Fall 2014 Sabbatical Report

Suzanne Rivoire
Department of Computer Science
Sonoma State University
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Purpose of Sabbatical

The primary purpose of my sabbatical was to spend the Fall 2014 semester as a visiting researcher at Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee. Oak Ridge National Laboratory is one of the premier supercomputing facilities in the world. It hosts three of the world’s hundred fastest supercomputers, including the fastest supercomputer in the United States.

My collaborators at ORNL’s Extreme Scale Systems Center have been charged with the task of anticipating the challenges of exascale supercomputers – supercomputers that are thirty times more powerful than the highest-performing system today. My portion of the project, which has brought more than $250,000 to SSU and supported 13 undergraduate researchers since 2012, concerns the energy efficiency of such supercomputing facilities.

The goals of my time at ORNL were to deepen our research collaboration by exploring aspects of our project that would benefit from more frequent interaction, and to broaden my knowledge of supercomputing in order to improve my teaching of computer architecture and parallel programming.

Summary of Sabbatical Activities

I worked onsite at ORNL from August 25 to November 12, 2014. Outcomes of that visit include the following:

- Submitted a peer-reviewed publication, which was accepted and published:
  

  The first six authors were SSU undergraduate researchers, and the last two authors are our collaborators at ORNL. Jacob Combs, who co-wrote the initial draft of the paper for his senior capstone project, presented the paper in New Orleans in November.

- Submitted a proposal to continue our work with ORNL into the 2015 fiscal year (funded for just under $60,000 in Feb. 2015)

- Collaborated with the Energy-Efficient High-Performance Computing Working Group (http://euhpcwg.1ib1.gov/) to develop a principled set of sampling rules for energy-efficiency benchmarking. Our work is being incorporated into the new version of the authoritative benchmarks in supercomputing performance (the Top 500) and energy efficiency (the Green 500). I am also a coauthor of a paper currently under review for the leading supercomputing conference (SC 2015) based partly on that work.
• Supervised 5 SSU undergraduate research students working on the ORNL project.

• Developed a high-level simulation of a supercomputer scheduler to quantify the potential of our work with power signatures. SSU undergraduate Kelsey Rangel’s senior capstone project in Spring 2015 built on this work.

• Presented an update on our work at a Department of Defense/ORNL program review meeting, along with two SSU undergraduate researchers (Oct. 2014 in the Washington, DC area)

• Submitted a proposal to the Provost’s Undergraduate Research Fund to allow two students to present their software engineering work on the ORNL project (funded for $900)

• Gave an invited talk to ORNL’s Computer Science Research group (Nov. 2014)

• Chaired the “Memory and Microarchitecture” technical paper session at the 2014 International Conference for High Performance Computing, Storage, Networking and Analysis (SC), the preeminent supercomputing conference (Nov. 2014 in New Orleans)

• Submitted a proposal to add a new permanent upper-division elective on parallel computing to the CS curriculum, which was approved by the Faculty Senate in Spring 2015.

I also engaged in the following scholarly and professional activities that were not directly related to my work at ORNL:

• Presented the paper “Star-Cap: Cluster Power Management Using Software-Only Models” (J. D. Davis, S. Rivoire, and M. Goldszmidt) at the Workshop on Power-Aware Systems and Architecture (Sep. 2014 in Minneapolis)

• Prepared a grant proposal to the National Science Foundation for student travel to the 2015 IEEE International Symposium on Performance Analysis of Systems and Software (funded for $10,000 in Mar. 2015)

• Submitted an RSCAP mini-grant proposal (funded for $4,403)

• Served on the external review committee of the 2014 International Symposium on Microarchitecture

• Reviewed for the 2015 ACM SIGCSE Technical Symposium on Computer Science Education

• Attended a meeting of the IEEE Publication Products and Services Committee as a voting member (Nov. 2014 in New Jersey)

I am grateful to SSU for the opportunity to pursue this work. Computing is a notoriously fast-moving field, and advances in computing research and technology affect the entire undergraduate curriculum. The break from normal campus responsibilities allowed me to dedicate the semester to maintaining the strength and relevance of my scholarship and teaching.