

Center Information

Innovative Computing Laboratory

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RESEARCH CENTER PROFILE

icl.utk.edu

INNOVATIVE COMPUTING LABORATORY

Overview

Established in 1989 by Professor Jack Dongarra, the Innovative Computing Laboratory (ICL) is a large computer-science research and development group situated in the heart of the University of Tennessee's Knoxville campus. ICL's mission is to establish and maintain the University of Tennessee as a world leader in advanced scientific and high performance computing through research, collaboration, and education.



Jack Dongarra,
Director

Since its establishment twenty-three years ago, ICL has grown into an internationally recognized research laboratory, specializing in Numerical Linear Algebra, Distributed Computing, and Performance Evaluation and Benchmarking. The lab now employs nearly fifty researchers, students, and staff, and has earned many accolades, including four R&D100 awards.

For more information on ICL, please visit:
[»http://icl.utk.edu/](http://icl.utk.edu/).

Collaborations and Partnerships

Vendors and industry research leaders are an integral part of ICL's partnerships, contributing significantly to the lab's efforts to be a world leader in computational science research. Many have utilized ICL's work, including the lab's linear algebra libraries and performance analysis tools. As a result of these exchanges, the lab maintains close working relationships with AMD, Cray, HP, IBM, Intel, MathWorks, Microsoft, NVIDIA, SGI, and VMware, just to name a few. ICL's relationship with NVIDIA, for example, has evolved into a productive exchange of hardware and expertise as ICL was named an NVIDIA CUDA Center of Excellence.

ICL's relationships with academic and government research institutions also play a pivotal role in the lab's success. By exchanging ideas, expertise, and personnel, ICL becomes more dynamic with each new collaboration. The lab routinely develops relationships with researchers whose primary focus is on other scientific disciplines, such as biology, chemistry, and physics, which makes many of its collaborations truly multidisciplinary.



Research Expertise

Numerical Linear Algebra

Numerical Linear Algebra algorithms form the backbone of many scientific applications in use today. With the ever-changing landscape of computer architectures, such as the massive increase in parallelism and the introduction of hybrid platforms utilizing both traditional CPUs and GPUs, these libraries must be revolutionized in order to achieve high performance and efficiency on these new hardware platforms. ICL has a long history of developing and standardizing these libraries in order to meet this demand.

Distributed Computing

Distributed Computing is an integral part of the high performance computing landscape. As the number of cores, nodes, and other components in an HPC system continue to grow explosively, applications need runtime systems that can exploit all this parallelism. Moreover, the drastically lower meantime to failure of these components must be addressed with fault tolerant software and hardware, and the escalating communication traffic that they generate must be addressed with smarter and more efficient message passing standards and practices. ICL has multiple efforts underway to confront these problems.

Performance Evaluation and Benchmarking

Performance Evaluation and Benchmarking are vital to developing efficient science and engineering applications. ICL's Performance Evaluation tools allow programmers to see correlations between the structure of source/object code and the efficiency of the mapping of that code to the underlying architecture. These correlations are important for performance tuning, compiler optimization, debugging, and finding and correcting performance bottlenecks. ICL's benchmark software is also widely used for developing performance profiles of modern HPC machines, and plays an essential role in the purchasing and management of major computing infrastructure around the world.

Education and Outreach

Interdisciplinary Graduate Minor in Computational Science

In 2007, ICL and CITR staff helped establish the University of Tennessee's Interdisciplinary Graduate Minor in Computational Science (IGMCS), which offers students an opportunity to acquire the balanced package of knowledge and skills required in today's computationally intensive research methods. Through the IGMCS, graduate students can augment the curriculum of their chosen field with computationally rich courses from other science and engineering areas, creating a solid interdisciplinary foundation in Computational Science.

[»http://igmcs.utk.edu/](http://igmcs.utk.edu/)

Center for Information Technology Research

The Center for Information Technology Research (CITR) was established in 2001 to drive the growth and development of leading edge information technology research at the University of Tennessee. As part of this goal, CITR staff members currently provide primary administrative support for ICL and the IGMCS, and have provided secondary support for other UT research centers.

[»http://citr.eecs.utk.edu](http://citr.eecs.utk.edu)



Facilities and Resources

ICL has access to multiple state-of-the-art high performance computing systems in house. In fact, ICL's hardware industry partners, including AMD, ARM, Intel, and NVIDIA, provide the lab with bleeding edge hardware resources (often under NDA and prior to public release) which are used to upgrade and maintain the lab's infrastructure. ICL's research staff also has access to other campus resources, including UT's Newton Cluster, as well as resources at the National Institute for Computational Sciences (NICS), Oak Ridge National Laboratory (ORNL), and multiple grid infrastructures all over the country. These wide-ranging resources are, in many cases, a result of ICL's long-standing collaborations and partnerships, and are vital to the lab's cutting-edge research.