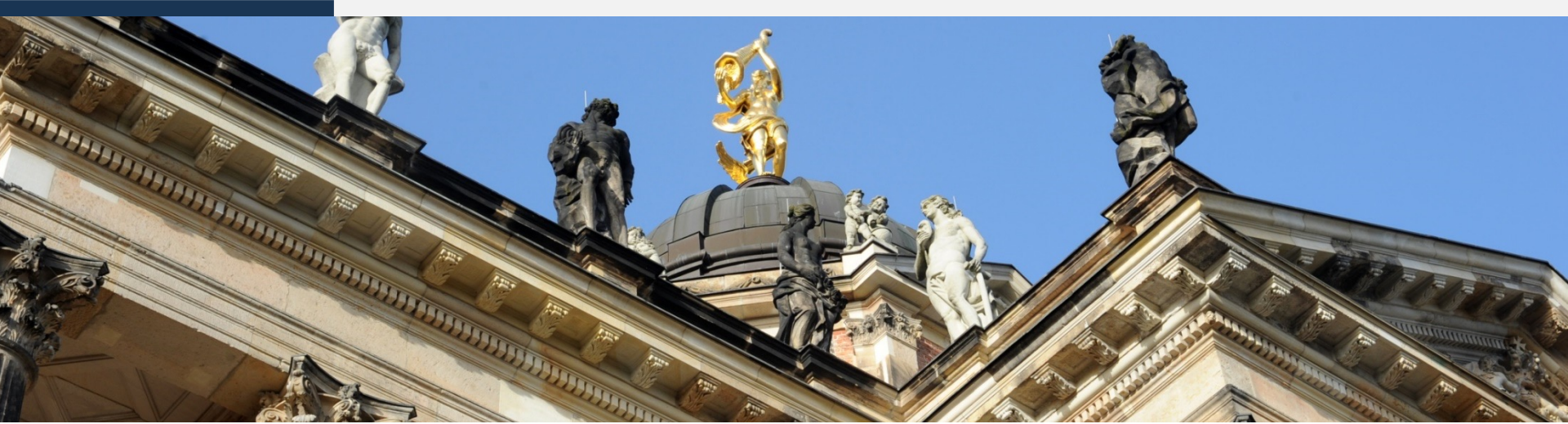




„Better Software, Better Research“

Research Software Engineering as a Central Pillar of 21st Century Science

Anna-Lena Lamprecht, 8.6.2023

Data-Centric Research



[Image by raftel](#) on Freepik, recolored

Data need Software!



Research needs Software

92%

of researchers
use software

67%

say its fundamental
for their research

56%

develop their own
research software

Brett et al.: *Research Software Engineers: State of the Nation Report*, 2017, <https://doi.org/10.5281/zenodo.495360>



*“Research Software includes source code files, algorithms, scripts, computational workflows and executables that were **created during the research process or for a research purpose.**”*

(Gruenpeter et al., *Defining Research Software: a controversial discussion*, 2021, <https://doi.org/10.5281/zenodo.5504016>)

Research Software Engineering

Workshop Web

- 2021

- 2021 International Workshop on Software Engineering for Computational Science (SE4Science'21)
Held in conjunction with the 2021 ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI 2021)

Anzt H, Bach F, Druskat S et al. **An environment for sustainable research software in Germany and beyond: current state, open challenges, and call for action.** F1000Research 2021, 9:295, doi: 10.12688/f1000research.23224.2

- 2020

- 2020 International Workshop on Software Engineering for Computational Science (SE4Science'20)
Held in conjunction with the 2020 ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI 2020)

A. Johanson and W. Hasselbring, **Software Engineering for Computational Science: Past, Present, Future**, in Computing in Science & Engineering, vol. 20, no. 2, pp. 90-109, 2018, doi: 10.1109/MCSE.2018.021651343.

- 2019

- 2019 International Workshop on Software Engineering for Computational Science (SE4Science'19)
Held in conjunction with the 2019 ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI 2019)

90-109, 2018, doi:

10.1109/MCSE.2018.021651343.

- 2018

- The 2018 International Workshop on Software Engineering for Computational Science (SE4Science'18)
Held during the 2018 ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI 2018), June 2-6, 2018, Houston, Texas, USA

C. Goble, **Better Software, Better Research**, in IEEE Internet Computing, vol. 18, no. 5, pp. 4-8, 2014, doi: 10.1109/MIC.2014.88.

- 2017

- 2017 International Workshop on Software Engineering for Computational Science (SE4Science'17)
Held in conjunction with the 2017 ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI 2017)

Shares many commonalities with “mainstream” software engineering.

Specific challenges through:

- Nature of scientific research
- Cultural environment of scientific software development

Increasingly receives separate attention.

Research Software Engineering

Term coined ~2012.

Emerging, cross-cutting discipline.

Combines:

- Computer science
- (Computational) science disciplines
- Open science practices

Diverse, international community.

Organized in national networks and an international council.



RSE Practice

Best practices and tools for day-to-day research software development

RSE Training

Developing (R)SE skills in researchers and R(SE) skills in software developers

RSE Careers

Developing RSE as an own professional profile, and career paths for RSEs.

RSE Infrastructure

Support for developing, executing and maintaining research software

RSE Policy

Working towards institutional support, funding and recognition of RSE and RSEs

RSE Research

Analyzing and improving (the development process of) research software

More on these today

RSE Practice

Best practices and tools for
day-to-day research
development

3. Frank Löffler:
deRSE

RSE Training

Developing (R)SE skills in
researchers and R(SE) skills in
software developers

4. Carina Haupt:
RSE am DLR

RSE Careers

Developing RSE as an own
professional profile, and
career paths for RSEs.

RSE Infrastructure

Support for developing,
executing and maintaining
research

6. Jan Bernoth:
NFDIxCS

RSE Policy

Working towards institutional
support, funding
recognition of RSE

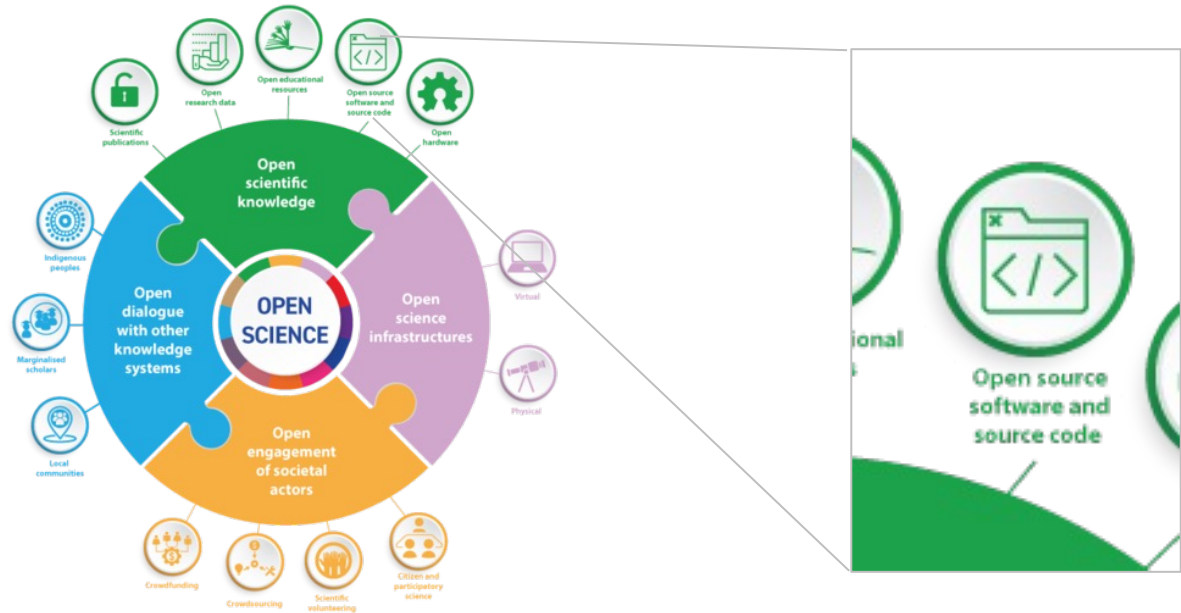
5. Robert Speck:
HiRSE_PS

RSE Research

Analyzing and improving (the
development process of)
research

2. Willi Hasselbring:
RSE Research

The future
is open
(science)!



Pillars of Open Science according to the UNESCO's 2021
Open Science recommendation,
<https://unesdoc.unesco.org/ark:/48223/pf0000383323>

Take-Home Message

**Research Software (Engineering) is a
Central Pillar of 21st Century Science.**

We should treat it like that.