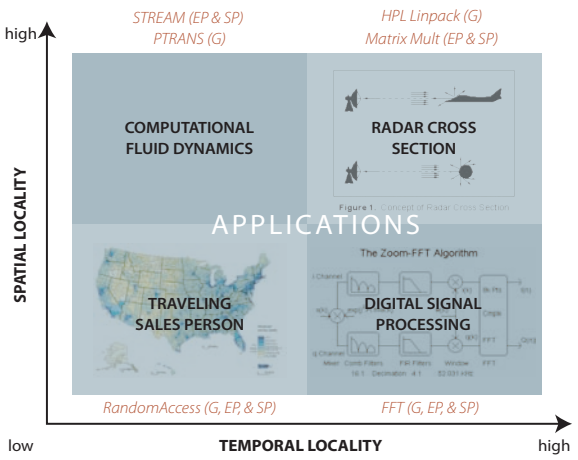
HPC CHALLENGE

http://icl.cs.utk.edu/hpcc/

PROJECT **GOALS**

- Provide performance bounds in locality space using real world computational kernels
- Allow scaling of input data size and time to run according to the system capability
- Verify the results using standard error analysis
- Allow vendors and users to provide optimized code for superior performance
- Make the benchmark information continuously available to the public in order to disseminate performance tuning knowledge and record technological progress over time
- Ensure reproducibility of the results by detailed reporting of all aspects of benchmark runs



SUMMARY OF **HPCC AWARDS**

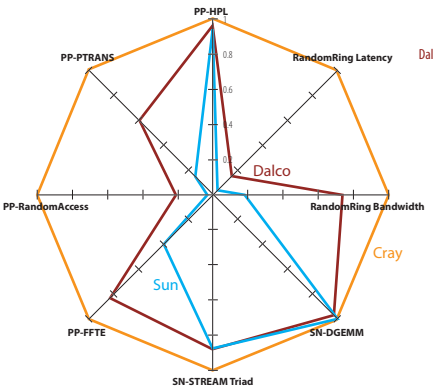
Class 1: Best Performance

- Best in G-HPL, EP-STREAM-Triad per system, G-RandomAccess, G-FFT
- Each of 4 winners gets $500

Class 2: Most Productivity

- One winner receives $1500
- Judged by a panel at SC06 BOF
- Stresses elegance and performance
- Implementations in various (existing and new) languages is encouraged
- Submissions consists of: code, description, performance numbers, and a presentation

Sponsored by HPCwire



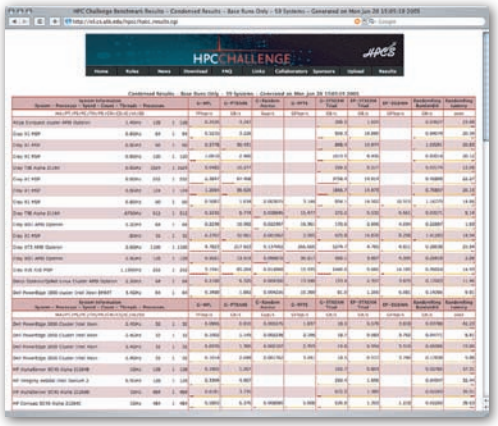
Dalco Opteron/QsNet Linux Cluster AMD Opteron
64 procs – 2.2 GHz
1 thread/MPI process (64)
QsNetII
11-04-2004

Cray XD1 AMD Opteron
64 procs – 2.2 GHz
1 thread/MPI process (64)
RapidArray Interconnect System
11-22-2004

Sun Fire V20z Cluster AMD Opteron
64 procs – 2.2 GHz
1 thread/MPI process (64)
Gigabit Ethernet, Cisco 6509 switch
03-06-2005

HPCC VERSION 1.0 FEATURE HIGHLIGHTS

- Simplified benchmark configuration
- Vastly improved FFT code with 64-bit scalable data size and support for Distributed Shared Memory machines
- More flexibility in running G-RandomAccess and much faster verification code
- Better result reporting capabilities



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HPC CHALLENGE

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Jack Dongarra and Piotr Luszczek of the Innovative Computing Lab (ICL) at the University of Tennessee Knoxville announced the new release of a benchmark suite - the HPC Challenge Benchmarks - at SC2004 in Pittsburgh, November 12, 2004 at a panel session. But work on the benchmark started more than a year earlier with the first result submissions dated November 5, 2003. March 2004 marked two important milestones for the benchmark: 1 T flop/s was exceeded on HPL test and the first submission with over one thousand processors was recorded. FFT test was introduced in version 0.6 in May 2004 and the first submission was recorded in July the same year. As of early October 2005, the fastest system in the database obtained nearly 1 T flop/s in the Global FFT test (three orders of magnitude increase over time). At the same time, the fastest (in terms of HPL) system is listed at position 11 on June's edition of TOP500 list, but the result recorded in the HPCC database is four percentage points higher in terms of efficiency. Today all of these achievements have been superseded by submissions from TOP500's highest ranking machines including the number one entry.

Jack Dongarra described the goals of the HPC Challenge Benchmarks: "The HPC Challenge Benchmarks will examine the performance of HPC architectures using kernels with more challenging memory access patterns than just the High Performance Linpack (HPL) benchmark used in the TOP500 list. The HPC Challenge Benchmarks are being designed to augment the TOP500 list, provide benchmarks that bound the performance of many real applications as a function of memory access characteristics - e.g., spatial and temporal locality, and provide a framework for including additional benchmarks." HPCC is already up to par with TOP500 in terms of HPL performance and it also offers a far richer view of today's High End Computing (HEC) landscape as well as giving an unprecedented array of performance metrics for various analyses and comparison studies.

HPCC has received exposure in numerous news outlets including Business Wire, Cnet, eWeek, HPCwire, and Yahoo!. The website receives over 100,000 hits per month and the source code download rates exceed 1,000 downloads per year. A different kind of publicity comes from the acquisition procedures as supercomputer centers around the world choose HPCC for their required performance testing from bidding vendors.

June 2005 marked the release of version 1.0 of the benchmark code and announcement of the HPCC Awards competition. In summary, the competition has two classes of submission; Class 1: Best Performance and Class 2: Most Productivity. The former invites submissions from large HPC installations around the globe and awards four winners ($500 each) in four categories (HPL, STREAM, FFT, RandomAccess). The latter invites mostly source code submissions in various languages and stresses the productivity aspect of programming languages and HEC architectures. A single winner is awarded $1500. The competition is sponsored by HPCwire and the results will be announced during a BOF session at the SC06 conference in Tampa, FL on November 14, 2006 at 12:15pm in Ballroom B-C. Additional information on the awards competition can be found on the HPCC Awards website: http://www.hpcchallenge.org/

Development of the HPC Challenge Benchmarks is being funded by the Defense Advanced Research Projects Agency (DARPA) High Productivity Computing Systems (HPCS) Program. William Harrod, the HPCS program manager, states, "We are interested in not only improved performance, but also ease of programming. These two combined are what will give us the productivity that the national security community needs. The HPCS program is developing activity and purpose benchmarks to allow developers and users to accurately evaluate emerging HPC systems. The HPC Challenge Benchmarks are the first major release of the activity or performance oriented benchmarks."

Additional information on the HPC Challenge Benchmarks can be found on the HPCC website: http://icl.cs.utk.edu/hpcc/

HPL This is the widely used implementation of the Linpack TPP benchmark. It measures the sustained floating point rate of execution for solving a linear system of equations.

STREAM A simple benchmark test that measures sustainable memory bandwidth (in GB/s) and the corresponding computation rate for four vector kernel codes.

RandomAccess Measures the rate of integer updates to random locations in large global memory array.

PTRANS Implements parallel matrix transpose that exercises a large volume communication pattern whereby pairs of processes communicate with each other simultaneously.

FFT Calculates a Discrete Fourier Transform (DFT) of very large one-dimensional complex data vector.

b_eff Effective bandwidth benchmark is a set of MPI tests that measure the latency and bandwidth of a number of simultaneous communication patterns.

DGEMM Measures the floating point rate of execution of double precision real matrix-matrix multiplication.