Git

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CSI 333 – System Fundamentals

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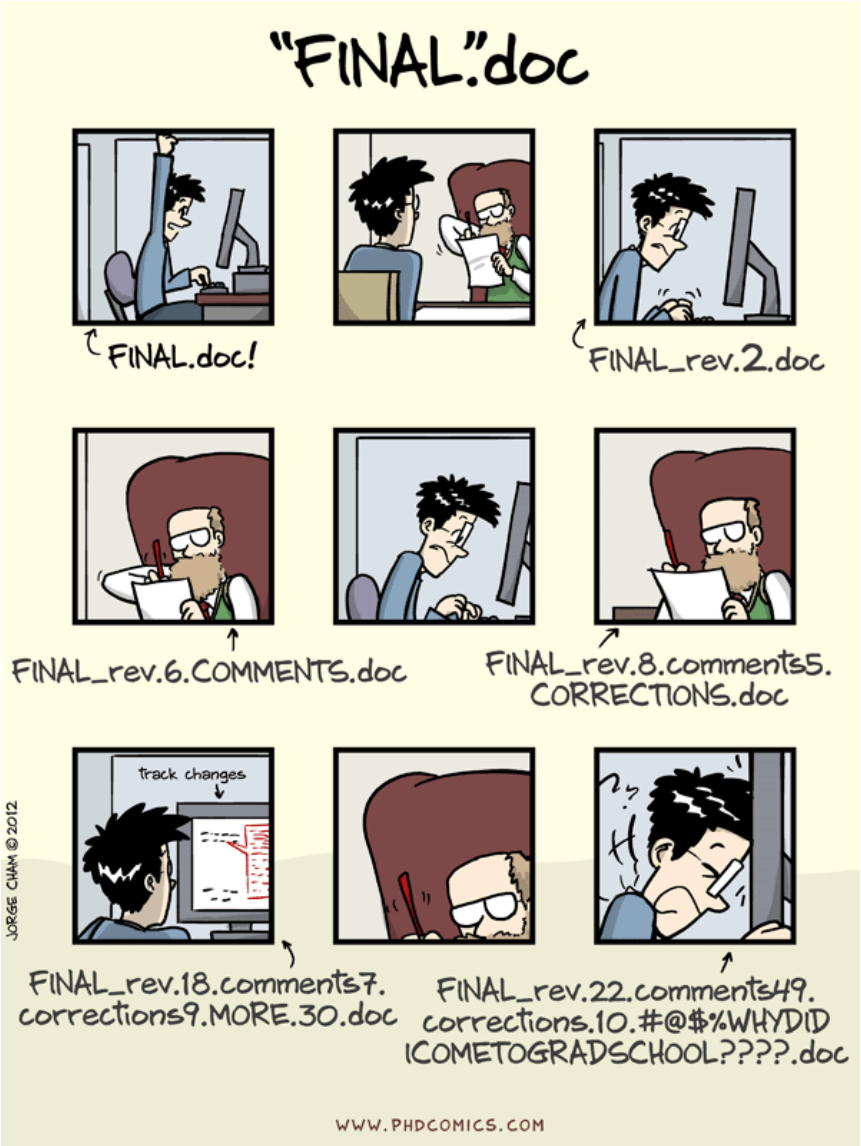
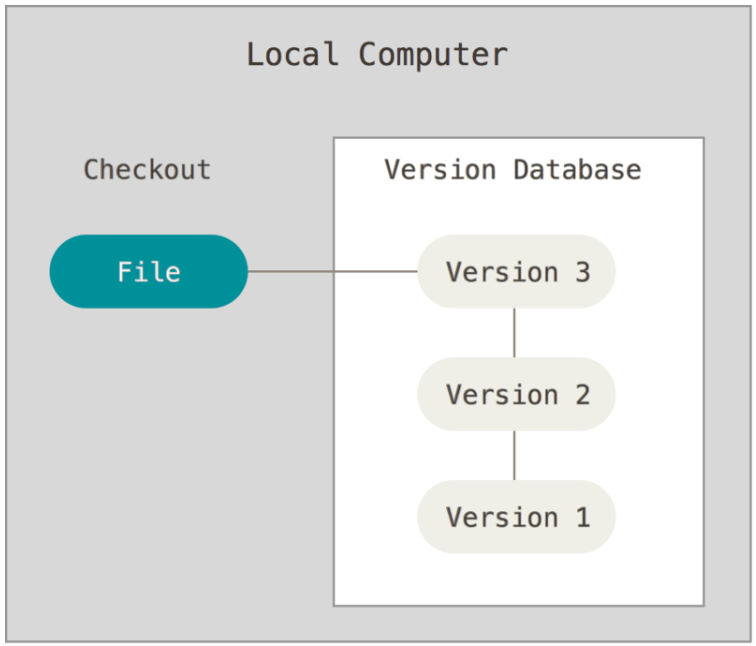
No Version Control



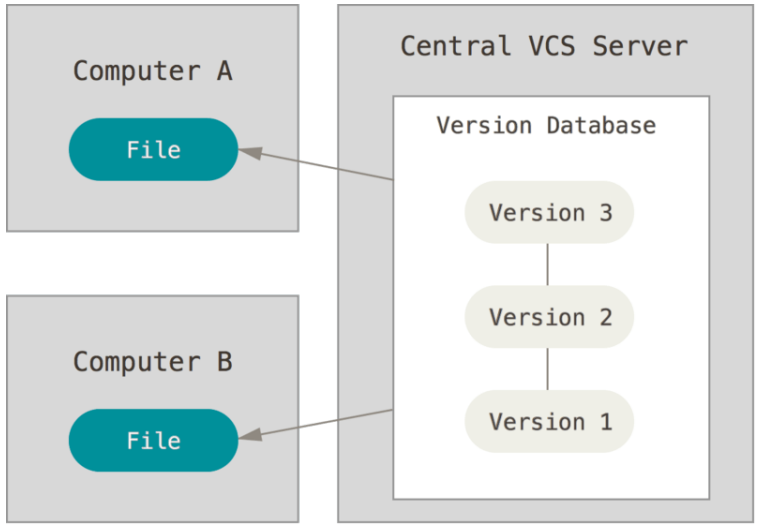
Local version control

- Simple database keeps all changes to files
- Example: RCS (Revision Control System)
  - Keeps patch sets (difference between files)
  - Can reproduce a file at different time points



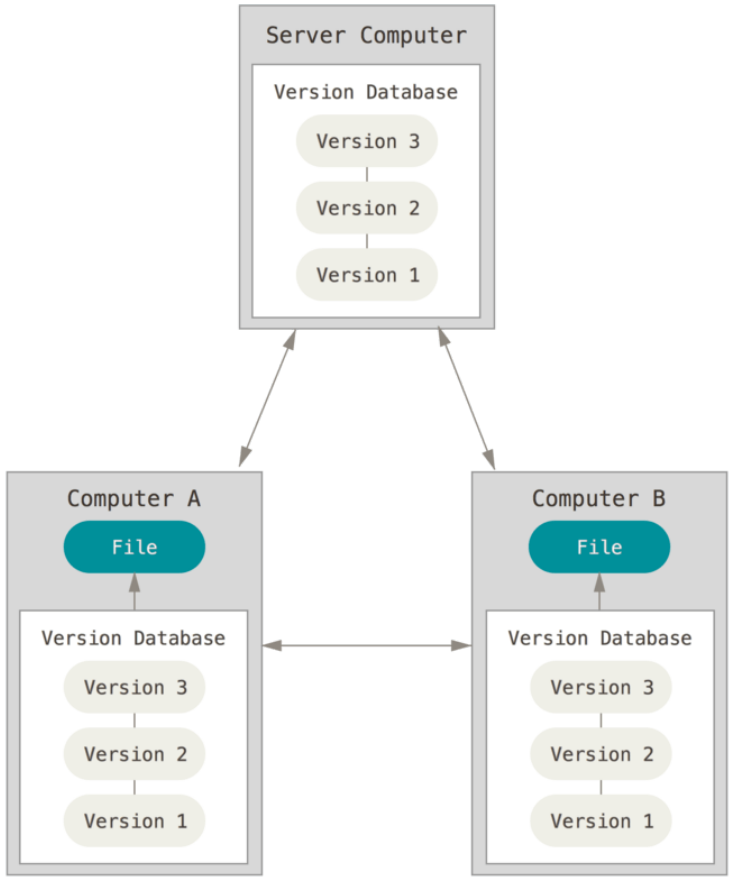
Centralized version control

- Examples: CVS, Subversion, Perforce
- Central server repo holds "official copy"
  - Also sole version history of the repo
- You make "checkouts" of it to your local copy
  - You make local modifications
    - Your changes are not versioned
- When done, you "check in" back to the server
  - Your checkin increments repo's version
  - What if someone has already submitted a new version?



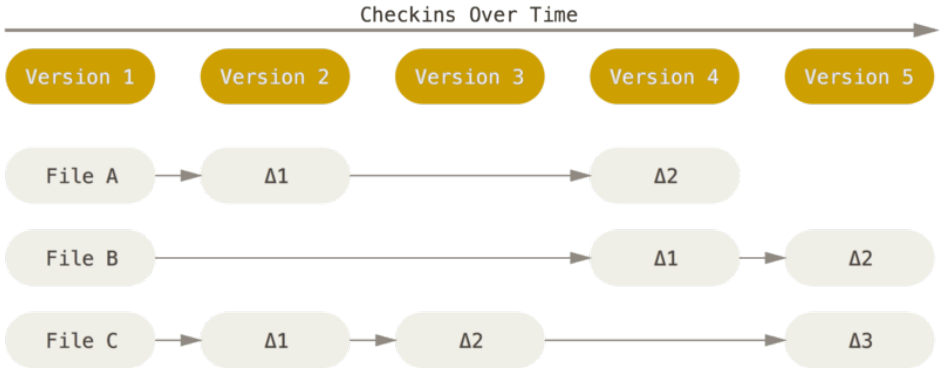
Distributed version control

- Examples: Git, Mercurial, ...
- You "clone" from a remote repo and "pull" changes from it
- Your local repo is a complete copy of everything on the remote machine
  - Yours is just as good as theirs
- Many operations are local:
  - Check in/out from local repo
  - Commit changes to local repo
  - Local repo keeps version history
- When you're ready, you can "push" changes back to remote machine

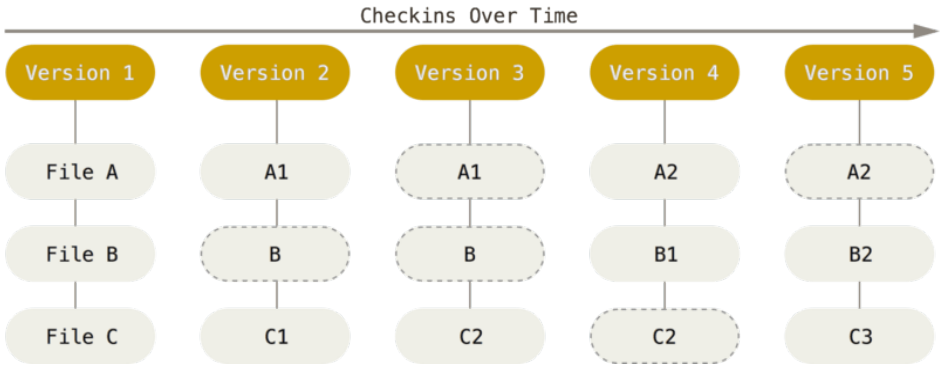


Git snapshots

- Centralized VCS's track version data on each individual file



- Git keeps "snapshots" of entire state of project
  - Each checkin version of overall code has a copy of each file in it
  - Some files change on a given checkin, some do not
  - More redundancy, but faster



Git: local, integrity-checked, immutable history

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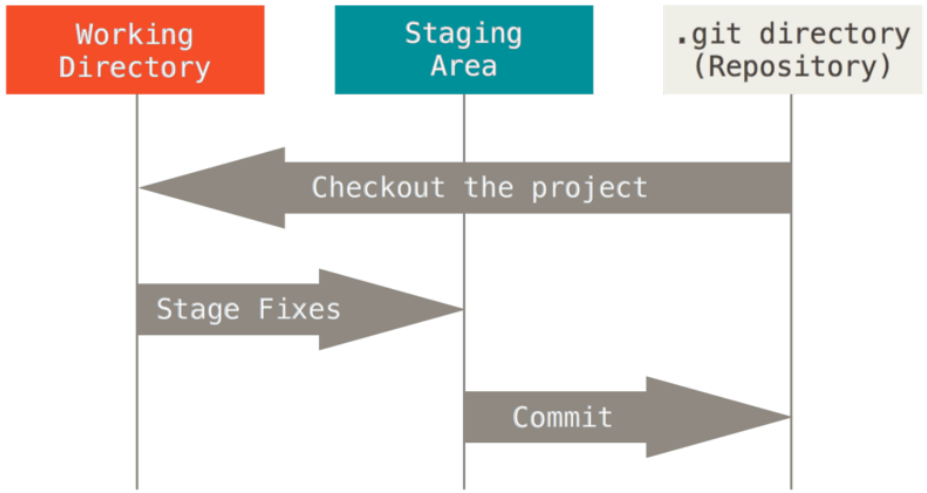
- You have all version history in your local repo
  - You can retrieve and modify it independently
  - No need to communicate to another server
- Everything is checksummed before storage
  - Checksum numbers used for reference
  - Git uses SHA-1 hash for checksumming
- Git generally only adds data

Git states

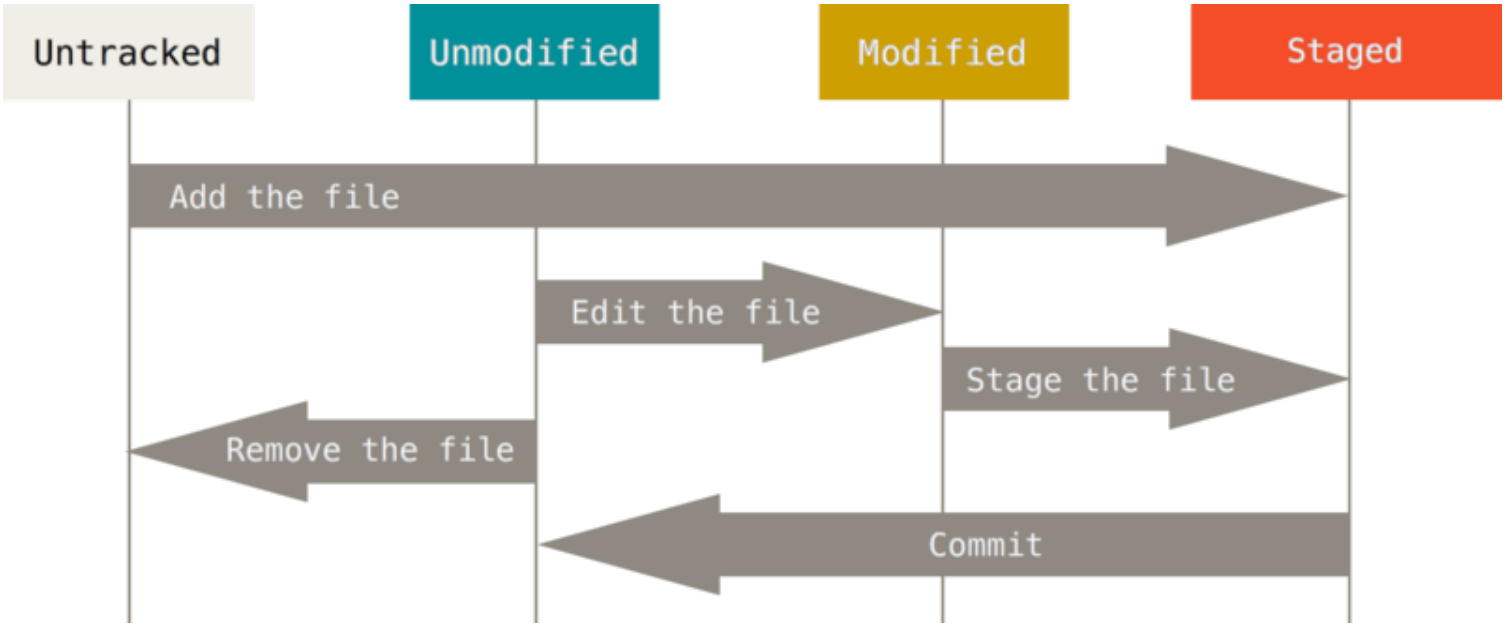
On your local machine files can be:

- In your local repo (committed)
- Checked out and modified, but not yet committed (working copy)
- In-between, in a "staging" area
  - Staged files are ready to be committed
  - A commit saves a snapshot of all staged state



Basic Git life cycle

- Modify files in your working tree
- Stage files (selectively), adding snapshots of them to your staging area
  - Also, track files in your working directory
- Commit, which takes staged files and stores that snapshot permanently to your Git directory



Basic Git life cycle: commands

Note: These are git sub-commands

- `init`: create an empty Git repo
- `status`: show working tree status
- `add`: stage a file
- `commit`: record staged changes to repo

Other commands you may use less frequently:

- `log`: show commit logs
- `diff`: show changes between commits, commit & working tree, etc.
- `rm`: remove files from working tree and index
- `checkout`: switch branches or restore working tree files

Git: working with remote repositories

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- `clone`: clone a repo (create a local duplicate)
- `remote`: manage set of tracked repos
- `fetch`: download objects from remote repo
- `pull`: fetch and merge with local repo
- `push`: update remote repo

Exercise ex2

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- Retrieve repo from:
  `https://github.com/ualbany-csi333-f23/inclass-git`
- In which snapshot *random.txt* contains random number 25083?
- Record the first 6 letters of SHA-1 hash code for the commit
- Hint: See section on "diff formatting" within `git log` man page
- Questions:
  1. Partial hash value indicated above?
  2. Commands you need to run to get to the answer (starting from retrieving the repo)?

Using Git for lecture slides

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- Suggestion: create a folder for this course (e.g., `~/csi333-repos`) and clone/create repos within that folder
- Clone our lectures repo: `https://github.com/ualbany-csi333-f21/lectures`
  - Then, just pull it each time to retrieve the new lectures!

Using Git for homework assignments

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- On release date of homework
  1. Check the repository of the homework
  2. Follow the link there to create a private repo for you for that specific homework: e.g., `lab01-azerrima`
- For working on your homework, you
  1. Clone your homework repo (e.g., `lab01-azerrima`, not `lab01`)
  2. Create/edit assignment files
  3. Add changes
  4. Commit
  5. Push (and go to 2 if needed)
- At the deadline, we
  1. Clone your repo to our machine
  2. Grade it
  3. Push it as a separate "graded" branch in your repository that contains feedback/grade