Cloud-Based CDA Health Information Exchange: Generation and Integration

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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 interoperability.

1.INTRODUCTION:

One of the key features of the cloud includes the flexibility, so we used the clouds for large data storage system. When a patient is recognize 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 some countries; therefore it is common for a patient to visit a number of different clinics. The interchange of CDA document is triggered in the following cases: when a

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physician needs to study a patient's medical history; when referral and response letters are drafted for a patient cared by multiple clinics; when a patient is in urgent situation and the medical history needs to be reviewed. It takes get larger 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 holds up 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 order per 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.

2.LITERATURE SURVEY

K. Ashish,1] presented meaningful use of electronic health records the road ahead. For practicing clinicians, the origins and likely effects of this rule may be opaque. It would be helpful to understand the motivation behind the key components of the meaningful use rules, where they are likely to take the US health care system (and the obstacles along the way), and the benefits and risks of a rapid transformation from paper to electronic record systems.

J. D. D'Amore, D. F. Sittig, A. Wright, M. S. Iyengar, and R. B. Ness,[3] proposed the promise of the CCD: challenges and opportunity for quality improvement and population health. Interoperability is a requirement of recent electronic health record (EHR) adoption incentive programs in the United States. One approved structure for clinical data exchange is the continuity of care document (CCD). While primarily designed to promote communication between providers during care transitions, coded data in the CCD can be re-used to aggregate data from different EHRs. This provides an opportunity for provider networks to measure quality and improve population health from a consolidated database. To evaluate such potential, this research collected CCDs from 14 organizations and developed a computer program to parse and aggregate them.

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Patterson, A. Rabkin, I. Stoica, and M. Zaharia,[6] presented a view of cloud computing which describes cloud computing. Authors goal in this article is to reduce that confusion by clarifying terms, providing simple figures to quantify comparisons between of cloud and conventional computing, and identifying the top technical and non-technical obstacles and opportunities of cloud computing.

S. Lee, J. Song, and I. Kim,[8] proposed clinical document architecture integration system to support patient referral and reply letters. Many Clinical Document Architecture (CDA) referrals and reply documents have been accumulated for patients since the deployment of the Health Information Exchange System (HIES) in Korea. Clinical data were scattered in many CDA documents and this took too much time for physicians to read. Physicians in Korea spend only limited time per patient as insurances in Korea follow a fee-for-service model. Therefore, physicians were not allowed sufficient time for making medical decisions, and follow-up care service was hindered. To address this, we developed CDA Integration Template (CIT) and CDA Integration System (CIS) for the HIES. The clinical items included in CIT were defined reflecting the Korean Standard for CDA Referral and Reply Letters and requests by physicians.

S. R. Simon, R. Kaushal, P. D. Cleary , C. A. Jenter, L. A. Volk, E. G. Poon, E. J. Orav, H. G. Lo, D. H. Williams, and D. W. Bates,[11] presented correlates of electronic health record adoption in office practices: A statewide survey in which despite emerging evidence that electronic health records (EHRs) can improve the efficiency and quality of medical care, most physicians in office practice in the United States do not currently use an EHR. We sought to measure the correlates of EHR adoption.

3.PROPOSED SYSTEM APPROACH

A solution that integrates multiple CDA documents into one does not exist yet to the best of our knowledge. There is a practical limitation for individual hospitals to develop and implement a 2CDA document integration technology. We proposed following systems: A CDA document generation system that generates CDA documents on different developing platforms.

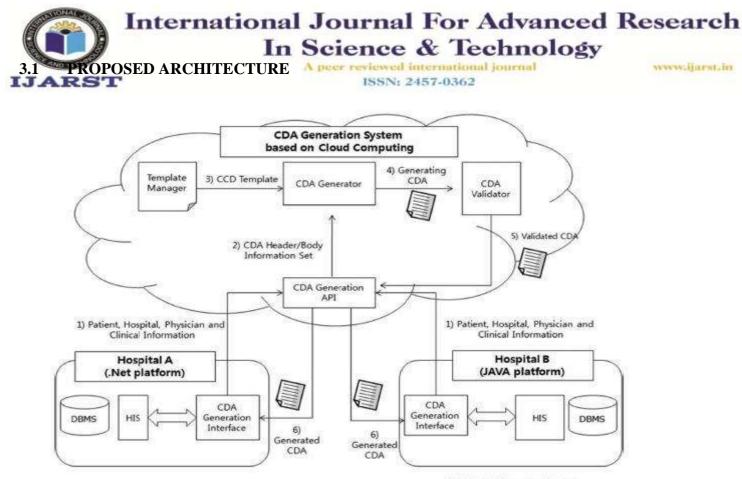CDA document integration system that integrates multiple CDA documents

scattered in different hospitals for each doctors and patient. Advantage:

❖ Hospitals do not have to purchase propriety software to generate and integrate CDA documents.

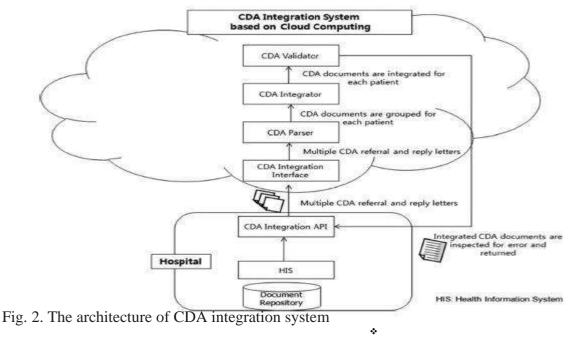❖ Hospitals do not bear the cost as before.

❖ Our service is readily applicable to various developer platforms because an Open API is to drive our CDA document generation and integration system.

❖ CDA document generation and integration system based on cloud server is more useful over existing services for CDA document if the variety of CDA document increases.

3.1 PROPOSED ARCHITECTURE

Fig 1.The architecture of CDA generation system

Fig. 2. The architecture of CDA integration system

3.2 .MODULE DESCRIPTION

MODULES:

❖ Construction of System Environment

❖ The CDA Document

❖ Construction of a Cloud Computing Environment

❖ Integration of CDA Documents via Our Cloud Server

Construction of System Environment

❖ In the first module we develop the Construction of the System Environment to

prove our proposed system model. In this module we develop Hospital A, Hospital B, Doctor, Patient/User, Admin and Cloud Modules.

❖ In Hospital A, we create the User Authorization with Login Credentials. This module provides the option of Upload the Patient details as XML File in the Cloud with Encrypted and also provides the option to check the status of the uploaded file with the XML Format. The same is followed in the Hospital B too.

❖ In the Admin part, we provide the Admin Authorization with login Credentials and view pending request of users and doctors. The admin only give Approval to the request by sending secret key to user/doctor to access the file.

The CDA Document:

❖ In this module we develop the CDA document. The HL7 Clinical Document Architecture Release 2 (CDA R2) was approved by American Nation Standards Institute. It is an XML-based document markup standard that specifies the structure and semantics of clinical documents, and its primary purpose is facilitating clinical document exchanges between heterogeneous software systems.

❖ A CDA document is divided into its header and body. The header has a clearly defined structure and it includes information about the patient, hospital, physician, etc. The body is more flexible than the header and contains various clinical data.

❖ Each piece of clinical data is allocated a section and given a code 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.

Construction of a Cloud Computing Environment:

❖ In this module we develop the Cloud computing environment. We use DriveHQ Cloud Service provider to upload our files in the Cloud.

❖ In this module, we develop the construction of a Cloud Computing Environment and how multiple CDA documents are integrated into one in our CDA Document Integration System. The standard for this is Korean Standard for CDA Referral and Reply Letters (Preliminary Version). Templates which generate a CDA use CCD part of Consolidated CDA which is released by ONC and made by HL7. However, an actually generated CDA has a form of CDA Referral and Reply Letters.

❖ The rationale for CDA document integration is as followed. When CDA-based HIE (Health Information Exchange) is actively used among hospitals, the number of CDA documents pertaining to each patient increases in time. Physicians need to spend a significant portion of their time on reading these documents for making clinical decisions.

❖ At a hospital, the CDA documents to be integrated are processed through our CDA Integration API. The CDA Integration Interface relays each CDA document sent to the cloud to the CDA Parser, which converts each input CDA document to an XML object and analyzes the CDA header and groups them by each patient ID. The CDA Document Integrator integrates the provided multiple CDA documents into a single CDA
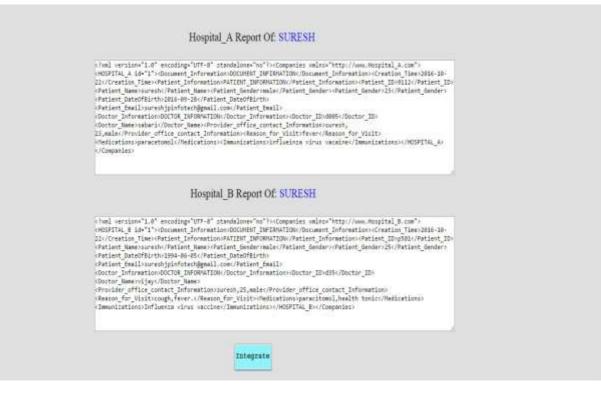
document. In this process, the data in the same section in the document body are merged.

Integration of CDA Documents via Our Cloud Server:

❖ We integrated multiple CDA documents of patient referrals and replies by using the API at our server. The use case scenario and patient data used for integration are shown in this module.

❖ We adopted sample patient data provided by the US EHR Certification Program, Meaningful Use. The data does not pertain to an actual person. It is fictional, and available for public access. This module is to show how a client integrating multiple CDA documents by using our API. The sample many clinical documents are shown to be successfully integrated.

4.RESULTS AND DISCUSSION

Fig 3: Hospital A home

Fig 4: Patient Report

5.CONCLUSION

Interoperability between hospitals not only helps ameliorate patient safety and quality of care but also minimize time and resources spent on data format conversion.Interoperability is act toward more important as the number of hospitals participating in HIE increases.As the number of HIE based on CDA documents increases, interoperability is accomplished. We proposed a CDA document generation system that generates CDA documents on different developing platforms and CDA document integration system that integrates multiple CDA documents scattered in different hospitals for each patient.The CDA document format a clinical information standard planed to guarantee interoperability between hospitals.CDA document generation and integration system based on cloud server is more helpful over existing services for CDA document if the variety of CDA document increases.

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