CDA Generation and Integration for Health Information Exchange Based on Cloud Computing System

T BHARATH KRISHNA[1], M VINOD KUMAR[2], J KAVITHA[3] Y NANCHARI[4]

[1]Assosiate Professor, Department of Civil Engineering, AnuBose Institute of Technology, KSP Road, New Paloncha, Bhadradri Kothagudem District, Telangana (TS), 507115

[2, 3, 4]Assistsnt Professor, Department of Civil Engineering, AnuBose Institute of Technology, KSP Road, New Paloncha, Bhadradri Kothagudem District, Telangana (TS), 507115

ABSTRACT- *Successful deployment of Electronic Health Record helps improve patient safety and quality of care, but it has the prerequisite of interoperability between Health Information Exchange at different hospitals. The Clinical Document Architecture (CDA) developed by HL7 is a core document standard to ensure such interoperability, and propagation of this document format is critical for interoperability. Unfortunately, hospitals are reluctant to adopt interoperable HIS due to its deployment cost except for in a handful countries. A problem arises even when more hospitals start using the CDA document format because the data scattered in different documents are hard to manage.*

In this paper, we describe our CDA document generation and integration Open API service based on cloud computing, through which hospitals are enabled to conveniently generate CDA documents without having to purchase proprietary software. Our CDA document integration system integrates multiple CDA documents per patient into a single CDA document 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 in Open API. Developers using different platforms thus can use our system to enhance interoperabili

1. INTRODUCTION

Electronic Health Record (EHR) is longitudinal collections of electronic health information for and about persons, where health information is defined as information pertaining to the health of an individual or health care provided to an individual and it can support of efficient processes for health care delivery. In order to ensure successful

an operation of EHR, a Health Information Exchange(HIE) system need to be implemented. However, most of the HIS in service have different characteristics and are mutually incompatible. Hence, effective health information exchange needs to be standardized for inter operable health information exchange between hospitals. Especially, clinical document standardization lies at the core of guaranteeing inter operability.

Health Level Seven has established CDA as a major standard for clinical documents. CDA is a document markup standard that specifies the structure and semantics of 'clinical documents' for the purpose of exchange. The first version of CDA was developed in 2001 and Release 2 came out in 2005. Many projects adopting CDA have been successfully completed in many countries.

Active works are being done on improving semanticinter operability based on open EHR and CEN13606. To establish confidence in HIE interoperability, more HIS's need to support CDA. However, the structure of CDA is very complex and the production of correct CDA document is hard to achieve without deep understanding of the CDA standard and sufficient experience

with it. In addition, the HIS development platforms for hospitals vary so greatly that generation of CDA documents in each hospital invariably requires a separate CDA generation system. Also, hospitals are very reluctant to adopt a new system unless it is absolutely necessary for provision of care. As a result, the adoption rate of EHR is very low except for in a few handful countries such as New Zealand or Australia. In the USA, the government implemented an incentive program called the Meaningful Use Program to promote EHR adoption among hospitals. When a patient is diagnosed at a clinic, a CDA document recording the diagnosis is generated. The CDA document can be shared with other clinics if the patient agrees.

Objectives of the study

1) Successful deployment of Electronic Health Record helps improve patient safety and quality of care, but it has the prerequisite of interoperability between Health Information Exchange at different hospitals.

2) The Clinical Document Architecture (CDA) developed by HL7 is a core document standard to ensure such interoperability, and propagation of this

document format is critical for interoperability.

3) Unfortunately, hospitals are reluctant to adopt interoperable HIS due to its deployment cost except for in a handful countries. A problem arises even when more hospitals start using the CDA document format because the data scattered in different documents are hard to manage.

4) In this paper, we describe our CDA document generation and integration Open API service based on cloud computing, through which hospitals are enabled to conveniently generate CDA documents without having to purchase proprietary software.

5) Our CDA document integration system integrates multiple CDA documents per patient into a single CDA document 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 in Open API.

6) Developers using different platforms thus can use our system to enhance interoperability.

2. LITERATURE REVIEW

Ensuring Fine-Grained Authorized Access Control for Healthcare Applications on Cloud Provisioned Platform

In this system, XACML 3.0 standard is implemented to develop a prototype application. Through cloud computing platform (WSO2 Servers), the system can support the patients and healthcare workers to access the digital health records in hospitals easily by ensuring the patient's privacy and access to information.

An Evaluation of Indoor Location Determination Technologies

This paper attempts to provide such a useful comparison by providing a review of the practicalities of installing certain location sensing systems. We also comment on the accuracies achieved and problems encountered using the position-sensing systems.

A Linked Dataset of Medical Educational Resources

In this paper, we illustrate a medical educational dataset (m Educator Linked Educational Resources dataset) that is published as part of the Linked Open Data cloud following Linked Data (LD) principles. The dataset contains educational

cloud following Linked Data (LD) principles. The dataset contains educational resource metadata harvested from ten different (medical) educational institutes.

3. EXISTING AND PROPOSED METHOD

Existing method

When a patient is diagnosed at a clinic, a CDA document recording the diagnosis is generated. The CDA document can be shared 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 means that data are distributed in different documents. This significantly delays the medical personnel in making decisions. Hence, when all of the CDA documents are integrated into a single document, the medical personnel is empowered to review the patient's clinical history conveniently in chronological orderper clinical section and the follow-up care service can be delivered more effectively. Unfortunately for now, a solution that integrates multiple CDA documents into one does 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 technology.

Proposed method

In this paper we present (1) a CDA document generation system that generates CDA documents on different developing platforms and (2) a CDA document integration system that integrates multiple CDA documents scattered in different hospitals for each patient. The benefits of adopting this system are as follows. First, the system is accessible through an Open API and developers can continue working on their developer platforms they specialize in such as Java, .NET, or C/Cþþ. Hospital systems can simply extend their existing system rather than completely replacing it with a new system. Second, it becomes unnecessary for hospitals to train their personnel to generate, integrate, and view

standard-compliant CDA documents. The cloud CDA generation service produces documents in the CDA format approved by the National Institute of Standards and Technology (NIST). Third, if this service is provided for free at low price to hospitals, existing EHR are more likely to consider adoption of CDA in their practices.

4. SOFTWARE REQUIREMENT SPECIFICATIONS

User Interface

The user interface of this system is a user friendly Java Graphical User Interface.

Hardware Interfaces

The interaction between the user and the console is achieved through Java capabilities.

Software Interfaces

The required software is JAVA1.6.

Operating Environment

Windows XP, Linux.

HARDWARE CONFIGURATION

- Processor   -   Pentium –IV
- Speed   -   1.1 Ghz
- RAM   -   256 MB(min)
- Hard Disk   -   20 GB
- Key Board   -   Standard Windows Keyboard
- Mouse   -   Two or Three Button Mouse
- Monitor   -   SVGA

SOFTWARE CONFIGURATION

- Operating System   :   Windows XP
- Programming Language   :   JAVA

Introduction to JAVA

Initially the language was called as "oak" but it was renamed as "java" in 1995.The primary motivation of this language was the need for a platform-independent (i.e. architecture neutral)language that could be used to create software to be embedded in various consumer electronic devices.

- Java is a programmer's language
- Java is cohesive and consistent

➤ Except for those constraint imposed by the Internet environment. Java gives the programmer, full control
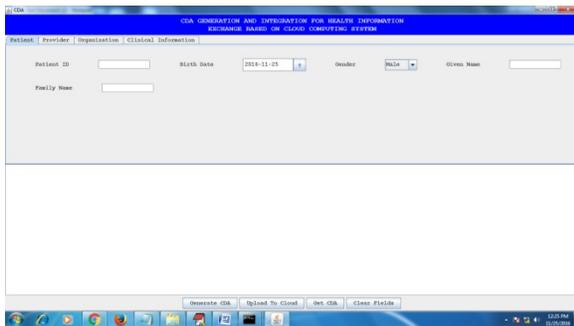
Finally Java is to Internet Programming where c was to System Programming.
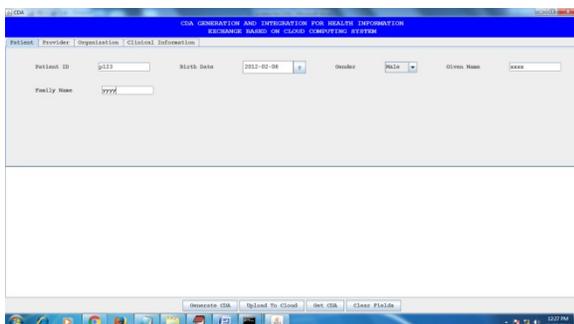
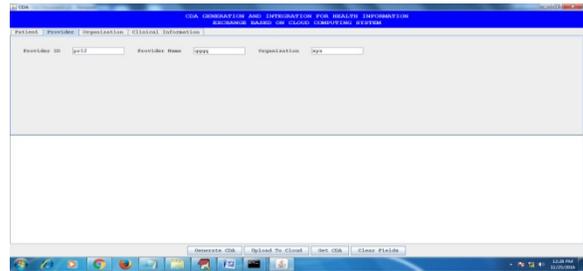## 5. RESULTS AND ANALYSIS

Run the cloud server:
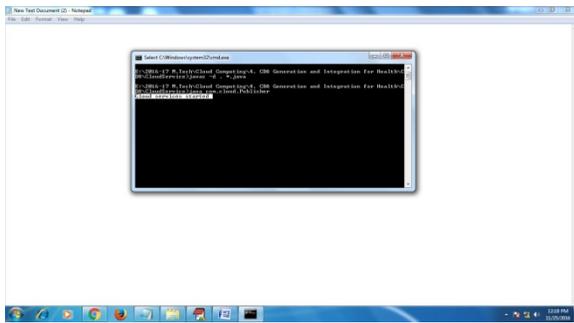
Hospital (client) application screen:
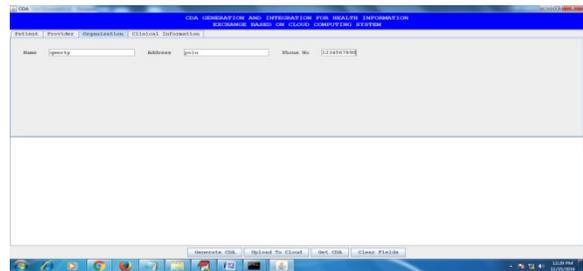

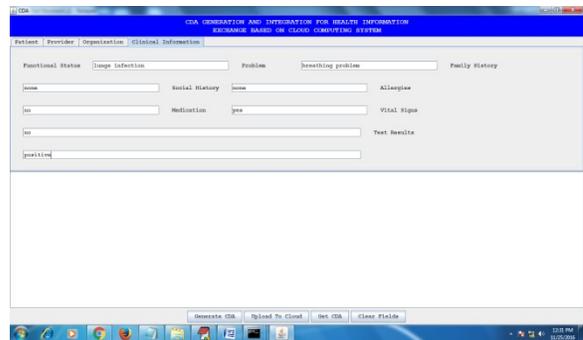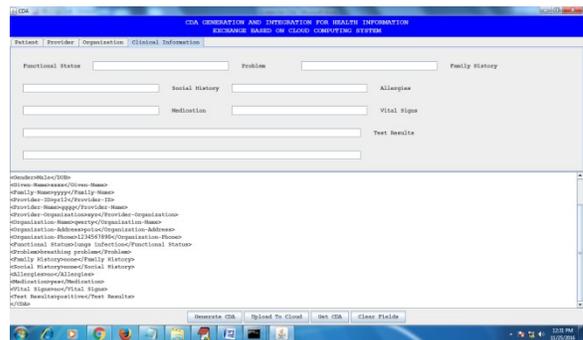Enter the patient information:

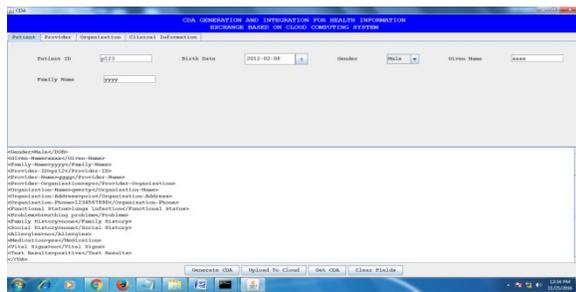Enter the provider information:

Enter the organization information:
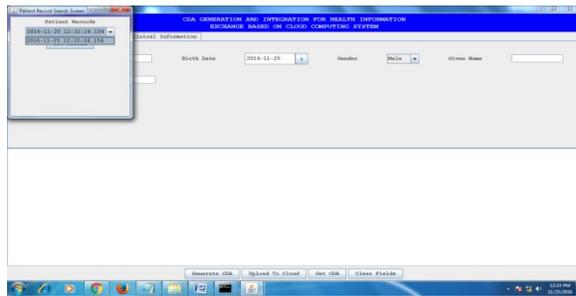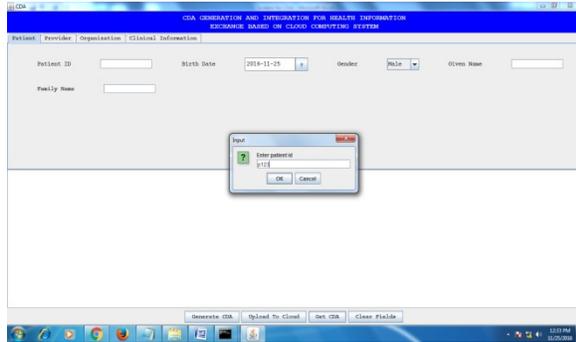

Enter the clinical information:
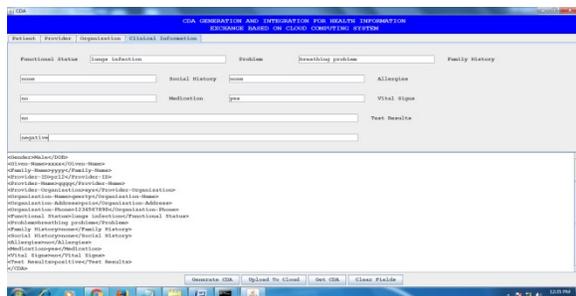

Click on generate CDA:

Click on upload to cloud to upload the generated CDA onto cloud.
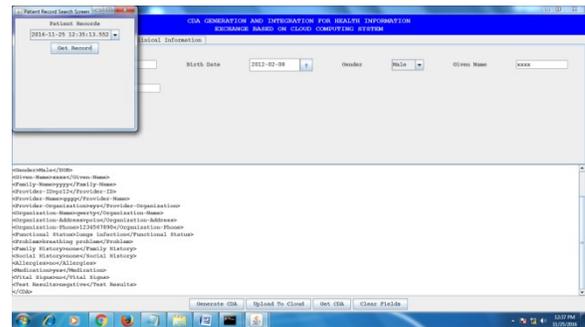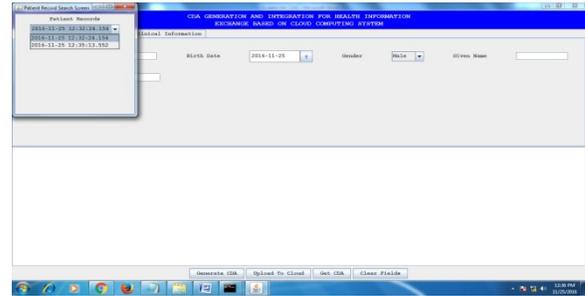
Click on get CDA:

We can modify any condition then generate CDA and upload on to cloud:

Get CDA:

6. CONCLUSIONS

While the client handled the strings in Korean language without problems, the server did not, which was resolved by installing Korean language pack in the server OS. When SaaS is offered targeting hospitals of different languages, developers will need to pay extra attention to this issue. Second, the API parameter for our CDA document generation service was of the list type, but under the C# language environment, the parameter was converted to the string array type. This is suspected to have been caused by the IDE software of C#, which automatically makes this type conversion. Hence, the returned data needs

to be as generic as possible to be applicable to as many platforms as possible.

REFERENCES

[1]. Y. Kwak, "International standards for building electronic health record (ehr)," in Proc. Enterprise Netw. Comput. Healthcare Ind., pp. 18–23, Jun. 2005.

[2]. M. Eichelberg, T. Aden, J. Riesmeier, A. Dogac, and Laleci, "A survey and analysis of electronic healthcare record standards," ACM Comput. Surv., vol. 37, no. 4, pp. 277–315, 2005.

[3]. T. Benson, Principles of Health Interoperability HL7 and SNOMED. New York, NY, USA: Spinger, 2009.

[4]. J. L€ahteenm€aki, J. Lepp€anen, and H.Kaijanranta, "Interoperability of personal health records," in Proc. IEEE 31st Annu. Int. Conf. Eng. Med. Biol. Soc., pp. 1726–1729, 2009.

[5]. R. H. Dolin, L. Alschuler, C. Beebe, P. V. Biron, S. L. Boyer, D. Essin, E. Kimber, T. Lincoln, and J. E. Mattison, "The HL7 Clinical Document Architecture," J. Am. Med. Inform. Assoc., vol. 8, pp. 552–569, 2001.

[6]. R. H. Dolin, L. Alschuler, S. Boyer, C. Beebe, F. M. Behlen, P. V. Biron, and A. Shabo, "The HL7 Clinical Document Architecture," J. Am. Med. Inform. Assoc., vol. 13, no. 1, pp. 30–39, 2006.

[7]. M. L. Muller, F.€Ückert, and T. Burkle, "Cross-institutional data€ exchange using the clinical document architecture (CDA)," Int. J. Med. Inform., vol. 74, pp. 245–256, 2005.

[8]. H. Yong, G. Jinqiu, and Y. Ohta, "A prototype model using clinical document architecture (cda) with a japanese local standard: designing and implementing a referral letter system," Acta Med Okayama, vol. 62, pp. 15–20, 2008.

[9]. K. Huang, S. Hsieh, Y. Chang, F. Lai, S. Hsieh, and H. Lee, "Application of portable cda for secure clinical-document exchange," J. Med. Syst., vol. 34, no. 4, pp. 531–539, 2010.

[10]. C. Martınez-Costa, M. Menarguez-Tortosa, and J. Tomas Fernandez-Breis, "An approach for the semantic interoperability of ISO EN 13606 and OpenEHR archetypes," J. Biomed. Inform., vol. 43, no. 5, pp. 736–746, Oct. 2010.