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Special Guest Lectures

Spotlight on UI-Based HPC Applications in Medical Imaging

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Johnston Hall 338
April 04, 2007 - 11:00 am**Abstract:**

This presentation demonstrates how the UI-ITS Scientific Computing and HPC Group (SCG) supports campus-wide medical imaging research using high-performance computing. The presenter begins by outlining the mission and responsibilities of the SCG. Then two representative projects are discussed. These multi-disciplinary projects have attracted significant external funds to the University. The first is the NIH-funded Digital Lung Project for multi-scale simulations of gas flow in human lungs. This project required development of parallel algorithms of Lattice Boltzman Methods (LBM) in modeling and simulating bubble airflow. The parallel LBM algorithm was designed and implemented on various HPC systems and/or in a distributed computing environment. The experience gained from this project provides a concrete foundation for designing and conducting large-scale, intensive computations using TeraGrid resources. The deployment of parallel computing technology accelerated the project, enhancing our prospects for future NIH grant applications. The second project, also funded by NIH, is the systematic development of parallel algorithms of large-scale CT medical image reconstruction. Although algorithms for generating CT patient images have improved over the years, one challenge remains: finding an economical and efficient way to quickly perform medical image reconstruction, especially for high-resolution datasets or micro CT image processing. The goal is to use today's parallel computing and Grid computing technologies to speed up future image reconstruction for radiological diagnostics. Following a description of today's parallel CT image reconstruction algorithms is an introduction of the Katsevich algorithm and its parallel implementation on various HPC systems, with emphasis on the promising results achieved to date. Future objectives are also highlighted. These two projects provide great opportunities for exploring unprecedented cyberinfrastructure-based medical imaging systems and networks.

Speaker's Bio:

Jun Ni received his BS in Navel Architecture from Harbin Engineering University, MS in Power Machinery Engineering from Shanghai Jiao Tong Univ. (SJTU), China, in 1982 and 1984, respectively, and Ph.D. in Mechanical Engineering from the University of Iowa, USA, in 1991. He was a postdoctoral associate, worked on human's vocal movement and laryngeal airflow, at National Speech Pathology Center at UI from 1992 to 1993, and then at School of Mech. Eng. of Purdue University from 1993 to 1994. Since 1994, he has employed as a senior computing consultant, associate research scientist, research scientist, and director. He has been administrating UI centralized HPC facility, providing HPC consultation in scientific computing, and developing Grid/HPC applications. He is an adjunct associate professor in the Depts. of Computer Science, and Mechanical Engineering at UI. He is the director of Medical Imaging HPC Lab, the associate director of CT/Micro-CT Lab at Dept. of Radiology, and the direct of HPC Nanotechnology Lab at UI's Nano-science and Nanotechnology Institute (NNNI@UI). He involves many multi-disciplinary research projects. He has 75 peer-reviewed conference and journal papers with more than 300 journal paper citations (ISI) to his first-author journal papers. He is an editor/guest editor for about 20 journals and sits on 5 editorial boards of journals in computer science. He edited many books, reviewed technical papers for 20 journals and 23 books/textbooks for 10 academic publishers. He served as a chair of many conferences/workshops and as a member of many conference committees. He is a member of IEEE, IEEE/CS, AAAS, ASME, ACM, FAS, National STEM Education Coalition. The details of Dr. Ni's accomplishments, grants, and project activities are available at: <http://www.cs.uiowa.edu/~jni/>.

