

Cloud Computing based EHR

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Abstract: *In the forum of cultured society, all the people in the society wishes to have the knowledge of the healthcare system. To minimize the complexity of access and to increase the “ease of access” for the health record of every patient has led to the development of electronic versions of health records i.e., Electronic Health Records (EHR). This EHR will serve as a mechanism to find any unauthorized practices in the healthcare system. Everyone are very keen to avoid this practices, because to avoid a spurious diagnosis of diseases in the healthcare that may lead other dimensional diagnosis. Hence we propose a platform of “cloud computing” as a solution to eliminate the confusion diagnosis to avoid unauthorized practices in the healthcare system. Our proposed system incorporates the open source cloud computing technology to construct the secure, scalable and affordable platform to process all our EHR operations. we recommend to call this platform services as “eHr-services”, which provides an common platform to share the health record informations with EHR and the experts in particular domain (doctors). “eHr-services” serves as an service point between all the delivery care system and the authorized participants. The proposed system has been developed using Software-as-a-Service (SaaS) application on the apex of open source cloud technology.*

Keywords: *cloud computing, health services, SaaS, Security, Authorization, Authentication.*

I. INTRODUCTION

Cloud computing is an novel internet based service that gives assorted resource processing of data to digital devices such as Computer, Personal Digital Assistant (PDA) for on-demand computing. It is an blueprint for on-demand access to the rack of shared configurable resources such as servers, network, routers, applications and services for rapid resources release reduced effort of managerial service. Cloud computing with storage access will offer an excellent access to user with its enterprise at different levels of capacities and capabilities to exchange of data at every data centers even at third party data access.

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It majorly depends on resource sharing to attain economy of scale with coherence, similar kind of utility as an network cloud computing is an conjunction of various service models such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).[1]

II. Problem Statement

Electronic Health Record (EHR) is proposed to find any unauthorized issues in the conventional healthcare system. In today’s practice all the healthcare associates such as health experts, hospital data analyst and insurance agents are relying on paper based records and documents. Billing details are then digitized for computer based billing and the possibility of abuse of records of patient data by frauds for the purpose of personal benefits.[2]

In today’s advanced monitoring system of health records are being done on an centralized server mechanism which is insecure, unreliability in access, medical data storage irrespective of location, time and cost. Hence the patient information may be revealed, addition of irrelevant information on to health record which may lead false diagnosis. Hence it results in an computer management system with heavy cost involved for EHR. Hence their exist need for an efficient design of cloud computing system as shown in figure 1.

The core objective of the proposed project is to design highly reliable, secure electronic health record management system. Our proposed system deals with minimizing the medical errors occurred due to improper patient data. Hence medical data privacy is maintained to avoid unauthorized attempt and corrupted handling of digital data. The different participants of EHR system such as patient, patient guardians, health care professionals, health care payers, health care experts, can interact with information/data irrespective of cost, time and locations. Hence, for global access of medical data has to be done. On a common platform of cloud computing technology to reduce the cost with high security for patient data stored in the cloud.[3]

A. Cloud computing models

The cloud computing models are broadly classified into three various levels of sub models based on the nativity of application they are

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

These three Submodels are grouped on the role system administrators, developers and end user as IaaS, PaaS and SaaS respectively as shown in figure 2.[4]

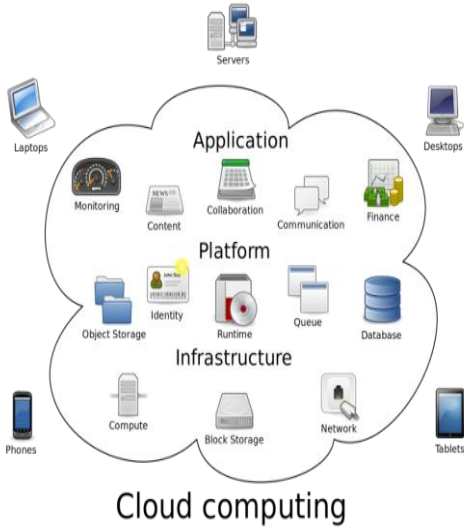


Figure 1: Architecture of Cloud Computing

III . OBJECTIVE OF THE PROPOSED SYSTEM

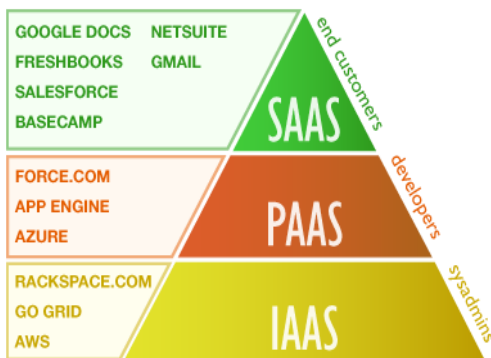


Figure 2: Cloud Computing Models.

B. Software As A Service (Saas):

This sub model provides access to remote functions on the software based application usually web based services such as Google docs, Netsuite, Gmail azure and other application as shown in figure 3. The SaaS provider cost effective access for all the organizations in our consideration hospital management system by using the interface of freely available application software their by avoiding the economic cost of payment for a licensed application on an contract fees. This SaaS provides authentic access even from third party access. This completely eliminates the investment on the hardware. Hence this SaaS can be considered as a remote hosted application. The major advantage of SaaS is users need not to monitor the infrastructure of the cloud models because of the reason the application itself provides multi-tenancy system architecture for the optimizing of speed, security, availability and its maintenance.[5]

C. Platform as a Service (PaaS)

This sub model is exclusively on developers zone which provides access to the infrastructure of cloud computing by suitable programming languages and appropriate tools for configuring the various management system by the service provider as shown in figure 4 (a) as the end users will not be allowed to control the infrastructure including network, operating system, memory and servers. This submodel ensures a creative platform to host with in progress and completed cloud application usual cloud application are Google App Engines, AWS, force.com.[6]



Figure 3: Schematic diagram of Software as a Service(SaaS).

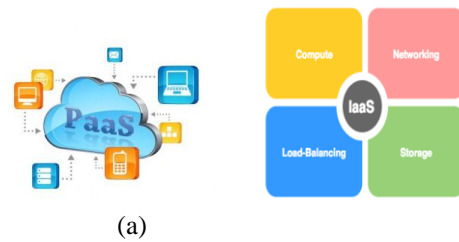


Figure 4: schematic diagram of (a)PaaS (b) IaaS.

D. Infrastructure as a Service (IaaS)

This submodel forms the basis for the other two submodels as it deals with the load-balancing (data), storage method, networking and other computations as shown diagrammatically in figure 4(b). This submodel established on the concept of virtualization in line of integrating all the physical resources as per the user requirement. This submodel include some of the example as Amazon’s EC2, Sun Microsystems and others. In spite of these sub models cloud computing includes different deployment models as public cloud, private cloud, community cloud and hybrid cloud.[7]

IV. LITERATURE SURVEY

Junwei Cao and et al. As cloud computing becomes more and more popular, understanding the economics of cloud computing becomes critically important. To maximize the profit, a service provider should understand both service charges and business costs, and how they are determined by the characteristics of the applications and the configuration of a multiserver system. The problem of optimal multiserver configuration for



profit maximization in a cloud computing environment is studied. Our pricing model takes such factors into considerations as the amount of a service, the workload of an application environment, the configuration of a multiserver system, the service level agreement. Two server speed and power consumption models are considered, namely, the idle-speed model and the constant speed model. [8]

Jing Mei and et al., has considered the profit maximization problem in a homogeneous cloud environment, because the analysis of a heterogenous environment is much more complicated than that of a homogenous environment. However, we will extend our study to a heterogenous environment in the future. Software as a service (SaaS) is an alternative to the standard software installation in the business environment (traditional model) where a user has to build the server, install the application and configure it. In SaaS, the user does not pay for the software itself. Instead, it works like a rental. They have the authorization to use it for a period of time and pay for the software that they are using. Use of SaaS reduce time to benefit, lower cost, scalability and integration, new releases(upgrades) and easy to use and perform proof of concepts. It is important to consider what data is sent to the cloud in order to mitigate any security-related risk. Since previous papers use IaaS there are above mentioned disadvantage. To overcome them we use SaaS. [9]

Narahari Narasimhaiah and et al., SaaS is a software distribution model in which are hosted by a service or vendor provider and over the network made available to customers, typically the Internet. SaaS is a prevalent delivery model that supports Web services and SOA mature and new developmental approaches. Around the world broadband services are available to support user access from more areas. SaaS is closely related on demand computing software delivery and ASP models. For SaaS, IDC identifies two slightly different delivery models. It is similar to ASP for the hosted application management (hosted AM) model: For customers it delivers over the Web, and a provider hosts commercially available software. The provider gives customers network-based access to a single copy of an application created specifically for SaaS distribution for the software on demand model. SaaS provides licenses an application to customers either as a service on demand, through a subscription, in a “pay-as-you-go” model, or (increasingly) at no charge. [10]

V. PROPOSED SYSTEM

To provide various services and computing resources to the users on demand in an effective and efficient manner. Cloud computing grabs its popular implications in view of cloud computing service provider, benefits to them is an eminent consideration and it is majorly done by the configuration of the cloud service platform. This point of concern for the service provider will not guarantee the quality of service to users but also hands on the resource wastage.

In the proposed system on dual resource renting scheme is considered, the firstly association of long term and short term

renting systems are done. Aiming at the existing issues we are aiming at dual resource renting will ensure the Quality of Service (QoS) for all the requests and minimize the resource waste. Secondly, on service system is considered as measurement of performance that will impact on the profit system for dual renting scheme are analyze. Lastly the profit maximization problem is completely formulated on dual renting scheme for optimization of the platform usage. Our proposed system not only ensure, the better QoS when compared with existing system but also providers highly secure and authentication at both the ends of the users by minimizing the resource wastage. In today’s cultured society, the peoples are created an awareness and importance of healthcare facilities, parallel in view to optimize the cost and complexity of processing conventional health record system. EHR have been considered or an necessary mechanism which serves to detect the unauthorized practices in the healthcare system. The concept of cloud computing in EHR system is the better solution to serve the healthcare services. It incorporates the open source cloud computing technology as an affordable tool for secure,scalable platform for EHR system. We recommend to call this entire platform shown in figure 5 as “eHr-services” which is an cloud station that interface the needs and services of all the participants of health care system in EHR. This proposed system is developed among the cloud service with proper combination of the three submodels of cloud technologies at the client side Application we wish to interface the mobile application that can be enabled on any Google Android device.

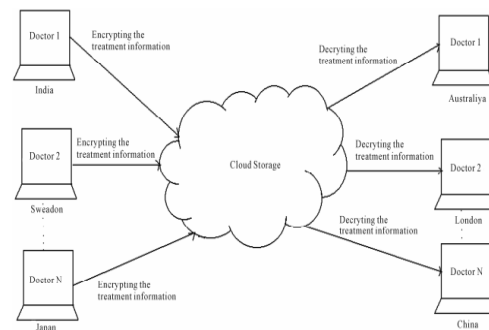


Figure 5: Proposed system for medical application using cloud computing.

In the proposed system shown in figure 5 we insist to protect the patient data which is referred as EHR with the unique password at the user end through the mobile application and data collection center before sharing onto the cloud storage. Then with the mechanisms of secure common key exchange technique which will be exchanged among doctors or health experts accessing the data from remote place. So that the possibility of any fraudulent activation the patient data can be avoided their by securing data as well as patient with pseudo diagnosis. [11]

VI. IMPLEMENTATION

This phase of our proposed system is the stage of transformation from the abstract view on to an working code. The major concern of this implementation is to correlate the design described into an best possible optimization with proper programming tools this phase can be divided into following:

- Selection of novel planning for abstract view.
- Analyze the planning with constructive ideas and challenges.
- Design suitable algorithm to match the challenges as required.
- Proper evaluation of the algorithm.
- Valid selection of the platform for implementation.
- Selecting the suitable language even the options available for the development of complete application.

With the various subphases enlisted above, the majority of the design issues lie in the submodel SaaS and PaaS apart from IaaS. Hence we select the suitable option from salesforce.com and force.com for SaaS and PaaS respectively and the detailed discussion about this will be discussed as shown below.

Salesforce.com:

With customer relationship management view this service is subdivided into sub categories viz., community cloud, marketing cloud, data cloud, sales cloud, service cloud, analytics cloud and internet of things with huge costumers on common platform. This salesforce provides an interface with various task and care management system for the purpose of automatic routing and to escalate essential events. This salesforce provides an suitable port for the every user to traceout its individual cases which will include the social networking interface that render the platform to converse with company on various social networking website which includes the personal chat and e-mail alert also.

Force.com:

Selection of appropriate data set for the end user plays the significant role in designing or interfacing any application. Hence we take from the designers platform for various data model on the otherhand it is highly important to fulfill the needs of end user requirement. This platform in regard of EHR it is associated with various datasets associated to each patient. This secures the data from fraudulent users for the high safety issues which eliminate form mishandling of data. This force.com platform provides configuration of data access in the four various levels such as Organization, Objects, Fields and Records. This platform also keep track of the information about the users and the location of access in the audit records as Record Modification Fields, Login History, Field History Tracking, Setup Audit Trail, Triggers used

Algorithm:

1. Create homepage of patient with relevant basic data (viz., name, age, contact no, address, etc).

2. Select record type relevant patient.
3. Select the key for encryption of EHR.
4. Update the patient data in EHR.
5. Upload to cloud securely with the encryption key
6. Select the patient's physician for consulting and share the key.
7. Physician granted access to particular EHR with shared secret key.
8. Update EHR of the patient simultaneously.
9. Access EHR by the patient/guardian by any of the android enabled device or PC granted permission.

VII. RESULTS AND DISCUSSION

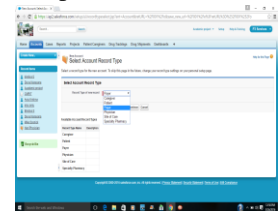
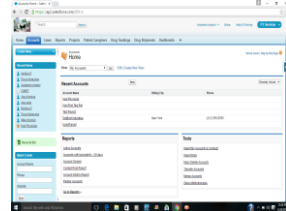
Figure 6 provides the some snapshots of results implemented in our proposed system with the patients EHR and satisfying all the steps proposed in the algorithm.

Advantages of Proposed System: With the abundant advantages of cloud computing interface in-terms of flexibility, security, data privacy and gurantee of authorization our proposed system achieves:

- Enhanced reliability when compared with the existing systems.
- Due to novel double renting scheme is proposed for service providers. It combines long-term renting with short-term renting, which can not only satisfy quality-of-service requirements under the varying system workload, but also reduce the resource waste greatly.
- Cost is claimed to be reduced when using cloud infrastructure and highly cost effective due to avoiding the hardware costs.

VIII. CONCLUSION

In today's civilized world of health all the human beings are much aware of knowledge of health. In this system discussed in the scanrio of health record system, hence we have introduced the concept of EHR i.e digitization of every health record of patient and interfacing the digital patient data onto the cloud storage with the open source.



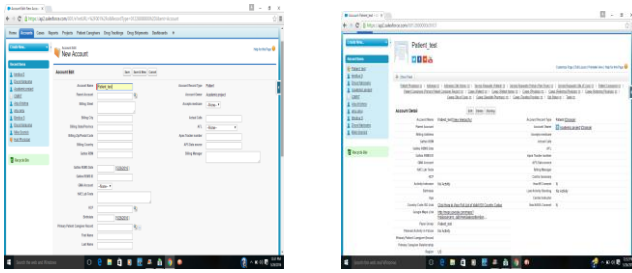


Figure 6. (a) Patient home page. (b) Patient record type with key (c) EHR updation (d)summary of patient EHR accessed from remote place.

We call this platform as “eHr-Services” by way of interface with cloud computing. This “eHr-Services” will serve as a one-stop point for all essential participants of health care system. The SaaS and PaaS interface will hold the essential required for the proposed system as our system provides access from any end-point even from third party node also level of security is an important feature even in terms of exchange of medical data from the maintenance node. Hence we have introduced the concept of unique common key at sender node and receiver for their processing this has resulted in adaptation of cloud computing to any android handheld devices.

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