

Prepare for Disasters & Tackle Terabytes When
Evaluating Medical Image Archiving

A Frost & Sullivan Healthcare Article



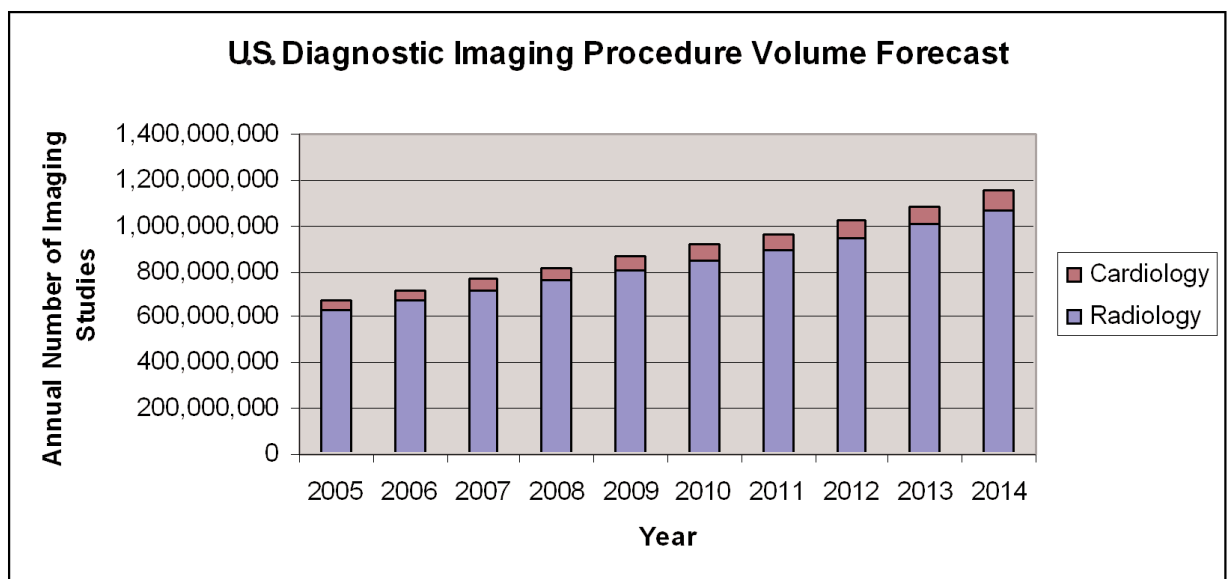
Medical imaging is in the midst of a dramatic paradigm change. The transition from analog to digital image acquisition is now in full swing, and in modalities such as CT and MRI, digital image capture is nearly universal. Not only are more images being captured digitally, but the amount of data being processed, analyzed, and stored in archives has exploded. This explosion of datasets in medical imaging has brought with it serious ramifications for healthcare organizations. It was once the case that medical image management costs were predictable, since their relationship with the growth in procedure volumes was linear. As the volume of images increased, the amount of additional film rooms and/or additional IT hardware, floor space and dedicated personnel required for storing and managing film and data grew by the same proportion. For example, in a film-based environment, when imaging volumes grew 10 percent each year, then at maximum utilization, floor space and clerking staff had to be scaled up by the same percentage in order to sustain the same level of service.

However, as many hospitals and imaging centers have discovered, in the world of Picture Archiving and Communications Systems (PACS), the cost and complexity of purchasing and managing additional digital storage do not scale in a linear fashion. In order to maintain a consistent standard of performance as the volume of imaging data dramatically expands, many of the digital archiving solutions implemented by healthcare providers have required major upgrades and overhauls that dramatically increase the total cost of ownership over time.

GROWING LONG-TERM COSTS OF MANAGING AN ONSITE MEDICAL IMAGING ARCHIVE

As an ever-expanding flow of imaging data floods into archiving systems, a point is reached when the existing storage infrastructure can no longer cope, and an expensive, often complex migration is required. This issue is gaining critical importance as on-demand access to prior diagnostic images becomes a firmly established requirement, while at the same time the complexity of imaging datasets and average file sizes are steadily increasing. According to estimates by the American College of Radiology (ACR), imaging procedure volumes grew at annual rates of 6 to 8 percent during the last decade. If this trend continues, the number of diagnostic medical imaging procedures performed in the United States can be expected to grow from approximately 600 million in 2006 to well over 1 billion annual procedures in 2014. (Figure 1).

Figure 1: U.S. diagnostic imaging procedure volume forecast

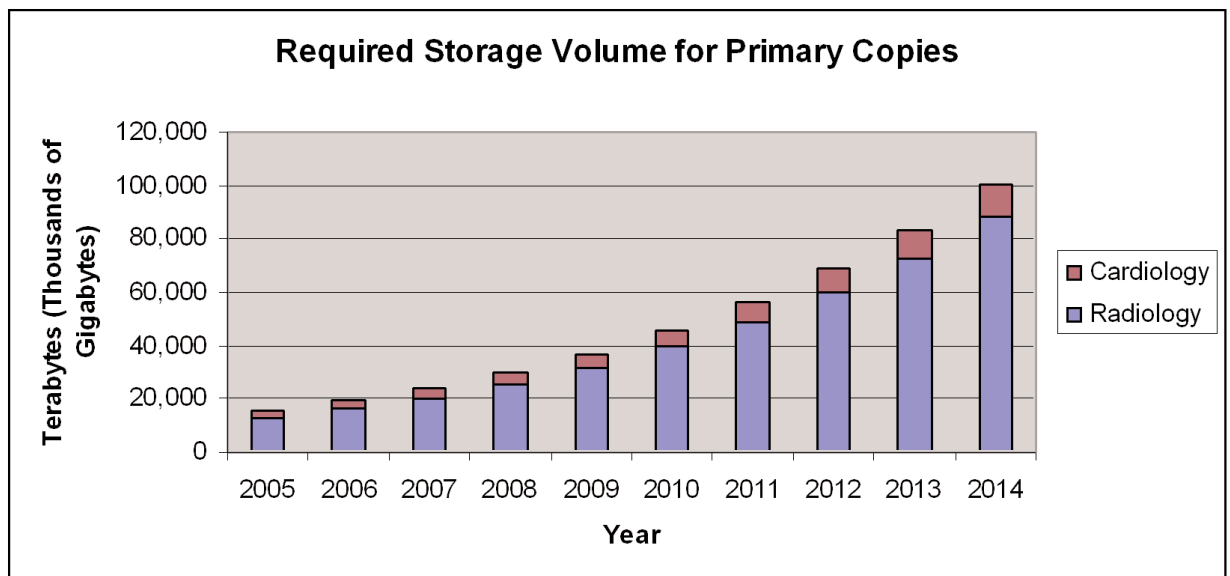


This growing utilization of diagnostic imaging is part of the global trend toward early detection, personalized treatment, and evidence based medicine. For storage considerations, however, the growth in procedure volumes, including healthcare providers' tendency to retain image data well over the legally required timeframe, is only part of the equation. Several additional factors are expected to contribute to the exponential growth in storage requirements.

IT managers at imaging provider sites are accustomed to trying to establish a rule of thumb that can be used to relate procedure volumes to the equivalent storage volume. In 2005, the typical U.S. provider estimated that 50 MB of storage were required for an average study. At that time, the estimate was still rather heavily weighted toward the file size of a standard x-ray procedure, which is 20 to 30 MB. Indeed until very recently, x-ray studies constituted the bulk of imaging procedures. However, as imaging providers rapidly adopt new technologies, such as multi-slice CT, MRI, and digital mammography, they start performing advanced imaging procedures involving volumetric and real time imaging, such as cardiac imaging, angiography and 3D/4D ultrasound. It has become commonplace for CT studies to generate 2 to 3 thousand slice images each and for MR studies to involve multiple scanning protocols that generate 200 to 500 MB of storage per study. Due to these rapidly evolving changes in medical imaging, storage rules of thumb developed at every site are constantly being revisited, such that today, the average per-study storage requirement is closer to 100 MB per procedure. This process is expected to further accelerate as technology and clinical standards continue to evolve.

In attempting to arrive at an estimate of the total storage volume required to store medical image data, the first assumption that one has to make is to consider only the primary copies of images, that is, to assume that there is no data duplication taking place for the sake of redundancy (e.g. RAID) or disaster recovery planning. Taking data replication into the equation can have the effect of doubling or even tripling the storage volume requirement. In 2006, Frost & Sullivan estimated the primary copy storage requirement for the all U.S. imaging sites to total 24,000 Terabytes (TB), or 24 Petabytes. This number is expected to increase to about 100 Petabytes in 2014 (Figure 2). In light of such numbers, it appears that healthcare is well at par with, and often outpaces, other industries in terms of storage volume requirements.

Figure 2: U.S. diagnostic imaging archive storage requirement forecast



* Primary copy only, assuming no duplication (RAID, Grid, DR/BC, etc.)

Transitioning briefly from volumes to costs, it is worth noting that while storage cost per Terabyte is declining, the overall cost to manage storage is growing. The common misperception is that storage is inexpensive. The reality is that storage volumes continue to grow faster than hardware price declines. It is also important to reinforce that storage hardware is only one component of the overall cost of managing storage and this element represents approximately 25% of the total costs. There are a number of other costs involved in an onsite archive, including facilities costs, power, cooling, support costs, software and storage administration. All of these elements combined contribute to the overall cost of managing an onsite archive.

DATA BACKUP AND DISASTER RECOVERY OPTIONS

There are a number of options that facilities can pursue in managing their backup and disaster recovery provisions. Many facilities decide to manage these functions on their own, using resources available to them onsite. This usually requires manual backup of copies to removable media. Unfortunately, depending on the amount of data to be recovered, in the event of a disaster it may take an unacceptably long time to retrieve data from removable media. Moreover, many facilities using this type of backup fail to create a copy for off-site storage. Somewhat surprisingly, this fundamental disaster recovery concept is not universally practiced. In the event of a total site disaster, an onsite copy will not be of value, since it is likely to be lost as well.

In order to make provisions for off-site storage of backup copies, healthcare organizations that have PACS running at multiple facilities can leverage their distributed architecture to create multi-site archives. In a multi-site archive, each facility archives its own data while also serving as the remote backup site for at least one other facility. This type of implementation has the advantage of creating a copy of each study that is truly off-site with respect to the originating facility. However, it is not immune to multiple failures or a system-wide disaster. In addition, although the cost of storing additional images off-site is incremental, ultimately a multi-site model means that system-wide storage capacity has effectively doubled.

Another option available to imaging facilities faced with the growing cost and complexity of managing long-term archives and disaster recovery, is to enlist the services of a Storage Service Provider (SSP). With an SSP, images and related data are stored off-site at the provider's secure data center. Imaging data and final reports can be sent instantly and securely from a healthcare facility to the outsourcing provider's data center for archiving and disaster recovery management. By doing so, the facility is virtually freed-up from long-term archiving concerns related to imaging and can dedicate more of its limited resources to providing patient care. This scheme ensures that prior images are available on-demand at the fingertips of the clinician regardless of the age of the data, since in all likelihood the outsourcing provider's data center utilizes the latest technology. Essentially, an outsourced archive provides an endlessly scalable archive whose cost and reliability are highly predictable, while the responsibilities for its unwavering operation are clearly defined. Although there are clearly a number of different options available, in the remainder of this article we will focus exclusively on the role that Storage Service Providers can play in helping healthcare facilities effectively manage their long-term archiving and disaster recovery requirements.

BUSINESS CONTINUITY PLANNING, AN ESSENTIAL COMPONENT OF EVERY IMAGE ARCHIVING STRATEGY

Another major challenge facing imaging providers is the need to ensure integrity and long-term availability of data in keeping with regulatory requirements and good clinical practice. Just keeping up with the demand for storage capacity can be quite a challenge in itself, but providing access to prior images from the archive is not the only critical requirement for a robust storage solution. Data integrity and business continuity are also mission critical requirements. Healthcare facilities have found that providing high levels of data availability as

well as ensuring data integrity and continuity of operations in the event of major service interruption can be extremely difficult to plan for.

Additionally, when developing a disaster recovery plan, healthcare providers must evaluate risk across two dimensions: Recovery Time Objective (RTO), how much time they can afford to lose before restoring critical operations and Recovery Point Objective (RPO), how much data a facility can afford to lose before it has a noticeable impact on their core mission of patient care. It is critical for providers to analyze their risks of disaster and identify the myriad of scenarios that they must recover from. As a related point, providers need to select backup media that is aligned with their recovery objectives.

Although many onsite solutions provide 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 sheer amount of imaging information that must be securely stored and protected poses a serious challenge as backup operations grow more complex and time-consuming. The flip-side of time-consuming and highly complex backup procedures is that, in the event of a major disruption, recovery time could be unacceptably long.

Another complex area of concern for hospitals and other medical imaging facilities is the stringent HIPAA requirements that specify exacting levels of data security, patient confidentiality, and system redundancy against data loss. It is necessary to encrypt patient data and imaging data throughout all stages in the data lifecycle, from acquisition, to storage, retrieval, and migration. The latest HIPAA requirements that all healthcare organizations must comply with include data backup plans for electronically protected health information, disaster recovery plans and procedures to restore any lost information, and emergency operational plans and procedures to enable continuation of critical business processes involving electronically protected health information.

Although HIPAA compliance is a necessary part of planning for business continuity in the event of a disaster or other major service interruption, strict HIPAA compliance is not sufficient to ensure an adequate level of business continuity for medical imaging operations. The number of processes that must be planned, the amount of data that must be recovered, and the complexity of the technology can be simply overwhelming even for larger, more sophisticated hospitals. Multi-vendor data system environments, heterogeneous data formats, distributed multi-site organizations, and limited onsite IT staffing are additional issues that can greatly increase the complexity of managing the disaster recovery solutions in-house. Many of the critical resources necessary to provide business continuity are highly technical, such as data encryption, server virtualization, and data backup. Medical facilities, struggling with burgeoning demand for services and limited resources, must often rely on outsourcing partners in order to provide essential disaster recovery and business continuity services.

Indeed, an increasing number of facilities have discovered that by outsourcing a large portion of their backup and disaster recovery operations, they are able to gain a much higher level of confidence in their business continuity plan, while ensuring greater compliance with exacting regulatory requirements. Moreover, the assistance of a partner in difficult times can be invaluable to the healthcare provider whose main concern will be to be up and running as quickly as possible.

SPECIAL CONSIDERATIONS FOR SMALLER HEALTHCARE FACILITIES

When it comes to both long-term archiving and disaster recovery, smaller facilities are far less likely to have the capital budgets necessary to acquire and maintain their own solutions. Therefore, many small facilities find it necessary to finance their back-end IT infrastructure, including the long-term archive and disaster recovery, through operating costs. This means that they require a cost structure that itemizes costs on a per-procedure basis. Outsourcers typically price their services on a fee-per-study basis. This enables ROI to be calculated in a

straightforward fashion, and makes it easy to compare the costs of outsourcing versus in-house ownership of the archive and other back-end IT functions.

A reliable outsourcing partner with archiving and disaster recovery services can provide the peace-of-mind that critical patient information and images will be available when needed. The ability to store and replicate images to an off-site data center provides protection against major disruptions at the facility site. A carefully chosen outsourcing partner can help healthcare organizations return to normal or near-normal operations more quickly in the aftermath of a major disruption. Moreover, by providing a rational, centralized disaster recovery process, data storage and backup storage applications can be performed quickly and more efficiently.

ARCHIVE AND DISASTER RECOVERY OUTSOURCING AS A PRACTICAL, COST-EFFECTIVE SOLUTION

Outsourcing disaster recovery and the image archiving also protects facilities against technology obsolescence and lack of scalability. Choosing the best storage architecture, monitoring storage utilization, and adding additional capacity when needed—all of these tasks are managed by the storage outsourcer's expert team using the most effective storage networks and backup solutions available. Thus, as the healthcare facility's storage and backup needs grow, the outsourcing provider can scale capacity accordingly. If the outsourcer manages this process well, storage technology can be scaled to virtually unlimited capacity and, more importantly, do so in a way that makes it completely seamless to the provider of care.

By providing a reliable, scalable, efficient, and secure storage and backup framework, an image archive outsourcer can help healthcare facilities reduce the cost and complexity of managing growing medical image volumes. An outsourcing provider can deliver all of the functionality and performance traditionally associated with onsite archiving methods, while providing enhanced safeguards against data loss and disaster recovery, and offering a greater degree of freedom from concerns about hardware obsolescence. Implementing a storage strategy that relies on an archiving outsourcer can continue to deliver benefits as the image archive continues to grow and evolves in the future.

IMPORTANCE OF CAREFULLY EVALUATING STORAGE SERVICE PROVIDERS

When choosing a Storage Service Provider, it is critical to understand the quality and depth of service that the outsourcing partner will provide. The mission-critical nature of medical images and related patient data and the importance of ensuring that imaging data is secure and available are key considerations. In order to achieve clinical end-user objectives, a number of robust requirements are placed on the archive outsourcer, including:

- Guaranteed connectivity and interoperability with relevant onsite healthcare data systems
- High availability of all servers, storage archives, and network appliances
- Timely technical support
- Unlimited scalability while insuring continuity of performance

Essential vendor selection criteria for end-users evaluating prospective vendors should include:

- Considerable resources committed to ongoing research and development
- An impressive portfolio of successful contract fulfillments with existing healthcare implementations
- Brand-name recognition that strengthens the prestige and credibility of the outsourcing provider

CONCLUSION

For a great many hospitals and imaging centers, outsourcing the long-term archive and disaster recovery functions is not only the most cost-effective solution, it also provides the greatest value in terms of data integrity, security, and management of complex backup and migration processes that deflect attention and resources away from the hospital's core mission, which is to diagnose and treat patients.

Storage Service Providers offer the flexibility of a variety of financing plans, including charging their customers on a per-study basis. This financial model offers a number of advantages to medical imaging facilities, particularly smaller ones. Opting for an outsourcing provider frees up capital expenditure budgets for more mission-critical investments, such as acquiring new diagnostic and therapeutic equipment that can have a more direct effect on revenue. This model also aligns well with and facilitates budgeting for operating costs. For customers that are extremely cash-challenged, it may even bring an otherwise unaffordable digitization effort within reach, since the deep archive is often the most capital-intensive component of an imaging infrastructure. Once they overcome the initial reticence to outsourcing a portion of their IT processes (as part of a natural tendency to wanting to keep mission critical systems entirely in-house), healthcare providers will soon realize that there are significant benefits to be gained from working with a reliable and capable outsourcing partner. Outsourced solutions for long-term archiving or for disaster recovery and business continuity planning are highly flexible and can meet the needs and requirements of a broad spectrum of workflows and facility types.

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