ANALYSIS ON HEALTH INFORMATION EXCHANGE CDA GENERATION AND INTEGRATION BASED ON CLOUD COMPUTING SYSTEM

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ABSTRACT
A successful implementation of an electronic health record can enhance patient safety and the standard of care, but interoperability across hospitals’ HIE systems is a need. The spread of this document format is essential for interoperability, and the Clinical Document Architecture (CDA) created by HL7 is a fundamental document standard to assure such compatibility. Sadly, hospitals are hesitant to embrace interoperable HIS because of its adoption costs, with the exception of a small number of nations. As all hospitals switch to the CDA document format, further issues appear since it is challenging to handle the data spread throughout so many papers. In this article, we discuss our cloud-based Open API service for CDA document production and integration, which enables hospitals to quickly produce CDA documents without having to buy software. Our CDA document integration system integrates multiple CDA documents per patient into a single CDA and physicians and patients can browse the clinical data in chronological order. Our system of CDA document generation and integration is based on cloud computing and the service is offered through Open API. Developers using different platforms thus can use our system to enhance interoperability.

1. INTRODUCTION
A longitudinal collection of health information that includes the patient's health, the healthcare that was delivered to that patient and the patient's response to that treatment can be recorded as electronic health information, creating an electronic health record (EHR). Thus, the HIE system’s deployment is designed to guarantee the EHR’s successful upkeep. But, there is also an issue with system incompatibility, because HIS has a variety of features. In order to ensure interoperability with regard to health information, it is necessary to standardize the sharing of health information across hospitals. Hence, standardizing the clinical document is essential to ensuring interoperability. The major standard for clinical documents is CDA which was established by Health Level Seven (HL7). CDA is the core document standard, an XML document which holds the structure and semantics of clinical documents for health information exchange. The first version of CDA was released on 2001 and it’s second version was released on 2005. Many countries have done many successful projects adopting CDA. To improve semantic interoperability, many active works are done based on openEHR and CEN3606.
More HIE system has to support CDA to establish confidence in interoperable Health Information Exchange. Moreover, the structure of CDA is too complex and the correct CDA Document production is difficult without the good understanding of the CDA standard and enough experience with it. Also, the HIS development platforms for hospitals differ so greatly in such a way that generation of CDA documents in every hospital invariably requires a separate CDA generation system. In addition to that, hospitals refuse to adopt a new system unless it is perfectly necessary for delivery of care. As a result, except for only few handful countries like New Zealand or Australia, the adoption rate of EHR is too low. To promote HER adoption among hospitals, the USA government had implemented an incentive program called the Meaningful Use Program. When a patient is diagnosed at a clinic, a CDA document the diagnosis is generated. The CDA document can be share with other clinics if the patient agrees. The concept of family doctor does not exist in Korea; hence it is common for a patient to visit a number of different clinics. The exchange of CDA document is triggered in the following cases: when a physician needs to study a patient’s medical history; when referral and reply letters are drafted for a patient cared by multiple clinics; when a patient is in emergency and the medical history needs to be reviewed. It takes increasing amount of time for the medical personnel as the amount of exchanged CDA document increases because more documents mean that data are distributed in different documents.
This definitely delays the medical personnel in making decisions. Therefore, when all the CDA documents are integrated into a single document, the medical personnel are motivated to view the patient’s medical history conveniently in chronological order per clinical section and the corresponding care service can be provided more effectively. Sadly, for now, a solution that integrates multiple CDA documents into one do not exist yet to the best of our knowledge and there is a practical limitation for individual hospitals to develop and implement a CDA document integration interface.

In this paper we show (1) a CDA document generation system that generates CDA documents on different developing platforms for the interface to be platform independent and (2) a CDA document integration system that integrates multiple CDA documents scattered in different hospitals for each patient.

2. LITERATURE SURVEY

A Prototype Model Using Clinical Document Architecture (CDA) with a Japanese Local Standard: Designing and Implementing a Referral Letter System. In this paper, since clinical document architecture (CDA) became an American National Standards Institute (ANSI)-approved health level seven (HL7) Standard, many countries have begun making an effort to make local standards conform to CDA. In order to make CDA compatible with the many different local standards existing in different countries, we designed a prototype model using HL7 CDA R2 with medical mark-up language (MML).

Application of Portable CDA for Secure Clinical-document Exchange. Health Level Seven (HL7) organization published the Clinical Document Architecture (CDA) for exchanging documents among heterogeneous systems and improving medical quality based on the design method in CDA. In practice, although the HL7 organization tried to make medical messages exchangeable, it is still hard to exchange medical messages. There are many issues when two hospitals want to exchange clinical documents, such as patient privacy, network security, budget, and the strategies of the hospital. In this article, we propose a method for the exchange and sharing of clinical documents in an offline model based on the CDA—the Portable CDA. This allows the physician to retrieve the patient’s medical record stored in a portal device, but not through the Internet in real time. The security and privacy of CDA data will also be considered.

3. MATERIALS IMPLEMENTED

In this section, we present the necessary techniques in detail for the design, and explain the implementation of our CDA generation and integration system based on cloud

3.1 The CDA Document

American Nation Standards Institute approved the HL7 Clinical Document Architecture Release 2 (CDA R2) in May 2005, where CDA is an XML-based document mark-up standard that specifies the structure and semantics of clinical documents and its primary purpose is to facilitate clinical document exchanges between heterogeneous software systems. A CDA document is divided into its header and body. The header has a defined structure and it includes information about the patient, hospital, physician, etc. The body part is flexible than the header and contains various clinical data. Each piece of clinical data is allocated a section and given an acode as defined in the Logical Observation Identifiers Names and Codes (LOINC). Different subcategories are inserted in a CDA document depending on the purpose of the document, and we chose the Continuity of Care Document (CCD) because it contains the health summary data for the patient and it is also widely used for interoperability. We chose the Korean Standard for CDA Referral and Reply Letters (Preliminary Version) format for CDA integration system as the number of clinical documents generated when patients are referred and replies made, is large.

3.2 Cloud Computing

Cloud computing is defined as using a network of remote servers, hosted in the Internet that helps to store, manage, and process data, rather than a local server or a personal computer. It refers to the applications delivered as services over the Internet and software in the data centres that provide those services. The user pays fee depending on the amount of resources allocated, such as network, server, storage, applications and services.
4. METHODOLOGY
The objective of our system is to generate the PDF format for the generated and integrated CDA Documents for the use of Patients. This conversion takes place in the CDA Generation and Integration Interface located in the HIS systems of the hospitals. Also, we have included another attribute in the CDA Header like Aadhar number applicable in India to generate the unique ID in the cloud to create security of information residing in the cloud. Our cloud computing based CDA generation and integration system has a few pronounced advantages over other existing projects. First, hospitals do not have to purchase propriety software to generate and integrate CDA documents and bear the cost as before. Second, our service is readily applicable to various developer platforms because an Open API is to drive our CDA document generation and integration system. Regardless of the type of the platform, CDA documents can be easily generated to support interoperability. Finally, the integrated CDA Documents is converted to PDF format.

4.1 Registration and Appointment
Users in the hospital environment will have an initial registration in the web end. The server in turn stores the information in its database. Now the patient login and fix appointment to the Doctor by mentioning time and date of the appointment, disease, specialist and name of the doctor. Each Doctor views their appointment in their appointment page.

4.2 Patient Report Generation
Doctor view the patient information such as disease, symptoms etc. If it necessary patient is advised to take lab test. Lab Technician provides test result to patient. Based on test result, Doctor suggests prescription to the patient, and also patient health history should be maintained in appropriate hospital database. Doctor can view patient health history before he suggests prescription to the patient.
4.3 CDA Generation
In this module patient health information’s are send to the cloud server. Now the cloud server will generate unique id for every user based on patient name, father name, date of birth and additionally Aadhar card number using PJW Hash Algorithm. If already id exists then the patient details will be appended with patient clinical history else new CDA document will be generated.

Fig 4.CDA Generation

4.4 Parsing CDA Document
In this module the new patient enters into hospital no need to give details about the disease and symptoms. The patient history already maintained in cloud server so we can get the patient histories by using key it is retrieve from patient personal details. The patient histories maintained in document which is contains patient clinical histories (hospital name, disease, prescription).

4.5 Converting CDA Document to PDF
The parsed CDA Documents are received at the HIS system where the documents are converted into PDF for the personal use of the patient. To do this, we need to add an application called PDF conversion interface. This can be simply extended with the existing software where the entities like CDA Document Generation and Integration resides.

CONCLUSION
We create a productive method of producing PDF files in the produced and integrated CDA documents for patients’ usage. Our CDA generation and integration system, which is based on cloud computing, offers a few clear benefits over other ongoing programmers. When CDA documents proliferate and interoperability is attained, a difficulty arises because it becomes difficult to manage distinct CDA papers for each patient because the clinical data for each patient is dispersed over numerous pages. This problem is properly solved by our cloud server’s CDA document integration solution, which combines different CDA documents created for specific patients.

First, Hospitals do not have to purchase propriety software to generate and integrate CDA documents and bear the costs before. Second, our service is readily applicable to various developer platforms because an Open API is to drive our CDA document generation and integration system. Regardless of the type of the platform, CDA documents can be easily generated to support interoperability. Also, additionally, the integrated CDA Documents of the patient is converted into the PDF format for the use by Patients. Thus, the time is saved for the doctors in taking medical decisions at emergency times and delivers the correct health care as the medical records are in chronological order.

Future enhancement
In our future work, we will explore the following points. First, we will make a concrete estimation of the reduction in cost when the EHR system becomes cloud-based. Establishing a reasonable fee system is an important issue for cloud computing. There is ample evidence that cloud computing is effective and efficient in cost reduction, and the medical field seems to be no exception. Security and stability is top priority for cloud computing resources as it is used by many users. Future work will attempt to enhance security while ensuring reasonable quality of service even with multiple users logged on the system at the same time.
REFERENCES