# Large-scale Computing and Visualization Systems at the Cybermedia Center

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Overview of High-performance Computing Environment at the CMC

Large-scale computing systems (SX-ACE, VCC and HCC), and large-scale visualization systems are deployed on CMC-Supercomputer network, a.k.a CMC-SCinet, a low-latency and wide-bandwidth network. This architectural design allows users to access to large-scale storage systems, perform large-scale high-performance computation and analysis on our large-scale computing systems, and then visualize its computation and analysis results without loosing any important information on our large-scale visualization system.
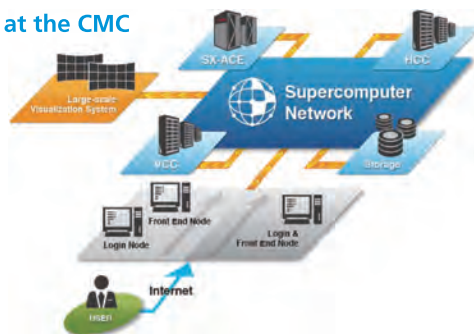
Large-scale Computing System

The large-scale computing systems at the CMC are classified into (1) Vector-typed Supercomputer and (2) Scalar-typed Supercomputer.

Type: Vector	Total memory: 96 TB
OS: Super UX	Peak performance: 423 TFlops
# of nodes: 1536	
# of cores : 6144	

SX-ACE

SX-ACE is a "clusterized" vector-typed supercomputer, composed of 3 clusters, each of which is composed of 512 nodes. Each node equips 4-core multi-core CPU and a 64 GB main memory. These 512 nodes are interconnected on a dedicated and specialized network switch, called IXS (Internode Crossbar Switch) and forms a cluster. Note that IXS interconnects 512 nodes with a single lane of 2-layer fat-tree structure and as a result exhibits 4 GB/s for each direction of input and output between nodes.

Library

Library
MathKeisan (BLAS, LAPACK, etc)
ASL, ASLSTAT, ASLQUAD
MPI/SX
HPF/SX
XMP

Type: Scalar	Total memory: 3.968 TB
OS: Linux	Peak performance: 24.8 TFlops
# of nodes: 62	Accelerator: NVIDIA Tesla K20 × 51
# of cores : 1240	

VCC (PC Cluster for large-scale visualization)

PC cluster for large-scale visualization (VCC) is a cluster system composed of 62 nodes. Each node has 2 Intel Xeon E5-2670v2 processors and a 64 GB main memory. These 62 nodes are interconnected on InfiniBand FDR and forms a cluster. Also, this system has introduced ExpEther, a system hardware virtualization technology. Each node can be connected with extension I/O nodes with which GPU resource, and SSD on 20 Gbps ExpEther network. A major characteristic is that this cluster system is reconfigured based on user's usage and purpose by changing the combination of node and extension I/O node.

HCC (General-Purpose PC Cluster)

Type: Scalar (VM)
OS: Linux
# of nodes: 575
# of cores : 1150
Total memory: 2.6 TB
Peak performance: 16.6 TFlops

IPC-C (Image Processing PC Cluster on Campus)

Type: Scalar
OS: Windows/Linux
# of nodes: 7
# of cores : 84
Total memory: 448 GB
Peak performance: 1.68 TFlops
Accelerator: NVIDIA Quadro K5000 × 6

IPC-U (Image Processing PC Cluster on Umekita)

Type: Scalar
OS: Windows/Linux
# of nodes: 6
# of cores : 72
Total memory: 384 GB
Peak performance: 1.44 TFlops
Accelerator: NVIDIA Quadro K5000 × 6

Library

Library
Intel MKL (BLAS, LAPACK, etc)
intelMPI, OpenMPI

Application

GROMACS	Gaussian09	Marc / Mentat	Nastran
GROMACS for GPU	IDL	Dytran	AVS/Express (DEV/PCE/MPE)
LAMMPS	NEC Remote Debugger	Patran	OpenFOAM
LAMMPS for GPU	NEC Ftrace Viewer	Adams	

Large-scale Visualization System

The large-scale visualization systems at the CMC are set up on Campus and on CMC's Umekita Office. Large-scale and interactive visualization processing becomes possible through the dedicated use of PC cluster for large-scale visualization (VCC) on these systems.

24-screen Flat Stereo Visualization System

The visualization system is composed of 24 50-inch Full HD (1920 x 1080) stereo projection module (Barco OLS-521), Image-Processing PC cluster (IPC-C) driving visualization processing on 24 screens. A notable feature of this visualization system is that it enables approximately 50 million high-definition stereo display with horizontal 150 degree view angle.

15-screen Cylindrical Stereo Visualization System

This visualization system is composed of 15 46-inch WXGA (1366 x 768) LCD, and Image-Processing PC Cluster (IPC-U) driving visualization processing on 15 screens. A notable characteristic of this visualization system is that it enables approximately 16-million-pixel high-definition stereo display.