

Leveraging ebXML for HL7 V3 Message Transportation

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Abstract

This paper presents a feasible solution for HL7 v3 Message transportation using ebXML standard over SMTP for asynchronous communications. The Healthcare systems aim to provide healthcare related capabilities and several attempts have been made to standardize the communication among all the healthcare organizations. Lack of interoperability has raised the need for standards with which these Healthcare Information Systems can interact and work together. Healthcare standards such as HL7 provide unified infrastructure for interoperability and communications. This work proposes simple and affordable method for HL7 v3 based message transportation using ebXML, which is XML framework for B2B communications.

Keywords: HL7; Messaging; XML; ebXML

1 Introduction

Healthcare informatics has been considered one of the major research areas and among much needed service infrastructures by healthcare domain experts. With increasing number of Healthcare Information Systems (HIS) developed and deployed around the globe by different organizations, the problem of interoperability has arose. Health Level 7 (HL7) [1] is one of such attempts to standardize the clinical standards and healthcare messaging formats that loosely define the ideal representation of clinical information and together the standards are meant to provide a framework in which the data should be exchanged.

Every hospital, laboratory, clinic and care facility is unique in its practices and have different demands which is the reason HL7 is sometimes dubbed as “non-standard standard” [2]. There are many entities ranging from clinics who need to create clinical reports to be exchanged among the applications and healthcare providers, different Governments and Medical informaticists who are involved in research on healthcare logic and clinical knowledge creation and transportation. These stake holders seek to generate and exploit a Clinical Ontology – a hierarchical structure representing a data model, a vocabulary to define the terminologies and a workflow on how things can be done.

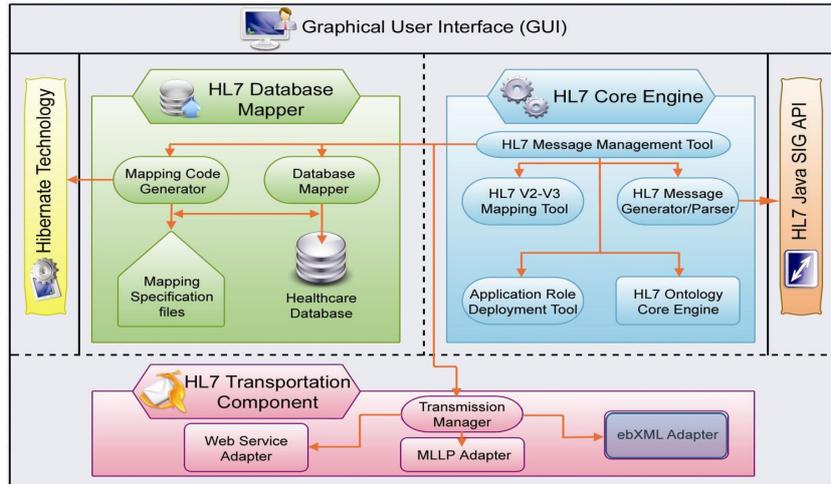


Figure 1: Health Life Horizon (HLH), Open source implementation of HL7 V3 protocol specifications.

HL7 provides standards for interoperability that improve healthcare delivery, help to optimize workflows, reduce domain ambiguity and enhance knowledge transfer among the healthcare stakeholders. Before HL7 [3] parties on both sending and receiving ends needed to customize their respective applications so they can provide interfaces for sending and receiving healthcare information among heterogeneous application vendors. Initial version HL7 V2 was mostly created by clinical entities while the latest version HL7 V3 is created mostly by medical informaticists who came forward to create the interfacing easier.

Features	ebXML	WS	MLLP
Addressing	Yes	Yes	No
Routing	Yes	Yes	No
Reliable	Yes	Yes	Yes
In-Order Delivery	Yes	Yes	Yes
Security	Yes	Yes	No
Integrity	Yes	Yes	No
Confidentiality	Yes	Yes	No
Non-Repudiation	Yes	Yes	No
Authorization	Yes	Yes	No
Authentication	Yes	Yes	No
Auditing	Yes	Yes	Yes
Encryption	Yes	Yes	No
HL7 v2 Support	Yes	Yes	Yes

Table 1: Comparison of HL7 v3 Transportation Protocols.

HL7 community has been focusing on predefining majority of interfaces in the HL7 framework roughly counting for 80%, thus leaving enough space for the adopters to meet their unique and special requirements which has been helpful in widespread acceptance of the HL7 standard [4]. HL7 V3 has been created with the goal of providing Internationalization, consistent data model and standard Communication model built upon existing Technologies such as Web services, MLLP and ebXML.

2 HL7 V3 Messaging using ebXML

Web services and e-Business XML [5] are set of tools and standards which enable online transactions, automated business collaborations and system integration. ebXML is providing interoperability among heterogeneous entities engaged in carrying out business worldwide. ebXML allows companies with no previous relationships to do business by subscribing to ebXML registry [6] discovering the entities providing services required and once the entity is discovered, exchange information across the web in automated and secure manner. It enables machine-to-machine interaction with minimum human interaction needed by using standard semantics for the documents exchanged among the parties. Currently HL7 version 3 supports three protocols for message transportation; MLLP, web services and ebXML. HL7 has published the transport specifications for the development of ebXML message wrapper is to provide a secure, flexible transport for exchanging HL7 messages and other content, and potentially other message formats, between message handling interfaces or ebXML Message Service Handlers (ebXML MSH). The ebXML Transport supports reliable messaging, encryption, authentication and digital signatures, and exchange of messages over a variety of lower level transports such as HTTP, SMTP and TCP/IP.

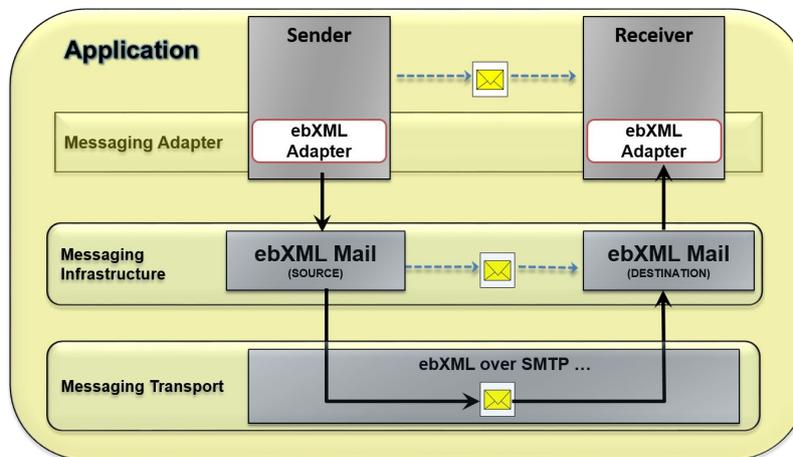


Figure 2: Functionality of ebXML based HL7 V3 Message Transportation adapter for HLH project, providing alternative asynchronous mechanism based on SMTP.

Multipart MIME [7] support is one of the reasons for choosing ebXML based Communication adapter for HL7 V3. The ebXML Message Header is divided into the two parts that are placed into the SOAP header and SOAP body respectively. First part of the ebXML Message Header contains mandatory information, such as routine information, and optional information such as error control or digital signatures. Second part of the ebXML Message header contains the manifest information which is mainly an index of the payload [8]. The ebXML payload is entirely stored in one or more MIME Attachment. This facilitates ebXML to easily transmit binary data such as images, reports and other information Proposed Architecture

3 Results

Our proposed architecture in Figure 3 for HL7 V3 ebXML transportation adapter provides the ease of utilizing the underlying protocols such as SMTP to enable healthcare information transfer. ebXML adapter will serve as HL7 transportation component for the open source project “Health Life Horizon” in Figure 1. It provides grounds to exploit the business-to-business implementation of ebXML in healthcare domain. Although web services provide a feasible solution for communication needs for the HL7 V3 framework, but using SMTP [9] will enable using the capability to asynchronously transport the HL7 V3 message to entity which do not support or are not registered with the web services registry service.

HLH [10] is an open source implementation of HL7 specification in Java so we have developed the ebXML adapter capable of communicating on SMTP protocol using Java API for MAIL[11]. For ebXML SOAP based ebXML messages we have leveraged using JAXM API [12] and JAXP API [13] which provide capabilities to creating and parsing. Similarly a module to validate messages which are sent and received using JAXP is also needed to provided integrity and security. Persistent storage to store information related to messages is needed for future referencing and for this SQLite based database is a feasible solution. While encryption and other security features are provided by XML security featuring such as digital signature, encryption and hash calculation for integrity [14].

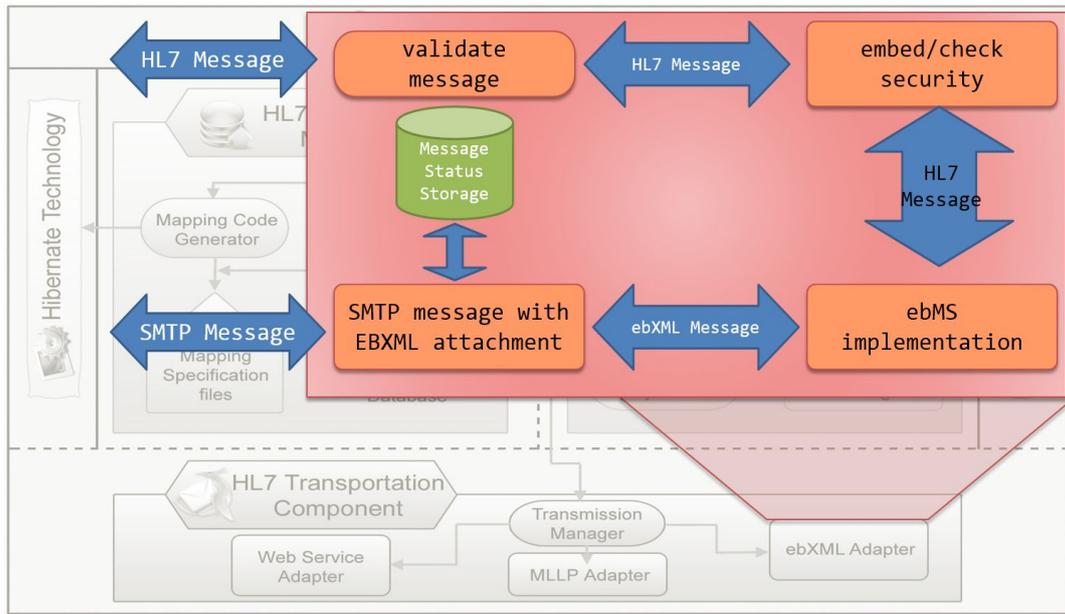


Figure 3: Modules of the HL7 v3 ebXML adapter.

The ebXML adapter in Figure 2 internally would be getting HL7 version 3 messages as payloads and encapsulates them in the ebXML message that would be captured in the SOAP Message with Attachments. Once the message is encoded, it would be transferred over the SMTP [9] protocol. The receiving application would be able to get the message on the corresponding protocol and then de-capsulate the received message to get the payload and pass it to the HLH application for further processing by HL7 core engine [15].

There are many options available for ebXML based message transportation but none of them is specifically related to healthcare domain. The proposed system is built for solving e-business related problems and enabling healthcare systems to communicate both synchronously as well as asynchronously [16]. Sample XML code for a simple ebXML message between two entities is given below. It can be observed that the message contains; information about the payload, information about both the sender and receiver, timestamp, message id as well as information about the collaboration of which this message is part of.

```
<eb:Messaging xmlns:eb="http://www.oasis-open.org/committees/ebxml-
msg/schema/msg-header-3_0.xsd" eb:version="3.0" SOAP:mustUnderstand="1">
<eb:UserMessage>
<eb:MessageInfo>
<eb:TimeStamp>2013-07-18T16:10:00.16Z+01</eb:TimeStamp>
<eb:MessageId>2.16.840.1.14254748.2.4.99.1.700222.1:34234</eb:MessageId>
```

```
</eb:MessageInfo>
<eb:PartyInfo>
  <eb:From>
    <eb:PartyId
      eb:type="urn:hl7ii">2.16.840.1.14254748.2.4.99.1:700222</eb:PartyId>
    </eb:From>
    <eb:To>
      <eb:PartyId
        eb:type="urn:hl7ii">2.16.840.1.14254748.2.4.99.1:700856</eb:PartyId>
      </eb:To>
    </eb:PartyInfo>
    <eb:CollaborationInfo>  <eb:AgreementRef>HL7ebxmlV3.0</eb:AgreementRef>
      <eb:Service>urn:services:HL7Request</eb:Service>
      <eb:Action>PORX_IN932000NL</eb:Action>
    <eb:ConversationId>2.16.840.1.14254748.2.4.99.1.700222.1:34234</eb:Conver
      sationId>
    </eb:CollaborationInfo>
    <eb:PayloadInfo>
      <eb:PartInfo href="cid:messagePart_1"></eb:PartInfo>
      <eb:PartProperties>
        <eb:property name="Standard">HL7</eb:property>
        <eb:property name="Version">V3PR3</eb:property>
        <eb:property name="Encoding">XML</eb:property>
      </eb:PartProperties>
    </eb:PayloadInfo>
  </eb:UserMessage>
</eb::Messaging>
```

4 Discussion

The work presented in this paper is one of the initiatives to take advantage of the capabilities of ebXML in healthcare domain, specially utilizing HL7 V3 and enable organizations to communicate via standard protocols while reducing ambiguity. HL7 International provides HL7 Message Transport Specifications for the usage of variety of communication transports for the exchange of HL7 based content, documents as well as messages. This work provides an experience of the deployment of these specifications that will enable healthcare domain to explore the ebXML arena and to leverage the benefits of leveraging ebXML by deploying ebXML based solutions for their respective organizations.

5 Conclusion

Future work for this project is to develop a complete solution which will provide additional functionalities such as ebXML Registry/Repository, ebXML Business Process, ebXML Core Components and ebXML Collaboration Protocol Profiles and Agreements, thus making full use of B2B features offered by ebXML and ebMS.

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