Achieving Private, Precise Data Collection in Cloud for Telemedicine

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Abstract - 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 mobile system that enables electronic healthcare data storage, update and retrieval using Cloud Computing. The mobile application is developed using Google's Android operating system and provides management of patient health records for telemedicine. The system is developed using openstack cloud which is open source. This article summarizes the implementation details and presents initial results of the system in practice.

Key Words— Telemedicine ,Cloud Storage , Healthcare, Android, Smartphone.

I. INTRODUCTION

MOBILE healthcare systems focus towards achieving two Specific goals: the availability of e-health applications and medical information anywhere and anytime and the invisibility of computing . Mobile pervasive healthcare technologies can support a wide range of applications and services including mobile telemedicine, patient monitoring, location-based medical services, emergency response and management, personalized monitoring and pervasive access to healthcare information, providing great benefits to both patients and medical personnel. The realization however of health information management through mobile devices introduces several challenges, like data storage and management (e.g., physical storage issues, availability and maintenance), interoperability and availability of heterogeneous resources, security and privacy (e.g., permission control, data anonymity, etc.), unified and ubiquitous access. One potential solution for addressing all aforementioned issues is the introduction of Cloud Computing concept in electronic healthcare systems. Cloud Computing provides the facility to access shared resources and common infrastructure in a ubiquitous and pervasive manner, offering services on demand over the network to perform operations that meet changing needs in electronic healthcare application. In this context Openstack Cloud has been developed; a mobile application for both patient and Doctor utilizing Cloud Computing and Android Operating System.

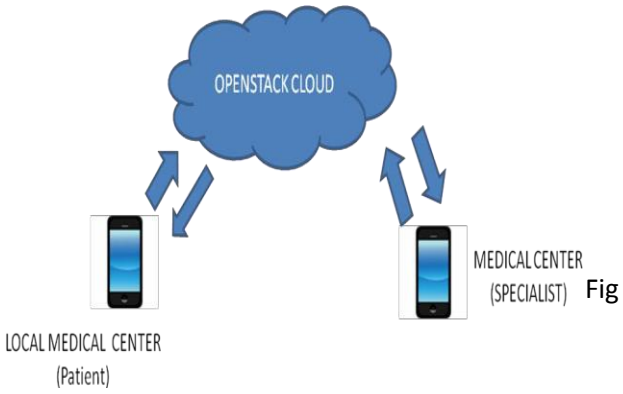

Fig 1.Openstack cloud with smartphones.

OPENSTACK CLOUD

A. *WHAT IS OPENSTACK?*

OpenStack is a cloud operating system that controls large pools of compute, storage, and networking resources throughout a data centre.

All of the above components are managed through a dashboard which gives administrators control while empowering their users to provision resources through a web interface.

SERVICES PROVIDED BY OPENSTACK

OpenStack Compute (Nova) is the component which allows the user to create and manage virtual servers using the machine images. It is the brain of the Cloud. OpenStack compute provisions and manages large networks of virtual machines.

Block Storage (Cinder) This component provides persistent block storage to running instances. The flexible architecture makes creating and managing block storage devices very easy.

Object Storage (Swift) This component stores and retrieves unstructured data objects through the HTTP based APIs. Further, it is also fault tolerant due to its data replication and scale out architecture.

OpenStack Networking (Neutron) It is a pluggable, scalable and API-driven system for managing networks. OpenStack networking is useful for VLAN management, management of IP addresses to different VMs and management of firewalls using these components.

Identity Service (Keystone) This provides a central directory of users mapped to the OpenStack services. It is used to provide an authentication and authorization service

for other OpenStack services.

OpenStack Image Service (Glance) This provides the discovery, registration and delivery services for the disk and server images. It stores and retrieves the virtual machine disk image.

OpenStack Telemetry Service (Ceilometer) It monitors the usage of the Cloud services and decides the billing accordingly. This component is also used to decide the scalability and obtain the statistics regarding the usage.

Dashboard (Horizon) This component provides a web-based portal to interact with all the underlying OpenStack services, such as NOVA, Neutron, etc.

Orchestration Heat This component manages multiple Cloud applications through an OpenStack- native REST API and a Cloud Formation-compatible Query API.

Database as a Service (Trove) Trove is Database as a Service for OpenStack. It's designed to run entirely on OpenStack, with the goal of allowing users to quickly and easily utilize the features of a relational database without the burden of handling complex administrative tasks.

Messaging as a Service (Marconi) Marconi is a cloud messaging and notification service for developers building applications on top of OpenStack. The service features a web-friendly HTTP API, which developers can use to send messages between the various components of their SaaS and mobile applications, using a variety of communication patterns.**(since this project is currently in development we have used a alternate messaging queue RabbitMQ)**

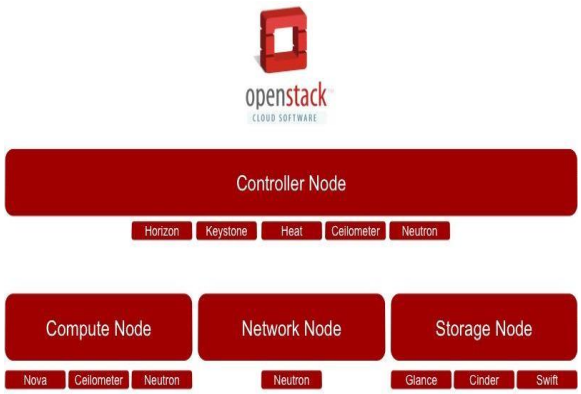

Fig 2.Basic storage Architechture of cloud byopenstack.

IMPLEMENTATION

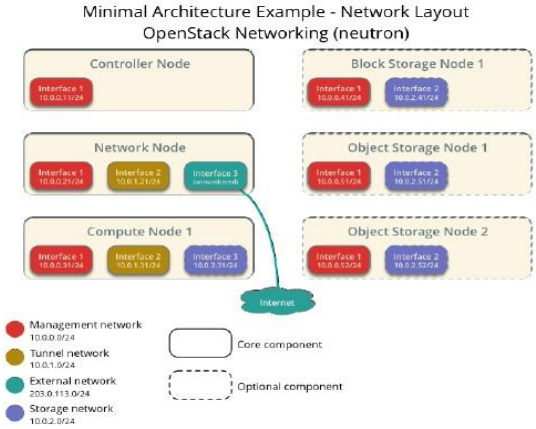

Fig 3.Minimal Architectural requirements forcloud.

Below is an example of a user who wants to host a instance. The workflow diagrams given above describe how the process flows in OpenStack.
All the communication between the nodes are done using a message broker**(RabbitMQ).**

RabbitMQ is open source message broker software (sometimes called message-oriented middleware) that implements the Advanced Message Queuing Protocol (AMQP).

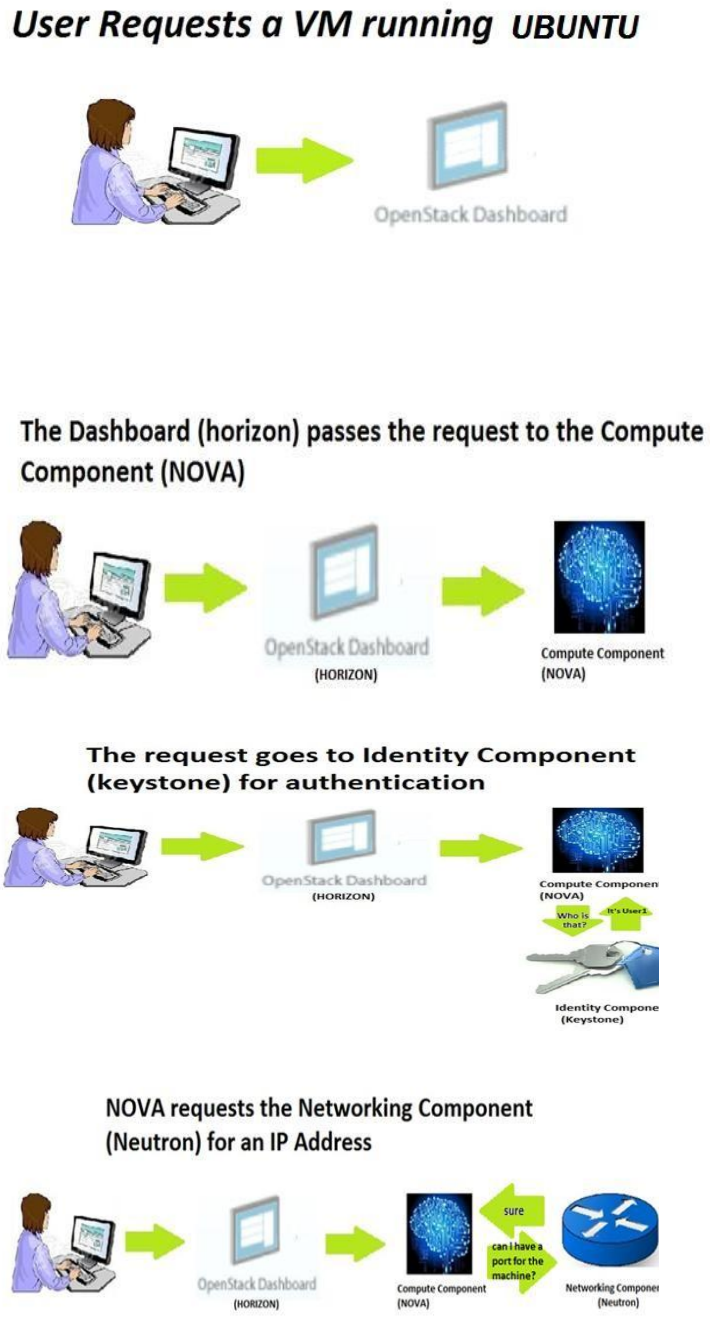

Fig 4.Workflow

ANDROID BASED APPLICATION

Android is a software stack for mobile devices that will include an operating system and its key applications. Android is the software platform and an operating system for the mobile devices based on the Linux operating system and developed by Google and the Open Handset [10]. It allows developers to write managed code in a Java-like language that utilizes Google developed the Java libraries, but it does not support the programs developed in native code .

In our scope,patient can upload information such as symptoms or medical reports on cloud storage using android application for openstack.This data can be downloaded by the Doctors who are registered in our cloud via application on smartphone.They will examine this data to revert back to patients by uploading prescription of advices on cloud storage.

II. TELEMEDICINE APPLICATIONS

Cloud storage and mobile device represent the new IT approaches that offer new economic benefits, an efficient process of service deployment and tight technological alignment with medicine goals. Due to the potential of Cloud Storage, the healthcare industry can take advantage of this technology in order to develop telemedicine solution which will help in the process of improving the quality and efficiency of medical services.
Mobile Cloud Storage offers important advantages to the healthcare sector, especially in what concerns virtual clinics, hospitals and healthcare clinics which all require an almost immediate access to large storage options which are not often ensured by the traditional medical environments. Moreover, healthcare information are needed across various settings and geographies locations in order to overcome this kind of limits and to avoid some significant delays during patients treatment or loss of time for both sides, medics and patients. This new technological approach provides an opportunity to improve medical services, to share information more easily between healthcare providers (physicians, researchers, pharmacists etc) and also to improve operational efficiency in the same time.

CONCLUSION

The sharing of medical information resources (electronic health data and corresponding processing applications) 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. This paper has presented system development using openstack cloud which is open source and android application. The system enables the include improving security by implementing advanced user authentication techniques on the mobile device (e.g, through voice recognition) and deploying the platform in real healthcare environment for evaluating the system in terms of user acceptability and performance.

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