Git

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Version Control

It allows to track and navigate development's

- history
- different paths

The project/folder to which you apply it gets called a `repository`.

From here, whenever the user feels like, he can mark selected changes as a `commit`, a "snapshot" of the folder in the form of the Δ with its previous (`git-`)recorded version.
`Git` will associate it with a `hash code`, which, in turn, will allow to *go back* to it at any future moment in time.

It's also possible to make the `repository` *remote*, so that it can be interacted with from elsewhere, via its url.
This will allow to work on the same project from different locations, machines, and *people*.

Finally, it allows to *split* the work on the `repo`'s files into separate `branches`, so that it will be possible to work on separate tasks independently and merge later as needed.
`Branches`, actually, are just pointers to `commits`, henche the good practice *"branch early, and branch often"* is performant, other than easy to apply.

Basic commands

local→remote

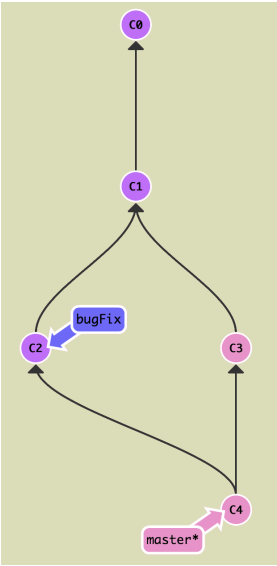
- initialize a new **local** repo: `git init`
- create a **remote** repo: go to website
- connect local and remote: `git remote add origin remote_repo_url`
  from within the local repo (from now on `origin` stands for the **remote** repo url)
- share your local changes to the remote:
  - `git add file1 file2`
  - aggiunge tutti i file del repo **locale** che sono stati modificati:
    `git add -A`
  - `git commit -m "desc"`
  - `git push origin destination_branch_name`

remote→local

- create a **local** repo with a copy of the contents of a **remote** repo:
  `git clone remote_repo_url`
  ! → can be used to clone a local repo too
- retrieve **remote** changes to your **local** folder:
  `git pull remote_repo branch_name`

Separation

- see the current branches: `git branch -a`
- create a new **local** branch: `git branch branch_name`
- move to (last commit of) another branch: `git checkout branch_name`
- create new **local** branch and move to it: `git checkout -b branch_name`
- push a **local** branch to the **remote**: `git push origin branch_name`
- merge `branch2` into `branch1`: `git merge branch2` from `branch1`
- !
  - `git merge master` → merges **local** master into the current branch
  - `git merge origin master` → merges the **remote** master into the current branch



This image is taken from this nice tutorial

```
git checkout -b bugFix
git commit
git checkout master
git commit
git merge bugFix
```

- delete a branch

  locally : `git branch -d localBranchName`

  → `-D` forces the operation

  remotely : `git push origin --delete remoteBranchName`

- get **remote** branches on **local**:

```
git fetch

git fetch -p #when branches were deleted, to retrieve
    the update (p = prune)

git checkout remote_branch_name #without this the branch
     will stay remote
```

Moving upwards and laterally

- see `commit` hash code from `git log`
  ! → to go out from the `log` press `q`
- go to a previous `commit`: `git checkout 0d1d7fc32`
- create new `branch` from there:
  `git checkout -b branch_name 0d1d7fc32`
- lose **local** changes (e.g. in order to retrieve the new **remote** ones: `git stash`
- the `HEAD` is the last commit you checked-out to, the one you're working on
  - `detach` a `commit`: `git checkout 0d1d7fc32` from there
    →previously the `HEAD` was `HEAD`→`branch_x`→`commit_q`, now it is `HEAD`→`commit_q`
    ! → making changes from here (and `commit`ting them) overwrites them on the `detached commit` not on the last one that was logged for the current `branch`, so this is can be used to **undo operations** (one must make further modifications to be able to commit from there)
  - `git` is smart about hashes: it only requires to specify enough characters of the `hash` until it uniquely identifies the `commit` (e.g. `fed2` instead of the `fed2da64c0efc5293610bdd892f82a58e8cbc5d8`)

- it's also possible to use `relative operators` to reference a `commit`:
  - moving upwards of one `commit`: `^` (*caret*)
    - go to parent `commit`: `git checkout branch_name^`
    - grandparent: `branch_name^^`
    - `git checkout HEAD^`
  - moving upwards of `num` commits: `~num`
    - move (by force) the `branch` 3 `commits` before: `git branch -f branch_name HEAD~3`
- add to the current `branch` the selected commits: `git cherry-pick commit-x commit-y etc`
  ! → e.g.: when debugging many `commit`s can be made, but we only want the final one with the fix to be brought into `master`:

```
git checkout debug
/*work*/
git checkout master
git cherry-pick last-commit
```

Merge conflicts

- **vscode** can provide some visual help to solve merge conflicts in general
- but it won't work with Jupyter notebooks because it has difficulties in rendering it and showing the conflicts at the same time
- the merge operation will show the conflicts in the related files by including both alternatives, the user solves the conflicts by deciding which to delete and which to keep