§4. LAN (*Local Area Network*) for LHD Experiment

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Construction of LAN for LHD experiment, which we call LHD-net, started 4 years ago (in 1996). F.Y.1999 was the 2nd year of the LHD experiment. After the LHD experimental campaign in the 1st year, we had 2 subjects which should be resolved. The 1st subject is improvement of the network traffic capacity for the viewing and handling of the measurement data. The 2nd subject is the security of network.

1. *Modification of Network Architecture*

In the 1st year of LHD experiment, LHD-net has 4 LANs, which are for operation, analysis, diagnostic data acquisition and diagnostic control. Before LHD experiment in 2nd year, we installed 2 layer 3 switching routers and added 2 LANs. Diagnostic data servers move to the Diagnostic Server LAN and the clients to view and handle the data, which was located in Analysis LAN in the 1st LHD experiment year, move to the Diagnostic Client LAN as shown in Fig.1. And the layer 3 switching router connects the severs' LAN and the clients' LAN.

The data severs for measurement data with physical units and calculation data like equilibrium data were demanded as the experiment progressed. The data servers were installed in the Analysis Sever LAN. Some CPU servers are also located there.

2. *Network Security*

From the view point of the security, Fire-Wall system was runnimg in the Operational LAN in the 1st year of LHD experiment. At the end of the 1st LHD experiment year, more than 400 computers, which had the variable experimental data, analized data and programs, were located in LHD-net. In order to protect the above data, programs and computers from any damages and attack through INTERNET, we decided the following guideline of the network security in LHD-net.

1) Security of the data and the computer is secured as the network.
2) The clients out of NIFS cannot directly access the computers in LHD-net.
3) The experimental group members can access the data and computer in LHD-net without any trouble from everywhere in NIFS.
4) The clients in LHD-net can access the computers out of NIFS through some network application (http, telnet and ftp).

To realize 1)-3) in the above guideline, we are applying the packet filtering in the router between the LHD-net and NIFS campus LAN. To realize 4) we have installed a PROXY server as shown in Fig.1.

3. *Monitoring Network Traffic*

We are monitoring the network traffic between LANs in LHD-net by using MRTG (*Multi Router Traffic Grapher*) [1], which is the softwere for traffic information acquisition. This information helps us when we have some troubles and we redesign or upgrade the LHD-net. Original output is graphic data. The numerical data is convenient when the data is analyzed. Then we added the function that the traffic data is stored as the numerical data.
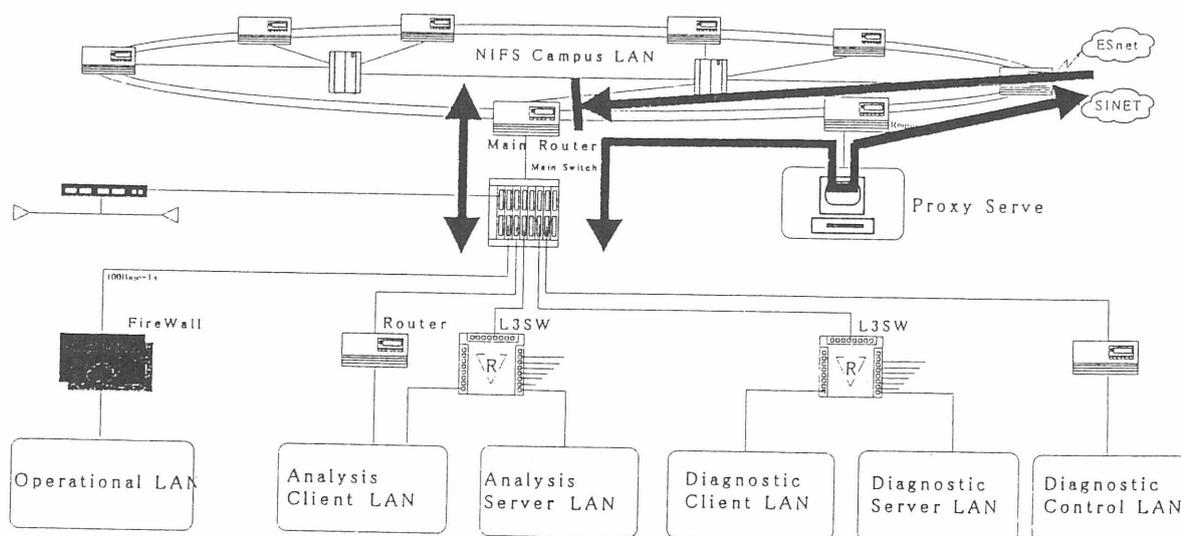
[1] http://www.ee.ethz.ch/stats/mrtg/

Fig1. Network Architecture and PROXY sever in LHD-net