From experimental software to research infrastructure maturity

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@CESSDA_Data

Earlier this year…

EURISE Network

European Research Infrastructure Software Engineers' Network

EURISE Workshop: Software Quality through Automation and Testing

26 Mar 2020 Utrecht (The Netherlands)

cessda CLARIN DARIAH OPERAS

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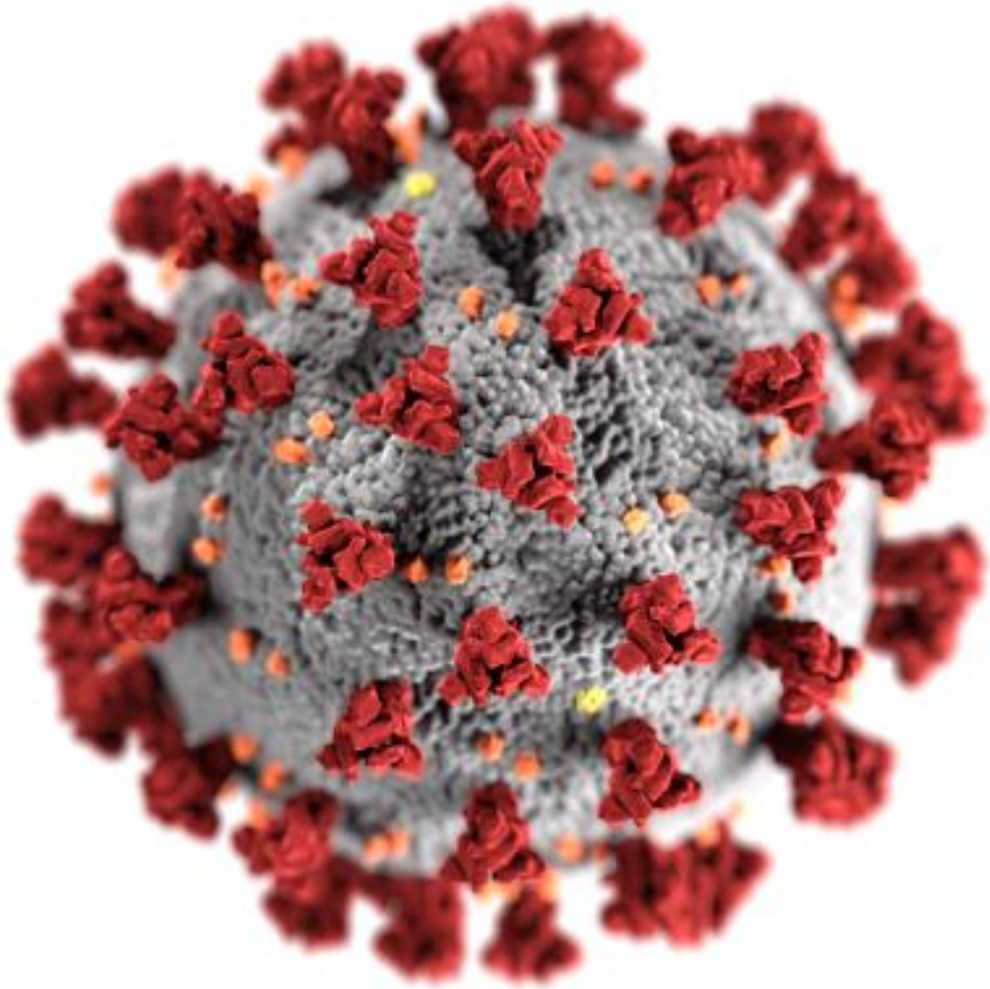


or so we thought …

Image: CDC, public domain

instead

digitisation hit the world

Although…

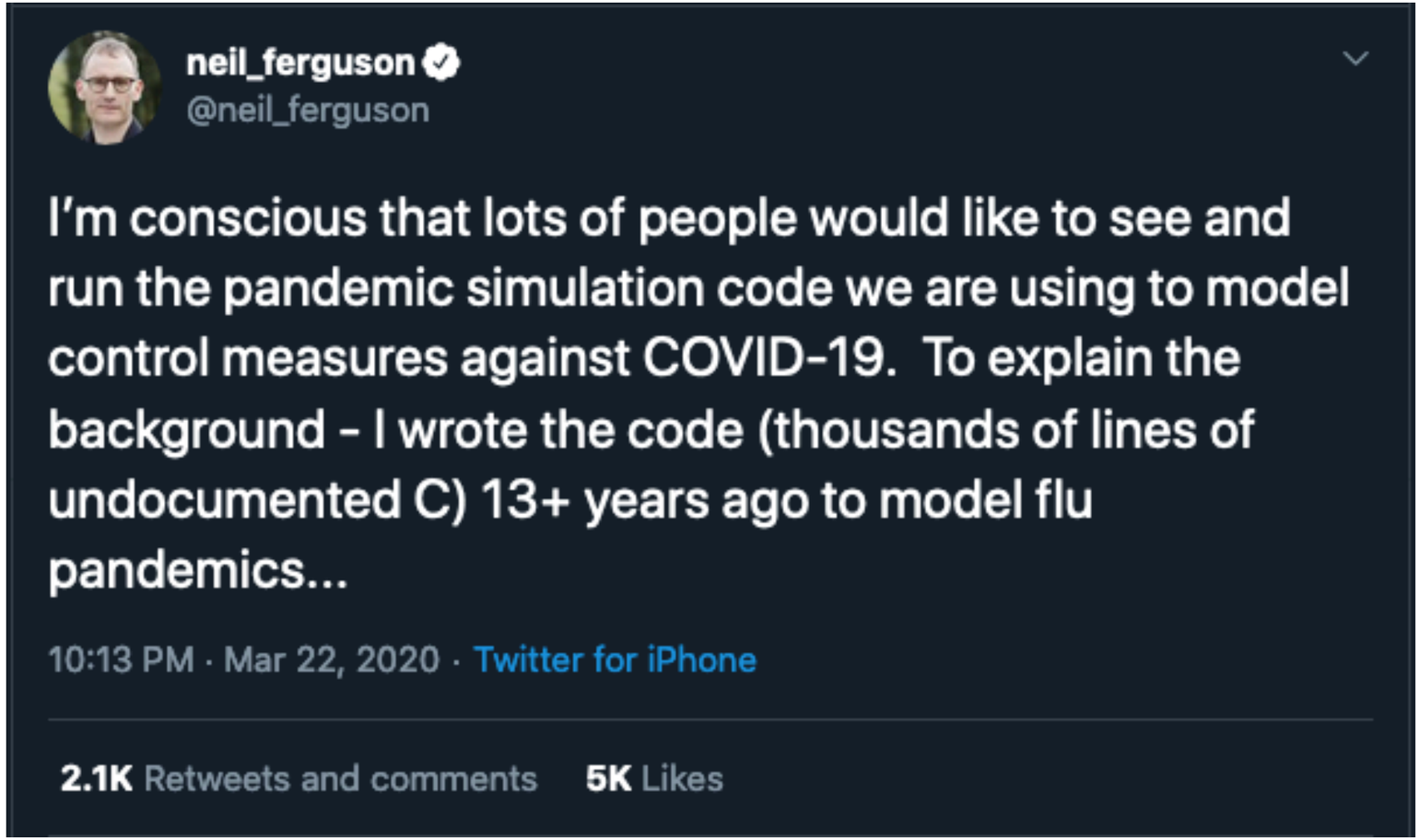
have you tried ordering a laptop or a webcam in 2020?

Bottleneck for U.S. Coronavirus Response: The Fax Machine

https://www.nytimes.com/2020/07/13/upshot/coronavirus-response-fax-machines.html

But wait… RSE?

Pandemic modelling



https://twitter.com/neil_ferguson/status/1241835454707699713

Industry standards

Testing and documentation

Quality assurance

Peer review

Model verification

Extensive manual verification

Open source

Image: Pixabay: OpenClipart-Vectors

Not really new

- Academic recognition only for the publication.
- The model is the result, the code only secondary.

⇒ The RSE community has been discussing this for years.

Scalability

- Did you ever get your webcam?
- Where are all the cruise ships?
- The Wikipedia article on Zoombombing was created on March 28, 2020
- Works on my machine…

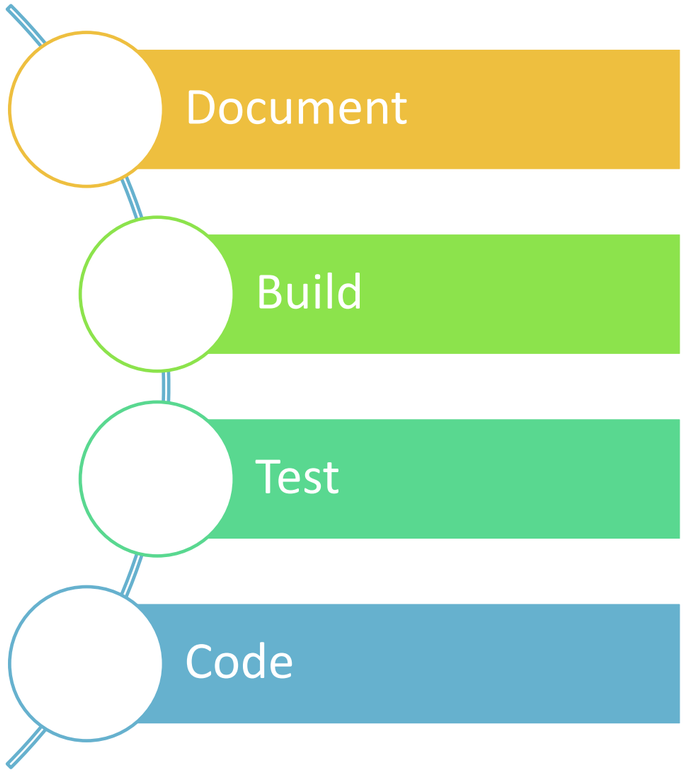
»Beware of bugs in the above code; I have only proved it correct, not tried it.«

Donald Knuth, Stanford University
Author "The Art of Computer Programming"

What to do?

Good practices

Scaling & weighting



if only it were that simple …

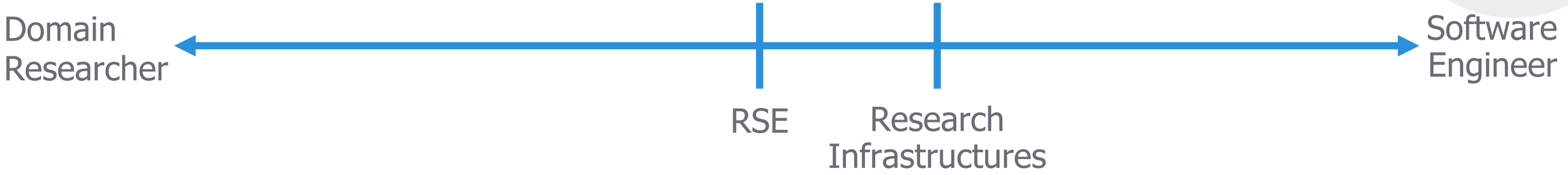
Just do it … ?

- Computer Science ≠ Software Engineering
- Learning by doing on your own doesn't always work
- Targeted training opportunities exist

https://software-carpentry.org https://coderefinery.org/

Where we come in

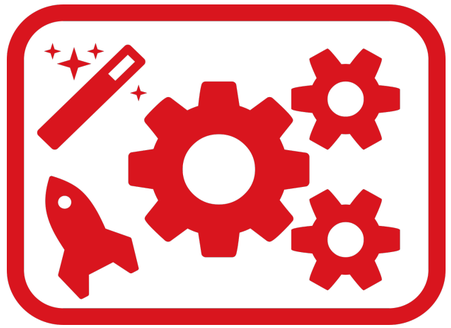
The research software spectrum



** positions along the axes serve demonstrative purposes*

Bridging gaps

- Developers
- Researchers/Scholars
- Projects



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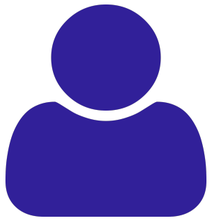
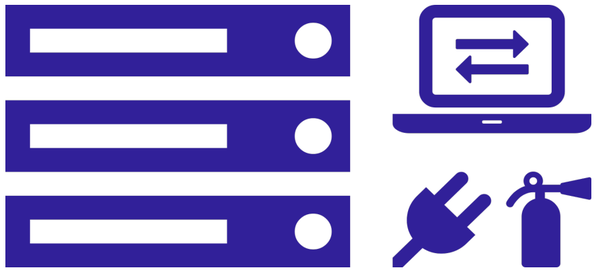




- Data Centres
- Libraries/Archives
- Horizontal Infrastructures
- Commercial/cloud providers

So what?

- Research software solves research questions.
- Infrastructures provide reliable services.

⇒ But these are not separate issues!

Technological Maturity

Technology Readiness Levels

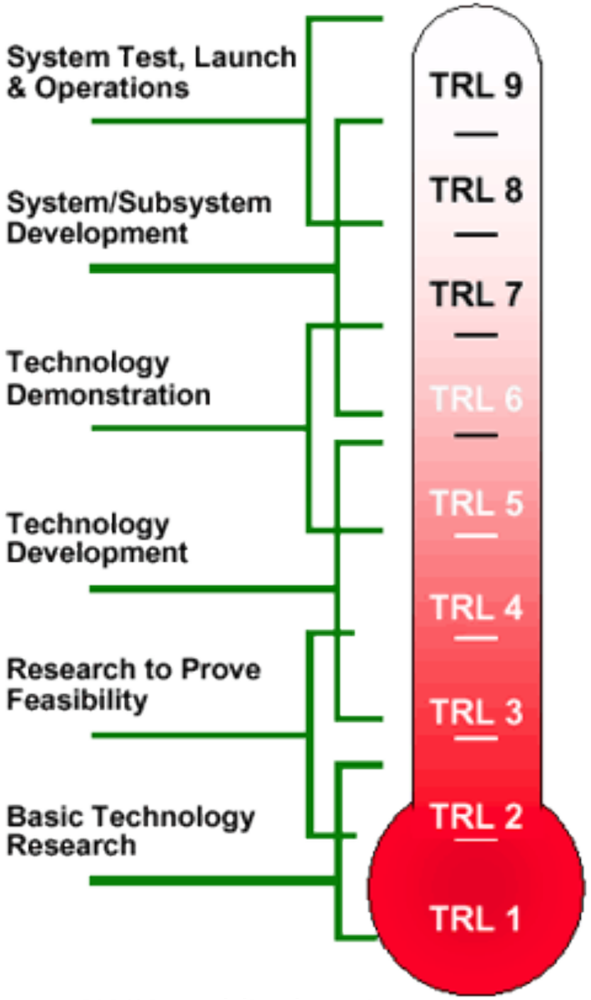


Image: NASA, public domain

TRL 9 – actual system proven in operational environment

TRL 8 – system complete and qualified

TRL 7 – system prototype demonstration in operational environment

TRL 6 – technology demonstrated in relevant environment

TRL 5 – technology validated in relevant environment

TRL 4 – technology validated in lab

TRL 3 – experimental proof of concept

TRL 2 – technology concept formulated

TRL 1 – basic principles observed

EC Horizon 2020 work programme
https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf

You can’t expect everything to be TRL-9

- Research is often experimental for good reasons
- You wouldn’t send an astronaut to space using a PhD candidate’s prototype rocket
- You wouldn’t invest in technology without more than a single laboratory testing it

Horizon 2020 deliverable types

- R document, report
- DEM demonstrator, pilot, prototype, plan designs
- DEC websites, patents filing, press & media actions, videos, etc.
- OTHER software, technical diagram, etc.

⇒ Standard question: where’s the PDF?

At CESSDA

Social Science Study Data

- Central Catalogue
  - Data access at our national institutions
- European Language Social Sciences Thesaurus
- Controlled Vocabularies
- Question Bank (soon)
- Data Management Expert Guide
- Training

⇒ https://www.cessda.eu/Tools-Services

Services are more than just software

- Documentation
- User Support
- Terms of Use / SLAs
- Sustainability & Reliability

Services powered by Products

- Internally developed solutions tailored to the use cases.
- Standard software where it exists.
- Reliable cloud infrastructure.
- Built with: Kubernetes, Docker, Jenkins, SonarQube, Java, Python …

CESSDA Projects

- Work awarded to our national archives to carry out for the infrastructure.
- Including deliverables, reporting and everything.
- Now includes the deliverable type “Software Release”

CESSDA's Software Release Deliverable

Link to the **git release tag** inside a **git repository**
that includes the **updated changelog** for the **version**
referencing the **relevant issues** in the repository.

- *Releases require manual QA, supported by automation.*
- *That's also what you'd publish to Zenodo.*

https://docs.tech.cessda.eu/software/releases.html

Software QA Requirements

- Software Maturity Level “Expected” *
- Code Test Coverage of at least 80.0%
- Duplicated Code Lines is less than 3.0%
- Maintainability, Reliability & Security Rating† of A

* https://doi.org/10.5281/zenodo.2614050
https://docs.tech.cessda.eu/

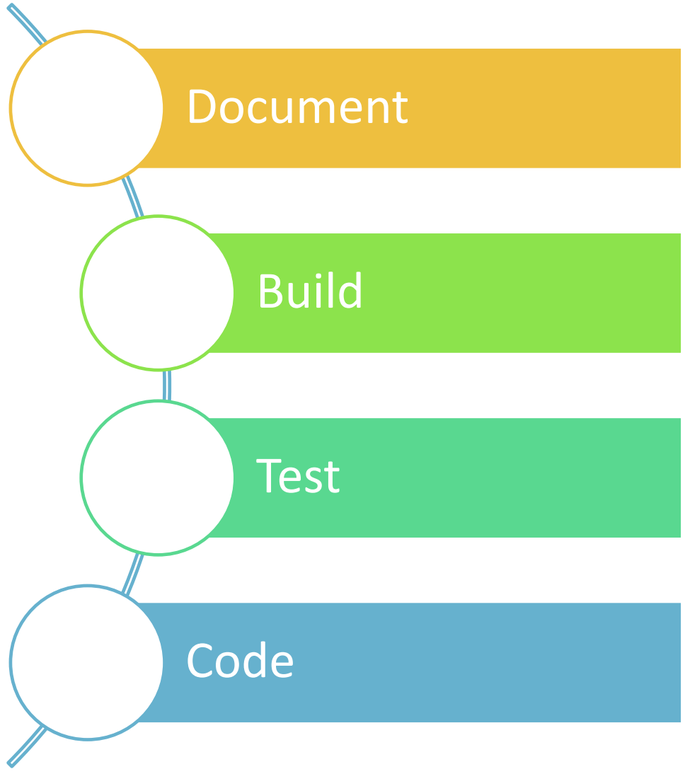
† SonarQube measurement

User engagement

- User representative and development leader must agree.
- Functionality must meet the pre-agreed requirements.

⇒ But quality is checked first.
⇒ We run internal trainings.

Good practices



Manual QA on release, tooling provided

CI/CD Pipelines with full automation

Unit and integration tests during deployment

Coding guidelines* and static analysis

* https://technical-reference.readthedocs.io/en/latest/

Solved it!?

But wait, you say

»My research software doesn’t have to be as robust as the rockets sending astronauts to space!«

imaginary researcher

Maybe not!

But what’s your response to

»Help me Oh-my-wise Researcher, you're my only hope!«

your government’s friendly envoy

So what now?

- Quality is crucial, when ensured wisely!
- Everything has a certain value
  and too often that isn’t clear in advance!

⇒ Incentives & rewards and proper requirements needed on all levels!

Thank you

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