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Survey on Cloud Computing In Health Care Systems

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***Abstract*- Cloud computing is a new way of delivering computing resources and services. The health care environment is changing faster than ever before due to the demand of delivering higher quality medical services for less money, and increased competitively between health care services providers. Cloud technology is used to create network between patients, doctors, and healthcare institutions by providing applications, services and also by keeping the data in the cloud. This paper mainly emphasize on challenges, need, benefits and advantages of using Cloud computing in Health Care Systems.**

Keywords: Cloud computing, Health Care

I.INTRODUCTION

Cloud computing is internet-based computing, where shared servers provide computing power, storage, development platforms or software to computers and other devices on demand. 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.

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.

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.

As healthcare providers need cost effective automating processes which gives more profits, cloud computing will provide perfect platform in the healthcare information technology space. Many hospitals may share infrastructure with large number of systems linked together. By this pooling the hospitals automatically reduce the cost and increase utilization. The resources are delivered only when they are required. This also means real-time availability of patient information for doctors, nursing staff and other support services personnel from any internet enabled device.

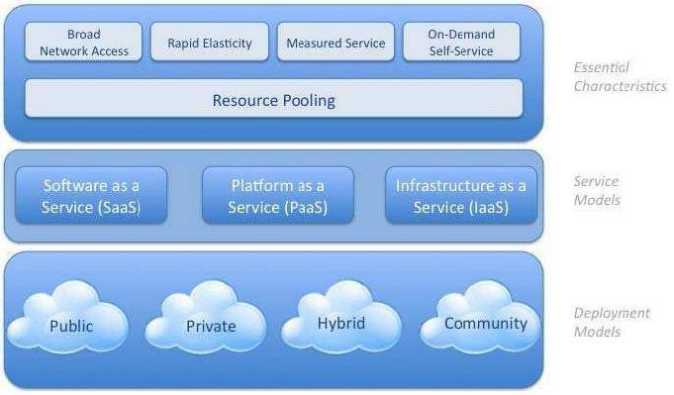
This article provides an overview of Cloud Computing in Health Care. First section provides an introduction to Cloud computing, its characteristics and services. In second we discuss in need of cloud computing in Health Care. Third, we provide impact of cloud computing in healthcare. Fourth, the advantages are identified. Lastly, we offer conclusions and future directions.

DEFINITION OF CLOUD COMPUTING

Cloud computing may be defined as the use of computing resources both hardware and software that are delivered as a service over a network most likely the Internet.

Cloud consists of three basic service models (IaaS, PaaS, and SaaS).

1. Infrastructure as a Service (IaaS) provides users with processing, storage, networks, and other computing infrastructure resources.
2. Platform as a Service (PaaS) enables users to deploy applications developed using specified programming languages or frameworks and tools onto the Cloud infrastructure
3. Software as a Service (SaaS**)** enables users to access applications running on a Cloud infrastructure from various end-user devices (generally through a web browser).



Cloud Computing Model

CHARACTERISTICS

1. **On-demand self-service**: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

2. **Broad network access**: Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).

3. **Resource pooling**: The provider's computing resources are pooled to serve multiple consumers using a Multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, and network bandwidth.

4. **Rapid elasticity**: Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.

4**. Measured service**: Cloud systems automatically control and optimize resource use by leveraging a Metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

II. NEED OF CLOUD COMPUTING IN HEALTH CARE SYSTEMS

The health care industry faces increased pressure to do more with less whether it's with patients, providers or regulators. Other industries facing similar pressures are increasingly running their business on the "cloud," giving them on-demand access to shared computing resources. Companies running on the cloud see lower costs, increased agility and improved ability to meet their business objectives.

1.The need to slash budgets

We must re-think health care IT purchasing habits. As the traditional black hole of cost, re-thinking how hospitals and care facilities document patient care can slash budgets dramatically. Cloud computing empowers providers to only pay for what they need. For example, there's no reason why every hospital room needs its own COW (computer on wheels) in addition to desktops at nurse stations and doctors' offices. By deploying iPads to document patient information at the point of care, hardware can be cut in half at a minimum.

2. The need to access increasing amounts of information

The importance of providing patient care with the correct records and information is widely understood. Moreover, information needs to be accessible at any time by anyone providing care. Cloud computing provides the flexibility of accessible data from a number of secure endpoints. From operating rooms, to examining rooms, to rehab facilities, information continuity is most effective when it's accessible to the right people.

3. The need to share and access information anywhere

Health care collaboration used to be synonymous with sending an email alert notifying a new patient has been added into the system. Today, it takes on a new meaning to focus on shared experience that increase information accuracy and overall patient care. Cloud-based platforms allow collaboration in real-time from any device with an Internet connection. Multiple care providers can update an EHR (electronic health records) synonymously, and those updates can be traced back to their original creators for as long as the EHR is around — making information readily available and more thorough.

4. The need for secure adoption by health care professionals

Patients don't need to worry that an executive or doctor is secretly accessing the network using his/her iPad or iPhone when there is no need for them to. Cloud-based applications have security at the application level — not the device level. In other words, there is no risk of patient information being accessed directly from the device. This level of security opens up health care IT departments to make better use of consumer-based hardware that they are already familiar with, such as an iPhone.

III.IMPACT OF CLOUD COMPUTING IN HEALTH CARE SYSTEMS

1. Record and Protect Patients' Information Safely.

There's a saying that doctors can never tell who their patients are to prevent judgments. Patients' information contains such confidential pieces of data that need to be protected at all times. This is the very reason why the hospital's IT infrastructure and network must be so secured from hackers or anyone who attempt to get data illegally. Cloud computing, in its most initial state, has had issues regarding security. However now that many experts joined in to make the system really hard to break into, organizations can rest assured that there are increased levels of security and privacy in the cloud. Hospitals who want to use cloud computing must adhere to the HIPAA (Health Insurance Portability and Accountability Act).

2. Store Data with Less Cost

Typically, businesses buy an additional storage system for

backing up their data aside from the storage space where they have the resources to use. Cloud storage costs about 10 times lesser than the server space and hardware materials plus training of human resources to maintain and support the system in daily operations. Cloud computing storage requirements only adapt to the needs of the client. Hence choosing a package well from the available offerings of the vendor is critical.

3. Share Records to Authorized People
Getting access to the hospital system is prohibited unless permitted by the doctor or physician in charge. But visibility and login details are not given to patients in normal cases. With the use of cloud computing, since data are available in the cloud, patients can then log on to the system to refer to the prescription fitted to their ailments. For instance, physicians who are out of the country can give patients accounts to be able to share data to them even when he's not physically in the clinic. Some sicknesses can lead up to death when not treated quickly. Since time is gold, understanding facts about the sickness immediately is gravely essential. Medical histories, symptoms and cures to it can be determined easily through cloud computing.

4. Less Risk for Data Loss
Cloud computing applications for health care would have constant updates which give way to raising the bar for security. While hackers are trying to get into the files in the current app, the system updates its current security measures and goes on for higher protection. Cloud technology can perform updates without causing any downtime and possible data loss in real time. This matches the efficiency requirement of hospitals to run and access their networks for 24/7.

5.MobileComponent Unlike the usual intranet-based systems utilized in hospitals which are mostly desktop-dependent, cloud computing systems offer convenience and much mobility to its users. The cloud structure allows both healthcare professionals and authorized patients to access important files and data on a smartphone, tablet and other mobile gadgets without special permissions and settings.

IV.BENEFITS OF CLOUD COMPUTING IN HEALTHCARE

There are immense benefits and advantages upon implementation of cloud computing in healthcare industry some of which may include:

I) Mobility of records:
In some cases a person's health information can be required by two or more health institutions in that case by implementation of cloud technologies a person's health information can be easily synchronized and shared at the same time. Hence this improves physicians ability to provide a better health care to the patients. Thus by implementation of cloud technologies a patients information is readily available.

II) Speed:
By using cloud based technologies and services always enable faster and accurate access to all the important information for the healthcare services providers and the history of their patients.

III) Security and Privacy:
By using cloud computing is mainly used for storage of medical records online. With the recent HIPAA update, cloud healthcare service providers are now accountable for HIPAA compliance as a healthcare entities they serve. Thus this includes encryption of data and secure backup of this data which contains the health information of a person, then verifying if the data can be easily regained, and finally security can be improved by using permission based and secured data bases.

IV) Reduction of costs:
By adopting these cloud techniques in healthcare patients, physicians, other medical organizations experience cost savings to a great extent. Since there is no need for these healthcare institutions and doctors to invest huge amounts in hardware infrastructure and their maintenance as these problems are already handled and taken care by the cloud computing providers

V.APPLICATIONS OF CLOUD COMPUTING IN HEALTH CARE SYSTEMS

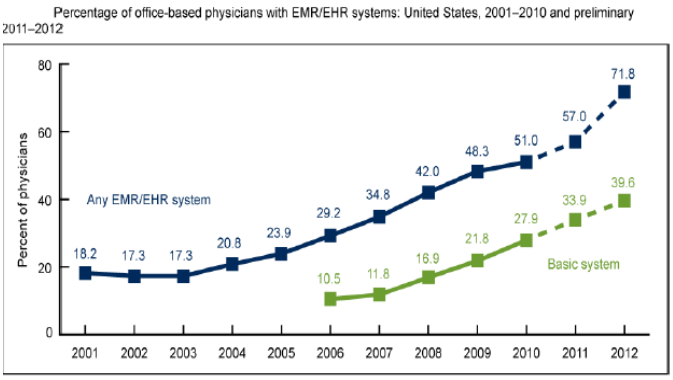
1. HIPAA AND ITS REQUIREMENTS
Health Insurance Portability and Accountability Act (HIPAA) was basically designed to protect the privacy of patient's medical health records.

HIPAA does the following:

a) It provides the ability to transfer and continue the health insurance coverage for millions of American workers and their families when they change or lost their jobs.
b) It reduces fraud and abuse of healthcare.
c) It mandates industry-wide standards for health care information on electronic billing and other processes.
d) Requires the protection and confidential handling of protected health information.

HIPAA omnibus and the American Recovery and Reinvestment Act (ARRA) requirements demanded everyone in the healthcare industry to begin the movement of patient's records and other data to cloud computing technologies. Essentially it is estimated that by 2015, all medical professionals with access to appropriate patient records must utilize the electronic medical/health records (EHR'S or EMR'S) or will face penalties.

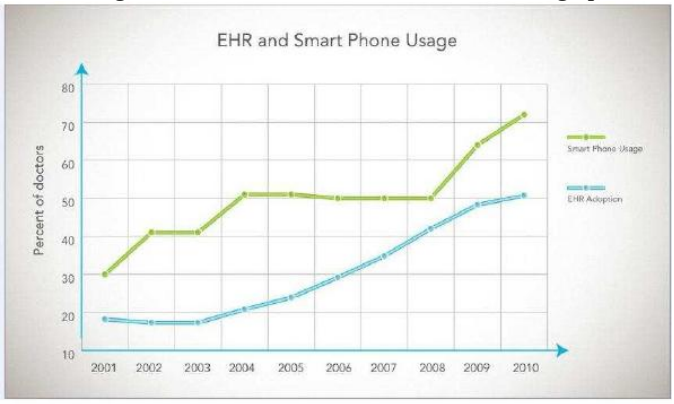
2. **EMR'S / EHR'S**
An electronic health record (EHR) can be defined as a proper and systematic collection of health information about an individual person or population in an electronic form. It is usually recorded in a digital format and hence can be easily accessed by a clinical practitioner or can be easily shared between different healthcare centers. Hence by adopting EHR'S storing the health information of the concerned individual becomes easy. These days adoption of EHR'S is being increasing considerably by the physicians. The biggest advantage of shifting the EHR'S to clouds is that the information about the patients' health can be shared by various healthcare facilities, clinical practitioners and others in order to facilitate quick and quality patient treatments.



The above figure clearly shows the increase in EMR adoptions every year. Even though EHR's can become a huge benefit to the patients, utilization of clouds should meet the requirements some of which may include data reversibility, traceability of access of the patient, confidentiality of the reports, and some security issues. Even the public cloud systems must satisfy the regulations of HIPAA and other electronic record guidelines for their successful utilization. Once if these requirements are met EHR's will become the most authentic way of storing the health information of a person safely and securely.

3. **MOBILE HEALTH**

Mobile health or mHealth usually uses mobile technologies as the basic elements for health research and delivering the healthcare services. In the future years to come these mobile systems will be able to retrieve and update the data that is stored in the electronic health records by the utilization of latest cloud technologies. Doctors and clinical physicians are still thinking on utilization of EHR's since they have their own disadvantages in that case mobile health can be a huge plus.



From the above figure it is clear that the percentage of doctors preferring mobile phones than EMR's/EHR's has always been more and is also increasing day by day. The mobile health may appeal well to the doctors over EHR's since these EHR's lack the storage of structured data which can be done by using this mobile technologies. Still mobile health records also have some disadvantages regarding the security issues, a lot more research is still going on in this field of mobile health care by utilizing the cloud technologies [1]. The major advantage of using mobile technologies with cloud technologies is its mobility and easy sharing of the information.

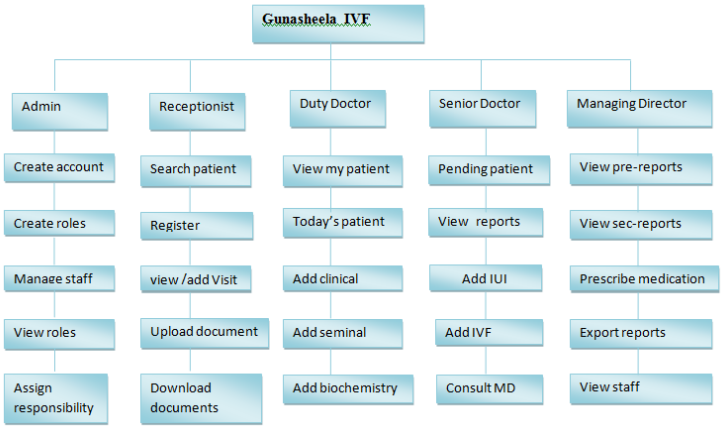
EXAMPLE OF CLOUD COMPUTING APPLICATION IN HEALTH CARE SYSTEM

The main objective of project is to maintain patient records and other information like scanned reports, test reports online.

All the patient records are identified using Information Folio Number (IF No).The software is mainly developed for IVF Center named Gunasheela IVF Center. It mainly consists of 5 modules:

1. Admin
2 .Receptionist
3. Duty Doctor
4. Senior Doctor
5. Managing Director

Block Diagram of Proposed System



Admin is responsible for creation of roles, responsibilities and staff accounts. Receptionist assigns the duty doctor for every visit of the patient. All the scanned documents of patient reports are uploaded and downloaded by the receptionist. Duty doctor role is to manage preliminary examination reports like Clinical Examination, Seminal Assay and Biochemistry Report. Senior doctor role is to manage all secondary examination reports. Managing Director role is to generate all the reports to pdf.

In the current project all the patient records are maintained online in databases. But data sharing is possible only within the network i.e. it uses only Local Area Network. Security is provided only for staff username and passwords using MD5 Algorithm.

To further enhance this project we can store the patient records on the cloud using applications like Mobile Health and EHR record maintenance where all the information is hosted on the cloud. By using this application which help in providing secured and confidential storage of records and only authorized person has the right to access the reports .It also provides quick sharing of health records within the hospital and also mobility of health records is also provided.

CONCLUSION

Cloud computing is changing our lives in many ways at a very quick pace. Day by day utilization of cloud computing technologies is increasing in every part of the world. The cloud computing solutions in healthcare can help the physicians to stay in touch with their patients and examine their health condition effectively at a low cost. By using the EHR health record maintenance and Mobile Health applications of cloud computing our proposed system has got more security benefits compared to the approach followed in that current system. There may be some concern regarding the security and other issues of data but still as every problem has a solution in the similar way these issues too will be

overcomed one day by man after which utilization of cloud technologies in healthcare industry would result in a new era in the field of healthcare. Every section in the society can access this healthcare by implementation of this technology. It is always remembered that cloud computing is still a developing technology ,which implies that in the future years the services it offers will be greater than our expectations or just beyond our imagination.

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