Git better

Collaborative project management using *Git* and *Github*

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These slides: https://bit.ly/SA_git

Sant'Anna School of Advanced Studies

Let's Git it done!

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References:

- Atlassian tutorial
- Github guides
- Git cheatsheet
- Git book

Troubleshooting:

- How to undo (almost) anything with Git
- Git flight rules

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Version control with Git

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Distributed:

- developers keep local copy of entire code and history;
- can make changes offline and asynchronously;
- changes (easily) reconciled later.

Git pros

Advantages of Git:

- widely used, supported, documented;
- online platforms: Github, bitbucket, Gitlab;
- dektop interfaces: shell, Github Desktop, SourceTree, GitKraken;
- integration in editors and IDEs: Emacs, Sublime Text, RStudio, XCode, Visual Studio, ...;
- distributed (asynchronous, offline) development;
- easy branching: eg, experimental branches for trying changes);
- easily make complex merges.

Let's Git on the same page

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Requires some workflow changes (see details):

- keep project under single directory (*outside* Dropbox, Google Drive, piCloud, ...!)
- consistency in personal and team coding style (eg, indentation, spacing, line-breaking);
- save and commit changes manually and frequently;
- requires to document code and explain changes.

Essential concepts

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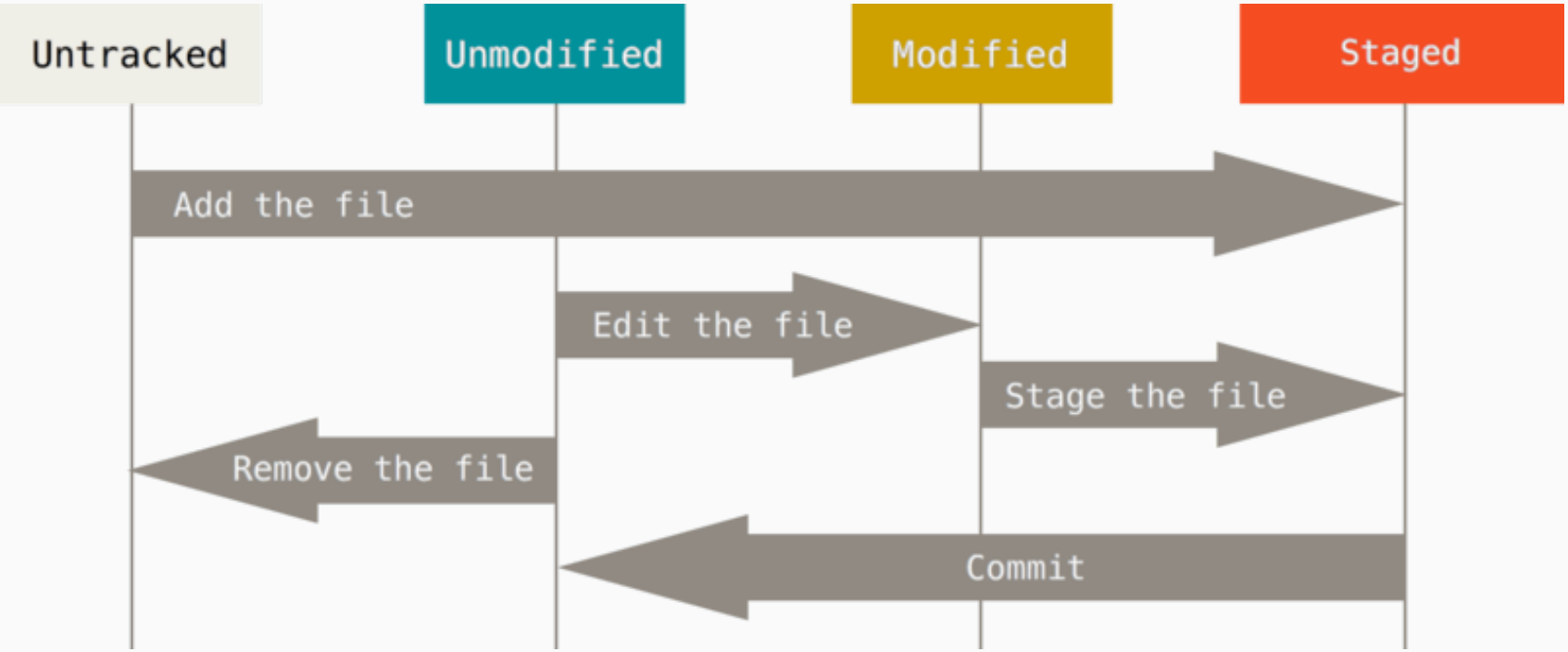
  - a repository is "just a directed acyclic graph of commits".

Git concepts: Where

Git has a sophisticated model of *where* things happen, based on how frequently you change things:

- **Working directory** (**working tree, workspace**): the files and sub-directories you can see and work on.
  These are visible files stored on your disk.
- **Staging area** (**index**): where you list files that will go into your next commit.
  This is a file in the hidden `.git/` *subdirectory on your disk.*
- **(local) Repository**: where the commits are stored; ie, it contains the full history of previous versions of the files in the repository, and relevant metadata.
  Contained in the hidden `.git/` *subdirectory on your disk.*
- **(remote) Repository**: a version of the repository hosted elsewhere.
  On another computer, or online service like GitHub or Bitbucket.

Life cycle of files in a repository: from changes to staging area



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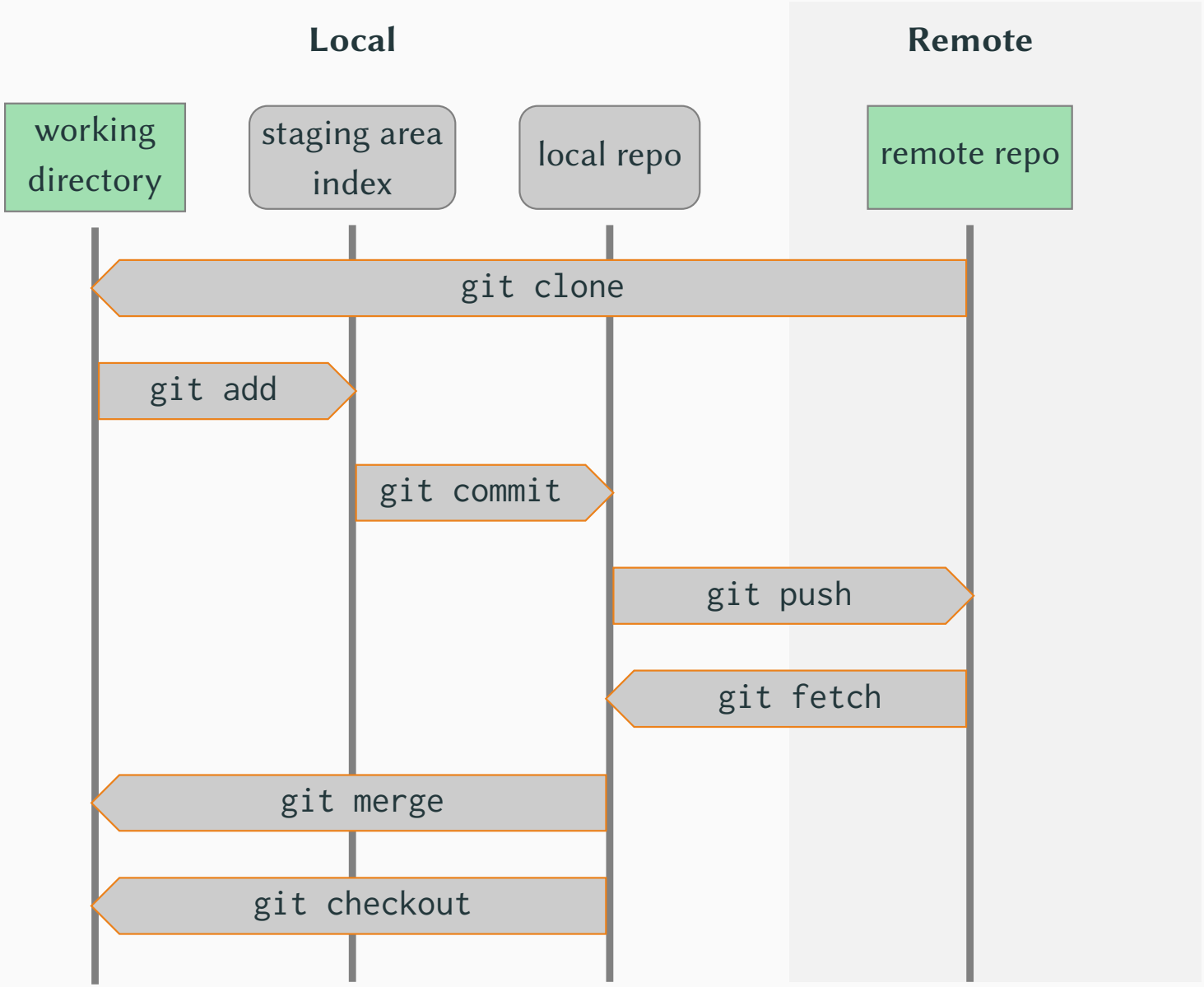
- `git clone`: copy a remote repository on your machine;
- `git init`: start a new repository in empty directory;

Example workflow 1

Solitary development, offline, from scratch

1. Create a new empty directory on your computer
2. `git init`: create a git repository in the directory
3. create, edit, and save some `file.txt` in the directory
4. `git status` shows the file is untracked
5. `git add file.txt` to stage the file
6. `git commit -m "First commit! added file.txt!"`
7. `git status` reports no changes
8. edit the file again, repeat from step (4).

Working with repositories: from changes to commits



Adapted from Stackoverflow. See also ndpsoftware.com/git-cheatsheet.html

History and branching

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Log of a solitary development workflow

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Note:

- Commits are uniquely identified by a SHA-1 hash (eg, a12b34...);
- Commit messages can have two parts:
  - short description ($\sim<$ 50 characters, above)
  - details after two line break (not shown);
- `HEAD` means "where your next commit would go" (pointer to branch);
- `Master` is the name of the main **branch**

Branches

Branches are sequences of commits, which can trace an alternative history and versions of the code in yout repo.

- There is always a `Master` branch, containing the *main*, *baseline* version of the code.
- Git makes creating and merging branches quick and easy: it's a great help to the worflow.
- Other branches can be created from any commit to *experiment*, *implement new features*, *keep diverging versions*.

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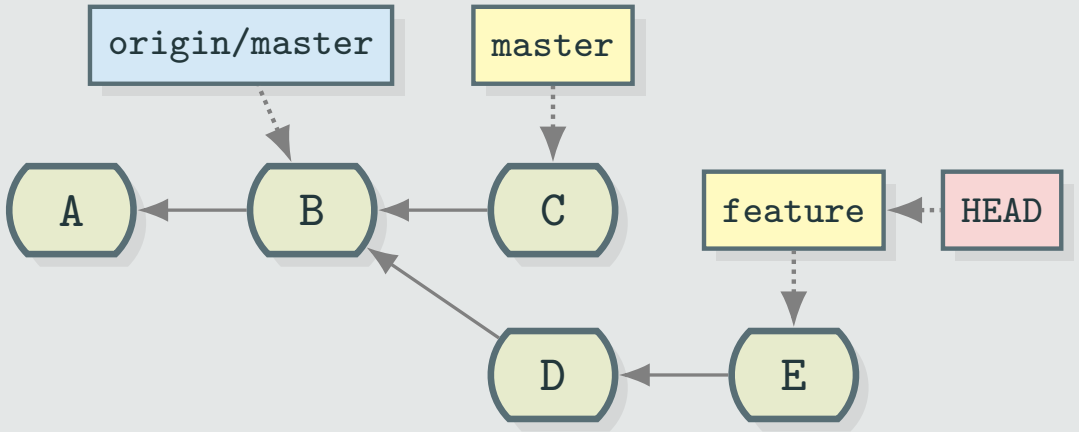
Example history with branches



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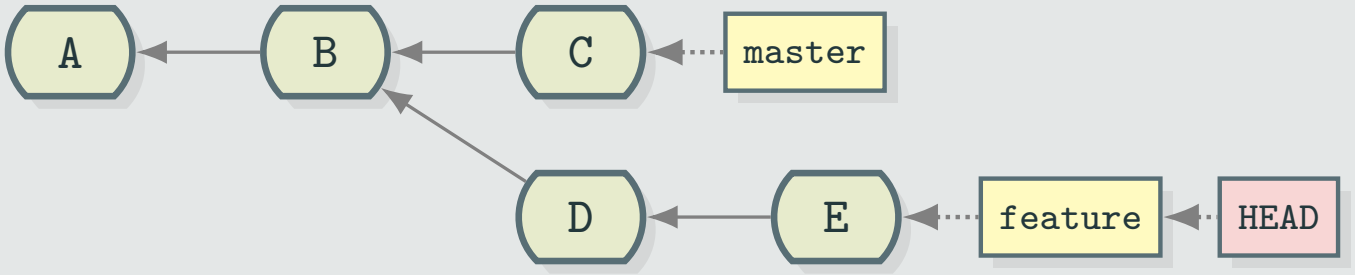

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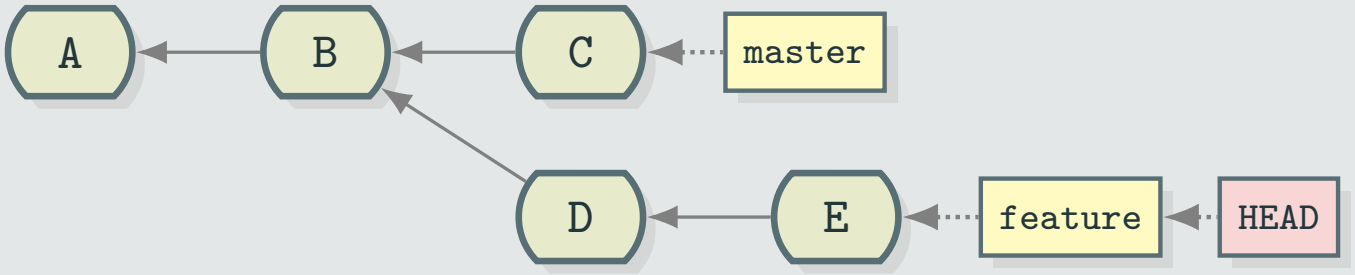


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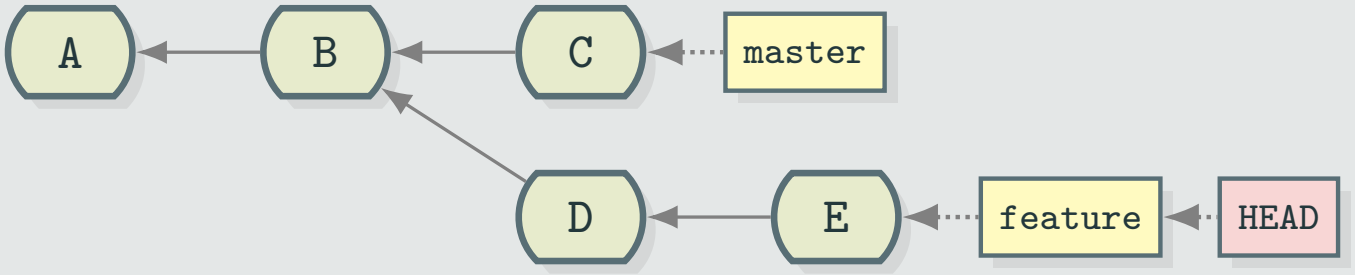

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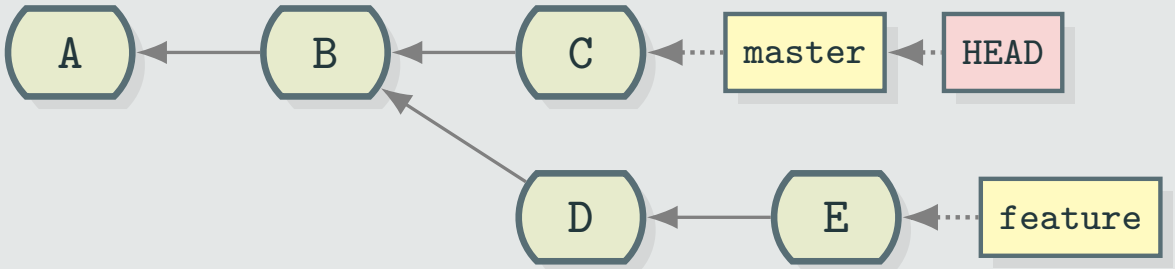

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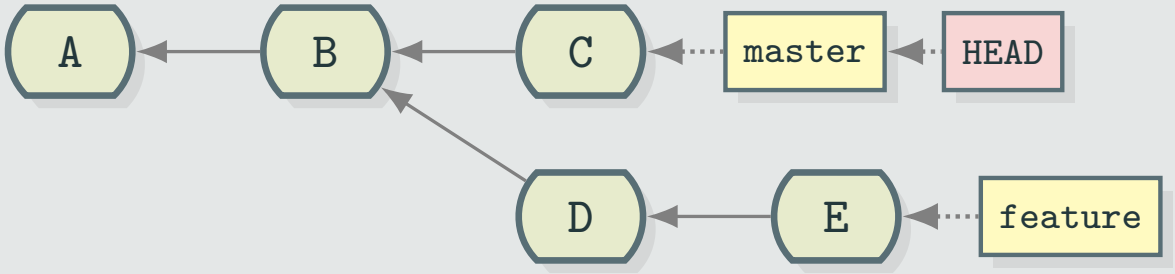

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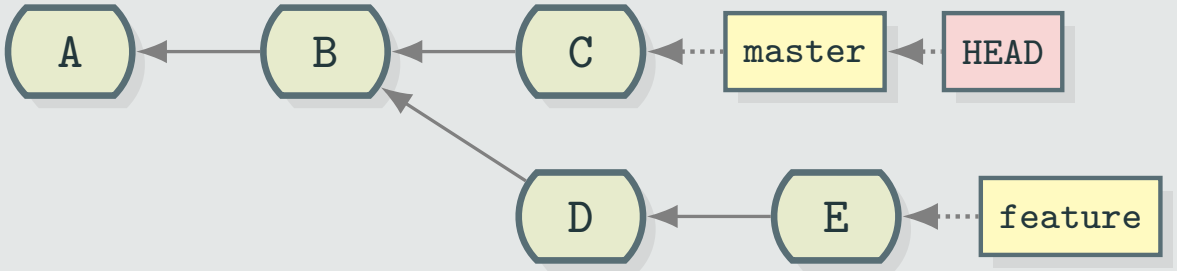

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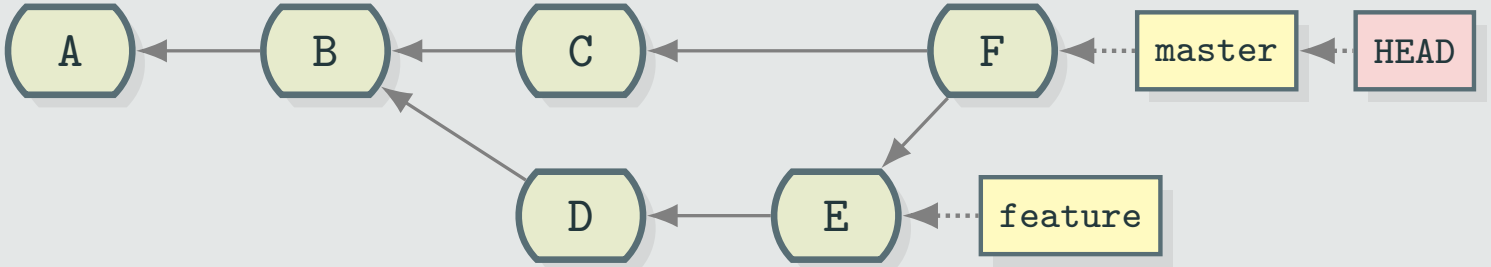

Collaborative development

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8. tag specific commits to refer to milestones of the project.

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- write meaningful commit messages.

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- **never commit broken code**! use `git stash` to save it instead.
- commit related files together;
- write meaningful commit messages.
- tag release (baseline, published) versions of your code with `git tag`.

Pricing plans

Organization pricing plans

Git is free software, but extensive access to the cloud platform (GitHub, Bitbucket,...) is paying for non-open-source projects.

GitHub

cloud	*Education*	free for education, (max 10 repos)
cloud	*Team*	from $25/month (5 users) + $9/user/month
cloud	*Business*	$21 per user/month
self-hosted	*Enterprise*	$21 per user/month (by $\times$10 users, annual)

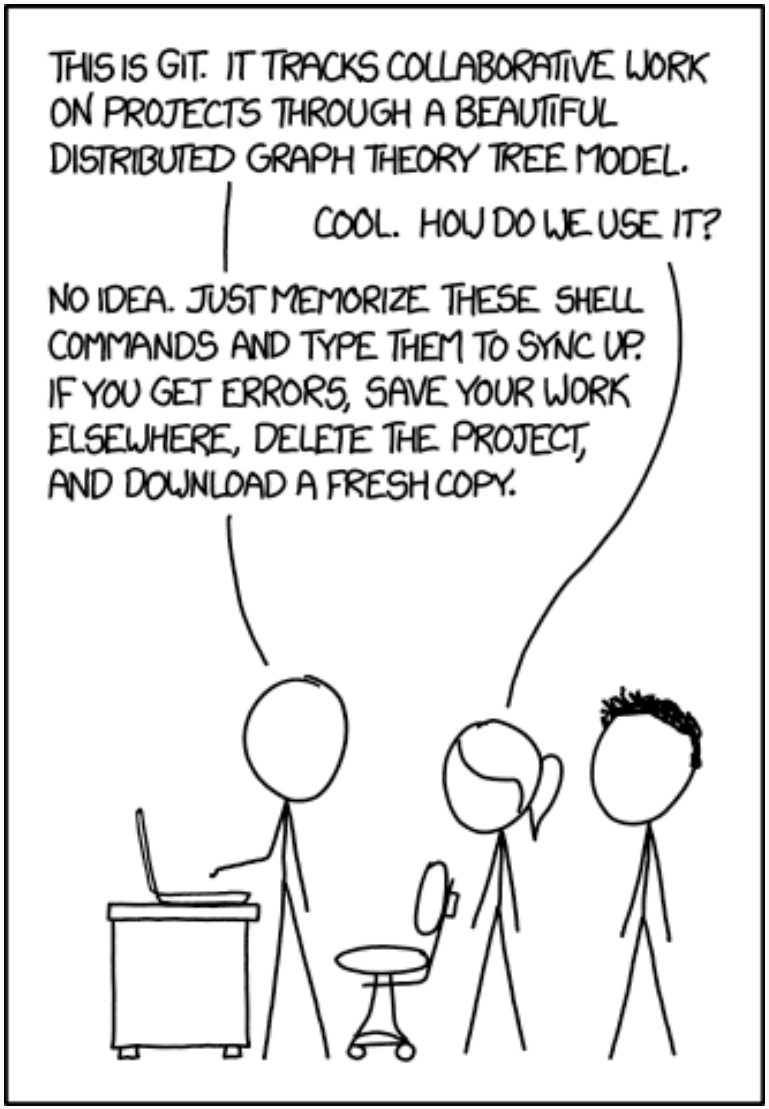
Bitbucket

cloud	*Standard*	$10/month + $2 per user/month
cloud	*Premium*	$25/month + $5 user/month
self-hosted		$1800/year (25 users)
self-hosted		$3300/year (50 users)

Thank you!

XKCD on git

back



If that doesn't fix it, git.txt contains the phone number of a friend of mine who understands git. Just wait through a few minutes of "It's really pretty simple, just think of branches as..." and eventually you'll learn the commands that will fix everything.