

The Concept of Cloud Computing Services e-health Education

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ABSTRACT

This paper presented a concept design of the software architecture of health education services in cloud computing. The design of health education services include open consultation with a doctor of preventive measures taken by a patient, the way the first aid accident, illness symptoms and consultation with expert consultation system. Methodology for analysis of the problem is the Strengths, Weaknesses, Opportunities, and Threats analysis. The approach used to build Software as Services is hierarchy data mining. Hierarchy data mining is the method used to distribute facts to multiple servers and integration of data from multiple clusters. Security systems for database and communication system in health education using public key methods. The result of this paper is a cloud computing service architecture concepts to help transformation of technology applications to the cloud with respect to opportunities and risks for development of these applications and the potential benefits of cloud computing services when people in the field of health education achieved.

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1. INTRODUCTION

Health is a state of well-being of body, soul and social life that allows socially and economically productive for everyone [1]. Public awareness to keep up health to create a healthy environment, but the awareness of health in Indonesia is still low due to lack of education, health facilities, medical staff and inadequate infrastructure from central or local government. Such a situation is so we do not expect that our society requires care and health education, and ultimately make a healthy lifestyle and good health hygienic sanitation.

Society strongly felt the impact of the gap between health services and education to meet the needs of public health in the city or province. Approach and touch technology makes information one alternative solution that we do to drop the gaps mentioned above, without disrupting the pattern and lifestyle of the community. Based on the patterns and lifestyle of the people is the most right information technology at the moment is health education by leveraging cloud computing technologies [1] [2]. Cloud computing technology used is a form of cloud computing service software applications that can give information to the public. Mobile devices such as Mobile phones and tablet used as a tool to give information and education on global health against all diseases [1] [2] [3], while for the diagnosis and health complaints or illness will be using the software interactive form of open consultation. Expected health education application in the form of cloud computing services to maturity to think of health care with a touch of paranormal medical quack or not, they not to give in to existing health services. The public will better understand the meaning of health and act more preventive in maintaining personal health, family and surrounding environment on an ongoing basis.

Research activities related to the use of computer technology for health information in Indonesia today is a system of web-based e-health to disease management [4]. E-Health System for Tuberculosis Management at biomedical [5] [6]. Preliminary Evaluation on Experimental m-Health System to Support Mother and Child Care Promotion for Community Health Centers in Indonesia [7]. These for activities are more focused on web-based waitress by applying telemedicine communications technology. Research-based cloud computing services for health information on the discussion still revolves around web services and how user adaptation to those services [8] [9], this is due to the technology of cloud computing services is still a new technology, there are several things to consider when it would make a service in cloud computing such as the characteristics of the service, a security system that will be given to the user, and how to make improve services to users [10] [11] [12] [13]. Based on state of the art on the author tries to create a cloud computing service with emphasis on the 'open service' to users. The concept of 'open service' is a process of real-time two-way communication between doctor and patient by using the technology of cloud computing services. The concept to enhance the physician's role in serving the society in general to deliver health information and preventive measures taken by the community to keep up the health of themselves and their surroundings. The cloud service consumer Neither manages nor controls the underlying cloud infrastructure Including network, virtual machines, operating systems, storage, or even personal application capabilities, with the possible exception of limited user-specific application configuration settings [14] [15].

2. RESEARCH METHOD

Analysis in this study is a Strengths, Weaknesses, Opportunities, and Threats analysis. The approach used to build software as services based service is a hierarchy of data mining is the method used to distribute results to multiple servers and integration of data from multiple clusters. Design interaction between users and e-health education using use case diagrams and sequence diagrams. Database security systems and communication systems will use public key methods (El Gamal algorithm using the key generation process and the discrete logarithm speed encryption and decryption process is very fast).

3. RESULTS AND ANALYSIS

3.1. Architectural design of SaaS e-health education

The concept of cloud computing services built is a software service (SaaS) application that health education accessed by doctors, pharmacists, patients, students, researchers and others (see Figure 1). Development Benefit expected with application architecture model of health education is that every user wills easier administration, automatic updates, and all users will have the same version of software, Easier collaboration for the same reason and global accessibility. Health education application accessed through mobile devices (iPad, tablet, and smart phone), personal computers, laptops and internet café. Users do not have to think about the services provided by the application, and the user will feel comfortable in using this application.

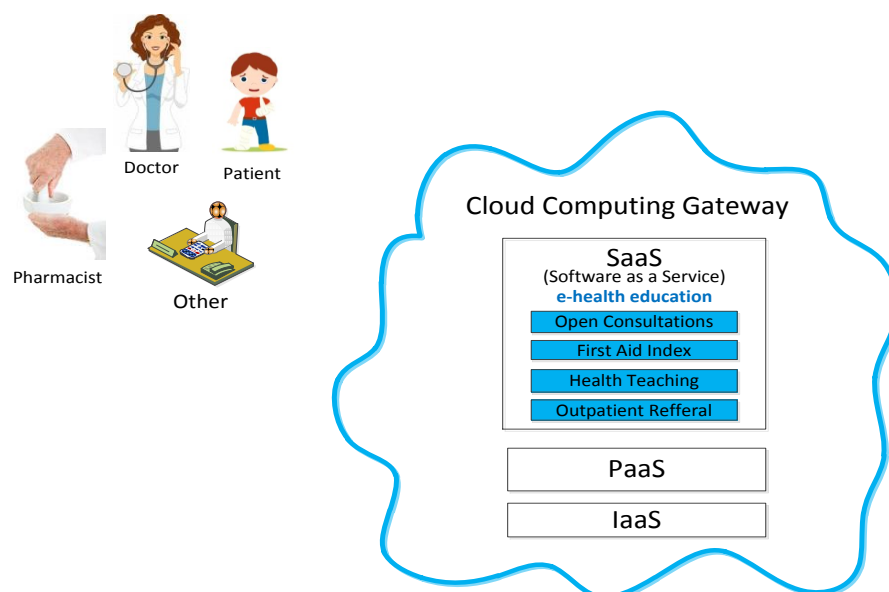


Figure 1. Architecture of SaaS e-health Education

In Figure 1 it seen that given consists of the first Open consultations include consultation between patients with a doctor or pharmacist. Consultation may include preventive measures that done, or how to use the medication continued after discharge from hospital care. Or how to use the drug for patient diabetes example is the use of insulin. The second service in the form of First Aid is Index has the actions taken an accident, the action is in the form of standardized measures that carried by the patient without any medical help. The third is the Health Service teaching or consultation by using an expert system. In these patients consulting services can find the information necessary to keep up and improve the health of examples of signs and symptoms of complications. The fourth service is Outpatient referrals are explaining to patients how and what available to ease the transition to independent living clients, e.g. physical therapy, set up diet by giving verbal and written instructions on how to change or restrict certain foods.

System management services e-health education will use data mining models, which distribute data source on multiple servers. Data integration process using the Hierarchy Clustering Algorithm [16, 17] is one of the clustering algorithms that used to document clustering. Results of hierarchical clustering technique are a sequential collection of partitions and clusters that have each point.

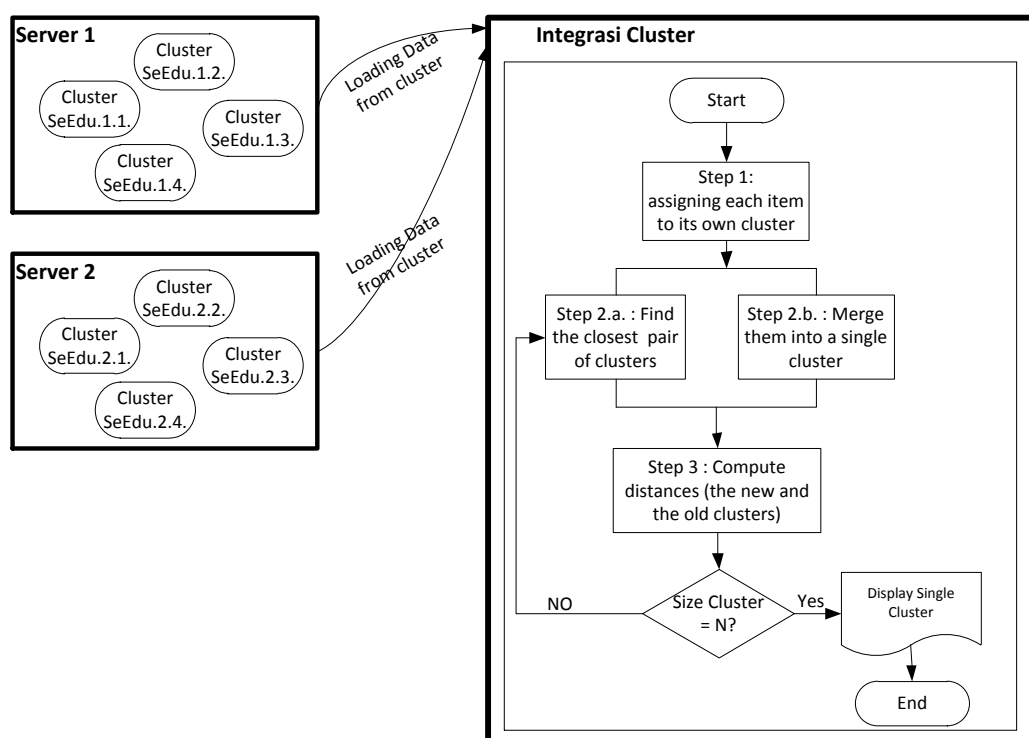


Figure 2. Integration scheme of N Cluster from multiple servers

In Figure 2 seen that the process was a Hierarchy Clustering Algorithm are given a set of N items clustered, and $N \times N$ distance (or similarity) matrix, the basic process hierarchical clustering is this step-1: start by assigning each item to its own cluster, so that if you have N items, you now have N clusters, each containing just one item. Step-2: Let the distances (similarities) between the clusters equal the distances (similarities) between the items they contain. Step-3: Find the closest (most similar) pair of clusters and merge them into a single cluster, so that now you have one less cluster. Step-4: Compute distances (similarities) between the new cluster and each of the old clusters. Repeat steps 2 and 3 until all items into a single cluster of size N .

3.2. The design of the user interaction with the SaaS e-health education

Behavior patterns e-health system and transactions education conducted by actor described using use case diagrams. Use case diagram illustrates the expected functionality of a system, describe the needs of the system from the point of view of the user, focuses on the process of computerization (automated processes), and describes the relationship between use cases and actors.

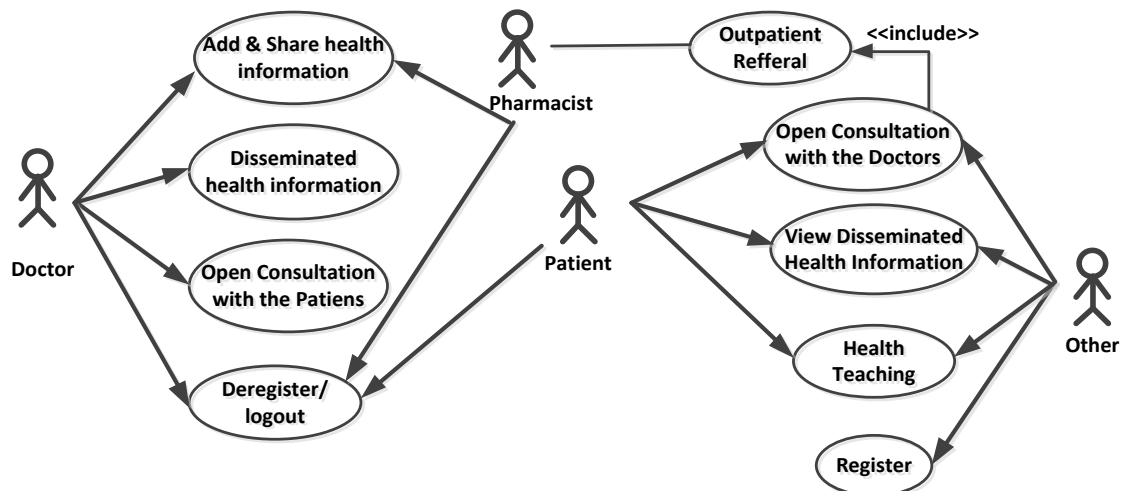


Figure.2. Use Case Diagram SaaS e-health Education

The system e-health education in figure 2 shows that doctor's role compared to other users. Role to play: first add and share health information, all sorts of new information about health presented in this forum. The second role gives health information, the process done so that users get new information so that the aim of upgrading the knowledge society delivered. The third role is open to patients consulting either patient who is members or non-members, the consultation process done by choosing a doctor who has been a member of this forum. A doctor can answer directly any patient complaints. Form of consultation is not limited to the type of disease suffered by patients but can also be a preventive measure to do when experiencing an emergency condition.

The second actor who has the highest potential to get access to the e-health Education is the patient. The role of a patient is seeing the health information provided by the doctor; patient accepted new information. The second is the role of open consultation with a physician, patients can ask their doctor about the disease, which suffered or complaints related to therapy, use of medication and diet foods (Outpatient referrals). The third role is teaching the health of a patient can consult with an expert system to know the symptoms of the disease as well as actions taken emergency conditions. Third is the other actor, this actor is other actors that come from the student, researcher or healthcare organizations that want to join the e-health Education. Access rights 'other' can be a member or not. If not the only members can read health information and may consult with an expert system that is health teaching, because if a member 'other' as an actor can have access to the patient. Other supporting actors are pharmacists, although in this system the role of a pharmacist is not too much but this actor will be given permissions to add health information and may also explanation on the use of drugs for patients coming out of hospital care.

In use case diagram, external entities are doctors, patients, pharmacists and 'other' which will offer a response to any request from the system. Entities in the e-health system education are 'Open Consultation', 'First Aid Index', 'Health Teaching' and 'Outpatient Referral'. Preview all the events described in the use case diagram by using flow scenarios using sequence diagrams (see Figure 3).

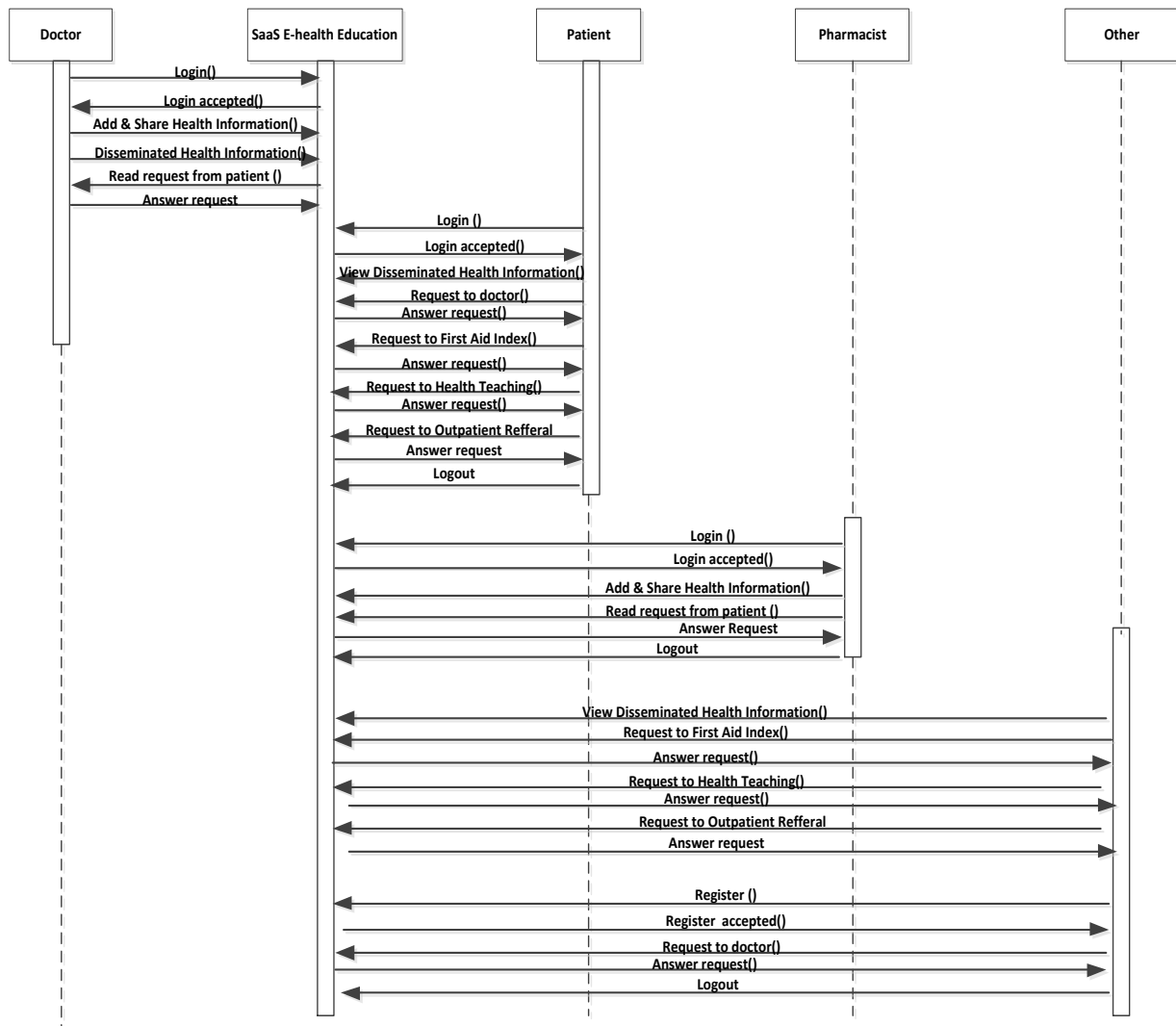


Figure 3. Sequence Diagram SaaS E-health Education

Information system developed on cloud computing services is that every patient who already registered can do 'open consultation' with all the physicians in this application. While unregistered users can only interact with the machine, the interaction in the form of consultation by using automated answering machine. The patients decide the preventive measures that carried out by the complaints experienced with expert system. The advantages gained enrolled patients who had consulted with the chat facility, so patients can immediately get the desired information. Actor Doctors found on this system are doctors who have registered and are willing to accept the 'consultation' open communication with the patient so that the process done two ways. If the doctor cannot communicate in real-time the physician can answer patient questions through email address patient. Doctors and pharmacists at any time to give health information, health information directly spread readable by the patient or other users who just want to find information about health. All the actors had only met in the SaaS e-health education, which manage the application process of information exchange, so that the user (all actors) in this application anywhere and anytime.

3.3. Open Consultation Process Design

Open Consultation is a system that provides flexibility to patients to consult with a doctor. Patients will choose a doctor based on the doctor's ability and specialization. Form of consultation contained in this application is the patient can fill in the form provided in the form of complaints experienced by patients may include statements or questions. Shape class diagram open consultation process seen in Figure 4.

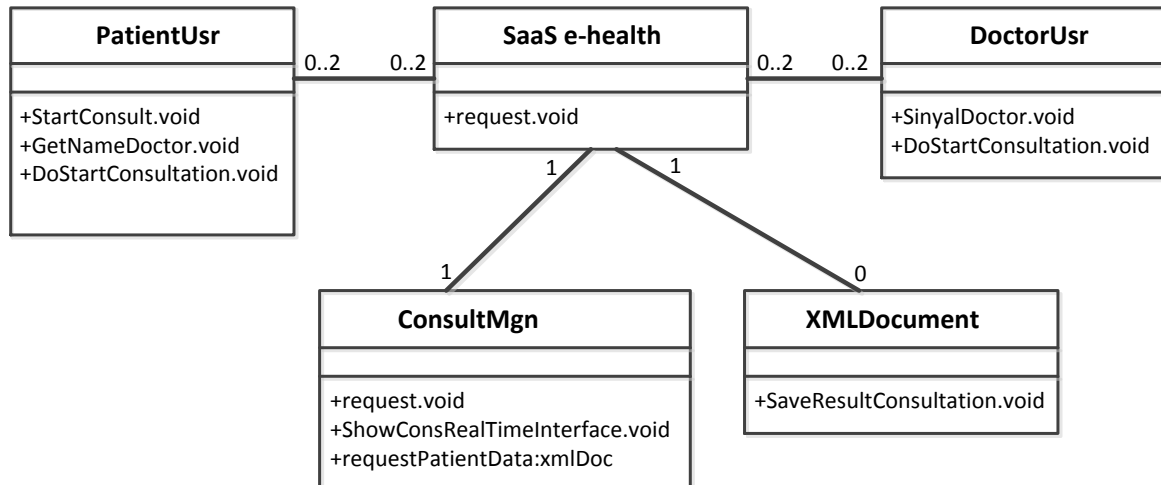


Figure 4 Class Diagram for Open Consultation Process

In Figure 4 it seen when the patient asks the consultation process, the system will take one doctor's name to the status of 'willing' to give consultation. System service e-health education will connect with physicians who using the class consulting (), so that the patient can communicate directly with physicians in real-time. If patients choose doctors with the status of 'not willing', then the answer will be given through email address patient. The results of consultation stored in XML document. XML document using a unique identity, so that when the patient takes the document can get access to it again and become a medical record for the patient. Every physician who has permissions to view the files consultation all patients by class region, sex and age. Freedom of the doctor to see the results of this consultation a patient's medical records when a patient at the same time to come back to consult either the same physician on the first option and different doctors.

E-health education has a feature that superior service by providing consultation form that is user friendly. Sequence diagram (see Figure 5) is made to look more detailed architectural design open consultation process among patients with a doctor. In this diagram, there are five main functions, namely 1: StartConsul().Void, 2: ShowConsRealTimeInterface (). Void for patients, 3: ShowConsRealTimeInterface(). Void for physicians, 4: DoStartOpenConsul().Void for patients and 5: DoStartOpenConsul (). Void for physicians. Of the five main functions is reduced to a few sub-functions of the sub-functions 1.1: Request (). Void from patient to SaaS e-health system, 1.1.1: GetNameDoctor(). Void function to choose a name that is desired by the patient's physician. From sub-functions 1.1.1. System ConsulMgn will activate and sending a signal to the doctor (function 1.1.1.1: SinyalDoctor().Void) to ask the doctor performing open consultation. Doctors who have the status of 'willing' that can make the process of consultation. Status of 'willing' will be accepted by the ConsulMgn function to provide a means of real-time interface open consultation (function 2: ShowConstRealTimeIntface), as well as a signal to the patient and the physician to initiate the consultation process.

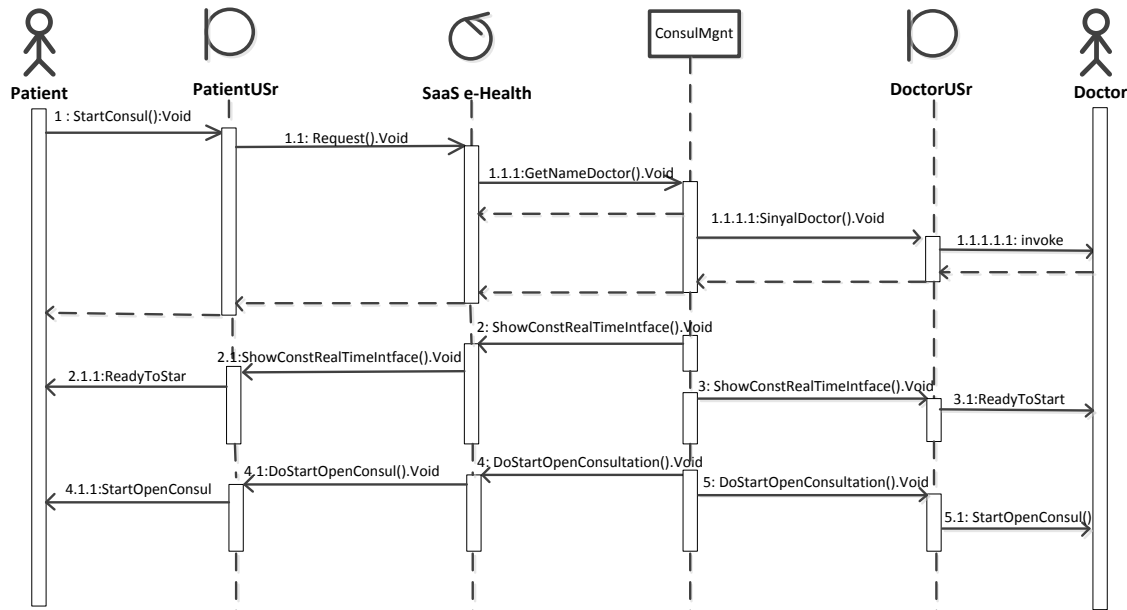


Figure 5. Sequence Diagram for Open Consultation Process

The draft sequence diagrams and class diagrams of the open consultation process in Figure 4 and 5 to give a pattern of communication and information delivery of optimal health. This form of consulting services performed in real-time where patients and doctors do not need in the same place. The advantages of a cloud computing service is that users can get access to anywhere, so that to-day mobility still be done without any interruption.

3.4. Design of Systems Consulting Security

Cloud computing services in addition to e-health system will use the security provided by the infrastructure of cloud computing services will also create a security system for XML documents in consultation (DocConsult.xml). XML document security system will use an asymmetric key concepts of communication protocols (see figure 6). These asymmetric keys [16] on several considerations including Confidentiality: service used to keep the contents of information from anyone except that it the authority or the secret key to unlock or drop the information that encoded. Data Integrity: relating to custody of unauthorized data changes. To keep up integrity of the data, the system must the ability to detect data manipulation by parties who are not entitled to, including insertion, deletion and substitution of other data into real data. Authentication: dealing with the identification or recognition, both the unity and the information system itself. The two parties must communicate introduced themselves. Where information sent through the canal must authentication, data contents, delivery time and so on. Non-repudiation: trying to prevent the denial of the transfer or creation of an information by the sending or making.

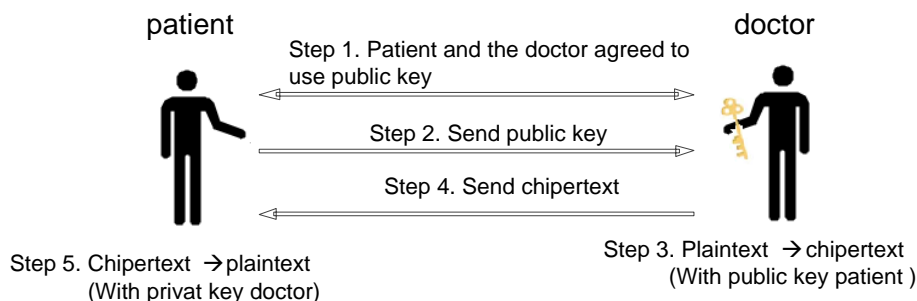


Figure 6. Concept of public-key cryptography systems[16]

The basic concept of public key cryptography in Figure 6 is that every member of the network has two keys i.e. public key and a private key. Public key is the key used to encrypt and decrypt the key. The private key held only by the person making the process of encryption and public key only known by many people. Asymmetric key algorithms are more commonly called public key, this algorithm is usually used in large

communication networks, and dynamic. Asymmetric key algorithms are relatively more difficult to solve method, because the key used to encrypt different key to decrypt it. Asymmetric key algorithms are relatively more difficult to solve method, because the key used to encrypt different key to decrypt it. Weakness asymmetric key algorithms are slower than symmetric key algorithms.

E-health education is an application that will access a web-based so that the database system must also be taken into account and secure. Based on analysis of several algorithms (see table 1), the algorithm in the e-health is the El Gama algorithm.

Table 1 SWOT Analysis for RSA and ElGamal

	RSA algorithm [18]	ElGamal algorithm [19]
<i>Strength</i>	Level of difficulty in factoring numbers into prime factors, which in this case $n = ax \cdot b$.	Algorithm which has a very high computation complexity.
<i>Weakness</i>	<ul style="list-style-type: none"> - RSA algorithm is slower than Rabin. - RSA is not used to encrypt a message, but encrypt the symmetric key with the recipient's public key. 	Need a good resource and processor that is able to do large computing
<i>Opportunity</i>	With large digits, then attempt to find the cause computing takes over 4 billion years.	<ul style="list-style-type: none"> - Key Generation using discrete logarithm - The method of encryption and decryption using the massive computing
<i>Threads</i>	Any form of attack: <ul style="list-style-type: none"> - Man in the middle attack - Chosen-Plaintext Attack 	If resources are not met, then the process becomes slow

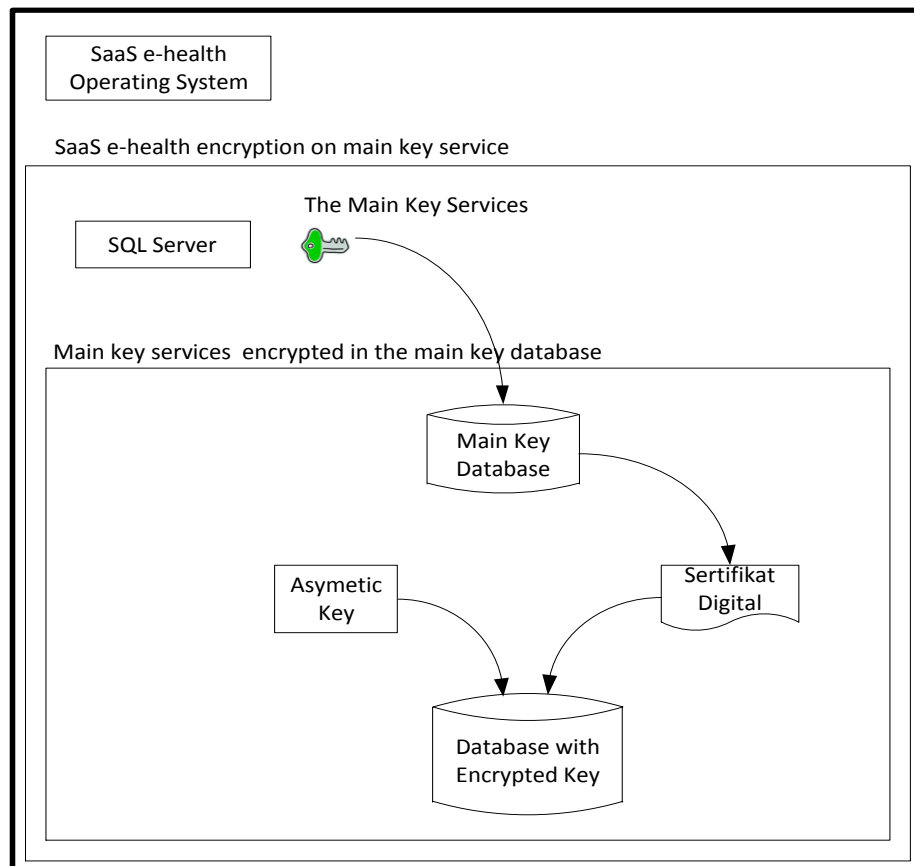


Figure 7. Concept of Security Database Ssystems

The design of the security system (seen in Figure 7) in which the operating system Linux base where the operating system will connect to the SQL server using the service key (master-key). In the master database that will contain the key used to unlock the digital certificate. While able to read data from the database user needs digital certificates and asymmetric keys. Based on the concept of SaaS server database security system of e-health, the authors believe that the user database securely for use asymmetric keys and digital certificates for digital certificates opened encrypted key services as well.

4. CONCLUSION

The design of the architecture of cloud computing services in the field of health education implemented to improve public education in terms of preventive measures, public attitudes and improve their health status. The concept of the service based on the pattern of people's lives today. Advancement of the Internet and communication network technologies are increasingly sophisticated, so the concept of the process of delivering health information and education in the same place but it done in different places in the same time or at different times. Open consultation draft presented with the concept of security system on the outcome of the consultation is a concern for patient confidentiality. Open consultation system does not mean that patient data public but is more focused on simplicity, flexibility and freedom with the expert doctors. Touch 'user friendly' in the application of e-health education the benchmark for ease of use and ease of information technology in areas such as health information dissemination. Further research to do is how to give the platform and infrastructure cloud computing services is that health education that uses cloud computing technology better.

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Since 2006 worked at the Center for Informatics Research - Indonesian Institute of Sciences as a researcher. Field of ability is with specialization in information systems modeling, data mining, and e-health. Activity is now involved in the design of cloud computing services, where the task is to develop a personal e-health services in cloud computing technology.