hData – A Simple Approach to Health Data Exchange

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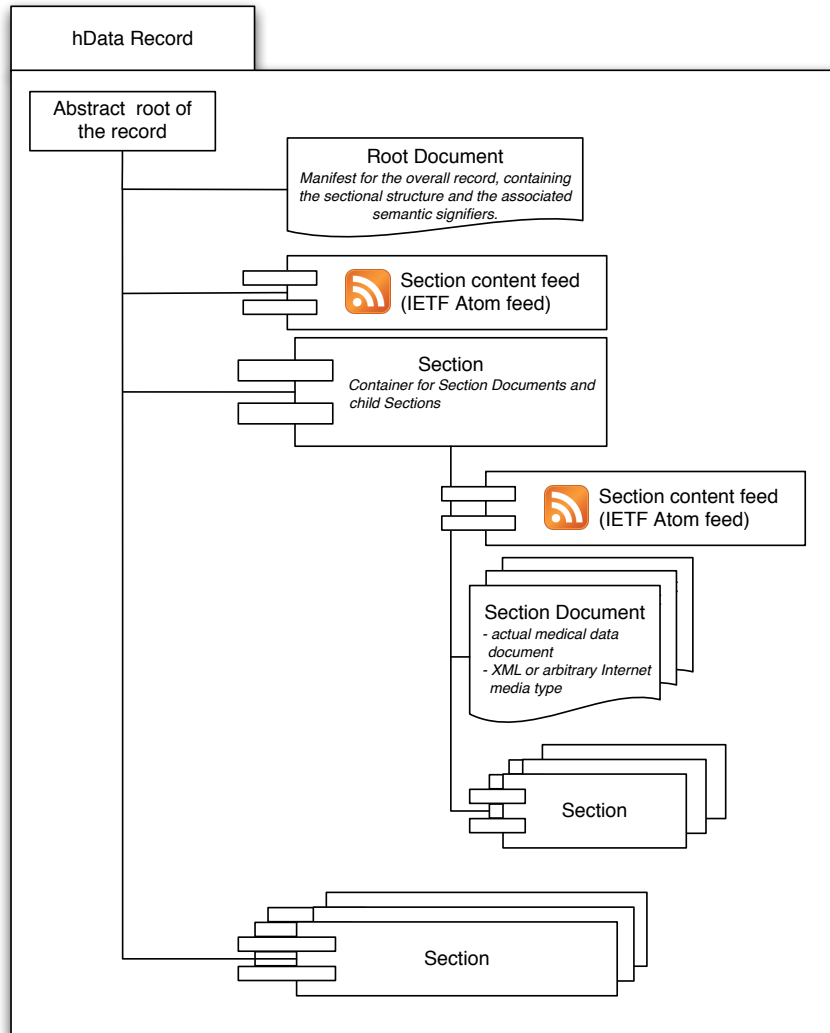
1. Introduction

Health data interoperability issues limit the expected benefits of Electronic Health Record (EHR) systems. Ideally, the medical history of a patient is recorded in a set of digital continuity of care documents that are securely available to the patient and their care providers on demand. The history of electronic health data standards includes multiple standards organizations, differing goals, and ongoing efforts to reconcile the various specifications. Existing standards define formats and protocols that are too complex for effective exchange of health data.

hData, a simple HTTP and XML-based framework for exchange of health data, addresses this complexity by introducing an intuitive, self-describing approach based on the concept of health record sections accessible using a uniform interface. Clients can perform dynamic queries of a health record to obtain links to sections that contain data of interest in a format they are able to process.

2. Health Record Structure

hData maps clinical data elements into an abstract hierarchy representing the overall record. Within the record, sections are used to group individual documents and sub-sections into logically connected groups. Each section corresponds to a single set of documents. Documents are typically grouped into sections by purpose. For example, a section may contain laboratory result documents. Sections can also contain other sections, for example, a section for radiology under laboratory results.

The overall layout of the record structure is described in the root document, which also identifies the type of content that is associated with each section using a URI. The specification recommends that URIs used to identify a section type resolve to a RDDL document that provides additional human readable and machine process-able information about the section type, e.g. an XML schema for syntax definition.

hData Record

Abstract root of the record

Root Document
Manifest for the overall record, containing the sectional structure and the associated semantic signifiers.

Section content feed
(IETF Atom feed)

Section
Container for Section Documents and child Sections

Section content feed
(IETF Atom feed)

Section Document
- *actual medical data document*
- *XML or arbitrary Internet media type*

Section

Section

The sections are represented by Atom feeds that contain metadata for each child (document or subsection) including a reference to the actual child.

The overall structure for a domain-specific hData record is described by an hData Content Profile, which specifies the sectional structure and types, the content type of section documents, semantics of the record elements, behavioral model, etc. When designed along the lines of the recommendations in the specification, hData Records can support multiple hData Content Profiles at the same time, allowing data to coexist within a single record.

3. The hData Protocol

The hData protocol is based on RESTful use of HTTP coupled with a self describing format to provide progressive discovery and browsability:

- GET on the root URI of a hData record returns an Atom feed containing a list of current child sections and their associated URIs
- POST on the root URI is used to create a new child section
- OPTIONS on the root URI returns a set of HTTP headers that describe the supported content profiles, security mechanisms and hData extensions for that record.

The root.xml is always available at the root URI + 'root.xml':

- GET on the root.xml returns the root.xml descriptor

Each section has its own URI:

- GET on a section URI returns an Atom feed containing a list of section documents and child sections and their associated URIs
- POST on a section URI is used to create a new section document or child section
- DELETE on a section is used to delete the section and all its documents and child sections recursively.

Each document has its own URI:

- GET on a document URI returns the document
- PUT on a document URI is used to update a document
- POST on a document URI is used to update document metadata
- DELETE on a document URI is used to delete a document

In addition to the basic operations described above, hData also defines two extension patterns for reliable operations and asynchronous operations.

4. Conclusion

hData addresses a number of topics within the scope of the W3C Workshop on Data and Services Integration, in particular: data formalism, matching of data structures and definitions, and service description. We would welcome the opportunity to share our experience with the workshop attendees and learn from other approaches to similar problems.

5. References

HL7 hData Record Format 1.0, DSTU Submission, September 2011, HL7 International

OMG hData RESTful API 1.0, RFC Submission, September 2011, Object Management Group