Interplatform Health Data Specifications and Exchange on Cloud Environment using Secure Clinical Document

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Abstract:
One of the key problems in healthcare informatics is the inability to share patient records across hospitals. In order to improve patient safety and quality of care, maintenance of Electronic Health Record is necessary but there is always the need for interoperability of Patient's Health Information Exchange between different hospitals. One of the best methods is to follow the Clinical Document Architecture (CDA) which is a core document standard to ensure such interoperability. But a problem arises even when more hospitals start using the CDA document format because the data scattered in different documents are hard to collect and manage. The integration system integrates multiple CDA documents per patient into a single CDA document and that clinical document can be browsed by Doctors and patients. All of the CDA documents are integrated into a single document, the medical personnel is empowered to review the patient’s clinical history in chronological order per clinical section and the follow-up care service can be delivered more effectively. The generation system that generates CDA documents on different developing platforms and a CDA document integration system that integrates multiple CDA documents scattered in different hospitals for each patient an Open API is used to drive our CDA document generation and integration system that allows to work on different platforms.

Keywords: CDA, Open API, Cloud Computing, Electronic Health Record.

I. INTRODUCTION

New technologies provide great opportunities to enhance business models. In particular, cloud computing paradigm moves computing and storage tasks from individual systems into the cloud, which provides hardware and software resources over the internet. Such cloud computing facilities can be employed for e-health platforms to provide information flow between multiple entities such as hospital, clinics, pharmacy, labs, and insurance companies [3]. Electronic health record (EHR) is longitudinal collection of electronic health information for and about person, where health information is defined as information pertaining to the health of an individual or health care provided to an individual and it can support of efficient processes for health care delivery [1]. In order to ensure successful an operation of EHR, a Health Information Exchange (HIE) system need to be implemented [2].

II. LITERATURE SURVEY

A. Project Title: Enhancing IHE XDS for Federated Clinical Affinity Domain Support

One of the key problems in healthcare informatics is the inability to share patient records across enterprises. To address this problem, an important industry initiative called “Integrating the Healthcare Enterprise (IHE)” specified the “Cross Enterprise Document Sharing (XDS)” Profile. In the IHE XDS, healthcare enterprises that agree to work together form a “Clinical Affinity Domain” and store healthcare documents in an ebXML registry/repository architecture to facilitate their sharing. The affinity domains also agree on a common set of policies such as coding lists to be used to annotate clinical documents in the registry/repository and the common schemes for patient identification. However, since patients expect their records to follow them as they move from one clinical affinity domain to another, there is a need for affinity domains to be federated to enable information exchange. In this paper we describe how IHE XDS can be enhanced to support federated clinical affinity domains. We demonstrate that federation of affinity domains are facilitated when ontologies, rather than coding term lists, are used to annotate clinical documents. Furthermore we describe a patient identification protocol that eliminates the need to keep a master patient index file for the federation.

B. Project Title: Ensuring Access Control in Cloud Provisioned Healthcare Systems

An important issues in cloud provisioned multi-tenant healthcare systems is the access control, which focuses on the Protection of information against unauthorized access. As different tenants including hospitals, clinics, insurance companies, and pharmacies access the system, sensitive information should be provided only to authorized users and tenants. In this paper, we analyze the requirements of access control for healthcare multitenant cloud systems and propose to adapt Task-Role Based Access Control with constraints such as least privilege, separation of duty, delegation of tasks, and spatial and temporal access. But it need to extend Task Role Based Access Control to include task and user constraints to support multitenant cloud applications.

C. Project Title: Deconstructing Amazon EC2 Spot Instance Pricing

Cloud providers possessing large quantities of spare capacity must either incentivize clients to purchase it or suffer losses. Amazon is the first cloud provider to address this challenge, by allowing clients to bid on spare capacity and by granting resources to bidders while their bids exceed a periodically changing spot price. Amazon publicizes the spot price but
does not disclose how it is determined. By analyzing the spot price histories of Amazon’s EC2 cloud, we reverse engineer how prices are set and construct a model that generates prices consistent with existing price traces. We find that prices are usually not market-driven as sometimes previously assumed. Rather, they are typically generated at random from within a tight price interval via a dynamic hidden reserve price. Our model could help clients make informed bids, cloud providers design profitable systems, and researchers. But they do not have a hard minimal price.

III. THE CDA DOCUMENT

The HL7 Clinical Document Architecture Release 2 (CDA R2) was approved by American Nation Standards Institute in May 2005. It is an XML-based document markup standard that specifies the structure and semantics of clinical documents, and its primary purpose is facilitating clinical document exchanges between heterogeneous software systems. A CDA document is divided into its header and body. The header has a clearly defined structure and it includes information about the patient, hospital, physician, etc. The body is more flexible than the header and contains various clinical data. Each piece of clinical data is allocated a section and given a code as defined in the Logical Observation Identifiers Names and Codes. Different subcategories are inserted in a CDA document depending on the purpose of the document, and we chose the Continuity of Care Document (CCD) because it contains the health summary data for the patient and it is also widely used for interoperability. Notable data included in CCD are listed in Table 1.

Table.1. Data Items in CCD Header and Sections In The CCD Body

<table>
<thead>
<tr>
<th>CDA location</th>
<th>Data items</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDA Header</td>
<td>Document Information (creation time, template ID, language code, purpose)</td>
</tr>
<tr>
<td></td>
<td>Patient’s information (ID, name, gender, birth date)</td>
</tr>
<tr>
<td></td>
<td>Author’s information (ID, name, represented organization)</td>
</tr>
<tr>
<td></td>
<td>Organization’s information (name, address, phone number)</td>
</tr>
<tr>
<td>CDA Body</td>
<td>Payers</td>
</tr>
<tr>
<td></td>
<td>Advance Directives</td>
</tr>
<tr>
<td></td>
<td>Support</td>
</tr>
<tr>
<td></td>
<td>Functional Status</td>
</tr>
<tr>
<td></td>
<td>Problems</td>
</tr>
<tr>
<td></td>
<td>Family History</td>
</tr>
<tr>
<td></td>
<td>Social History</td>
</tr>
<tr>
<td></td>
<td>Allergies</td>
</tr>
<tr>
<td></td>
<td>Medications</td>
</tr>
<tr>
<td></td>
<td>Medical Equipment</td>
</tr>
<tr>
<td></td>
<td>Vital Signs</td>
</tr>
<tr>
<td></td>
<td>Results</td>
</tr>
<tr>
<td></td>
<td>Procedures</td>
</tr>
<tr>
<td></td>
<td>Encounters</td>
</tr>
<tr>
<td></td>
<td>Plan of Care</td>
</tr>
</tbody>
</table>

IV. EXISTING SYSTEM

The concept of family doctor does not exist in existing system; hence it is common for a patient to visit a number of different clinics. The exchange of cda document is triggered in the following 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 emergency and the medical history needs to be reviewed. It takes increasing amount of time for the medical personnel as the amount of exchanged cda document increases because more documents means that data are distributed in different documents. This significantly delays the medical personnel in making decisions.

V. PROPOSED SYSTEM

In our proposed system all of the CDA documents are integrated into a single document, the medical personnel is empowered to review the patient’s clinical history conveniently in chronological order per clinical section and the follow up care service can be delivered more effectively. In our proposed method a CDA document generation system that generates CDA documents on different developing platforms and a CDA document integration system that integrates multiple CDA documents scattered in different hospitals for each patient. 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.

Figure.1. System Architecture

VI. CDA SPECIFICATIONS

A. Registration and appointment specification

Users in the hospital environment will have an initial registration at the web end. The server in turn stores the information in its database. Now the patient login and fix appointment to the Doctor by mentioning date and time of the
appointment, disease, specialist and doctor name. Each Doctor views their appointment in their appointment page.

B. Patient Report Generation specification

Doctor view the patient information such as disease, symptoms etc. If it necessary patient is advised to take lab test. Lab Technician provides test result to patient. Based on test result, Doctor suggests prescription to the patient, and also patient health history should be maintained in appropriate hospital database. Doctor can view patient health history before he suggests prescription to the patient.

C. CDA Generation specification

In this module patient health information’s are send to the cloud server. Now the cloud server will generate unique id for every users based on patient name, father name and date of birth using PJW Hash Algorithm. If already id exists then the patient details will be appended with patients clinical history else new CDA document will be generated.

D. Parsing CDA Document specification

In this module the new patient enter into hospital no need to give details about the disease and symptoms. The patient history already maintained in cloud server so we can get the patient histories by using key it is retrieve from patient personal details. The patient histories maintained in document which contains patient clinical histories (hospital name, disease, prescription).

VII. 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 [13]. 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. Unfortunately, hospitals are reluctant to adopt EHR systems that support interoperability, because changing an existing system adds cost for software and maintenance [14], [15]. As of December 2013, there are 54 different types of CDA documents recognized by US NIST, and the number continues to grow year by year [5] As the number of HIE based on CDA documents increases, interoperability is achieved, but it also brings a problem where managing various CDA documents per patient becomes inconvenient as the clinical information for each patient is scattered in different documents. In the field of document-based health information exchange, the IHE XDS profile is predominant [7] and our cloud computing system can be readily linked with the IHE XDS profile. In addition, patients are enabled to use the CDA document integration service to obtain Personal Health Record (PHR) [16], [17], [18], [19], which contains not only clinical documents but also Personal Health Monitoring Record (PHMR) [20] and Patient Generated Document (PGD) [21]. When SaaS is offered targeting hospitals of different languages, developers will need to pay extra attention to this issue. Second, the API parameter for our CDA document generation service was of the list type, but under the C# language environment, the parameter was converted to the string array type. This is suspected to have been caused by the IDE software of C#, which automatically makes this type conversion. Hence, the returned data needs to be as generic as possible to be applicable to as many platforms as possible.

VIII. FUTURE ENANCEMENT

Future work will consent with the security of the electronic health records in the cloud storage. There is ample evidence that cloud computing is effective and efficient in cost reduction, and the medical field seems to be no exception [6]. Security and Stability is improved in the future and even the efficiency is improved when multiple users login at the same time

IX. REFERENCES


