

# USING HEALTH CARE WITH CLOUD COMPUTING

P Gayathri, KMounika, Dr. G.AnjanBabu

**Abstract:**Cloud computing is a recent and fast growing area of development in healthcare. Ubiquitous, on-demand access to virtually endless resources in combination with a pay-per-use model allow for new ways of developing, delivering and using services. Cloud computing is often used in an "OMICS-context", e.g. for computing in genomics, beyond this traditional domain proteomics and molecular medicine, while other field of application still seem to be underrepresented. Thus, the objective of this scoping review was to identify the current state and hot topics in research on cloud computing in healthcare.

**Keywords:** Cloud computing, Internet, E-health, Medicine, Healthcare

## 1 INTRODUCTION

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 workflow and increase the breadth and quality of patient care. The reality is, these type of initiatives can mean huge upfront capital expenditures, sizable ongoing operating 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 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

## 2.1 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**



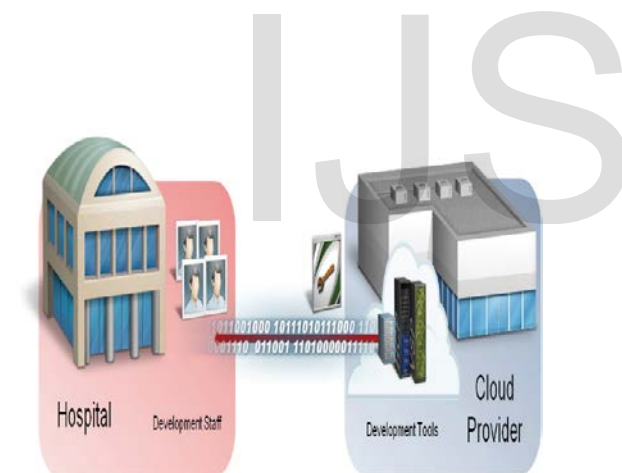
## 2.SERVICE MODELS:

## 2.2 Platform as a Service (PAAS)

PAAS is a service model where by 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.

### Figure 2. Platform as a Service Healthcare Model

- P Gayathri is currently pursuing 2<sup>nd</sup> MCA in KMMIPS, Tirupathi, PH-01123456789. E-mail: gyponna@gmail.com
- K.mounika is currently pursuing 2<sup>nd</sup> MCA in KMMIPS, tirupathi PH-01123456789. Email:mounikamouni1222@gmail.com
- Prof G.AnjanBabu head of the department of computer applications in S.V.Universitytirupathi



## 2.3 SOFTWARE AS 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.

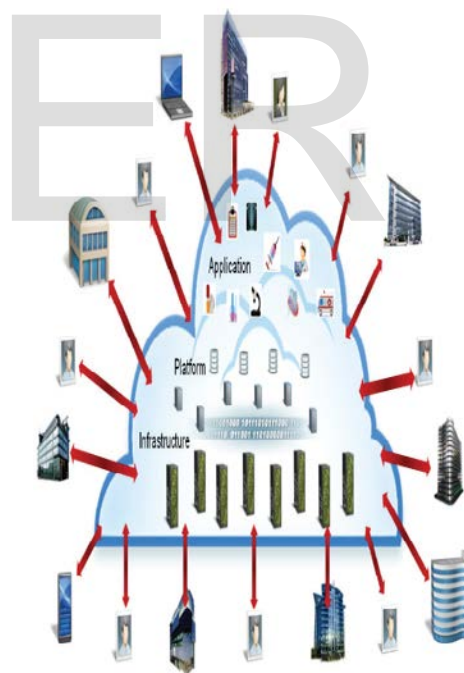
## 3 DELIVERY MODELS:

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.

### 3.1 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.

#### Public Cloud Architecture



### 3.2 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

### 3.3 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. 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.

### 3.4 Private Cloud Deployments

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 their sources as needed to the different departments.

## 4 CURRENT STATE OF HEALTH CARE

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 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.

## 5 THE CLOUD: WHAT IS IT?

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.

## 6 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.

### 6.1 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.

### 6.2 Government Incentive

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.

### 6.7 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.

### 6.8 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. Bytes 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.

## 7. 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

could be lost, misused or fall into the wrong has 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."

### 7.1 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 affects adoption.

### 7.2 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 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.

### 7.3 Workflow Growth

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.

## Benefits of Cloud Computing for Healthcare

The five aforementioned trends in the healthcare industry are having significant impact on HIT systems. There is substantial growth in demand for healthcare services because of aging populations, the increasing prevalence of chronic diseases and comorbidities. Concurrently, there are cost pressures stemming from the need to do more and higher quality work with fewer and more costly resources and also reduced revenue. Expectations for better outcomes, higher quality treatment and more value from the healthcare services provided increase the need for point-of-care access to medical data and the parallel evolution and adoption of mobile devices, both for medical staff and for patients, are forcing the need for IT systems to adapt. Also, the significant increase in digitization of medical records – including the accelerating increase in adoption of electronic medical records (EMR), electronic health records (EHR) and personal health records (PHR) – and the increasing prevalence of digital outputs from scanning and monitoring devices, such as magnetic resonance imaging (MRI) scanners and bedside monitors and infusers, provide more voluminous and varied digital data to maximize the potential benefit of cloud solutions.

Healthcare provider systems leveraging cloud-based computing and cloud services offer an array of benefits in comparison to in-house client-server systems; including economic, operational and functional advantages.



## 8 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.

### 8.1 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.

### 8.2 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.

## 9 HEALTHCARE CLOUD SOLUTION CHECKLIST

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

### 9.1 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.

### 9.2 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 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

### 9.3 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

## 10 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.

### 10.1 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 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 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 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. An environment.

## 11 .Conclusions

Even though cloud computing in healthcare is of growing interest only few successful implementations yet exist and many papers just use the term "cloud" synonymously for "using virtual machines" or "web-based" with no described benefit of the cloud paradigm. The biggest threat to the adoption in the healthcare domain is caused by involving external cloud partners: many issues of data safety and security are still to be solved. Until then, cloud computing is favored more for singular individual features such as elasticity, pay-per-use and broad network access, rather than as cloud paradigm on its own.

## References:

- [1] <http://www.expresshealthcare.in/201109/itathhealthcare04.shtml>
- [2] <http://www.ecommercetimes.com/story/Goog-Goo-No-Bellwether-for-Healthcare-Cloud-Services-72829.html>
- [3] [http://www.computerworld.com/s/article/9215921/Report\\_Iron\\_Mountain\\_to\\_shutter\\_cloud\\_storage\\_service](http://www.computerworld.com/s/article/9215921/Report_Iron_Mountain_to_shutter_cloud_storage_service)
- [4] <http://www.information-management.com/news/health-care-cloud-computing-10020883-1.html>
- [5] <http://newsroom.cdw.com/features/feature-05-26-11.html>
- [6] <http://www.cloudcomputingzone.com/2011/00/healthcare-coming-to-the-cloud/>
- [7] <http://www.cloudbook.net/resources/stories/ca-cloud-computing-help-fix-health-care>
- [8] <http://www.zdnet.com/news/challenges-of-cloud-computing-in-healthcare-integration/6266971>
- [9] <http://info.exist.com/blogs/bid/61400/Cloud-Computing-for-Healthcare>
- [10] <http://thehealthcareblog.com/blog/2011/05/00/health-care-in-the-cloud/>
- [11] <http://www.oxford-consulting.com/industry-news/2011/08/integration-challenges-slowing-adoption-of-cloud-for-healthcare/>
- [12] IBM Explorys  
Health population management ,analytics and data management