CONTROLS & COMPUTING

Virtualization of the Operator Consoles on Beamline Control System

The control system is the nerve center of SPring-8. Upgrades of the control system increase the efficiency of experimental studies at beamlines. Since fiscal 2006, we upgraded the operator consoles of the beamline control system. At that time, nearly 50 high-performance workstations were being operated around the beamlines as operator consoles for experimental users. The proliferation of the workstations made it difficult to keep them in continous operation. Some computers occasionally malfunctioned, stopping users' experiments during exchange to new workstation. There have been over 20 instances of hardware trouble since 2000. A downtime of several hours was needed to exchange workstation and set up the replacement workstation. The increase in the number of workstations caused the total cost of ownership (TCO) to increase rapidly. To solve the above problems, we integrated the operator consoles of the beamlines into four enterprise-class server computers by applying virtualization technology, which enabled us to consolidate a large number of computers to a few host computers, thus reducing system maintenance costs drastically. Figure 1 shows the virtualization host server computers. We adopted an HP c-class blade system that has hot-swap functionality of all the modules without any interference with each other. A CPU module has two dual-core AMD Opteron processors and 8 GB memory. Over 50 operating systems are now running on only four server computers. The availability of the blade system, which has redundant power supplies and cooling fans, is high. In addition, one CPU module is a hot standby for emergencies. We adopted Xen as the virtualization environment. Xen has a live migration capability that can transfer a running guest operating system from one CPU module to another nearly instantaneously. We can maintain a CPU module with the control system in coutinuous operation. Two types of thin client systems, SunRay and VNC, were introduced as user control terminals to replace the previous X-terminals. Because these have no breakable boot devices such as a hard drive, the client systems are quite stable. Both systems boot up from a boot server. When a problem occurrs in the thin client, restoration becomes very easy. Previous workstations had another function of data acquisition for the interlock system. We have recently introduced

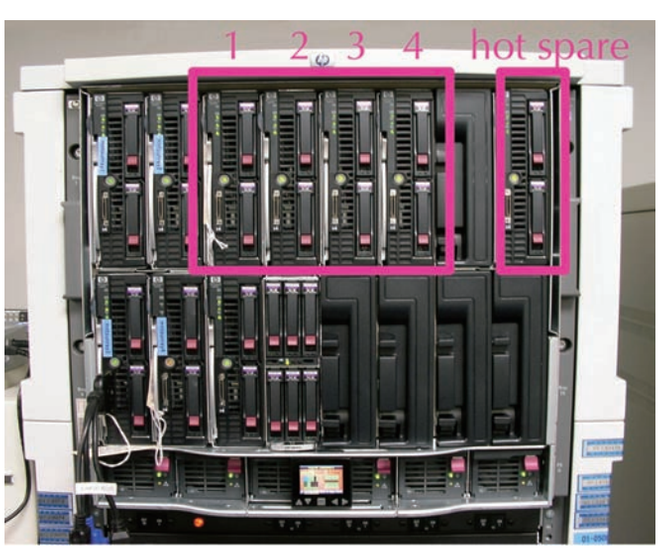

Fig. 1. Virtualization host server computers. Only four CPU modules cover all the operator consoles of the SPring-8 beamline.

an alternative data acquisition computer system, Armadillo. Armadillo is an ultrasmall embeded computer for uninterrupted operation. We used it as a serial-ethernet converter to communicate with the PLC of the interlock system. This contributes to the stablilization of the control system with the above-mentioned thin client systems. Figure 2 shows an overview of the new beamline control system.

The introduction of the virtualization system has resulted in many benefits. One is that the serviceability of the system has improved. The resources of CPU, memory and storage are consolidated at one location, and thus can be managed efficiently. Also, reliability has improved. We have had no serious trouble with the operator consoles since the update. During one year of operation there has been no downtime due to the live-migration function even though a hardware failure occurred in the host server. It is notable that the control response is faster than the previous system of high-performance workstations. The communication overhead between the control systems was observed to be shorter by up to about 64% as a result of the actual experimental study at the beamline.

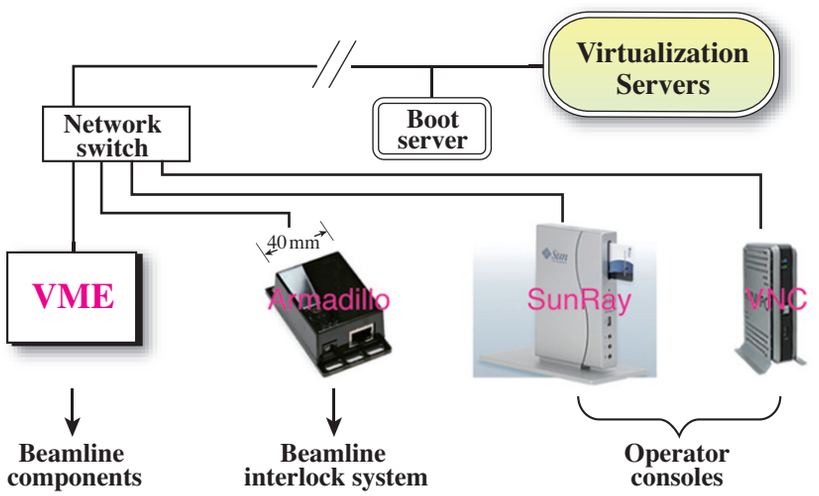

Fig. 2. Overview of newly installed beamline control system. Each beamline has VME, Armadillo, SunRay and VNC systems.

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