

Cloud Based Clinical Document Generation and Integration for Health Information Exchange

Miss. Rohini A. Dhote

Department of Computer Science & Information Technology
HVPM, COET Amravati, Maharashtra, India

Mr. Vinod S. Gangwani

Asst. Professor in P.G. Department of Computer Science &
Information Technology
HVPM, COET Amravati, Maharashtra, India

Abstract: The Healthcare Industry is one of the world's biggest and quickest developing enterprises, devouring more than 10 percent of total national output (GDP) of most created countries, and majorly affects any nation's economy. One of the greatest issues the medicinal services industry battles with is Interoperability of Health Information. Key to interoperability is the capacity of one medicinal services association errand to be "noticeable" in another social insurance association. The Clinical Document Architecture (CDA) created by HL7 is a center archive standard to assure such interoperability, and augmentation of this report organization is basic for interoperability. The Clinical Document Architecture (CDA) has turned out to be a profitable and capable standard for an organized trade of clinical records between heterogeneous programming frameworks like a Hospital Information System and a Physician Office System. In this paper, we describe our CDA document generation and integration Open API service based on cloud computing, through which clinics are permit to advantageously create CDA records without purchasing restrictive programming. Our system of CDA document generation and integration is based on cloud computing and the service is offered in Open API.

Keywords: Health information exchange, HL7, CDA, cloud computing

1. INTRODUCTION

Clinical Document Architecture (CDA) is a well known, adaptable markup standard created by Health Level 7 International (HL7) that characterizes the structure of certain medicinal records, for example, release outlines and advance notes, as an approach to better trade this data amongst suppliers and patients. These documents can include text, images and other types of multimedia -- all integral parts of electronic health records (EHRs).

CDA -- which is among the most widely adopted HL7 standards -- uses a common design structure with the following six characteristics, as set forth by HL7:

Persistence A clinical document continues to exist in an unaltered state, for a time period defined by local and regulatory requirements.

Stewardship. A clinical document is maintained by a person or organization entrusted with its care.

Potential for confirmation A clinical report is a gathering of data that is planned to be legitimately confirmed.

Wholeness Confirmation of a clinical report applies to the entire and does not have any significant bearing to parts of the archive without the full setting of the record.

Human readability A clinical document is human readable.

Many draft and existing benchmarks have educated the advancement of the CDA and a few managing standards have driven the outline.

Give priority to documents generated by clinicians involved in direct patient care. There are many requirements and uses for clinical information, such as direct patient care, outcome research, and public health reporting. The CDA will give priority to defining documents that are created by clinicians involved in direct patient care, assuming the other uses will be derivable. The CDA will define documents produced by providers seeing patients and will not define views or downstream uses of those documents.

Limit the technical barriers expected to execute the Standard. There are assessed to be a huge number of non-institutionalized clinical reports in presence. The CDA will encourage institutionalization of these records by permitting financially savvy usage crosswise over as wide a range of frameworks as could be expected under the circumstances; by supporting trade of comprehensible archives between clients, incorporating those with various levels of specialized modernity; by empowering an extensive variety of post-trade handling applications; by furnishing similarity with an extensive variety of report creation applications; and by utilizing non-wellbeing care-specific gauges where conceivable.

Promote longevity of all information encoded according to this architecture. The CDA documents will be application- and platform-independent and can be viewed and edited by a number of tools, both now and in the future.

Promote exchange that is independent of the underlying transfer or storage mechanism. The ability to exchange or store CDA documents will be application- and platform-independent. These documents can be exchanged in HL7 messages, via e-mail, on a floppy disc, etc. CDA document can be

Empower strategy creators to control their own data necessities without data that is not formally spoken to in the standard.

2. BACKGROUND AND RELATED WORK

2.1 Cloud Computing

Cloud computing is a computing paradigm, where a large pool of systems are connected in private or public networks, to provide dynamically scalable infrastructure for application, data and file storage. With the advent of this technology, the cost of computation, application hosting, content storage and delivery is reduced significantly. Cloud computing is a practical approach to experience direct cost benefits and it has the potential to transform a data center from a capital-intensive set up to a variable priced environment.

Cloud Computing depends on an extremely crucial key of “reusability of IT abilities”. The distinction that distributed computing conveys contrasted with customary ideas of "Grid Processing", "Distributed Computing", "utility Computing", or "autonomic Computing" is to widen skylines across organizational boundaries. Cases of cloud services include online file storage, social networking sites, webmail, and online business applications. The distributed computing model permits access to data and PC assets from anyplace that a network connection is available.

2.1.1 Types of cloud

There are diverse sorts of Cloud that you can subscribe to relying upon your necessities. As a home client or entrepreneur, you will most likely use public cloud services

1. **Public Cloud** - A public cloud can be accessed by any subscriber with an internet connection and access to the cloud space

2. **Private Cloud** - A private cloud is established for a particular group or Association and limits access to only that group.

3. **Community Cloud** - A community cloud is shared among at least two associations that have comparative cloud prerequisites.

4. **Hybrid Cloud** - A hybrid cloud is essentially a combination of at least two clouds, where the clouds included are a mixture of public, private, or community.

2.1.2 Choosing a cloud provider

Every supplier serves a particular capacity, giving clients pretty much control over their cloud depending on the type. When you pick a supplier, contrast your requirements with the cloud Services accessible. Your cloud needs will change Depending upon how you expect to utilize the space and assets connected with the cloud. if it will be for individual home utilize, you will require an alternate cloud type and supplier than if you will utilize the cloud for business. Remember that your cloud supplier will be pay-as-you-go, implying that if your innovative needs change anytime you can buy more storage room (or less so far as that is concerned) from your cloud supplier.

There are three types of cloud providers that you can subscribe to: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). These three types differ in the amount of control that you have over your information, and conversely, how much you can expect your provider to do for you. Briefly, here is what you can expect from each type.

1. SaaS – Software as a Service: This service or module allows us to use every software as a service and it serves software solution to the end user. This module is the top most layer of the Cloud Computing; the End user can directly consume this service. For example, when you use Google docs, Email services and sales force applications, ERP, CRM Applications.

2. PaaS – Platform as a Service: This module allows users to create their own cloud applications using Cloud service providers with simplified specific tools and languages. PaaS is completely Built-in Service for Databases, Web Applications, and Deployments.

3. IaaS – Infrastructure as a Service: Infrastructure as a service offers virtualized servers and software to the users. It will be hosted in within the Cloud Data Centers. If you want to use that Virtualized Hardware or Servers, we have to pay the Cloud vendors. The

main benefit is we don't need to buy all the Hardware and software for a longer time. we only pay for the services what we use in a virtual environment(cloud). The Cloud Vendors manage and maintain the Data Centers. You can simply focus on your business. IaaS serves Complete Infrastructure level services like Virtual Servers, Storage, Network, Security and System Management.

SERVICE CLASS	WHO USE IT	FOCUSES ON
SAAS	Business Users	Service Consumer, Applications including Archive, Backup, BC/DR, Email Collaborate, CRM, Entertainment, Erp, Ecommerce, Finance
PAAS	Developers and Deployers	Developers or Solutions Providers Development Tools and environment, Software for Establishing Cloud service
IaaS	System Manager	Physical, Virtual resources, servers, storage, networking, hardware

Figure 2.1.2.1 cloud computing models

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

2.2 Clinical Document Architecture Overview

The HL7 Version 3 Clinical Document Architecture or CDA is "a document markup standard that specifies the structure and semantics of clinical documents for the purpose of exchange between healthcare providers and patients." It aims to provide Persistence, Stewardship, and Potential for authentication, Context, Wholeness, and Human Readability to a clinical document. A CDA document is usually a Discharge Summary, Imaging Report, Admission & Physical, and Pathology Report *etc.*

The Clinical Document Architecture is a three-layer architecture implemented in XML, where each level is defined by a DTD. Level one is the root of the hierarchy and each additional level adds further specificity and constraints to the architecture

Level One – the root hierarchy, and the most unconstrained variant of the record. Level one backings full CDA semantics, and has constrained coding capacity for the contents. A case of a level

one constraint on document type would be a "Release Summary" with just textual directions.

Level two - add extra constraints on the Document by means of Templates at the "Segment" (free content) level. A case of a level two constraint would be a "Release Summary" with an area coded as Medications.

Level Three – extra constraint on the report at the "Entry" (encoded content) level, and optional extra constraint at the "Segment" level. A case of a level three constraint would be a "Release Summary" with an area coded as Medications with coded RxNORM sections for every Medication.

A CDA document (figure 2.2.1) consists of a header containing information about the document, the encounter data, the service actors like document originators, intended recipients, health care providers involved in the service and the service targets like the patient or family members. The body represents clinical data which is represented in the current CDA Level One as structural components which can be nested, containing narrative text, multimedia objects or codes drawn from standard terminologies. can impose constraints on content

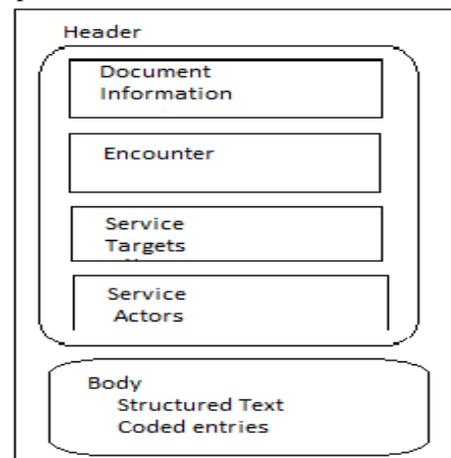


Figure 2.2.1 Generic structure of a CDA document

2.2.1 CDA Header and CDA Body

A CDA document has a header and a body. The header conveys the context in which the document was created, and the body contains the informational (factual) statements that make up the actual content of the document. The header has four logical components

- **Document information** recognizes the report, characterizes secrecy status, and describes connections to different records and requests.

- **Encounter data** describes the setting in which a documented encounter occurred
- **Service actors** include those who authenticate the document, those intended to receive a copy of the document, document originators and transcriptionists, and health care providers who participated in the service(s) being documented
- **Service targets** incorporate the patient and other huge members,(for example, relatives).

CDA Body includes clinical details, diagnosis, medications, follow-up, etc. Presented as free text in one or multiple sections, and may optionally also include coded entries.

2.3 Cloud Based CDA Generation System

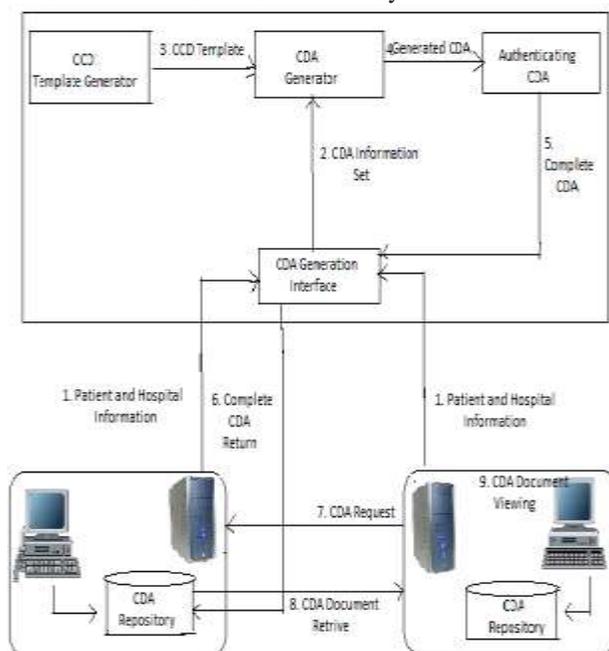


Figure2.3.1 Cloud based CDA generation system
Fig. 2.3.1 demonstrates the general Architecture of how CDA reports can be produced on the health information systems of various doctor's facilities by utilizing our Cloud computing based CDA generation framework. A CDA report generation framework that produces CDA reports on various developing platforms.

2.4 Cloud Based CDA Integration System

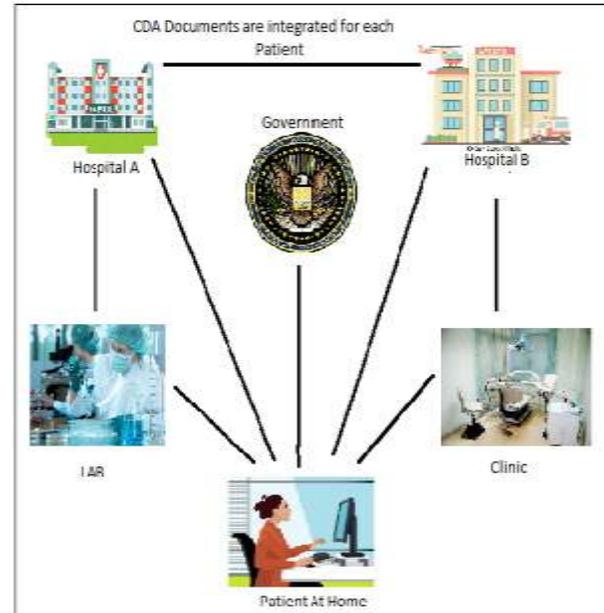


Figure2.4.1 Cloud Based CDA integration system

Figure (2.4.1) demonstrates the general Architecture of how multiple CDA documents are integrated into one in our CDA Document Integration System.

CDA document integration system that integrates multiple CDA documents scattered in different hospitals for each doctors and patient. At a hospital, the CDA documents to be integrated are processed through our CDA Integration API.

3. CONCLUSION

The first release of the ANSI-approved HL7 CDA represents the culmination of close to four years of effort. With this standard, HL7 has entered the realm of defining the structure and semantics of clinical documents. This first standard has attempted to fill a huge gap by standardizing common clinical notes such as history and physicals, discharge summaries, and progress notes. It deliberately leaves out certain advanced and complex semantics both to foster broad implementation and to give time for these complex semantics to be flushed out in the RIM. Health Level 7 is currently balloting the new version 3 messaging specifications; as a result, considerable energy is going into refining the RIM. It is expected that future releases of CDA will include deeper layers of the architecture that encode richer semantics and that the current standard will serve as a stepping stone, allowing users to implement these releases progressively.

More and more, decision support applications will communicate with electronic more and more, decision support applications health records via an HL7 interface. For this transfer of information to be

rich, detailed, and unambiguous, a high degree of semantic interoperability between applications is needed. The HL7 version 3 families of standards, including the CDA, are moving us closer to the realization of this vision.

REFERENCES

- [1] K. Ashish, "Meaningful use of electronic health records the road ahead," JAMA, vol. 304, no. 10, pp. 1709–1710, 2010.
- [2] 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.
- [3] C. J. Lin and D. M. Liou, "Design and implement a generator with Clinical Document Architecture Standard," In Communication Systems, Networks and Applications (ICCSNA), 2010 Second International Conference on, vol. 1, (2010), pp. 97-100.
- [4] Sinha, Pradeep, Gaur Sunder, Prashant Bendale, Manisha Mantri, and Atreya Dande. —Introduction to HERI, Electronic Healthcare Record: Standards, Coding Systems, Frameworks, and Infrastructures, (2013), pp. 1-11.
- [5] [1] L. Alshuler and R. Dolin. (Ed.) *Version 3 Standard: Clinical Document Architecture Release 1.0*. Canada HL7. November 6, 2000.
- [6] Dolin RH, Alschuler L, Beebe C, Biron PV, Boyer SL, Essin D, Kimber E, Lincoln T, and Mattison JE. The HL7 Clinical Document Architecture. *J Am Med Inform Assoc* 2001; 8(6): 552-569.
- [7] Muller ML, Butta R, and Prokosch HU. Electronic Discharge Letters Using the Clinical Document Architecture (CDA). *Stud Health Technol Inform* 2003; 95: 824-828.
- [8] Lewis, Grace. *Cloud Computing: Finding the Silver Lining, Not the Silver Bullet*.
<http://www.sei.cmu.edu/newsitems/cloudcomputing.cfm> (2009).
- [9] Lewis, Grace. *Basics About Cloud Computing*.
<http://www.sei.cmu.edu/library/abstracts/whitepapers/cloudcomputingbasics.cfm>

Authors Details:-

Miss. Rohini A. Dhote student of ME 2nd Year (CSIT) at HVPM COET Amravati, Maharashtra (India)

Mr. Vinod S. Gangwani is Asst Professor in P.G. Department of Computer Science & Information Technology HVPM COET Amravati, Maharashtra