CS 4320 / 7320
Software Engineering

Version Control Systems

Topics

- Version Control Systems
  - What are they
  - Types
- Terminologies
- Collaborative Development through VCS
- Introduction GIT

Version Control Systems

Centralized

- Work directly against a central server
- Subversion, CVS, Perforce, etc.

Distributed

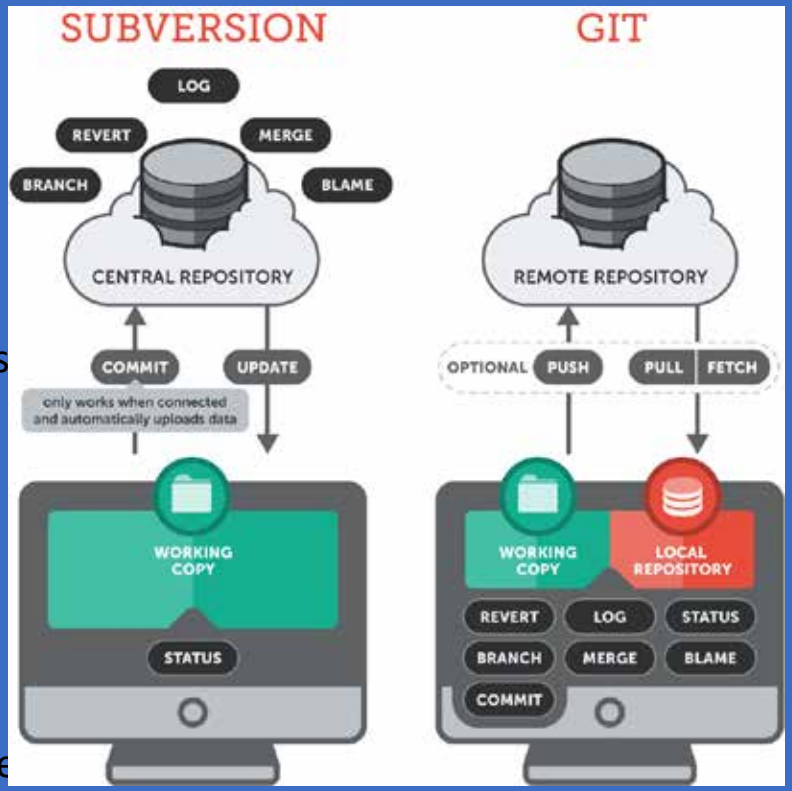
- Work locally, optionally push to remote repositories
- Git, Mercurial (Hg), etc.

Hosted solutions

- GitHub, BitBucket, Visual Studio Online, etc.

On-Premise solutions

- GitHub Enterprise, Stash, Team Foundation Server, e



git-tower.com

Version Control System

- Track changes and revisions to both files and file system structure of working environment
  - File Additions / Deletes
  - Folder Additions / Deletes
  - File Edits
- aka
  - Source control system
  - Source code control system
  - Revision control system

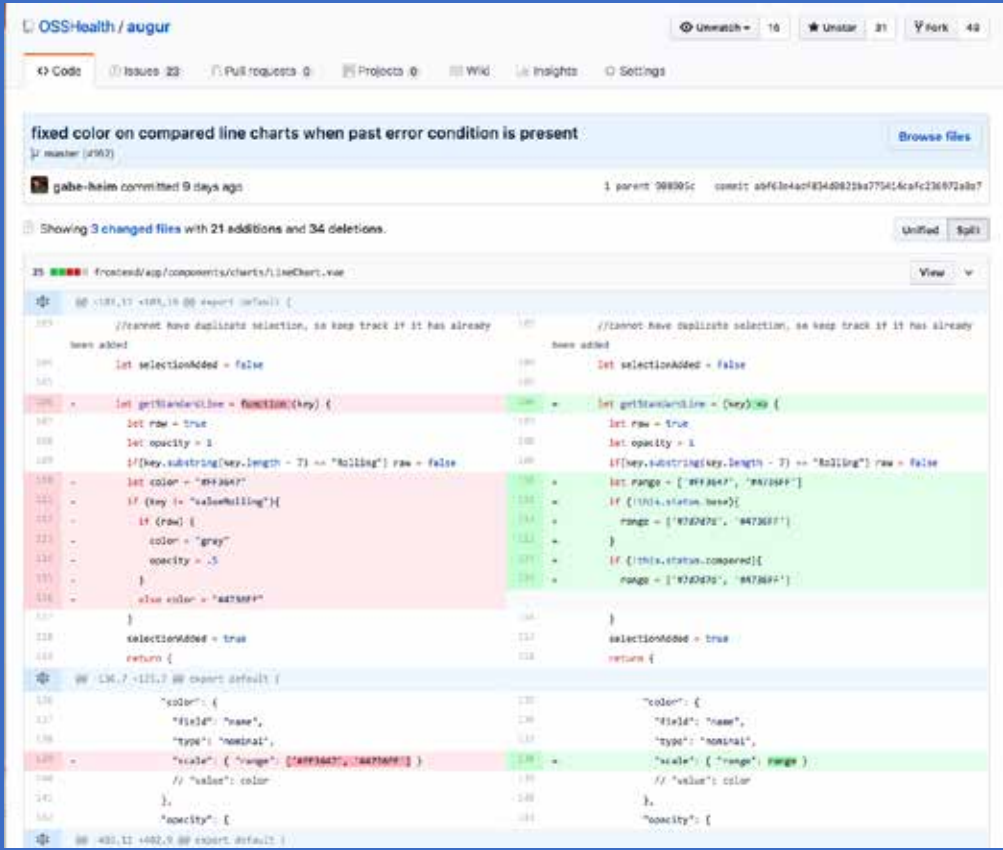
What is Version Control?

System to manage changes to files

- Who — Sean Goggins
- When — January 3, 2012
- What — Files and differential
- (Sometimes) Why — Fix Color …

Why use it?

- Revert to or review prior changes
- Maintain multiple versions
- Compare differences
- Share and collaborate
- Modern solutions might assume you have it!
  - Infrastructure-as-code
  - Continuous Integration and Delivery
- Google around for many more reasons!



AKA Revision Control, Source Control

Change Tracking

- Files (and folders) exist in a temporal condition
- File A:
  - T-1 has 100 lines
  - T-101 has 1000 lines
  - How was the file changed over time from T-1 to T-101 ?
- VCS can answer this question easily
- Can also roll-back to point in time, e.g., T-99

VCS Types

- VCS come in various flavors that roughly align to three types of systems:
  - Local
  - Client-Server
  - Networked / Distributed

VCS Types : Local

- Source Code Control System (SCCS)
  - Developed at Bell Labs, 70's
  - Critical early stage use in development of UNIX
  - Part of the *Single UNIX Specification*
- File are locally version controlled
- Collaboration is limited to a single system
- Some VCS still use internals

VCS Types : Client-Server

- Client programs read and write changes to a development tree that exist on a server
  - Multiple developers can pull down to push up changes
- Concurrent Versions System (CVS)
  - Or: Concurrent Versioning System
  - 80's
- Subversion (SVN)
  - One of most popular today
  - Early 2000s

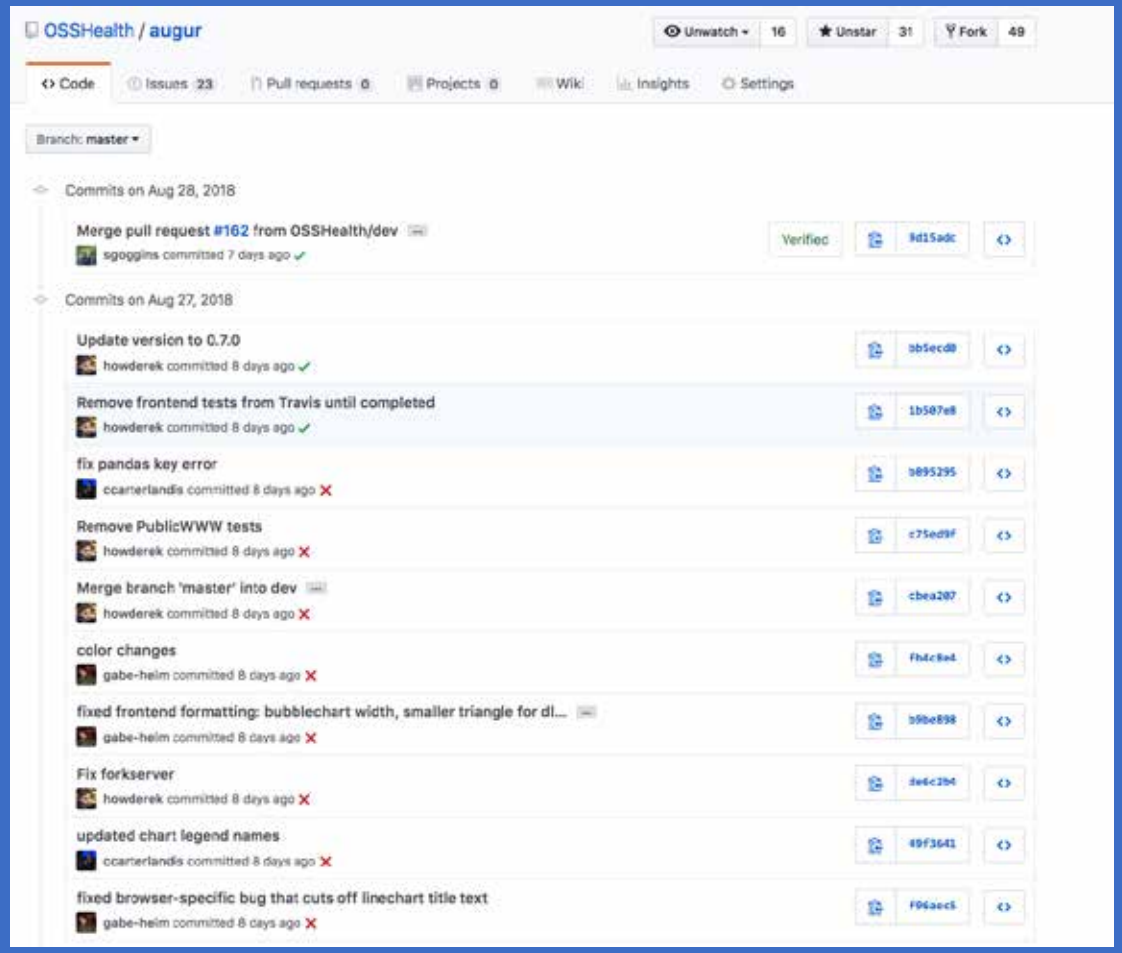
VCS Types : Distributed

- Decentralized VCS,
  - Built from the concepts of peer-to-peer trust
  - Each user has full repository in local storage
- GIT is most common
  - Developed by Linus Torvolds specifically for Linux Kernel development
  - 2005
  - GIT and other distributed VCS becoming the most popular VCS, close to SVN in usage

VCS Advantages

- Provides a control and tracking method to collaborative software development
  - Concepts can be applied to documents, e.g., non-software
- Changes (revisions)
  - Tracked by numerical or hash id
  - Timestamped
  - User stamped

Hash ID’s


OSSHealth / augur
Unwatch 16
Unstar 31
Fork 49
Code
Issues 23
Pull requests 0
Projects 0
Wiki
Insights
Settings
Branch: master
Commits on Aug 28, 2018
Merge pull request #162 from OSSHealth/dev
sgoggins committed 7 days ago
Verified
9d15adc
Commits on Aug 27, 2018
Update version to 0.7.0
howderek committed 8 days ago
9b5ecd0
Remove frontend tests from Travis until completed
howderek committed 8 days ago
1b507e8
fix pandas key error
ccarterlandis committed 8 days ago
9895295
Remove PublicWWW tests
howderek committed 8 days ago
c75ed9f
Merge branch 'master' into dev
howderek committed 8 days ago
cbea207
color changes
gabe-heim committed 8 days ago
fb4c8e4
fixed frontend formatting: bubblechart width, smaller triangle for dl...
gabe-heim committed 8 days ago
b9be898
Fix forkserver
howderek committed 8 days ago
de6c2b4
updated chart legend names
ccarterlandis committed 8 days ago
49f3641
fixed browser-specific bug that cuts off linechart title text
gabe-heim committed 8 days ago
f96aec5

VCS Advantages

- Version control is important for development groups to function effectively
- Also utilized for non-software development
  - Word-processing
  - Configuration files
  - Content management systems
  - Database records

VCS Terminology

- Trunk / Main / Master
  - the primary development branch
  - often the receiver of changes from other branches that are used for small development efforts, e.g., bug-fixes
- Branching
  - Duplication of a folder structure for the purpose of isolating development work from the Trunk

Branch Demo

VCS Terminology

- Merge
  - Reconciling multiple changes to a version controlled resource
  - e.g., two versions of a file, the end result is one file with both sets of changes
- Fork
  - A branch that is not intended to be later merged
    - **NOTE, on GitHub, Forks are merged back using Pull Requests. More on this Later.
-

Merge and Fork Demos

VCS Terminology

- Tag
  - A read-only branch that serves as the end-point of a development effort / interval, e.g., a release
  - Captures a branch at a point in time
  - Labels the point in time
- Commit
  - Saving a change to live files into the repository's set of know edits, i.e., revisions

Tag Demo

VCS Terminology

- Baseline
  - The starting point of a branch
- Delta / Diff
  - A revision to one or more files or the file system (tree)
- Conflict
  - Two or more users have changed the same version controlled resource in a manner that cannot be automatically resolved by the VCS

VCS Terminology

- Head
  - The most recent / current / up-to-date version of a branch
- Update / Pull
  - Pulling in changes from other developers
- Working copy
  - The local working copy of files from the repository

GitHub

Global setup:

```
Set up git
  git config --global user.name "Rich Jones"
  git config --global user.email rich@anomos.info
```

Next steps:

```
  mkdir TestRepository
  cd TestRepository
  git init
  touch README
  git add README
  git commit -m 'first commit'
  git remote add origin git@github.com:Miserlou/TestRepository.git
  git push -u origin master
```

Existing Git Repo?

```
  cd existing_git_repo
  git remote add origin git@github.com:Miserlou/TestRepository.git
  git push -u origin master
```

GitHub Now!

GitHub

git

Goals

Use version control for your own projects

Background to make a case to bring version control to your team at $Work

Further Reading

There's a lot out there. Here are some highlights. Don't be intimidated, you don't need all this, but it may come in handy if you want to dive a bit deeper into the weeds. The key is starting to use it, just like PowerShell!

Interactive guides

- GitHub's interactive guide – Learn Git in 15 minutes: https://try.github.io/
- Learn Git Branching: http://pcottle.github.io/learnGitBranching
- Interactive Cheat sheet: http://ndpsoftware.com/git-cheatsheet.html

References

- Official git reference: http://git-scm.com/docs
- Pro Git (free!): http://www.git-scm.com/book/en/v2 - the first two or three chapters are a great intro
- Understanding Branches: http://blog.thoughtram.io/git/rebase-book/2015/02/10/understanding-branches-in-git.html
- Git Explained: For Beginners: http://www.dotnetcodegeeks.com/2015/06/git-explained-for-beginners.html
- GitHub Flow – GitHub from a Browser: https://github.com/blog/1557-github-flow-in-the-browser

Contributing to Microsoft's DSC Resources on GitHub

- Guide to getting started with GitHub: https://github.com/PowerShell/DscResources/blob/master/GettingStartedWithGitHub.md
- DSC Contributions guide: https://github.com/PowerShell/DscResources/blob/master/CONTRIBUTING.md
- DSC Resource Style Guidelines: https://github.com/PowerShell/DscResources/blob/master/StyleGuidelines.md

More references

- Pro Git (free!): http://www.git-scm.com/book/en/v2 - the rest of the book :)
- A Visual Git Reference: http://marklodato.github.io/visual-git-guide/index-en.html
- Git From the Inside Out: https://codewords.recurse.com/issues/two/git-from-the-inside-out
- Git For Computer Scientists: http://eagain.net/articles/git-for-computer-scientists - Great read with pictures, don't be intimidated by the title
- Branching, forking, other concepts explained: http://stackoverflow.com/questions/3329943/git-branch-fork-fetch-merge-rebase-and-clone-what-are-the-differences