Development of Electronic Hospital Management System utilizing Cloud Computing and Android OS using VPN connections.

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Abstract: Cloud Computing provides facilities for storage, management, processing, and accessing information and other data stored in several system, platforms, applications etc . The above work represents the implementation of electronic hospital management system which enables date storage, update, retrieval, modification through cloud using the virtual private network which enhances the security of the data. The management system is developed using the popular Android OS.

Keywords: Android, Cloud Computing, management system, VPN.

I. INTRODUCTION

Android is a software stack for mobile devices that includes an operating system, middleware and key applications. It allows developers to write managed code in the Java language, controlling the device via Google-developed Java libraries. Applications written in C and other languages can be compiled to ARM native code and run, but this development path is not officially supported by Google. Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources such as networks, servers, storage, applications, and services that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of essential characteristics, deployment models, and various service models. A VPN is a private network that uses a public network to connect remote sites or users together. By using a VPN, businesses ensure security anyone intercepting the encrypted data can't read it. An Android hospital management application system will be developed for Cloud Server within the Virtual Private Network of public network. In which establishes the flow of data between cloud server and android application securely.

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II. Electronic Hospital Management system and cloud computing.

Many studies have demonstrated that there is a very limited access to patient-related information in hospital system which is available, during decision-making and the communication among patient observation team members are usual causes of medical errors in healthcare ([8], [9]). Thus, there is a need for the pervasive and ubiquitous access to healthcare data is considered to be most essential for the proper diagnosis and treatment procedure for the patient. Cloud Computing is a model for enabling convenient, on-demand network access to a shared group 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 promotes availability and is composed of five essential characteristics, three service models, and four deployment models. The major characteristics of Cloud Computing can be summarized into the following [11]: (A) On-demand self-service. A consumer can unilaterally obtain access to computing capabilities, such as server computing time and/or network storage, as needed automatically without requiring human interaction with each service's provider; (B) Broad network access: Resources are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., smart phones); (C) 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. Examples of resources include storage, processing, memory, network bandwidth, and virtual machines; (D) Rapid elasticity: Resources can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale. Given the characteristics of Cloud Computing and the flexibility of the services that can be developed, a major benefit is the agility that improves with users being able to rapidly and inexpensively re-provision technological infrastructure resources. Device and location

independence enable users to access systems using a web browser regardless of their location or what device they are using (e.g., mobile phones). Multi-tenancy enables sharing of resources and costs across a large pool of users thus allowing for centralization of infrastructure in locations with lower costs. Reliability improves through the use of multiple redundant sites, which makes Cloud Computing suitable for business continuity and disaster recovery. Security typically improves due to centralization of data and increased security-focused resources. Sustainability comes about through improved resource utilization, more efficient systems. A number of Cloud Computing platforms are already available for pervasive management of user data, either free (e.g., iCloud [13], Box, Mozy and DropBox [15]) or commercial (e.g., GoGrid [12] and Amazon AWS [14]). The majority of them however, do not provide to developers, the ability to create their own applications and incorporate Cloud Computing functionality, apart from Amazon AWS.

III. Mobile hospital management system and VPN.

The VPN protect data while it's traveling on the public network. If intruders attempt to capture the data, they should be unable to read or use it. The VPN provide the same quality of connection for each user even when it is handling its maximum number of simultaneous connections. It is able to extend its VPN services to handle that growth without replacing the VPN technology altogether. The purpose of the tunneling protocol is to add a layer of security that protects each packet on its journey over the Internet. The packet is traveling with the same transport protocol it would have used without the tunnel; this protocol defines how each computer sends and receives data over its ISP. Each inner packet still maintains the passenger protocol, such as Internet protocol (IP) or AppleTalk, which defines how it travels on the LANs at each end of the tunnel. The tunneling protocol used for encapsulation adds a layer of security to protect the packet on its journey over the Internet. The electronic hospital management system provides a way in which the patient details are available anytime , anywhere whenever required and these data is highly secured because of VPN connections.

IV. Related work.

The hospital management system is developed for the android devices in which the patients details is stored in the server side database. Many articles presents the advantages of the mobile hospital management system for the common people. Here in this paper the main purpose of the work is to provide all the patients related data to flow more securely using virtual private network. Furthermore, the works focus mostly on delivering data to healthcare applications and do not address issues of data management and interoperability issues introduced by the heterogeneous data resources found in modern healthcare systems. The usage of Cloud Computing provides data management and access functionality overcoming the aforementioned issues as discussed in previous sections. The concept of utilizing Cloud Computing in the context of healthcare information management is relatively new but is considered to have great potential . To our best knowledge there is no other work in the literature utilizing Cloud Computing for providing pervasive healthcare information management services on mobile devices.

V. Electronic hospital management system overview.

This section discusses the main features of the application and presents implementation details. The prevalent functionality of the application is to provide medical experts and patients with a mobile user interface for managing healthcare information more securely. The latter interprets into storing, querying and retrieving patient health records and patient-related medical data (e.g., biosignals). The data may reside at a distributed Cloud Storage facility, initially uploaded/stored by medical personnel through a Hospital Information System (HIS). In order to be interoperable with a variety of Cloud Computing infrastructures, the communication and data exchange has to be performed through non-proprietary, open and interoperable communication standards. Electronic hospital management utilizing Web Services connectivity and Android OS supports the following functionality: *Seamless connection to Cloud Computing storage:* The main application allows users to retrieve, modify and upload medical content (medical images, patient health records and biosignals) utilizing Web Services and the REST API [17]. The content resides remotely into the distributed storage elements but access is presented to the user as the resources are located locally in the device. Patient Health Record Management: Information regarding patient's status, related biosignals and image content can be displayed and managed through the application's interface. Image viewing support: The DICOM [18] medical image protocol is supported, while the JPEG2000 standard has been implemented to support loss and lossless compression, progressing coding and Region of Interest (ROI) coding. The progressive coding allows the user to decode large image files at different resolution levels optimizing this way network resources and allowing image acquisition even in cases network availability is limited. The code for performing wavelet decoding on mobile devices in has been modified to support the JPEG2000 standard on the Android platform. Image annotation is also supported, using the multi-touch functions of the Android OS. Proper user authentication and data encryption: User is authenticated at the Cloud Computing Service with SHA1 [19] hashing for message authentication and SSL [20] for encrypted data communication.

VI. Proposed system architecture and implementation details.

Figure 1, illustrates the proposed system architecture for developing and deploying the electronic hospital management system application that utilize Cloud Computing and the VPN connection. The main components of a Cloud Computing Service usually are the platform front-end interface that communicates directly with users and allows the management of the storage content. The interface can be a web client or a standalone application.

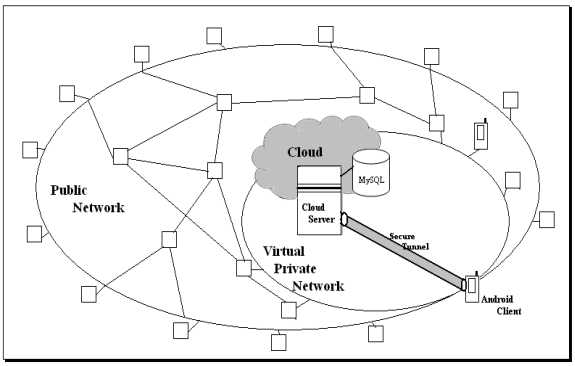

Figure 1 Proposed system architecture.

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. Previous work by authors ([10]) has demonstrated the applicability of mobile devices into retrieving medical image data from remote repositories wirelessly utilizing proper content coding. This work has been now extended to include the functionality of communicating with Cloud Computing platforms and support communication through Web Services. In this context, electronic hospital management system has been developed based on Google's Android mobile Operating System (OS) [2] using the appropriate software development kit (sdk). Android is a mobile operating system running on the Linux kernel. Several mobile device vendors already support it. The platform is adaptable to larger and traditional smart phone layouts and supports a variety of connectivity technologies (CDMA, EV-DO, UMTS, Bluetooth, and Wi-Fi). It supports a great variety of audio, video and still image format, making it suitable for displaying medical content. Finally, it supports native multi-touch technology, which allows better manipulation of medical images and generally increases the application's usability. The Cloud Service client running on Android OS consists of several modules. The Patient Health Record application acquires and displays patient records stored into the cloud. 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. In order to provide the user with data querying functionality, medical records and related data (images and biosignals) are stored into a SQLite [21] file. SQLite is the database platform supported by Android. The file resides into a specific location at the Cloud and is retrieved on the device every time user needs to query data. The query is performed locally and the actual location of the data in the cloud is revealed to the applications. The database file is updated and uploaded into the Cloud every time user modifies data, respectively.

VII. Conclusion

In this paper, we proposed a mobile cloud execution framework to execute android applications for virtualized private cloud environment. Encryption and isolation is used to protect data, against the eavesdropper from users and the cloud providers using Virtual private network. Our approach offers opportunity for end users to migrate their android applications from one mobile to another quickly and efficiently. Our framework is still a work in progress. We believe that more applications and systems can benefit from our approach. It is our hope that our framework will provide users and developers a versatile environment to carry out their applications on a range of systems, from mobile devices to cloud servers, in a convenient, efficient and secure fashion.

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