

# Design and implementation of Converter V2 and V3 for HL7 messages

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**Abstract -- HL7 appears in two series of versions; version 2.x (V2) and version 3.0 (V3). Both versions are not compatible with each other. V2 is a market success but not fulfilling the emerging requirements of the world. V3 has the fame to claim as global and futuristic standard. In America 93% hospital are using applications that are developed according to HL7 version 2.x specification. To enhance the adoption rate of applications that will develop according to HL7 Version 3 specification, for the short term, we have to support the conversion of HL7 V2 message to HL7 V3 so that people who have invested a huge amount in developing the application according to HL7 V2 specification can evenly shift to HL7 Version 3 standard. To address the most challenging problem of interoperability among version 2.x and Version 3.0, we propose architecture of converter V2 and V3. It acts as mediator that has ability of converting communications messages of HL7 V2 messages and HL7 V3 messages using conversion mapping rules which user creates by mapping HL7 V2 segment's fields to its corresponding V3 entity's attributes. Finally this map file is used to generate target message.**

## I. INTRODUCTION

To enhance the adoption rate of applications that will develop according to HL7 specification we have to support the conversion of HL7 V2 message to HL7 V3. To facilitate the people who have invested a huge amount in developing the application according to HL7 V2 specifications can evenly shift to HL7 V3 standard. If an application already supports HL7 V2 then HL7 V2-V3 migration by means of a mapping is problematic. Mapping itself is not the main problem although HL7 V3 is much more detailed than HL7 V2, but the trigger events in V2 and V3 are sufficiently different [1]. If an application has to support both HL7 v3 as well as HL7 v2 then we have to develop a new communication module for the HL7 v3 messages and use it in parallel to the HL7 v2 communication module. We will develop a mediator that has ability of converting communications messages of HL7 V2 messages to HL7 V3 messages using conversion mapping rules which will be created by the user by mapping HL7 V2 segment's fields to its corresponding V3 entity's attributes. At the moment we will give the system that has ability to convert HL7 V2 message to HL7 V3. After completion of this task, we will make this tool able to integrate with HL7 V2 application and communicate with HL7 V3 application.

### A. HL7 V2

In V2, Each message has a message type that defines its purpose. For example, the ADT Message type is used to

transmit portions of a patient's Patient Administration (ADT) data from one system to another. A message is comprised of a group of segments in a defined sequence. A segment is a logical grouping of data fields. A data field is a string of characters.

**Message Type:** Specifies purpose of the message.  
Ex. ADT → signifies patient admission, discharge, transfer.

**Message Event:** Use with particular message type, specifies the event for message generation.  
Ex. A04 → signifies patient registration, used with ADT message.

**Message Format:** Specifies the syntax and semantics of the message, depends upon message type and event type.Ex.ADT^A04

→MSH..EVN..PID..[{{NK1}}]..[PV1]..[PV2]..[{{AL1}}]..[{{DG1}}]..[IN1]..[ACC]

**Data Type:** Specifies type of the data of a particular portion of the message. Format of segment is shown in Fig 1.

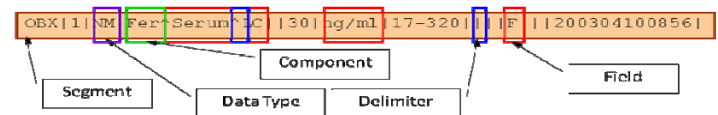


Fig. 1 V2 Message Format

### B. HL7 V3

The Health Level Seven (HL7) Reference Information Model (RIM) is a static model of health and health care information as viewed within the scope of HL7 standards development activities [2]. It is the combined consensus view of information from the perspective of the HL7 working group and the HL7 international affiliates. The RIM is the ultimate source from which all HL7 version 3.0 protocol specification standards draw their information-related content [3].

RIM, on one hand, is a pure and flexible model but on the other hand, it is more complex especially in reading, understanding and mapping to other models. RMIMs classes are normally connected with Common Message Element Types (CMETs) to complete the model. The question arises that how a single Act class can represent all of the elements of

clinical action – their definition, request, order, and report. In fact the Act “mood” code specifies whether the Act is an activity that has happened, can happen, is happening, is intended to happen, or is requested/demanded to happen [3].

### C. Mapping

In table.1, the mappings of V2 Event fields to V3 RMIM are shown.

Table. 1  
Mapping of V2 EVN and V3 RMIM Attributes

V2 EVN Segment	V3 RMIM Attribute	
Event Type Code	Encounter Event (ACT)	Code
Recorded Data/Time	Encounter Event (ACT)	Activity Time
Date Time Planned	Encounter Event (ACT)	Effective Time
Event Reason Code	Encounter Event (ACT)	Reason code (CWE)
Event Occurred	Encounter Event (ACT)	Activity Time
Event Facility	Encounter Event (ACT)	ID (Assigning Authority)

## II. HLH PROPOSED FRAMEWORK

In healthcare messaging HL7 standard is mainly meant for data exchange among healthcare applications in the form of messages. So the core functionalities of an HL7 compliant Healthcare Information System will be autonomous and independent from HL7 core components HIS will only interact with HL7 interface when the system exchanges data with other sub systems, external HIS/LIS or service. Within established HIS network, each HIS HL7 interface implements all necessary application roles – having well-defined messages. The system architecture, we proposed- as depicted in Figure 2- is comprehensive and is used as reference architecture for various modules. It supports GUI based message specification tools, HL7 V2 to V3 conversion platform, database mapping tools, application roles deployment tools, web service deployment tool and ontology integrator tool [8].

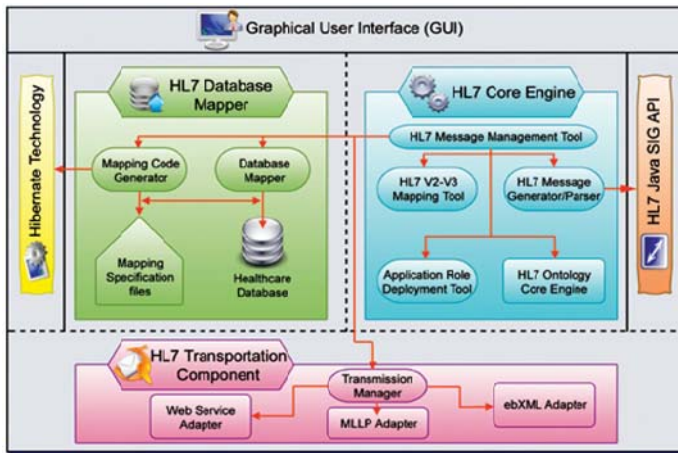


Fig. 2 HLH Proposed Framework

## III. CONVERTER V2 AND V3 ARCHITECTURE

In HL7 Core Engine we have different modules. One of them is Converter V2 and V3. The Detailed architecture of Converter V2 and V3 is given in Figure 3. Hospital A is using V2 based application while Hospital B is using V3 based application. Converter V2 and V3 will act as

middleware to make enable the communication between these two applications. If Hospital A want to communicate with Hospital B, it will send HL7 V2 message to Hospital B. Converter V2 and V3 module is integrated with Hospital B V3 application. Converter V2 and V3 will get the V2 message from V2 application of Hospital A. Component description of Converter V2 and V3 is given below.

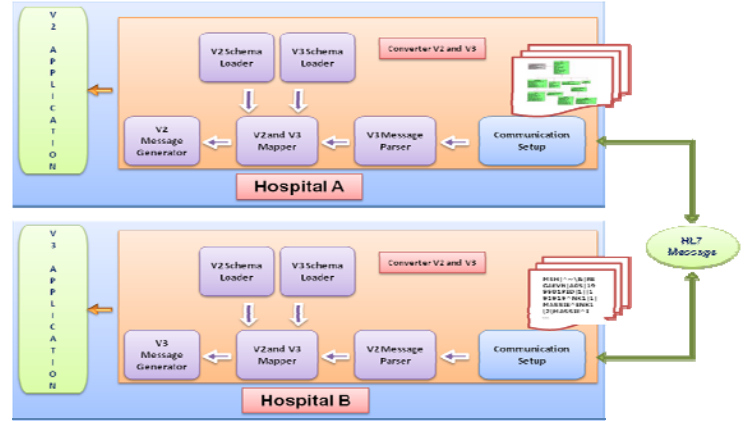


Fig. 3 Converter V2 and V3 Architecture

### A. Communication Setup

Communication setup is used to transmit the HL7 messages among applications. It works as a middleware between sender and receiver. It takes messages from sender and passes them to receiver.

### B. Message Parser

It takes message contents from received message and after parsing, it saves the contents into structure.

### C. V2 and V3 Mapper

It is used to map V2 field of segment to V3 attribute of entity to generate from source message to target message. These mappings are stored in CSV format mapping file.

- V2 Schema Loader is responsible to load the V2 message schema
- V3 Schema Loader is responsible to load the V3 message schema

### D. Generate Message

It takes the mapped contents from the mapping file and generates message according to those contents using JavaSig API and HAPI.

## IV. IMPLEMENTATION

Net Beans (Java) V 6.7 is used to develop this application. JavaSIG Api [9], HAPI [10] and JDOM [11] are used.

### A. Use case Model

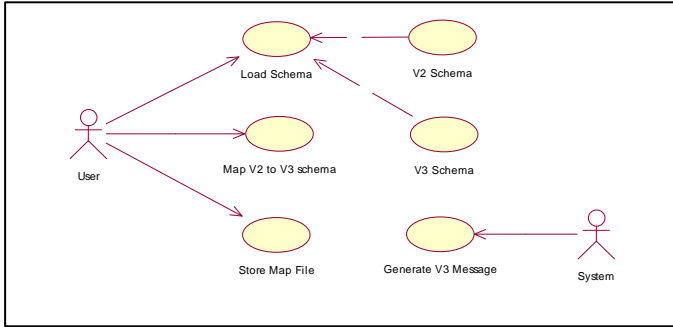


Fig. 4 Converter V2 and V3 Use Case Model

#### A. Load Schema

The primary actor for this use case is administrator. It captures the scenario for loading message file into system and then it loads corresponding V2 and V3 schema for user mapping.

#### B. Map V2 and V3 Schema

This use case captures the scenario where retrieved data about two versions is mapped into each other. The generation of message is dependent on correct mapping. Primary actor in this use case is the administrator itself and pre condition is that data is successfully loaded. One to one mapping should be carried out so that it becomes ready for correct generation of the message

#### C. Generate Message

This use case is responsible for the generation of message. Primary actor for this use case is system and it is necessary that data is loaded and mapped to the RMIM elements for its proper working. The message will be ready for communication after successful generation.

#### D. Sequence Diagram for Load Schema

Administrator loads the message file into system using `loadMessageFile(file)`. System gets the file successfully using `receivedSuccessfully(file)`. System parse the message content using `parseMessage()`. HAPI api helps to parse V2 message. After getting the contents, system loads appropriate schemas using `loadSchemas()` method into tree format and display to user.

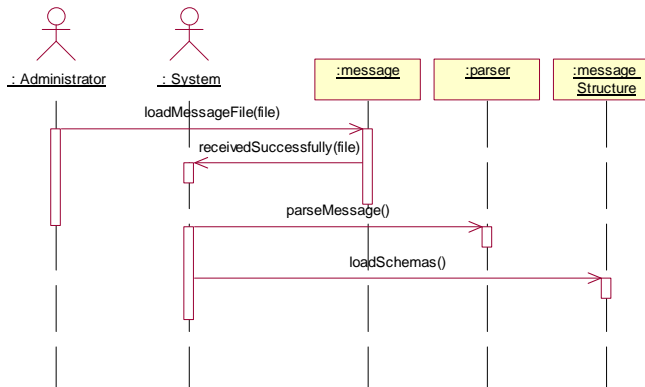


Fig. 5 Sequence Diagram for Load Schema

#### E. Sequence Diagram for Map V2 and V3 Schema

Administrator selects the field of segment from the V2 tree displayed in GUI to user. After it selects the attribute of entity from V3 tree and then press map button. It will map the these fields and attribute using `mapV2andV3()`. These mapping will be written in .csv file format in described folder and it will be displays in tabular format as well.

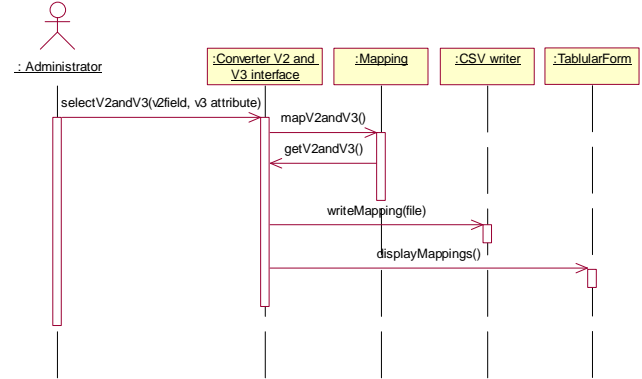


Fig. 6 Sequence Diagram for Map V2 and V3 Schema

#### F. Sequence Diagram for Generate Message

System loads the mapping file using `loadMappingFile()` method. System parse the mapping file to know the mappings. Mapping file will be parsed to generate to hl7 V3 message. According to mapping specifications, message is generated by calling `HlV3MessageGeneration()` method.

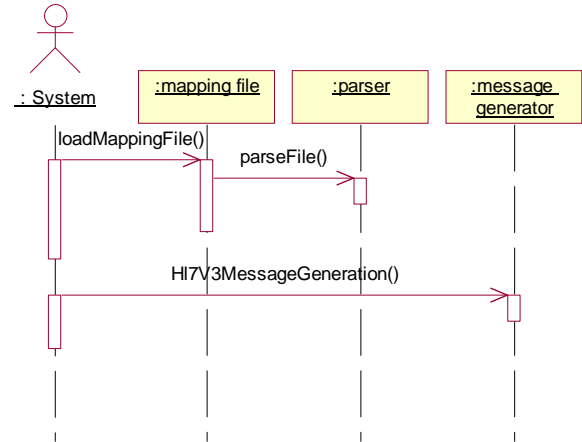


Fig. 7 Sequence Diagram Generate Message

#### G. User Interface Design

Interfaces are necessary part of any system as these are used by the end users for interaction with the system. Therefore the more interactive, easy and user friendly the interfaces would be, the easier it would be for the end user to communicate use the system. In this document, important user interfaces has been discussed and shows how various components of the system are working.



to convert HL7 V2 message to HL7 V3. After completion of this task, we have the intention to make this tool able to convert V3 message to V2 message. In future, we will make this tool integrate able with V2 and V3 message applications.

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