Version control for researchers with Git and GitHub

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Why use Git and GitHub?

- Sleep better at night with version control and remote repositories
- Collaborate smoothly with teammates
- Promote and maintain quality in your code
- Increase the impact of your research
- Develop your career
- Contribute in the open source community

After this workshop you should be able to…

- Explain how version control, Git, and GitHub can help you and your team
- Create a new project that is tracked with Git, or add Git to an existing project
- Use a simple workflow with Git and GitHub that is useful for small or individual projects
- Use a more complex workflow with branches and pull requests
- Contribute to some else’s open source project on GitHub
- Know where to go to learn more

Git vs. GitHub

- Git = software for version control

Will learn to use basic Git commands: `init, remote, fetch, merge, status, add, commit, merge, push, fetch, checkout`

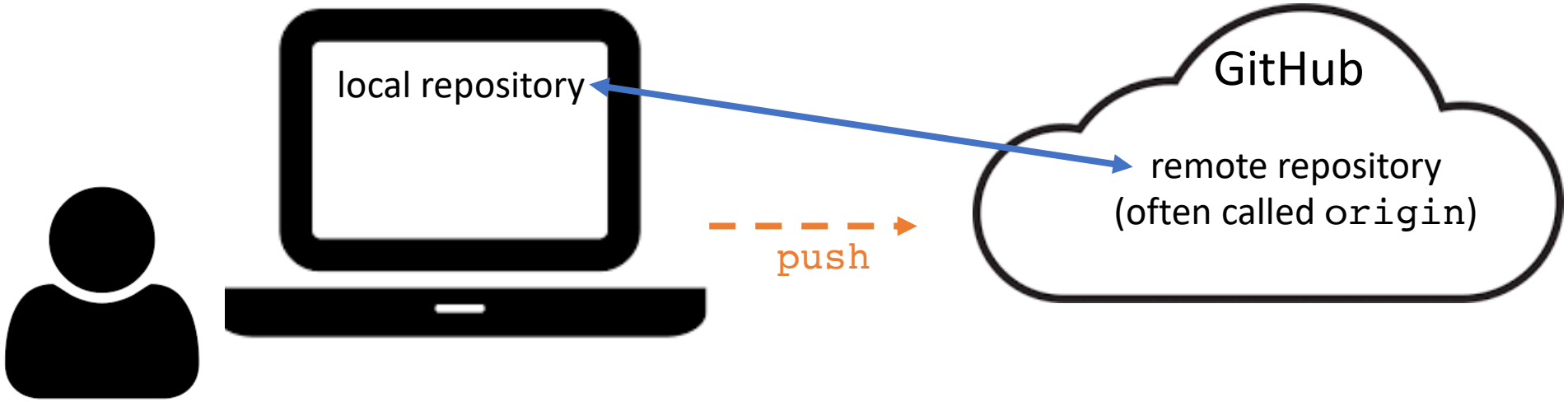
- GitHub = a repository hosting service with a graphical interface and additional tools for collaboration and more

Will learn to put repositories on GitHub, collaborate when others' have GitHub repositories, use GitHub pull requests.

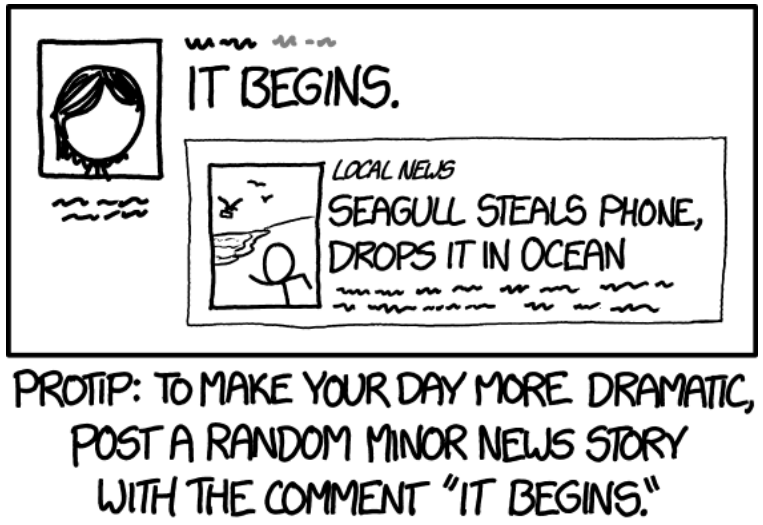
Other options: e.g. BitBucket

Set up a new repository with Git and GitHub

- Initialize with `git init`
- Connect your repository to a remote GitHub repository with GitHub's interface and `git remote add`
- Copy the content you created to your remote repository (hosted on GitHub) with `git push`



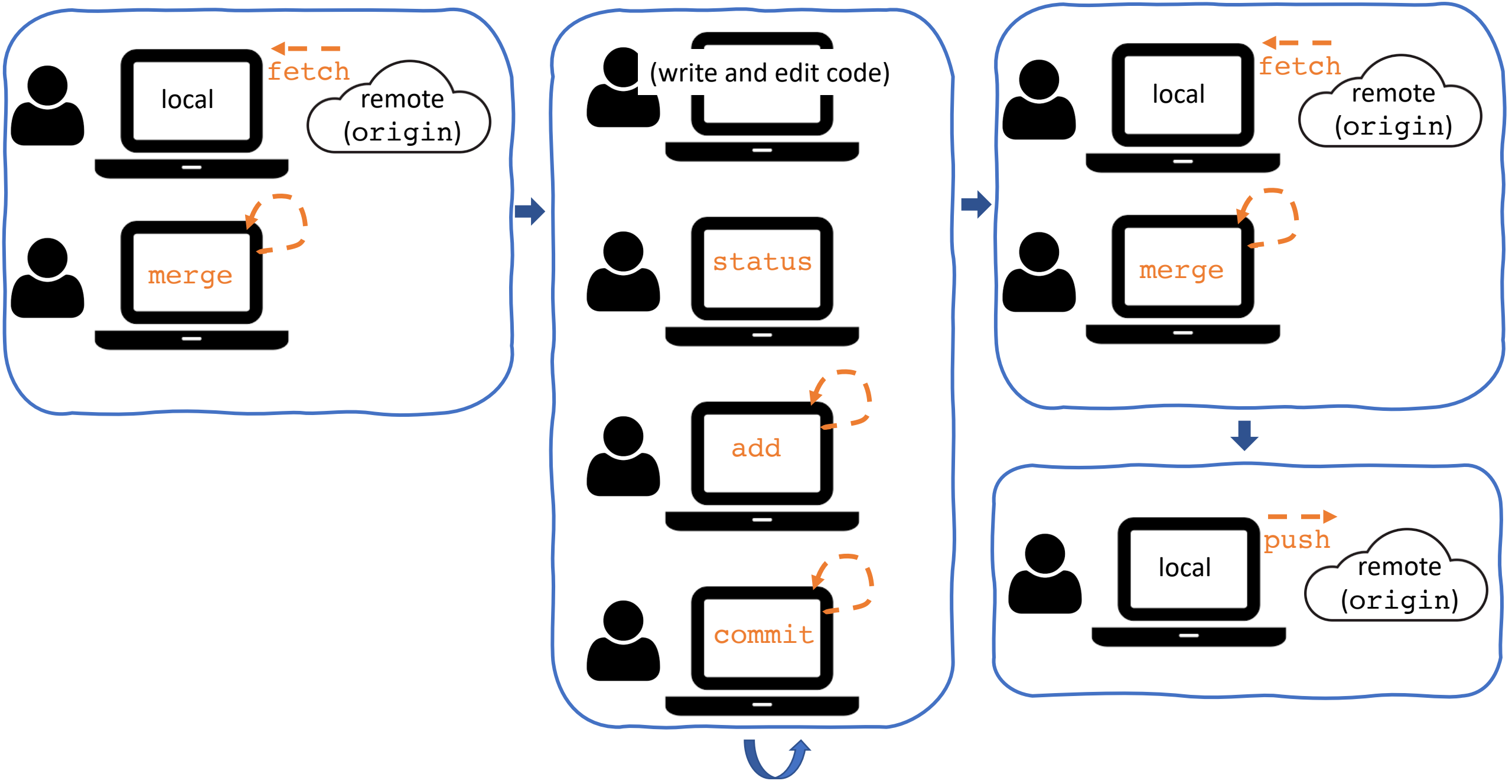
Follow the numbered instructions in parts I and II



https://xkcd.com/1656/

git + command + flags/arguments

```
git push -u origin master
git fetch origin
git merge origin master
git add hello.py
```


local
fetch
remote
(origin)
merge
(write and edit code)
status
add
commit
local
fetch
remote
(origin)
merge
local
push
remote
(origin)

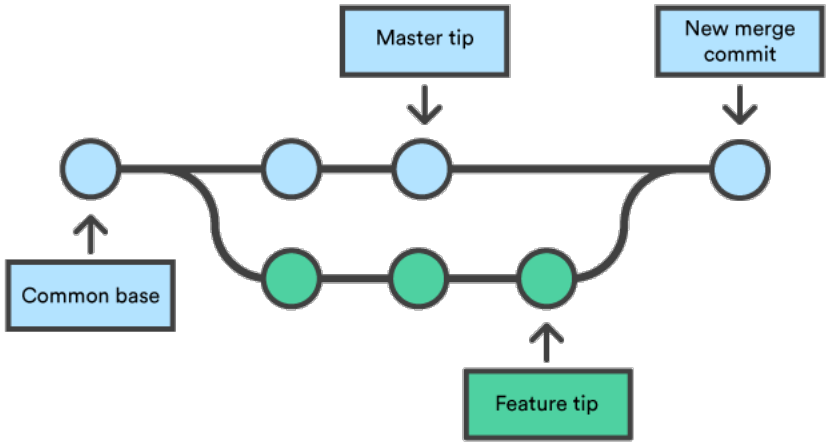
Follow the instructions in part III to practice the workflow now

https://xkcd.com/1296/

Merge conflicts

- If you and a collaborator are simultaneously changing different parts of the code and merging, no problem!
- If you change a line of code, and in the meantime some one has made a different change to **the same line** and pushed those changes, you can have a merge conflict.

Use Git branches and GitHub pull requests

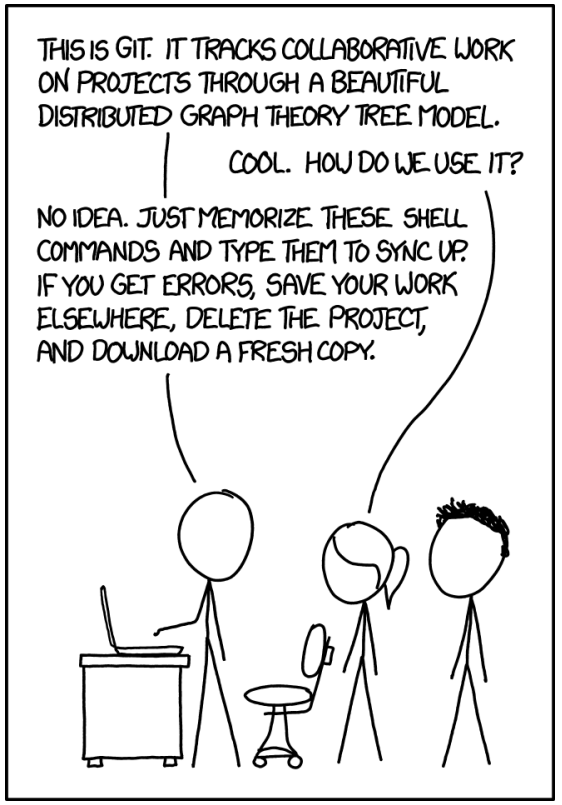


- Instead of making all changes to master branch, create different branches for different features you develop.
- Make branches locally, and then create and connect them to corresponding remote branches.
- Once your feature-specific branch is where you want it to be, *then* merge the changes on this branch back into the master branch of the remote repository.
- Use GitHub's **pull requests** to get collaborator's consent and input before merging the code on feature branch into the master branch of the remote repository.
- Move between branches with the `checkout` command

  (caution: `git checkout <filename>` is dangerous).

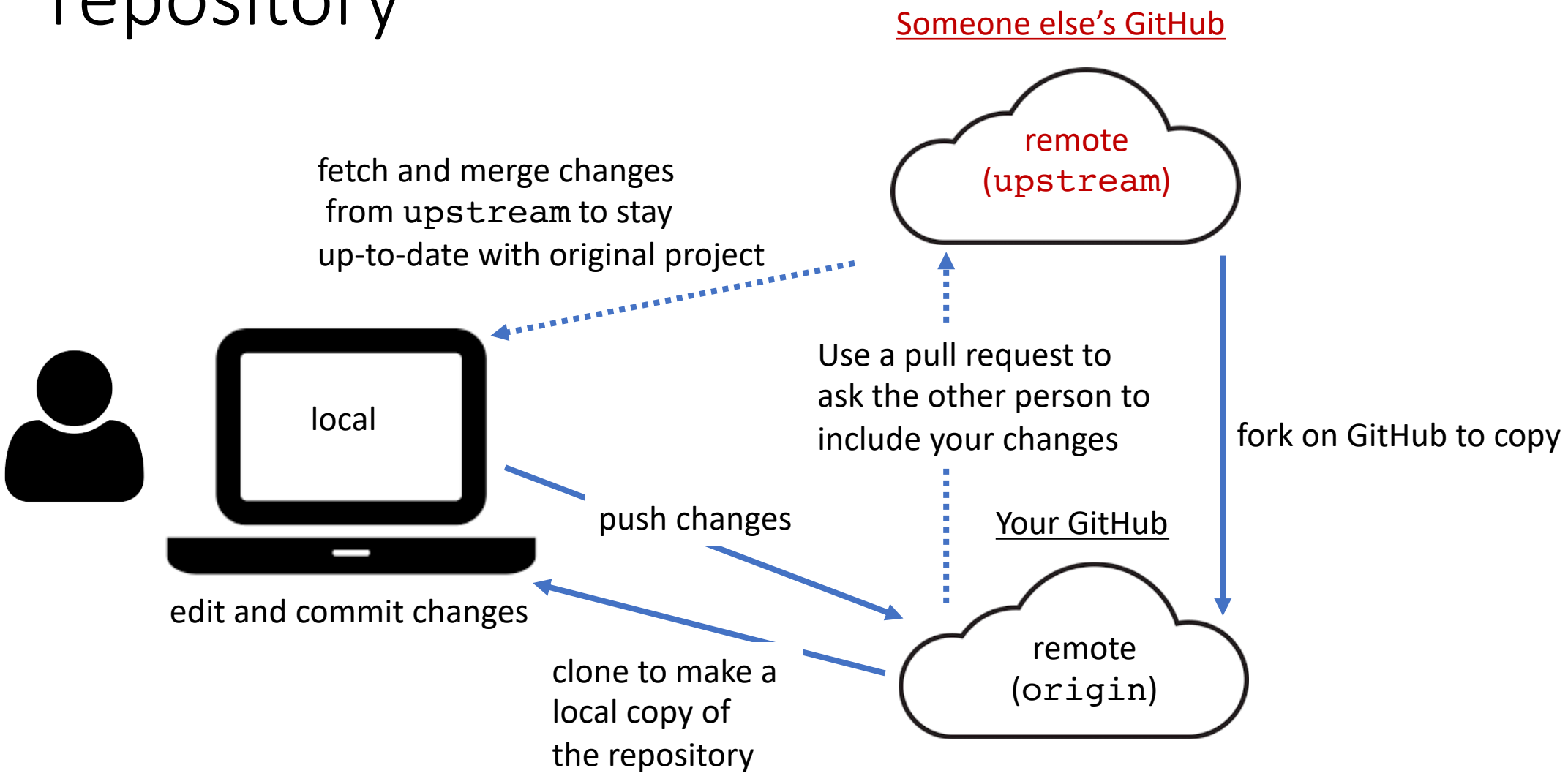
Image source: https://wac-cdn.atlassian.com/dam/jcr:83323200-3c57-4c29-9b7e-e67e98745427/Branch-1.png?cdnVersion=jt

Follow the instructions in part V to practice the workflow now



https://xkcd.com/1597/

Using GitHub forks to build on someone else's repository



“Homework”

- Contribute to https://github.com/karink520/TuftsGitHubSampleToUpdate using the process above as outlined in part VI.

Some other important topics

- Stashing changes
- Undoing changes and reverting
- See what has changed with `git diff`
- Ignoring files you don’t want to track
- Use ssh to connect to GitHub
- GitHub actions (e.g. to automatically run tests or other checks)

(see part VII)

Resources (part VIII)

- Searches and StackOverflow
- DangitGit!? https://dangitgit.com/
- GitHub Guides https://guides.github.com/introduction/git-handbook/
- Browser game for learning about Git branching https://learngitbranching.js.org/
- “A minimal tutorial”: https://kbroman.org/github_tutorial
- Atlassian tutorials https://www.atlassian.com/git/tutorials

  and Git “cheat-sheet” https://www.atlassian.com/git/tutorials/atlassian-git-cheatsheet)
- MIT CSAIL's "Missing Semester" lesson on Git:

https://missing.csail.mit.edu/2020/version-control/

Office hours:

Questions??