Cloud Computing based Health Information Exchange using CDA Generation and Integration

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Abstract

The Successful deployment of Electronic Health Record which helps a lot in the aspect of patient safety and quality of care, yet it has the prerequisite of interoperability between Health Information Exchange at various hospitals. Clinical Document Architecture (CDA) developed by HL7 is a standard of core document to ensure such interoperability and propagation of this document format is critical for interoperability. Very Unfortunate, hospitals are hesitant to receive interoperable HIS because of its sending cost aside from in a modest bunch nations. An issue emerges notwithstanding when more clinics begin utilizing the CDA archive design in light of the fact that the information scattered in various records are difficult to oversee. In this paper, we portray our CDA report era and combination Open API benefit in view of distributed computing, through which clinics are empowered to advantageously create CDA archives without purchasing restrictive programming. Our CDA archive combination framework coordinates different CDA reports per understanding into a solitary CDA record and doctors and patients can peruse the clinical information in sequential request. Our arrangement of CDA record era and coordination depends on distributed computing and the administration is offered in Open API. Developers using different platforms thus can use our system to enhance interoperability.

Keywords : health information exchange, HL7, CDA, cloud computing, software as a service, EHR.

1. Introduction

Electronic Health Record (EHR) is longitudinal gathering of electronic health data for and about people, where health data is characterized as data relating to the strength of an individual or medicinal services gave to an individual and it can support of proficient procedures for health care conveyance [1]. In order to ensure successful an operation of EHR, a Health Information Exchange (HIE) system need to be implemented [2]. Be that as it may, the vast majority of the HIS in administration have diverse qualities and are commonly contrary [3][4]. Consequently, powerful wellbeing data trade should be institutionalized for interoperable

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wellbeing data trade between healing centers. Particularly, clinical record standardization lies at the core of guaranteeing interoperability.

Health Level Seven has built up CDA as a major standard for clinical reports [5]. CDA is a record markup standard that determines the structure and semantics of 'clinical reports' with the end goal of trade. The main variant of CDA was produced in 2001 and Release 2 turned out in 2005 [6]. Many tasks embracing CDA have been effectively finished in numerous nations [7-9]. Dynamic works are being done on enhancing semantic interoperability based on openEHR and CEN13606 [10][11].

To establish trust in HIE interoperability, more HIS's have to support CDA. However, the structure of CDA is extremely complex and the production of right CDA record is difficult to accomplish without deep understanding of the CDA standard and adequate involvement with it. Furthermore, the HIS improvement stages for hospitals fluctuate so incredibly that era of CDA reports in every healing center perpetually requires a different CDA era framework. Additionally, healing facilities are extremely hesitant to embrace another framework unless it is completely vital for arrangement of care. Accordingly, the selection rate of EHR is low with the exception of in a couple of modest bunch nations, for example, New Zealand or Australia [12]. In the USA, the government implemented an incentive program called the Meaningful Use Program to promote EHR adoption among hospitals [13].

2. Research of Cloud Computing

2.1 Cloud Computing

Cloud computing alludes to both the applications conveyed as administrations over the Internet and the hardware and systems software in the server farms that give those administrations [14-19]. The client pays charge depending on the amount of resources allotted, such as network, server, storage, applications and services [20-28]. As of now, three major types of cloud computing service exist:

- 1) Software as a Service (SaaS): This service model provides software.
- 2) Platform as a Service (PaaS): Cloud providers supply a computing platform to its clients where they can deploy applications of its own, program language of its own.
- 3) Infrastructure as a Service (IaaS): Vendor integrates basic infrastructure such as IT systems and database and then rents them to client.

In this paper, we chose a widely used cloud service, Amazon Cloud [20], and provide the CDA generation and integration system as SaaS.

[Fig. 1] The architecture of our CDA generation system based on cloud computing.

2.2 CDA Generation System Based on Cloud Computing

Fig. 1 shows the overall architecture of how CDA documents can be generated on the health information systems of different hospitals by using our cloud computing-based CDA generation system.

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:

- CDA Generation API generates CDA documents on cloud.
- CDA Generation Interface uses the API provided by the cloud and relays the input data and receives CDA documents generated in the cloud.
- Template Manager is responsible for managing the CDA documents generated in the cloud server. Our system uses CCD document templates.
- CDA Generator collects patient data from hospitals and generates CDA documents in the

template formats as suggested by the Template Manager.

- CDA Validator inspects whether the generated CDA document complies with the CDA schema standard.

2.3 Existing System

At the point when a patient is analyzed at a center, a CDA report recording the diagnosis is generated. The CDA report can be imparted to different facilities if the patient concurs. The idea of family specialist does not exist in Korea, consequently it is normal for a patient to visit various diverse centers. The trading of CDA archive is activated in the accompanying 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 crisis and the restorative history should be looked into. It requires expanding measure of investment for the restorative faculty as the measure of traded CDA report increments since more archives implies that information are dispersed in various records. This essentially postpones the medicinal faculty in deciding. Thus, when the greater part of the CDA records are coordinated into a solitary archive, the medicinal work force is enabled to audit the patient's clinical history helpfully in sequential request per clinical segment and the subsequent care administration can be conveyed all the more viably. Tragically for the present, 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.

2.4 Proposed System

In this paper we show (1) a CDA document generation system that creates CDA reports on various creating stages and (2) a CDA record integration system that incorporates numerous CDA records scattered in various hospitals for every patient. The advantages of receiving this system are as per the following. First, the system is available through an Open API and developers can keep taking a shot at their developer platforms they specialize in such as Java, .NET, or C/C++. Hospital systems can basically broaden their existing system rather than completely replacing it with a new system. Second, it gets to be distinctly superfluous for healing facilities to prepare their staff to create, incorporate, and see standard-agreeable CDA

records. The cloud CDA era benefit produces records in the CDA organize affirmed by the National Institute of Standards and Technology (NIST). Third, if this administration is given to free at low cost to healing facilities, existing EHR will probably consider reception of CDA in their practices.

2.5 Advantages of Proposed System

Our cloud computing based CDA generation and integration system has a couple declared focal points over other existing activities.

1. Hospitals don't need to buy appropriateness software to create and incorporate CDA reports and bear the cost as before.
2. Our administration is readily applicable to various developer platforms because an Open API is to drive our CDA document generation and integration system. Despite the kind of the stage, CDA reports can be effectively produced to support interoperability.
3. CDA record generation and integration system in view of cloud server is more helpful over existing administrations for CDA document if the assortment of CDA report increases.

[Fig. 2] The architecture of CDA integration system based on cloud computing.

2.6 Module Description

In this implementation we have two Main modules,

1. CDA Generation System Module: CDA document generation system that generates CDA documents on different developing platforms.
2. CDA Integration System Module: CDA document integration system that integrates multiple CDA documents scattered in different hospitals for each patient.

3. Conclusion

Interoperability between hospitals not only helps improve patient safety and quality of care but also reduce time and resources spent on data format conversion [23]. Interoperability is treated more important as the number of hospitals participating in HIE increases. If one hospital does not support interoperability, the other hospitals are required to convert the data format of their clinical information to exchange data for HIE. When the number of hospitals that do not support interoperability, complexity for HIE inevitably increases in proportion.

Unfortunately, hospitals are reluctant to adopt EHR systems that support interoperability, because changing an existing system adds cost for software and maintenance [24], [25]. The advantages of an API service as ours are at the amount of resources that hospitals need to allocate for interoperability is minimal [26]. Therefore, offering a system that supports interoperability with cloud computing is a good alternative for hospitals that have not yet adopted EHR because of cost issues.

The CDA document format a clinical information standard designed to guarantee interoperability between hospitals, a large number of HIE projects that use the CDA document format have been undertaken in many countries. 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. Third, 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.

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