

A Study on DBaaS system for the HL7-based health information sharing in the cloud environment

Ho-Kyun Park¹, Seok-Jae Moon²

¹ School of IT Convergence Engineering, Shinhan University, Gyeonggi, Republic of Korea

² Department of Computer Science, Kwangwoon University, Seoul, Republic of Korea
hkpark@shinhan.ac.kr, msj8086@kw.ac.kr

Abstract. The latest development of Information and Communication Technology brings about important changes to the medical environment. A system that enables hospitals with different hospital systems to efficiently share and exchange medical information is demanded. This study suggests a cloud based DBaaS system in which interoperability of medical data can be enabled through efficient connections by using each HL7 standard protocol in spite of different medical information systems.

Keywords: Cloud, HL7, XMDR-DAI, Interoperability, health information system

1 Introduction

The latest rapid development of Information and Communication Technology brings about swift informatization in the medical area. Medical informatization results in many changes to the medical system more than easily arranging and utilizing plenty of information [1]. Given that an emergency patient is transferred to a general hospital for an operation after a diagnosis in a small clinic, when basic test information that is made during patient's transfer is informed to the general hospital for the understanding of the patient's condition and the preparation for the operation in advance before the patient's arrival, diagnosis delay due to the repetition of the emergency test can be deterred. Exchanges of medical data between each different hospital information systems occur at times and even a hospital that treats affairs by department often uses programs developed by various companies. Accordingly, data exchanges between diverse programs without compatibility are required and at this point, HL7 (Health Level Seven) [2] was developed as a standard to correctly exchange data between different medical institutions. This study suggests a cloud based DBaaS [3] system in which medical data between hospital systems can be shared in compliance with the HL7 type according to the protocol defined in the HL7 standard. [4] This system has the characteristic to store and share medical information based on the HL7 message required for interchange between hospitals through each mapping of medical information of different types. Moreover, it can mutually integrate medical information, and create individual medical information Schema and share individual medical information with other hospitals through a relay server. The

composition of this study is as follows. Chapter 2 describes related studies and Chapter 3 explain the suggested system composition and internal flow. Chapter 4 describes results and future research.

2 Related Works

HL7 is a standard protocol to exchange data between health and medical information systems. At present, it is the standard protocol of North America for electronic exchanges of medical information. The HL7 message is composed of segment, field and component.

MSH	ADT A01	Message	EVB
delimiter	MSH	message header	event type
message type	EVN	event type	event time
send	PID	patient ID	event persons code
send time	PV1	call patient info	operator ID
auth ID			
HL7 version			
	PV1	PID	
	patient class	patient ID	
	patient location	patient name	
	hospitalization type	gender	
	hospitalization count	age	
	doctor	obstacle code	
	assistance	protecteur	

Fig. 1. HL7 Protocol Message Structure.

Figure 1 is the structure of the HL7 message. This message is the smallest unit of data transfer and composed of segments. The message starts with Message Header Segment (MSH) and divides messages with a message type and a trigger event. A segment is a logical gathering of fields in fixed order. There are an essential segment, a selective segment and a segment left for downward compatibility. An essential segment is a segment that must be filled within a message. A selective segment is not used or allows many repetitions. A segment can be distinguished by 3 initial letters of segment ID. The segment is divided by a segment separator (<CR>). A field is a gathering of components and a component of subcomponents. The field is defined as a variety of data such as letter, number, date, time and mixed sentence and it is transferred as a type of String. The max length property of a field defines the max letter number that can be expressed in a field. The field allows null value. The field allows repetition.

3 The DBaaS System Architecture

3.1 Proposed System Overview

The system suggested by this study is the same as Figure 2. Medical information systems used by each hospital interwork with Coordinator by using Hospital DB based on the HL7 protocol. Coordinator provides interwork information with each

medical information systems through Hospital Category DB and enables exchanges of medical information through Data Hub. When medical information required by a hospital is demanded to Coordinator, it searches for a hospital and patient information through a previously registered original key. Medical data of each hospital system is operated after mapping in compliance with the HL7 protocol. Below is component explanation of this system.

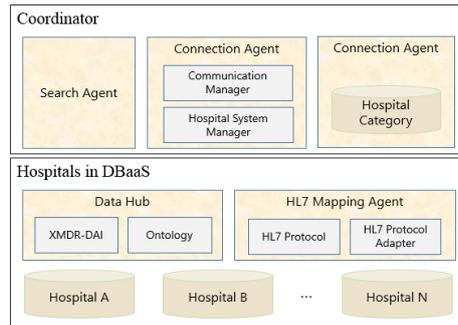


Fig. 2. HL7 Protocol Message Structure.

Coordinator. This class makes each physical hospital information as category key value and connects each hospital and mutually search for medical data, and is composed of Search Agent, Connection Agent, and Hospital Category DB.

- Search Agent: This agent interworks medical data required by each hospital with Connection Agent and supports swift search.

- Connection Agent: This agent deals with a demand to connect medical system of each hospital. When a connection demand is received through Communication Manager, Hospital System Manager starts connecting and searching through a category key value.

Hospitals DBaaS. This class provides handling of a medical data demand of each hospital by using the HL7 protocol message through mapping, and is composed of Data Hub, HL7 Mapping Agent, and Hospitals DBs.

- Data Hub: It enables medical information stored in each hospital DB to be connected. At this moment, handling of Schema collision that can occur between medical data is solved by XMDR-DAI[5] and Ontology.

- HL7 Mapping Agent: It provides the results from mapping medical information data through each HL7 protocol message and Adapter as a file type.

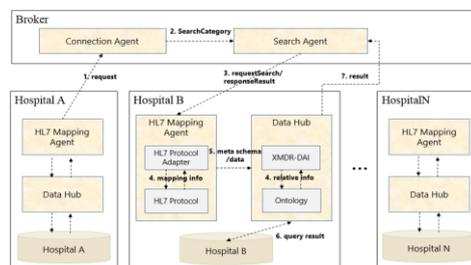


Fig. 3. HL7 Protocol Message Structure.

Figure 3 is the whole process that interoperates medical information between systems suggested by this study. Medical information data of Hospital A and Hospital B is demanded to connect through Connection Agent. Then, Search Agents searches for Hospital B by using Hospital Category DB and uses the HL7 protocol message through HL7 Mapping Agent and acquires necessary information. And Data Hub searches for requested information from the operating DB of Hospital B in XMDR-DAI and confirms the possibility of collision and performs queries on the requested information. After its performance, the results requested by Search Agent are rendered to Hospital A.

4 Conclusion

This study suggests the DBaaS system in the cloud environment in which each hospital system can interoperate medical information data in spite of different medical information systems. The suggested system implemented the DBaaS system that enables data interoperability by connecting Schema of medical information data of each hospital with the HL7 based standard message, and allowed swift search through the internal category hospital information list of the relay server. Regarding the Schema collision problem occurring in the process of connecting medical data, XMDR-DAI overcame heterogeneity. Future studies should focus the possibility to enable medical information integration between body clouds by using a sensor.

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