§54. Highly Reliable Common Data Platform for Fusion Virtual Laboratory (FVL)

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Since 2008, the LHD data acquisition and archiving system, *i.e.* LABCOM system, has been used additionally for QUEST experiment of Kyushu Univ. and GAMMA10 experiment of Univ. of Tsukuba as the common data access platform. Its remote access network is based on the fusion research dedicated virtual private network named "SNET", which is provided under SINET4 academic network carried by National Institute of Informatics (NII). This bidirectional collaboration framework for Japanese fusion researches is named "Fusion Virtual Laboratory (FVL)" [1].

FVL framework is quite advantageous for modern remote experiments and therefore the operational requests for the storage system become harder. The LABCOM storage, for instance, has less time slot for having a temporal maintenance stop because it must cover all three different experimental campaigns.

For enabling such the non-stop data services, the following requirements should be satisfied by the storage system:

- ✓ Ability of hot plug-in and -out for each node
- ✓ Capacity scale-out on the fly
- ✓ Shortest recovery time from non-optimal states
- ✓ Auto-replication for data safety
- ✓ High-speed I/O performance (> 10 Gbps) .

"Cloud" based Storage

"Cloud" is a new technology which enables us to scale out the computing and data storing performances easily. After completing several years' verification tests, we have installed a new cloud storage system named *"IznaStor"* into the LABCOM data system and started its operation since last 15th campaign of LHD[2]. Through the whole campaign period, it showed us high availability and good performance. Actually, even during the experimental sequences we successfully hot plugged-in a new storage node to add more space to the online volume.

The whole data amount accumulated in LABCOM archiving system has gone up more than 0.5 Peta-bytes and the number of entries has been over 0.1 billion. Annual download count was 0.9 million for three experimental sites of LHD, QUEST, and GAMMA10 last year.

Common Data Platform for FVL

While high-performance computing (HPC) systems often use so-called the parallel filesystems or cluster ones[3], the cloud storage could be a long-term data store for numerical simulations and theoretical model calculations. In other words, it is expected to be the unified data platform for both the experimental data analyses and numerical computation studies. If the computational results could be accessed completely with the same manner as experiments' data, then it could bring a new epoch for fusion research.

Now we can imagine a composite of HPC and fusion experimental sites under FVL framework, as shown in Fig. 1. A similar idea is also discussed for the new development of ITER data archiving system.

1) Yamamoto, T. *et al.*: Fusion Eng. Des. **85** (2010) 637.
2) Nakanishi, H. *et al.*: NIFS Annual Report (2011) 140, 480.
3) *K computer*: http://en.wikipedia.org/wiki/K_computer (2011).

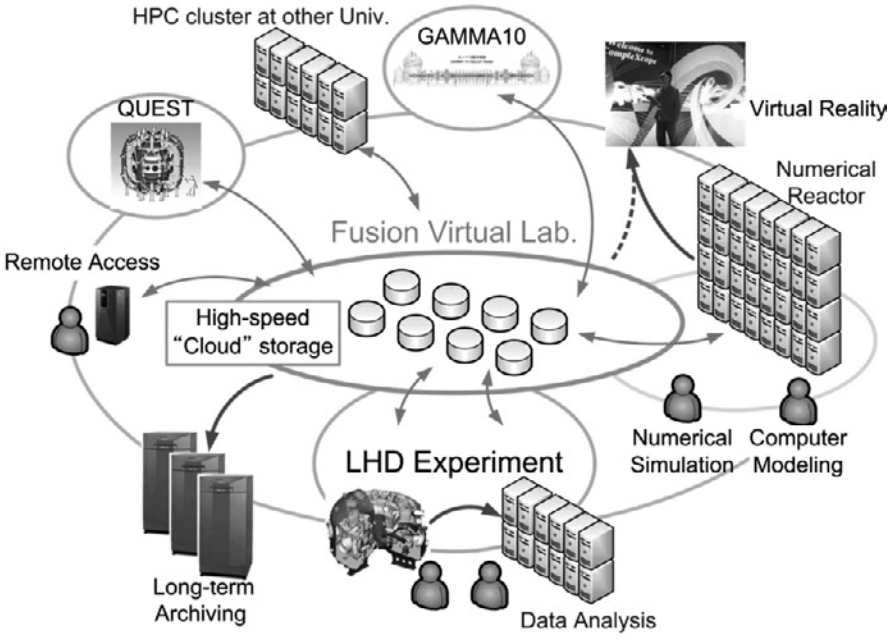

Fig. 1. Conceptual view of the common data platform based on high speed "cloud" storage: It goes between not only remote experiments but also HPC clusters on SNET.