Healthcare Cloud Service Architecture and Service Platform

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ABSTRACT—*Telehealth is an ideal way to provide the healthcare services to people. Contrast to previous programs applied to individual patient care only, telehealth, or the terminology of ICT integration "cloud computing", is more broadly to population health well development. This study takes the Taiwan T city healthcare cloud service as a case study to survey 1) the architecture of government healthcare cloud; 2) the services of healthcare Cloud Computing; 3) the development stages from a few ICT services to healthcare cloud. The findings enhances the knowledge for developing cloud computing service and provides the experience to mitigate the transformation risks.*

Keywords—Healthcare, Cloud services

1. INTRODUCTION

To adapt the technology rapid changes for healthcare, telehealth is an ideal way to provide the healthcare services to people. Contrast to previous telehealth programs applied to individual patient care only, nowadays telehealth, or the latest terminology of ICT integration "health cloud", might be more broadly to population health well because development and adoption of teleheath has already increased the spectrum of information and communication technologies in health cloud (Alverson et al., 2010; Doarn & Merrell, 2014).

The definition of Cloud Computing is the applications delivered as services over internet, hardware and systems software in the datacenters that provide those services. In Taiwan, the government also revealed 8 important items regarding the infrastructure construction for application of cloud (Yang & Hsu, 2011), including the health cloud. With the benefits the Cloud Computing (Hameed, 2003; Wu, Wang, & Lin, 2005, 2007), most of governmental telehealth / telecare programs upgrades exist healthcare service model and migrate the service to the cloud servers, cloud platforms, and cloud infrastructures.

2. MATERIALS AND METHODS

2.1 The Concept of Cloud Computing

Cloud computing is defined as a type of computing that relies on sharing computing resources rather than having local servers or personal devices to handle applications(Armbrust et al., 2010). In cloud computing, the word cloud is used as a metaphor for the Internet.So cloud computing means "a type of Internet-based computing," where different services — such as servers, storage and applications — are delivered to an organization's computers and devices through the Internet(Zhang, Cheng, & Boutaba, 2010). Cloud computing uses networks of large groups of servers typically running low-cost consumer PC with specialized connections to spread data-processing chores across them. This shared IT infrastructure contains large pools of systems that are linked together. Often, virtualization techniques are used to maximize the power of cloud computing.

Cloud computing is a general term for anything that involves delivering hosted services over the Internet. These services are broadly divided into three categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS).IaaS providers such as Amazon Web Services (AWS) supply a virtual server instance and storage, as well as application program interfaces (APIs) that let users migrate workloads to a virtual machine (VM). Users have an allocated storage capacity and start, stop, access and configure the VM and storage as desired. IaaS providers offer small, medium, large, extra-large, and memory- or compute-optimized instances, in addition to

customized instances, for various workload needs.

In the PaaS model, providers host development tools on their infrastructures. Users access those tools over the Internet using APIs, Web portals or gateway software. PaaS is used for general software development and many PaaS providers will host the software after it's developed. Common PaaS providers include Salesforce.com's Force.com, Amazon Elastic Beanstalk and Google App Engine. Finally, SaaS is a distribution model that delivers software applications over the Internet; these are often called Web services. Microsoft Office 365 is a SaaS offering for productivity software and email services. Users can access SaaS applications and services from any location using a computer or mobile device that has Internet access.

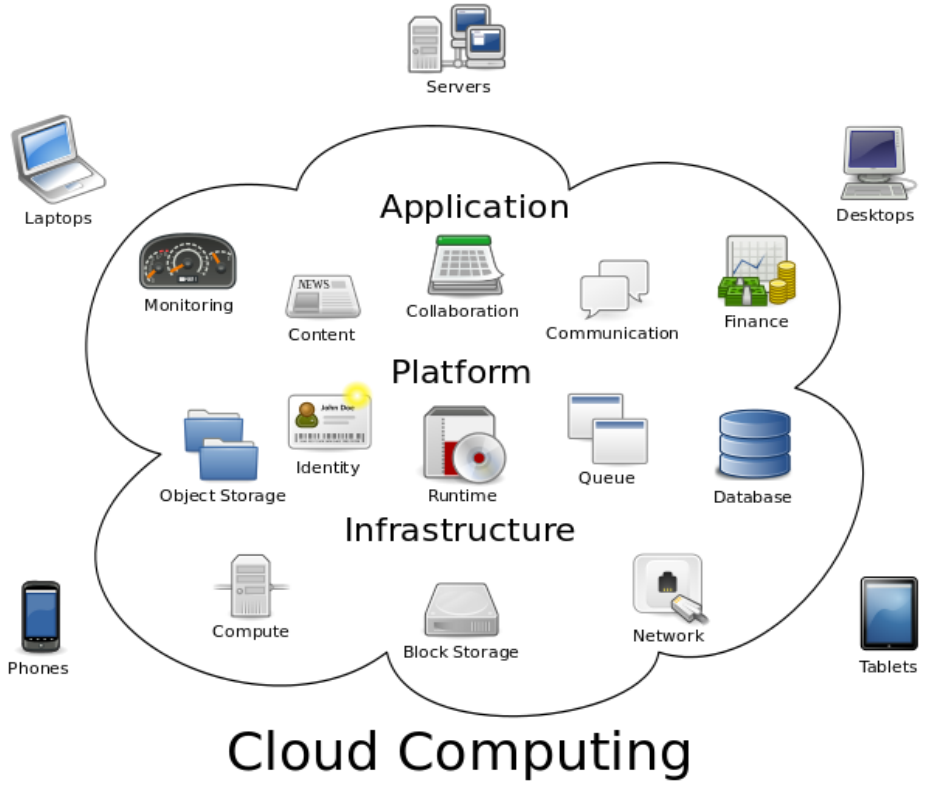

Figure 1: The Concept of Cloud Computing (Wikipedia, 2010)

2.2 Computing Services

Cloud Computing services is first initiated by Amazon.com and several prominent technology companies, such as Google, SUN, IBM, Oracle, and Salesforce, etc. With the combination of existing technology elements like virtualization, grid computing and distributed computing, Cloud Computing delivers scalable IT services via the Internet on a pay-per-use basis(Weinhardt et al., 2009). Cloud services thus allow for more optimal resource utilization, easier access, and more effective cost reduction(Venters& Whitley, 2012).

2.2 Telehealth

By innovation in information and technology communication, healthcare has already extended its adoption from individual person to population broadly(Alverson et al., 2010) . Most countries are aggressively upgrading their public health system with advanced telehealth tools. There still needs researches to prove the feasibility of telehealth technologies applying on national clinical and public health system (Alverson et al., 2010). Before explicit evidences on application of telehealth technologies revealed, the key factor in telehealth development is the level of integration on government organizations and non-government organizations services in interdisciplinary research and medical related legislations.

2.3 Telehealth Service Model

The T city health telehealth program has offered non-emergency health assistances from the measurement of blood

pressure, glucose, body temperature, and BMI since 2008. Most telehealth services are designed for elderly based on the perspective of chronic disease, and make telecare a niche service in healthcare. T city telehealth program is constructed based on the existing public health infrastructure to adopt the seamless public health service to people. The service architecture of the program could be classified into 3 groups: members, service agents, and service providers.

T city telehealth program provides followed services: remote self-administrated vital signs measurement and analysis, vital sign abnormality alert, personal health and medication consultation, personal health record downloading, distance health education, social welfare referral service, health activity notification, personal health evaluation, respectively.

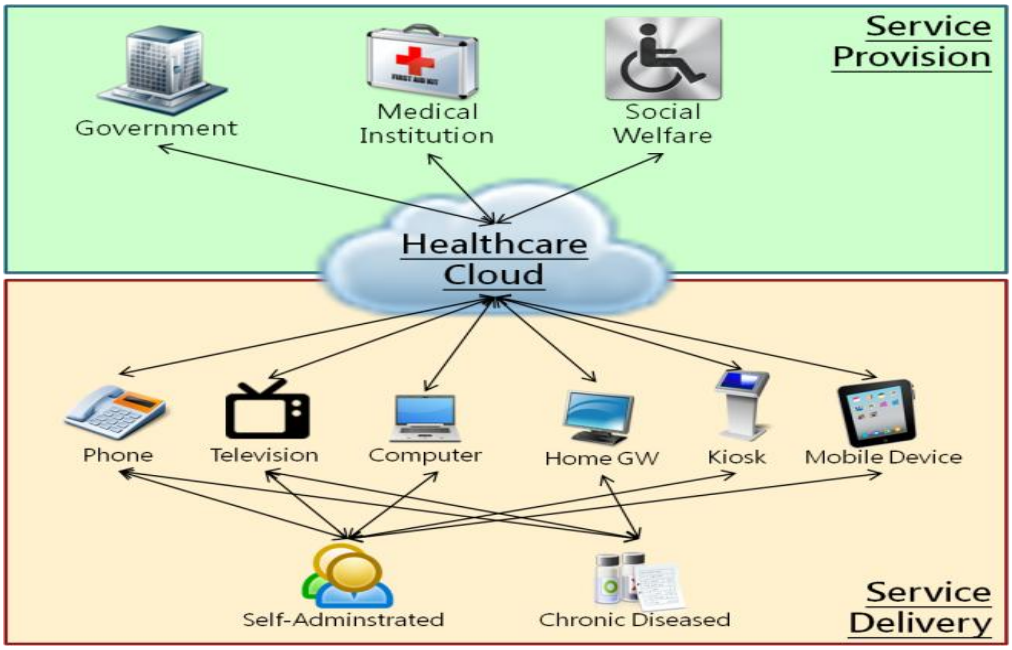

Figure 2: Healthcare Cloud Service Model

In the traditional service model, members access the data via customized home gateway, kiosk, phone, and web only. In the healthcare cloud service model, people can access the data from digital television by set-top-box and mobile devices Apps. The latest ICT makes members access service via more digital channel, the service logic hence upgrade. Members can use location-based-service by mobile devices with GPS, the consultation can be carried in video conferencing, physical visiting and telehealth can be connected more closely.

2.4 System Architecture

T city healthcare cloud service delivers in 3 heterogeneous network. The system architecture of the service is shown in Figure 3.Members connect the call center by phone via public switched telephone network. The request signal transform into digital format at the contact center server. The operators in the call center can access the correspondent information from healthcare server and the supported systems after the identification the caller of inbound calls.The healthcare cloud service provides location-based service when user access service via mobile device, home gateway, and kiosk. However, mobile device with GPS is the only type of device locating the position by GPS network.Most members access the healthcare cloud service, via internet, from healthcare server and supporting systems. Various authorization and authentication are controlled by the healthcare cloud and processing at the first entry of service.

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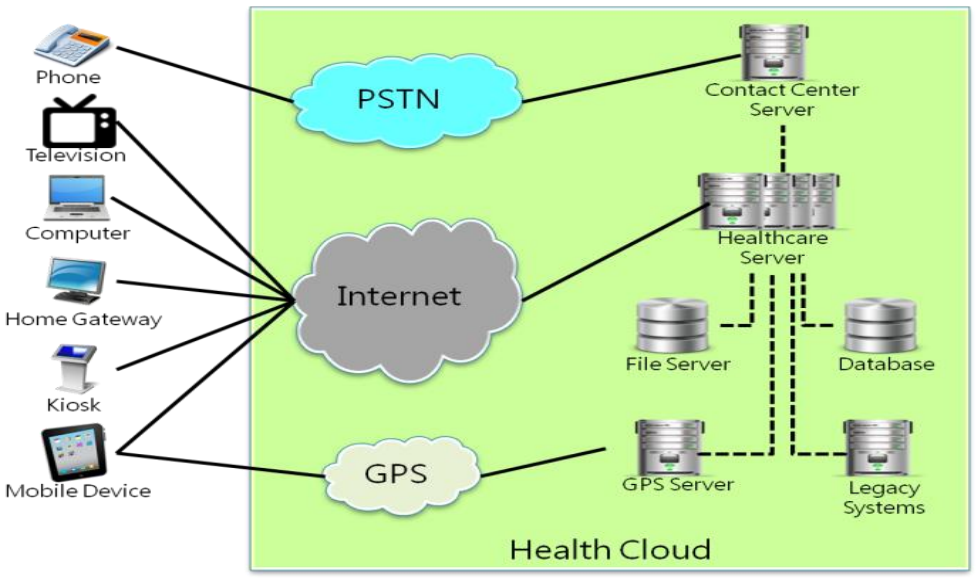

Figure 3: System architecture of healthcare cloud service

3. DISCUSSION AND CONCLUSION

It has been more than 10 years since Taiwan government started e-government programs. Taiwan government catches the information trend well and has opened a "8 clouds program" already. Many organization and company catch the Cloud Computing fad and build lots of "cloud service". T city government intends to build a "healthcare cloud service". They develop an integrated service for people and become a cloud service with high satisfaction.

This study shows that T city government runs the healthcare cloud service with versatile accessing channels, and complete service types. T city delivers seamless service via versatile channels after complete integrating the service provision with mitigate the Cloud Computing risks instead of compositing the services in a hurry to catch the fad. This might be a sharp advice for those governments preparing to deliver the Cloud Computing service and also a successful case to follow.

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