The NAS Parallel Benchmarks on Virtual Parallel Machines

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Overview

- Description of NAS "Kernels"
- Implementation of MG and FT
- Platforms
- Enhanced PVM
- Communication Results

NAS "Kernels"

- EP: Embarrassingly Parallel

  2^{28} Gaussian Random Deviates
- MG: Multigrid Solver

  $\nabla^2 u = v$ on a 256^3 grid
- CG: Conjugate Gradient

  Smallest eigenvalue of sparse matrix
- FT: Fourier Transform

  3D FFTs on $256 \times 256 \times 128$ array to solve PDE
- IS: Integer Sort

  Rank 2^{23} integers

Benchmark	Communication
EP	None
MG	Structured Neighbor
CG	Unstructured Long Distance
FT	Structured Long Distance
IS	Connected Frequent Low Volume

Implementations

- Implementations based on code for Intel iPSC/860
- MG
  - Block distribute one dimension with overlap
  - Exchange borders

- FT
  - Block distribute one dimension
  - Transpose

Environments

- Workstation Clusters
- Cray Y-MP/1
- iPSC/860 32, 64, 128

#	WS	MFLOP/s	Net	MB/s
16	SS1+	28.8	E-net	1.25
8	RS/6000	146.0	Shared FDDI	12.5
9	SGI R4000	88.0	Switched FDDI	50.0
1	Y-MP/1	270.0	-	-
32	i860	313.6	-	-
64	i860	627.2	-	-
128	i860	1254.4	-	-

Enhanced PVM

- Implemented additional library called fsend/frecv
- Directly use TCP
- Eliminated PVM separate buffer initialization and packing
  argue packing costs 12 % of throughput
- Support heterogeneous environments, homogeneous message contents
- Node-Node performance shows near maximum throughput
- Over three times the BW of PVM for messages larger than 1KB