IJCSE International Journal of Computer Sciences and Engineering Open Access
Survey Paper Vol.-7, Issue-1, Jan 2019 E-ISSN: 2347-2693

Clinical Document Architecture (CDA) Generation and Integration for Health Data Exchange based on Cloud Computing: A Survey

Komal R. Jadhav[1*], Nitin N. Patil[2]

Department of Computer Science, R. C. Patel Institute of Technology, North Maharashtra University, Jalgoan, India

Corresponding Author: komaljadhav1010@gmail.com

Available online at: www.ijcseonline.org

Accepted: 22/Dec/2018, Published: 31/Jan/2019

Abstract— The Health level seven developed Clinical Document Architecture (CDA) is a core document that supports XML-based mark-up commonplace that is used to specify the structure, linguistics, and encryption of a clinical document like a discharge outline or progress note for the aim of exchange between totally different hospitals. A CDA document is a set of the complete information object that may embody text, images, sound, and alternative transmission content. CDA will hold any reasonably clinical information that enclosed in every patient's anamnesis like discharge outline following patient's care history & physical specialist reports like those for medical imaging or pathology. Electronic Health Record helps improve patient safety and quality of care; however, it's the necessity of interoperability between health data exchange at completely different hospitals. CDA document generation and integration Open API service supported cloud computing, through that hospital's area allowed to handily generate CDA documents whereas not having to buy proprietary code software. The CDA document integration system integrates multiple CDA documents per patient into one CDA document and doctor and patients can browse the clinical information in chronological order. In this, the CDA document generation and integration depend on cloud computing and so the service is gettable in Open API. Developers using totally different platforms thus can use this system to increase ability. It providing security to the CDA document and unique identity (id) is generated and given to the patients for avoiding the interchanging and duplication of medical reports. Every detail in CDA Document is Encrypted and stored in the Database. All Details in CDA Document is secured utilizing different Security Algorithms.

Keywords— Health Information System (HIS), Infrastructure as a Services, Cloud Computing, Health Level 7 (HL7), Electronic Health Record (EHR).

I. INTRODUCTION

Electronic Health Record (EHR) helps us to enhance the self-made readying of patient safety and quality of care; however it's the necessity of interoperability between Health Information Exchange at numerous totally different hospitals. The HL7 has developed Clinical Document Architecture (CDA) which is a core document normal to confirm such ability and propagation of this document format is important for interoperability. The hospitals area reluctant to adopt practical by HIS because of its preparation value apart from during a handful countries. The information scattered in several documents area unit exhausting to manage as a result of a haul arises even once additional hospitals begin mistreatment the CDA document format.

This paper represents CDA document generation and integration Open API service supported cloud computing, through that hospitals are enabled to handily generate CDA documents while not having to get proprietary software system. This CDA document integration system integrates multiple CDA documents per patient into one CDA document and physicians and patients will browse the clinical information in chronological order. In this the CDA document generation and integration relies on cloud computing and therefore the service is obtainable in Open API. Developers using different platforms thus can use this system to enhance interoperability. EHR is longitudinal assortment of electronic health information for and regarding persons, wherever health information is outlined as data referring to the health of a personal or health care provided to a personal and it will support of economical processes for health supplying so as to make sure self-made operation of EHR, a Health info Exchange (HIE) system is required in place. However, most of the HIS's in services are completely different and incompatible. Hence, effective health data Exchange has to be standardized for practical health data exchange between hospitals. Especially, clinical document standardization lies at the core of guaranteeing interoperability. CDA by Health Level Seven could be a major standard for clinical documents. CDA could be a document markup customary that specifies the structure and

linguistics of 'clinical documents' for the aim of exchange [1].

Many health based mostly comes are with success completed in several countries. Active works area unit being done on improving semantic interoperability based on open EHR. To ensure ability of go the quantity of HIS that supports health has to be sufficiently massive. However, the structure of health is incredibly advanced and therefore the production of correct health document is tough to realize while not deep understanding of the health standards and adequate expertise with it.

In addition, the HIS development platforms for hospitals vary therefore greatly that generation of health documents in every hospital invariably needs a separate health generation system (HIS). Also, there's a resistance towards new systems unless it's fully necessary for provision of care. As a result, the adoption rate of EHR is incredibly low aside from a number of handful countries like New Zealand or Australia. The US government runs the purposeful use program to improve efficiency in healthcare and patient safety.

The health document bearing on a patient is generated at the clinic wherever the patient is diagnosed. The generated health document can be sent to alternative clinics when patient's consent is no inheritable. The concept of family doctor does not exist in Korea, thus it's common for a patient to go to variety of various clinics. The exchange of health document is triggered within the following cases: when a physician needs to refer to the patient's medical history; when referral and reply letters are needed for a patient who is being taken care of by multiple clinics; once the patient is in an emergency and therefore the medical history must be reviewed. In this survey authors represents a health document generation system that generates health documents on totally different developing platforms and a health document integration system that integrates T health documents scattered in numerous hospitals for every patient [2].

II. EXISTING WORK

Effective health data exchange needs to be standardized for interoperable health data exchange between hospitals. Especially, clinical document standardization lies at the core of guaranteeing interoperability. It takes increasing quantity of time for the medical personnel because the amount of change health document will increase as a result of additional documents means knowledge area distributed in several documents. This considerably delays the medical personnel in making decisions. Hence, once all of the health documents are integrated into single document, the medical personnel is authorized to review the patient's clinical history handily in chronological order per clinical section and also the follow-up care service are often delivered a lot of effectively. Unfortunately for now, an answer that integrates multiple health documents into one doesn't exist nevertheless to the simplest of our information and there's a sensible limitation for individual hospital to develop and implement a health document integration technology [3].These approach have many disadvantages: The HIS development platform for hospital vary thus greatly that generation of health documents in every hospital invariably needs a separate health generation system. Also, hospitals are very reluctant to adapt a replacement system unless it's fully necessary for provision of care. As a result, the adoption rate of EHR's is extremely low apart from in an exceedingly few handful countries. Unfortunately for now, 3a solution that integrates multiple health documents into one doesn't exist nonetheless to the most effective of our information and there's a sensible limitation for individual hospitals to develop and implement a health document integration technology. To establish confidence in HIE interoperability, more HIS's need to support health. However, the structure of health is extremely advanced and also the production of correct health document is difficult to realize while not deep understanding of the health normal and decent expertise with it. In this paper we present a health document generation system that generates health documents on different developing platforms and a health document integration system that integrates multiple health documents scattered in different hospitals for each patient.

III. LITERATURE SURVEY

K. Ashish, presented purposeful use of electronic health records the road ahead. For active clinicians, the origins and certain effects of this rule could also be opaque. It might be useful to grasp the motivation behind the key parts of the purposeful use rules, wherever they're possible to require the U.S. health care system (and the obstacles on the way), and therefore the advantages and risks of a fast transformation from paper to electronic record systems [1].

D. F. Sittig, A. Wright, R. B. Ness et.al proposed the promise of the CCD: challenges and opportunity for quality improvement and population health. Interoperability is demand of recent Electronic Health Record (EHR) adoption incentive programs within the United States. One approved structure for clinical information exchange is that the continuity of care document (CCD). Whereas primarily designed to push communication between providers during care transitions, coded information within the CCD are often reused to combination information from completely different EHR's [2].

A. Rabkin, I. Stoica, and M. Zaharia et.al presented a view of cloud computing that describes cloud computing. In this authors describes is to scale back that confusion by instructive terms, providing straightforward figures to quantify comparisons between of cloud and traditional computing and distinguishing the highest technical and non-technical obstacles and opportunities of cloud computing [3].

S. Lee, J. Song, and I. Kim, projected clinical document architecture integration system to support patient

referral and reply letters. Several Clinical Document Architecture (CDA) referrals and reply documents are accumulated for patients since the readying of the Health information Exchange System (HIE'S) Clinical information were scattered in several CDA documents and this took an excessive amount of time for physicians to read. Physicians in Korea pay solely restricted time per patient as insurances in Korea follow a fee for service model. Therefore, physicians weren't allowed comfortable time for creating medical decision, and follow-up care service was hindered. To handle this, authors tend to developed CDA Integration Template (CIT) and CDA Integration System (CIS) for the HIE'S. The clinical things enclosed in CIT were outlined reflective the Korean standard for CDA Referral and Reply Letters and requests by physicians [4].

S. R. Simon, R. Kaushal, P. D. Cleary et.al proposed correlates of electronic health record adoption in office practices: A wide survey within which despite rising proof that electronic health records (EHRs) will improve the potency and quality of medical aid, most physicians in office practice in the United States do not currently use an EHR. We tend to sought after to live the correlates of EHR adoption [5].

J. L ahteenmaki, J. Leppanen, and H. Kaijanranta proposed the establishment of the purposeful Use criteria has created a critical need for robust interoperability of health records. A universal definition of a Personal Health Record (PHR) has not been approved. Standardized code sets are designed for specific entities; however integration between them has not been supported. The aim of this analysis study was to explore the hindrance and promotion of interoperability standards in relationship to PHR's to explain interoperability progress in this area.The study was conducted following the fundamental principles of a systematic review, with 61 articles used within the study. Lagging interoperability has stemmed from slow adoption by patients, creation of disparate systems due to speedy development to fulfill needs for the meaningful Use stages, and speedy early development of PHR's prior to the mandate for integration among multiple systems. Findings of this study recommend that deadlines for implementation to capture Meaningful Use incentive payments area unit supporting the creation of PHR information, there by hindering the goal of high-level interoperability [6].

S. Kikuchi, S. Sachdeva, and S. Bhalla Proposed cloud computing model in PHR architecture. They stated that some practical and commercial Personal Health Records and some related services such as Google Health and Microsoft Health Vault have been launched. On the other hand, Cloud Computing has matured more and become the major streams to realize a more effective operational environment. However, there have been few studies in regards to applying Cloud architecture in the PHR explicitly despite generating volume data. They review on the general architecture design by applying the Cloud components for supporting healthcare record areas and clarify the required conditions to realize it [7].

M. Bellare introduced Health Information Privacy, Security, and Your EHR. If your patients lack trust in Electronic Health Records (EHR's) and Health Information Exchanges (HIE's), feeling that the confidentiality and accuracy of their electronic health information are at risk, they will not reveal health information to you. Withholding their health information could have life-threatening consequences. Digital health information is to achieve better health outcomes, smarter spending, and healthier people, providers and individuals alike must trust that an individual's health information is private and secure. EHR developer is responsible for taking the steps needed to protect the confidentiality, integrity, and availability of health information in your EHR system [8].

Sundararaman, K. Parthasarathi, Appa Rao et.al proposed a solution to monitor cardiovascular disease using personal digital assistant (PDA) and applying Grid Computing as a technology enabler. Medical staff can use an application in software as a service (SaaS) basis. The resulting solution provides some requirements of work; however, it focuses on a different solution thus not covering how vital data is acquired, i.e. it must implement the methods to collect, process and distribute patient's vital data, from bedside to remote accessibility [9].

Liu et al. have illustrated an EHR system developed in China to solve the challenges of preventive medicine and management of chronic diseases. The healthcare system based on a Cloud-computing architecture was developed and deployed in Xilingol county of Inner Mongolia. The system used several computing resources to deliver services over the healthcare network using the Internet. There are some challenges to the system like integrating different levels of the healthcare system which makes it difficult for obtaining the information needed to implement public health records and to manage chronic diseases [10].

Rodriguez-Martinez et al. have introduced MedBook, a platform to exchange EHR's and billing activities to assists patients, healthcare providers, and healthcare players collaboration and information exchange. MedBook has some benefits as it matches the US HIPAA standardization and privacy. MedBook is a SaaS platform built on top of open source cloud technologies and running atop an IaaS platform. The platform offers the full benefit of cloud computing. The server applications are implemented using different web services and web applications, Python, Django, PostgreSQL, HBase, and the Apache web server in order to benefit from each technology. MedBook uses Ubuntu Linux 10.04 for security assurance and MedBook Eucalyptus 2 for management and resource allocation which is considered one of the challenges in cloud computing. MedBook is built using free cloud technology that grants users the freedom of customization, modification and distribution. On the other hand, MedBook has limitations on

its privacy and legislation status since its built using open source cloud computing [11].

Hus et al. have proposed a solution for protecting personal health records in the cloud by encrypting patient data before sending them to the cloud. The solution proposes two encryption keys. The first key is owned by the user called "a right-to-decrypt code", while the second key is called "a substitute-key-half code." Thus, patient data stored in the cloud will be secure and will not be disclosed to anyone without proper authorization [12].

Fernndez-Cardeosa et al. have introduced a cloud-based solution for different scenarios of an EHR management system. The proposal covered a large hospital and a network of Primary Healthcare center. They estimated the cost of the implementation using the Amazon calculator tool. EHRs with no images have been migrated to the Cloud environment, because of the large size of the DICOM images. They said that the implementation might be dependent on the bandwidth of the center and the amount of money that health centers want to spend [13].

IV. ARCHITETURE

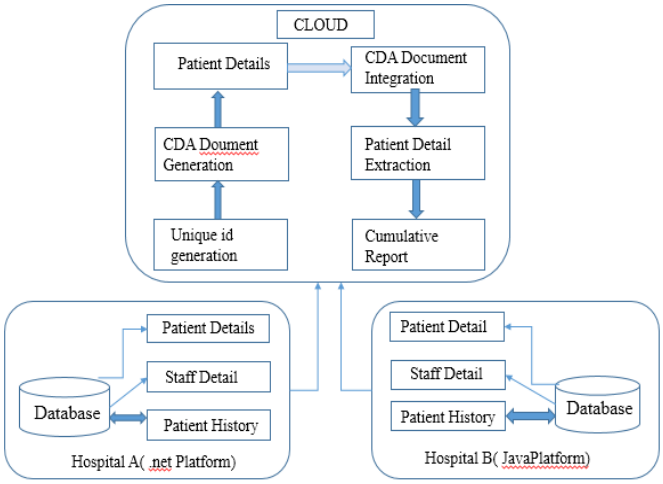

Figure 1: The Architecture of CDA Generation System Based on Cloud Computing

Hospital A and Hospital B are demonstrated to show that it is easy to generate CDA documents on a variety of platforms if done via cloud. The purpose of each of the components is as follows: The DBMS at each hospital and the HIS are linked as follows. Hospital A, which uses a .Net-based system is connected via ODBC to connect to the DBMS while Hospital B, which uses a JAVA-based system, is linked with Hibernate. At a hospital, the clinical information of patient, hospital, and physician is entered via CDA Generation Interface and sent to the cloud server via CDA Generation API. We utilize SOAP (Simple Object Access Protocol) as transmission protocol for the purpose of enhancing interoperability among different HIS when a hospital sends data to the cloud. CDA Generation API relays the data in the CDA Header/Body in the list type. The items included in CDA Header are: PatientID, BirthDate, Gender, GivenName, and Family-Name [14] [15].

V. CONCLUSION AND FUTURE WORK

In this survey, CDA document format for clinical information in normal design to promote interoperability between hospitals, a large number of HIE projects that use the CDA file arrangement have been undertaken by a lot of countries. Our cloud computing based CDA production and combination structure have a few articulated advantages over other existing projects.CDA file generation and integration system based on a cloud server are more useful over accessible services for CDA file if the variety of CDA file increases. Future work is to provide security in upload a CDA Document and Download /View the CDA Document and also the challenge to improve security while ensuring sensible superiority of service even with numerous users logged on the system at the similar time. In proposed work is providing security to the CDA document and a unique identity (id) is generated and given to the patients for avoiding the interchanging and duplication of medical reports. Every detail in CDA Document is Encrypted and stored in Database. All Details in CDA Document is secured using various Security Algorithms [16] [17].

REFERENCES

[1] K. Ashish, “Meaningful use of electronic health records the road ahead,”JAMA, vol. 304, no. 10, pp. 1709–1710, 2010.

[2] 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.

[3] M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. Katz, A. Konwinski, G. Lee, D. Patterson, A. Rabkin, I. Stoica, and M. Zaharia, “A view of cloud computing,” Commun. ACM, vol. 53, no. 4, pp. 50–58, 2010.

[4] S. Lee, J. Song, and I. Kim, “Clinical document architecture integration system to support patient referral and reply letters,” Health Informat. J., Published online before print Jun. 2014.

[5] 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, “Correlates of electronic health record adoption in office practices: A statewide survey,” J. Am. Med. Inform. Assoc., vol. 14, pp. 110–117, 200.

[6] 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.

[7] S. Kikuchi, S. Sachdeva, and S. Bhalla, “Applying cloud computing model in PHR architecture,” in Proc. Joint Int. Conf. Human-Centered Comput. Environments, pp. 236–237, 2012.

[8] 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.

[9] 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.

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

[11] 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.

[12] 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.

[13] S. Lee, J. Song, and I. Kim, "Clinical document architecture integration system to support patient referral and reply letters," Health Informat. J., Published online before print Jun. 2014.

[14] 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.

[15] E. W. Huang, T. L. Tseng, M. L. Chang, M. L. Pan, and D. M. Liou, "Generating standardized clinical documents for medical infor-mation exchanges," in Proc. IT Pro., pp. 26–32, 2010.

[16] P. C. Tang, J. S. Ash, D. W. Bates, J. M. Overhage, and D. Z. Sands, "Personal health records: Definitions, benefits, and strategies for overcoming barriers to adoption," J. Am. Med. Inform. Assoc., vol. 13, no. 2, pp. 121–126, 2006.

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

