The use of standard content specifications in a national health interoperability framework

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Introduction

National eHealth programs require standards in order to provide a foundation for distributed and specialised health care without fragmentation, repeated investigations and silos of health information. While industry and payer driven standards have been the norm in the past, *open*EHR has grown as a community driven standard based on interest, research outputs and collaboration. Such a 'grass-roots' movement has been able to establish processes fit for the endeavor and develop governance processes that evolve with uptake and interest. This paper addresses the pathway to interoperability and information sharing using the *open*EHR Framework and standard content specifications.

Background

The *open*EHR Framework provides a means of creating, validating, communicating and storing personal health information in the manner required for accountable health care while allowing the clinical content to be specified in a just-in-time manner. The content specifications are first expressed as archetypes, which are authored by clinician experts as formal and machine readable expressions. The archetypes are reusable and can be selectively aggregated and refined to meet specific needs. When bound to terminology archetypes provide the agreed foundation of clinical semantics. Use specific aggregations and refinements, with appropriate terminology subset bindings, are called templates. Thus a template might be created for a discharge summary in one hospital that is laid out quite differently from that in another hospital, but as both are based on the same archetype library the information can be machine processed at the receiving end.

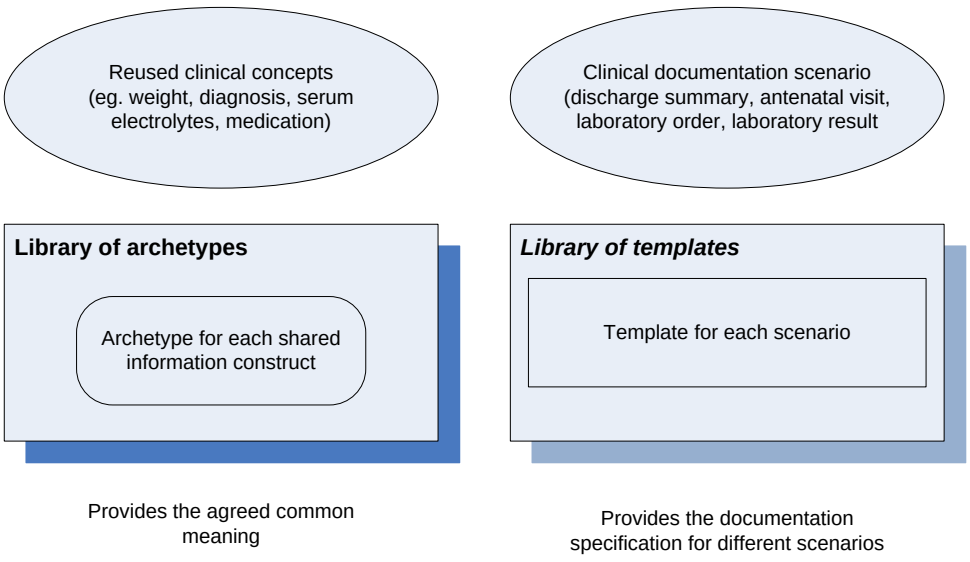

Figure 1: Relationship of *open*EHR archetypes and templates

The *open*EHR community has a growing library of high quality authored archetypes for use in clinical care and tools to support their maintenance, governance and release.

Standards in health care

Within health care there is a range of data communication standards. The message standard in most widespread is HL7 version 2. UNEDIFACT and locally agreed XML schemas are also widely used. Some countries have developed HL7 v3 implementations. Document standards in use include HL7 CDA, CCR and *open*EHR, with PDF and other image formats in common use for non-computable content representation. The computable forms all use terminology differently with specific vocabularies and the ability to use standard terminologies.

As *open*EHR has a formal mechanism to author, review, maintain and govern clinical content, it is a candidate for bringing the diverse range of standards into a common semantic framework.

Specifying standards

Once a jurisdiction has decided to use a message standard like HL7 version 2, 3 or CDA, the work then begins to negotiate the message structure and content. Ideally this will be re-useable in other jurisdictions, but the diversity of health care, language dependencies etc make it very difficult. Each message becomes an end-to-end agreement, which in some cases reflects the commercial interests of vendors rather than the needs of clinical users within the jurisdiction.

A community-based standard like *open*EHR allows clinician experts to determine the content specifications and formally express these independently of any particular application or message structure. This is achieved through the separation of archetypes from templates, allowing system developers the freedom to recombine clinician-defined content with no possibility of endangering data interoperability, which is guaranteed at the archetype level. The resulting specifications can be used to consolidate information in *open*EHR based repositories and to specify the how specific information will be carried in messages and CDA documents.

Developing clinical content specifications

Creating the content specifications as archetypes and templates is a task that takes time and experience. There is now growing international experience of using the *open*EHR Framework for this purpose. One advantage of using *open*EHR is its support for clinical process through the INSTRUCTION and ACTION classes. While this does not capture the business rules *per se*, it does mean that the pathway steps that might be documented in performing interventions of any kind can be specified.

This content definition process requires specification of value sets, usually from an external terminology. Terminology binding will usually be done at the time of template design to allow future flexibility in coding.

The process as described can be applied at various levels of scale. It might be performed by clinical system developers, hospitals, jurisdictions or nations in the same manner using the same tools and services.

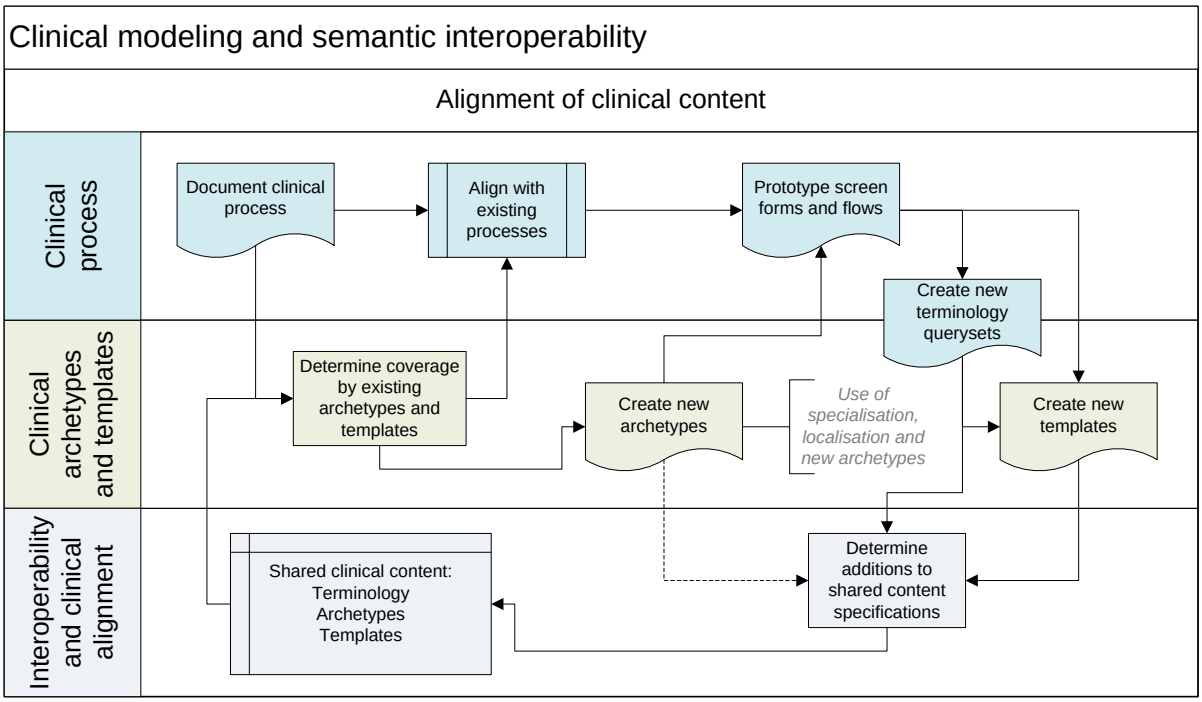

Figure 2: The specification of clinical content

Such a process, with attendant debate on suitable clinical archetypes, has the potential to support national healthcare transformation through ongoing process improvement. In time, this may be seen as the great strength of the approach.

The Semantic Interoperability Framework

Having developed the shared archetypes and templates for specific purposes, it is now possible to generate a range of artefacts that offer a variety of ways for different stakeholders to participate. These include:

1. **Template Data Schema (XML)** which consolidates the information model and set of archetypes into a 'classic' XML schema. Any data that is captured and validated against these schemas (using a range of off the shelf tools e.g. Microsoft Infopath) can be converted using a single transform script to standard openEHR (or to other known formats with a per-archetype transform). The Template Data Schema can be used for data capture, data integration as well as message generation. The schema can contain identifying information if required.

2. **Template Programming Objects** are code snippets that can be used by application developers to enable standard screen building environments to communicate directly with an *open*EHR repository via the web. This allows users to view, create and edit data in a shared repository with no special knowledge of *open*EHR or web services.

For the full power of transformation to other standards to be realised, transformation scripts are required, generally one per archetype. Thus, for a standard summary health record to be generated in CCR, HL7 CCD, CDA v1 and 2, PDF and HL7 v2, it is necessary to know how specific information such as allergies, medication, alerts, problems etc are represented in each standard. Sharing these

transformation scripts and working from a high fidelity *open*EHR environment makes light work of data integration. What makes it possible is a formal and well engineered health record architecture and tools – the *open*EHR Framework.

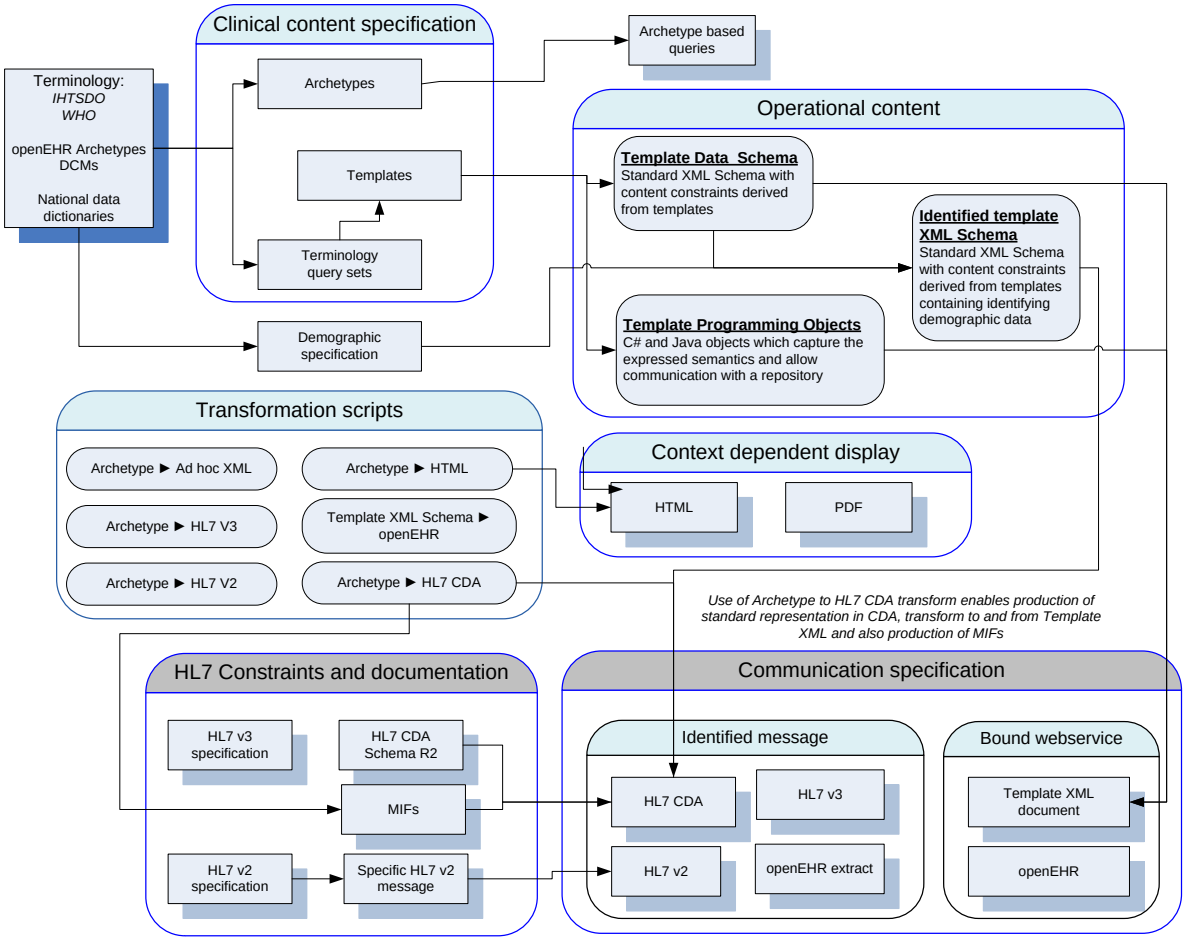

Figure 3: Single source eHealth semantic artefacts

A few scenarios are offered to illustrate how people might participate and what artefacts enable the interaction:

1. **Viewing information:** Information can be provided as **HTML, PDF** or other agreed formats. This can be done directly over the web or by downloading a document in a suitable format. The transforms to PDF or HTML is determined on a per-archetype basis (which can be different for different contexts). The ability to **change the view by context** is very important in, for example, creating summary views, views for the patient themselves, views for different health professionals etc.
2. **Contributing to the shared EHR:** Stakeholders who are part of the health system but have limited messaging infrastructure can create **Template XML Schemas** either to populate or use within the local application. These **can be identified, or** if the stakeholder is part of the jurisdictions authorisation framework, can be **de-identified**. **Programming objects** can be used by the system developers for direct authorised access to edit and create data in the shared space.

3. **Query the shared EHR:** Archetype query language allows **authorised queries** of the shared EHR for specific content based on the archetypes. This web service allows reporting, decision support and other services to be based on the shared content specification.
4. **Create and incorporate HL7 messages:** By agreeing the transform of archetypes to different formats (such as HL7 CDA, HL7 v2 and HL7 v3) it is possible to transform data conforming to the **Identified Template Data Schema**, with its validation mechanism based on archetypes, to any message format. It is also possible to transform messages of that type back to the Template Data document. This provides utility in two ways: stakeholders can use simple XML schemas to validate their data; and be guaranteed to produce **standard HL7 artefacts**.
5. **Create documentation or constraints in other formats:** It is theoretically possible, but has not been done due to lack of standards, to create standard specifications of HL7 CDA (**MIFs**) or HL7 v2 messages (**Documentation**) from an *open*EHR template (given the transforms are available for all the archetypes). This work is being planned at present.

Summary

The community-driven development of *open*EHR puts it outside the traditional standards environment and allows clinicians, patients and other stakeholders to determine the content independently of specific implementations. The *open*EHR Framework provides a unifying approach to semantic interoperability which will greatly simplify the specification of communications and clinical systems. Use of the *open*EHR Framework has the possibility to save money for national health programs as well as the resources of the international clinical community currently burdened with a myriad of charting efforts. There must be millions of hours every year spent by clinicians all over the world working on clinical documentation projects that can be greatly simplified through use of the *open*EHR framework.