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How to Improve Healthcare with Cloud Computing

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Table of Contents

Introduction: The Role of Cloud in Improving Patient Care

It is no secret that healthcare organizations lag behind most other industries in adopting new technologies, by some estimates by as much as 10 years. Providers must modernize their IT infrastructures and massively overhaul their paper-based workflows, all while dealing with budget cuts and government reforms. It's no wonder that healthcare organizations are often slow to move. Healthcare providers invest a mere 10% of revenue into IT compared to other industries that regularly invest 25%. That's not to say that all providers are slow to adopt new technology; however, to date, the IT focus (and thus the productivity increases associated with it across other industries) has been primarily around the digitization of images with picture archive and communication systems (PACS), payment and reimbursement applications and maintaining regulatory compliance. In addition, government incentives are driving providers to look at electronic health records, health information exchanges and business intelligence or analytics tools as a way to drive efficiencies, streamline workflow and increase the breadth and quality of patient care. The reality is, these types of initiatives can mean huge upfront capital expenditures, sizable ongoing operating expenses and a huge investment in change management in adjusting to the workflows of the digital era. All this is happening in an industry that has been historically reluctant to change.

Enter cloud computing. A panacea? Probably not; however, it is perhaps the biggest potential change to the healthcare industry since the computer. Embracing cloud technology in healthcare may be the answer to enabling healthcare organizations to focus their efforts on clinically relevant services and improved patient outcomes. Additionally, it may reduce and even remove the burden of infrastructure management. Cloud technology can provide access to hardware, software, IT knowledge and resources and services, all within an operating model that drives down costs and simplifies technology adoption. Suddenly, management and migration of legacy hardware fall upon the cloud provider, allowing hospitals to get back to their primary intent of business — patient care.

As with any new technology, there are concerns that are both unique to healthcare and common to all industries. Security and privacy become regulatory compliance issues, while high availability is a must for systems that deal with life-and-death situations. Data movement across borders and ownership of that data are also important. Reports show as many as 30% of healthcare organizations are either implementing or operating cloud-based solutions[1], and the result is a wealth of vendors moving their applications to cloud models. Although these cloud technologies are mostly limited to email applications and collaboration tools like Microsoft Live Meeting, the movement to clinical systems is starting to grow. Electronic health records, diagnostic imaging, analytics and the introduction of health information exchanges all lend themselves to be cloud-based with a clinical focus.

This white paper will explore the different aspects of cloud adoption and how healthcare providers can move forward with a cloud-based solution.

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[1] CDW 2011 Cloud Computing Tracking Poll - http://www.cdw.com/cloudtrackingpoll

Current State of Healthcare

The healthcare industry has traditionally underutilized technology as a means of improving the delivery of patient care. Even today, organizations still rely on paper medical records and handwritten notes to inform and make decisions. Digital information is siloed between departments and applications, making access to a patient's longitudinal record difficult, if not impossible. This lack of access costs the healthcare industry millions of dollars each year in duplication and waste.

Sharing of patient data among clinicians, departments and even patients is rare and complex. A hospital's reliance on vendors to "knit" together their diverse technologies leads to expensive and unproven data experiments that fail to deliver the expected outcomes. Various countries have approached this issue in different ways, from the central national clearinghouse (UK) to regional health centers (Canada) to more granular health information exchanges; all are realized with various degrees of success. Those countries that have skipped over paper records and started with diagnostic imaging seem to have had more success in a limited manner but have yet to achieve success with the larger components of the patient record.

Most provider IT departments are accustomed to traditional technologies that require licensed software platforms, and elaborate and hardware-heavy infrastructures supported by a large staff. The staff members need to be experts in all areas of IT, including hardware, software, networking, backup and archiving. As new technologies are introduced, the demands on the IT infrastructure start to push the limits of the promised efficiencies. While groundbreaking in concept, government incentives simply don't cover enough of the true costs of overhauling legacy equipment and modernizing a facility.

As electronic health records, PACS and advanced clinical systems are evolving and becoming more prominent, current storage resources are stretched. The implementation of a digital pathology system alone could put petabyte-level demands on the current infrastructure instantly. Implementation time of these projects is consumed with ensuring the back-end technologies are properly configured and working, often taking focus away from the clinical aspects of the applications and the attention users need. Reducing this implementation time is critical to a facility's ability to adapt quickly to changing needs and the introduction of new applications.

Patients today are better advocates for their own healthcare; they are more educated to their diseases and increasingly demand access to the latest technologies. At the same time, they seek the best care at the best cost and are willing to investigate their options. As a result, demands for access to personal patient records are increasing and organizations need to keep up. When citizens can access bank accounts from anywhere in the world, withdraw money, get balances and make payments, it is hard for them to understand why they cannot have universal access to their secure health information.

The picture is not all doom and gloom, however, as many facilities have recognized these challenges and still provide top-notch care. Many developed countries are establishing healthcare data clearing houses or data centers that can help make data more portable. Canada has established diagnostic imaging repositories across the country with demonstrated benefits to both patient care and cost savings. Countries everywhere continue to invest in new technology that will improve patient care. And this is where cloud computing can help drive the industry. CDW's study (referenced above) showed that 37% of healthcare providers have cloud adoption in their strategic plans, 22% are in

Hitachi Data Systems provides the infrastructure in the National Health System (NHS) North East and East Midland project in England, providing a managed service to the national healthcare system core.

the planning stages and 25% are in the midst of implementing. Only 5% have already embraced cloud computing, but they have recognized an average of 20% savings on implemented applications. The next step is to move more clinically focused applications into the cloud.
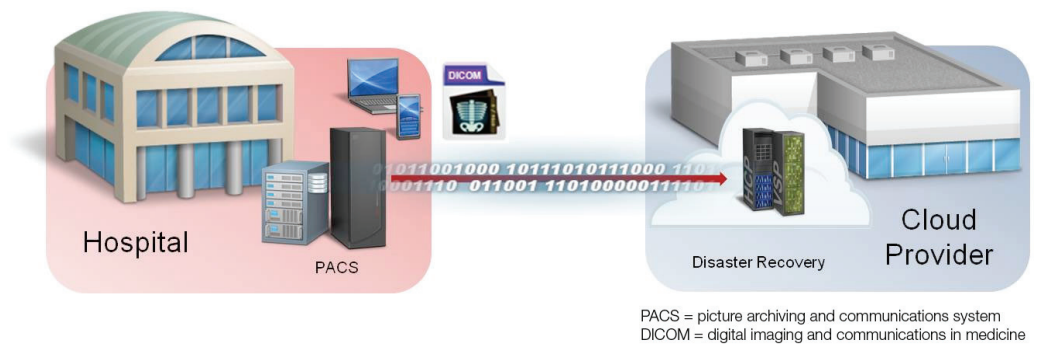
The Cloud: What Is It?

There are many definitions of the cloud and the massive marketing efforts have somewhat blurred the realities of what cloud computing is. The cloud is much more than just a financial model. Cloud technologies can be delivered in different ways and in various formats. It is important to know what an organization's cloud strategy is expected to accomplish, in order to determine the service and deployment model that is best suited for the organization.

Service Models

Infrastructure as a Service (IaaS)
IaaS provides an organization with the infrastructure needed to run its business. This may include networks, computing resources, such as servers or storage, and staffing expertise. Typically in these cases, the organization controls the operating system, applications and frameworks. For example, a hospital may use the cloud for diagnostic imaging disaster recovery (see Figure 1). The facility has its own PACS and archive, but it purchases storage and network services to route a copy of data to the cloud provider in case of lost data. The cloud service provider has little interaction with the daily events at the hospital and access to this data is limited to an as-needed basis in the face of disaster.

Figure 1. Infrastructure as a Service Healthcare Model

PACS = picture archiving and communications system
DICOM = digital imaging and communications in medicine

Platform as a Service (PaaS)
PaaS is a service model whereby users manage the applications deployed, but not the underlying infrastructure. This is most common in developing software applications where engineers have access to development tools, databases and middleware as well as infrastructure software. Healthcare providers with IT development staff may leverage this model to develop a local electronic medical record (see Figure 2).

Figure 2. Platform as a Service Healthcare Model
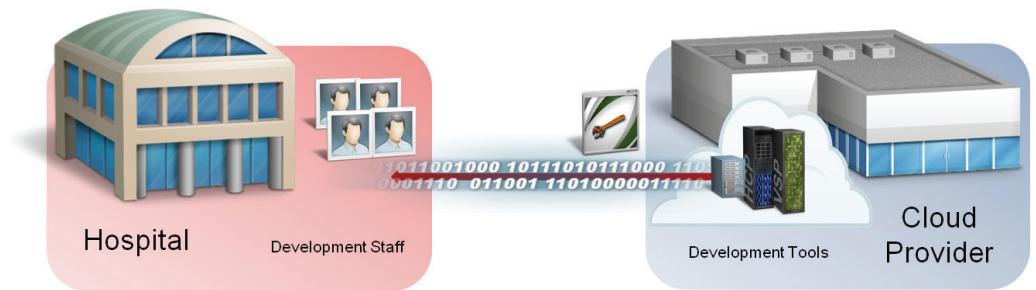
Software as a Service (SaaS)

SaaS becomes a model for healthcare providers to quickly adopt new technologies without excessive capital costs or readiness efforts (see Figure 3). SaaS provides users with remote access to the application, usually through a web browser. Facilities need not worry about storage or application management as only specific parameters are enabled for the user. Digital pathology, PACS or even email could be utilized through the cloud, where the organization would only pay for the use of the application: a pay-per-study or gigabyte model. SaaS can be quickly deployed and utilized without the need for any capital outlays, achieving maximum uptime and benefit from the technology.

Figure 3. Software as a Service Healthcare Model
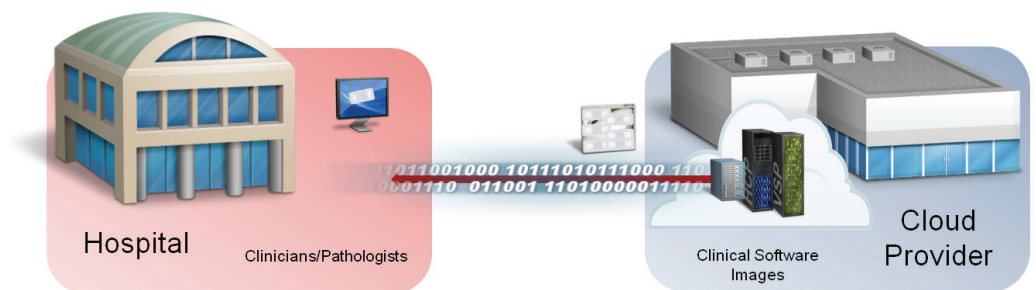
The above service models speak to what can be delivered in a cloud and they also denote the cost to a customer — typically increasing as the complexity or demands increase. But the models can also be deployed in a manner that provides varying degrees of control.

Delivery Models

The cloud can be delivered in a variety of different models, each utilized in a specific environment and delivering different benefits to the user. Through these delivery models, healthcare facilities can choose which services best suit their requirements, be it disaster recovery or application deployment. With each model there are benefits and associated risks that need to be considered in the facility's cloud strategy.

Public Cloud Deployment
A public cloud is the most cost-effective model of deployment, as economies of scale are maximized. The public cloud is open to the general public and is completely managed by the cloud service provider. Users will typically purchase the use of an application from a public cloud provider. Examples of public cloud are Amazon.com or salesforce.com. Users upload their information into this complete environment. The servers, storage and networking are shared among all subscribers and the applications are delivered over the Internet. Public cloud deployments are more risky, as they are open to anyone, and perception is that security and privacy breaches are predominant with public clouds. Disaster recovery for healthcare organizations could be well-suited to a public cloud model, as there are limited access points to the data, storage is more cost-effectively managed and access is only in the case of emergency (see Figure 4). Mission-critical systems do not need to rely on this data and so service level agreements (SLAs) can be minimal.

Figure 4. Public Cloud Architecture
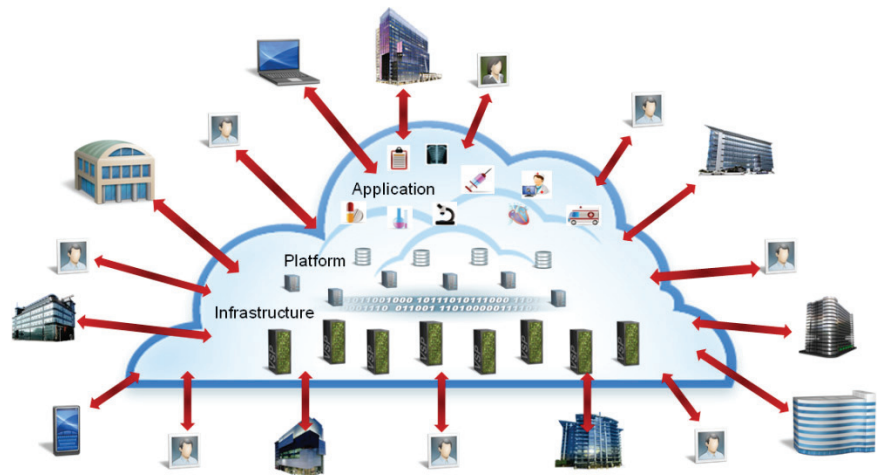
Community Cloud Deployment
A community cloud is a public cloud on a smaller scale (see Figure 5). It will serve several organizations that support a particular community of users. For example a Linux community cloud would enable developers to share tools common to Linux development. The organization would not need to outlay the capital that would otherwise be required to purchase a traditional software license and they would only pay for the use of the software as it was used by the developers. The same risks are associated with community cloud as with public cloud, so consideration of security and privacy

are important with community clouds. In the past, some vendors have offered disaster recovery and long-term archiving of medical images through a community cloud-based model.

Figure 5. Community Cloud Architecture
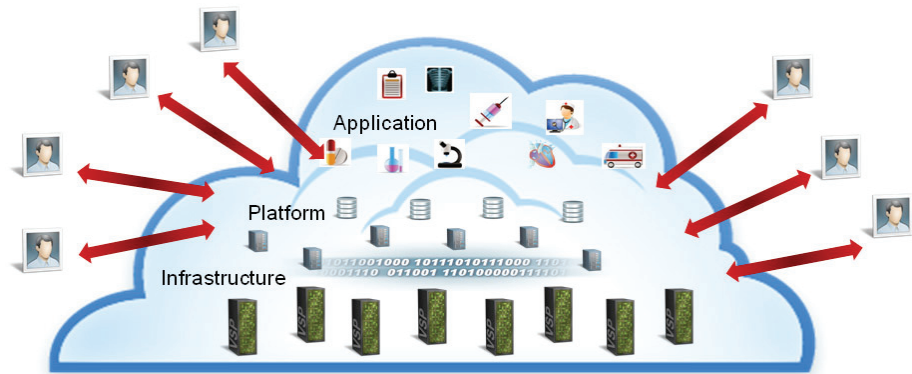
Hybrid Cloud Deployment

A hybrid cloud combines 2 or more clouds, but they remain unique entities. A hybrid cloud deployment will share technology, but the information, applications, etc., will be kept apart. The use of tenants and namespaces provides separation of users while running on the same "box." Healthcare providers may deploy a hybrid cloud for disaster recovery of diagnostic images or clinical systems (see Figure 6). Use of hybrid cloud introduces less risk to organizations, as participants are more aware of who is utilizing the services. Increased levels of control over the data are more apparent in a hybrid model, as applications keep a degree of separation between facilities while utilizing economies of scale in the infrastructure.

Figure 6. Hybrid Cloud Model
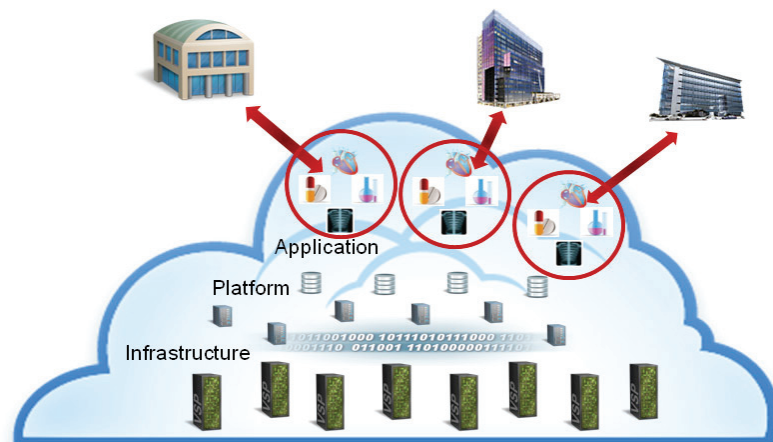
Private Cloud Deployment

Private clouds are simply that: a private cloud model that is operated by a single organization. The technology resides within an organization's own data center, and they are able to deploy the resources as needed to the different departments. Private clouds are expected to be the most likely model adopted by healthcare providers, until such time that cloud providers have demonstrated how to overcome the many challenges associated with other cloud models. With private clouds the ability to manage and control sensitive patient data remains within the organization (see Figure 7). Private clouds are more expensive, as economies of scale are somewhat lost; however, confidence in deployment is higher. This trade-off must be weighed as part of the cloud strategy.

Figure 7. Private Cloud Architecture
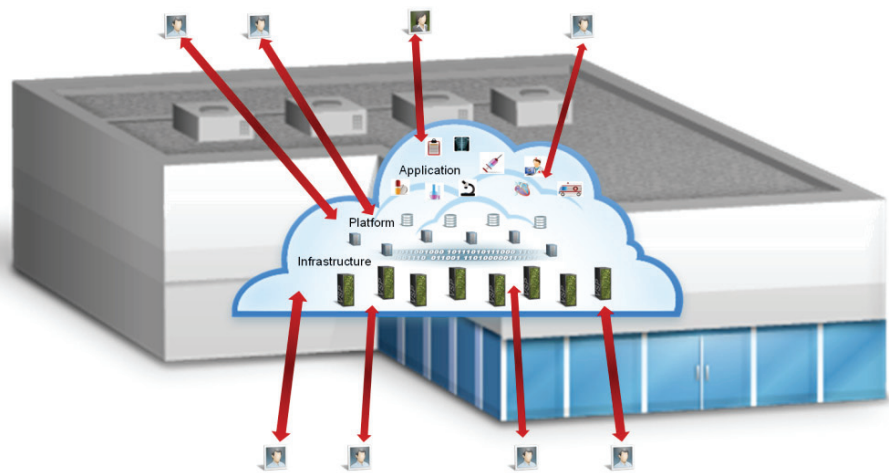
Drivers

As with any industry, certain drivers need to be present in order for new technologies to be adopted. For many years, these drivers have been minimally present in healthcare, resulting in a reluctance to change. Recent investments and the increased visibility of healthcare on many countries' national agendas have raised the drivers for cloud adoption.

Delivery of Cost-effective Healthcare

The cost of healthcare delivery has grown to such huge proportions that governments face serious funding issues if there is no resolution. Healthcare costs in some countries amount to 35% of gross domestic product, an unsustainable figure. The drive to lower the cost of healthcare delivery has become so predominant in society that governments have risen and fallen on their healthcare platforms. Alternative models that deliver cost savings and efficiencies must be explored in order to rein in the increasing costs.

Government Incentives

Governments around the world are providing financial incentives for healthcare facilities to adopt new technologies such as electronic health records. The recognition that technology can improve patient care while reducing costs has meant that governments are willing to push the traditionally slow healthcare industry to a faster pace of adoption. Reimbursement, the development of standards, introduction of legislation and regulatory compliance are just some of the mechanisms governments are using to advance the healthcare technology infrastructure. The result is an increased awareness and consideration of these new technologies by healthcare facilities.

Clinical Innovation

Healthcare is always striving to innovate. The ability of healthcare providers to adopt new technologies that drive better patient care has always been a challenge, born out of the cost and complexity of rolling out new technologies. Today, facilities seeking to improve their technology adoption must identify funding for a capital purchase and develop complex tenders (likely without a full understanding of the impact on their existing infrastructure and staff). Advances in technology combined with government incentives push organizations to adopt new technologies. Thus, there must be mechanisms in place for these organizations to deploy, test and validate the effectiveness of these proposed solutions and prove the return on investment (ROI), without significant upfront investment. Clinical innovation drives better patient care and outcomes, which is a hospital's primary objective. Enabling facilities to deploy these new technologies in a cost-effective manner will be a driver for cloud adoption.

Big Data Growth

Healthcare has become the best example of big data. As the amount of digital information increases, the ability to manage this data becomes a growing problem. Petabytes of data exist in storage devices. This data holds the keys to future clinical advances, but often remains inaccessible to researchers. The ability to access this data and utilize analytical tools against it can drive clinical and business intelligence. This will contribute to better healthcare practices, even driving new clinical decision-making processes. Big data analysis holds the promise of better treatment paths for diseases and faster recovery times through the understanding of best practices.

Administrative Simplification

Hospitals are patient care centers, not centers of technical innovation. IT departments are stretched to accommodate the different clinical systems that are introduced into use, dealing with different vendor systems, platforms and licensing models. Clinical departments drive the acquisition of applications without always considering the existing infrastructure, and the result is inefficiencies. Take storage purchases as an example. Departments typically buy 5 years of storage during the procurement cycle without any consideration of the storage needs of other departments. This storage can sit unused but paid for, tying up valuable capital. Add to that the need for the IT department to then manage the application's backup and archiving needs with those of other departments. There can be 10 to 20 different applications that need managing, taking the IT department's time away from being strategic in responding to physicians needs and being more focused on day-to-day operations. Simplifying administration in the IT department allows more time to be spent on clinical systems and less time on the infrastructure.

Cloud Challenges in Healthcare

We have established that healthcare lags behind other industries with respect to technology adoption, and embracing the cloud is certainly in that category. Healthcare providers face many challenges as they investigate moving to a cloud model. Once these challenges have been satisfied, cloud technology will become less a question of "if" and more a question of "when."

Privacy Challenges

Privacy and security rank at the top of the list of reasons for slow adoption rates. Putting personal health information into a 3rd-party, remote data center raises red flags where patient privacy laws are concerned. The possibility that patient data could be lost, misused or fall into the wrong hands affects adoption. What recourse does an organization have should a cloud provider lose data? It has happened, and it has the potential to be a very expensive problem to resolve. Violation of patient confidentiality carries heavy fines, including significant costs of recovery and patient notification.

A potential solution is a private cloud model. In this case the data still resides at the customer data center and a certain degree of control still exists for organizations to manage patient privacy. The organization can also ensure that the data center complies with certain standards, such as NIST 800-146 Cloud Computing Synopsis and Recommendations[2]. This model may be more expensive, but security and privacy are more visible.

Security Challenges

This may be a moot point where healthcare providers are concerned. One of the benefits of cloud technology is the ability to access resources that would otherwise be unattainable. A cloud provider will have security experts deploying the latest patches and software to its data center. Secure access to the physical property will be well guarded, and many policies, processes and mechanisms will be in place to ensure data security. Add to that the fact that any applications operating through the cloud will store all their data in the cloud. This means there is no protected health information (PHI) residing on hospital computers, which is a more secure situation than today's current environment.

Health and human services studies show that PHI violations have come from the theft of computers taken from facilities, loading docks and even physicians' vehicles. These thefts have been more for the computer and less for the PHI. This raises the question: Wouldn't it be better to have everything in the cloud?

Workflow Challenges

As it can be difficult to enact change throughout healthcare provider organizations, we may assume that adoption of a cloud model would present significant change management issue for providers. Current processes are often inefficient, relying on paper in many cases to manage patient care.

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[2] This document reviews the NIST-established definition of cloud computing, describes cloud computing benefits and open issues, presents an overview of major classes of cloud technology, and provides guidelines and recommendations on how organizations should consider the relative opportunities and risks of cloud computing. It describes cloud systems and discusses their strengths and weaknesses.

Any transition to a cloud would require significant support from the technology partners to ensure a smooth transition for users.

Take for example, the current practice of requesting a diagnostic exam. A physician fills out a request form with patient details, history and reason for exam. This gets sent to the radiology department for scheduling. The clinical staff books the exam and informs the doctor, who advises the patient, who has a conflict with the appointment time. Back and forth it goes. Now, consider an electronic scheduling system based in the cloud, whereby the doctor enters all the relevant information and the system determines the most appropriate exam and notifies the patient directly of possible options. The patient logs in, selects the best time for the exam, and the system books the exam. It seems simple, but change management is required to ensure the transition is smooth.

As a part of this workflow transition, serious consideration should be given to staffing needs within the organization's IT department. As the cloud starts to permeate the clinical environment, no longer will the same skill sets be required. Different technology will need to be supported, new training will be required and new skill sets will need to be defined. An organization that had staff working on managing backups and archiving will now migrate to network connections and clinical applications. IT staff will focus on the rollout of the electronic medical record (EMR) instead of managing the storage layer the EMR sits upon. Access to this kind of skill set is in high demand today.

These challenges contribute to slow adoption of cloud technologies but should not stop cloud progress. Organizations are weighing the benefits against the risks. As more providers migrate to the cloud, we will see these challenges overcome with new and innovative solutions.

Benefits of Cloud Adoption for Healthcare

While many challenges have contributed to slow adoption of the cloud, there are equally as many benefits for providers to embrace this new technology across the enterprise. These benefits encompass both business and clinical areas. In today's world of cost cutting, many facilities must show clinical benefit in order to justify expenditures, and the cloud technologies are potential tools to do just that.

Clinical Benefits

The single biggest clinical benefit that cloud technology can provide is access to applications that were previously unattainable. For example, the implementation of digital pathology, managed through cloud services, has a huge clinical impact on an organization. The organization can roll out a service that would have cost millions just for the storage alone, but now can pay for it as they use it. Access to pathologists who previously were reachable only near centers of excellence means that remote facilities can offer new services to the local patient population, relying on remote experts to render their diagnoses. Patient care can be improved by providing this service through the cloud faster and more efficiently. Since patients don't need to travel, waiting lists are more easily managed as more patients can have the same tests in more locations with a larger availability of experts.

These same experts can access patient data remotely and on demand through the Internet via a variety of connected devices. Physicians can review the latest diagnostic results from home and perhaps determine that the patient can be discharged immediately, rather than wait for their afternoon rounds.

Collaboration between researchers or physicians and allied health professionals suddenly becomes a reality, as patient information is centrally located and accessible to authorized users. Patient information is now being shared between caregivers, regardless of location, allowing for better-informed decisions.

Business Benefits

Obviously there must be some business benefit for a new technology to be adopted, or it won't be considered. Cloud technologies provide tremendous benefits that can contribute to the welfare of a provider organization.

Healthcare providers are in the business of treating and caring for patients. They are not IT focused; their purchasing patterns indicate that investment into IT falls far below other industry standards. In many cases providers' IT staffs are stretched very thin, and other staff must assist. For example, in radiology it is often a medical technologist with a technical affinity but no formal technical background, who becomes the PACS administrator. The cloud offers providers the ability to access specific experts to manage and maintain their systems. A cloud provider will have a block storage expert, a network security expert, and an archiving and backup expert who will manage the different components. Providers need not build up these skill sets, but instead can, for example, focus on a clinical applications specialist for PACS who helps clinical users maximize the application. These experts can spend the time and effort to implement the best practices for each component, which ultimately delivers added benefit to the clinical users and their patients.

Today's purchasing environment usually works in cycles. A department will be given capital for the next 5 years and then will need to reapply and compete for funds to continue to operate their systems. The cloud provides a way to manage the investments while guaranteeing that they can continue to operate.

Take the radiology example again. The department adds a new CT scanner and their data volume increases by 10%. Their storage is not scaled to handle this added volume, and so they will deplete their available storage faster than expected. In a cloud model, the facility has access to the needed capacity and performance to meet the demand of the new CT. This "unlimited" scalability allows for the IT department to meet the interests of various departments simultaneously and respond more quickly to changing needs.

This model lowers the barriers for adoption of innovative new technologies and helps to address the massive overhaul and modernization needs in healthcare.

Cloud models provide transaction-based pricing. As a facility uses more storage, they pay for it. Traditional capital models mean that the storage purchased in year 1 sits mainly idle waiting for data to be captured. The ROI is low as utilization rates are very low to start. With cloud technologies, utilization rates are 100% from the start. And the cloud provider is responsible for maintaining the hardware. For example, by year 5, cloud technology has probably been refreshed by the cloud provider, while in the traditional scenario the organization would be looking to replace the capital equipment and migrate the data: a costly proposition.

Cloud technology shifts the paradigm for the delivery of healthcare. Consistent delivery of IT services and scalable hardware and software on a pay-per-use model enables healthcare providers to focus on what they really should be focused on: effective delivery of patient care.

Cloud Economics

It is a common misconception that cloud technology equates with inexpensive technology. There are economies of scale that must be achieved for savings to be realized. In the case of healthcare providers, a private cloud will cost more than a public or hybrid cloud would, as the resources are shared among fewer constituents. It should also be noted that price does not equal cost, and total cost of ownership should be evaluated when looking at a cloud architecture.

It is necessary that all of the costs that are important to the facility be examined, beyond just those of capital outlay. For example, if cooling and power are not a visible expense, any cost savings here will not be immediately felt. Costs that are borne by other departments need to be considered in the overall business justification for cloud adoption.

CONSIDERING CLOUD?

For those considering adoption of cloud technology, attention should be paid to the following financial areas:

- Architecture
- Total cost of acquisition (TCA)
- Total cost of data ownership (TCDO)
- Total cost of ownership — hard (TCOH)
- Total cost of ownership — soft (TCOS)
- Operational transition (labor and management 30%)

When considering the **architecture** of the cloud provider, facilities should consider the underlying technologies. Direct attached storage will likely be the cheapest of technologies, but it carries a risk of performance issues with the very large-scale growth common to hospitals. Modular storage and enterprise storage systems have improved benefits of performance and features, such as thin provisioning and dynamic tiering, but bring increased costs. It will be important for adopters to consider what they are buying in any cloud model.

Total cost of acquisition is what most people think of immediately when making buying decisions. TCA takes into account the initial outlay or capital expenditure but does not consider the ongoing costs. Considering only TCA will result in an architecture that may not fully support the initiatives trying to be achieved by the organization.

Total cost of data ownership takes a more practical view of the costs associated with managing data. When considering a cloud model, TCDO has real meaning as the operating expenditure costs are factored in and can be more easily compared to the current costs a facility is experiencing. This becomes an apples-to-apples comparison that will help in decision making.

Total cost of ownership — hard includes items that are easily measured, such as maintenance, cooling, power and so on. TCOH should be considered with cloud technologies. However, TCOS (below) is where the real financial benefits will be shown.

Total cost of ownership — soft for a hospital adds in the business and clinical impact that cloud technology enables. For instance TCOS would include access to specialist resources that otherwise would not be affordable, adoption of new applications in a more dynamic manner or reduced paperwork in trying to purchase additional storage in order to scale to meet the demands of the department. These financial aspects can't be overlooked when looking to make a decision on the adoption of the cloud.

Another area outside of operational costs that should be considered is the costs of remedying a privacy breach. Any agreement with a cloud provider should identify who bears the costs of such a breach. Insurance policies that cover payments to 3rd parties as a result of a breach need to be included in the costs.

Cloud technology can bring many benefits, but only due diligence will show what the financial outcomes will be. It is important that facilities look beyond just the acquisition costs.

Healthcare Cloud Solution Checklist

Ultimately there are certain minimum requirements that providers need to consider when evaluating a cloud provider.

Security

To overcome current perceptions of the risks associated with using the cloud for personal health information, cloud providers must demonstrate security measures that prevent unauthorized access to patient data. Consideration must be given to the following:

- Secure access to the facility
- Network security
- Data security
- Staff training and regulatory compliance awareness

High Availability

Healthcare organizations are dealing with mission-critical applications where downtime can mean the difference between a patient's life and death. Cloud providers need to be aware of and prepared for these stringent availability requirements and should be ready to guarantee delivery of information. Consider:

- Downtime for maintenance
- Responsiveness as data volume grows
- Network latency and redundancy
- Hardware redundancy

Standards-based Data Management

Healthcare is driving the development of standards throughout many different areas. The use of standards in managing data will futureproof the data to ensure that access and migration of data will always be possible.

- DICOM/HL7
- XML metadata
- NIST
- IHE framework

Scalability

As new systems come online, the volume of data will grow, creating a need for the cloud provider to be able to scale up, out and deep. As the data volume grows, the impact on performance should be negligible. Consider:

- Provisioning
- Plug-and-play growth

- Dynamic scaling

Remote Access

Flexibility to access the data should be considered by healthcare organizations as they look to the cloud. Various aspects need to taken into account to ensure adequate services are provided to the users.

- Capacity of users
- Performance at peak access times
- Flexibility of mobile devices

Contractual Assurance

As with any agreement, healthcare facilities should develop ironclad agreements that ensure the delivery of services will not be interrupted without penalty. Contracts should include items such as:

- Curing periods for breach of contract without interruption of service
- Insurance for breach of privacy
- Service level agreements
- Migration assistance
- Scalability

The Future State

What will healthcare delivery look like in the next 10 years? Will cloud technology catch on or will it fade away as application service provider models did? Demands for improved infrastructure continue to increase and are not likely to slow down. With the current state of healthcare and the many adoption challenges that it faces, it is logical to conclude that cloud technology will be at the forefront of healthcare innovation. Government incentives for electronic health records adoption, digitization and lowering costs will require that cloud technology (or some form of what we know as cloud technology today) become more mainstream. Cloud providers are very aware of the obstacles to adoption and will work to overcome these significant challenges through education and proof of concepts.

Eventually, perceptions that exist today will be changed for the better. And what will that do for patient care? Imagine a system where patient information is accessible from any mobile device in a secure and private manner. The entire patient record, consolidated into a single view from any number of different applications, provides accurate and up-to-date information upon which physicians can make better informed decisions. Clinics, hospitals, insurance payers and patients are all able to access the relevant information as needed.

In addition, electronic medical records, digital medical imaging, pharmacy records and doctor's notes are all consolidated and accessible. The ability of researchers to run analytics, better treatment options, optimal insurance programs and the possibilities of truly personalized healthcare have become a reality. Data drives the new healthcare world and access is greater than ever before. Big data becomes better managed due to cloud technology, as storage, compute power and

consolidation reach levels never before achieved. Portability of data delivers information where it is needed, when it is needed.

Coordinated care with patients conducting their own treatment regimes becomes a possibility with cloud technology. Patients are able to become more deeply engaged as their information is in a single index. This means they can seek preferred treatment that addresses their state of health. The possibility of duplicate tests and medical errors, such as contraindicated medications, can be minimized as access to the data becomes a reality.

And healthcare provider IT departments can offload the burden of managing infrastructure and focus on supporting more patient-care-related activities. New technologies can be quickly evaluated for their effectiveness and deployed broadly from a cloud model, allowing healthcare providers to stay abreast of the latest and greatest tools.

Ultimately, patient care will improve, which in turn will drive down costs and improve efficiencies. Cloud technology will be a driving force in the healthcare ecosystem for years to come. The alternative is bankrupt facilities, healthcare costs that skyrocket to unaffordable levels and patient care delivery that relies on an archaic and inefficient system.

At the Foundation of the Cloud

Cloud technologies and the vendors that can deliver proven cloud technologies have an important role to play in the future of healthcare delivery.

Hitachi Data Systems provides a unique 4-stage cloud adoption strategy that ensures the pace of adoption can be rationalized with the needs of the business. Stage 1 of cloud adoption starts with implementing "cloud-ready" technology. This is an investment that can deliver not only value on the short term, but also added ROI as the future foundation of a cloud-based strategy. Take for example Hitachi Content Platform (HCP) which, as a first step, can be utilized to manage patient information from the radiology department. This would be locally hosted and managed and be like all other departments: a silo of storage.

Stage 2 encompasses moving this storage investment to a hosted environment, while adding applications to HCP and expanding its capabilities. At this stage, virtualization of an existing data center, such that multiple applications are now sharing the storage virtually, takes on a managed service methodology, with storage on demand becoming a viable option. This stage is called **infrastructure cloud**. In this scenario, organizations can manage multiple applications and their accompanying storage as a cloud model.

Stage 3 of this model focuses on the utilization of data for clinical decision making, or the "content cloud." At this level, HDS offers Hitachi Clinical Repository (HCR) to enable data ingestion via the cloud. HCR ensures indexing of that data, as it arrives, so physicians can see the patient longitudinal record. Through various applications, facilities can now provide physician data access through cloud-based applications; these include electronic medical records and physician and patient portals. The content cloud methodology offers healthcare providers the opportunity to expand their services and to provide new services and methods of communications, much more easily and quickly. At the same time it helps them to realize all the benefits of cloud, such as reliability, lower costs, higher utilization rates and a simplified IT management environment.

As the final step, Stage 4, HDS brings hospitals and caregivers to the highest level of cloud adoption, the "information cloud." By applying data analytics to the healthcare information cycle, providers can leverage the content collected from across multiple facilities, patients and physicians, to derive actionable clinical intelligence. Within this information cloud is the potential for the development of clinical best practices, like better understanding clinical decisions for a particular population or identifying health trends in the early stages. With the right applications, providers are better able to manage chronic diseases like diabetes, cancer and heart disease. Thus, they lower the cost of healthcare for all and improve the quality of life for many.

Providers and patients stand to benefit from the adoption of the cloud and its associated benefits. Despite the current obstacles to adoption, providers will seek the gains that the cloud provides, and the benefits will far outweigh the risks.

Cloud technology can be summarized into 2 basic benefits:

- Increased access to data
- Dynamic management of the infrastructure

These 2 items address everything that justifies cloud adoption. Cloud technologies solve clinical problems faced today and solve business issues that have plagued healthcare providers for years.

There are still many steps to take in order to get to this utopian state of healthcare delivery, and the cloud will play a major role in achieving this.

Appendix A: References

- http://www.expresshealthcare.in/201109/itathealthcare04.shtml
- http://www.ecommercetimes.com/story/Googles-No-Bellwether-for-Healthcare-Cloud-Services-72829.html
- http://www.computerworld.com/s/article/9215679/Report_Iron_Mountain_to_shutter_cloud_storage_service
- http://www.information-management.com/news/health-care-cloud-computing-10020883-1.html
- http://newsroom.cdw.com/features/feature-05-26-11.html
- http://www.cloudcomputingzone.com/2011/02/healthcare-coming-to-the-cloud/
- http://www.cloudbook.net/resources/stories/can-cloud-computing-help-fix-health-care
- http://www.zdnet.com/news/challenges-of-cloud-computing-in-healthcare-integration/6266971
- http://info.exist.com/blogs/bid/61400/Cloud-Computing-for-Healthcare
- http://thehealthcareblog.com/blog/2011/05/02/health-care-in-the-cloud/
- http://www.oxford-consulting.com/industry-news/2011/08/integration-challenges-slowing-adoption-of-cloud-for-healthcare/

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