PACS-CS Performance Evaluation

Linpack Performance

P×Q	N	Rmax (Tflops)	Efficiency (%)	3D routing
16×160	706560	10.33	72.05	No
32×80	722944	10.35	72.20	Yes

- 10.35 TFLOPS with 2560 nodes #34 at 2006/June TOP500 list (#2 in Japanese manufactured machine)
- Performance differs by 2-D array configuration on HPL with routing overhead on 3-D HXB
- 6.7 hours of running time

## Performance of PM/Ethernet-HXB network layer
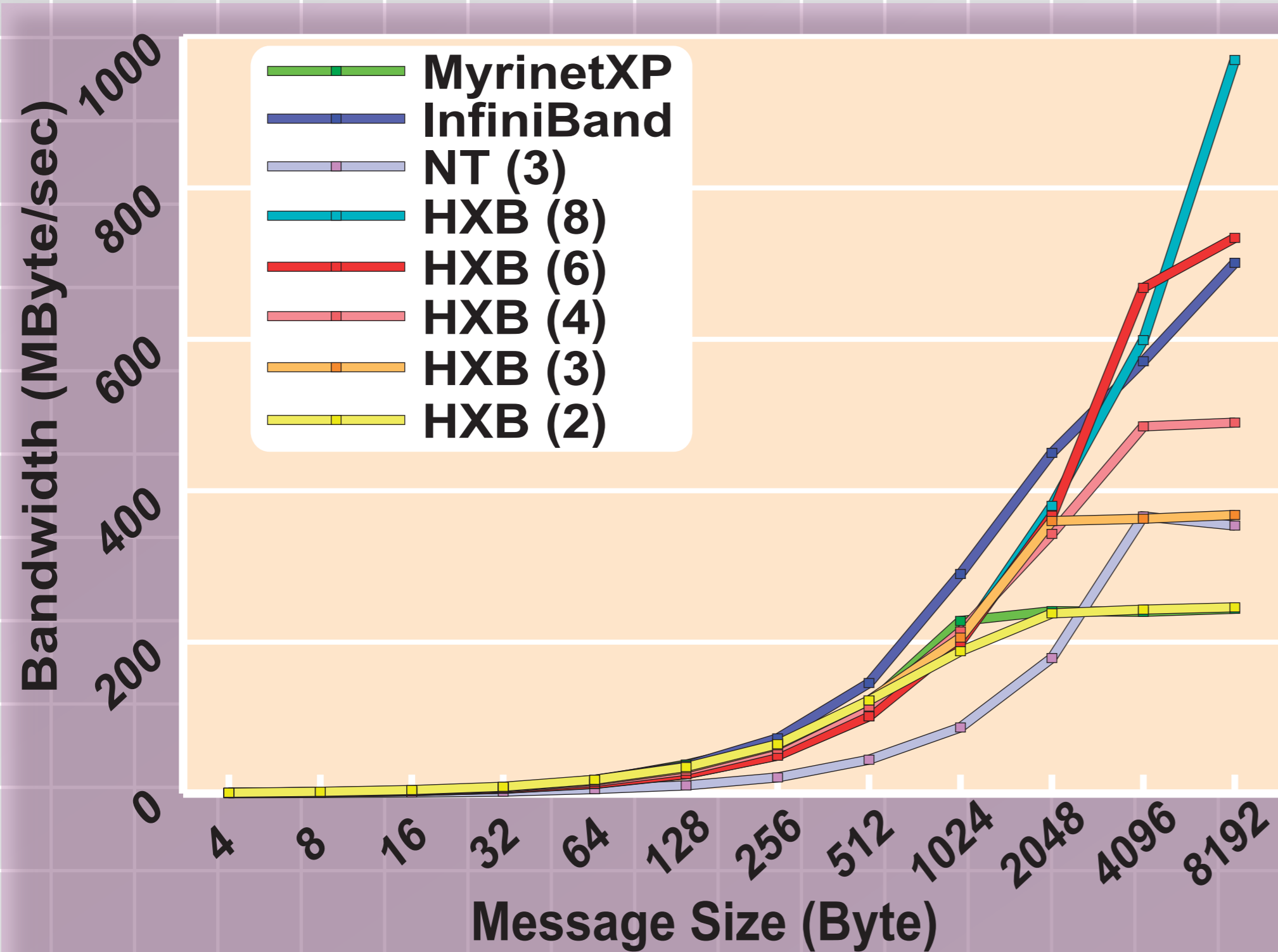
- HXB(n) = Sustained bandwidth with n links of GbE in PM/Ethernet-HXB communication layer
- Aggregated bandwidth with 6 GbE links is much wider than MyrinetXP and comparable with InfinibandSX
- High performance with low-latency software technology by PM/Ethernet-HXB
- Trunk network technology is applicable for wide variety of networks including 10GbE and Infiniband

3-D Simultaneous Burst Transfer Performance

Bandwidth/node [MB/s]	256 node	512 node
average	586.8 (78.2%)	582.0 (77.6%)
max.	619.3 (82.6%)	629.6 (84.0%)
min.	559.2 (74.6%)	434.0 (57.9%)

Bisection bandwidth on a single dimension
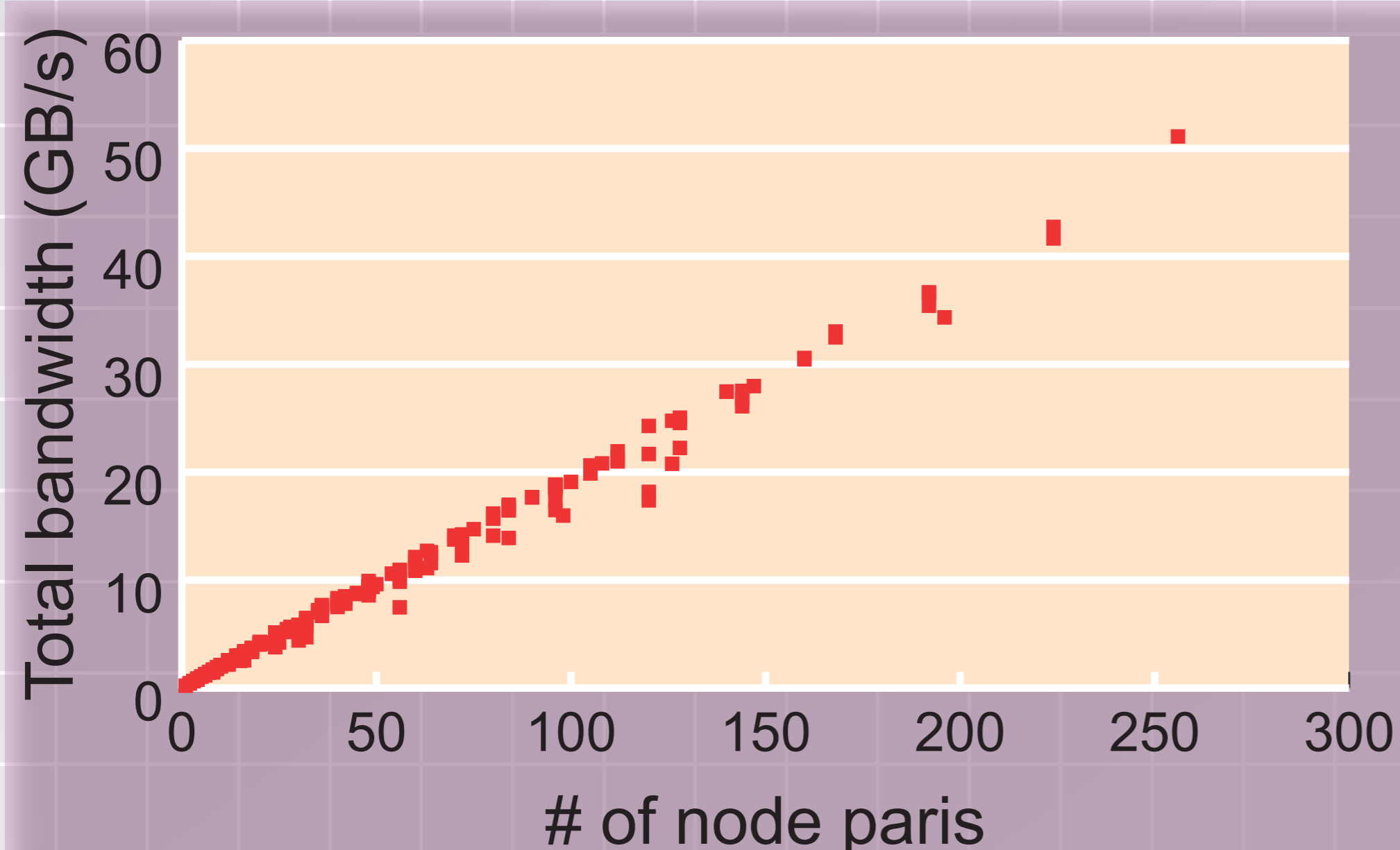
- Single-sided simultaneous burst transfer between two groups of nodes separated by the half point on one dimension
- MPICH user level sustained bandwidth
- Bisection bandwidth scales with the number of node pairs and it is never degraded
- The same performance on any dimension of 3-D Hyper-Crossbar network

CPU performance on QCD kernel

Data buffering	SSE3 assembler	SSE3 intrinsic	Fortran90 (SSE3 auto-vectorization)	Computation efficiency
NO	1872.94	1910.04	1451.25	34%
YES	1619.53	1645.64	1291.08	29%

- About 30% of peak performance with SSE3 instructions (data buffering for MPI communication included)
- High sustained performance even on heavily-loaded memory access application
- The best performance with SSE3 intrinsic rather than SSE3 hand assembler (SSE3 intrinsic helps the best usage of 16 of EM64T XMM registers.)