

Special Issue on the Future of Research Software Engineers in the United States—Part I

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This is part one of a two-part special issue focused on research software engineers (RSEs) in the United States. RSEs are members of the research software ecosystem who have knowledge, expertise, and interest in developing the high-quality software that is integral to advancing the frontiers of research across various scientific, engineering, humanities, and other domains. The people in the RSE role are critical to the success of both the research software and the underlying research project advanced by the software. RSEs are particularly important within the complex research landscape, which integrates high-performance computing (HPC), data science, machine learning, and complex workflows on advanced technology computing systems.

The people who fill the RSE role, whether they carry the title of RSE or something else (e.g., postdocs, computational scientist, research staff, and so forth), develop, maintain, and contribute to research software and come from a broad spectrum of scientific domains across academia, national laboratories, and industry. In the last five years, there has been a movement toward defining, recognizing, and growing communities around the formalized role of the RSE. This increase in prominence for the RSE position is largely motivated by the overwhelming need for more RSEs to support increasingly complex computational research. This increase can be seen also in the growth of professional organizations for RSEs around the world and, specifically, with the US-RSE Association (<https://us-rse.org/>) in the United States. In the first part of this special issue, the articles focus on the current state of RSEs in the United States. They provide different perspectives on what is working in the current

environment and best practices that can be applied across the community.

Even with the current success of RSEs and the increased need and prominence for the RSE role in the future, major obstacles remain in attracting, developing, and retaining the next generation of RSEs. These obstacles include technical as well as social and cultural factors. Continuing to move the community forward requires an honest and introspective analysis from a wide variety of people who have experiences to share. The articles in the second half of the special will identify the challenges of attracting, supporting, and retaining RSEs at various types of institutions in the United States and provide thoughts on how to build for the future.

"Giving Research Software Engineers a Larger Stage Through the Better Scientific Software Fellowship," by William F. Godoy and colleagues,^{A1} provides an overview of a U.S. Department of Energy fellowship program geared toward improving the productivity of scientific developers and the sustainability of their code. The article describes the experiences of a number of the fellowship recipients and how they have used the fellowship to advance scientific software and the goals of the fellowship program.

"Research Software Engineering at Oak Ridge National Laboratory," by Addi Malviya-Thakur and colleagues,^{A2} describes the mission, culture, and practices of RSE teams at Oak Ridge National Laboratory (ORNL), including their team dynamics and composition, work ethics, standard practices, and ever-evolving skill sets vital to pursuing scientific innovations and implementing novel ideas. The authors share case studies and lessons learned toward shaping the identity and growth of RSEs at ORNL, primarily from ORNL's annual Software and Data Expo, and provide strategies that have helped ORNL establish, lead, and nurture RSE teams.

"The Princeton University Research Software Engineering Group Model: Operational and Organizational Approaches," by Ian A. Cosden,^{A3} details Princeton University's model to create and foster a centralized RSE group that partners with academic research units across the university. The RSE group works directly with researchers to apply cross-disciplinary computational techniques to create efficient, scalable, and sustainable research software. The organizational and operational best practices described in the article provide a template for developing professional RSEs at academic institutions.

We hope you enjoy this first set of articles on an emerging and important development in the professionalization of research software teams.

APPENDIX: RELATED ARTICLES

- A1. W. F. Godoy et al., "Giving research software engineers a larger stage through the Better Scientific Software Fellowship," *Comput. Sci. Eng.*, vol. 24, no. 5, pp. 6–13, Sep./Oct. 2022, doi: [10.1109/MCSE.2023.3253847](https://doi.org/10.1109/MCSE.2023.3253847).
- A2. A. Malviya-Thakur et al., "Research software engineering at Oak Ridge National Laboratory," *Comput. Sci. Eng.*, vol. 24, no. 5, pp. 14–23, Sep./Oct. 2022, doi: [10.1109/MCSE.2023.3260211](https://doi.org/10.1109/MCSE.2023.3260211).
- A3. I. A. Cosden, "The Princeton University Research Software Engineering Group model: Operational and organizational approaches," *Comput. Sci. Eng.*, vol. 24, no. 5, pp. 24–31, Sep./Oct. 2022, doi: [10.1109/MCSE.2023.3264113](https://doi.org/10.1109/MCSE.2023.3264113).

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