

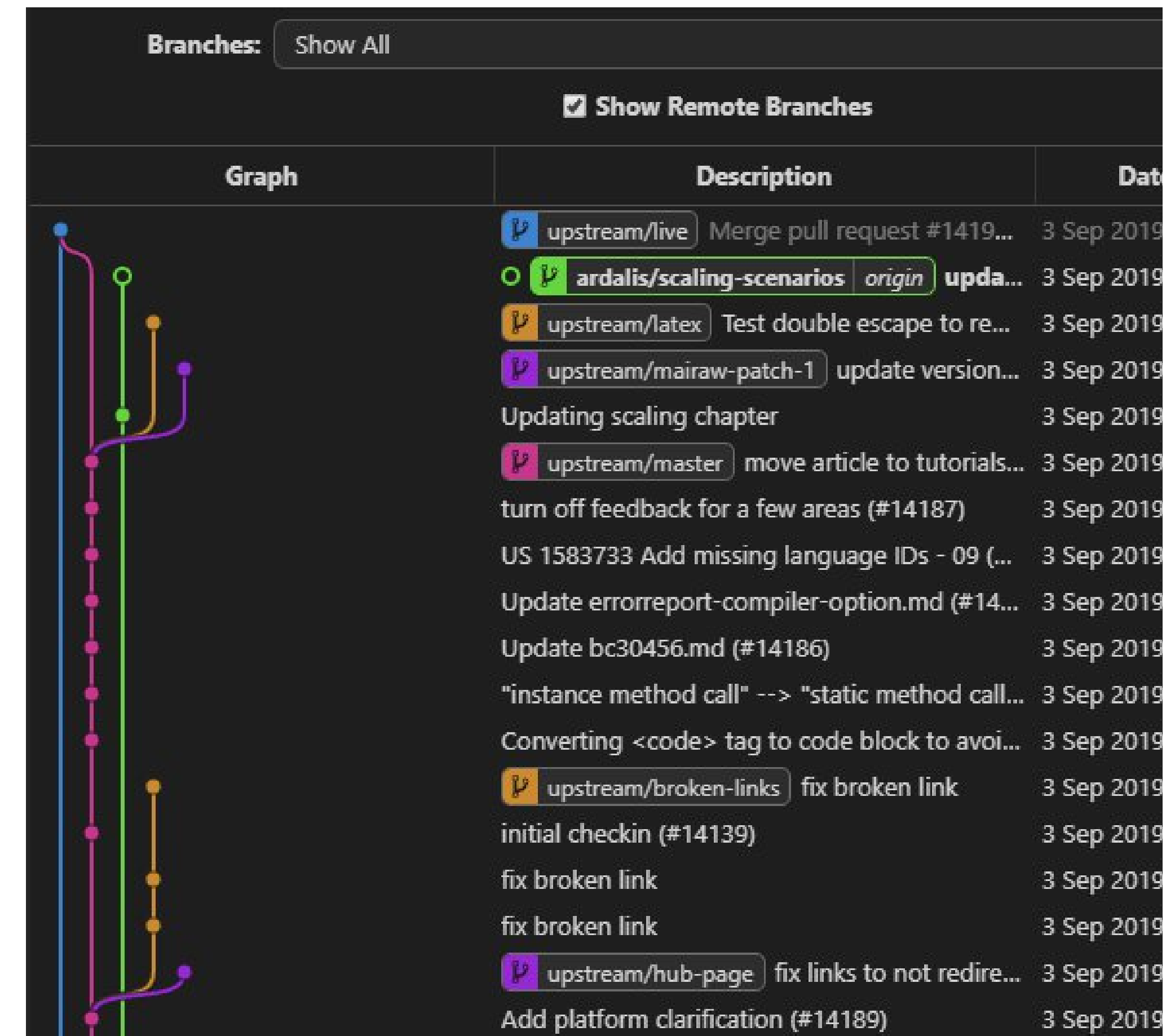
CGVR Lab

Introduction to



Introduction to git

- < What is git?
 - < versions control software (VCS) for cooperative work on software / code
 - < Code changes can be stores locally or remotely on a server / the cloud.
 - < Changes can then be synchronized and integrated.



Source: ardalis.com

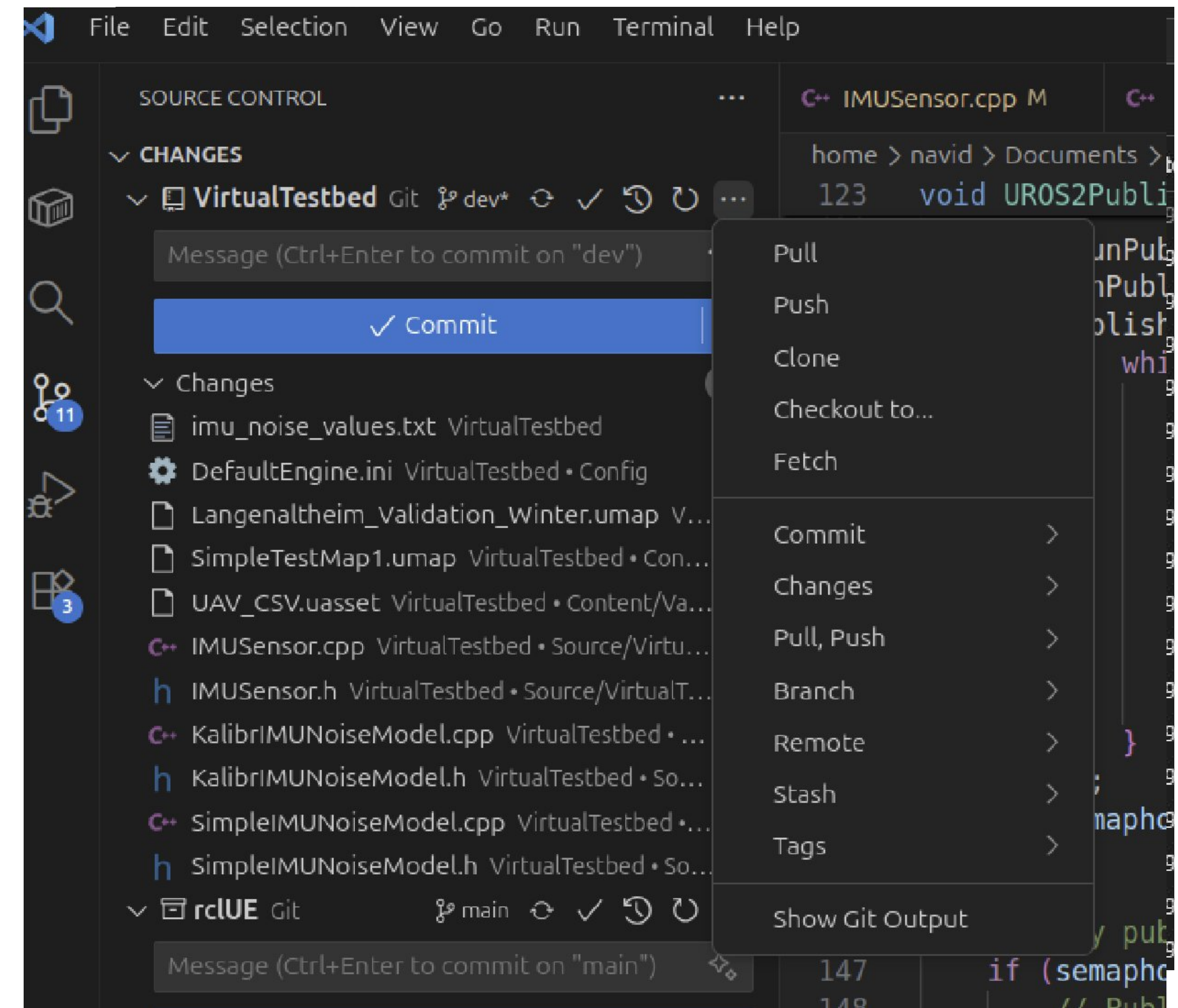
Introduction to git

< How to use git?

- < Via the terminal or GUI-applications (e.g. Github-Desktop).
- < Nowadays all IDEs / code editors have git-integration, therefore also VS Code.

< Installation

- < Usually preinstalled on Linux & Mac.
- < For Windows: <https://git-scm.com/downloads/win>



Introduction to git

< relevant terminology

< repository

< clone

< commit & commit history

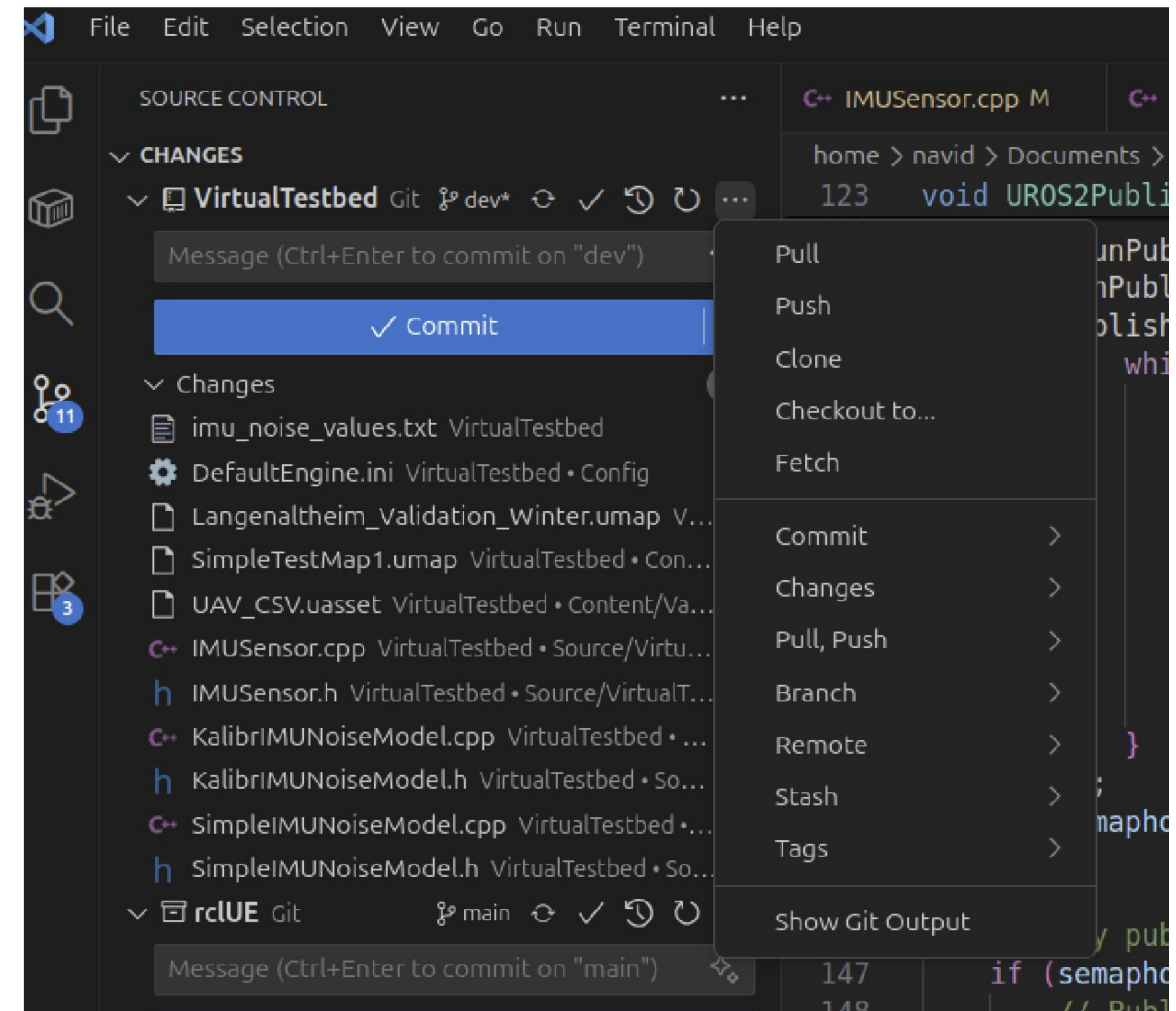
< branch & branch tree

< staged changes

< pull / push

< stash

< merge



Interactive Demonstration with VS Code

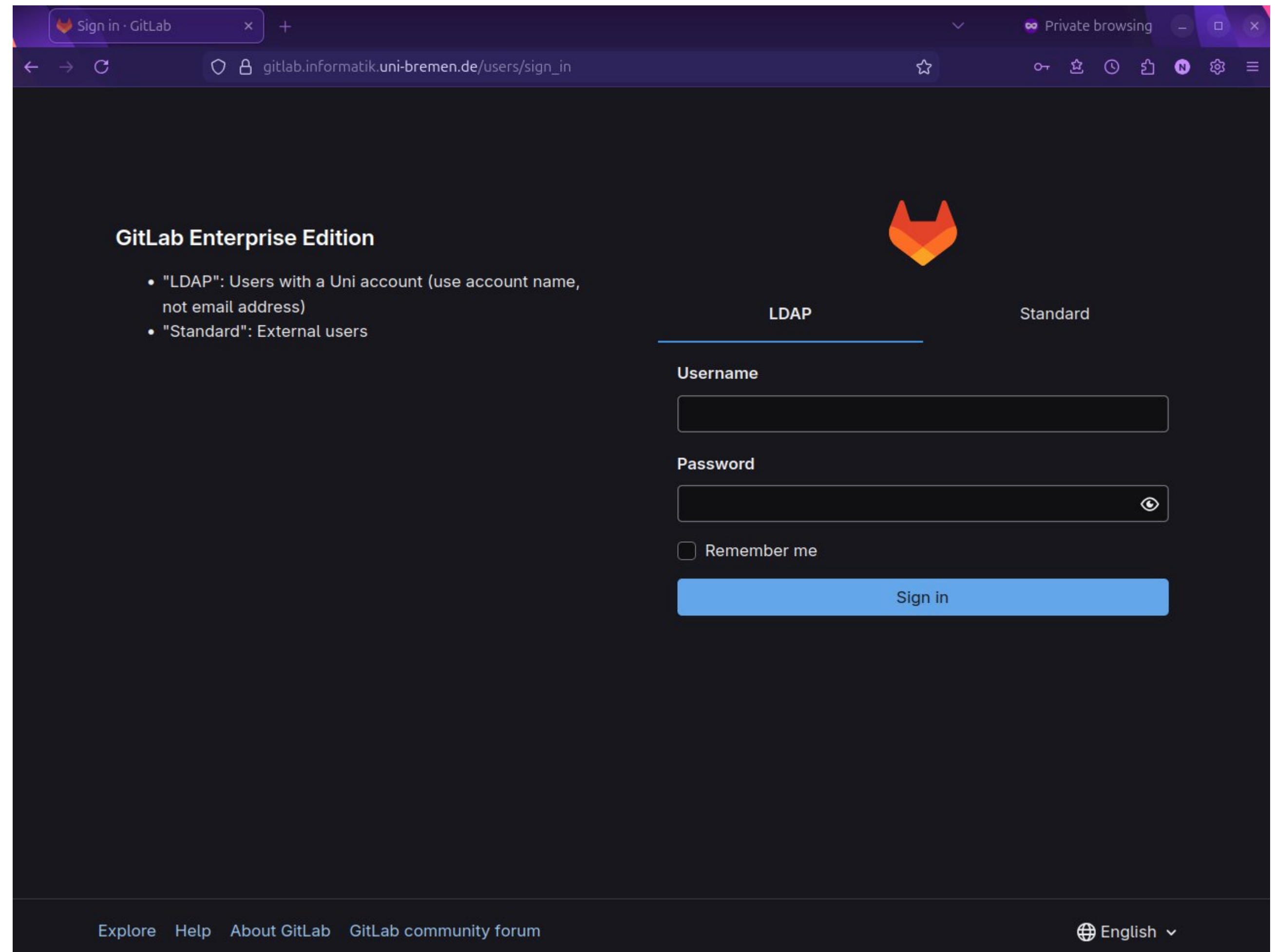
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Creating a Repository

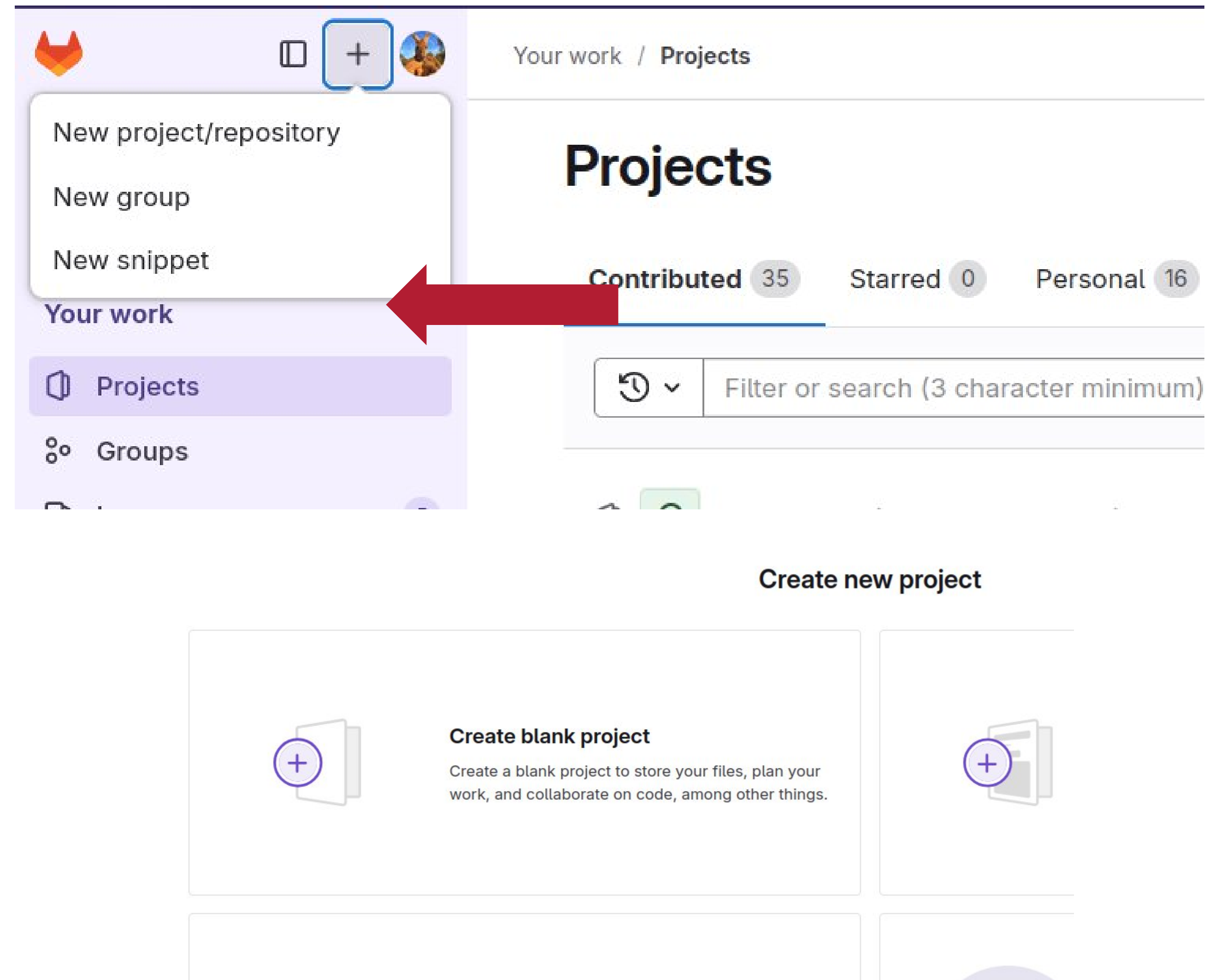
1. Log into GitLab with your university credentials. Link: <https://gitlab.informatik.uni-bremen.de>



The screenshot shows the GitLab Enterprise Edition login interface in a web browser. The browser's address bar displays the URL `gitlab.informatik.uni-bremen.de/users/sign_in`. The page features the GitLab logo at the top center. Below the logo, there are two tabs: "LDAP" (which is selected) and "Standard". Under the "LDAP" tab, there are input fields for "Username" and "Password", a "Remember me" checkbox, and a blue "Sign in" button. To the left of the login form, there is a list of user types: "LDAP": Users with a Uni account (use account name, not email address) and "Standard": External users. The footer of the page includes links for "Explore", "Help", "About GitLab", and "GitLab community forum", along with a language selector set to "English".

Creating a Repository

1. Log into GitLab with your university credentials. Link: <https://gitlab.informatik.uni-bremen.de>
2. On the top left, select “New Project / Repository”, then “Empty Project”.



Creating a Repository

1. Log into GitLab with your university credentials. Link: <https://gitlab.informatik.uni-bremen.de>
2. On the top left, select “New Project / Repository”, then “Empty Project”.
3. Select a projekt name, namespace, visibility level, and projekt configuration.

Create blank project

Create a blank project to store your files, plan your work, and collaborate on code, among other things.

Project name

My project

Must start with a lowercase or uppercase letter, digit, emoji, or underscore. Can also contain dots, pluses, dashes, or spaces.

Project URL

<https://gitlab.informatik.uni-bremen.de/>

Pick a group or namespace

Project slug

my-awesome-project

Visibility Level ?

☒ Private

Project access must be granted explicitly to each user. If this project is part of a group, access is granted to members of the group.

☐ Internal

The project can be accessed by any logged in user except external users.

☐ Public

The project can be accessed without any authentication.

Project Configuration

☒ Initialize repository with a README

Allows you to immediately clone this project's repository. Skip this if you plan to push up an existing repository.

☐ Enable Static Application Security Testing (SAST)

Analyze your source code for known security vulnerabilities. [Learn more.](#)

☐ Enable Secret Detection

Scan your code for secrets and credentials to prevent unauthorized access. [Learn more.](#)

Create project

Cancel

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Clone a Repository - `git clone <repository url>`

1. Choose a method of authentication.

- [HTTPS](#) or [SSH](#)
- HTTPS either via password or auth-token

Clone a Repository - `git clone <repository url>`

1. Choose a method of authentication.
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2. Open your target folder either in your IDE or the terminal.

Clone a Repository - `git clone <repository url>`

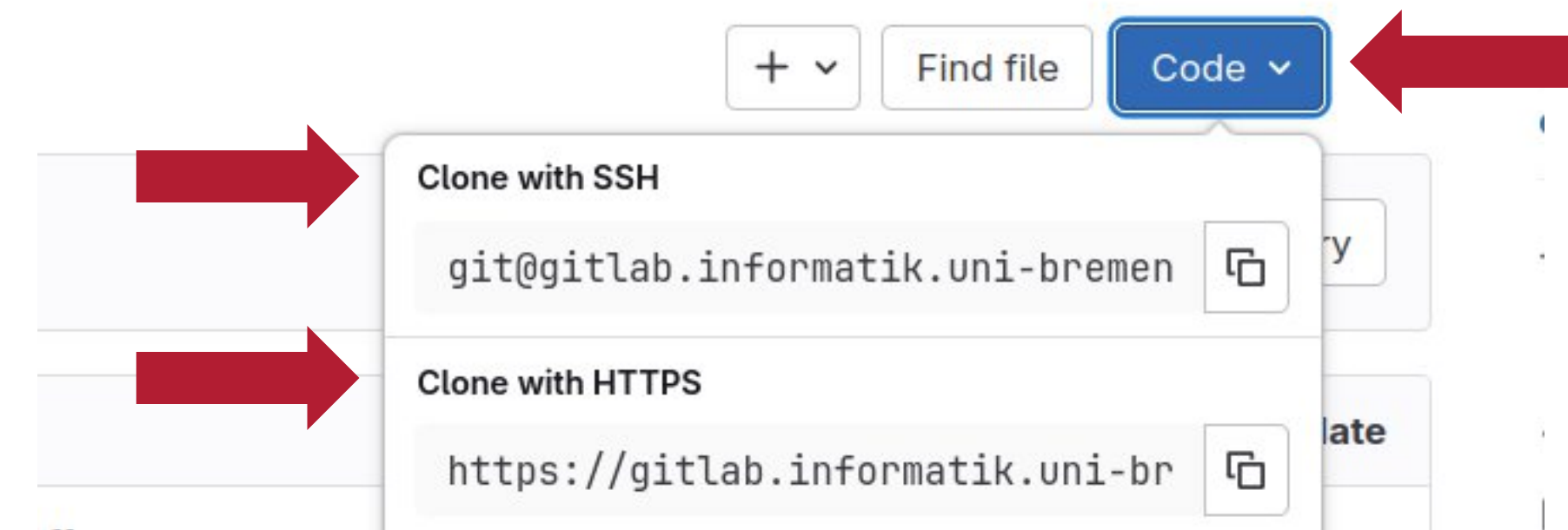
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2. Open your target folder either in your IDE or the terminal.

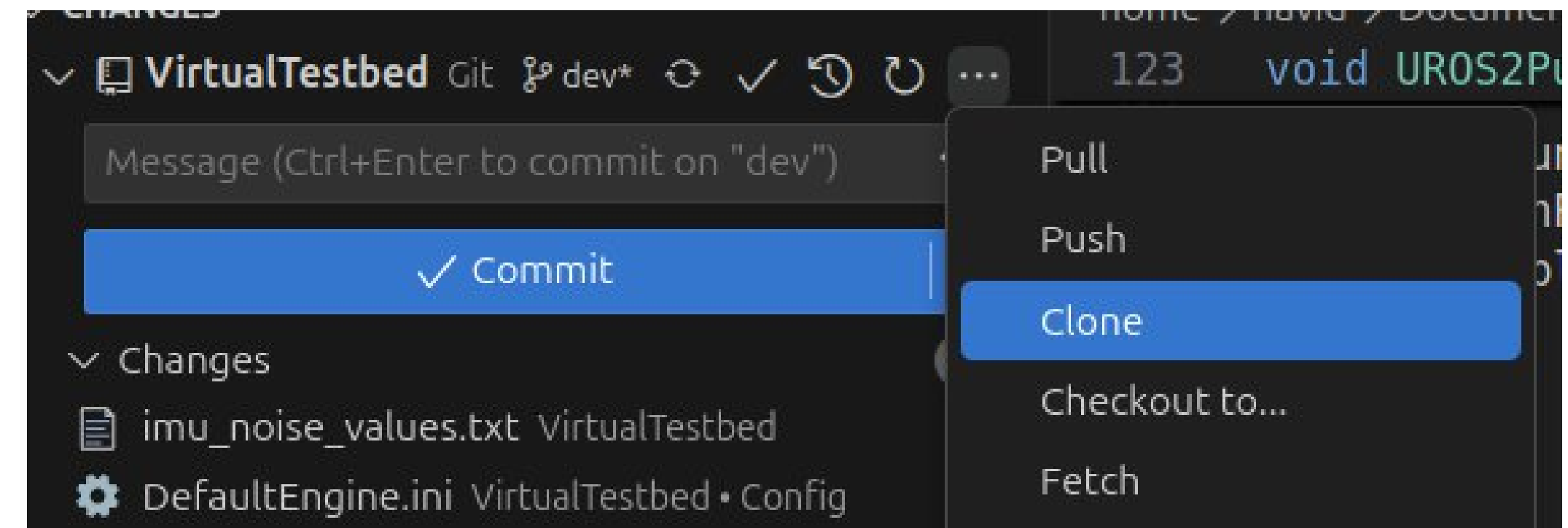
3. Copy the Url of the repo.

- In top right, under “Code”.
- Pay attention to the Url-type!



Clone a Repository - `git clone <repository url>`

1. Choose a method of authentication.
 - [HTTPS](#) or [SSH](#)
2. Open your target folder either in your IDE or the terminal.
3. Copy the Url of the repo.
4. Clone the repo via your IDE or the terminal!



Interactive Demonstration with VS Code

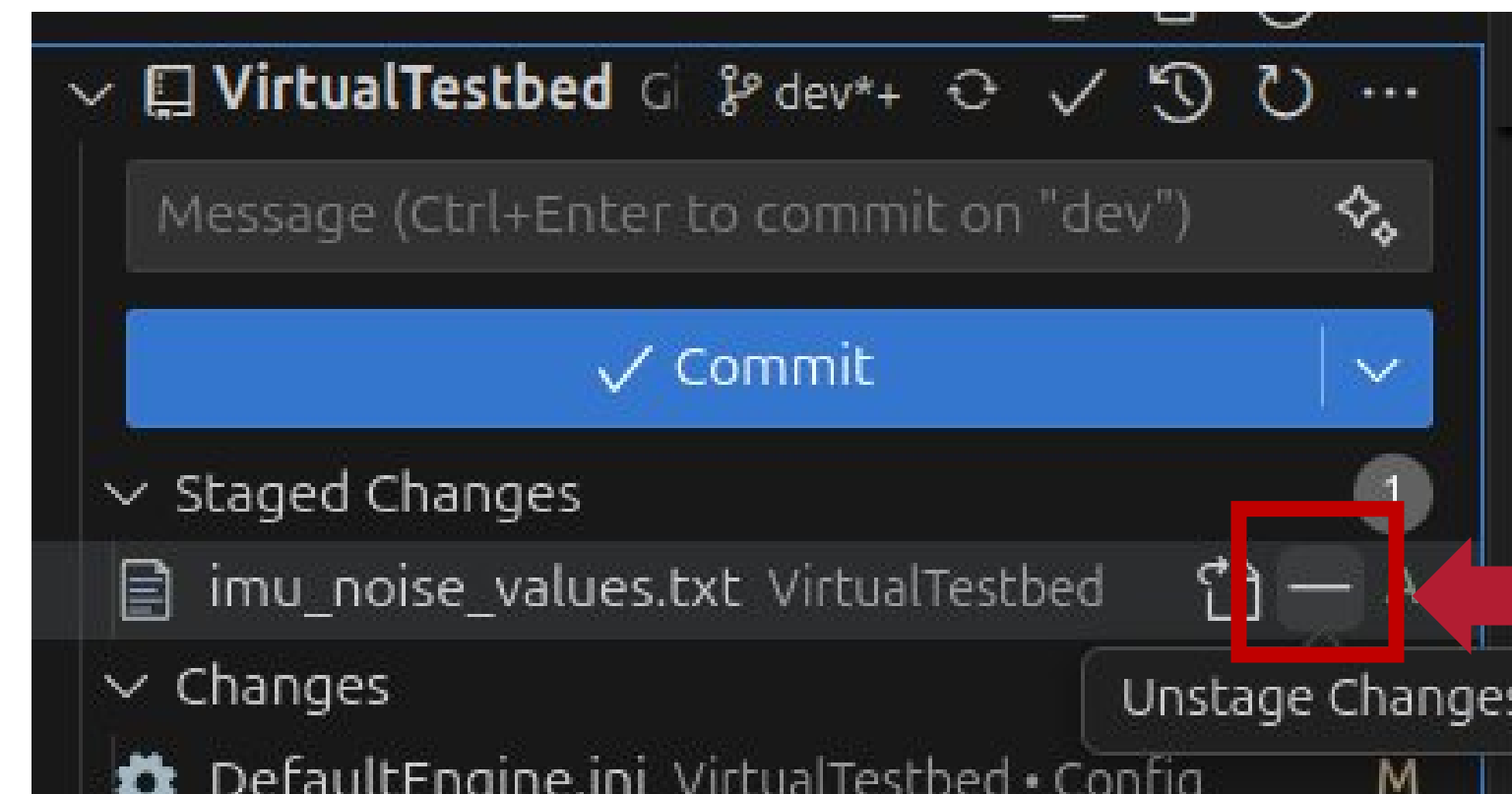
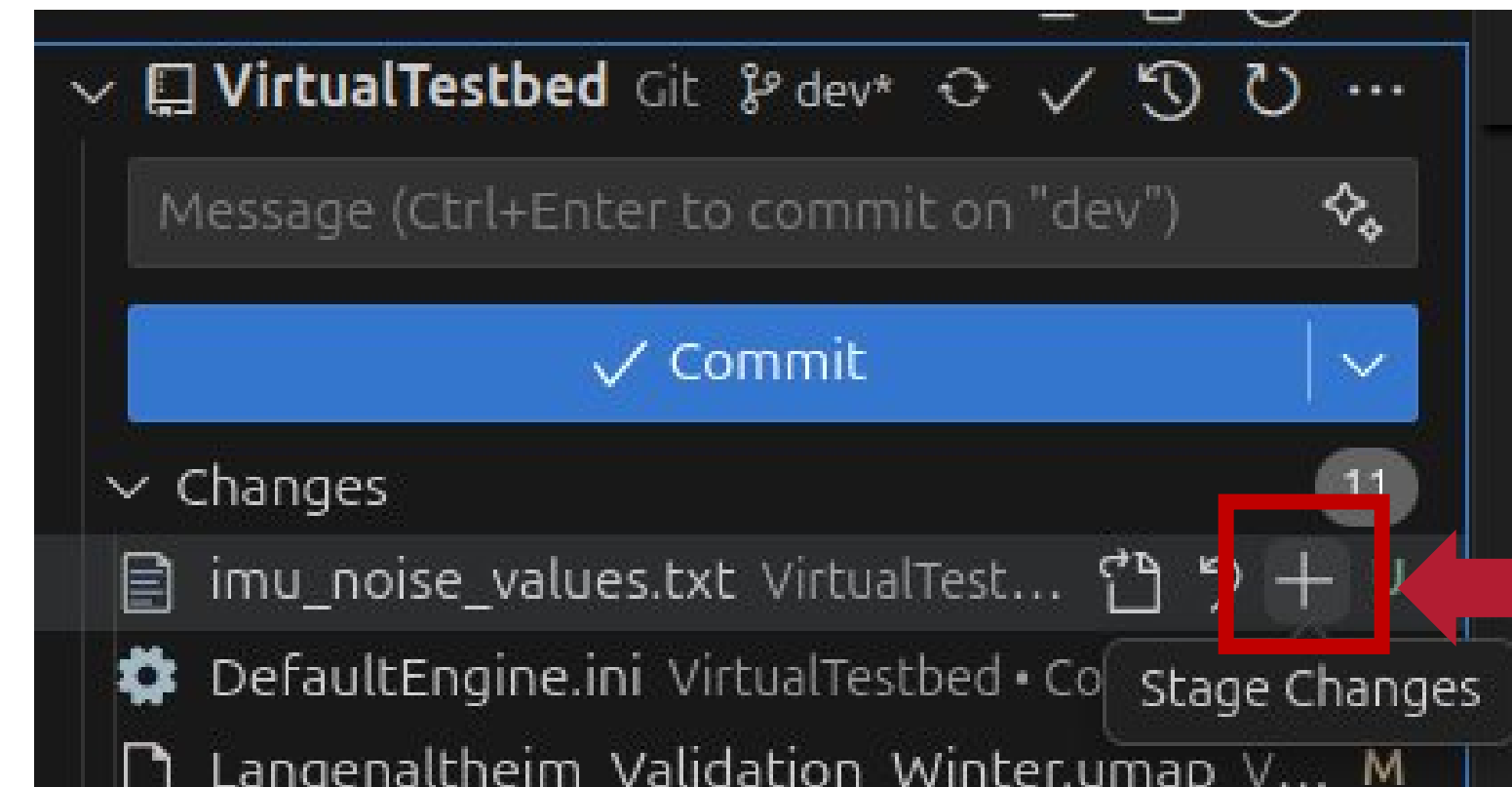
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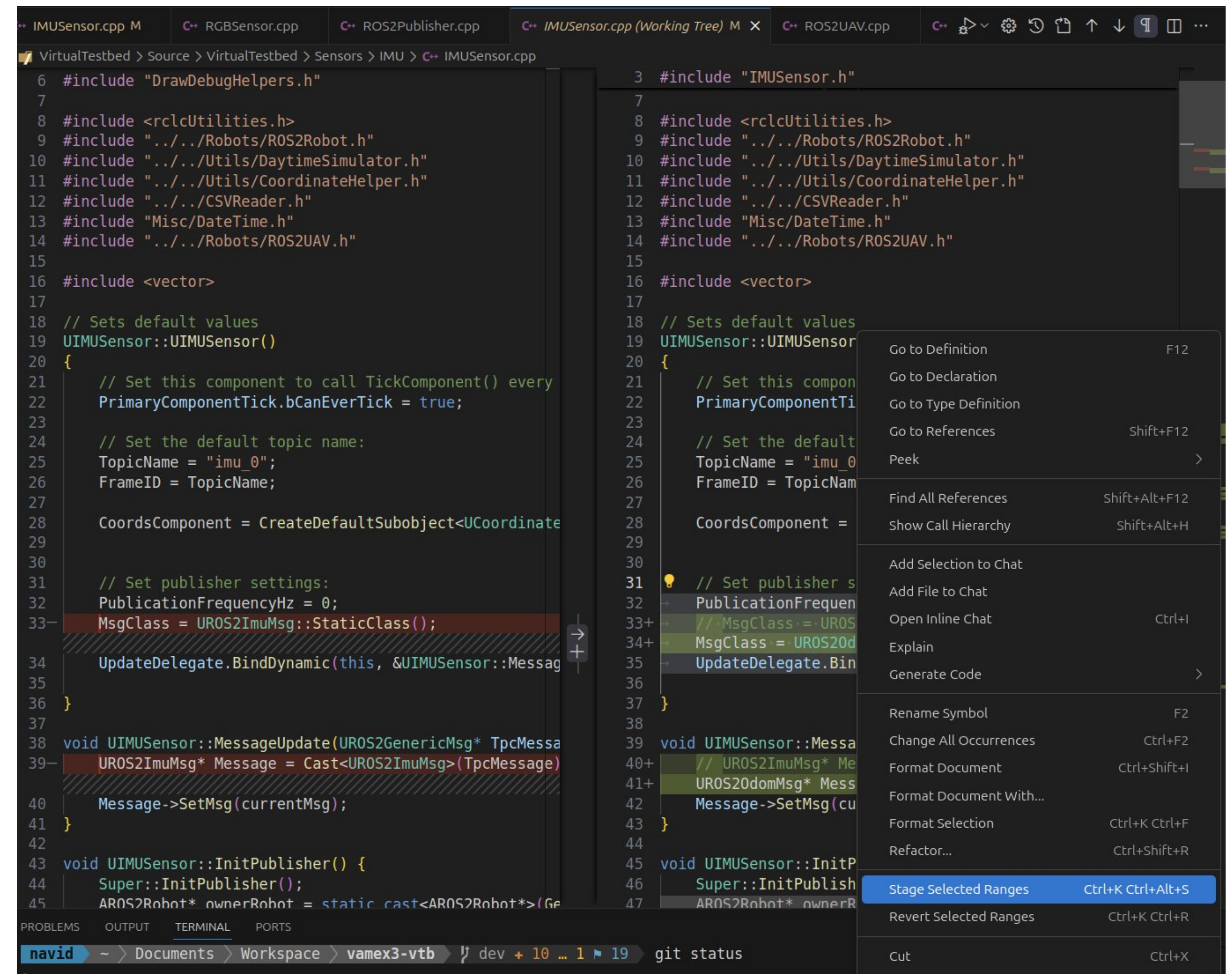
Staging Changes - `git add <file path>`

1. Select files for staging (+) or deselect them (-).



Staging Changes - `git add <file path>`

1. Select files for staging (+) or deselect them (-).
2. It's also possible to only stage parts of a changed file.
 - Can be a bit flimsy at times.



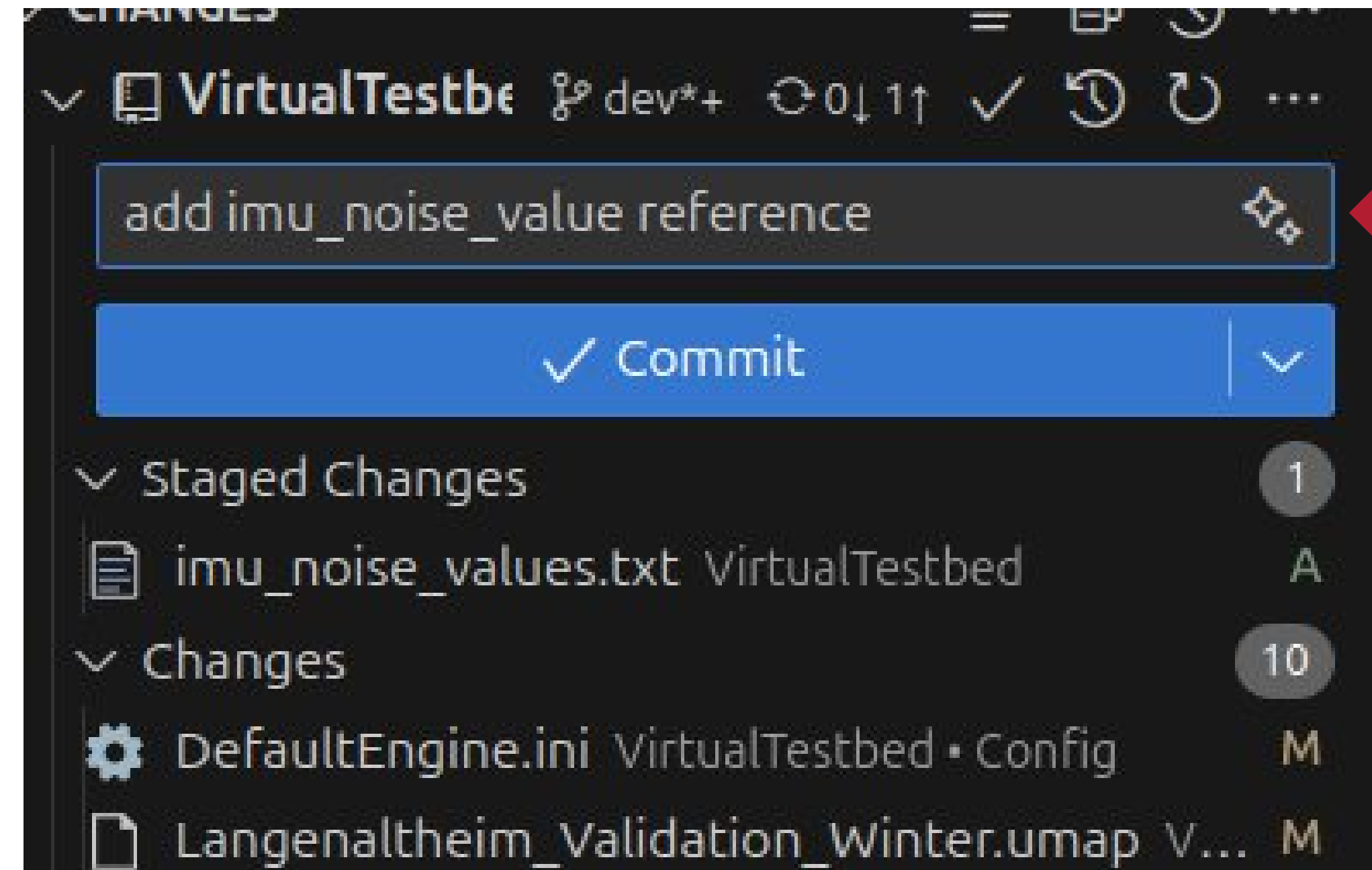
The screenshot shows the VS-Code interface with a diff editor open. The left pane shows the original file, and the right pane shows the modified file. A context menu is open over the diff, listing various actions. The 'Stage Selected Ranges' option is highlighted in blue, with the keyboard shortcut 'Ctrl+K Ctrl+Alt+S' displayed next to it. Other options in the menu include 'Go to Definition', 'Go to Declaration', 'Go to Type Definition', 'Go to References', 'Peek', 'Find All References', 'Show Call Hierarchy', 'Add Selection to Chat', 'Add File to Chat', 'Open Inline Chat', 'Explain', 'Generate Code', 'Rename Symbol', 'Change All Occurrences', 'Format Document', 'Format Document With...', 'Format Selection', 'Refactor...', 'Revert Selected Ranges', and 'Cut'.

Changes between two revisions of the same file in the VS-Code diff editor. It is possible to mark sections and stage those separate from other changes.

Committing Changes - `git commit -m "<message>"`

1. Give your changes a descriptive commit message.

- This step is not optional!!!

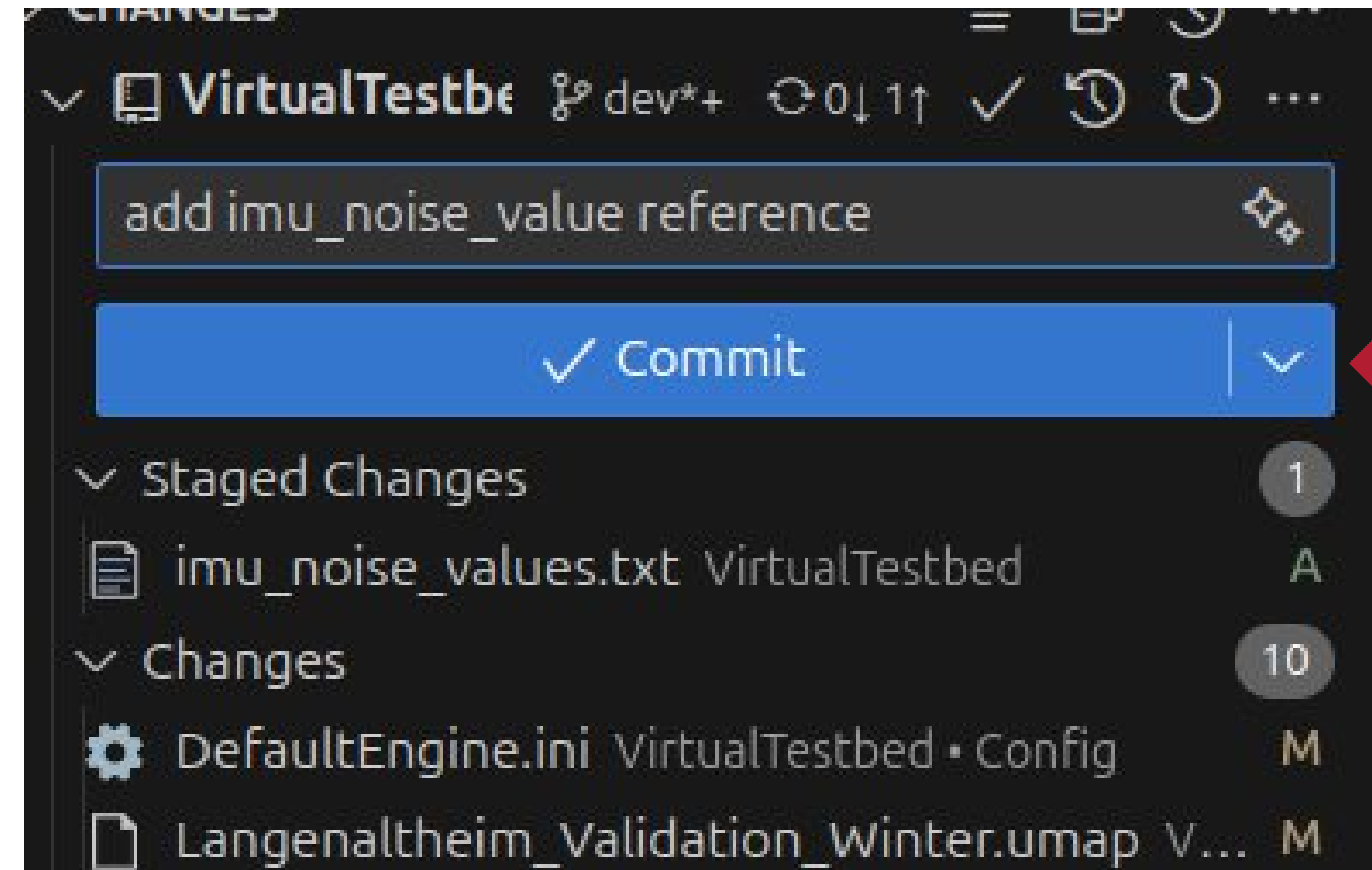


Committing Changes - `git commit -m "<message>"`

1. Give your changes a descriptive commit message.

- This step is not optional!!!

2. With the “Commit”-Button, your changes are added to the local Commit History.



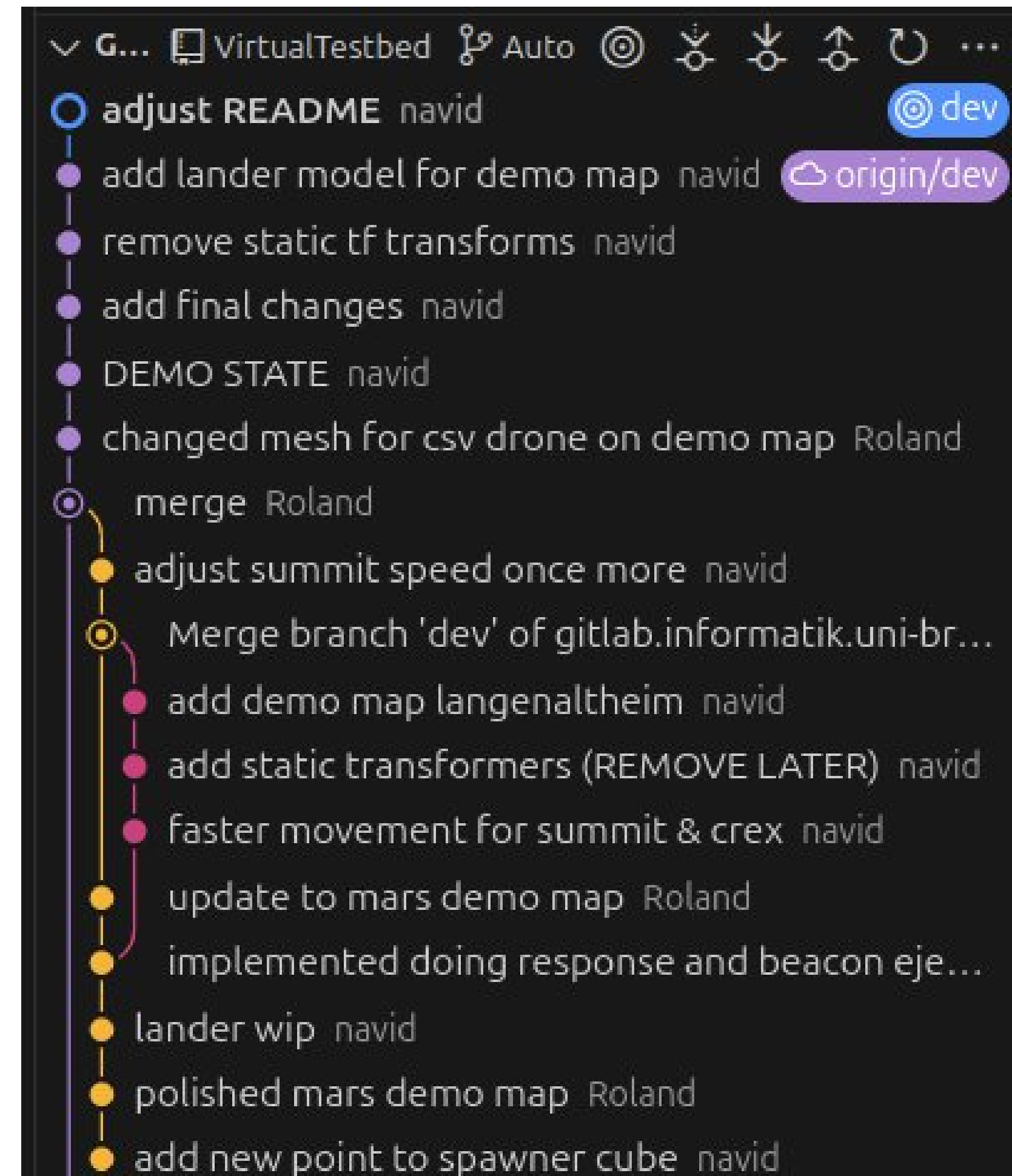
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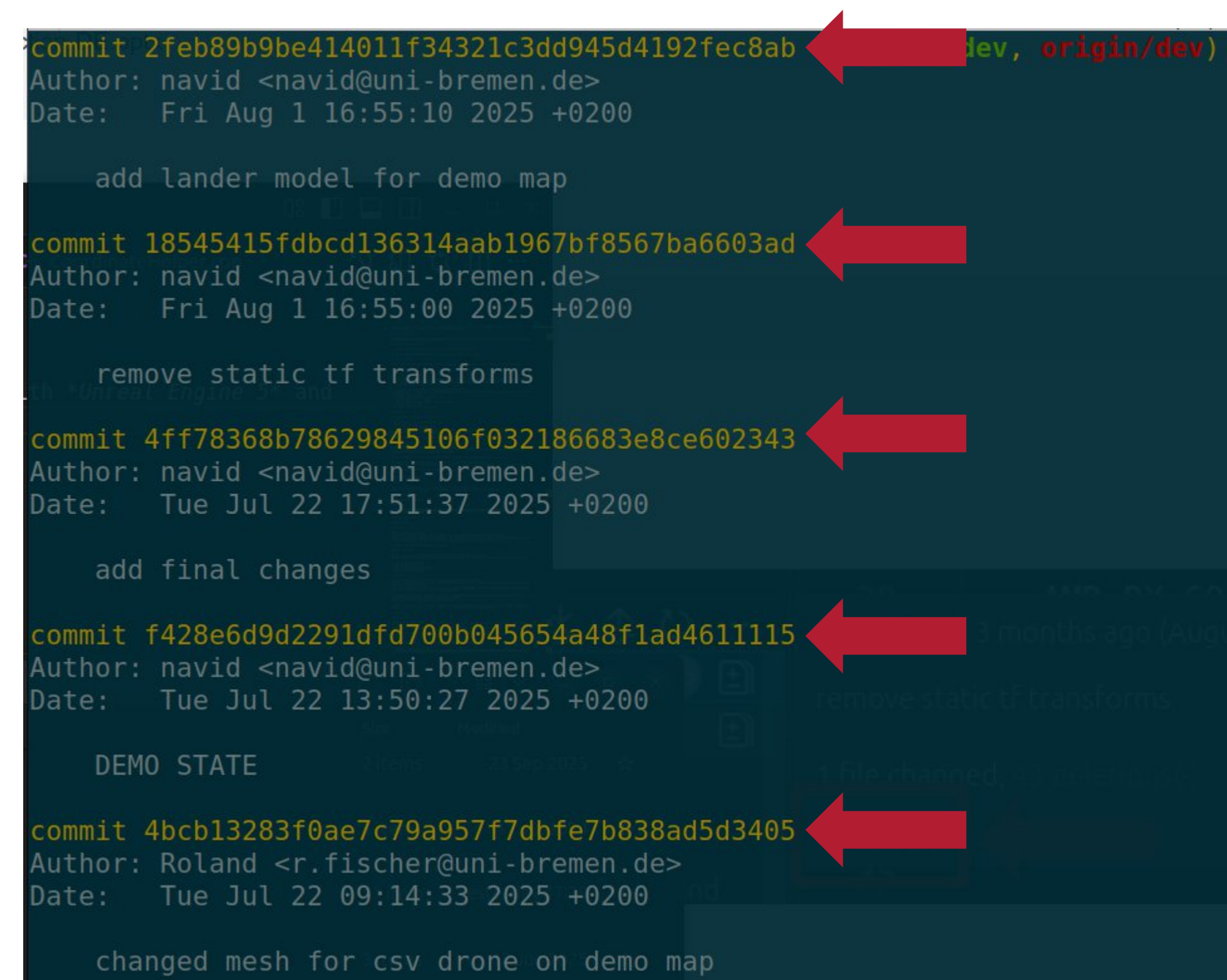
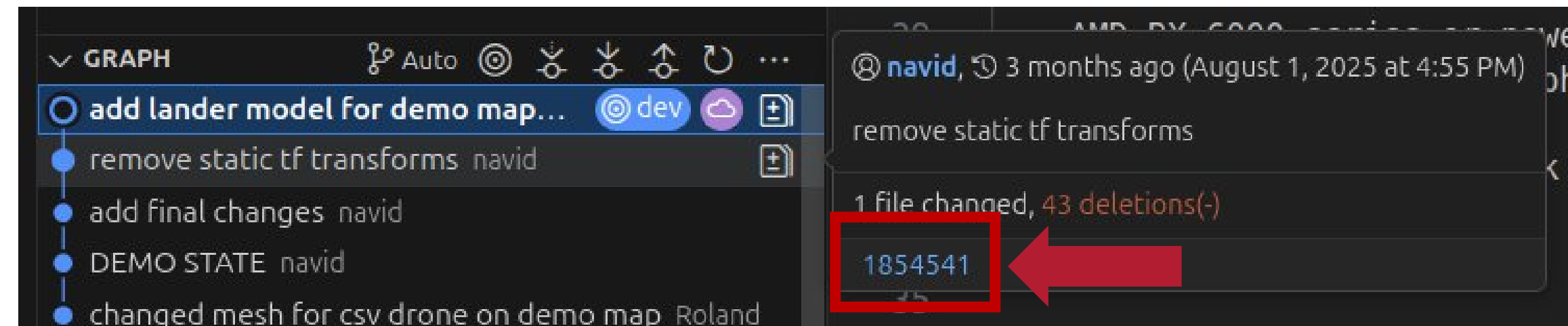
2. With the “Commit”-Button, your changes are added to the local Commit History.

- But not yet to the remote repository (GitLab, GitHub, etc.). Usually denoted with `origin/`.



Commit Hashes & History

- Each commit has a unique hash.
- It is commonly used to reference it.
 - Usually the short hash suffices.
- Always listed in the commit history.
 - `git log`



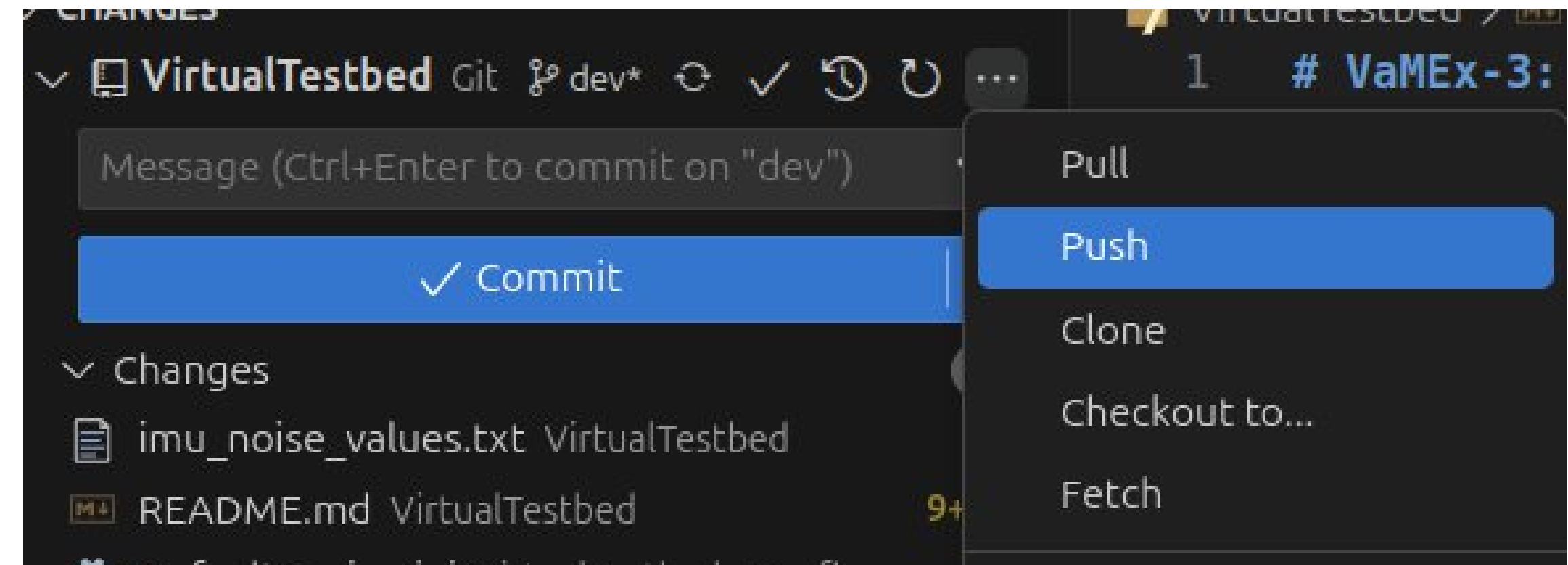
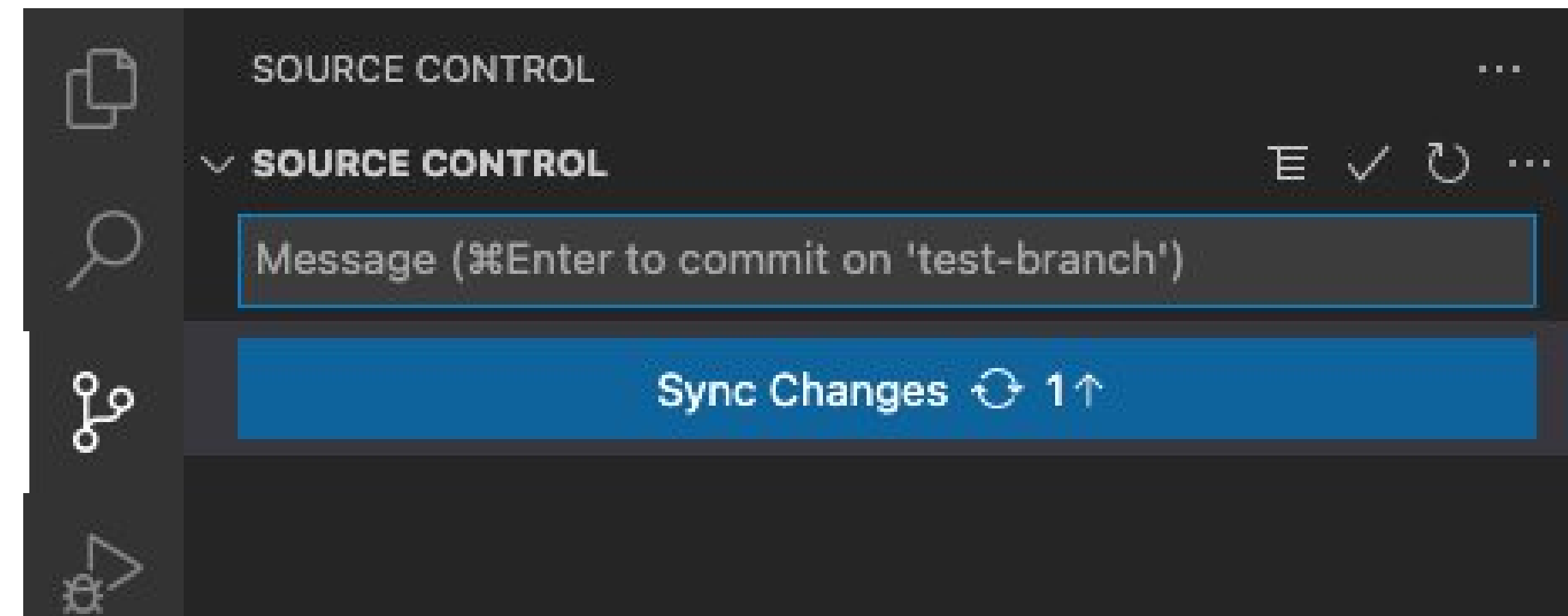
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Pushing Commits - `git push`

1. Push the changes via one of the following two options:

- “Sync Changes”; only shown if there are no more local changes to be committed
- source control context menu



Pushing Commits - `git push`

1. Push the changes

2. If someone has already pushed on that branch, there can be problems.

- Changes need to first be integrated locally.
- There are many approaches:
 - Branch & Merge
 - Rebase
 - ...

Interactive Demonstration with VS Code

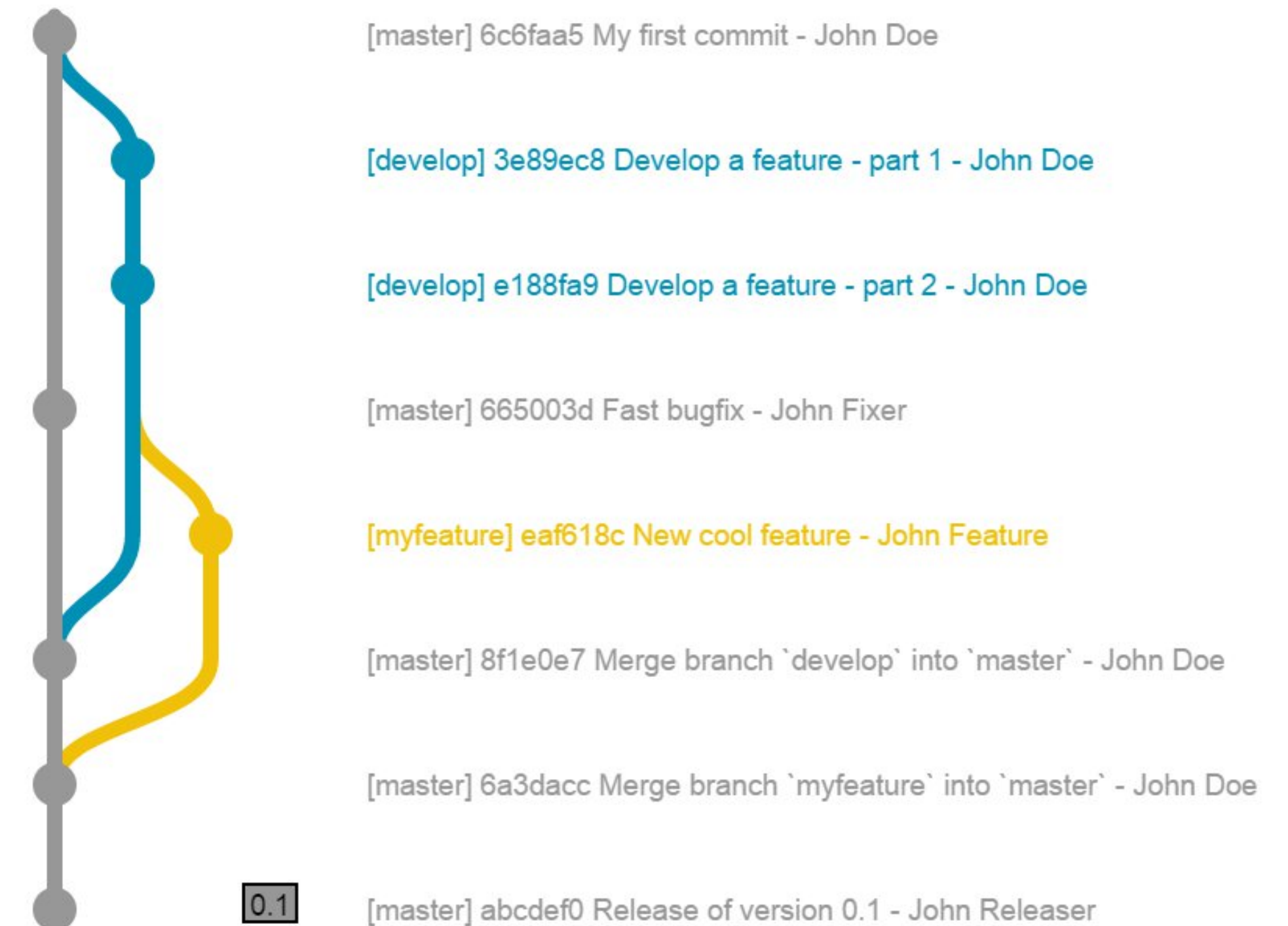
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Branches

- < “alternate states” of your project

 - < Why? Gives the possibility to work on something in isolation, without constantly needing to reintegrate external changes.
- < reintegration via a „merge”

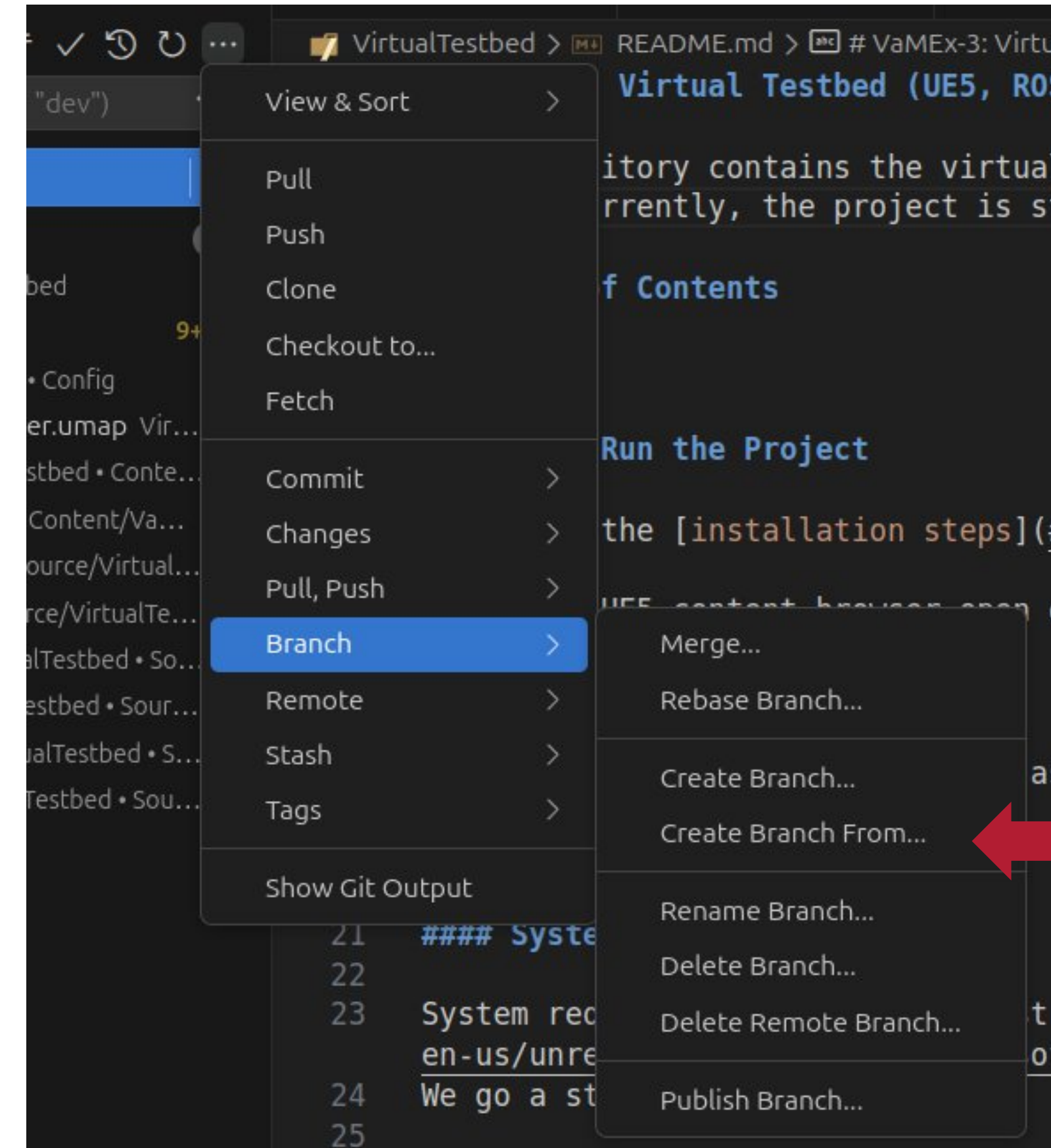
 - < Creates a merge commit.
 - < In the case of a merge conflict adjustments need to be made.



Quelle: [GitHub/frappe/charts](https://github.com/frappe/charts)

Creating a Branch - `git branch -c <branch name>`

1. Create a new branch based on `main`.

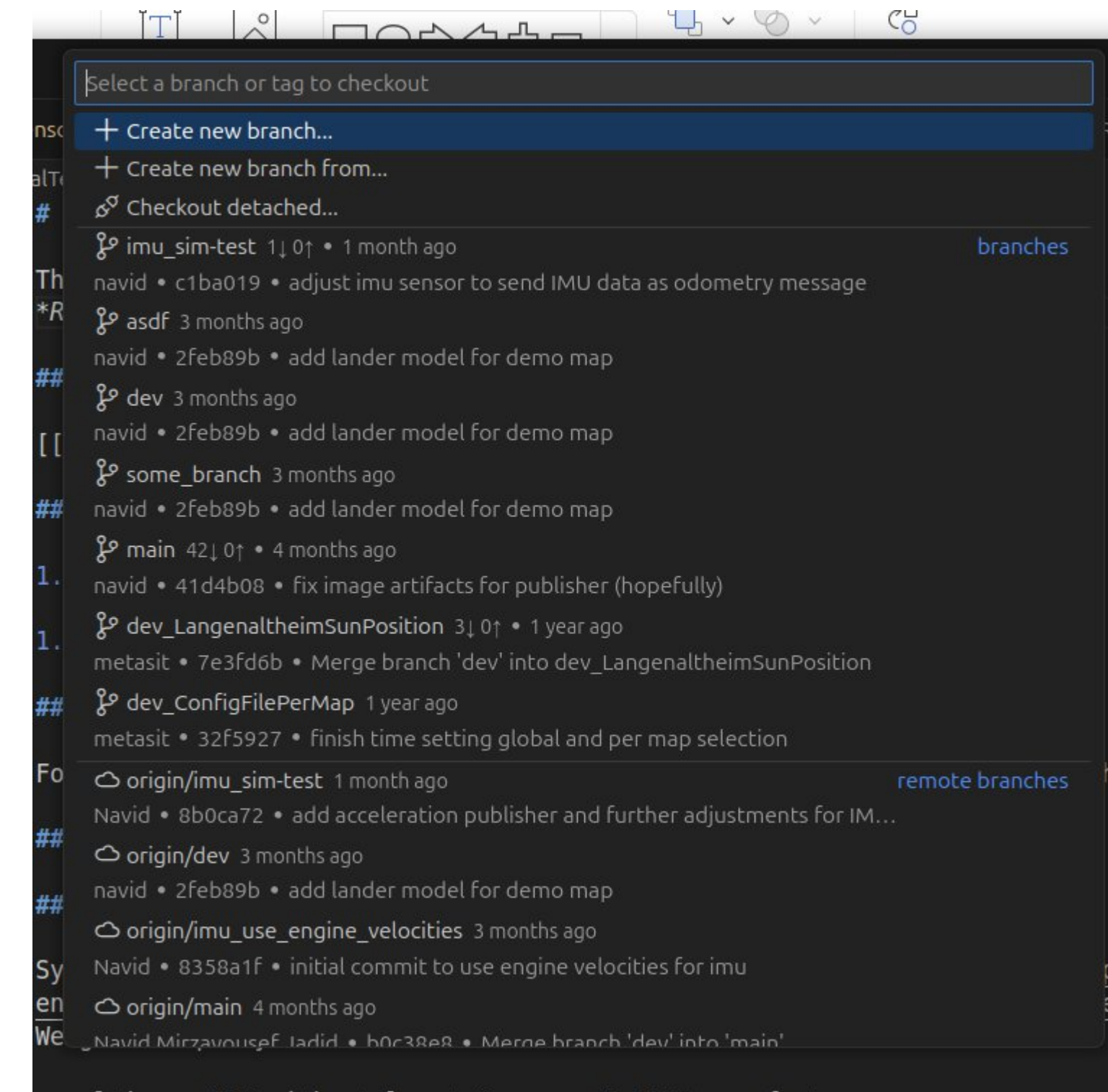
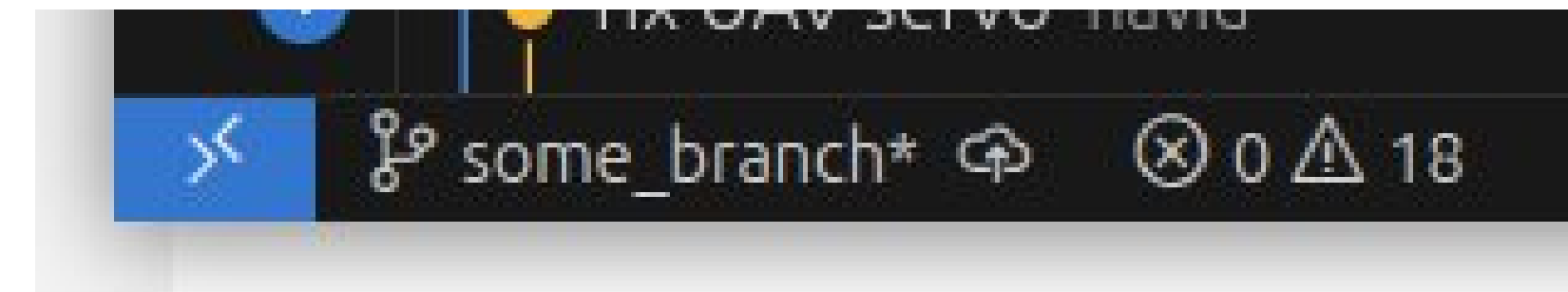


Creating a Branch - `git branch -c <branch name>`

1. Create a new branch based on `main`.

2. Branches can also be created with the button on the bottom left.

- `git switch <branch>`
- Can also create a new branch from there.



Interactive Demonstration with VS Code

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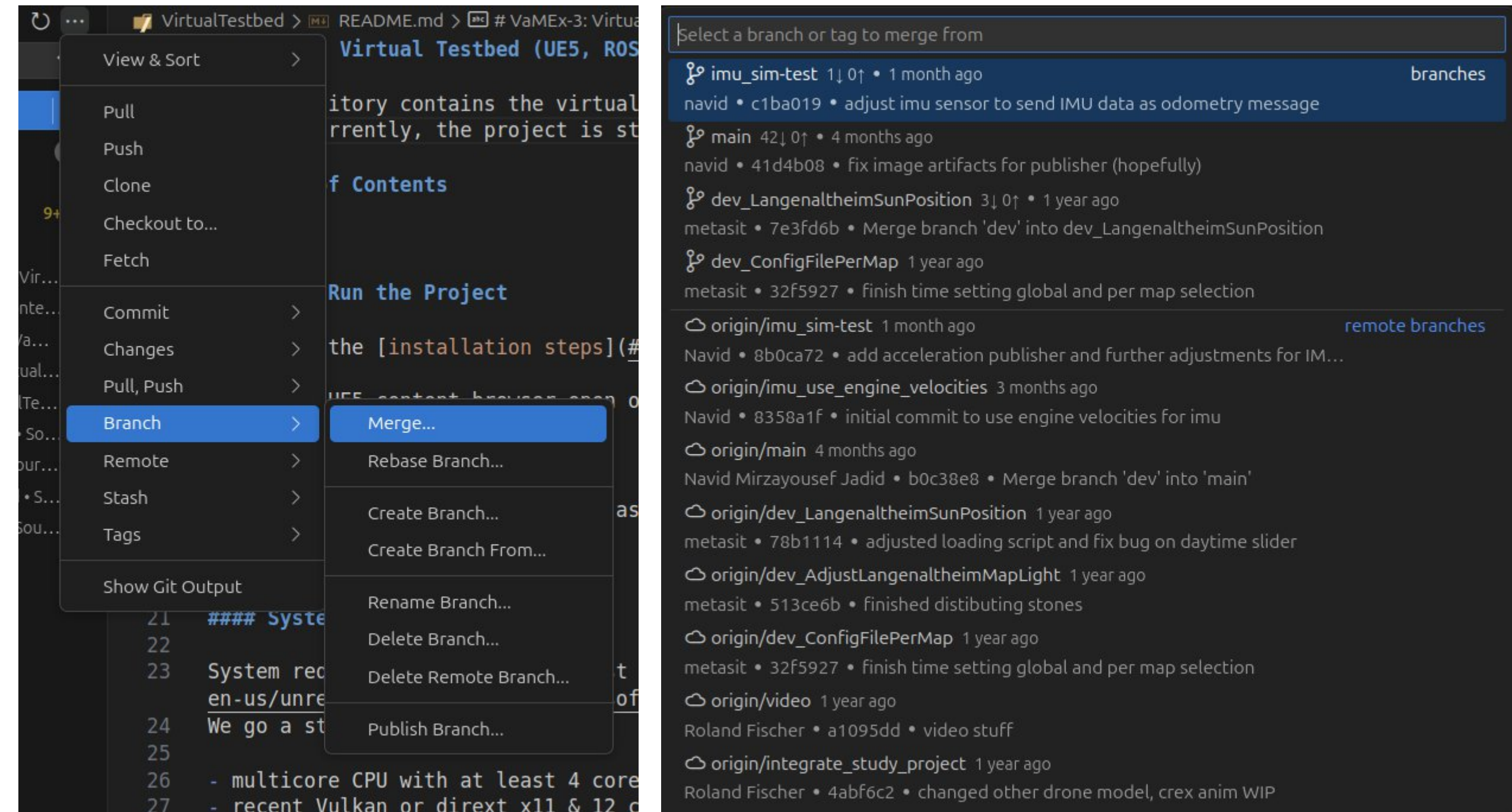
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Merging Branches - `git merge <branch name>`

1. Switch to `main`.

2. Merge your new branch into `main`.

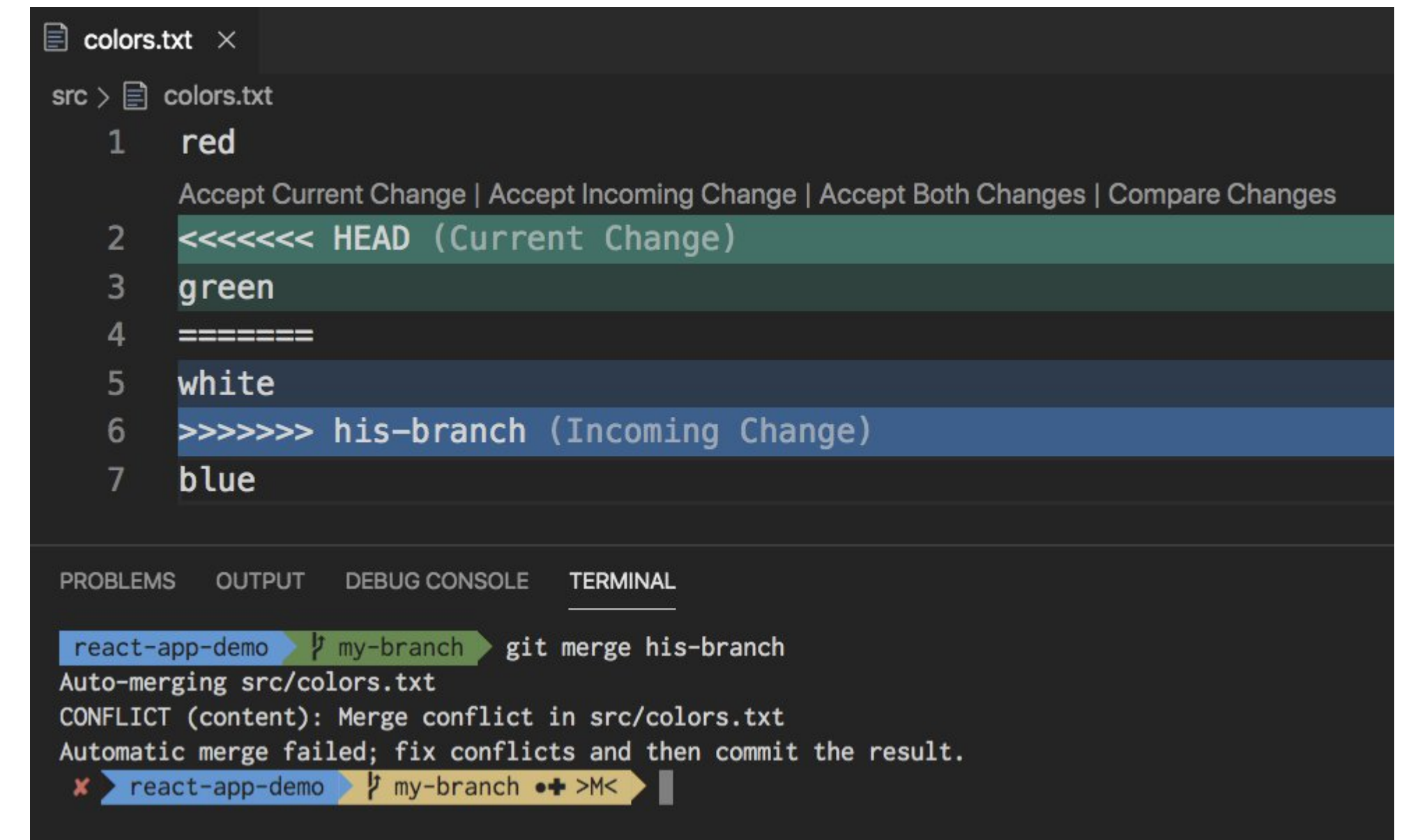
- Merge always incorporates changes into the active branch.



Merge Conflicts

- What if multiple people worked on the same file and push / merge to the same branch?
- We get a so-called „merge conflict“.

 - Now it is necessary to decide which changes to keep and which to discard.
 - In case of uncertainty, a merge can always be aborted.
 - `git merge --abort`



```

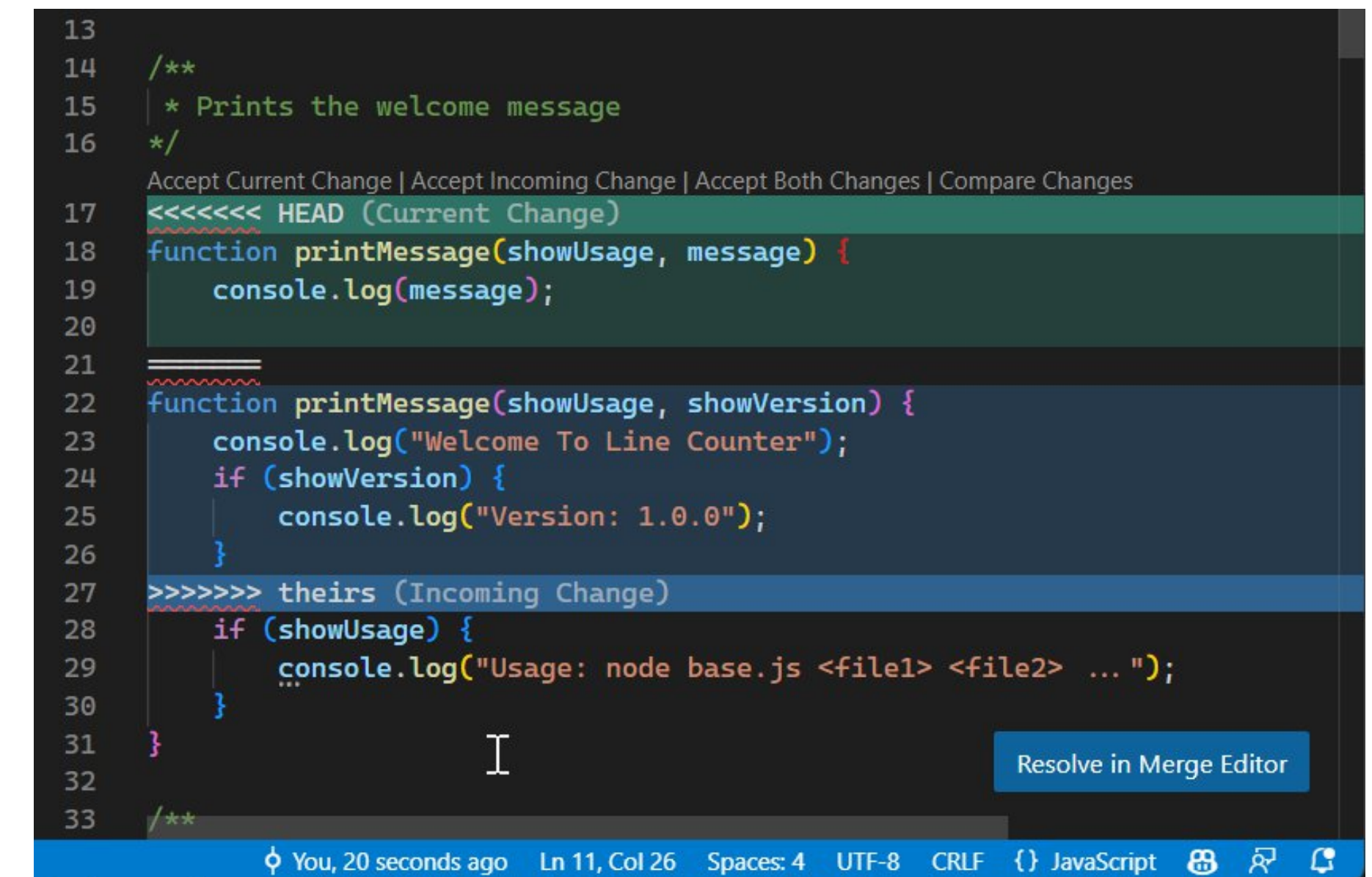
src > colors.txt
1 red
   Accept Current Change | Accept Incoming Change | Accept Both Changes | Compare Changes
2 <<<<<< HEAD (Current Change)
3 green
4 =====
5 white
6 >>>>>> his-branch (Incoming Change)
7 blue

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
react-app-demo my-branch git merge his-branch
Auto-merging src/colors.txt
CONFLICT (content): Merge conflict in src/colors.txt
Automatic merge failed; fix conflicts and then commit the result.
x react-app-demo my-branch >M<
  
```

Quelle: ihatetomatoes.net

Merge Conflicts

- ⟨ VS Code has built-in solution.
- ⟨ Inline Merge-Editor (top)
 - ⟨ Current Change: local state
 - ⟨ Incoming Change: incoming changes
 - ⟨ Both: combination
- ⟨ Three-Way Merge Editor (bottom)
 - ⟨ Left incoming, right current, bottom result.
 - ⟨ Options can be selected via the GUI. But changes can also be directly made in the editor.



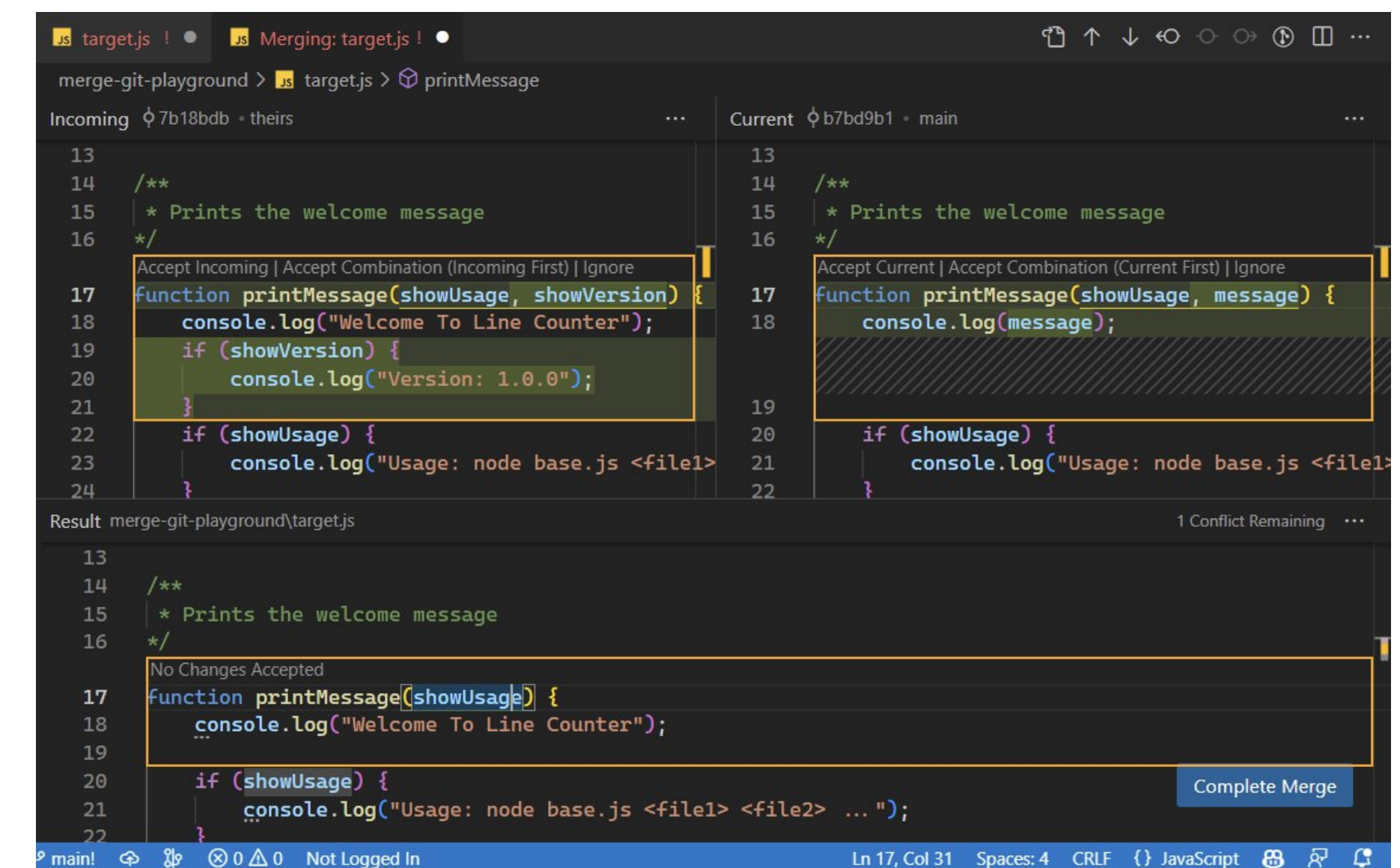
```

13
14 /**
15  * Prints the welcome message
16  */
17 <<<<<< HEAD (Current Change)
18 function printMessage(showUsage, message) {
19     console.log(message);
20 }
21
22 function printMessage(showUsage, showVersion) {
23     console.log("Welcome To Line Counter");
24     if (showVersion) {
25         console.log("Version: 1.0.0");
26     }
27 >>>>>> theirs (Incoming Change)
28 if (showUsage) {
29     console.log("Usage: node base.js <file1> <file2> ...");
30 }
31 }
32
33 /**
    
```

Accept Current Change | Accept Incoming Change | Accept Both Changes | Compare Changes

Resolve in Merge Editor

You, 20 seconds ago Ln 11, Col 26 Spaces: 4 UTF-8 CRLF {} JavaScript



merge-git-playground > target.js > printMessage

Incoming 7b18bdb · theirs Current b7bd9b1 · main

```

13
14 /**
15  * Prints the welcome message
16  */
17 function printMessage(showUsage, showVersion) {
18     console.log("Welcome To Line Counter");
19     if (showVersion) {
20         console.log("Version: 1.0.0");
21     }
22     if (showUsage) {
23         console.log("Usage: node base.js <file1> <file2> ...");
24     }
25 }
    
```

Accept Incoming | Accept Combination (Incoming First) | Ignore

Accept Current | Accept Combination (Current First) | Ignore

Result merge-git-playground\target.js 1 Conflict Remaining

```

13
14 /**
15  * Prints the welcome message
16  */
17 function printMessage(showUsage) {
18     console.log("Welcome To Line Counter");
19 }
20
21 if (showUsage) {
22     console.log("Usage: node base.js <file1> <file2> ...");
23 }
    
```

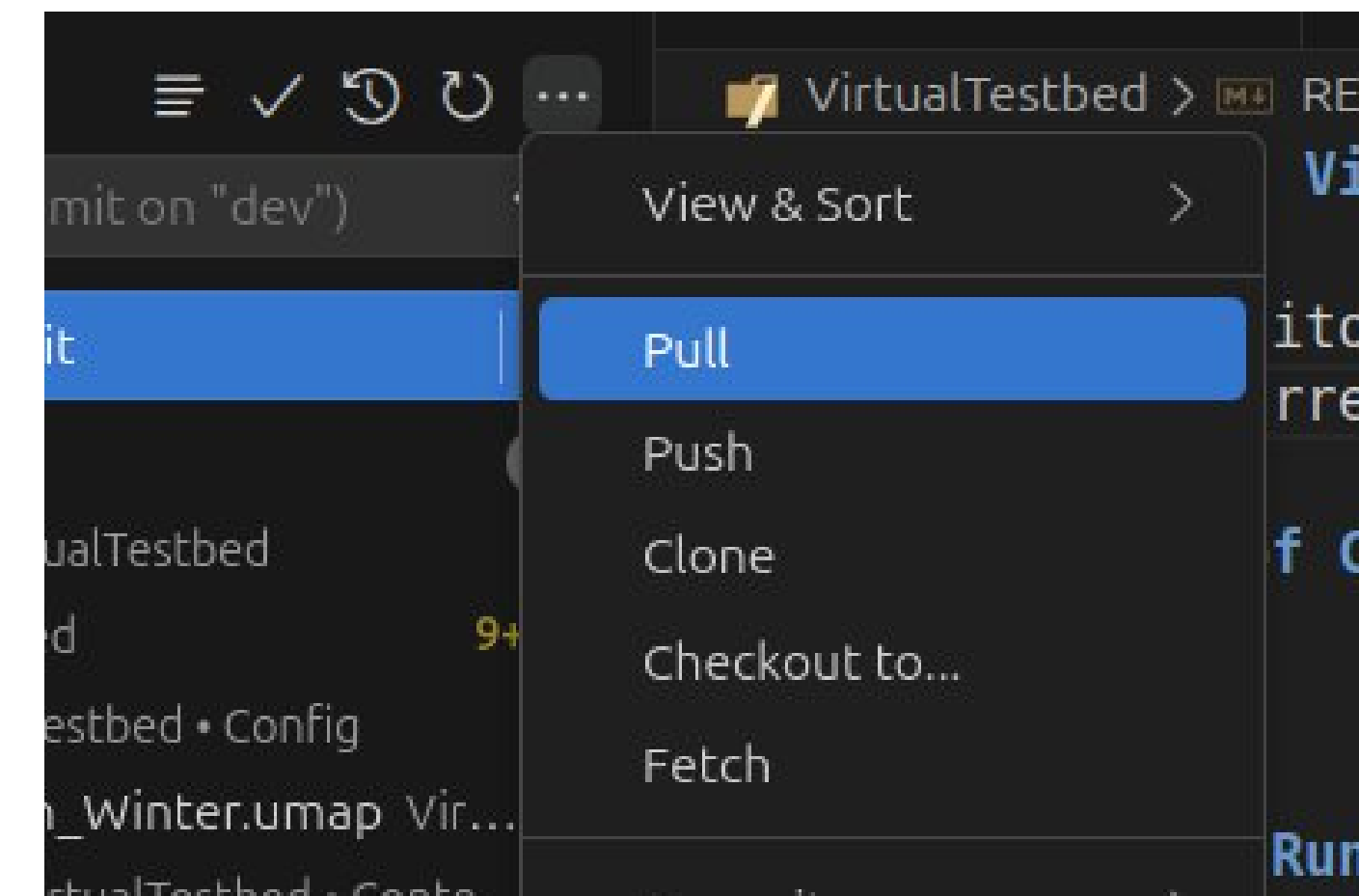
Complete Merge

main! 0 0 Not Logged In Ln 17, Col 31 Spaces: 4 CRLF {} JavaScript

Quelle: [Microsoft](https://code.visualstudio.com/docs/sourcecontrol/merging)

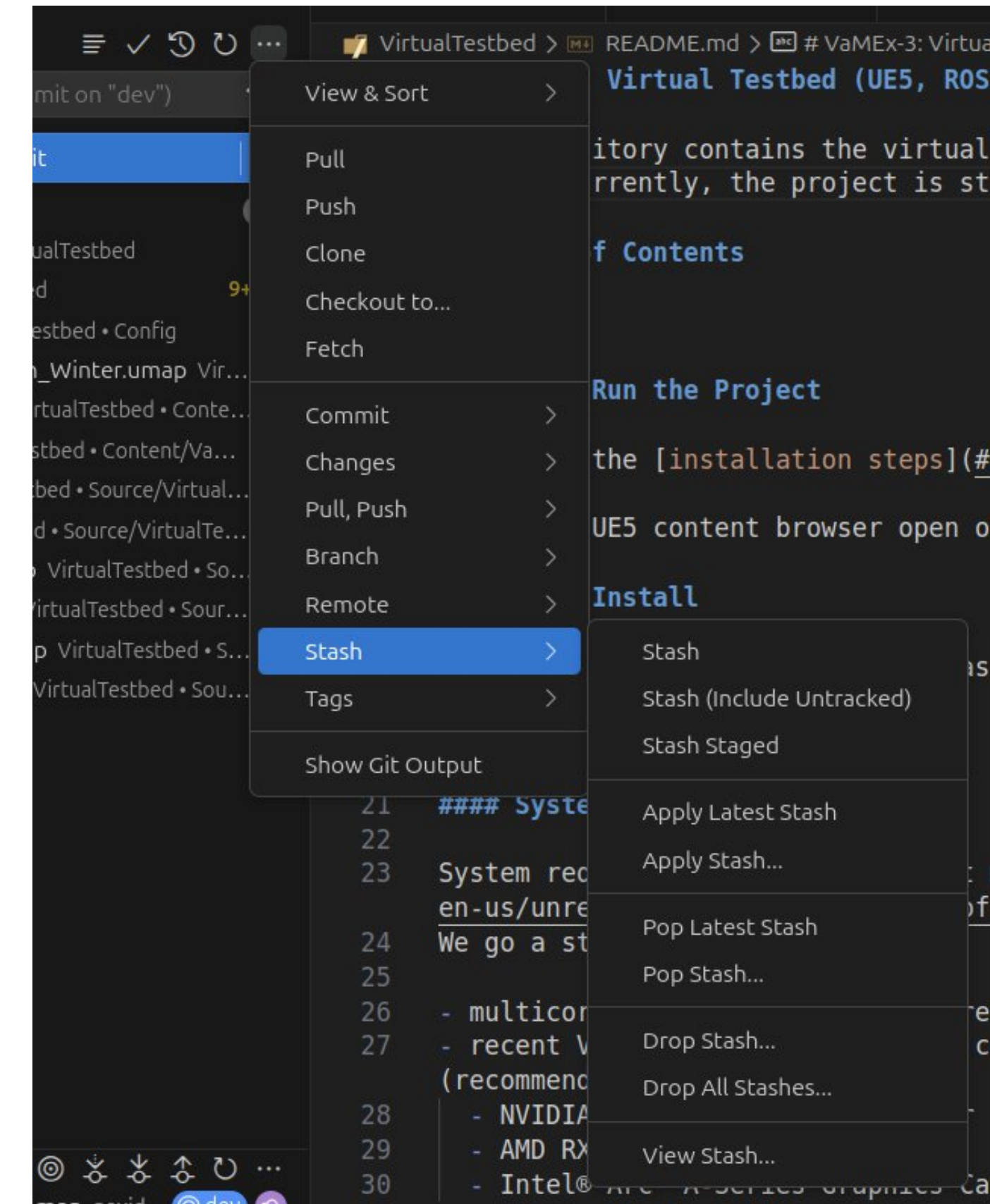
Pulling Changes / Commits - `git pull`

- `git pull`: Retrieves changes from the remote repository.
- Can create problems, if the same file was edited both locally and remotely.
 - If changes have been committed locally, then we get a merge conflict.
 - If not, then the local changes can be “stashed” away and reintegrated after pulling.



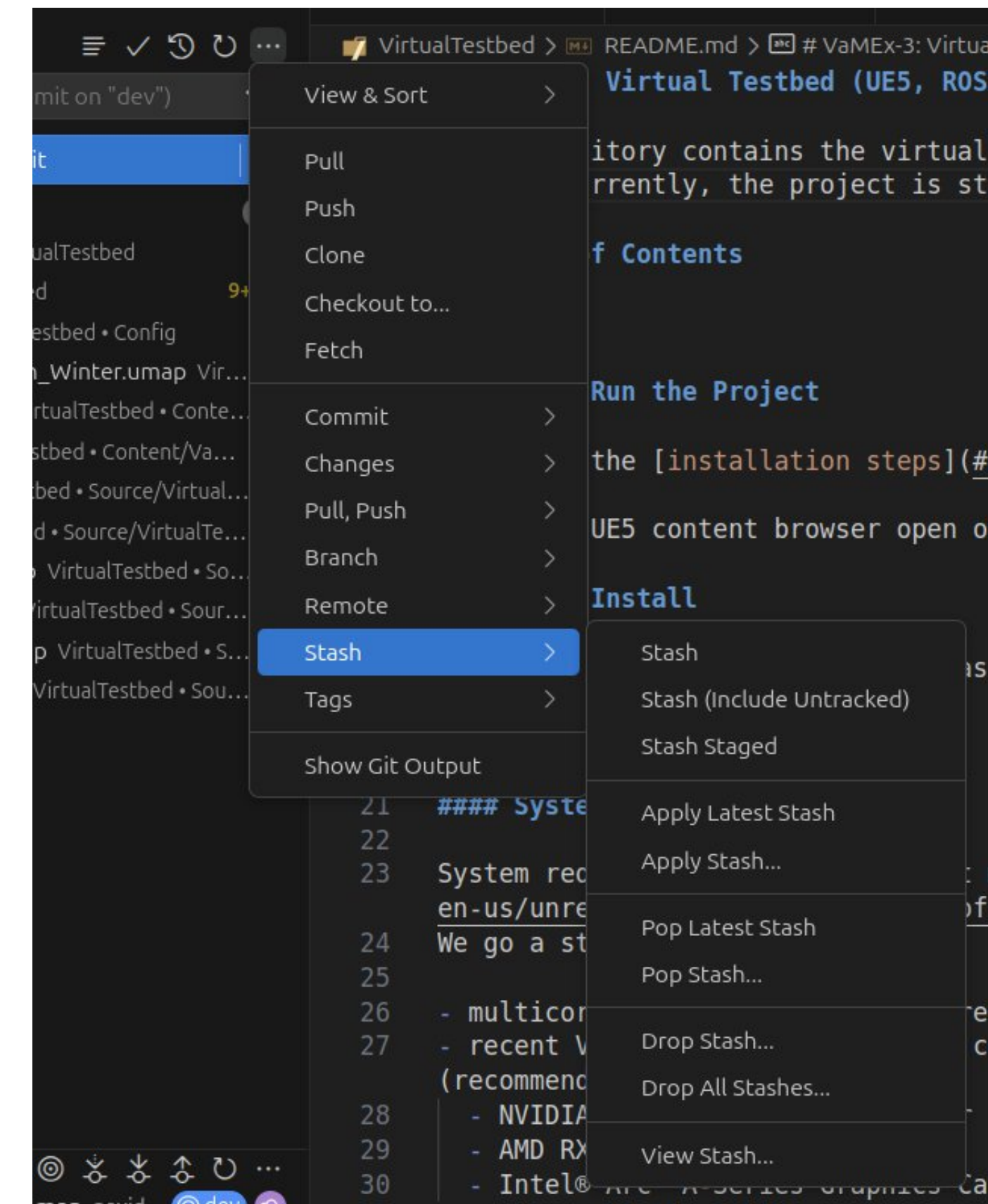
Stashes

- Sometimes it is useful to “stash away” local changes.
- `git stash`: Put the local changes into a stash.
- Warning: Untracked files are not stashed by default.
- `git stash -u`
- `git stash list`: Show the current list of stashes.



Stashes

- `git stash pop [stash number]` :
Remove the last / newest entry in the list of stashes and apply the changes. There is the option to select an earlier stash by passing the `[stash number]` (counts from 0).
- `git stash apply [stash number]` :
Same as `stash pop`, but keeps the entry.
- The stash entry is always kept for safety, if there is a conflict during `pop` or `apply`.



Other Useful Commands

- `git checkout <commit hash>` : Change to the state of the specified commit on the current branch.
- `git checkout -` : Change to the latest state on the active branch.
- `git checkout <branch name>` : Switch to the specified branch.
- `git checkout -b <branch name>` : Create a new branch and switch to it.
- `git revert <commit hash>` : Revert / Undo the changes of the specified commit. Creates a revert commit; also keeps the original commit in the history.

A Few Final Words of Advice

- Git / VCS is both powerful and essential in software development!
- This was just an introduction. You will learn much more in your own work.
 - For most things, there are already online tutorials or forum entries.
 - Chat Bots can also be of help.
 - Be cautious in both cases! Wrong decisions / commands can lose you hours of prior work.

Additional Resources

- ⟨ Git Explained in 100 Seconds ([Youtube](#))
- ⟨ Learn Git in 15 Minutes ([Youtube](#))
- ⟨ A Grip On Git (<https://agripongit.vincenttunru.com/>)
 - ⟨ short visual introduction to git
 - ⟨ ~11 min read
- ⟨ Learn Git Branching (<https://learngitbranching.js.org/>)
 - ⟨ interactive tutorial for git in the webbrowser
 - ⟨ ~30-60 min