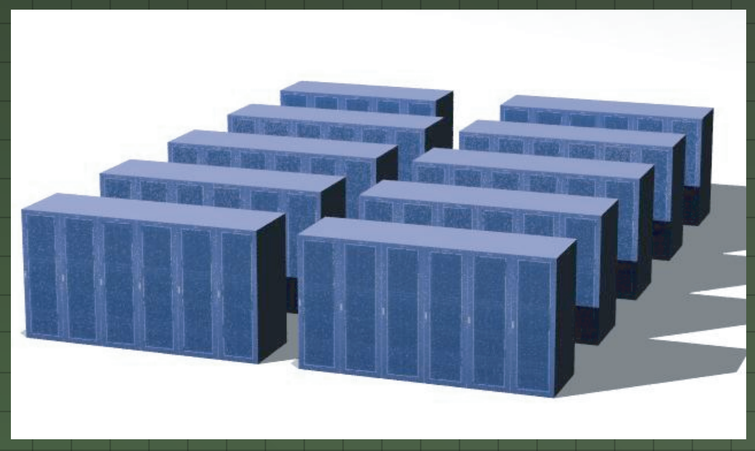
Center for Computational Sciences, University of Tsukuba
http://www.ccs.tsukuba.ac.jp/

# PACS-CS

## Next generation computational resource

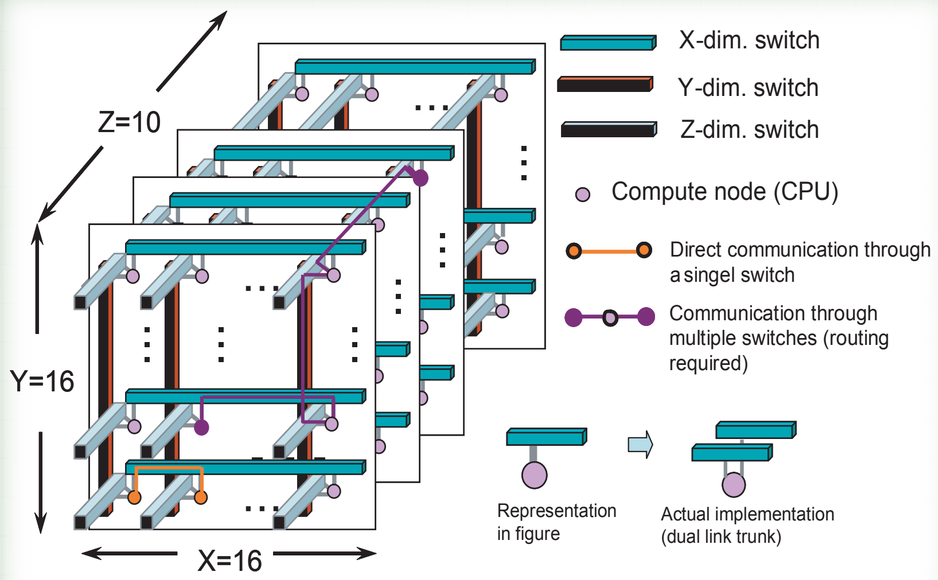
## PACS-CS (Parallel Array Computer System for Computational Sciences)

PACS-CS is a specially designed PC cluster which will be the largest and fastest one in Japan after its completion on June 2006. It is designed for true high-performance on scientific calculations which require wide bandwidth both on memory and network. The concept of PACS-CS is "bandwidth-aware massively parallel processing system based on commodity technology".



## 3-D Hyper-Crossbar Network with trunked Gigabit Ethernet

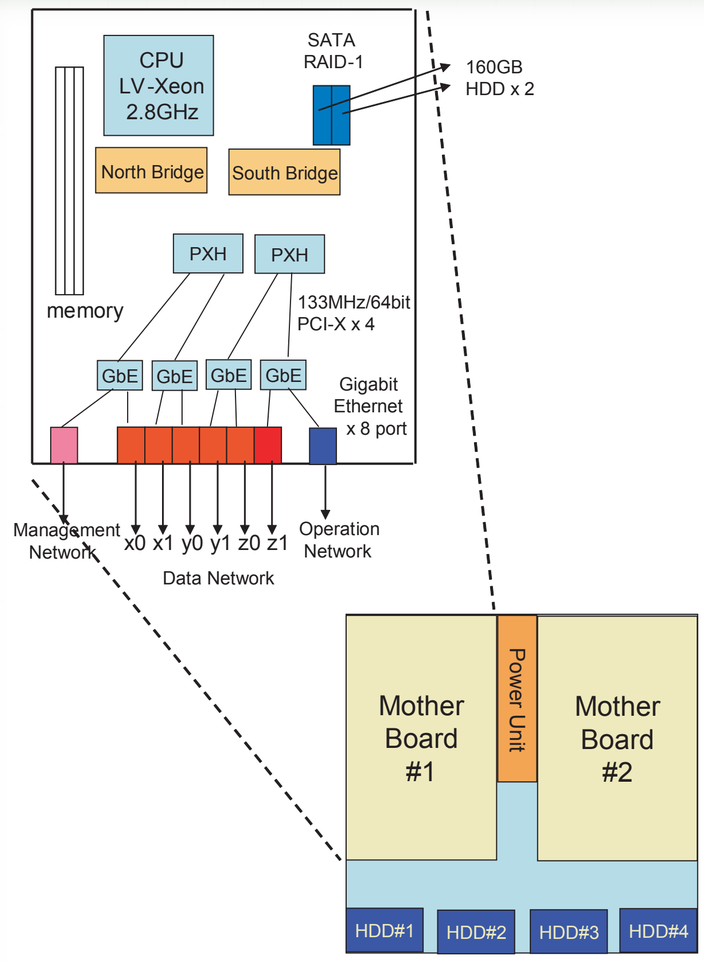
We adopt 3-dimensional Hyper-Crossbar Network as the interconnection network to trunked Gigabit Ethernet links which realize scalable and high-bandwidth communication with low-cost NIC and switch. It provides a powerful network to support nearest neighboring communication as well as random communication, without I/O bus bottleneck. The mother-board is equipped with eight of Gigabit Ethernet interfaces without standard PCI slot form factor, which are driven by a dedicated driver for this special network.




Network Architecture (3-D Hyper-Crossbar)

## Special mother-board for single CPU/node

Each node consists of a single CPU which exploits the full bandwidth of memory to keep the performance even for non cache-aware applications. We are developing a special mother-board to realize the same density of implementation with traditional PC clusters with dual-CPU SMP.




19-inch 1U form chassis

## PACS-CS Specifications

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|---|---|
| Number of nodes (CPUs) | 2560 (16 × 16 × 10) |
| Peak performance | 14.3 TFLOPS |
| CPU | Intel Low-Voltage Xeon EM64T 2.8GHz 1MB Cache |
| Memory size | 2 GByte/node (5.12 TByte/system) |
| Memory bandwidth/CPU | 6.4 GByte/sec (1.14 Byte/sec/FLOPS) |
| Local HDD | 160 GByte × 2 (RAID-1 mirroring) |
| OS | Linux (Fedora Core) + Score |
| Programming | Fortran90, C, C++, MPI |

| | |
|---|---|
| Interconnection Network | 3-dimensional Hyper-Crossbar Network |
| Link bandwidth | 250 MByte/sec/dimension<br>750 MByte/sec (simultaneous transfer on 3-D) |
| Network bisection bandwidth | 640 GByte/sec |
| Shared disk storage | 10 TByte |
| System size | 59 racks in total (19-inch rack) |
| Power dissipation | 545 kW |
| Schedule | Start to operate on June 2006 |