HL7 Version 3.0: A Preview for CIOs, Managers, and Programmers

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Healthcare organizations face a number of challenges and opportunities as new IT/IS applications and systems proliferate, and the demands for interoperability between those systems become more urgent. One of the key enabling technologies that make it possible to respond to these demands is the HL7 (Health Level Seven) standard of data exchange and interface design.

The primary purpose of HL7 is to reduce costs and improve interoperability by simplifying the complex challenge of interfacing among applications and systems. HL7 is not a software application, however. It is a specification that allows any healthcare software application or system to exchange data with other compliant systems, using a standard syntax. In effect, HL7 defines the “rules of conversation” so that separate systems and applications can share patient-centric data throughout the healthcare enterprise.

Over 13 years of growing acceptance, HL7 has provided its users significant benefits and savings. Exchanging data between healthcare IS systems and applications, although still highly complex and expensive, is markedly easier and cheaper to accomplish when HL7 is used.

Much like the systems it interconnects, HL7 continues to evolve — from an initial collection of generic protocol options to a new, radically improved, comprehensive specification that can effectively guide interface development.

Carefully designed by the HL7 organization, version 3.0 addresses the ambiguities of the previous “ad hoc” versions, and establishes a new structure of encoding rules based on a comprehensive Reference Information Model (RIM) that will further improve the exchange of patient-centric information. HL7 3.0 has four main objectives:

- Establish a more robust, comprehensive, and definitive data model and protocol for exchanging data between systems.
- Further reduce custom programming requirements by replacing the current “define-negotiate-compromise” approach with documented protocol specifications that must be followed by any developer.
- Establish HL7 3.0 specifications as a clear set of benchmarks for testing and validation of standards compliance.
- Create a foundation for data exchange that can support new technologies as they gain acceptance — including, but not limited to, XML (Extensible Markup Language).

To clarify the benefits of HL7 3.0 and its importance to the future of healthcare IS, this paper offers a brief historical perspective, as well as a comparison of the current 2.x standards to version 3.0.

HL7 Background

The voluntary HL7 organization is accredited by ANSI (American National Standards Institute) to write standards representing a consensus of various entities in the healthcare arena. Technology vendors, healthcare providers, and governing organizations participate as HL7 members, helping to create new standards and voting on their acceptance. (See www.hl7.org for more information on the organization.)

“HL7” is also the term given to the data exchange protocols published by this organization for use in the healthcare industry. Unlike other healthcare standards, HL7 interface protocols interconnect a wide range of diagnostic technologies, fields of practice, and medical specialties. This industry-wide impact makes HL7 unique and ubiquitous, and makes a basic understanding of HL7 concepts essential for healthcare technology developers and executives.

Development of the HL7 Standard

Before the initial publication of HL7 in 1988, there was no common framework for defining interfaces between healthcare systems. The resulting nonconformity made interfaces costly to develop, painful to implement, and expensive to maintain — every interface was a custom job.

In response, the healthcare IS community established an initial HL7 standard based on general interface practices. One of its core concepts was “intentional optionality,” the flexibility for “almost anyone” in healthcare to make use of the standard or to develop enhancements as needed. To make adoption easier, early versions (circa version 2.1) were locked against future changes, and supplemented (not replaced) by later versions. New features of new 2.x versions were almost always optional, to maintain backward compatibility.

What was originally created as an intra-hospital communications standard has thus evolved into the de facto model for data exchange within the healthcare industry. Over the past 12 years, the HL7 standard has continued to evolve in close cooperation with the premier standards organizations, including ACR/NEMA, DICOM, ASC X12N, ASTM, NCPDP and others.

HL7 Today

The current HL7 standard (2.4) interconnects a variety of
technical and administrative environments to the widest degree possible. Because HL7 is not a software application, vendors and hospitals running on different operating systems and using multiple network infrastructures can implement HL7. In its most concrete form, version 2.4 is a four-inch thick, three-ring notebook with nearly 1,500 pages of detailed interfacing information.

The HL7 standard suffers, however, from the limitations of its origins: built on a foundation of optional elements\[lt2\], it provides only a framework and starting point from which programmers and analysts can begin their technical discussions on how to create an interface. Although version 2.x specifies many interface requirements clearly, it’s not a fixed set of rules, and numerous subject areas are still loosely defined. A fair number of those 1,500 pages contain a detailed “laundry list” of interfacing items for developers to discuss and negotiate, which means it’s highly likely that no two interfaces will ever look or function exactly alike. This broad flexibility also leads to variations in interpretations of the standard, with the inevitable complications, delays, and costs that follow.

**HL7 Version 3.0: The Standard Matures**

Key improvements to version 3.0 include:

- Adoption of a formal Reference Information Model (RIM), which contains numerous class attributes used to create HL7 messages, and maps the relationships of each class of objects. This data model is five years in the making, and it limits ambiguity and variability. As version 3.0 is reviewed by vendors and providers, the RIM should be viewed as the key feature that will drive adoption of the standard.
- Support for XML (Extensible Markup Language) to increase interoperability between systems. The HL7 organization has developed the Patient Record Architecture (PRA), an XML-compliant clinical document architecture that provides an exchange model for documents. Using the PRA, HL7 3.0 enables systems to “wrap” HL7 message content in XML, to generate messages from XML content, and to exchange and process messages and documents with other XML-compliant systems. In addition, the version 3.0 messages themselves will be exchanged using XML.
- Adoption of an Interaction Model (IM) to capture information flows and define application roles. The IM includes trigger events, message formats, and data elements required for each application role — and produces testable criteria for validating and certifying compliance.
- In addition, HL7’s Vocabulary Technical Committee is developing methods to allow HL7 messages to draw upon codes and vocabularies from a variety of new sources, so that HL7-compliant systems can clearly understand code sources and code value domains.

Clearly, version 3.0 addresses many of the limitations of the previous versions of the HL7 standard. The shift from a “framework for negotiation” to a set of clearly defined protocols, the introduction of the RIM and IM, and the inclusion of new technologies such as XML and ActiveX, represent a quantum leap in the effectiveness and value of the HL7 standard. Version 3.0 is scheduled for ballot and approval by HL7 members in 2002.

**Challenges of Version 3.0**

Version 3.0 represents significant impacts and challenges for the healthcare IS industry. The impacts include:

- Developing HL7 3.0 interfaces between systems will be less complicated and less expensive.
- Programmers/analysts will require less training.
- HL7 compliance and compliance testing will become a meaningful reality and a competitive requirement.

The challenges include:

- Existing 2.x interfaces will continue to operate and require support; the changeover to 3.0 is not going to happen overnight. (In fact, several more versions of 2.x will likely be released before version 3.0 is finalized.) Many organizations will have to support both 2.x and 3.0 development even after the new standard is fully phased in.
- Most providers and vendors will eventually be compelled by the marketplace to make their systems 3.0-compliant. However, they will still need to support 2.x for some time.
- With support for new technologies built into 3.0, some functions — such as message routing — will become more powerful, more complex, and more costly to implement.
- Some retraining and retooling will be necessary to “close the gap” between 2.x and 3.0 programming skills.
- Version 3.0 is a significant new release. Initial implementation issues and other surprises are likely.

**Summary**

HL7-based data exchange will be a critical component of the healthcare enterprise of the future. Clearly, the healthcare marketplace is driving toward full interoperability, in which HL7 plays a leading role.

Version 3.0 effectively addresses the limitations of previous versions, and expands both the capabilities and value of the HL7 standard. The inclusion of new technologies such as XML ensures HL7’s longevity, and its testing and validation capabilities are significant improvements. Version 3.0’s RIM is the key “artifact” and represents the most comprehensive data model for healthcare. Although adoption of version 3.0 will take planning, time, and money, the resulting improvements offer significant benefits and efficiencies to providers and vendors alike.

**About the Author**

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