Advanced Git

IVS demonstration exercise

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Red Hat

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Prerequisites

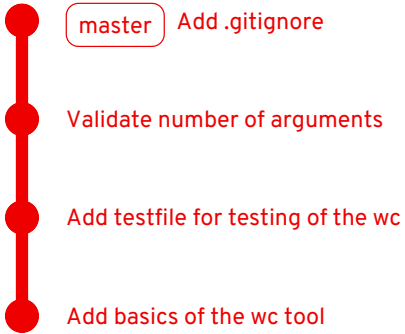
- Basic knowledge of Git commands for:
  - creating commits (`git add`, `git commit`)
  - inspecting current state (`git status`, `git diff`)
  - inspecting history (`git log`, `git show`)
  - working with remotes (`git pull`, `git push`)
  - working with branches (`git checkout`, `git branch`)
  - merging branches (`git merge`, `git rebase`)

”Advanced” work with Git

Let's start

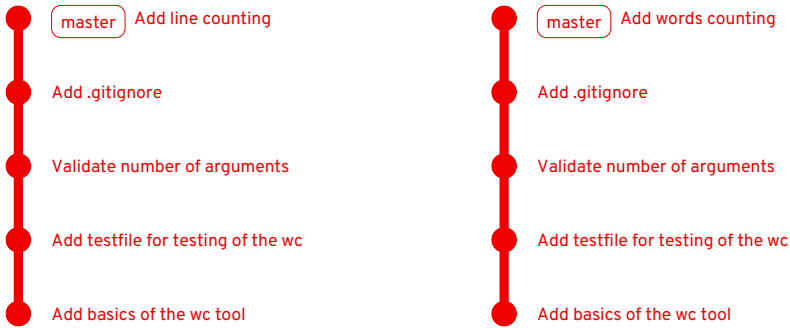
- We'll write a simple tool for counting characters, words, and lines in a file (similar to the `wc` utility)
- We start with a pre-initialized repo containing very basics of the tool: `https://github.com/viktormalik/git-workshop`
- The repo contains:
  - source file `wc.c`
  - testing file `testfile`
  - `Makefile`
  - `.gitignore`

Current status of the repo



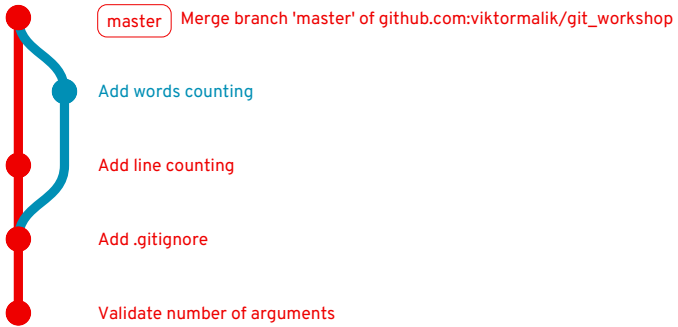
Basic team synchronisation

Every member implements a different feature in their *master*



Basic team synchronisation

The second one to push must do a merge (and resolve a merge conflict)



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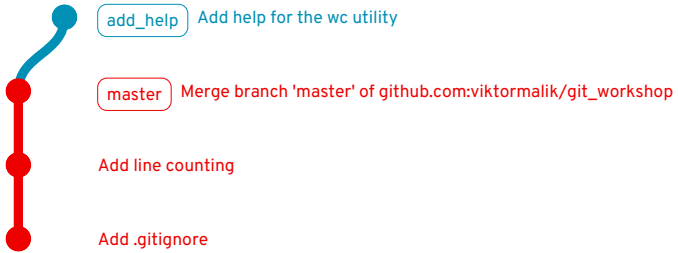
Better team synchronisation

- **This is not a good practice!**
- Always implement new features in **separate branches**.
- Potential merge conflicts should be resolved in the feature branch.
- Ideally, merging into master should be always done using **pull requests**
  - They allow other team members to comment on the changes
  - Changes can be **reviewed** before they get into master
  - Master always contains a working and approved version of the project

Using a feature branch

Let us add help into the tool using a separate branch *add_help*



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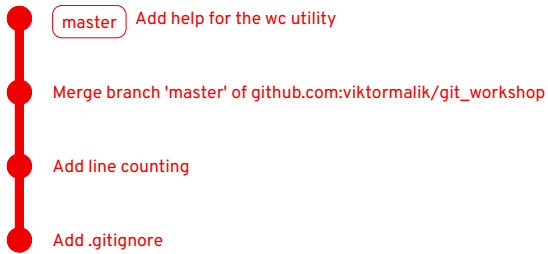
Using a feature branch

The state of *master* after **rebase**:



Moving branches

We have 2 branches pointing to the same commit and we want to move one backwards.

own-separator, option-opt Add counting by custom separator

master Add help for the wc utility

Merge branch 'master' of github.com:viktormalik/git_workshop

Moving branches

This can be done using `git reset HEAD^`

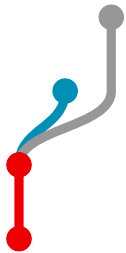
own-separator Add counting by custom separator

master, option-opt Add help for the wc utility

Merge branch 'master' of github.com:viktormalik/git_workshop

Moving branches

After adding a new commit to *options-opt*:



option-opt Optimise getting CLI options

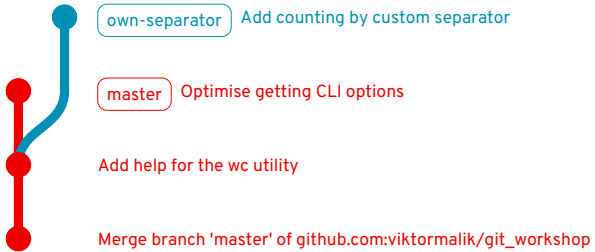
own-separator Add counting by custom separator

master Add help for the wc utility

Merge branch 'master' of github.com:viktormalik/git_workshop

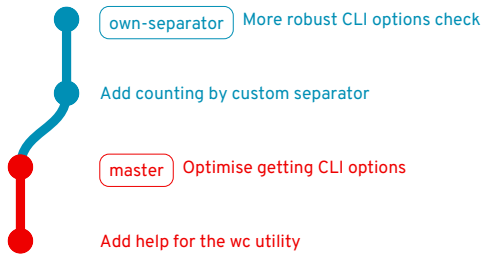
Moving branches

options-opt can be now merged into master while *own-separator* remains a feature branch in development.



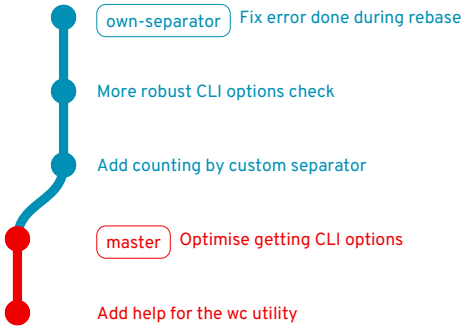
Rebasing feature branches

We add more commits to the feature branch and then **rebase** it onto *master* (to avoid creation of a merge commit).



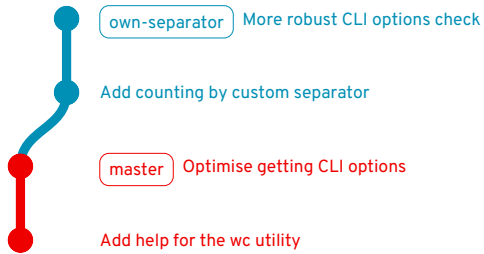
Rebasing feature branches

We made a mistake during the rebase, which we had to fix with an additional commit.



Rebasing feature branches

It is possible to merge the “fix commit” into one of the previous commits using **interactive rebase** (`git rebase -i`).

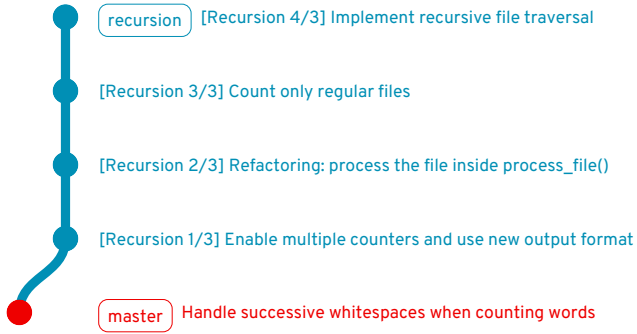


Interactive rebase

- One of the most important Git features in the modern pull request-based workflow.
- Allows to **edit**, **reorder**, **merge (squash)**, or **drop** commits.
- **Rewrites history** – should be only used on feature branches.
- **Never rewrite history of master!**
  - Other developers would not be able to do `git pull`.

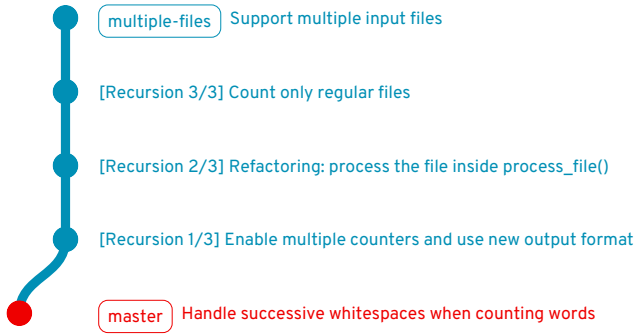
Copying commits from other branches

It is possible to copy commits from other branches (e.g. commits implementing useful features from co-workers feature branches) using `git cherry-pick`.



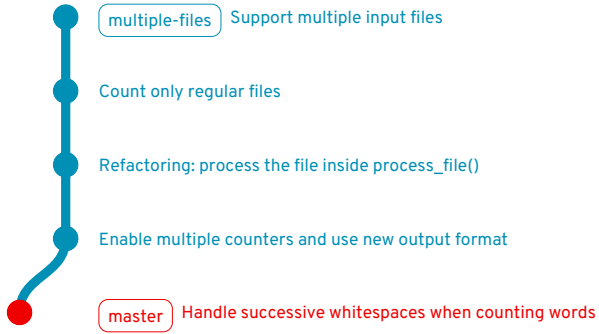
Copying commits from other branches

After moving 3 commits from *recursion* into *multiple-files*:



Copying commits from other branches

If the commits are altered in *multiple-files*, it may be needed to use `skip` when rebasing *recursion* onto *multiple-files*.



Hunting bugs in Git history

- We often discover a bug that was certainly introduced **somewhere in the Git history**.
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- Git offers `git bisect` that uses **binary search** to localise the commit that caused the bug.
  - `git bisect start` starts bisecting.
  - `git bisect good` marks a commit that does not contain the bug.
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- The process can be **automated** using a script that returns 0 on success and a non-zero result on failure.

Git tips and tricks

Cloning repositories with a long history

- If a repo has a long history, it may take long time to clone it.
- If the entire history is no needed, it is possible to use a **shallow copy**:
  `git clone --max-depth N`
- Try it with the Linux kernel:
  `git clone --max-depth 1 https://github.com/torvalds/linux`

Signing commits

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- To resolve this problem, Git offers **signing commits** using GPG keys.
- GitHub offers a nice tutorial on how to setup commit signing: `https://help.github.com/en/github/authenticating-to-github/signing-commits`

Setup your environment

There are various possibilities on how to ease your life with Git:

- **Git prompt**
  - It is possible to setup Bash prompt such that it shows the current branch, state of the directory, etc.
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  - It is useful to see which lines were added/removed/changed from HEAD.
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- **Use tools for history inspection**
  - There is a number of tools for an easier history traversal
  - E.g. **tig**, gitk, ...

Setup your environment

- **Command aliases**
  - Many Git commands are quite long (or have many options).
  - It is possible to setup short aliases for most commonly used commands.
  - Git offers a way to set aliases:

    ```
    git config --global alias.co checkout
    ...
    ```

    or edit `$HOME/.gitconfig`:

    ```
    [alias]
     co = checkout
     ...
    ```
  - An alternative is to setup aliases via shell

Useful links

- Atlassian Advanced Git Tutorials
  `https://www.atlassian.com/git/tutorials/advanced-overview`
- GitHub Guides
  `https://guides.github.com`
- GitHub Help
  `https://help.github.com/en/github`

TL;DR

What you should take out of this talk:

- Learn and practice **interactive rebase**
- **Read what Git tells you**, there are often good hints (e.g. for undoing things)
- Keep *master* in good shape

Thank you for the attention!

Questions?