Chapter 21
Research of Multiple Tenants for Medical Information Service

Jie Liu and Qing Zhu

Abstract With the development of Web technology, SaaS-as-a-Service (SaaS) mode which is used as the top-level architecture of cloud computing has become a new concept of software as a service model. How to design efficient and secure system architecture is the key of the application of the SaaS model. This paper starts with the medical information field service, giving the solution of the medical information service platform. This scheme is mainly designed that (multi-tenant) and system security issues can be well designed in SaaS software.

Keywords Cloud computing · SaaS · Software as a service · Medical information service · Multiple · Tenants

21.1 Introduction

In recent years, the number of diabetic patients increased very fast in China. With the rapid development and maturity of Web 2.0, regardless of diabetic patients or the general population are concerned about the situation of diabetes through the Internet. However, in China, due to the different types of existing diabetes information service platform, scattered resources and information sharing limited, leading the patients to seek care from blindness, medical treatment of intermittent process of treatment and lack of continuity in medical statistics are not standardized. Diabetes medical information service platform is not well play a role.

Facing the problems in the existing platform, compared with the traditional software systems, we should combine with the Software, Service SaaS model [1],

J. Liu (✉) · Q. Zhu
School of Software Engineering, Beijing University of Technology, 100124 Beijing, China
e-mail: liujie023525@sina.com

W. Lu et al. (eds.), *Proceedings of the 2012 International Conference on Information Technology and Software Engineering*, Lecture Notes in Electrical Engineering 212,
DOI: 10.1007/978-3-642-34531-9_21,

provide software services in a low cost and low risk way. SaaS model with its own advantages and the ability of internet spreading quickly build software services to avoid duplication a waste of resources.

At the same time, it enables the software service provider to pay more attention to the quality of software services. In this paper, the actual research project, combined the theory and practice, we analyze the significance of the SaaS model in the diabetes medical information service platform, and discuss the need for and the proposed SaaS applications in the medical services industry.

21.2 Advantage of the Medical Information Services Based on SaaS

SaaS is (software as-a-service [2]) referred, it is a mode of delivering software over the Internet, users do not need to purchase software, but leased to the provider of Web-based software to carry out business activities, without the need for software maintenance, service providers, the Chamber of Commerce, discretionary management and maintenance software, for many small businesses, SaaS is the best way for the use of advanced technology, it eliminates the enterprises to purchase, build, and maintenance of infrastructure and application needs.

21.2.1 SaaS Service Model

SaaS service providers to build the information technology needs of all network infrastructure and software, hardware, operating platform for SMEs, and it is responsible for the implementation of all pre-and post-maintenance and a range of services. Enterprises don't need to purchase hardware and software, construct of the engine room, the recruit IT person, just simply pre-pay a one-time project implementation costs and regular software rental service fee, they can enjoy the information system via the Internet., There is no basic difference, in effect, between SaaS service model and self-built information systems, but it saves a lot of funds for the purchase of IT products, technology and maintenance to run and easy-to-use information systems, thus greatly reduces the SME information the threshold of risk.

21.2.2 SaaS Service Advantage

For medical items in the subject, the advantages of the SaaS model are as follows: From the technical point of view: It no longer needs to arrange the IT and technical persons, meanwhile can get the latest technology to meet their information management needs.

From an investment point of view: only a relatively low investment, not a one-time investment in place, do not take up too much system operation and maintenance funds, thus easing the pressure of inadequate health care funding; without considering the cost of depreciation, and timely access to the latest hardware platforms to get the best solution.

In terms of maintenance and management: taking rented to business management of the platform does not require special maintenance and management person which do not need to pay additional costs for maintenance and management person. Greatly ease the pressure on the human, to enable them to concentrate funds to strengthen the service building and improve the quality of service.

21.3 Medical Information Service Model Based on SaaS

21.3.1 SaaS Maturity Model

SaaS software to serve multiple tenants, high-performance, configurable, scalable SaaS services characteristic of SaaS maturity model is generally divided into four levels. These models of SaaS maturity are illustrated in Fig. 21.1.

Level 1—Ad-Hoc/Custom

At the first level of maturity, each customer has its own customized version of the hosted application and runs its own instance of the application on the host's servers. Migrating a traditional non-networked or client-server application to this level of SaaS typically requires the least development effort and reduces operating costs by consolidating server hardware and administration.

Level 2—Configurable

The second maturity level provides greater program flexibility through configurable metadata, so that many customers can use separate instances of the same application code. This allows the vendor to meet the different needs of each customer through detailed configuration options, while simplifying maintenance and updating of a common code base.

Level 3—Configurable, Multi-Tenant-Efficient

The third maturity level adds multi-tenancy to the second level, so that a single program instance serves all customers. This approach enables more efficient use of server resources without any apparent difference to the end user, but ultimately is limited in its scalability.

Level 4—Scalable, Configurable, Multi-Tenant-Efficient

At the fourth and final SaaS maturity level, scalability is added through a multi-tier architecture supporting a load-balanced farm of identical application instances, running on a variable number of servers. The system's capacity can be increased or decreased to match demand by adding or removing servers, without the need for any further alteration of application software architecture.

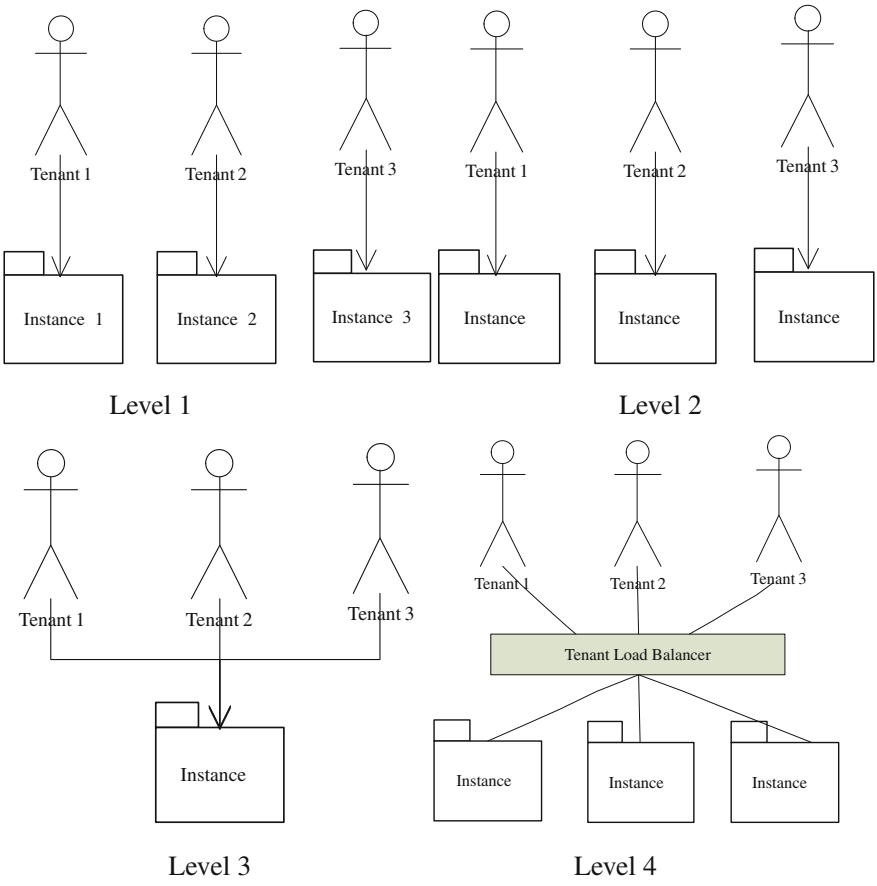

Fig. 21.1 SaaS maturity model

21.3.2 Medical Information Services Strategy

SaaS maturity model, and only reach the third level and above the requirements of SaaS services can be regarded as the true sense of the software as a service. Therefore, the medical information service platform for the construction of multi-tenant model focuses on the shared instance multi-tenant, configurable, scalable, and several other aspects.

21.3.2.1 Database Design

In the information systems of the multi-tenant model, the data storage and isolation mode of tenants directly affects the tenants' confidence in the use and data security [3]. SaaS application database has three storage modes (Fig. 21.2).

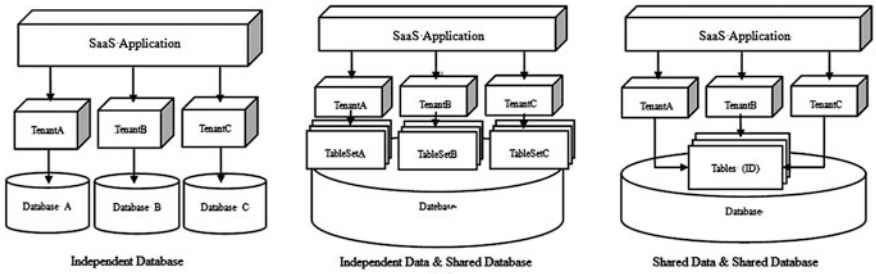

Fig. 21.2 Database model

1. Independent database schema

Each of the logical relationships among the database instances is independent, but can be deployed on the same hardware. Performance is controlled easily, security and isolation of data are strong but cost is more. This model fits the users whose requirements to performance and independence of data are high.

2. Independent data architecture model of shared database

Each tenant has an mutually exclusive set of tables in which the performance of security, isolation and controllability of data are weaker than that in an entirely independent mode. And cost of the hardware has increased. This model fits the users whose requirements to performance and independence of data within the limited budget are high.

3. Shared data architecture model of shared database

In this mode, the security and isolation of data are accomplished with a particular method in which way the resources of a system are utilized maximally and the most cost-effective; but controllable performance is relatively poor. This model is suitable for users who are sensitive to price.

Isolation and shared strategy of data are key factors to the design of service-oriented database in the SaaS. Meanwhile, the data in the Medical Information Service obeys the medical standardization, consistency of data structures, the identity of data content and other characteristics in high degree, the use of shared data architecture of shared database is more appropriate.

21.3.2.2 Multi-Tenant Configuration Design

Under the multi-tenant conditions, the requirements to versatility and universal applicability of SaaS service are higher, and easy-to-use configuration is an important feature of the SaaS model. Configurable designs in the multi-tenant SaaS platform include functional configuration and interface configuration [4], and so forth.

Functional configuration

SaaS services satisfy tenants who have a large number of different functional requirements, SaaS services should be able to support tenants to selectively customize the features they need, and form a complete feature-oriented set, which can truly reflect "on-demand use, on-demand pays "model in SaaS applications.

The decomposition of atomic functions is the basis to realize the functional configuration.

In the process of the decomposition of the atomic functions, decomposition principle, including the atomic function value, not be subdivided, and non-overlapping, non-circular dependencies and systematic integrality, should be obeyed. At the same time, the atomic function is too small and there are some dependencies between all functions in the actual design, but also depending on the type of tenants, scenarios, business logic and habits, the atomic function of integration, the formation of a relatively independent functional package, in accordance with commercial intent, the sales package is divided into a minimum Edition, Standard Edition full version.

Interfacial configuration

The interface of the traditional made-to-order application system can basically meet the needs of users. Among the multi-tenant SaaS applications, the interfaces should change with tenant customization features dynamic interface configuration including the configurable system menu and page content.

21.3.2.3 Scalable Design of the Multi-Tenant

The scalability of multi-tenant, simply increase or decrease in the corresponding hardware devices will be able to guaranteed service levels on the basis of no adjustment of the system architecture. The scalability of multi-tenant SaaS system is an important evaluation [5], including the scalability of the application server, database server, storage system, etc. The scalability of the application server makes access and application services equally to more than one application server through the design of certain load balancing mechanism. Access increased considerably, by increasing the application server to ensure that the application layer has good scalability and performance. The scalability of the database by analyzing the characteristics of the applications and data, segmentation data, reading and writing separation methods such as the decentralization of the service pressure to multiple database servers.

21.4 SaaS Model Used in the Medical Information Service Platform

The significance of using SaaS model in medical information service platform are as follows:

First, using of the service is simple by SaaS model characteristics [6], thereby it enhances the efficiency in the use of medical information service platform.

Management and use of the platform is not computer professional, computer application technology capacity can not be fully qualified for the large-scale information services software. SaaS platforms, easy-to-use features for the information service platform staff, are familiar with good operability, and laid the foundation for the development of service-oriented software platform.

Using the easy deployment features of SaaS model platform, we can reduce software development costs and hardware costs and maintenance overhead reduction of a great extent by the platform. The traditional software to customer service with a professional is responsible to maintain, therefore, the medical institutions need to be equipped with one or more of the information system engineers to complete the corresponding work under the guidance of the software provider. Platforms in SaaS mode are deployed in the software provider's network server, eliminating the need for the installation and commited of the steps, without installation and maintenance.

Third, the idea of system integration (or service integration), can maximize the integration of existing software system or part of the function, and reduce the secondary development. In the original system, the information service platform for certain applications, these special procedures are discarded rather a pity. However, if you want to be integrated into the software provider of proprietary systems, they have to make the appropriate secondary development, which resulted in waste. The platform under the SaaS model allows system integrators to avoid secondary development of the human and material waste.

21.5 Conclusion

In this paper, by doing the research of the structure of the medical information service platform which is based on the SaaS model, describing and analyzing the platform selection and strategy, it takes a good use of the SaaS business mode and the application value in the medical field, and provides a reasonable solution for medical information service.

References

1. Song F, Wu B, Wang Z, Jia X (2010) Research on laboratory information management system based on SaaS mode. Exp Technol Manage 97–100 (in Chinese)
2. Xu S (2009) SaaS Software as a service Model. Silicon Valley 9 (in Chinese)
3. Hu X, Chen Q, Zhang Z (2011) The study of library information system based on multi-tenant. Libr Inf Serv 112–115 (in Chinese)
4. Ye W (2009) The software revolution of the internet. Publishing House of Electronics Industry, Beijing (in Chinese)
5. Wang Y, Zhang B, Liu Y, Wang D (2010) The modeling tool of saas software, advanced computer control (ICACC). 2nd international conference on 2010. pp 298–302
6. He H (2010) Applications deployment on the SaaS platform, pervasive computing and applications (ICPCA). 5th international conference on 2010. pp 232–237