Kirk E. Jordan

Title: Petascale Barrier Surpassed But How Will We Solve Real Problems on Petascale Systems and/or Exascale Systems?

IBM T J Watson Research Center
http://www-3.ibm.com/software/info/university/people/kjordan.html
kjordan@us.ibm.com

High performance computing (hpc) is a tool frequently used to understand complex problems in numerous areas such as aerospace, biology, climate modeling and energy. Scientists and engineers working on problems in these and other areas demand ever increasing compute power for their problems. In order to satisfy the demand for increase performance to achieve breakthrough science and engineering, we turn to parallelism through large systems with multi-core chips. For these systems to be useful massive parallelism at the chip level is not sufficient. I will describe some of the challenges that will need to be considered in designing Petascale and eventually Exascale systems. However, the hardware development is not as hard as designing algorithms that will exploit these systems. Through the combination of hpc hardware coupled with novel algorithmic approaches, such as multigrid methods, some efforts toward breakthroughs in science and engineering are described. While progress is being made, there remain many challenges for the computational science community to apply ultra-scale, multi-core systems to Big science problems with impact on society. In conclusion, some discussion not only on the most obvious way to use ultra-scale, multi-core hpc systems will be given but also some thoughts on how one might use such systems to tackle previously intractable problems.