



HA-AP APPLIANCE SUCCESS STORY

A Provincial Hospital in China Guaranteeing Zero-downtime Continuity for Hospital Information System (HIS)

KEY HIGHLIGHTS

Industry: Hospital

The Challenge

- Provide high-availability access and protection of HIS database on 2 HP 3PAR StoreServ 7400C storage systems; support 5 physical servers, 5 VMware virtual clients, and 50 TB of data.
- Support 7*24 hospital operations by ensuring performance and availability of the mission-critical HIS system.

HA-AP 8G Benefits

- Real time hot-swappable protection for critical data.
- Continuous availability of mission-critical HIS system for around-the-clock operations.
- Affordable, high-availability, easy-to-manage solution that protects against failures of FC fabric and primary RAID storage.
- Simple, centralized administration.

HA-AP 8G Versatility

- HA-AP engines can be clustered over Fibre Channel to create local or remote mirroring.

The Customer

Our case subject is a provincial hospital located in the East China Region. Originally founded by American missionaries in the late 1900th, the century-old tradition and evolution has turned it into a nationally recognized first-rate regional healthcare facility. To protect its privacy, our customer has requested that we write this story under a disguised name. We honor that request and from here on out, will simply refer to it as CSPH, short for Case Study Provincial Hospital.

CSPH specializes in the fields of gynecology, obstetrics, pediatrics and neurology; operates 10 clinical centers including internal medicine, surgery, reproduction and urology, cosmetology, rehabilitation, intensive care, physical examination, and more. With a recently built 400-acre campus and planned 3000-bed capacity, it aims to serve the needs of five million people within the region.

Background: Hospital Information System

A hospital information system (HIS) is a comprehensive information system dealing with all aspects of information processing in a hospital. It is an integrated, computer-assisted system designed to collect, store, manipulate, retrieve and communicate information concerned with the administrative and clinical aspects of services within the hospital.

HIS has been acknowledged by the international academia as an important discipline of medical informatics. An effective HIS system can elevate the efficiency of all tasks -- from administrative to clinical to managerial. Ultimately, it raises quality of work and assures economic benefits for both patients and the hospital.

Challenge: Provide High-Availability HIS System

Of all existing enterprise-level information systems, HIS is among the most complex. This fact is dictated by the nature of the industry – namely the goals, duties and characteristics of a hospital. An HIS has to not only track and manage data that is generated by the flow of customers, finance and logistics like any other MIS system, so as to improve and maintain efficient operations; it also needs to support all treatment, education and research activities based on accurate and large volume of patient medical records.

The HIS is basically the core transactional system of the hospital. It is often the main data entry point, the main database, the main source of census and reports of almost all hospital transactions. The most commonly-available modules in an HIS - such as patient registration,



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admission, discharge, transfer, billing, insurance claims submission, pharmacy management, supply and inventory, accountings, human resources - give a hint of the wide coverage of transactions handled by the system. These and other transactions are mission-critical to the hospital, they generate and utilize large volume of data around the clock on daily basis, they rely on a dependable HIS that is available 7*24.

The system's high availability (HA) must be addressed at all levels, including application, host, network, and storage. A sound HA system should deploy software-clustered hosts and virtual host technology, to ensure the availability of hosts and continuity of applications; as well as fully redundant SAN switches to ensure the availability of network paths. In addition, the storage must be enabled to deliver equivalent availability, so that an end-to-end redundancy from hosts through network to storage may be achieved.

While the applications of host virtualization and networking technologies for HA purpose have largely reached maturity, the same could not be said about storage HA. Therefore selecting a best-fit HA SAN architecture was identified as one of the key requirements for the project team.

Solution: HA-AP HA SAN Architecture

The project team considered the Loxoll's HA-AP Appliance, EMC VPLEX and IBM SVC solutions. Upon further examination, the team found that although all three solutions provide storage HA function by mirroring data, however in more ways than one, the HA-AP and the other solutions are actually based on two very different designs and technologies:

1. **Solution Type.** The VPLEX/SVC is a virtual storage solution that also offers HA function, the storage virtualization nature dictates that the original LUN is either "stamped" or re-packaged before it is mapped and presented to the servers. Since servers do not see the original LUN, the LUN would become inaccessible if the gateway should fail.

On the other hand, the HA-AP is a physical hardware data router built to perform only HA function. HA-AP retains LUN data in its unmodified, native format on disk. If necessary, direct storage system access could be restored by simply removing HA-AP from the data path.

2. **Hardware Configuration.** The VPLEX/SVC is a clustered Linux x86 PC system with multi-core high-power processor, large high-speed cache memory, and 8GB/sec. HBA card. This type of system structure is complex, requires dedicated administrative server and metadata LUN. It would seem that longer installation cycle, more tedious setup and configuration tasks, more complicated maintenance procedures, and higher stability and security risks are all valid concerns it.

Instead, the HA-AP's single-purpose, modular enterprise-grade integral design and embedded operating system can deliver reliable HA SAN without any of these drawbacks.

3. **Synchronized Write Caching.** The VPLEX/SVC's virtualization approach requires high CPU power and large cache memory to process data. The most critical technical challenge is that in order to avoid data corruption, data consistency of cache memory amongst all engines must be maintained at all times.

In comparison, the HA-AP's data-routing approach accomplishes LUN synchronization through analyzing standard SCSI3 read/write commands, and dispatching/re-directing data accordingly. Engine cache memory is used for command queuing purpose only, no write-caching is performed and therefore no cache synchronization is necessary, so there is no concern for data integrity.



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4. **Failover.** Upon system component failure, the VPLEX/SVC's clustered Linux structure requires the analysis of various factors in reaction to failure. It usually takes 40 seconds or more to complete the failover, which is more than likely to have a negative impact on the applications.

Because HA-AP does not utilize synchronized writing caching, in all cases of failure caused by storage, FC connection, or HA-AP engine, failover simply involves switching over to a healthy data path, which can be accomplished instantaneously and without forcing application downtime.

The project team carefully evaluated these findings, visited existing HA-AP client site to confirm their findings, and chose the Loxoll HA-AP Appliance solution:

- Two 3PAR StoreServ 7400C array storage systems, about 50TB data, at the back-end
- An Oracle RAC database and the HIS on the front-end
- A total of 5 physical servers and 5 VMware-based virtual clients
- A clustered dual-engine Loxoll HA-AP Appliance connecting the front and back ends

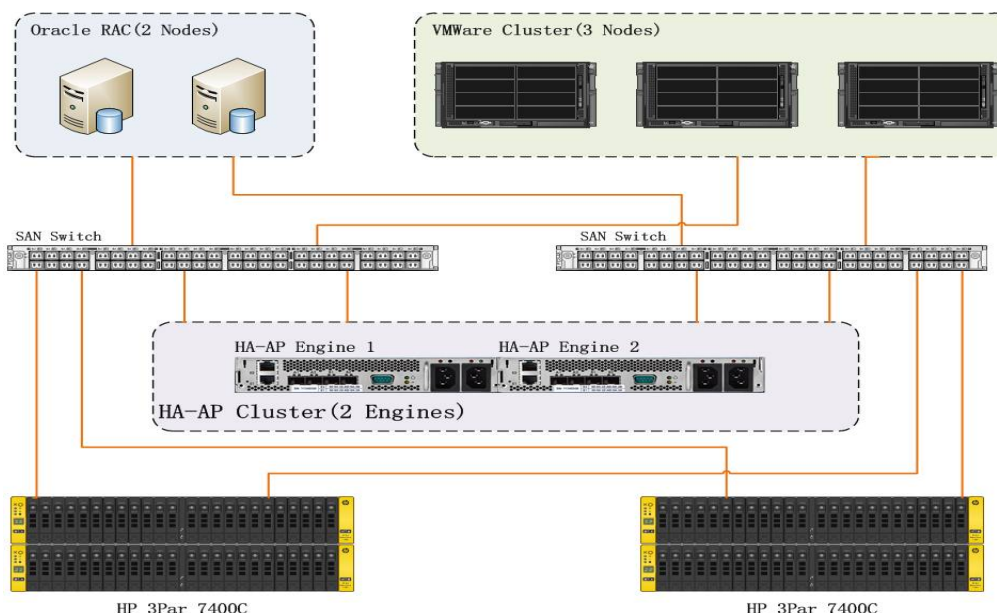


Figure 1. CSPH HIS System Configuration

Benefits: Affordable Zero-downtime Business Continuity

The system has been installed, tested, and in production with highly satisfactory results. The SI's manager-in-charge, Mr. Zhu, passed on these customer comments, "The Loxoll HA-AP Appliance is a dedicated hardware that enables storage HA. Its active-active design is so effective, repeated testing has demonstrated that failover/failback do not affect the applications. We have very strong confidence in this system."

Mr. Zhu also drew his own conclusion, "The Loxoll HA-AP Appliance is a very affordable, high price-performance HA SAN solution. It assures zero-downtime business continuity for our customers."

Loxoll Inc.

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