The Role of Research Software in Sustainable Computing

Kelvin Living Lab

Queen's University Belfast

Collaborations Workshop 2026 (CW26)

Kelvin Living Lab

Software and hardware-based solutions towards sustainable computing

Engage with users to study and inform better energy-efficient behaviour in HPCs

Investigate whether an HPC facility can be used to help stabilise the grid

Sustainable Digital Research

- UKRI has committed to aligning with the UK Government's 2050 Net Zero target.
  - 50% reduction in greenhouse gas emissions from direct operations by 2030, compared to a 2017 to 2018 baseline.
- UKRI recognises that computing infrastructures are significant consumers of energy and natural resources.

The future of research funding

UKRI plans to align expectations on environmental sustainability within funding applications and assessments.

- The environmental impact of computing equipment must be an element of assessment for future investments and procurement.
- A generic requirement for environmental sustainability measures for all UKRI investments is planned for development by 2029.
- An assessment tool for environmental sustainability measures in research calls, known as **SPARKHub**, is scheduled for roll-out in 2030.

Role of the Researchers and RSEs

The **Concordat for the Environmental Sustainability of Research and Innovation Practice** is a collaborative effort to ensure the future design and practice of UK R&I is environmentally sustainable.

- Take ownership of decisions (within your means) to ensure environmental impacts are included in R&I plans.
- Design and carry out R&I endeavours in a way that optimises the sustainable operation and efficiency of equipment infrastructure.
- Show leadership by carrying out work in an environmentally sustainable manner reflecting the expectations of their host organisation/funders.

We need to understand the perspectives of researchers and RSEs.

What are the biggest technical hurdles or perceived risks that stop you from adopting energy-efficient techniques in your research software?

Answer

- Training
- Legacy codes hard to optimise
- Low level easy to optimise, but harder to code
- People are polarised in the issue of runtime slowdown – some require exact runtime (runtime eval, deadline), some are ready to tolerate

If you were required to include an accurate "energy budget" alongside your financial budget, what tools do you require that might equip you to estimate the energy consumption of your software?

Answer

- Premature optimisation
- Require step-by-step walkthrough
- Training
- Carbon calculator, e.g., Green Algorithms
- Utilisation metrics – scheduling, e.g., with carbon-aware task schedule (CATS)
- SLURM addon to show what wasted resources were requested for a given job

What specific tools, profilers, or dashboards exist to help you monitor, analyse and optimise the energy consumption of your compute?

Cancelled (timeout)

Where does the primary responsibility for sustainable High-Performance Computing (HPC) lie? Is it the Research Software Engineer (RSE), the researcher, or the HPC center?

Answer

- Issue goes away when purchased energy is green
- HPC

Sources

- “Concordat for the Environmental Sustainability of Research and Innovation Practice.” *Wellcome*, https://wellcome.org/about-us/positions-and-statements/environmental-sustainability-concordat
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- *UKRI Net Zero Review 2024*. 7 Oct. 2024, https://www.ukri.org/publications/ukri-net-zero-review-2024/

Thank You

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