Version control management and research collaboration using git and github

An introduction

APSIS group

MCC Berlin

July 11th, 2019

What is git and GitHub?

Why should I use it?

How can I use it?

What is version control management?

Software to keep track of the history and different versions of files within project folders

What is git?

- git is a program for version control
- designed for distributed software development
- created by Linus Torvalds for his work on the Linux kernel

Explain idea of a git repository

What is GitHub?

Explain the idea of a remote repository
Explain github (and providers of remote repositories like gitlab, bitbucket, SourceForge, Launchpad ...)

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Why use version control in research?

- getting some order in the mess
  - data
  - software code/scripts
  - manuscripts for papers
- sharing your code or
- collaboration and attribution of work

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How can I use it?

Git Workflow (simplest)

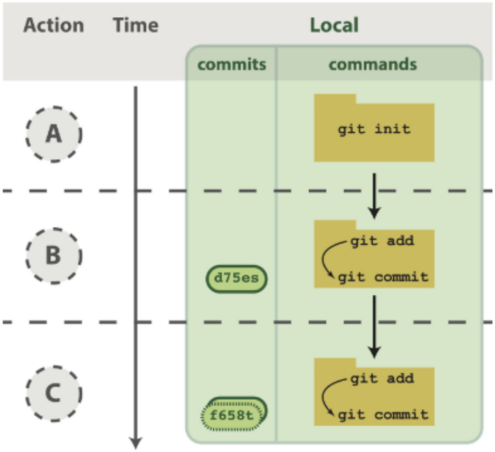

Figure: **?**

- Keep track of changes in a folder on your computer

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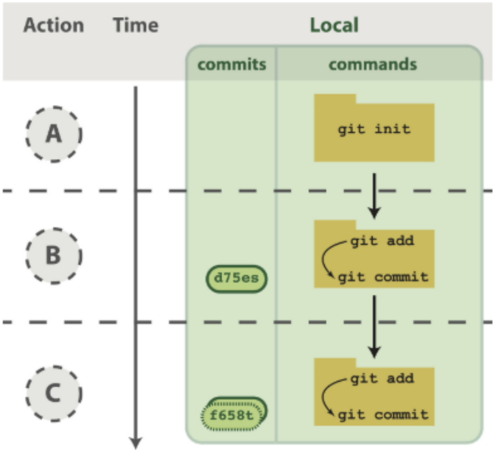

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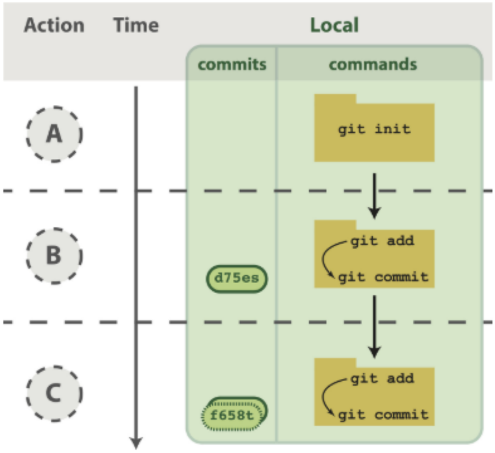
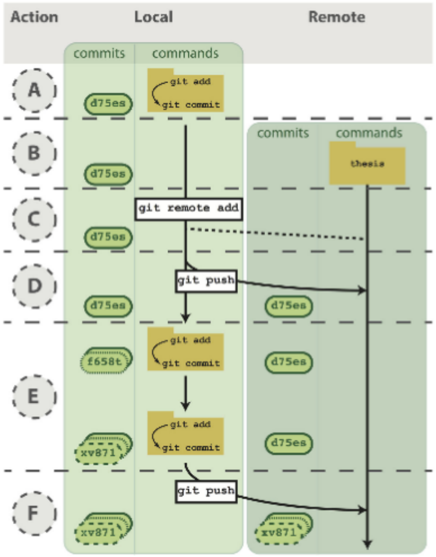


Figure: **?**

- Keep track of changes in a folder on your computer
- Changes are stored as lines added and removed
- No need to save multiple versions of the same file; you have recorded all changes and can view or revert these at any time

Git + Github Workflow (simplest)



- Attach your repository to a remote version

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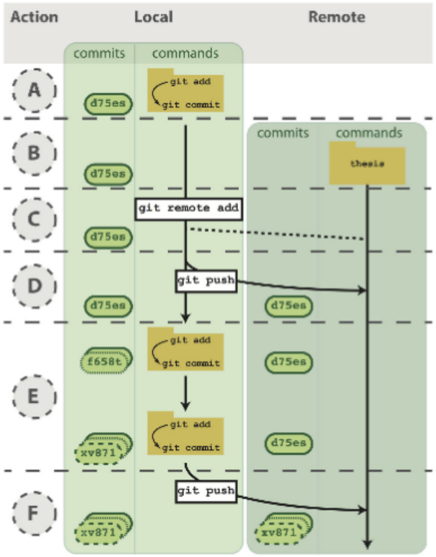

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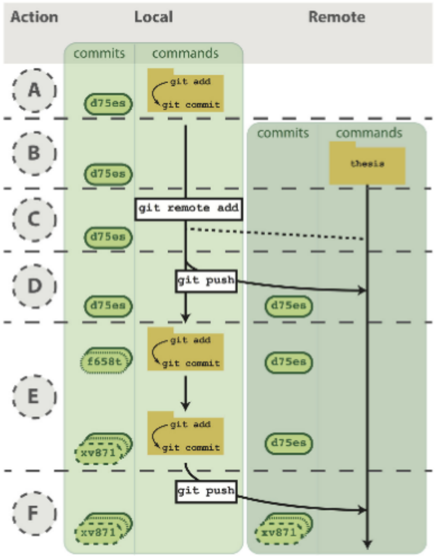

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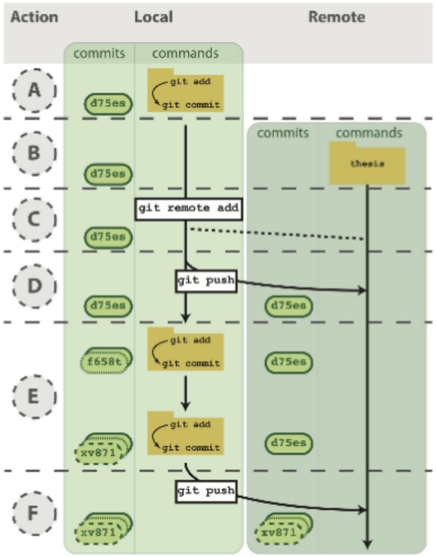
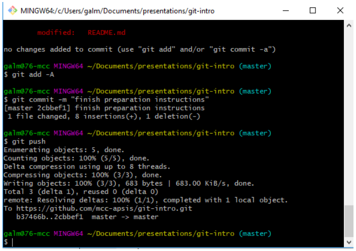


- Attach your repository to a remote version
- If working with collaborators, they also can make a copy (**`clone`**) on their machine
- By both using **`pull`**, you can keep up to date with each others' changes
- For more complicated workflows, especially where maintaining a working version is critical, check out branching `https://guides.github.com/`

Tools

Command Line

- Easy to document/explain



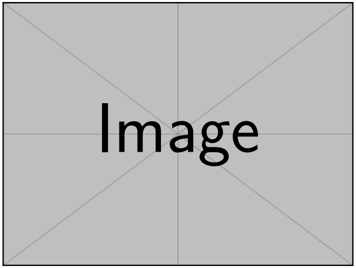
MINGW64:/c/Users/galm/Documents/presentations/git-intro

```
        modified:   README.md

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

galm@76-mcc MINGW64 ~/Documents/presentations/git-intro (master)
$ git add -A

galm@76-mcc MINGW64 ~/Documents/presentations/git-intro (master)
$ git commit -m "finish preparation instructions"
[master 2cbbef1] finish preparation instructions
 1 file changed, 8 insertions(+), 1 deletion(-)

galm@76-mcc MINGW64 ~/Documents/presentations/git-intro (master)
$ git push
Enumerating objects: 5, done.
Counting objects: 100% (5/5), done.
Delta compression using up to 8 threads.
Compressing objects: 100% (3/3), done.
Writing objects: 100% (3/3), 683 bytes | 683.00 KiB/s, done.
Total 3 (delta 1), reused 0 (delta 0)
remote: Resolving deltas: 100% (1/1), completed with 1 local object.
To https://github.com/mcc-apsis/git-intro.git
   b37466b..2cbbef1  master -> master

galm@76-mcc MINGW64 ~/Documents/presentations/git-intro (master)
$ |
```

Steeper learning curve, but more flexible and harder to do things unintentionally

GUIs

- Easy to use



Often there are integrations in development environments, e.g. RStudio, Atom

Starting a repository

To start working with a repository, either turn an existing folder into a git repository

```
git init
```

or copy an existing repository into a folder

```
git clone
```

Editing a respository

- Edit files (write some new code or a nice new paragraph)

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- Stage changes (tell git about the changes you want record)
  - **`git add -A`**
  - Or add only certain files using patterns or exact file names

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Editing a respository

- Edit files (write some new code or a nice new paragraph)

- Stage changes (tell git about the changes you want record)
  - **`git add -A`**
  - Or add only certain files using patterns or exact file names

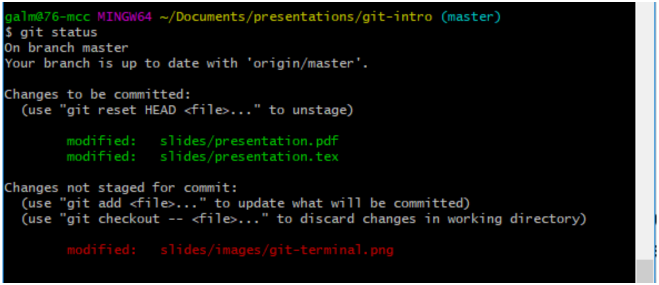
---

- Commit changes (make a timestamped version of the repository, recording all the changes you have told git about)
  - **`git commit -m "made a cool new graph"`**
  - It's best if each commit describes a discrete change, and has an interpretable name.

Managing the repository

Where are we?

`git status` tells us which files have changed and are staged or unstaged:



```
galm@76-mcc MINGW64 ~/Documents/presentations/git-intro (master)
$ 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)

        modified:   slides/presentation.pdf
        modified:   slides/presentation.tex

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:   slides/images/git-terminal.png
```

What's changed?

`git diff` lets us know the difference between the files we could stage, and the staged version of them

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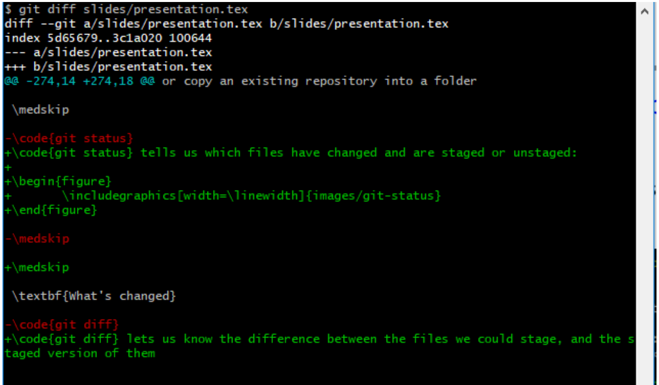

```
$ git diff slides/presentation.tex
diff --git a/slides/presentation.tex b/slides/presentation.tex
index 5d65679..3c1a020 100644
--- a/slides/presentation.tex
+++ b/slides/presentation.tex
@@ -274,14 +274,18 @@ or copy an existing repository into a folder

 \medskip

-\code{git status}
+\code{git status} tells us which files have changed and are staged or unstaged:
+
+\begin{figure}
+       \includegraphics[width=\linewidth]{images/git-status}
+\end{figure}

-\medskip

+\medskip

 \textbf{What's changed}

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```

Managing the repository

Where are we?

`git status` tells us which files have changed and are staged or unstaged:

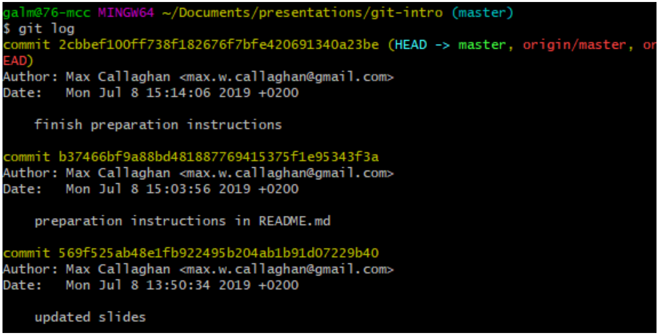
What's changed?

`git diff` lets us know the difference between the files we could stage, and the staged version of them

`git diff` can also tell us about the difference between variously specified versions of files

Navigating different versions

`git log` shows us a list of all the commits that have been made.



```
galm@76-mcc MINGW64 ~/Documents/presentations/git-intro (master)
$ git log
commit 2cbbef100ff738f182676f7bfe420691340a23be (HEAD -> master, origin/master, or
EAD)
Author: Max Callaghan <max.w.callaghan@gmail.com>
Date:   Mon Jul 8 15:14:06 2019 +0200

    finish preparation instructions

commit b37466bf9a88bd481887769415375f1e95343f3a
Author: Max Callaghan <max.w.callaghan@gmail.com>
Date:   Mon Jul 8 15:03:56 2019 +0200

    preparation instructions in README.md

commit 569f525ab48e1fb922495b204ab1b91d07229b40
Author: Max Callaghan <max.w.callaghan@gmail.com>
Date:   Mon Jul 8 13:50:34 2019 +0200

    updated slides
```

`git checkout`

Interacting with remote repositories

```
git pull
git push
```

Warning: careful with copyrighted materials in public repositories
forking and pull request for working on repository for which you are no collaborator

Further useful commands and tools

.gitignore file
create doi for citations:
https://guides.github.com/activities/citable-code/

Questions?

Practice / task

- clone remote repository with
  `git clone https://github.com/mcc-apsis/git-intro.git`
- add some question or feedback to the presentation in the file
- add and commit changes
- pull changes already made by other
- push your own changes

References