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## Preventative Medicine

HOSPITAL UPGRADES ITS HEALTH CARE STORAGE NETWORK

By Calvin Hsu

**W**ith electronic data, storage reliability is paramount. When that electronic data represents the critical medical records that ensure quality patient care—charts, exams or prescription orders—reliability takes on a whole new meaning. In preparing to launch one of the world's first all-digital, paperless and film-less hospitals, the Community Health Network of Indiana needed to take a fresh look at its disaster recovery strategy.

Community comprises four hospitals,

six immediate-care centers, three nursing homes, and more than 60 other premier health care facilities located throughout central Indiana. It has a long-standing commitment to leveraging advanced information technology to provide best-in-class patient care and was recently named one of the most innovative hospital systems in the U.S. by the American Hospital Association (AHA).

### LIFE-CRITICAL INFORMATION SYSTEMS

Community's Indiana Heart Hospital is scheduled to open its doors in

2003 with new all-digital clinical information systems that will affect every aspect of a patient's stay. Radiology exams, patient charts, bedside documentation, prescription-order entry, and patient tracking with wristbands and scanners will eliminate errors that can occur with handwritten notes and paper tracking.

Community has consolidated much of the organization's critical applications and data with a storage area network (SAN) at its East campus data center. The application environment includes a combination

of Microsoft and IBM AIX clusters. IBM Enterprise Storage Servers (ESS, aka “Sharks”) originally handled the bulk of the storage and high-availability requirements, and the redundant controllers and RAID capabilities of the array provided some protection for the mission-critical data.

Data storage was approaching maximum capacity levels of the existing hardware, and with data projected to explode when the Heart Hospital was fully operational, the hospital’s IT staff faced two major data storage challenges. First, the team needed a solution for rapidly and cost-effectively managing and scaling the storage capacity required to house all the digital medical histories. Second, any solution implemented needed to thoroughly protect the data from localized outages and large-scale disasters.

#### **OUTGROWING THE DISASTER-RECOVERY (DR) PLAN**

Previously Community leased a “cold site” (a separate location with office space and basic infrastructure necessary to set up operations) for disaster recovery (DR). In the event of a catastrophe, Community’s IT staff would spend 24 to 48 hours moving equipment to the cold site with the expectation that all systems be back up and running within three to four days.

Although Community never used the cold site, they did suffer a systems outage—not a wholesale disaster, but a significant storage-hardware crash—and the clinical information systems were out of com-

mission for a total of seven tense hours. Fortunately, the outage occurred prior to the implementation of a full-scale paperless system, so in this instance, the impact on patients and physicians was minimal. With more critical information systems regularly coming online, seven hours of downtime—(much less three to four days)—was no longer acceptable. The hefty annual cost of the cold-site arrangement heightened the pressure to develop a new strategy with a faster recovery time, lower cost, easier implementation and greater flexibility.

Community’s IT staff examined a number of options. The team considered purchasing additional Shark servers, leveraging IBM’s Peer-to-Peer Remote Copy (PPRC) feature to replicate data between the East campus and the new Indiana Heart Hospital. However, because 12 miles separate the data centers across public right of way, PPRC would require a long implementation window and a major investment in dark-fiber connectivity. While Community’s IT staff was pleased with the functionality and reliability of the IBM hardware, they knew the costs and administration of this approach might be cost-prohibitive. They also considered StorageWorks options from Compaq, but encountered similar limitations.

Community’s integration partner STI (an IBM TotalStorage Solution Center) proposed an alternative strategy based on DataCore Software’s SANsymphony storage networking platform. The solution was the only one able to fulfill the need for simplified storage management, cost-effective, scaleable

architecture and affordable disaster recovery, it was also the only option that leveraged existing Ethernet infrastructure to fit Community’s budget and timeframe. The combination of capabilities and a functional demonstration earned Community’s approval, and the implementation took place in the summer of 2002.

#### **HIGH STORAGE UTILIZATION: A KEY TO COST-EFFECTIVE DR**

Boosting the efficiency of the primary site is critical in rapid data growth environments, because extraneous costs or waste are multiplied by DR replication. Prior to implementing the current SAN, Rick Copple, Community’s CTO, estimated that on average, utilization rates were only around 50 percent. Certain applications would run out of disk space, while others used only a small fraction of allocated capacity. This type of low utilization is common due to several limitations of operating systems and traditional storage environments:

- Administrators are forced to guess how much storage an application will need over its lifetime and provision that amount of storage long before it’s needed.
- Due to the challenge of accurately estimating each application’s storage needs, administrators tend to over provision capacity to avoid the downtime costs of adding more storage.
- Enterprise-class arrays offer volume-copy features useful for backups, application testing and other tasks, but these secondary copies are confined to and compete for space on the same array, depriving mission-critical applications of valuable and costly disk capacity.

With half of the storage capacity already going to waste at the primary site, replicating volumes to a remote DR site would only perpetuate the same wasteful practices. Copple wanted to address this issue as part of the DR plans.

### **AUTO-PROVISIONING YIELDS HIGH UTILIZATION**

DataCore's SANsymphony software maximizes capacity utilization at Community's primary and contingency sites by automating storage provisioning with Network Managed Volumes (NMVs). NMVs dynamically allocate small volumes of physical disk resources to applications as needed, so actual disk usage keeps pace with actual data requirements. This approach has enabled Community to tap 90 percent or more of available capacity with less administrative overhead.

NMVs are specialized "virtual volumes" that present an oversized image of a disk to applications. In other words, the application sees a locally attached 2TB disk (or any arbitrary size) – but on the back-end, only a fraction of the real disk capacity is reserved. When the application data reaches a pre-determined threshold, SANsymphony automatically allocates more space from pooled storage resources—from any make or model.

### **FLEXIBLE STORAGE INFRASTRUCTURE ENABLES AFFORDABLE DR**

With the utilization issues resolved, Copple and his team turned to SANsymphony's Asynchronous IP Mirroring (AIM) for remote replication to the DR site.

Delivering significant cost-savings, AIM enables the organization to use

existing or lower-cost IP Wide Area Network infrastructure for remote replication, in lieu of the expensive, dedicated optical cable required by many other storage-based remote copy solutions. It also eliminates the need to purchase specialized communications converters at each site.

Community implemented 2Gbit Ethernet connections with Cisco 3550 switches, providing adequate bandwidth to handle the volume of data that is asynchronously replicated on a daily basis. When additional funds become available to build a complete Fibre Channel infrastructure between sites, Community has the option of using SANsymphony's synchronous mirroring feature to keep a remote copy of data in lock-step with the production site.

In addition, AIM delivers the flexibility to use any mixture of storage hardware at the primary and contingency sites—enabling Community to implement a tiered-storage approach to match the costs of arrays to the magnitude of the task. Rather than having to build two identical Shark configurations across the locations, Community struck a perfect price/performance balance and deployed IBM's FAStT700 storage arrays for the primary site at the East campus and lower-cost FAStT500 arrays for the North campus contingency site.

With SANsymphony, Community maintains two copies of data at the primary site on separate FAStT700s, replicated to one copy (on a single FAStT500) at the contingency site. This configuration contrasts sharply with most hardware-based remote replication offerings which require

each array at the primary site to have a dedicated, one-to-one relationship to a like array at the DR site.

### **HIGH PERFORMANCE OPTIMIZES IT STAFF PRODUCTIVITY**

SANsymphony accelerates the throughput performance of Community's midrange arrays with powerful caching technology. Database processes that took 30 minutes now take just 10; backups received a similar boost, and one application that previously took 25 minutes to complete 2,200 transactions now takes only seven minutes.

In addition, SANsymphony consolidates the remote mirroring function in the network to uniformly replicate data for multiple heterogeneous servers—without additional server software and across disparate storage devices. From a single console, administrators can establish remote mirroring relationships for any volumes within the SAN, eliminating the time-consuming process of configuring each device repetitively. The benefits of this centralized approach eases the administrative burden of managing two large data centers for Community's IT server staff of 14.

Overall, the economic advantages of this entire approach have made it possible for Community to quickly and affordably implement an entirely self-assured DR solution, making the most of internal resources.

### **THIRTY MINUTES OR LESS**

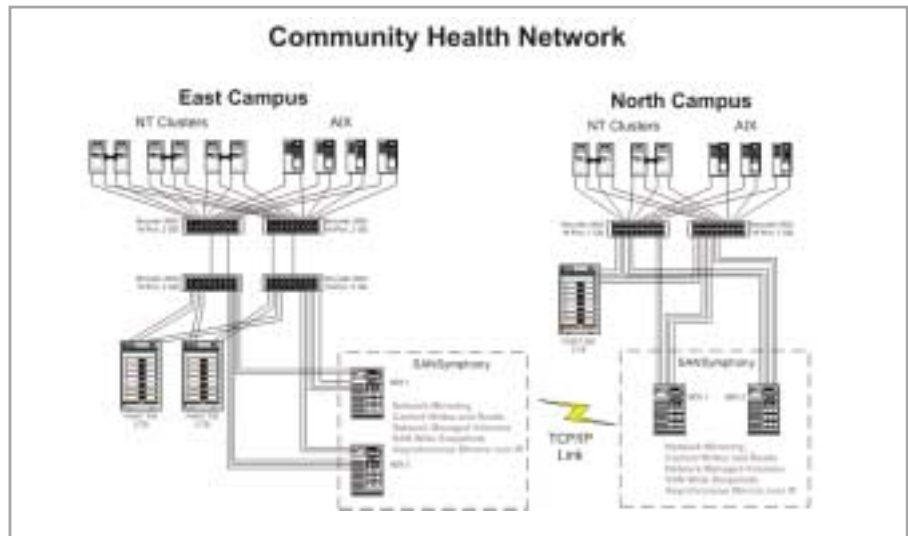
The current state of the implementation is shown in Figure 1 (courtesy of Community Health Network). Standby Windows and AIX server clusters at the North campus are at the ready to take over processing duties

from their East campus counterparts. The environment ensures that data is protected through remote replication and there is absolutely no single point of failure at the primary data center:

- Clustered servers with redundant host-bus adapters (HBAs) and multi-pathing software protect operations at the application level.
- Redundant paths through multiple switches and redundant storage domain servers (SDSs) running SANsymphony software protect the network and control its management.
- At the storage level, rather than rely simply on RAID in the subsystems, Community can mirror volumes with SANsymphony across completely separate storage devices, providing an added level of protection.

At the North campus the environment is similar; fewer switches and a single storage device are suitable for DR purposes.

Community maintains two types of scripts to assist in the transition to the remote site. If there is enough advance warning of trouble, one script inserts a SANsymphony command in the data stream that synchronizes the most recent transferred data, renames



the remote servers and brings up the clusters at the remote site. In the event there is no time to prepare, a different script is used to roll back to the most current available data and bring up the contingency servers. In procedural testing, Community has validated test failovers to the contingency data center in less than 30 minutes. As Community's implementation matures and the Indiana Heart Hospital opens with its all-digital operations in the coming year, a rotation of staff at both sites ensures a swift recovery in the event of a major outage.

DataCore's flexible storage networking architecture gives Community Health Network and the physicians and patients who rely on it for superior health care, a reliable platform that can grow and scale in

resiliency, performance and capacity as modernization and digitization continues to improve the quality of its services. ■

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