§55. Development of SNET-based Remote and Steady-state Data Acquisition Scheme Using CPD Experiments

Nakanishi, H., Nagayama, Y., Yamamoto, T.,
LABCOM & Kaiseki Groups,
Hasegawa, M., Higashijima, A., Nakamura, K.
(Kyushu Univ.)

1. Introduction

Under the bilateral collaboration between Kyushu Univ. and NIFS, a spherical tokamak (ST) research are held to make progress in steady-state plasma experiment on a new "QUEST" device. On the other hand, a technical preparation is also indispensable to realize a virtual collaboration space shared with All Japan ST Research members through SNET, the fast and distant SINET3 VPN platform in fusion research. This study plans to extend the ultra-wideband and real-time data acquisition technology, which has been already established in LHD, to become able to cover two different and distant experimental sites in seamless ways. It aims not only at developing a remote collaboration data system for handling multiple sites but also at exploring further prospects toward more effective fusion experiments in future.

2. New development of Remote DAQ system

At the beginning of this study, the CPD remote data acquisition system (DAQ) has been constructed with the hardware listed below:

- ✓ DAQ computer: Windows XP w/ Intel Core2Duo 1.86GHz CPU, 2GB RAM
- ✓ PXI chassis: NI PXI-1033 w/ MXI-Express I/F
- ✓ ADC module: NI PXI-6133, 3MS/s, 8 ch … 2
- ✓ Uplink: NI PCIe-6361 MXI-Express I/F
- ✓ LHD DAQ system for plasma diag.: LABCOM/X

In order to operate above-mentioned system synchronously with the experimental sequence signals in CPD, two pre-processing timing signals and a post-processing one are provided, on wired TTL, from the CPD central control to the PC parallel port of DAQ host computer. This is almost the same situation of LHD experimental sequences to be received and delivered to DAQ PCs. The shot number can be referred through the CPD Web service to the Internet.

This DAQ equipment have been operated in a normal experimental campaign of CPD. Sixteen channels of PXI ADCs acquired 10 M samples per channel for every ten seconds of plasma discharge experiments. Their shot numbers were from #504794 to #505002 for five days. As a result of this consecutive examination, we have confirmed that all the plasma measurement signals can be successfully acquired and stored to be soon ready for read-out in both NIFS and Kyushu Univ. sites.

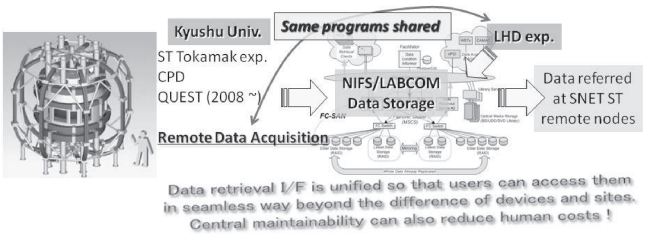

Fig. 1. Schematic view of remote data acquisition and storage system for CPD and QUEST collaborative experiments

3. Examination for new acceleration method of WAN TCP/IP communications

It is well known that TCP/IP communications in general can be accelerated in speed by some optimization of sliding window size and the congestion algorithm. However, there still exists another difficulty in far-distributed architecture, such as multiple SNET remote nodes of collaborative universities, where all the client/server computers should be independently tuned with different optimization parameters. Different OS platform is also another big problem for unifying the tuning procedures.

In order to solve such the problems in practical use, we have examined specific hardware equipment, Fujitsu WANDIRECTOR A100, which optimizes TCP/IP WAN communications. The test was done between Kyushu Univ. and NIFS sites whose RTT is about 20 ms through SINET3 1Gbps port and 10/40Gbps backbone. As Fig. 2 shows, a pair of two A100 was installed for both sides just in front of the data transferring server computers, and the communication speeds were surveyed on both Linux and Windows OS.

With the general-purpose Windows or Linux OS, the bare connection only provided about 60 Mbps throughput. However, it has been improved up to almost 300 Mbps when the A100 pair is inserted in both the route ends. (Fig. 2) Effective speed in Super SINET Layer-3 TCP/IP was generally said as 400 Mbps, therefore, 300 Mbps with no optimization can be considered as a quite effective solution. Another A100 evaluation using our network latency simulator has also revealed that it still can provide ~ 200 Mbps throughout on oversea distance of RTT ~ 300 ms. These series of our field examinations have confirmed that it is very concrete solution as the remote collaboration network platform.

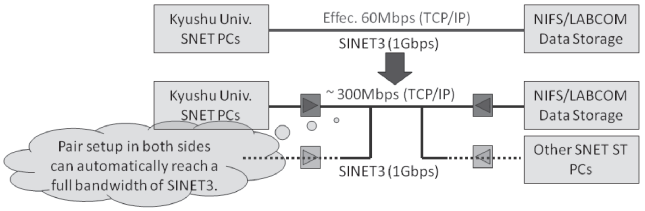

Fig. 2. Evaluation test scheme for TCP/IP acceleration equipment