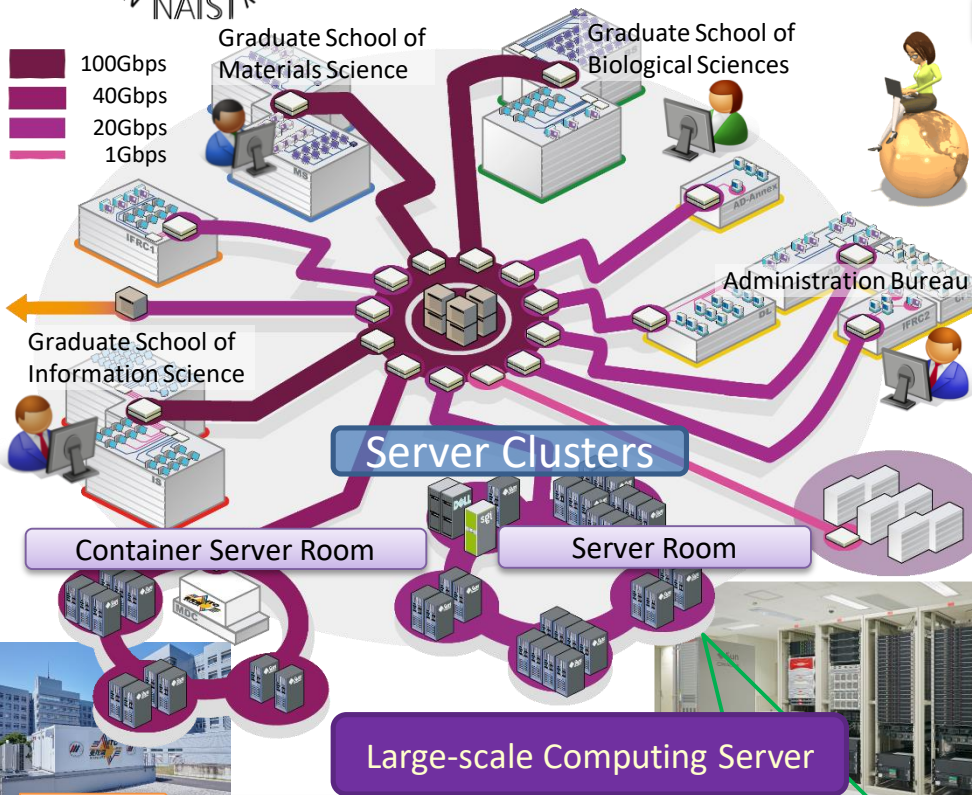


# MANDARA (曼陀羅)

## Computing Server



### All Mandara User

**High-Speed Access**  
to all Servers in NAIST Campus

### Private Cloud Computing Server

- Biological calculation
- Large scale simulation

### Container Server Room

- Saving Electricity
- Effective Utilization
- Resources for CPU and Memory etc.
- Space
- Disaster Recovery Plan

### Large-scale Computing Server

### Goal Promoting effective use and unified management of computing resources

- ▶ Aggregation and integration of the computing resources in the organization
- ▶ For effective utilization
  - Design effective job queues in the job scheduler appropriate for each program
  - Leverage dedicated HPC appliances (Hadoop, GPU cluster) for specific applications
- ▶ For management
  - Use Docker to isolate user and system privileges
  - Develop an integrated logging mechanism for audit and unified management

### Spec List

**Materials analysis server**  
**Oracle Server X5-8 (x1)**  
 CPU: Intel Xeon E5-2699v4 x 2 (2.2GHz 22cores) x 2 = 44 cores  
 Memory: 768GB, HDD: 1.2TB x 6  
 InfiniBand-QDR x 2, 10GBASE-SR x 2  
**Software:** BIOVIA Materials Studio  
 ChemDraw Professional V16  
 TCAD

**Large shared memory nodes**  
**Oracle Server X5-8 (x2)**  
 CPU: Intel Xeon E7-8895v3 x 8 (2.6GHz 18cores) x 8 = 128 cores  
 Memory: 2TB, HDD: 1.2TB x 6  
 InfiniBand-QDR x 2, 10GBASE-SR x 2  
**2 nodes total,**  
 256CPU cores, 4TB Memory

**Cluster nodes**  
**SYS-1028GR-TR (x64)**  
 CPU: Intel Xeon E5-2650v4 x 2 (2.2GHz 12cores) x 2 = 24 cores  
 Memory: 256GB, SSD: 240GB  
 InfiniBand-FDR x 1, 1GBASE-T x 2  
 • **NVIDIA Quadro P4000 x 1**  
 GPGPU: 1,792 CUDA Cores  
**64 nodes total,**  
 1,536 CPU cores, 16TB Memory  
 114,688 Cuda Cores

**Super parallel computing nodes**  
**PRIMERGY CX400 M1 (chassis) (x4)**  
 • **PRIMERGY CX2570 M2 x 2**  
 CPU: Intel Xeon E5-2650v4 x 2 (2.2GHz 12cores) x 2 = 24 cores  
 Memory: 256GB, HDD: 1.2TB x 2  
 InfiniBand-FDR x 2, 1GBASE-T x 2  
 • **NVIDIA Tesla P100 x 4**  
 GPGPU: 3,584 CUDA Cores  
**4 nodes total,**  
 192 CPU cores, 2TB Memory  
 57,344 Cuda Cores

**Large-capacity data processing node**  
**Oracle Big Data Appliance X6-2 (x1, 8nodes)**  
 CPU: Intel Xeon E5-2699v4 x 2 (2.2GHz 22cores) x 2 = 44 cores  
 Memory: 256GB(6nodes), 768GB(2nodes)  
 HDD: 8TB x 12  
 InfiniBand-QDR x 2, 10GBASE-T x 2  
**8 nodes total,**  
 352CPU cores, 3TB Memory  
**Software:** Hadoop/SPARK/HDFS, Big Data Discovery, Oracle PGX



**Broadband distributed file server**  
**DDN SFA7700X (x1)**  
 Use: Distributed Storage for work area  
 • **GRIDScaler Server x 2**  
 InfiniBand-FDR x 2, 10GBASE-T x 2  
 • **Network Shared Disk SFA7700X x 1**  
 Dual Controller, InfiniBand-FDR x 2  
 HDD: 4TB x 208  
 20 x (8D + 2P) + 8 spare disk  
**Total Capacity, 571TiB (628TB)**

**Management of virtual environment of Docker/KVM/LXC**  
 Provide environment that users can easily deploy their KVM/LXC virtualization machines.  
 Provide Docker environment so that users can easily install specific applications.

**Under planning**  
 Send a job to the cloud servers through the Internet.  
 Cloud HPC

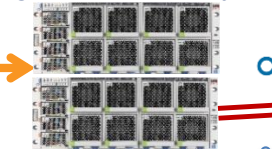
- 40/56G Infiniband
- ==== 10GBASE-SR x 2
- ==== 10GBASE-T x 2
- ==== 1GBASE-T x 2

**Materials analysis server**



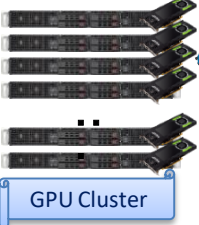
Large Memory & CPU

**Large shared memory nodes**



Large Memory & CPU

**Cluster nodes**



GPU Cluster

**Super parallel computing nodes**



GPU Cluster

**Broadband distributed file server**



Distributed File Servers



BigData Cluster

**APACHE HADOOP**  
 Large-capacity data processing node

**Campus Network**

**Analysis procedure**

1. Collect tweets about a typhoon.
2. Split into words by morphological analysis. (make full use of Hadoop!)
3. Words with higher appearance frequency is expressed with a larger character font.

**Large-scale Calculation Server – Examples for User Usage**

**Case: Classification of Tweets using Hadoop (Large-capacity data processing node)**  
 The figures below show the classification of tweets when a typhoon approaches.

