§35. Scalable Real-Time Data Acquisition/ Analysis System with Multicasting

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We incorporated the following three new features into our UNIX-based data acquisition/analysis system:

(1) Real-time graphical monitoring.
(2) Reduced network traffic using multicasting.
(3) Character-based remote monitoring.

Our system is "scalable" in that the system performance is proportional to the number of workstations conprising the system.

A simple client-server system, with $O(n)$ data-acquisition servers and $O(n)$ display/ analysis clients, is not fully scalable, because the network traffic can grow as $O(n^2)$.

We used *multicasting*, a comparatively new mode of network communications where any number of interested workstations can listen to the same packet. In this case, the packet number grows as $O(n)$ rather than $O(n^2)$. Multicasting is different from conventional broadcasting, where all broadcast packets must be processed by the network drivers of all the workstations, thus degrading the performance.

In the NIFS IV-coil experiment we ran our software on a very limited system comprising two workstations communicating with multicasting. We used Sun SPARCstations running a multicast-enabled version of SunOS 4.1.x. One workstation, connected to a multichannel ADC (analog-to-digital converter), sent data packets to another workstation by multicasting. The latter then displayed data graphically on its windows. One window displayed data for several minutes, while another for several hours, another for several days, thus enabling easy glance of data in multiple time scales.

Moreover, to serve the needs of remote character-based terminals, a "guest" account was set up in one workstation, where newest thermometer readings were displayed.

One point that must be borne in mind is that multicast (or broadcast) packets do not correct errors by retransmission, because many workstations would tend to ask for retransmission of bad packets at the same time, leading to network storms. We are now developing a new packet encoding scheme capable of error correction without retransmission.

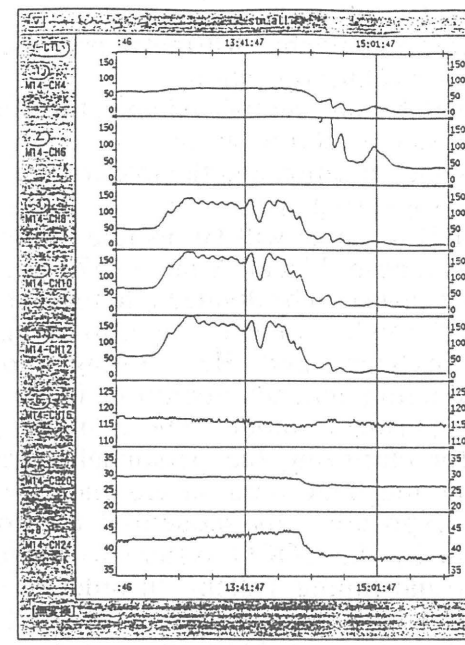

Fig. 1. Real-time monitoring system.

References

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1) Yamaguchi, S. *et al. 52nd Meeting on Cryogenics and Superconductivity, Book of Abstracts* (1994), 264.
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