Editor’s Preface

Proceedings of the 2004 DoD HPCMP Users Group Conference

Wernher Von Braun is purported to have said “research is what I’m doing when I don’t know what I’m doing.” Although it does have a certain charm, I never really liked this quote. I actually think that most scientists and engineers—including the late Dr. Von Braun—believe they do know what they are doing when they’re doing research. But, from time to time, the unexpected happens and discovery may ensue.

To help fulfill our vision to provide a pervasive culture among DoD’s scientists and engineers where they routinely use advanced computational environments to solve the most demanding problems, the builders, users, managers and providers of the DoD’s High Performance Computing Modernization Program (HPCMP) have been gathering once a year for a Users Group Conference (UGC) since the Program’s inception in 1993. For the first time in 2003, we arranged for the Proceedings of the UGC to be published (Proceedings/2003 Users Group Conference, 9–13 June 2003, Bellevue, Washington; sponsored by Department of Defense High Performance Computing Modernization Program, IEEE Computer Society, Los Alamitos, CA). For those inaugural Proceedings, authors of 55 of the 103 contributed and invited abstracts from the 2003 UGC took advantage of the opportunity to write full-length technical papers. The response was enthusiastic, and the HPCMP has decided to make publishing the proceedings of the UGC an annual tradition! These second Proceedings of the UGC are based on presentations made at the 2004 UGC held 7–11 June at the Williamsburg Marriott in Williamsburg, VA.

The 380 attendees represented the U.S. government, the U.S. Department of Defense research, development, test, and evaluation communities, academia, and industrial partners. The UGC program committee, led by General Chair Steve Finn, Technical Chair Alan Wallcraft, and Tutorial Chair Stacy Howington, organized the conference and built an excellent technical program from the wide range of activities within the HPCMP community.

A pair of plenary sessions were held during the mornings of the first two days of the technical program. The conference opened with a keynote address from Dr. Charles J. Holland, Deputy Under Secretary of Defense for Science and Technology. Dr. Holland oversees several DoD Programs including the HPCMP, and helps execute the $10B annual Defense Science and Technology budget. He stated that “S&T is a key enabler of transformation. It not only provides the technology for future warfighting capabilities, but provides opportunities for changing doctrine that govern the way future forces fight.” A former Director of the HPCMP, Dr. Holland knows first hand how HPC can accelerate the development of technology for future warfighting capabilities, and he highlighted several areas in which HPC is having impact such as using computational fluid dynamics (CFD) for fast certification of weapon stores, weather and oceanographic prediction models for recent operations in Operation Iraqi Freedom, multidisciplinary applications of CFD with computational structural mechanics and plasma physics for advanced concepts in hypersonics, and IT technologies for protecting the information infrastructure.

Also speaking in the first plenary session was Mr. Walter Hollis, Deputy Under Secretary of the Army for Operations Research. Mr. Hollis reminisced about the first major shared resource center acquisition and emphasized the importance of high performance computing to the community and how it has changed over the years. Dr. Mark Moran of the U.S. Army Corp of Engineers Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, spoke of how the current generation of high performance computing hardware opens the doors to new technical possibilities of holding down the costs for development of a wide number of Future Combat Systems concepts.

Dr. Jermey Kepner, MIT Lincoln Laboratory presented an overview of the DARPA High Productivity Computing Systems program and reviewed progress made by the HPCS Productivity Team that he leads and that is developing a framework for HPC productivity by modeling and analyzing existing HPC codes, developing tools and models for the analysis of productivity, building meaningful HPC benchmarks, and conducting HPC development time and execution time experiments. Mr. Cray Henry, Director of the HPCMP reported on the state of the Program...
and noted several changes that are in the planning states. For example, the software component of the Program
(formerly CHSSI) is now called Software Applications, and Mr. Henry discussed a new initiative to create HPC
Software Applications Institutes in a few strategically chosen areas at several sites in the DoD HPC community.

During the second plenary session, Dr. Steven Ashby, Deputy Associate Director, Computing Applications and
Research, Computation Directorate, Lawrence Livermore National Laboratories (LLNL), spoke about computational
science at Lawrence Livermore National Laboratory and how Livermore is partnering with industry and academia to
advance the state-of-the-art in scientific simulation and computational science research to enable breakthrough
scientific discoveries. Dr. Ashby noted that LLNL is planning for the BlueGene/L machine from IBM in 2005 that
will have 216 compute nodes and an aggregate peak theoretical computational speed of 360 teraFLOPS (trillion
floating-point operations per second).

Dr. Raymond Gordnier, Air Force Research Laboratory, Air Vehicles Directorate, Computational Science
Center showed that the U.S. Air Force requires that Unmanned Air Vehicles systems are novel in platform and
operation, where a successful computational framework for multi disciplinary simulations has been established.

Dr. Jerry Bernholc, Department of Physics, at North Carolina State University, gave an introduction to the
physics of nanotubes and discussed how advanced computational algorithms and high-end computational resources
are enabling researchers to predict from first principals the properties of new materials. His parallel electronic
structure code Using real-space multigrid methods allows him to perform ab initio studies of very large systems
including semiconductors, nanotubes, and biomolecules.

The last activity in the second plenary session was another experiment. I led a panel discussion on the topic
“What are we doing and what should we be doing to achieve sustained and productive high-end computing in
2010?” Panel members included: Dr. Frederick Johnson, Senior Technical Manager, DoE Office of Science; Dr.
David Koester, Mitre and DARPA HPCS Productivity Team; James McGraw, Deputy Director of the Institute of
Scientific Computing Research at LLNL; and Dr. Ronnal G. Minich, Advanced Computing Laboratory at LANL.
Each panelist briefly shared his answer to the question with the audience, and then the panel took questions from the
floor. The discussions were lively, but time was not sufficient to explore all the issues in sufficient depth. Most
attendees with whom I spoke agree that this was a good experiment that should be repeated at future UGCs.

The contributed topics addressed at the conference reflected the breadth of HPC activities performed throughout
the DoD science and technology and test and evaluation communities. Consistent with our Program’s vision “to
solve the most demanding problems”, many of the abstracts and papers discussed multidisciplinary projects that
impact important activities in the Department. The applications covered the spectrum from pure scientific
investigation through integrated modeling and testing, across all Services, and addressed important Defense
research, development, test and evaluation interests.

For these 2004 Proceedings, authors of 50 of the 98 invited and contributed abstracts took advantage of the
opportunity to write full-length technical papers. These papers are not ordered as they were presented during the
UGC, but rather are organized into sections that correspond roughly to some of the Program’s largest Computational
Technology Areas. I hope you enjoy these papers, and I believe if you read them all you will be impressed with the
depth and breadth of the DoD’s computational science activities. In fact, you may even think the authors really do
know what they are doing, even though most of them are doing research! I’ll end here with another Von Braun
quote—one that I really do like. “Man is the best computer we can put aboard a spacecraft... and the only one that
can be mass-produced with unskilled labor.” Happy reading!

Robert E. Peterkin, Jr.
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