Before We Begin…

All links can be found on:
https://github.com/UWB-ACM/git-gud-workshop-spring-2019

1. Install Git (command line)

   https://git-scm.com/downloads

2. Create a GitHub account if you don't have one already.

   Use a private email (not your school email)

   https://github.com/

3. Comment in the following issue to get added as a contributor to today's example repository

   https://github.com/UWB-ACM/FancyCalculator/issues/60

```
$ git gud
git: 'gud' is not a git command. See 'git --help'.

The most similar command is
        gui
```

Presenters: Alan Gonzalez

Git Gud

Workshop

By your friends at

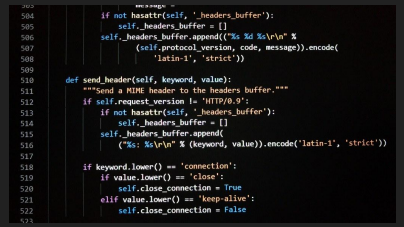
UWB ACM

Git Gud

Let’s review old concepts

How Git Works - Overview

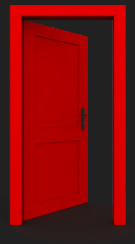
Step 1 - Code



```
            if not hasattr(self, '_headers_buffer'):
                self._headers_buffer = []
            self._headers_buffer.append(("%s %d %s\r\n" %
                    (self.protocol_version, code, message)).encode(
                        'latin-1', 'strict'))

    def send_header(self, keyword, value):
        """Send a MIME header to the headers buffer."""
        if self.request_version != 'HTTP/0.9':
            if not hasattr(self, '_headers_buffer'):
                self._headers_buffer = []
            self._headers_buffer.append(
                ("%s: %s\r\n" % (keyword, value)).encode('latin-1', 'strict'))

        if keyword.lower() == 'connection':
            if value.lower() == 'close':
                self.close_connection = True
            elif value.lower() == 'keep-alive':
                self.close_connection = False
```

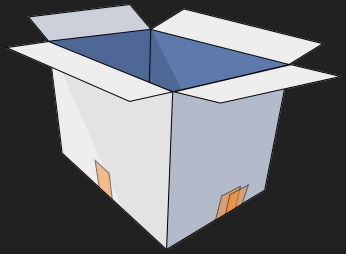
Code on your **local computer.**

Step 2 - Stage



Choose which file changes you want to save.

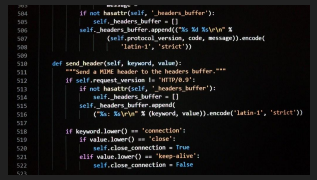
Step 3 - Commit

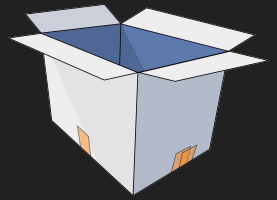


Save your changes to your code in a commit.

We'll go into more detail in the workshops

Code Commit Upload





GitHub

Vocabulary: Repo

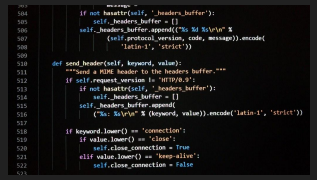
- **Repo / Repository**

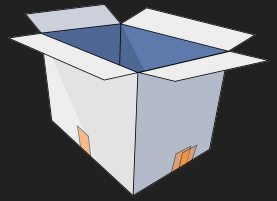
A directory tree which is named `.git`.

The repository contains a representation of the contents of a directory tree, or *project*, on your computer.

Git tracks changes to files in your project, and stores the revision history of the project in the repository folder.

Code Commit Upload





GitHub

Vocabulary: Commit

- **Commit**

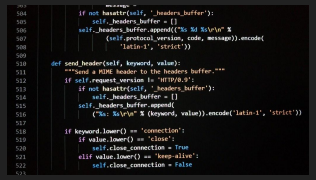
A set of changes applied to files which is permanently saved to the repository history.

A commit is always linked to one or more *previous commits* (called *parents*), creating a chain of revisions.

Commits also have authors and messages associated with them, detailing who created the changes and why.

Commits are uniquely identified using a SHA256 hash.

Vocabulary: More Goodies



- **Status**

The current state of your repository. It has lots of great information. If (or when) you feel lost, run `git status` to see what's up with your project.

- **Staging**

Staging changes in git ensures those changes will be included in your next commit.

Typically, this is done through the git add command.

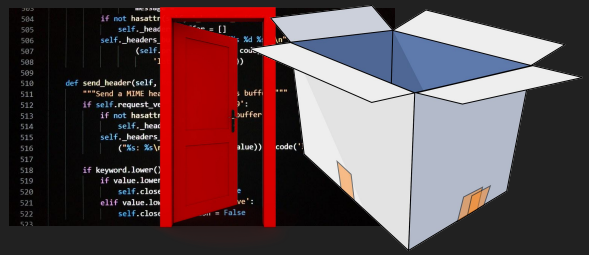
The staged changes will be in your ***staging area*** until you commit them or remove them from the staging area.

How Remote Syncing Works - Overview

Step 1 - Pull

Download (aka pull)
new changes and
update your local
copy of the repository.

Step 2 - Commit



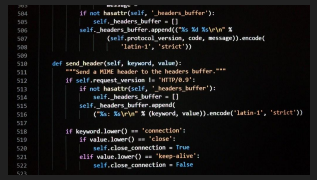
Make changes and
save your changes
in a commit.

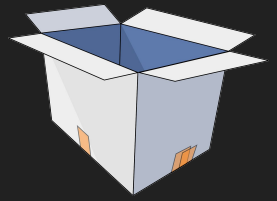
Step 3 - Push

Upload (aka push)
your commit(s) to the
server.
Now others can view
the code with your
changes included.

We'll go into more detail on the next slides

Code Commit Upload





GitHub

Vocabulary

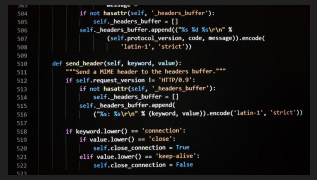
- **Remote**

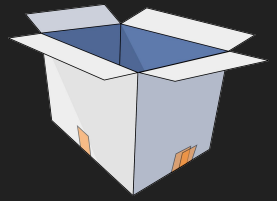
The repository’s remote points to a remote storage endpoint which contains a copy of the current repository.

The remote has a name; a common convention is to call the remote `origin`.

Code Commit Upload

Vocabulary





GitHub

- **Push**

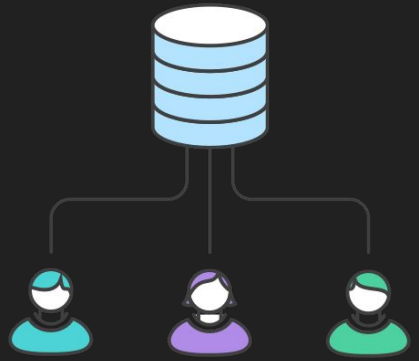
Sync local changes to the repository by uploading local commits to remote storage (GitHub, GitLab, BitBucket, SourceHut, private servers, etc.).

- **Pull**

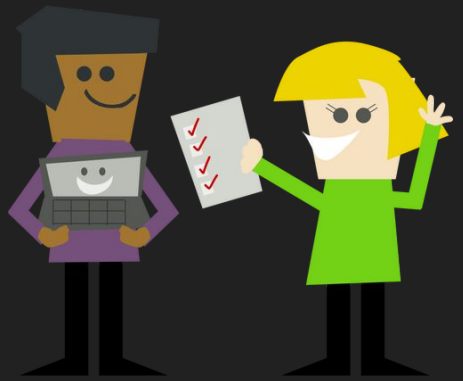
Retrieve changes from repository by downloading commits from remote storage.

Note: you can only run push & pull when you have a remote identified in your repository.

How Collaboration Works - Overview



Multiple people can collaborate on the same code easily.

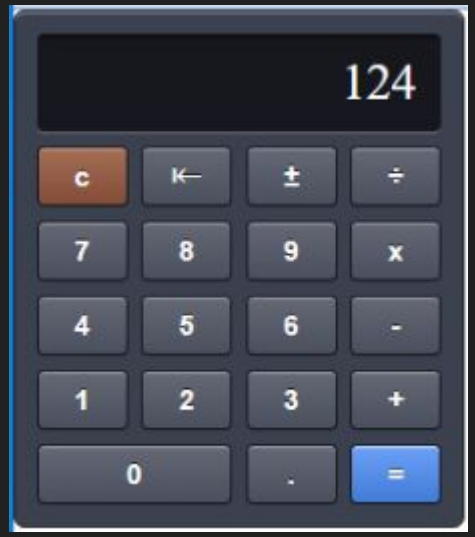


Bugs, feature requests, and large projects can be tracked alongside the code.

Collaborators can easily review each other's code to find bugs faster and build better software.

Today's mission: build the **Enterprise Calculator**

We are the development team for **UWB ACM Incorporated**. Our company has just bought a startup: FancyCalculator. Our management has asked this team to use this as a starting point to create our new flagship product: The Enterprise Calculator.



Git Better

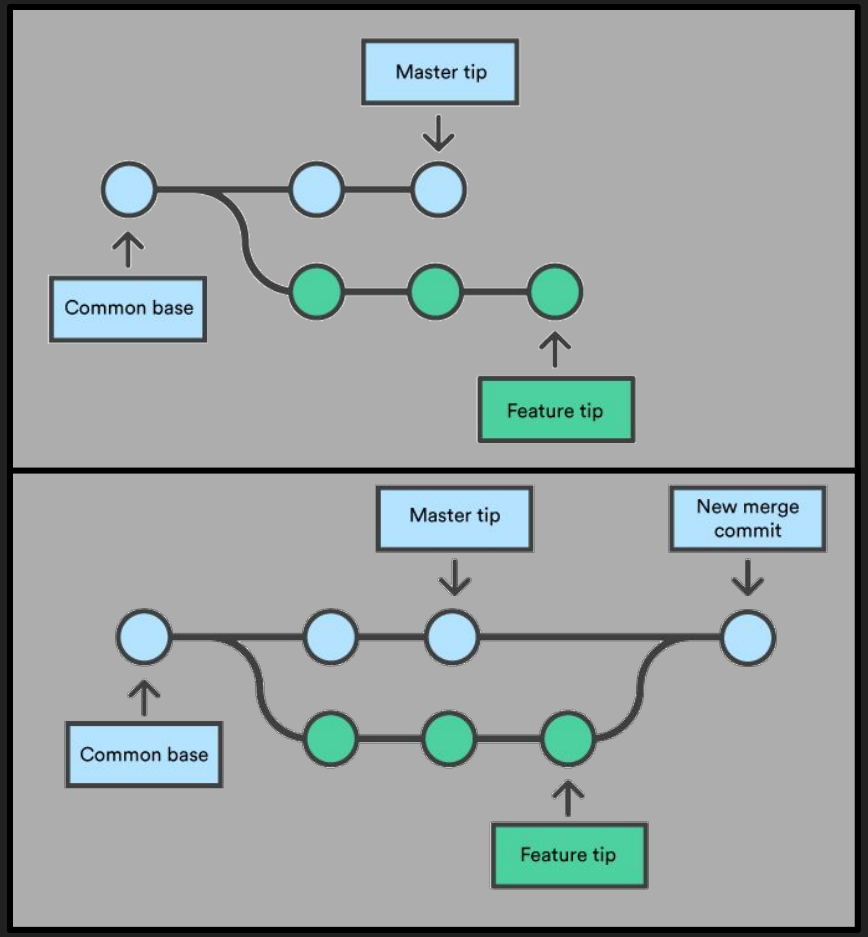
More useful things to know about git

Branches

Branches keep track of changes, from a shared starting point.

Branches can:

- Separate from another branch
- Merge into another branch
- Contain different contents from another branch



Using Branches

Why are branches useful?

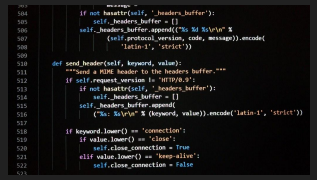
- Add new features or potentially hazardous changes to the codebase without affecting the stable version of the repository
- Allow multiple developers to make changes to the same files without overwriting each others' work

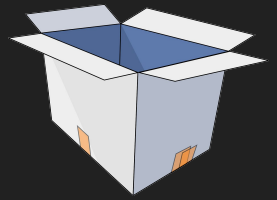
How do branches get merged together?

- GitHub: *pull request*
- GitLab: *merge request*
- Command Line: `git merge`

Code Commit Upload

Vocabulary - Cont.





GitHub

- **Branch**

A *branch* is a human-readable label which points to a series of commits. The commit history for different branches can diverge, and users can switch between branches as needed.

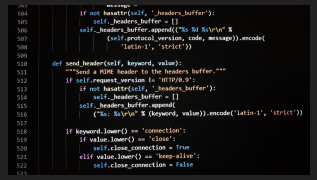
Branches are used to manage parallel development efforts within projects, and allow for experimentation and prototyping without impacting “finished” code.

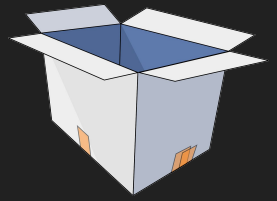
- **Merge Commit**

A merge commit combines the changes from two different diverging branches back into a single branch. A merge commit has two parent commits instead of the typical single parent.

Code Commit Upload

Vocabulary - Cont.





GitHub

- **Pull Request (aka Merge Request)**

A pull request is closely related to branches, and not related to “pulling changes” at all. A pull request is a *polite way of creating a merge commit*.

Most remote storage providers (GitHub, GitLab, etc) provide a browser-based solution of creating merge commits, and facilitating code reviews in the process.

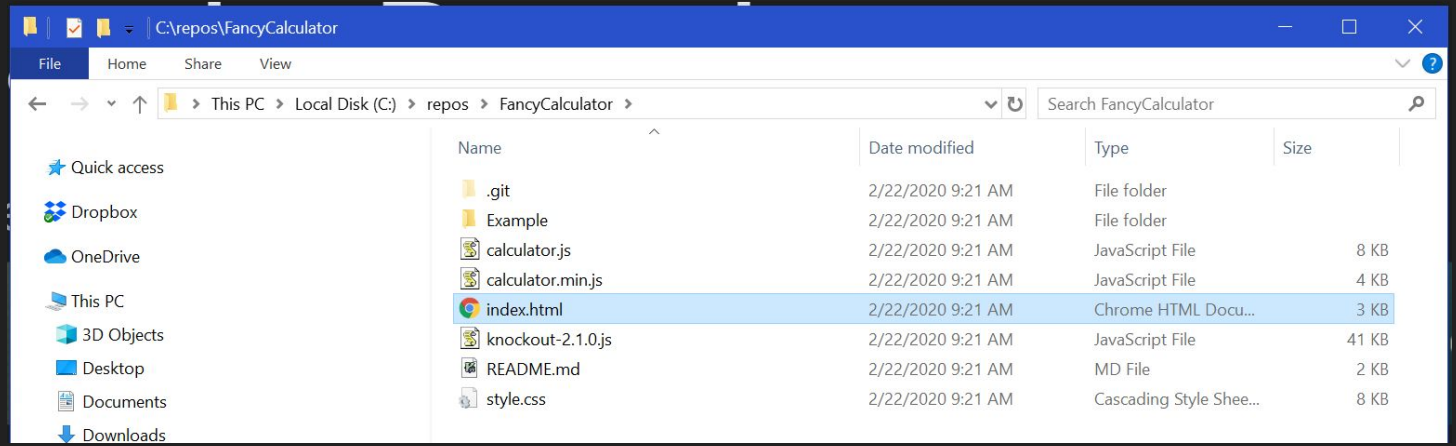
Pull requests are not a part of the git command set. It is an invention of remote storage providers.

Commands: Branches

- Clone the repo:

```
C:\repos>git clone https://github.com/UWB-ACM/FancyCalculator.git
```

- Inspect the contents of the cloned repo:

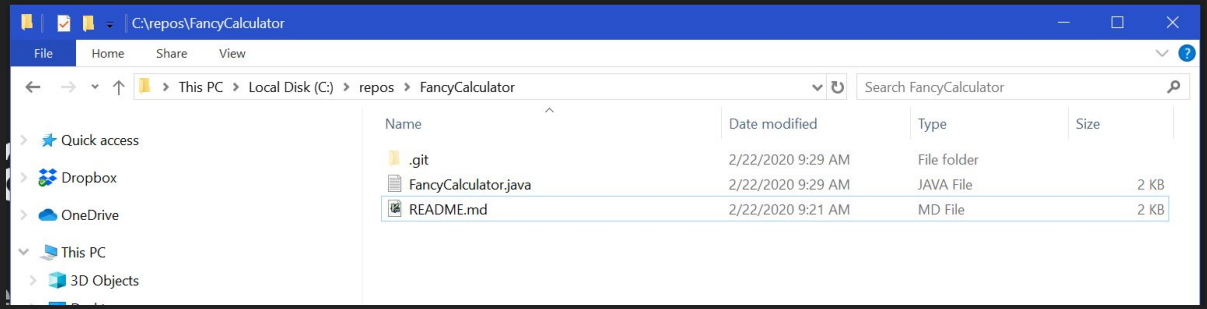


Commands: Branches

- Checkout the **feature/move-to-java** branch:

```
C:\repos\FancyCalculator>git checkout feature/move-to-java
Switched to branch 'feature/move-to-java'
Your branch is up to date with 'origin/feature/move-to-java'.

C:\repos\FancyCalculator>
```

- Inspect the contents of the cloned repo, **the files changed**!



Commands: Branches

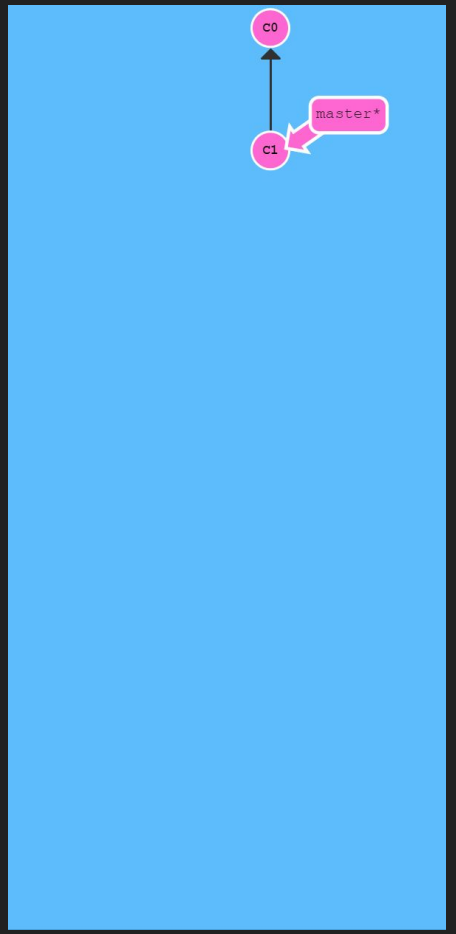
- Go back to the master branch:

```
C:\repos\FancyCalculator>git checkout master
Switched to branch 'master'
Your branch is up to date with 'origin/master'.
```

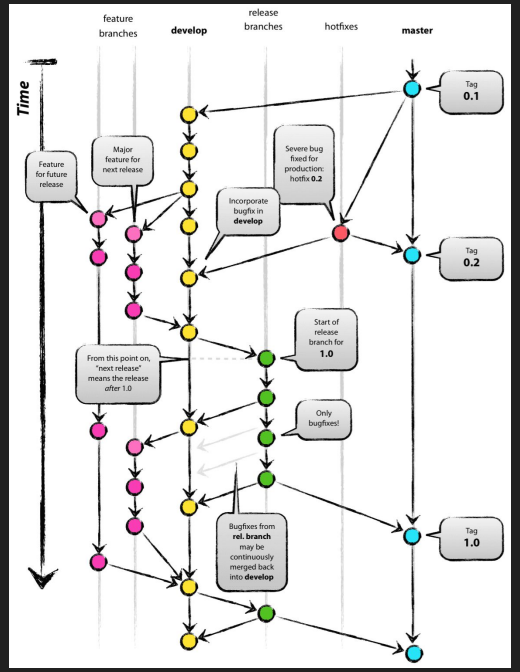
Branches: what happened?

- Commits are being added to master branch.
- At some point a new branch was created:

  feature/move-to-java
- Commits are being added to the new “feature” or “topic” branch.
- Git has a reference to both HEADs of the branches so we can easily switch to them.

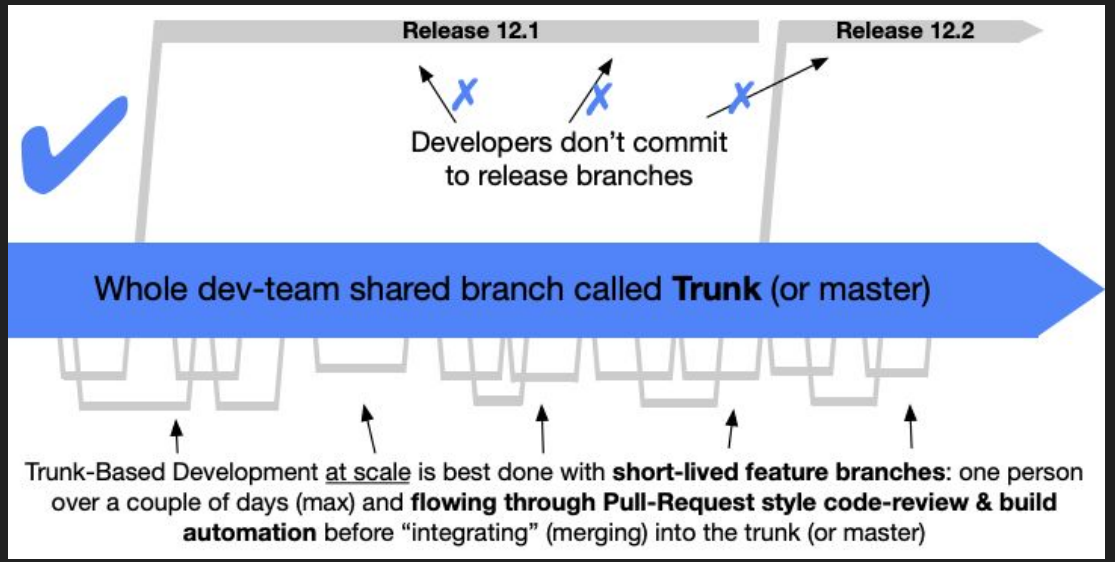


Workflows: Branching strategy or flow



gitflow

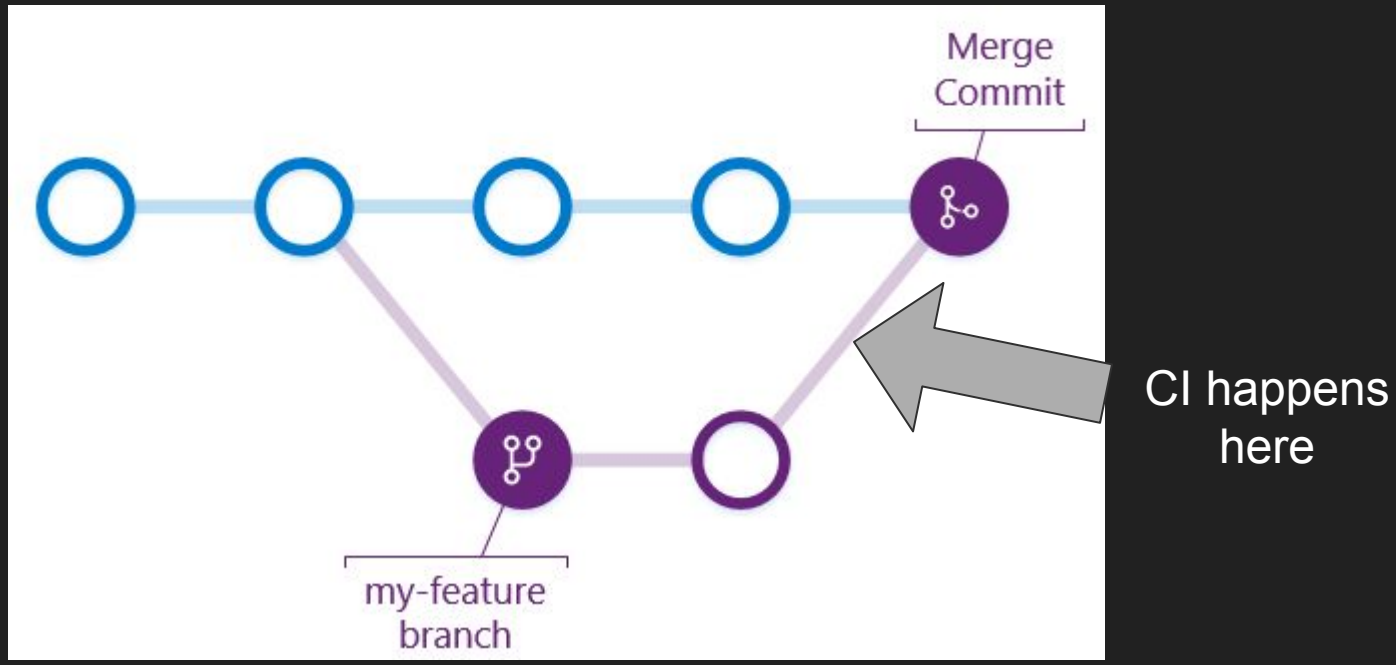
https://nvie.com/posts/a-successful-git-branching-model/



single trunk

https://trunkbaseddevelopment.com/

Protecting the master branch: **Continuous Integration**

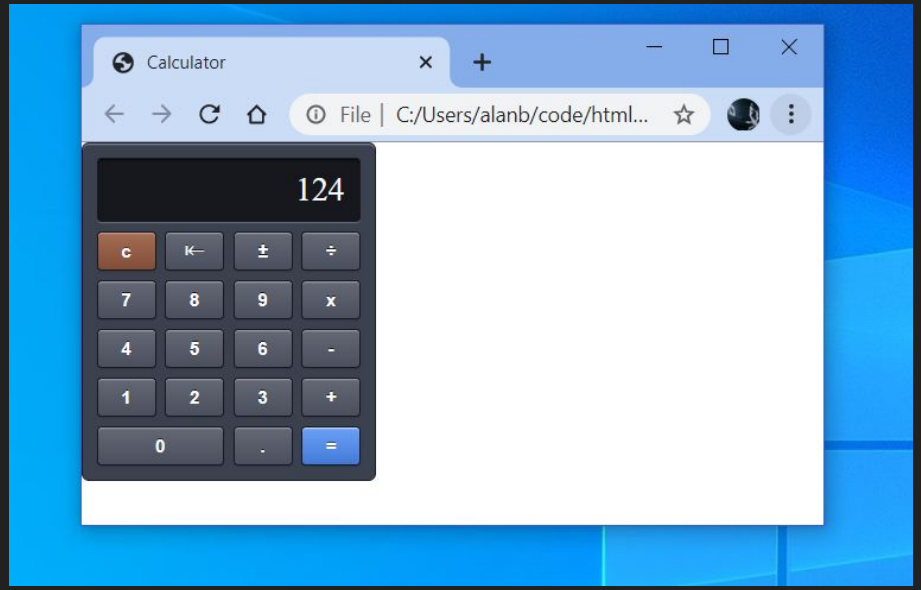


Workshop

Let’s do our first contribution

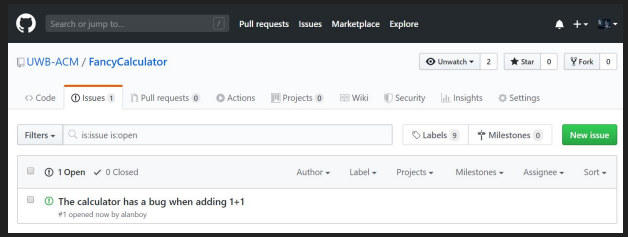
Run the project locally

1. You have the project cloned.
2. Make sure you are in the **master** branch.
3. Open Index.html

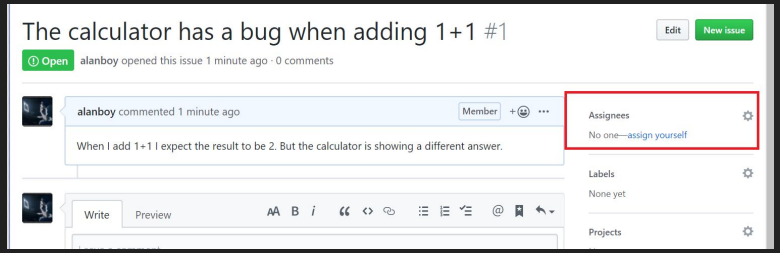


Pick a bug and create your topic branch

1. Go to https://github.com/UWB-ACM/FancyCalculator/issues



2. Look for a bug and **assign it to yourself**!

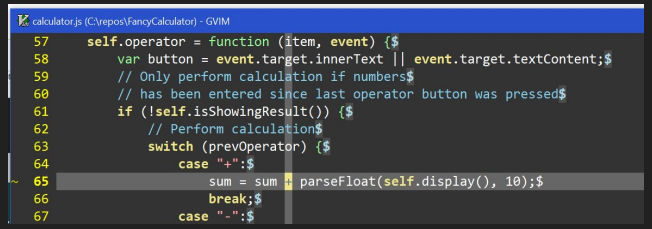


3. `Create a new branch:`

```
C:\repos\FancyCalculator>git checkout -b fixing_addition
```

Push your changes to GitHub

1. Fix the bug:
   a. The bug description has precise instructions on hot to fix the bug
2. Add to staging area and commit:
   a. Your file is now modified. Add it to the staging area with `**git add**` and then commit your changes with `**git commit**`.
3. Push your branch
   a. Your branch is known locally (in your PC) but we want the remote server to also know about it, so we do `git push --set-upstream origin <<name of branch>>` (see notes for more on this)



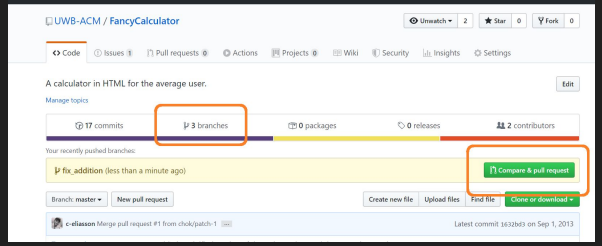

```
C:\repos\FancyCalculator>git status
On branch fix_addition
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   calculator.js

no changes added to commit (use "git add" and/or "git commit -a")
```

```
C:\repos\FancyCalculator>git add calculator.js

C:\repos\FancyCalculator>git status
On branch fix_addition
Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
        modified:   calculator.js
```

```
C:\repos\FancyCalculator>git commit -m "Fixed the addition operation"
[fix_addition 48f7d73] Fixed the addition operation
 1 file changed, 1 insertion(+), 1 deletion(-)
```

Find your branch and start a Pull Request

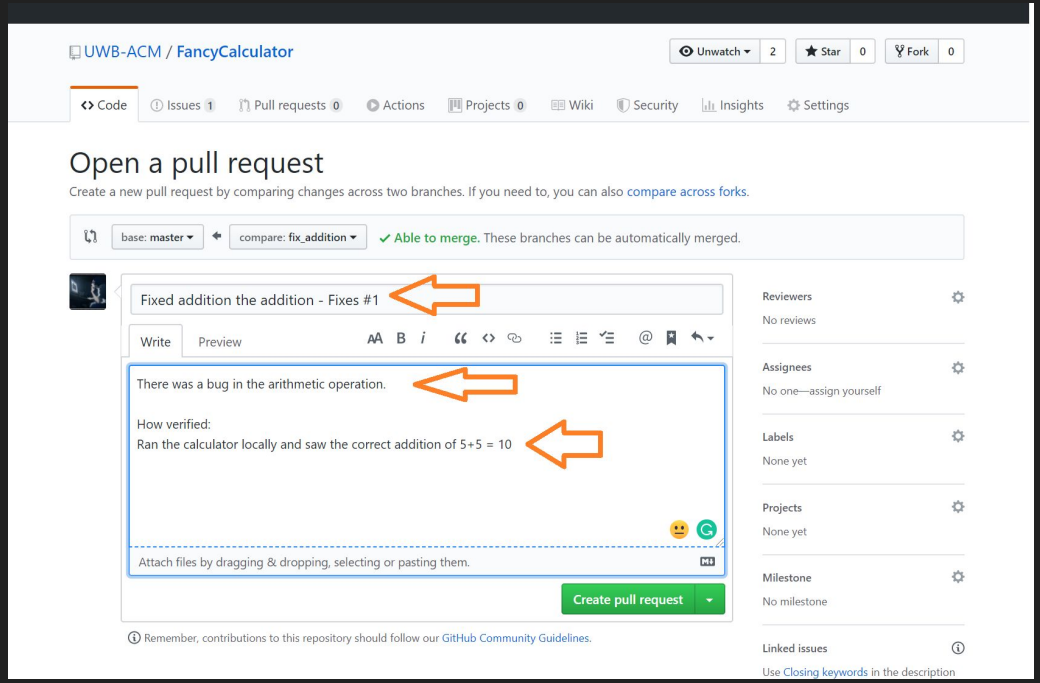
1. Go to https://github.com/UWB-ACM/FancyCalculator/branches



2. Find your branch and start a Pull Request

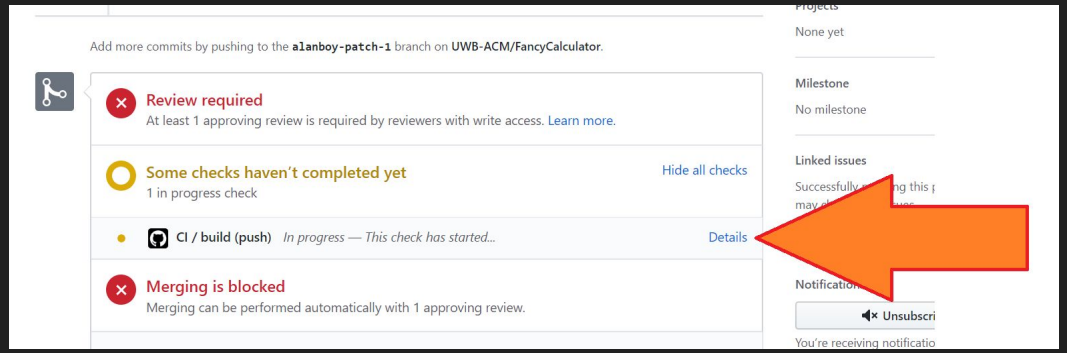
Add details to the Pull Request

1. Add a title. Include the text “Fixes #1” if you want to automatically close bug #1 when you complete this PR.
2. Add a description.
3. Add a how verified section so that reviewers know how you tested this code.



Check on your CI build

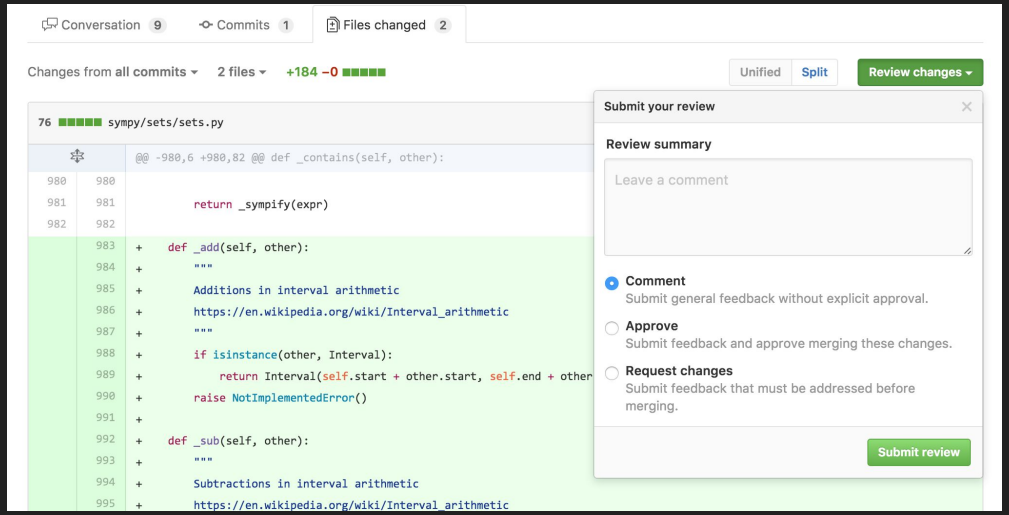
- Continuous Integration will run some tests on your branch.



- Our repo has two policies:
  - 1 reviewer must approve
  - Must pass CI build

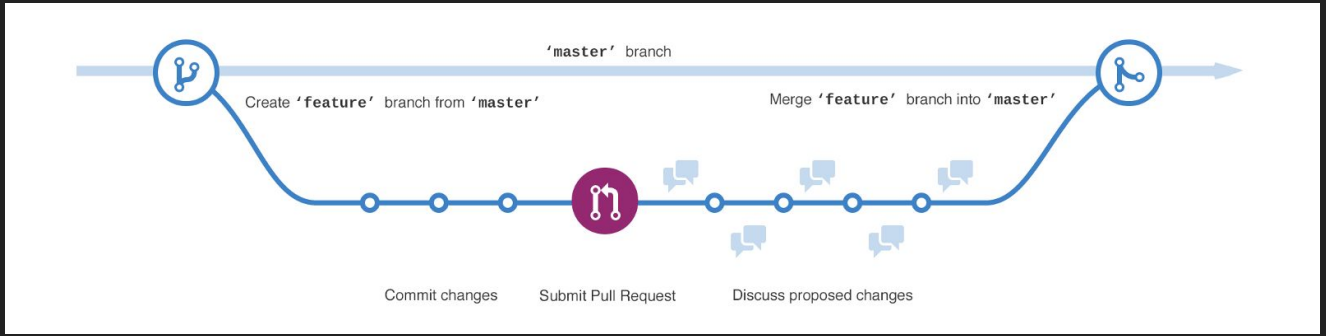
Complete someone else's PR

- Review changes and approve the PR for someone else



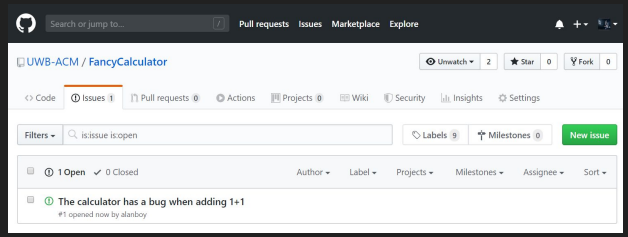
Your PR is completed: what happened?

- Your PR was completed.
- Your changes are now in master branch.
- The issue should be closed.

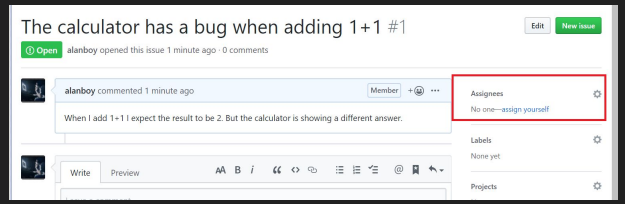


Let’s try this again: pick a bug to fix

1. Go to https://github.com/UWB-ACM/FancyCalculator/issues

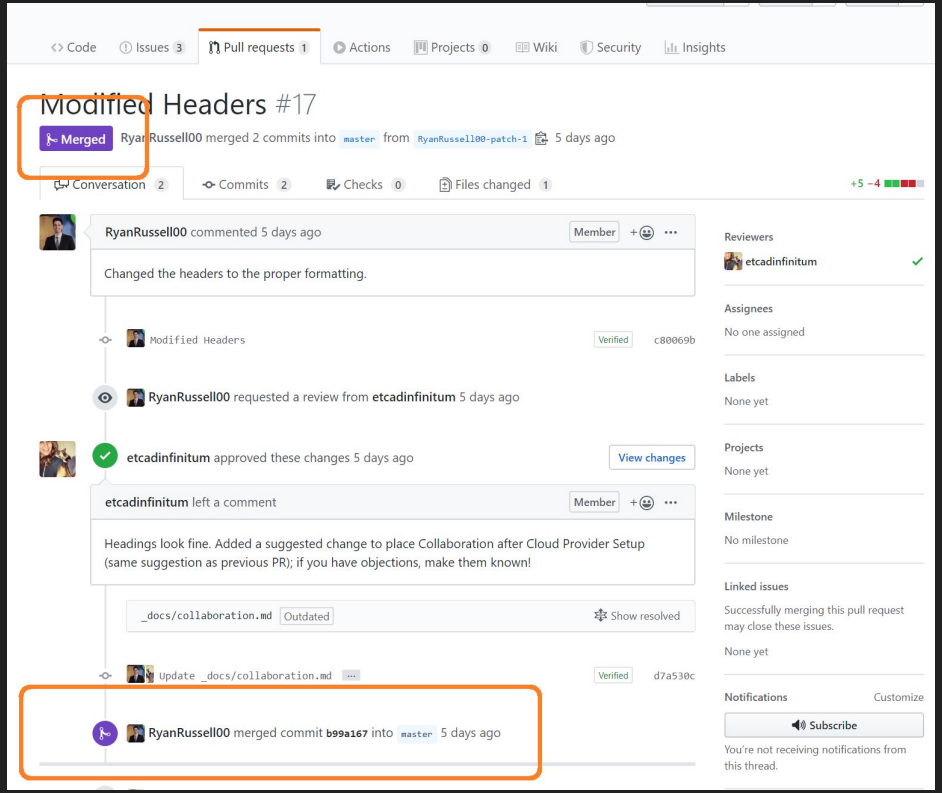


2. Look for a bug and **assign it to yourself**!



Make sure you create a new branch off master!

Your topic was merged in the **remote** repository (on GitHub), but your **local** repository does not know nothing about these changes, you need to **PULL** the changes.



Make sure you create a new branch off master!

- The **PULL** command works on the current branch, since we want to PULL master, let's change branches.
- Run `` `git status` `` to know which branch you are in.
- If you are not in master, checkout master with `` `git checkout master` ``
- Now you can `` `git pull --rebase` ``

```
C:\repos\FancyCalculator>git status
On branch fix_addition
Your branch is up to date with 'origin/fix_addition'.

nothing to commit, working tree clean

C:\repos\FancyCalculator>
```

```
C:\repos\FancyCalculator>git checkout master
Switched to branch 'master'
Your branch is up to date with 'origin/master'.
```

```
C:\repos\FancyCalculator>git pull --rebase
Updating 4951467..1632bd3
Fast-forward
 calculator.js | 6 +++---
 1 file changed, 3 insertions(+), 3 deletions(-)
Current branch master is up to date.
```

Now you can create your own branch off the new updated master

Now you can create your new branch

use branch naming structure: users/(your name)/fixbux)

```
C:\repos\FancyCalculator>git checkout -b users/alango/fix-a-bug
Switched to a new branch 'users/alango/fix-a-bug'
```

And start working on your new bug (the instructions on what to do are in the bug description)

Make your code changes, but DON'T COMMIT anything yet.

Show your changed files (not commited)

If you run git status now, it should look something like this:

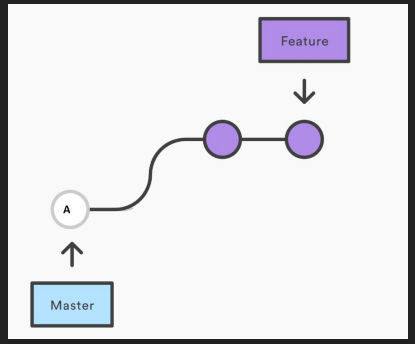
```
C:\repos\FancyCalculator>git status
On branch a_different_bug
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   calculator.js

no changes added to commit (use "git add" and/or "git commit -a")

C:\repos\FancyCalculator>
```

Your changed files should NOT be staged for commits. If you accidentally committed just make a different change to the file.

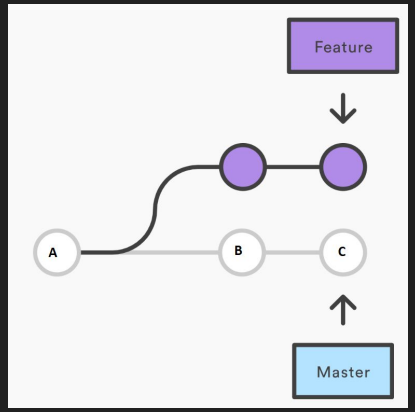
Master was updated*!*

You are on your way working on the feature branch and adding commits to your branch and that's great… until...

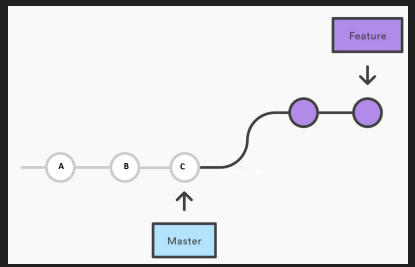
a dev has updated the **master** branch by completing a PR. This means that you are now "behind". You want to "update your feature branch".



This is how we started. We created a new branch off the master tip. And started adding commits (purple).



Then, master got two new commits (B and C). We want to bring these changes to our topic branch.



We rebased the branch, we are again starting off the master head.

Saving your work: Stash

We want to catch up our branch, but we are in the middle of uncommitted work, for that we can use stash. The stash command saves your local modifications away and reverts the working directory to match the HEAD commit.

Run `git stash`

```
C:\repos\FancyCalculator>git stash
Saved working directory and index state WIP on a_different_bug: 8362669 .
```

Now run `git status` to see the result of the stash:

```
C:\repos\FancyCalculator>git status
On branch a_different_bug
nothing to commit, working tree clean
```

Let’s catch up with the remote master

Let’s “rebase” with `git pull --rebase origin master`

```
C:\repos\FancyCalculator>git pull --rebase origin master
From https://github.com/UWB-ACM/FancyCalculator
 * branch            master     -> FETCH_HEAD
First, rewinding head to replay your work on top of it...
```

Don’t forget your stashed changes

The stash is a stack, so by stashing you have “pushed” a set of changes, and now you can “pop” them back into your working area:

```
C:\repos\FancyCalculator>git stash pop
On branch a_different_bug
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   calculator.js

no changes added to commit (use "git add" and/or "git commit -a")
Dropped refs/stash@{0} (d0ecda9d0e14c0d806e5fd41b011f974ade11a30)
```

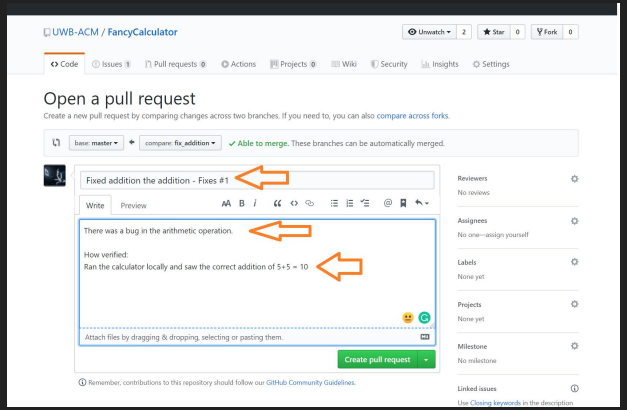
You are back on track, now create and complete the PR

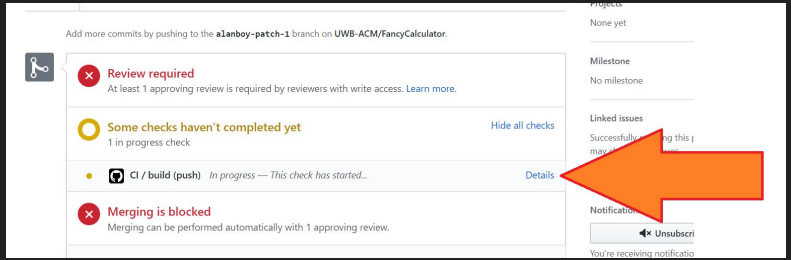
Create the PR, add the title, description and how verified section.

Get someone to review

Wait for continuous integration

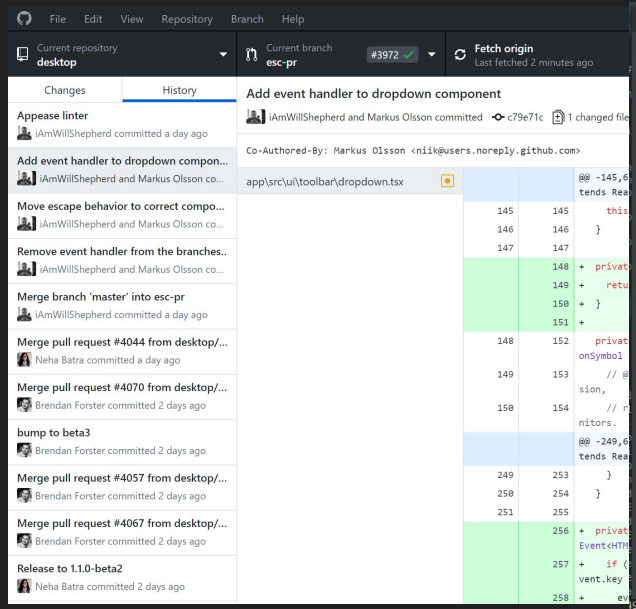
Complete the PR

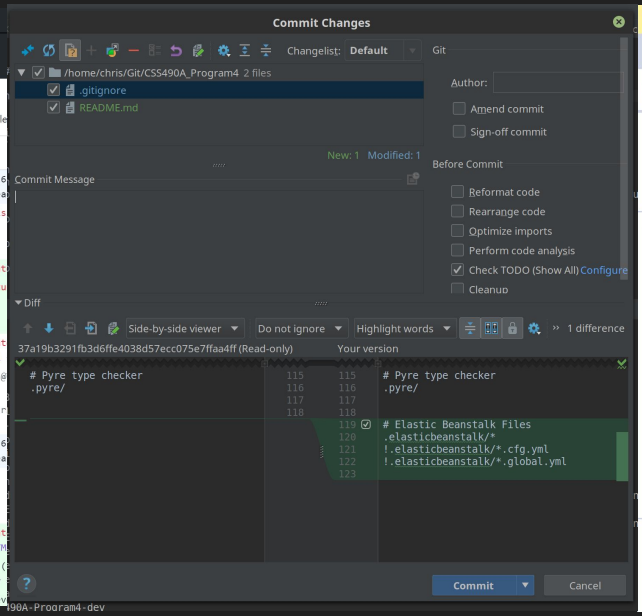


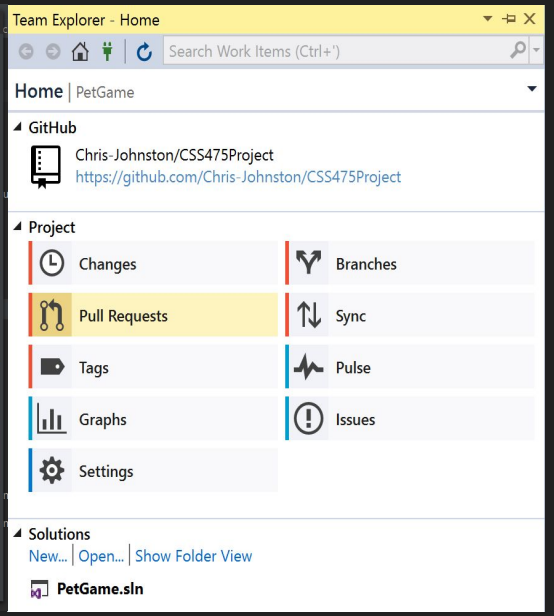


Git GUIs

Nearly every modern IDE will have a Git plugin (so does vim)





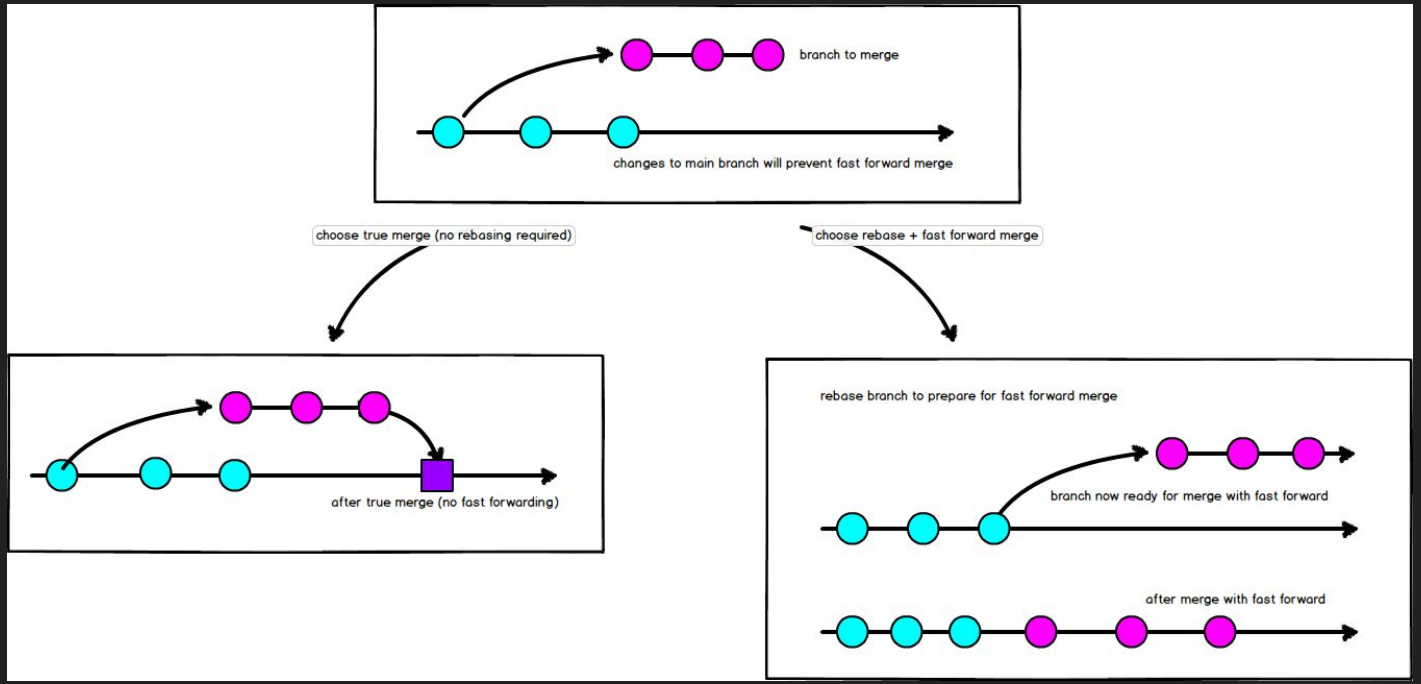


GitHub Desktop is a Git client that is oriented around GitHub. It works with non-GitHub repos too.

The JetBrains IDEs (IntelliJ, PyCharm, CLion) have pretty good Git integration.

Visual Studio has a pretty solid Git integration.

Merge vs Rebase



Further Topics

*GitHub Issues

*Markdown & making a good readme

*Continuous Integration & Continuous Deployment: GitHub Actions, TravisCI, Jenkins, CircleCI

Releases / tags

Licensing

In-Depth Merging

Interactive Rebasing

Forking a repo

Gitignore

Gitattributes

hooks

If you have *questions* right now, we can try to give a brief explanation.

We encourage you to learn these on your own! Practice! Try using Git for your programming assignments.

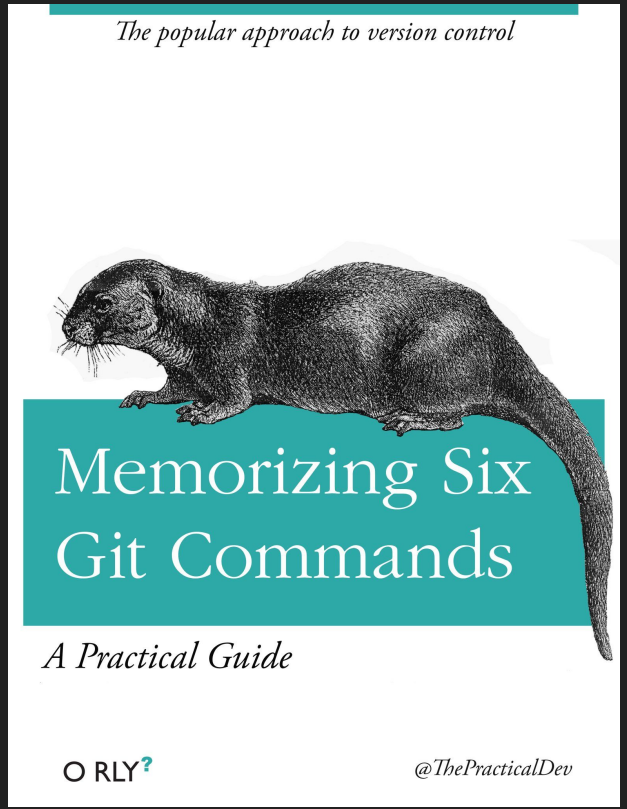
Great Resources for Further Reading

The official Git documentation: https://git-scm.com/doc

GitHub documentation: https://guides.github.com/

Atlassian Git tutorials: https://www.atlassian.com/git/tutorials

And of course: Google, Stack Overflow, and your peers!



Questions?
Comments?
Concerns?

Anything from the previous slides or b e y o n d?