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# HL7 Version 2.x Goes FHIR

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**Abstract.** Although HL7 v2.x has been in use for more than 25 years and is thus probably the most widely used data exchange standard in the healthcare domain, there are still ongoing discussions about technical terminology, i.e., how exactly individual specifications are to be interpreted. This has led to the idea of modernizing the specification/standard without requiring any change in implementations. In other words, formalize the standard using words that are easier to understand. In parallel, the coexistence with the upcoming FHIR standard triggers modifications within HL7 v2.x. This paper explores the interaction between the modernization of HL7 v2.x and the convergence with FHIR.

**Keywords.** HL7 Version 2.x, FHIR, technical terminology, conformance constructs

## 1. Introduction

The rise of the HL7 Fast Healthcare Interoperability Resources technology (FHIR) [1] is speeding up. More and more vendors are interested in this new standard. Does that mean HL7 Version 2.x [2] has been made or is becoming obsolete?

Quite the opposite seems to be the case: Existing interfaces based on HL7 v2.x will not be switched off just because FHIR is coming. However, because of FHIR, healthcare software has to accomodate new data model details, which in turn have to be communicated via v2.x-based interfaces. The coexistence with FHIR shall most probably prompt a development and maintenance effort within v2.x, which may keep HL7 v2.x around for another 10 years.

## 2. Version 2 goes FHIR

This paper discusses and presents selected issues to be considered when trying to modernize and simplify version 2.x while keeping backward compatibility of implementations in place. Innovations are due both in the governance process (maintenance, tooling, publication) and in the resulting content of standard itself. One promising possibility appears to be the reuse of FHIR, as provided by the Unified Terminology Governance (UTG) Project [3]. The following individual issues deserve attention:

- structural enhancements within the standard

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- changes in technical terminology
- vocabulary maintenance (UTG)
- complete range of specifications to be offered
- web-based publication of the specification
- web-based editing of the specification

On the other hand, this is a good opportunity to overhaul the conformance part and make it self-contained, allowing it to combine with any version as pre- or post-adoption. For the long run, the even further enhanced conformance methodology should be used across all HL7 product lines.

### *2.1. Structural enhancements*

Refactoring should take place, especially regarding the abstract specification (control), domain information (chapters), data types and vocabulary.

All of the above points are adressed by the initiative under the working title "HL7 v2+" [5] and further elaborated. The first feedback is consistently positive. In the future, however, the standard will be migrated to a new HL7 v2+ location [6].

### *2.2. Change in Technical Terminology*

An essential issue for aligning HL7 v2.x with FHIR is to refine and disambiguate the technical terminology [7] used in v2.x, namely the notion of

- optionality / usage and
- repetitions / cardinality

Vital terms like "usage R" and "usage RE" are still under discussion. The following changes are due:

#### *2.2.1. for Fields*

The conformance constructs *optionality/usage* and *repetitions* are converted into the constructs *must-support* and *cardinality*, that are also used with FHIR. Optionality/usage and the corresponding abstract message syntax (AMS) constructs are replaced by a "must-support" flag, that allows for the values "yes", "no" and "empty". "empty" is the default and can be constrained to either "yes" or "no" in derived profiles /specializations; once constrained, it cannot be changed any more.

The concept of repetitions with the corresponding AMS constructs are replaced by cardinality as is shown in Table 1. Cardinality is a tuple of integers, indicating the minimal (min) and maximal (max) number occurrences for the given element. The permitted values are 0, 1, …*, with asterix indicating “an unbounded number” – the mathematical infinity (∞). The values of min and max are subject to a constraint expressed in relational operators as: 0 <= min <= max <= *. Along the path of profile derivation/specialization, the value of min is supposed to increase, while the value of max is expected to decrease until they become equal.

**Table 1.** Translation optionality and repetition into new conformance constructs

| Optionality | Repe-tition | => | Must Support | Cardinality | Comment |
|---|---|---|---|---|---|
| R | | | Yes | min = 1 | |
| RE | | | Yes | min = 0 | |
| O | | | | | fully open |
| X | | | No | min = 0, max = 0 | |
| B | | | | | represented as a comment |
| W | | | | | represented as a comment |
| C(a/b) | | | | | that depends on the evaluation of "a" and "b", but can be translated into must-support and cardinality |
| | N | | | max = n | |
| | * | | | max = * | |

The attributes are combined accordingly.

### *2.2.2. for Message Structures*

The constructs from AMS are converted into a combination of Must-support and Cardinality (Tab. 2).

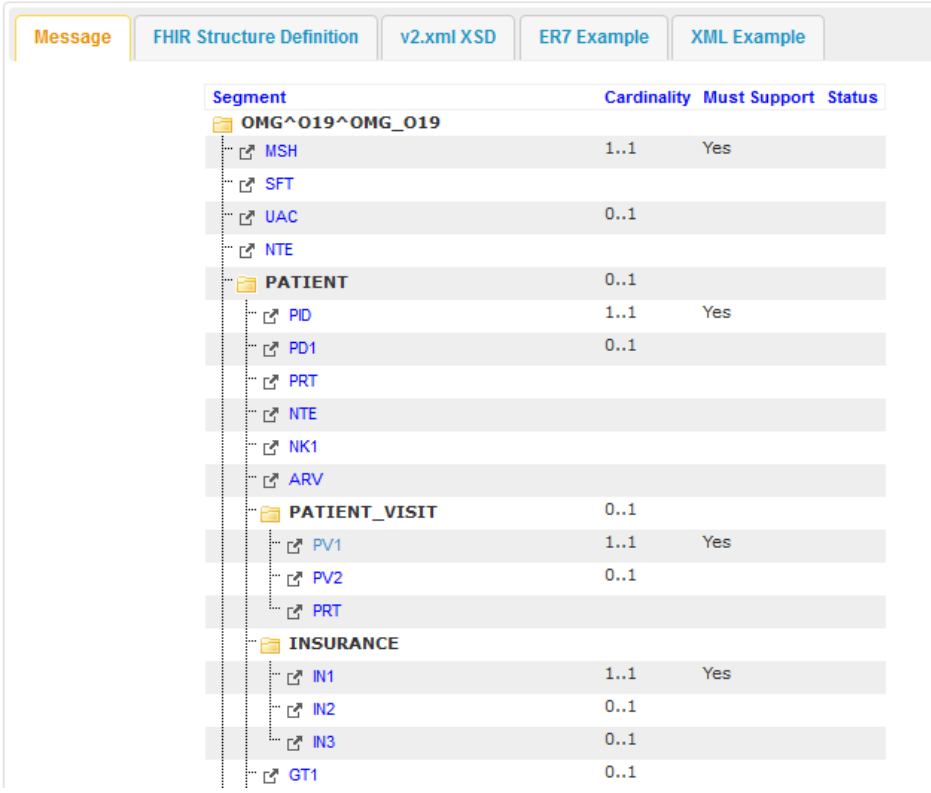


**Figure 1.** HL7 v2+ message structure representation.

**Table 2.** Translation of message structure constructs into new conformance constructs

| AMS | => | Must-support | Cardinality |
|---|---|---|---|
| [ { } ] | | | 0 .. * |
| [ ] | | | 0 .. 1 |
| { } | | | 1 .. * |
| <empty> | | yes | 1 .. 1 |
| marked as withdrawn | | no | 0 .. 0 |

An example of a resulting description is shown in Figure 1. Opening parentheses are used to introduce groups of segments. An advantage of a tree-like view is a better readability.

### *2.2.3. must-support translates to usage RE for HL7 2.x*

In FHIR, the exact meaning of the term "*m*ust-support" is left to the implementation guide and thus the individual profile. It is merely required to maintain a consistent behavior across the whole implementation guide or profile when "must-support" is set to "yes". HL7 2.x already posseses an established global definition of what "supporting a data element" means: the usage value of "RE" (required, but may be empty). To allow for the v2.x compliance of existing implementations, this definition has to be preserved. Thus v2+ defines "must-support" as equal to the previously existing notion of "usage RE".

## *2.3. Vocabulary Maintenance*

The contents of the vocabulary chapter (Chapter 2C) for HL7 v2.x is now a result of the harmonization by the Unified Terminology Governance (UTG) Project, which aligns the vocabulary across product families. In the specification of HL7 v2.9, the contents of this chapter is automatically generated out of the database, for the first time.

## *2.4. Completeness*

An important issue is to include different parts of the standard which are spread across separate specifications like "HL7 v2.xml" [8] or "HL7 over HTTP" [9] so that a maximum of relevant resources is available from a single location. Further inclusions like implementation guides and schemas (XSD) are envisioned.

## *2.5. Web-based publication*

HL7 v2.x has been available as hypertext for 20 years now. It is self evident that this multiplies the productivity in search, analysis and re-use of the specification. The HTML form is available both on the HL7 Inc. members web site and to the general public [4]. The most recent web presentation adapts the structure and the layout of FHIR, as well as its technical terminology (Fig. 2).

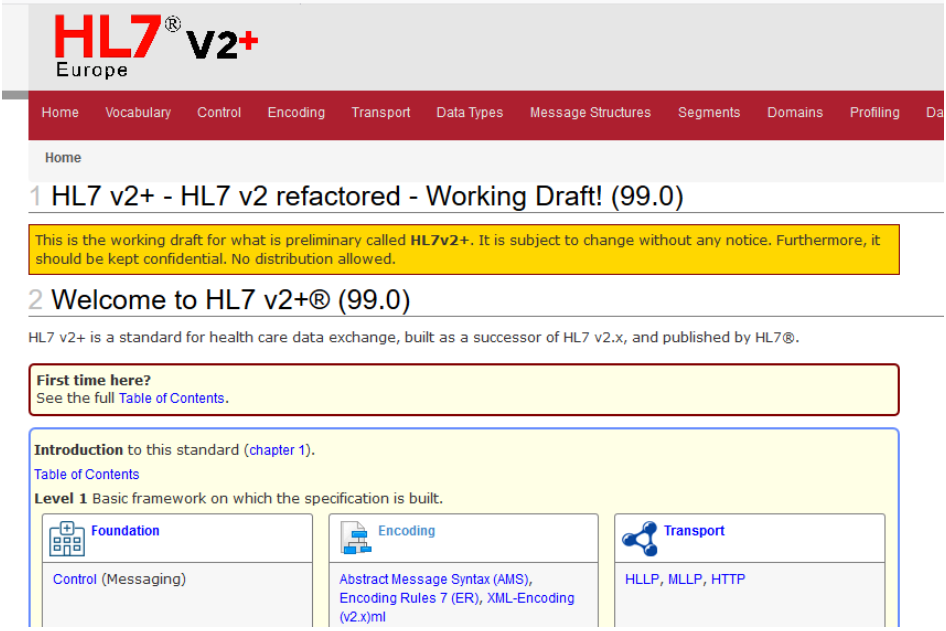


**Figure 2.** HL7 v2+ Landing Page.

### *2.6. Web-based editing*

The idea of managing the standard's content over a web interface has been around for years. During the IHIC conference in Reading, UK, in 2001 a motion towards web-based editing was made, backed up by a practical live demonstration. This proposal has been rejected in favor of HL7 Version 3 and the demonstrated software is lost today, unfortunately.

Web-based administration facilitating specialized widgets would reduce the effort necessary for a new release so significantly that a regular cycle of frequent releases (e. g. annually) appears within a reach.

### *2.7. Reuse of FHIR for Storage (Persistence) and Editing*

The storage (persistence) of the "master copy" of the specification is a crucial issue itself. Today, the specification's contents are maintained as Microsoft-Word documents, which is not sufficient because of possible inconsistencies. Even the structured relational database (*Comprehensive HL7 Database)* has arrived at the limits of its maintainability. One solution could be to make it FHIR aware as shown in Figure 3.

The standard requires specific structures (e.g. segments, data types) that may be provided by specific logical modules in form of structure definitions, that can be maintained in combination with composition resources for the documentation and vocabulary from the UTG project. All together will form a network of resource instances facilitating the reference mechanism from FHIR. Versioning is a built-in feature then.

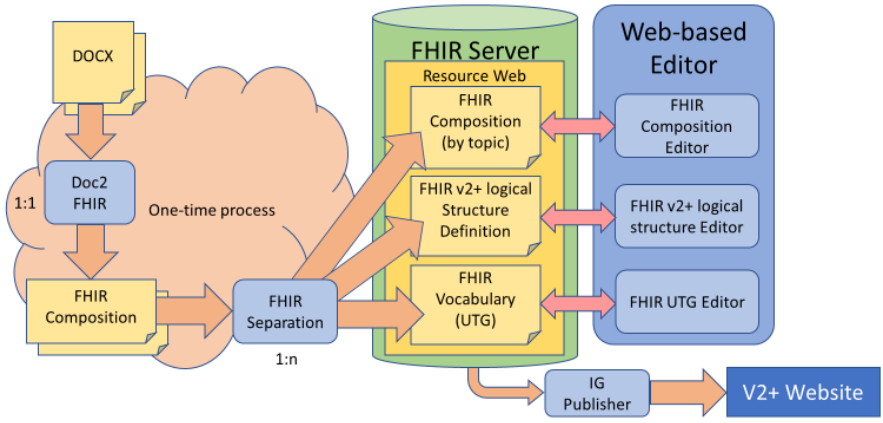


**Figure 3.** HL7 v2+ Storage and Editing.

## 3. Resume

Last year, an HL7 Version 2 Management Group was established to manage all version 2.x related topics, with the mandate to propose next development steps and to strategically shape the future of v2.x.

The representation of the standard's contents described above will facilitate its understanding thanks to a unified technical terminology, shared with FHIR. However, to preserve the implementors' compatibility with the "old" standard, HL7 v2.x must continue to include basic definitions as well as the corresponding minimum requirements - and not to leave them to individual profiling by implementation guides, as practiced by FHIR.

A German proverb says: Those believed dead actually live longer. The life story of HL7 v2.x seems to exemplify this. However, living a long life is not possible without reinventing the own self anew, every now and then. The convergence of HL7 v2.x with FHIR is such a step. The story of HL7 v2.x continues and it shall certainly be exciting to observe this standard in the years to come.

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