Health Reference Information Model Architecture Research Issues and Challenges

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ABSTRACT
The purposed Customization of patients care history in Personal health record (PHR) in hospital information system is to improve their health care service, about to build a database for the patient history in the hospital. It is very much needed in the current times because hospitals get many patients from various referral sources and most of the time the new hospital don't have patient history with them. All the tests and analysis carried out on the patients are asked to get it done again which cost lot of money and time. This kind of problem can be solved by adopting the Health Information Reference Model and adopting the HIS-HL-7. Standards are developed; the question is how to adopt them in different countries and different hospitals. If there is a framework and model that can help them to adopt this, it could prove to be very useful. In this paper efforts are made to analyses and study the health information reference model. Data quality, cost and patient care are the main areas of concerns for almost all health information models [1].

General Terms
Software Systems, Computing, Health Systems, Models, Research, Future Directions.

Keywords
Health Reference Information Model, HIS-HL-7 Model, Research Issues

1. INTRODUCTION
Most of the developing countries are building their health infrastructure and it is very premature stages. It is suggested that these developing infrastructure countries can adapt the existing models which are at least well researched; even these models also have issues that need to be addressed[2,3,4,5]. Authors suggest that HL7 can be adapted in the developing countries. Heath Level Seven (HL7) is an ANSI-accredited Standards Developing Organization (SDO) operating in healthcare arena; it provides standards for data exchange to allow interoperability between healthcare information systems. HL7 focuses on the clinical and administrative data domains [6, 7, 8]. This is a not-for-profit organization made up of volunteers – providers, payers, vendors, government, and key goal is syntactic and semantic interoperability [9,10,11].

1.1 Benefits of using HL7
Recommended by the Health and Human Service (HHS) as the messaging standard for electronic exchange of clinical data, and this can be directly adapted in the developing countries [12,13,14].

Over 90% of US hospitals have implemented some version of 2.x HL7 messages.

Support for translational research requires integration of research data with the clinical data.

V3 offers the syntactic and semantic interoperability to make this possible

1.2 Structure of HL7
There are 4 main pillars of semantic interoperability and these are as follow:

- A common Reference Information Model (RIM) spanning the entire clinical, administrative and financial healthcare universe
- A well-defined and tool-supported process for deriving data exchange specifications ("messages") from the RIM
- A formal and robust Data Type Specification upon which to ground the RIM
- A formal methodology for binding concept-based terminologies to RIM attributes.

1.2.1 Reference Information Model (RIM)
Follows object oriented developmental methodology based on a UML model, it represents the fundamental model from which all v3 messages are derived is referred to as the Reference Information Model (RIM), it is a generic, abstract model that expresses the information content of all the areas of healthcare [16,17]. It defines all the information from which the data content of HL7 messages are drawn and it forms a shared view of the healthcare domain and is used across all HL7 messages independent of message structure.

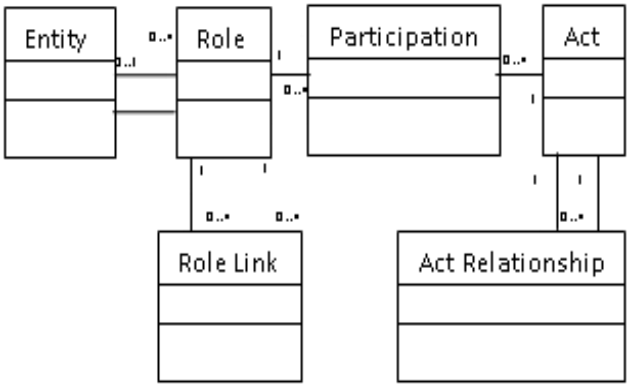

Figure.1 Reference Information Model

2. THE CLASSES IN THE MODEL

2.1 Entity class

This class represents a person, animal, organization or thing, it contain a collection of classes representing specializations and related qualifying classes. The classes represent health care stakeholders and other things of interest to health care, it has the following sub-classes :

Container, Device, LanguageCommunication, LivingSubject, ManufacturedMaterial, Material, NonPersonLivingSubject, Organization, Person and Place. The super class has the following attributes, each attribute can be inherited by a sub class, these attributes are:

classCode, determinerCode, id, code, quantity, name, desc, statusCode, existenceTime, telecom, riskCode, handlingCode.

2.2 Role class

Represents responsibility or part played by an entity (e.g. Person in a role of patient, employee, etc.) – a collection of classes related to this class and its specializations can represents different faces of an Entity. These classes focus on the roles participants may play in health care. Role class has the following attributes:

classCode, id, code, negationInd, addr, telecom, statusCode, effectiveTime, certificateText, quantity, positionNumber. Role has the following sub-classes:

Access, Employee, LicensedEntity and Patient.

2.3 Participation class:

This is an association class between an Act class and a Role class with an Entity playing that Role. Participation has the following sub-class (ManagedParticipation). The Participation class attributes are:

typeCode, functionCode, contexCotrolCode, sequenceNumber, negationInd, noteText, time, modeCode, awarenessCode, signatureCode, signatureText, performInd, substitutionConditionCode.

2.4 Act class

This class represents a record of something that is being done, has been done, can be done, or is intended or requested to be done. A collection of classes including the Act class and its specializations will relate to the actions and events that constitute health care services.

2.4.1. Act class has the following sub-classes

Account, ControlAct, DeviceTask, DiagnosticImage, Diet, FinancialContract, FinancialTransaction, InvoiceElement, Observation, Participation, PatientEncounter. Procedure, PublicHealthCase, SubstanceAdministration, Supply and WorkingList.

2.4.2. Act class attributes are as following:

ClassCode, moodCode, id, code, negqtionInd, derivationExpr, text, title, statuseCode, effictiveTime, activityTime, availabilityTime, priorityCode, confidentialityCode, repeatNumber, interruptibleInd, levelCode, independentInd, uncertaintyCode, reasonCode, languageCode.

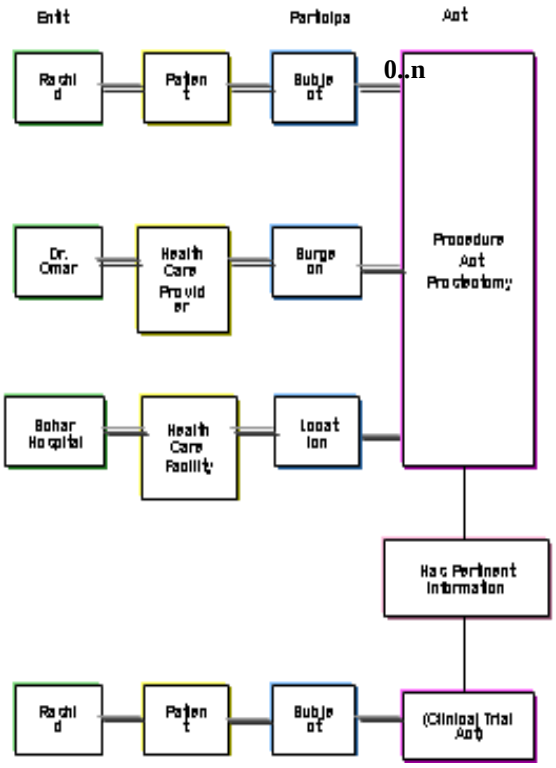

Figure2. Instance Scenario of RIM

The need of internationally acceptable standards to ensure systematic electronic data interchange (EDI) in the health care field led to development of Health level 7 in 1987[3].

HL7 has seven layers of interoperability namely the Testing Business Process, Application, Transport and Network Layers [4]. In the US, most of the electronic health data is already transferred to this standard [5, 6].

•Data transfer via networks - The computer network systems must be compatible in order to allow standard-based communication among various kinds of healthcare applications [7].

•Error in Data – HL7 messages use simple delimiters to separate data, this makes the message difficult to decipher and is easily error-prone [3]. There are projects that are exploring the error in message parsing and it help

3. INTEROPERABILITY AND TESTING OF HL7

The ability of systems to exchange and use processed data is called interoperability. Interoperability is also called the ability of systems to exchange data in such a manner that the system receiving the processed data or service request can perform the task efficiently without the support from another secondary operator.[22,23,25]

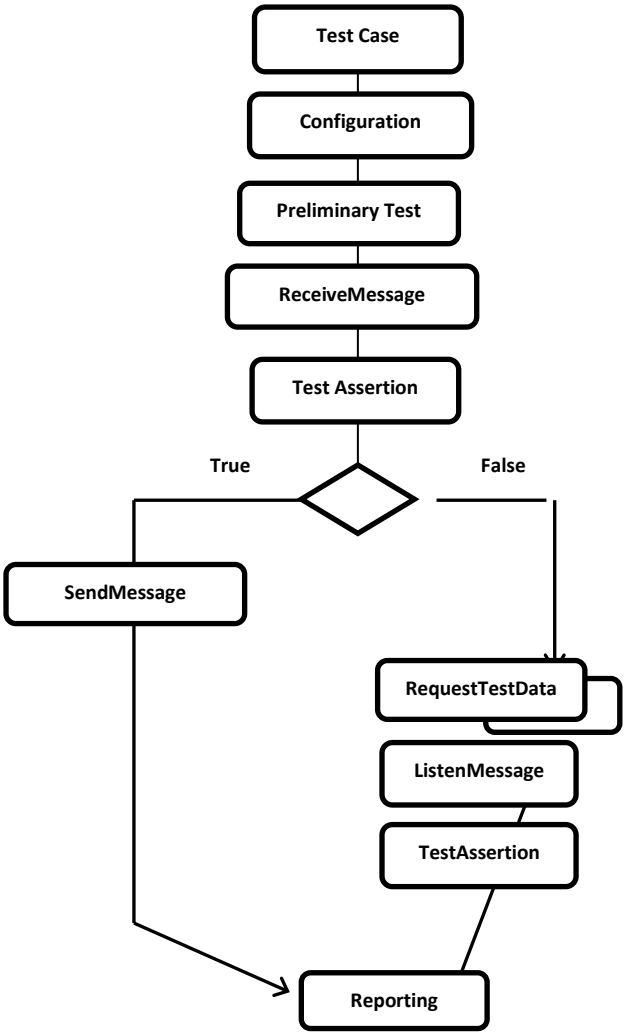

Figure 1 - Flow of Testing in HL-7

4. HL7 VERSION 3 AT NCICB

Highlights of the NCICB Clinical Architecture Vision

•caAdapter – Open source toolkit which facilitates v3 message building, parsing and validation, caAdapter Facilitates the building, parsing, and validation of HL7 v3 messages

•Message Exchange – Service supporting message transmission and routing

•HL7 Transactional Database - HL7 RIM-based transactional database and data access service

•De-identification Service – Service for de-identifying patient information from HL7 messages

•Analytical Applications - Applications for querying, reporting, mining clinical data

•Cancer Data Standards Repository (caDSR) - Shared metadata repository

•Enterprise Terminology Services (EVS) - Terminology service for hosting controlled vocabulary, including HL7 registered terminology

4.1Components Include

HL7 v3 Message Parser – parses HL7 version 3 messages to RIM object graph

HL7 v3 Message Builder – builds HL7 version 3 messages from the RIM object graph

HL7 v3 Artifacts – implements RIM objects, data types and metadata objects

Metadata Loader – represents HL7 version 3 metadata in-memory

Validation Services – integrates with NCICB caCORE components such as Enterprise Vocabulary Service (EVS) and W3C XML schema validation services

Mapping Tool – maps clinical data to the HL7 version 3 message specification currently, with extensible mapping and data transformation in the near future

caAdapter API – uses mappings to generate HL7 version 3 messages

Message Service – integrates with message exchange services (future plans)

A platform to enable clinical applications to build and parse HL7 v3 messages based on specific schema definitions [20,21,22].

Capability to perform vocabulary validation of the RIM structural attributes.

An open source solution for implementing an international messaging standard allowing data to be exchanged between disparate systems.

Integration with NCI metadata repository (caDSR) and terminology services (EVS)

Facilitating the building and parsing of HL7 v3 messages from source clinical systems will promote data exchange in a standards based common format.

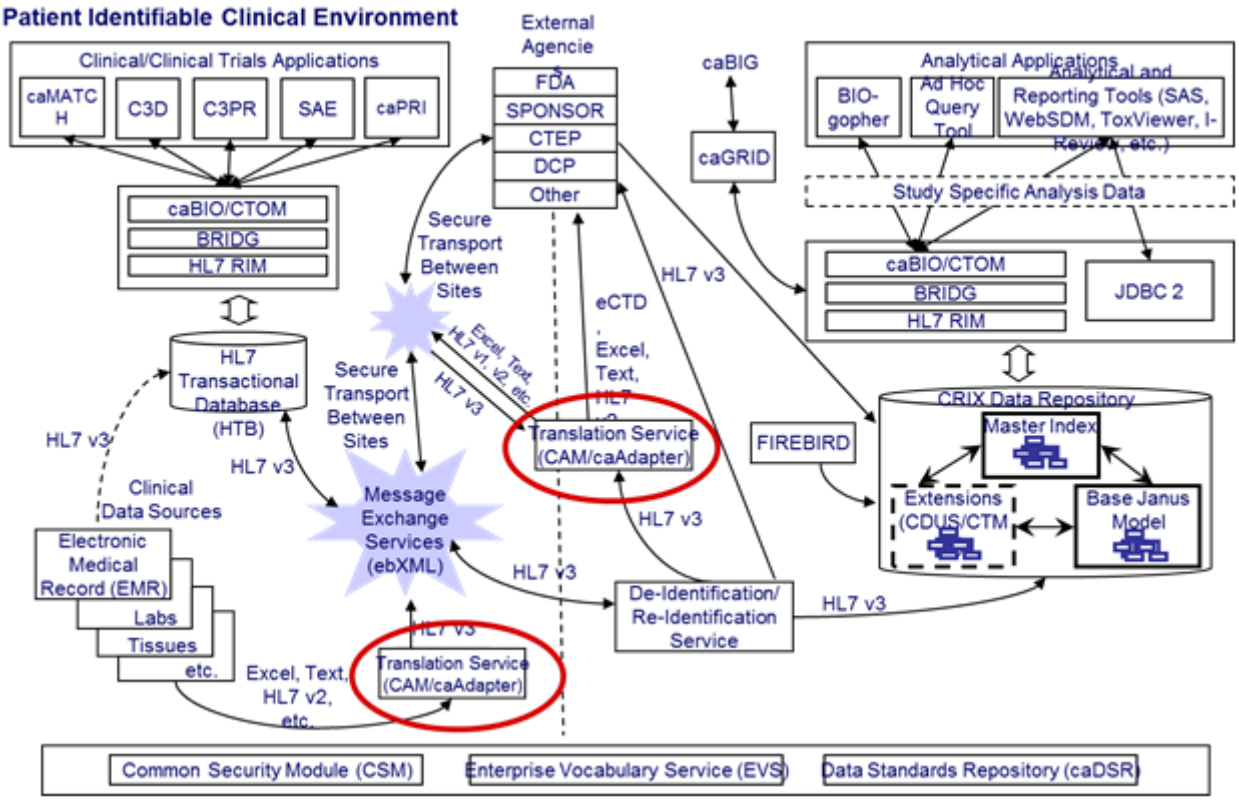

Figure3: Clinical Environment for Patient Record managed in HIS systems using HL-7 v3.

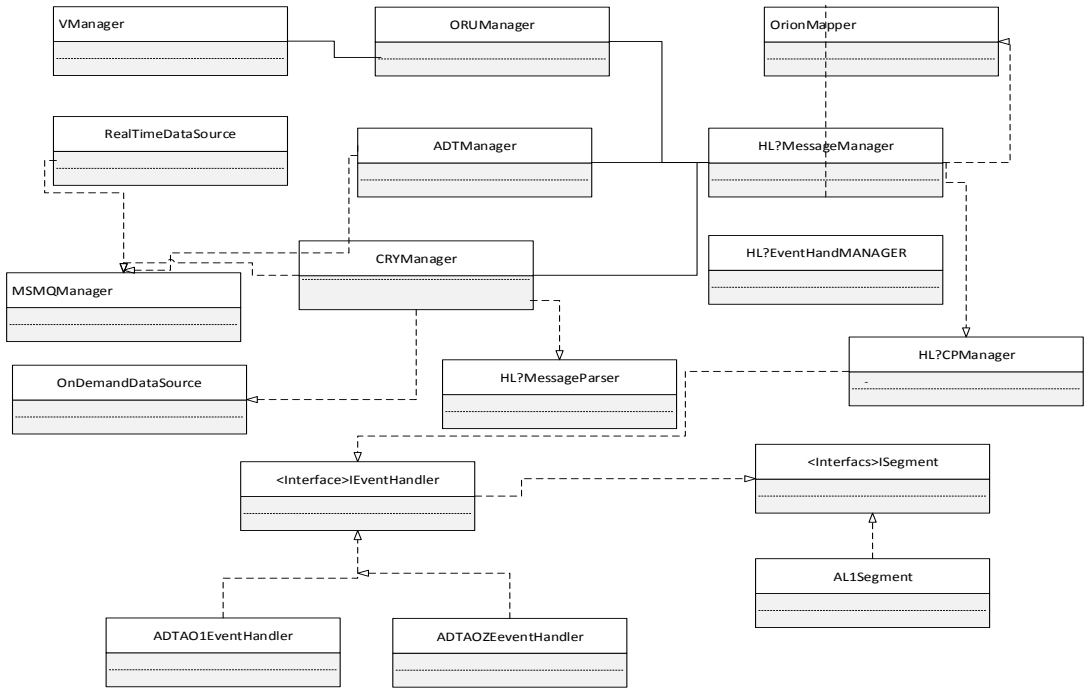

Figure4.Class Diagram for HIS-HL7

The QRYManager feeds into OnDemandDataSource which runs four requests GetData, GetMessagebyPatient, GetMessagebyUnit, GetMessagebyFacilitiesList, GetMessagesByParameter.sends messge to MSMQManager and HL7MessageParser.

The HL7TCPManager sends message QRYManager

The IEventHandler interface has the following methods AddRequiredSegments, PrepareMessage,AddOptionalSegments

There are two classes ADT01EventHandlers and ADT02EventHandler that inherit from the IEventHandler class.

The AL1Segment class inherits interface ISegment and this class has method AddSegmentData (in MessageData).

5. CONCLUSION

In this paper we emphasize the importance of the standards and how these standards help in improving the patient care. Model and adopting the HIS-HL-7. Standards are developed; the question is how to adopt them in different countries and different hospitals. If there is a framework and model that can help them to adopt this, it could prove to be very useful. In this paper efforts are made to analyses and study the health information reference model. Data quality, cost and patient care are the main areas of concerns for almost all health information models. There is a scope for health sector for multinational research participation in this area**.**

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