Princeton Radiology keeps up with storage growth with Dell Compellent SANs

Challenge
Princeton Radiology needed to replace its direct-attached storage environment in order to accommodate the onslaught of data created by digital imaging, electronic medical records and a new picture archiving and communication system (PACS).

Solution
After evaluating storage solutions from several hardware vendors, Princeton Radiology selected the Dell™ Compellent Storage Center SAN, part of the Dell Fluid Data architecture, for its ability to efficiently accommodate storage growth and provide cost-effective data protection and disaster recovery.

Benefits
- Able to accommodate a data growth rate of 500 gigabytes per month without pre-allocating space
- Storage allocation changes can be made in minutes vs. up to a day
- Up to fourfold improvement in storage utilization
- 90% of data automatically migrated to cost-effective, Tier 3 disk

Application areas
- Disaster Recovery
- Electronic Medical Records
- Intelligent Data Management

“Automated tiered storage allows us to grow cost effectively. We have more than 30 terabytes sitting on tier-three storage of the primary system. It just wouldn’t be an option for us to have all that sitting on tier one—that would put us out of business.”

Alan Howard, Director of Information Technology, Princeton Radiology

Customer profile

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Digital imaging throughout the practice is the latest in a long line of advancements that Princeton Radiology has seen in its 50-plus years of operation. It’s also one of the most dramatic in terms of improving patient care. Digital images are more flexible and robust. They’re easier to share and preserve than their film-based predecessors. Yet, the benefits come with new challenges, mostly associated with storing those images and electronic patient records.

“We need to retain both electronic medical records and digital images of patients’ radiology exams,” says Donald F. Denny, Jr., M.D., president of Princeton Radiology. “We choose to keep the data indefinitely and with nearly 20 years of using electronic records, we have collected data for millions of patients.”

Princeton Radiology’s IT team knew that data storage needs could grow even more rapidly with the implementation of a GE Centricity PACS-IW picture archiving and communication system (PACS). “To accommodate such a massive amount of capacity, we clearly needed a better model than the direct-attached disk drives we were using,” says Alan Howard, director of information technology at Princeton Radiology. “The new infrastructure had to provide the capacity we require today while scaling easily for future growth.”

Long-term data retention was not the only challenge. Princeton Radiology was not seeing the storage performance and reliability it needed. The medical staff couldn’t access images and records quickly enough to ensure top-notch patient care. “We need to share information with hospitals and medical practices around the country on demand,” says Howard. “We need to have a storage infrastructure capable of supporting the performance and capacity the long-term and on-demand model requires.”

After evaluating storage solutions from several hardware vendors, Princeton Radiology selected Dell Compellent Storage Center SANs, part of the Dell Technology at work

### Technology at work

#### Services
- Dell™ Compellent™ Copilot Support

#### Hardware
- Dell Compellent Storage Center SANs

#### Software
- Apple Mac OS
- Dell Compellent Data Instant Replay
- Dell Compellent Data Progression
- Dell Compellent Dynamic Capacity
- Dell Compellent Enterprise Manager
- Dell Compellent Fast Track
- Dell Compellent Remote Instant Replay
- Dell Compellent Replay Manager
- Elekta MOSAIQ®
- GE Centricity® PACS-IW
- IBM® AIX®
- Microsoft® Active Directory®
- Microsoft SQL Server®
- MySQL database
- PostgreSQL database
- Samba Web server
- Ubuntu Linux®
- UltraGateway
- VMware® ESX Server
- WebDAV file server
- Zimbra® Collaboration Server Network Edition 7.1 on Ubuntu 8 LTS email server
- Zotec EBC Radiology Information System/Billing System

**“The radiation oncology system engineers required us to do stress testing on our storage. The comment I got back about how our Dell Compellent storage performed was ‘wow, that’s impressive.’”**

Alan Howard, Director of Information Technology, Princeton Radiology
Fluid Data™ architecture, for their ability to efficiently accommodate storage growth and provide cost-effective data protection and disaster recovery. The company now has three Dell Compellent SANs, each at a different site, which replicate data in a triangle fashion.

Dynamic Block Architecture eases growing pains
To affordably manage the massive influx of data, Howard and his team rely on Dell Compellent Dynamic Block Architecture, which tracks metadata about each block of data stored on the Dell Compellent system and automatically assigns it to either high-performance drives or more cost-effective, large-capacity drives.

Using Dell Compellent Dynamic Capacity software, Princeton Radiology can allocate any size volume up front, without having to buy excess disk drives to accommodate allocated but unused space. Thin provisioning has had a drastic impact on the cost of buying storage.

“As we implemented the PACS, we realized that we could not predict precisely the amount of storage we might need over the long term,” says Howard. “Dell Compellent Dynamic Block Architecture proved to be the ideal solution. Dell Compellent Dynamic Capacity allows us to allocate what we think we might need, but purchase the physical capacity only when we actually need it. It allows us to expand any underestimated allocation with just a few mouse clicks—we can do in minutes what it would have taken us a day to accomplish without Dell Compellent.”

Smooth scaling, better storage utilization
With Dell Compellent, Howard and his team can scale capacity, connectivity and performance incrementally and make upgrades without disruption or downtime. This flexible, scalable storage architecture paid off during the first year at Princeton Radiology.

“We first deployed a single PACS for two offices, and we planned our storage needs accordingly,” says Howard. “But just six months later, another one of our offices decided it wanted a PACS. Suddenly we needed to accommodate 50 percent more data. With the Dell Compellent SAN, we were able to simply add drives and allocate that capacity without re-provisioning servers.”

Today, Dell Fluid Data architecture is helping Princeton Radiology accommodate 500 gigabytes of growth per month without expensive upgrades or unacceptable downtime. Storage utilization has also improved, by as much as fourfold for some systems. “Before we bought Dell Compellent, we had to buy a dedicated shelf of disk just for our radiology information system,” says Howard. “There was one terabyte of space dedicated, and that was carved up into a couple partitions. As soon as we switched to Dell Compellent, we started out by mapping the exact same volume structure. We mapped a terabyte over, and we saw that on the Dell Compellent SAN, we were actually using only about 250 gigabytes.”

Cost-effective, automated storage tiering
Patient data has a long life cycle. It can be inactive for long periods of time before being accessed again. Automated tiered storage using Dell Compellent Data Progression software makes efficient information lifecycle management a reality. Princeton Radiology relies on a mix of high-performance and high-capacity drives in the Dell Compellent systems to balance disk performance and cost.

Dell Compellent Data Progression automatically classifies and migrates data to the ideal tier and RAID level based on actual usage patterns. Since Howard implemented the first Dell Compellent storage system, 90 percent of Princeton
Radiology’s data has migrated down to the lowest tier of disks, without any application-based hierarchical storage management and without any specific per-tier provisioning.

“Automated tiered storage allows us to grow cost-effectively,” Howard explains. “We have more than 30 terabytes of data sitting on Tier 3 SATA storage of the primary system. From a cost standpoint, it just wouldn’t be an option for us to have all that sitting on our Tier 1 15K Fibre Channel storage—that would put us out of business. And it would take far too much time for us to move data from one tier to another manually. With the Dell Compellent SAN, we establish the rules, and then let the Data Progression software move block-level data automatically.”

No compromises on performance
With high-performance drives focused only on the most active data, Princeton Radiology can maximize storage performance where it’s most needed. “In the past, we had to use one type of drive for each storage system,” Howard explains. “Now we can automatically reserve the highest-performance, high-cost drives for frontline care.”

Dell Compellent Fast Track enhances automated tiered storage by dynamically placing the most frequently accessed data on the fastest, or outer, tracks of each drive. Meanwhile, the least active blocks of data remain on the inner tracks of all drives in each tier. The result is ready access to frequently used data with fewer drives than conventional enterprise network storage systems.

“One of our Dell Compellent SANs is primarily dedicated to our Elekta MOSAIC radiation oncology system, and when we deployed the system, their engineers required us to do stress testing on our storage before they would authorize us to move forward,” says Howard. “The comment I got back from their engineers about how our Dell Compellent storage performed was ‘wow, that’s impressive.’”

Even the Tier 3 storage is as fast as it needs to be. “We have a lot of spindles, and Dell Compellent must do a very good job of caching, because we don’t have any performance problems,” says Howard.

Improving data protection and availability
Princeton Radiology’s previous storage architecture made it impossible to perform a complete backup if a single user was accessing the system. Restores were also problematic. Given the 24x7 nature of healthcare and the complexities of synchronizing downtime for users, the IT team experienced major problems synchronizing restored data into the master database. In several cases, the team had to go through a labor-intensive process of re-synchronizing data.

Dell Compellent Data Instant Replays and Consistency Group technology enable the Princeton Radiology IT group to dramatically improve data protection by taking frequent, space-efficient snapshots of data spanning multiple volumes. “We needed to better protect our data by taking point-in-time snapshots more than once per day, and we just couldn’t do that with the previous infrastructure,” says Howard. “We take Replays as often as every 15 minutes for critical data on the Dell Compellent SAN, while doctors and staff continue to use the system uninterrupted.”

Replays have also dramatically accelerated data recovery. “To restore from tape used to take more than 12 hours, and that was with much less data than we have now,” says Howard. “Now we can recover from a local Replay—either fully or by copying specific files—in a few minutes, or recover critical operations from an off-site Remote Replay within two- to three-hours. Since moving to Dell Compellent, we have greatly improved our recovery objectives, as well as the availability of patient data.”

Saving $24,000 a year
Princeton Radiology found the deployment and day-to-day operation of the Dell Compellent Storage Center SAN to be largely automated, with little need to contact Dell Compellent Copilot Support. Dell Compellent Enterprise Manager provides a unified interface that automates formerly time-consuming, repetitive storage maintenance tasks, enabling the IT group to eliminate the costs they had budgeted for additional SAN management services.

“We had initially budgeted up to $2,000 per month for professional services,” says Howard. “We thought we would need a contractor available or vendor support to manage day-to-day configuration issues. But with the Dell Compellent system, we haven’t needed that help. We can handle daily management in-house, without having to allocate any additional personnel resources.”

Looking good with Dell
Howard views Princeton Radiology’s success with Dell Compellent as a confirmation that he made the right choice of storage platform. “We really wanted to invest in Compellent as soon as we saw what it could do, and this technology is making me look good,” he concludes. “We’re a relatively small company, but we’re actually doing a lot of big-company things when it comes to technology. We’re able to do this at a fairly low cost largely because of Dell Compellent.”

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