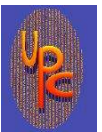


Benchmark Measurements of Current UPC Platforms

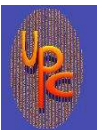
Zhang Zhang, Steven Seidel
Michigan Technological University

UPC Developer's Workshop
Washington D.C.

9/21/04



- Studied four currently available UPC compilers and run time systems.
 - MuPC
 - Berkeley UPC
 - HP UPC
 - Intrepid UPC (GCC UPC)
- Gathered benchmark measurements on three parallel machines.
 - Myrinet x86 Linux cluster
 - AlphaServer SC-40
 - Cray T3E



- The first to report on MuPC's performance.
- The first comparison of performance for currently available UPC implementations.
- This is the first report of UPC performance on a Linux cluster and a Cray T3E.
 - Previous studies have reported benchmarking results on HP AlphaServer and SGI Origin:

F. Cantonnet and T. El-Ghazawi, *UPC Performance and Potential: An NPB Experimental Study*. SC 2002.

W. Chen, D. Bonachea, et al. *A Performance Analysis of the Berkeley UPC Compiler*. ICS 2003.

F. Cantonnet, Y. Yao, et al. *Performance Monitoring and Evaluation of a UPC Implementation on a NUMA Architecture*. IPDPS 2004.



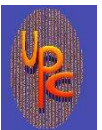
Benchmarks

- Synthetic benchmarks:
 - The STREAM microbenchmark was rewritten using UPC with more diversities of shared memory access patterns:
 - Local shared read / write
 - Unit stride shared read / write / copy
 - Random shared read / write / copy
 - Stride-n shared read / write / copy
 - Block transfers with variations of source and sink affinities.

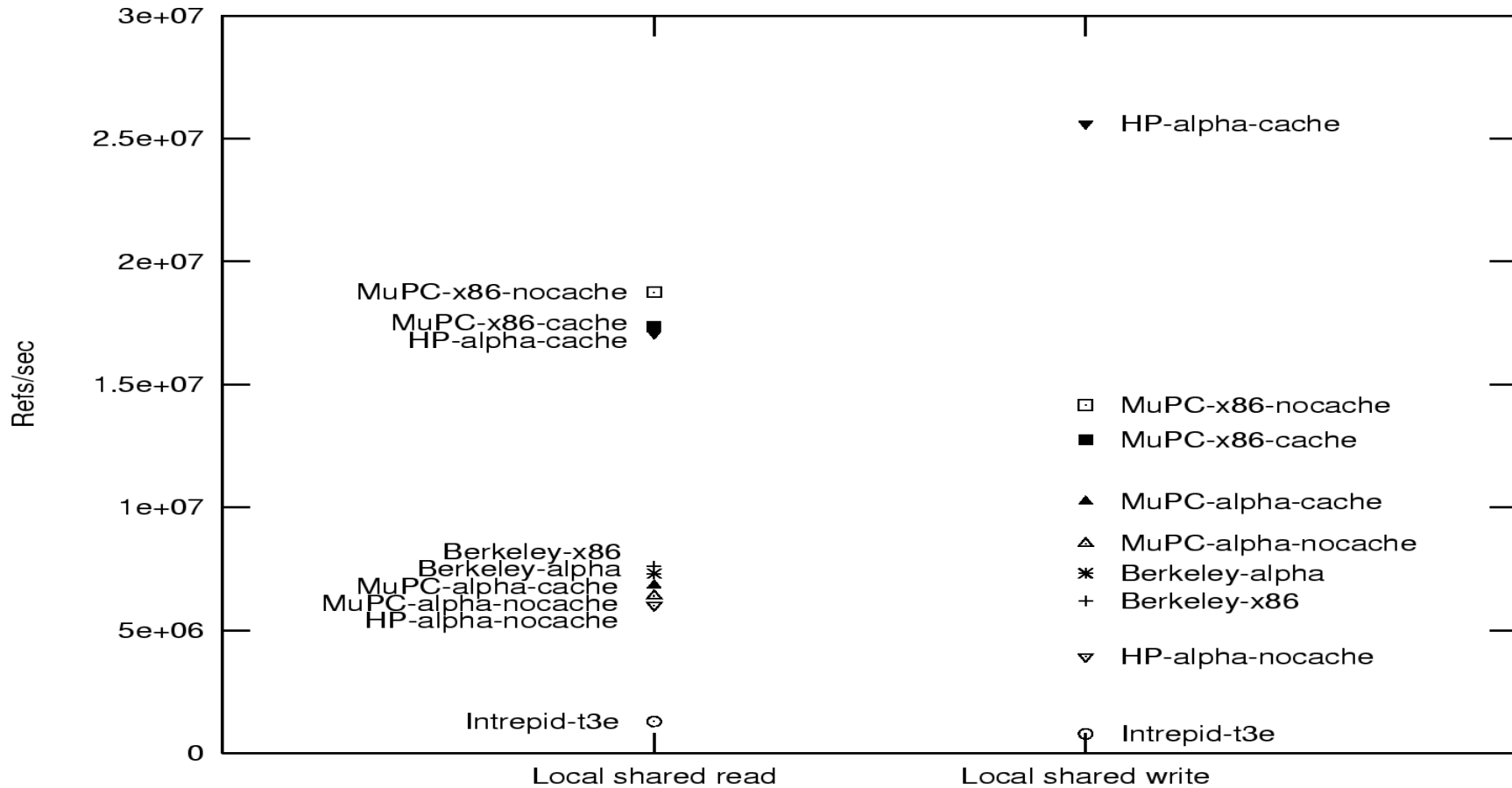


Benchmarks (cont'd)

- NAS Parallel Benchmark Suite v2.4
 - Five cores: CG, EP, FT, IS and MG.
 - The UPC implementation of the NPB suite was developed by GWU.
 - Class A workload was used as the input size for all benchmarks.
 - This study measured performance for the naïve version and the most hand-tuned version of each core.



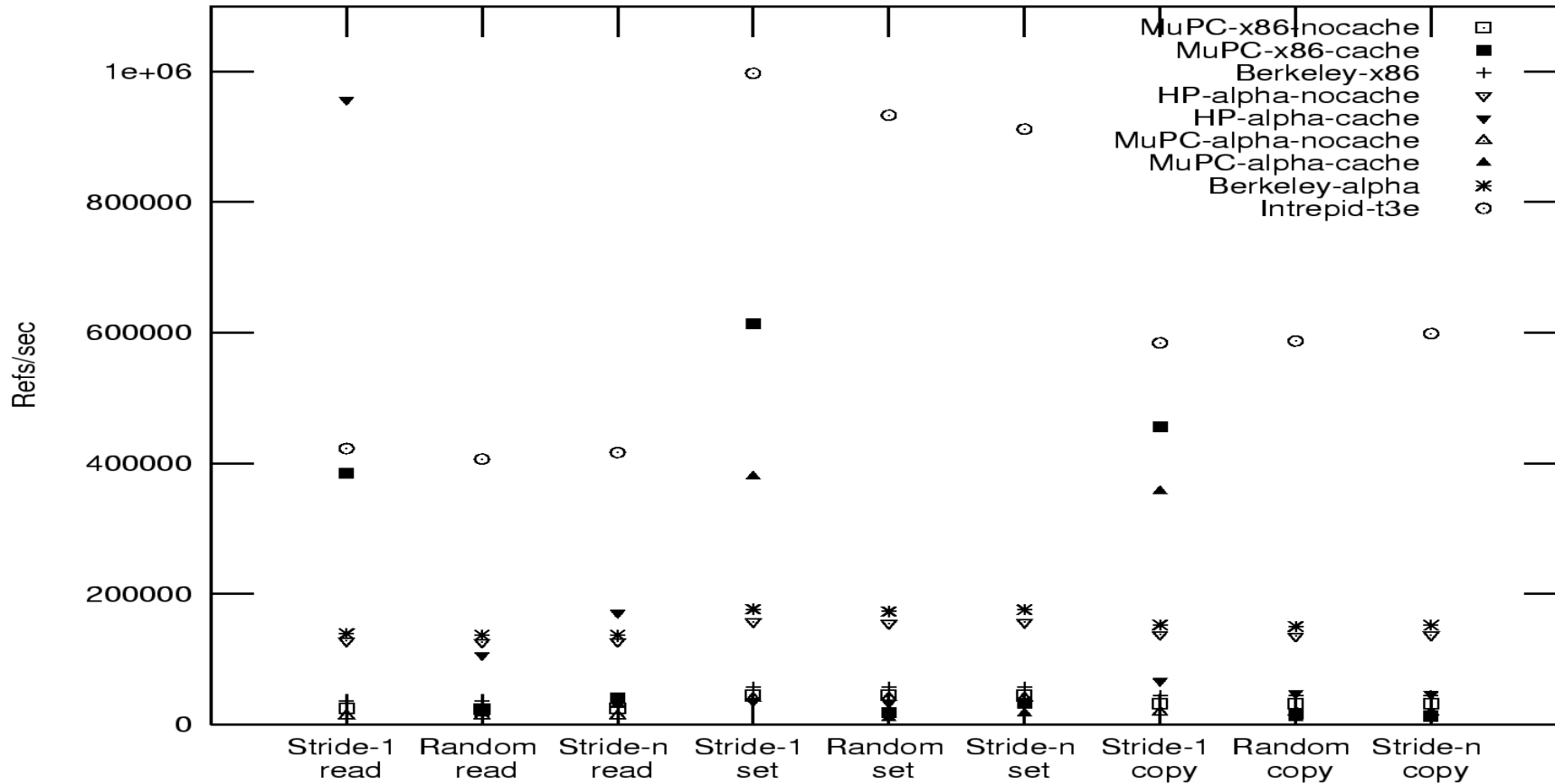
Local Shared Accesses



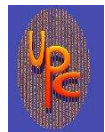
- Intrepid UPC: performance is poor on local shared accesses.
- HP UPC: cache state has significant effects on local shared accesses.



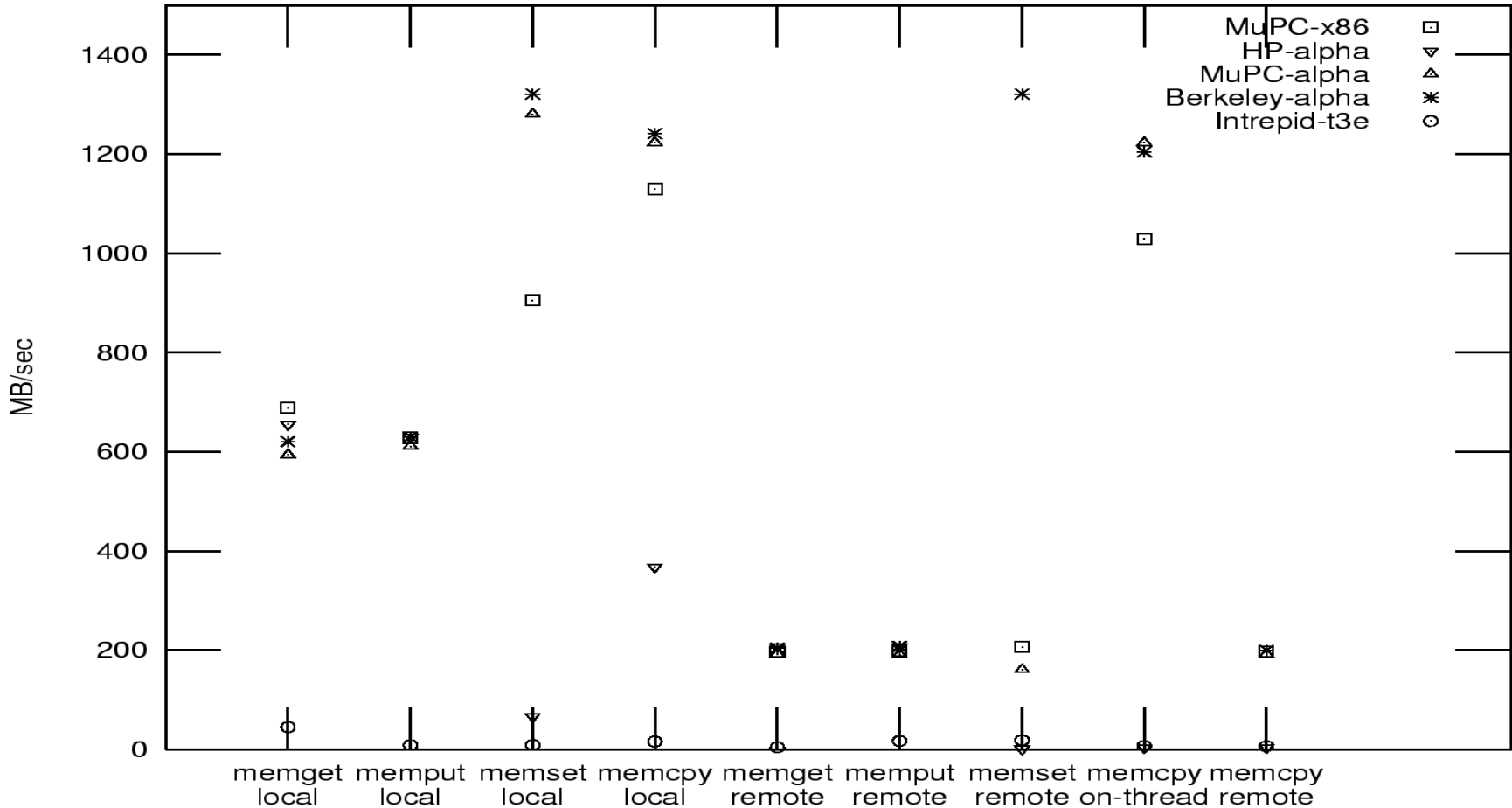
Remote Shared Accesses



- HP UPC and MuPC: caches help unit stride remote shared accesses.
- Intrepid UPC does the best for remote shared accesses.

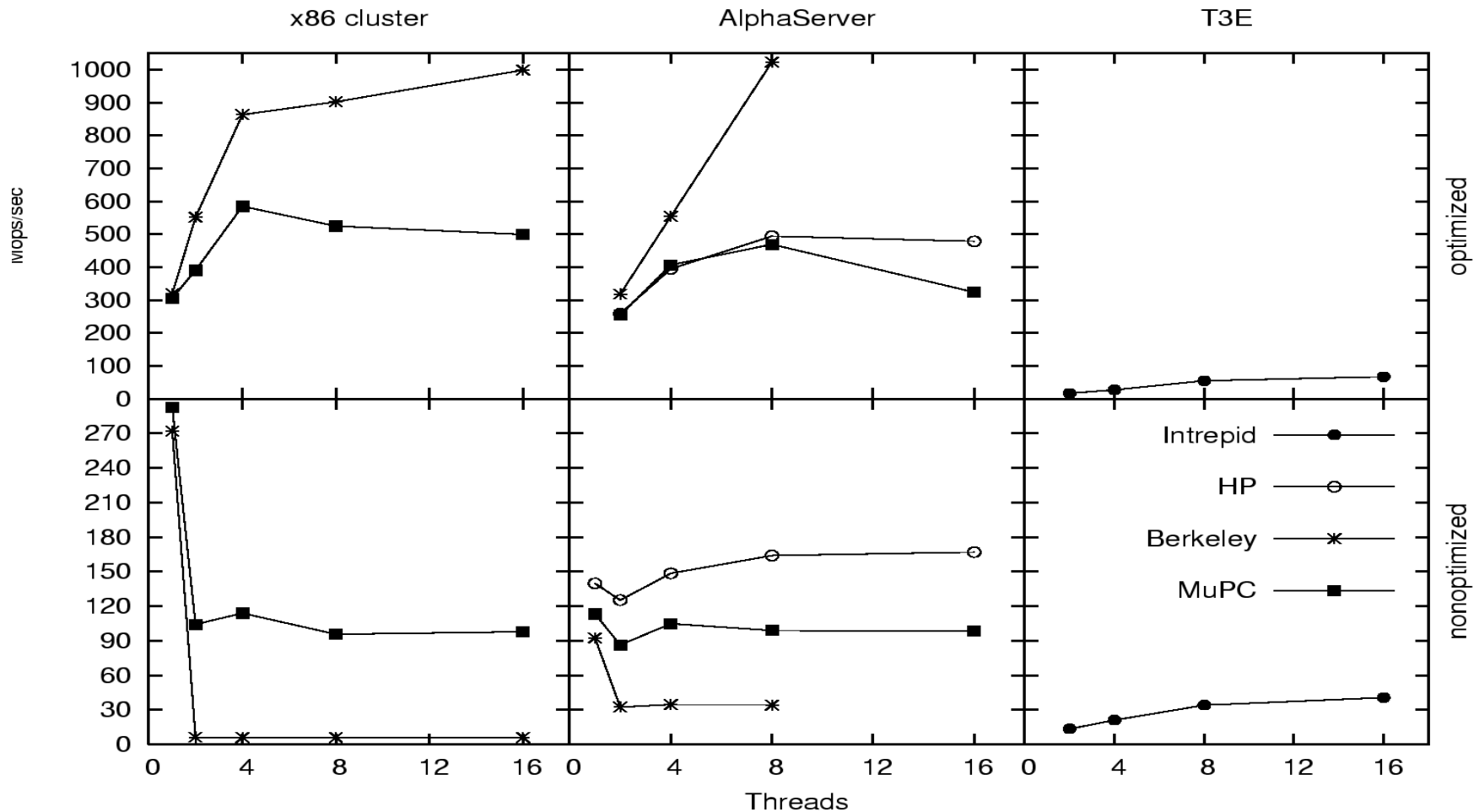


Shared String Handling Functions



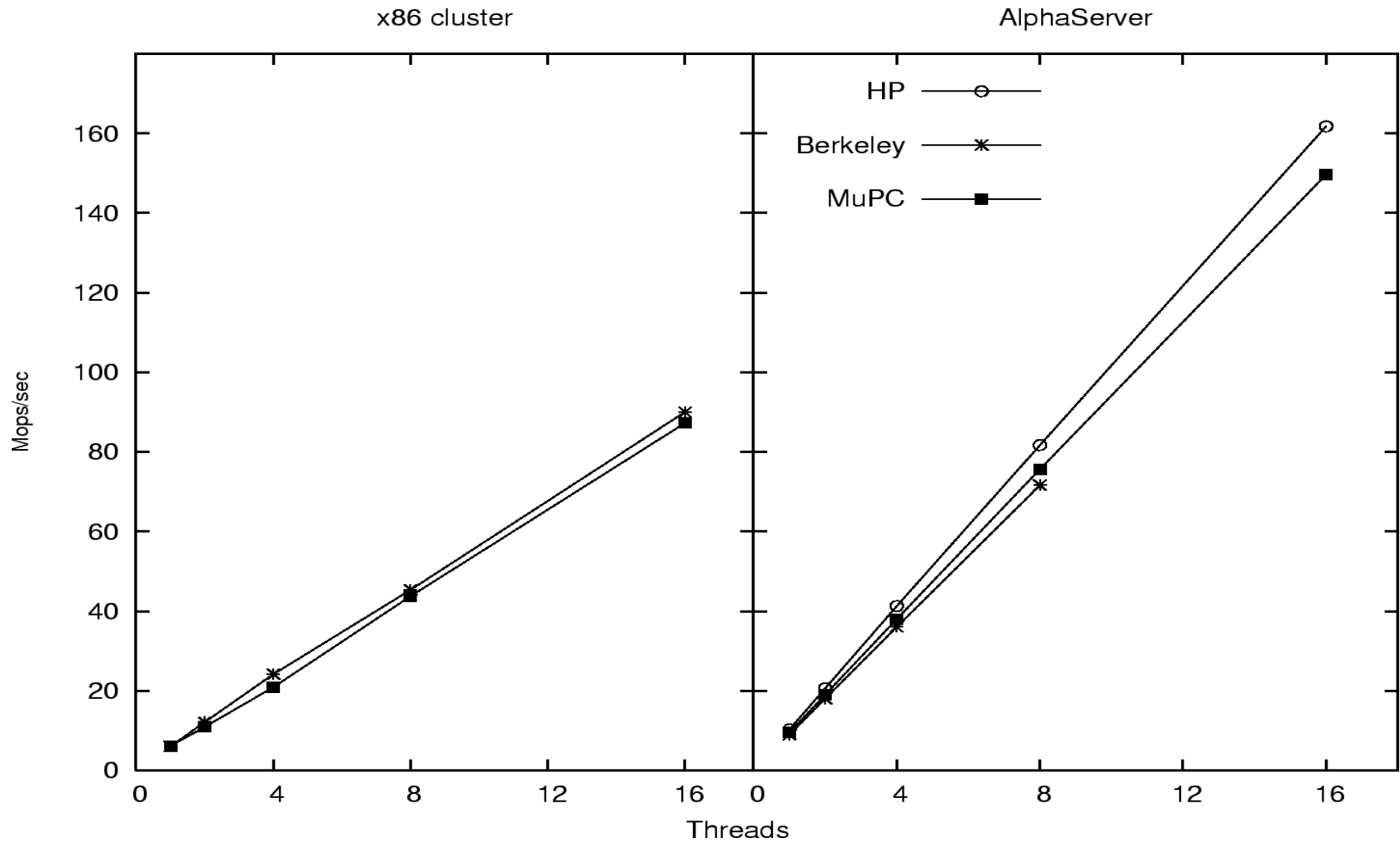
- HP UPC: performance is poor on certain string functions.
- Intrepid UPC: low performance on all categories.

NPB - CG

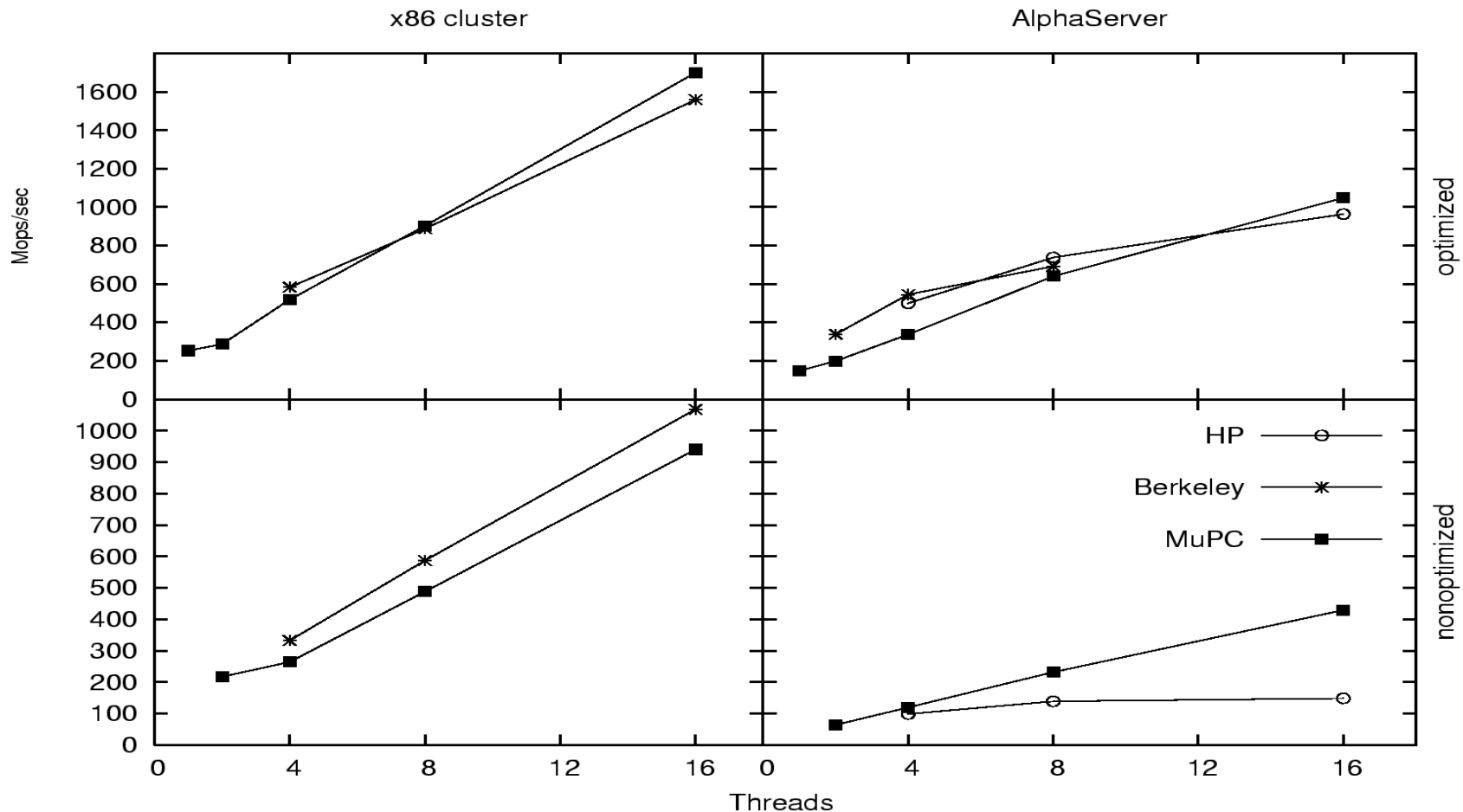


- Only Berkeley UPC scales well.

NPB - EP

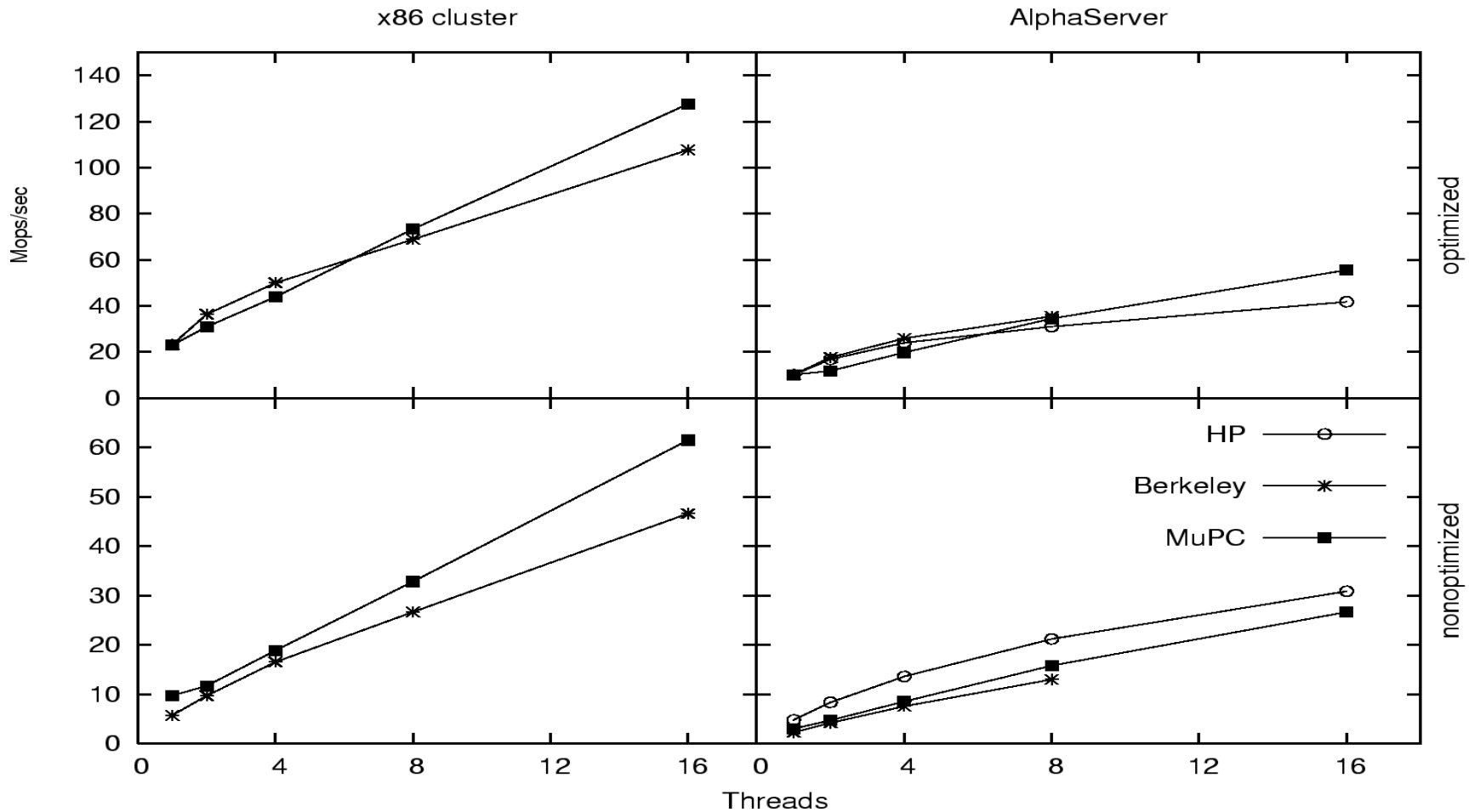


NPB - FT



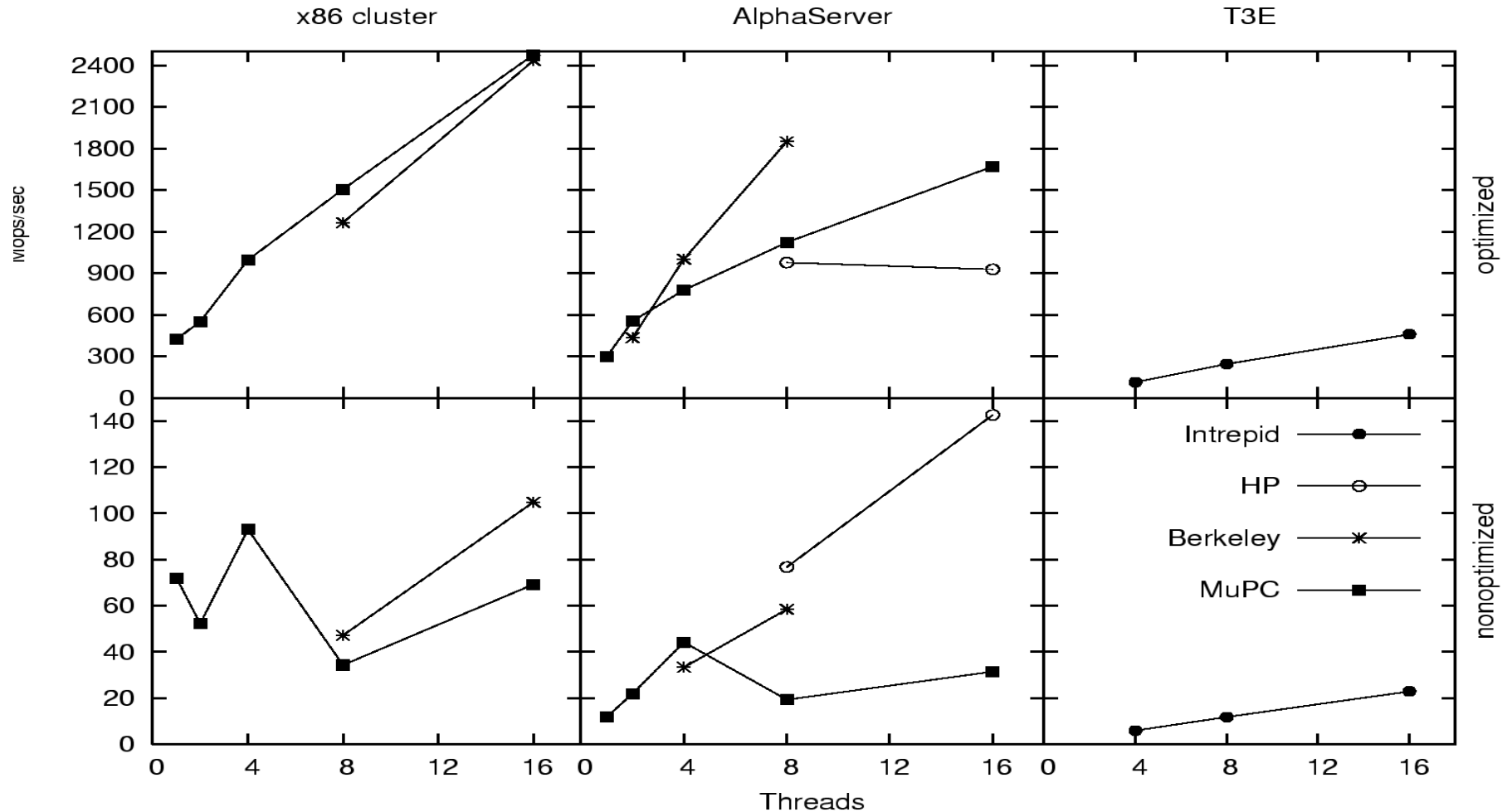
- HP, Berkeley and MuPC: performance is comparable.

NPB - IS



- HP, Berkeley and MuPC: performance is comparable.

NPB - MG



- MG performance is very inconsistent.