IMPLEMENTATION OF CLOUD BASED HEALTHCARE SERVICES: NEED AND CHALLENGES

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Abstract:
As healthcare data is growing over the Internet, there are several challenges in web based systems like scalability, availability, etc. Recent trends aim towards accessing information anytime, anywhere, which can be achieved when moving healthcare information to the cloud services. There is tremendous change in the healthcare sector by implementation of cloud computing in the medical field such as EMR. Computer and communication technology advances and affordable devices have made data as well as information more manageable for patients that are now easily accessible.

Keywords: healthcare, cloud computing, EMR, communication technology.

Introduction

Nowadays everyone is upgrading their systems by using modern technologies. Cloud computing is providing web based technologies to enhance the system in modern digital world. This technology includes resources like software, services, platforms, etc by the online platform.

In India people are facing basic health problems in diseases like cancer, tuberculosis, diarrhea, HIV, malaria, etc. Till reach the age five children die due to underweight is also serious cause in healthcare. Infant mortality rate was 42 per 1000 live births in the year 2014 [1].

Healthcare services are in high demand even there is shortage of healthcare providers like qualified and experienced healthcare professionals such as doctors, nurses and pharmacists [2].

For the adoption of cloud computing reduction in electronic health record (EHR) startup expenses like software, networking, hardware, and personnel is possible. Rosenthal et al displays the biomedical informatics community, especially associated with data sharing and applications, which takes an advantage of cloud computing [3].

Most of the issues regarding biomedical research data management and analysis are complexity, data-handling problems and expensive or unavailable computational solutions in research [4].

Architecture of Cloud Computing:
Cloud computing is today's most revolutionizing technology in the computing world. With reference to service delivery models and deployment models by Harshpreet Singh et.al. [5], the security and privacy problems that must be tackled and controlled for smooth functioning of this new computing paradigm. At the time of using the cloud services, problems like confidentiality and integrity of data of the enterprise is needs to be examined. It is needed to analyze everything offered by the cloud, from the minimum level to maximum level services, hardware, etc. [5].

Architecture of Cloud computing contains: Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). Infrastructure as a Service (IaaS) includes hardware services like servers, network technologies, storage, etc. It also provides resource management services like operating system and virtualization technology.

Platform as a Service (PaaS) is offering (PaaS) software collection which provides everything that a software developer needs to build an application. By using browser-based development tools, quick development of web applications can be done by online environments.

Software as a Service (SaaS) provides service via the web based business applications hosted and delivered.

Cloud Computing: A New Economic Computing Mode:

According to NIST (National Institute of Standards and Technology) [6] cloud models are:

(1) *Public cloud:* Customer utilizes the resources available on the internet for the general public provided by the service provider pay-as-you-go basis. For example, Amazon (EC2) allows users to rent virtual computers on which to run their own applications.

(2) *Private cloud:* The data center or the proprietary network supplies hosted services to a group of specific peoples. For example, Microsoft Azure is enabling customers to build the foundation for a private cloud infrastructure which uses Windows Server and System Center family of products with the Dynamic Data Center Toolkit.

(3) *Community cloud:* Several organizations can shares the cloud infrastructure with things like security requirements, policy, mission, and consideration of compliance. For example, the Google GovCloud is providing Los Angeles City Council with a segregated data environment for storing its applications and data that are accessible only to the city's agencies.

   The cloud infrastructure is shared by several organizations with common concerns (eg,). For example, the Google GovCloud provides the Los Angeles City Council with a segregated data environment to store its applications and data that are accessible only to the city's agencies.

(4) *Hybrid cloud:* The cloud infrastructure made up of more than two clouds (private, public, or community). This type of infrastructure contains and manages resources provided by an organization within its own data center and also others provided externally. For example, IBM collaborates with Juniper Networks for providing infrastructure to enterprises to extend their private clouds to remote servers in a secure public cloud [7].

Status and Adoption of Cloud Computing in Health Care

Implementation of cloud computing in healthcare can minimize IT cost in healthcare companies make improvement in the medical services for patients and healthcare organizations [8]. There is reduction in the use of paper is up to 75 per cent as well as automation of workflow by Electronic Records Management System (ERMS) [9].

One of the key benefits will be the ability to exchange data between disparate systems. This capability is something healthcare IT is desperately needs. For instance, cloud computing can support healthcare organizations to share information such as EHR, doctor's references, prescriptions, insurance information, test results stored across different information systems. This is already happening in the radiological area, where many institutions have moved to the cloud to lower their storage costs and facilitate the exchange of images [10]. Electronic Health Records (EHRs) and telehealth services are being used more frequently, bridging the geographical distances that can interfere with access to health care.

The use of web technologies is a way for efficient solutions to provide citizens with private access to their medical data. Since health care services are highly fragmented, patients and medical doctors are facing difficulties to easily consult requested clinical information. Computer and communication technology advances and affordable devices have made data information more manageable for patients that can now easily access to their personal information distributed in compliance with privacy and confidentiality requirements.

Need of Cloud Computing in Health Cloud:

1. **Green Computing:** The more efficient use of computer resources is helping for the environment and promotes energy saving, also saves on resources required to cool off computers and related IT resources, thus reduces electricity expenses [11].
2. **Third Party Provider:** Information Technology is the management burden for bigger health organizations, so third-party provider is needed to provide the solution.
3. **Reduction in the cost:** Cloud Computing can make reduction in the cost of IT resources and can enhance resources utilization and service delivery [12].

Challenges of Cloud Computing in Healthcare:

The healthcare sector in India is combat with adaptation of the new systems for supporting EMR, and share data with security and in time to the health organizations as well as government. Patient is expecting healthcare services with minimum cost including laboratory, medicines, doctor, specialists, and surgeons. Reducing service time for patient care is another aspect in

the fight to keep costs low and lessen delay in getting back results from a laboratory. Due to the increase in the population, there is an increase in the medical resources and the growing demand from people for health care is rapidly increasing.

Due to the fast lifestyle there is fast increment of patients, results in the rising medical expenses. Today, everyone demands for the quality of medical services. Use of information technology in the healthcare is the solution is one of the solutions. In order to solve them, information technology must be deployed to this field.

1. **Insufficient IT Staff:** In case of the Small hospitals, there is adequate internal IT staff to maintain and service in-house infrastructure. Hence, cost of implementing the new infrastructure and the IT resources maintenance becomes obstacles in an adoption for the EHR [13].
2. **Security Providers:** Implementation on a large scale security concern like management costs, software, hardware, and human resources is cheaper. Many cloud providers can make replica of users' data at various locations to achieve high availability. [14]
3. **Privacy & Security:** Healthcare organizations needs to establish strong cloud service agreements with detailed provisions relating to security and privacy in order to fully understand their liabilities and risks as well as being able to absorb those risks in the event of non-compliance.
4. **Rural health care:** health care professionals are being educated for the efficient use of technology in the way patient care is being delivered and how future generation is undergoing a dramatic transformation.
5. **Increase in data center traffic:** The prediction made by CISCO shows global data center traffic in Exabyte for 2011 to 2020. In figure 1 global cloud data center IP traffic by Type and by Segment of a data center is shown (Source: Cisco Global Cloud Index, 2014–2019) [15].

Figure 1: Cloud Data Center IP Traffic, 2011-2020

Conclusion:

The paper discussed about basic healthcare related issues in India, and their solution via implementation of cloud services in health care sector. It states about the requirement of cloud services for maintaining health records by organizations, that is, use of health cloud. It also discussed various challenges in implementing and deploying health cloud in India considering present IT infrastructure.

References:

[1] http://www.cdc.gov/globalhealth/countries/india/ [Source: Population Reference Bureau 2014: India].
[2] HEALTHCAST 2020: Creating a Sustainable Future. PricewaterhouseCoopers: London, UK, 2006.
[3] Rosenthal A, Mork P, Li MH, Stanford J, Koester D, Reynolds P. Cloud computing: a new business paradigm for biomedical information sharing. J Biomed Inform. 2010 Apr;43(2):342–53. doi: 10.1016/j.jbi.2009.08.014.S1532-0464(09)00115-4.
[4] Anderson NR, Lee ES, Brockenbrough JS, Minie ME, Fuller S, Brinkley J, Tarczy-Hornoch P. Issues in biomedical research data management and analysis: needs and barriers. J Am Med Inform Assoc. 2007;14(4):478–88. doi: 10.1197/jamia.M2114.
[5] Harshpreet Singh, Promila Manhas, Deep Maan and Nisha Sethi,"Cloud Computing Security and Privacy Issues- A Systematic Review", International Journal of Control Theory and Applications , August 2016 9(11) , pp. 4979-4992.

[6] U.S. Dept. of Commerce, Nat'l Inst. of Standards & Tech., ―The NIST Definition of Cloud Computing: Recommendations of the National Institute of Standards and Technology‖, Special Pub., 800-145, no. 2, 2011, available at csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf.

[7] IBM and Juniper Networks Solutions Brief IBM Global Services. 2009. [2011-07-25]. website IBM and Juniper Networks: Delivering Solutions That Transform Your Networking Infrastructure ftp://public.dhe.ibm.com/common/ssi/ecm/en/jns03002usen/JNS03002USEN.PDF.

[8] A Survey of the State of Cloud Computing in Healthcare, Sanjay P. Ahuja1, Network and Communication Technologies; Vol. 1, No. 2; 2012, ISSN 1927-064X E-ISSN 1927-0658, doi:10.5539/nct.v1n2p12.

[9] Virtual Medical Worlds: 2005 Healthcare technology trends will have strong impact on small businesses, ITSPA, 2004.

[10] Terry, K. (2012) "Cloud computing in healthcare: the question is not if, but when. Retrieved from http://www.fiercehealthit.com/story/cloud-computing-healthcare-question-not-if-when/2012-01-09.

[11] Baliga J, Ayre RWA, Hinton K, Tucker RS. Green cloud computing: balancing energy in processing, storage, and transport. Proc IEEE. 2011;99(1):149–167. doi: 10.1109/JPROC.2010.2060451.

[12] Maria, A.F.; Fenu, G.; Surcis, S. An Approach to Cloud Computing Network. In Proceedings of the 3rd International Conference on Theory and Practice of Electronic Governance, Bogota, Colombia, 10–13 November 2009; pp. 409–410.

[13] Zhang R, Liu L. Security models and requirements for healthcare application clouds. Proceedings of the 2010 IEEE 3rd International Conference on Cloud Computing (CLOUD); The 3rd IEEE International Conference on Cloud; July 5-10, 2010; Miami, FL, USA. New York, NY: IEEE; 2010.

[14] European Network and Information Security Agency ENISA. 2009. [2011-09-08]. 'Cloud Computing: Benefits, Risks and Recommendations for Information Security'. website:http://www.enisa.europa.eu/act/rm/files/deliverables/cloud-computing-risk-assessment.

[15] W. Paper, "Cisco Global Cloud Index: Forecast and Methodology, 2013–2018," Cisco Press, pp. 2014–2019, 2014.