

Electronic Health Record Exchange Using a Peer to Peer

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Ringkasan

These days when a patient go to the hospital, most of the times we're forced to do the checks that may have previously been done in other hospitals, such as checking blood types, hereditary disease, and so forth. Or maybe patients just moved from an area whether you need to do re-checking. Why not have a container that can accomodate the data, so the things mentioned above can be reduced. There should be an electronic health record system that stores all the patient's health history. Therefore we try to discuss a system with the method of peer-to-peer that is developed until today. We will shows the dierences of each method architecture peer-to-peer, and will also illustrate it in a example case. This is expected to help patients and other health institution in making decisions and optimize the health services.// Keywords: peer-to-peer, electronic health record, decision making, health institution

1 Introduction

Health condition in Indonesia has increased significantly when seen in recent decades. The Indonesian population is more and more familiar with modern health care system as in developing countries like the United States and several other European countries. Facilities and medical experts also have the necessary credibility in the face of health in an agrarian country like Indonesia.

At this time, health is very important for life in society. Everywhere, people desperately need the hospital to check their condition when they're sick. But the problems that the current Indonesian government facing now, is to collect the information data concerning patient history that still small.

Make better communication of all stakeholders of a healthcare system is one solution to reduce the existing information gaps that already all patients facing o. These gaps contribute signicantly to the public health problem of epidemic proportion that results from medical errors. The improvement of the continuity of care in modern, complex and fragmented healthcare systems has the potential to increase their quality, their eciency and the satisfaction of their patients.

Although this time in Indonesia already has a modern medical facility but at this point can also be said that the value of health in the world is experiencing a decline. This is caused by poor air quality, the mind of stress, climate change and several

other causes. So with this condition, humans are more vulnerable to diseases that make their health declined.

Human nature that often settle in a new place also make their health may decline at any time and anywhere. The mobility of patients between healthcare professionals has led to heterogeneous patient's healthcare information stores (islands of information), which are making access to the vital information by healthcare providers whenever and wherever they need becomes a crucial strategy for various healthcare foundations.

Healthcare systems are extremely complex and information demanding area, creating and utilizing a huge amount of healthcare information, which implies an assertion that paperbased records, can no longer reach the requirements of advanced healthcare system. Due to the emergent need to improve healthcare services, which is growing more to organize and deliver high quality services that paper-based records cannot be supported especially with an increasingly complex data entry. There is an increasing desire to improve the ability to access patient record information that is distributed across multiple sites by using the latest Information and Communication Technology (ICT).

Computers have been used in healthcare organizations for decades to facilitate the integration and manipulation of patient's data and improve the clinical decision making process to be more promptly, surly and reasonably. However, utiliza-

tion of computers may affect the communication between healthcare providers and patients. A number of patients may feel calmed by the influence of technological, clinical and organizational assistance provided by computers contrasted to living papers.

In the context of improving the quality, efficiency and consistency of healthcare service, creating, storing and sharing the patient healthcare information among different healthcare systems has been assigned as high priority in various nations, which can be achieved by using Electronic Health Record (EHR)[2]. If there are emergency cases, the best medical hospitals or clinics that require a complete patient medical records in order to perform appropriate treatment. But the problems faced if we are using electronic health record system is how the patient data source can be found in the database then the data will be linked to any information that is useful to diagnose and treatment process.

2 Related Works

The concept of a patients healthcare information stored electronically instead of on paper has been around for several decades. However, healthcare organizations did not directly adopt the electronic health record. Many of the former systems are still not paperless, as healthcare professionals applied both an electronic and paper-based healthcare record systems.

Nowadays, there has been much research and study papers on decision support system that uses a peer to peer in the field of health records systems, particularly for emergency treatment at the case. In this section we will give you a few examples that has similarities in some aspects.

Antoine Geissbuhler, Stephane Spahn, Andre Assimacopoulos, Marc-Andre Raetzoc and Gerard Gobet wrote in their paper Design of a Patient-Centered, Multi- Institutional Healthcare Information Network Using Peer-to-peer Communication in a Highly Distributed Architecture"[1]. The paper explains about how to design a system to connect 450 000 public health community in Geneva, Switzerland with the professional doctors who are in the area. In this paper, they used the method of pure peer-to-peer or decentralized peer-to-peer, in order to make the information remains close to its source. There are three pilot projects in this paper, the first pilot projects aimed at getting access to the health of a patient, it is expected to collect all information of public health. The second pilot project illustrates how to combine all patient records into electronic health records, and the third pilot project demonstrates how the electronic health record that has been produced can be made accessible to other

care providers. In order to get all the information they use the concept of "mediator" to get the information from every stakeholders. Mediator serve as a liaison, and also handle requests for information by the other mediators, causing all the information can be collected properly.

Serge Abiteboul, Bogdan Alexe, Omar Benjeloun, Bogdan Cautis, Irini Fundulaki, Tova Milo, and Arnaud Sahuguet wrote in their paper "An Electronic Patient Record " on Steroids" : Distributed, Peer-to-Peer, Secure and Privacy - conscious"[6] . This paper describes how to create an electronic health record for all patients, it's contain a comprehensive health record without disregard the security and integrity of patient health records. To deal with so much data, the authors use the approach of peer-to-peer. To make sure the system would make a good record, every existing data in the hospital, physicians, monitoring devices, insurance company and department of health will always be connected and for the rights to access the information, are set according to patient wished (in accordance with what written in the SMART card each patient). In this paper, the EPR will be seen as large virtual XML document for each user. They provide new ideas for making the EPR data information and data accessible was integrated and safe (privacy) by combining two technologies, such: Active XML (AXML), which provides flexibility when integrating the data using a peer-to-peer and they also use GUPster to restrict the grant access, and also a source of patient data, especially for XML data.

Shinji Kobayashi, Takefumi Ueno, Kazuhiko Kato, Yoshiaki Nose, Mine Harada wrote in their paper "Peer-to-Peer Communication System for Sharing Electronic Medical Records"[4]. Almost every hospital uses a system of client-server method, but it caused a lot of costs to be borne by the hospitals and also the system only covered information that's contained within the same network, so that the information obtained will be limited. Therefore, the authors of this paper create a hospital system using hybrid peer-to-peer method to overcome all the weaknesses inherent in clientserver method. With a system of hybrid peer-to-peer, information gathering will be easily allow each hospital to communicate with each other and exchange data. The advantages from peer-to-peer is the cost for maintenance system was cheaper and is also open source. In this system there are three modules, the First is the editor of Medical referral letter, where in this module patients can input their health record history, the next module is a module P2P Communication, in this module, data about patient that still in another place were collected and implemented to EHR. The third module is the Message Management Module, this module stores all the data or messages that be sent or received via P2P Communication Module,

and all data is stored into the local disc using Java streams.

From few papers that we have discussed above, many similarities that ultimately can we implement in our papers. These three papers use the method of peer-to-peer but has a different implementation, Antoine Geissbuhler on his paper, he used the method of mediators as a liaison of each information, this is made so that resources can be tracked and data collection reservoirs can be done quickly and accurately. On paper, Serge Abiteboul, he focuses on data flow systems used in peer-to-peer as well as data on each patient's privacy, that privacy is less discussed in the paper Geissbuhler Antoine, patients do not just want to be able to see their data Electronic health records, but also wanted the data is well preserved. On paper Shinji Kobayashi, he focuses on the transfer of data from one party to another party, the communication from both parties conducted through the system of peer-to-peer and when the data in and out, all that will be directly stored, and recorded up to become a good electronic Health Record.

3 Methodology

Peer-to-peer (P2P) systems have recently become a popular medium through which to share huge amounts of data. Because P2P systems distribute the main costs of sharing data disk space for storing data and bandwidth for transferring them across the peers in the network, they have been able to scale without the need for powerful, expensive servers. Peer-to-peer (P2P) computing can be best described as the direct exchange of data between two computers or peers in a common network. In a P2P network, all client computers in the network, known as nodes, are considered to be equal in their capacity for sharing resources with other network members. Unlike the traditional Client-Server system, a P2P system requires no central coordination of nodes.

3.1 Peer to Peer Architecture

The peer-to-peer architecture is a way to structure a distributed application so that it consists of many identical software modules, each module running on a different computer. The different software modules communicate with each other to complete the processing required for the completion of the distributed application. One could view the peer-to-peer architecture as placing a server module as well as a client module on each computer. Thus each computer can access services from the software modules on another computer, as well as providing services to the other computer. However, it

also implies that the discovery process in the peer-to-peer architecture is much more complicated than that of the client-server architecture.

Each computer would need to know the network addresses of the other computers running the distributed application, or at least of that subset of computers with which it may need to communicate. Furthermore, propagating changes to the different software modules on all the different computers would also be much harder. However, the combined processing power of several large computers could easily surpass the processing power available from even the best single computer, and the peer-to-peer architecture could thus result in much more scalable applications.

3.2 Pure Peer to Peer Architecture

Pure Peer To Peer architecture is a model that uses decentralized topology. Nodes join the network by randomly connecting to the existing participants and all requests are broadcasted. Each node, known as a server, acts as a server to handle requests of other nodes, and at the same time acts as a client to receive services provided by other nodes. Pure P2P networks do not provide a central server for managing the network or a central router that forwards requests to other networks.

3.3 Hybrid Peer to Peer Architecture

Hybrid Peer To Peer architecture has a central server that monitors and maintains information on each peer as well as responding to a peer when someone asks that information. Each peer is also responsible for providing the available resources. This occurs because the central server is set up in such a way as to not have them. In addition, this is also done so that the central server can know what resources will be distributed within network. And there is a router that becomes the center of the network.

3.4 Super Peer to Peer Architecture

As shown in figure 1, SuperPeer Peer To Peer is a new architecture that is obtained by combining the benefits of centralized topology with the decentralized topology. In this architecture there are two levels, where the first level is the relationship between SuperPeer that follow pure P2P model / decentralized, while each SuperPeer Members of the peer will have to follow centralized model [7].

In this paper we use SuperPeer architecture to solve the electronic exchange of patient records. In our view, SuperPeer an architecture that is more efficient, scalable and Easier to manage compared

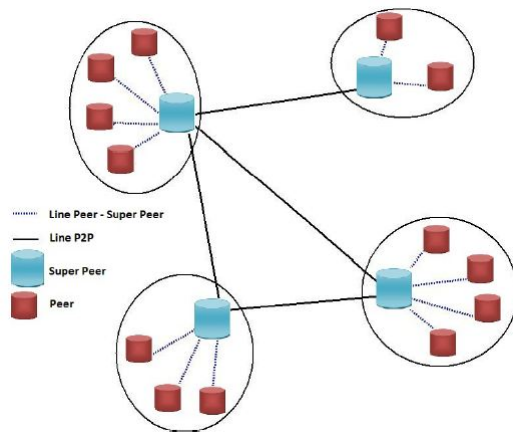


Figure 1: SuperPeer P2P architecture

with other architectures. Because of this architecture is a mix of architectural model of decentralization with architectural model of centralization. The advantages of super peer are [3]:

4 Approach

In order to solve this problem we have two pieces of model communication between peers namely data exchange models and agent model, whereby each model has strengths and weaknesses. For data exchange model[5], the advantage if you are taking of this model is at SuperPeer damaged so making the request query not until to the provider peer, the data has been collected previously can be used as the latest patient records which are directly used to perform the analysis and treatment for the patients concerned. However, this model also have weaknesses that existing data on each superpeer didn't up to date because the demand of data is not done in real time, but regularly (1 week, 1 month, or 1 year). While for the agent model, the advantages is that we can do data request to the provider peer in real time so that the data is obtained up-to-date. Then the weakness of this model is that if the network experiencing breakdown or death, we can not perform the request query to the provider peer.

In this paper, we prefer to use the data exchange model because current Indonesia's network is oftenly experiencing breakdown or being disconnected. Such conditions would be difficult to implement if we use the agent model. This condition occurred because the network in Indonesia is only available in big cities only, not to the local village. After determining the model to be used, the next approach we do is the layout standardization of electronic health records for all hospitals, clinics and pharmacy. Since the standardization of the layout, oftenly said as an important key to running processes for the electronic health record ex-

change. if there are two hospitals that perform data exchange, the display layout of electronic health records between hospitals should be the same or in other way must through the process of layout standardization. Unfortunately, we can't do the process of layout standardization because this is only conceptual discussion.

5 Achievement

The conclusion is we can use SuperPeer P2P architecture to exchange electronic health records in hospitals, clinics and pharmacy. Peer to Peer system is believed to solve the problem of how to find and communicate with the patient data source. But among these three architectures, Super-Peer architecture is the most effective model for this architecture is a combination of centralized architecture with a decentralized architecture. we expect with existence of this paper, hospitals, clinics and pharmacies will no longer suffering difficulties in the process of patient data exchange. These conditions can reduce human errors during the process of diagnosis and treatment of patients, thus increasing the health services in Indonesia. The difficulties that we will face in the next level is still no availability layout standardization to each superpeer that causes the patient data exchange can't be done. For the future, we hope the next research can implement the process of layout standardization so that there is no boundaries when the patient data exchange are made.

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