CODE REFINERY

Collaboratively training the next generation of Research Software Engineers

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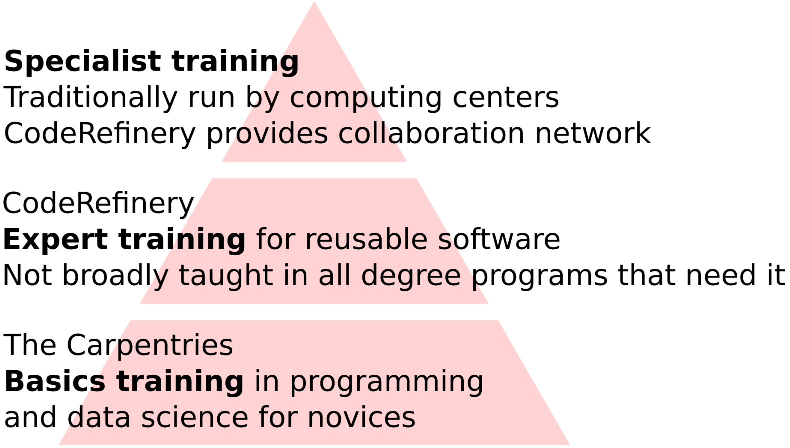
ACM SIG HPC Education webinar, April 2024

Team and project: codrefinery.org

What we are

- A hub for FAIR research software practices
- Since 2016, now phase 3 until 2025
- Currently funded by NeIC
- Training network
- Community



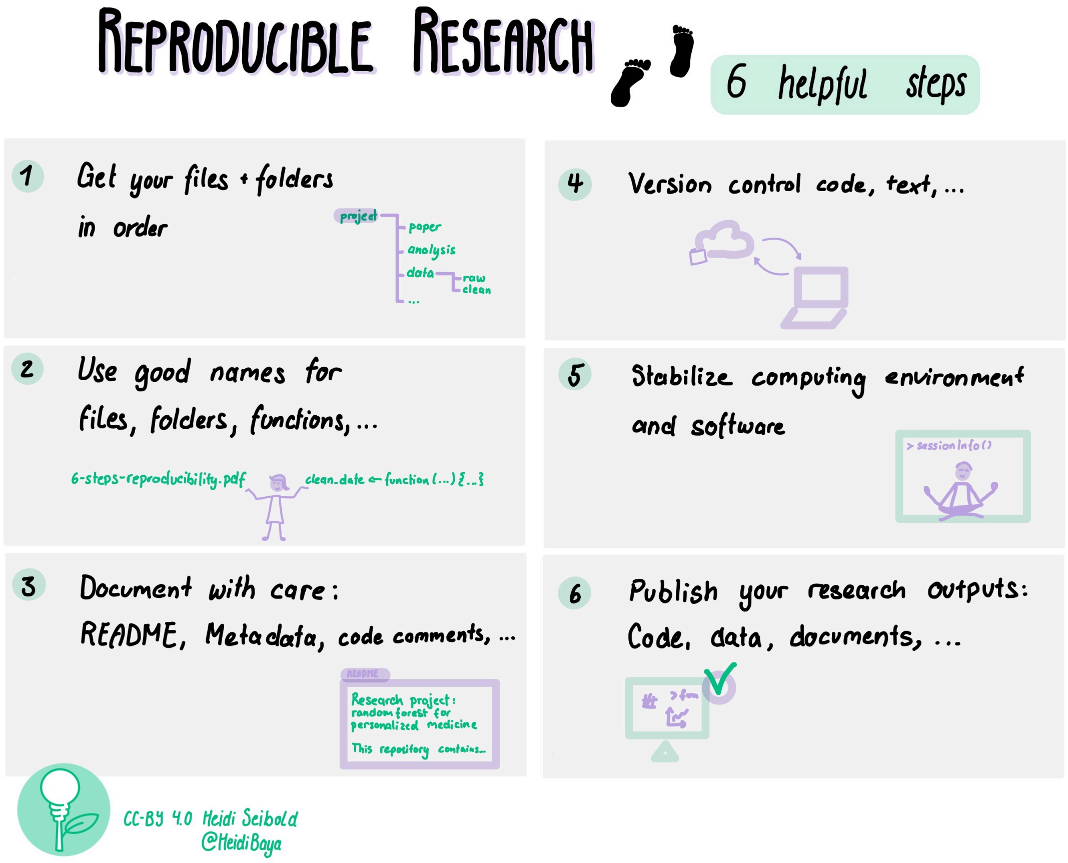
Specialist training
Traditionally run by computing centers
CodeRefinery provides collaboration network

CodeRefinery
Expert training for reusable software
Not broadly taught in all degree programs that need it

The Carpentries
Basics training in programming
and data science for novices

What we do

- We teach and co-organize
- Share lessons, video recordings, manuals
- All open source


Reproducible Research
6 helpful steps
1 Get your files + folders in order
project
paper
analysis
data
raw
clean
...
2 Use good names for files, folders, functions, ...
6-steps-reproducibility.pdf
clean_data <- function(...){...}
3 Document with care: README, Metadata, code comments, ...
README
Research project: random forest for personalized medicine
This repository contains...
4 Version control code, text, ...
5 Stabilize computing environment and software
> sessionInfo()
6 Publish your research outputs: Code, data, documents, ...
> fun
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Similar projects: UNIVERSE-HPC, DIGITAL RESEARCH ACADEMY, INTERSECT, and probably many more ...

Available lesson material

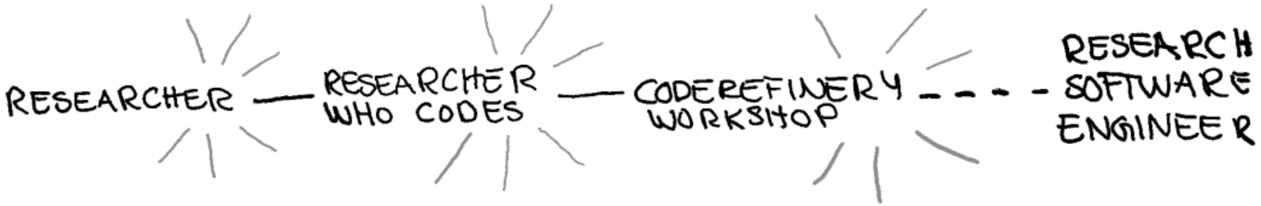
- **Introduction to version control**: Git and GitHub for own projects
- **Collaborative version control**: Branching, pull/merge requests, forks, and collaboration.
- **Reproducible research**: Reproducible dependencies, environments, and computational steps.
- **Social coding and open software**: Software and data licensing and software citation.
- **How to document your research software**
- **Reusable and reproducible Jupyter notebooks**
- **Automated testing**: Motivation, test design, and tools.
- **Modular code development**: Organizing projects as they grow from one screen-full to larger.

Tested in 9 online and 28 in-person workshops

- We reach over 500 persons/year
- Over 30 instructors/speakers
- Over 100 helpers/ exercise leaders

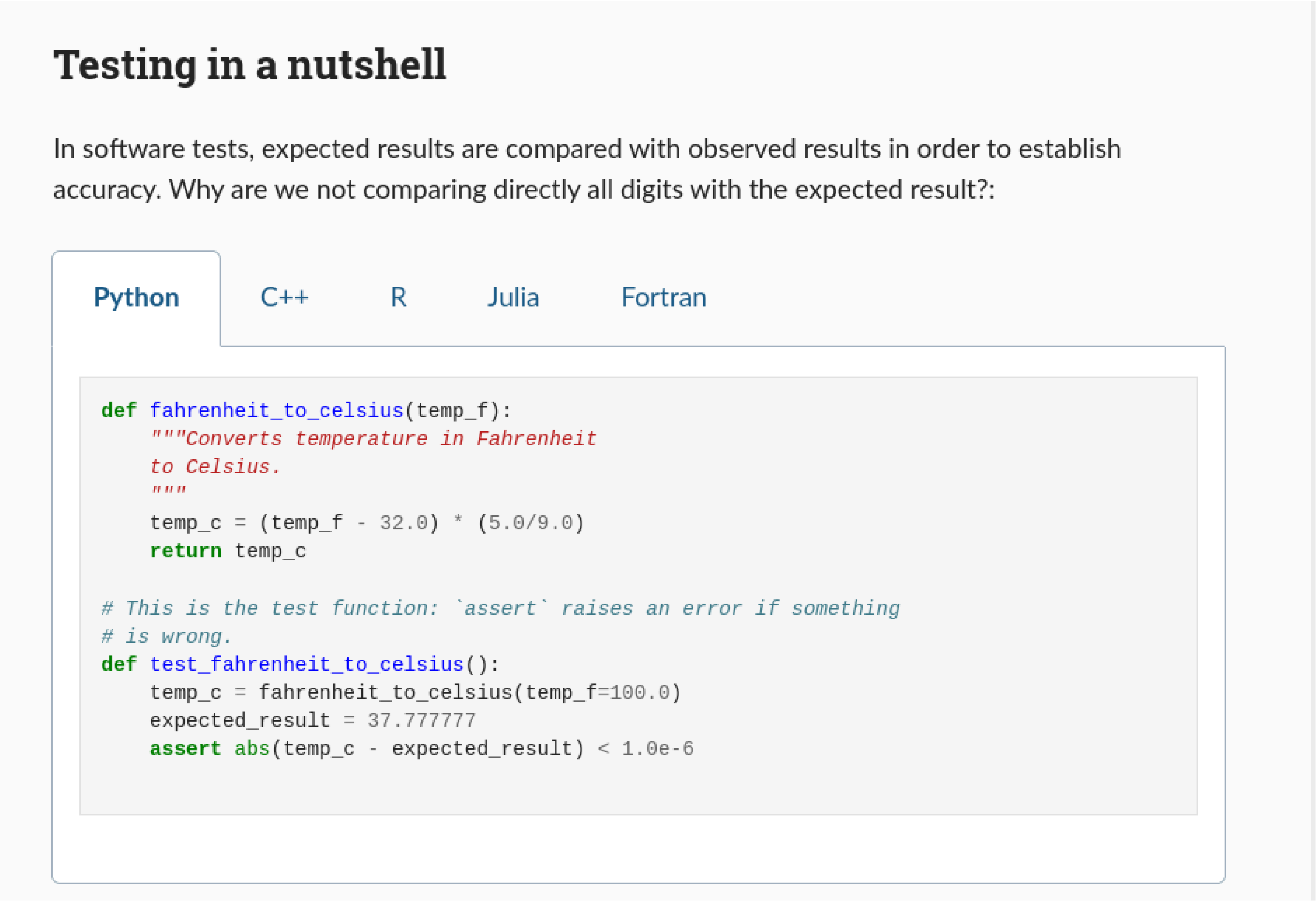
Relation to research software engineering

- We teach topics which are helpful for researchers and essential for RSEs.
- Nordic RSE colleagues hang out and discuss on the CodeRefinery community chat



Lessons

We use Sphinx/sphinx-lesson to build our lessons from Markdown.



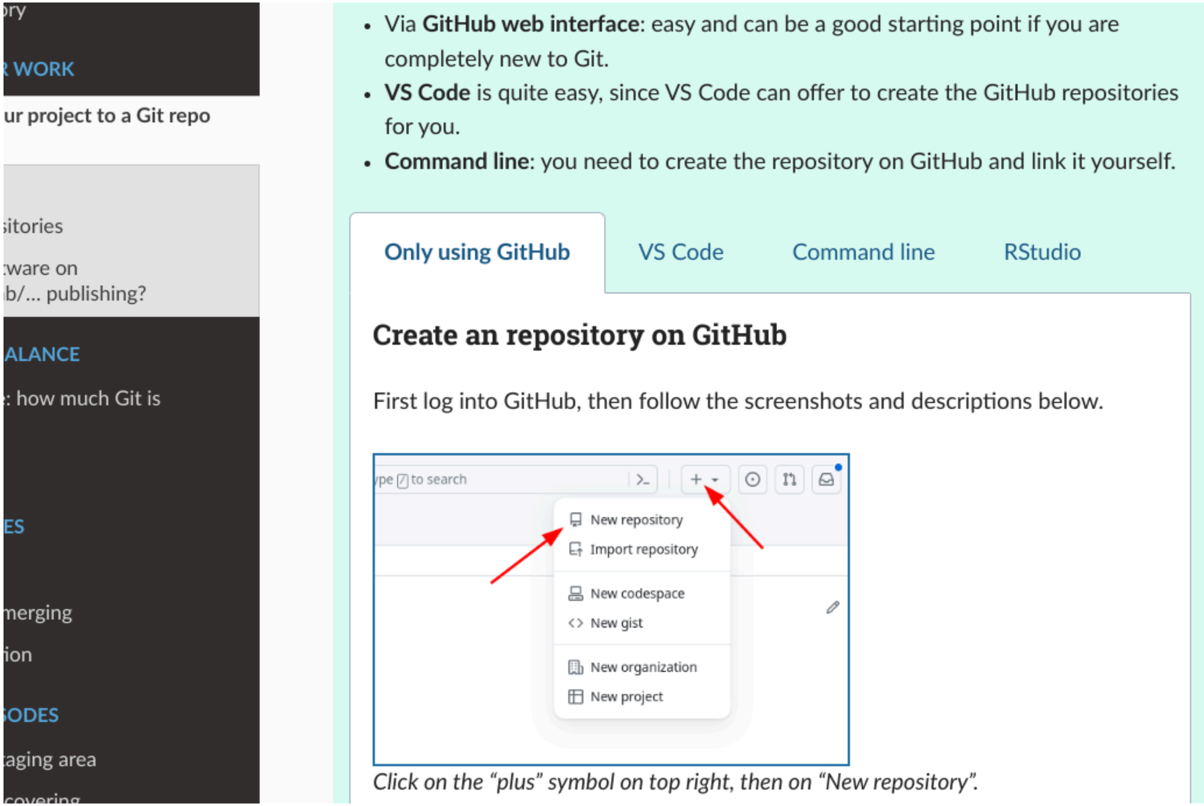
Testing in a nutshell

In software tests, expected results are compared with observed results in order to establish accuracy. Why are we not comparing directly all digits with the expected result?:

```python
def fahrenheit_to_celsius(temp_f):
    """Converts temperature in Fahrenheit
    to Celsius.
    """
    temp_c = (temp_f - 32.0) * (5.0/9.0)
    return temp_c

# This is the test function: `assert` raises an error if something
# is wrong.
def test_fahrenheit_to_celsius():
    temp_c = fahrenheit_to_celsius(temp_f=100.0)
    expected_result = 37.777777
    assert abs(temp_c - expected_result) < 1.0e-6
```

Another example: Git lesson



- Via **GitHub web interface**: easy and can be a good starting point if you are completely new to Git.
- **VS Code** is quite easy, since VS Code can offer to create the GitHub repositories for you.
- **Command line**: you need to create the repository on GitHub and link it yourself.

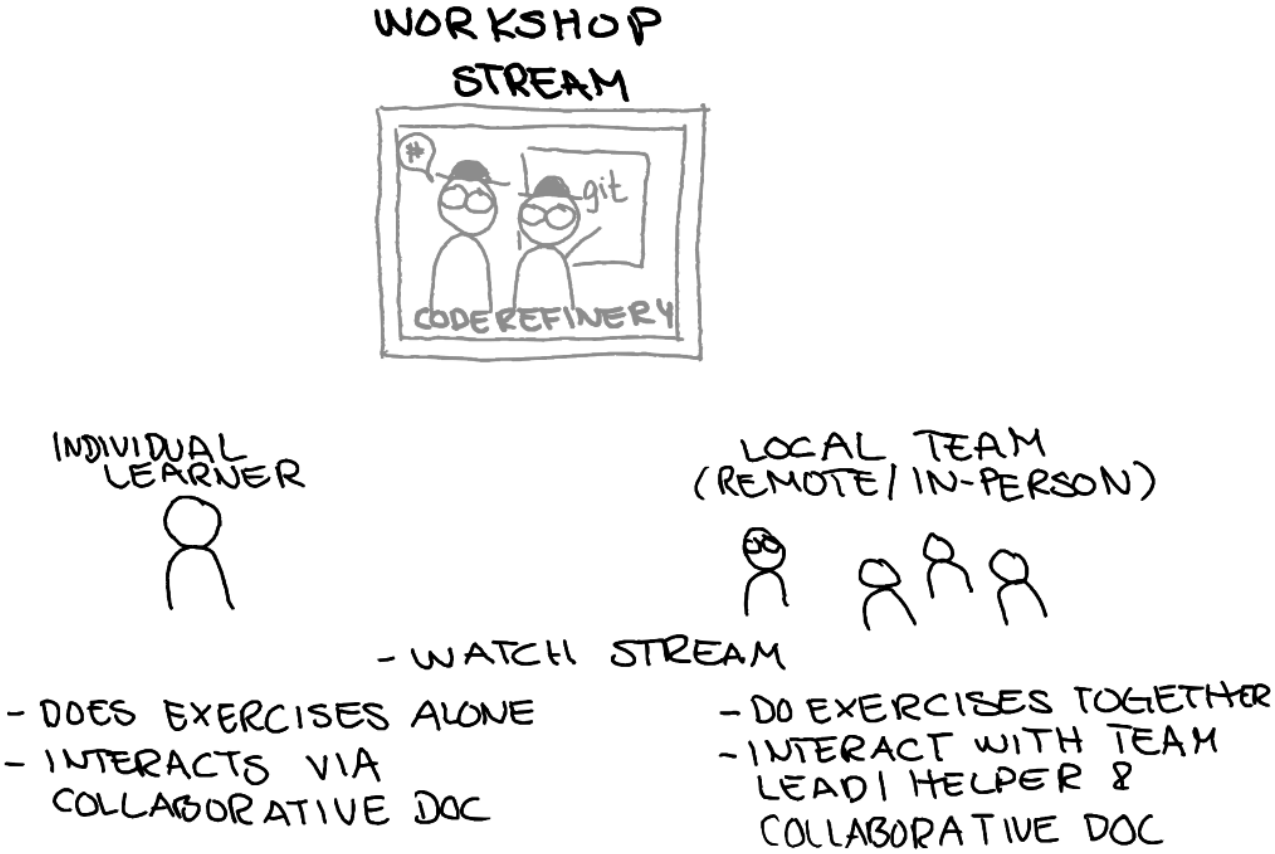
Create an repository on GitHub

First log into GitHub, then follow the screenshots and descriptions below.

Click on the "plus" symbol on top right, then on "New repository".

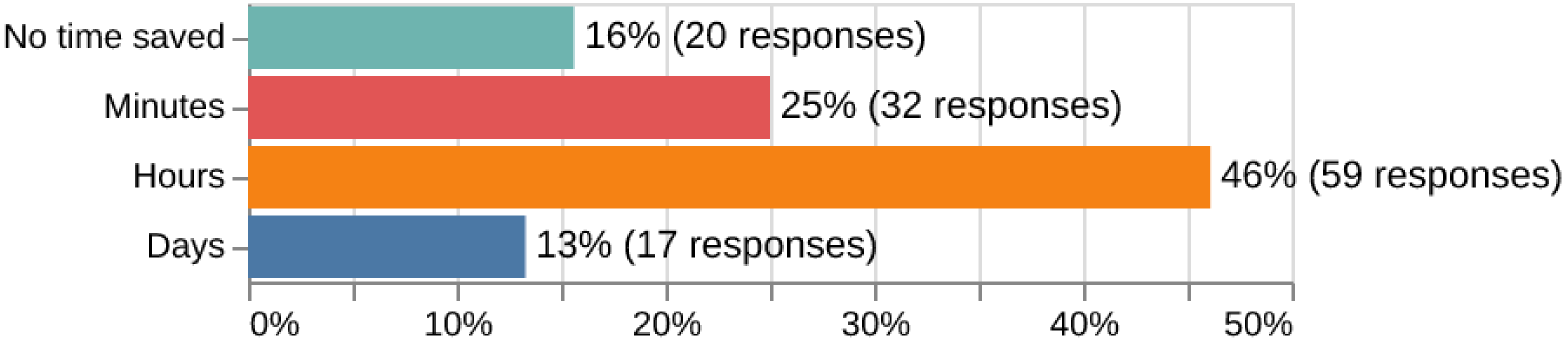
You can try our lesson template

How to participate as a learner

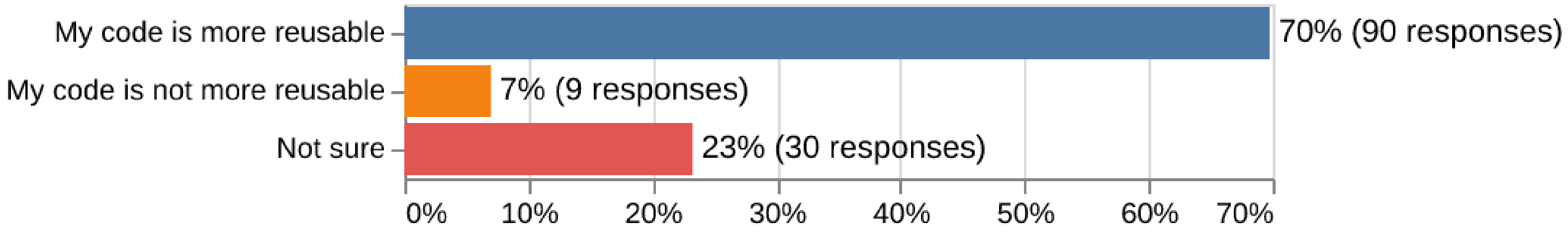

WORKSHOP STREAM
#
git
CODEREFINERY
INDIVIDUAL LEARNER
LOCAL TEAM (REMOTE/IN-PERSON)
- WATCH STREAM
- DOES EXERCISES ALONE
- INTERACTS VIA COLLABORATIVE DOC
- DO EXERCISES TOGETHER
- INTERACT WITH TEAM LEAD/HELPER & COLLABORATIVE DOC

Results from post-workshop survey 2024

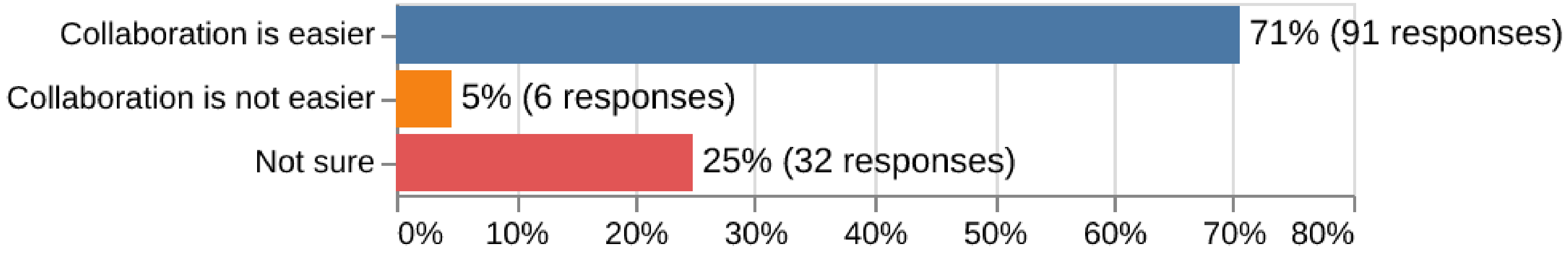
- Sent out to workshop participants from 2022 and 2023
- 129 answers



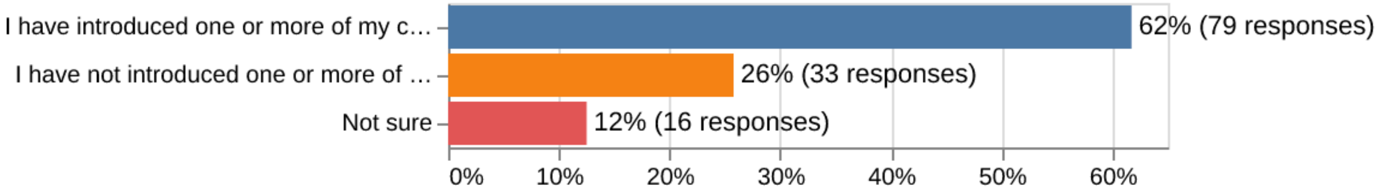
In your estimate, how much time per month have you saved as a result of attending a CodeRefinery workshop?



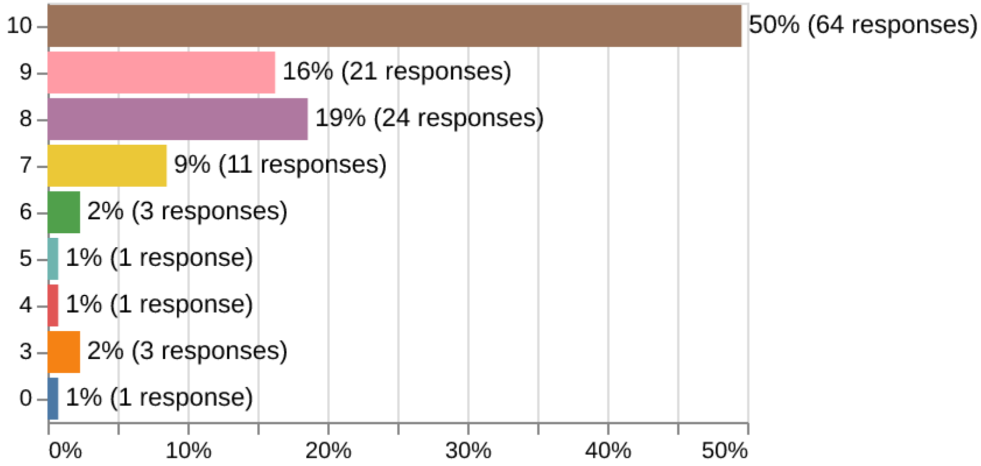
After attending the workshop, would you judge your code to be more reusable or not more reusable?



After attending the workshop, has it become easier or not for you to collaborate on software development with your colleagues and collaborators?



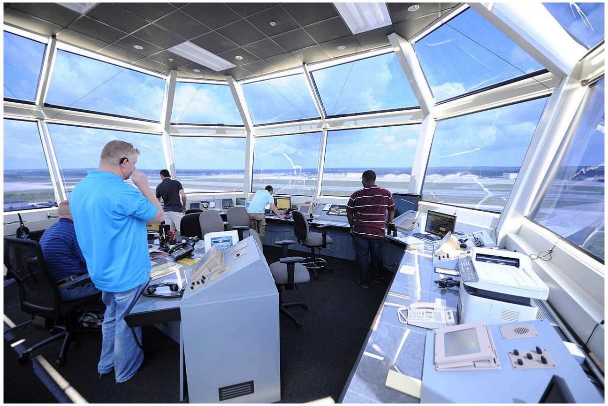
Have you introduced one or more of your colleagues to new tools or practices as a result of the workshop?

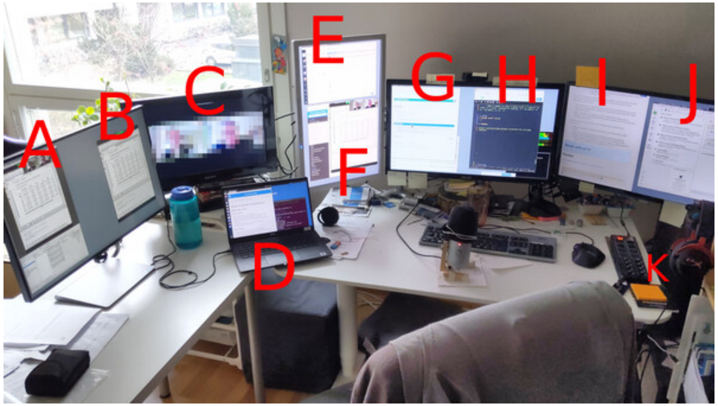


How likely is it that you would recommend CodeRefinery workshop to a friend or colleague?

0 means definitely not. 10 means definitely yes.

Collaboration across funding borders





0.9 FTE (2 persons) + 10 persons in-kind + volunteers

ASC CSC CENTER FOR HUMANITIES COMPUTING DeiC ENCCS EuroCC National Competence Centre Sweden NAISS NRIS sigma2

Co-advertize and co-organize with us

TU Delft netherlands eScience center VU VRIJE UNIVERSITEIT AMSTERDAM

Connection to high-performance computing

- Many partners with HPC involvement
- Aalto University very active in inviting others to join HPC kickstart
- Tuesday Tools & Techniques for High Performance Computing
- ENCCS instructor training -> Materials based on CR train-the-trainer
- NRIS (Norway) and LUMI (EuroHPC-JU) have adopted our training approach and material as template
- We started sharing tools across borders at https://github.com/nordichpc

What we have learned

About motivating/teaching

- Teaching isn't a lecture anymore. It's more like a live TV production, which *can* be as interactive as people in a room.

- Co-teaching is a great way to onboard, get better quality, and reduce stress

- Good enough practices better than perfect practices not applied

- Instead of "good for others": "good for your future you and as side effect good for others"

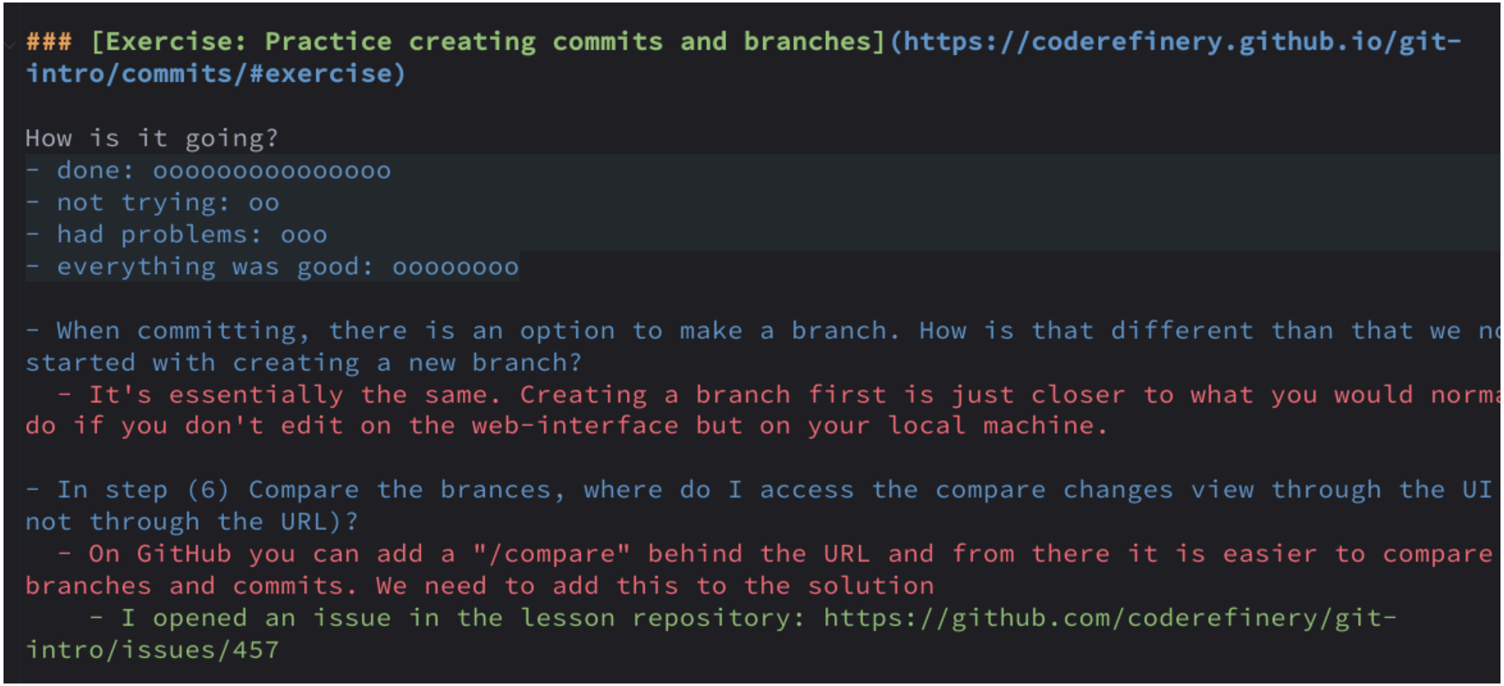
What we have learned

About scaling

- "bring your own classroom" seems to be a way to scale
- Installation instructions and on-boarding become more important
- We don't "see" classrooms -> feedback mechanism in Q&A doc
- Make exercises longer to give classrooms the chance to interact

Collaborative document: Markdown

- Interactive, anonymous, parallel, async
- New question every 1-2 minutes!
- ASCII-graph feedback



```
### [Exercise: Practice creating commits and branches](https://coderefinery.github.io/git-
intro/commits/#exercise)

How is it going?
- done: ooooooooooooooo
- not trying: oo
- had problems: ooo
- everything was good: oooooooo

- When committing, there is an option to make a branch. How is that different than that we no
started with creating a new branch?
  - It's essentially the same. Creating a branch first is just closer to what you would norma
do if you don't edit on the web-interface but on your local machine.

- In step (6) Compare the brances, where do I access the compare changes view through the UI
not through the URL)?
  - On GitHub you can add a "/compare" behind the URL and from there it is easier to compare
branches and commits. We need to add this to the solution
    - I opened an issue in the lesson repository: https://github.com/coderefinery/git-
intro/issues/457
```

We publish Q&A for each workshop: Example

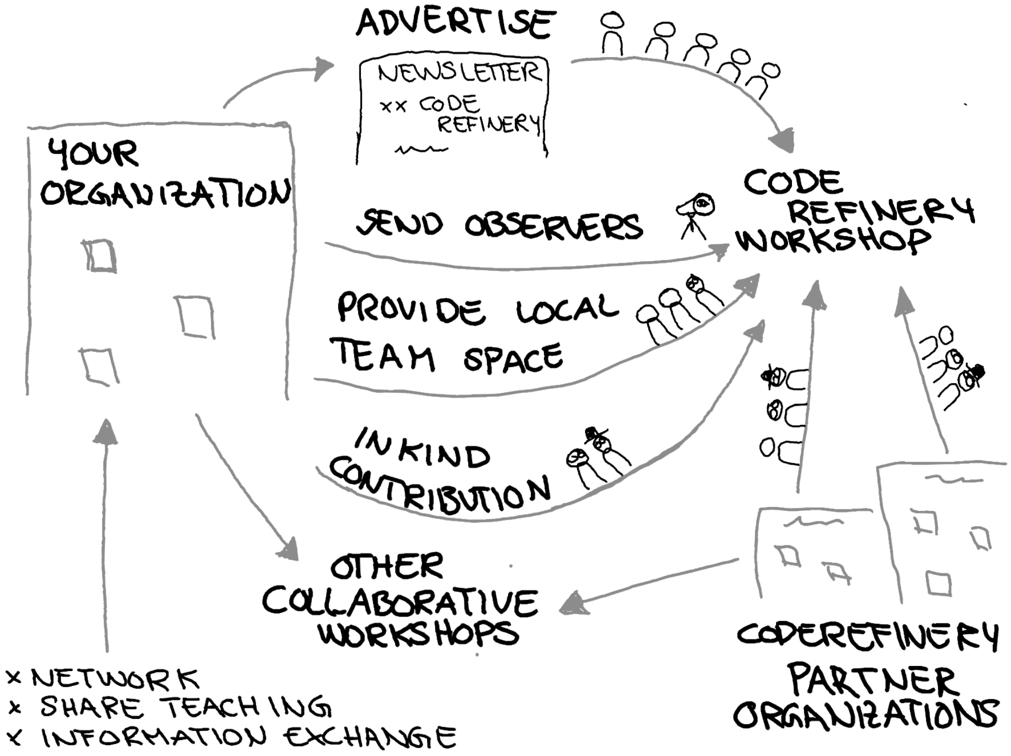
Future: Community project

- Communicate value for volunteers and organizations
- Research groups send their students to us instead of creating isolated material
- More collaboration with similar projects ("helper exchange program")
- Governance is community-driven

Teaching format

- Continue large-scale workshops
- Support local events
- More asynchronous content coupled with online events ("flipped classroom approach")

How you or your organization can participate



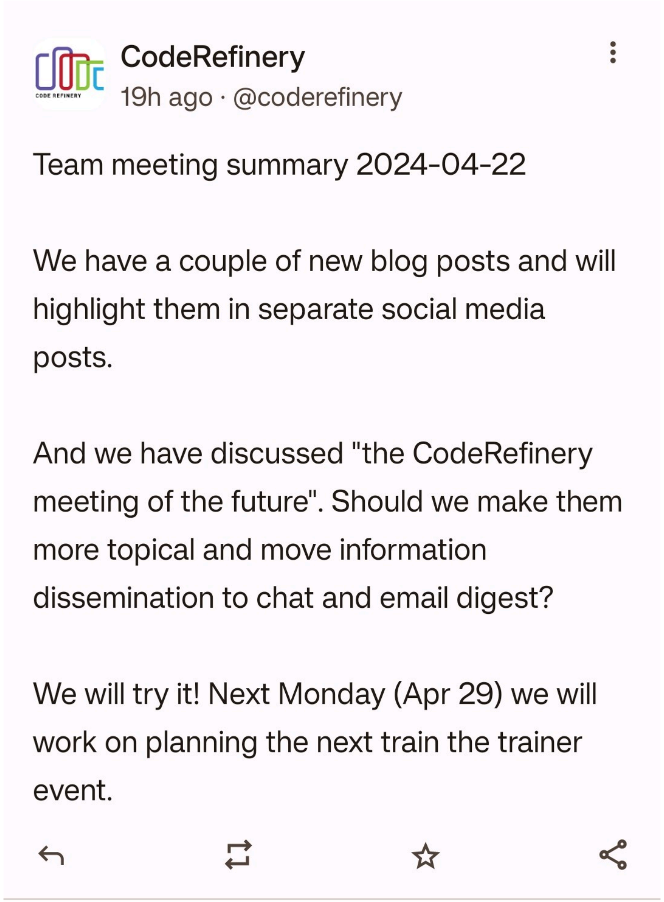
- **Join our next workshop** autumn 2024; follow our newsletter to get involved
- Tell your students and researchers about it
- Send one or more **exercise teams** or **join as observer**
- Use our material and give feedback

What is in it for you?

- Joining is easier than organizing: It is easier to bring 10% to an event than to organize the 100% yourself
- Material exchange: let's not reinvent the wheel
- Train-the-trainer: we can help you to get started
- Community as test-bed: let's try out new ideas together

We try to make it easier to join

- **Chat with us**: https://coderefinery.zulipchat.com (ask questions about coding or learn about new tools)
- Onboarding manual
- Blog
- Newsletter and chat digest
- X/Twitter
- Mastodon
- Support e-mail



CodeRefinery
19h ago · @coderefinery

Team meeting summary 2024-04-22

We have a couple of new blog posts and will highlight them in separate social media posts.

And we have discussed "the CodeRefinery meeting of the future". Should we make them more topical and move information dissemination to chat and email digest?

We will try it! Next Monday (Apr 29) we will work on planning the next train the trainer event.

Nordic RSE Conference

May 30 - 31, at Aalto University campus in Otaniemi, Espoo, Finland

https://nordic-rse.org/events/2024-in-person-conference/

These slides: https://doi.org/10.5281/zenodo.11065411

Credits and license

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