

Upgrading the server system using virtualization technology in the RIBF control system

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In an RIBF control system, the Experimental Physics and Industrial Control System (EPICS) has been introduced on Linux and vxWorks since 2001¹⁾. Owing to a centralized management system, all computers for EPICS programs share common network storage that implements a file transfer protocol (FTP) and a network file system (NFS) as key services. In order to achieve service reliability enhancement of the key services, we constructed failover clusters in 2008²⁾.

Considering the short life cycle of server hardware, aging servers should be replaced periodically. In term of the reliability, the replaced system should enhance the efficient operation of server hardware resources, for example improvement of CPU utilization. Currently,

virtualization technologies, such as KVM, Xen, and VMware are widely used in many scenarios. For the RIBF control system, virtualization software, which realizes a hardware sharing system, was selected for the following reasons:

- (1) To reduce operational costs, it is efficient to make virtualized image files from current physical servers without modifications to the system.
- (2) Other required services should be constructed by a High-availability (HA) system.
- (3) Complex clustering should be avoided in order to minimize maintenance cost.
- (4) Virtualization software with reliable support services are commercially available.
- (5) Even if physical servers encountered an issue, there should be no downtime for the guest operating system.

Table 1. Comparison of the old redundant system and the new server system in the main services.

Service	Old methods	Replaced system
NFS	Failover cluster	Dual NAS controllers
PostgreSQL	Failover cluster	vMotion
FTP	Failover cluster	vMotion
EPICS IOC	None	vMotion
DNS	Primary/Secondary	Primary/Secondary, vMotion
LDAP	None	vMotion
EPICS applications	DNS round robin	DNS round robin, vMotion

Therefore, we adopted VMware vSphere 5 as a virtualization software for the RIBF server system, and Network Attached Storage (NAS) manufactured by NetApp as a shared storage with an HA system has been implemented (See Fig. 1). In this system, the services for the shared EPICS programs and the virtualized image files in VMware environment are provided by the NAS. To improve service reliability, live-migration, which moves the guest hosts to other physical servers without downtime, is provided by VMware vMotion.

For ensuring the scalability and availability of the network, the network between NAS and a network switch uses the Link Aggregation Control Protocol (LACP). LACP bundles several physical Ethernet ports in a single logical channel. In fact, EPICS Input/Output Controllers (IOCs), Domain Name System (DNS), Lightweight Directory Access Protocol (LDAP), PostgreSQL, MySQL, Process Variable gateway³⁾, backup systems, and EPICS application servers were constructed on the virtualization environment (See Table 1).

The VMware cluster consists of three physical servers (dual-socket Intel Xeon E5-2630), and 20 virtualized servers have been running on this cluster since Jan 2014. Replacing an aging system with a virtualization system with HA, it can facilitate efficient use of server resources and operational costs.

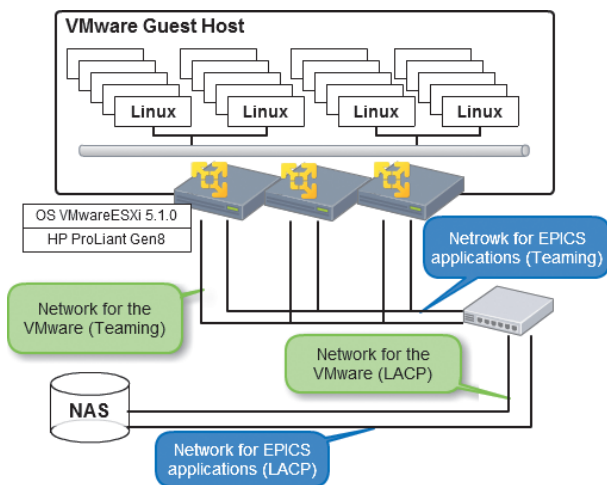


Fig. 1. System chart of the upgraded virtualization server system, NAS, and LACP-based network.

References

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