Analysis Tools for the HPCC Benchmarking Suite
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http://www.csm.ornl.gov/Internships/abstracts/antoinnetteTaylor.pdf

Abstract

This project focuses on exploring graphical tools to assist high-end computing (HEC) system evaluation researchers in studying benchmark results. These tools must provide various plotting capabilities for researchers to graph, examine and compare benchmark results collected from a number of HEC machines. The benchmark results are generated from the High Performance Computing Challenge (HPCC) benchmark suite. HPCC is in active use and produces a complex set of inter-related measurement data. The relationships are not always apparent due to the number and complexity of the metrics. Effective inter-comparison requires one to consider multiple metrics and their relationships to determine whether a particular set of measured results is "good" or "bad" relative to other similar machines. This project organizes and systematically analyzes the HPCC results through a spreadsheet-based prototype tool.
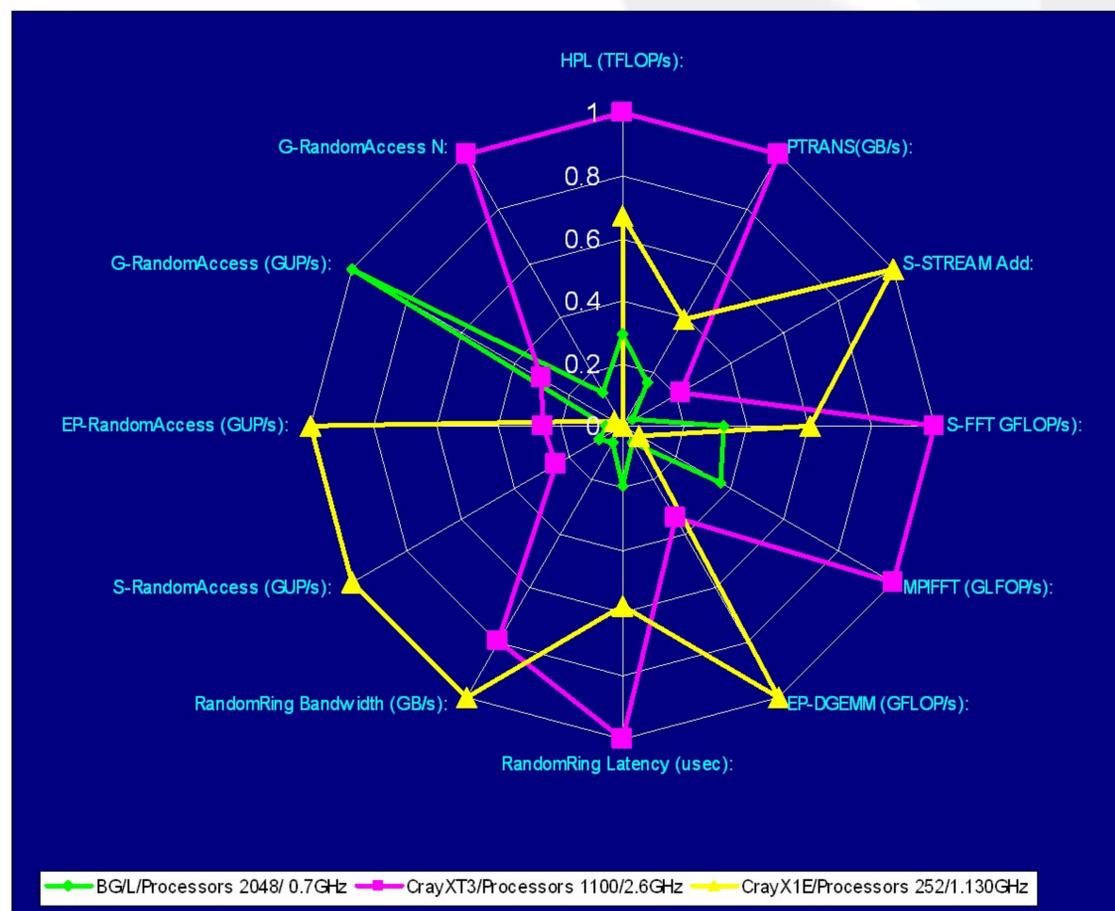
Generated Original Data

Processor Type:	BlueGene	Cray XT3	CrayX1E
Processors Entered:	2048	1100	252
Theoretical peak (Tflops/sec):	5.734	5.72	4.55616
HPL (TFLOP/s):	1.4075	4.78234	3.19409
PTRANS(GB/s):	34.251	217.923	85.204
S-STREAM Add:	0.907855	4.9484	23.1081
S-FFT GFLOP/s:	0.232085	0.716041	0.431237
MPIFFT (GLFOP/s):	96.1923	266.66	15.5352
EP-DGEMM (GFLOP/s):	0.904826	4.8105	14.1847
RandomRing Latency (usec):	4.97806	25.9424	14.9344
RandomRing Bandwidth (GB/s):	0.0208877	0.286379	0.360239
S-RandomAccess (GUP/s):	0.0067651	0.0194931	0.0799919
EP-RandomAccess (GUP/s):	0.0042195	0.0199543	0.0776293
G-RandomAccess (GUP/s):	0.454092	0.137002	0.0148684
G-RandomAccess N:	8.59E+09	6.87E+10	1

Normalized Data

Processor Type:	BlueGene	Cray XT3	CrayX1E
Processors Entered:	2048	1100	252
Theoretical peak (Tflops/sec):	1	0.9975584	0.7945867
HPL (TFLOP/s):	0.294312	1	0.6678927
PTRANS(GB/s):	0.1571702	1	0.3909821
S-STREAM Add:	0.0392873	0.2141414	1
S-FFT GFLOP/s:	0.3241225	1	0.6022518
MPIFFT (GLFOP/s):	0.3607301	1	0.0582585
EP-DGEMM (GFLOP/s):	0.0637889	0.339133	1
RandomRing Latency (usec):	0.191889	1	0.5756753
RandomRing Bandwidth (GB/s):	0.0579829	0.7949695	1
S-RandomAccess (GUP/s):	0.0845723	0.2436884	1
EP-RandomAccess (GUP/s):	0.054355	0.257046	1
G-RandomAccess (GUP/s):	1	0.3017054	0.0327431
G-RandomAccess N:	0.124999	1	1.455E-11

Project Objectives

- Gain an understanding of the seven basic benchmark test terms

- Compare benchmark results between the CrayX1, Cray TX3, and BG/L

- Construct a kiviat diagram using the benchmark results

BG/L/Processors 2048/ 0.7GHz — CrayXT3/Processors 1100/2.6GHz — CrayX1E/Processors 252/1.130GHz

Summary

- Basic benchmarks do not always show true picture
  - G-RandomAccess can be made 700x faster on X1E with UPC rewrite
- BG/L did well on the G-RandomAccess, but was beaten on MPIFFT by XT3
- Choice of "best machine" depends on application
- Kiviat diagrams (left) shows relationships between components
  - BG/L does well on RA, but problem size is small
- Impressive basic specifications not equivalent to performance
  - Many BG/L processors not faster on PTRANS
  - Low BG/L network latency does not make MPIFFT fast