Git In YU Computer Science

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Perspective On This "Git" Lecture

- We'll discuss what you need to get by
- And a bit more to whet your appetite

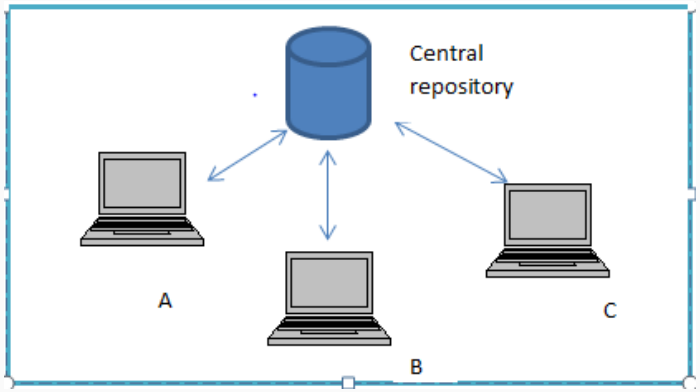
Why Version Control?

- A system that keeps track of your code changes
  - "code" == all of your project's artifacts
- Who changed the code? When?
- Revert any changes, return to known state

Why Git?

- Git provides distributed version control
- Users keep entire code base (and *history*) on their own machines
- Users can work locally
  - Without network access
  - Blazingly fast
- Until you're ready to push or pull

A Very Small Subset of Git



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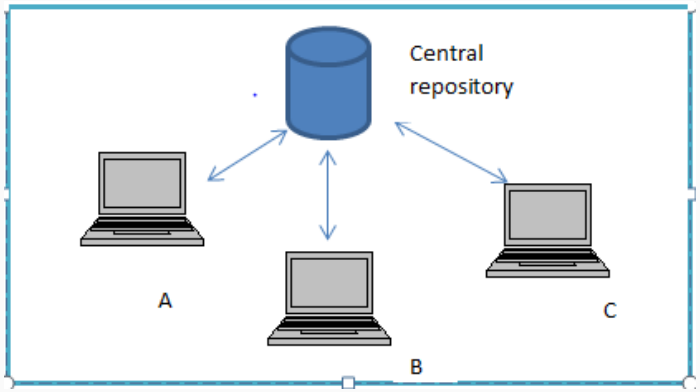

- You'll be using git to as a place to make your code visible to me
- And, optionally, for me to give you feedback
- You also benefit from having your code backed up to github

Git Features We're Not Using

- You will **not really** be using git's powerful *distributed version control* features

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- You will **not really** be using git's powerful *distributed version control* features
- Or, *peer-to-peer* development features

Workflow Sketch

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5. Did I make changes to your code (or add a file etc)?
6. You **pull** any changes from the remote repository to your local machine

Install Git On Your Laptop: Many Options

- Command-line
- Other command-line installs
- Altassian SourceTree, visual interface to git
- Other GUI clients
- Github Desktop
- Versions available for both Mac and Windows
    - Some are free, some are not.

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- Versions available for both Mac and Windows
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- Or use your favorite search engine

Minimal Git Configuration

You'll only need to do this once!

- *git config –global user.name "John Doe"*
- *git config –global user.email johndoe@example.com*
- If you want to specify the editor to use when interacting with git

You Already Have a Git Repository!

```
avraham@leff-3:tmp$ pwd
/tmp
avraham@leff-3:tmp$ mkdir YU_Git
avraham@leff-3:tmp$ cd YU_Git/
avraham@leff-3:YU_Git$ git clone https://github.com/Yeshiva-University-CS/testforleff.git
Cloning into 'testforleff'...
remote: Counting objects: 121, done.
remote: Total 121 (delta 0), reused 0 (delta 0), pack-reused 121
Receiving objects: 100% (121/121), 35.91 KiB | 5.13 MiB/s, done.
Resolving deltas: 100% (7/7), done.
avraham@leff-3:YU_Git$ ls
testforleff
avraham@leff-3:YU_Git$ ls testforleff/
IntroToAlgorithms IntroToCompSci    README.md         test.md
avraham@leff-3:YU_Git$
```

- git clone URL
  - You received that **URL** in your Git *invitation*
- You'll continue to push work to that repo

Connect File System To Remote Git Repo

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    - **My choice** on IntroToAlgorithms/homework

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   - As a *subdirectory* of your cloned repo
   - e.g., ../YUGit/IntroToAlgorithms/homework
   - **Your** choice on YUGit
   - **My choice** on IntroToAlgorithms/homework
   - "IntroToAlgorithms/homework" is your ROOT directory

Arrange File System To Taste

- You can clone the **URL** anywhere in your file system
    - Multiple times

Arrange File System To Taste

- You can clone the **URL** anywhere in your file system
  - Multiple times
  - Multiple locations
- Create sub-directories as needed

```
ROOT/RationalNumbers/src/main/java/edu/yc/oats/
    algs
```

Work Locally

```
avraham@leff-3:YU_Git$ cd testforleff/IntroToCompSci/homework/
avraham@leff-3:homework$ ls
arrays            conditional_logic exceptions        objects
avraham@leff-3:homework$ mkdir showme
avraham@leff-3:homework$ git status
On branch master
Your branch is up-to-date with 'origin/master'.

nothing to commit, working tree clean
avraham@leff-3:homework$ cd showme/
avraham@leff-3:showme$ touch App.java
avraham@leff-3:showme$ more App.java
avraham@leff-3:showme$ git add App.java
avraham@leff-3:showme$ git status
On branch master
Your branch is up-to-date with 'origin/master'.

Changes to be committed:
  (use "git reset HEAD <file>..." to unstage)

        new file:   App.java
```

Create, edit, remove files in blissful ignorance of git

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  - Can be a *subset* of these changes: you decide

You Made Changes To Your Code

- Created, edited, removed files
- You're ready to *bundle these changes together* in a snapshot
  - Can be a *subset* of these changes: you decide
- Invoke *git add file*
  - This adds file to the snapshot you're preparing

Commit When Appropriate Locally

```
avraham@leff-3:showme$ git commit -m 'Started empty homework assignment.' App.java
[master 99279fe] Started empty homework assignment.
 1 file changed, 0 insertions(+), 0 deletions(-)
 create mode 100644 IntroToCompSci/homework/showme/App.java
```

- *Ready?*

Commit When Appropriate Locally

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```

- *Ready?*
- Invoke *git commit*
  - You've just created a snapshot!
- Use *-m* option to specify a message that will be associated with this commit
  - Or git will demand one from you ☺

Some Useful Commands

- *git status*: What is git's view of your repository's status?
- *git diff* : What changes have been made since your last commit?
- *git log*: What's the history of commit messages
- You can supply a specific file name to these commands
    - To see the status of, or changes to, a specific file

Push When Ready

```
avraham@leff-3:showme$ git push
Counting objects: 6, done.
Delta compression using up to 4 threads.
Compressing objects: 100% (3/3), done.
Writing objects: 100% (6/6), 430 bytes | 430.00 KiB/s, done.
Total 6 (delta 2), reused 0 (delta 0)
remote: Resolving deltas: 100% (2/2), completed with 2 local objects.
To https://github.com/Yeshiva-University-CS/testforleff.git
   0ae10ff..99279fe  master -> master
avraham@leff-3:showme$
```

- git push takes your *local* commit(s)
  - And pushes those changes to your remote repository
- Now other people (with access to your repository) can see your commit(s)

Pull When Available

```
avraham@leff-3:showme$ git pull
Already up-to-date.
avraham@leff-3:showme$
```

- git pull takes the changes made to your *remote* repository
  - Any *commits* made by other people
  - Pulls them to your local computer
  - Updates your file system with these changes

(Re)Moving Files

- If you've made git aware of a file

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(Re)Moving Files

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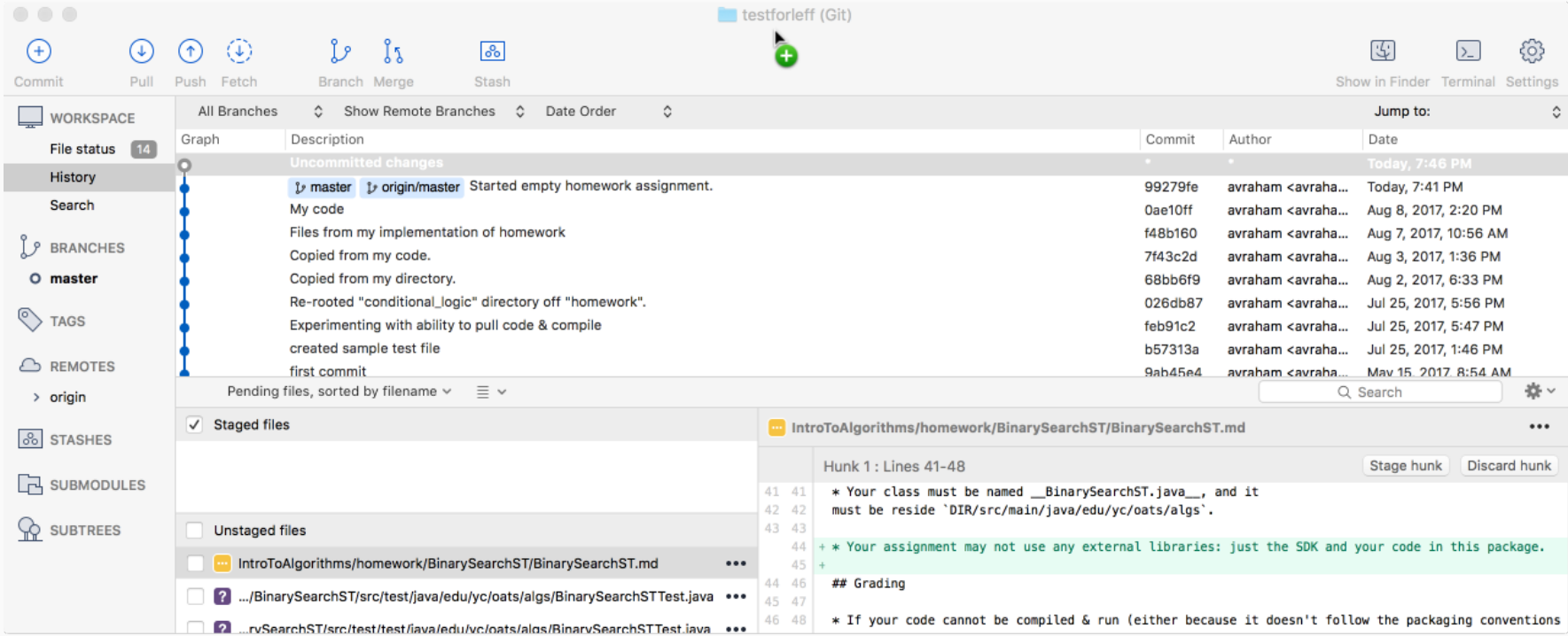
- What do you think will happen if you yank it away?
  - *rm file* or *mv file*
- Trust me: you don't want to confuse git
- Instead
  - *git rm file* removes file from working tree
  - *git mv file* move or rename a file or a directory
- You *commit* those changes like any other change set

A Graphical View: SourceTree



Gazillion Resources

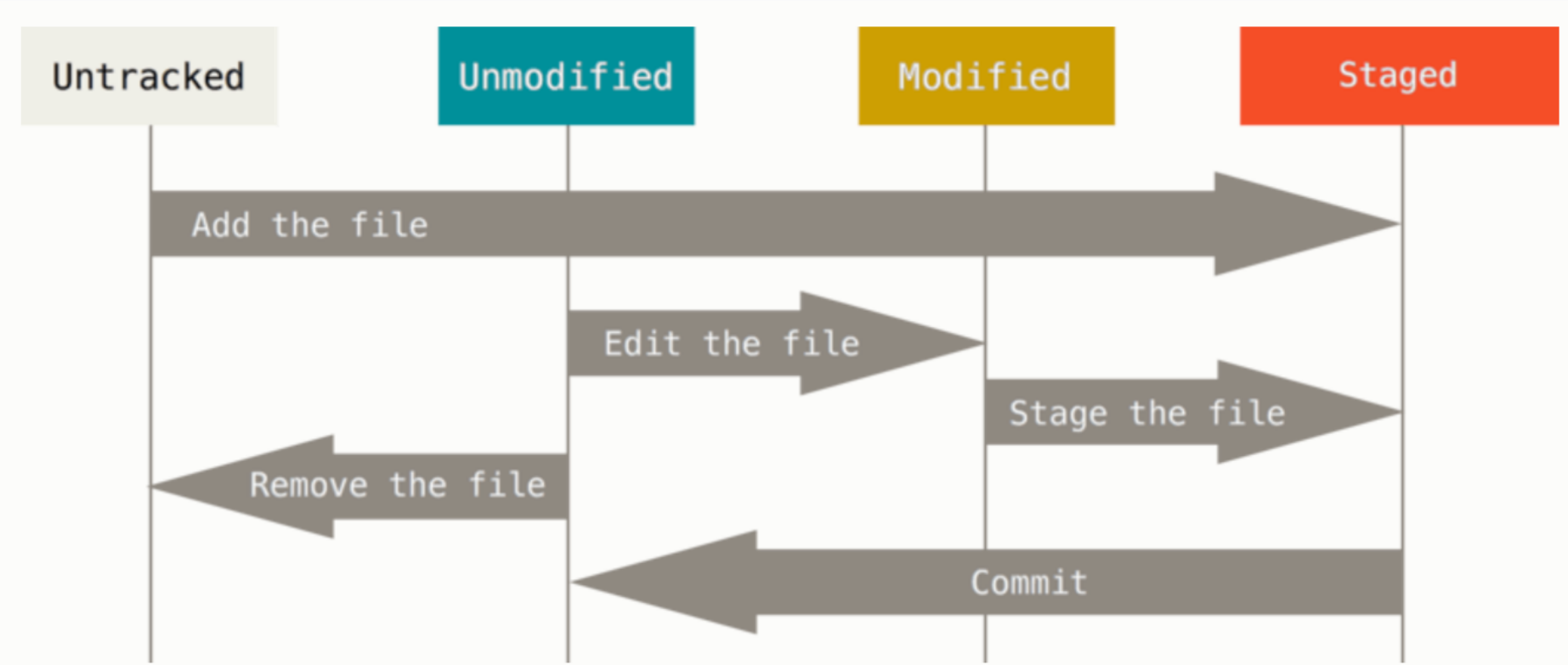
- I strongly urge you to keep it simple!
  - Not the focus of this course
  - And you don't need more to get your work done
- git - the simple guide
- Using Git (Sections A through E)
- OK: you asked for it ...

The Three Git States

Your files can be in one of three states:

- Committed: data are safely stored in your local git database
- Modified: file has been changed, but not yet **committed**
- Staged: you asked that current version of **modified** file go into your next commit snapshot

Git File Lifecycle



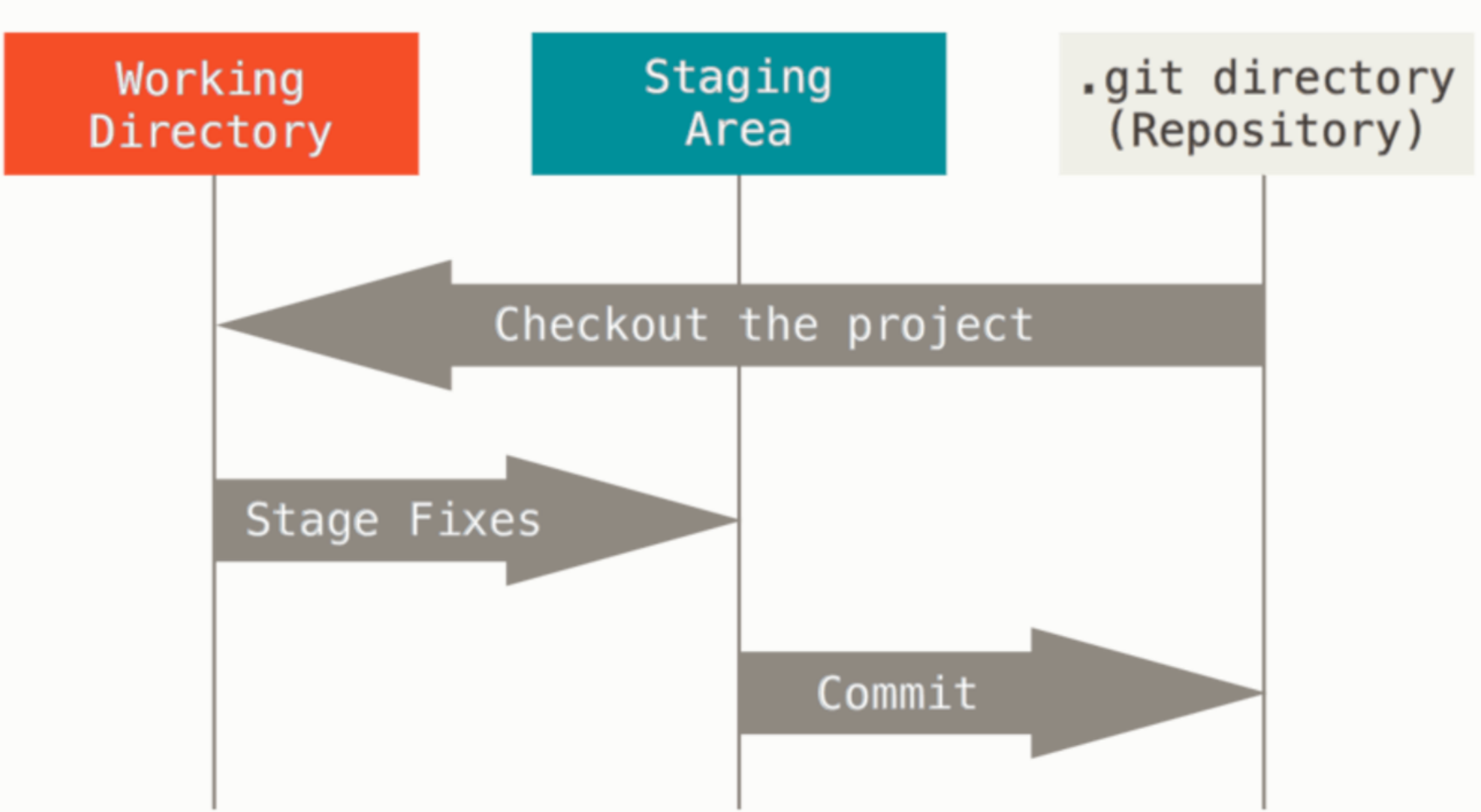
Git Directories: .git & Working Tree

- .git directory: where Git stores the metadata and object database for your project
  - Most important part of Git: what's copied when you clone a repository from another computer
- Working tree: a single checkout of one version of the project
  - Files are pulled out of the compressed **.git database**

Git Directories: Staging Area

- Staging area: a file in **.git directory** that stores information about what will go into your next commit
  - You modify that file, e.g., with git add and git commit

Interaction Between Git Directories



Tracked versus Untracked

- Each file in your working directory can be in one of two states
  - *Tracked*: files in last snapshot
  - *Untracked*: everything else – any files in your working directory that were
    - not in your last snapshot
    - not in your staging area
- Tracked files can be unmodified, modified, or staged
- As you edit files, Git sees them as modified
  - You changed them since last commit

Commits Create a Snapshot

- Records entire state of your file system at that point
- Efficient
  - Delta relative to previous commit
  - Reference to parent (previous) commit
  - SHA-1 hash (40-character string), calculated based on the contents of a file and directory structures

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- Interactions (nearly all) with Git only add data to git database
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- Once you commit

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- Interactions (nearly all) with Git only add data to git database
  - Data are not erased
- Once you commit
  - Especially if you **push**
- Hard to lose data
- This make it easy to undo things
  - Which we won't be discussing

What Else Aren't We Discussing?

- Concept of branch
- Concept of merge
- Concept of rebase

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- Concept of branch
- Concept of merge
- Concept of rebase
- These give you tremendous freedom to **experiment** and thus be more *agile*