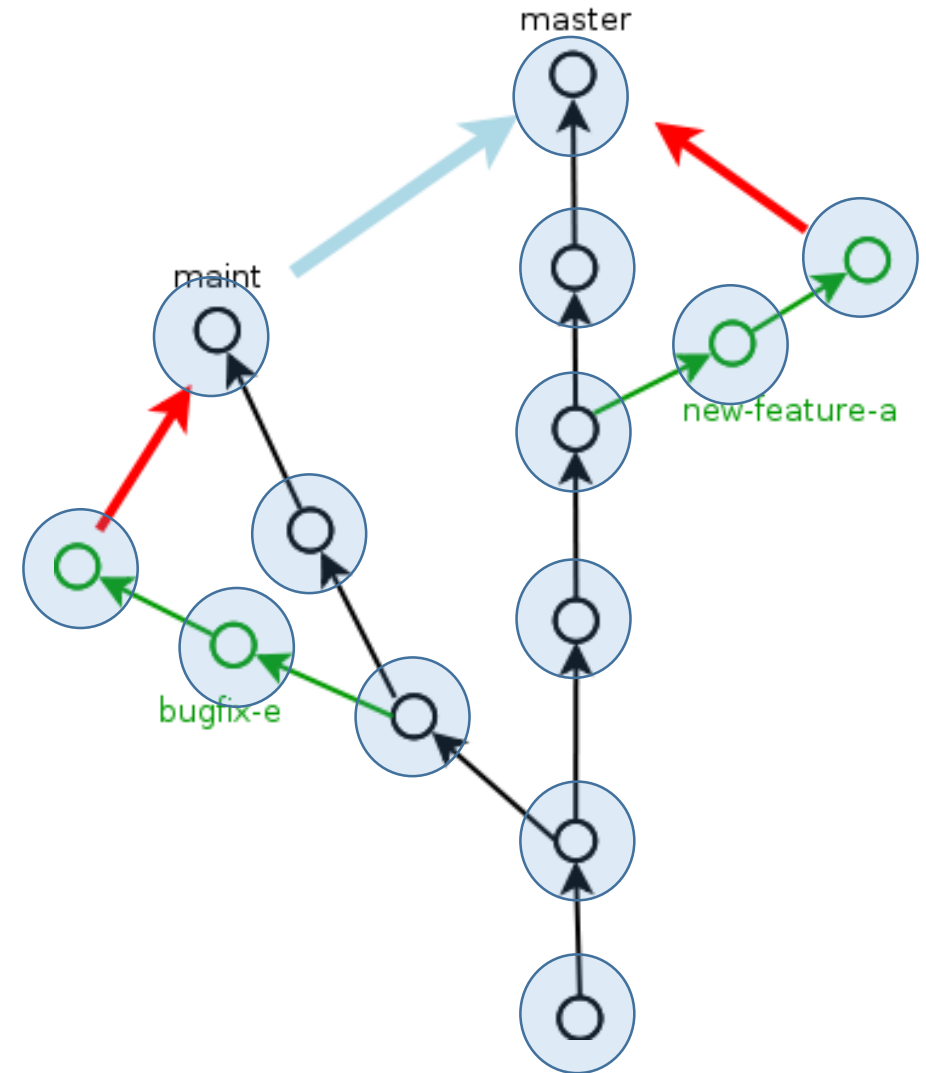
# Workflow

1. Create a **development branch**
2. Make Changes
3. Stage File for Commit
4. Commit Change

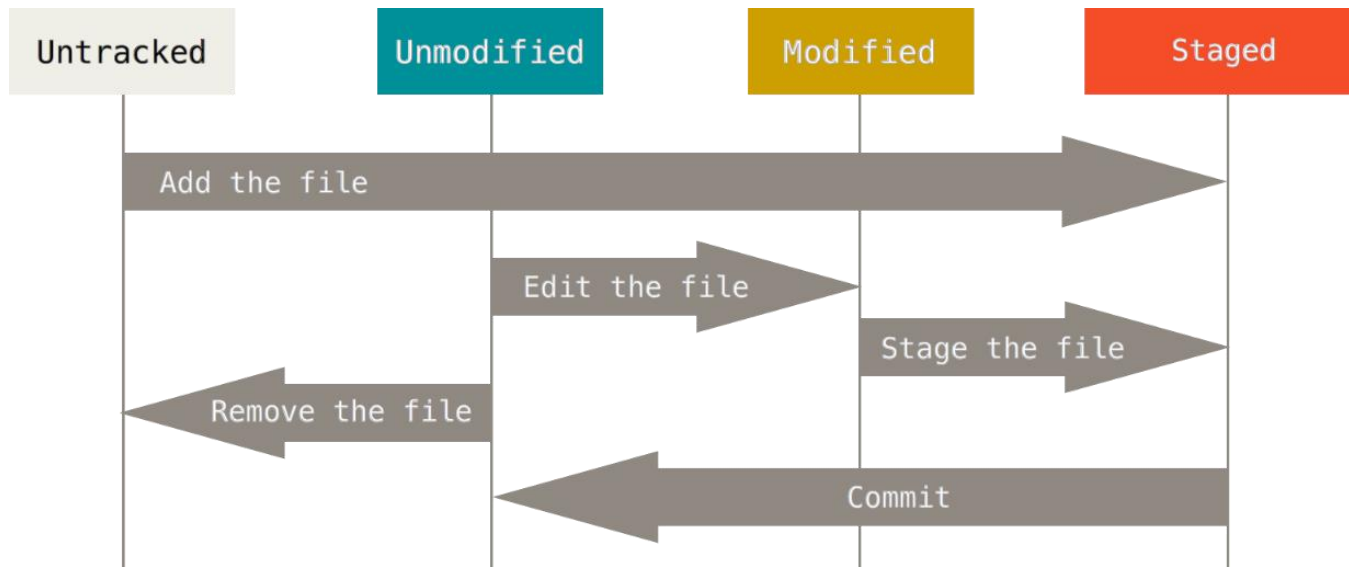


# Workflow

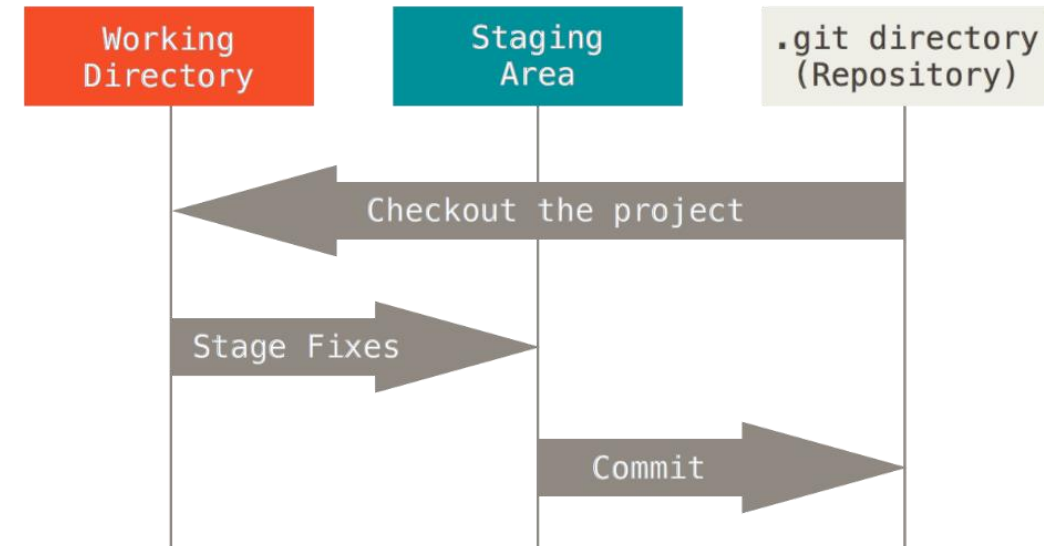
1. Create a **development branch**
2. Make Changes
3. Stage File for Commit
4. Commit Change
  - Each bubble is a commit
  - Each commit is a collection of changed files



# Workflow



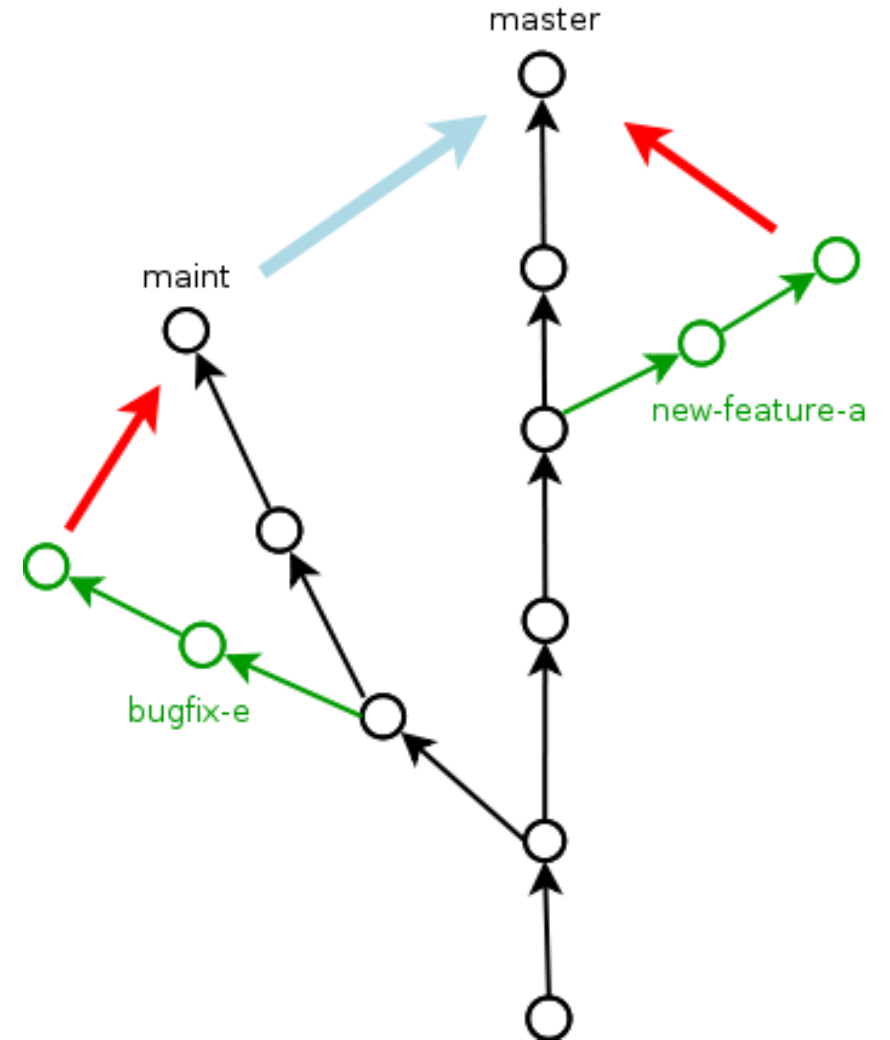
**File Classification and the file/git actions**



**Process of making a commit**

# Workflow

1. Create a **development branch**
2. Make Changes
3. Stage File for Commit
4. Commit Change
5. Push Change to Remote



# Conflicts

- Conflicts can occur when collaborating on a project
- **Conflict Resolution**: Process of resolving conflicting changes between to change-sets
- Tools related to merging and conflict resolution:
  - git merge
  - git rebase
  - git diff

# Importance of Version Control

- Historical Analysis of code changes
- Metadata helps track progress (Task Management/Bug Tracking)
- Advocates Collaboration and Co-Development of code