COMPUTING IN THE CLOUD FOR MEDICAL CARE

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Abstract

The most recent advances, information technology (IT) has transformed the healthcare industry. The majority of stakeholders see cloud computing as an exciting and vital methodology in the healthcare industry. In the field of electronic healthcare, it has the unique capacity to provide unlimited capacity and power of procedure. As a result, computers are only and effectively utilized for resource sharing in the healthcare industry. This study offers an overview of different cloud-based e-healthcare designs that have been suggested, along with problems with the underlying technology and the key arguments in favor of moving toward one, particularly in Malaysia.

Keyword: information technology(IT), Cloud

Introduction:

In order to promote, maintain, monitor, or restore health, healthcare is defined as the service provided to individuals or populations by healthcare service providers [1]. Internationally, the healthcare crunch is well forecast because it is anticipated to continue to grow indefinitely in the future due to real causes including anticipated demographic changes related to the aging population, life expectancy, and lifestyle disorders.

Due to Malaysia's high ranking as one of the most important emerging nations, particularly among the ASEAN countries, it has significantly increased as a favored healthcare tourism destination for the global market. The goal of this agenda is to develop a seamless and integrated healthcare system that will be the preferred healthcare destination in the constituency, which is in line with the vision and strategies of Malaysia's 12 National Key Economic Areas (NKEA) under the new Economic Transformation Program (ETP) for the economy drive over the next ten years [2].

The key selling point of healthcare in Malaysia is the availability of top-notch medical treatments that are both easily accessible and fairly priced for patients. The public and private sectors make up Malaysia's two main healthcare delivery systems. Malaysia's total healthcare spending is estimated to be 4.75 percent of GDP, with the public and private sectors each contributing correspondingly 55 and 45 percent of the total budget.

Accordingly, the value of the Malaysian healthcare sector is estimated to be $8.4 billion, with 145 public a review to statistics, there are hospitals, 2880 health clinics, and 165 mobile health clinics, while the private sector has 217 private hospitals, 34 maternity nursing homes, 36 ambulatory care centers, and 6442 medical clinics[3]. The expanding healthcare industry and the increasing number of domestic and international patients will undoubtedly result in a large aggregation of patient data that is diverse, accurate, and necessitates the use of a faultless system. The intricacy of the situation increases the requirement for IT expertise, which poses two major issues for the healthcare system.

Moving the healthcare industry to the cloud in order to combat this tendency will undoubtedly be a good idea rather than trying to solve each issue separately [4]. As the sole representative of the current IT trends of effectiveness, business agility, and cost savings, cloud computing is highly regarded. The purpose of this study is to evaluate different cloud-based healthcare architectures that have been suggested, along with any problems that may arise with this technology and the main justifications for moving Malaysian healthcare toward the cloud.

II. OFFSHORE COMPUTING

Cloud computing is an archetype that enables universal, on-demand network access to a shared, configurable pool of computer resources, including servers, storage, networks, applications, and services. Additionally, cloud computing operates with little managerial effort or service provider contact, according to its own unique criteria [5]. According to the National Institute of Standards and Technology, U.S. Department of Commerce, this masterpiece has five crucial qualities, three service models, and four deployment models. The following are the five highlighted qualities:

On demand Self Service: Consumer or client of cloud computing can fascinate computing capabilities individually including server period and network storage as required spontaneously deprived of human interaction with the entire service provider. Resource pooling: A multi-tenant model that enables various physical and virtual resources to be dynamically assigned and reassigned rendering to consumer demand without control or knowledge over the precise location of the provided resources, unless in a higher level of abstraction, is used by the providers to serve a large number of consumers.Rapid elasticity: In some circumstances, cloud computing may automatically scale outward and inward in response to demand. It can also be provisioned and released flexibly. One of the most important and pressing issues for consumers in particular is the ability to provision for an appropriate period of time and in an unlimited amount. Measured service: By integrating into a range of services, cloud computing systems could control and optimize resource usage with some level of abstraction. Typically, this is carried out using the usage conceptual model. Both the provider and the consumer have the ability to track, manage, and report resource usage, which dramatically increases transparency for both sides.

A Service Models in Cloud

Operating expenses and flexibility have a strong relationship with service models. The operating costs of SaaS are the lowest, followed by PaaS and IaaS, and these conditions lead to higher flexibility in IaaS, which is followed by PaaS and SaaS. The factors mentioned above are inversely proportional. The following are the three essential service models for cloud computing.

Software as a Service (SaaS): Service provided or available to theclient is to use the applications created by host which directly available on a cloud infrastructure, and the applications are easily accessible throughout various devices such as a web browser or even through a program interface. Infrastructures including network, servers, operating systems, storage, and even individual application capabilities are not managed by the consumer or client unless with the omission oflimited users specific application configuration settings.

Platform as a Service (PaaS): With PaaS, users have the ability to upload apps they have developed themselves or purchased that were created with the aid of programming languages, libraries, services, and other tools that are supported by the service provider. The consumer has control over the deployed programs and possibly the configuration options for the application hosting environment but does not manage or control the underlying cloud infrastructure, including the network, servers, operating systems, or storage.

Infrastructure as a Service (IaaS): This service allows theestablishment of processing, network, storage, and ensuring computing resource in where end users are arrayed and route arbitrary the software such as operating systems and applications. As per remaining other two services, theconsumer does not oversee the cloud infrastructure but administer over frameworks, storage, and set up applications with therestricted regulator of selected components networkingsuch as host firewalls.

PB.Distribution Models

The four model types used in cloud computing are as follows:

Free cloud: The general public may freely use this kind of cloud infrastructure. Organizations that are corporate, academic, governmental, or a combination of these are often accountable for managing and running them as they are owned. The idea of payment is that it authorizes a spectrum of resources to satisfy continuously varying requirements, whether favorable or unfavorable.

Private cloud: A single firm with numerous clients may only use the private cloud's infrastructure. It may exist on or off premises and be owned, managed, and controlled by the organization, a third party, or a combination of them. Due to the fact that the data will only be used by one company, there is more leeway in applying relevant compliance requirements of data ownership and seclusion.

Community Cloud: This type of model is designed specifically for thecommunity of consumers from organizations that have communal concerns such as in mission and policies. A third party, one or more than one organization from thesamecommunity and even combination of the twomention above may hold, managed, and operate this type of cloud and it may exist as on or off premises. Sharing conceptual of this leads the organizations to typically have parallel security, privacy, performance and even compliance requirements, but conversely, the community curbs participant from similar industry or desires. Hybrid Cloud: This hybrid cloud architecture is made up of two or more of the above-mentioned distinct cloud infrastructures but continues to exist as a single, distinct entity thanks to standardized or proprietary technology that enables data and application portability.

III. HEALTHCARE SECTOR CLOUD COMPUTING

The healthcare industry has historically underutilized technology, especially when it comes to enhancing patient care. Despite the fact that healthcare has been around for sixteen years now, a large number of systems still rely on manual labor or paper-based communication, such medical records, to inform and make decisions in the majority of situations. The healthcare industry is very different from other industries, and the main distinctions between the two can be divided into three categories.

First of all, this industry is heavily regulated by legislation, including rules to protect people. Additionally, the cost of high-risk errors in healthcare is higher than in any other industry. Finally, this industry has a large number of different units, including hospital administration employees, labs, and patients.

The exceptional level of patient privacy and security makes the data itself sensitive, and any misrepresentation will have a serious impact and occasionally result in life or death. Therefore, the adoption of new technologies may result in the sensitivity of data processing being handled slowly. Healthcare is being reformed across the board, and as part of this reform, healthcare information technology (HIT) are being modernized. Without a doubt, cloud computing is the main driver of this transition [7].The adoption of cloud computing in the healthcare industry has the potential to significantly improve the healthcare system, especially where comfort, efficacy, and dependability are concerned. Cloud computing provides an infrastructure that enables medical facilities,esearch institutions that use computational resources at lower initial capital expenditures, such as practices and insurance businesses [7]. Implementing cloud computing in healthcare can significantly reduce access costs, which are typically in the millions of dollars annually, especially in terms of duplication and waste. As stated by authors in their articles below, it can be said with confidence that cloud computing in healthcare is expanding day by day and is playing a significant role in the industry Moving toward cloud computing in the healthcare system is the best course of action, per sources [8], as the rise of electronic records has led to a number of insoluble issues [4] [9].

[9] Reference Although there are benefits to this choice, the suggested transfer of the healthcare sector to the cloud has some risk that is closely tied to privacy and security. As a result, it's important to maintain, update, and monitor

the hardware and software that contain healthcare data because doing otherwise could have unfavorable effects. If cloud computing is included into the healthcare industry, complexity and facilitating can be decreased while communication among the information systems can be increased. Doctors can access patient records at any time and from any location because to the cloud computing architecture's capacity to compile, integrate, and analyze data from diverse sources in real time. The capacity to restore data in an emergency situation such as disaster recovery and backup data redundancy as it replicates the data in several locations for more heft and accessibility is one of the crucial services that cloud computing might provide in the healthcare industry. [10] [8] [11].

A. Current State Of Cloud Computing In Healthcare

Over the last few years, cloud computing technology has gradually gained attention in research and numbers of implementations have increased in public and private sectors as well. According to Economics Commerce and Management of United Kingdom, major businesses was expected to invest over $150 billion on cloud computing by 2014 but however thefinal results shows the final amount is far more higher than predicted earlier. ThereforA human life is incredibly valuable, but access to medical resources is limited, claims Reference [13]. The majority of affluent nations are setting up healthcare data clearinghouses to help make data more transferable than in the past. For instance, Canada is the nation that officially recognized national diagnostic imaging repositories as a means of improving patient care and reducing costs. The patient care will undoubtedly be improved if all nations continue to invest in cloud computing technology. According to research, 37% of healthcare service companies have cloud adoption strategies in place.

ThereforA human life is incredibly valuable, but access to medical resources is limited, claims Reference [13]. 25% are currently executing, while 22% are still in the planning stages, and this will undoubtedly push each industry. Additionally, the 5% of users who have already adopted cloud computing have seen approximately 20% cost savings on deployed programs, which is a positive development that will raise this industry's standing.Previously, majority of IT departments providers are habituated to traditional technologies in where the necessity of licensed software platforms, and heavy hardware infrastructures and followed by a large group staff. As innovated technologies presented, IT infrastructure demands forces the bounds of the assured more efficient. While groundbreaking in theory, government enticements do not shield overhauling legacy equipment cost and modernizing facilities. As electronic health records, advanced clinical systems are evolving and becoming more well-known which causes current storage resources to be extended.

HEALTHCARE IN MALAYSIA USING CLOUD COMPUTING

The healthcare cloud computing business has occasionally demonstrated a continuous rise [17]. The development of cloud adoption can be attributed to regulatory effects from the American Recovery and Reinvestment Act of 2009 (ARRA), which promote the use of electronic patient information in hospitals [18]. One of the most important developments right now in Malaysia is the installation of cloud-based ICT solutions, which is expected to grow from $43 million in 2012 to $900 million in 2020. Comparatively speaking, especially after the middle of 2010, Malaysia's interest in cloud computing and that of other nations is relatively sim This claim is more firmly reinforced by the downward trend in Google search results that began in the middle of 2011, which ominously suggests that technology has permeated every aspect of human life.

cloud computing in its many forms. Recently, decisions have been made to support adoption and implementation of cloud services in each association by the Malaysian government, cloud stakeholders, commercial businesses, and public ones [19]. Similar to this, IBM recently announced in Malaysia, in particular, the national expansion of Kumpulan Perubatan Johor, also known as KPJ Healthcare Berhad, in the cloud healthcare infrastructure. As the first private healthcare provider to use cloud computing, KPJ Healthcare Berhad deserves recognition. Additionally, KPJ Healthcare Berhad, a well-known private healthcare provider, serves more than 2.8 million patients annually in more than 25 hospitals in Malaysia and 4 hospitals abroad [20].The management of KPJ expects that this initiative will allow them to cut their IT costs and expenses by 30% to 40% over time. Furthermore, owing to support integration that will work to provide better, faster, and effective services to patients and families when they need them at the earliest moment possible, collaboration across KPJ hospitals using cloud computing, particularly in the

network, is further protected intermediately. Generally speaking, KPJ Healthcare may function at a reduced cost while maintaining its efficiency, dependability, and flexibility by moving to cloud infrastructure [21].

V.CONCLUSION

In summary, cloud computing provides its own set of advantages for the healthcare information system, which go beyond simply focusing on issues like storage and bandwidth and results in cost savings through resource optimization. Additionally, by utilizing cloud computing in healthcare settings,patient communication should be excellent. This implementation directly aids in achieving better treatment outcomes or milestones and raises the caliber of patient care. As a result, the advent of cloud computing as a solution in the healthcare sector allows management to manage their individual patients' information and health in a more exact manner that complies with their general regulations.Additionally, it is crucial to recognize the requirements of a healthcare business while using cloud computing in order to overcome challenges like security concerns that form as

major hurdles. Based on the aforementioned assertion, cloud computing providers, especially those serving the healthcare industry, must conduct multiple research in this field to gather sufficient proof of the security risks. When the healthcare industry has greater confidence in and is more eager to fully use cloud computing as a remedy for these shortcomings, cloud providers can create appropriate security strategies in that environment.The Ministry of Health in Malaysia, working with the other ministry bodies, has to place more focus on this important cloud computing asset, which will help this idea win out in the long run. To do this, the government should raise financing or investment in the health sector, which will enable them to use it wisely in raising the bar for cloud computing.

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