Cloud Computing - Review

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Abstract

In this paper we are going to discuss about the vital role of cloud computing in the field of telemedicine. Cloud computing has had, and will continue to have, a revolutionary effect on telemedicine. In particular we describe how Cloud Computing is the key to user determined goals. In fact, the medical professionals are already using cloud computing in its most basic form effectively. This paper gives a brief explanation of application of Cloud Computing in patient's data collection, its history, characteristics and working as well. We explain the benefits of cloud-based video conferencing which is a cost-effective service. Also this paper explains the improvements of Cloud computing in patient's admission, scheduling and monitoring. Thus we are going to propose the cost effective application of cloud computing in this paper. Finally we summaries the argument with the advances in computer speed and processing power, better software and new hardware will seamlessly integrate the two forever. Thus we are going to propose the cost effective application of cloud computing in this paper.

Keyword- Cloud Computing, British Sign Language (BSL), Wireless Communication

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I. INTRODUCTION

Cloudcomputing[1]in the field of Telemedicine[2] can provide significant economies of scale, through efficiencies gained in power management and allocation of fixed IT assets. Improvements in security and availability can be realized through the use of managed hosting providers with effective plans for failover and network and infrastructure redundancy. Business agility is supported through on-demand, elastic, and pay-as-you-go cloud services. These are all recognized as traditional business drivers for cloud computing, yet what are the drivers specific to healthcare? Let's take a look.

A. A Cloud Computing Solution for Patient's Data Collection in Health Care Institutions

Telemedicine allows remote diagnoses and monitoring of patients [1]. It guarantees agility, safety, and reliability in modern health-care institutions. There are several challenges associated to automation in this sort of environment [2]. Heterogeneity of devices, protocols, and programming interfaces, the requirement for flexible, impact free deployment; the requirement for easy to configure, easy to manage, scalable and, if possible, self-adjusting systems, and others. Sensors are attached to existing medical equipment's that are inter-connected to exchange services; these are integrated to the institution's computing network infrastructure. The information becomes available in the cloud, from where it can be processed by expert systems and distributed to medical staff for analysis. In order to avoid latency during data gathering and information accessibility we have designed service provisioning model that provides adaptive, flexible and simple access to computing resources, enabling a pay-per-use model for computing similar to traditional utilities such as water or electricity.

This model provides inherent support to ideas of outsourcing and on-demand availability of resources, which is desirable for creating composed services in dynamic environments. To provide support to existent sensors in environment we considered aspects of wireless sensor networks (WSN) [3] [4]. Wireless networks facilitate the collection and distribution of information to and from mobile devices. The structure created by wireless sensor nodes is flexible, low cost and can leverage the combination of local sensors to collect data with remote processing power to analyze and deploy information as a utility computing. This setup allows the deployment of dynamic and collaborative applications. This technology provides the solution to Interconnect heterogeneous devices over an open area and without wired structures. This service acts like a door, were medical staff devices can access all available information. There are several practical advantages in this implementation, such as:

- It provides always-on, real-time data collecting;
- It eliminates manual collecting work and possibility of typing errors; and
- It facilitated the deployment process, as wireless networking means no need for cabling or other physical setup. The proposed architecture covers the several elements in current systems, such as:
  - Sensors attached to legacy medical devices replace the necessity of (i) manual data gathering and (ii) data entering on medical system.
  - Computer resources available in the cloud are responsible to (i) organize, index, and make the data accessible, and; distribute the data to (ii) medical staff.

The figure which is given below explains working of patient's data entry in Health Care Institutions.

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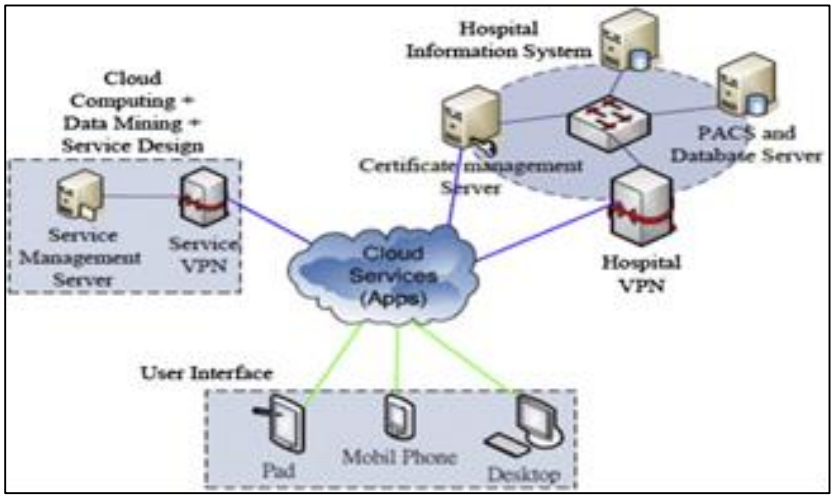

Fig. 1: Design of concept

It is based on simple components deployed to commodity computing devices. In this case, we utilized commercially available wireless routers that allow the replacement of the operating software by Linux solution.

Here Link Sys WRT54 router is used and a simple application that collects the data from a serial port (attached to the medical device), transforms and load this information the exchange server. We suggest that the same functionality can be replicated in different hardware/software combinations.

The elements and interactions are described below:

- Sensor module contains the elements to extract, transform and load the data from the attached hardware; the software provides a standard set of control interfaces easily configurable for different medical equipment's; the data is transmitted over the wireless network to cloud services.
- Exchange Service Application contains a number of service functionalities to organize overall related patients data; it acts as a broker between locally attached devices and remote services; it has two main functionalities: (i) it works as an access point; and; (ii) it allows sensors to store data locally for pre-processing e.g. for aggregation or simple analysis before the transmission to the main system.
- Content Service Application is a common interface used to show information to medical staff; it talks to the exchange service application to request pre-processed data.
- Utility Computing Provider is responsible to provides logical and physical infrastructure for storage, processing and content delivery services.

B. Vital value for the Cloud: Innovation in Medical Field

Cloud computing describes a new supplement, consumption, and delivery model for IT services based on Internet protocols. Due to data integration and sensor based systems Doctors find their jobs much easier. Fig.1 shows a Doctor using touch screen to verify scan details of his patient. At the level of the individual, telemedicine can support improvements in a patient's health and quality of life, particularly for those with chronic diseases, by enabling safer monitoring at home and reducing the number of hospital visits.

Fig. 2: Doctor verifying patient's details

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Doctors might use cloud services for claims processing, labs and prescriptions, rather than manage the infrastructure themselves. This gives them business and process efficiencies to spend more time on developing their practice and delivering higher quality care to their patients. Pharma Sciences utilize cloud computing for elastic storage and high performance computing associated with processing large datasets. Cloud infrastructure providers can offer equivalent functionality at greatly reduced costs with tiered services for availability, utilization and security than if pursued independently by healthcare organizations.

II. TELEMEDICINE THROUGH VIDEO CONFERENCING

Healthcare organizations and providers now use web based conferencing to improve efficiency and reduce travel costs for both themselves and for their patients. The following example shows how simple the technology gives more efficiency and visceral benefits.

Fig. 3: Video conferencing between doctors

Due to national shortage of qualified British Sign Language (BSL) interpreters, patients have to wait for more than five weeks before they can meet a doctor with an interpreter. Sign translate operates an online BSL interpreting service that enables medical staff and deaf patients to make video calls to fully qualified British Sign interpreters so that with the use of their PC, Webcam and the internet connection. The doctor speaks to the interpreter on the phone, and the interpreter and the deaf patient sign the conversation. No specialist equipment's are needed and here the patient can avoid delays as they are easily connected to the interpreters .A deaf patient named Bartholomew Kelly usually asks his daughter to act as an interpreter .At the time while he was ill, his daughter was away for a holiday .So there was no interpreter for him. Bartholomew was profoundly deaf and his first language is British Sign Language (BSL).When he turned up to surgery Dr. Shaikh of the peel precinct surgery in Carlton Vale, used online British sign online service that made the surgery successful and Bartholomew was lucky to have it .Similar to this many surgeries are done not only for the deaf but for all kind of patients.

III. TELEMEDICINE THROUGH SATELLITES

The advantages that satellite communications can bring to telemedicine include instant access to broadband services, particularly in remote areas where telecommunications are poor or non-existent and swift response in disaster situations where speed is vital. Satellites also provide a powerful and relatively inexpensive tool, particularly for video links between multiple users. Plus, costs are constantly decreasing and satellites are a tried, tested and extremely reliable means of telecommunication. In discussing telemedicine in general, participants agreed that although a promising start had been made in many areas, its expansion was hindered by a lack of universal standards; the availability, quality and speed of information transfer; legal and ethical concerns; security of data, funding, and general lack of support, at European and national level, to encourage doctors and hospitals to set up telemedicine services.

Satellites will be used for networking and link the already existing landlines and microwave systems. Such networks will have to have shared channels to be cost effective. Programs must be produced by physicians in collaboration with experts in video communications. The educators must be willing to abandon conservative attitudes towards providing medical education and embrace interesting, innovative methods.

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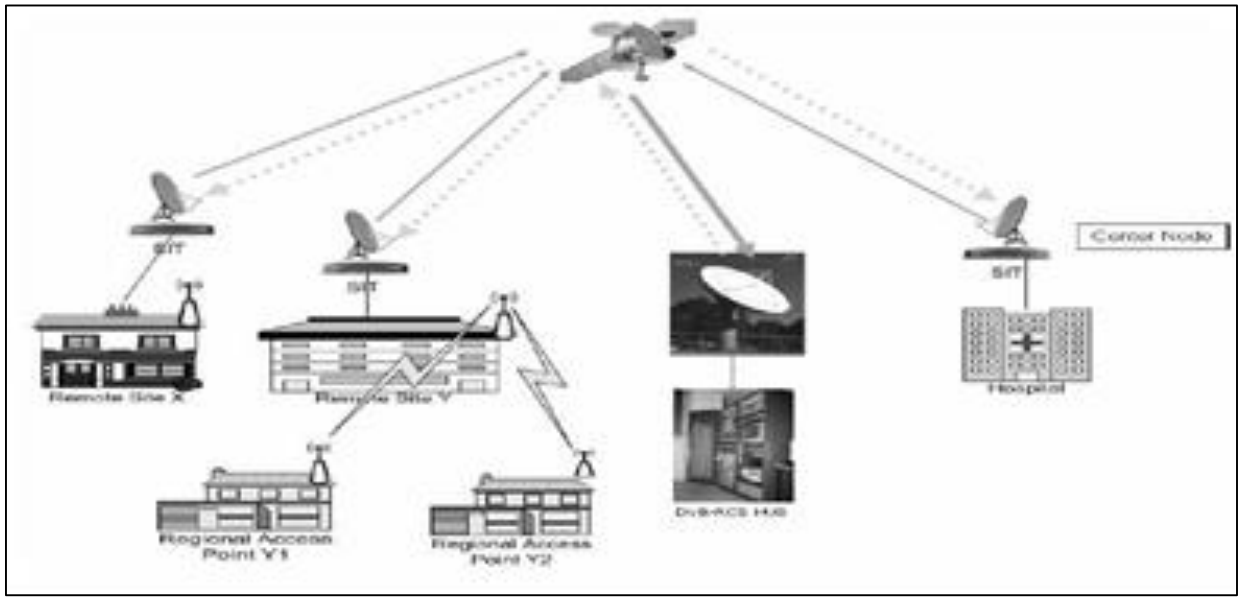

Fig. 4: Diagrammatic representation of satellite communication

IV. TELEMEDICINE THROUGH WIRELESS COMMUNICATION

Continuous and pervasive medical monitoring is now available with the present of wireless healthcare systems and telemedicine services. In emergency situations, real-time health parameter is crucial. Wireless technology could be the best solution for mass emergency situations like natural or human-included disasters and military conflict where patient's records such as previous medication history, Identification and other vital information are necessary. With the assistant of hand held devices in which wireless network integrated, the amount of time the doctors need to identify the problem, trace back the medication history of the patient and consult fellow doctors will be reduced significantly. Moreover, databases of patients that can be built up by continuous medical monitoring will be accessed and updated easily. This has improved both the efficiency and accuracy of the records, as well as save time as there is no duplication of work and no dictation is required. The rapid growth of the technologies extends the potential for exploitation of wireless medical application market. Nowadays, the large-scale wireless network and mobile computing solutions, such as cellular 3G and beyond, Wifi mesh and WiMAX, caregivers can access into vital information anywhere and at any time within health care.

Fig. 5: obtaining any data at any time

V. TELEMEDICINE IN INDIA

In a hospital-strapped country such as India, telemedicine is proving to be a boon. Over 270 hospitals have adopted telemedicine and the sector is estimated to grow at over 21 percent per annum till 2014.In telemedicine, clinical and medical services or information is provided via communication networks such as the telephone and Internet. Yogender Peddinti, senior manager at

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Apollo Telemedicine, told ZDNet Asia in an e-mail interview: "Every day, we treat around 100 patients, spread across India in various specialties through the Apollo Telemedicine Networking Foundation (ATNF)."

Fig. 6: Patient's video conferencing with doctor

The Apollo Hospitals Group, the largest healthcare provider in Asia, began its foray into telemedicine in 1999. Today, the ATNF (the group of telemedicine arm) has successfully set up over 120 telemedicine locations, of which, seven are in countries outside India, including Pakistan, Sri Lanka, Oman, the Maldives and Nepal. According to Peddinti, a teleconsultation ranges between 15 minutes and 30 minutes. Yugal Sharma, regional director for India and SAARC (South Asian Association for Regional Cooperation) at Polycom, told ZDNet Asia in an e-mail interview: "Telemedicine may change the face of healthcare in India by improving access to experts, specialized medical information, diagnostic tools and consultations."

A. Advantages of Telemedicine

- Helpful for the people who are located in remote and rural areas.
- Paves the way to make a discussion with physicians all over the world.
- Very useful for the military men.

B. Disadvantages of Telemedicine

- It takes away the one on one interaction which is very beneficial in psychiatric consultations.
- The dangers of leaking out personal information are high and especially when it becomes available for everyone.
- Many industry experts believe that it is more cost effective however the fact of the matter is that as of now it is very expensive.
- It is quite expensive.

Fig. 7: Telemedicine

VI. CONCLUSION

Increased use of telemedicine could help reduce the significant disparities between rural healthcare and this delivered in urban and suburban areas. This was said by United Health. There are some measures that must be taken so that it will reach all the parts of the world effectively. The measures include expansion of broadband connectivity in rural areas; encourage physicians to

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incorporate telemedicine in to their practices and also to reduce regulatory barriers to telemedicine use. According to the report, from the UnitedHealth Center for Health Reform and Modernization, payments to physicians for remote consultations are more prevalent than those for remote monitoring of patients. This makes it cost effective while using it for rural area.

DEFINITIONS, ACRONYMS AND ABBREVIATIONS

1) Cloud computing is the delivery of computing as a service rather than a product, whereby shared resources, software, and information are provided to computers and other devices as a utility (like the electricity grid) over a network (typically the Internet).
2) Telemedicine is the use of electronic communication and information technologies to provide or support clinical support clinical health care at a distance.
3) Videoconferencing is the conduct of a video conference (also known as a video conference or video teleconference) by a set of telecommunication technologies which allow two or more locations to interact via two-way video and audio transmissions simultaneously. It has also been called 'visual collaboration'.
4) Wireless telecommunications is the transfer of information between two or more points that are not physically connected. Wireless operations permits services, both short and long range communication.

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