Git

An expert cheat sheet

Donaueschingen, December 2024

Intro

Who am I?

Florian Schick

// Independent Software Developer //

Focused on

Full-Stack with .NET/Core, C#, Angular, Vue.js

Clean code // easy to read, easy to maintain //

Creator of

PLAINQUIRE.com

Filtering, sorting & pagination for ASP .NET Core

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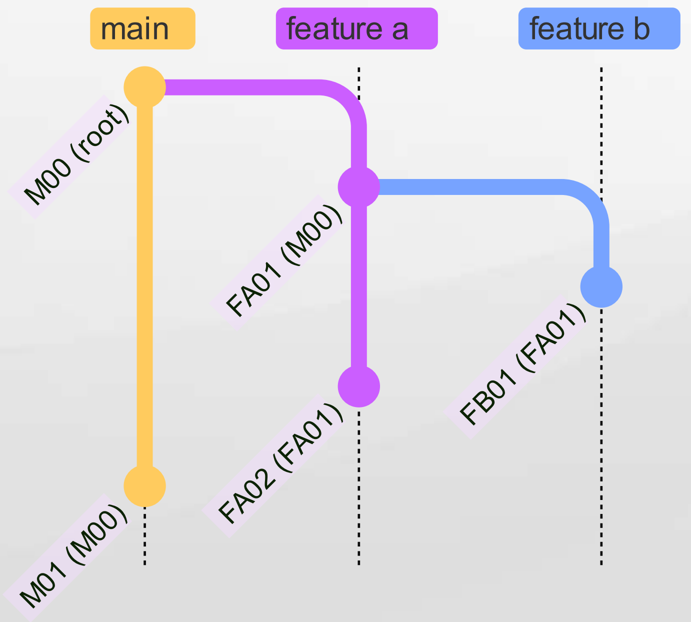
Easily comes what you already know

Graph anatomy

Git is based on a data structure concept called "Directed Acyclic Graph" (DAG) (German: "gerichteter azyklischer Graph")



Commit anatomy

A commit encapsulates the changes to the files since the last commit. It records what was added, removed, or modified in the project

Commit
SHA
Tree | SHA
Commit | Message
Commit | Parent
Author | Name, E-Mail, Timestamp
Comitter | Name, E-Mail, Timestamp

Merge commit
SHA
Tree | SHA
Commit | Message
Commit | Parent 1, Parent 2
Author | Name, E-Mail, Timestamp
Comitter | Name, E-Mail, Timestamp

Commit anatomy

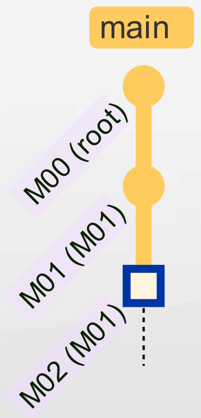
The SHA of a commit is build from the following information

```
tree <TREE-SHA>
parent <PARENT1-SHA>   # Only if there are parent commits
parent <PARENT2-SHA>   # Only if a merge commit
author <AUTHOR-NAME> <AUTHOR-EMAIL> <AUTHOR-TIMESTAMP>
committer <COMMITTER-NAME> <COMMITTER-EMAIL> <COMMITTER-TIMESTAMP>

<COMMIT-MESSAGE>
```

Node, Commit, SHA

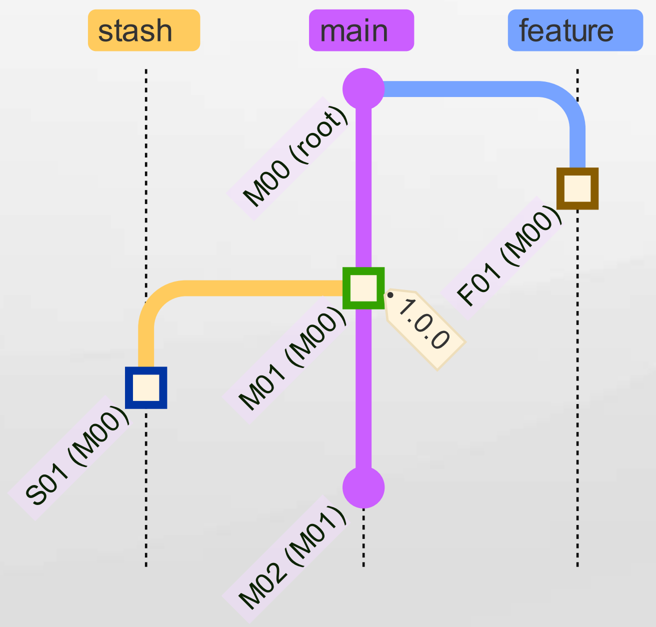
A node, called a 'commit' in git, represents a specific state or snapshot of the repository. A node is represented by its SHA.



Tag, Branch, Stash

Technically, a tag, a branch, and a stash are all the same:

An alias (pointer) to a particular snapshot (commit, identified by its SHA) of the repository



Tag, Branch, Stash

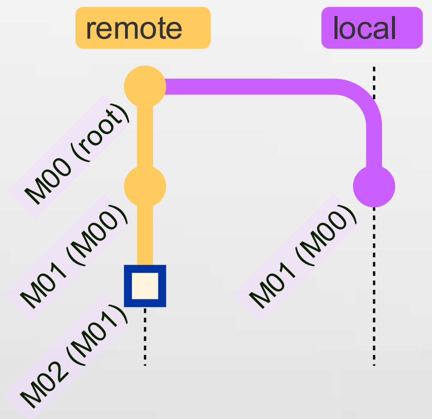
Technically, a tag, a branch, and a stash are all the same

But each serves a different purpose:

- Tags mark fixed points in history
- branches track ongoing development
- stashes temporarily save uncommitted changes

Pull

A `git pull` internally fetches changes from remote (`git fetch`) and integrate (merge) them afterwards into your local branch (`git merge`)



Pull

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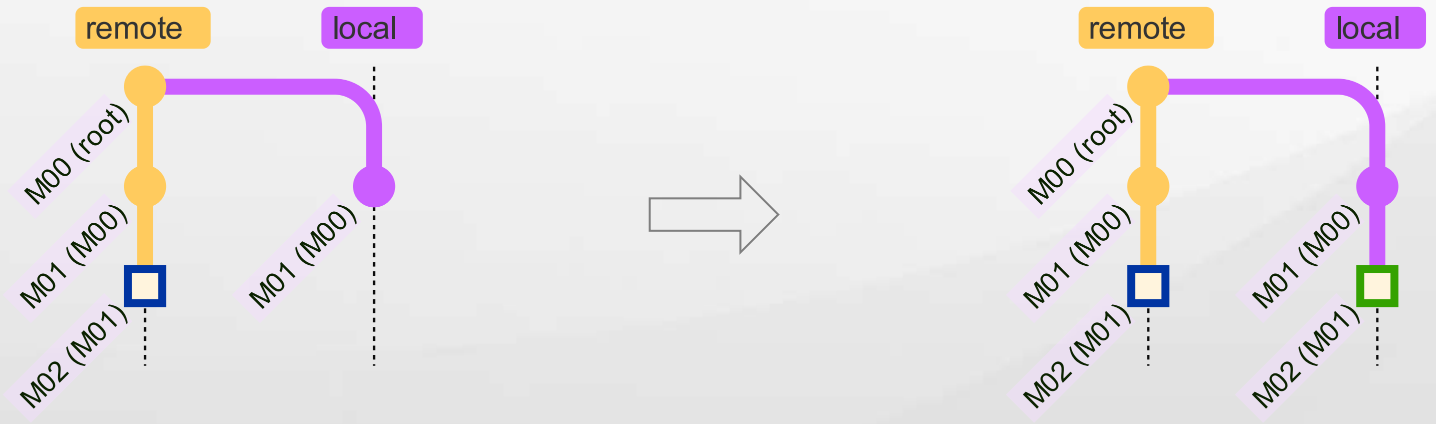
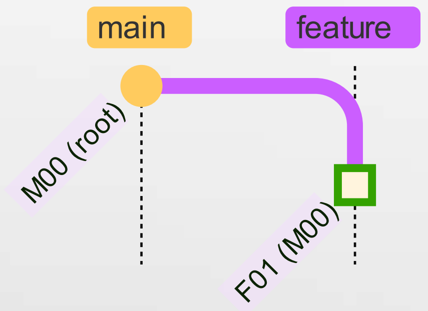


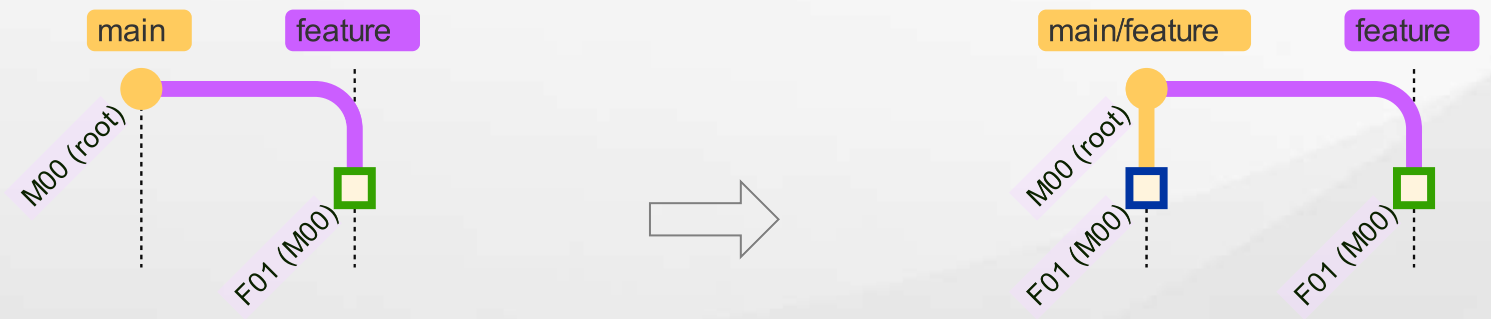
Merge (fast-forward)

Merge branch `feature` into `main` (using `fast-forward` strategy)



Merge (fast-forward)

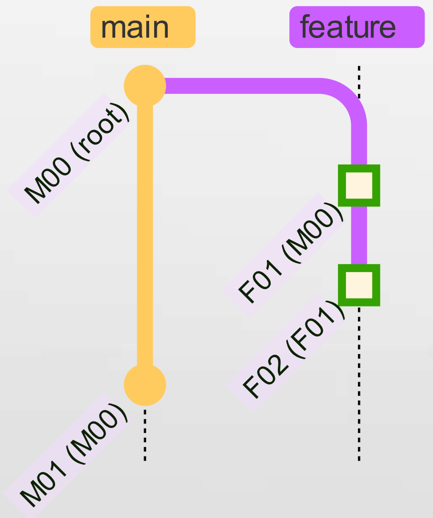
Merge branch `feature` into `main` (using `fast-forward` strategy)



Technically, the pointer to the latest commit of `main` branch is set to the latest commit of `feature` branch.

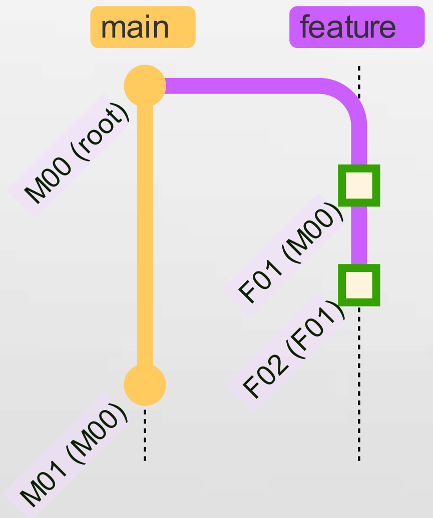
Merge (recursive)

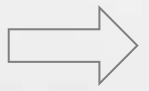
Merge branch `feature` into `main` (using `recurive` strategy)

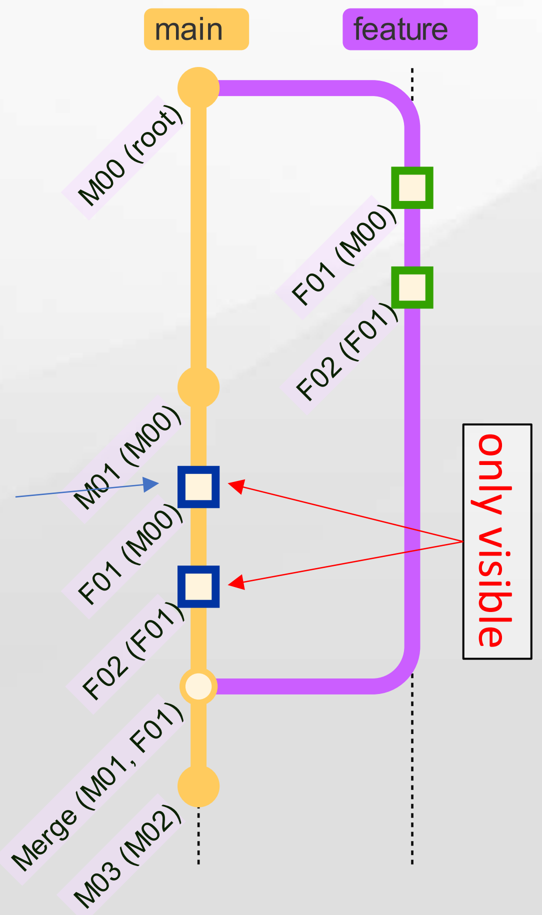


Merge (recursive)

Merge branch `feature` into `main` (using `recursive` strategy)







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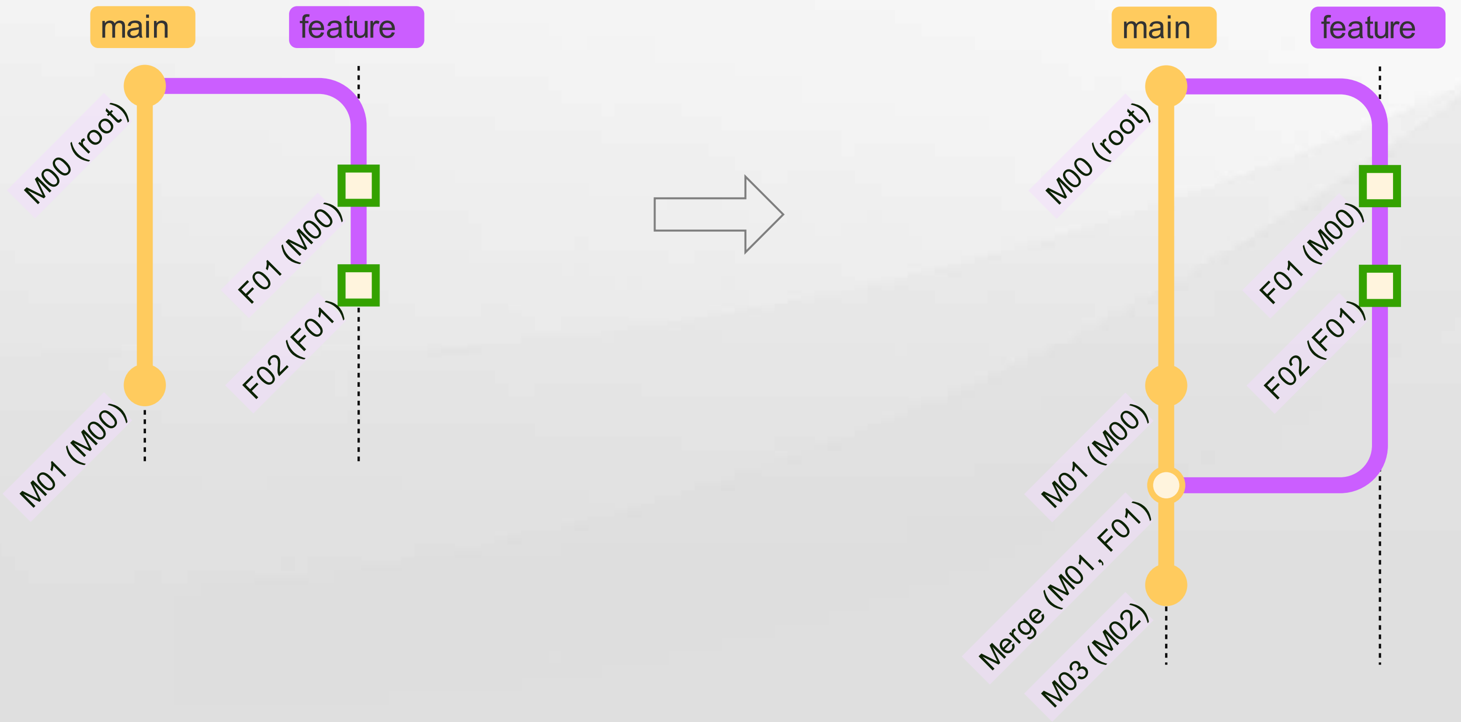


Merge (recursive)

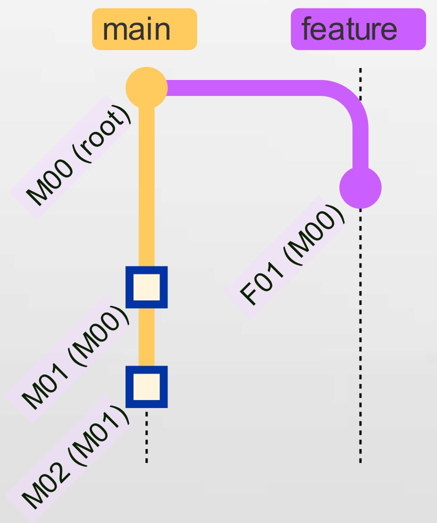
Merge branch `feature` into `main` (using `recurive` strategy)

Technically

- Changes to files of **all** commits on `feature` branch are applied to `main` branch
- merge conflicts are resolved (either automatically or by user)
- a **single** merge commit with 2 parents is created on branch `main`

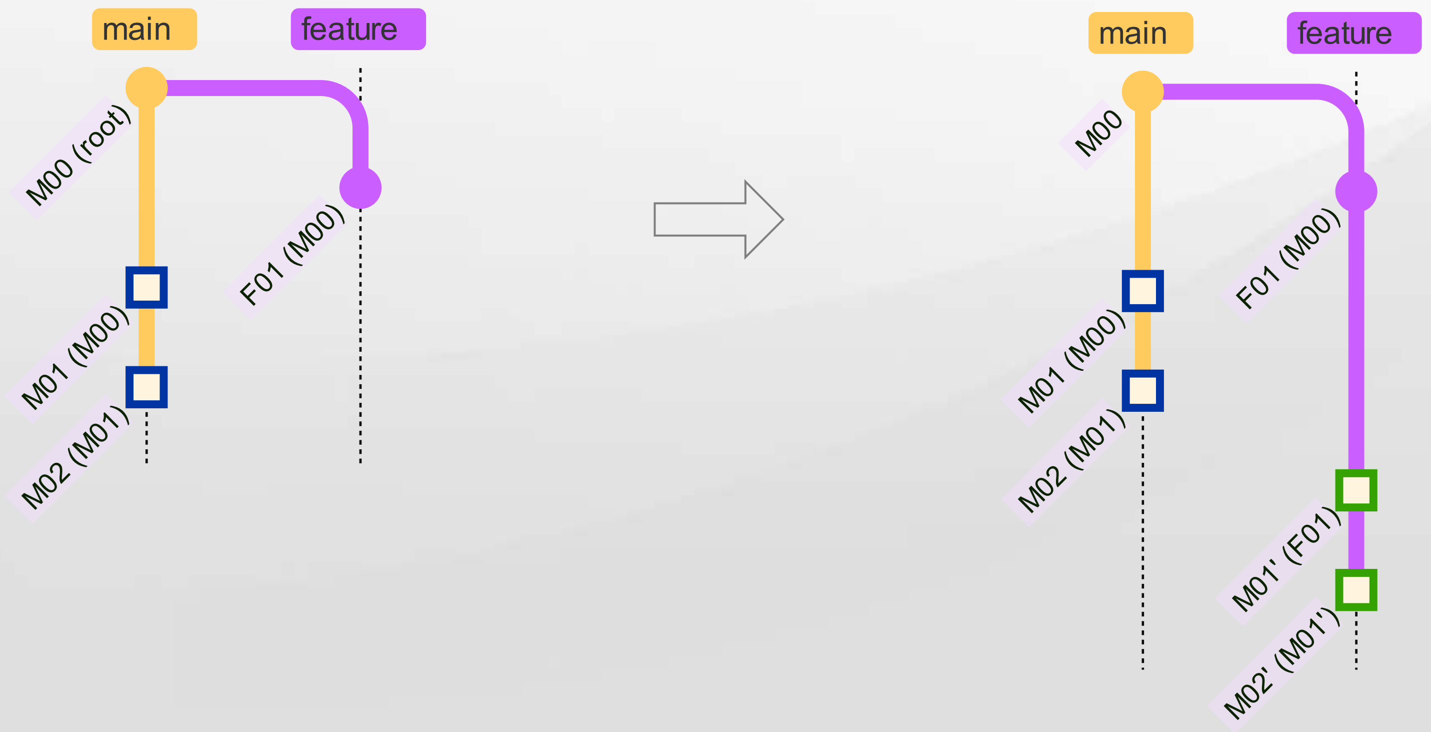
Cherry picking

Cherry pick commits `M01` and `M02` from `main` to `feature` branch



Cherry picking

Cherry pick commits `M01` and `M02` from `main` to `feature` branch



Cherry picking

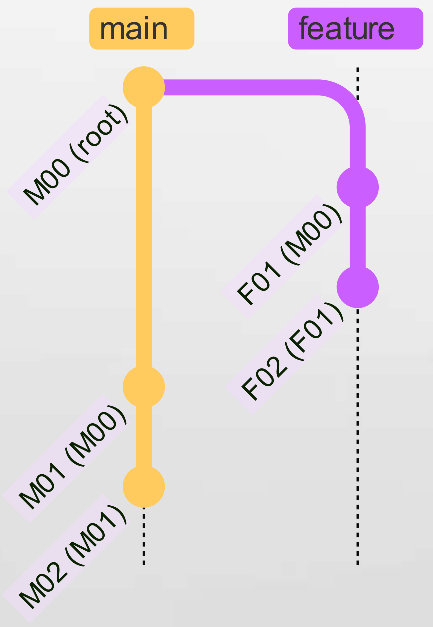
Cherry pick commits `M01` and `M02` from `main` to `feature` branch

Changes to files of **individual** commits on branch `main` are replayed, merged and committed as **individual** commits on branch `feature`.

It's the same as if changes of individual commits were made and committed manually by a user.

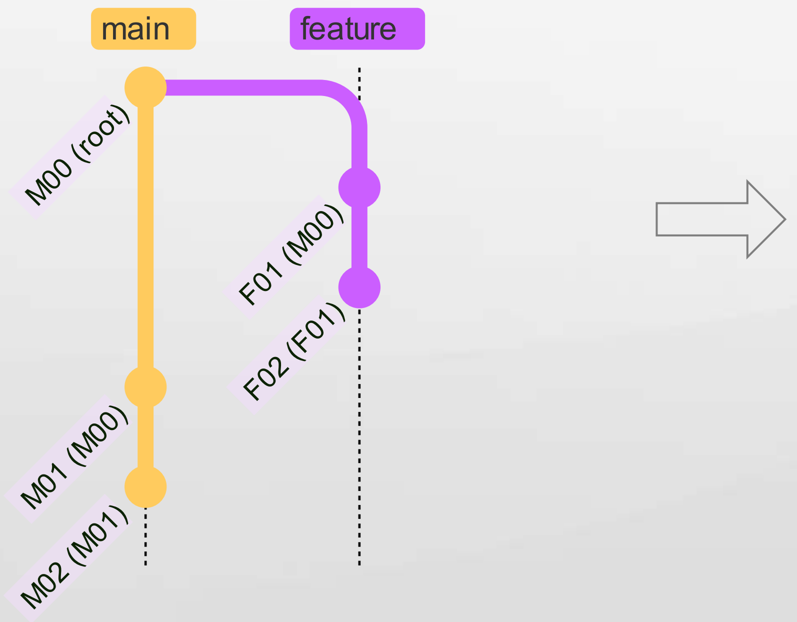
Rebase

Rebase branch `feature` onto `main`



Rebase

Rebase branch `feature` onto `main`



Rebase

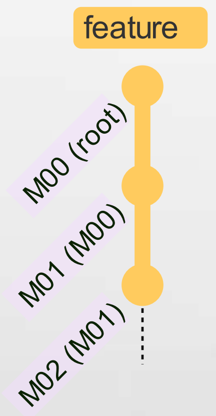
Rebase branch `feature` onto `main`

Internally (schematic, real code works slightly different)

- a temporary branch `feature_tmp` is created on commit `M02` of `main` branch
- the commits `F01` and `F02` are **cherry-picked** from `feature` branch into `feature_tmp`
- the `feature` branch is deleted
- the branch `feature_tmp` is renamed to `feaure`

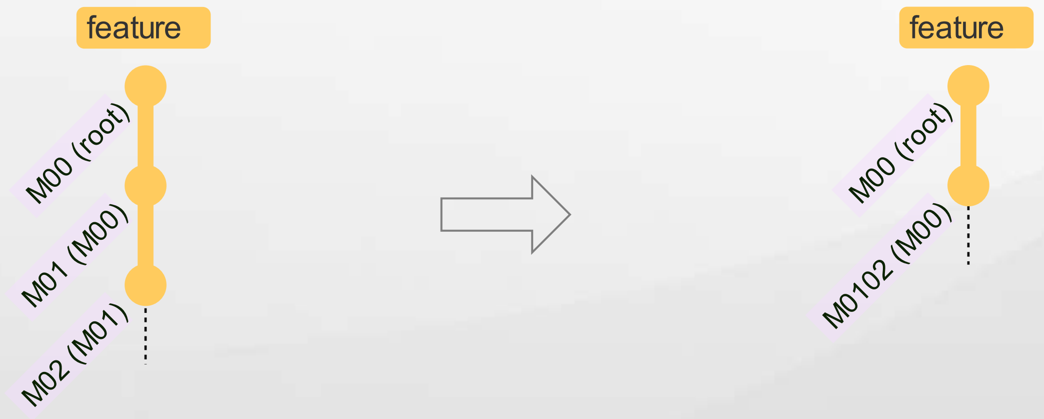
Squash

Squash the commits `M01` and `M02` to a single commit



Squash

Squash the commits `M01` and `M02` to a single commit



Squash

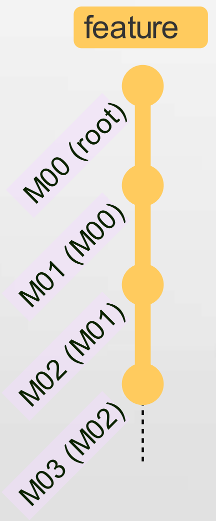
Squash the commits `M01` and `M02` to a single commit

Internally (schematic, real code works slightly different)

- a temporary branch `main_tmp` is created on commit `M00` of `main` branch
- changes to files of **all** commits to squash are applied to `main_tmp` branch
- changes are committed as **single** commit `M0102`
- the `main` is deleted
- the branch `main_tmp` is renamed to `main`

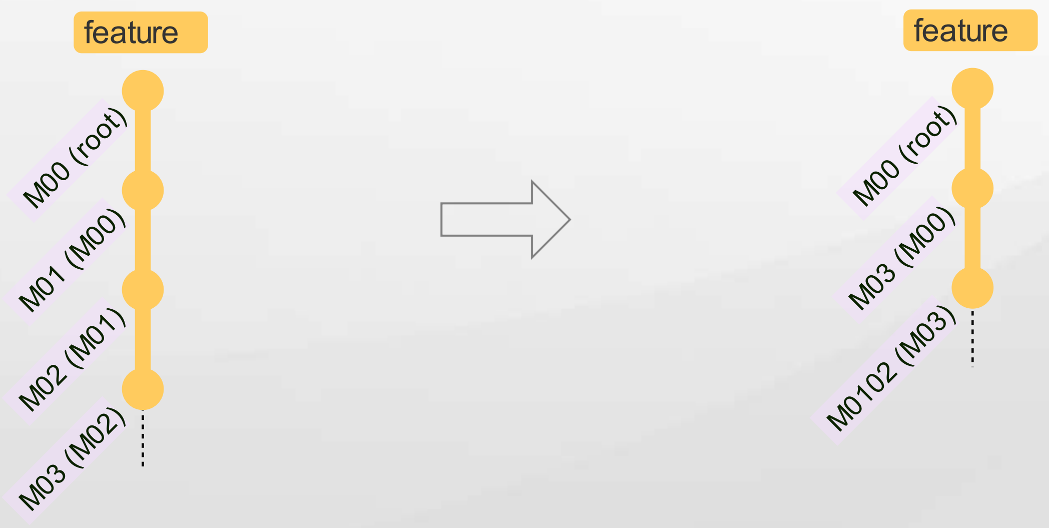
History rewriting

Rearrange and / or squash individual commits on a branch



History rewriting

Rearrange and / or squash individual commits on a branch



History rewriting

Rearrange and / or squash individual commits on a branch

Internally, history rewriting is a forced rebase on any previous commit of the same branch.

Thank you

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