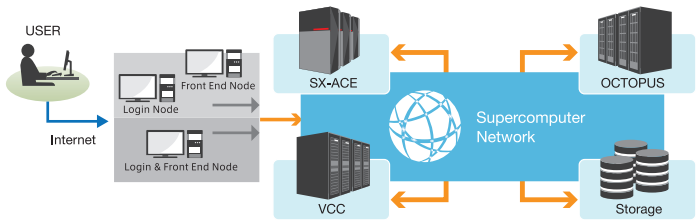
Cybermedia Center

Osaka University, Japan

SC19 BOOTH 1843

Large-scale Computing Systems at the Cybermedia Center

Overview of high-performance computing environment at the CMC



Large-scale computing systems (SX-ACE, VCC, and OCTOPUS) 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.

Large-scale Computing System

OCTOPUS

OCTOPUS means Osaka university Cybermedia cenTer Over-Petascale Universal Supercomputer. OCTOPUS is a cluster system supposed to start its operation in December 2017. This system is composed of different types of 4 clusters, General purpose CPU nodes, Xeon Phi nodes, GPU nodes and Large-scale shared-memory nodes, total 319 nodes. These nodes and large-scale storage "EXAScaler" (Lustre 3.1 PB) are interconnected on InfiniBand EDR (100 Gbps) and form a cluster.

General purpose CPU nodes

CPU	Intel Xeon Skylake
OS	RHEL 7.3
# of nodes (total)	236 nodes
# of cores (total)	5,664 cores
# of memory (total)	45.3 TB
Peak performance	471.2 TFLOPS

Large-scale shared-memory nodes

CPU	Intel Xeon Skylake
OS	RHEL 7.3
# of nodes (total)	2 nodes
# of cores (total)	256 cores
# of memory (total)	12 TB
Peak performance	16.4 TFLOPS

GPU nodes

CPU	Intel Xeon Skylake
OS	RHEL 7.3
# of nodes (total)	37 nodes
# of cores (total)	888 cores
# of memory (total)	7.1 TB
Peak performance	858.3 TFLOPS
GPU	NVIDIA Tesla P100 x 148

Xeon Phi nodes

CPU	Intel Xeon Phi KNL
OS	RHEL 7.3
# of nodes (total)	44 nodes
# of cores (total)	2,816 cores
# of memory (total)	8.4 TB
Peak performance	117.1 TFLOPS

SX-ACE

CPU	NEC Vector Processor
OS	SUPER-UX
# of nodes (total)	1,536 nodes
# of cores (total)	6,144 cores
# of memory (total)	98 TB
Peak performance	423 TFLOPS

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. SX-ACE will be retired on September 30, 2020. Next system will be introduced in 1Q/2021.

VCC

CPU	Intel Xeon Ivy Bridge & Broadwell
OS	Cent OS 6.8
# of nodes (total)	69 nodes
# of cores (total)	1,404 cores
# of memory (total)	4.4 TB
Peak performance	100.1 TFLOPS
GPU	NVIDIA Tesla K20 x 59

VCC is a cluster system composed of 69 nodes. These nodes are interconnected on InfiniBand FDR and form 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. VCC will be retired on March 31, 2020.

Application

GROMACS, LAMMPS, OpenFOAM, Relion, Quantum Espresso, VisIt , Gaussian09/16, IDL, AVS/Express (DEV/PCE/MPE), NEC Remote Debugger, NEC Ftrace viewer, Anaconda, Caffe, Theano, Chainer, TensorFlow, Digits, Torch, GAMESS, NICE Desktop Cloud Visualization, HΦ, MODYLAS, NTChem, OpenMX, SALMON, SMASH, FreeFem++, FLASH

Library (SX-ACE)

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

Library (VCC, OCTOPUS)

Intel MKL (BLAS, LAPACK, etc), IntelMPI, OpenMPI, MVAPICH2, XMP, OpenACC, NetCDF, HDF5, GSL

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