Chapter 37

Healthcare SaaS Based on a Data Model With Built-In Security and Privacy

Ruchika Asija
Indira Gandhi National Open University, India

Rajarathnam Nallusamy
Embnology Solution Private Limited, India

ABSTRACT

Cloud computing is a major technology enabler for providing efficient services at affordable costs by reducing the costs of traditional software and hardware licensing models. As it continues to evolve, it is widely being adopted by healthcare organisations. But hosting healthcare solutions on cloud is challenging in terms of security and privacy of health data. To address these challenges and to provide security and privacy to health data on the cloud, the authors present a Software-as-a-Service (SaaS) application with a data model with built-in security and privacy. This data model enhances security and privacy of the data by attaching security levels in the data itself expressed in the form of XML instead of relying entirely on application level access controls. They also present the performance evaluation of their application using this data model with different scaling indicators. To further investigate the adoption of IT and cloud computing in Indian healthcare industry they have done a survey of some major hospitals in India.

1. INTRODUCTION

A methodical, continuous and systematic adoption of innovative solutions is required in healthcare sector for giving cost- effective, efficient, organized and high quality services. Traditionally, in healthcare, the primary focus has been on digitisation of health records and automation of back office systems, billing and reimbursements making the healthcare industry a slow adopter of technology. But these days, technology has taken roots in human lives making it more intrinsic. Our expectations on communications, data, content, and applications have increased in a way such that an immediate and global access to

information has become a de-facto requirement in today's world. With the enactment of HITECH Act (Health Information Technology for Economic and Clinical Health Act) in 2009 (HITECH, 2009), by the end of 2010, most of the doctors in United States were using electronic medical records. The PPACA (Patient Protection and Affordable Care Act) enacted in March 2010, elevated the goals of high quality and affordable health insurance, expansion of public and private insurance coverage and reduced the costs of healthcare for individuals and the government. While choosing the best option to store and backup electronic protected health information (ePHI) as represented by the Act, many healthcare providers are looking at cloud storage. The proliferation of cloud computing has allowed many organisations to extend their environments, utilize flexible resources, and empower their users. It can improve the delivery of healthcare services and can also benefit healthcare research. With the adoption of cloud computing, large IT investments can be converted to a series of smaller operating expenses. Cloud architecture could potentially be superior to traditional electronic health record (EHR) designs in terms of economy, efficiency and utility (Eugene J Schweitzer, 2011). According to a survey of cloud computing adoption in healthcare provider organizations, HIMSS Analytics found that 83% of IT executives are using cloud services today, with SaaS based applications being the most popular (HIMSS Analytics, 2014). Considering the proliferation of cloud computing in various domains, we propose to leverage it to create an application that can foster and support the healthcare system. The accelerating migration of healthcare to cloud can help in supporting increased sharing and accessibility of health data. But it also raises the concerns over the security and privacy of healthcare data. The challenging task of providing a solution which can protect the security and privacy of health data along with efficient performance by using a data model with built in secuirty is addressed in this paper.

The rest of the paper is organized as follows: The need and importance of cloud computing in healthcare is discussed in Section 2. Some of the frameworks and models which have been implemented in cloud are briefly outlined in Section 3. The concerns and challenges in providing security and privacy to healthcare data are presented in Section 4. To deal with such concerns and security and privacy challenges, the application "Healthcare SaaS" is presented in Section 5 implemented in cloud and its architecture is described in Section 6. Implementation and performance evaluation with all scaling indicators for our application "Healthcare SaaS" on cloud are discussed in Section 7. The advantages of the application using the data model (Asija et al., 2014) is discussed in Section 8. In order to understand the level of adoption and implementation of IT in healthcare and the move towards cloud, we have done a survey in three major hospitals of India which is discussed in Section 9 and the conclusions and future work are presented in Section 10.

2. CLOUD COMPUTING CONCEPTS

As defined by National Institute of Standards and Technology (NIST) (Cloud Survey, 2011), Cloud Computing is a model for enabling on-demand and convenient access to shared pool of computing resources that can be configured, provisioned, and released rapidly with minimum effort or cloud provider interaction. Five essential characteristics of cloud computing identified by NIST are: broad network access, on-demand self-service, resource pooling, measured service and rapid elasticity or expansion. *Broad network access* defines the capabilities available over the network and accessed through standard mechanisms and used by heterogeneous thick or thin client platforms, for example, tablets, laptops and mobile phones. *Resource pooling* incorporates a multi-tenant model with dynamically assigned physical

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