

Research on the Intercommunication of Healthy Records and Hospital Medical Records

Abstract. According to the requirement of data intercommunication, this paper presents a solution of community health and the hospital information system intercommunication. Based on the ESB, SOA and XML technology, we construct a exchange platform of community health service center and medical and health institutions. In addition, we design the message middleware and data exchange adapter based on HL7 and DICOM3.0 standard. Consequently, this paper realizes the information exchange of the resident healthy records and hospital medical record system.

Streszczenie. Artykuł przedstawia system przesyłu danych medycznych między centrum serwisowym a szpitalami. Przedstawiono oprogramowanie bazujące na standardach HL7 i DICOM3.0. (Badania przesyłu danych medycznych)

Keywords: hospital medical records, healthy records, exchanges platform, message middleware

Słowa kluczowe: dokumentacja medyczna, przesył danych.

Introduction

Western countries attach great importance to developing the information system related technical research and application, especially strengthening community-based health information system construction. England, the United States, Canada, Australia, France and other countries have spent a huge sum of money on carrying out the regional health information construction of national and local level in the more than 10 years, for the core to the electronic healthy records and electronic medical records data sharing.

It has been fully verified that the effect of improving the medical service efficiency, quality, and accessibility and reducing health-care costs and medical risk through the health information sharing, and acknowledged as the future development direction of health information construction.

At present, HIS system application in the domestic hospital has already become more and more mature, but community health information system is a new system implemented in recent years. However, because the hospital information system was usually developed by different developers, the standards and specifications of each hospital information system are not unified and the information formats among each medical institution are also not same. Consequently, there are several problems when community health information system exchanges and shares data with the hospital, namely we can not get a very good solution to the problem of system interconnection and resources sharing. So this makes each system independent and causes a lot of information isolated points, not really to realize information exchanging and sharing[1,2]. To solve this problem, it needs to shield the concrete technology used by the hospital information system and its realization ways, and utilizes the intercommunication system to realize the resources sharing between the resident health records[3] and hospital medical records[4,5].

Method

Enterprise Service Bus (ESB)[6] is a group of basic architecture implemented by the middleware technology, and supports Service-Oriented Architecture (SOA)[7]. In addition, ESB supports service and message in the heterogeneous environment and the interaction based on events, and ESB is provided with the appropriate levels of service and manageability[8,9].

In order to realize the linkage of the medical health business data and community health information platform, the first thing to do is to realize the standardization of heterogeneous data between system, which needs to

arrange the lead service component of data exchange in the medical and health institutions. Each application system realizes the information interaction with the news interactive center by installing the corresponding software adapter in the business system part through the service bus ESB. The theory of the resident healthy records and hospital medical records intercommunication is shown in figure 1 below.

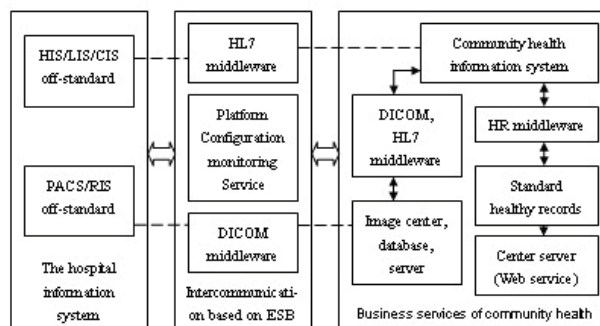


Fig. 1. The model of the resident healthy records and hospital medical record system intercommunication.

Based on message middleware technology and the routing function of news content, this system integrates the workflow service. And we can realize the integration access of each regional medical and health information system such as HIS, LIS, CIS, PACS, RIS, and so on, in the way of data exchange adapter. The integrated system need to encapsulate the functional components and data components interacting with the data exchanges platform into "service", and to shield the concrete technology used by integrated system and its realization ways, and finally to realize the link with exchanges platform in the way of standard interface[10].

In the integral designing structure of the news bus system, various specific business systems can transmit and receive business data through the adapter connected to information exchange platform. The adapter plays a role of coupling news exchange platform and specific business system.

1) Middleware technology based on HL7 and DICOM3.0 standard, to realize the information transmission of medical records between systems

In this part, combined with HL7, DICOM3.0 standards and XML language, we design message middleware, and realize the information intercommunication of the resident healthy records and diagnostic information domain, the drug prescription information domain, clinical examination

information domain and medical imaging information domain in the hospital medical record systems such as HIS, LIS, CIS, PACS, RIS, and so on.

a) Utilizing the middleware based on HL7 to realize HL7 standardization of heterogeneous data

HL7 standardization of heterogeneous data firstly transforms data of each system into a standard HL7 message format, and then in accordance with the consultative communication rules sent to the receiving system. The receiving system resolves the received HL7 message and transforms into the application data, so as to realize the data exchange between the systems[11].

According to the diversity and complexity of medical record information storage and performance in each medical institution, we first have to realize constructing and analyzing an HL7 standard information and news transmission. HL7 standardization of heterogeneous data realizes transformation from heterogeneous data to HL7 standard data format, and it is realized by construct and analysis of HL7 messages[12]. HL7 standardization of heterogeneous data is realized by HL7 middleware, whose technical principle is shown in figure 2 below.

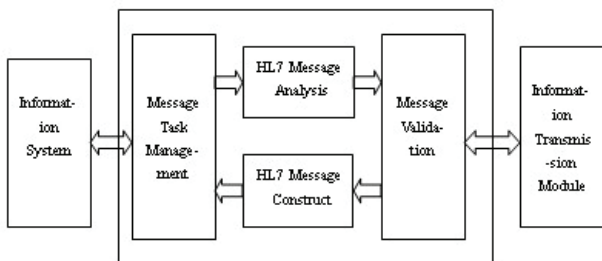


Fig. 2. The model of HL7 message communication.

HL7 middleware consists of three modules. The first module is used to achieve HL7 message construction, namely to transform the information in the database which will be sent into the text data of HL7 format through function. Another module is to achieve the HL7 message analytical function, namely, to extract structure based on the HL7 message structure and field structure according to paragraph structure, which will be processed into the corresponding information, and store or update the corresponding data in the database. The third module is responsible for sending and receiving messages[13]. The system structure of HL7 middleware is shown in figure 3 below.

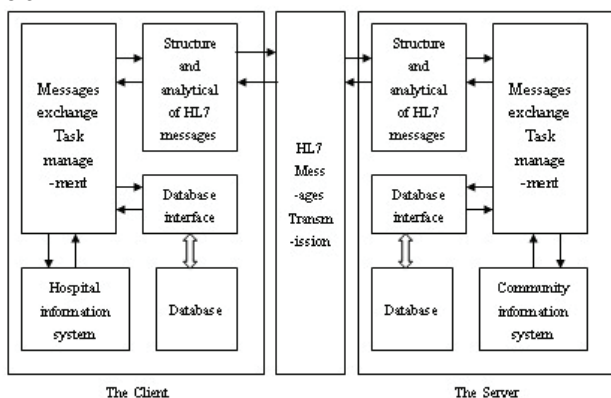


Fig. 3. The system structure of HL7 middleware.

The system structure of HL7 middleware has adopted the C/S mode and is divided into the server and the client. The client extracts the corresponding fields from the local database, which are processed to comply with the data

structure of HL7 through the HL7 middleware, and then transforms the corresponding data into HL7 messages and sends them to the server. It is considered that producing a standard format or XML format, according to the situation of applicant. After the server receives news, the server will resolve the HL7 messages through the HL7 middleware, and which will be reverted to data structure which is consistent with this system[14].

b) Realize the DICOM standardization of heterogeneous data through DICOM middleware

In the standard of DICOM, any communication process is through the various service classes to realize. DICOM service class is based on client/server mode. Among them, the client is called service class user (SCU), the server is called service class provider (SCP). However, SCU is mainly used to stimulate service, and SCP is mainly used to execute service.

The DICOM standardization of heterogeneous data should have two functions which are conversion and transmission of data. For the medical equipments and medical images which do not accord with DICOM3.0 standards, we can convert the non-DICOM data into DICOM data through the DICOM middleware, and transmit in accordance with the standards of DICOM. After the conversion from the non-standard data to the DICOM data is completed, we should send the DICOM data to the server PACS and complete archiving and storing.

The communication mechanism of DICOM middleware is shown in figure 4 below[15]. Compared with the traditional ESB accessing mode, The DICOM sending equipment is the outside visitor, and the service cell of receiving DICOM on ESB is the service provider. When accessing ESB in the outside, we can use the custom protocol interface by way of a communication tool.

This communication tool has two aspects of the requirements.

1. It must comply with the DICOM communication format, namely, must include the necessary elements information such as the IP address, port, entity title, and so on.

2. It must be able to establish a connection with ESB bus, because this is the basis and premise of accessing the service unit.

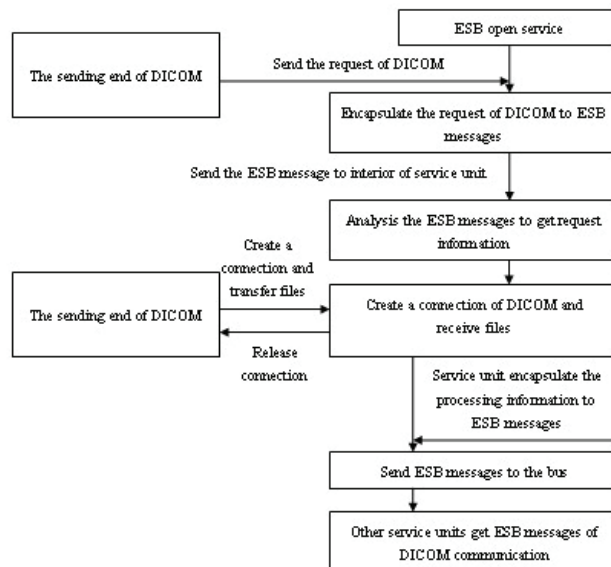


Fig. 4. The communication mechanism of DICOM middleware

In the sending end on DICOM, after the service of ESB bus is opened, the DICOM sender only need to send the

request of establishing a connection to the receiving entity with specify IP address, port and entity title, and doesn't have to consider the realization of the receiving end. This way reduces the coupling coefficient between components in practical application, and in the condition that the sending end on DICOM does not make any changes, the traditional pattern which is from the sending equipment to the receiving equipment will be promoted to the new model which is from the sending equipment to ESB bus.

According to the normal protocol of DICOM communication, the work which the internal functional components of service unit will accomplish is to establish a connection with the DICOM sender based on the analytic entity title, IP, port and other information, and to complete the task of file transmission. After the service unit completes internal functions, it will send the ESB message to the bus for being used by other service unit.

c) The realization of HR middleware technology

We can realize the generation of standard health records from the diagnosis and treatment data with the way of middleware, which is in the hospital information system and community health information management system. And its work principle and technology are shown in figure 5 below. Firstly, we should extract diagnosis information and put into messages cache through the HL7 middleware. Then, we need to extract health records necessary information through business processing. Finally, we can build and generate the standard health records by HR.

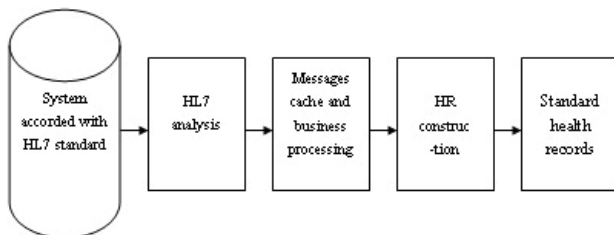


Fig.5. The communication model of HR middleware.

2) Realize the reliability and integrity of the data transmission based on the data cache service technology

In this part, we should optimize and deploy the lead database according to the requirement, exchange the lead cache of data, and provide the caching mechanism of medical institutions in the process of uploading the original medical data[16]. In the process of uploading mass original data, we will adopt the uploading forms of the quasi real-time and batch, which can ensure the service response time and stability and improve the transmission efficiency of system.

Conclusion

The information-based construction in health has experienced from scratch, from local to global and from hospitals to other businesses which is a process of unceasing infiltration. Health Information has gradually become an indispensable part of the medical and health service system. At present, the information system of medical institutions at or above the county level have basically gained popularity, but 85% of HIS systems still make financial accounting as the center. However, the information-based construction of integration and information sharing of the information system within the health industry has just started.

The resident healthy record is a collection of healthy information records for a man from birth to death. And it has researched the key technology of the intercommunication of the resident healthy records and hospital medical record systems, realized the grading medical treatment and two-way diagnoses, and formed a new medical treatment pattern of "indisposition in the community, a serious illness into the hospital and rehabilitation back to the community". This system will effectively guide the rational flow of patients and promote the reasonable use of health resources.

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