

=

Cloud Computing Services in Medical Healthcare Solutions

Devendra Singh Kaushal¹ & Yunus Khan²

Abstract:

Within a hospital, indeed within the majority of medical practices, patient charts and medical histories are often kept within a computer system of some kind. In a hospital this is especially useful as the sheer number of patients within the building at any one time can be daunting. Cloud computing can help facilitate easier access and distribution of information among the various medical professionals who may come in contact with each individual patient. In current vast hospitals, servers are connected, but the sheer amount of information and computers that must be connected is staggering. A cloud based system will improve information sharing by allowing everything to be hosted in the same place, allowing a doctor to input test results in the lab, instantly updating the chart of a patient in a completely separate wing. The technical foundations of Cloud Computing include Service-Oriented Architecture and Virtualizations of hardware and software. The goal of Cloud Computing is to share resources among the cloud service consumers, cloud partners, and cloud vendors in the cloud value chain. With the help of this paper is to explore the current state and trends of cloud computing in healthcare.

Key Words: ECG analysis, DNA, Mobile Health Care Saas, Paas, Iaas.

¹ devendrasinghkaushal@gmail.com, Department of Computer Science & Engineering
Jawaharlal Institute of Technology Borawan Khargone MP India

² callyunuskhan@gmail.com, Department of Computer Science & Engineering
Jawaharlal Institute of Technology Borawan Khargone MP India

=

Introduction

Cloud Computing has become a scalable services consumption and delivery platform in the field of Services Computing. Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the Internet). The name comes from the use of a cloud-shaped symbol as an abstraction for the complex infrastructure it contains in system diagrams. Cloud computing entrusts remote services with a user's data, software and computation. The technical foundations of Cloud Computing include Service-Oriented Architecture (SOA) and Virtualizations of hardware and software. The goal of Cloud Computing is to share resources among the cloud service consumers, cloud partners, and cloud vendors in the cloud value chain. The resource sharing at various levels results in various cloud offerings such as infrastructure cloud (e.g. hardware, IT infrastructure management), software cloud (e.g. SaaS focusing on middleware as a service, or traditional CRM as a service), application cloud (e.g. Application as a Service, UML modeling tools as a service, social network as a service), and business cloud (e.g. business process as a service). A hybrid computing model enables an organization to leverage both public and private computing services to create a more flexible and cost-effective computing utility:

- The public cloud is a set of hardware, networking, storage, service, and interfaces owned and operated by a third party for use by other companies or individuals.
- A private cloud is a set of hardware, networking, storage, service, and interfaces owned and operated by an

organization for the use of its employees, partners, and customers.

- In a hybrid cloud environment, an organization combines services and data from a variety of models to create a unified, automated, and well-managed computing environment.

Whether your cloud is public, private, or hybrid, you'll need a cloud provider that provides elasticity, scalability provisioning, standardization, and billed usage. Elasticity is important because it means that you are able to use a service for a long or short period of time based on need. You can add more services from a self-service portal rather than wait for IT to do the heavy lifting for you. Increasingly, as companies begin to understand that they will use a combination of different platforms to meet different business needs, the hybrid cloud will become the foundation for computing. The advent of the hybrid cloud will also help redefine the purpose and use of the traditional data center as well.

Are you wondering why there's so much buzz around cloud computing? Do you know what it means to have cloud-based services working for your practice or health system? Cloud computing is more than just a passing technology trend. It's the current and future means for conducting business around the world, from financial services to retail to health care. But what does it mean to be "in the cloud"? And how do benefits increase when services—not just software—are provided through the cloud.

Cloud-based services go far beyond delivering software. They offer a solution that's more flexible, scalable, and available. And the combination of software, knowledge, and service drives improved results for all providers and all organizations on the network. Cloud-based services represent the highest level in the evolution

of health care IT. It's time to get on the cloud or be left behind.

Review of Healthcare Services and Facilities before Moving to the Cloud

Healthcare organizations have been dealing with growing amounts of electronic records and digital images, would seem a good fit for cloud storage services. Among the reasons for this sudden interest in cloud-based computing and communications are the need for collaboration among the increasing number of remote and mobile workers, several office locations, a desire to improve patient quality of service and the ever present goals of improving operational excellence while driving down technology equipment and healthcare management costs (Whitemore, 2012).

To help healthcare organizations decide whether they are ready to move to the cloud there are a few important points to consider.

Distributed vs. Centralized Facilities

Depending on how the health organization operates - whether their IT infrastructure are distributed between their medical facilities or in a datacenter, moving to the cloud would help communications, applications, and collaboration between the health organizations. This approach reduce the need for IT staff in each facility satellite station, as well as to reduce IT budget.

Prepare the Infrastructure

Most of the current networks at healthcare facilities and their multiple office locations were built years ago. Adopting cloud-based systems, an inadequate infrastructure can quickly collapse due the high network traffic by up-tick in voice, video and data traffic applications deal with. In addition, deploying a MPLS (Multiprotocol Label Switching) will keep a reliable internet

connection due the multiple connections and redundancies; if the main carrier's connection goes down, it will automatically switch over to one of the others, providing the high-level business reliability and disaster recovery that many of the healthcare facilities don't have today.

Healthcare Security Issues with Cloud Computing

While the cloud appears to present several benefits it also appears to present special risks to healthcare organizations with respect to privacy and security. It is very important that the cloud service providers fully understand these security concerns in public clouds and address them as the healthcare organization comply with HIPAA privacy rules set by federal regulations. Guaranteeing security on storing medical health records and safeguarding them will be their most important jobs since cloud computing seems to be the future for this purpose (Allen, 2011). This health records information also needs to be made centrally accessible while still supporting these privacy guidelines. Cloud Security Alliance (Cloud Security Alliance, 2010) has published a list of best practices that should be implemented in the cloud to achieve maximum security in the Service as a Platform (SaaS) and Platform as a Service (PaaS) models. The alliance advises that following these security procedures will provide robust security against potential threats in both private and public clouds. It suggests implementing several layers of authentication to adequately secure health data records such as authenticating user login, administration capabilities to assign appropriate privileges to the users and groups, enforcing strong passwords creation and encryption, encrypted data exchange (Cloud Security Alliance, 2010).

In addition, consider federated authentication (Cloud Security Alliance,

2010) which delegate's authentication to the organizations that uses SaaS. As a user the healthcare organizations must ensure that their cloud provider enforces these security measures. Because of the amount of personal information available in the health records it could be a target for hackers and malicious users and use it their benefits. Insecure APIs and loose interface can be easy targets for these users. Breach notification enforcement is another security practice, which is a law in some states.

The backup services and disaster recovery policies definitely appear to be more robust and cloud providers are equipped than the local data centers that organizations maintain. Bigger cloud providers such Google App Engines and Amazon EC2 create and manage several copies of the data at different locations and data retrieval processes. So in the event of any data loss it can be restored without much damage. Data can be more easily and widely available and more consistent than that of privately maintained data centers. In that view the cloud data storages can be considered for persistent data storages by the health organizations. Designing and implementing community cloud model can be another approach to create more interconnected network of the healthcare providers and organizations (Raut, 2011) to mitigate some security concerns. The cloud infrastructure can be shared across payers and other healthcare entities and demand specific security needs and policies. This might create applications on infrastructure that will help in sharing the information in secured environment and quickly. This model may be a little bit different from public cloud model but it will allow the organizations to address security changes specific to their needs. Since the data, images and other records will be available within the community physicians, pharmacies, payers

=

can perform tasks such as counseling, diagnose faster there reducing costs for everyone involved.

Application of Health care services using Cloud computing:

The ecosystem of the healthcare system is vast, diverse and highly complex that includes health insurance companies, hospital and physician networks, laboratories, pharmacies, patients and other entities (Wan, Greenway, Harris, & Alter, 2010). And all these must work within several governmental regulations (Raut, 2011) In order to for this ecosystem to perform effectively and fast it is critical that some important information is shared quickly and accurately between them confidentially and in a secured way between these entities. Securing the patient's information is considered very sensitive and privacy concerns in the healthcare industry. Probably one of the reasons, which has negatively impacted the progress of healthcare moving into the cloud. Sharing of it must be handled with innovative technologies and tools when it comes to cloud. There are however lot of other data, information and services that can undoubtedly benefit by collaboration from using the cloud as they potentially span between cities, states and even countries. In the current scenario it appears that private clouds will be implemented first due to security concerns and then move into public infrastructure (Wan, Greenway, Harris, & Alter, 2010). May be it will be a good idea to first layout the top priorities of the healthcare industry and then evaluate which cloud computing aspects can be effectively applied to benefit them. In today's world rising health care costs, quality of services

provided to the patient and customers, privacy, data security & integrity, and disaster recovery appear to be the top priorities (Wan, Greenway, Harris, & Alter, 2010; Cloud Security Alliance, 2010). Some of the inherent features such as scalable infrastructure, data centers for providing persistent data, security models, fast access to information etc. can be leveraged so some of these priorities can be addressed.

Various phases of the cloud based medical health care system:

- *Infrastructure and Dynamic Scalability*
- *Information Sharing*
- *Availability*
- *Cloud Monitoring Tools*

Future of Cloud Based Medical Health Care Services:

In recent years, and with growing speed, “the cloud” has stormed the technology world. Its use and inherent values have affected a wide array of industries, as well as the average consumer using the Internet at home. People with Apple or Amazon accounts are already participating in cloud computing. And yet an understanding of the cloud in health care will vary. A physician’s exposure may be limited to television ads touting the benefits of archiving photographs and content online. A hospital CIO, by contrast, will have more direct familiarity with cloud computing, as it has been promoted as a cost-effective technology to replace aging legacy systems. As a recent article in the Harvard Business Review reported, “Over time the economics of building and running a technology infrastructure will favor the cloud over on-premise computing.” Why? And what exactly does “cloud computing” mean? In short, cloud computing refers to working

=

with content that’s available at a shared online location, rather than a personal disk drive or server. All software and information is stored exclusively on an online network (and referred to as “in the cloud”) with the Internet as the point of access for all users. As an example, here’s how the cloud stores photographs: First, a user uploads digital pictures to a secure website instead of a local hard drive. Then, that person’s circle of friends or co-workers can view those photos by connecting to that website. Sharing can take place among many people simultaneously, all accessing the same destination or URL “in the cloud.” What makes “cloud computing” different? And why is it important to get on the cloud now before it’s too late? Unlike conventional solutions, such as installed software, cloud computing is uniquely defined by these Characteristics:

- **On-demand self-service:** Any resources, from vital business functions to basic email, are available to all users at practically any time
- **Agility:** Upgrades can be made and applied across the network on one instance of software
- **Broad network access:** Availability ensured, as access is location independent--users can access services from any standardized device, like a PC or tablet, no matter their locations
- **Resource pooling:** Many can use the network at one time, accessing the same tools and functions.
- **Rapid elasticity:** Compared to a traditional computing infrastructure, a cloud-based network can easily accommodate, and respond to, a rapid increase in the number of users as well as spikes in demand.

- **Measured Service:** A provider of cloud services measures service in the same way an energy utility measures the amount of power it provides and makes the necessary adjustments. The federal government has even recognized and promoted the benefits of cloud computing, announcing in early 2011 a preferential “Cloud First” policy as well as a Federal Cloud Computing Strategy.

“This policy is intended to accelerate the pace at which the government will realize the value of cloud

computing by requiring agencies to evaluate safe, secure cloud computing options before making any new investments,” said Vivek Kundra, former chief information officer for the federal government.⁵ “Cloud computing will enable a fundamental shift in how we serve the American people,” Kundra continued. “Citizens able to access their health records electronically will be able to easily share them with doctors and providers, and thus improve their healthcare.”

Now, we can add one more promising aspect of the cloud: enormous growth. Across industries, global revenue from IT cloud services is expected to reach \$72.9 billion in 2015, up from \$21.5 billion in 2010—“with spending for public IT cloud services growing at more than four times the rate of the worldwide IT market as whole.” This ever-expanding adoption of the cloud suggests that business decision-makers view the cloud’s offerings as important improvements to their operation.

Yet, despite the cloud’s widespread growth and potential, the health IT world has been relatively late—and comparatively slow—to adopt its use.

But that’s changing and the change is coming from within the industry. In a

=

November 13, 2011, New York Times⁸ opinion piece, an oncologist and college professor called for an electronic means to reduce massive waste in health care and eliminate paper based administration, in the way “[b]anks, FedEx and scores of other business” have already done.

You may already be familiar with some of the health care services currently in the cloud:

- **RxHub**, using a cloud-based network to transfer prescription-specific data
- **Patient portals**, or websites that deliver services and information to patients, provided by practices or pharmacies (ex: CVS Caremark)
- Government-sponsored efforts such as **online HIEs** and **NHIN Direct**

To realize exactly how cloud computing makes a difference for these and other services, it helps to know how the health IT world got to this point. It’s been an evolution.

The Discovery of health care and software to the cloud:

With each stage of health IT development—and technology, in general—two points of consistent progress emerge:

- 1. Information becomes more readily available to participants and**
- 2. Costs go down.**

With the massive amount of data involved in HIT, and the traditionally high up-front costs in implementing an IT solution, each subsequent rung on the “evolutionary” ladder (see Figure 1) has been a plus for medical practices and businesses.

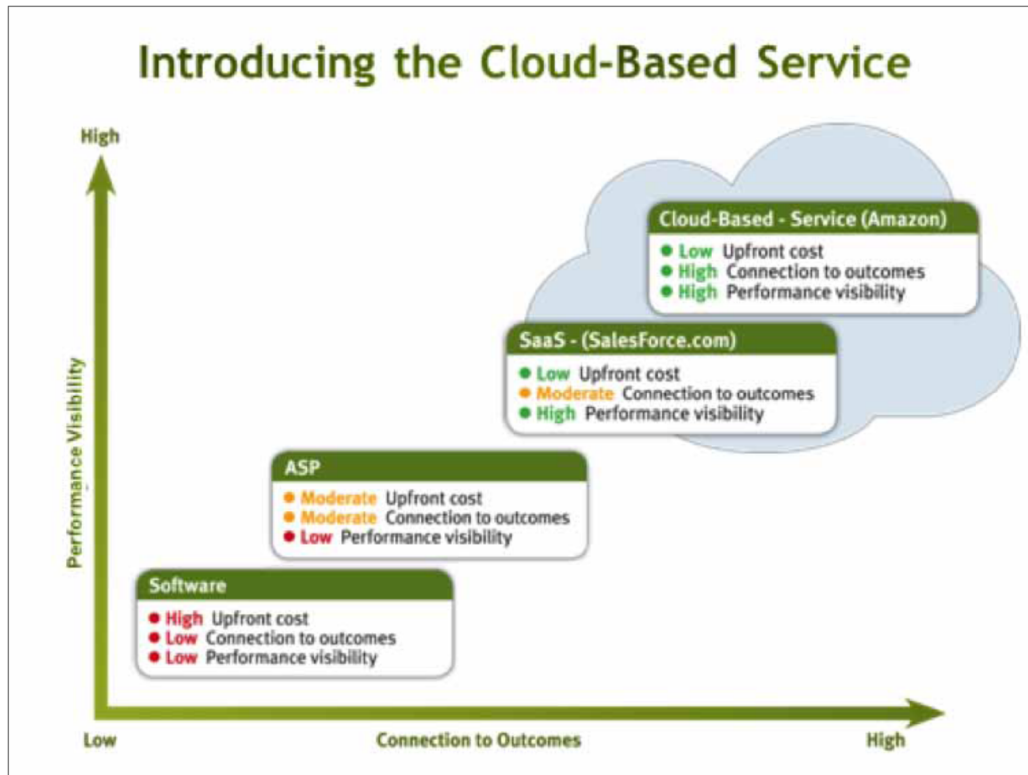


Figure: 1: Cloud based services

Software

The word “software” may conjure up images of plastic-wrapped boxes containing CDs that require

Installation onto a computer or server. For years, health IT vendors have offered a wide array of such software solutions, sometimes custom-built, used by practices to enter and manage patient information and handle administrative tasks.

This has proven to have limitations—and financial pain points. Software is usually associated with high upfront costs needed to get the infrastructure up and running. And when that infrastructure needs updating, all-new installations are required for upgrades or patches. Most notable, software can’t offer its users or the vendor any insight into success or progress; a practice’s accumulated data exists only within the silo that is their particular office, and is visible only to them, if at all. The relationship

between provider and vendor may very well end with the sale.

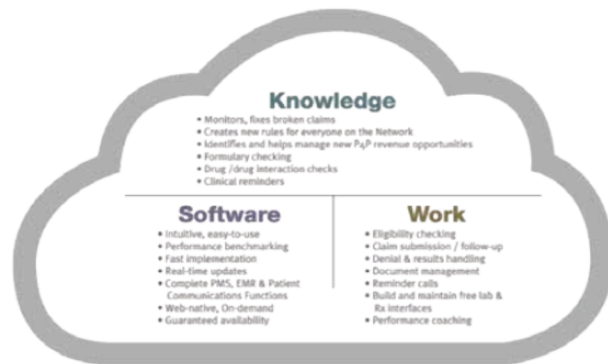
Application Service Provider (ASP)

With an ASP, the software delivers the same benefits but lives on the vendor’s system rather than the customer’s. This advance on the evolutionary scale can reduce a practice’s initial expenditures, however operating costs can rise: the responsibility for maintaining security, updates and technical support rests squarely with the ASP. The need for ASPs arose as a response to small or medium-sized businesses whose budgets couldn’t afford expensive software. But while ASPs may deliver lower start-up costs for smaller medical practices, they still lack the value of a shared network or any collaborative visibility into a practice’s performance, growth opportunity and pertinent benchmarks.

Software as a Service (SaaS)

At this stage of information evolution, software and data finally move to the cloud.

With the SaaS model, all clients access the latest, most updated software, which exists as a single instance online. There's no need for the practice to exert any technical effort or perform any maintenance—all work is done by the provider and is stored in the cloud. For the health care industry, this model provides marked advantages over its predecessors. Consider vital information services, like nationwide billing requirements or Pay-for-Performance rules: With SaaS, all details can be updated once on a single network, available to all that access that network. It's an ideal example of the technology evolution yielding increasingly greater information visibility. As such, this model can easily support a nationwide provider database for health care needs like orders, referrals, and globally deployed vocabularies and templates. It can also act as a single communications connection to multitudes of payers, clearinghouses, hospitals, and pharmacies. And, in terms of costs, SaaS providers tend to charge a monthly fee rather than an upfront investment seen in the earlier software and ASP models. But for all the advantages of a SaaS solution, there's a



Cloud-based Software

Software is the core of any cloud-based health IT network. The right software provides an easy-to-use framework with which to manage your practice's workflows, from scheduling to the patient encounter to billing and order management. And since all

glaring issue: The vendor has no particular investment in the practice's results. No services are provided beyond the software: There's no staff behind the scenes taking over client work, monitoring regulatory change or providing additional value to the customer. But that all changes at the highest point in this technological evolution—cloud-based services.

Advantages of Cloud based medical health care services:

With each instance of progress detailed above, IT delivers software that's more flexible, scalable and available, with lower and lower up-front costs. Clearly, these are big plusses. A cloud-based service goes even further. It extends and amplifies those baseline benefits by injecting continually evolving knowledge and back-office services into the cloud, where they drive improved results for everyone on the network. This three-pronged approach to health IT—software, knowledge and services—is the hallmark of a cloud based service. They make up a powerful combination of elements that define the most sophisticated level of IT evolution.

of the network's participants (in this case, medical practices) use the same instance of software for the same purposes, you have opportunities to gauge and benchmark your performance against that of similar practices. With that level of knowledge, you can easily monitor your revenue, efficiency, and, ultimately, your improvements.

Since the software only exists in the cloud, the vendor can make regular updates to the network instantly available to all clients. With cloud-based software, there's no waiting around for new disks or downloads, no costly upgrades or labor-intensive changes. All updates are simply waiting for you the next time you access the network.

Network Setup

What if a cloud-based network's software was infused with continually updated intelligence? A vendor could then deliver a smarter system to its customers, every day. In the universe of health IT, that additional knowledge could mean your practice can keep up with the ever-changing set of payer and government standards, all without lifting a finger. Fresh information is embedded directly into the software and appears automatically as part of your electronic workflow.

New ANSI 5010 payer codes. Meaningful Use and Pay-for-Performance program requirements. Updated clinical guidelines and protocols. A cloud-based service can embed updates into your various workflows where they are easy for staff to capture or act on. This saves you and your staff precious time revising paperwork and researching updates; you can spend your workday—and save money—by concentrating on patient care and running your practice more smoothly.

For instance, this kind of intelligence can deliver instant access to drug interaction or allergy alerts, which “pop up” during a patient encounter; it can lead to easier capture and more accurate reporting of Meaningful Use measures; and it can get you paid more and faster, aligning your practice with new payer standards, or adding reasons for claim denials into the system, thus allowing all other practices in the network to avoid those denials in the future.

And the more participants there are on the network, the smarter the entire system gets. Each practice's experience contributes to an aggregate level of knowledge, as illustrated in the denial example above. To go one step further, a cloud-based service pairs that experience with world-class expertise that informs the network and, in turn, all of the practices on it. Consider a busy solo practitioner in a rural setting, or bustling

=

metropolitan health system for that matter. These doctors may never acquire the knowledge needed to ensure he or she receives all incentive payments from available programs—in fact, the doctor may not even know which ones exist. But due to size and scale, what's often referred to as “comparative advantage,” a cloud-based service can employ highly knowledgeable experts, including health care professionals, to advocate for client practices and share learning with all providers on the network.

Admin Services

The final piece of the three-pronged approach to cloud-based service offerings can be a revelation to practice managers and office staff. It's the provision of expanded back-office services, eliminating administrative duties that devour time and prevent you and your staff from focusing on practice growth, strategy and other value-add efforts. Our data show that the average provider needs to process hundreds of documents each month. A cloud-based service provider can take over these tasks, tracking every claim, managing any denials, posting your EOBs and payments. A cloud-based service can receive and classify every one of your faxes. Any document your practice needs to see, from a faxed lab result to a claim that needs review, is placed in your cloud-based “inbox,” always routed to the right staff member. With this level of service, your practice staff no longer needs to monitor the fax machine, review and file the day's paperwork, or get a payer on the phone to discuss a reimbursement issue.

A cloud-based service entity does all that for you and more, with the goal of improving your practice's efficiency and financial health, and providing you with clear metrics so you can track your performance and make strategic decisions for your future.

Security in the Cloud

Data protection tops the list of cloud concerns today. Vendor security capabilities are key to establishing strategic value, reports the 2012 Computerworld “Cloud Computing” study, which measured cloud computing trends among technology decision makers. When it comes to public, private, and hybrid cloud solutions, the possibility of compromised information creates tremendous angst.

Organizations expect third-party providers to manage the cloud infrastructure, but are often uneasy about granting them visibility into sensitive data.

Derek Tumalak, vice president of product management at Vormetric, explains, “Everyone wants to use the cloud due to cost savings and new agile business models. But when it comes to cloud security, it’s important to understand the different threat landscape that comes into play.” There are complex data security challenges in the cloud:

- The need to protect confidential business, government, or regulatory data
- Cloud service models with multiple tenants sharing the same infrastructure
- Data mobility and legal issues relative to such government rules as the EU Data Privacy Directive
- Lack of standards about how cloud service providers securely recycle disk space and erase existing data
- Auditing, reporting, and compliance concerns
- Loss of visibility to key security and operational intelligence that no longer is available to feed enterprise IT security intelligence and risk management
- A new type of insider who does not even work for your company, but

may have control and visibility into your data

Such issues give rise to tremendous anxiety about security risks in the cloud. Enterprises worry whether they can trust their employees or need to implement additional internal controls in the private cloud, and whether third-party providers can provide adequate protection in multitenant environments that may also store competitor data. There’s also ongoing concern about the safety of moving data between the enterprise and the cloud, as well as how to ensure that no residual data remnants remain upon moving to another cloud service provider. Unquestionably, virtualized environments and the private cloud involve new challenges in securing data, mixed trust levels, and the potential weakening of separation of duties and data governance. The public cloud compounds these challenges with data that is readily portable, accessible to anyone connecting with the cloud server, and replicated for availability. And with the hybrid cloud, the challenge is to protect data as it moves back and forth from the enterprise to a public cloud. Specific security challenges pertain to each of the three cloud service models—Software as a

Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).

Good Health care cloud-based service selection

When selecting a cloud-based service, it helps to keep this in mind: A cloud-based service is not just a product. It’s a service provided by, and continually supported by, people. To begin, make sure your service satisfies the primary advantages of any cloud-based offerings:

1. Low upfront cost—since there's no hardware to purchase, beyond a laptop that can access the Internet, this is a no-brainer.

2. Optimal mobility—You should be able to access your information anytime, from anywhere.

3. Integrated services—For health care providers, this means any and all functions—practice management, EHR, patient communications and care coordination—operate smoothly from the same platform. As you move beyond these initial requirements, you should look for a cloud-based service that will identify the array of problems a practice experiences and tackle them with refined knowledge and tireless back-office work.

Definition of practice management, EHR, and care coordination of cloud based services:

- Employ a document service team to process and manage faxes and paperwork in the cloud
- Deploy appointment reminders and offer health information via patient portals
- Identify Pay-for-Performance incentive opportunities and make it easy for you to capture program measures
- Provide formulary checking
- Alert the provider to potential drug interactions—in real-time, during the patient encounter
- Keep your software updated and prepare your practice for ANSI 5010 and ICD-10 changes
- Create and push out new database “rules” that automatically benefit every practice
- Track, monitor, and fix broken claims

Perhaps most important, the right cloud-based service should act as a partner, not

=

just a vendor. You'll want an organization that provides an account manager to help monitor your practice's performance, serve up benchmark comparisons to similar practices on the network, and provide valuable insight and coaching. A partner will share your risk, be rewarded for improving your financial performance and be invested in your ultimate success. Put it all together, and the right cloud-based service will make the most of all its easily accessible data and expertise, and make it work for you with improved collections, reduced days in accounts receivable, more efficiency, and alleviation of your sharpest administrative pain points.

I. Medical Cloud Computing Methods, Fields:

Within a hospital, indeed within the majority of medical practices, patient charts and medical histories are often kept within a computer system of some kind. In a hospital this is especially useful as the sheer number of patients within the building at any one time can be daunting. Cloud computing can help facilitate easier access and distribution of information among the various medical professionals who may come in contact with each individual patient. In current vast hospitals, servers are connected, but the sheer amount of information and computers that must be connected is staggering. A cloud based system will improve information sharing by allowing everything to be hosted in the same place, allowing a doctor to input test results in the lab, instantly updating the chart of a patient in a completely separate wing. Similarly, it can allow offsite buildings and treatment facilities like labs, doctors making emergency house calls and ambulances, to have and update information remotely,

instead of having to wait until they can access a hospital computer.



Figure: 2. Cloud Computing In Medical Field

Cloud computing can also be greatly beneficial to private practice doctors as well. The mobility option in this case may be even more important than in hospitals. While you may see a patient for a yearly physical, or to treat non-emergency illnesses, a sudden injury or disease will send that patient to an emergency room, not your office. With a cloud based server, you could integrate your own system with the local hospitals, and when a patient of yours is admitted, your own files could be updated immediately. Similarly, if you were to go and treat this patient in said hospital or in their home for whatever reason (such as a home birth) you'd not only be able to immediately and remotely access their records, but request assistance or, in the case of the birth, immediately add the new patient. Cloud computing is a relatively new way to host information, and as such, the benefits for every individual business isn't always immediately obvious, but for a field like

medicine, it's difficult to find any downsides. There are many other application areas of cloud computing such as:

- ***Cloud Computing in Business***
- ***Cloud Computing in Education***
- ***Marketing Companies***
- ***Online Entertainment***
- ***Information Technology***
- ***Finance and Banking***
- ***Enabling Enterprise Mobility***
- ***Security***
- ***Telecommunication***

Conclusion:

The current trend of adopting cloud computing in the medical field can improve and solve several collaborative information issues in healthcare organizations as well as cost optimizations. Standardized cloud-based applications will bring obvious



=

advantages to patients, physicians, insurance companies, pharmacies, imaging centers, etc. when sharing information across medical organizations yielding better results. Challenges such as security concerns and interoperability will rise due to the cloud-computing model.

References:

- [1] Sanjay P. Ahuja1, Sindhu Mani1 & Jesus Zambrano1, "A Survey of the State of Cloud Computing in Healthcare" *Network and Communication Technologies; Vol. 1, No. 2; 2012 ISSN 1927-064X E-ISSN 1927-0658 Published by Canadian Center of Science and Education.*
- [2] White paper on "What Cloud-Based Services Can Do for Your Medical Practice or Care Organization" *athenahealth, Inc. Published: January 2012*
- [3] Manoj Chopra1, Jai Mungi2, Kulbhushan Chopra , "A Survey on Use of Cloud Computing in various Fields" *ISSN: 2278 – 7798 International Journal of Science, Engineering and Technology Research (IJSETR) Volume 2, Issue 2, February 2013*
- [4] <http://www.hindawi.com/journals/tswj/si/848162/cfp/>