INF2002 Lab 2

Version Control with Git

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Adapted from R. Anderson, UW
And from http://git-scm.com/book/en/

Objectives

- Learn about version control
- Learn simple git commands
- Store code in a repository
- Collaborate with your teammates
- Use it for your project!

Basic Intro to Git

- Why version control?
- Install Git
- Basic Git model
- How Git differs from Subversion (SVN)
- Pull/clone files from a repository on github
- Edit files in your own local Git repo
- Push files to a repo on github

Why use version control?

- Collaboration
- Storing versions properly
- Restoring previous versions
- Understand the history and what happened
- **BACKUP!!!**

Install Git

Git
https://git-scm.com/downloads

GitHub CLI
https://github.com/cli/cli

GitHub Desktop (UI for Git, more about that coming up)
https://desktop.github.com/

SmartGit (UI for Git)
http://www.syntevo.com/smartgit/download

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/

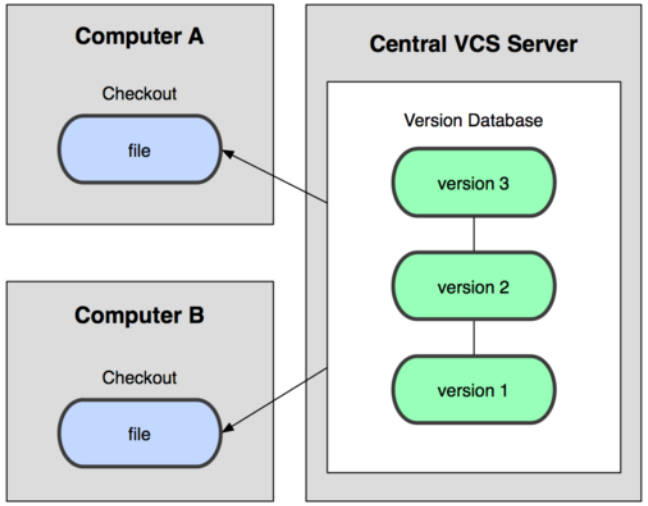
- Git for Computer Scientists
- http://eagain.net/articles/git-for-computer-scientists/

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

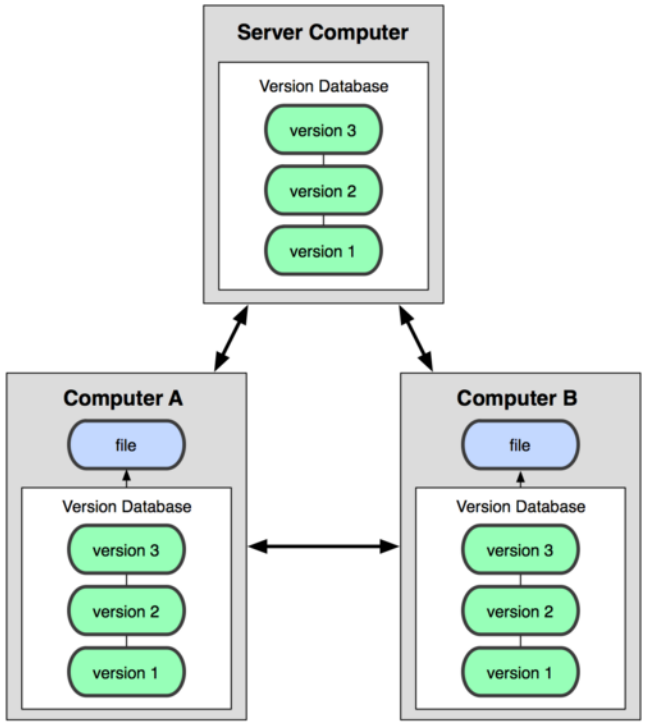
Git uses a distributed model

Centralized Model



(CVS, Subversion, Perforce)

Distributed Model

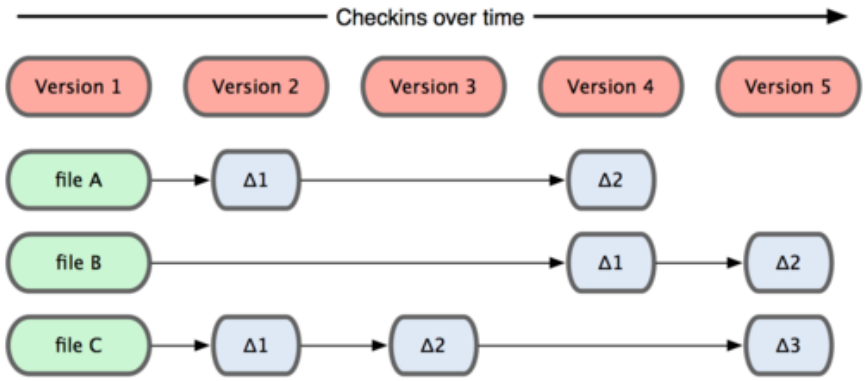


(Git, Mercurial)

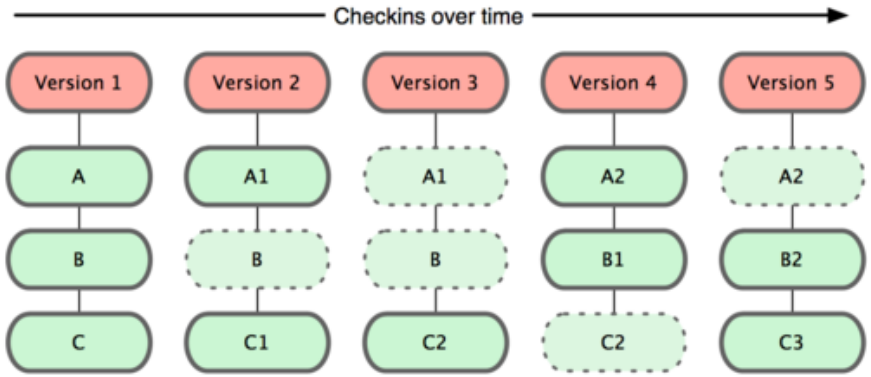
Result: Many operations are local

Git takes snapshots

Subversion



Git



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?????

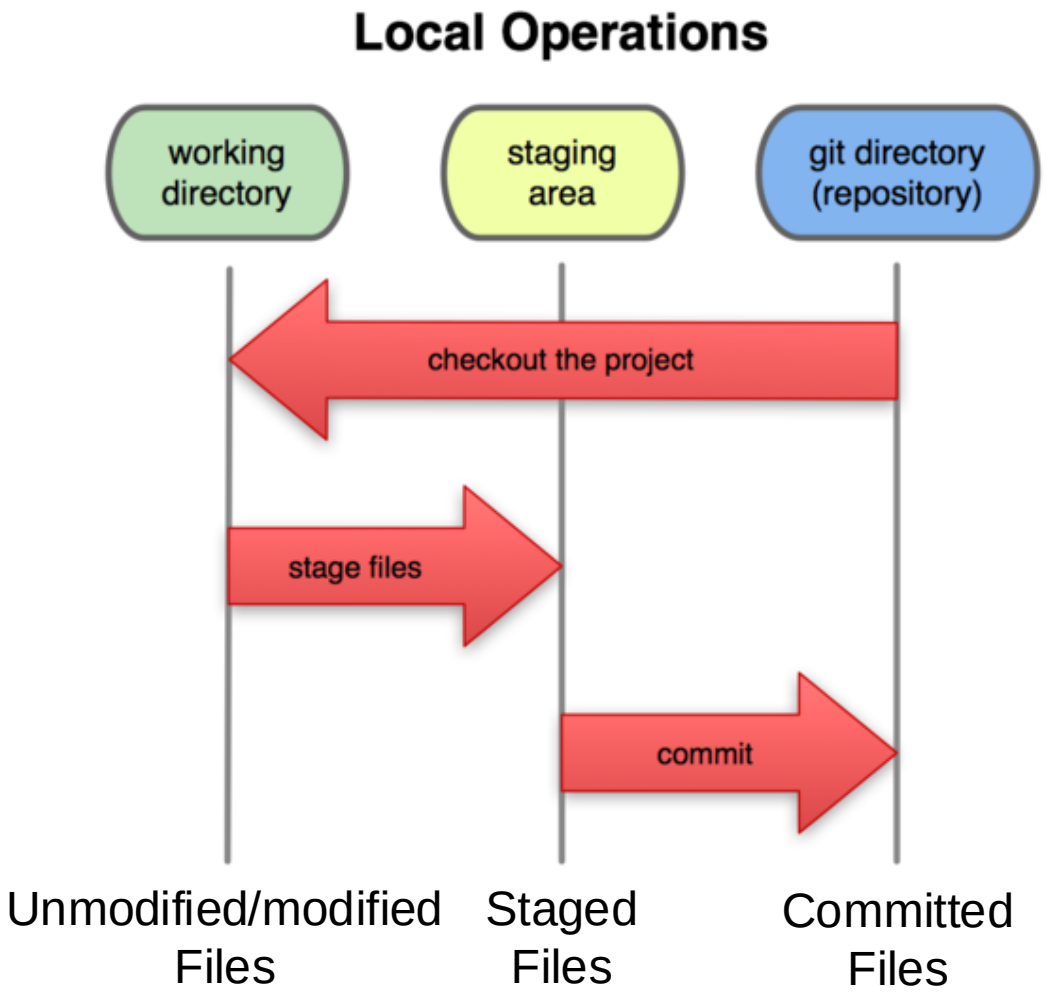
- Instead, Git generates a unique SHA-1 hash – 40 character string of hex digits, for every commit. Refer to commits by this ID rather than a version number. Often we only see the first 7 characters:

  1677b2d Edited first line of readme

  258efa7 Added line to readme

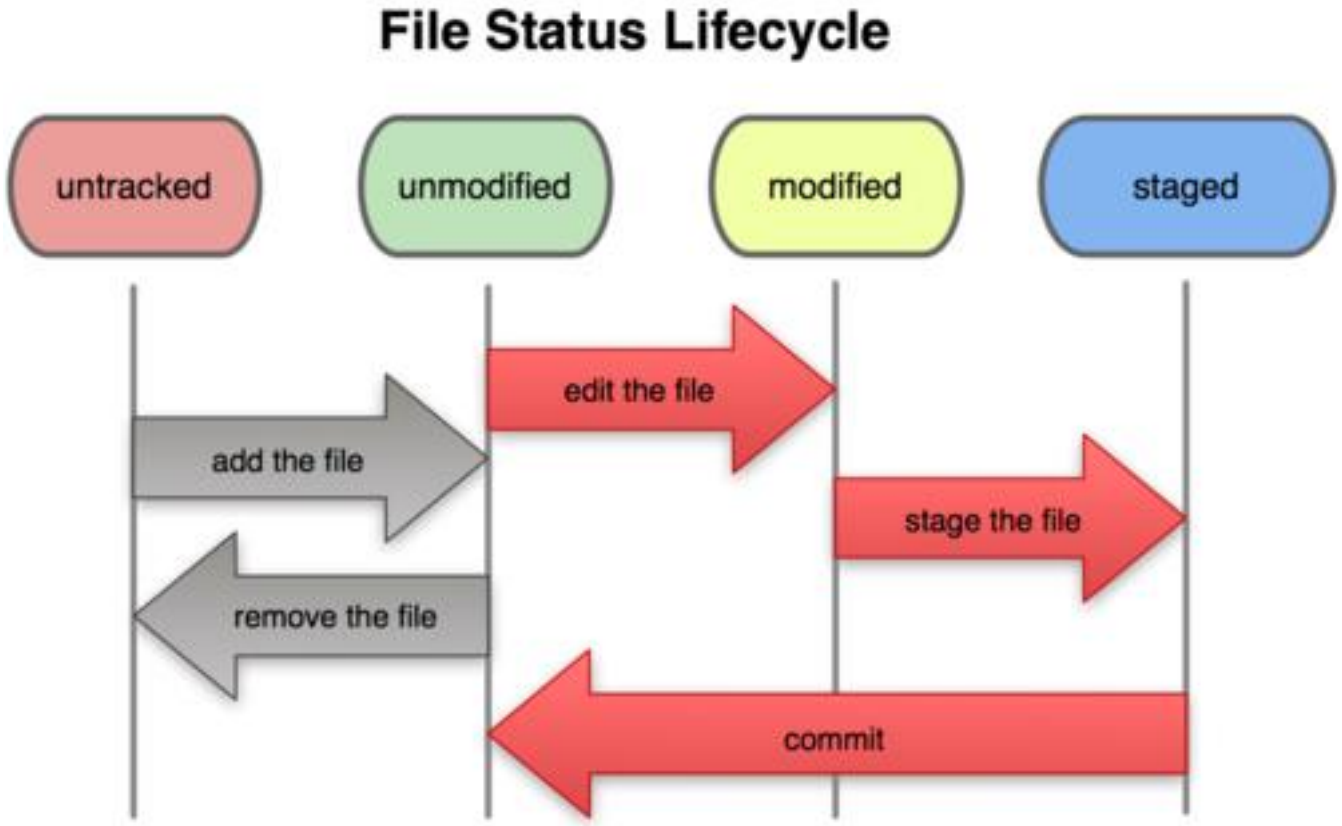
  0e52da7 Initial commit

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

Basic Git 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**.

So, what is 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

Sign Up for a GitHub account

https://github.com/join

Choose the free account

Please make sure to fill out your Git profile in the account, it will be used in subsequent labs

Sign up for the student pack for free repositories

https://education.github.com/pack

Get ready to use Git!

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

```
$ git config --global user.name “Ah-Seng Tan”
$ git config --global user.email tanahseng@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…

```
$ touch test.txt
$ 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:   test.txt
#
no changes added to commit (use "git add" and/or "git commit -a")
$ git status -s
 M test.txt                          ← Note: M is in second column = “working  tree”
$ git diff                          ← Shows modifications that have not been staged.
diff --git a/test.txt b/test.txt
index 66b293d..90b65fd 100644
--- a/test.txt
+++ b/test.txt
@@ -1,2 +1,4 @@
 Here is  a test file.
+
+One new line added.
$ git diff --cached                 ← Shows nothing, no modifications have been staged yet.
$
```

After adding file to staging area…

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

Viewing logs

To see a log of all changes in your local repo:

- `$ git log` or
- `$ git log --oneline` (to show a 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.)

Note: changes will be listed by commitID #, (SHA-1 hash)

Note: changes made to the remote repo before the last time you cloned/pulled from it will also be included here

Configure and push to remote repo

Create a repository online on GitHub, the repo page will list the repository URL.

```
$ git remote add origin
https://github.com/inf2002/examplerepo.git
```

This creates a remote, or *connection*, named “origin” pointing at the GitHub repository you just created.

Don’t use the above URL, create and use your own!!!!1!

```
$ git push -u origin master
```

This sends your commits in your “master” branch to GitHub.

Refresh the GitHub repo page, you should see your files!

Configure and push to remote repo

```
$git remote add origin https://github.com/inf2002/examplerepo.git
$git push -u origin master
Username:
Password:
Counting objects: 3, done.
Writing objects: 100% (3/3), 242 bytes | 0 bytes/s, done.
Total 3 (delta 0), reused 0 (delta 0)
To https://github.com/inf2002/examplerepo.git
 * [new branch]      master -> master
Branch master set up to track remote branch master from origin.
```

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
```

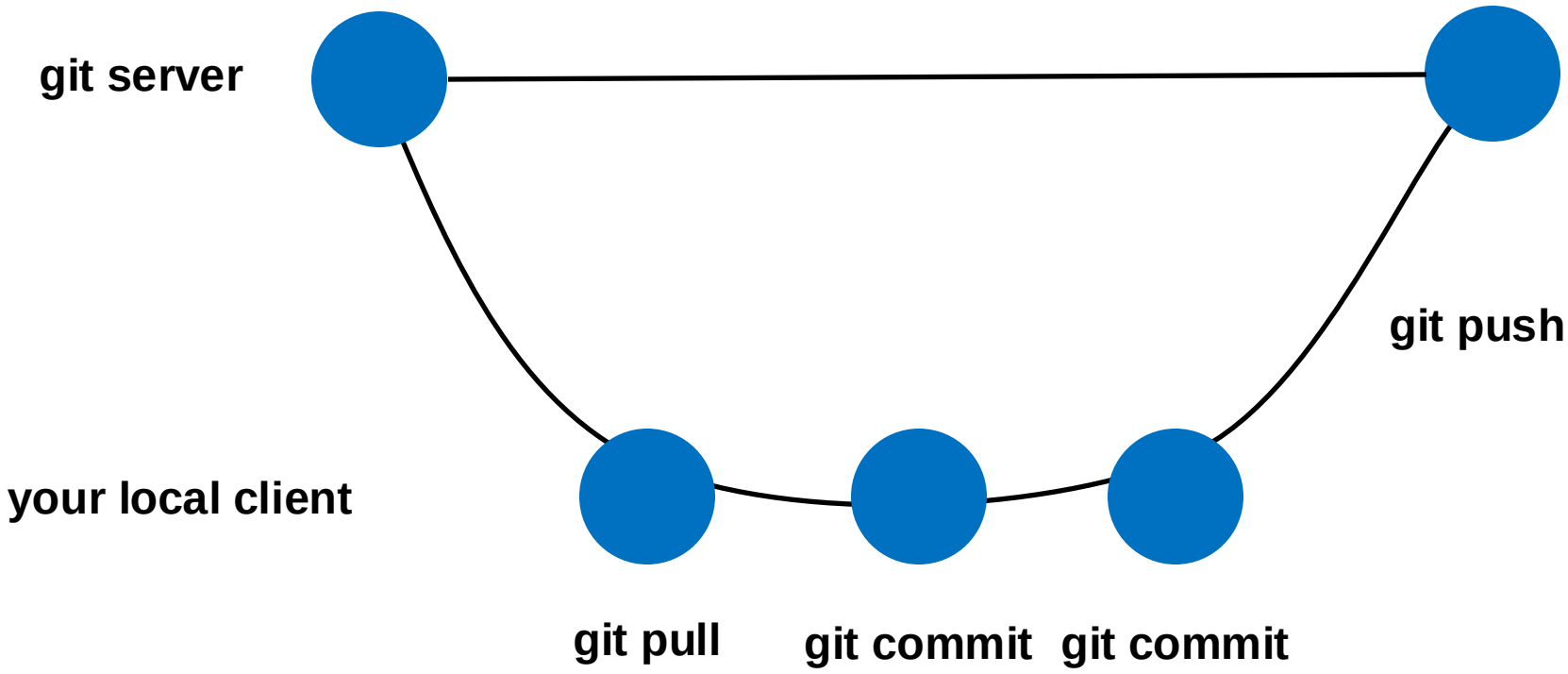
To push your changes from your local repo to the remote repo:

```
$ 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)

Git Workflow



Adapted from UCSD COGS120/CSE170

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

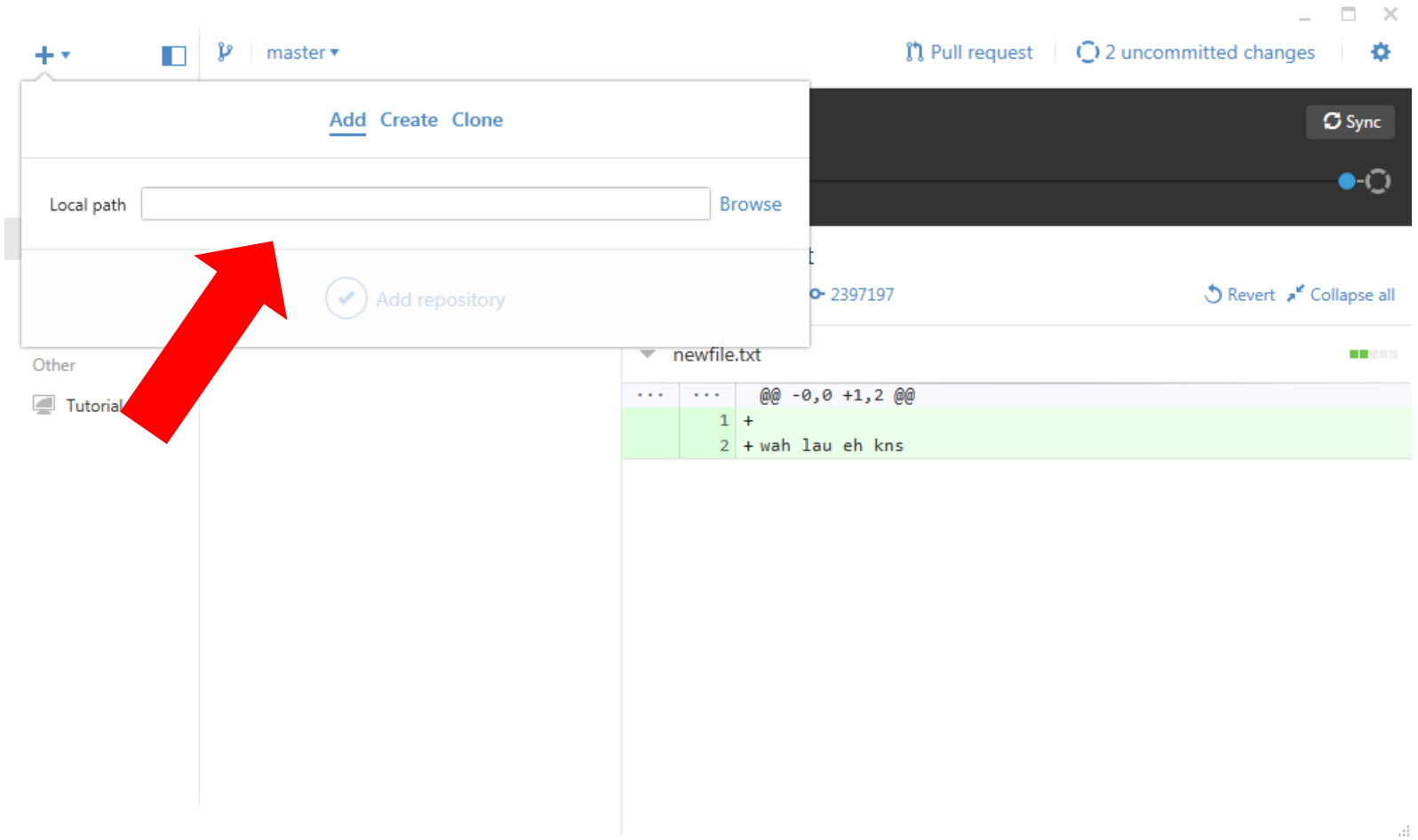
SVN:

- 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

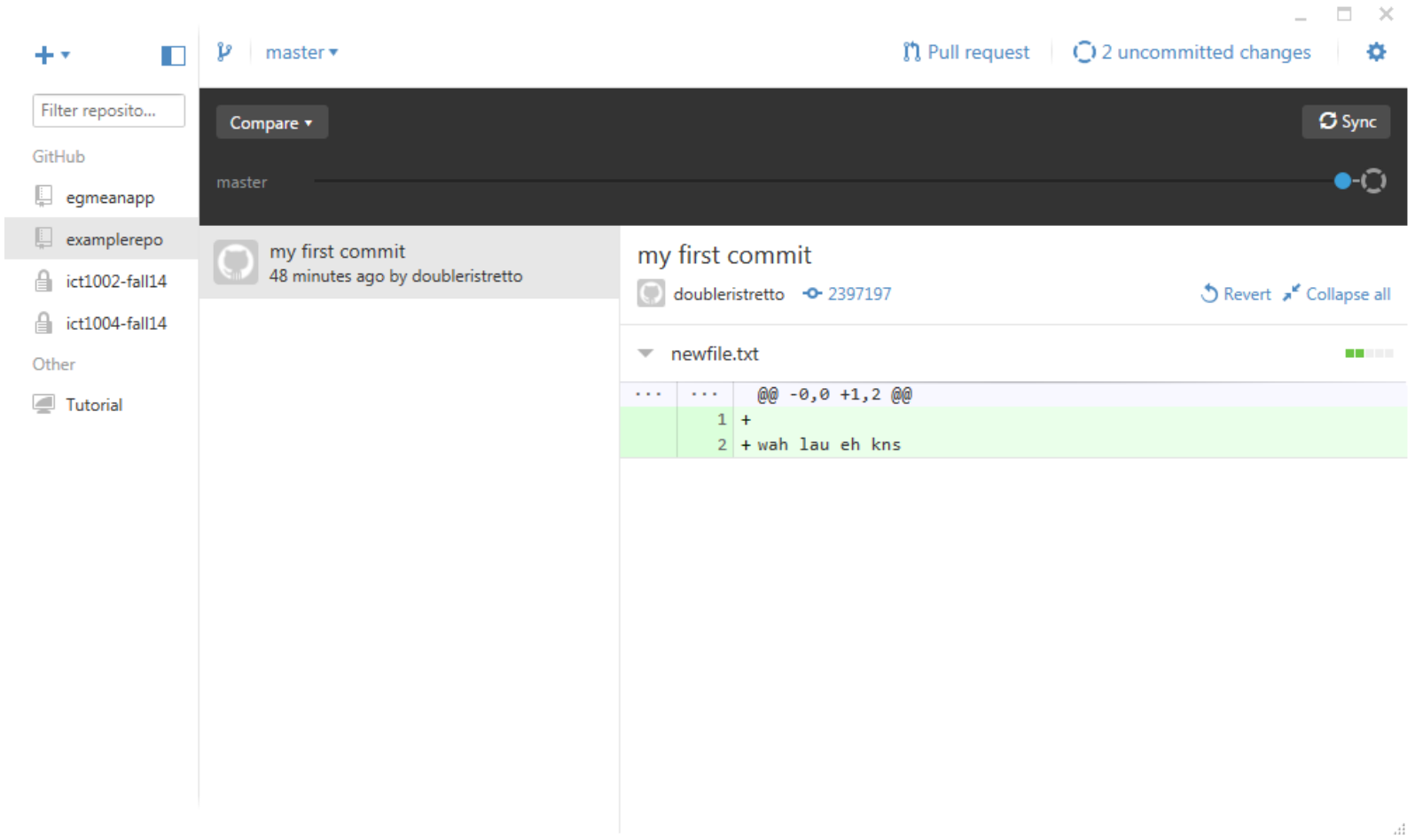
Git:

- 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

Add a repo in the GitHub Client



UI instead of command line



IMPORTANT

Ensure you are added to the HCI organization on Github!

https://github.com/inf2002

Lab Exercise (30 mins)

DUE DATE: WED 18 SEPT 2024 2359 HRS

Part 1

1. Create a folder and create a file called “team.txt” within that folder
2. Modify “team.txt” to add a line with your favorite football team and commit that to the repo
3. Create and push to **your own remote repo** (on Github) called “mylab2”

Part 2

Clone and pull from the **shared** INF2002 Lab 2 repo:

`https://github.com/inf2002/inf2002-lab02-2024.git`

1. Create a file of the format “<studentid>_<your name>.txt” and line 1 with your favorite song title and artist, line 2 with your github userid and line 3 with the URL of your Part 1 repo
2. Commit the text file to the shared repo
3. Push this file to the INF2002 lab 2 repo (how to handle conflicts?)

Resources

Getting Started

https://docs.github.com/en/get-started/quickstart/hello-world

GitHub Starter Course

https://github.com/inf2002/github-starter-course

GitHub Flow

https://github.com/education/Series-Intro-to-GitHub-Flow