Computer server and network for HiCARI experiments

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The HiCARI project[1] has been launched at the RIKEN RIBF. To process signals from Ge detectors, the GRETINA data acquisition system (DAQ)[2] is adopted. 100 MHz digitizers acquire information on the energy, timing, and pulse shapes of detectors and send data to data processing nodes. For tracking-type Ge detectors, data processing nodes perform pulse shape analysis (PSA) to obtain position information. Finally, processed data are merged by the event builder node and stored into a RAID storage system. For this DAQ system, computer servers and network equipment were newly installed. In addition, HOKUSAI SS[3] is used as a near-online analysis environment. In this report, we describe the computer server and network for the HiCARI experiment.

Table 1 lists the computer nodes. Five nodes of HP ProLiant DL360 G10 (16 CPU cores) were newly installed. One node is for the event builder; three nodes (48 CPU cores in total) are for the PSA of a triple segmented tracking detector from LBNL Berkeley (LBNL P3), which has 111 signals in total; and the last one is for the data process (DP) of Miniball and clover detectors (152 signals in total). Since PSA is not applied for Miniball and clover detectors, the demand for CPU resources is small. However, owing to the limitation of the GRETINA DAQ software, the number of processes per OS is limited. To optimize the allocation of CPU resources, four virtual machines (VM) are launched using KVM.[4] Three CPU cores are allocated to each VM, and four CPU cores are reserved for the KVM host process. In addition, ten HP ProLiant DL380 G6 (8 CPU cores) were transported from RCNP Osaka. Eight nodes (64 CPU cores in total) are used for the PSA of the RCNP quad-type segmented tracking detector (RCNP Quad). One of them is used for the DAQ controller, and the last one is reserved as a spare node.

Table 1. List of computer nodes.

Function	Model	Unit	Core
DAQ Controller	DL380 G6	1	8
Event Builder	DL360 G10	1	16
PSA for LBNL P3	DL360 G10	3	48
DP for Miniball/Clover	DL360 G10	1	16
PSA for RCNP Quad	DL380 G6	8	64
Spare	DL380 G6	1	8

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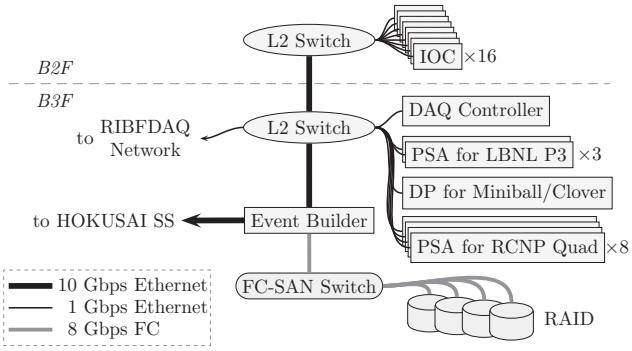

Fig. 1. Network diagram for HiCARI experiments.

A data analysis environment has been prepared in HOKUSAI SS for RIBF experiments. HOKUSAI SS is a private cloud system based on OpenStack.[5] As of January 2021, a total of 80 cores and a disk space of 100 TB has been secured, and it can be expanded upon request. These resources are allocated not only to the HiCARI project, but also to other experimental projects. In 2020, 64 cores out of 80 cores were tentatively allocated to the VM of HiCARI experiments. From 2021, the resource allocation will be optimized according to the usage.

The network diagram for the HiCARI experiment is shown in Fig. 1. Sixty digitizers are installed on the B2F, and sixteen CPU boards (called IOC) send data to the PSA nodes. Processed data are merged by the event builder and stored in the RAID system via an 8-Gbps fibre channel-storage area network (FC-SAN). For now, a total of 160 TB of space has been prepared for the HiCARI project, and 36 TB of data were acquired in 2020. These data were also transferred to the HOKUSAI SS through a 10-Gbps Ethernet connection for near-online analysis.

In summary, the computer server and network equipment were set up for the HiCARI project. They worked stably and successfully acquired data of seven experimental proposals. The equipment reported in this paper will be used for upcoming HiCARI experiments in 2021.

References

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