The Excitement in Parallel Computing

Laxmikant Kale

Department of Computer Science
University of Illinois at Urbana-Champaign, USA

Abstract. The almost simultaneous emergence of multicore chips and petascale computers presents multidimensional challenges and opportunities for parallel programming. Machines with hundreds of TeraFLOP/S exist now, with at least one having crossed the 1 PetaFLOP/s rubicon. Many machines have over 100,000 processors. The largest planned machine by NSF will be at University of Illinois at Urbana-Champaign by early 2011. At the same time, there are already hundreds of supercomputers with over 1,000 processors each. Adding breadth, multicore processors are starting to get into most desktop computers, and this trend is expected to continue. This era of parallel computing will have a significant impact on the society. Science and engineering will make breakthroughs based on computational modeling, while the broader desktop use has the potential to directly enhance individual productivity and quality of life for everyone. I will review the current state in parallel computing, and then discuss some of the challenges. In particular, I will focus on questions such as: What kind of programming models will prevail? What are some of the required and desired characteristics of such model/s? My answers are based, in part, on my experience with several applications ranging from quantum chemistry, biomolecular simulations, simulation of solid propellant rockets, and computational astronomy.

Biography: Professor Laxmikant (Sanjay) Kale has been working on various aspects of parallel computing, with a focus on enhancing performance and productivity via adaptive runtime systems, and with the belief that only interdisciplinary research involving multiple CSE and other applications can bring back well-honed abstractions into Computer Science that will have a long-term impact on the state-of-art. His collaborations include the widely used Gordon-Bell award winning (SC'2002) biomolecular simulation program NAMD, and other collaborations on computational cosmology, quantum chemistry, rocket simulation, space-time meshes, and other unstructured mesh applications. He takes pride in his group's success in distributing and supporting software embodying his research ideas, including Charm++, Adaptive MPI and the ParFUM framework. Prof. Kale received the B.Tech degree in Electronics Engineering from Benares Hindu University, Varanasi, India in 1977, and a M.E. degree in Computer Science from Indian Institute of Science in Bangalore, India, in 1979. He received a Ph.D. in computer science in from State University of New York, Stony Brook, in 1985.

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