EPSRC
Investing in research for discovery and innovation

EPSRC SOFTWARE INFRASTRUCTURE STRATEGY 2018

Introduction

EPSRC believes that software and its development is a key tool for all areas of engineering and physical sciences research, and has supported software development activities for many years. Computer-supported modelling and simulation is now widely recognised as the third `leg` of scientific method, alongside theory and experimentation.

Many phenomena can be studied only by using computational processes such as complex simulations, or by analysis of experimental data, including that produced by large facilities such as Diamond and ISIS. The large suite of codes used across all areas of research needs to be regarded as a research infrastructure in its own right, requiring support and maintenance throughout its lifecycle. Software is where much intellectual property, knowledge and understanding resides and this is why software has such longevity: people replace their hardware, but don't dispose of their codes.

In recognition of this, EPSRC, with the assistance of the community, developed a strategy for investing in software, ensuring that our funding (current and future) adds value to the complex and evolving e-infrastructure eco-system and supports the needs and requirements of the Engineering and Physical Sciences community. This first strategy was published in 2012. Six years on, the importance of software in research has only increased, with seven out of 10 researchers reporting that their work would be **impossible without** it. EPSRC held a community workshop in October 2016 in order to update the Software Infrastructure strategy to ensure future investments and activities continue to provide the optimal support.

Current landscape

Over the last five years EPSRC has continued to invest in support for software, with investment decisions guided by our 2012 Software strategy. These investments have covered the spectrum from new algorithm development at the leading edge of research applications through software development to code maintenance. They have also supported communities working together, international links, and training and career development for students, post-docs and Research Software Engineers.

Specific examples include:

- Three Software for the Future calls invested over £18 million on the development and improvement of codes that are essential to the Engineering and Physical Sciences community.
- A call for Collaborative Computational Projects (CCPs) which bring together the major UK groups in a given field of computational research to tackle large-scale scientific software development projects, maintenance, distribution, training and user support. Through the call, existing computational communities (such as condensed matter physics, plasma physics, materials) continued to receive support, and some new communities were established. It was noticeable that several of the new communities were focused around experimental techniques, and the software required for their data analysis; these include NMR crystallography, PET-MR, and tomographic imaging. There are hundreds of UK groups participating in the CCPs and they have extensive collaborations with international groups and industry.
- Calls for High-End Computing Consortia have also seen the establishment and support of new communities, particularly in engineering, as well as ongoing support for strong longstanding consortia.
- Ongoing funding for the SLA with STFC's Computational Science Centre for Research Communities (CoSeC) has been provided, in order to support the expert staff from CoSeC who work with researcher communities to develop and strengthen software.
- Two rounds of Research Software Engineer (RSE) Fellows have been held, with a total of eleven fellows funded. These fellows are playing a leadership role within their institutions and across the UK, highlighting the importance of software support and training for the research community.
- The wider RSE community has also been supported through a network grant, which has enabled the RSE Association to go from strength to strength, with over 700 members. A travel fund supported RSE leaders from the US to visit the UK to help establish strong links for the future

The current portfolio of activities has supported a thriving community of computational scientists who are recognised internationally.

EPSRC Future Strategic Framework and Plans

The overall aim remains: **to support the development of reliable and reproducible research software by providing funding, training, and appropriate policy and best practice frameworks.** The strategic framework has been formulated with input from members of the community via the workshop held in October 2016. It is structured around five objectives: software, communities, people, impact, and trust and accessibility. Against each strategic objective, there is a number of key activities that we will undertake that will enable us to meet our objectives for Software Infrastructure

In addition, there are several important issues that are best tackled across UKRI, rather EPSRC acting alone. EPSRC will undertake to take a lead in influencing UKRI policy and strategy in the following areas:

- The development of guidance, for inclusion in funding guides and calls, to clarify that software engineers and associated costs such as training can be included in research grants. This will ensure that projects contain the right resources for software to enable high quality science.
- The development of software management plans and associated guidance and peer review processes. This would need to cover:
- expectations on publication of source code;
- a review process that enables the software development component of any proposal and the suitability of the plan and appropriateness of software expertise to be assessed and feedback provided where appropriate;
- peer reviewers and panel members to be briefed and educated.
- Strengthen the reporting of software outputs on ResearchFish e.g. by developing and publishing additional guidance on the requirements for reporting on software availability.
- Raise awareness of the importance of software engineering skills across the UKRI remit, enlisting the help of the RSE Fellows to raise awareness in the wider research communities
- Raise awareness in research institutions of the research potential, importance and value that software engineering can bring, highlighting: available investment in the UK; the various models of software support and career development that institutions have put in place; and encouraging the sharing of best practise.
- Explore the potential to influence the REF exercise to get software accepted as a valid research output.
- Explore options for investing in a national UKRI-wide continuous integration service, to include a suite of software development tools that support build and testing infrastructure.

	Objective	Implementation approach
Software:	To ensure the software codes used by the community continue to be developed and maintained.	• Continue to provide funding through a range of mechanisms, to support the UK code base, to cover: • The development of novel code in new or existing application areas to enable new research to be carried out in priority areas of strategic relevance and importance to EPSRC; • The addition of new functionality to existing codes to address new research challenges; • The development and re-engineering of existing codes for emerging hardware architectures, including scalability and performance testing, to allow users to 'future-proof' key codes. • Ensure that computational software experts are well-represented on the peer review college and are invited to review proposals that involve a software development component, and to take part in peer review panels as appropriate.
Communities:	To support computational research communities to develop and grow.	• Ongoing support for existing community networks such as CCPs and HEC Consortia that act as a focal point for software in a particular field. • Encourage and support international collaboration with centres of excellence through the exchange of people and expertise. • Identify new areas of computational research that need software development support. • Develop ways to support more effective networking across communities.
People:	To support training and skills development across all career stages and levels of expertise.	• Ensure that digital skills training features strongly within future CDTs (Centres for Doctoral Training). • Promote widely, the comprehensive software training provision available across the UK. • Work with industry partners to understand the value they place on software skills as professional, transferrable, and employable. • Develop and share case studies and career path models for those working in computational research to reflect the diversity in terms of experience and research areas covered. • Continue to provide appropriate long-term support mechanisms for potential and established leaders e.g. through fellowships. Review the RSE Fellowships to evaluate their effectiveness and learn lessons for the future.
Impact:	To maximise the impact of software infrastructure on research.	• Promote awareness of, and encourage interactions between industry and the academic software community. For example: • Facilitate workshops with the CCPs, HEC Consortia and industrial users to discuss academic/industry interactions, encourage discussions around academic and industrial software needs, and inspire new collaborations and partnerships; • Develop case studies. • Encourage CCPs and HEC Consortia to continue their outreach activities to the wider academic community, to enable communities to access and exploit shared software resources that can meet their needs. • Publish guidance and best practice on improving the impact of research software e.g. producing metrics around what makes software successful, introducing software management plans into grants, providing advice on how to publish and cite software where possible to improve software reuse.
Trust and accessibility:	To ensure that software developed and used for research is of a high quality, is accessible and is sustainable.	• Develop and implement a software accreditation framework which can be used to assess and measure whether a piece of software is reusable and reliable. • Encourage sharing of examples of best practice in software development through, for example, case studies in areas such as continuous integration, documentation, release management, maintenance management, issue tracking, performance and scalability testing, use of appropriate repositories etc. • Encourage reporting of software outputs on ResearchFish e.g. by developing and publishing additional guidance on the requirements for reporting on software availability.

Engineering and Physical Sciences Research Council

Polaris House, North Star Avenue, Swindon SN2 1ET

epsrc.ukri.org

EPSRC is part of UK Research and Innovation