Security Policies of Sharing Health Care Data with Authentication and Authorization

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Abstract- The E-Health is a business scenario in which the integration problem is greater than before by the intensive use of knowledge, by the need of accurately handling citizens' privacy and by live or death inferences. E-Health has been seeking for semantic interoperability for more then a decade, but securely sharing health care data among healthcare associations remains an open challenge. Numerous standardization activities (For e.g., openEHR, HL7 CDA, CEN ENV 13606, DICOM, EHRcom, IHE) are addressing current problem but none of them has achieve the attractive level of flexibility. The paper is being addressed about security policies of sharing of health care data respecting vendors' autonomy and citizens' privacy. It is aiming at developing a highly scalable, semantically improved communication infrastructure. Such infrastructure is the result of the integration of web services technologies. Semantic web provide machine procedural semantics in order to allow mechanized integration of services.

Keywords – TRSC, Integration, HL7, Interoperability, HL7 CDA

I. INTRODUCTION

The healthcare secretarial structure in all countries is naturally distributed, being a geographical spread of centers at different levels of difficulties: from the general hospitals down to individual physicians. The crucial objective of such a structure is to build a network of corresponding centers (For e.g., hospitals, laboratories, ambulatories, coordination centers, etc.) spread over the country, to meet effectively the social needs in the area.

This necessary distribution makes it very hard for physicians to capture a complete clinical history of a patient, because a patient's health information may be spread out over a number of different organizations or different departments within the same healthcare institute. As a matter of fact, the medical and economic blow of not knowing a patient's complete medical history is thoughtful. Medical practice today still involves sorting through a stack of laboratory reports, trying to find specific patient information. But thousands of people die each year due to lack of patient information. As per investigations, poor information is the primary killer in the world.

The challenge of E-Health is to allow health care experts' to interact in time with heterogeneous and distributed medical relational databases. So, the vital problem to address is exchanging patient medical records between healthcare institutions or between different units within the same organization: radiology, cardiology, neurology, etc. The mechanism is that to provide healthcare institutions with a complete collection of patient

information. It should firstly recognize a patient and then it should locate the patient's information, including clinical and laboratory results. The access to and the availability of this information have to be authenticated, according to rules strong-minded by the data owner through a data access security policy engine.

II. EXISTING METHODOLOGIES

A dominant integration technology, which allows for immediate access to distributed information, is needed in order to provide healthcare institutions with a complete collection of patient information.

A number of standardization proposals are progressing to address these interoperability problems such as:

a. HL7 (Health Level Seven) [1], a non-profit, ANSI accredited Standards Developing Organization, founded in 1987, that provides standards for the exchange, management and integration of data to support patient clinical care and the management, delivery and evaluation of health care services

b. GEHR/openEHR [2], an initiative that fosters EHR interoperability started in 1992 as the "Good European Health Record" EU research project that is currently maintained by the openEHR Foundation

c. CEN/TC 251 [3], the technical committee on Health Informatics of the European Committee for Standardization, that, since 1998, is standardizing CEN EN 13606 / EHRcom [4, 5] and

d. IHE (Integrating the Healthcare Enterprise) , a not-for-profit initiative founded in 1998 that does not develop standards as such, but selects and recommends appropriate standards for specific use cases [6]. Most

of those initiatives have been active for more than a decade and, after a first attempt in specifying the format of each of the message that can be exchanged among any couple of systems (e.g., HL7 v2.x), they realized that they need to derive messages and interaction patterns from a common shared conceptual model.

A substitute is offered by HL7 Reference Information Model (RIM) which is the ultimate source from which all HL7 v3 protocol specification standards draw their information related content [8]. The RIM model is an unambiguous data semantics model by which the messages can be implemented locally and top-down, highlighting reuse across multiple situations. Furthermore, RIM offers formalism for vocabulary support that permits to get domain concepts from the most excellent terminologies (SNOMED, LOINC, etc.).

III. MODERN TENDENCY TOWARDS SEMANTIC INTEROPERABILITY

All the suggestions for standardizing an application protocol for the health care division may differ in the progress achieved, but they are all similar in idea and capabilities. All of them try to address the interoperability problem by introducing a shared conceptual model (i.e., Ontology). This is very similar to the Semantic web services method in which "semantic interoperability" is achieved by modelling, at a conceptual level, web services and the domain they are organized in [11, 12]. In all E-Health standardization efforts, data structure and sequencing information are improved with semantic information that encodes the definition of each element of data including its relationship with other elements. In a different way from semantic web services, all E-Health standardization hard work are focusing on developing a horizontal ontology to capture the health care information reference model, which can be linked to the most appropriate vertical domain ontology specifying domain vocabularies. In this sense, E-Health standardization efforts lack in:

a. the opportunity of dealing with systems that perform to different horizontal (e.g., one uses HL7's RIM in CDA [7], the other uses openEHR archetypes based on EN 13606 RIM) and vertical ontology (e.g., one uses SNOMED, the other some proprietary coding), and

b. A comprehensive model for automating service usage such as discovery, choreography and mediation, at both data and process level.

So, even if an obvious trend toward coordination can be perceived and many people expect a unification of the reference information models, yet such result will only be achieved in the long term systems, implemented following different version of all these standard protocols will be on-line even longer. For all these causes, it is believed that E-Health could greatly advantage from the adoption of Semantic web service technology.

IV. TRIPLE SPACE COMPUTATION (TRSC)

The TRSC is an inventive model that is taking an important move towards a new age of the Internet [10]. As reported on the home page of TripCom, the most important European project in this area, since the invention of the

Internet in the 1960's, the two major evolution steps were E-Mail and the Web. E-mail altered the communication processes of humans by providing instant communication over any geological distances in an asynchronous mode based on the message-exchange model [9]. The Web modifies communication processes of humans by providing instant magazine over any geological distances in an asynchronous mode. It is based on broadcasting via persistent magazine of information.
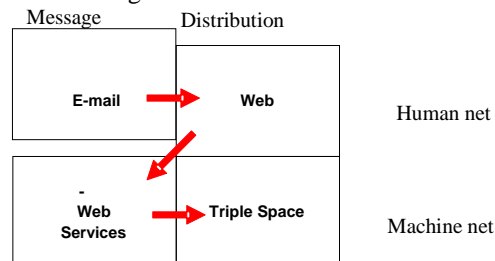

Figure 1: Development of communication

So, the two major asynchronous methods of human communication have been significantly improved through E-Mail.

TRSC asserts that the next step for the internet is likely to be the direct integration of appliances and computers via web service technology. This network no longer directly interlinks humans but interlinks applications and programs to provide integrated services to the end-user. It is based on the message exchange model similar to E-mail communication. In fact web-enabled web services will communicate via persistent publication of information as shown in the Figure 1.

TRSC aims at offering a transportation that scales conceptually on an internet level. Like the web supports the distributing of web pages for end-users to read, TRSC supports issuing of machine-interpretable information. The main advantages in TRSC approach, with respect to current message-based solution are:

a. **Time Autonomy** – providers of data can print data at any point in time;

b. **Location Autonomy** – once published the data becomes independent of providers internal storage

c. **Reference Autonomy** – providers are independent of the knowledge about potential readers; and

d. **Schema Autonomy** – the data are represented independently for any provider internal data schema.

V. SHARING HEALTH CARE DATA

As per the description in section II, the existing methodologies in sharing health care data is achieved by standard application protocols (For e.g., HL7, openEHR, EHRcom and IHE), which define meaningful components of the messages to be exchanged, and domain vocabularies (e.g., SNOMED, LOINC, etc.), which define the meaning of the data transported by each message. On the converse TRSC enables communication via persistent magazine of the information.

Such message-based communication has confirmed efficient and effective for certain activities in this area (i.e., hospital management), but has shown some difficulties to effectively and flawlessly collecting and integrate data from EHRs. When addressing such a need, at least two are the

possible solutions. On the one hand a possible solution is to build centralized databases that would contain all the medical records on every patient. It would also incorporate all of the different access rules and policies regarding different users and different levels of access. But this kind of efforts has four weak points:

a. The cost of constructing the infrastructure and collecting the data is massive,

b. The centralized repository method creates competitive and security issues about who controls and has access to the information on a unambiguous patient,

c. The complexity in maintaining up-to-date a repository originating from a large number of independently evolving systems, and

d. Last but not least a message once sent gives the owner a sense of rescue instead of strengthening the sense of ownership.

On the other hand a possible solution is to exchange messages only when required. In this way no central repository is required and the ownership of the data seems respected, but this solution has several weak points too:

e. Each receiver must know in advance where to look for the information

f. Each receiver must know in advance the terminology (e.g., SNOMED, LOINC) to use when asking for a specific record

g. Each receiver ends up maintaining a specific interface for each system it has to interact with, and

h. Data mining (for disease prevention, early diagnosis, pharmaceutical research, improvement of patient safety) becomes almost impossible due to the large amount of messages to be exchanged

On the converse, TRSC provides an novel solution to health and medical data sharing among heterogeneous, distributed environment, because TRSC is addressed on persistent publishing of knowledge and not on its collection and distribution. Such a new technology will allow authenticated users to identify which health care data are available and where they are located in order to share them when necessary (e.g. authorized clinicians will have a complete view of the treatments their patients are receiving, and this is very important for chronic diseases as diabetes). Practical strong points in using TRSC are:

i. It is a realistic solution for the data ownership problem because healthcare organizations will not loose their control over resources and they will be able to share information only with those that are authorized,

ii. It provides a simple way to guarantee reliability because health data won't be neither transmitted or copied but simply used,

iii. It supplies a straight forward way to deal with integrity because data won't be transmitted and it should be impossible for anybody, but the owner, to modify the data,

iv. Finally, it is a cost-effective solution because additional storage resources related to the management cost are radically reduced.

VI. CONCLUSION

TRSC aims at transforming the networking of machines. To work in time for sharing health care data

respecting both parties' autonomy and citizens' privacy. It is believed that this E-Health scenario is a very demanding because it poses significant challenges in terms of Interoperability that provides a distributed infrastructure that enables maximum decoupling (i.e. time, space, information schema and terminologies) between the various receivers that own the information (e.g. labs, GP's patient record, hospital information systems, etc.) and those receivers that need to intricate such information (e.g. an application on board ambulance). In other words, it is required to support different E-Health services in writing information in a way that other E-Health services can later access such information without regards to the standard they implement (HL7, ENV13606, etc.). Another aspect is Information security and trust which enables the enforcement of Authentication and Authorization rules in a distributed way which is not commonly available and quite worth in highly decentralized scenarios such as healthcare, in which every party involved is responsible for keeping the ownership of the data, but the health of citizens depends on the ability to trustworthy sharing data.

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