BRANCHING E MERGING

PROGRAMMAZIONE AD OGGETTI

C.D.L. INGEGNERIA E SCIENZE INFORMATICHE

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Branches as labels

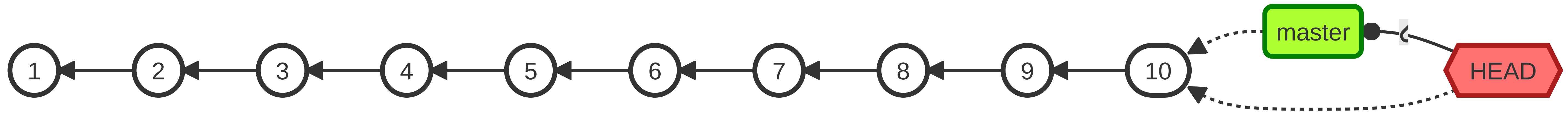
To be able to start new development lines, we need to *create* a **branch**.

In Git, branches work like *movable labels*:

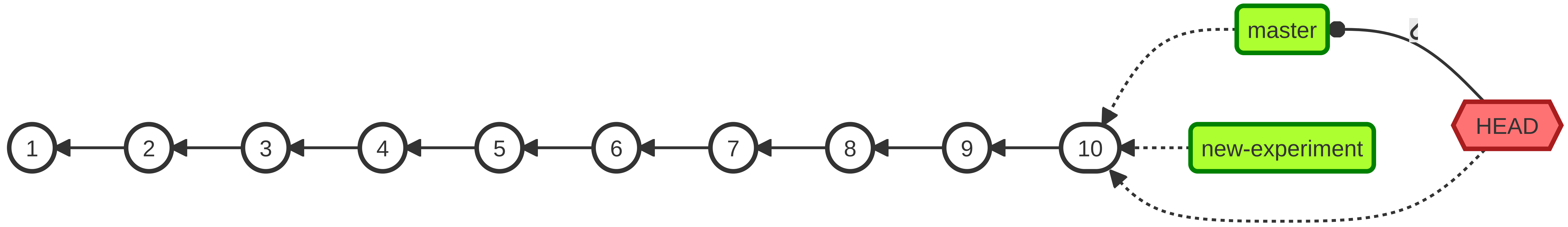
- Upon creation, they are attached to the same commit HEAD refers to
- If a new commit is made when HEAD is attached to them, they **move along with** HEAD

Branch creation

Branches are created with `git branch branch_name`



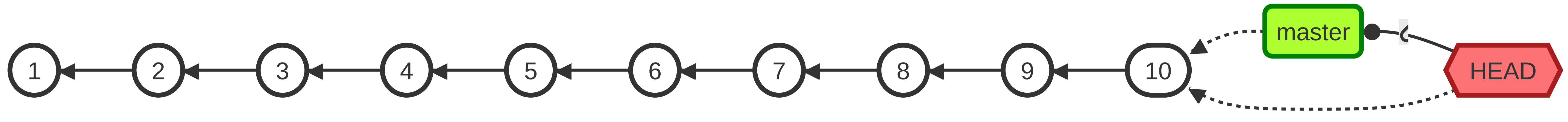
⬇️ `git branch new-experiment` ⬇️



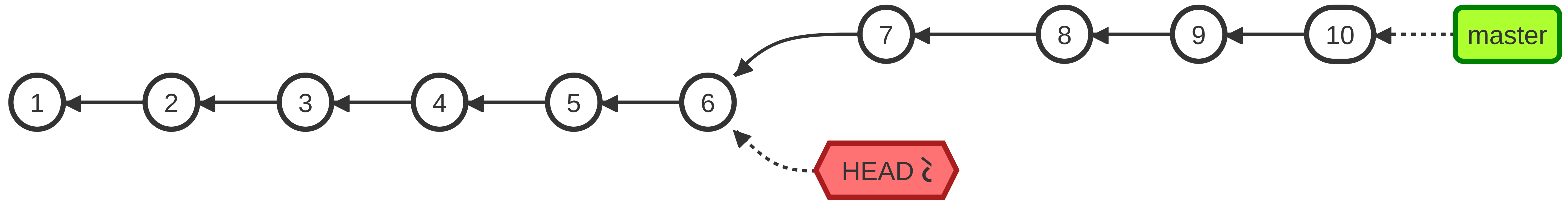
HEAD does not attach to the new branch by default, an explicit checkout is required.

Creating branches when in DETACHED_HEAD

Creating new branches allows to store changes made when we are in **DETACHED_HEAD** state.



⬇️ `git checkout HEAD~4` ⬇️

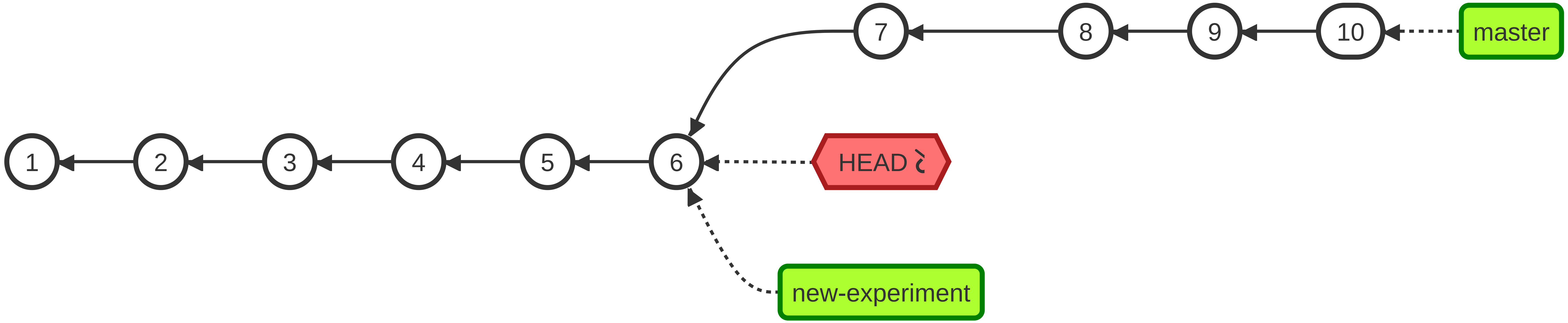


- **DETACHED_HEAD**: our changes will be discarded, unless...

➡️ Next: `git branch new-experiment` ➡️

Creating branches when in DETACHED_HEAD

⬇️ `git branch new-experiment` ⬇️

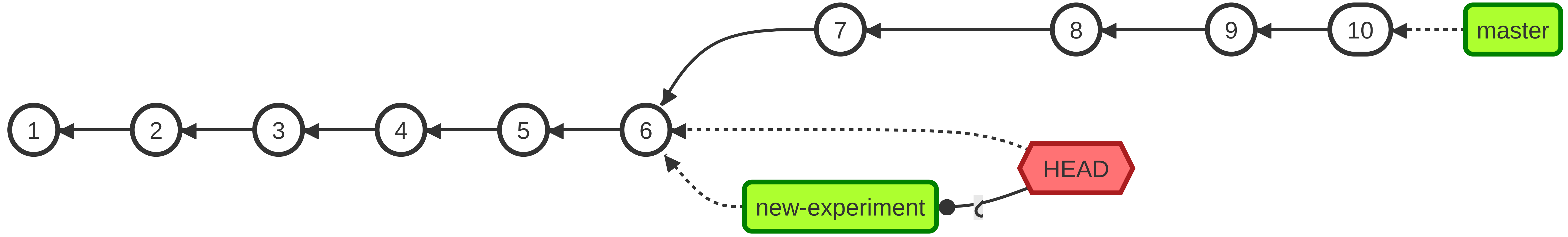


HEAD is still *detached* though, we need to *attach it to the new branch* for it to store our commits

➡️ Next: `git checkout new-experiment` ➡️

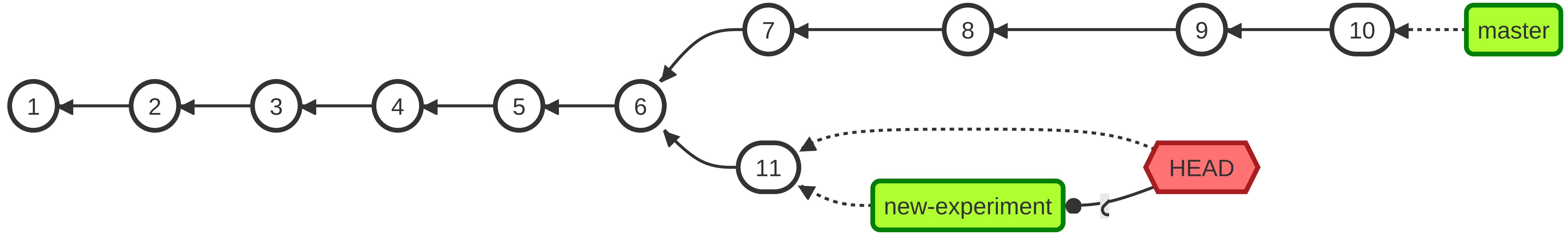
Creating branches when in DETACHED_HEAD

⬇️ `git checkout new-experiment` ⬇️



- New commits will now be stored!

⬇️ [changes] + `git add` + `git commit` ⬇️

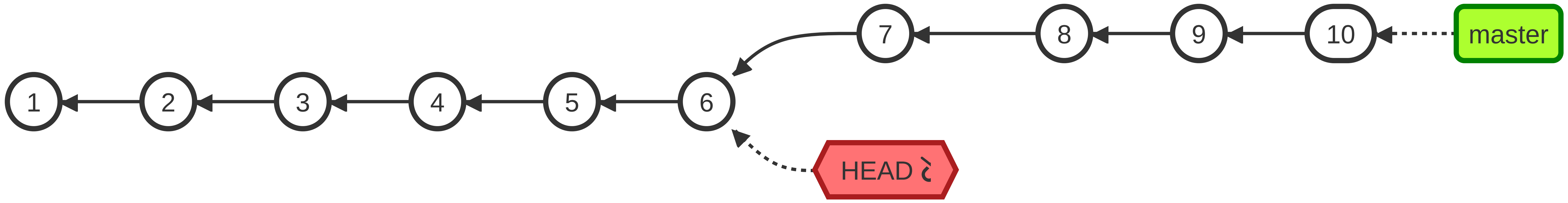


One-shot branch creation

As you can imagine, creating a *new branch* and *attaching HEAD* to the freshly created branch is pretty common

As customary for common operations, a short-hand is provided: `git checkout -b new-branch-name`

- Creates `new-branch-name` from the current position of `HEAD`
- Attaches `HEAD` to `new-branch-name`



⬇️ `git checkout -b new-experiment` ⬇️

Merging branches

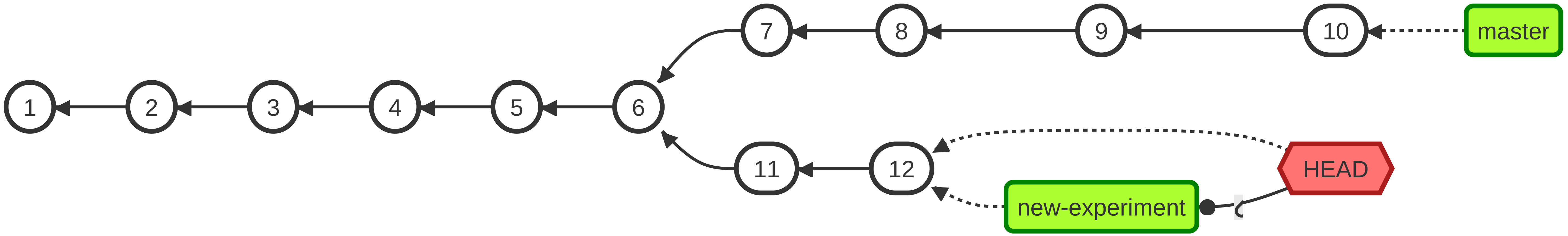
Reunifying diverging development lines is *much trickier* than spawning new development lines

In other words, *merging* is **much trickier** than *branching*

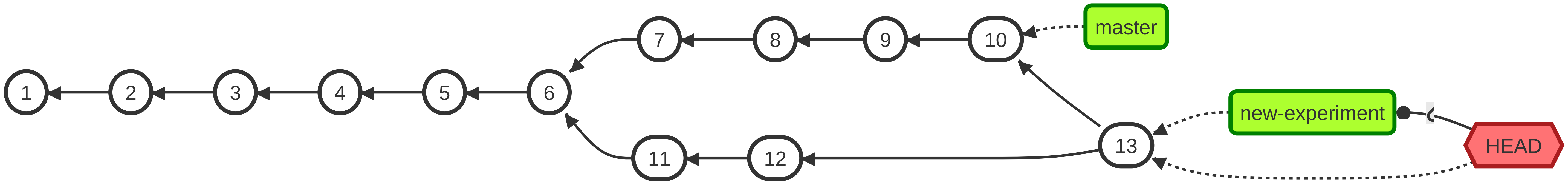
- Historically, with *centralized* version control systems, merging was considered extremely delicate and difficult
- The *distributed* version control systems promoted *frequent*, *small-sized* merges, much easier to deal with
- **Conflicts** *can still arise!*
  - what if we change the same line of code in two branches differently?

In Git, `git merge target` merges the branch named `target` into the current branch (`HEAD` must be attached)

Merge visual example

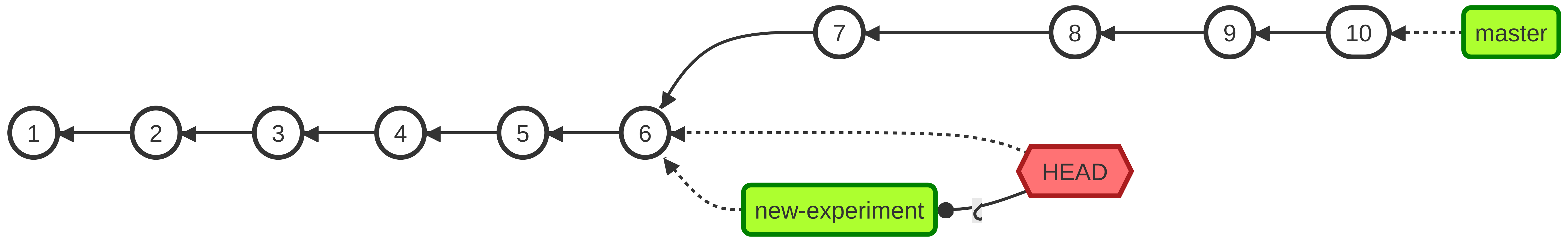


⬇️ `git merge master` ⬇️



Fast forwarding

Consider this situation:



Merge conflicts

Git tries to resolve most conflicts by *itself*

- It's *pretty good* at it
- but things can still require *human intervention*

In case of conflict on one or more files, Git marks the subject files as *conflicted*, and modifies them adding *merge markers*:

```
<<<<<<< HEAD
Changes made on the branch that is being merged into,
this is the branch currently checked out (HEAD).
=======
Changes made on the branch that is being merged in.
>>>>>>> other-branch-name
```

- The user should *change the conflicted files* so that they reflect the *final desired status*
- The (now fixed) files should get added to the stage with `git add`
- The merge operation can be concluded through `git commit`
  - In case of merge, the message is pre-filled in
  - If the message is okay, `git commit --no-edit` can be used to use it without editing

Good practices

Avoiding merge conflicts is *much* better than solving them

Although they are unavoidable in some cases, they can be *minimized* by following a few *good practices*:

- **Do not** *track files that can be generated*
  - ▶ This is harmful under many points of view, and merge conflicts are one
- **Do** *make many small commits*
  - ▶ Each coherent change should be reified into a commit
  - ▶ Even very small changes, like modification of the whitespaces
  - ▶ Smaller commits help Git better figure out what changed and in which order, generally leading to finer grained (and easier to solve) conflicts
- **Do** *enforce style rules* across the team
  - ▶ Style changes are legitimate changes
  - ▶ Style is often enforced at the IDE level
  - ▶ Minimal logical changes may cause widespread changes due to style modifications
- **Do** *pay attention to newlines*
  - ▶ Different OSs use different newline characters
  - ▶ Git tries to be smart about it, often failing catastrophically