INTRODUCTION TO GIT

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- What is GIT
- Principles of GIT
- Starting with GIT
- Working with GIT
- More stuff

WHAT IS GIT

- GIT is a VCS
- Birth of GIT
- Goals of GIT
- GitHub
- GIT adoption

GIT IS A VCS

- VCS (Version Control System)
- Other VCS in order of appearence:
  - CVS (1986),
  - ClearCase (Rational, 1992),
  - Perforce (Perforce, 1995),
  - Subversion (2000),
  - "TFS" (Team Foundation Version Control - Microsoft, 2005),
  - Mercurial (2005),
  - Bazaar (2005),

BIRTH OF GIT

- created by Linus Torvalds (father of Linux) in 2005
- initially developed for linux kernel development, in replacement of proprietary BitKeeper
- project mantainer since end of 2005 is Junio Hamano

GOALS OF GIT

The initial goals of GIT where:

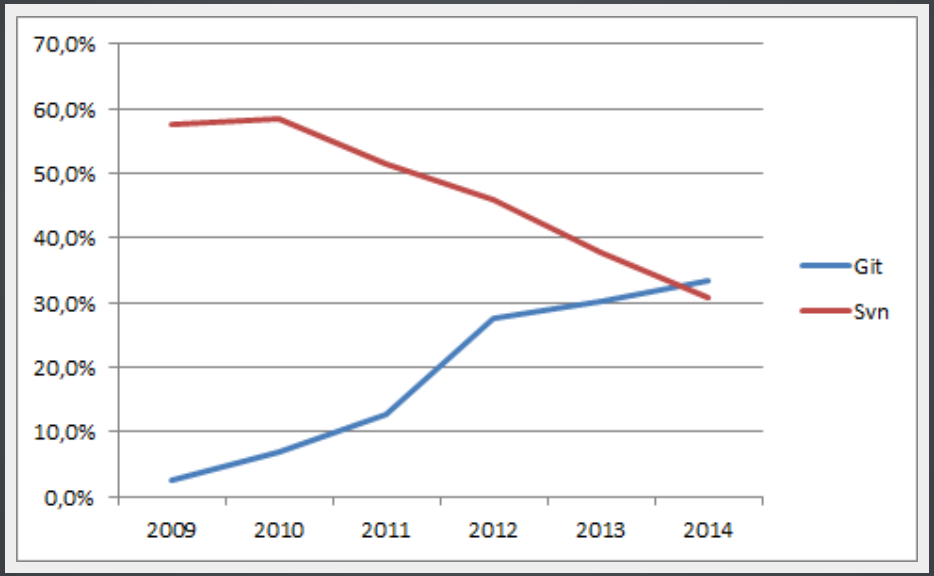
- Speed
- Simple design
- Strong support for non-linear design
- Fully distributed
- able to handle efficiently large projects (like Linux kernel)

GITHUB

- GIT host repository, free for Open Source
- launched in 2008
- offers many project services over source code hosting:
  - Documentation, wikis, mini-sites
  - Tasks, issue tracking
  - ...
  - Gist
- GitHub is today the world's biggest code host, it has more than 3 million users, over than 10 million repositories

GIT ADOPTION

- popularity of Git explosed with **GitHub**
- in 2014 Git overtook Subversion in Eclipse Foundation results (biaised Java Open Source)



PRINCIPLES OF GIT

- Git is a DCVS (Distributed VCS)
- Git works on snapshots
- Git has integrity builtin
- Git works locally (amap)
- Git has 3 local states

GIT IS A DCVS

CVCS (CENTRALIZED VERSION CONTROL SYSTEM)

Probably what you had until now: CVS and Subversion are VCS.

One Server is responsible for mantaining versioned files.

This allows for heavy collaboration, having an HEAD version, easely controlling authorizations and rights

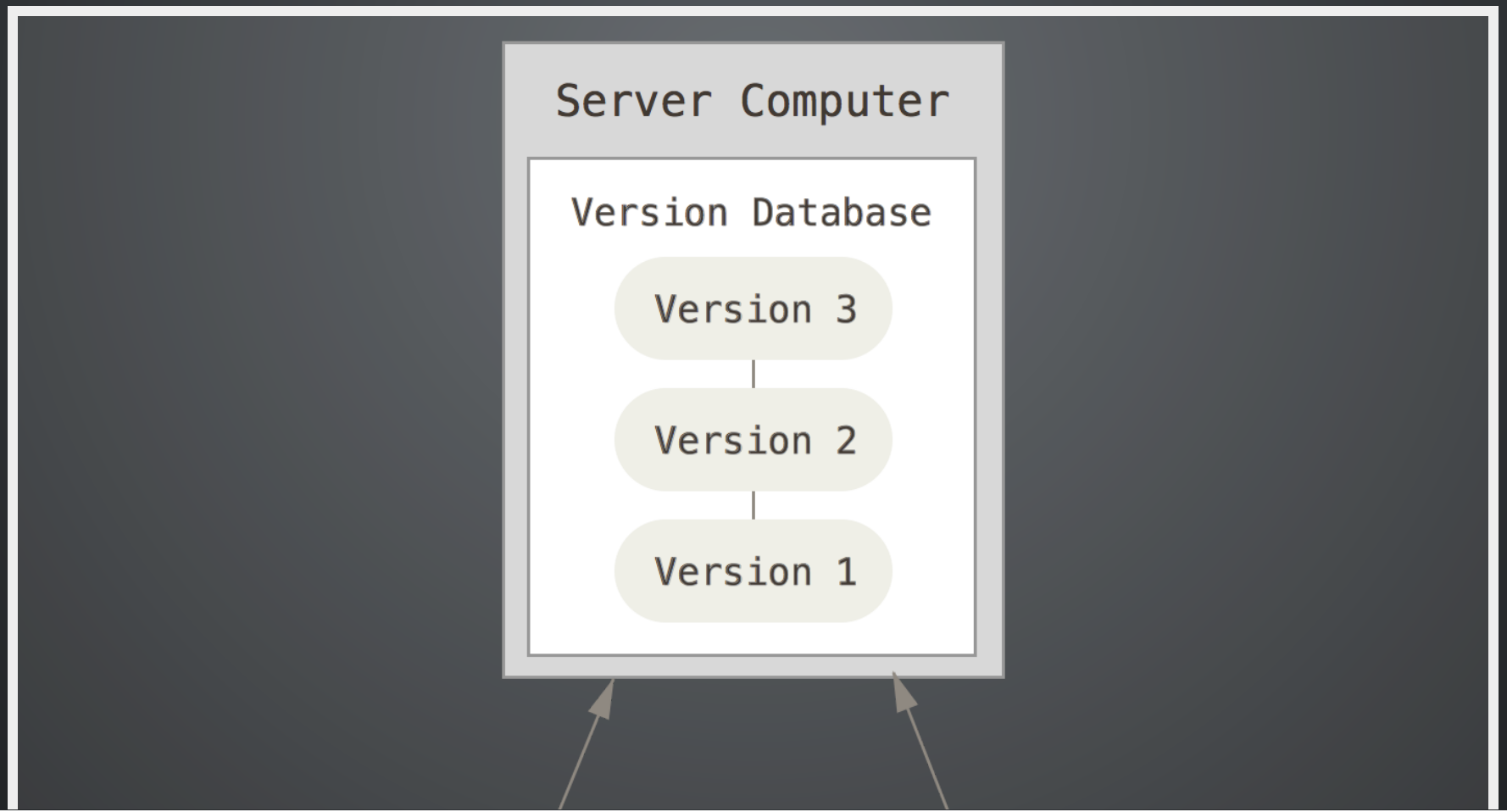
But Server is a SPOF, and some heavy operations can be slow.

DVCS (DISTRIBUTED VERSION CONTROL SYSTEM)

New VCS (Git, Mercurial, Bazaar, Darcs) tend to be distributed.

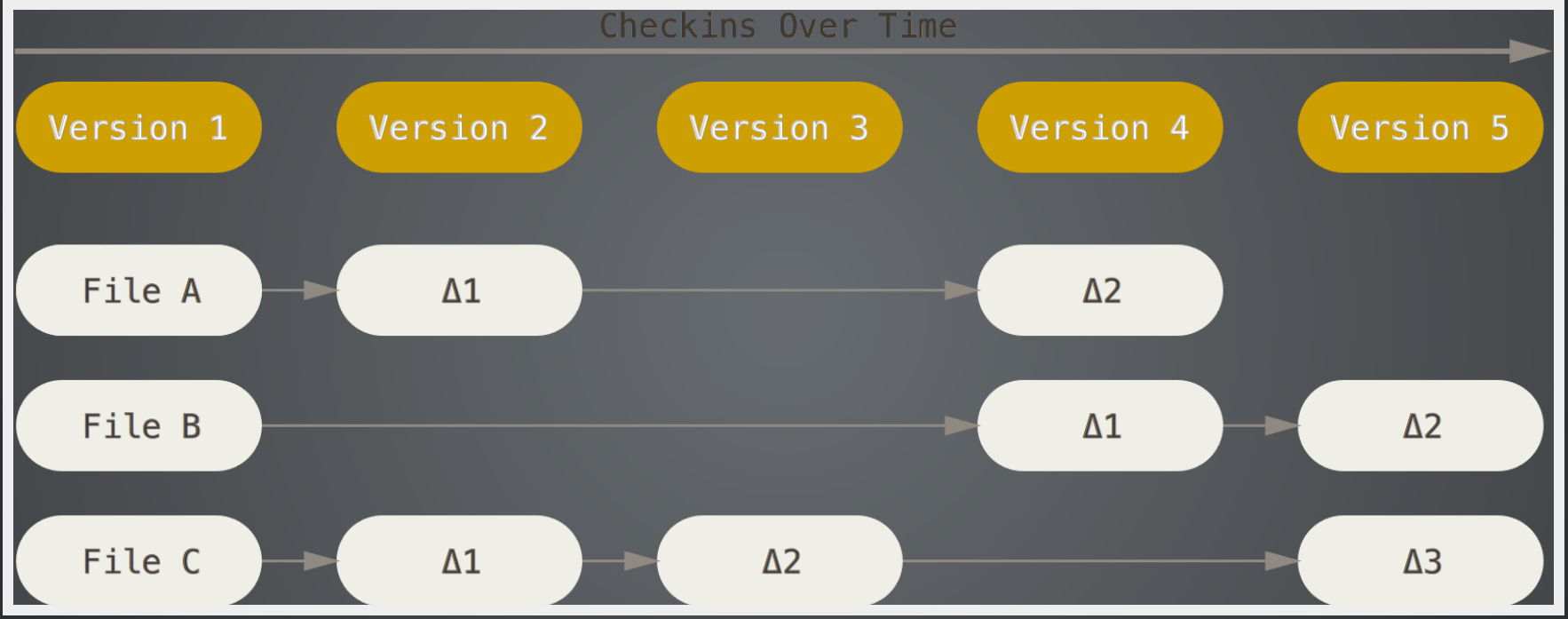
Each Client is a potential server (it has all history).

This eliminates constant need of server, SPOF and allows local collaborations



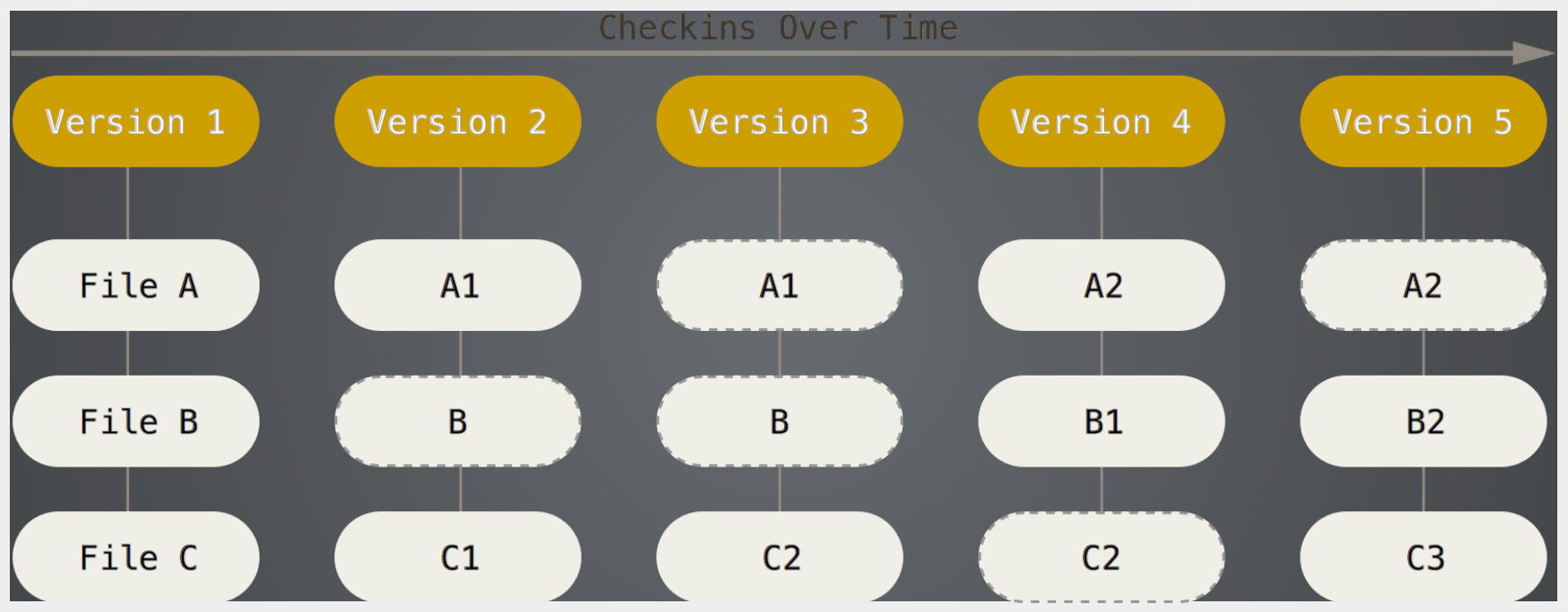
GIT WORKS ON SNAPSHOTS

WORKING ON FILES



GIT WORKS ON SNAPSHOTS

WORKING ON SNAPSHOTS



GIT HAS INTEGRITY BUILTIN

GIT checksum everything internally and use SHA-1 checksum hashes instead of filenames on his DB

No data corruption possible.

GIT WORKS LOCALLY (AMAP)

As almost everything is stored locally, the real needs to perform distant operations are minimized.

This allows for working without connection to server, and to gain speed.

GIT HAS 3 LOCAL STATES

NB: VERY IMPORTANT TO UNDERSTAND!

This is often confusing when starting to use Git.

On your project you will have three possible states:

- a **Working Copy** (the physical files with which you work, your workspace)
- a **Staging Area** (a virtual place that contains infos about what will go in next commit), historically called **Index** and **Cache**
- the **Git Directory** (where Git stores all metadata and objects for the project, the repository)

The Git basic workflow is:

- you modify files in your working directory
- you "stage the files" (you add snapshots of them to "staging area")
- you commit them locally (this takes the snapshots from staging area to Git directory)

STARTING WITH GIT

- Install GIT
- GIT CLI
- Configure GIT

INSTALL GIT

Of course every linux distrib has git packages

```
> apt-get install git
> yum install git
```

Git is also available on Mac and Windows

GIT CLI

Use the Command Line!!

```
    > git
usage: git [--version] [--help] [-C <path>] [-c name=value]
           [--exec-path[=<path>]] [--html-path] [--man-path] [--info-path]
           [-p|--paginate|--no-pager] [--no-replace-objects] [--bare]
           [--git-dir=<path>] [--work-tree=<path>] [--namespace=<name>]
           <command> [<args>]

The most commonly used git commands are:
   add        Add file contents to the index
   bisect     Find by binary search the change that introduced a bug
   branch     List, create, or delete branches
   checkout   Checkout a branch or paths to the working tree
   clone      Clone a repository into a new directory
   commit     Record changes to the repository
   diff       Show changes between commits, commit and working tree, etc
   fetch      Download objects and refs from another repository
   grep       Print lines matching a pattern
   init       Create an empty Git repository or reinitialize an existing one
```

It is intuitive, rich of infos!

It is powerful! The full Git

It has wonderful help!

```
> git help -a
> git help <verb>
```

Exercise: read all help on `git config`

```
> git help config
```

CONFIGURE GIT

Git configuration has three system levels:

1. `--system` - **system global** (on Linux in /etc/gitconfig)
2. `--global` - **user global** (on Linux in ~/.gitconfig)
3. `--local` - **repository** (in .git/config)

Values override (specific over generic).

CONFIGURE IDENTITY

```
> git config --global user.name "John Doe"
> git config --global user.email johndoe@example.com
```

CONFIGURE EDITOR

```
> git config --global core.editor vim
```

CHECK YOUR CONFIG SETTINGS

```
> git config --list
> git config <key>
```

BASIC WORK WITH GIT

- Get a Repository
- Working with local changes
- Working with remote(s)
- Branching (opt.)
- Tagging (opt.)

GET A REPOSITORY

Initialize a repository for an empty local project,
or put an existing local project under version control:

```
> git init
```

It will create a **.git** folder that contains the repository

Clone an existing repository:

```
> git clone https://github.com/project/project
> git clone username@host:/path/to/repository
```

(according to protocol choice *https* or *ssh*)

This does all necessary using defaults:

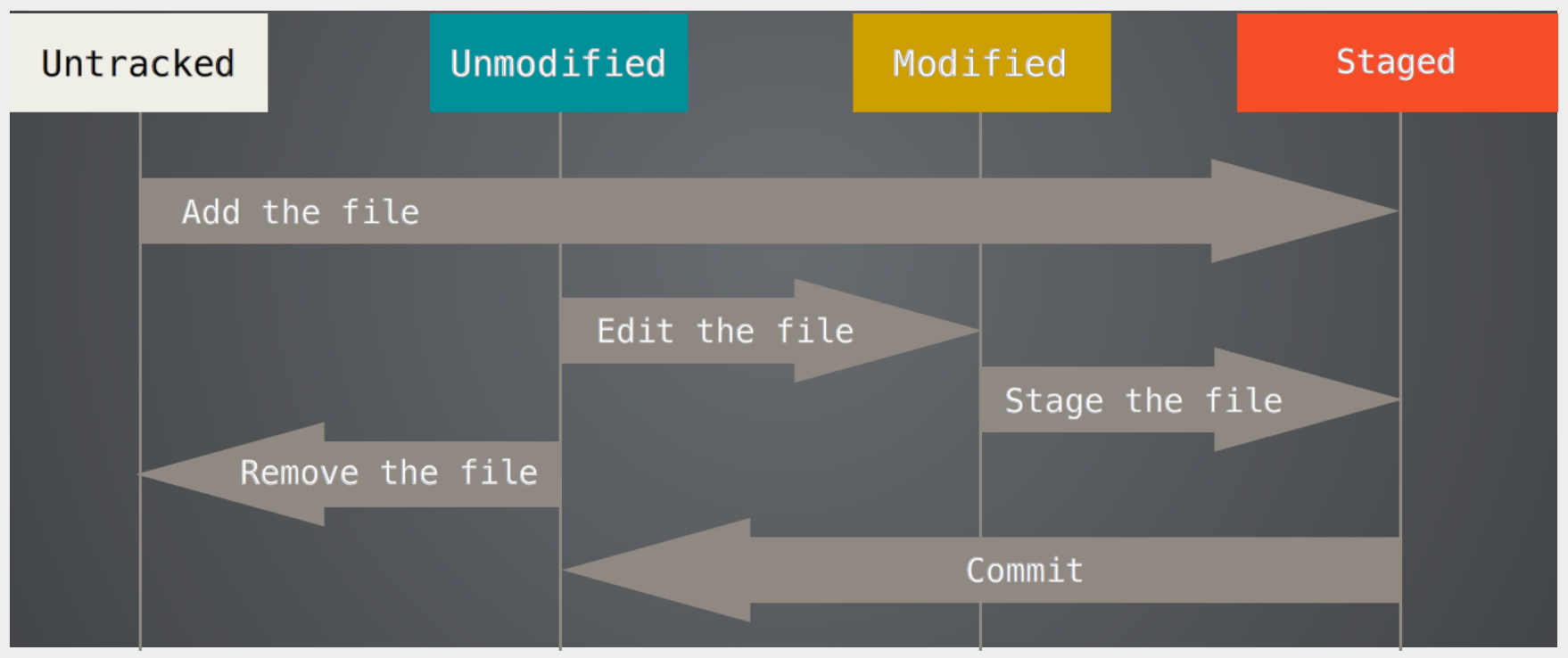
- it creates the working directory from remote master branch
- cloned repository becomes remote origin
- local branch is set to master

(all this will become clearer later)

WORKING WITH LOCAL CHANGES

Each file can be tracked or untracked, modified or unmodified.

So there is a workflow for files



LOOKING FILE STATUS

```
> git status
> git status -s
```

TRACKING A FILE

```
> git add <filename>
> git add *
```

IGNORING FILES

Use .gitignore file

```
# no .a files
*.a

# but do track lib.a, even though you're ignoring .a files above
!lib.a

# only ignore the root TODO file, not subdir/TODO
/TODO

# ignore all files in the build/ directory
build/

# ignore doc/notes.txt, but not doc/server/arch.txt
doc/*.txt

# ignore all .txt files in the doc/ directory
doc/**/*.txt
```

LOOKING MODIFIED FILES

```
> git diff
> git diff --staged
```

COMMIT

```
> git commit -m "This is my beautiful commit!"
> git commit -a -m 'committed skipping staging'
```

REMOVING FILES

```
> git rm <filename>
> git commit -m "removed <filename>"
```

MOVING FILES

```
> git mv <file_from> <file_to>
```

```
> mv <file_from> <file_to>
> git rm <file_from>
> git add <file_to>
```

EXERCICE 1-A

Follow the tutorial tryGit by GitHub

Stop after step 9

(Ask instructor when in doubt)

WORKING WITH REMOTE(S)

LOOKING UP REMOTES

```
> git remote
> git remote -v
```

```
> git remote -v
defunkt   https://github.com/defunkt/grit (fetch)
defunkt   https://github.com/defunkt/grit (push)
koke      git://github.com/koke/grit.git (fetch)
koke      git://github.com/koke/grit.git (push)
origin    git@github.com:mojombo/grit.git (fetch)
origin    git@github.com:mojombo/grit.git (push)
```

INSPECTING REMOTES

```
> git remote show origin
* remote origin
  Fetch URL: https://github.com/schacon/ticgit
  Push  URL: https://github.com/schacon/ticgit
  HEAD branch: master
  Remote branches:
    master                               tracked
    dev-branch                           tracked
  Local branch configured for 'git pull':
    master merges with remote master
  Local ref configured for 'git push':
    master pushes to master (up to date)
```

ADDING A REMOTE

```
> git remote add origin https://github.com/schacon/ticgit
> git remote add pb https://github.com/paulboone/ticgit
> git remote -v
origin    https://github.com/schacon/ticgit (fetch)
origin    https://github.com/schacon/ticgit (push)
pb    https://github.com/paulboone/ticgit (fetch)
pb    https://github.com/paulboone/ticgit (push)
```

RENAMING AND REMOVING REMOTES

```
> git remote rename pb paul
> git remote rm paul
```

PUSHING

Pushing sends new local commits to remote server.

It requires write access to remote AND that local repository is up to date.

If local repository is not, a fetch/pull is required.

```
> git push <remote-name> <branch-name>
> git push origin master
```

FETCHING

Fetching gets data from remote to local

```
> git fetch <remote-name>
```

Fetching works at the *repository* level!

PULLING

```
> git pull
```

Fetch *and merge* into your current branch.

At least it tries to merge, you can have conflicts

EXERCICE 1-B

Follow the tutorial tryGit by GitHub

Stop after step 17

(Ask instructor when in doubt)

BRANCHING

Create a new branch named "feature_x" and switch to it:

```
> git checkout -b feature_x
```

Switch to an existing branch:

```
> git checkout master
```

Merge a branch into your local active branch

```
> git merge <branch>
```

Delete a branch:

```
> git branch -d feature_x
```

Pushing the branch to a remote

```
> git push origin <branch>
```

TAGGING

```
> git tag 1.0.0 1b2e1d63ff
```

EXERCICE 1-C

Finish the tutorial tryGit by GitHub

(Ask instructor when in doubt)

MORE STUFF

- Working out common problems
- Calm down and get your cheat sheet
- GIT references and tutorials

WORKING OUT COMMON PROBLEMS

replace the changes in your working tree with the last content in HEAD (current branch)

```
> git checkout -- <filename>
```

drop all your local changes and commits, recover server infos and history and point your local master branch at it

```
> git fetch origin
> git reset --hard origin/master
```

change last commit

```
> git commit --amend
```

Not exactly that, but very similar *until you don't propagate changes* to remotes.

Do not use otherwise!

CONFLICTS

Resolve conflicts by looking at them:

```
> git diff <source_branch> <target_branch>
```

resolve then manually, then "mark as marged" adding them back:

```
> git add <filename>
```

EXERCICE 2

Follow the tutorial Git Immersion

(Ask instructor when in doubt)

CALM DOWN AND GET YOUR CHEAT SHEET

fournova

GIT CHEAT SHEET

presented by TOWER – the most powerful Git client for Mac

CREATE

Clone an existing repository

```
$ git clone ssh://user@domain.com/repo.git
```

Create a new local repository

```
$ git init
```

LOCAL CHANGES

Changed files in your working directory

```
$ git status
```

Changes to tracked files

```
$ git diff
```

Add all current changes to the next commit

```
$ git add .
```

Add some changes in <file> to the next

BRANCHES & TAGS

List all existing branches

```
$ git branch
```

Switch HEAD branch

```
$ git checkout <branch>
```

Create a new branch based on your current HEAD

```
$ git branch <new-branch>
```

Create a new tracking branch based on a remote branch

```
$ git branch --track <new-branch>
  <remote-branch>
```

Delete a local branch

```
$ git branch -d <branch>
```

Mark the current commit with a tag

```
$ git tag <tag-name>
```

MERGE & REBASE

Merge <branch> into your current HEAD

```
$ git merge <branch>
```

Rebase your current HEAD onto <branch>

Don't rebase published commits!

```
$ git rebase <branch>
```

Abort a rebase

```
$ git rebase --abort
```

Continue a rebase after resolving conflicts

```
$ git rebase --continue
```

Use your configured merge tool to solve conflicts

```
$ git mergetool
```

Use your editor to manually solve conflicts and (after resolving) mark file as resolved

GIT REFERENCES AND TUTORIALS

- Official Git Tutorial
- Pro Git - The Git Book
- Git Real - video tutorial
- Git - the simple guide, by Roger Dudler
- Git - Tutorial, by Lars Vogel

THE END