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DATA OVERFLOW

Options are available to hold the tide of images and information.
 by Mark Hagland

Director of Technology Management Michael Carper and his colleagues at Northwestern Memorial Hospital in downtown Chicago have seen the future, and it's crowded with documents, images and files. The 750-bed academic medical center, like many hospitals and health systems around the country, is rapidly outgrowing its storage capacity, compelling its leaders to make outsized future plans.

Northwestern Memorial has 150 servers (average, 10 gigabytes per server) with direct storage--30 terabytes for clinical files and 10 to 12 terabytes for nonclinical storage. But its storage needs are growing at an astonishing rate of 60 percent a year, fueled primarily by new and expanding clinical applications and by growing picture archiving and communications systems (PACS). "From an infrastructure perspective, I tell people that everything's changing. If someone who's working here comes back a year-and-a-half from now, they won't even be able to find the data center," says Carper, who functions as both chief technology officer and chief information security officer.

Clearly, the organization needs a strategic storage plan. And it has one, Carper reports. The plan dovetails with the overall IT plan, which includes completing implementation of a comprehensive electronic medical record (EMR) in the next couple of years. Carper says that he and his colleagues are busy executing their storage plan now, with the assistance of the hospital's storage vendor, Louisville, Colo.-based Storage Technology Corp. (StorageTek), and its core clinical systems vendor, Cerner Corp., Kansas City, Mo.

The plan includes disaster recovery through one of Cerner's data centers, as well as StorageWorks EMA from Hewlett-Packard, Palo Alto, Calif., for clinical data, and the Symmetrix 8830 networked storage system from EMC Corp., Hopkinton, Mass., for nonclinical data. All is backed up by a StorageTek digital tape library.

The hospital's virtualization of data (storage in diversified locations rather than a centralized one) is extremely important, he adds. "Being centrally located in Chicago is good for a lot of reasons but puts us at a disadvantage per data recovery. It doesn't make much sense to build a second center here in downtown Chicago," Carper says. "The bottom line is, if your storage network grows large enough, it's physically impossible to recover it by tape. If you needed to completely restore your business from tape, it's going to take you quite some time. Most folks are moving toward real-time mirroring of data," he explains. "All of our storage networks are capable of mirroring; with virtualization, you have 100 databases. We're virtualized on the entire network. The next step will be mirroring the data off to a second location."

A rush to storage

What Carper is doing at Northwestern Memorial is being attempted in hospitals, health systems, medical groups and health plans nationwide as realization of the need for strategic storage planning comes, and quickly, to healthcare IT executives and managers. Although storage is becoming less costly per terabyte over time, right now it is costing healthcare organizations daily as data and images continue being created.

Among the key factors in the rapid push for storage:

- Development and expansion of PACS, which have exploded the number of diagnostic images being viewed, stored, and shared for consultation
- Development of diagnostic and other technologies in specialties such as cardiology and surgery
- Implementation of full EMR systems in hospitals and health systems
- Security, privacy and accessibility requirements under the Health Insurance Portability and Accountability Act
- An ongoing decrease in costs of storage
- Integration of information systems across enterprises

Buzzwords and concepts in storage include virtualization, tiering, storage area networks (SANs), information life cycle management, connectivity and flexibility. "I think the leading edge in this is that hospitals are deploying patient information life-cycle management approaches and strategies," says John Mello, director of global healthcare solutions at EMC Corp. The intent of this approach is to take information when the patient enters the system, manage it with no down time, migrate the data and network it wherever needed, and archive it for continuous storage and access, he says.

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The four elements in a successful strategic plan for data storage, Mello says, are management, automation, migration/networking and archiving. And though they still represent a tiny minority, some organizations, like Boston's CareGroup integrated health system, a client of EMC's, claim an important achievement--making data readily available to all who need it, especially clinicians, while storing it efficiently and cost-effectively according to the organization's needs and priorities.

All this is coming just in time, as larger files begin to swamp current storage systems. "It looks like 90 percent of the 500+-bed hospitals will have deployed PACS by 2008," Mello says. "And the big surprise is, the great majority of small- to medium-size hospitals will be expanding to deploy PACS." Although only about 5 percent of hospitals have a comprehensive EMR right now, virtually all of them will by the end of the decade, he predicts.

Opinions on tape storage

Every aspect of storage planning holds a range of choices, so it can be a challenge for healthcare IT leaders to figure out the most appropriate approach for their organization. One area of debate is the type of storage--whether and to what extent storage for particular types of data and files should remain, or become, tape-based, and what kind of tape to use.

Some in the industry advocate a complete move away from tape-based storage, among them Melinda Gross, vice president of healthcare solutions at Walnut Creek, Calif.-based EVault, which offers non-tape-based solutions. "We find that about 40 to 60 percent of tape-based recoveries fail because of human error," Gross contends. "We're asking human beings to stick a tape in a tape drive, take it off on a daily basis, get it offsite. And in many establishments, that's not that person's primary job."

Although some consultants advise training to reduce human error, the solution is really to eliminate human involvement as much as possible, she says. She favors disk-to-disk storage, which minimizes human error-related problems. But it represents no more than 10 percent of storage in healthcare at the moment.

Disk-to-disk storage is more expensive, Gross concedes, but it offers levels of security, reliability and error avoidance that are appealing in healthcare. And it allows for availability of files and folders in seconds or minutes vs. "hours to days in the old tape world," she says. She predicts that disk-to-disk storage will represent close to half of all data storage in healthcare in two years.

Tiering storage according to priority of need is inevitable in patient care organizations, says Vani Uppugunduri, product marketing manager of healthcare solutions for StorageTek. Data and information must always be available in healthcare, though at different levels of immediacy, she notes. For example, emergency room treatment data for a patient about to go into surgery must be immediately available, while routine physical examination information from five years ago can be stored at a less-immediate (and less expensive) level.

Spinning disk-based storage, the most immediate level, can retrieve data within fractions of a second and is often described as "online storage." The next level down, which StorageTek calls "bladestore," is "nearline" storage and involves less-expensive disk storage based on advanced technology attachment, Uppugunduri explains. Low-immediacy data can be stored in the tape-based "deep archive." Organizations have a certain percentage of data that is appropriate for each level of storage.

Another solution is storage clustering, which arises naturally out of efforts to virtualize storage, according to Robert Pegler, chief architect at Eden Prairie, Minn.-based XIOtech. He defines it as "many nodes or elements in the cluster that all are managed centrally and easily and distributed throughout the environment--not in the same cabinet and rack, but acting as a single entity. Clustering means many nodes, but all coordinated and synchronized." XIOtech's cluster-based solution involves small-size storage controllers and high-speed "fibre channels" in nodes distributed up to 300 meters apart. Using such solutions will help health systems achieve the level of data and image availability that users demand, Pegler says.

"Complexity is the killer" of storage solutions he contends, "especially in environments like healthcare that aren't as facile as the classic Fortune 500 corporations." Simplicity keeps costs down, Pegler says, citing reports that for every dollar spent on storage, organizations spend \$7 to \$13 on operating and maintaining storage equipment over its lifetime. "A lot of CIOs tend to gravitate toward cost," he says, "but it's the cost of operation that makes us competitive."

The trend toward SANs is also becoming pronounced, says Jackie Ross, vice president of marketing for the storage business unit of San Jose, Calif.-based Cisco Systems, a SAN vendor. Being able to offer "multiple connectivity options or multiple transports" to help hospitals appropriately tier their storage is what will be important, she says. Although fibre channel is still the transport of choice for SANs, "the trend is moving to PCP-IP [Internet protocol] technologies integrated into SAN switches for maximum flexibility," Ross says. "That trend will help hospitals save as much as 50 percent or more in connectivity costs over pure fibre channel-based solutions as hospitals will be able, through the I-SCSI translation protocol, to create more cost-effective ways to connect, including via regular Ethernet connectivity."

Cooperation is key

With organizations moving, inevitably, toward larger and broader solutions, developing comprehensive storage plans has become quite challenging, says Bob Griswold, vice president of technology and information and chief technologist at Austin, Texas-based Crossroads Systems Inc., a SAN connectivity vendor. "I wish I could say there was a simple conceptual solution to all this," he says. But the reality is that although a few large vendors have the capacity to develop an enterprisewide solution, it has to be implemented in conjunction with the medical equipment vendors that installed existing systems.

"You need a partner who's going to work with you in conjunction with those vendors of earlier systems," Griswold explains, "because the last thing you need is people pointing fingers at each

other." Only when all an organization's vendors are working in concert can the biggest problem be confronted, which is "content-addressable storage--how do I get to the storage based on the type of data in the files, rather than how do I get to the storage based on the storage," he says.

In the real world, vendors sometimes have to be forced to work together, says Community Health Network's Copple. The big players want you to use their solutions, which are direct attached storage, not SAN-based, he explains. The big vendors are used to selling in a package deal, "and for you to defy that is a challenge." But Copple maintains that given the right kinds of pressures, coordination and integration among vendors is possible.

There's no time to lose. Storage needs are only going to accelerate. Organizations that seize the opportunities to enhance the work environment for clinicians and staffs, secure data, improve reliability and save money can reap the rewards.

Mark Hagland is a contributing writer based in Chicago.

HOSPITALS SCRAMBLE TO COPE

Many organizations are already moving toward the next level of storage capability and connectivity. For example, at the Medical University of South Carolina in Charleston, manager of radiology informatics Jay Crawford and his colleagues have gone through several generations of storage solutions, beginning in the 1980s when the organization first adopted PACS. But with requests for diagnostic images from PACS reaching 100 a day at the 585-bed teaching hospital, Crawford's staff was being overwhelmed.

So in April 2002, they went live with a two-tiered system of both spinning disks and a tape library, with a buildout capacity of 67 terabytes. They'll probably add another 10 terabytes on spinning disks within the next year, Crawford says, "and the 67 terabytes of deep storage gives us potentially 10 years." Just in time. "We recently acquired five 16-slice CT scanners, and our storage needs will double as we get those, with probably eight new terabytes of storage needed per year. That's 165,000 studies per year."

At the five-hospital Community Health Network in Indianapolis, chief technology officer Rick Copple and manager of technical services Chris Stewart report implementing a SAN-based system from Fort Lauderdale, Fla.-based DataCore Software Corp. It involves synchronous mirroring, with every file written to two separate disk arrays for redundancy, as well as asynchronous mirroring (with a third copy of each piece of data) to the system's secondary data center--all using fibre channel connectivity from IBM, Armonk, N.Y., and attached disk storage.

Last fall at the University of Washington School of Medicine in St. Louis, technical support manager Rick Taylor led implementation of a virtualized storage system from XIOTech, Eden Prairie, Minn., that is providing 3.6 terabytes of disk space for the growing storage needs of the research physicians. Immediate access to data was a key driver of a virtualized approach, Taylor says.

--M.H.

SOME STORAGE TERMS

Disk-to-disk storage: Entirely disk-based storage--does not involve tape drives

Storage area network (SAN): High-speed subnetwork of shared storage devices whose architecture makes all storage devices available to all servers on a local or wide area network

Storage clustering: Connecting two or more storage sources to increase speed, immediacy and availability of data; most often used in large and multifacility organizations

Tiered storage: Maintaining different levels of storage for different types of data and images--from spinning disks, also called "online" storage, the most immediate and most expensive option; to "nearline" storage with less-expensive disks; to "offline" tape-based storage

--M.H.