An Introduction to “git”

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Basic Intro to Git

- We will:
  - Discuss how Git differs from Subversion
  - Discuss the basic Git model
  - Pull/clone files from a repository on github
  - Edit files in your own local Git repo
  - Push files to a repo on github

Git Resources

- At the command line: (where verb = config, add, commit, etc.)

  $ git help <verb>

  $ git <verb> --help

  $ man git-<verb>

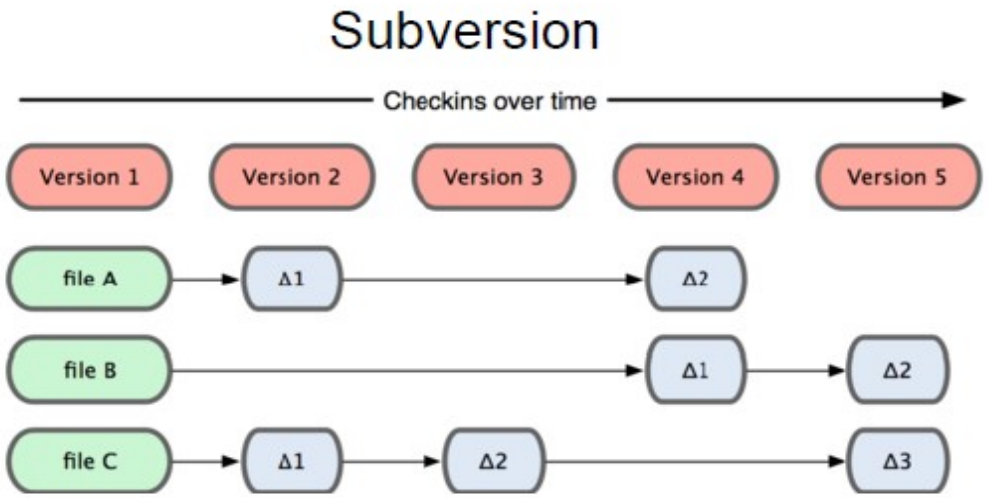
- Free on-line book: http://git-scm.com/book
- Git tutorial: http://schacon.github.com/git/gittutorial.html
- Reference page for Git: http://gitref.org/index.html
- Git website: http://git-scm.com/

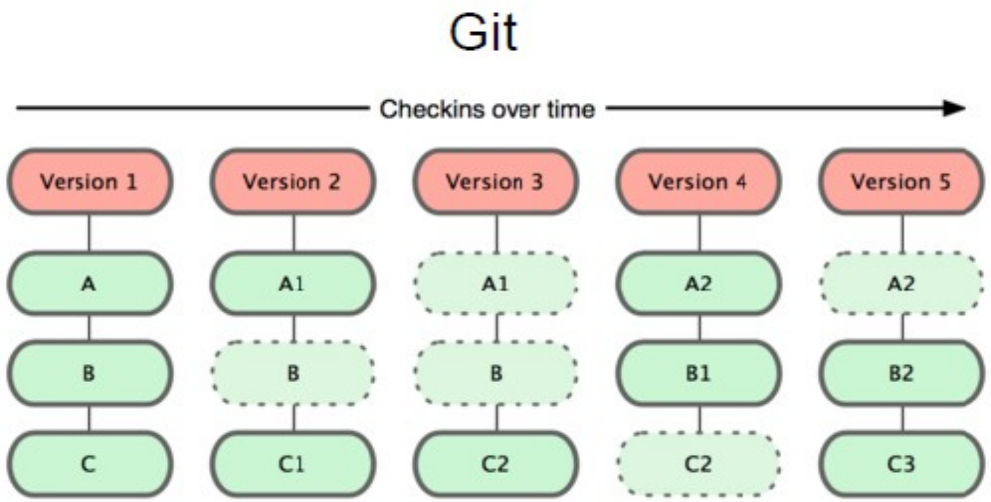
- Git for Computer Scientists (http://eagain.net/articles/git-for-computer-scientists/)

Git History

- Came out of Linux development community
- Linus Torvalds, 2005
- Initial goals:
  - Speed
  - Support for non-linear development (thousands of parallel branches)
  - Fully distributed
  - Able to handle large projects like Linux efficiently

Git takes snapshots





Git uses checksums

- In Subversion each modification to the **central** repo incremented the version # of the overall repo.
- How will this numbering scheme work **when 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?????

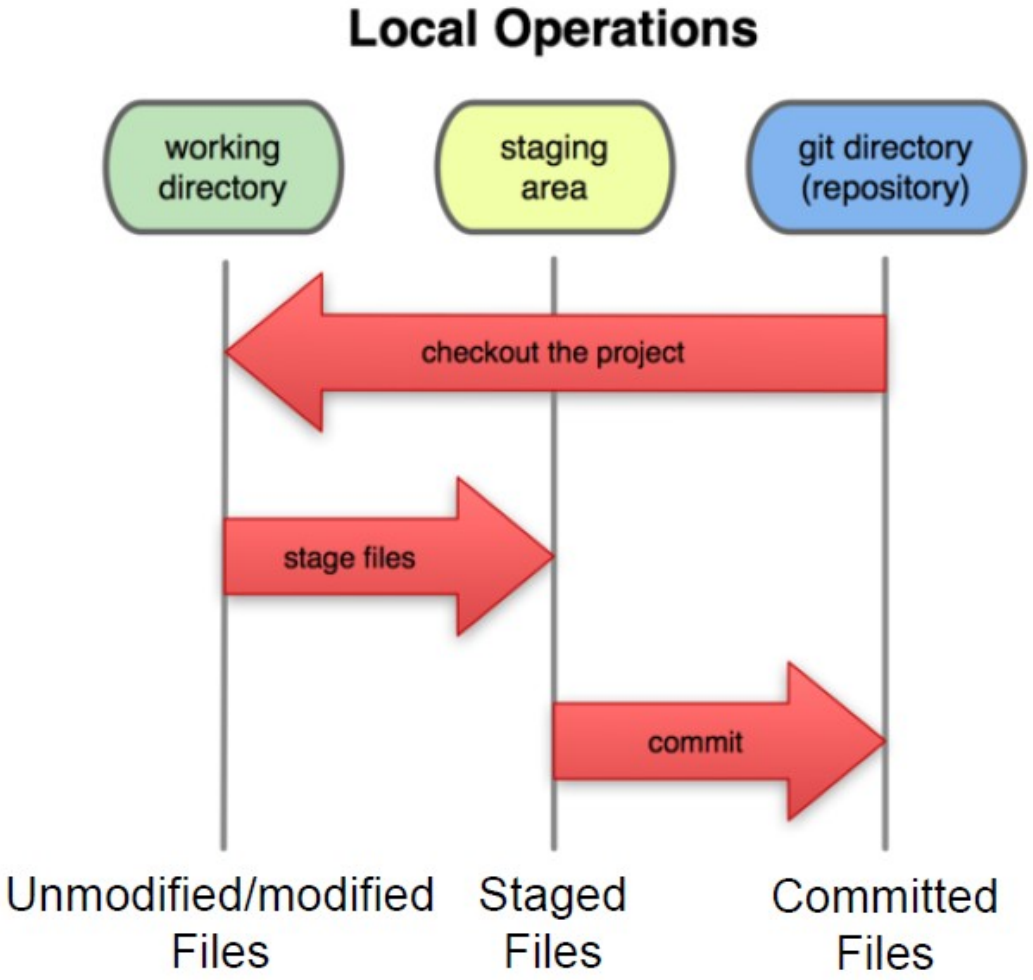
- Instead, Git generates a unique SHA-1 hash – 40 character string of hex digits, for every commit. Refer to commits by this ID rather than a version number. Often we only see the first 7 characters:

  1677b2d Edited first line of readme

  258efa7 Added line to readme

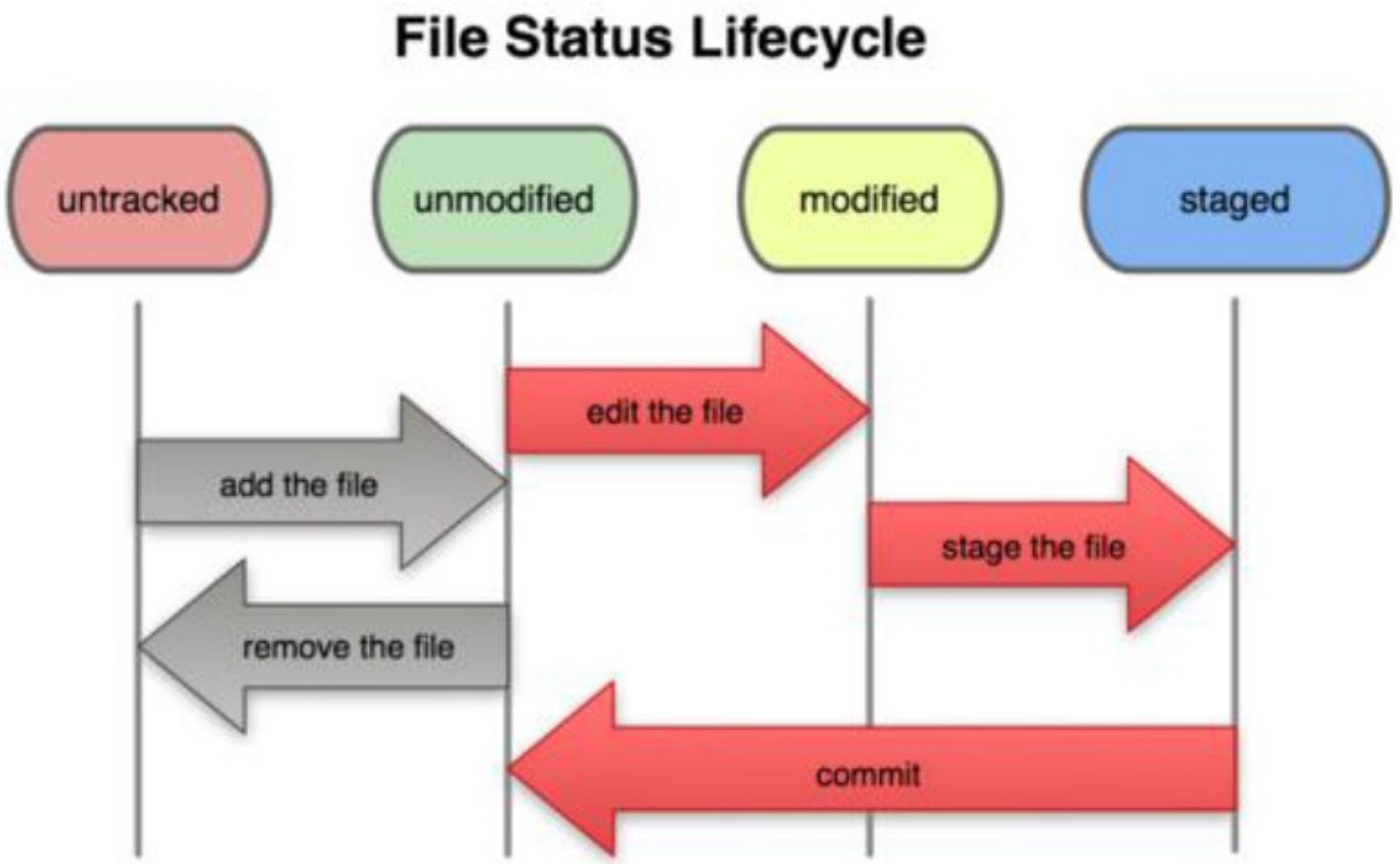
  0e52da7 Initial commit

A Local Git project has three areas



Note: working directory sometimes called the “working tree”, staging area sometimes called the “index”.

Git file lifecycle



Basic Workflow

1. **Modify** files in your working directory.
2. **Stage** files, adding snapshots of them to your staging area.
3. Do a **commit**, which takes the files as they are in the staging area and stores that snapshot permanently to your Git directory.

- Notes:
  - If a particular version of a file is in the **git directory**, it's considered **committed**.
  - If it's modified but has been added to the **staging area**, it is **staged**.
  - If it was **changed** since it was checked out but has not been staged, it is **modified**.

Aside: So what us github?

- GitHub.com is a site for online storage of Git repositories.
- 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.

Question: Do I have to use github to use Git?

Answer: No!

- you can use Git completely locally for your own purposes, or
- you or someone else could set up a server to share files, or
- you could share a repo with users on the same file system, such as we did for homework 9 (as long everyone has the needed file permissions).

Get ready to use Git

1. Set the name and email for Git to use when you commit:

```
$ git config --global user.name "Bugs Bunny"
$ git config --global user.email bugs@gmail.com
```

- You can call **`git config –list`** to verify these are set.
- These will be set globally for all Git projects you work with.
- You can also set variables on a project-only basis by not using the **`--global`** flag.
- You can also set the editor that is used for writing commit messages:
  $ git config --global core.editor emacs (it is vim by default)

Create a local copy of a repo

2. Two common scenarios: (only do one of these)

   a) To **clone an already existing repo** to your current directory:

   ```
   $ git clone <url> [local dir name]
   ```

   This will create a directory named *local dir name*, containing a working copy of the files from the repo, and a **.git** directory (used to hold the staging area and your actual repo)

   b) To **create a 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 file1.java
   $ git commit –m “initial project version”
   ```

Git commands

command	description
`git clone` ***`url [dir]`***	copy a git repository so you can add to it
`git add` ***`files`***	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`	

Committing files

- 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 README.txt hello.java
```

This takes a snapshot of these files at this point in time and adds it to the staging area.

- To move staged changes into the repo we commit:

```
$ git commit –m “Fixing bug #22”
```

Note: To unstage a change on a file before you have committed it:

```
$ git reset HEAD  --  filename
```

Note: To unmodify a modified file:

```
$ git checkout  --  filename
```

Note: These commands are just acting on **your local version of repo**.

Status and Diff

- To view the **status** of your files in the working directory and staging area:

```
$ git status          or
$ git status -s
```

(`-s` shows a short one line version similar to svn)

- To see what is modified but unstaged:

```
$ git diff
```

- To see staged changes:

```
$ git diff --cached
```

After editing a file …

```
[rea@attu1 superstar]$ emacs rea.txt
[rea@attu1 superstar]$ git status
# On branch master
# Changes not staged for commit:
#   (use "git add <file>..." to update what will be committed)
#   (use "git checkout -- <file>..." to discard changes in working directory)
#
#       modified:   rea.txt
#
no changes added to commit (use "git add" and/or "git commit -a")
[rea@attu1 superstar]$ git status -s
 M rea.txt                                  ← Note: M is in second column = "working  tree"
[rea@attu1 superstar]$ git diff             ← Shows modifications that have not been staged.
diff --git a/rea.txt b/rea.txt
index 66b293d..90b65fd 100644
--- a/rea.txt
+++ b/rea.txt
@@ -1,2 +1,4 @@
 Here is rea's file.
+
+One new line added.
[rea@attu1 superstar]$ git diff --cached    ← Shows nothing, no modifications have been staged yet.
```

After adding file to staging area …

```
[rea@attu1 superstar]$ git add rea.txt
[rea@attu1 superstar]$ git status
# On branch master
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#       modified:   rea.txt
#
[rea@attu1 superstar]$ git status -s
M  rea.txt                                  ← Note: M is in first column = "staging area"
[rea@attu1 superstar]$ git diff             ← Note: Shows nothing, no modifications that have not been staged.
[rea@attu1 superstar]$ git diff --cached    ← Note: Shows staged modifications.
diff --git a/rea.txt b/rea.txt
index 66b293d..90b65fd 100644
--- a/rea.txt
+++ b/rea.txt
@@ -1,2 +1,4 @@
 Here is rea's file.
+
+One new line added.
```

Pulling and Pushing

Good practice:

1. **Add** and **Commit** your changes to your local repo
2. **Pull** from remote repo to get most recent changes (fix conflicts if necessary, add and commit them to your local repo)
3. **Push** your changes to the remote 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 push your changes from your local repo to the remote repo:

```
$ git push origin master
```

Notes: **`origin`** = an alias for the URL you cloned from

`master` = the remote branch you are pulling from/pushing to,
(the local branch you are pulling to/pushing from is your current branch)

Note: On attu you will get a Gtk-warning, you can ignore this.

Branching

To create a branch called experimental:

- `$ git branch experimental`

To list all branches: (* shows which one you are currently on)

- `$ git branch`

To switch to the experimental branch:

- `$ git checkout experimental`

Later on, changes between the two branches differ, to merge changes from experimental into the master:

- `$ git checkout master`
- `$ git merge experimental`

Note: `git log --graph` can be useful for showing branches.

Note: These branches are in *your local repo*!

SVN vs. Git

- SVN:
  - central repository approach – the main repository is the only “true” source, only the main repository has the complete file history
  - Users check out local copies of the current version
- Git:
  - Distributed repository approach – every checkout of the repository is a full fledged repository, complete with history
  - Greater redundancy and speed
  - Branching and merging repositories is more heavily used as a result

Do this:

1. **$ git config --global user.name “Your Name”**
2. **$ git config --global user.email youremail@whatever.com**
3. **$ git clone https://github.com/rea2000/santalist.git**

Then try:

1. **$ git log, $ git log --oneline**
2. Create a file named *userID*.txt (e.g. rea.txt)
3. **$ git status, $ git status -s**
4. Add the file: **$ git add *userID*.txt**
5. **$ git status, $ git status -s**
6. Commit the file to your local repo:
   $ git commit -m “added rea.txt file”
7. **$ git status, $ git status -s, $ git log --oneline**

***WAIT, DO NOT GO ON TO THE NEXT STEPS UNTIL YOU ARE TOLD TO!!**

1. Pull from remote repo: **$git pull origin master**
2. Push to remote repo: **$git push origin master**