

Impact Of Cloud Computing In Healthcare

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ABSTRACT

We will be discussing impact of Cloud Computing in Healthcare Industry from when it was introduced till the date and also some future growth and also we will be discussing the solutions of some advanced Healthcare solutions for example, EHR (Electronic Health Records)

Keywords

Cloud Computing, Growth, Solutions

1. 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. This frequently takes the form of cloud services, such as 'Infrastructure as a Service' (IaaS), 'Platform as a Service (PaaS)' or 'Software as a Service' (SaaS). Users can access web-based tools or applications through a web browser or via a cloud-based resource like storage or computer power as if they were installed locally, eliminating the need to install and run the application on the customer's own computers and simplifying maintenance and support. There are several possible deployment models for clouds, the most important being public, private and hybrid.[6] Cloud computing is the fastest growing field that provides many different services, which are provided on demand of the client over the web. Cloud computing is based on the model of pay-as-you-go.

This gives the user cost reduction, fast and easy way to deploy the applications. Cloud computing usage in the Information Support Systems will facilitate businesses to run smoothly and efficiently. A number of virtual machines and applications can be managed very easily using a cloud. With the use of cloud in businesses will not only save the cost of

staff required to maintain servers, but will also require lesser servers and with that less power consumption.

The most important sector which requires a lot of information, data and computing power is healthcare system. Doctors require medical history of the patients in critical times and within no time. But we see that different departments of a healthcare system have different information of the patients medical history, with require time to get assembled. Doctors have to start the treatment without the complete information of patient's medical history, which sometimes, is life threatening for the patient. Technologies could be used in healthcare sector to provide better healthcare facilities and reduce the operations costs. In our country we see that there is scarcity of doctors, nurses and pharmacy. But still there is rapid growth in healthcare services, while diseases are becoming more complex. More and more new and efficient diagnostic techniques and new way of treatments are being developed and used in healthcare sector so as to provide the patients with best possible treatment and in their budget. Many healthcare organizations are providing different kind of services to cater to highly diversified economic population which in turn has resulted in competition in the market. So the organizations which do not perform well are out of business.

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 realtime availability of patient information for doctors, nursing staff and other support services personnel from any internet enabled device .

2. LITERATURE REVIEW

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3. METHODOLOGY

3.1 Impact of Cloud Computing

1. Lowering Of Costs

The basic premise of cloud computing is on-demand availability of computer resources like data storage and computing power. Hospitals and healthcare providers are freed from the need to purchase the hardware and servers outrightly. There are no up-front charges associated with cloud storage of data. You only pay for the resources you actually use which results in massive cost savings.

Cloud computing also provides the optimum ergonomic environment for scaling which is a desirable quality in the current times. With patient data flowing in not just from the records in the form of EMRs but also through the plethora of healthcare apps and health wearables, a cloud-based environment proves to be perfect for scaling and undergoing capacitive overhaul while keeping the costs in check.

2. Ease Of Interoperability

Interoperability aims at establishing data integrations throughout the healthcare system, irrespective of the point of origin or storage. As a result of interoperability fueled by cloud adoption, patient data is readily available for distribution and gaining insights to facilitate healthcare planning and delivery. Cloud computing allows healthcare providers to gain easy access to the patient data collated from numerous sources, share it with the important stakeholders and give out timely prescriptions and treatment protocols. It also diminishes the distance between the specialists allowing them to review cases and give their opinions irrespective of the geographical limitations.

Having the patient's data in the cloud also promotes interoperability among the various segments of the healthcare industry- pharmaceuticals, insurance, and payments. This allows for a seamless transfer of data between the different stakeholders thus accelerating healthcare delivery and introducing efficiency in the process.

3. Access To High Powered Analytics

Healthcare data, both structured as well as unstructured, is a huge asset. Relevant patient data from different sources can be collated and computed in the cloud. The application of Big Data analytics and artificial intelligence algorithms on the cloud-stored patient data can power up medical research. With the

advanced computing power of the cloud, processing of large datasets becomes more feasible.

Performing analytics on patient data also can pave the way for formulating more personalized care plans for patients on an individual level. It also ensures that all the pertinent patient details are on record and nothing gets missed out when prescribing treatments. Cloud-based data analysis comes in handy when extracting relevant patient information.

Patient's Ownership Of Data

Cloud computing democratizes data and gives patients control over their own health. It boosts patient participation in decisions pertaining to their own health and leads to informed decision making by acting as a tool for patient education and engagement.

Patient records and medical images can be easily archived and retrieved when storing data on the cloud. While cloud security remains a concern, the reliability of cloud for data storage is definitely higher. Data redundancy is reduced with an increase in system uptime. Since the backups are automated and there isn't a single touchpoint where the data is stored, recovery of data becomes much simpler.

5. Telemedicine Capabilities

Remote accessibility of data is possibly the biggest advantages that cloud storage of data offers. The combination of cloud computing with healthcare has the potential to improve a number of healthcare-related functions such as telemedicine, post-hospitalization care plans, and virtual medication adherence. It also improves access to healthcare services through telehealth. Telemedicine apps add the element of convenience to healthcare delivery while upgrading the patient experience. Cloud-based telehealth systems and applications allow easy sharing of healthcare data, improve accessibility and provide healthcare coverage to the patients during the preventative, treatment as well as the recovery phase.

3.2 Application of Cloud Computing

3.2.1 Architecture and Charectristic of EHR(Electronic Health Record)

Cloud computing, defined by NIST (National Institute of Standards and Technology) is a technology that supports ubiquity, it is convenient, supplies on demand access to the network for sharing computing resources (e.g., networks, servers, storage, applications and services), can be launched and developed quickly with minimal management and without service provider interaction. The figure 1 shows visual model of cloud computing definition and this model is composed of five essential characteristics, three service models, and four deployment models.Fig[1]

• 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.

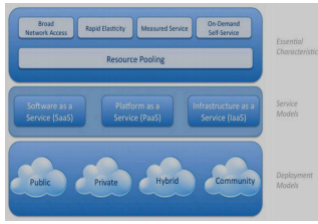


Figure 1: Cloud computing overview model (NIST)

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.

5. Measured service.

Cloud systems automatically control and optimize resource use by leveraging a metering capability¹ 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.

- Cloud computing Service Models:

1. Software as a Service (SaaS).

The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure². The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.

2. Platform as a Service (PaaS).

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.

3. Infrastructure as a Service (IaaS).

The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications; and possibly limited control of select networking components (e.g., host firewalls).

- Deployment Models:

1. Private cloud.

The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.

2. Community cloud.

The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.

3. Public cloud.

The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider.

4. Hybrid cloud.

The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds). For healthcare system private model could be used as it will provide data privacy and security. Only authorized healthcare professionals can access the data.

3.2.2 Challenges And Security

With the survey of Healthcare Information Management Systems Society (HIMSS)[2], we get to know the data storage of hospitals done in Cloud are, fig[2]

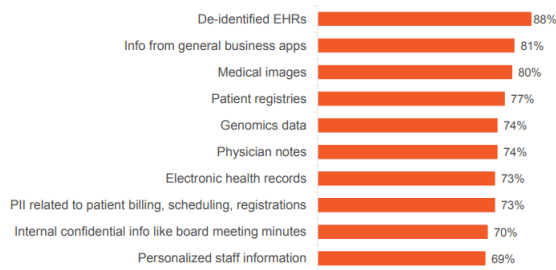


Figure 2: Healthcare Data Comfortable Storing in Cloud

Due to this the problem of security arises which through the survey is reported as, fig[3]

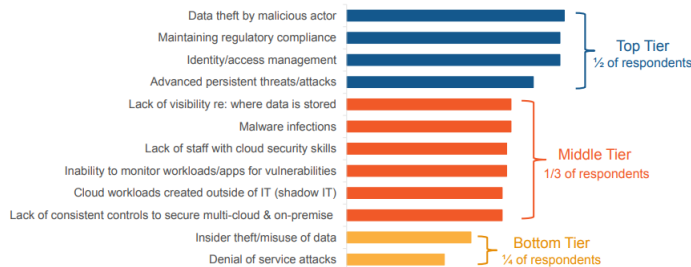


Figure 3: Cloud Security Concerns

3.3 Growth of Cloud Computing

Due to the pandemic the cloud computing growth has risen and also we have checked the Technavio report given by their analyst[4] from 2019 to 2024 in fig[4], We have also



Figure 4: Market Overview

found from the report the top 4 country contributed the most in the market for Cloud Computing in Healthcare industry, fig[5]

4. POSSIBLE SOLUTION

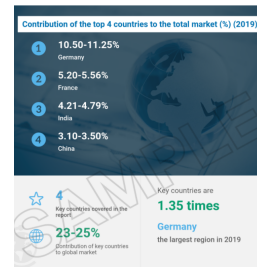


Figure 5: Key Countries

1. Blockchain Technology

The Blockchain is evolving as one of the most promising and resourceful technologies of cloud infrastructure security. Blockchain is meant to store, read and validate transactions in a distributed database system. It has the ability to enhance security and confidentiality through undisputable shared distributed ledger on cloud nodes. Tampering of Blockchain is enormously thought-provoking due to the use of cryptographic data structures.

2. Monitor End User Activities With Automated Solutions to Detect Intruders

Real-time monitoring and analysis of end user activities can help you spot irregularities that deviate from normal usage patterns, e.g., log in from a previously unknown IP or devices.

These abnormal activities could indicate a breach in your system so catching them early on can stop hackers in their tracks, and allow you to fix security issues before they cause mayhem.

3. Deploy Multi-Factor Authentication (MFA)[8]

The traditional username and password combination is often insufficient to protect user accounts from hackers, and stolen credentials is one of the main ways hackers get access to your on-line business data and applications.

Once they have your user credentials, they can log into all those cloud-based applications and services that you use every day to run your business.

5. CONCLUSION

In the past few years digital information has experienced an amazing growth. Cloud-based solutions arise as a way of handling this huge amount of information. The e-health environment can take advantage of this new technology; improving the availability of clinical information will help medical personnel improve their efficiency. Through cloud-based solutions the patients can also play an active part in this process, consulting their own EHR from any device with an Internet connection. Privacy and security issues must be the priority for both parties: health organisations and cloud service providers in order to guarantee the confidentiality of patient data.

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