

# Collaborative Programming

Kilian Lieret

Princeton University

CoDaS-HEP school 2022

Markdown-based slides available as  open source; contributions welcome!

Please open these slides on your laptop as we'll jump back and forth between the slides and the browser!

# Structure of this lecture

## 1. Exploring github in the browser

1. Creating issues
2. Forking a repository
3. Creating commits
4. Opening pull requests
5. Handling merge conflicts

## 2. Working with a local repository

## 3. Advanced tips & tricks

# Let's open an issue!

1. Please navigate to  
<https://github.com/klieret/codas-hep-22-git-playground>.
2. Open an issue with a random feature request

## Bonus tasks

- Edit the text & title of your issue
- Add a comment mentioning another participant
- Use an emoji reaction
- Close & reopen your issue
- Check for other issues and comment there

## Advanced

- Install the gh command line tool
- Clone the repository
- Use the CL to open an issue

# Forking & committing changes

While you can open issues, you do not have permissions to directly modify content.

1. Click the **fork** button. This will create a "copy" of the whole repository
2. Open the ``content`` folder and click ``Add file``  
> ``Create new file``
3. Call your file ``<your gh username>_first`` and add a few lines to it

5. Add a commit message and commit
6. Confirm that you see your file & a new commit

⚠️ Usually you always want to commit to a separate branch in this scenario (later!)

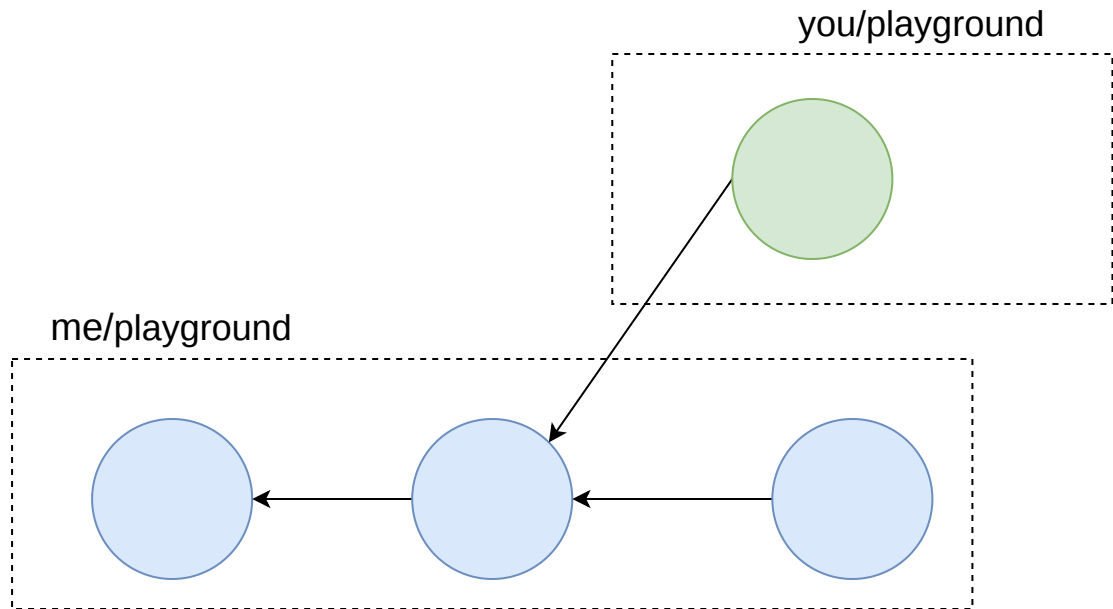
## 🏆 Bonus tasks

- Add a second file
- Open your previous file and make changes to the text

## 👑 Advanced

Do the same with the gh CLI.

# What did we do?



- Every node is a commit. Every commit points to a parent.
- Your fork "branched off" of the original repository: You're adding additional commits to a parallel reality
- Next step: Bringing your commits back to the original repository

# Creating a PR

- We want to bring our changes back to the original repository
- If you create new commit on a fork, github will already offer you a button to open the PR

## Bonus tasks

- Mention one of your issues. If you write ``Closes #<number of your issue>`` and the PR is merged, the issue will automatically close.
- Check the differences that the PR will create
- Comment under one of the differences
- Mention another participant ``@<name>``

# What did we do?



# Branches

- If we want to start another PR, we do not need to fork again, we can create another **branch**.
- Use cases:
  - Working on several independent experimental features
  - Not all of your PRs might be merged!
- Branches are cheap and flexible, go use them!





# Forks vs Branches

- A *fork* copies the entire repository:
  - Similar to copying the entire local project folder (including your `.git` repository)
  - If the original repository is deleted, your fork persists
  - You *own* your fork and have every permission there
- A *branch* belongs to its repository and only tracks certain changes
- Branches are cheap and easy, forks are expensive
  - If you have write permissions for a repository you do not usually need/want to fork it
    - If you need to fork, fork once and then use branches

# Branches

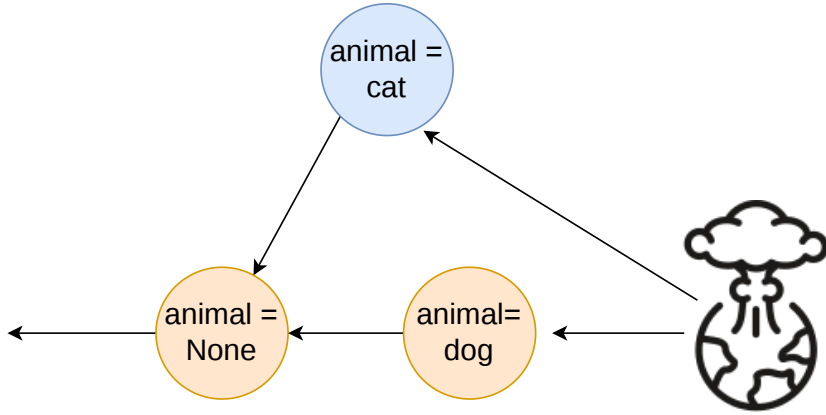
1. Add another file ``content/<your_gh_username>_second``
2. Select ``Create a new branch for this commit and start a pull request``
3. Give your branch a reasonable name (whitespace discouraged)
4. Commit!
5. Create another PR to either:
  - The original repository (``klieret/codas ...``)
  - Your own ``main`` branch
  - Your neighbors ``main`` branch
6.  If you want to do the bonus exercises, mark your PR as ``draft``
7. If you receive a PR, merge it (unless it's a draft)
5. Go back to the default view of your repository and verify that you now have multiple branches
6. Select your new branch
7. Modify your just created file and create a new commit on the same branch
8. Check that your PR has been updated by this new commit
9. Remove ``draft`` status and ask repository owner to review + merge

 Bonus task: Adding additional commits to a PR

 Bonus task: Go crazy!

Commit to various branches, create PRs between your branches or to your neighbors branches.

# Merge conflicts



# Merge conflicts

⚠ Please follow these instructions precisely!

1. Go to your fork
2. Verify that you are on the ``main`` branch (yellow)
3. Change something in ``content/<your_gh_username>_first`` and commit to the branch (!)  
``merge-conflict`` (blue)
4. Open a pull request to your own ``main`` branch.  
Do not merge the PR yet!
5. Change to your ``main`` branch again

6. Change the same (!) line to something different and commit (to ``main``)
7. Check back on your PR, it should warn you about a conflict
8. Resolve the conflict by determining how both changes should be reconciled
9. Commit the merge



🔧 **Bonus tasks:** Verify that if you change different lines with unchanged lines between them, git will do the merge automatically.

## Part 2: The command line



# Let's get you set up

Configure name, email and editor

If you run git for the first time,

```
git config --global user.name "John Doe"
git config --global user.email johndoe@example.com
# Choose your favorite editor, e.g., nano or vim
git config --global core.editor nano
# Requires git 2.28
git config --global init.defaultBranch main
```

If you haven't done already, generate ssh keys for authentication to github

```
ssh-keygen
# follow the instructions
cat ~/.ssh/id_rsa.pub
```

and add the key to github. Then clone your repository:

```
git clone git@github.com:<your username>/collaborative-programming-github.git
```

Please raise your hand if you have any issues!

# Your first commit

```
cd collaborative-programming-github
cd content
ls
# Get changes that were done on the remote, just in case
git pull
# show status of git repository
git status
# Create new file
touch <your gh handle>-third.txt
# Status is dirty now
git status
# Commit file
git commit <your gh handle>-third.txt -a -m "My third file"
# Clean again
git status
# View past commits (quit with q)
git log
# Push to the remote
git push
```

## Bonus tasks:

- Create a few more commits (changing the file)

# Changing multiple files in one commit

```
# change all three of your files
git status
# multiple files should now show "unstaged changes"
git add <your gh handle>-first.txt <your gh handle>-second.txt
git status
# two files "staged"
# Commit. Careful: Do not use the -a option
git commit -m "Committing changes to two files"
git status
# one file still showing unstaged changes
git add <your gh handle>-third.txt
git commit -m "Commit to one file"
# Bring changes to github again
git push
```

## Hints:

- If you want to add everything to the stage: `git add .` or use the `-a` option for git commit
- If you want to remove a file from the staging area: `git reset <file>`
- If you want to unstage all files: `git reset`



# Branches

```
git branch my-new-branch
git status
# still on branch 'main'
git switch my-new-branch # or: git checkout my-new-branch
git status

# Now use your previous knowledge to create some more commits

git status
# Make sure that everything is committed
git log
# Verify that you have added a view commits

git switch main
# Verify that the changes from the other branch are not present
git log
# Also our commits aren't present
```

# Merging

Bring the commits from ``my-new-branch`` back to ``main``

👑 **Advanced:** Add more commits to main before merging to set yourself up for a merge conflict

```
# On branch main  
git merge my-new-branch  
# Should work directly unless you're doing the advanced exercise
```

👑 **Advanced:** Manually modify the files to resolve the conflict, then ``git commit -a``.

# What we didn't tell you about today

... but what you should really know about

- ``git show``: Show details about a commit
- ``git diff``: Show differences
- ``git stash``: Temporarily put changes aside
- ``.gitignore`` files: Avoid tracking irrelevant files
- ``git revert``: Revert changes
- ``git checkout``: Jump through history (or between branches)
- ...

Take a look at a cheat sheet like this one and make sure you understand all commands listed.

## Part III: Learning to love git



source

- If you are developing software, you almost certainly will use git, no matter where.
- Learning to master git is perhaps THE most transferable skill you can hone.
- Git would not be so dominant if you could not learn to love it.

# Your git config

- All repository specific settings live in `<your_repo>/.git/config`. Take a look!
- You can set global settings in `~/.git/config`. Take a look!

## Defining aliases

```
# Type `git c` instead of `git commit`  
git config --global alias.c commit  
git config --global alias.ca commit -a  
# ...  
# Use `g` instead of git  
alias g="git"  
# You need to put this definition in your bashrc (or other zshrc etc.) to make it last
```

Alternatively you can also directly write into your config file.

**Rule of thumb:** If you are unsure about the metadata of your repository or about commands that modify it, take a look at your `~/.git/config`.

# Practice, practice, practice

and then some more

This page has very nice suggestions for different levels, all of them using **gamification** but increasing in realism.



# Graphical tools

can give you more intuition

Go here for a curated list of them.



source

# Thanks!

- You can also practice by improving these very slides! Go to <https://github.com/klieret/collaborative-programming-github>. Issues, forks and PRs are very welcome! You only need to speak markdown to help.
- In general, contributing to documentation is the most easy way to start to make "real" contributions. How about one of the projects at [scikit-hep](#)? Or some open source training material at [HSF training](#)?