Design of the HL7 messaging RIM-based sharing components for HIS

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Abstract: The advancement of electronic health records (EHR) in healthcare systems, it becomes necessary for the healthcare organizations to use certain standards for the exchange of EHR's of individuals among different healthcare providers, organizations, hospitals consuming less time and is not expensive. EHR replaces paper records which are not easy to maintain and also leads to manual errors, takes much time and efforts. HL7 (HEALTH LEVEL 7) is an ANSI-accredited standards developing organization that provides standards for the exchange, integration, sharing, and retrieval of electronic health information among various healthcare providers. That is, exchange of electronic health records is done through standards developed by HL7.

Keywords — HL7, EHR, Healthcare, Standards

INTRODUCTION

The electronic health record allows healthcare providers to record patient information electronically rather than using paper records. EHR’s not only record information but do much more than that. EHR’s may include text, medical images, medical history, laboratory test results and personal data such as name, age, weight and many more. Patients are able to access their own records. Less storage space is required for electronic data. Information of patients can be easily transferred from one organization to another. At present, only a few organizations are interested in this technology. The reason behind this are: doctors prefer their own typed notes, installation of systems that convert general data into standard format is complex. Cost is also an issue for some hospitals. In addition to the cost of implementing EHR’s, costs associated with maintaining the system is also high.


HL7 (HEALTH LEVEL 7) provides standards for data exchange to allow interoperability between healthcare organizations. It is recommended by the Health and Human Service (HHS) as the messaging standard for electronic exchange of clinical data. HL7 is called “Level Seven” because its message formats are layered upon the seventh level of the Open Systems Interconnection (OSI) protocol of ISO (International Standards Organisation). HL7 concentrate on the logical arrangement of data and what is meant by information in various parts of the message.

HL7 is textual orientated and it is defining the transfer of data through event based text messages. A typical situation for an HL7 message would be a new patient in a hospital, who needs to be examined in the radiology department. This event would trigger the sending of an HL7 message to the radiology department, including the necessary patient data. Just as people from different countries with completely different native tongues are only able to communicate with each other if they can speak a common language, computer applications can only share data if they communicate with a common protocol. For people or computers to be able to share clinical information with one another, they must both:

(a) have functions to be able to physically communicate, e.g. speak & hear, send and receive documents and data files, share data and information. This is called functional interoperability.
(b) speak a common language and share the same vocabulary that allows them to understand complex medical conditions and processes. This is called semantic interoperability.

DECISION SUPPORT SYSTEM

DSS’s are categorized into two types: Conventional DSS, Clinical DSS (CDSS). Conventional DSS: financial and scheduling. Clinical DSS (CDSS):
diagnosis, pharmacy, emergency and nursing practices. CDSS is used to send alerts and reminders to patients about preventive care. DSS aim to detect critical situations and errors in care and then notify the clinician and then accordingly provide appropriate information. Decision support systems provide timely reminders for busy clinicians.

METHODOLOGY

For the exchange of electronic health records of patients among various healthcare providers, first the information needs to be in a standard format that is acceptable by the healthcare system on the other side. First, the information is converted into standard format using HL7 standards, then the information is send to other healthcare system. Information received by the receiving system is then interpreted as basic data. HL7 standard, used by both the sending and receiving end must be the same to provide semantic and syntactic interoperability.

HL7 message consists of a group of segments in a defined sequence. Some of these segments are optional, required and/or both repeatable. Message types are identified by a three-character code and are used in conjunction with a trigger event. An HL7 trigger event is a real world event that initiates the communication and the sending of a message.

HL7 is different from other types of standards. Other standards focus on the need of a specific healthcare department, while HL7 focuses on the interface necessities of the whole healthcare organization. HL7 focuses on meeting the immediate requirement of each of its stakeholders.

The initiatives of HL7 are: HL7 organization is involved in HIPAA, RIM, HL7 template, HL7 vocabulary and XML technology.

BENEFITS OF USING HL7

HL7 is technology independent standard that allows information exchange between different computer systems developed by different vendors. HL7 helps in information exchange within and beyond the physical region of hospital or any healthcare organization. Using HL7 messages and documents can be moved from one system to another in a standardized format. HL7 reduces long term cost such as maintenance and implementation.

STANDARDS OF HL7

DICOM: The DICOM standard is the universal medical image file format and should be considered over all other image file formats. Digital Imaging and Communications in Medicine. This is a standard for handling, storing, printing, and transmitting information on medical imaging.

PACS: A PAC system is a host of technologies that contribute to the creation, distribution, and archiving of clinical digital images. In a PACS, images are acquired from medical imaging modalities like Computer Tomography (CT), X-ray or nuclear medicine imaging and digitally stored. It is preprocessing these images and making them easily accessible from different workstations within a medical environment. A PACS should provide an HL7 interface to communicate with these systems.

HL7: Health Level Seven. It is an international healthcare standard for medical data exchange between computer systems in healthcare.

LOINC: Logical Observation Identifiers Names and Codes. These identify the test results or clinical observations uniquely.

ICD-10: International Statistical Classification of Diseases and Related Health Problems. ICD provides codes to classify diseases and a wide variety of signs, symptoms etc. Every health condition can be assigned to a unique category and given a code.

ICD-10-PCS: ICD-10 Procedure Coding System. This is a system of medical classification used for procedural codes which is developed as a replacement of ICD-9-CM volume 3 (contains inpatient procedures).

REFERENCE INFORMATION MODEL

HL7 is a language, and every language has a grammar. The HL7 RIM (Reference Information Model) specifies the grammar of HL7 messages and, the basic building blocks of the language and their relationships. The RIM backbone has just five core classes and a number of permitted relationships between them.

In HL7 V3, every happening is an Act, which is analogous to a verb in English. Each Act may have any number of Participations, in Roles, played by Entities. These are analogous to nouns. Each Act may also be related to other Acts, via Act-Relationships.
Act, Role and Entity classes also have a number of specialisations. For example, Entity has a specialisation called Living Subject, which itself has a specialisation called Person. Person inherits the attributes of both Entity and Living Subject.

**GOALS OF HL7**

HL7 International's Vision is "To create the best and most widely used standards in healthcare". HL7 International's Mission is to provide standards for interoperability that:

- improve care delivery
- optimise workflow
- reduce ambiguity
- enhance knowledge transfer

HL7 has been very successful in achieving these goals - it is the predominant healthcare interoperability standard world-wide.

**HL7 MESSAGE STRUCTURE**

Each HL7 message contains one or more segment. A carriage return separates one segment from another. Each HL7 segment contains one or more fields. A pipe (|) character is used to distinguish between two fields. Subfields within a field is separated by ^ character.

**MSH SEGMENT**: Each HL7 message begins with MSH segment which contains the message type, version, and other important information.

**PID SEGMENT**: PID segment contains Patient Identification Data. This segment contains patient’s permanent identifying and demographic information that is not likely to change. This segment is required in each HL7 message.

**OBR SEGMENT**: OBR is Observation Report ID. This segment contains information like who is observing a particular patient, degree of the observer and many more.

**OBX SEGMENT**: OBX is Observation/Result Segment. This segment is used to report one atomic part of an observation. It contains date/time of the observation, result of that observation.
NK1 : NK1 is Next-Of-Kin Segment. The NK1 segment contains information about the patient’s next of kin or other related parties. Any associated parties may be identified.

APPLICATION AREAS OF HL7

The HL7 contains messages for almost every area of healthcare that includes:
- Patient Administration
- Order Entry
- Financial Management
- Observation Reporting
- Medical Records
- Patient Care

CONCLUSION

HL7 messages are the backbone of communication among different healthcare departments that provide interoperability among them.

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