**Working Paper: FHIR API for OHIE Terminology Services**

**Version 2 - 22 September 2014**

**Introduction**

This document provides an overview of the HL7 FHIR API relating to Terminology Services (TS). The document’s objective is to introduce the FHIR Value Set Resource capabilities to the OHIE community in order that these APIs can be evaluated for utilization by the OHIE TS.

There are two FHIR **Resources** that are immediately relevant to OHIE, Value Sets and Concept Maps. The sections below present an overview of these Resources including relevant methods (APIs) and payload data elements. The APIs are based on RESTful web services, supporting both XML and JSON payloads. While the descriptions below attempt to be relatively complete, they are not comprehensive. Refer to the full FHIR specification at <http://hl7.org.fhir> for additional information.

**The ValueSet Resource**

The FHIR ValueSet Resource provides a mechanism for accessing descriptive and membership information on Value Sets and Code Systems. (FHIR does provide full CRUD operations on Value Sets. In order to simplify the presentation of “run-time” capabilities, this document only describes Read operations.)

**Access a Value Set/Code System**

GET [base-url]/ValueSet?\_id=12345

See http://fhir.healthintersections.com.au/open/ValueSet?\_id=101

This request returns the Value Set Resource object relating to the Value Set (or Code System) having the internal FHIR id 101. Elements in a Value Set Resource are:

identifier The string identifier for this value set used when referenced externally. This should be a globally unique OID, UUID, or URI. Example "256a5231-a2bb-49bd-9fea-f349d428b70d" or www..

version The string identifier used to denote a specific version of this value set. This value is given by the value set author. Example “20120613”. Queries are available for fetching all versions

name A string describing the value set. Example “LOINC Codes for Cholesterol”.

publisher The string name of the individual or organization that published/created the value set. Example: “FHIR Project Team”.

telecom The **Contact** structure (web site, email address, telephone number, etc.) for the publisher.

description The string description of the value set – reason, usage, etc.

copyright A string copyright statement if required.

status The status of the value set: “draft”, “active”, “retired” (see [http://hl7.org/fhir/ValueSet-status.html](http://hl7.org/fhir/valueset-status.html))

experimental Whether this value set was authored for testing purposes: “true, “false”.

date The date that the value set status was last changed. Example: “2012-06-13”

define A structure used when the value set defines its own codes. Define elements can be versioned.

compose A structure used when the value set includes codes from other value sets/code systems. Both extensional (enumerated) and intentional (algorithmic) composition is supported. (See below.)

expansion A structure used when an expansion of a value set is requested (See below.)

A Value Set Resource payload must contain either a define, a compose or an expansion element. Specific example payloads are provided in Appendix A.

**Compose a Value Set**

A value set always includes any codes it defines itself (via the **define** element). Additional codes are included through the **compose.import**, **compose.include** and **compose.exclude** elements.

import A URI for an external reference to a value set such as a SNOMED CT RefSet or value set definition. All codes from the referenced value set are included in the base value set.

include A structure that defines a set of codes from a code system that are to be included in the value set. Individual codes can be specified (**include.code** element) or sets of codes (**include.filter** elements).

exclude A structure that defines a set of explicit codes to be excluded from the value set.

The value set codes included via a compose element are the union of the codes resulting from the import and include elements less the codes from any exclude element.

The include.filter mechanism provides a way to including codes in a value set based on intensional, or algorithmic, operations rather than enumeration (include.code). Inclusion is based on evaluation of defined expressions (filters) on a target value set/code system. Filtering of code systems is only possible when the target code system defines the appropriate properties. Include filter elements are:

property The name of the property in the code system upon which filtering will be performed. This could be something a complex as “expression” in SNOMED CT (meaning interpretation of the SCT expression given in the value) or as basic as the “METHOD\_TYP” property for LOINC.

op the kind of filter operation to be performed (see below).

value The string code/regex value for the filter.

Filter operators:

= Adds the codes/concepts whose property has the specified by the value.

is-a Adds all codes/concepts subsumed by the code specified by the value (property is typically “concept”).

Is-not-a Adds all codes/concepts not subsumed by the code specified by the value (property is typically “concept”).

regex Adds all codes/concepts whose value representation matches the regex value.

in Adds all codes/concepts in the defined set (RefSet or Subset) named by the value (property is typically “concept”).

not in Adds all codes/concepts not in the defined set (RefSet or Subset) named by the value (property is typically “concept”).

Certain filter operators may only be applicable to specific properties.

**Expand a Value Set**

The expansion of a value set is the creation of a complete list of the codes that are included in the value set. The “definition” of the value set (via its import, include, exclude and define elements) are evaluated to create a result set which is returned in the **expansion** element.

Sub-elements of the expansion element include:

identifier A unique identifier for this expansion of the value set. Note that expansions can change over time as the definitions of the value set change.

timestamp The time the expansion was created.

contains The codes of the value set:

contains.system System value for the contained code

contains.code The code value for the contained code

contains.display The user display name for the contained code.

An expansion can be requested via the following call:

GET [base-url]/ValueSet/?\_query=expand&?\_id=101

**[Issue: how is/can the enumeration object related to SVS?]**

**Search for Value Sets**

Standard FHIR search mechanisms can be used to locate value set resources.

GET [base-url]/ValueSet?[parameter][modifier]=[value]&…

Search is supported on the following value set parameters:

\_id The logical resource id associated with the resource.

\_language The language of the resource.

code A code defined in the value set: ValueSet.define.concept.code

date The date that the value set status was last changed: ValueSet.date

description The string description of the value set – reason, usage, etc.: ValueSet.description

identifier The string identifier for this value set used when referenced externally: ValueSet.identifier

name A string describing the value set: ValueSet.name

publisher The string name of the individual or organization that published/created the value set: ValueSet.publisher

reference A code system included or excluded in the value set or an imported value set: ValueSet.compose.include.system

status The status of the value set: ValueSet.status

version The string identifier used to denote a specific version of this value set: ValueSet.version

Modifiers provide for further specification of the search methodology:

missing Tests for the existence of the parameter. E.g., “gender:missing=true” returns all resources that don’t have any value for the gender parameter (usually means the element is not present in the resource).

exact Standard FHIR searches are case insensitive “contains”. Use of this modifier makes the search case-sensitive and exact.

text Specifies search on the text component of CodeableConcept or Coding.

type Specifies that the target is a name of a type of resource.

The search value can also be prefixed by the “>”, “>=”, “<=” and “<” strings to designate the associated operation on parameters having number or date values.

Additional searching options are available. See <http://www.hl7.org/implement/standards/fhir/search.html> for details.

Examples:

To get all the value sets that include “LOINC” use:

[http://fhir.healthintersections.com.au/open/ValueSet?name=loinc](http://fhir.healthintersections.com.au/open/valueset?name=loinc)

This gets all those values sets with a status of draft:

[http://fhir.healthintersections.com.au/open/ValueSet?name=loinc&status=draft](http://fhir.healthintersections.com.au/open/valueset?name=loinc&status=draft)

To get a single values set by its exact name:

[http://fhir.healthintersections.com.au/open/ValueSet?name:exact=LOINC%20Codes](http://fhir.healthintersections.com.au/open/valueset?name:exact=LOINC%20Codes)

To investigate all the Value Set search options, see the Repository Search form at: <http://fhir.healthintersections.com.au/open/valueset>

FHIR also supports a number of “advanced search/query” options. These are specialized forms that use the \_query parameter:

GET [base-url]/ValueSet?\_query=[querytype]&[parameters]…

One of these query types is the **expand** query as shown above. Another example is the **validate** query below.

To investigate other search options see <http://fhir.healthintersections.com.au/open/valueset>

**Value Set Validation**

While code validation can be performed by testing the code against an expansion, this could be an expensive operation. FHIR provides a special advanced query so that individual codes can be more easily validated against a value set:

GET [base-url]/ValueSet/?\_query=validate&id=XXX&system=SSS&version=VVV&code=NNN…

For a single validation, version is optional, but code and system are mandatory. The result of this query is an **OperationOutcome** message (see <http://www.hl7.org/implement/standards/fhir/operationoutcome.html>).

Now the “code” value can be either a code+system (as described above), an HL7 **Coding** data type or **CodeableConcept**. If the latter, a set of codes can be passed, enabling the server to “batch” test a number of codes.

[Issue: Need further details on the response payload for the multiple code case]

**Subsumption Testing**

TBD

**The ConceptMap Resource**

The ConceptMap resource provides operations for accessing relationships from one set of concepts to one or more value sets/code systems.

**Access a ConceptMap**

GET [base-url]/ConceptMap?\_id=12345

This request returns the Concept Map Resource object for the internal FHIR id 12345. Elements in a Concept Map Resource are:

identifier The string identifier for this concept map used when referenced externally. This should be a globally unique OID, UUID, or URI. Example "256a5231-a2bb-49bd-9fea-f349d428b70d" or www..

version The string identifier used to denote a specific version of this concept map. This value is given by the concept map author. Example “20120613”. Queries are available for fetching all versions.

name A string describing the concept. Example “SNOMED CT to ICD-9—CM Map”.

publisher The string name of the individual or organization that published/created the concept map. Example: “FHIR Project Team”.

telecom The **Contact** structure (web site, email address, telephone number, etc.) for the publisher.

description The string description of the concept map – reason, usage, etc.

copyright A string copyright statement if required.

status The status of the value set: “draft”, “active”, “retired” (see [http://hl7.org/fhir/ValueSet-status.html](http://hl7.org/fhir/valueset-status.html))

experimental Whether this concept map was authored for testing purposes: “true, “false”.

date The date that the concept map status was last changed. Example: “2012-06-13”

source A reference to the Value Set Resource that is the source (from) side of the concept map.

target A reference to the Value Set Resource that is the target (to) side of the concept map.

concept Zero or more instances of a **Concept** structure (see below).

The Concept Map **Concept** structure encapsulates the information on mapping a single source concept to one or more target concepts. This structure includes:

System The value set/code system for the source concept.

Code The code for the source concept

dependsOn ???

map Zero or more **Map** objects representing the targets for the source concept. A Map consists of **system**, **code**, **equivalence** (<http://hl7.org/fhir/concept-equivalence.html> ) and **comments** elements.

The **equivalence** values are:

|  |  |  |
| --- | --- | --- |
| equal |  | The definitions of the concepts are exactly the same (i.e. only grammatical differences) and structural implications of meaning are identical or irrelevant (i.e. intensionally identical). |
| equivalent |  | The definitions of the concepts mean the same thing (including when structural implications of meaning are considered) (i.e. extensionally identical). |
| wider |  | The target mapping is wider in meaning than the source concept. |
| ..subsumes |  | The target mapping subsumes the meaning of the source concept (e.g. the source is-a target). |
| narrower |  | The target mapping is narrower in meaning that the source concept. The sense in which the mapping is narrower SHALL be described in the comments in this case, and applications should be careful when attempting to use these mappings operationally. |
| ..specialises |  | The target mapping specializes the meaning of the source concept (e.g. the target is-a source). |
| inexact |  | The target mapping overlaps with the source concept, but both source and target cover additional meaning. The sense in which the mapping is narrower SHALL be described in the comments in this case, and applications should be careful when attempting to use these mappings operationally. |
| unmatched |  | There is no match for this concept in the destination concept system. |
| ..disjoint |  | This is an explicit assertion that there is no mapping between the source and target concept. |

**Concept Mapping**

Mapping (aka translation) services can be offered by using the concept map search capabilities in association with the **translate** query:

GET [base-url]/ConceptMap/ ?\_query=translate&identifier=[valueset]&system=[system]&version=[version]&code=[code]&…

The identifier is the ValueSet.identifier of source/target???. If an identifier is provided, the service locates a concept map for a matching value set. I no identifier is given, the service must look for a code equivalence in a concept map where the value set of the provided context matches the entire code system ???. The values for system, version, and code are those from the **Coding** data type. Version is optional; code and code system are required. Alternately, the **Coding** or **CodeableConcept** can be used.

The result of the query is an Operation Outcome object with an extension (<http://hl7.org/fhir/Profile/general-extensions.html> (#translations) which is a CodeableConcept that expresses the translation result if one exists or an error if not.

**Search for Concept Maps**

Standard FHIR search mechanisms can be used to locate concept resources.

GET [base-url]/ConceptMap?[parameter][modifier]=[value]&…

Search is supported on the following value set parameters:

\_id The logical resource id associated with the resource.

\_language The language of the resource.

date The date that the concept map status was last changed: ConceptMap.date

dependson The reference to the element/field/valueset that provide the context. ConceptMap.concept.dependsOn.concept

description The string description of the concept map – reason, usage, etc.: ConceptMap.description

identifier The string identifier for this concept map used when referenced externally: ConceptMap.identifier

name A string describing the concept map: ConceptMap.name

publisher The string name of the individual or organization that published/created the concept map: ConceptMap.publisher

source The value set for any concepts mapped by this concept map: ConceptMap.source

status The status of the concept map: ConceptMap.status

target The target value set of the concept map: ConceptMap.target

version The string identifier used to denote a specific version of this concept map: ConceptMap.version

**Appendix A – Example Payloads**

**XML Payload from** [**http://fhir.healthintersections.com.au/open/ValueSet?\_id=101**](http://fhir.healthintersections.com.au/open/ValueSet?_id=101)

<?xml version="1.0" encoding="UTF-8"?>

<ValueSet xmlns="http://hl7.org/fhir">

<text>

<status value="generated"/>

<div xmlns="http://www.w3.org/1999/xhtml">

<p>Value set "LOINC Codes for Cholesterol": This is an example value set that includes &#x0A; all the LOINC codes for serum cholesterol from v2.36. &#x0A; Developed by: FHIR project team (example)</p>

<p>Published for testing on 13-June 2012</p>

<p>This is a restriction on

<a href="http://hl7.org/svc/fhir/ValueSet/03acace4-5206-4c8f-a8b4-df27a4c18b09?format=text/html">the value set "all serum test codes"</a>, and contains the following LOINC codes:</p>

<ul>

<li>14647-2</li>

<li>2093-3</li>

<li>35200-5</li>

<li>9342-7</li> </ul> </div>

</text>

<!-- this example, we elected to use a UUID. We could have used an OID, or a URI - depends on how it will be used. -->

<identifier value="256a5231-a2bb-49bd-9fea-f349d428b70d"/>

<!-- for version, we are going to simply use the day of publication. This is also arbitrary - whatever is here is what people use to refer to the version. Could also be a UUID too -->

<version value="20120613"/>

<!-- set of loinc codes for cholesterol for LONC 2.36 -->

<name value="LOINC Codes for Cholesterol"/>

<publisher value="FHIR project team (example)"/>

<telecom>

<system value="url"/>

<value value="http://hl7.org/fhir"/>

</telecom>

<description value="This is an example value set that includes all the LOINC codes for serum cholesterol from v2.36"/>

<status value="draft"/>

<experimental value="true"/>

<date value="2012-06-13"/>

<compose>

<!-- we claim that this value set is a constraint on this other value set this actual URL is a reference to a fictitious value set definition on a fictitious FHIR value set registry. We claim here, simply for illustrative purposes, that the value set referred to here is all LOINC codes for serum tests, and that this value set is therefore a constraint on that one. Currently this is not included in the resource pending further investigation.

<restricts value="http://hl7.org/svc/fhir/ValueSet/03acace4-5206-4c8f-a8b4-df27a4c18b09"/> -->

<!-- given that this value set is small, it doesn't make sense to import another one - what would it say? But if that made sense, we'd do it like this:

<import>http://hl7.org/svc/fhir/ValueSet/f0f65621-ae8c-4c57-9f96-5326c2acefe3</import> -->

<!-- you could have multiple includes, if you wanted to include codes from more than one code system, or include codes with different modes. we don't, in this case -->

<include>

<system value="http://loinc.org"/>

<version value="2.36"/>

<!-- for LOINC, we simply include the listed codes - no subsumption in LOINC -->

<!-- these were selected by hand -->

<code value="14647-2"/>

<code value="2093-3"/>

<code value="35200-5"/>

<code value="9342-7"/>

</include>

</compose>

</ValueSet>

**JSON Payload from** [**http://fhir.healthintersections.com.au/open/ValueSet?\_id=101**](http://fhir.healthintersections.com.au/open/ValueSet?_id=101)

{

"resourceType" : "ValueSet",

"text" : {

"status" : "generated",

"div" : "<div xmlns=\"http://www.w3.org/1999/xhtml\">&#x0A; <p>Value set \"LOINC Codes for Cholesterol\": This is an example value set that includes &#x0A; all the LOINC codes for serum cholesterol from v2.36. &#x0A; Developed by: FHIR project team (example)</p>&#x0A; <p>Published for testing on 13-June 2012</p>&#x0A; <p>This is a restriction on&#x0A;<a href=\"http://hl7.org/svc/fhir/ValueSet/03acace4-5206-4c8f-a8b4-df27a4c18b09?format=text/html\">&#x0A; the value set \"all serum test codes\"</a>, and contains the following LOINC codes:</p>&#x0A; <ul>&#x0A; <li>14647-2</li>&#x0A; <li>2093-3</li>&#x0A; <li>35200-5</li>&#x0A; <li>9342-7</li>&#x0A; </ul>&#x0A; </div>"

},

"identifier" : "256a5231-a2bb-49bd-9fea-f349d428b70d",

"\_identifier" : {

},

"version" : "20120613",

"\_version" : {

},

"name" : "LOINC Codes for Cholesterol",

"\_name" : {

},

"publisher" : "FHIR project team (example)",

"telecom" : [

{

"system" : "url",

"value" : "http://hl7.org/fhir"

}

],

"description" : "This is an example value set that includes all the LOINC codes for serum cholesterol from v2.36",

"status" : "draft",

"experimental" : true,

"date" : "2012-06-13",

"compose" : {

"include" : [

{

"system" : "http://loinc.org",

"version" : "2.36",

"code" : [

"14647-2",

"2093-3",

"35200-5",

"9342-7"

]

}

]

}

}