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Cloud Computing Support for Enhanced Health Applications

Poonam B. Sutar, Bharat P. Kulkarni

Abstract*— Mobile devices are being considered as service platforms for mobile health information delivery, access and communication. However mobiles face challenges with regard to delivering secure multimedia based health services due to limitations in computation and power supply. Since mobile devices have limited computational capacity and run on small batteries; they are unable to run heavy multimedia & security algorithms. Cloud Computing provides functionality for managing information data in a distributed, ubiquitous and pervasive manner supporting several platforms, systems and applications. This work presents the implementation of a system that enables electronic healthcare data storage, update and retrieval using Cloud Computing. The proposed application provides management of patient health records and medical images by using cloud and mobile or stand alone computer. The client is capable of accessing his record anywhere in the world by using this application. This report summarizes the limitation of existing health system and implementation details of new enhanced health application.

Index Terms— **Cloud Computing, Electronic Health Data Storage.**

I. INTRODUCTION

Mobile phones as a service platform can provide several societal, business and governmental services. Further developments will allow mobile devices with unique features that can sense the environment and physiological parameters to enhance quality of life and remote monitoring of patients. However mobile devices have limitations in computational capacity and power consumption. Hence, cloud computing could be regarded as an unlimited resource that can be accessed anytime and anywhere in the world.

II. RELATED WORK

A. Mobile Health Services-:

The mobile health service is provided by the mobile health providers. The provider gives the facility of health monitoring according to patient's convenience with the maximum use of mobile device. The client who wants to use this application subscribes to the mobile health provider through his mobile. The providers register them as authenticated user after validation of information. The further communication is done through the mobile only.

B. Cloud Computing-:

As the mobile device has the limited computational capacity, the applications which can't be executed on the mobile are sent to the cloud and cloud provides the platform for execution.

C. Limitations of Existing Health System-:

1Limitations of mobile device-:

The proposed model intends to address or answer to security concerns in mobile devices. Some of security concerns to be addressed by this model are briefly discussed below: Secure Software Execution Environment: viruses from malicious software can cause a serious negative impact to the functioning of a mobile device, therefore threat detection and prevention mechanism is required to avoid this impact.

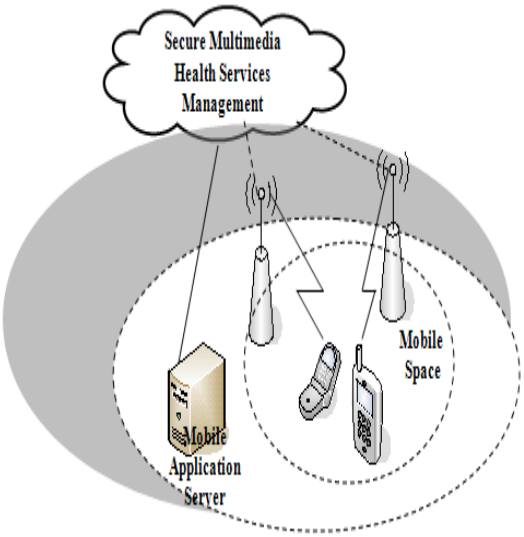

Fig.1. Block Diagram

- **Secure Data Communication:** communication channel must retain privacy and integrity of data communicated to and from mobile applications.
- **User Identification:** unauthorized access to mobile applications must be prevented.
- **Secure Network Access:** only subscribers must be able to connect to network and access services.
- **Content Security:** The content downloaded and stored in the mobile device must be utilized as per the terms set by the content provider.
- **Secure Storage:** Private and sensitive information must be protected from unauthorized access.

III. PROPOSED WORK

The ordinary user can't afford the use of mobiles based on Android system so that the existing system is scaled to use the standalone computer with the mobile. Figure illustrates the proposed system architecture for developing and deploying the mobile healthcare applications that utilize Cloud

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Computing. The main components of a Cloud Computing Service usually are the platform front-end interface that communicate directly with users and allows the management of the storage content. The interface can be a web client or a standalone application.

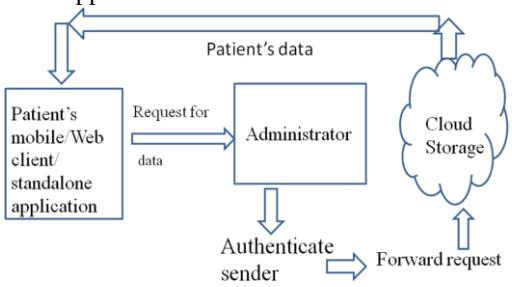

Fig.2. Patient's and Cloud Relation diagram

The Cloud Storage Facilities manages the physical infrastructure (e.g., storage elements) and is also responsible for performing maintaining operations (e.g., backing up data, etc.) The Cloud Platform interface is also connected to the Cloud Service module, which handles and queues user requests. Finally, the Cloud Infrastructure module manages user account, accessibility and billing issues. This work has been now extended to include the functionality of communicating with Cloud Computing platforms and support communication through Web Services. The Cloud Service client consists of several modules. The Patient Health Record application acquires and displays patient records stored into the cloud. The Medical Imaging module is responsible for displaying medical images on the device and heard information data. When JEPG2000 compression is used, the appropriate sub-module decodes the image. The communication with the Cloud is performed through an implementation of Web Services REST API that is supported natively by Android. The inherent interoperability that comes with using vendor, platform, and language independent XML technologies and the ubiquitous HTTP as a transport mean that any application can communicate with any other application using Web services. Data in Cloud are seamlessly stored and presented to the user as if they reside locally. This means that the Cloud repository is presented as a virtual folder and does not provide the features of a database scheme. The proposed work contains the following modules-:

1. The Patient Module
2. Administrator Module(Medical Personnel)
3. Cloud Module

Functions of various modules-:

- **Patient Module-:** The patient is the client who uses this application.
  - **Subscribe-:** The client who wants to use this has to subscribe to the administrator (the person from the medical background) and send the necessary documents for the registration.
- **Administrator module-:** The administrator is the person who has the medical background. He does the following functions-:
  - **Generation of patient ID-:** Whenever the client sends the request for registration the administrator first verify the necessary documents and register him as the authorized customer with the unique PatientID.
  - **Authentication of the Patient with PatientID-:** Whenever the client sends the request for data the administrator first verifies him with PatientID.
  - **Update the data in cloud-:** The client can access the data in the cloud storage but can't do the modification in the record. For the security purpose the administrator only has the rights to make the changes in the record.
  - **Account Management-:** The all registered customers have their accounts with unique ID and password. These accounts are managed by the administrator. He has the backup of all information related to these accounts.
  - **Billing issues-:** The customer has to pay the charges for each access of record from the cloud storage. These billing issues are handled by the administrator.
- **Cloud Module**
  - **Cloud Storage-:** Cloud provides the storage for patient record. Send the data to the client when request is generated.

IV. ENCRYPTION

The patient record is first encrypted with the RC5 algorithm. Then the encrypted record is sent to the cloud storage. **RC5-:** RC5 is a symmetric encryption algorithm whose plaintext and cipher text are fixed-length bit sequences. RC5's biggest advantage is its simplicity: encryption and decryption can each be implemented with only five lines of C code. In addition, due to the simplicity of RC5, it has extremely low memory requirements. RC5 also offers flexibility and versatility by giving users the option to change the number of rounds performed, key size, and block size. By adjusting these options users can manipulate the trade-off between speed and security. One unique aspect of RC5 is the usage of data-dependent rotational shifts. Data-dependent rotational shifts involve manipulating bits with the shift amount determined by a block of data, instead of a fixed integer value. Each encryption and decryption function accepts two blocks (32 bits for each block) of data, either as cipher text or plaintext. When the data manipulation occurs, the function outputs two blocks of cipher text or plaintext, depending on whether the function encrypts or decrypts. Just like other algorithms, RC5 has a set-up process, and the set-up time is dominated by the creation of an expanded key table whose elements are used as a second argument in XOR operations during encryption and

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decryption. A thirty-two bit word, sixteen round and four-byte sized key configurations was used in this analysis.

Encryption Algorithm-:

Input: Plaintext in two 32-bit variables A and B
Number r of rounds
Expanded key table S
Output: Cipher text stored in A, B
A=A+S [0]
B=B+S [1]
For i=1 to r
A= ((A XOR B) <<< B)+S[2*i]
B= ((B XOR A) <<< A)+S[2*i+1]

Decryption Algorithm-:

Input: Cipher text in two 32-bit variables A and B
Number r of rounds
Expanded key table S
Output: Plaintext stored in A,B
For i=r to 1
B= ((B-S [2*i+1]) >>>A) XOR A
A= ((A-S [2*i]>>>B) XOR B
B=B-S [1];
A=A-S [0];
>>> = rotational right shift.
<<< = rotational left shift.

V. ADVANTAGES

The application is advantageous for-:

1. **Patient-:** Consider the example of the patient who is taking the treatment of the doctor from local doctor. If now, he goes to somewhere else and wants to take the advice from the experts, then he has to carry all his records, case history etc. with him. But by using this application he can access his data from anywhere in the world within no time.
2. **For hospital maintenance-:** If the hospital wants to maintain its record on the cloud which is easy and secure way then this application is advantageous.

VI. CONCLUSION

The sharing of medical information resources is a key factor playing an important role towards the successful adoption of pervasive or mobile healthcare systems. The concept of Cloud Computing and applications similar to the one presented in this article will attract the interest of scientists, developers and industrial partners working in the field of biomedical informatics. The system enables the management of patient health records and medical images and utilizes the Cloud Storage Service. Future work might include improving security by implementing advanced user authentication techniques on the mobile device and deploying the platform in real healthcare environment for evaluating the system in terms of user acceptability and performance.

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Author's Profile

Poonam B. Sutar completed her B.E. from Shivaji University, Kolhapur in 2008. Currently she is a post graduate fellow at Computer Science and Engineering department. Her current research interests include cloud computing for health applications.

Bharat P. Kulkarni completed his B.E. and M.E. from Shivaji University, Kolhapur in 2005 and 2009 respectively. Since 2006 he has an Assistant Professor in the department of Electronics and Telecommunication Engineering, PVPIT Budhgaon. His current research interests include remote health monitoring, signal processing and cloud computing.