

Research Alliance in Math and Science

<http://computing.ornl.gov/Internships/RAMS.html>

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Summary

The Research Alliance in Math and Science (RAMS) program is carried out through the Computing and Computational Sciences Directorate at the Oak Ridge National Laboratory (ORNL) for the U. S. Department of Energy's Office of Advanced Scientific Computing Research. The RAMS program continues to provide unique, hands-on educational experience through innovative approaches to underrepresented students majoring in mathematics, computer science, engineering technology, and the computational sciences.

Parallel computing intern used RAMS research to finish senior thesis

Research Alliance in Math and Science (RAMS) summer intern Jonathan Rann, then a computer science major at Winston-Salem State University in Winston-Salem, North Carolina, researched parallel computing techniques during his summer 2006 research internship at the Computing and Computational Sciences Directorate at the Oak Ridge National Laboratory (ORNL).

Mr. Rann spent that summer at ORNL studying computer science. "I researched parallel computing techniques. Specifically, I compared the efficiency of Message Passing Interface (MPI) and Multithreaded parallel programming techniques, on a Bubblesort program written in C language."

"The RAMS experience was invaluable. My computer programming skills increased threefold. I was introduced to the LINUX OS and the research techniques I acquired fully prepared me to complete my senior thesis.

Mr. Rann received a BS in computer science from Winston-Salem State University and is currently awaiting acceptance to North Carolina A&T's masters program in computer science, where he wants to begin study in Fall 2009. "Overall, RAMS helped me to understand the field of computer science and showed me my ability to actively participate in the industry."

In April, 2009, he represented the RAMS program and talked about the program's benefits at the 2009 Tapia conference (Richard Tapia Celebration of Diversity in Computing), in Portland, Oregon. "Attending the TAPIA Conference afforded me another opportunity to spread the word about the success of the RAMS program. I loved interacting with professionals from all over the world, with like minds. I believe sharing my experiences and attending the event added greatly to my personal career development while also promoting the importance of RAMS."

"It was extremely exciting to meet Richard Tapia and the other guest speakers,

as they were very willing and open to offer advice and guidance about a career in the computer science industry.”

In 2007, Mr. Rann presented and won second place with his computational research poster at a poster competition at the ADMI conference (Association of Computer and Information Science/Engineering Departments at Minority Institutions), held at Spelman College in Atlanta, Georgia. Since then, he has attended many seminars and professional meetings.

Smoky Mountains, had I not taken the drive from Charlotte, North Carolina. I also met some great people and have maintained many of those friendships over the years. RAMS has done so much to prepare me for a career in computer science.”

Additional information on the RAMS summer program, student projects, and photographs from tours and events can be viewed by year at: <http://computing.ornl.gov/internships/RAMS>.

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Message Passing Interface vs. Multi-threading: Which Parallelization Technique is More Efficient?

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Introduction

- Parallel computing is a valuable technique used for exploiting the combined power of hundreds to thousands of processors available on PC clusters and supercomputers, for a single scientific simulation.
- Message Passing Interface (MPI) is a popular software infrastructure that allows parallel programming on a variety of computer hardware.
- A more recent parallel programming paradigm, known as multi-threading, focuses on utilizing the power of Multi-core processors.
- MPI and multi-threading programming have been shown to provide different benefits to applications in various environments.

Application Parallelization

- Identifying parts of programs that will benefit from parallelization
- Create parallelized programs using both MPI and multi-threading techniques
- Compare efficiency for a sample program **Merge sort**

Goals

- To characterize the efficiency of applications using alternate parallel programming methods
- To determine which parallelization technique is better suited for each application in different environments
- To help create optimized biological applications which utilize the maximum efficiency of the computer hardware

Results

- For sequential (single-processor) runs, the time required for solution increases with increasing size of array.
- For parallel runs, the time required for solution decreases as the number of processors are increased: 1, 2, 4 and 8 processors.
- Multi-threaded version of the program is currently under development.

Future Research

- Further explore efficiency comparisons once multi-threaded program is developed
- Create more efficient biological applications based on research using MPI and multi-threading techniques
- Future supercomputers will have dual core and quad core processors. These studies will help in utilizing the CPU power efficiently.

Fig. 1. Vignans activity levels within network in reconstituted linkage. Fig. 2. Merge sort efficiency comparisons (sequential vs. parallel).

Mr. Jonathan Rann’s poster from his Research Alliance in Math and Science summer 2006 internship program was displayed in competition at the Association of Computer and Information Science / Engineering Departments at Minority Institutions (ADMI) held at Spelman College, Atlanta, Georgia.

“I enjoyed my RAMS experience greatly,” Mr. Rann said. “Tennessee is a beautiful state. I may never have seen the Great