

Git advanced usage

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HPC Café, February 3, 2026





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Introduction

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So you probably know those commands?

- `git clone https://github.com/RRZE-HPC/likwid`
- `git pull`
- `git add main.c`
- `git commit -m "very much interesting!"`
- `git push`

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But do you know about?

- staging area

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- staging area
- history

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- history
- reflog

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- `git pull`
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But do you know about?

- staging area
- history
- reflog

Don't worry, this won't be a "just theory" lesson :-)

Introduction

Have you seen those “errors” before?

Introduction

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```
michael@michael-HP:~/Projects/BabelStream$ git status
HEAD detached at 78ba4ff
nothing to commit, working tree clean
```

Introduction

Have you seen those “errors” before?

```
michael104h@unrz104h:~/Projects/rocm-systems$ git pull
HEAD detached from master
nothing to merge, aborting.
Untracked files:
  (use "git add <file>" to include in what will be committed)
        README.md
```

Introduction

Have you seen those “errors” before?

```
michael@unrz104h:~/Projects/rocm-systems$ git pull
HEAD detached from master
nothing to commit, working directory clean
unrzs104h@testfront1:~/Projects/rocm-systems$ git pull
Updating e45c56c0f8..66ee941fea
error: Your local changes to the following files would be overwritten by merge:
michael@michael-HP:~/tmp/mygit$ git merge feature-a
Auto-merging main.c
CONFLICT (content): Merge conflict in main.c
Automatic merge failed; fix conflicts and then commit the result.
```

Introduction

Have you seen those “errors” before?

```
michael@unrz104h:~/Projects/rocm-systems$ git pull
HEAD detached from master
nothing to commit, working directory clean
Updating e45c56c0f8..66ee941fea
error: Your local changes to the following files would be overwritten by merge:
michael@michael-HP:~/tmp/mvait$ git merge feature-a
Auto-merging feature-a
CONFLICT (content): Merge conflict in feature-a
Automated merge failed; fix conflicts and then commit the result.
! [rejected]          master -> master (non-fast-forward)
error: failed to push some refs to 'github.com:ipatix/deleteme.git'
hint: Updates were rejected because the tip of your current branch is behind
hint: its remote counterpart. If you want to integrate the remote changes,
hint: use 'git pull' before pushing again.
hint: See the 'Note about fast-forwards' in 'git push --help' for details.
```

Introduction

Have you seen those “errors” before?

```
michael@unrz104h:~/tmp/mygit2$ git pull
HEAD detached from master
Updating
nothin
error: You are the current branch
To git@github.com:ipatix/deleteme
  ! [rebase]
error: There is no tracking information for the current branch.
      Please specify which branch you want to rebase against.
      See git-pull(1) for details.

      git pull <remote> <branch>
If you wish to set tracking information for this branch you can do so with:

      git branch --set-upstream-to=origin/<branch> master
```

merge:

ls behind
changes,
details.

“solid fundamentals → advanced user”

Git history

Git history

First things first:

- What it is not: The history of the tool Git itself

Git history

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- What it is: The history of commits of a Git repository

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Why is history relevant?

- We use it to look back in time.

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- What it is: The history of commits of a Git repository

Why is history relevant?

- We use it to look back in time.
→ It should be easy to look back in time

Git history

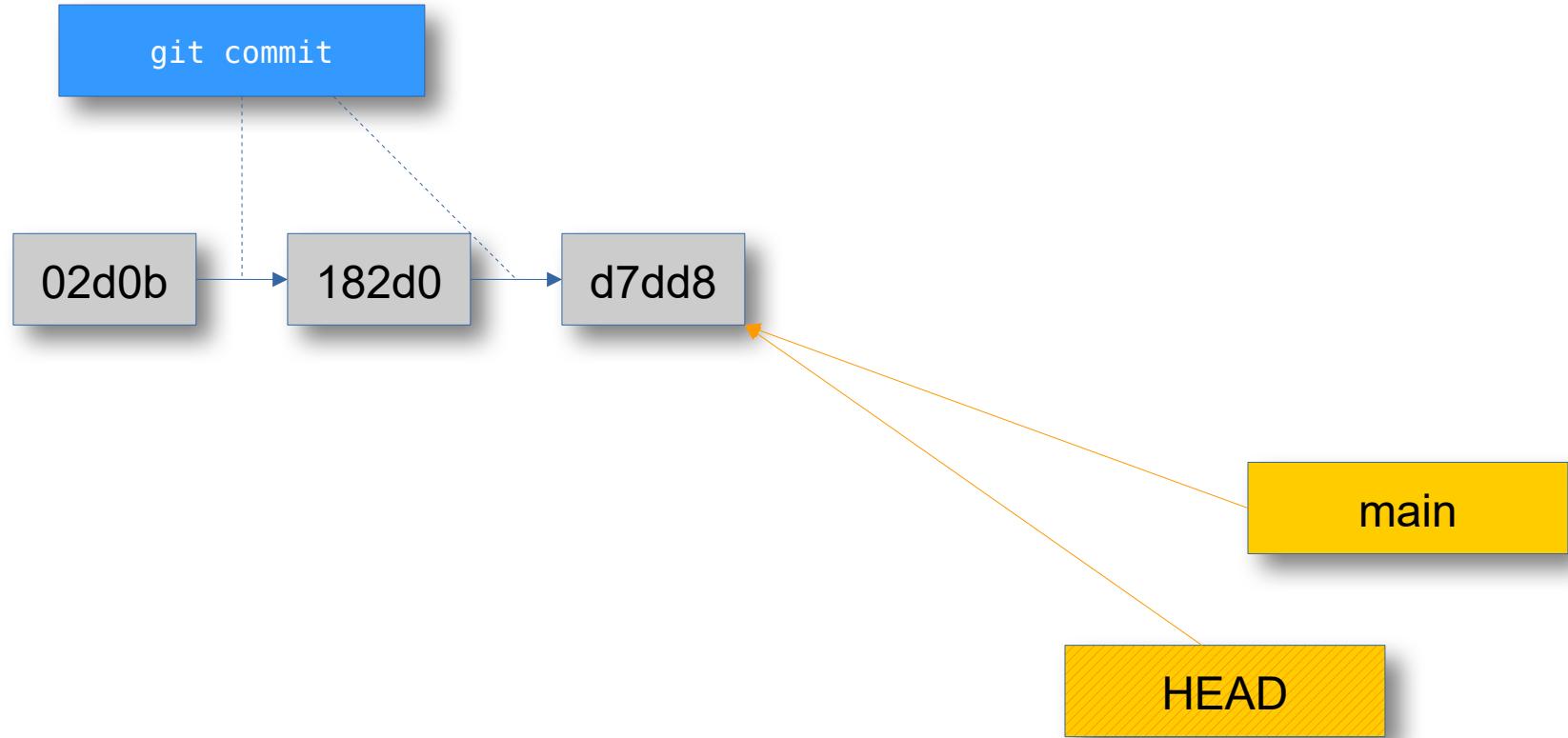
First things first:

- What it is not: The history of the tool Git itself
- What it is: The history of commits of a Git repository

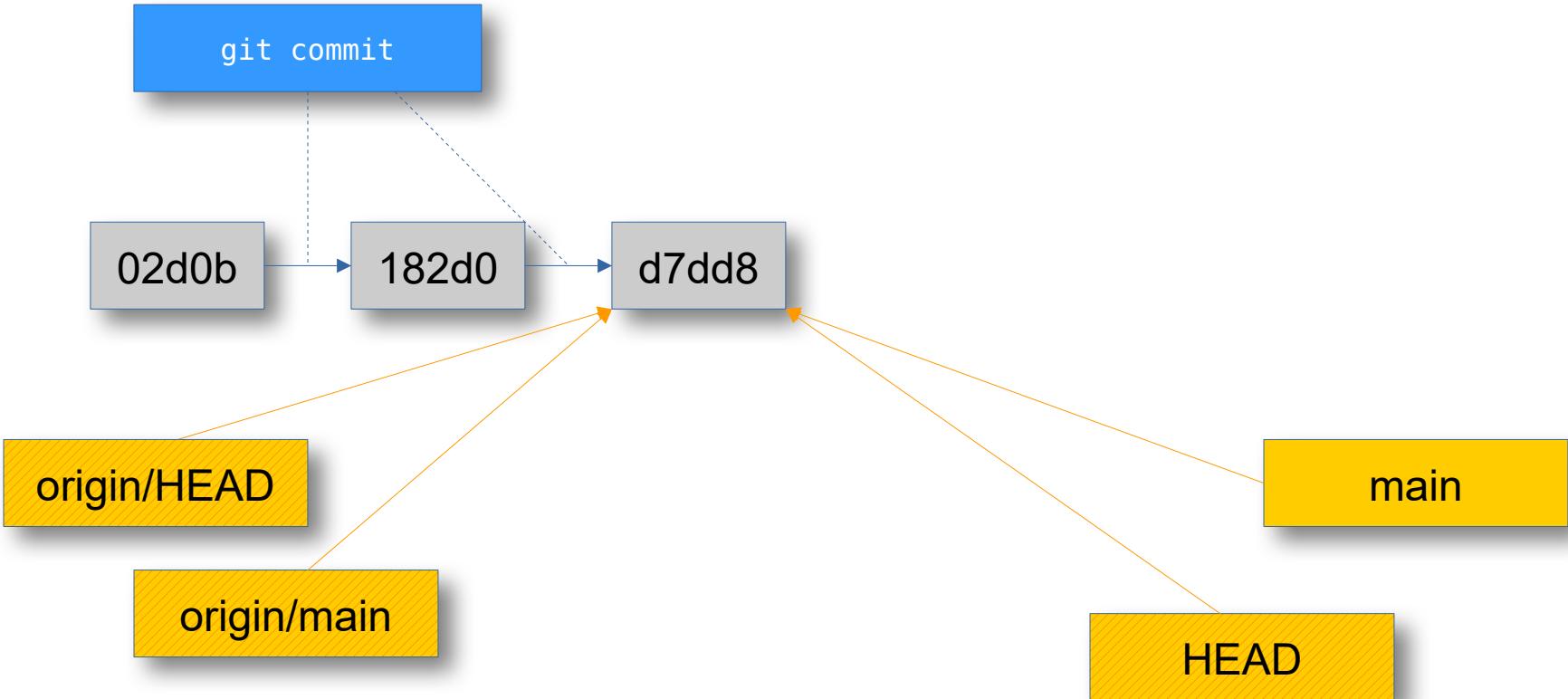
Why is history relevant?

- We use it to look back in time.
 - It should be easy to look back in time
- Because it is non-linear (directed acyclic graph)
 - complications during merge/rebase

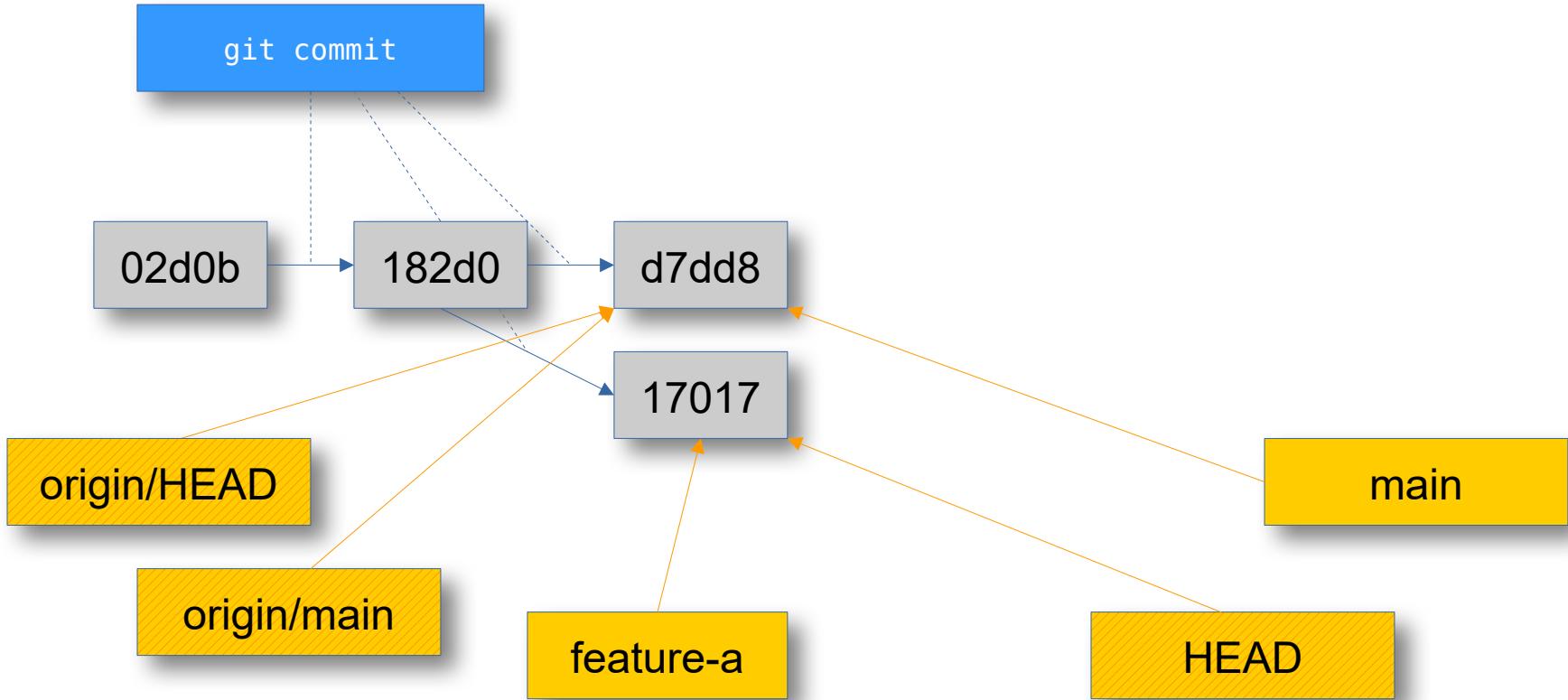
Git history (with merge)



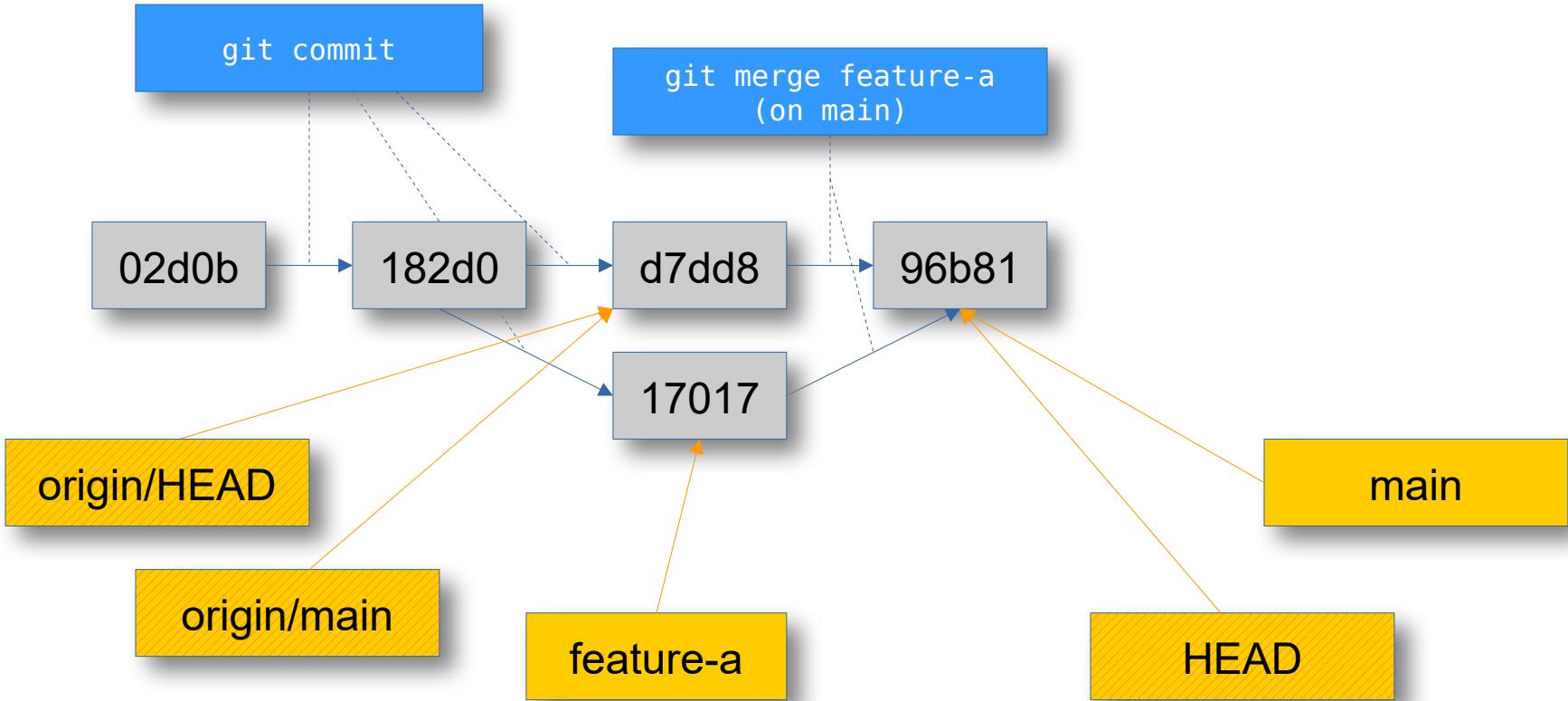
Git history (with merge)



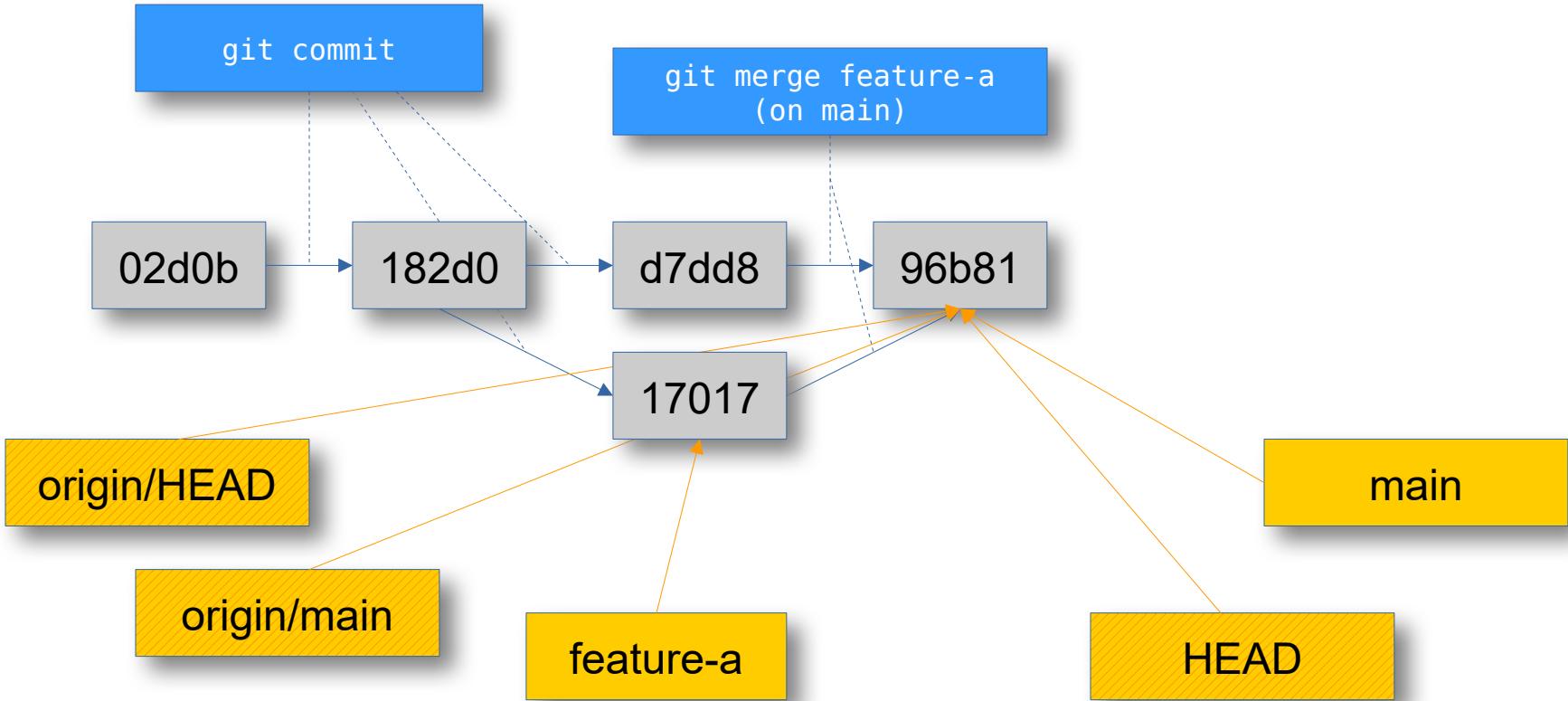
Git history (with merge)



Git history (with merge)



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Git history (with merge)

Reproduce step 1:

- `mkdir myrepo && cd myrepo` # Create directory

Git history (with merge)

Reproduce step 1:

- `mkdir myrepo && cd myrepo` # Create directory
- `git init` # Init Git repository

Git history (with merge)

Reproduce step 1:

- `mkdir myrepo && cd myrepo` # Create directory
- `git init` # Init Git repository
- `echo "hello" > file.txt` # Create **file.txt** with some content

Git history (with merge)

Reproduce step 1:

- `mkdir myrepo && cd myrepo` # Create directory
- `git init` # Init Git repository
- `echo "hello" > file.txt` # Create **file.txt** with some content
- `git add file.txt && git commit` # Create commit #1 (**02d0b**)

Git history (with merge)

Reproduce step 1:

- `mkdir myrepo && cd myrepo` # Create directory
- `git init` # Init Git repository
- `echo "hello" > file.txt` # Create **file.txt** with some content
- `git add file.txt && git commit` # Create commit #1 (**02d0b**)
- `echo "there" >> file.txt` # Add some content to **file.txt**

Git history (with merge)

Reproduce step 1:

- `mkdir myrepo && cd myrepo` # Create directory
- `git init` # Init Git repository
- `echo "hello" > file.txt` # Create `file.txt` with some content
- `git add file.txt && git commit` # Create commit #1 (`02d0b`)
- `echo "there" >> file.txt` # Add some content to `file.txt`
- `git add file.txt && git commit` # Create commit #2 (`182d0`)

Git history (with merge)

Reproduce step 1:

- `mkdir myrepo && cd myrepo` # Create directory
- `git init` # Init Git repository
- `echo "hello" > file.txt` # Create `file.txt` with some content
- `git add file.txt && git commit` # Create commit #1 (`02d0b`)
- `echo "there" >> file.txt` # Add some content to `file.txt`
- `git add file.txt && git commit` # Create commit #2 (`182d0`)
- `echo "NHR" >> file.txt` # Add more content to `file.txt`

Git history (with merge)

Reproduce step 1:

- `mkdir myrepo && cd myrepo` # Create directory
- `git init` # Init Git repository
- `echo "hello" > file.txt` # Create `file.txt` with some content
- `git add file.txt && git commit` # Create commit #1 (`02d0b`)
- `echo "there" >> file.txt` # Add some content to `file.txt`
- `git add file.txt && git commit` # Create commit #2 (`182d0`)
- `echo "NHR" >> file.txt` # Add more content to `file.txt`
- `git add file.txt && git commit` # Create commit #3 (`d7dd8`)

Git history (with merge)

Reproduce step 1:

- `mkdir myrepo && cd myrepo` # Create directory
- `git init` # Init Git repository
- `echo "hello" > file.txt` # Create `file.txt` with some content
- `git add file.txt && git commit` # Create commit #1 (`02d0b`)
- `echo "there" >> file.txt` # Add some content to `file.txt`
- `git add file.txt && git commit` # Create commit #2 (`182d0`)
- `echo "NHR" >> file.txt` # Add more content to `file.txt`
- `git add file.txt && git commit` # Create commit #3 (`d7dd8`)

Commit hashes will differ for you!

Git history (with merge)

Reproduce step 2:

- `git remote add origin "git@github.com:myuser/myrepo.git"`
Add a remote called **origin**

Git history (with merge)

Reproduce step 2:

- `git remote add origin "git@github.com:myuser/myrepo.git"`
Add a remote called **origin**
- `git push --set-upstream-to origin main`
Push the current branch remote **origin** and mark it as upstream

Git history (with merge)

Reproduce step 2:

- `git remote add origin "git@github.com:myuser/myrepo.git"`
Add a remote called **origin**
- `git push --set-upstream-to origin main`
Push the current branch remote **origin** and mark it as upstream

Reproduce step 3:

- `git switch 182d0` # Switch to a previous commit

Git history (with merge)

Reproduce step 2:

- `git remote add origin "git@github.com:myuser/myrepo.git"`
Add a remote called **origin**
- `git push --set-upstream-to origin main`
Push the current branch remote **origin** and mark it as upstream

Reproduce step 3:

- `git switch 182d0` # Switch to a previous commit
- `git switch --create feature-a` # Create branch **feature-a** and
switch to it

Git history (with merge)

Reproduce step 2:

- `git remote add origin "git@github.com:myuser/myrepo.git"`
Add a remote called **origin**
- `git push --set-upstream-to origin main`
Push the current branch remote **origin** and mark it as upstream

Reproduce step 3:

- `git switch 182d0` # Switch to a previous commit
- `git switch --create feature-a` # Create branch **feature-a** and
switch to it
- `echo "FAU" > file2.txt` # Create **file2.txt**

Git history (with merge)

Reproduce step 2:

- `git remote add origin "git@github.com:myuser/myrepo.git"`
Add a remote called **origin**
- `git push --set-upstream-to origin main`
Push the current branch remote **origin** and mark it as upstream

Reproduce step 3:

- `git switch 182d0` # Switch to a previous commit
- `git switch --create feature-a` # Create branch **feature-a** and
switch to it
- `echo "FAU" > file2.txt` # Create **file2.txt**
- `git add file2.txt && git commit` # Create commit #4 (**17017**)

Git history (with merge)

Reproduce step 4:

- `git switch main` # Switch back to **main** branch

Git history (with merge)

Reproduce step 4:

- `git switch main` # Switch back to **main** branch
- `git merge feature-a` # Merge changes from **feature-a** into **main**

Git history (with merge)

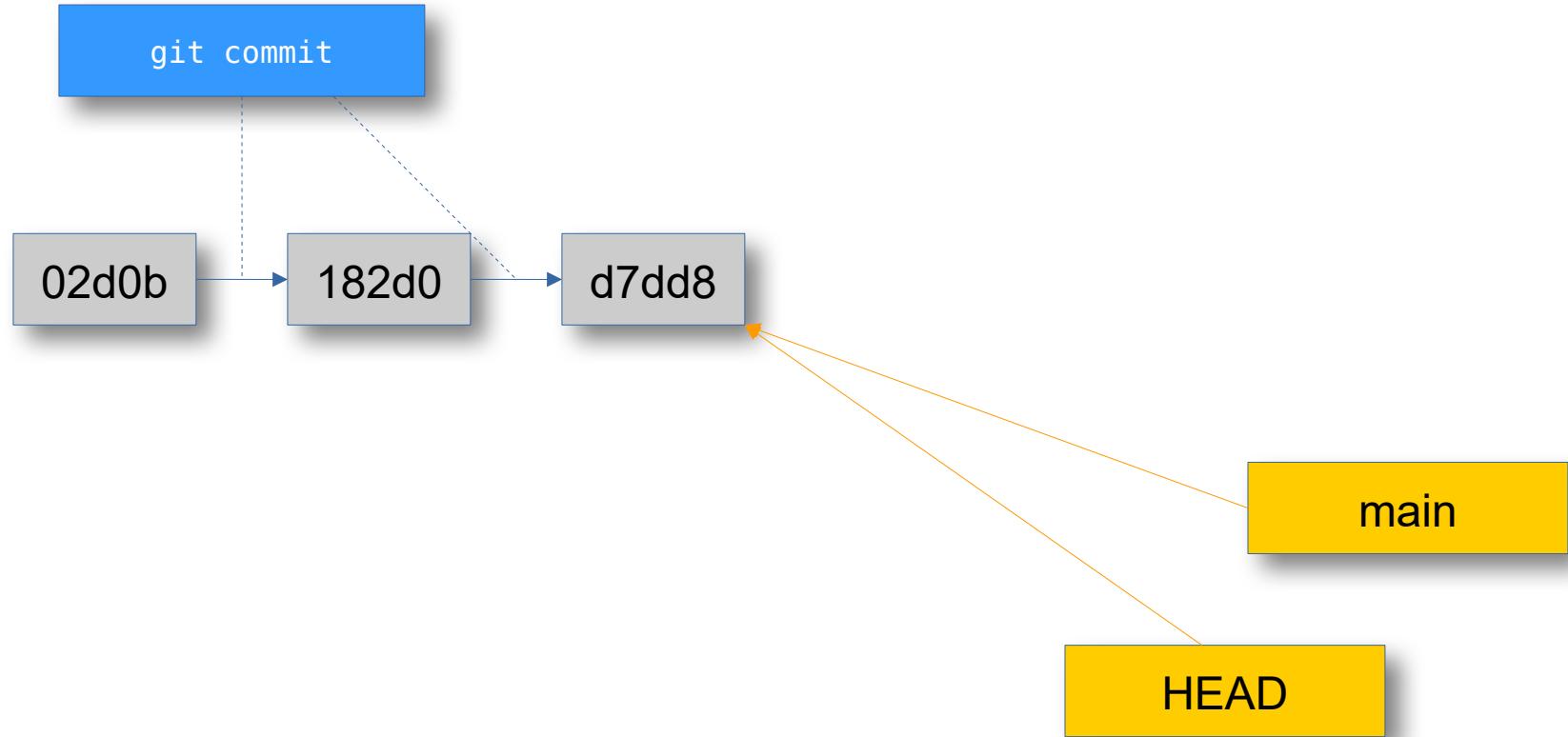
Reproduce step 4:

- `git switch main` # Switch back to **main** branch
- `git merge feature-a` # Merge changes from **feature-a** into **main**

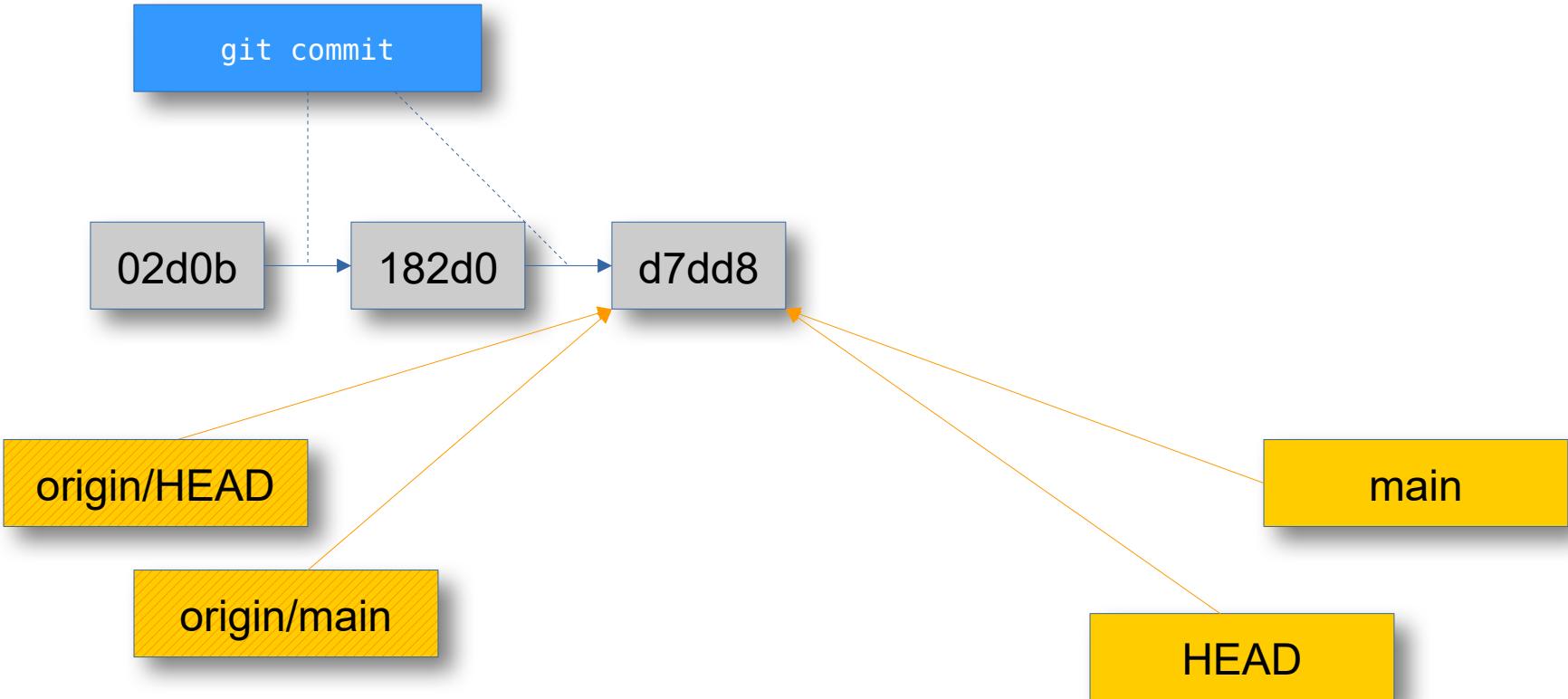
Reproduce step 5:

- `git push` # Push new state of **main** branch to **origin**

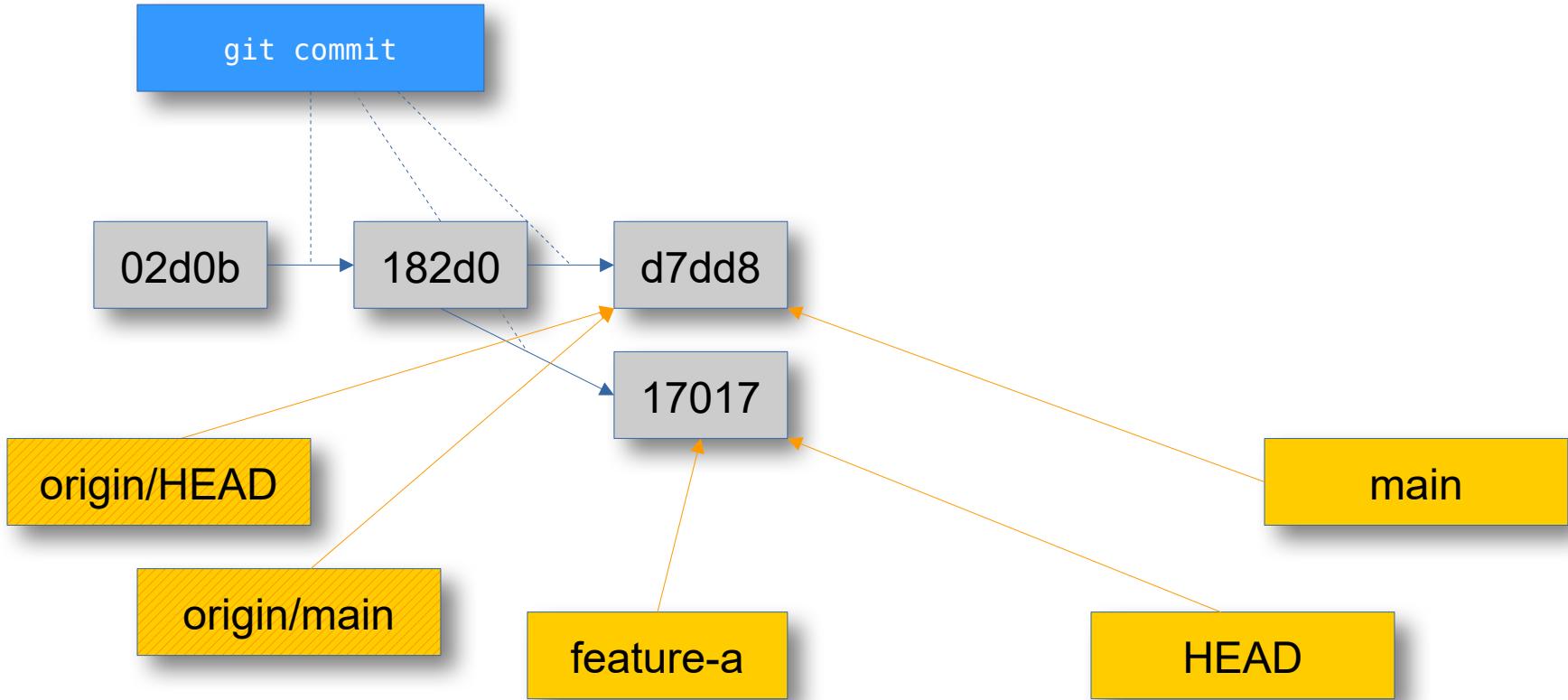
Git history (with rebase)



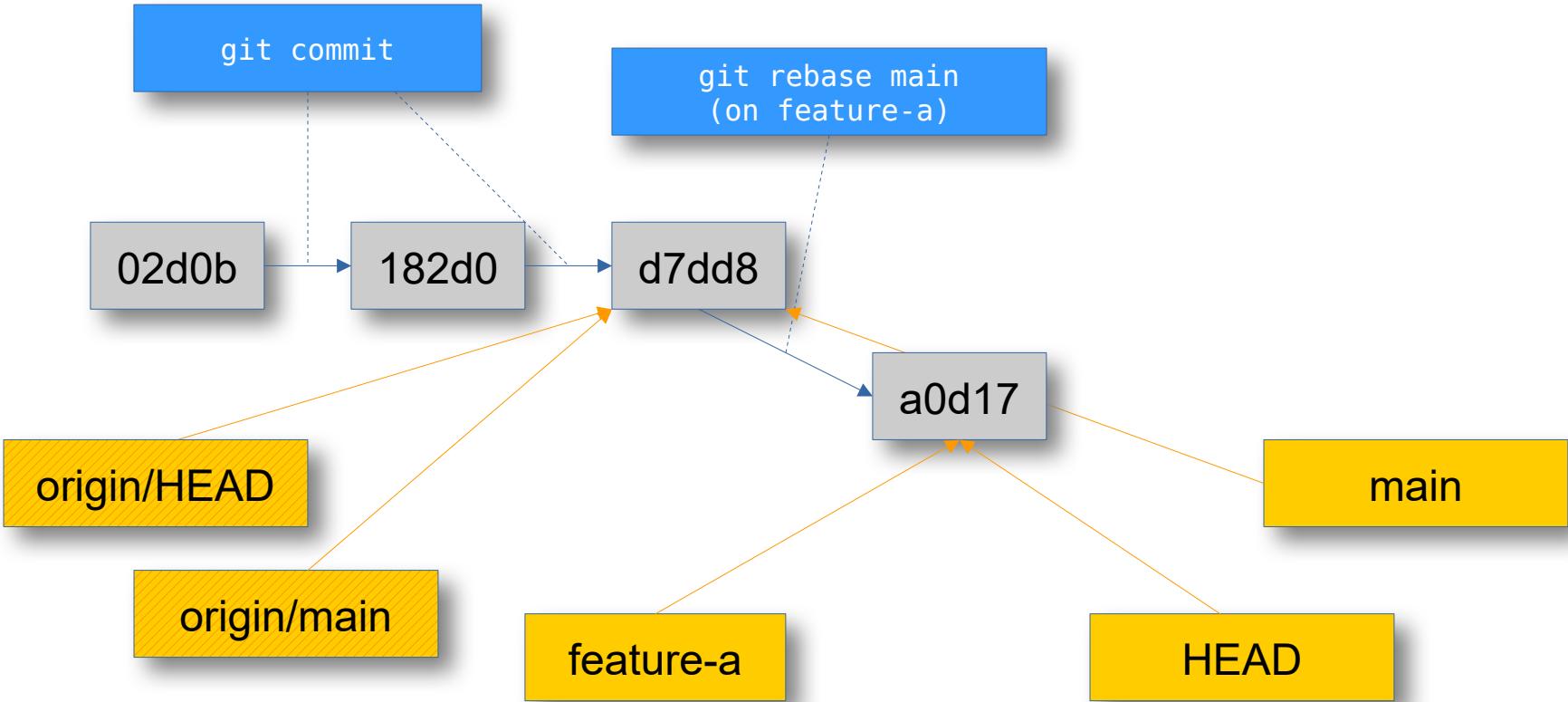
Git history (with rebase)



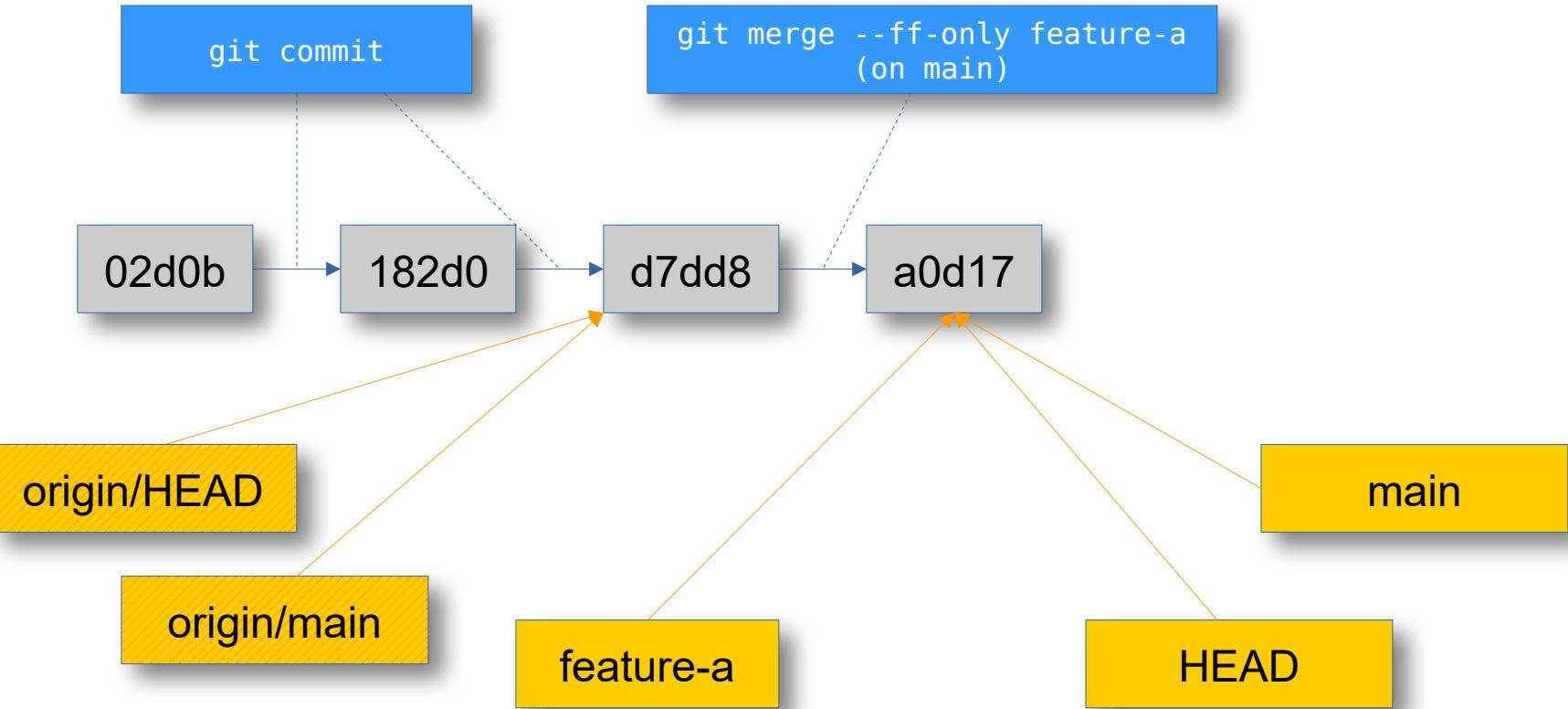
Git history (with rebase)



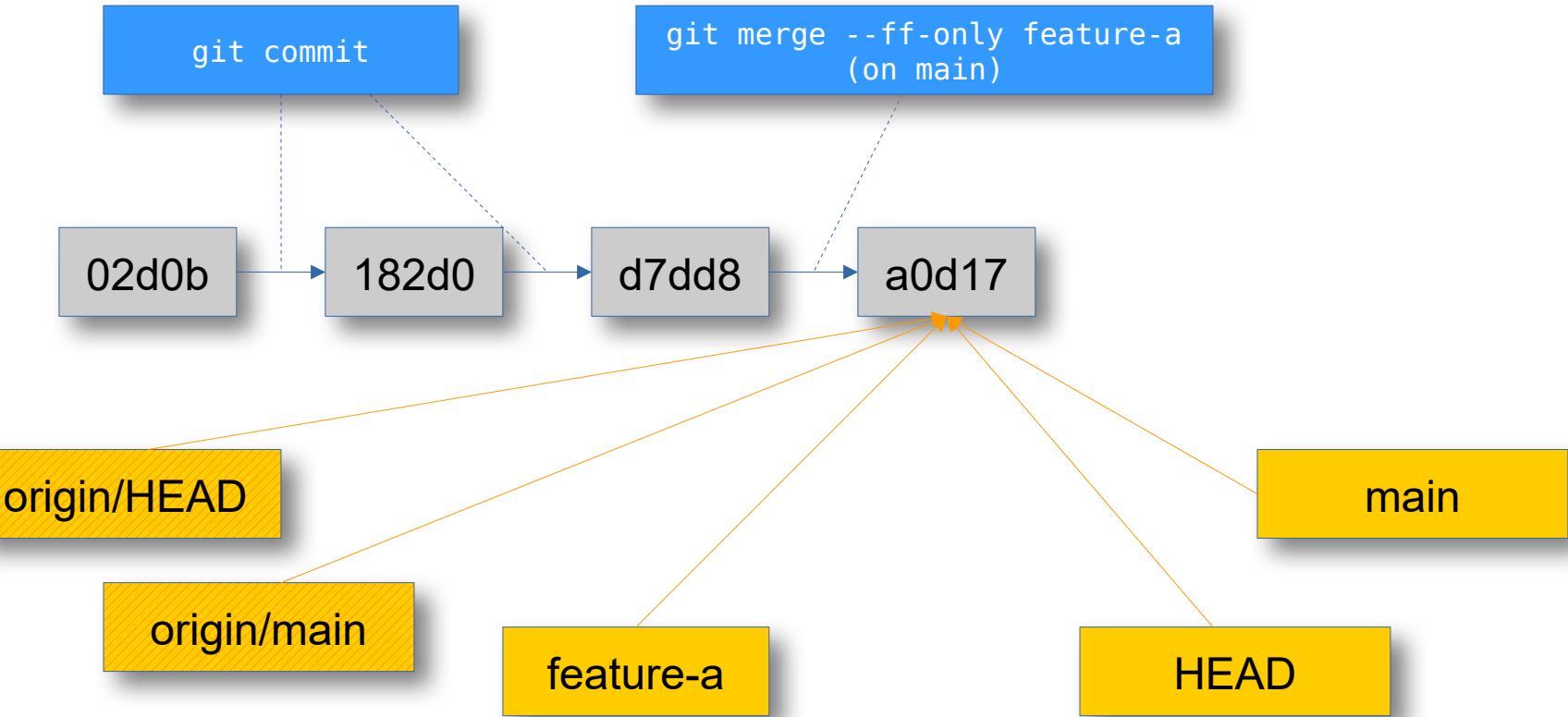
Git history (with rebase)



Git history (with rebase)



Git history (with rebase)



Git history (with rebase)

Reproduce step 4:

- `git rebase main` # Rewrite history so that **feature-a**'s commits are ontop of **main**

Git history (with rebase)

Reproduce step 4:

- `git rebase main` # Rewrite history so that **feature-a**'s commits are ontop of **main**

Reproduce step 5:

- `git switch main` # Switch to **main**

Git history (with rebase)

Reproduce step 4:

- `git rebase main` # Rewrite history so that **feature-a**'s commits are ontop of **main**

Reproduce step 5:

- `git switch main` # Switch to **main**
- `git merge --ff-only feature-a` # Merge **feature-a** into **main**, but do # not create an explicit merge commit

Git history (with rebase)

Reproduce step 4:

- `git rebase main` # Rewrite history so that **feature-a**'s commits are ontop of **main**

Reproduce step 5:

- `git switch main` # Switch to **main**
- `git merge --ff-only feature-a` # Merge **feature-a** into **main**, but do # not create an explicit merge commit

Reproduce step 6:

- same as “merge” example

Git history (merge vs. rebase)

Why rebase (at all)?

- Project maintainers may ask you to do so

Git history (merge vs. rebase)

Why rebase (at all)?

- Project maintainers may ask you to do so
- Avoids future merge conflicts. Immediate resolution is required on rebase.

Git history (merge vs. rebase)

Why rebase (at all)?

- Project maintainers may ask you to do so
- Avoids future merge conflicts. Immediate resolution is required on rebase.
- Avoids “opaque” merge commits (“does this merge commit produce functional code?”)

Git history (merge vs. rebase)

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- → clean and linear “easy to read” history

Git history (merge vs. rebase)

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Why not rebase?

- One conflict may have to be resolved more than once (→ more work).

Git history (merge vs. rebase)

Why rebase (at all)?

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- Avoids future merge conflicts. Immediate resolution is required on rebase.
- Avoids “opaque” merge commits (“does this merge commit produce functional code?”)
- → clean and linear “easy to read” history

Why not rebase?

- One conflict may have to be resolved more than once (→ more work).
- Other people are working on your branch (→ do not delete someone’s base commit).

Git history (merge vs. rebase)

*Example: history comparison **cc-backend** and **likwid***

Git history (pull)

So what does `git pull` actually do?

Git history (pull)

So what does `git pull` actually do?

- `git fetch`
- `git merge origin/mybranch` (remote and branch determined via “tracking”)

Git history (pull)

So what does `git pull` actually do?

- `git fetch`
- `git merge origin/mybranch` (remote and branch determined via “tracking”)

It can also rebase (with `git config --global pull.rebase true`):

- `git fetch`
- `git rebase origin/mybranch`

Git history (pull)

So what does `git pull` actually do?

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- `git merge origin/mybranch` (remote and branch determined via “tracking”)

It can also rebase (with `git config --global pull.rebase true`):

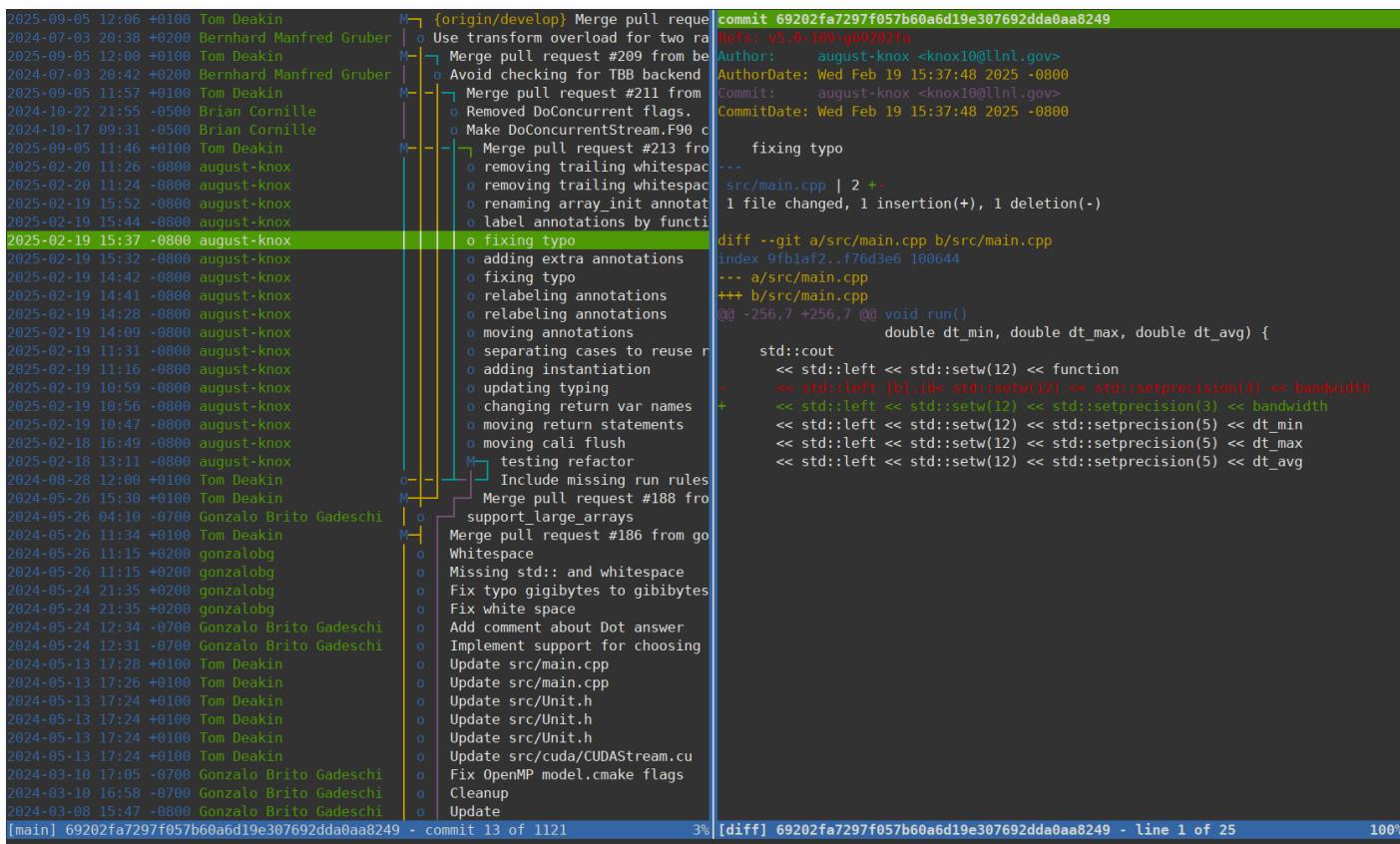
- `git fetch`
- `git rebase origin/mybranch`

I highly suggest to use `git pull` with rebase enabled

Useful commands - `tig`

Interactively
browse history

Use `--all` to see
all branches



The screenshot shows the `tig` command-line interface for browsing a git history. The interface is a terminal-based visualization where commits are represented as nodes and branches as lines connecting them. The history is color-coded by author and shows various commits across different branches, including `origin/develop`, `tomdeakin`, `bernhard`, `briancornille`, `august-knox`, and `gonzalobrito`.

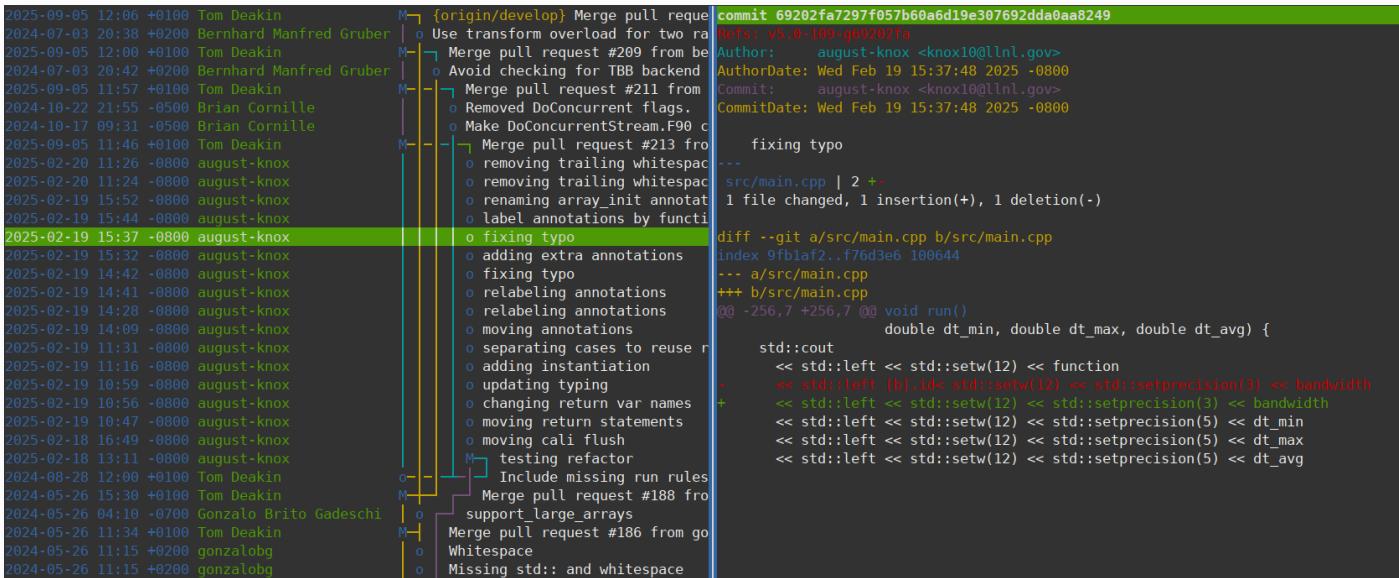
Key features visible in the interface:

- Branches:** `origin/develop`, `tomdeakin`, `bernhard`, `briancornille`, `august-knox`, `gonzalobrito`.
- Commits:** Numerous commits are shown, such as "Merge pull request #209 from `tomdeakin`" and "Merge pull request #211 from `tomdeakin`".
- Annotations:** Commits are annotated with various changes, including "fixing typo", "adding extra annotations", "fixing type", "relabeling annotations", "relabeling annotations", "moving annotations", "separating cases to reuse", "adding instantiation", "updating typing", "changing return var names", "moving return statements", "moving cali flush", "testing refactor", "Include missing run rules", "Merge pull request #188 from `gonzalobrito`", "support_large_arrays", "Merge pull request #186 from `gonzalobrito`", "Whitespace", "Missing std:: and whitespace", "Fix typo gigabytes to gibabytes", "Fix white space", "Add comment about Dot answer", "Implement support for choosing", "Update src/main.cpp", "Update src/main.cpp", "Update src/Unit.h", "Update src/Unit.h", "Update src/Unit.h", "Update src/cuda/CUDASTream.cu", "Fix OpenMP model.cmake flags", "Cleanup", and "Update".
- Commit Details:** A specific commit is highlighted in green, showing its details. The commit hash is `69202fa7297f057b60a6d19e307692dda0aa8249`. The commit message is "fixing typo". The author is `august-knox <knox10@llnl.gov>` and the date is "Wed Feb 19 15:37:48 2025 -0800". The commit is part of the `origin/develop` branch.
- Diff View:** The right side of the interface shows the diff for the highlighted commit, comparing the file `src/main.cpp` between the `a/src/main.cpp` and `b/src/main.cpp` states. The diff shows changes like "double dt_min, double dt_max, double dt_avg" and various whitespace and style changes.

Useful commands - `tig`

Interactively
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```
2025-09-05 12:06 +0100 Tom Deakin
2024-07-03 20:38 +0200 Bernhard Manfred Gruber
2025-09-05 12:00 +0100 Tom Deakin
2024-07-03 20:42 +0200 Bernhard Manfred Gruber
2025-09-05 11:57 +0100 Tom Deakin
2024-10-22 21:55 -0500 Brian Cornille
2024-10-17 09:31 -0500 Brian Cornille
2025-09-05 11:46 +0100 Tom Deakin
2025-02-20 11:26 -0800 august-knox
2025-02-20 11:24 -0800 august-knox
2025-02-19 15:52 -0800 august-knox
2025-02-19 15:44 -0800 august-knox
2025-02-19 15:37 -0800 august-knox
2025-02-19 15:32 -0800 august-knox
2025-02-19 14:42 -0800 august-knox
2025-02-19 14:41 -0800 august-knox
2025-02-19 14:28 -0800 august-knox
2025-02-19 14:09 -0800 august-knox
2025-02-19 11:31 -0800 august-knox
2025-02-19 11:16 -0800 august-knox
2025-02-19 10:59 -0800 august-knox
2025-02-19 10:56 -0800 august-knox
2025-02-19 10:47 -0800 august-knox
2025-02-18 16:49 -0800 august-knox
2025-02-18 13:11 -0800 august-knox
2024-08-28 12:00 +0100 Tom Deakin
2024-05-26 15:30 +0100 Tom Deakin
2024-05-26 04:10 -0700 Gonzalo Brito Gadeschi
2024-05-26 11:34 +0100 Tom Deakin
2024-05-26 11:15 +0200 gonzalobg
2024-05-26 11:15 +0200 gonzalobg

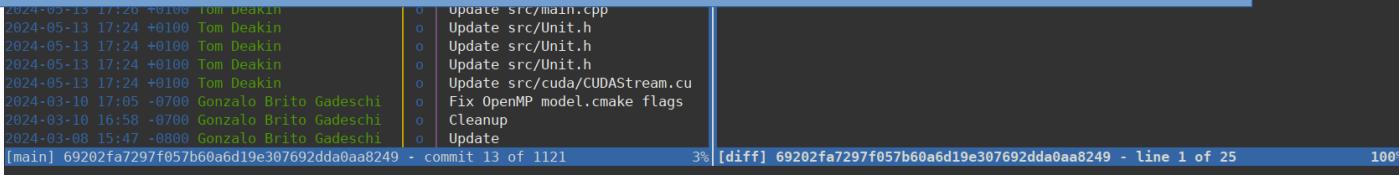
M {origin/develop} Merge pull request #209 from be
o Use transform overload for two r
o Merge pull request #209 from be
o Avoid checking for TBB backend
o Merge pull request #211 from be
o Removed DoConcurrent flags.
o Make DoConcurrentStream.F90 c
o Merge pull request #213 fro
o removing trailing whitespace
o removing trailing whitespace
o renaming array_init annotat
o label annotations by functi
o fixing typo
o adding extra annotations
o fixing typo
o relabeling annotations
o relabeling annotations
o moving annotations
o separating cases to reuse r
o adding instantiation
o updating typing
o changing return var names
o moving return statements
o moving call flush
M testing refactor
o Include missing run rules
Merge pull request #188 fro
o support_large_arrays
o Merge pull request #186 from go
o Whitespace
o Missing std:: and whitespace

commit 69202fa7297f057b60a6d19e307692dda0aa8249
Refs: v5.0-109-g69202fa
Author: august-knox <knox10@llnl.gov>
AuthorDate: Wed Feb 19 15:37:48 2025 -0800
Commit: august-knox <knox10@llnl.gov>
CommitDate: Wed Feb 19 15:37:48 2025 -0800

fixing typo
...
src/main.cpp | 2 +-
1 file changed, 1 insertion(+), 1 deletion(-)

diff --git a/src/main.cpp b/src/main.cpp
index 9fb1af2..f76d3e6 100644
--- a/src/main.cpp
+++ b/src/main.cpp
@@ -256,7 +256,7 @@ void run(
    double dt_min, double dt_max, double dt_avg) {
    std::cout
        << std::left << std::setw(12) << function
-       << std::left << std::setw(12) << std::setprecision(3) << bandwidth
+       << std::left << std::setw(12) << std::setprecision(3) << bandwidth
        << std::left << std::setw(12) << std::setprecision(5) << dt_min
        << std::left << std::setw(12) << std::setprecision(5) << dt_max
        << std::left << std::setw(12) << std::setprecision(5) << dt_avg
```

Poor man's tig: `git log --all --graph --decorate --oneline`



```
2024-05-13 17:20 +0100 Tom Deakin
2024-05-13 17:24 +0100 Tom Deakin
2024-03-10 17:05 -0700 Gonzalo Brito Gadeschi
2024-03-10 16:58 -0700 Gonzalo Brito Gadeschi
2024-03-08 15:47 -0800 Gonzalo Brito Gadeschi
[main] 69202fa7297f057b60a6d19e307692dda0aa8249 - commit 13 of 1121 3% [diff] 69202fa7297f057b60a6d19e307692dda0aa8249 - line 1 of 25 100%
```

Git history (interactive rebase)

Rebase can do much more than reordering commits:

- Edit/fix commits
- Delete commits
- Insert new commits
- Merge/split commits

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→ `git rebase -i 0d8fdf1`: Edit history down to (excluding) commit **0d7fdf1**

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- Edit/fix commits
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- Insert new commits
- Merge/split commits

→ `git rebase -i 0d8fdf1`: Edit history down to (excluding) commit **0d7fdf1**

→ `git rebase -i HEAD~8`: Edit history of previous 8 commits

Git history (interactive rebase)

Rebase can do much more than reordering commits:

- Edit/fix commits
- Delete commits
- Insert new commits
- Merge/split commits

```
→ git rebase -i  
→ git rebase -i
```

```
1 pick c07e433b # rocmon: Remove obsolete destroyMarkerFileRocm
2 pick f7fa60ab # rocmon: Remove debug printf
3 edit 82fa47ce # rocmon: Fix memory leak in Lua API
4 pick b1a81528 # rocmon: Fix error handling for memory allocation
5 pick 37d6f907 # rocmon: Do not fail if metric cannot be calculated
6 pick 5f8bbcd8 # rocmon: Fix new counter last/full counting
7 pick 2e196ee2 # rocmon: Fix agent selection
8 pick fbf01bb3 # rocmon: Print more detailed device info
9
10 # Rebase fce4598b..fbf01bb3 onto fce4598b (8 commands)
11 #
12 # Commands:
13 # p, pick <commit> = use commit
14 # r, reword <commit> = use commit, but edit the commit message
15 # e, edit <commit> = use commit, but stop for amending
16 # s, squash <commit> = use commit, but meld into previous commit
17 # f, fixup [-C | -c] <commit> = like "squash" but keep only the previ
```

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“I messed something up during my rebase. What do I do?”

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If you have already completed the rebase, use the reflogs for recovery.

- Reflogs contain previous commits (even “deleted” commits).
- `git reflog`
- `git reset --hard 84d72f1`
- Caution: “deleted” commits expire eventually

Git history (“clean” commits)

Tips:

- “I forgot something”: You can update (without creating a new one) the last commit via: `git commit --amend`.

Git history (“clean” commits)

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- Use verbose `git commit`. Either via `-v` or `git config --global commit.verbose true`.

Git history (“clean” commits)

Tips:

- “I forgot something”: You can update (without creating a new one) the last commit via: `git commit --amend`.
- Abort committing by leaving the commit message blank or clearing it.
- Use verbose `git commit`. Either via `-v` or `git config --global commit.verbose true`.
- My opinion: Avoid `git commit -m “...”`. Review your commits via verbose commit.

Git history (“clean” commits)

Tips:

- “I forgot something in my last commit via: `git commit -am “My commit message”`”
- Abort committing via: `git commit --abort`
- Use verbose `git commit` via: `git commit --verbose`
- My opinion: Avoid committing via `git commit`.

```
1 Added more text.
2
3 The paragraph after the first line gives you opportunity to explain your
4 commit in more detail. Why did you change things?
5
6 # Please enter the commit message for your changes. Lines starting
7 # with '#' will be ignored, and an empty message aborts the commit.
8 #
9 # Date:      Mon Feb 2 16:51:53 2026 +0100
10 #
11 # On branch master
12 # Changes to be committed:
13 #       modified:   myfile
14 #
15 # ----- >8 -----
16 # Do not modify or remove the line above.
17 # Everything below it will be ignored.
18 diff --git a/myfile b/myfile
19 index 1756cf9..5427306 100644
20 --- a/myfile
21 +++ b/myfile
22 @@ -1 +1,3 @@
23 Hello people.
24 +
25 +Nobody there.
```

Don't be afraid of rewriting/rebasing history!

Don't be afraid of rewriting/rebasing history!

Unless it is already public!

Git staging area

Git staging area

“I want to commit. I have to type `git add file.txt` and `git commit`”:

Git staging area

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- Before we commit we can carefully choose what to commit!

Git staging area

“I want to commit. I have to type `git add file.txt` and `git commit`”:

- Yes, but why? Not all version control systems have it (e.g. SVN)
- Before we commit we can carefully choose what to commit!

```
michael@michael-HP#/tmp/mygit3$ git status
On branch master
Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
    modified:   myfile2

Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
    modified:   myfile

Untracked files:
  (use "git add <file>..." to include in what will be committed)
    myfile3
```

Git staging area

“I want to commit. I have to type `git add file.txt` and `git commit`”:

- Yes, but why? Not all version control systems have it (e.g. SVN)
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```
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On branch master
  Changes to be committed:
    (use "git restore --staged <file>..." to unstage)
      modified:   myfile
  Changes not staged for commit:
    (use "git add <file>..." to update what will be committed)
    (use "git restore <file>..." to discard changes in working directory)
      modified:   myfile2
  Untracked files:
    (use "git add <file>..." to include in what will be committed)
      myfile3
```

Git staging area

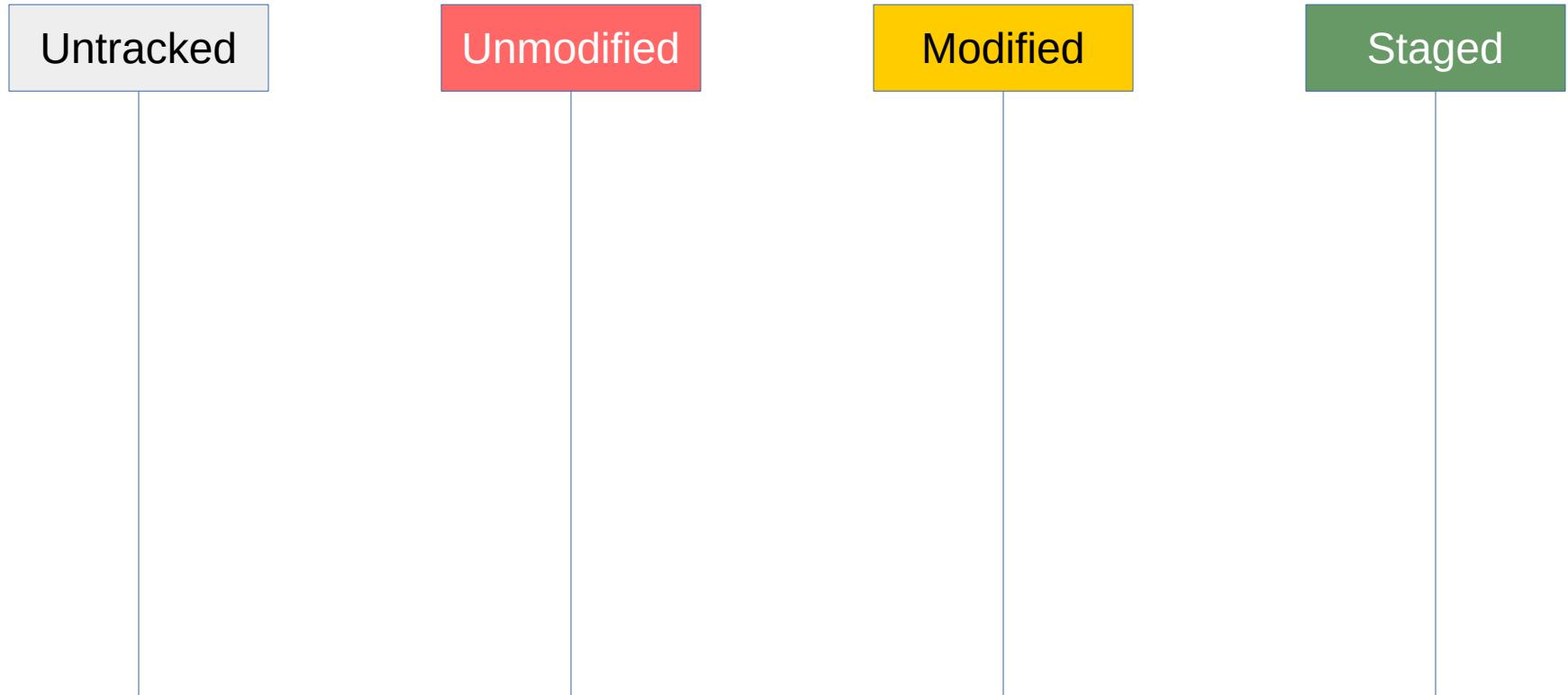


Image inspired by Pro Git chapter 2.2

Git staging area

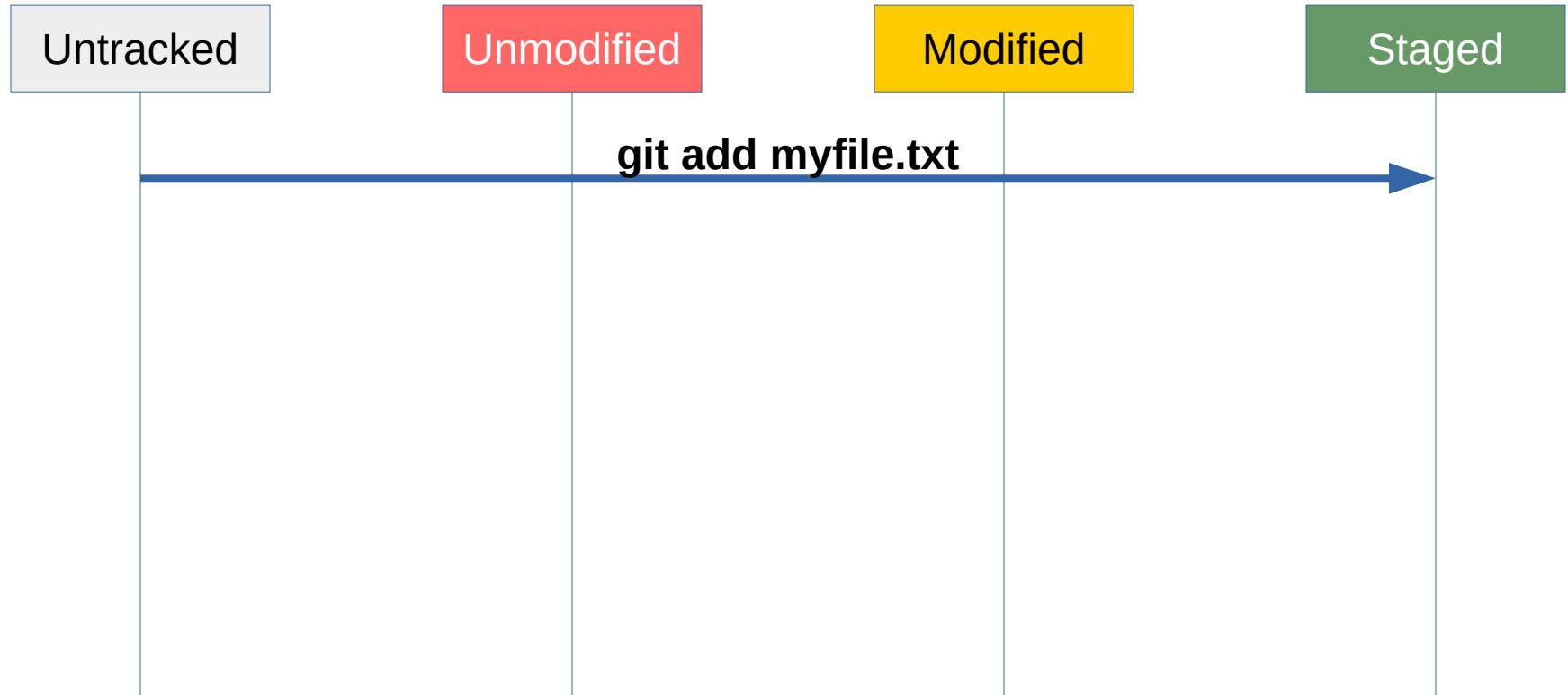


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Git staging area

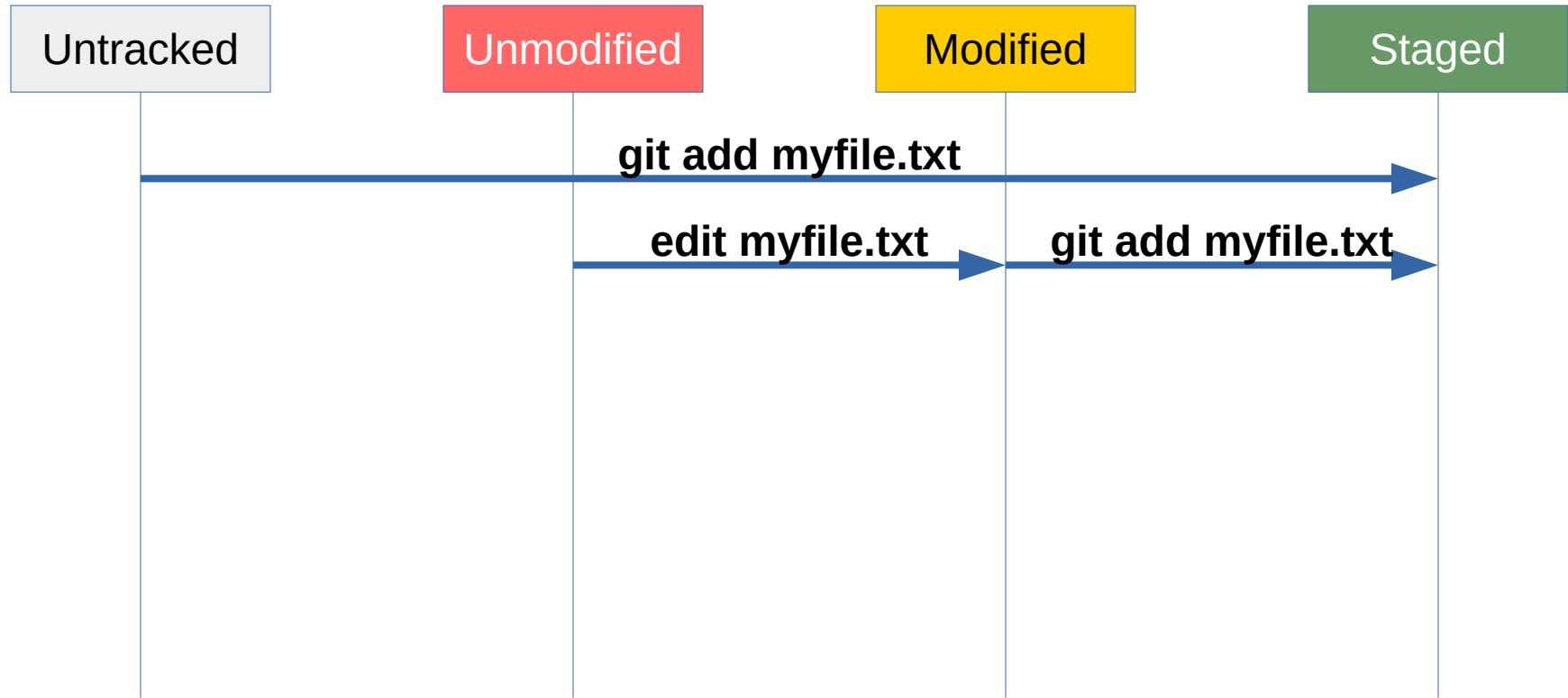


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Git staging area

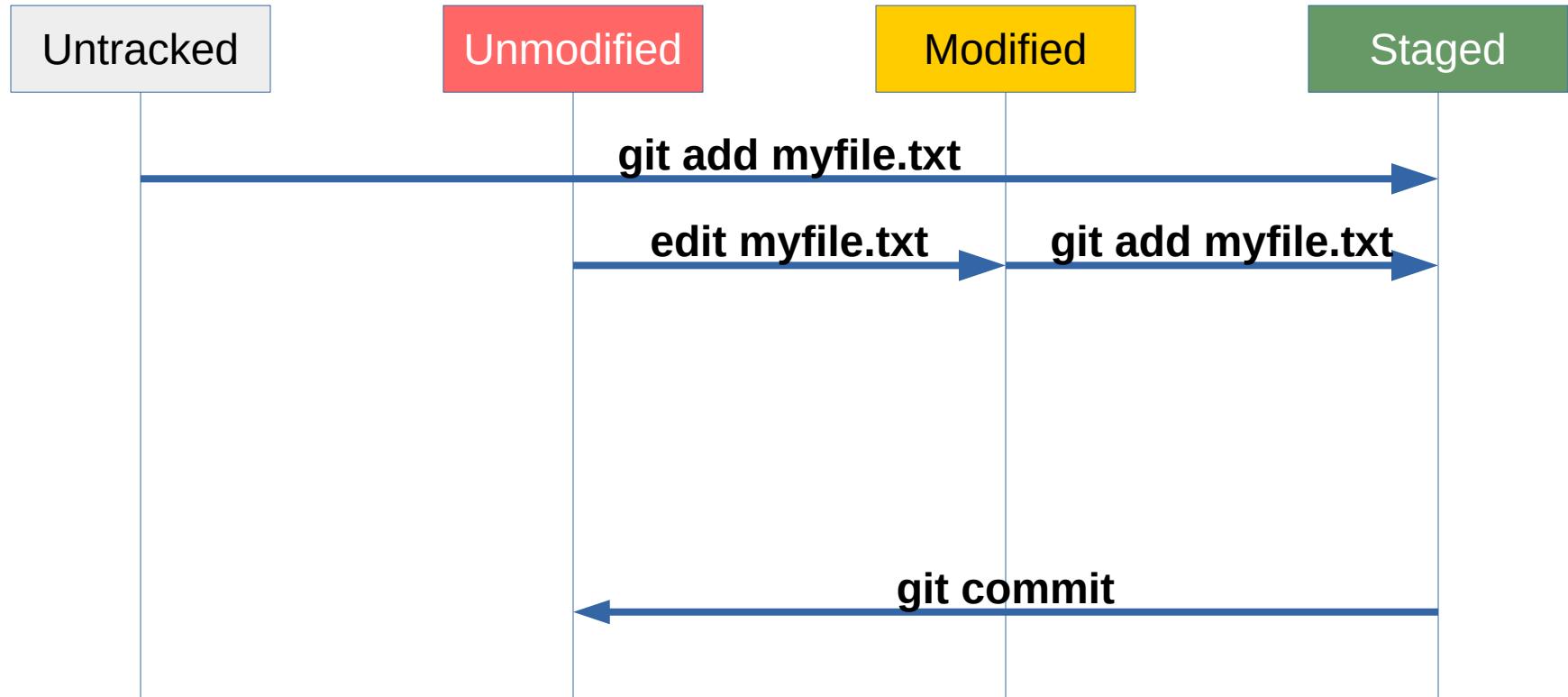


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Git staging area

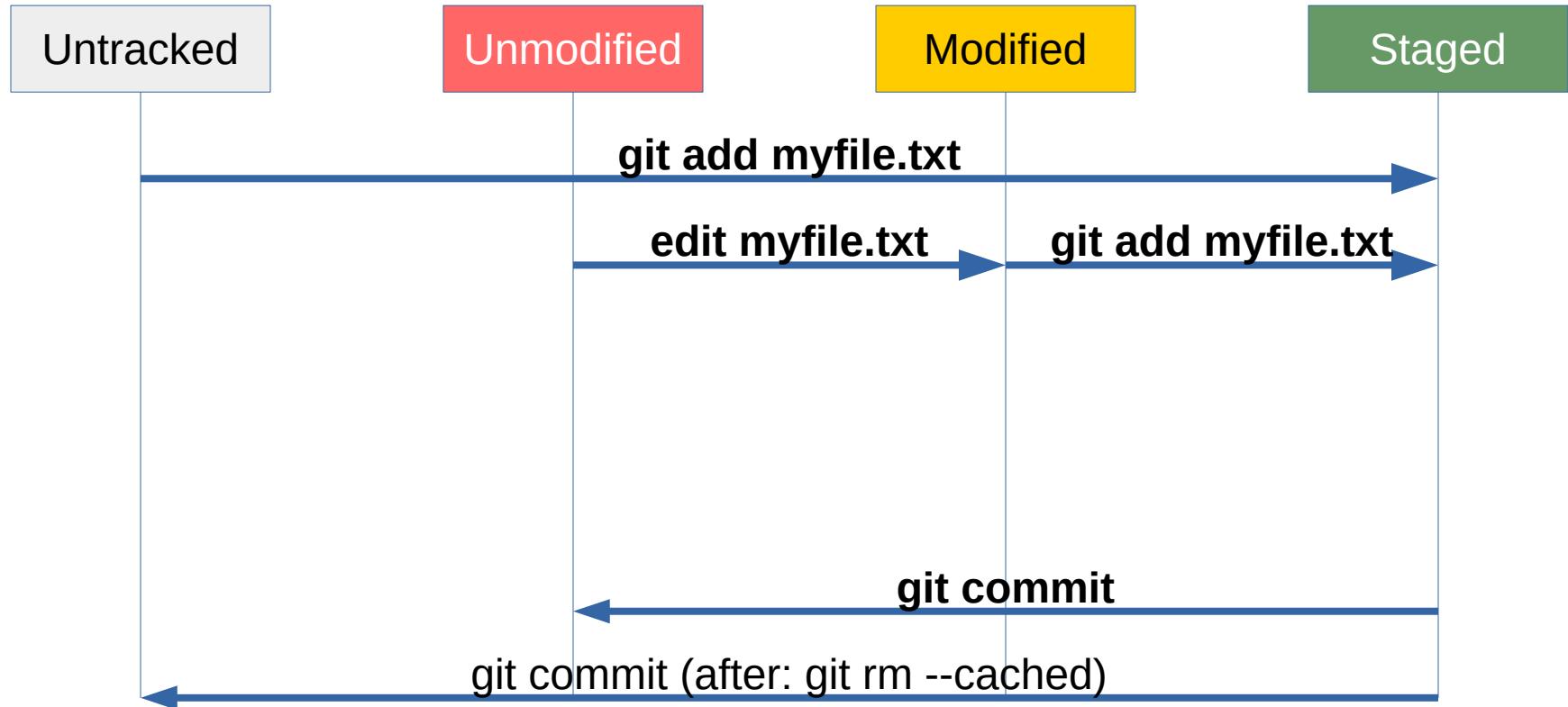


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Git staging area

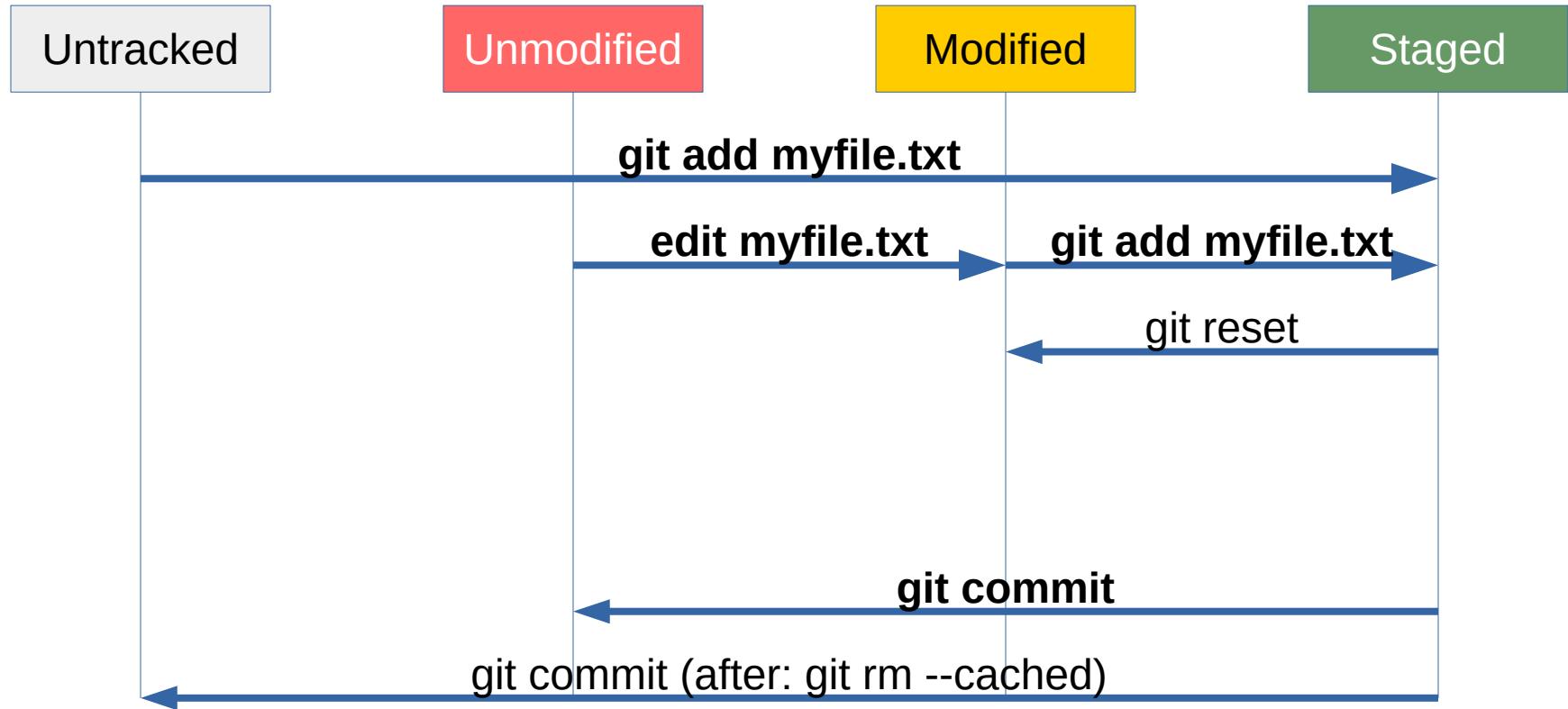


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Git staging area

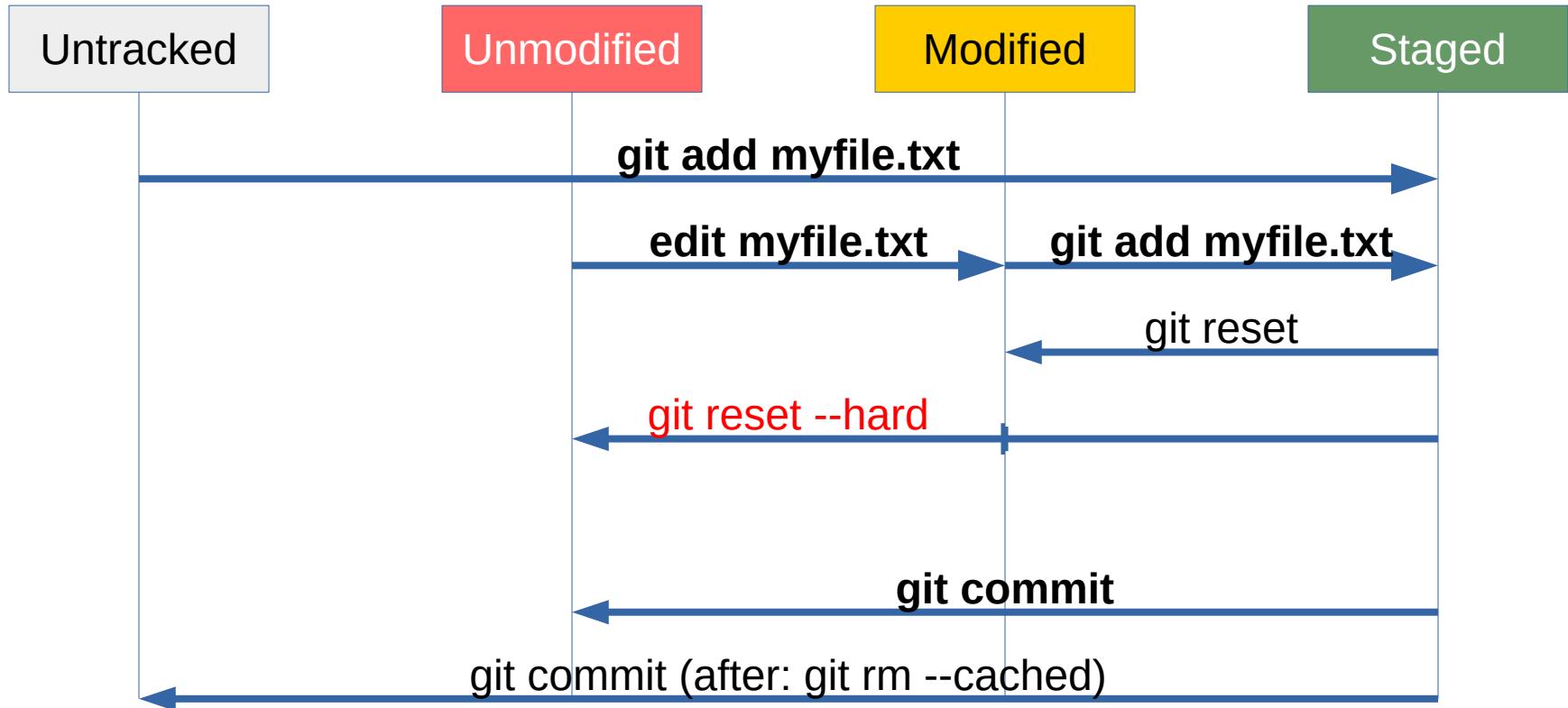


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Git staging area

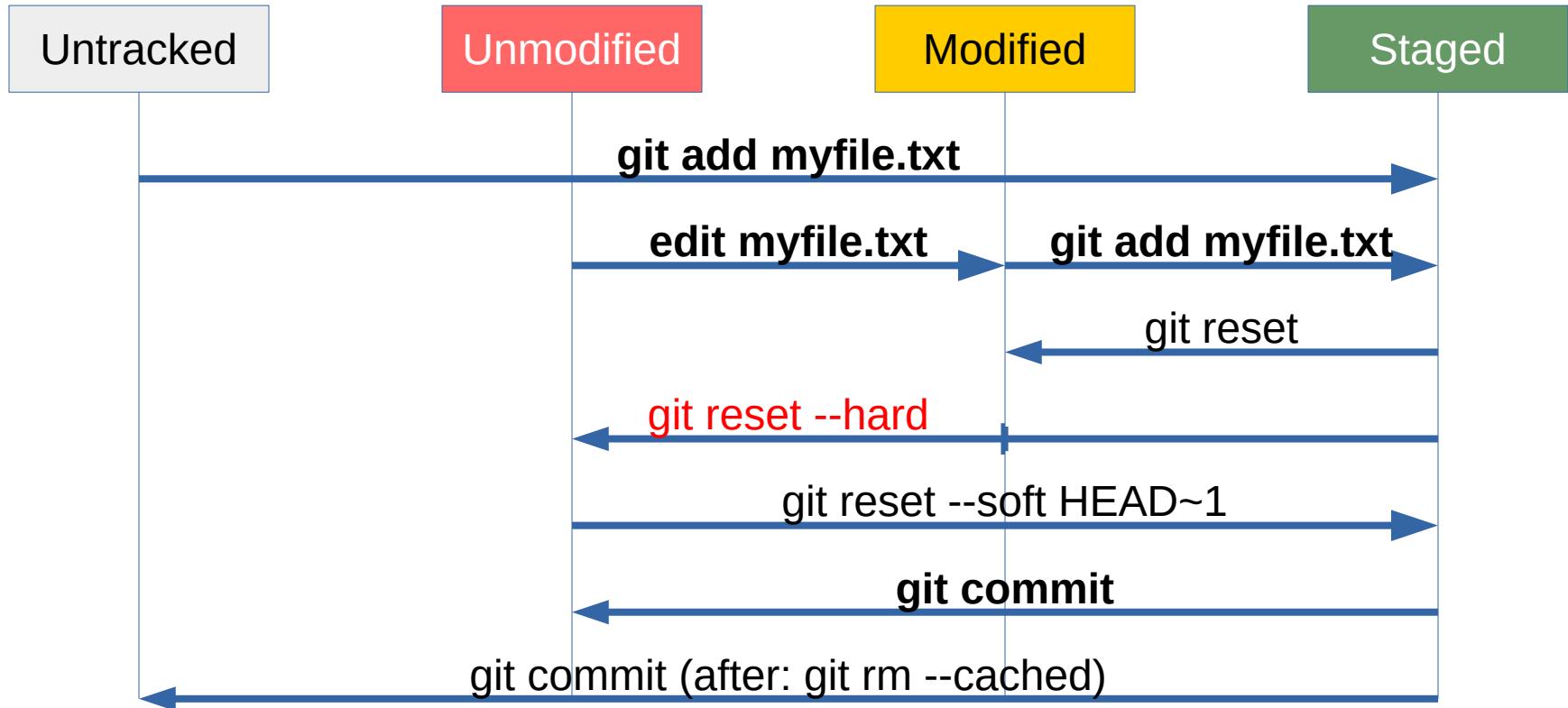


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Git staging area

“But I only want to commit funcA in main.c, not my debug statements”:

Git staging area

“But I only want to commit funcA in main.c, not my debug statements”:

```
→ git add -p main.c
```

Git staging area

“But I only want to commit funcA”

→ `git add -p main.c`

```
michael@michael-HP:~/tmp/testc$ git add -p main.c
diff --git a/main.c b/main.c
index cc388fa..c12b2bc 100644
--- a/main.c
+++ b/main.c
@@ -1,11 +1,12 @@
 #include <stdio.h>

     int funcA(int x) {
-    return x + 42;
+    return x + 44;
}

     int main(void) {
         int x = 3;
+        printf("debug: %d\n", x);
         x = funcA(x);
         printf("a: %d\n", x);
     }
(1/1) Stage this hunk [y,n,q,a,d,s,e,p,?] ? s
```

Git staging area

“But I only want to commit funcA”

→ `git add -p main.c`

```
michael@michael-HP:~/tmp/testc$ git add -p main.c
diff --git a/main.c b/main.c
index cc388fa..c12b2bc 100644
--- a/main.c
+++ b/main.c
@@ -1,11 +1,12 @@
 #include <stdio.h>

@@ -1,8 +1,8 @@
 #include <stdio.h>

     int funcA(int x) {
-        return x + 42;
+        return x + 44;
    }

    int main(void) {
        int x = 3;
(1/2) Stage this hunk [y,n,q,a,d,j,J,g/,e,p,?]? y
(1/1) Stage this hunk [y,n,q,a,d,s,e,p,?]? s
```

Git staging area

“But I only want to commit funcA”

→ `git add -p main.c`

```
michael@michael-HP:~/tmp/testc$ git add -p main.c
diff --git a/main.c b/main.c
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--- a/main.c
+++ b/main.c
@@ -1,11 +1,12 @@
 #include <stdio.h>
@@ -5,7 +5,8 @@
 }

int main(void) {
    int x = 3;
+    printf("debug: %d\n", x);
    x = funcA(x);
    printf("a: %d\n", x);
}
```

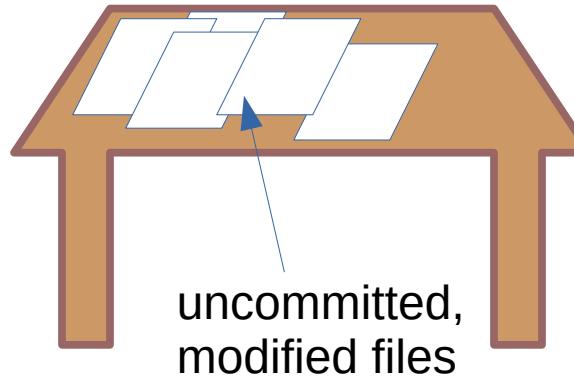
```
(2/2) Stage this hunk [y,n,q,a,d,K,g/,e,p,?]? n
(1/2) Stage this hunk [y,n,q,a,d,j,J,g/,e,p,?]? y
(1/1) Stage this hunk [y,n,q,a,d,s,e,p,?]? s
```

Git stash

git stash

```
unrz104h@testfront1:~/Projects/rocm-systems$ git pull
Updating e45c56c0f8..66ee941fea
error: Your local changes to the following files would be overwritten by merge:
  README.md
Please commit your changes or stash them before you merge.
Aborting
```

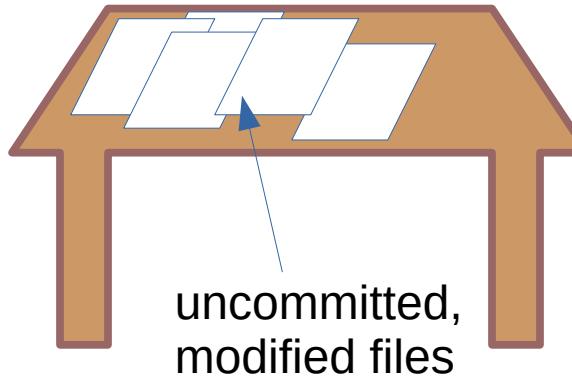
Current branch: **main**



git stash

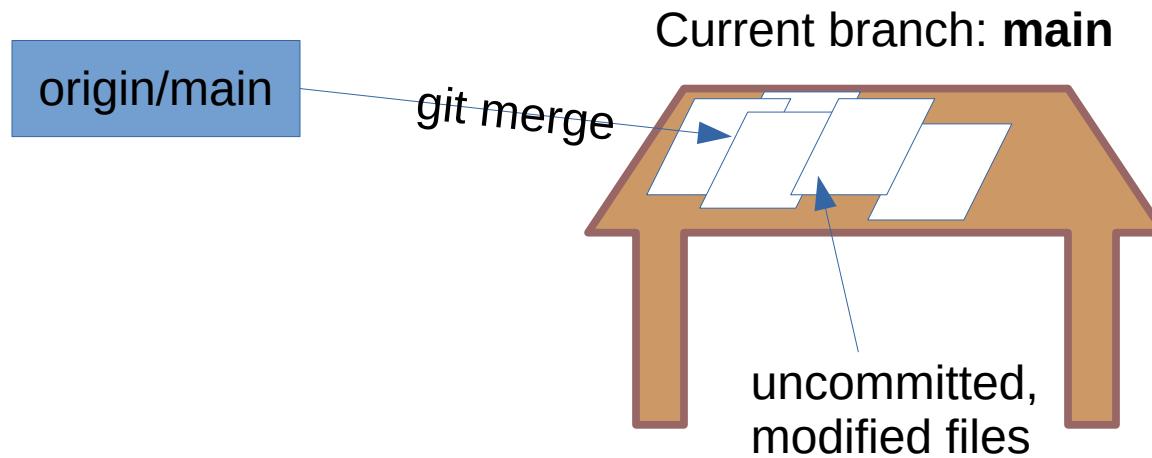
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```

Current branch: main



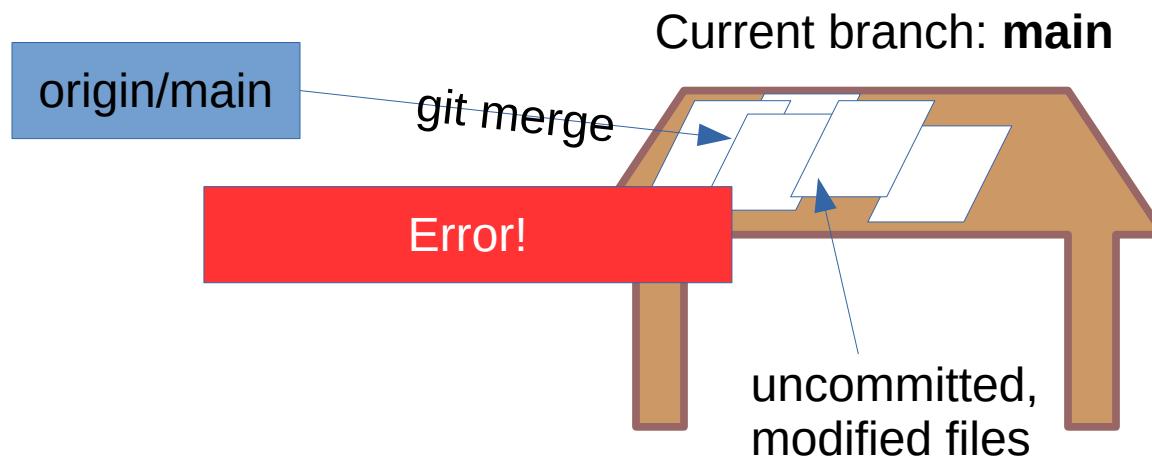
git stash

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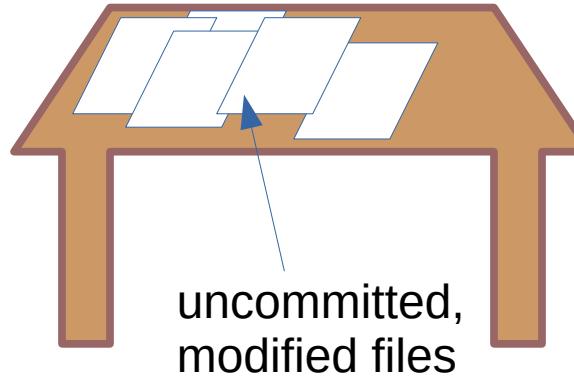


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```

origin/main

Current branch: main



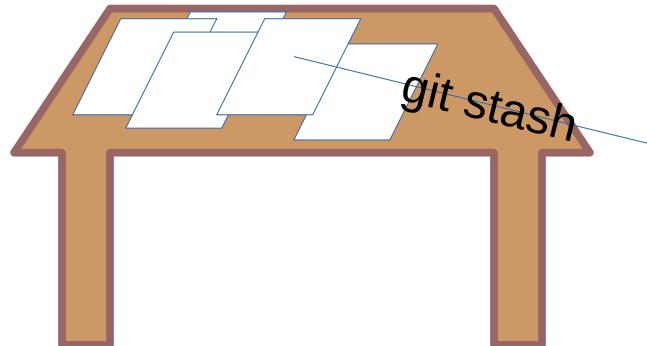
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```

Solution!

origin/main

Current branch: main



stash@{0}

...

git stash

```
unrz104h@testfront1:~/Projects/rocm-systems$ git pull
Updating e45c56c0f8..66ee941fea
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```

Current branch: **main**

origin/main



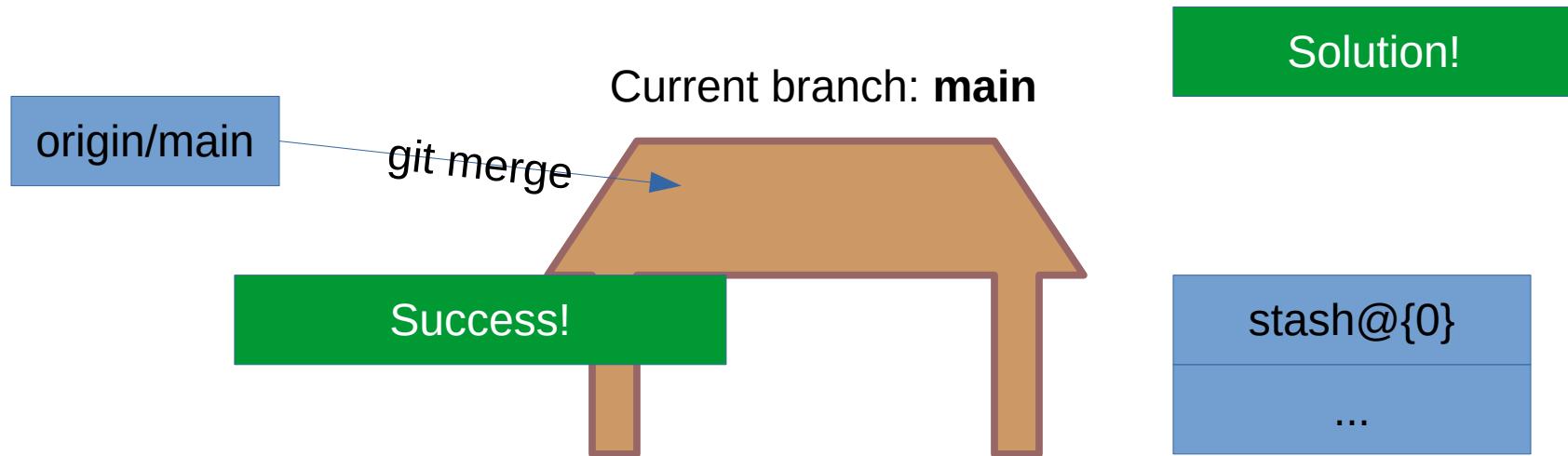
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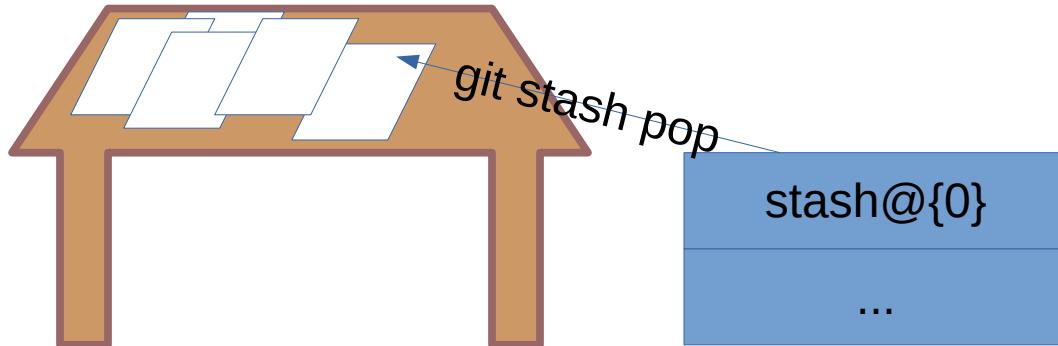
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Solution!

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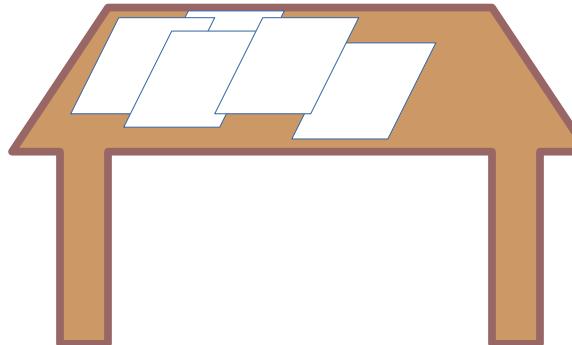


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Git remotes

Git remotes

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Git remotes

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Git remotes

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Git remotes

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Equivalent of `git clone 'https://github.com/RRZE-HPC/likwid'`:

- `mkdir likwid && cd likwid`
- `git init`

Git remotes

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Equivalent of `git clone 'https://github.com/RRZE-HPC/likwid'`:

- `mkdir likwid && cd likwid`
- `git init`
- `git remote add origin 'https://github.com/RRZE-HPC/likwid'`

Git remotes

“I want to push to my GitHub/GitLab. This is what **origin** is, right?”:

Equivalent of `git clone 'https://github.com/RRZE-HPC/likwid'`:

- `mkdir likwid && cd likwid`
- `git init`
- `git remote add origin 'https://github.com/RRZE-HPC/likwid'`
- `git switch --track origin/master`

Git remotes

“I want to push to my GitHub/GitLab. This is what **origin** is, right?”:

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→ **origin** is Git’s default name for a remote

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- `git remote add origin 'https://github.com/RRZE-HPC/likwid'`
- `git switch --track origin/master`

→ **origin** is Git’s default name for a remote

→ **master** is the default branch of LIKWID

Git remotes

Interact with repositories outside yours:

- Way of interacting with GitHub / GitLab

Git remotes

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- “Fancy platforms” are not mandatory. Remote can also be:
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Git remotes

Interact with repositories outside yours:

- Way of interacting with GitHub / GitLab
- “Fancy platforms” are not mandatory. Remote can also be:
 - A folder on a machine reachable via standard SSH
 - A different folder on your local machine
- You can have as many remotes as you like (e.g. mirrors, backups, etc.)

Git remotes

Example: Copy **main** branch from Github repository to GitLab:

- `git clone 'git@github.com:myuser/myproject.git'`

Git remotes

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Git remotes

Example: Copy **main** branch from Github repository to GitLab:

- `git clone 'git@github.com:myuser/myproject.git'`
- `cd myproject`
- `git remote add gitlab 'git@gitlab.com:myuser/myproject.git'`

Git remotes

Example: Copy **main** branch from Github repository to GitLab:

- `git clone 'git@github.com:myuser/myproject.git'`
- `cd myproject`
- `git remote add gitlab 'git@gitlab.com:myuser/myproject.git'`
- `git push gitlab main`

Git remotes

“Why do I sometimes need to specify the remote and sometimes not?”:

Git remotes

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Git remotes

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- Branch “tracking” assigns a local branch to a remote
- `git clone` automatically tracks the remote’s default branch
(origin/HEAD)

E.g. **main** automatically tracks **origin/main**

Git remotes

“Why do I sometimes need to specify the remote and sometimes not?”:

- Branch “tracking” assigns a local branch to a remote
- `git clone` automatically tracks the remote’s default branch (`origin/HEAD`)
E.g. `main` automatically tracks `origin/main`
- You can change it any time: `git branch -u neworigin`

Git remotes

“Why do I sometimes need to specify the remote and sometimes not?”:

- Branch “tracking” assigns a local branch to a remote
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E.g. `main` automatically tracks `origin/main`
- You can change it any time: `git branch -u neworigin`
- When it doesn’t exist yet on remote: `git push -u neworigin`

Git remotes

“Why do I sometimes need to specify the remote and sometimes not?”:

- Branch “tracking” assigns a local branch to a remote
- `git clone` automatically tracks the remote’s default branch (`origin/HEAD`)

E.g. `main` automatically tracks `origin/main`

- You can change it any time: `git branch -u neworigin`
- When it doesn’t exist yet on remote: `git push -u neworigin`
- Afterwards you can push/pull “normally”

Git summary

Summary

Useful commands to remember:

- `git status` → Know what's going on
- `git log -p <filename>` → Show history of a file
- `git log -S <searchterm>` → Search for diff affecting a term
- `git log -G <searchterm>` → Search for diff containing a term
- `git blame <filename>` → Show file with history annotation
- `git reflog` → Show all commits (including “lost” commits)
- `git gc` → Cleanup unreferenced commits (reflog recovery impossible!)
- `git rebase <branch>` → Reapply commits onto *branch*
- `git rebase -i <commit>` → Interactively edit commits up to *commit*
- `git cherry-pick <commit>` → Reapply *commit* to current branch

Summary

Useful commands to remember:

- `git add -p <filename>` → Perform `git add` on parts of *filename*
- `git commit -v` → See what you commit
- `git stash` → Move unstaged changes to “stash” and reset files
- `git stash pop` → Restore all previous unstaged changes
- `git reset <filename>` → Unstage all changes of *filename*
- `git reset --hard` → **Discard** all uncommitted changes
- `git reset --hard <commit>` → Make current branch point to *commit*. **Discards** all commits that are not part of new branch history!
- `git reset <commit>` → Show changes of commit
- `git bisect start <badcommit> <goodcommit>` → Find a regression between two commits

Summary

Other useful resources:

- Manpages are really good!
- `man gitrevisions` → Explanations how version strings look like
- [Pro Git book](#)