

## CDA: Combine Health Records Based on Genetic Algorithm Approach in Cloud Computing

**P. Peramma**

M. Tech,  
Department of CSE,  
Shri Vishnu Engineering College for  
Women (A),  
Vishnupur, Bhimavaram, West Godavari  
District, Andhra Pradesh.

**T. MADHAVI**

M. tech  
Assistant Professor, Department of CSE,  
Shri Vishnu Engineering College for  
Women (A),  
Vishnupur, Bhimavaram, West Godavari  
District, Andhra Pradesh.

### *Abstract*

*Maintenance of Electronic Health Record helps improve patient safety and quality of care, but to do that we need the operation of interoperability between Health Information Combine at different hospitals. The Clinical Document Architecture (CDA) established by Health Level is a core document standard to ensure such interoperability. Unfortunately, a hospital refuses to adopt interoperable Health information service due to its deployment cost. More problems arise when all hospitals start using the CDA document format because the data scattered in many documents are difficult to manage. In this paper, we describe our CDA document Creation and integration which is an Open API service based on cloud computing, through which hospitals are enabled to conveniently generate CDA documents without having to purchase software. Our CDA document integration system integrates multiple CDA documents per patient into a single CDA and physicians and patients can browse the clinical data in chronological order. Our system of CDA document creation and integration is based on cloud computing and the service is offered through Open API. Developers using different platforms thus can use our system to enhance interoperability. Cloud infrastructure with mapping software "health care information"*

*and using improved genetic algorithm for the allocation and distribution of resources. Based on conducted simulations and experimental results, the proposed methods brings high scalability, simplicity, flexibility and fully customizability in addition to 40% cost reduction and twice increase in speed.*

*Keywords:* Clinical Document Architecture (CDA), Health Level (HL), Electronic Health Record (EHR).

### **INTRODUCTION**

The health information that consists health of the patient, health care provided to that patient as well as the reaction of the patient to the provided healthcare can be stored as electronic health information in the form of longitudinal collection, thus forming an Electronic Health Record (EHR). Therefore, the implementation of Health Information Electronic system is made to ensure successful maintenance of Electronic Health Record. But there is also a problem of incompatibility between systems and also there are different characteristics involved in HIS. Thus, there is a need to standardize the health information Combine between hospitals ensuring interoperability over health information. Therefore, the core of guaranteeing interoperability is to standardize the clinical document.

The major standard for clinical documents is CDA which was established by Health Level (HL). CDA is the core document standard, an XML document which holds the structure and semantics of clinical documents for health information combine. Many countries have done many successful projects adopting CDA. To improve semantic interoperability, many active works are done based on open HER. More Health Information Electronic system has to support CDA to establish confidence in interoperable Health Information Combine System. Moreover, the structure of CDA is too complex and the correct CDA Document production is difficult without the good understanding of the CDA standard and enough experience with it. Also, the Health Information Service development platforms for hospitals differ so greatly in such a way that creation of CDA documents in every hospital invariably requires a separate CDA creation system.

### **Related Work**

A CDA document which has the record for the diagnosis is generated, when a patient is diagnosed at a clinic. This CDA document will be shared with other hospitals if the patient agrees. A person or a patient may shift his location from one place to another hence it is common for that patient to visit a number of different hospitals for check-in or treatment. The Combine of CDA document is invoked in the following cases: when a medical personnel needs to study a patient's medical history; when referral and reply letters are drafted for a patient cared by multiple hospitals; when a patient is in emergency and the medical history needs to be reviewed. It takes a huge amount of time for the medical personnel because the amount of Combined CDA document increases because more documents means that data are distributed in different documents. This definitely delays the medical personnel in making decisions. Therefore, when all the CDA documents are integrated into a single document, them

medical personnel is motivated to view the patient's medical history conveniently in chronological order per clinical section and the corresponding care service can be provided more effectively.

A solution that integrates multiple CDA documents into one do 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 interface. The benefits of implementing this system are as follows.

1. The system can be accessed through an Open API and developers can continue working on their developer platforms. Hospital systems can simply extend their existing system instead of completely replacing it with a new system.
2. The hospitals do not have to train their personnel to generate, integrate, and view standard-compliant CDA documents. The cloud based CDA creation service produces documents in the CDA format approved by the National Institute of Standards and Technology (NIST).
3. 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.

### **Electronic Health Record with CDA**

Electronic Health Record is a collection of patient and population electronically is stored the health information through systematized in digital format. It is a digital version of a patient's paper chart. The records are shared through different healthcare settings. The authorized providers can be created and managed of an Electronic Health Record is that health information in a digital form at capable shared with other providers across more than one health care organization.

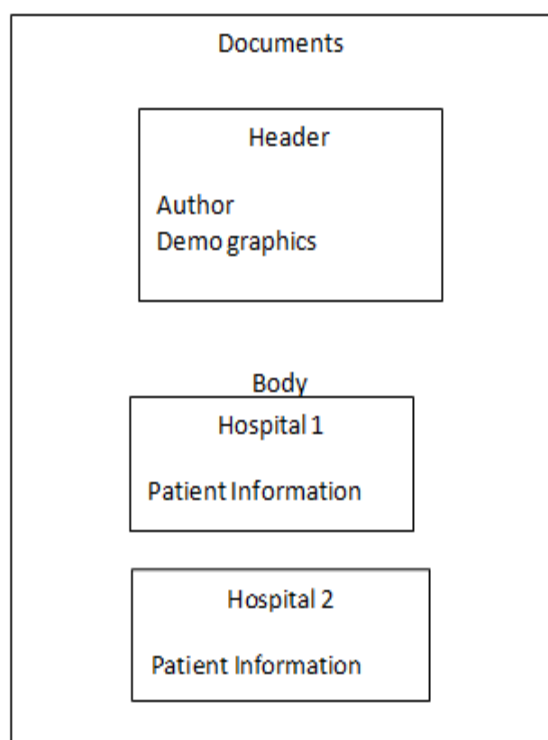


Fig:- CDA Header and Body

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, Electronic Health Record is generated and maintained within an institution, like a hospital, integrated delivery network, clinic, or physician office. The patient receives those service from an auxiliary department are created as an electronic record.

### Clinical Document Architecture

Clinical Document Architecture is in XML based format. It is classified from the HL RIM(Reference Information Model) and uses HL 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. Each piece of clinical data is allocated a section and given a code as defined in the Logical Observation Identifiers Names and Codes. For

the integrated CDA document, we chose the Korean Standard for CDA Referral and Reply Letters format as the number of clinical documents generated when patients are referred and replies made, is large. The CDA is divided into two categories such as Header and Body. 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 because it contains the health summary data for the patient and it is also widely used for interoperability.

### CDA in Cloud Computing

The information can Combine and use the information that has been combined 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 .

The focus on HL Clinical Document Architecture and Continuity of Care Document (CCD). CDA is a document markup standard that defined with clear structure and semantics of clinical document for the purpose of data combine and cloud is any of the following: discharge summary, referral, clinical summary, history/physical examination, diagnostic report, prescription, or public health report. 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. 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.

### Genetic Algorithm

Genetic algorithms such as the multi agent genetic algorithm can offer superior performance over traditional genetic algorithms when very large scale and dynamic optimization problems are concerned. Likewise, an improved genetic algorithm (IGA) has been shown to be nearly twice as fast at finding optimized solutions as a purely genetic algorithm placement solution.

A genetic algorithm is used to find an optimized solution within the pool of viable nodes. The most prominent advantages of proposed method are:

- A method based on open source tools for implementing cloud computing infrastructure with high scalability and fully Customizable.
- Simple, flexible, and hierarchical.
- Management and applications interfaces at different levels.
- Reduce restrictions on CPU, memory, storage and network bandwidth with Two-fold increase in speed and 40% reduction in cost despite the high reliability

### CDA Creation and Integration on Cloud computing

CDA creation 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 Creation interfaces and sent to the cloud server by CDA creation API. The data are relays in the CDA Header/Body. The Header and Body contains about the patient's, and clinical information. The CDA Creation 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 evaluator. 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. So the multiple CDA documents are integrated into single document in CDA Integration system.

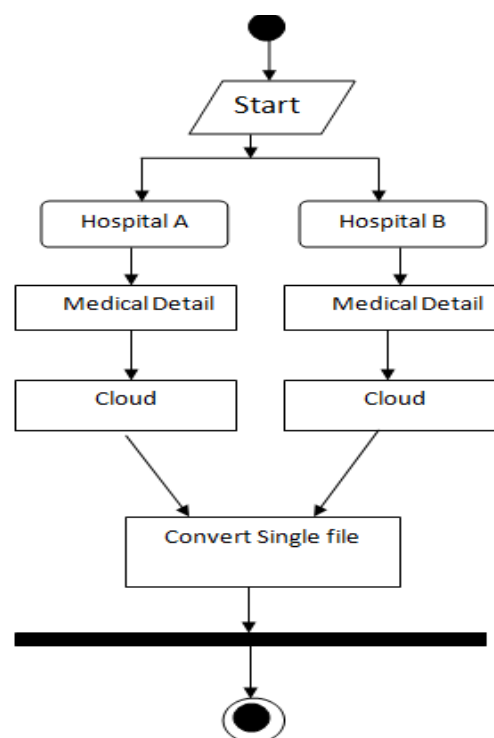


Fig:- CDA integration flow

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 evaluator, 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. So all the CDA documents are integrated into a single document, the physician is empowered to review the patient's clinical history conveniently.

### Implementation

For health concepts representation, CDA uses Health Level's Reference Information Model (RIM), which puts data in a clinical or administrative context and expresses how pieces of data are connected. The health information system can be generated as a CDA document through CDA Creation and Integration on cloud computing Open API. The world widely adopted Health Level CDA standards and is based on XML (Extensible Markup Language).

Common for a patient to consult a number of different clinics. When a physician needs to study a patient's medical history which are cared for patient by multiple clinics. In this case, the creation of multiple CDA documents that integrates into single document in CDA Creation and Integration of Open API on cloud. The result 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. So the health information of the CDA document that is converted to readable format through API. The steps should be following as: The health information that includes patient, Hospital, Physician, and Clinical Details care send to Creation 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. They can download as a readable format directly from the server (cloud). So this can be a best solution for XML based CDA file to convert to other format. The defined structure of new architecture for CDA document to convert to other format is useful to the developer to give as a user friendly document that which had details of about the patient health information.

### 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 Health Information Electronic projects that use the Clinical Document Architecture format have been undertaken in many countries .So the health information records are Generated and Integrated as a clinical document XML based file format in chronological order on cloud. The hospitals are not ready to buy licensed software to generate and integrate CDA documents. Since the up gradation of the software and supporting software's are to be purchased in regular intervals. The service can applicable to various developer platforms because the CDA document creation and integration system is drive by open API. With cloud server the document can provide easy access with CDA. Increases of Health Information Electronic based on the CDA documents, achieves its interoperability. But physicians get inconvenient to refer multiple documents. So multiple CDA documents are

integrates into one through CDA Integration system. Final result of CDA Document is based on XML format. In the proposed system, the CDA XML based document converted to readable format using the API. Cloud infrastructure with mapping software “health care information” and using improved genetic algorithm for the allocation and distribution of resources. Based on conducted simulations and experimental results, the proposed methods brings high scalability, simplicity, flexibility and fully customizability in addition to 40% cost reduction and twice increase in speed.

### Reference

- [1]M. Eichelberg, T. Aden, J. Riesmeier, A. Dogface, and Lilac, “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. Byron, S. L. Boyer, D. Essen, E. Limber, T. Lincoln, and J. E. Mattson, “The HEALTH LEVEL 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. Bohlen, P. V. Byron, and A. Shaba, “The HEALTH LEVEL 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-documentarchitecture-cda-overview/>
- [6]K. Hashish, D. Dolan, D. Grand, T. Scott, and D. W. Bates, “The use of health information technology in seven nations,” *Int. J. Med. Informant.*, 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. Sitting, 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 Annul. Symp. Proc.*, pp. 285–294, 2011.
- [10]E. Ceramic, *Web Services Essentials*. Third Indian Reprint, O’Neil Media, Inc., 2007. ISBN10:81-7366-339-4.
- [11]Oana Sorina LUPSE, Michaela VIDA and Lacramioara STOICU-TIVADAR University “Polytechnic” 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 Combine and interoperability,” in *Proc. Health Aff.*, pp. 10–18, 2005.
- [13]Sung-Hyun Lee, Jon Hyun Song, and Il Kong Kim MARCH/APRIL 2016.
- [14]<https://blog.interfaceware.com/clinical-documentarchitecture-cda-overview/>
- [15]K. Hashish, D. Dolan, D. Grand, T. Scott, and D. W. Bates, “The use of health information technology in seven nations,” *Int. J. Med. Informant.*, 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 (Preliminary Version).
- [18]J. D. D’Amore, D. F. Sitting, 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 Annul. Sump. Proc.*, pp. 285–294, 2011.
- [19]E. Ceramic, *Web Services Essentials*. Third Indian Reprint, O’Neil Media, Inc., 2007. ISBN10:81-7366-339-4.
- [20]Oana Sorina LUPSE, Michaela VIDA and Lacramioara STOICU-TIVADAR University “Polytechnic” 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 Combine and interoperability,” in *Proc. Health Af.*, pp. 10–18, 2005.
- [22]Sung-Hyun Lee, Jon Hyun Song, and Ilk on Kim MARCH/APRIL 2016.