**Executive Summary**

The wealth of electronic data generated by the U.S. healthcare system presents a paradox for healthcare providers. Cloud services offers healthcare an attractive solution, helping hospitals scale with ease, better manage resources, and provide fluid access, viewing, and sharing of medical images across organizations, departments and providers – achieving a connectedness that supports healthcare organizations’ patient care goals. Learn why cloud services may be the solution to your healthcare organization’s medical imaging challenges.
The Challenge
The wealth of electronic data generated by the U.S. healthcare system presents a paradox for healthcare providers. On one hand, rich patient and health data created by electronic health records and other information systems promises to radically improve patient care and increase efficiencies for lower system-wide costs. The federal government has placed great emphasis on access to better patient data as the salvation for many of healthcare’s woes.

On the other hand, there is the sheer burden of wrangling this increasing volume of data and patient information, which falls largely on the shoulders of the hospitals and health systems. They must store, file, manage, protect and, of course, make patient records readily and rapidly accessible to clinicians, legal and compliance departments, and other internal operations when requested in order to enhance patient care.

Medical imaging is a big slice of the digital data pie. Some 400 million procedures a year in the U.S. now involve at least one medical image. From a data management point of view, digital medical images represent a particular challenge. They produce extremely large data files, and the modalities used to create them are constantly evolving. At the same time, healthcare organizations’ existing technology – including existing data storage capabilities and the picture archiving and communication systems (PACS) used by radiologists – are radically limiting efforts to harness this massive amount of medical imaging data.

Healthcare organizations are beginning to consider cloud computing as an attractive option for helping them manage medical imaging data. This white paper examines the medical imaging challenges facing the healthcare industry and lays out many of the key considerations hospitals should weigh as they explore cloud services as a solution for storing, sharing, accessing and archiving medical imaging data.

Explosive Growth of Medical Imaging
The millions of medical images generated each year represent an enormous challenge for healthcare organizations as they struggle to manage, access and share this data while trying to reduce costs. How significant is this issue? Some eye-opening statistics:

- Medical image archives are increasing by 20-40 percent each year.
  - It is projected that by 2012 there will be 1 billion medical images stored in the U.S.
- It is estimated that medical imaging information storage constitutes one-third of global storage demand, which, in 2007, was the equivalent of 1.2 billion average hard drives.
- One individual’s online medical record could equate to 12 billion novels.
- As of 2010, it was estimated that medical centers needed to hold 2 trillion filing cabinets worth of information.
- The sheer number of images ordered by physicians has exploded in the past 15 years. One study showed that the number of MRI units more than doubled between 1995 and 2004, while the number of CT units grew more than 50 percent.

Causes of Explosive Data Growth
Over the past decade, the amount of medical imaging data generated in the U.S. has experienced exponential growth, creating a “tsunami effect” and huge demand for data storage. There are a number of factors behind this explosive growth:

- Aging population – The Baby Boomer generation continues to age, and by 2020 there will be 6.6 million Americans who are age 85 and older. Advances in healthcare mean people are living longer, but there is more chronic disease, accounting for $1.4 trillion of our nation’s healthcare spending.
- Improved technology/modalities – Medical imaging technology has improved, and a number of new and evolving modalities create more detailed images for less invasive and more accurate methods of diagnosis. Technological advancements such as 3D imaging, full-body PET/MR scans and other techniques deliver unprecedented detail, but also create new image complexities and massive data storage requirements.
- Defensive medicine – Doctors are ordering more medical images to protect themselves against malpractice lawsuits. One 2011 study showed that 19 percent of diagnostic imaging tests ordered by orthopedic surgeons were purely for “defensive” purposes – accounting for about 35 percent of imaging costs.
- Siloed data – By some estimates, more than 20 percent of diagnostic imaging tests are repeats – as a patient moves from provider to provider, multiple images of the same area may be taken because patient records cannot be shared or accessed.
- Federal and state retention requirements for medical record archives – Health Insurance Portability and Accountability Act (HIPAA) requires healthcare providers to keep medical records archived for six years after discharge, though the rule can differ by state. HIPAA’s baseline requirements preempt state laws if the state has a shorter retention requirement. Because there is no national standard, most hospitals tend to keep records on hand indefinitely for legal reasons, contributing to the rising demand for data storage.

Managing the Data Tsunami
Healthcare organizations historically have underinvested in IT staff and infrastructure compared to other information-intensive industries.

Therefore, many healthcare organizations may not have adequate IT resources or storage capabilities to manage the growing amount of data, including medical images, that they need to retain to meet requirements. Cost and security are two huge factors as healthcare organizations evaluate their capabilities to manage data storage and access. Hospitals also must consider the accessibility and “shareability” of medical images, as well as the overwhelming issue of data migration as they consider how to scale their data stores.

Security and Privacy Regulations
Healthcare organizations are required by federal legislation to ensure the security of their data from all “reasonably anticipated threats.” Specifically, the HIPAA Security Rule (Security Standards for
the Protection of Electronic Protected Health Information) requires that healthcare organizations put in place administrative, physical and technical safeguards to ensure the confidentiality, integrity, and availability of electronic protected health information (PHI). Technical safeguards include access, audit and integrity controls, as well as transmission security. In case of disaster, the Security Rule requires various contingency plans to be put in place and tested regularly, including data backup, recovery and access plans. These stringent requirements can put a great deal of pressure on already overburdened hospital IT departments.

In addition, new HIPAA privacy and security rules required by the Health Information Technology for Economic and Clinical Health Act (HITECH) – part of the American Recovery and Reinvestment Act (ARRA) – make it even more important for healthcare organizations to be able to access data in a timely manner. HITECH requires healthcare providers with an electronic health record system (EHR) to provide, upon request, an access report of who accessed a patient’s records.¹

Sharing and Accessing Diagnostic Images

Federal legislation, healthcare reform and aging technologies are pushing healthcare organizations to implement forward-thinking information-sharing capabilities – and the ability to share medical images is part of that push.

The need to share medical data and images is becoming especially relevant in two areas. First, impending healthcare reform, the pressing need to slash costs in many organizations, and the need for healthcare organizations to scale to negotiate better reimbursement rates and purchasing contracts are driving a boom in healthcare mergers and acquisitions. As organizations merge, their providers need to be able to quickly share data and work together across locations and departmental boundaries.

Second, the federal government is encouraging the establishment of health information exchanges (HIEs) with grants via the State Health Information Exchange (State HIE) Cooperative Agreement Program. Especially as healthcare organizations strive to achieve meaningful use requirements as stipulated by HITECH, HIEs are becoming a critical part of the big picture in finding ways to use data for improved patient care.

Unfortunately, the technology primarily used by healthcare organizations today to create, access, view, annotate, manage and store medical images – picture archiving and communication systems (PACS) – is prohibitive when it comes to sharing images. Because they use proprietary software, PACS typically only share information between other “like” PACS.

This makes the critical sharing of information difficult even within a single organization or department if multiple PACS were purchased from different vendors. Healthcare organizations increasingly are called upon to share medical images, and for some, currently the only way to do so is to burn images to CDs and deliver them by mail or courier – a labor-intensive, timely process.

Data Performance, Storage Costs and Protection

With some older PACS, accessing, viewing and annotating digital images can be a slow process for radiologists and physicians, delaying patient care and frustrating users. When older PACS do not have the needed bandwidth to handle the image volume, some organizations have opted to store less data on the PACS system and archive older images in less costly data storage systems.

This means that images are not readily accessible for users, resulting in long wait times for image delivery. Backup tapes and other “budget” storage methods can compromise the quality of image archives. Additionally, healthcare organizations must budget for the capital expenses to buy and maintain servers and backup centers as well as the IT department to support them, while at the same time paying for unused PACS capacity. The cost and complexities of data backup and redundancy can be cumbersome for many IT departments that choose to manage this in-house, as they must deal with multiple proprietary storage solutions and systems from a variety of vendors.

Migration to New PACS/Storage Servers

About 80 percent of all PACS in the U.S. are five years or older;¹ with aging hardware and expiring vendor contracts. Healthcare organizations may be considering replacement of these aging PACS as they struggle to keep up with the emerging demands of larger image sizes and new image types.

PACS upgrades can cause issues of performance, interoperability or non-support with other systems in an organization. Additionally, healthcare organizations will need to make the decision of whether to migrate existing data to their new PACS, or to keep them archived on backup servers. Archiving years of past data can be a prohibitively costly and time-consuming endeavor that can be disruptive to hospital workflow. Hospitals will want to make sure if they invest in data migration, it is a one-time activity. The idea of needing to continue to invest in upgrades and migrations every few years can cause anxiety for hospital CIOs and other leaders with an eye on operational efficiency and cost management.

Considering the Cloud for Medical Imaging

Cloud services (known in modern tech jargon as “the cloud”) refers to a network of servers connected by the Internet or other network that enables users to combine and use computing power on an as-needed basis. Each user does not have to purchase and maintain individual computing power. The cloud provides virtual centralization of applications, storage, etc. which can be accessed by any web-friendly device (computer, laptop, smart phone, tablet, etc.) virtually anywhere. Centralization gives the cloud service provider system-wide control over, for example, security and application upgrades, negating the need for installation of upgrades on individual devices. Typically customers pay for the amount of computing power they use (comparable to how we pay for electricity or other utilities).

For the healthcare industry, cloud services represent an enormous opportunity. Storing, archiving, sharing and accessing images in the cloud allows the industry to manage data more efficiently and cost-effectively while overcoming many of the legal, regulatory and technical challenges that data requirements pose. The cloud enables hospitals to:

- Efficiently handle large bandwidth images
- Use non-proprietary, standards-based, vendor-neutral architecture
- Expand or contract storage capacity easily as needed
- Manage authentication, encryption and security protocols
- Conduct efficient system-wide application upgrades
- Extend the life of existing infrastructure/investments
Cloud services may be the solution that enables healthcare organizations to harness their data to create a more patient-centric system and improve patient care, become more cost-efficient, and increase organizational efficiency and productivity.

Creating a More Connected, Patient-Centric System
Consolidating and storing patient imaging and information in one centralized repository in the cloud instead of in multiple siloed PACS in different locations means healthcare professionals can quickly access and share images and information about a patient across departments and organizations, creating a comprehensive picture of a patient’s health status and enabling better care.

Scalable to Cost-Effectively Meet an Organization’s Needs
With medical image archive volumes increasing exponentially, many healthcare organizations are wondering how they will manage and pay for potentially huge amounts of future data storage. Cloud services work on a pay-as-you-go model, with users paying for the amount of capacity actually used. For healthcare organizations, this can be a cost-effective way to increase storage and computing needs as the organization grows, paying for storage as an expense without making additional capital investments.

Extends the Life of PACS
The cloud does not have to replace existing PACS that still have value to an organization. Instead, it can make an organization’s PACS work more efficiently. With software that can convert proprietary data to vendor-neutral imaging data, the cloud can function as the thread that ties all PACS together by consolidating storage from disparate PACS, expanding to address increased storage volume, avoiding migration for new PACS and upgrades, and providing for backup and business continuity.

Saves Money Over Time
By ending the need for future migration and taking ownership of data, hardware and storage, hospitals may be able to save significant money over time by migrating to the cloud.

Increases Productivity and Efficiency
Purchasing cloud services to extend infrastructure investments and supplement already-stretched IT staff can make a healthcare organization much more efficient when it comes to labor, patient care, and IT resource management. The cloud negates the need to upgrade individual technology. Security, regulations compliance, backup systems and disaster recovery can be managed in a centralized fashion. On the user end, physicians/healthcare professionals save time when accessing/using images — avoiding the sometimes long wait times to access images from disconnected data storage systems.

Key Considerations When Looking to the Cloud
Those who have not used cloud services previously may be skeptical or nervous about off-site medical data storage for many reasons, especially in light of the complex and stringent privacy and security requirements facing hospitals. As hospitals consider the cloud as an option for medical imaging and explore the variety of cloud-based medical imaging solutions on the market, it is important to weigh a number of factors.

Security
The HIPAA Security Rule and relatively new privacy and security requirements imposed by HITECH add new levels of complexity to hospitals’ existing IT security methodologies and infrastructure. Moving to the cloud may provide a more secure option for hospitals — with a solid infrastructure and security procedures for protecting against network-borne attacks and hackers as well as ensuring business continuity. The right cloud solution for medical imaging should bear the endorsement of these two key standards-bearers for the healthcare industry.

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<thead>
<tr>
<th>HITECH</th>
<th>ISO</th>
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<tr>
<td>The Health Information Technology for Economic and Clinical Health Act (HITECH) is the portion of the 2009 American Recovery and Reinvestment Act (ARRA) that establishes requirements for healthcare organizations to achieve “meaningful use” of healthcare data through the use of electronic health records and other technology. ONC-ATCB certification means that a vendor’s technology meets the guidelines that can support hospitals in meeting these meaningful use requirements.</td>
<td>The International Organization for Standardization (ISO) establishes formal standards for various industries, including healthcare information security. ISO certification indicates that international regulations and controls concerning information security are being met.</td>
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Solutions providers should be able to provide an extensive business continuity plan, with full image redundancy and instant access to backup images for clinicians. The network used to store and deliver cloud-based data should be armed with layers of security to protect information while enabling flexible control over how you can access and deliver data.

Vendor-Neutral Archive
There are a number of cloud-based medical imaging archive solutions on the market today that claim to be “vendor-neutral” — but what does that really mean? A vendor-neutral archive should give hospitals the ability to not only send images to the cloud from any PACS, but also to be able to access any of those images from any PACS systems simply stated, to be able to send from PACS A and view from PACS B. This “one to any” relationship means it is a truly vendor-neutral imaging solution that can:

- Interface with other clinical information systems and disparate PACS via DICOM and HL7
- Store images in a non-proprietary DICOM format across all DICOM SOP classes
- Enable access to centralized storage of patient images and electronic health records (EHRs) and integrate with EHR systems
- Support health information exchange (HIE) goals
- Increase a healthcare organization’s control over its data
- Enable use of the best imaging technology — not just what is compatible
- Support an organization’s existing imaging access and storage infrastructure
- Support an organization’s information life cycle management (ILM) strategy
Networking and Mobility

Many times, service providers that offer digital archiving solutions treat them like a rented storage space in the sky – something you put things into and lock them up for safekeeping. But hospitals need to keep medical imaging data fluid and flexible, enabling providers to quickly find, view, work with, and share files regardless of where they need them and how they need to use them. This includes the ability to continue using a hospital’s PACS reading workstations (regardless of vendor), but also the ability to use mobile devices such as iPads and mobile phones at the bedside or while on rounds, and to access images from a PC desktop.

Hospitals can only extend their enterprises into the cloud if they are able to bridge the gaps between their existing IT and communications systems and their cloud-based information. The ability to securely connect wired and wireless assets together in order to deliver cloud services and apps to any computer or device is a key consideration for cloud services to support connected, efficient care. Hospitals should consider whether their cloud services enable:

- Connectivity of the cloud archive to PACS servers and reading workstations
- Connectivity to mobile devices and PCs
- Custom design of data structure for easy browsing and discovery of data
- Network optimization to ensure speed and reliability for greater clinician satisfaction

Data Migration

A key benefit of vendor-neutral cloud technology is that data needs only to be migrated one time – and can be accessed and utilized with any PACS. It is important for an organization to work with a vendor that can migrate data efficiently and correctly, as this is a time- and resources-intensive investment. Partnering with a vendor that is experienced in medical imaging data migration and that works to understand your hospital’s goals for accessibility and workflow is essential.

AT&T Medical Imaging and Information Management

AT&T has introduced a solution that helps hospitals achieve the benefits of cloud services to address their medical imaging needs while heading off many of the traditional challenges. AT&T Medical Imaging and Information Management is a highly secure, vendor-neutral, cloud-based medical imaging solution that:

- Allows access, sharing, exchange and viewing of medical images from virtually anywhere, with full image redundancy for clinical continuity
- Provides a truly managed, end-to-end service in the market – from network to mobility to security and everything in between – at a scale unmatched in the industry
- Extends the value of customers’ existing network investment and helps them meet ongoing and growing medical imaging needs (operationally, clinically, financially)
- Is currently pursuing HITRUST Common Security Framework and ISO certification for security and data management processes and infrastructure technology

AT&T Medical Imaging and Information Management delivers enterprise cloud services that create more efficient healthcare while vigilantly protecting patient information with the industry-leading security of the AT&T global network. The service provides your hospital with a high degree of customization and flexibility in how you manage your data and deliver it to your end users – the providers who will use it for more insightful patient care.

Additionally, AT&T offers a U.S. Food and Drug Administration (FDA)-cleared mobile diagnostic viewer with AT&T Medical Imaging and Information Management. This mobile diagnostic viewer is a highly-secure, cloud-based application that extends medical image diagnosis from the confines of a desktop to a provider’s tablet or smartphone. With this enhancement, physicians can quickly access, view and interact with patient images and reports stored within the healthcare facility and render a clinical diagnosis from virtually anywhere. The two coupled solutions harmonize patient records, images and reports to make vital patient information accessible virtually anytime – in remote locations and 24 hours a day – helping to speed patient diagnoses. Finally, since no data is sent, stored or downloaded to the devices, there is no additional cost for data sends. More important, by keeping data off the device and behind a highly-secure firewall, you promote the security of personal health information as well.

Consolidated Access, Viewing, Sharing and Storing of Medical Images

![Diagram of medical imaging solution](image-url)
Conclusion

Hospitals’ data deluge is already overwhelming, and there is more to come as the U.S. population ages and healthcare becomes increasingly reliant on advanced, complex diagnostic imaging as a standard part of medicine. Hospital IT teams are looking for ways to keep costs and labor demands low while supporting providers’ efficient, effective use of medical imaging for superior patient care.

Cloud services offers healthcare an attractive solution, helping hospitals scale with ease, better manage resources, and provide fluid access and sharing of medical images across organizations, departments and providers – achieving a connectedness that supports healthcare organizations’ patient care goals. Hospitals should carefully weigh the benefits and implications of cloud medical imaging and the special considerations that can make ascending into the cloud a true success.

Contact Us to Learn More

Contact one of our AT&T healthcare technology advisors today to begin talking about your organization’s image and information management needs, and see how we can help you manage your expanding medical imaging storage and image management needs.

Endnotes


ii. Ibid

iii. Science, December 22, 2006


v. Ibid


vii. U.S. Census; Projections of the Total Resident Population by 5-Year Age Groups, and Sex with Special Age Categories: Middle Series, 2016 to 2020: http://www.census.gov/population/projections/nation/summary/np-t3-e.txt


For more information contact an AT&T Representative or visit www.att.com/imaging.

AT&T Medical Imaging and Information Management is a solution for all key industry challenges:

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<tr>
<th>Current Challenges</th>
<th>AT&amp;T Medical Imaging and Information Management Benefits</th>
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<tr>
<td>As image size increases, aging storage archives and space capacity are causing concerns for health systems</td>
<td>Scalable capacity as needs change</td>
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<tr>
<td>Medical images are stored in siloed PACS archives in separate physical locations</td>
<td>Updated storage technology</td>
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<td>Proprietary datasets for each PACS system require migrations if department wants to change PACS</td>
<td>No need for additional hardware/server purchases</td>
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<tr>
<td>Siloed PACS prevent sharing PACS images with other organizations (referring facility, HIE member)</td>
<td>Consolidated, cloud-based storage and archive</td>
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<td>Limited access to capital funding requires a move toward operational funding</td>
<td>Software conversion to standard neutral format</td>
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<tr>
<td>Organization needs to ensure business continuity to remain in compliance and protect medical records</td>
<td>No longer tied to PACS vendor’s storage</td>
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<td>Inability for providers to collaborate across the enterprise and care continuum in a secure manner on mobile devices</td>
<td>Freedom of medical image storage choice</td>
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<td>Medical images are stored in siloed PACS archives in separate physical locations</td>
<td>Medical images ingested from any authorized organization regardless of PACS</td>
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<td>Proprietary datasets for each PACS system require migrations if department wants to change PACS</td>
<td>Pay-as-you-go model (per medical image study and per consumption on storage)</td>
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<tr>
<td>Siloed PACS prevent sharing PACS images with other organizations (referring facility, HIE member)</td>
<td>Two copies of each image stored as well as two copies of the associated database</td>
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<tr>
<td>Limited access to capital funding requires a move toward operational funding</td>
<td>Data stored in two different, geographically dispersed data centers</td>
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<tr>
<td>Organization needs to ensure business continuity to remain in compliance and protect medical records</td>
<td>Viewing from virtually any location through common Internet web browsers</td>
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<td>Inability for providers to collaborate across the enterprise and care continuum in a secure manner on mobile devices</td>
<td>Accessible from laptops, tablets, smartphones and other smart devices</td>
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<tr>
<td>No data leaves the cloud and is viewable on the mobile devices highly-secure</td>
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