Improving patient care at Iowa Health System with the IBM Grid Medical Archive Solution

Iowa Health System, the state's largest integrated healthcare system, is a growing federation of 11 hospitals and 130 clinics. One of the benefits of membership is access to common IT systems. For example, the same GE Centricity PACS environment and Carecast hospital information system are used for all hospitals and clinics throughout Iowa Health System. As a result, member firms can harness technology that may otherwise be unaffordable, says Bob Thompson, director of governance and the "product owner" for the PACS environment.

PACS image volume grows dramatically

The transition to PACS began in 2003. Today, radiology imaging at all but two hospitals in Iowa Health System (who are now installing PACS) is completely digital, and digital cardiology imaging is expected to be in place at all hospitals in 2008. The GE Centricity system is distributed among the hospitals. Digital images from each hospital and a growing number of surrounding clinics are stored at the hospital as well as in a central archive. The hospitals maintain at least one year of studies while the central archive is intended to store images for durations up to the entire life of the patient.

Overview

- **Challenge**

  The growth of digital health records and medical images led to scalability and maintenance issues with Iowa Health System's picture archiving and communication system (PACS) archive

- **Solution**

  The IBM Grid Medical Archive Solution (GMAS) provides an automated, highly reliable multi-site storage archive

- **Key Benefits**

  — *Automated management tools enable the entire archive to be managed with less administrative time*

  — *Fast access to historical images helps contribute to improved patient care*

  — *Redundant architecture helps to ensure image accessibility even in the event of the loss of a data center*

Business is growing rapidly. Today, almost 700,000 digital exams are conducted each year throughout the Iowa Health System. Once the last two hospitals are converted to digital imaging, Thompson expects to exceed one million exams per year.

Archive requirements are growing rapidly due to the addition of more rural hospitals and clinics. Increasing image size is also driving up the amount of storage required. New high-resolution scanners are being deployed each year, including 128-slice scanners that produce 500 MB to 1 GB files for each study. Thompson says, "We see no end to the growth in our image archiving needs."

Paperless processing adds to archiving requirements

Besides diagnostic imaging, other critical documentation is moving to digital form and must be archived—Iowa Heath System clinics are in the process of converting patient health records from paper to electronic form. New information will be maintained electronically using Allscripts Touchworks software. Scanned patient health records from McKesson Horizon Patient Folder (HPF) software are also archived. All work will be conducted on workstations in the exam rooms, which is expected to lower administrative costs and improve staff productivity.

Scalability challenges develop in the central archive

The PACS archive was initially part of a 40 TB storage area network (SAN) shared by the entire enterprise. The GE Centricity PACS system operated as if the archive was simply additional network-attached storage. Today, the SAN is composed of IBM System Storage™ DS4000™ disk storage systems. An IBM System Storage TS3500 Tape Library provides backup and long-term storage.

But rapid growth in PACS archiving needs—from 4 TB to 12 TB during the first half of 2006 alone—led to scalability and maintenance issues. As a result, the Iowa Health System IT staff began to explore alternative approaches to image archiving. Three vendors were asked to propose solutions—GE (using EMC storage), Hewlett-Packard and IBM.

IBM GMAS archive offered increased flexibility and scalability

Thompson describes his team's assessment of the vendors, noting, "The EMC archive is based on a proprietary file system, which would have tied us to a particular vendor. Because our medical images need to be retained for many years, it is important to have a choice of vendors when the time comes to migrate to the next generation of equipment."

When asked about HP, Thompson adds, "The HP archive is managed by the same software as the IBM archive, but the hardware is different. We felt that the storage devices used in the IBM archive were more appropriate for an enterprise environment. IBM Grid Medical Archive Solution uses the same storage systems that we have in our data center. We knew those products were reliable, and we had grown to trust IBM support."

Thompson also liked that IBM System Storage Multilevel Grid Access Manager software is based on open standards. He says, "With IBM GMAS, we could move our data to another device at any time. Overall, IBM GMAS offered the best combination of flexibility and enterprise scalability—exactly what we needed in an archive for our critical medical records."

GMAS helped lower archive costs

Because Iowa Health System allocates the cost of the archive to the departments that use it, Thompson had concerns that he might have to raise prices to cover the additional cost of GMAS compared to the data center SAN. He says, "After we tallied the cost of GMAS software, hardware,

installation and training, we were actually able to forecast slightly reduced ongoing costs. The move from the Fibre Channel drives used in the previous SAN to SATA disk drives in the GMAS archive saved enough money to more than cover the added software cost."

Redundant deployment added to GMAS resiliency

It took only three weeks to deploy the GMAS system, which initially included a 30 TB protected solution. GMAS is composed of two redundant systems, a configuration that provides resiliency against failures. Thompson's team planned to locate each of the redundant GMAS systems in its own data center—one each in two cities in Iowa. Having duplicate data would help improve availability so medical staff could continue to access data even if one of the data centers was inoperable.

One data center location was still under construction when the deployment took place, so the two systems were initially located in the primary data center. In early 2007, one half of the GMAS system was moved to the new facility. Says Thompson, "The move was a non-event because of the automatic failover protection built into GMAS.

We sent our administrator along to observe the process, but the transition was seamless to our users."

Tape storage is also part of the GMAS archive environment. Once the migration of legacy images from the GE Centricity PACS environment is complete, the Archive Node is planned to be added to GMAS to integrate tape as one of the storage tiers. GMAS allows Iowa Health System to limit the growth of disk storage within GMAS by moving older images to a tape library—flexibility that helps to keep storage costs low.

Smooth deployment and enhanced reliability helped improve patient care

IBM Global Services took responsibility for the entire project. IBM Business Partners also supported the deployment. Iowa Health System selected MSI System Integrators, an IBM Business Partner, to provide the hardware. And GE assisted with the migration of images from the SAN to GMAS.

Commenting on the smooth deployment, Thompson says, "IBM did an excellent job at keeping everything on schedule and on budget. We were

greatly impressed by how the companies worked closely together to provide a complete, integrated solution for us. Execution was flawless."

Iowa Health System plans to add about 15 TB of data per year to the archive, and scaling needs are more predictable now, thanks to reporting from GMAS. Says Thompson, "We no longer rush to add disk storage because we are about to outgrow the archive. And over time, I know we can add other applications to the archive because GMAS is designed to grow."

GMAS is transparent to the system's end users—radiologists, directors of imaging and PACS administrators. "That's exactly the way we want it," says Thompson. "Our clinicians know their images are protected in a very reliable archive, enabling them to provide better care to patients for many years to come."

And from a financial point of view, Thompson adds, "I'm quite happy about the cost—this is clearly an example of how technology can help Iowa Health System provide better healthcare to our patients at the same or lower cost."

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HealthAlliance goes paperless, filmless with the IBM Grid Medical Archive Solution

Overview

■ **Challenge**
The skyrocketing growth of digi-tal patient records and diagnos-tic images had outstripped the capabilities of the hospital's DVD jukebox-based archival system

■ **Solution**
The IBM Grid Medical Archive Solution (GMAS) provides a highly reliable, automated, multi-site storage archive

■ **Key Benefits**
— *Nearly instant access to images from anywhere there is Internet access helps improve staff productivity, allowing them to spend more time with patients*
— *Convenient access to histori-cal images contributes to improved patient care*
— *The redundant architecture of the grid-based archive helps ensure image accessi-bility even in the event of software or hardware faults*

HealthAlliance Hospital, a member of UMass Memorial Health Care, serves the communities of north-central Massachusetts and southern New Hampshire with acute care facilities, a cancer center, outpatient physical ther-apy facilities and a remote home health agency. The adoption of advanced technology is one of the keys to the hospital's success, according to Rick Mohnk, HealthAlliance Vice President and Chief Information Officer.

In recent years, the hospital has made strategic investments to move toward digital health records while eliminating traditional paper and film. Today, digital information is used everywhere—from admission to follow-up care. Says Mohnk, "Being paperless not only helps our staff improve their productivity and the quality of patient care but also low-ers our costs and improves our com-petitiveness. I'm sure that having the latest technology has helped us attract some leading physicians. And patients

often recognize the improved responsiveness that technology brings, helping them see that they are getting better care."

Over time, the benefits of technology will extend beyond the boundaries of the hospital. In an effort to deepen relationships with patients, Mohnk plans to send personal health records to consumers in the future.

New IT infrastructure delivers electronic health records

"Our new clinical systems are all electronic," Mohnk says, "Fast, easy access to diagnostic images is a priority. Our objective is to make patient records available to our clinicians anywhere—in the hospital, in their office, in the patient's room or anywhere else the staff member might be. That way, our staff has the tools to do their work in a very effective and productive manner."

The move to all-digital health records required a revamp of several underlying IT systems. After two years of planning, in 2005 HealthAlliance deployed new document management and financial systems. All the key systems run on IBM System x™ servers in the data center with information stored on IBM System Storage™ DS4200 disk storage systems in two storage area networks (SANs).

In addition, the hospital installed the Siemens Soarian Clinicals healthcare information system and the Siemens MagicStore picture archiving and communication system (PACS) for managing medical images.

Initially, the HealthAlliance IT team chose a DVD jukebox to archive diagnostic images. But it quickly became apparent that this approach would not satisfy users. Retrievals were slow and the jukebox could store only the most recent 18 months of studies. Older studies were stored on the shelf. Says Mohnk, "One of the great potential advantages of digital imaging is that our physicians can easily compare current images to others taken years earlier. But even if the images were in the jukebox, physicians had to wait minutes for retrieval. If the images were not in the jukebox, the PACS administrator had to load the correct DVD into the jukebox or the physician had to retrieve film. Either way, it was a time-consuming process. From the standpoint of quality care and staff productivity, it was not optimal. We want images to be available in seconds, not minutes."

The growing volume of retrievals was also overwhelming the jukebox. According to Mohnk, "Physicians

requested offline information approximately 50 times a day, or more than 18,000 times a year. The fact that much of the data was not readily accessible online was limiting physician adoption of the jukebox system."

The future brings even more digital data

The HealthAlliance IT team expects a continuing rise in image volume, which would place even greater demands on the storage archive. Says Mohnk, "We just added a second CT scanner, a new PET scanner and new MRI system. We also have a new digital mammography system in the plan."

Not only is the volume of scans growing, but image sizes are ballooning too. The introduction of 32-slice CT scans is expected to increase file sizes by a factor of five—from 40 MB to approximately 200 MB. Digital mammography scans can be as much as 500 MB each.

Mohnk's first priority was to replace the DVD-based archive for diagnostic images. "Patient data such as medical images and lab reports are the lifeblood of what we do," he explains. "The integrity and availability of the data must be protected, and that requires more efficient management as volume grows."

HealthAlliance turns to IBM and Siemens to help archive patient data

To address these challenges and set the best course for the future, in 2006 Mohnk turned to IBM and Siemens—companies that had been strategic partners with HealthAlliance for many years. "We considered a number of IT suppliers," says Mohnk. "In the end, we stayed with IBM because we have had a successful working track record with the company. The Siemens software runs on IBM hardware, so we knew that the two companies would address any potential incompatibilities."

The IT team began by describing their archiving requirements to IBM. Says Mohnk, "The storage system needed the flexibility and scalability to grow with us for many years to come—and it needed to be cost-effective. At the onset, we wanted the ability to store five years of PACS images—expected to reach a size of 20 TB. Given the critical nature of the files, the storage archive needed to be very reliable and always available. We also wanted a standards-based system so the archive could interface with other systems that we might add in the future. Also, we did not want to be locked into a technology that did not have market economics behind it."

IBM and Siemens prescribe the IBM Grid Medical Archive Solution

IBM and Siemens came back to Mohnk with a recommendation to deploy the IBM Grid Medical Archive Solution. Says Rik Primo, regional sales director for Siemens Medical Solutions, "We reviewed the requirements of HealthAlliance and quickly realized that the IBM GMAS was the right solution for their needs."

Mohnk adds, "Our IBM and Siemens representatives assured us that the companies would work together to make sure the GMAS storage system would meet all our requirements. After reviewing the proposal, we felt that GMAS was the right technology for us."

The initial GMAS configuration includes 15 TB of storage provided by IBM System Storage DS4200 disk systems and five System x servers, all managed by the IBM GMAS software, which consists of Bycast StorageGRID and IBM Tivoli® Storage Manager software building blocks. (In 2007, IBM began to offer Bycast StorageGRID software as the IBM System Storage Multi-level Grid Access Manager, which is now included in GMAS.)

The HealthAlliance configuration is duplicated at a separate building on the hospital campus. A wide-area network connects the two systems, allowing the GMAS archive to continue functioning even if something happens to one of the buildings. Tape backup is not required because the strategy is to keep all images online for many years. This approach has proven successful. "Since deployment, we have had absolutely no downtime," says Mohnk.

Installation and deployment were fast and uneventful, performed by teams from IBM Global Technology Services and Siemens Professional Services. Says Mohnk, "GMAS was deployed in three days. We then migrated nearly three terabytes of data to the GMAS system with zero issues during the conversion. We are very pleased."

The scalable GMAS architecture can grow well beyond the initial capacity of the system at HealthAlliance, facilitating Mohnk's plans to add other data to GMAS over time. As the existing enterprise SANs reach capacity, he plans to migrate financial data and document images to GMAS. Adding capacity is as simple as adding servers and storage systems. Says Mohnk, "Consolidating

onto a single enterprise storage infrastructure will bring management efficiencies as well as economies of scale and higher utilization of our storage investment."

The GMAS archive is accessible through many different applications

Clinicians can access patient data stored in GMAS through Siemens Soarian Clinicals, an electronic medical record and enterprise workflow application that provides Health Insurance Portability and Accountability Act-compliant access to patient medical images, lab results, radiology reports and pharmacy records. Radiologists can access the patient's diagnostic images through the Siemens PACS application that stores these images in GMAS.

Orthopedists may access the PACS system directly. Mohnk adds, "One of our doctors takes a wireless PC on a cart from one exam room to the next to show patients their MRIs. They no longer need to use the CDs commonly produced by the scanners."

Plus, medical workers at any location can access the storage grid using their Web browsers.

GMAS brings efficiency and productivity to IT and healthcare workers

Since the PACS administrator can manage the storage grid as a single entity, GMAS administration has proven to be simple and easy. "Our administrator just monitors disk storage," says Mohnk. "Maintenance and management are minimal. The software provides real-time alerts, so if there is a problem such as a failing disk, a notification is sent based on the rules we set up."

Compelling economics and better patient care make for the right medicine

"Compared to the historic cost of storage, GMAS is very attractive," says Mohnk. "In addition, GMAS has the potential to drive storage costs down further. For example, the extensive redundancy eliminates the need to invest hundreds of thousands of dollars in a tape library." But the real value, according to Mohnk, is the difference GMAS is making in patient care.

"The positive feedback we've received from hospital staff tells us in IT that we've made a difference."

One of the hospital's surgeons described a situation to Mohnk in which he was in the operating room and wanted to take a last-minute look at an image. Thanks to GMAS, the image was right there at his fingertips.

Robert L. Shelton, M.D., a general surgeon at HealthAlliance, describes how he has benefited from the new GMAS archiving system. "Having instant access to images anywhere is especially beneficial at home when I have a case first thing in the morning. I'm able to prepare before I leave for the hospital," Shelton says. "It not only makes me more productive, but it also lets me spend more time with my patients while I am at the hospital. Having quick access to years of images through GMAS helps me improve the quality of the care I provide—it is really a dream come true."

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University Health Care System improves patient care with enterprise grid storage system

University Health Care System is a not-for-profit community hospital network that serves 25 counties throughout Georgia and parts of South Carolina. The region served by UHCS is a very competitive healthcare environment, according to Bill Colbert, UHCS CIO. "Our use of technology can be a differentiator when local employers decide where to send their employees and when doctors assess the capabilities of local hospitals to determine where to send their patients. We position ourselves as a technologically advanced facility that provides high-touch care."

In recent years, UHCS has undergone a transformation into a digital healthcare facility, particularly with regard to clinical services. Caregivers have electronic access to patient records, medical images, lab results and other business data. According to Colbert, "Since starting our first Picture Archiving and Communication System (PACS) project four years ago, we are now primarily digital. The next step is to evolve the IT infrastructure to improve scalability and resiliency."

Overview

■ *Business Challenge*
The transformation into a digital healthcare facility had created the need to improve the scalability, reliability and resiliency of the hospital's information storage infrastructure.

■ *Solution*
IBM helped University Health Care System (UHCS) develop a plan for using technology to enable caregivers to provide high-touch care. The IBM Grid Medical Archive Solution protects data and simplifies the deployment, operation and management of massive fixed-content storage systems.

■ *Key Benefits*
— *Improved access to archived cardiology studies provides a competitive advantage for UHCS in the community while also helping to improve caregiver productivity*
— *Grid-based storage can dramatically help improve application resiliency and data protection so doctors can continue to treat patients 24/7, even in the event of a disaster or failure in the data center*
— *Data protection, automated administration and migration features can help improve IT productivity, enabling a small team to manage a large amount of storage*

Achieving value through IT transformation

Business Benefits

- Continual access to archived cardiology studies, harnessing technology to help improve healthcare

- GMAS delivers three important capabilities to ensure UHCS clinicians are assured of reliable data access: data protection, business continuity and automated recovery from disasters

- Grid-based storage can help improve resiliency so doctors can continue to treat patients 24/7, even in the event of a failure in the hospital's storage infrastructure

- Support for open, standard interfaces enables UHCS to leverage the storage system across the enterprise

- GMAS provides a flexible storage platform that scales to increase capacity, the number of storage tiers and the number of disaster recovery sites

The move to a digital healthcare facility has resulted in astronomical growth in data storage needs. The cardiology system alone produces over 15 TB of new data each year. That has driven the need for the UHCS IT staff to evaluate fresh, transformative approaches to information storage and archiving.

IBM and Dynamix Group propose an innovative storage solution

The IT staff wanted an open storage infrastructure that could be initially deployed in a department or two and then evolve over time into a single virtualized storage pool to support enterprise storage needs across all facilities. According to Rob Tiller, manager of Technical Support Services, "Virtualization is an ideal way for us to meet the hospital's storage needs in a cost-effective manner."

Colbert adds, "We wanted to partner with key vendors to help us plan strategically for how to use technology to further our business objectives. We had a growing relationship with the IBM healthcare group. IBM and local IBM Business Partner Dynamix Group had taken the time to learn our business, so they could propose solutions to some of the toughest challenges we had in improving efficiency—which in turn can improve patient care."

The team of IBM and Dynamix Group proposed the IBM Grid Medical Archive Solution (GMAS). GMAS combines the power of IBM Global Technology Services, IBM eServer™ xSeries® servers and IBM TotalStorage® hardware with industry-leading storage grid software to deliver a simple and cost-effective enterprise storage solution for

fixed-content data. GMAS is designed to provide data authenticity, scale on demand, automate recovery from disasters and deliver a cost-effective platform for long-term data retention by leveraging tiered storage and automating data migration to deal with hardware obsolescence.

According to Ken Sweatman, lead systems programmer, "GMAS has the scalability we need to support our enterprise and can expand to archive all our enterprise fixed-content data—cardiology and radiology studies, clinical records and business documents. We've also increased the resiliency of business systems by making GMAS the storage system for our database snapshots."

GMAS fits the demanding requirements of cardiology archiving

Archival storage for the cardiology system was the first deployment of GMAS at UHCS. Integration with existing systems was simple using the solution's CIFS and NFS support. Each night, cardiology studies are transferred from the cardiology system to an archive to make room for new images the next day. But with increased volume, archiving took more than three hours each night. With GMAS, storage systems were able to accommodate the transfer without administrator intervention or system downtime while reducing the transfer time to only 45 minutes.

Previously, the cardiology archive was maintained on a non-IBM system that was reaching its capacity. Says Tiller, "When we forecasted the cost of scaling that non-IBM system over the next several years, it was going to be very expensive due to its proprietary design."

"The GMAS storage platform was the ideal solution to the requirements of cardiology archiving," says Colbert. "Not only was GMAS cost-effective, it would protect the image data in case of

Key Components

Software

- StorageGRID software

Systems

- IBM eServer xSeries servers featuring Intel Xeon processors
- IBM TotalStorage DS4100 storage servers

Solution

- IBM Grid Medical Archive Solution

Business Partner

- Dynamix Group, Inc.

a disaster at the facility. Performance looked outstanding." Adds Tiller, "Our cardiologists need rapid access to studies, and they were complaining about slow retrievals." Availability was an issue with the EMC Centera because the system had to be brought down for maintenance. "That was a serious problem for cardiologists because they needed 24/7 access to their studies to provide the best care for their patients," says Tiller.

GMAS provides a platform for long-term growth

The GMAS storage grid software helped enable a more affordable phased deployment at UHCS. This grow-as-you-go approach allowed UHCS to benefit while leveraging new hardware advancements. Initially, the grid had two IBM TotalStorage DS4100 disk storage systems, which would handle about six months of cardiology images. Then UHCS added four more DS4100 systems to raise the total capacity of the grid to 21 TB—enough capacity to handle approximately a year or more of images. GMAS allowed UHCS to exploit the performance of new hardware advancements and benefit from the cost savings.

To provide computing power for GMAS, UHCS began their enterprise-class IBM hardware deployment with just four eServer xSeries servers powered by Intel® Xeon® processors and running the Linux® operating system. Coinciding with the storage upgrade, four xSeries 336 servers and two additional xSeries 346 servers were added. Tiller says, "This invest-as-you-grow approach is ideal for a hospital environment, where large upfront investments are difficult to justify."

The IBM products underlying the grid were all familiar to the UHCS IT staff. Says Tiller, "We already use xSeries servers and TotalStorage systems in other areas. They offer great price/performance and have been very reliable. We have been particularly impressed with the high quality and durable construction of xSeries servers. They have proven to be a solid foundation for our server and storage virtualization initiatives, which have led to us standardizing on those products for new deployments."

GMAS brings healthcare-class reliability and resiliency

In a digital hospital, fast, reliable storage systems help nurses and doctors respond quickly to changing patient conditions. Says Colbert, "Our objective is to give our staff quick access to the information they need—available at their fingertips—to make rapid medical decisions."

The IBM GMAS storage platform supports 24/7 operations, which is a major advantage relative to the prior system, which incurred downtime when UHCS needed to add capacity or perform maintenance. With GMAS, all management and maintenance is being performed while the system is operational. Management downtime has been virtually eliminated. "Now, we add capacity without disrupting the staff's use of the cardiology studies," says Sweatman.

GMAS delivers three important capabilities to help assure healthcare providers of reliable data access:

- *Data protection*
- *Business continuity*
- *Automated recovery from disasters*

GMAS maintains two physically independent copies of data to help ensure high availability and data integrity. Thus, if one storage server fails, a second replica can be used to fulfill immediate data retrieval requests and to transparently self-heal and restore a new replica on another storage resource. Automated recovery saves tremendous IT resources.

The next phase of the evolving grid is to split it between two locations to enhance disaster recovery. Says Tiller, "The distributed storage grid can help us protect our data in case we lose one site. We can continue without interruption with services delivered by the other site."

Grid helps UHCS address regulations

The grid helps UHCS address regulatory guidelines, such as the Health Insurance Portability and Accountability Act (HIPAA), which require that patient data be protected and not modified. GMAS assigns a unique digital signature to every image that is saved in the archive and then automatically checks those signatures to help ensure the integrity of the data throughout its life. Says Tiller, "With so much data and so many people wanting to access it, GMAS provides the security and flexibility we need to adapt to evolving regulations."

Cost-effective mass storage is budget-friendly

GMAS is an open system built from industry-standard hardware. According to Sweatman, "We had an investment in storage that we did not care to give up. The PACS and storage vendor neutrality of GMAS allow us to capitalize on existing investments. Further, the solution's implementation of open standards protects us from the vendor lock-in we have experienced with past investments."

The storage grid at UHCS is expected to evolve into a two-tiered storage system, beginning with disk-only storage that can archive two years of studies so cardiologists can quickly retrieve the information most relevant to patient care. Once the grid maintains two years of images on disk, the UHCS IT staff plans to add IBM tape libraries to hold the older studies. The information lifecycle management feature of GMAS will automatically manage the migration of images from disk to tape based on policies set by the IT staff. Furthermore, data is protected and authenticity assured during the migration between tiers through GMAS digital signature checks. Says Tiller, "We like the idea that as the disk-based archive grows based on the number of studies done per day, the growing collection of past studies will be stored on low-cost tape."

Success adds to the perception of leadership

Commenting on the results achieved, Colbert says, "We now have an environment where caregivers can spend more time at the bedside dealing with patients instead of the logistics of cardiology studies. GMAS is part of the technology infrastructure that has led the public and the healthcare profession alike to perceive UHCS as a leading healthcare facility in our region. We look forward to expanding the use of GMAS in other areas of the hospital."

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Facilitating the sharing and long-term storage of medical images and research data

IBM Healthcare and Life Sciences Grid Medical Archive Solution

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Highlights

■ *Optimizes storage investment by creating a virtual shared storage pool across locations*

■ *Helps ensure business continuity and facilitate disaster recovery with resilient, self-healing capabilities to protect an image for its lifetime*

■ *Offers the convenience of a packaged solution to work directly with your existing PACS applications*

Improving patient care with timely access to critical medical images

Healthcare organizations today are experiencing an explosion in the volume of medical images and research data. Serving an aging population that requires more and more exams and procedures, these organizations are coping with an annual storage growth rate that is nearly 52 percent. In fact, their storage needs are almost doubling every 18 months. At the same time, healthcare providers and researchers are becoming more distributed. To provide quality care, doctors need easy access to medical images and data across departments and facilities—even across states and continents.

The Grid Medical Archive Solution is designed to meet this growing need by facilitating the sharing and storage of critical medical images and research data across departments and geographies. By connecting silos of digital images such as those generated by radiology and cardiology, it provides easier image access and long-term storage that complies with Health Insurance Portability and Accountability Act (HIPAA) requirements. This is important to the healthcare and pharmaceutical industries because fixed-content data, such as medical images and research data that cannot be changed, is frequently accessed and must be retained for decades or in perpetuity.

Optimizing storage utilization

A grid-powered information lifecycle management solution, the Grid Medical Archive Solution creates a virtual, shared storage pool for medical images and research data. By operating across locations and storage hardware brands, it not only offers flexibility and extensibility but also provides tiered storage so organizations can use the most cost-effective storage according to their own policies and previously made storage investments.

Helping you maintain business operations and improve disaster recovery

The Grid Medical Archive Solution also helps ensure business continuity by creating multiple copies of data and separating them geographically so they are no longer vulnerable to a single point of failure. Designed for continuous operations even in the event of failure, this solution provides automated recovery to help maintain business resiliency. The solution also allows for continuous uptime even during hardware refreshes, capacity upgrades and data migration.

Offering an end-to-end solution in easy-to-understand, easy-to-buy packages

The Grid Medical Archive Solution is also simpler to buy and implement. Available in single-site starter kits or multi-site standard models, it delivers a total storage solution that includes server and storage hardware and software designed to work alongside your existing infrastructure. Plus it includes a full range of implementation services, including infrastructure planning and requirements, implementation and configuration, and technical support.

For more information

To learn more about the Grid Medical Archive Solution, contact your IBM representative or visit:

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GTD01114-USEN-00

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IBM GMAS PROVIDES ENHANCED SAFEGUARDS AGAINST DATA LOSS, INCREASES EFFICACY OF STORAGE INVESTMENTS

IBM GMAS PROVIDES ENHANCED SAFEGUARDS AGAINST DATA LOSS, INCREASES EFFICACY OF STORAGE INVESTMENTS

The world of medical imaging has changed dramatically over the last decade. The pace of technological change has been truly breathtaking. The transition from analog to digital image acquisition is now in full swing, and in modalities such as CT and MRI it is nearly universal. This dramatic change in the medical imaging world has brought with it serious ramifications for medical imaging economics. It used to be the case that medical image and patient record management costs were predictable, since their relationship with the growth in procedure volumes was linear. As the volume of images increased, the amount of floor space and dedicated personnel required for film management grew by the same proportion. For example, in the film world, if imaging volumes grew by 10 percent, then at maximum utilization, floor space and human resources could be scaled up by the same percentage in order to sustain a similar level of service to radiologists and referring physicians.

However, in the realm of picture archiving and communication systems (PACS) and newer systems such as Digital Pathology systems, the complexity as well as the costs of purchasing and managing additional digital storage do not always scale in a linear fashion. In order to maintain a high level of performance as additional storage is added, traditional solutions have required major upgrades and overhauls that can dramatically increase the total cost of ownership. As an ever-expanding flow of imaging data floods into archiving systems, a point is reached when the existing computational infrastructure is no longer capable of providing an optimal level of service. This issue is gaining critical importance as on-demand access to diagnostic images becomes a firmly established requirement among growing numbers of clinicians at the same time as the volume and complexity of imaging data continues to grow exponentially. Computed Tomography (CT) is exemplary in this regard. As shown in Figure 1, between 1983 and 2007, the number of CT procedures grew tenfold, from 7 million to 70 million. Following a quadratic-exponential trend line, by 2013 total procedures are expected to reach 100 million.

The Explosion of Fixed Content Data Calls for Flexible, Powerful Storage Solutions

It is no longer enough to merely guarantee "five-nines" of availability within a dedicated PACS storage network. Although challenging in itself, ensuring adequate availability is not the only critical requirement. Data integrity and business continuity management (BCM) are also mission critical requirements in any PACS environment. Healthcare facilities have found that providing high levels of availability as well as ensuring data integrity and continuity of operations can only be achieved by investing in technology enhancements.

Figure 1: CT procedure volumes grow exponentially.

Frost & Sullivan Whitepaper
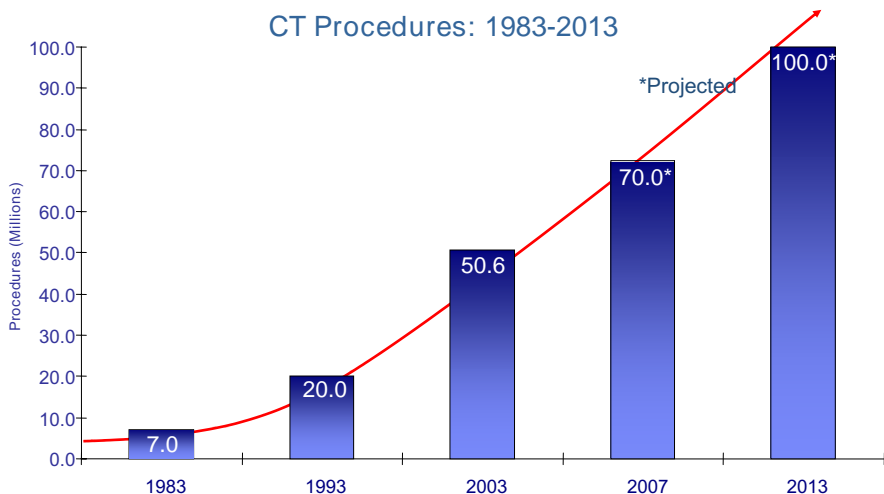
PACS have historically been implemented as "silo" solutions for individual departments and facilities, often operating on highly idiosyncratic platforms. However, these solutions are not capable of managing the tremendous growth that is occurring in the volume of fixed content data that is being sent into PACS. In addition to the lack of bandwidth, there is the complexity of managing heterogeneous PACS platforms across diverse healthcare enterprises. As more healthcare facilities become part of integrated delivery networks, the ability to manage and ensure the integrity and quality of patient data and images is becoming increasingly important. Unfortunately, because each PACS has its own siloed storage solution, the result is a high level of inefficiency. Medical images and diagnostic reports are often replicated several times across an integrated delivery network, since clinicians require local access to the patient information, and there is often no structure in place allowing the efficient allocation of needed images and storage capacity across facilities. Moreover, despite the ostensibly high levels of redundancy, there is no overarching provision for integrity of the data and business continuity in the event of a major disruption.

The IBM Grid Medical Archive Solution: Ensuring Integrity of Data throughout the Lifecycle

It is clear that the difficulty associated with scaling PACS, as they are currently implemented, stems not from the PACS architecture itself nor from an inherent lack of storage resources, but rather from an inadequate investment in technologies that can provide an overarching structure to rationalize the allocation of computing resources while guaranteeing high levels of performance and data integrity to users. The IBM Grid Medical Archive Solution (IBM GMAS) with automated information lifecycle management (ILM) capabilities embodies precisely the type of technology that is needed. IBM GMAS leverages state-of-the-art grid computing technology to enable the efficient and highly reliable management of medical images and other patient data. In addition, whereas PACS application vendors typically stress the importance of a robust local area network in providing an optimal level of service, wide area networks must be taken into consideration as well in today's distributed healthcare environments. As such, IBM has developed a solution that provides sustained performance within individual PACS networks while enabling a high level of speed and availability across heterogeneous and geographically dispersed provider sites.

Grid computing technology, traditionally associated with the harnessing of unused computational cycles on heterogeneous servers, enables IBM to deploy "storage grids," effectively creating "pools" of storage by linking previously unconnected PACS storage silos. The unique IBM GMAS architecture enables the logical separation of the PACS or other clinical application from the storage infrastructure. Thus, IBM GMAS enables the healthcare enterprise to extract additional utility from its existing storage investments, or alternatively, maximize its utility from any future storage upgrades. In addition, by deploying grid computing technologies, the IBM GMAS solution allows the entire enterprise storage infrastructure to be centrally managed like a single storage network, so that storage capacity can be automatically allocated wherever needed as it becomes available.

IBM's exclusive GMAS product is precisely the type of paradigm-breaking technology that is required in order to enable PACS managers to continue delivering high levels of performance and accuracy despite the explosion in data throughput and the ever-increasing complexity of healthcare environments. However, unlike the hardware-centric solutions traditionally favored by IT vendors selling into the healthcare market, IBM GMAS is centered on cutting-edge software technology that revolutionizes the way hardware assets are managed, thereby providing more options to healthcare organizations as they expand their imaging archives and facilities.

Moreover, by providing a rational framework that provides high levels of automation as data transitions from high value to lower value storage media, IBM GMAS helps healthcare facilities reduce the cost and complexity of managing images across the complete data management life cycle. Thus, IBM GMAS provides the functionality traditionally provided by hierarchical storage management schemes, while introducing enhanced safeguards against data loss and offering a greater degree of freedom from concerns about hardware obsolescence. A direct benefit of these technologies is that future infrastructure related upgrades and data migrations from an older to a newer PACS or enterprise application can be managed more efficiently via automated conversion and auto-exploitation functions. Thus, establishing a storage infrastructure like GMAS today will continue to deliver benefits as the imaging archive continues to grow and evolves in the future.

IBM GMAS Anticipates Contingencies for True Business Resilience, Not Just Disaster Recovery

A key feature differentiating IBM GMAS from other solutions on the market is IBM's innovative approach to business continuity. IBM understands the mission-critical nature of medical images and related patient data and the importance of ensuring that imaging systems do not fail. IBM GMAS leverages IBM's System Storage® portfolio of storage and business resiliency solutions, enabling users to streamline and even eliminate backup and restore procedures, ensure the continuity of crucial storage operations by reducing downtime to scheduled maintenance events, and assure the on-demand availability of images and data to users throughout the enterprise.

Unlike competitors implementing traditional disaster recovery solutions that rely on data centers to house backup images and data, IBM GMAS deploys grid technology in order to create a resilient solution that proactively anticipates business continuity contingencies rather than providing a reactive plan for disaster recovery. Traditional disaster recovery schemes have a single point of failure, since they rely on a unique pathway to the data center. The IBM GMAS architecture, on the other hand, allows the system to be both network aware and content aware. For example, if an image file is corrupted, IBM GMAS automatically allows the user to obtain an uncorrupted image from the closest location on the storage grid. If a network pathway is unavailable, IBM GMAS can automatically find another path to the requested data. All of this is done transparently to the application itself.

IBM GMAS Solidifies IBM's Commitment to Open Standards in Computing and Storage

In recent years, applications providers and users have invested considerable resources in defining and implementing standards for interoperability of various image and patient data management applications. However, less attention has been paid to the necessity of standards and an open framework for the interoperability and manageability of the storage infrastructure itself. Archives have been —and continue to be— implemented on a department-by-department basis, often with little thought for the needs of the enterprise. This has led to the proliferation of storage silos that have little or no interaction with other locations. In the absence of a robust set of standards, IBM GMAS is ideally positioned to provide the needed framework to enable healthcare facilities to move away from storage silos and toward a grid-enabled enterprise-wide storage repository that can be allocated in a more efficient manner by automatically taking into account resource availability and the storage requirements of the various locations across the grid. Moreover, the openness and flexibility of IBM GMAS makes it an ideal solution for the multi-vendor storage environments that characterize today's integrated delivery networks. While other vendors tie their enterprise archive solutions to proprietary hardware appliances, IBM GMAS is

vendor-neutral with regard to hardware. The ability of IBM GMAS to support multi-vendor hardware environments is a powerful testament to IBM's commitment to reducing the cost and complexity of enterprise storage management through adherence to open standards.

Deployment of IBM GMAS with Automated Information Lifecycle Management Capabilities

IBM brings its considerable technological expertise and an extensive portfolio of solutions to bear in its GMAS, combining its industry-leading services and servers with the IBM GRID Access Manager software. The components of IBM GMAS are deployed as required at each physical site within a healthcare organization in order to create a unified storage system for existing imaging operations, while preserving the flexibility required by geographically independent locations. PACS users acquire local autonomy from the underlying application, thus permitting faster remote access over a wide area network. Figure 2 shows the logical architecture of IBM GMAS.
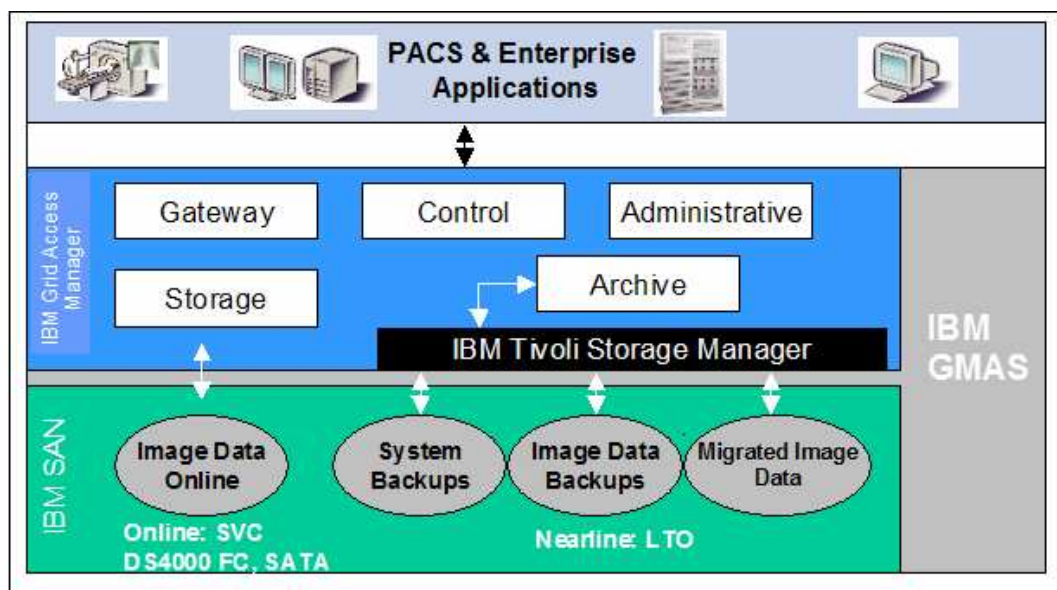

Figure 2: Medical archive grid storage architecture using the IBM Grid Medical Archive Solution.

The IBM Grid Medical Archive Solution is built as a set of services leveraging a service-oriented architecture. These services are deployed across the organization as a set of interrelated software nodes that reside as part of IBM's System Storage Multilevel Grid Access Manager Software. Data management, indexing and intelligent replication are automated to a high degree with IBM's Information Lifecycle Management features. Data exchanged between nodes is encrypted and compressed for superior security and speed. If data replication to a remote site is required, such as for business continuity purposes, in many cases the data will be replicated first to the local storage node cache and then asynchronously from the local cache to the remote site storage node. The system architecture effectively guards against data loss by providing real-time failover protection. Thus, the GMAS replication scheme ensures high levels of performance and reliability, effectively encapsulating the efficiency-generating functionalities of a Hierarchical Storage Management (HSM) system, while going beyond simple data migration to total lifecycle management that includes active safeguards for the protection of data integrity.

With its focus on reference data that is non-erasable and non-rewriteable, IBM GMAS ensures the integrity of the data. A digital signature is created and associated with each image as it is received. When the image is accessed later, the digital signature is verified to ensure that it is identical to the image originally received. IBM GMAS can notify the administrator if the

signatures do not match, or it can be configured to automatically access a parallel copy of the image without requiring user intervention.

Frost & Sullivan believes that, based on the architecture and core technology leveraged by IBM GMAS, the solution can substantially enhance the efficiency and performance of heterogeneous, multi-vendor image management environments distributed across multiple clinical sites. The benefits of IBM GMAS extend beyond the considerable enhancements it enables with regard to the availability and integrity of data for enterprise PACS users. IBM GMAS also provides for improved business resiliency by anticipating network and data contingencies rather than planning for reactive measures, such as those employed in traditional disaster recovery schemes. Moreover, through its consistent support of industry standards, IBM GMAS enables more efficient data migration and management of image data over its entire lifecycle. In summary, IBM GMAS represents the type of paradigm-breaking technology that is required in order to support high levels of service and data quality as the number of images managed within integrated delivery networks continues to grow dramatically and as medical imaging environments become increasingly complex.

ABOUT FROST & SULLIVAN

Frost & Sullivan, a global growth consulting company, has been partnering with clients to support the development of innovative strategies for more than 40 years. The company's industry expertise integrates growth consulting, growth partnership services and corporate management training to identify and develop opportunities. Frost & Sullivan serves an extensive clientele that includes Global 1000 companies, emerging companies, and the investment community, by providing comprehensive industry coverage that reflects a unique global perspective and combines ongoing analysis of markets, technologies, econometrics, and demographics. For more information, visit http://www.frost.com.

By **Jamie Bellavance**

special section: The Imaging Center
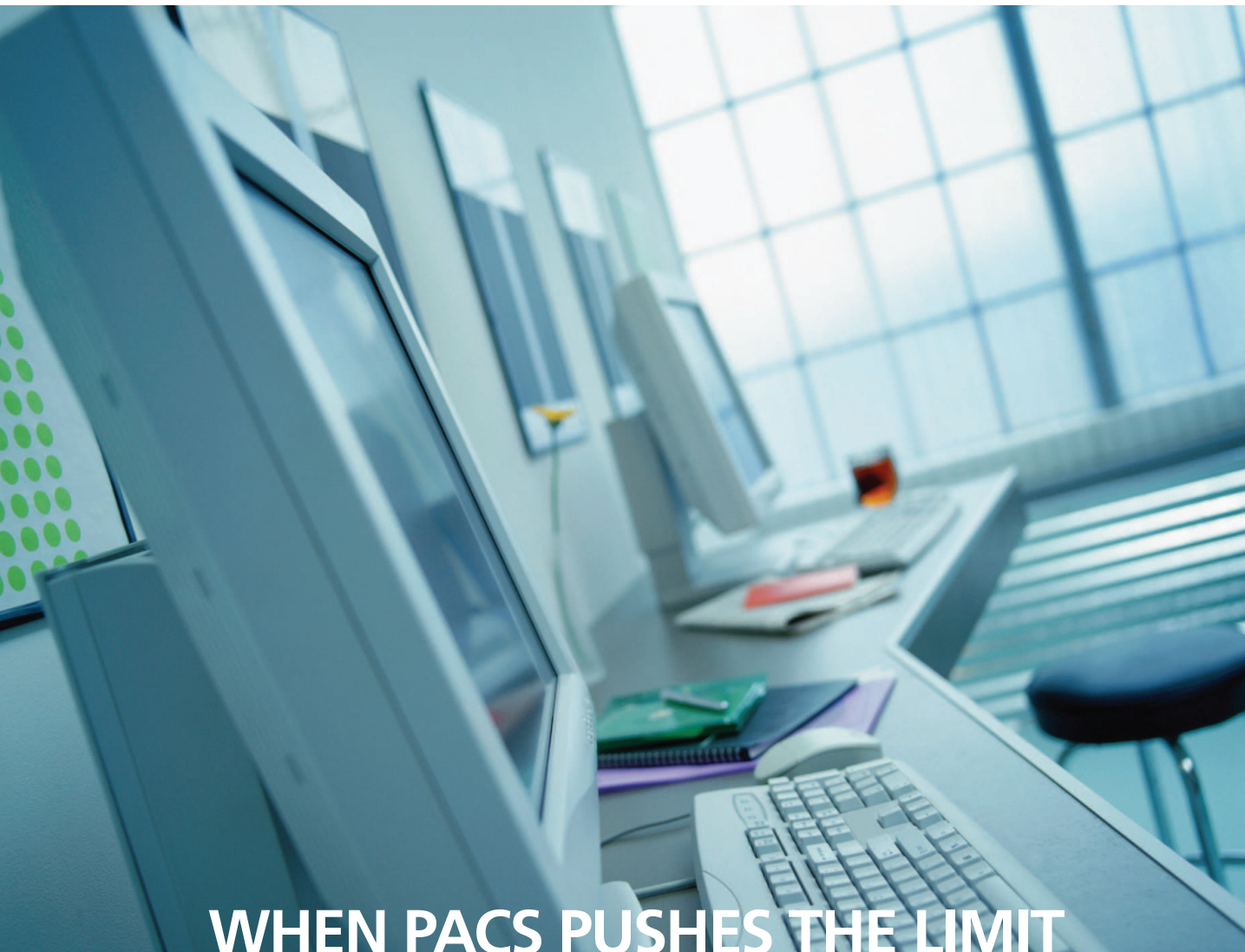
WHEN PACS PUSHES THE LIMIT
Image Storage: The Basics

With image volumes surging every day, many healthcare facilities are re-evaluating their image storage strategies. And as more sites move toward filmless and paperless environments, the need for more storage space seems to be never-ending. Fortunately, as patient data, imaging studies and archived images increase, the cost of storage is coming down and choices in data storage are expanding.

Hospitals and imaging centers running out of disk space on their PACS are looking for ways to upgrade infrastructure to expand capacity. "We're seeing growth all over, but specifically in cardiology and medical imaging, as we digitize more, the images are getting bigger and bigger, such as in digital mammography and 64-slice CT," says Jonathan Goldberg, VP and CIO at St. Peter's Healthcare Services in Albany, N.Y. "We're seeing huge growth rates in terms of what the needs are."

Facilities down the road and across the country are experiencing the same thing. *Health Imaging & IT* spoke with several that are revisiting their storage strategies. How to save short term? What to save long term? How can I guarantee immediate image access? They provide some answers on quenching the storage need.

Image storage overview

A PACS archive requires two levels of storage: short-term and long-term. The short-term or online storage is a temporary directory that receives files directly from the imaging modality, and typically stores images for 12 to 18 months on fast-access, spinning disk with a retrieval rate of two to five seconds per study on average. Long-term or near-line storage is the more permanent form of storage where images are housed for about two years.

PACS archives typically need networked storage, such as a storage attached network (SAN) — a network that connects storage devices to computers, or network attached storage (NAS) — a network that's not attached to servers, allowing access to storage using network standard protocols. A SAN is about two and a half times more expensive than NAS because a SAN requires dedicated networks and costly gigabyte switches.

The long-term view

Created in 1995, Iowa Health System (IHS) of Des Moines, Iowa, also required an infrastructure upgrade, but they were looking for storage software that could outlast future technology changes and upgrades. Iowa Health generates more than 1 million imaging exams per year that use about 15 terabytes of primary storage.

There are lots of images to manage for a health system that operates 11 physical hospitals in seven large Iowa communities and Rock Island, Ill. They also support a system of rural hospitals in 14 Iowa communities and partner with physicians and clinics in more than 80 communities in Iowa, western Illinois and eastern Nebraska.

To store these images, IHS opted for the IBM Grid Medical Archive Solution (GMAS) that uses a standard file system instead of a proprietary file system. IHS preferred IBM's standard system approach because they knew for the long term that they would be able to migrate data regardless of the futures of IBM or other software companies involved.

GMAS is an automated, self-optimizing distributed grid storage solution. It allows a multi-campus hospital to link separate storage systems together while offering redundancy and ensuring multiple copies of data are stored in at least two places. GMAS is Digital Imaging and Communications in Medicine (DICOM) content aware and allows for Hierarchical Storage Management/Information Lifecycle Management based upon a file's metadata.

In a grid storage architecture, independent storage nodes are linked and governed by common control software. That control layer provides a single management interface and fault tolerance among the nodes, as well as the ability to access either file-level or block-level storage. It also makes it possible to reassign nodes to different functions, such as from online to archival storage, as needs change.

"Organizations like ours are required to keep digital images for many years, in some cases the lifetime of the patient. Technology doesn't last that long, so we know that every five years or so we'll need to transfer the media that are holding those images from one technology to another," says Bob Thompson, director of governance at IHS. If a vendor chooses a proprietary file system, the health system is dependent on that vendor's expertise and product being available to actively support that environment when it comes time to transfer data, Thompson says. But if that vendor expires, is acquired or withdraws support, then users may be stuck with their current environment and not able to easily transfer images, he adds.

Other reasons that IHS chose GMAS: IBM's enterprise class (IBM eServer xSeries Intel Servers and TotalStorage DS4000) and its excellent support, Thompson says. "We were looking for compatibility with our GE Healthcare environment. IBM and GE worked very well together to prove that integration and performance," Thompson says. "We saw excellent support from IBM. We knew that if there was a hardware issue, IBM would be there on the spot to correct it."

The redundancy — maintaining two copies of the images — is completely automated through GMAS, and IHS achieves that automation at a lower cost than would be the case if a hospital had to purchase conventional technology and labor to get that type of redundancy, Thompson says.

GMAS requires very little labor to manage it, which is a great contrast from Iowa Health's previous environment where they were using similar hardware but were trying to manage it themselves. "The additional software that GMAS adds to the equation automates the difficult labor involved in managing that environment," Thompson says.

Worth the investment

What all of these facilities have in common is that investing in storage software that integrates easily with current PACS has helped improve data retrieval time and overall storage utilization. St. Peter's, IHS, and William Beaumont Hospitals have all made advances toward preparing for explosive data growth and image overflow in the future. A word of advice from these technological pioneers: Start thinking about storage options now, before your hospital runs out of disk space. **HI&IT**

Providing business and clinical innovations to dramatically improve healthcare

Progressing towards healthcare transformation

THE ENVIRONMENT

Today's healthcare organizations face unprecedented demands. They must outperform competitors, deliver patient satisfaction, address patient safety initiatives, reduce clinical and administrative costs, meet compliance and security mandates, harness an explosion of data and transform it into useable information, streamline distribution processes, accelerate drug discovery and create targeted treatments. It is critical that organizations thoroughly understand the scope of each of these challenges in order to implement the most productive – and successful - solutions.

THE STRATEGY
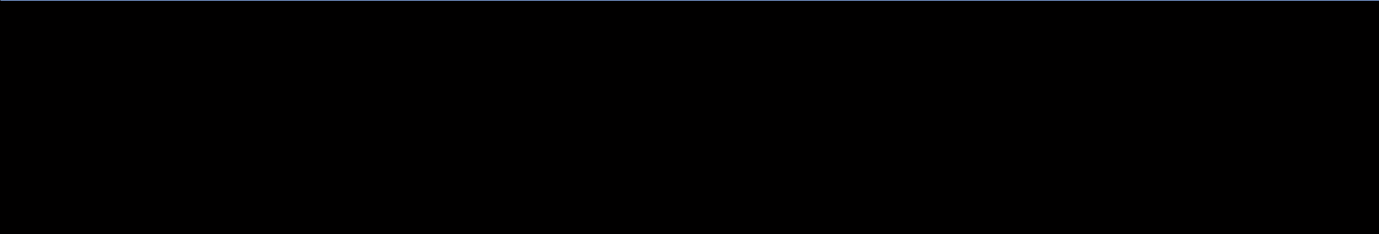
Change is complex. A single adjustment in one department can affect many others — extending out to health plans, patients and employers. Creating balance among these constituents is critical to success. In isolation, this could be a daunting task. But with an experienced team of professionals trained in healthcare processes, applications and infrastructure, organizations can greatly reduce exposures while improving their success rate.

IBM, with its network of Business Partners, provides solutions in clinical and business process optimization, patient centric networks and health and wellness management. Designed to help deliver safer, more affordable and effective diagnostics, drugs and medical care, these innovative solutions and services facilitate collaboration, interoperability, patient safety and efficiency — in a responsive, scalable and secure environment.

Since the acquisition of Healthlink Incorporated, one of the nation's foremost healthcare process improvement and IT consulting companies — the IBM healthcare solutions portfolio has been enhanced and expanded to include:

- Clinical and financial system implementations
- Patient data management
- Clinical data optimization
- Financial and operational management
- Compliance

In addition, more than 300 Healthlink consultants have joined IBM to collaboratively serve healthcare organizations. Together with its Business Partners, IBM can provide the guidance and solutions necessary to help optimize patient care and drive breakthrough operational efficiency.
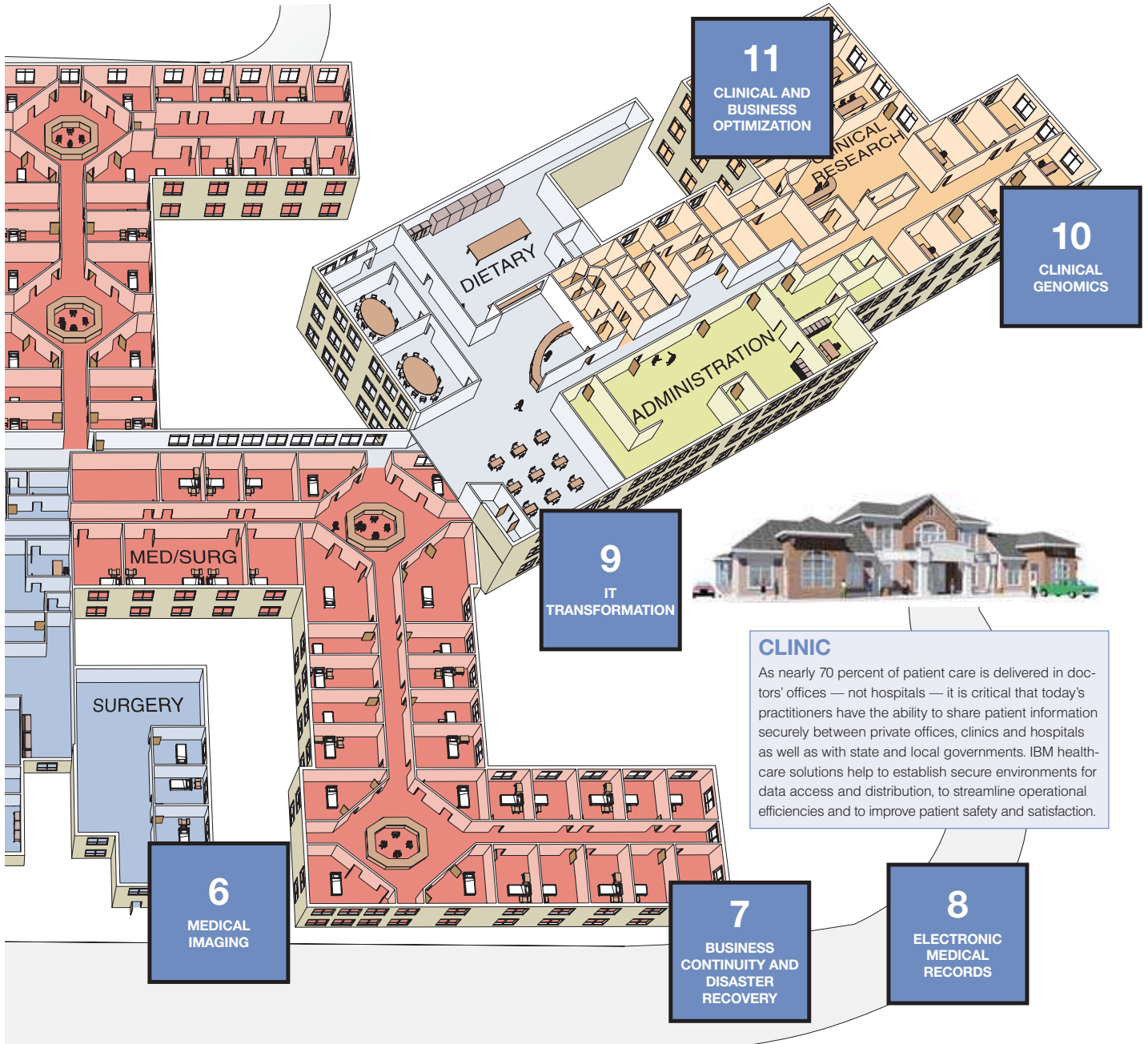
HEALTH PLANS

IBM provides solutions that can help enable health plans to reduce the time and costs associated with customer operations, enhance care with disease management and wellness programs and develop innovative, customer-focused products. By using solutions that link constituents, health plans can enhance communication, collaboration and convenience for all, while gaining significant operational efficiencies and improving member retention and growth.

BUSINESS OFFICE

1
BUSINESS INTELLIGENCE

12
PORTALS

MED/SURG

LAB

PHARMACY

2
MOBILITY SOLUTIONS

IMAGING

ASU

RT/CP

EMERGENCY

3
REGULATORY COMPLIANCE

PACU

MEDICAL RECORDS

4
ON DEMAND INFRASTRUCTURE

5
SECURITY AND PRIVACY

HOME

Today's physicians are on call from home, on the road and everywhere else. They need secure, immediate access to patient information to quickly respond to patient needs. IBM solutions help enable secure, reliable access to patient information at anytime. This not only provides remote access but can also help physicians make the most of a precious resource: time.

11
CLINICAL AND BUSINESS OPTIMIZATION

CLINICAL RESEARCH

DIETARY

10
CLINICAL GENOMICS

ADMINISTRATION

MED/SURG

9
IT TRANSFORMATION

SURGERY

CLINIC

As nearly 70 percent of patient care is delivered in doctors' offices — not hospitals — it is critical that today's practitioners have the ability to share patient information securely between private offices, clinics and hospitals as well as with state and local governments. IBM healthcare solutions help to establish secure environments for data access and distribution, to streamline operational efficiencies and to improve patient safety and satisfaction.

6
MEDICAL IMAGING

7
BUSINESS CONTINUITY AND DISASTER RECOVERY

8
ELECTRONIC MEDICAL RECORDS

IBM IN THE HOSPITAL →

CLINICAL DEPARTMENTS

NURSING

FINANCE & ADMINISTRATION

IT

CLINICAL RESEARCH

AMBULATORY

RADIOLOGY

OFF-SITE PHYSICIANS

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The time, cost and administrative burden of acquiring, deploying, supporting and disposing of IT equipment has become onerous for organizations, both large and small. IBM Global Financing has developed a broad portfolio of programs and tools to assist you in navigating the different phases of the IT Lifecycle, from planning to disposal. For more information on IBM Global Financing solutions, visit **ibm.com**/financing.

For more information on IBM solutions for healthcare, visit **ibm.com**/healthcare.

1 BUSINESS INTELLIGENCE

Understand and act on information in clinical practice, healthcare management and administration and medical research to improve the quality of patient care, improve patient safety and curb costs. IBM can help healthcare organizations transform existing data into actionable information across the enterprise — sparking insight and supporting timely, thoughtful business decisions.

2 MOBILITY SOLUTIONS

Transform clinical environments to provide immediate, secure access to patient information at the point of patient care. IBM can provide the enabling technology — including infrastructure, wireless communication devices, RFID technology and integration middleware — needed to support existing and emerging clinical processes. No matter where organizations are in the implementation process, IBM consultants can help develop and deploy departmental solutions or comprehensive, end-to-end solutions that extend throughout the hospital and beyond.

3 REGULATORY COMPLIANCE

Anticipate and adhere to regulatory compliance by JCAHO, HIPAA and other mandates in healthcare. IBM helps to translate regulatory requirements, identify related business and IT strategy challenges and define and implement responsive action plans.

4 ON DEMAND INFRASTRUCTURE

Improve patient safety by securely integrating patient data across the enterprise and beyond (local regional health information organizations, clinics, etc.) and transforming it into usable information. Control costs by deploying a variable IT infrastructure. IBM can help healthcare enterprises evolve and use existing IT infrastructure, enabling them to respond quickly, work efficiently, seize new opportunities and remain resilient.

5 SECURITY AND PRIVACY

Protect patient data from internal and external threats. Help ensure 24X7 availability and secure, immediate accessibility to critical patient data. Eliminate the need for multiple sign-ons and user passwords but ensure immediate access to data by authorized users. IBM has a broad array of security and privacy point technology enablers and solutions to help address informational and physical security and privacy needs, as well as regulatory compliance.

6 MEDICAL IMAGING

Facilitate digital image storage, access and workflow, and enable remote diagnosis and consultation across the hospital and beyond. Enhanced integration of digital imaging with both internal and external clinical data helps IBM provide comprehensive, secure, and cost-effective imaging and storage solutions.

7 BUSINESS CONTINUITY AND DISASTER RECOVERY

Maintain seamless and secure access to patient information during scheduled and unscheduled downtimes. Business Continuity and Disaster Recovery solutions from IBM enable healthcare organizations to remain operational and responsive amidst planned and unplanned service disruptions. In the event of a service failure, priority-based recovery strategies reduce risk, mitigate downtime and preserve a secure IT environment by keeping the most critical applications safe.

8 ELECTRONIC MEDICAL RECORD (EMR)

Transform silos of patient data and multiple service records into a single, concise, user-friendly view of patient information at the point of patient care. IBM helps to minimize confusion surrounding EMR with solutions that integrate patient information securely across an enterprise - both between internal divisions and external organizations.

9 IT TRANSFORMATION

Focus time and resources on providing flexible, scalable systems within an IT operating environment that supports immediate and secure 24X7 access to critical patient information. Using proven methodologies and service-oriented architecture (SOA), IBM works with healthcare organizations to develop tailored IT strategies, to identify preferred delivery methods (on-site, off-site, near-site, out-sourced, etc.) and to implement solutions.

10 CLINICAL GENOMICS

Utilize data in search of scientific discovery and new treatments for disease. IBM and its Business Partners can assist by providing the domain expertise, technology and services that researchers and professionals in biotechnology, pharmaceuticals, academic and government laboratories and medical research centers need.

11 CLINICAL AND BUSINESS OPTIMIZATION

Align your clinical system with your needs and processes. Optimize its functionality. IBM Healthlink Solutions help healthcare organizations advance existing clinical systems through improvements in business processes and information technology. By helping healthcare organizations select and implement solutions that integrate clinical information with back-office and administration systems, productive use of information increases across the enterprise. IBM's advisory services, designed to smooth operational issues such as interim management, IT assessment and physician integration, also help organizations understand how today's technology choices may impact their vision for the future.

12 PORTALS

Provide secure, roles-based single point of access to patient information, applications, tools and services to increase staff productivity, efficiency and improve operational effectiveness. IBM and its Business Partners work with the existing IT infrastructure to develop a solution tailored to each healthcare organization's needs.

IBM

Simpler, smarter choices, customized for you.

Your one-stop IT financing partner

Just as today's businesses increasingly rely on sophisticated IT solutions—hardware, software and services from multiple vendors—the financing requirements associated with them can become similarly complex. That's why it's important to choose a financing partner that can help you make simpler, smarter choices—offering financing solutions that are customized for your business needs and are flexible over time.

In the same way that IBM knows how innovative IT solutions can contribute to the success of your business, IBM Global Financing knows how innovative financing can contribute to the value your company realizes from its IT investments. Our objective is to be your partner—providing a one-stop source of competitively priced IT financing solutions. When you choose IBM Global Financing, you're getting a strategic partner for managing all aspects of your financed solution.

Over the lifecycle of your IT investment, IBM Global Financing offers asset tracking, services for the disposal of assets no longer required and high quality used equipment. IBM Global Financing also offers channel financing for resellers, value-added resellers and independent software vendors.

" Leasing from IBM Global Financing gives us the flexibility to migrate to a new architecture—and better utilize our capital."

– Jesse Perez, CFO, Geotrace Technologies, Inc.

Smarter financing decisions

IBM Global Financing has the expertise to help you make smarter financing decisions. We work with companies of all sizes and can create customized financing packages. Depending on your business, IT and financial priorities, we offer plans that take into account the lifecycle of your investment, helping you acquire, manage and even eventually dispose of technology assets. Our financing solutions are competitive and can give you the flexibility to change or upgrade hardware and software—so you can keep your IT capabilities in line with an evolving business and technology environment.

Partnership across the lifecycle

As the world's largest provider of IT financing, IBM Global Financing has a worldwide asset base of nearly US$31 billion, enabling us to provide financing expertise, comprehensive solutions and competitive terms. Whether you are a global business or a smaller local company, we can apply our experience and innovative thinking to serve your goals—something we already do for 91 of the United States Fortune 100 and for 125,000 customers in more than 40 countries.

Right from the start, we've operated from a simple, core assumption—it's in our best interest to serve your best interest. We value our client relationships and emphasize clear, straightforward contracts that can minimize surprises and bumps in the road. When finances are tight, you can include IBM Certified Used Equipment™ as part of your financing solution. We build partnerships that put the full range of our expertise and resources to work for you.

A simpler experience—one-stop financing

We know you want to acquire technology more easily, so IBM Global Financing works to simplify the decision-making process for IT financing. We provide rapid quotes and approvals. We can provide customized financial solutions and easy online tools for tracking and managing your financed assets.

Finally, we know you want a comprehensive financing package that addresses your total IT solution—for hardware, software, services and maintenance, including both IBM and non-IBM components. IBM Global Financing provides one-stop shopping for IT financing, with a single point of contact to make it easier for you to address all the elements of your financing solution.

For more information

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