

# Expeditions in Applied High-Performance Distributed Computing

**Abstract:** To support science and engineering applications that are the basis of many societal and intellectual challenges in the 21st Century, there is a need for comprehensive, balanced and flexible distributed cyberinfrastructure. The process of designing and deploying such large scale distributed cyberinfrastructure however, presents a critical and challenging research agenda along at least two different dimension: conceptual and implementation challenges.

The first challenge is the ability to architect and federate large scale distributed resources so as to have collective performance that can be designed and predicted as well as the ability to plan and reason about executing distributed workloads. The second challenge -- is to produce tools that provide a step change in the sophistication and scale of problems that can be investigated using DCI, while being extensible, easy to deploy and use, as well as being compatible with a variety of other established tools.

In the first part of the talk we will discuss how we are laying the foundations for the design and architecture of the next-generation of distributed cyberinfrastructure. In the second part of the talk, we will introduce RADICAL-Cybertools -- a standards-based, abstraction-driven approach to High-Performance Distributed Computing. RADICAL Cybertools builds upon important theoretical advances, production software development best practices and carefully analyzed usage and programming models. We will discuss several science and engineering applications that are currently using RADICAL Cybertools to utilize DCIs in a scalable and extensible fashion. We will conclude with a discussion of the connection between the two challenges and thus the first steps towards the "Science of Cyberinfrastructure".

**Bio:** Shantenu is an Associate Professor of Computer Engineering at Rutgers University and a RADICAL (Research in Applied Distributed Computing and Applications Laboratory (<http://radical.rutgers.edu>)) researcher. His research interests lie at the triple point of Cyberinfrastructure R&D, Applied Computing and Computational Science. His research is currently supported by DOE and NSF awards, including CAREER (CISE-ACI), SI2 (elements, integration and conceptualization), CDI and EarthCube. Shantenu leads the the RADICAL-Cybertools (<http://radical-cybertools.github.com>) project which are a suite of standards-driven and abstractions-based tools used to support large-scale science and engineering applications. He is co-leading a "Conceptualization of an Institute for Biomolecular Simulations" project. He leads the design and development of "MIDAS: Middleware for Data-intensive Analytics and Science" as part of the SPIDAL/HPBDS (<http://arxiv.org/abs/1403.1528>) -- a 2014 NSF DIBBS project. Away from work, Jha tries middle-distance running and biking, tends to indulge in random musings as an economics-junk and has a "knack" for encountering British ex-politicians and Corrupt Police Officers (currently mutually exclusive). He'd be glad to wax lyrical about either of these.