

Developing tools for reproducibility

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The concept of reproducibility is vital when it comes to research, as it provides transparency and ensures clarity for findings. However, reproducibility is often difficult because investigators publish only their papers and not the data or other important aspects that support their results. Now, Notre Dame researchers at the Center for Research Computing (CRC) are developing several tools that can be used to save data, analytical methods, and processes so that these elements can be shared among the research community.

Jaroslav (Jarek) Nabrzyski, director of the CRC, and his team are collaborating on a variety of projects that are tied to the concept of research reproducibility. The [Data and Software Preservation for Open Science](#) (DASPOS) project – a collective effort of several universities

funded by the National Science Foundation (NSF) to explore the realization of viable data, software, and computation preservation architecture for High Energy Physics – is just one example of Nabrzyski's collaborations.

In describing the DASPOS project, Nabrzyski said, "Our goal is to build tools that allow scientists to capture their workflow in a way that is not intrusive to their research process. This provides researchers with an outlet to preserve their experiments while maintaining focus on their work and allowing the project to be more easily reproduced in the future."

Other tools supporting science reproducibility are being developed in the [Whole Tale](#) project. This NSF-funded project has brought together researchers from all over the country, including the University of California, Santa Barbara, University of Illinois at Urbana-Champaign, and the University of Texas at Austin, to develop building blocks for a data-sharing infrastructure. Nabrzyski and Ian Taylor, a research professor of Computer Science and Engineering and the CRC, are working with these groups to establish a repository that will again enable researchers to publish their papers along with the data and methods used in their experiments.

"Whole Tale will enable researchers to examine, transform, and then seamlessly republish research data that was used in an article. As a result, these 'living articles' will enable new discoveries by allowing researchers to construct representations and syntheses of data," says Nabrzyski. "The goal of Whole Tale is to help document and track research on a national scale."

Through a project funded by the Defense Advanced Research Projects Agency (DARPA), Nabrzyski and his team are also creating and maintaining a repository that supports several research groups in

academia and industry. Researchers working on the Circuit Realization at Faster Timescales (CRAFT) project are developing affordable low-energy circuits, which could potentially be applied to technologies, such as drones.

"The idea behind this project is to develop a design-flow repository so that methods, documentation, and intellectual property do not need to be reinvented with each design and fabrication cycle," says Nabrzyski. "The project seeks to shorten the design cycle for custom integrated circuits in a matter of months rather than years, resulting in cost savings of millions of dollars per design."

Academic research groups currently utilizing the repository designed for the CRAFT project include Carnegie Mellon University, Harvard University, Princeton University, Stanford University, University of California Berkeley, University of California, San Diego, and the University of Southern California. Industry collaborators and government organizations include the Boeing Company, Cadence Design Systems, Inc., DARPA, NVIDIA Corporation, Northrop Grumman Corporation, and Synopsys, Inc.

"All of our projects at the CRC involve state-of-the-art, software development," says Nabrzyski. "This is fundamental to research, thus our team cultivates better, sustainable research software to enable world class research at Notre Dame and beyond."

Provided by University of Notre Dame

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