Early experience with Itanium Cluster

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Overview

- High Performance Computing in Norway.
- About the Itanium processor.
- Expericence with the cluster/benchmarks.

High Performance Computing in Norway

- Norwegian High Performance Computing Consortium NOTUR.
- Mainly large shared memory machines.
- Little knowledge about clusters.

The Tromsø site

- HP SuperDome.
  - 32 550MHz PA-RISC cpus.
  - 32GB Memory.
- Four HP i2000 workstations.
  - dual 800MHz Itanium cpus.
  - 2GB Memory.
  - 100Mb/s ethernet network cards.

Why IPF cluster?

- Learn how to administrate clusters.
- Is cluster's a better solution than SMP for our users?
- Want to know more about IPF.
- Need a test-bed.

About the Itanium

- Instruction level parallelism (ILP)
  - Compilers responsibility.
- Predication - removes branches.
  - Executes both paths in a branch, and do check.
- Speculation - Hide memory latency.
  - Control speculation.
    - Move Loads before Branches.
  - Data speculation.
    - Move Loads before Stores.

Experience with the cluster

- (Cluster) Software.
- Benchmark results.
  - All results are obtained using Red Hat Linux 7.1, except where specified.

Cluster Software

- OSCAR, ROCKS
  - C3, LAM/MPI, MPICH, MAUI, OpenSSL, OpenSSH, PBS, Works.
  - (LUI), SystemImager, Does not work.
- Compilers, two options.
  - GNU
  - Intel

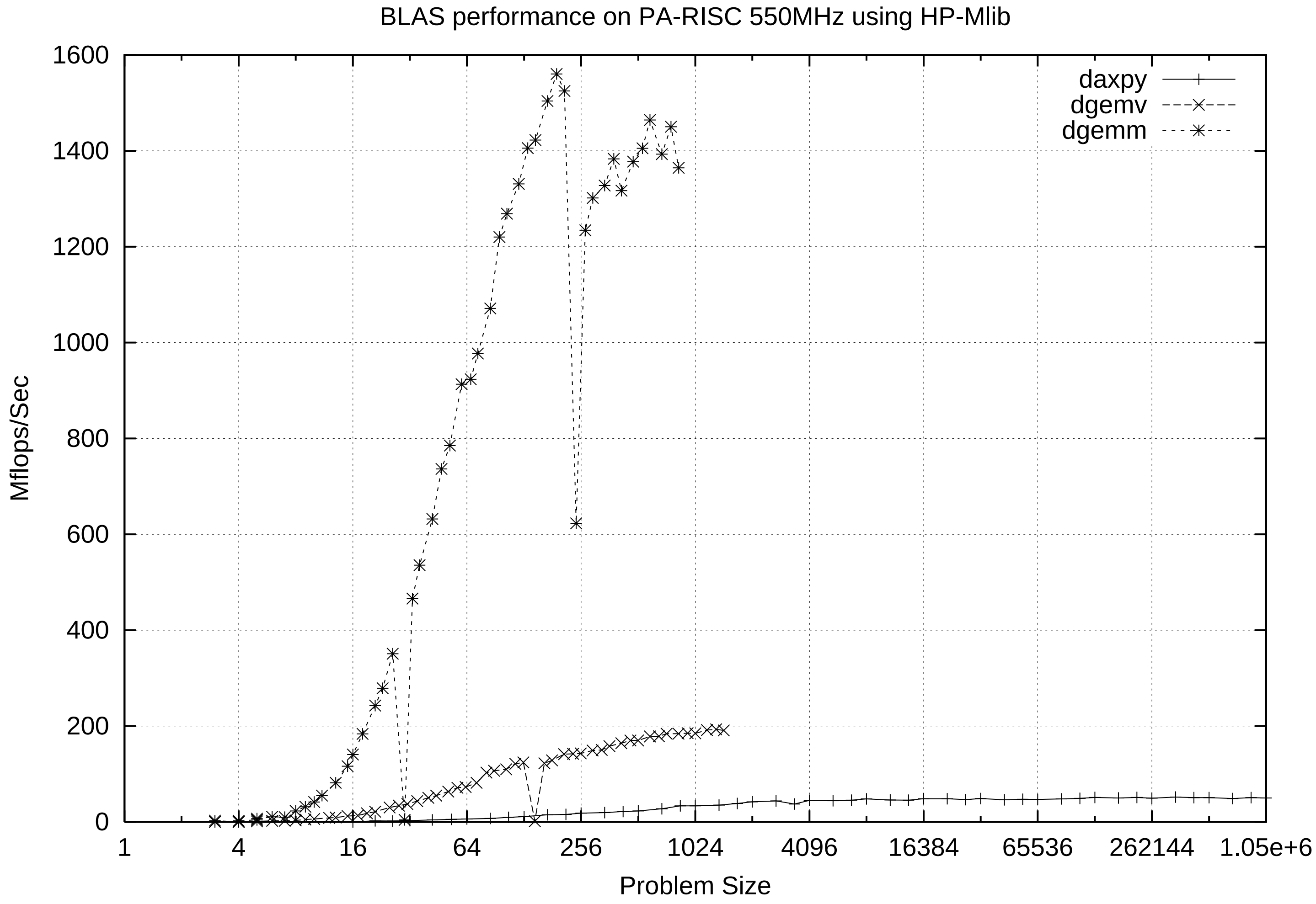
Benchmarks

- Llcbench
  - BlasBench
  - CacheBench
  - MPBench
- Stream
- Spec

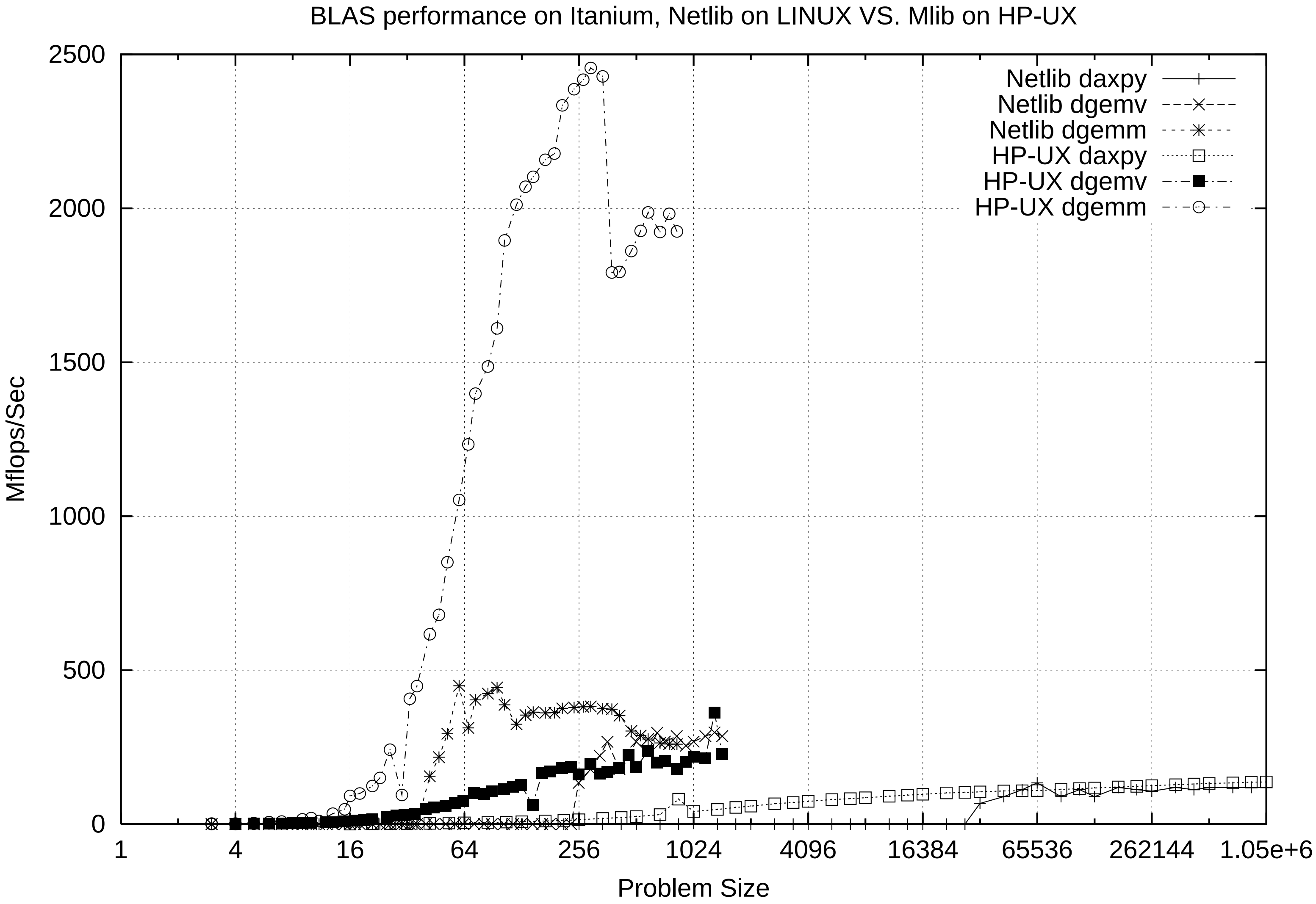
Llcbench

- BlasBench
  - Intel Math Kernel Library (MKL)
    - C-interface does not work
    - Fortran linking is buggy
  - ATLAS, poor performance, not tested.
  - Left with netlib blas/lapack.
- CacheBench
  - Good performance with the intel compiler.
- MPBench
  - Nothing new here since we use standard 100 Mb/s ethernet.

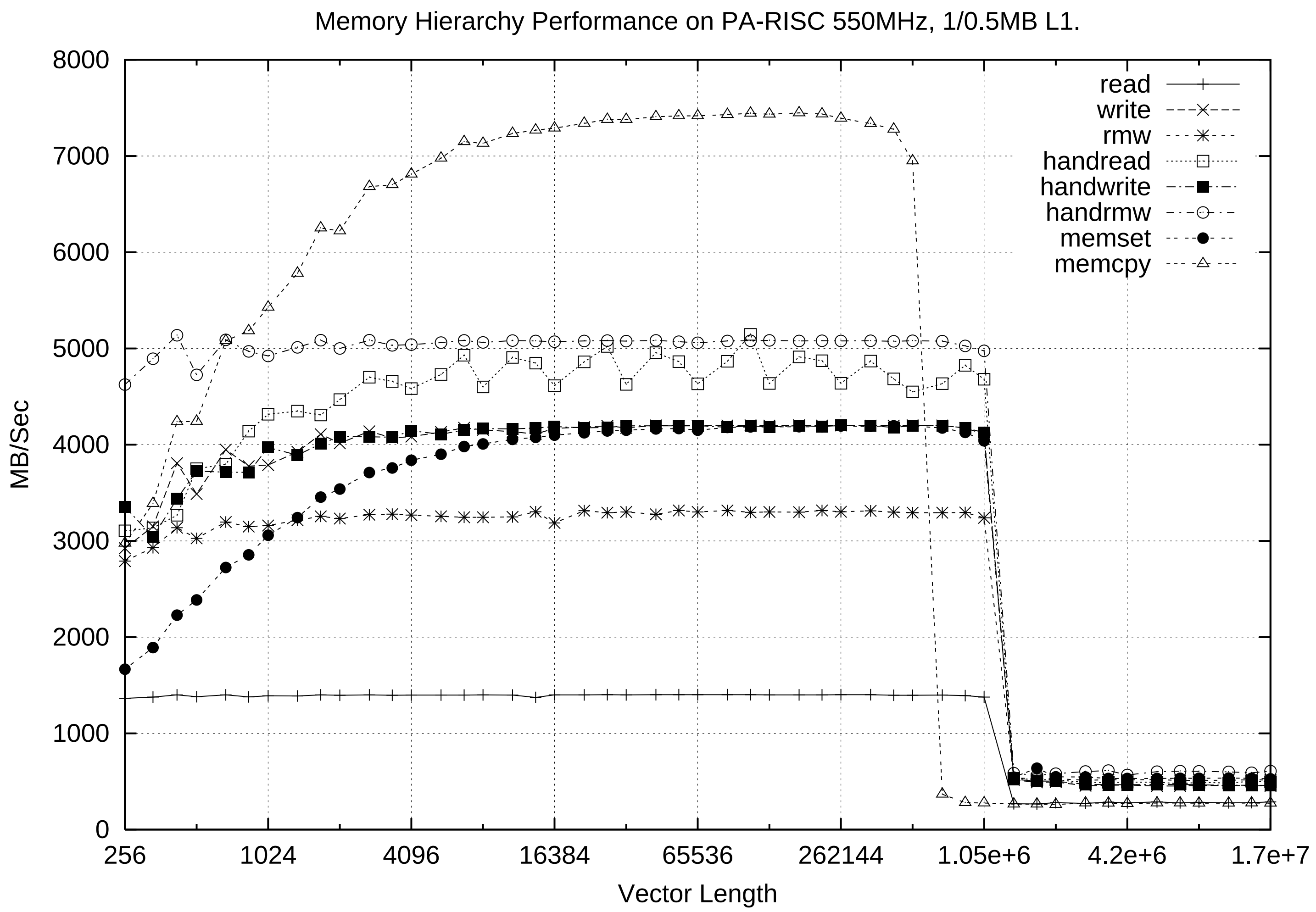
Llcbench, BlasBench on SuperDome



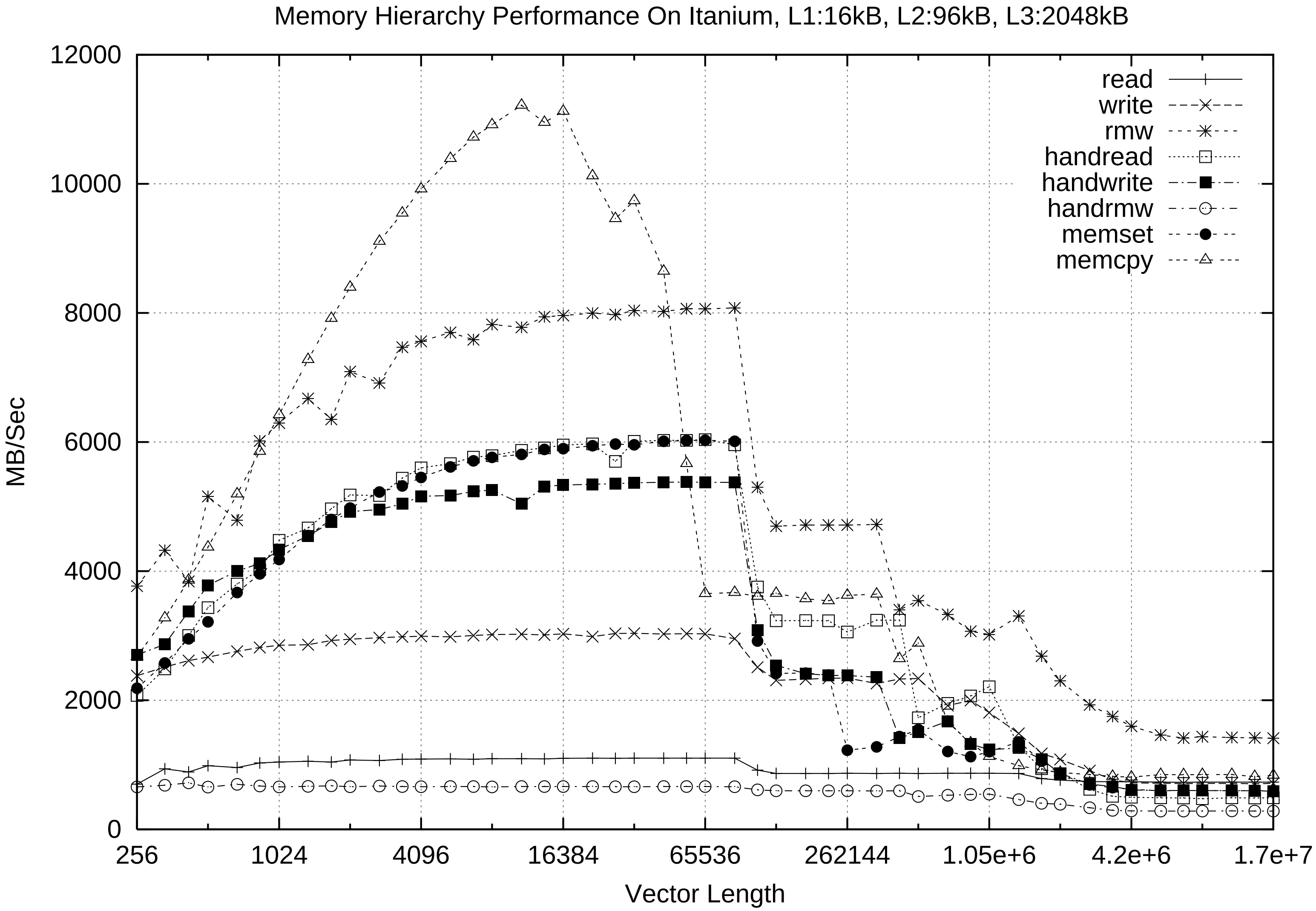
Llcbench, BlasBench



Llcbench, CacheBench on SuperDome



Llcbench, CacheBench



The Stream benchmark

Processor	Itanium			PA-RISC 8600
Compiler	GNU	Intel	HP	HP
OS	Linux		HP-UX	HP-UX
Function	Rate (MB/s)	Rate (MB/s)	Rate (MB/s)	Rate (MB/s)
Copy:	370.4	1091.6	1137.8	751.1
Scale:	299.6	1091.6	1128.0	749.1
Add:	351.4	1091.6	1228.1	776.5
Triad:	350.9	1091.6	1230.4	767.9

Table 1: Results from Stream Benchmark

The Spec benchmark

CPU	alpha 833MHz	Pentium4 2GHz	PentiumIII 1.13GHz	Itanium 800Mhz
OS	True64	Windows	Windows	Windows
Base	571	704	320	655
Peak	644	714	331	655

Table 2: Results from Spec CFP2000 Benchmark

- All numbers are obtained from: http://www.spec.org/

RESUME

- STILL BETA, but promising.
- Much to do on the GNU compiler.
- Hopefully new release of MKL soon.
- Cluster administration software needs improvement.

Some links

- High performance computing in Norway: http://www.notur.org/
- The linux on IPF project: http://www.linuxia64.org/
- Intel Itanium homepage: http://developer.intel.com/design/itanium/
- Scientific Computing on the Itanium processor: http://www.sc2001.org/papers/pap.pap266.pdf
- The AMD 64-bit processor project: http://www.x86-64.org/