git - Part I
Introduction & Local Repositories

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Overview

What is git?

Quoting Wikipedia:

git is a *distributed version-control system* for tracking changes in source code during software development. ... goals include speed, *data integrity*, and support for *distributed*, *non-linear workflows*.

Examples of distributed version-control systems: *CVS*, *BitKeeper*, *SVN*, *git*, ...

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git $\neq$ github, gitlab, etc.

A brief History

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$ git clone http://github.com/torvalds/linux.git
$ cd linux
$ cloc .
> 18518596
```

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$ cd linux
$ cloc .
> 18518596
```

He needed a way for the developers to work with each other!

What do we use git for?

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1. software projects,
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but also for

5. theses,
6. storing configuration files,
7. storing password files (`$> pass`),
8. etc.

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Why attend this course?

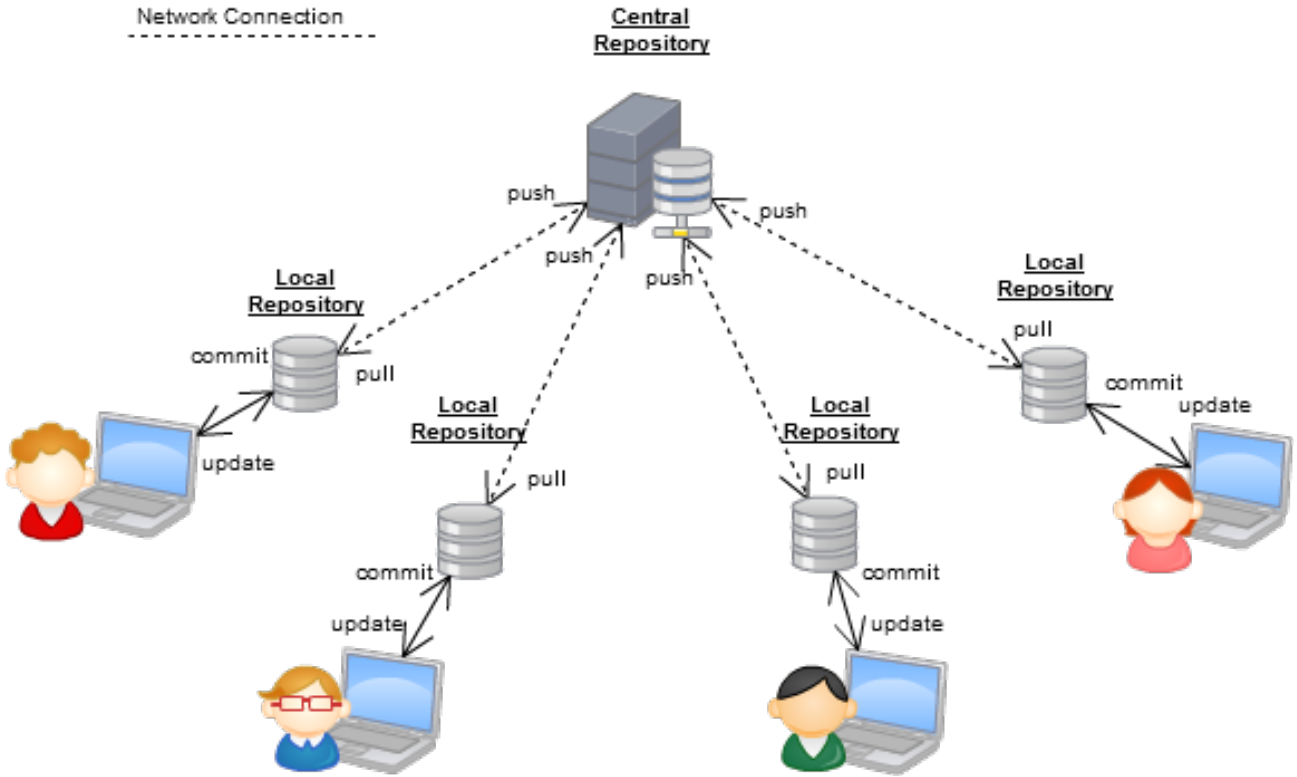
1. Get to understand background,
2. cover basic usage commands and
3. preparation (*and hopefully hours of saved time and struggles!*).

Road Map

- *Today*: Local Repository and git basics
- 24. 10.: Branches, Remotes, non-linear workflow and working in a team
- 29. 10.: Miscellaneous: Tagging, Reflog, .gitconfig, Best Practices and Workflows, Hooks, Background, etc. . .

Credit: *https://xkcd.com/1597/*

Distributed Systems



Credit: *https://jordankasper.com/lessons-learned-teaching-git/*

Similar to *DropBox*, *Google Drive*, *iCloud*, etc., but working very differently in the background!

Local Repository

Local Repository

- Almost all of your work happens here
- Helps keeping a history
- Tracks any changes made
- Divided into four states of stages

Repositories

The *heart* of a git project.

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```
test>$ ls
drwxrwxr-x 40 4096 Sep 26 18:42 ..
drwxrwxr-x  3 4096 Sep 26 18:42 .
drwxrwxr-x  7 4096 Sep 26 18:42 .git
```

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```

How can we *initialize* a git repository?

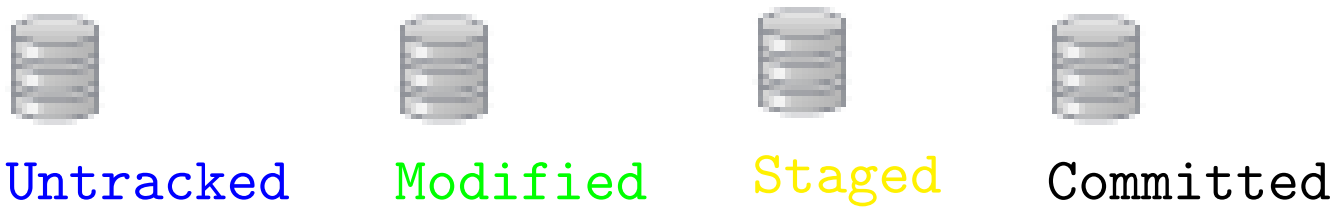
1. `$> git init`
2. `$> git clone <git-url>`

.git


```
test/.git$ ls
drwxrwxr-x 3 4096 Sep 26 18:42 ..
drwxrwxr-x 2 4096 Sep 26 18:42 info
-rw-rw-r-- 1   73 Sep 26 18:42 description
drwxrwxr-x 2 4096 Sep 26 18:42 branches
drwxrwxr-x 4 4096 Sep 26 18:42 refs
drwxrwxr-x 4 4096 Sep 26 18:42 objects
-rw-rw-r-- 1   23 Sep 26 18:42 HEAD
-rw-rw-r-- 1   92 Sep 26 18:42 config
drwxrwxr-x 7 4096 Sep 26 19:32 .
drwxrwxr-x 2 4096 Sep 30 21:17 hooks
```

Stages

- Every file in your directory is either:
  1. Untracked
  2. Modified



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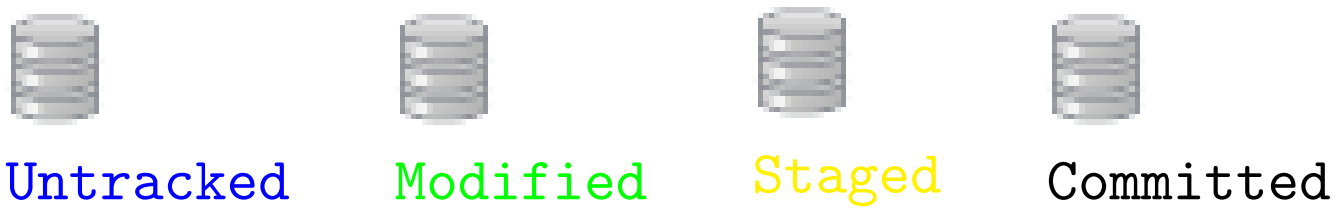

Stages

- Every file in your directory is either:
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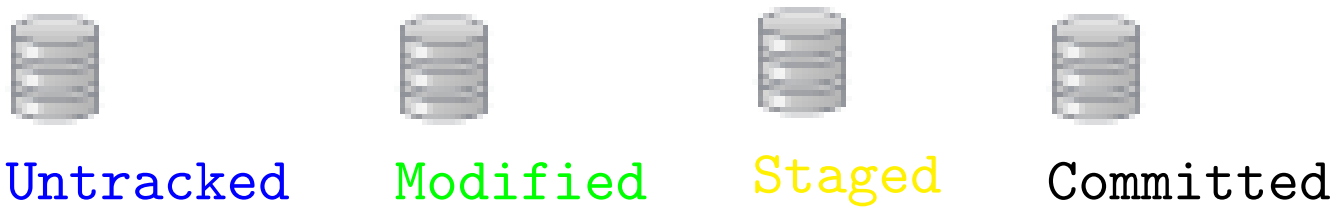
  3. Staged
  4. Committed



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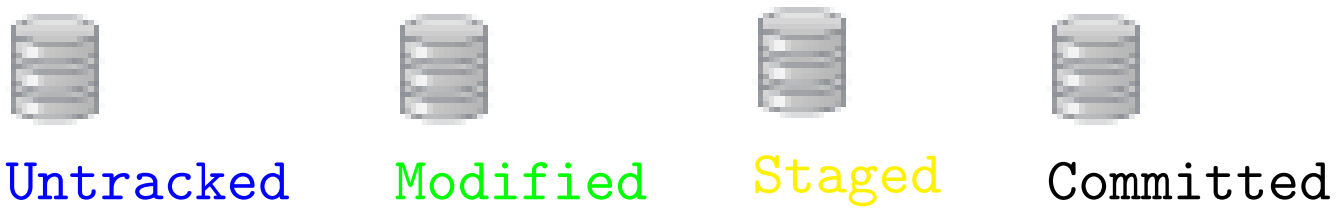

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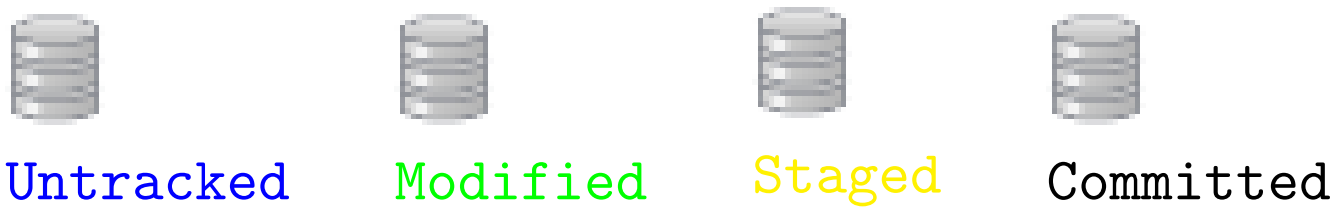

Stages

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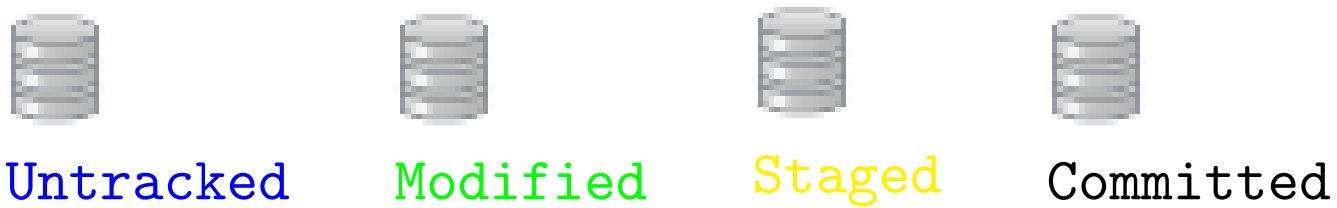
  1. `Untracked`
  2. `Modified`
  3. `Staged`
  4. `Committed`
  5. or `(Unmodified)`
- You move files between these stages
- git keeps track of moves from `Staged` to `Committed` (i.e. your *commits*)



Stages

How do we move files between the stages?
How can we fix mistakes before committing?
How do we inspect a git-directory (and the stages of individual files)?

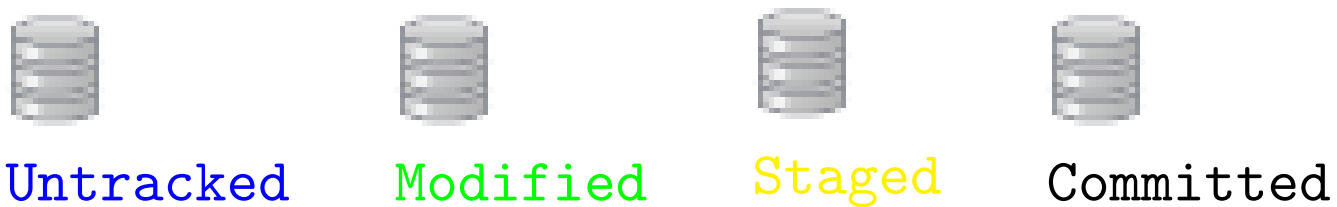
Commits

What is a *commit*?

Commits

What is a *commit*?

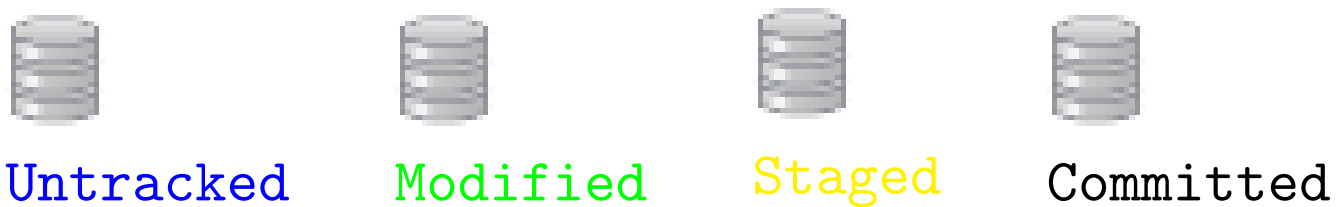
- One entry in the history of you project
- Saves your staged changes in your local repository
- Messaging interface for you and your team



Commits

What is a *commit*?

- Author
- Message
- Date
- Committed Files



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Adding and Staging

Move files from Untracked/Modified to Staged:

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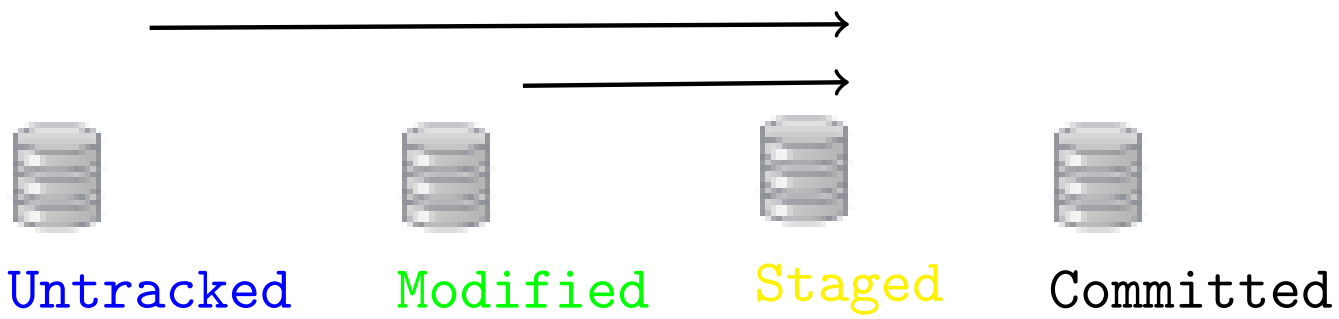

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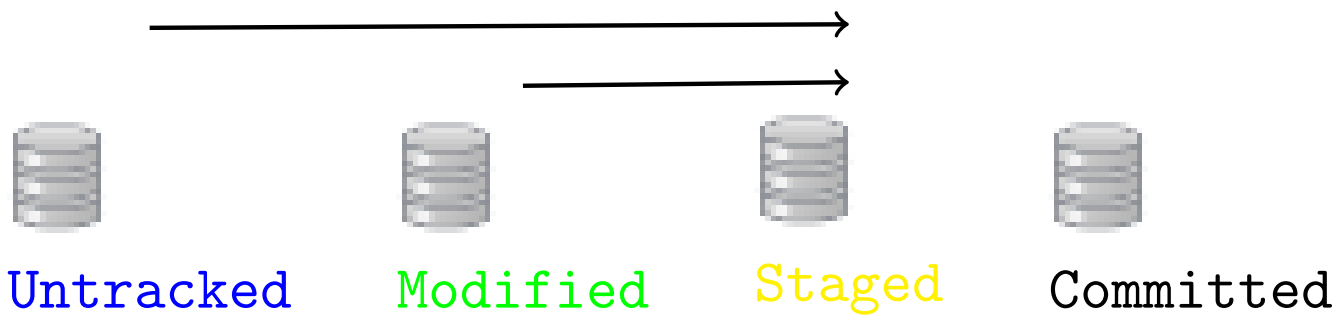

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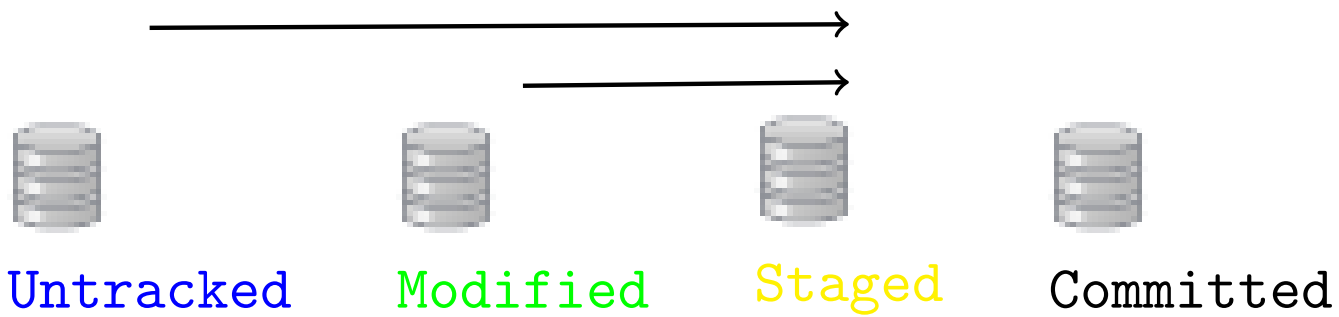

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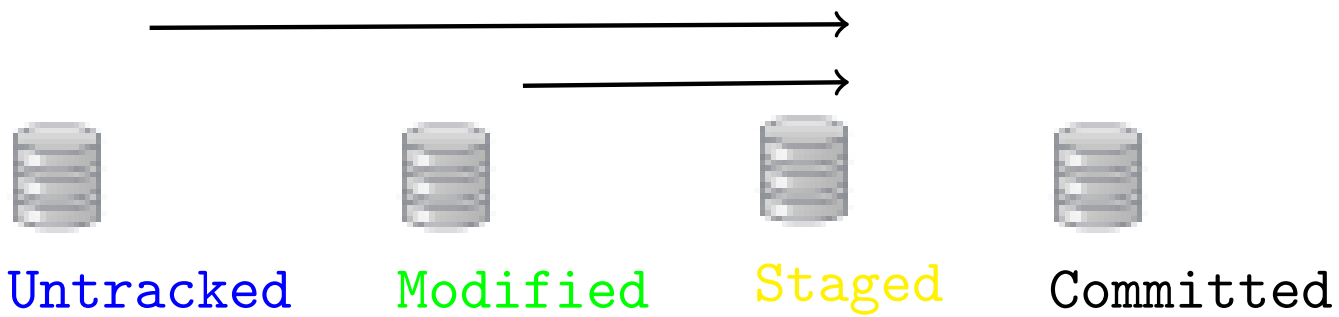
- `$> git add -p <file,dir>`
- `$> git add -A` *(considered to be bad practice)*



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- Better: `$> git commit`

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Status

- `$> git status`
- Shows you the current status of you working directory.
- Which files are *staged*, *modified*, etc.

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- `$> git log --oneline`
- `$> git log --graph`
- ... and combined: `$> git log --oneline --graph`
- A bit more advanced:

```
$> git log --graph --pretty=format:'...'  ...
```

How to undo things

- git generally only adds data and information, but it is possible to undo, amend and even change the history!
- Obviously changing commited history is not considered to be best practive.
- You can also drop changes you have made completely.

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- Two important use cases:
  1. Fixing typos in the commit message and
  2. if you have forgotten to add files:

```
$> git commit -m "some commit"
$> git add ...
$> git commit --amend -m "some commit and xyz"
```

git reset

- `$> git reset (--soft|--mixed|--hard) <commit>`
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- This discards `$> git commit`.

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- This discards `$> git commit` and `$> git add`

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- Three different options, *–mixed* being the default.
- `--hard` Undo all commits back until `<commit>` and **discards** all changes made.
- This discards `$> git commit`, `$> git add` and any changes to the files.

Unstaging Files

- `$> git status` tells you how to do this:
- `(use "git reset HEAD <file>..." to unstage)`
- `$> git reset --mixed <file>` undos `$> git commit` and `$> git add`, if the file is not commited it will just do the latter!

Untracking Files

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  - `$> echo <filename> >> .gitignore`
- Add `*.<filetype>` to exclude all files of the given type.

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  - Useful if you are experimenting or
  - you went a bit to far and want to go back to a safe state.
- **Caution:** Both `$> git checkout <file>` and `$> git reset --hard <commit>` make changes to your working directory by discarding changes.

Summary

- What is version control?
- What is a distributed system?
- What is a local repository?
- What are the different stages a file may be in?
- What is a commit?
- What is a snapshot?
- How can we move files between stages?
- What is the git log?
- How can we fix errors?
- What does the `.gitignore` file do?