

Storage Service Provider (SSP)

Out-Sourcing Data Storage

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The medical environment is in the midst of an ever-expanding volume of digitized information (data and image files) that must be stored.

The decision to fund, develop and manage an enterprise-wide electronic archive for the Healthcare Enterprise (HE) is a major issue facing both public and private medical institutions whether they are a single or multi-site institution. The burgeoning storage requirements for medical images, the additional medical specialties joining the digital environment and the requirement to have an operational disaster recovery plan that is compliant with the Health Information Portability and Accountability Act (HIPAA) by April 21, 2005 is exacerbating the decision-making process.

A medical institution has multiple choices to resolve the expanding storage requirement and become HIPAA compliant. HIPAA mandates that all medical information be secure, available and protected against corruption. HIPAA regulations also contain the words "reasonable" and "feasible" that could be taken to mean the solution should not bankrupt the institution nor complicate operations to a degree that it would negatively impact patient care.

Characteristics of Storage

The information storage system is made up of three components: online storage for information required rapidly and at frequent intervals; long-term storage for information that is required within a minute or so and needed every now and again; and legal or disaster recovery storage that in all likelihood will only be needed should there be a major disaster that makes the online or long-term storage unavailable. There must always be at least two copies of all information stored in two secure separate and distant locations.

Table 1 Characteristics of Data Centers as Specified by the Uptime Institute

Characteristic	Tier 1	Tier 2	Tier 3	Tier 4
Year first deployed	1965	1970	1985	1995
Construction cost \$/sq ft	450	600	900	1,100
Annual downtime due to site (hrs)	28.8	22.0	1.6	0.4
Site availability (%)	99.671	99.749	99.982	99.995

All components of the storage solution must be scalable and studies must be retrievable from any workstation within the HE. As soon as a study has been validated on the online storage component, it should be automatically forwarded to the other two components based on bandwidth availability.

Online Storage

Online storage capacity should be equal to the storage requirements for the number of procedures generated for between six and 24 months. The actual number of months required would depend on patient demographics, in- or out-patient facility, the past history for retrieving prior studies for review with current studies and the bandwidth and availability of wide area network (WAN) for multi-site implementations. These studies must be stored on fast spinning media to ensure delivery of the first image of a study to a workstation in three seconds or less.

All storage service providers (SSP) and application service providers (ASP) must provide some quantity of online spinning media storage. This will vary by vendor from three months to 12 months or more.

Long-Term Storage

Long-term storage is for the life of the study that is dictated by state and federal regulations. The media for long-term storage can be either magnetic or optical spinning media or magnetic tape in some type of storage cabinet or jukebox with robotics. The media can be configured as Network Attached Storage (NAS), Storage Area Network (SAN), Content Addressable Storage (CAS) or some combination. This storage system must be highly available and scalable to address the ever-increasing storage requirements of the HE. In addition, this storage component must be designed to provide high reliability and accessibility for stored studies so that studies can be repeatedly retrieved from the storage system without error or corruption.

Typically, this component of storage is not provided by an SSP. If long-term storage were provided, the cost would be significantly greater than if the SSP simply provided the legal or disaster recovery storage component. Long-term storage typically would be provided by an ASP that would provide the entire PACS solution on a fee-per-use basis.

Legal or Disaster Recovery Storage

Legal or disaster recovery storage, like long-term storage, is for the life of the study. The design objective of this storage component is to provide a secure, accessible storage system that will ensure the data are not corrupted. This system is not designed to routinely retrieve studies. It is designed so that studies can be restored at the site where major component failure has occurred due to a catastrophic event that destroys or makes the HE's data center unavailable.

HIPAA has mandated the existence of disaster recovery capability even though it should be standard operating procedure for any HE. This is the primary reason for an SSP to exist.

Requirements for an SSP

The SSP vendor may provide storage for disaster recovery or storage for both the long-term archive and disaster recovery. The requirements and cost for these different levels of service differ significantly.

An SSP should store data in two secure distant data sites if it is providing both the long-term archive and disaster recovery. However, a single site would be adequate if only disaster recovery is being provided. The infrastructure of the data center must be secure and highly available. One approach to grading data centers is to use the tier classification of the Uptime Institute (www.uptime.com), as depicted in Table 1. The vendor should be able to certify that the data center has effective data and access security, e.g. SAS 70 Type II audit (www.sas70solutions.com and <http://datacenter.cit.nih.gov/security>).

On-site spinning media will be required to allow studies to

PARTICIPANTS

Agfa HealthCare

BRIT Systems

Emageon

GE Medical Systems

InSiteOne Inc.

Siemens Medical Solutions Inc.

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Dr. Smith is the conference director for PACS 2004 sponsored by the Department of Radiology that will be held March 10-13, 2004 in San Antonio, TX at The Westin Riverwalk Hotel. For more information visit www.urmc.rochester.edu/pacs2004. PACS 2005 will be held March 9-12, 2005 in San Antonio, TX at The Westin Riverwalk Hotel.

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The editors gratefully acknowledge the assistance and expertise provided by Edward M. Smith in providing the chart introduction and outline. Responses to the outline were obtained by Reilly Communications Group from the manufacturers. This chart is available on our website.

Research Report 476, March 2004, Conducted by Reilly Communications Group

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be validated prior to transmitting to the data center, for online storage and to act as a buffer to accommodate the available bandwidth to the data center. The quantity of on-site spinning media must be specified. A detailed cost proposal, defining what constitutes a study — number of megabytes, accession number, telecom cost, ownership of data, cost of restoring the stored data should the institution want to take over managing the data and more — needs to be prepared.

The vendor should: guarantee that all stored data have been verified; guarantee that data will be restored and tested at least annually; and provide an estimate of how long it will take to retrieve a study based on available bandwidth for long-term archive retrieval and for disaster recovery. Ideally, the vendor should not only store the image data in DICOM format but also in the demographic database, which should be updated at frequent intervals.

The Pros and Cons of Out-Sourcing

Out-sourcing data storage is typically most cost-effective for individual hospitals with or without nearby (within one or two miles) outpatient imaging centers and small private radiology practices or organizations with limited financial capital and/or information technology resources. The factors affecting the decision to out-source storage for disaster recovery should include:

- Relative advantages of funding from the capital or operating budgets;
- Total cost of ownership of the disaster recovery program;
- Cost of constructing and operating space for disaster recovery or rental of space to securely store data tapes;
- Personnel;
- Hardware and software cost;
- System maintenance;
- Disaster recovery site maintenance cost;
- The length of time you are willing to wait to restore the data and therefore operations, which will impact patient care and the cash flow for the institution.
- Continuation of business with your own facility is very expensive, but guarantees that you are operational in a matter of minutes.
- Restoration of service with your own disaster recovery facility or use of an SSP of moderate cost but may take hours to a day to be fully operational.
- Restoration of service by storing data securely off-site is inexpensive but involves days or maybe a week or more to be operational.
- Availability of personnel to manage and operate a disaster recovery center;
- Availability of a physical facility to house a disaster recovery center;
- Relinquishing hands-on control of your data; and
- Determine whether the institution wants the responsibility of maintaining a HIPAA compliant disaster recovery center.

Reliability and Longevity of SSP Vendor

Irrespective of the option selected for disaster recovery, the HE must have a Disaster Recovery Plan documented, implemented and in practice by April 21, 2005 to be in compliance with the security requirements of HIPAA.

It may be advantageous to out-source data storage for three to six months prior to going live with PACS, and then maybe for a year or two and before implementing the institution's own disaster recovery center and downloading the data stored on the SSP. Advantages to this approach are:

- Studies can be archived prior to initiating soft-copy read, allowing radiologists to have prior studies in a digital format for comparison when they start softcopy reading.
- Since the storage component of PACS is capital intensive, this approach will allow PACS to be implemented on a smaller initial capital budget.
- It will also ease the initial information technology personnel requirements and spread capital expenditures over a longer period of time

Initiating a PACS program with inadequate funds will result in a less than satisfactory reception of the concept as well as significantly increasing cost since both a film-based and electronic-based systems will have to be operated. Each institution must evaluate the above factors and decide whether or not out-sourcing data storage will be in their best interest.

The following comparison of SSP providers presents an overview of their functionality, security, service level and cost of service. ■■■

COMPANY	AGFA HEALTHCARE	BRIT SYSTEMS
Product name	IMPAX ES	e-Rad Files
Is SSP your core business, or sold w/ vendors' PACS	Sold with Agfa PACS	Either
# of years company sold/offered SSP to the healthcare market	5 years	4 years
# of sites storing images	Over 25 with remote storage through Agfa	Proprietary
Estimated # of studies currently stored		~600,000
Type(s) of studies supported	DICOM, JPEG	DICOM
Cardiology	Yes	
Radiology	Yes	Yes
Mammography	Yes	Yes
Visible Light	Yes	
Others (please list by modality)	PET	All modalities in a radiology department
Scalability of service		
# of data centers/data warehouses at which each study is stored for long-term archiving	2	2
For disaster recovery?	1	1
Distance b/t each data center/warehouse, miles	>2000 miles	Varies
Classification level of each data center/warehouse?	Tier 3, mirrored	Disaster recovery is level 4
Stored images		
List storage media used	DVD, others available	Disk/tape/optical
GB per media as listed above	Varies	Disk: var. tape is 100, 200 GB/optical is 5, 9 GB
Vendor & Model # for each media listed above	Varies	Disk : IBM FastT or Maxstor 6000 or RAIDZone/ tape is LTO/optical is 5 or 9 GB platters
List storage jukebox used	Varies	IBM 3995 or Plasmon M series
Vendor & Model # for each jukebox listed above	Varies	See above
# of copies of each study stored at each site for redundancy	1	1, however studies on disk are in RAID 5
Stored studies verified after being stored to ensure no information degradation	Yes	Yes
If yes, what is the frequency of verification?	Every 90 days	Once after copy
Do you have a process for verifying stored data can be restored?	Yes	Yes
If yes, what is the frequency of restoration?	Every 90 days	With tapes, it is verified before tape is removed - & that time frame depends on customer volume
Is on-site spinning media available?	Yes	Yes
If yes, on what parameter is storage capacity based?	Typically a minimum of 1 year	What the customer wants
Quantity of on-site spinning media provided (by procedures) by months or GB?	Months	It is a one-time fee based on the study
Storage costs		
Average cost/study for disaster recovery only: a) 25,000 stored; b) 50,000 stored; c) 100,000 stored; d) 250,000 stored	N/A	Depends on if it is disk or disk & tape, speed of connection, numbers below are for tape
With 1 year contract	N/A	a) \$.60 b) \$.55 c) \$.50 d) \$.40 stores for 1 year
With 3 year contract	N/A	a) \$.65 b) \$.60 c) \$.55 d) \$.45 stores for 3 years
With 5 year contract	N/A	a) \$.67 b) \$.62 c) \$.57 d) \$.47 stores for 5 years
Average cost/study for disaster recov. & long-term retrieval: a) 25,000 stored; b) 50,000 stored; c) 100,000 stored; d) 250,000 stored	N/A	Depends on technology used & speed, numbers below are for disk and tape
With 1 year contract	N/A	a) \$1.75 b) \$1.50 c) \$1.25 d) \$1.00 stores for 1 year
With 3 year contract	N/A	a) \$2.25 b) \$2.00 c) \$1.50 d) \$1.25 stores for 3 years
With 5 year contract	N/A	a) \$2.50 b) \$2.25 c) \$1.70 d) \$1.40 stores for 3 years
Cost for storage equal for all types of studies, regardless of modality & study size?	N/A	No
If no, explain		Assuming that there is a mix. of modalities, could be addnl charges if they are all lg. studies
Store demographic database	Not typically	Yes
If yes, at what frequency is database updated		Continuously
How do you charge for this service?		No
Do you test restoration of the demographic database?		Mirrored drives & backed up to tape/optical nightly, not every media is tested for restoration
Do you have GPO contracts for SSP?	Through partners	No
If yes, which?		
Storage duration		
Length of study storage	Legal life of study	From 1 year to whatever customer requires
Average time needed to retrieve study from local spinning media, in sec.	2 sec.	1, depends more on customer network
Avg. time to retrieve study from long-term archive in data center warehouse, sec/min	Varies on bandwidth, typically 3 to 5 minutes	Dependent on the speed of the WAN leased
Are telecom charges included in cost/study?	None	Depends on the volumes
If no, what is the charge?	Varies	Depends on the volume & requested speed
Who is your preferred Telecom partner?	None	None
All images stored as DICOM part 10?	Yes	No, depends on the media used
If no, what other format is used?		.dcm files are also used
Storage & retrieval for non-DICOM files avail.	Yes	No
Studies compressed for transmission to storage?	Yes	Yes
If yes, what compression algorithm?	JPEG	JPEG lossless
Data encrypted for transmission?	Yes	Yes
If yes, at what level?	128 bit	Depends on if a real VPN is used, DES-3 is supported, Ssl is supported & uses its own encrypt.
Circle No.	145	146

COMPANY	EMAGEON	GE MEDICAL SYSTEMS	INSITEONE INC.	SIEMENS MEDICAL SOLUTIONS INC.
Product name	Intelligent Visual Medical System	Centricity ASP Solutions	InDex Online/Nearline/Recovery	Sienet
Is SSP your core business, or sold w/ vendors' PACS	Core business	Sold with PACS & as stand-alone archive	SSP is core business: integ. w/ any PACS solution, ASP: total apps./study pricing upon rqst.	Both
# of years company sold/offered SSP to the healthcare market	4 years	4	Founded in 1999, commercially available 2000	4 years for PACS, 20 years for other applications such as billing info
# of sites storing images	>75	>70	117 customers representing 256 sites	Proprietary
Estimated # of studies currently stored	Contact Emageon for latest number	>3,000,000	Over 110M images, 2.2M studies	>1000 K
Type(s) of studies supported	DICOM & JPEG	DICOM	DICOM	DICOM
Cardiology	Yes	Yes	Yes	Yes
Radiology	Yes	Yes	Yes	Yes
Mammography	Yes	Yes	Yes	Yes
Visible Light	Yes	Yes, if wrapped in DICOM header	Yes	Yes
Others (please list by modality)	All DICOM objects	Any, if wrapped in DICOM header	Investigating all visible light DICOM data such as pathology, ophthalmology, also dental images	
Scalability of service				
# of data centers/data warehouses at which each study is stored for long-term archiving	Data stored on-site, Emageon does not currently support a data center storage model	2	Two mirrored centers - Wallingford, CT & Phoenix, AZ	1, offer backup strg. for cost/perform. reasons, first archive copy stored to customer location
For disaster recovery?	N/A	2	One data center: Wallingford, CT	Yes
Distance b/t each data center/warehouse, miles	N/A	>2,000 miles	2,500 miles	N/A
Classification level of each data center/warehouse?	N/A	Ernst & Young validated: SAS 70 Type II	Tier 3, mirrored	
Stored images				
List storage media used	IBM FASTT, EMC Symmetrics & EMC Clariion	ATA Disk	DVD-R, 4.7 GB	Tape
GB per media as listed above	N/A	R200, 272GB, 96TB/78TB useable	4.7 GB	20/40/100
Vendor & Model # for each media listed above	IBM & EMC	NetApp R200	Media Independent - currently Pioneer, PN: DVS-R47BD50F	STK 9840 or IBM LTO
List storage jukebox used	See below	N/A	Pioneer	N/A
Vendor & Model # for each jukebox listed above	Backup LTO Tape Library, 3583-L72: IBM 3583 Ultrium Scalable Tape Library	N/A	Pioneer DRM-7000 FlexLibrary	N/A
# of copies of each study stored at each site for redundancy	2	2	Two mirrored centers: Wallingford, CT & Phoenix, AZ, 1 identical copy/site	One in the data center, one at customer site, one in a remote site
Stored studies verified after being stored to ensure no information degradation	Emageon supports Storage Commitment	No	Yes, verified before burned to DVD & when in the jukebox	Yes
If yes, what is the frequency of verification?	Real time	N/A	4 times per year	N/A
Do you have a process for verifying stored data can be restored?	Yes	Yes	Yes	Yes
If yes, what is the frequency of restoration?	Customer dependent	Incident-based	Four times per year, studies will be retrieved from jukebox daily	N/A
Is on-site spinning media available?	Yes	Yes	RAID is provided, RAID 5, ADG depending on size	Yes
If yes, on what parameter is storage capacity based?	Storage requirement is based on annual image data and type of compression	Per customer preference 6 month minimum	Type of exams, one year projected volumes standard, longer durations upon request	Production GB/day
Quantity of on-site spinning media provided (by procedures) by months or GB?	Storage requirements are based on monthly volumes which translate to GB	GB	By months, minimally 12 months	GB
Storage costs				
Average cost/study for disaster recovery only: a) 25,000 stored; b) 50,000 stored; c) 100,000 stored; d) 250,000 stored	Data stored on-site, Emageon does not currently support a data center storage model	N/A		N/A
With 1 year contract	N/A	N/A	Radiology list price of \$1.80/study, 1 year contract <7,500 studies	N/A
With 3 year contract	N/A	N/A	Reduction from list price cost based on annual study vol., GPO contract & duration terms	N/A
With 5 year contract	N/A	N/A	Reduction from list price cost based on annual study vol., GPO contract & duration terms	N/A
Average cost/study for disaster recov. & long-term retrieval: a) 25,000 stored; b) 50,000 stored; c) 100,000 stored; d) 250,000 stored	N/A	N/A		N/A
With 1 year contract	N/A	N/A	Radiology list price of \$4.00/study, 1 year contract, <7500 studies	N/A
With 3 year contract	N/A	N/A	Reduction from list price cost based on annual study vol., GPO contract & duration terms	N/A
With 5 year contract	N/A	N/A	Reduction from list price cost based on annual study vol., GPO contract & duration terms	N/A
Cost for storage equal for all types of studies, regardless of modality & study size?	No	N/A	Yes, assumes average industry file size for radiology, cardiology & mammography	N/A
If no, explain	Cost/study based on actual strg. rqmnt. for equip. & srvc. provided thru std. 5 yr. agree.	N/A		
Store demographic database	Yes	Yes	Currently under evaluation	Yes
If yes, at what frequency is database updated	Immed. upon receipt of HL7 comm. from HIS/RIS	Real time	N/A	Weekly
How do you charge for this service?	Included in our solution pricing	Included in storage price	N/A	N/A
Do you test restoration of the demographic database?	Yes	Yes	N/A	N/A
Do you have GPO contracts for SSP?	No	Yes	Yes	N/A
If yes, which?		Confidential	Amerinet, MedAsset, Healthtrust	N/A
Storage duration				
Length of study storage	5 years or longer	Per customer request	For life, based on contract terms	As required
Average time needed to retrieve study from local spinning media, in sec.	2 to 3 seconds from query to display	5 seconds for first image	Maximum 3 seconds	Seconds
Avg. time to retrieve study from long-term archive in data center warehouse, sec/min	N/A	Depends on modality, size, bandwidth	Assuming T1 to site/radiology study - in pipe - 56 sec., average 6 min.	Depending on WAN performance & type of connection
Are telecom charges included in cost/study?	No	Yes	If requested	N/A
If no, what is the charge?	Customer responsibility	N/A	Sprint partnership average \$1K for T1 monthly	N/A
Who is your preferred Telecom partner?	N/A	Qwest	Sprint, but support all Telecom providers	Customer defined
All images stored as DICOM part 10?	Yes	Yes	Yes	Yes
If no, what other format is used?		N/A		
Storage & retrieval for non-DICOM files avail.	No	No	No	Yes
Studies compressed for transmission to storage?	Yes, when transmission is over WAN to archive	Yes, if client supports compression	Full bit preserving, up to 3:1	Yes
If yes, what compression algorithm?	Typically lossless 2:1	JPEG, Wavelet	JPEG-LS	JPEG
Data encrypted for transmission?	Yes	No	Yes	Yes
If yes, at what level?	VPN & TLS security protocols are commonly used	N/A	128 bit	SSL 128
Circle No.	147	148	149	150