§38. Investigation for the Next-Generation Technology of Data Acquisition and Remote Participation for Fusion Research

Okumura, H. (Mie Univ.),
Nakanishi, H.

1. Introduction

LHD has experienced a drastic increase of acquired data amount which has grown over two-digits compared to the beginning of its 1st experimental campaign. This is the "Data Explosion" phenomenon often observed in other fields than fusion research. In addition, there is a definite tendency having a smaller number of larger experimental devices in fusion experiments. Under these circumstances, a brandnew collaborative data acquisition technology is quite expected based on ultra-wideband and wide-area network connections. LHD data acquisition system should be a pioneer service provider to fusion research collaborators as it is in the central institute of excellence in this field.

This study has investigated several key technologies: ultra-fast real-time data acquisition with streaming and storing, massive-size data handling, and remote collaboration environmental utilities. Well-tested new technologies developed in LHD are intended to be applied not only for its second phase but also for SNET-based bilateral collaborations and the QUEST experiment in All Japan ST Research Project.

2. New Improvements

We can understand the high and urgent demands for technical improvements in experimental data system as follows:

I. Multi-site data handling capability, in which users can retrieve any data from multiple sites at once. It should be realized in a seamless manner among many experimental sites.

II. More computational data-analysis throughputs, which can make in harmony with theoretical model calculation, numerical simulation, and massive-size experimental data analysis.

First in this study, the necessary specifications have been analyzed to realize a (I) multi-site data handling function in the LABCOM data acquisition system used in LHD. Until that time, the system was designed only for users of a single site. Therefore, the data request keys were only two; data name and shot number. In taking a multi-site accessibility into account, a new function needs three inquiry keys of "site name", data name, and shot number. They can accept duplicate data names or shot numbers in different sites. Access permissions to search and retrieve the data will be also given based on separate user group for each site.

For the (II) purpose, we newly formulate a grand conception of massively-sized data computational platform in which the LHD storage area network (SAN) is directly connected to the MPI computing PC cluster. It also implies that all the data and computer cluster system could be united virtually into a "Fusion Virtual Laboratory" based on the NAREGI or AEGIS grid infrastructure and SNET, the SINET3 1Gbps VPN for fusion research.

Above mentioned new approaches can be applied straightforward to the next-generation international remote experimental collaborations in ITER and ITER-BA.
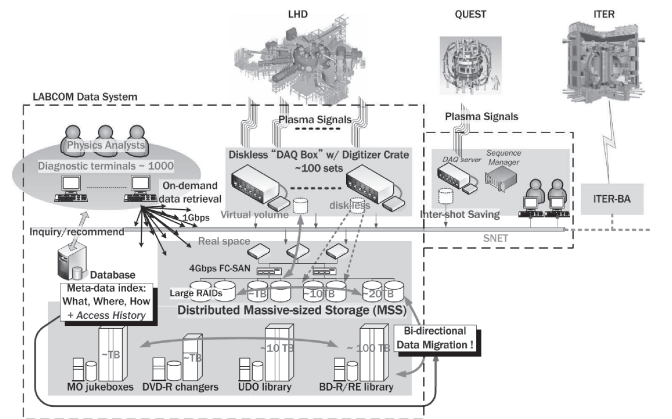

Fig. 1. Schematic view of LABCOM data acquisition and retrieval system with SNET extension
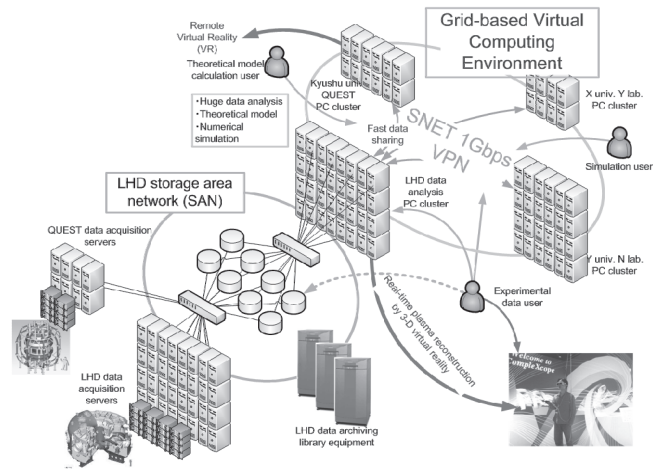

Fig. 2. Conceptual design of Grid-unified multi-purpose computing environment based on 1Gbps SNET VPN with a broad and direct I/O connection to LHD massive-size data storage system

1) H. Nakanishi, et al.: Fusion Eng. Des. 83 (2008) 397.
2) M. Kojima, et al.: Proc. 6th IAEA TM on Control, Data Acquisition, and Remote Participation for Fusion Research, 4-8 June 2007, Inuyama, Japan.
3) M. Ohsuna, et al.: Proc. 6th IAEA TM on Control, Data Acquisition, and Remote Participation for Fusion Research, 4-8 June 2007, Inuyama, Japan.