# IJESRT

## INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

## DESIGNING FRAMEWORK FOR BETTER HEALTHCARE USING CLOUD COMPUTING

**Dr. Ranjana Rajnish**
Amity Institute of Information Technology, Amity University Uttar Pradesh, Lucknow, India

## ABSTRACT

Technology and Healthcare industry move hand-in-hand. Healthcare industry can reap benefits of recent advancements in the field of information technology. Cloud computing is centralized virtual machine that manages the internal and the external framework for the storage, provides a hardware, software platform to managing it. This technology reduces the use of local hardware, software for storing, sharing and retrieving data. Cloud computing's important feature provides a remote access to share data. It uses different online access resources such as client-server, applications of storage. Healthcare industry generates lot of data (Big data) in the form of Lab test results, Patient registration and day to day monitoring data. Lot of storage may be required to store this data. Cloud computing environment enables to use several real time client server machines to fulfill the requirement of storage phenomenon.

The paper discusses how storage requirements of healthcare systems can easily be taken care in the cloud based environment. Electronic healthcare systems are integrated with cloud for storing the generated data, enabling medical professionals to provide better medical assistance to the patients. The doctors can refer to the history and medical reports of patient from the cloud from anywhere. In future, we may also think of using data generated from wearable devices in an IOT environment to provide better medical assistance and patient care.

**KEYWORDS**: Cloud Computing, Healthcare, Wearable Devices, Wearable Computing, Cloud Services, Internet of Things (IoT)

## I.    INTRODUCTION

We are living in the world where everything is connected through internet. Lot of technology is being used in almost all the sectors of life; healthcare is a part of it. Machines are used for monitoring patients, during operations, maintaining day to day records, and performing lab test. All this data has to be stored in order to maintain a record of history of patients. Machines are to be used for different purposes, as discussed above. Cloud computing technology provides shared computing resources comprising of applications, storage, computing, networking, development, and deployment platforms for all business processes. In this paper I would be discussing the concept and importance of Cloud Computing environment, its different models of cloud computing environment, its implementation in healthcare sector and proposed framework that implements cloud based services in the healthcare sector.

## II.    WHAT IS CLOUD COMPUTING?

According to NIST, Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models [1].

*Important Characteristics:*

- **Resource pooling:** In pooling of resources, service provider's computing resources are pooled to aid various users. This pool-in can have diverse resources (physical & virtual). These resources are assigned dynamically and are then reassigned according to the request of user. Having location independence feature user generally has no information about where resources are physically located

but they can specify location such as country, state, or datacenter. The resources for resource pooling that are generally pooled are storage, processing, memory, and network bandwidth.

- **On-demand service:** Given computing capabilities such as, server and network storage, may be used by the user as per there need, routinely without any communication between human and the service provider.
- **Broad network access:** User can use network capabilities offered across the network and can access these resources using defined mechanisms that support heterogeneous thin or thick client platforms. Some of the examples are mobile phones, tablets, laptops, and workstations.
- **Rapid elasticity:** Capabilities of cloud computing platform may be accommodated and freed flexibly. In few cases it may happen automatically, to balance as per rapid increase and decrease with demand. It appears to the end-user that capabilities available for provisioning are unlimited.
- **Measured service:** Cloud systems provide metering capability that allows automatic control and optimization of resources suitable to the service type (i.e., storage, processing, bandwidth, and active user accounts). Usage of resources can be monitored, controlled, and reported to provide transparency to both the provider and the user.
  Cloud computing automatically manages the complexity of the storage management for the users. Cloud computing also promises to provide high availability, lower cost, high scalability and disaster recoverability options.

## III. SERVICE MODELS

The cloud infrastructure can be seen as a combination of both hardware and software or to be more precise. The hardware resources to support cloud services, such as the server, storage and network devices are managed by physical layer. However, the software installed on physical layer is managed by the abstraction layer. Cloud service provider provide services such as Infrastructure as a service(Iaas), Software as a service(Saas) and Platform as a service (Paas).

- **Infrastructure as a service (Iaas):** IaaS provides and manages all infrastructure related issues for its user. The provider shall host the hardware, software (such as OS), server, networking resources, storage and other infrastructure components. We can say, the provider should provide all computing resources to its client. Some of the Infrastructure as a service (IaaS) providers are Amazon Web Services (AWS), Windows Azure, IBM Smart Cloud enterprise, Google Compute Engine, Rackspace Open Cloud.
- **Software as a service(Saas):** Provider's applications are provided on the cloud by the provider in Saas. Thin client interface or a web browser is used to accesses the applications. Biggest advantage of the software as a service as cloud application is that it provides services without downloading any software. The user need not bother about the infrastructure used at backend, software, license or any other issues. Some of the SaaS providers are Windows azure, Apache stratus.
- **Platform as a service (Paas):** In PaaS, the provider installs applications created by consumer using various programming languages, libraries, services, and tools supported by the provider. The end-user does not have any control on the cloud infrastructure comprising of network, servers, operating systems, or storage, but has control over his applications that have been installed/ deployed and on the configuration settings associated with the application for hosting environment. According to Computer Business Review major PaaS providers are Amazon Web Services – Elastic Beanstalk, Salesforce, Software AG – LongJump, Microsoft – Azure, IBM – Bluemix, RedHat – OpenShift, Google – App Engine[11].



*Figure 1: Service Models in a Cloud Computing Environment*

## IV.    DEPLOYMENT MODELS

Various models used for deploying cloud computing are Private Cloud, Community Cloud, Public Cloud and Hybrid Cloud.

Private cloud: Cloud's infrastructure that is stipulated exclusively to be used by a single organization. This infrastructure may be owned, managed, and operated by the organization for which private cloud is provisioned, a third party, or both of them as per there mutual agreement. It may exist on or off premises of the organization for which it is provisioned.

Community cloud: The cloud infrastructure that is stipulated for being used by a particular community of consumers from organizations that have common interests. It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or both of them as per there mutual agreement. Community cloud could be present on or off premises of the organization for which it is provisioned.

Public cloud: Cloud infrastructure that is to be used by the general public is known as Public cloud. Business, academic, or government organization may own, manage, and operate this infrastructure. It may also be operated by a combination of all of these. It should exist on the site of the service provider.

Hybrid cloud: Combination of two or more than two diverse cloud infrastructures that are bound together by standardized technology enabling data and application portability is known as Hybrid cloud.
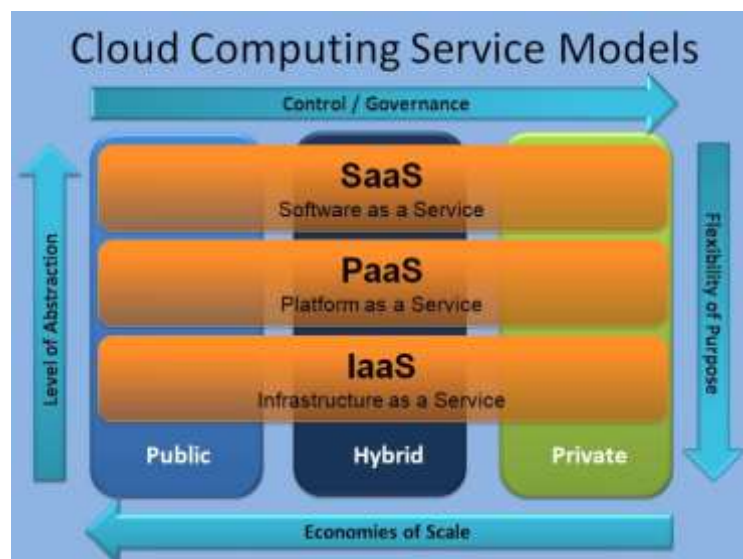


*Figure 2: Deployment Models of Cloud Computing[2]*

## V.    EXISTING TECHNOLOGIES IN HEALTHCARE

### Telemedicine Systems

With the use of this technology, the medical practitioners are able to remotely diagnose and treat the patients. It helps to provide good medical facilities and patient care remotely, to the rural population, which otherwise may not be possible. This also helps in removing the distance barrier for the patients who need immediate attention. This is actually beneficial to the patients who are deprived of the care, resources and medical supervision from specialist that is available far away from them. The big problem in this is the distance itself as the doctor can not physically see the patient, thus increasing the chances of error.

### Pervasive Healthcare Systems

In Pervasive healthcare, the concept is to provide healthcare to anyone, at any time, and anywhere by removing the constraints of time and location in order to increase the coverage and the quality of healthcare. This is an emerging area of research that is inevitable to play an important role in future of healthcare industry.  Various devices such as the mobile devices i.e. mobile phones,

tablets, laptops and PDAs, all types of wearable devices i.e. computer-enhanced textiles, accessories, or medical devices or implanted devices etc. can be used in Pervasive Healthcare systems. Pervasive computing is becoming more and more beneficial with the advent of Wearable devices/ computing.

## VI. HEALTHCARE IN CLOUD AND WEARABLE COMPUTING ERA

Lot of data is being generated by devices used in healthcare. Specially, using pervasive/ wearable computing makes data all the more voluminous. Storing this data in a way that it can easily be retrieved is also a challenge faced by the healthcare industry.
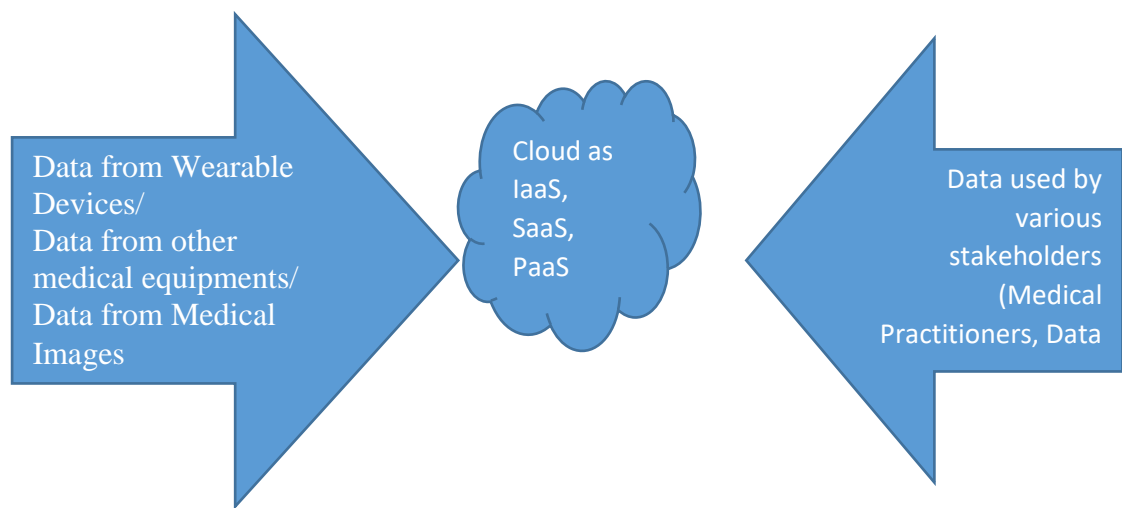


*Figure 3: Healthcare in Cloud and Wearable Computing Era*

Increasing dependency on cloud computing coupled with the understanding of various roles in which cloud computing can be deployed in healthcare industry is becoming guiding factor to industry's collaborative approach to find new ways to use cloud. Thus, a prediction can be made about trends in application of cloud in healthcare industry:

**Increased Interaction between Patient & Clinician:** Patient care can be increased by having a two-way communication between patient and clinicians with the use of mobile devices, wearable devices, instant alerts, reminders to doctors and patients etc.

**Records in Real Time/ Predictive Analytics:** Due to availability of records on cloud, the records will be available in real time and can be used by both doctors and patients providing a holistic view towards patient care. Being at available in digital formats, the data may also be used for any kind of analysis about the patient history and prediction of future problems (Prediction Analytics).

**Consumer Driven Approach:** Cloud is very effective platform for healthcare organisations to make healthcare consumer driven and thus could help in providing more personalized approach.

**Big Picture for Line of Treatment:** Creating innovative methods for healthcare using cloud data where all involved players participate to simplify, organize and streamline various processes involved in patient care. They can focus more on the big picture for their patients.

**Research Purposes:** The volume, veracity and variety of patient healthcare data available on cloud platform can be used for various.

**Medical Imaging Archive:** Due to increased usage of IT, the diagnostic imaging procedures are generating about 100 Petabytes of data. Creating medical imaging archive on the cloud may help all involved players

**Data Acquisition for Data Analytics:** Data acquired by the use of wearable devices can be used for various types of analytics and sentiment analysis.

**Data wearable devices:** Wearable devices are producing lot of data, storing the data produced efficiently in a way to make quick retrieval is a challenge. This challenge is handled by cloud services.

## VII. PROPOSED CLOUD BASED FRAMEWORK

---

In the framework proposed, the complete proposed system consists of mobile/ desktop of user/ patient, hospital cloud and mobile/ desktop of receptionist at hospital and doctor as shown in figure 4.
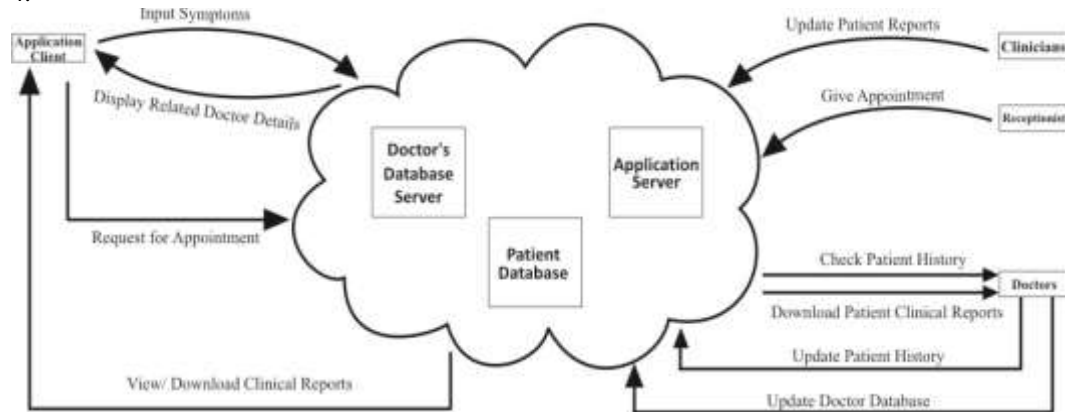


*Figure 4: Proposed Cloud based Framework*

All the computational servers will be deployed in the hospital community cloud. In the framework proposed, the patient will be connected to Hospital community cloud through an Application on users mobile/ desktop. Medical database will help patient to search for the best doctors related to his/her disease. Patient's data is updated by clinicians and doctors, and is stored on the cloud database server. The application server and main server of hospital or doctor are connected through cloud and are authorized to access data from the database server.

This framework should work for both types of settings i.e. for private doctors and for government hospitals. The only requirement is that they should have access to the application.

## VIII. CONCLUSION

In a modern world everything goes online and cloud computing manages the database. It helps in delivering the data around the world without human intervention. It eliminates the limited storage capacity. It formulates a distributed data management technique to fulfill the real time on-demand data delivering system. The medical fraternity or the hospital administrators do not have to look after the management of the underlying computing infrastructure, applications their licenses, storage mediums etc. They can rather focus on providing better medical care to the patient. Patient history, their report of past investigations and any other relevant information, such as allergies are available at the click of mouse. Also, as cloud provides anytime and anywhere access to the patient information. The only issues could be in the area where proper connectivity and good bandwidth is not available. Though, with the outreach of 4G services, it seems the proposed model may benefit to the majority of the population and could be considered as solution for better healthcare. The whole benefit of this proposed framework is that user is not needed to carry details of all his investigations and reports. Through medical database he can search for the best doctors related to his/her disease.

## IX. REFERENCES

1.  "Towards pervasive computing in health care – A literature Review", BMC Medical Informatics and Decision Making, 2008, DOI: 10.1186/1472-6947-8-26, Orwat et al; licensee BioMed Central Ltd. 2008
2.  "A Survey on Data Storage and Security in Cloud Computing", V. Spoorthy, M. Mamatha, B. Santhosh Kumar
3.  "A Medical Image Archive Solution in the Cloud", Chia-Chi Teng, Jonathan Mitchell et al, IEEE Explore, 978-1-4244-6055-7/10/$26.00 ©2010 IEEE

4.   "Designing a Cloud based Framework for HealthCare System and applying Clustering techniques for Region Wise Diagnosis", Maulik Parekh, Dr. Saleena B., 2nd International Symposium on Big Data and Cloud Computing (ISBCC'15), Procedia Computer Science 50 ( 2015 ) 537 – 542.
5.   IBM (2010), Cloud Deployment and Delivery Models, Available from https://www.ibm.com/developerworks/mydeveloperworks/c2028fdc
6.   P., Metri, G., Sarote (2011).Privacy Issues and Challenges in Cloud Computing, International Journal of Advanced Engineering Sciences and Technologies (IJAEST), vol. 5, pp.1-6.
7.   P., Mell, T., Grance. The NIST definition of cloud computing [Online], Available: http://csrc.nist.gov/groups/SNS/cloud computing/cloud-def. v15.doc, 2009.
8.   https://apprenda.com/library/paas/iaas-paas-saas-explained-compared/
9.   http://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf
10.  http://cloudcomputingnet.com/category/clouldcomputing/cloudcomputingfundamental/https://apprenda.com/library/paas/iaas-paas-saas-explained-compared/
11.  https://www.cbronline.com/cloud/10-of-the-best-paas-providers-4545381/

## CITE AN ARTICLE