# FHIR Profile using FHIM and MDHT

## Implementation specification and profiling

Fast Healthcare Interoperability Resources (FHIR) is the latest interoperability paradigm created by HL7to augment its existing standard specifications (i.e. product lines). Similar to previous standards, FHIR uses profiles to add specificity to its standards definitions in order to enable implementation. Therefore FHIR follows previous standards that have used implementation guides containing “profiles” or “templates” to define how implementers should populate and interpret the base standard structures:

* HL7 Version 2.x - widely adopted messaging specification starting with release 2.3 all the way to release 2.9 currently under development. This messaging standard uses a terse encoding syntax (“pipes and hats”) and is widely used in inpatient settings, laboratory results reporting, and public health. HL7 Version 2.x is referenced by IHE Technical Frameworks and Implementation Guides required for Meaningful Use Stage 2 certification. There are two main principles that HL7 Version 2.x minor versions have followed for the past 20 years:
  + Each release (e.g. HL7 Version 2.7) is backwards-compatible with the previous release (e.g. HL7 Version 2.6) as the later release adds more message specificity or clarity to the previous iteration/release.
  + HL7 Version 2.x implementation guides contain message profiles. These profiles specify structural and semantic constraints.
* HL7 Version 3.0 - was intended to replace and improve conformance to HL7 Version 2.x and add a rigorous model-based approach to standards development based on a Reference Information Model (RIM). HL7 Version 3 is not widely implemented in the US except as parameters for some SOAP web services specified by the IHE IT Infrastructure Technical Framework and available as an option (along with HL7 Version 2) for patient identity and demographics cross-referencing. Due to its complex XML definitions and conformance shortcomings, HL7 Version 3 is not likely to have a significant impact on the future interoperability landscape of the US.
* HL7 Clinical Document Architecture (CDA) Release 2 – was initially proposed as a clinician-friendly representation of formatted text documents required across the continuum of care. This standard is based on an early subset of HL7 Version 3 content. The initial intent of this standard was to communicate health information clinician-to-clinician using a document paradigm, not a as replacement for message transactions. However as CDA section entries became complex “clinical statements” CDA documents became both a text and structured content exchange format in need of complex constraints organized into “templates”. CDA provides a very flexible, recursive structure for representing clinical documents; including a header, sections with text and structured entries. However, the counterpoint to flexibility is lack of interoperability, thus CDA Implementation Guides add numerous conformance statements that constrain every aspect of a document (i.e. header elements, sections, and structured clinical statements) including their presence, cardinality, and terminology encoding.
  + Consolidated CDA Implementation Guide (1.1 and 2.1) are required for MU certification.
  + Other CDA-like document specifications were developed to exchange clinical quality measure information (i.e. HQMF).

This historical background is necessary to explain the space that FHIR occupies in the HL7 standards suite:

* FHIR specifies an approach to RESTful services to manage health information at an atomic level similar to the “Date Elements” envisioned by the 2010 PCAST report on Health IT.
* FHIR services/resources have built-in functionality for creating, updating, deleting, viewing, and searching information matching specific criteria.
* FHIR has moved away from the model-based approach used by HL7 Version 3.0 because it failed to provide the semantic clarity and specificity envisioned. FHIR resources are developed using an informal 80/20 rule (i.e. attempt to address 80% of requirements and defer the least often used 20% for “profiles”). Since the 100% scope is undefined, the precision of such an approach is doubtful and there is no way to predict if in five years the profiles will reveal that more than 20% of requirements were deferred.
* The semantics of data elements in FHIR resources are somewhat ambiguous and could be interpreted very differently by different implementation teams.
* FHIR resources are more granular than HL7 Version 2.x message types, CDA documents, or H7 Version 3 message types.
* Implementers need to create transaction-specific aggregate resources equivalent to messages and documents, thus FHIR is more appropriate for managing or querying atomic data elements than composite data structures.
* FHIR mandates the use of REST for information exchange unlike other HL7 standards that are transport protocol neutral. Therefore adopters find it easier to create solutions since the entire transport stack is identified in the standard.
* Similar to HL7 Version 2.x, FHIR allows implementers to specify extensions. These data elements may add new content to existing resources (e.g. ‘race’ and ‘ethnicity’ are US-specific extensions to the FHIR Patient resource).
* Similar to HL7 Version 2.x and CDA, implementers must use “profiles” to implement FHIR. This means that FHIR will be highly reliant on tooling for profiling and on implementation guides similar to HL7 and CDA.
* Profiles and extension definitions are important for a requesting system that receives FHIR data (e.g. one using the US-specific Data Access Framework Implementation Guide).
* Unlike CDA, FHIR profiles may contain local extensions in addition to constraints. These extensions may be national or local. Thus they may lead to some confusion when a system is attempting to process “extension” data elements.
* Unlike HL7 Version 2.x and HL7 Version 3, FHIR makes it very easy to search for a specific type of information (e.g. search for results over a time interval).
* Similar to CDA templates developed prior to the “Consolidated” specification, FHIR profiles tend to be duplicative.
  + The development of duplicative profiles is due to lack of tooling to allow implementation guides to reuse previously-defined FHIR profiles (e.g. a US-generic IG that specifies FHIR profiles for data structures intended to be used consistently across the US).
  + Tooling and better analysis of US requirements based on a common information model would ensure consistency across IGs and across profiles.
* FHIR like its predecessor, CDA R2, specifies a way to “profile” the standards without adequate tooling to ensure that profiles are properly constraining or extending the parent resource or profile. Unlike CDA, FHIR specifies an XML format for a “profile”, but the benefit of this syntax will depend on a stable XML Profile definition. If the definition changes frequently – similar to the HL7 Version 3 “Model Interchange Format” – then FHIR will discourage other tool developers willing to create profile editing and profile generation tools from existing logical models (e.g. FHIM).

As federal partners start to adopt FHIR, they will be expected to constrain or extend a set of US-specific FHIR profiles and the need for a FHIR profile tool that allows one profile to inherit and reuse the constraints and extensions of a parent profile. Furthermore there is an implicit need for semantic consistency across paradigms (i.e. V2 messages, CDA documents, FHIR resources) to ensure that an EHR system capable of processing inbound MU CDA and V2 messages is capable of supporting queries using FHIR services.

It is therefore obvious, especially in an environment where there is no clear successor standards, that FHIM can play a crucial role in ensuring Federal agencies and the health industry at-large is exchanging the same semantic information regardless of information exchange format.

## From Data Requirements to FHIR Profile

It is very important to have tooling that can take data requirements represented in FHIM and apply structural and semantic constraints to generate a FHIR conformant implementation standard.

FHIM can also provide a way of documenting US-specific requirements and other data elements not supported in a FHIR resource. FHIR extensions based on FHIM content may be vetted and adopted by Federal agencies to ensure that they can communicate clear, understandable semantics.

FHIM was always intended to define data elements, relationship between them, and clear, understandable semantics, including business and terminology meaning (i.e. value sets, coding systems). These important definitions can be directly translated into FHIR profile constructs using tools such as MDHT.

## The solution – goals and objectives

* FHIM already represents US-specific requirements gathered from Federal agencies, therefore FHIM is the ideal model for supplying data requirements for FHIR Profiles which are crucial to successful adoption of the FHIR standard.
* Model-based representation of the base standard (FHIR resources)
  + Modeling constraints similar to CDA template constraints may be applied to FHIR resources (SHALL/SHOULD/MAY constraints)
  + FHIM provides full semantic clarity and relationship to MU requirements
  + FHIM can be leveraged during the MU certification process
* Reuse of the FHIM to identify business semantics and terminology
  + FHIM can be the basis for creating FHIR profiles using MDHT.
  + Constraints already documented in FHIM can be automatically leveraged by MDHT

## MDHT tooling support

[Dave’s content]