Semantic Representation of Clinical Care and Research in HL7 FHIR

Abstract

The semantic infrastructure for clinical data has quietly arrived. HL7's Fast Healthcare Interoperability Resources (FHIR(R)) has emerged as the next generation standards framework for healthcare related data exchange. FHIR-based solutions are built from a set of modular components called "Resources", which can be assembled into working systems. FHIR is becoming available in a variety of contexts including mobile phone apps, cloud communications, EHR-based data sharing, server communication between and across healthcare providers and much more. FHIR resources provide a common "platform specification" for the exchange of clinical information. The combination of FHIR resource definitions and a standardized RESTful API allows clinical information to be created, queried and consumed without the need for specialized transformations and mapping.

FHIR defines standardized XML and JSON representations of FHIR resource instances and, as of the latest version (STU3) RDF. While the RDF representation is still not a normative part of the FHIR standard, FHIR RDF services and tools are now becoming widely available. The FHIR RDF representation opens a myriad of new opportunities in the Linked Data Community.

As the adoption and use of the FHIR standard continues to expand, more and more clinical data will automatically become available using a standard set of tags and semantic. Coded data values will be represented as standard URIs providing a direct link into common ontologies. Open sources tools are being developed provide security, authentication, de-identification and many other capabilities. The FHIR technology stack is rapidly advancing into the area of clinical trials, drug research, cancer studies, decision support and many other areas. The availability of FHIR data (and metadata!) as standardized RDF datasets presents a huge opportunity for integration and innovation.

This tutorial provides an update to the 2016 tutorial on the same subject. It will describe how to access and understand the FHIR technology stack and how to access FHIR resource definitions, REST API's and conformance profiles as RDF datasets. It will describe how FHIR definitions are represented in the Shape Expressions Language (ShEx) and how the ShEx definitions can be used to test RDF datasets for conformance. It will introduce the FHIR Metadata Vocabulary (FMV), an RDFS/OWL based catalog of FHIR URI's. It will then show several examples of FHIR RDF in use, including how SNOMED CT, a medical ontology, can be used in combination with the FMV to classify FHIR resource instances, how the FMV is being used to build a standard "ontology" for the i2b2 platform that allows FHIR RDF to be represented as entries in the i2b2 observation fact table, and how the FMV can be used in HTML, XML and even unstructured data as annotations of the function of information.

Aims:

At the end of this course, participants should be able to:

- Explain the background and goals of FHIR and its relationship to clinical interoperability
- Locate and read a FHIR resource definition
- Understand how FHIR profiles relate to FHIR resources and how they are defined
- Access FHIR data instances on public FHIR test services
- Understand a ShEx definition of an RDF representation a FHIR resource

- Test an RDF dataset for conformance with a FHIR ShEx definition
- Explain how terminologies and value sets are used in FHIR
- Explain how FHIR semantics can be mapped to external ontologies
- Demonstrate how the combination of FHIR RDF, an terminology ontology, and an OWL reasoner can be used to perform useful queries over patient records.
- Describe the content FHIR Metadata Vocabulary and some of its uses

Presenter

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Harold has been an active participant in a variety healthcare and metadata standards organizations for well over 25 years. He is the editor and primary author of a series of of terminology service standards, worked with ISO/IEC TC1 SC32 on the ISO 11179 Metadata Repository standard, the OMG on the Common Terminology Services 2 (CTS2) and Archetype Modeling Language (AML) standards, ISO TC 215, Health Level 7 (HL7) and the World Health Organization (WHO).

He is a member of SNOMED International Modeling Advisory Group, is the Mayo representative on the W3C Advisory Council and is actively involved in the HL7/W3C Health Care Life Sciences working group. Harold holds a master's degree in Software Engineering from Oxford University.