# Performance Analysis and Comparison of MPI, OpenMP and Hybrid NPB – MZ

Héctor J. Machín Machín
Texas A&M CS Department
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hjmachin@cs.tamu.edu

## Abstract

Chip multiprocessors (CMP) are widely used for high performance computing and are being configured in a hierarchical manner to compose a node in a parallel system. CMP clusters provide a natural programming paradigm for hybrid programs. Can current hybrid parallel programming paradigms such as hybrid MPI/OpenMP efficiently exploit the potential offered by such CMP clusters? In this research, with increasing the number of processors and problem sizes, we systematically analyze and compare the performance of MPI, OpenMP and hybrid NAS Parallel Benchmark Multi–Zone (NPB–MZ) on two supercomputers: DataStar p655 at San Diego Supercomputer Center (SDSC) and Hydra at Texas A&M Supercomputing Facilities to address the question. We also upload the performance data of NPB-MZ to Prophesy database and use Prophesy system to model the performance online.

Basic Tasks:

1. Parallel Environments and two supercomputers (SDSC p655 and TAMU Hydra)

2. Application: NAS Parallel Benchmarks with Multi-Zone Version

3. Scalability Analysis (with increasing number of processors and problem sizes)

4. Performance Comparison of MPI, OpenMP and Hybrid NPB-MZ

5. Processor Partitioning Impacts (with different number of processors per node)

6. Manually upload performance data to Prophesy Database

7. Online performance modeling using Prophesy system