Git for Version Control

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http://git-scm.com

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Plan

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1. About Git

- Created by Linus Torvalds, creator of Linux, in 2005
  - Came out of Linux development community
  - Designed to do version control on Linux kernel

- Goals of Git:
  - Speed
  - Support for non-linear development (thousands of parallel branches)
  - Fully distributed
  - Able to handle large projects efficiently

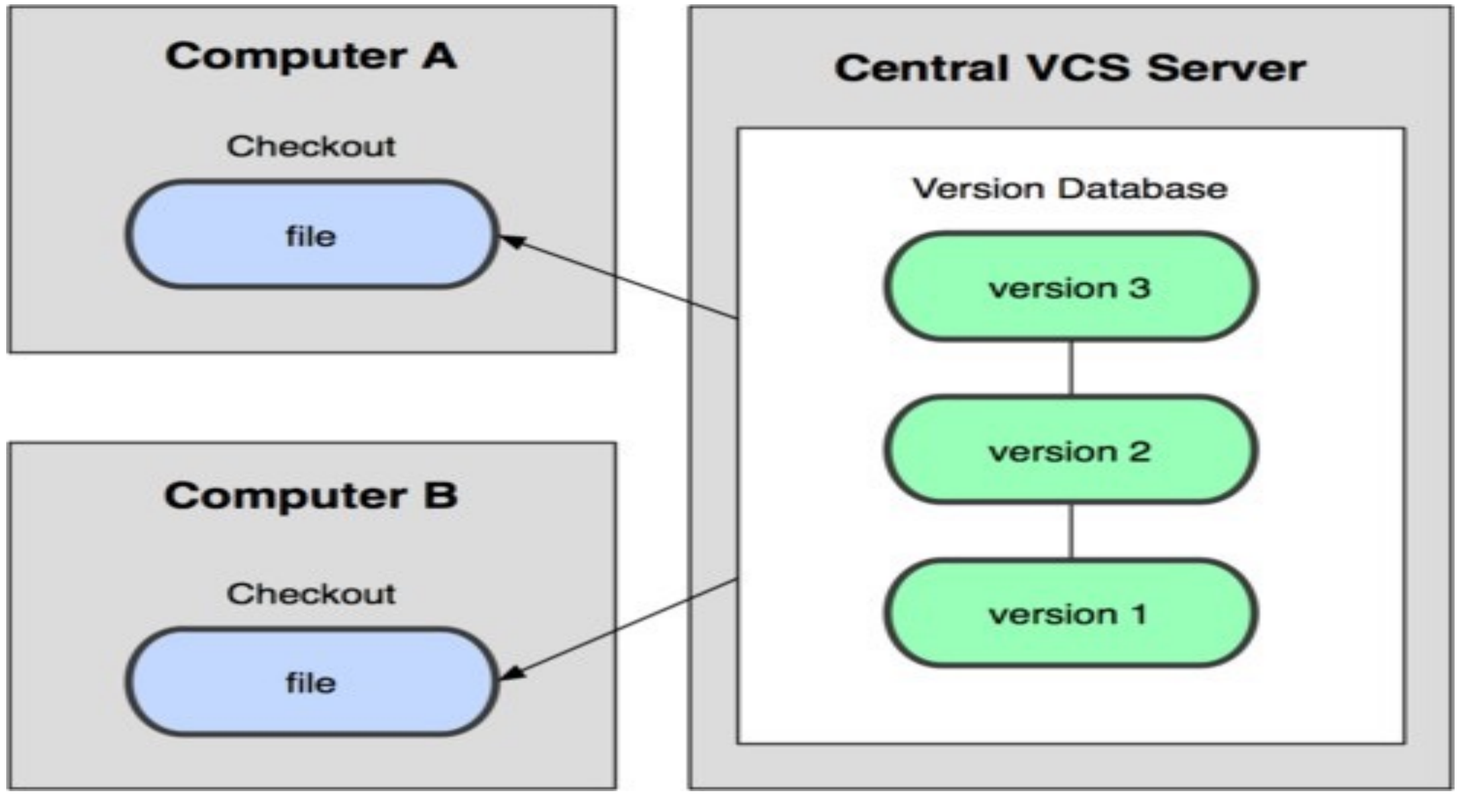
  - *(A "git" is a cranky old man. Linus meant himself.)*

2. Installing/learning Git

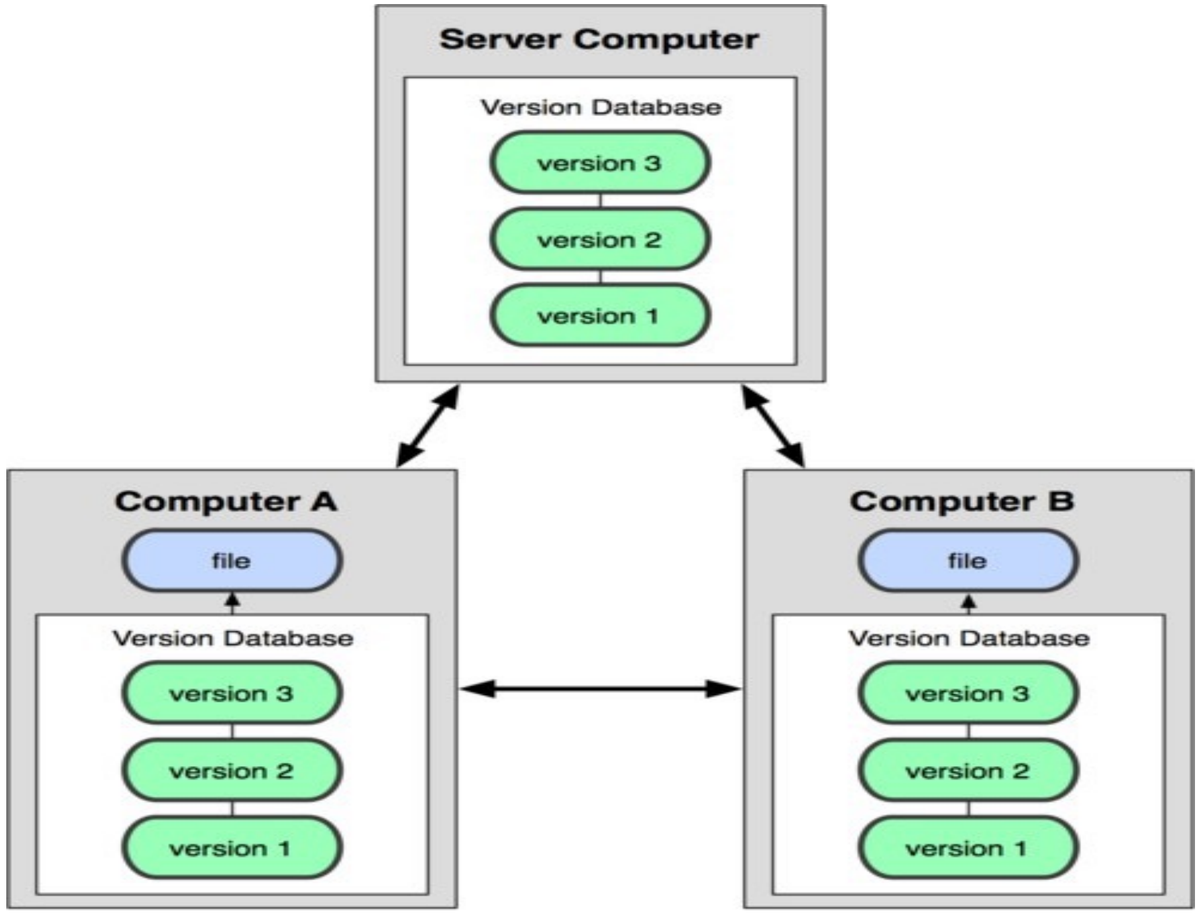
- Git website: http://git-scm.com/
  - Free on-line book: http://git-scm.com/book
  - Reference page for Git: http://gitref.org/index.html
  - Git tutorial: http://schacon.github.com/git/gittutorial.html
  - Git for Computer Scientists:
    - http://eagain.net/articles/git-for-computer-scientists/

- At command line: *(where verb = config, add, commit, etc.)*
  - `git help` *`verb`*

3. Centralized VCS

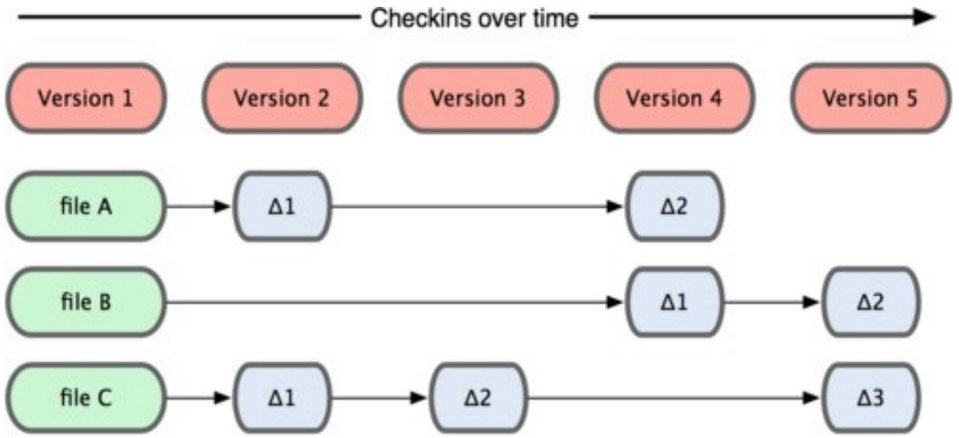


4. Distributed VCS (Git)

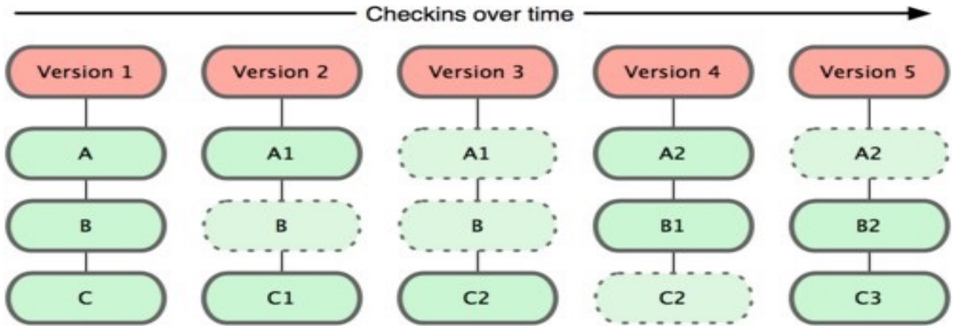


5. Git snapshots

- Centralized VCS like Subversion track version data on each individual file.

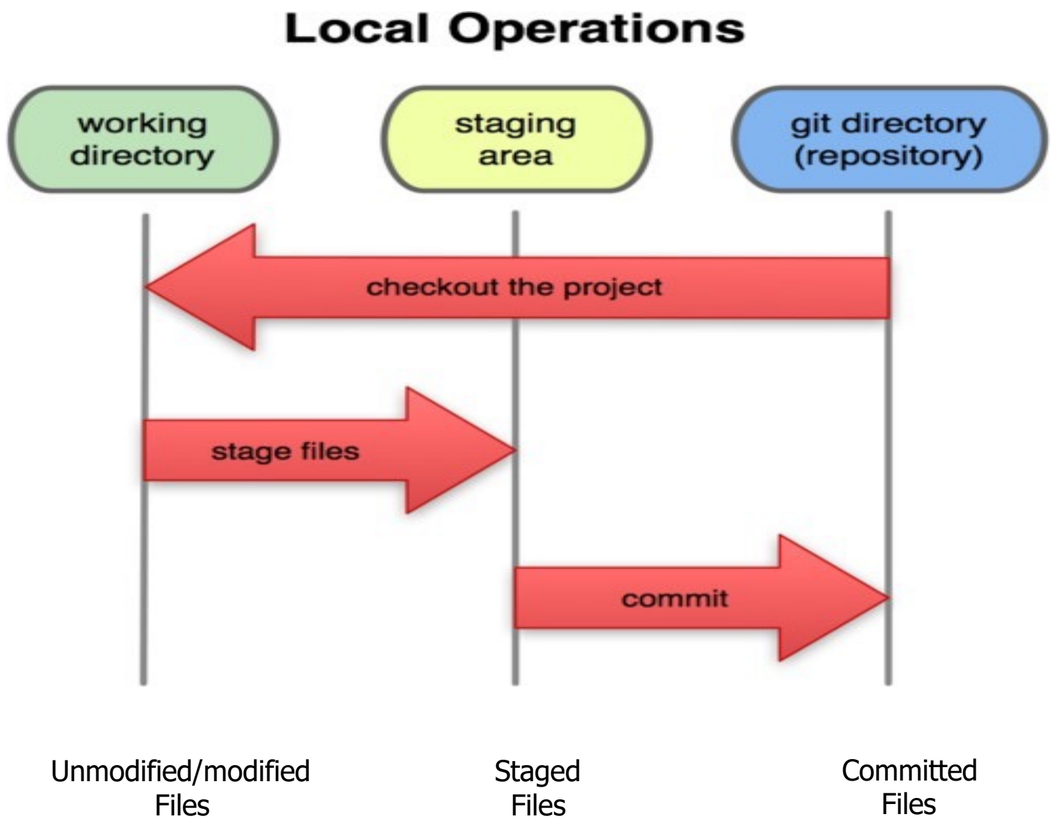


- Git keeps "snapshots" of the entire state of the project.
  - Each checkin version of the overall code has a copy of each file in it.
  - Some files change on a given checkin, some do not.
  - More redundancy, but faster.



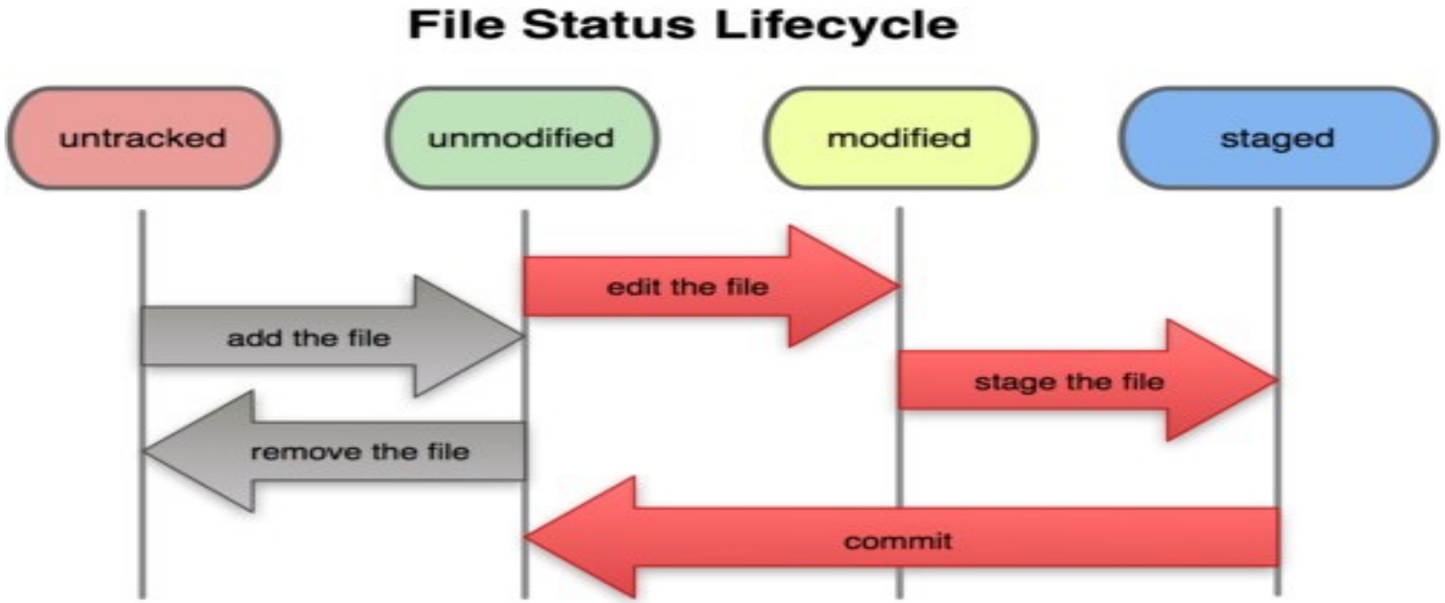
6. Local git areas

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



7. Basic Git workflow

- **Modify** files in your working directory.
- **Stage** files, adding snapshots of them to your staging area.
- **Commit**, which takes the files in the staging area and stores that snapshot permanently to your Git directory.



8. Git commit checksums

- In Subversion each modification to the central repo increments the version # of the overall repo.
  - In Git, each user has their own copy of the repo, and commits changes to their local copy of the repo before pushing to the central server.
  - So Git generates a unique **SHA-1 hash** (40 character string of hex digits) for every commit.
  - Refers to commits by this ID rather than a version number.

  - Often we only see the first 7 characters:
    - `1677b2d  Edited first line of readme`
    - `258efa7  Added line to readme`
    - `0e52da7  Initial commit`

9. Initial Git configuration

- Set the name and email for Git to use when you commit:
  - `git config --global user.name "Bugs Bunny"`
  - `git config --globaluser.email bugs@gmail.com`
  - You can call `git config -list` to verify these are set.

- Set the editor that is used for writing commit messages:
  - `git config --global core.editornano`
    - (it is vim by default)

10. Creating a Git repo

Two common scenarios: (only do one of these)

- To create a new **local Git repo** in your current directory:
  - `git init`
    - This will create a `.git` directory in your current directory.
    - Then you can commit files in that directory into the repo.
  - `git add` *`filename`*
  - `git commit -m "`*`commit message`*`"`

- To **clone a remote repo** to your current directory:
  - `git clone` *`url localDirectoryName`*
    - This will create the given local directory, containing a working copy of the files from the repo, and a `.git` directory (used to hold the staging area and your actual local repo)

11. Git commands

command	description
git clone ***url [dir]***	copy a Git repository so you can add to it
git add ***file***	adds file contents to the staging area
git commit	records a snapshot of the staging area
git status	view the status of your files in the working directory and staging area
git diff	shows diff of what is staged and what is modified but unstaged
git help *[**command**]*	get help info about a particular command
git pull	fetch from a remote repo and try to merge into the current branch
git push	push your new branches and data to a remote repository
others: init, reset, branch, checkout, merge, log, tag	

Add and commit a file

- The first time we ask a file to be tracked, *and every time before we commit a file*, we must add it to the staging area:
  - `git add Hello.java Goodbye.java`
    - Takes a snapshot of these files, adds them to the staging area.
    - In Git, "add" means "add to staging area" so it will be part of the next commit.
- To move staged changes into the repo, we commit:
  - `git commit –m "Fixing bug #22"`
- To undo changes on a file before you have committed it:
  - `git reset HEAD -- filename` (unstages the file)
  - `git checkout -- filename` (undoes your changes)
  - All these commands are acting on your local version of repo.

Viewing/undoing changes

- To view status of files in working directory and staging area:
  - `git status` or `git status -s` (short version)
- To see what is modified but unstaged:
  - `git diff`
- To see a list of staged changes:
  - `git diff --cached`
- To see a log of all changes in your local repo:
  - `git log` or `git log --oneline` (shorter version)

```
1677b2d Edited first line of readme
258efa7 Added line to readme
0e52da7 Initial commit
```

  - `git log -5` (to show only the 5 most recent updates), etc.

11. Git commands

An example workflow

```
[rea@attu1 superstar]$ touch rea.txt
[rea@attu1 superstar]$ git status
  no changes added to commit
  (use "git add" and/or "git commit -a")
[rea@attu1 superstar]$ git status -s
  M rea.txt
[rea@attu1 superstar]$ git diff
  diff --git a/rea.txt b/rea.txt
[rea@attu1 superstar]$ git add rea.txt
[rea@attu1 superstar]$ git status
  #       modified:   rea.txt
[rea@attu1 superstar]$ git diff --cached
  diff --git a/rea.txt b/rea.txt
[rea@attu1 superstar]$ git commit -m "Created new text file"
```

11. Git commands

Branching and merging

Git uses branching heavily to switch between multiple tasks.

- To create a new local branch:
  - `git branch` *`name`*
- To list all local branches: (* = current branch)
  - `git branch`
- To switch to a given local branch:
  - `git checkout` *`branchname`*
- To merge changes from a branch into the local master:
  - `git checkout master`
  - `git merge` *`branchname`*

11. Git commands

Interaction with remote repo

- **Push** your local changes to the remote repo.
- **Pull** from remote repo to get most recent changes.
  - (fix conflicts if necessary, add/commit them to your local repo)

- To fetch the most recent updates from the remote repo into your local repo, and put them into your working directory:
  - `git pull origin master`

- To put your changes from your local repo in the remote repo:
  - `git push origin master`

11. Git commands

GitHub

- GitHub.com is a site for online storage of Git repositories.
  - You can create a **remote repo** there and push code to it.
  - Many open source projects use it, such as the Linux kernel.
  - You can get free space for open source projects, or you can pay for private projects.
    - Free private repos for educational use: github.com/edu