

Privacy Protection and Integration for Health Information Exchange

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Abstract: *Electronic Health Record maintenance helps to improve patient safety and quality of care, for that we need the operation of interoperability between different hospitals. The Clinical Document Architecture (CDA) built up by HL7 is a center record standard to guarantee such interoperability, But emergency clinics would not embrace interoperable HIS because of its sending cost. Problems increased when all hospitals start using the CDA document format as the data scattered in many documents are difficult to manage. Here, we portray our CDA record age and joining which is an Open API administration dependent on distributed computing, through which emergency clinics are empowered to helpfully create CDA archives without obtaining programming. This CDA document integration system integrate a patient all documents into a single file. This file helps the physicians and patients to browse the data in chronological order. Developers using different platforms can use our system to enhance interoperability as it's a Open API.*

Keywords: Clinical Document Architecture (CDA), Health Level Seven (HL7), Electronic Health Record (EHR).

1. INTRODUCTION

The health of the patient, health care provided to that patient as well as the reaction of the patient to the provided health care are stored in the form of longitudinal collection, forming an Electronic Health Record (EHR). The implementation of HIE is made to ensure maintenance success of EHR [2]. The problem occurs because of incompatibility between systems and also there are different characteristics involved in HIS [3], [4]. Hence, we need to standardize the health information exchange between hospitals and ensure interoperability over information. Therefore, the core is to standardize the clinical document. The major standard was established by Health Level Seven (HL7). CDA is the center report standard, a XML record which holds the structure and semantics of clinical archives for wellbeing data trade. In 2001 the first version was released and in 2005 second version was released. Many successful projects adopting CDA were done by many countries., Many active works are done based on open HER and CEN3606 [10], [11] to improve semantic interoperability.

As the amount of exchanged CDA document increases it takes a huge amount of time for the medical personnel. This delays the medical personnel in making decisions. Due to the integration of the CDA documents into a single document, medical staff can view the medical history of the patient conveniently in chronological order per clinical section and more effectively provide the corresponding care service.

But now, an answer that integrates multiple CDA documents into one do not exist yet to the best of our knowledge and there is a practical limitation. The benefits of implementing this system are as follows. First, the system can be accessed through an Open API and developers can continue working on their developer platforms they are specialized for example Java, .NET, or C/C++. Hospital systems can simply extend their existing system instead of completely replacing it with a new system. In the other hand, the hospitals do not have to train their staff to create, amalgamate, and view standard-compliant CDA documents. The cloud

based CDA generation service produces

documents in the CDA format approved by the National Institute of Standards and Technology (NIST) [14]. Third, as these services are provided free of cost at low price to hospitals, existing Electronic Health Record are more likely to consider adoption of CDA in their practices.

II. ELECTRONIC HEALTH RECORD WITH CDA

Electronic Health Record (EHR) is a patient collection and the health information is stored electronically by the population through digital format systematization. It is a digital version of the paper chart of a patient. The records are shared through different healthcare settings. The authorized providers can be created and managed of an EHR is that health information in a digital form at capable shared with other providers across more than one health care organization. The HER has the capacity to generate a complete record of a clinical patient come across, as well as supporting other care related activities directly or indirectly via interface. The important note is that in an institution, such as a hospital, integrated delivery network, clinic, or physician office, EHR is generated and maintained. The patient receives those service from an auxiliary department are created as an electronic record.

III. CLINICAL DOCUMENT ARCHITECTURE

Clinical Document Architecture is in XML based format. It is classified from the HL7 RIM(Reference Information Model) and uses HL7 version 3 data types. The documents contain any relevant information to a healthcare provider or government entity and all information about a patient's medical history, such as allergies, medications, insurance information or lab results [14]. Each piece of clinical data is allocated a section and given a code as defined in the Logical Observation Identifiers Names and Codes (LOINC) [15]. We chose the Korean Standard for CDA Referral and Reply Letters format for the integrated CDA document because the number of clinical documents generated when referring patients and replies are large [16][17]. The CDA is divided into two categories such as Header and Body in Fig 1. In CDA Header that includes Patient ID, Birth Date, Gender, Given Name, and Family- Name. In CDA Body, the items are included as Problem, Medication, Laboratory, Immunization, and so on. Different subcategories are inserted in a CDA document depending on the purpose of the document, and chose the Continuity of Care Document (CCD) [18] because it contains the health summary data for the patient and it is also widely used for interoperability.

IV. CDA IN CLOUD COMPUTING

The information can exchange and use the information that has been exchanged between two or more systems or components through interoperability. The cloud computing services model refers the cloud SaaS where the software applications HIS are offered as services. A web services is any service that is available over the internet or intranet, uses standardized XML messaging system and is self describing, discoverable and not tied to any operating system or programming language [19]. So the focus on HL7 CDA (Clinical Document Architecture) and CCD (Continuity of Care Document). CDA is a document markup standard that defined with clear structure and semantics of clinical document for the purpose of data exchange and cloud be any of the following: Summary discharge, referral, clinical summary, history / physical examination, diagnostic report, prescription or report on public health. In a private or public cloud, the medical data are stored with the condition for the public cloud to provide a strong security and all the departments of the hospital access this medical data of the patients. Cloud computing can help patients to gain access to their medical history from anywhere in the world via the internet [20]. It defines the new style of computing where resources are dynamically scaled, virtualized and are provided as a service on the internet. Health care Information System recommends the technology for its benefits: flexible and quick access to information, features needed more and more in these times characterized on one side by budget cutting and on the other side by ageing societies.

V. CDA GENERATION AND INTEGRATION ON CLOUDCOMPUTING

CDA generation software is platform dependent and it is not centralized. So the process of CDA document an Open API is developed. The clinical information of patient, hospital, and physician are entered through CDA Generation interfaces and sent to the cloud server by CDA generation API. The data are relays in the CDA Header/Body. The Header and Body contains about the patient's, and clinical information. The CDA Generation API are packaged the data in the CDA Header Set and Body Set and relayed to CDA Generator. The Continuity of

care document template is received by CDA Generated in the cloud. Result of the generated CDA document is inspected by Validator. Usually the patients are consults with multiple physicians in different hospitals. The CDA document scattered in different location. Physicians need to spend more time on reading these documents for making clinical decisions. In the CDA integration system, the multiple CDA documents are integrated into a single document. Each CDA document sent to the cloud to the CDA parser, which converts each input CDA documents to an XML object and analyses the CDA header and groups them by each patient ID. The integrated CDA sent to validator, and the result is returned as string to the hospital that requested CDA document integration. Using the system on cloud, hospitals are enabled to conveniently generated CDA documents without having to purchase proprietary software. The physician is empowered to review the clinical history of the patient conveniently so that all the CDA documents are integrated into a single document.

VI. IMPLEMENTATION

For health concepts representation, CDA uses HL7's Reference Information Model (RIM), which puts data in a clinical or administrative context and expresses how pieces of data are connected. Through CDA generation and integration on cloud computing, the health information system can be generated as a CDA document.



Fig.1

The world widely adopted HL7 CDA standards and is based on XML (Extensible Markup Language). When a physician needs to study a patient's medical history which are cared for patient by multiple clinics. In this case, the generation of multiple CDA documents that integrates into single document in CDA Generation and Integration of Open API on cloud. The product of the CDA document is in XML based document. For the physician it should be as uncomfortable to read and understand and take time to get conclusion.

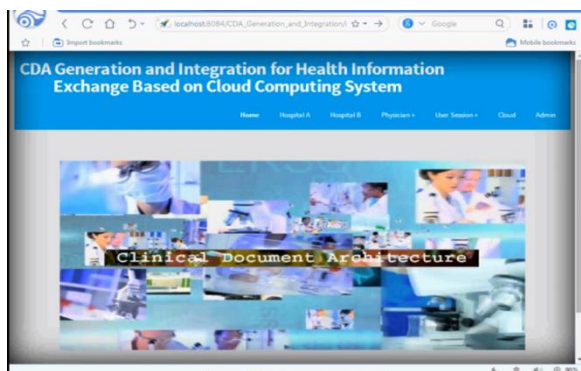


Fig.2

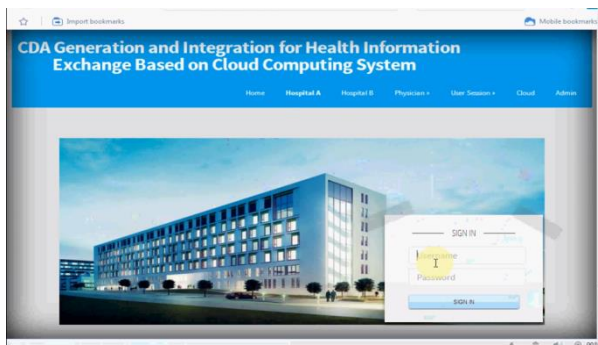


Fig.3

The steps should be following as: The health information that includes patient, Hospital, Physician, and Clinical Details care send to Generation and Integration of API through interfaces. The CDA Document produced after generate and integrate process. Output of the document can be validate and returned to parser. Using java API, the parsed documents send for conversion to receive the readable format. Result can be send as a output to the recipient of the hospital. When the physicians need to make quick decision's the readable format can be as a flexible and efficient to their knowledge. Using API, CDA document can change to other format. The readable text format is comfortable to read for both physicians and patients. Users can be avoided unnecessary conversion for specified formats.

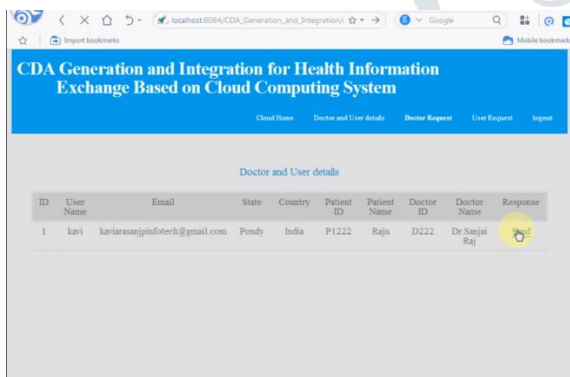


Fig.4

They can download as a readable format comfortable to read for both physicians and patients. Users can be avoided unnecessary conversion for specified formats.

VII. CONCLUSION

Interoperability not only helps to improve patient safety and quality of care but also reduce time and resources spent on data format conversion between hospitals. The CDA document format a clinical information standard hospitals, a large number of HIE projects that use the Clinical Document Architecture format have been undertaken in many countries. As a result, health information records are generated and integrated in chronological order on cloud as a clinical document XML-

based file format. Hospitals are not prepared to purchase licensed software for generating and integrating CDA documents. Since the upgradation of the software and supporting software's are to be purchased in regular intervals. The service can be applied to different developer platforms because open API drives the CDA document generation and integration system. The document can provide easy access to CDA with the cloud server. HIE increases based on CDA documents, its interoperability is achieved.

But doctors are having trouble referring multiple documents. Thus, through the CDA integration system, multiple CDA documents are integrated into one. CDA Document's final result is based on XML format. The CDA XML-based document has been converted to readable format using the API in the proposed system.

VIII. REFERENCE

- [1]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.
- [2]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.
- [3]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.
- [4]Kevin marks, *Social Media Expert at Google*, Kevin, Kelly 2016.
- [5]<https://blog.interfaceware.com/clinical-document-architecture-cda-overview/>
- [6]K. Ashish, D. Doolan, D. Grandt, T. Scott, and D. W. Bates, "The use of health information technology in seven nations," *Int. J. Med. Informat.*, vol. 77, no. 12, pp. 848–854, 2008.
- [7]KS X 7504 Korean Standard for CDA Referral Letters (Preliminary Version).
- [8]KS X 7505 Korean Standard for CDA Reply Letters (Preliminary Version).
- [9]J. D. D'Amore, D. F. Sittig, A. Wright, M. S. Iyengar, and R. B. Ness, "The promise of the CCD: Challenges and opportunity for quality improvement and population health," in *Proc. AMIA Annu. Symp. Proc.*, pp. 285–294, 2011.
- [10]E. Cerami, *Web Services Essentials. Third Indian Reprint*, O'Reilly Media, Inc., 2007. ISBN10:81-7366-339-4.
- [11]Oana Sorina LUPSE, Michaela VIDA and Lacramioara STOICU-TIVADAR University "Politechnica" of Timisoara, Romania.
- [12]J. Walker, E. Pan, D. Johnston, J. Adler-Milstein, D. W. Bates, and B. Middleton, "The value of health care information exchange and interoperability," in *Proc. Health Aff.*, pp. 10–18, 2005.
- [13]Sung-Hyun Lee, Joon Hyun Song, and IlKon Kim MARCH/APRIL 2016.
- [14]<https://blog.interfaceware.com/clinical-document-architecture-cda-overview/>
- [15]K. Ashish, D. Doolan, D. Grandt, T. Scott, and D. W. Bates, "The use of health information technology in seven nations," *Int. J. Med. Informat.*, vol. 77, no. 12, pp. 848–854, 2008.
- [16]KS X 7504 Korean Standard for CDA Referral Letters (Preliminary Version).

[17]KS X 7505 Korean Standard for CDA Reply Letters (PreliminaryVersion).

[18]J. D. D'Amore, D. F. Sittig, A. Wright, M. S. Iyengar, and R. B. Ness, "The promise of the CCD: Challenges and opportunity for quality improvement and population health," in *Proc. AMIA Annu. Symp. Proc.*, pp. 285–294,2011.

[19]E. Cerami, *Web Services Essentials. Third IndianReprint*, O'Reily Media, Inc., 2007.ISBN10:81-7366-339-4.

[20]OanaSorina LUPSE, Michaela VIDA and Lacramioara STOICU-TIVADAR University "Politechica" of Timisoara, Romania.

[21]J. Walker, E. Pan, D. Johnston, J. Adler-Milstein, D. W.Bates, and B. Middleton, "The value of health care information exchange and interoperability," in *Proc. Health*

Aff., pp. 10–18,2005.

[22]Sung-Hyun Lee, Joon Hyun Song,

