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# DTS FHIR Terminology Service: Concept Maps and Translations

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## 1 Overview

A FHIR *ConceptMap* defines relationships (or mappings) from a set of concepts in one *CodeSystem* to one or more concepts in another *CodeSystem* (or *ValueSet*).

This guide is intended to outline the usage of the FHIR Terminology Service to perform ConceptMap specific operations within the context of DTS.

## 2 What is FHIR

From [https://en.wikipedia.org/wiki/Fast\\_Healthcare\\_Interoperability\\_Resources](https://en.wikipedia.org/wiki/Fast_Healthcare_Interoperability_Resources):

*“Fast Healthcare Interoperability Resources (FHIR, pronounced "fire") is a draft standard describing data formats and elements (known as "resources") and an Application Programming Interface (API) for exchanging Electronic health records. The standard was created by the [Health Level Seven International](#) (HL7) health-care standards organization.”*

*“FHIR provides an alternative to document-centric approaches by directly exposing discrete data elements as services. For example, basic elements of healthcare like patients, admissions, diagnostic reports and medications can each be retrieved and manipulated via their own resource URLs.”*

## 3 What is a FHIR Terminology Service

From <https://www.hl7.org/fhir/terminology-service.html>:

*“A service that lets healthcare applications make use of codes and value sets without having to become experts in the fine details of code system, value set and concept map resources, and the underlying code systems and terminological principles. A server that supports all the functionality described here can be described as a "FHIR Terminology Service", and SHALL conform to the [Terminology Service Capability Statement](#)”*

## 4 What is DTS and its Relation to FHIR

Apelon’s Distributed Terminology System (DTS) is a high-quality open source solution for the acquisition, management, and practical deployment of standardized terminologies as well as the creation and management of local terminologies and ontologies. For more information on how to use DTS, refer to the DTS Editor User Guide.

DTS implements HL7’s FHIR Terminology Service API and augments it, allowing users access to a standards-based interface for easily searching and querying terminologies and value sets.

## 5 FHIR ConceptMap Functions

As a FHIR Terminology Service utilizes REST based API, the following RESTFUL functions are available for usage against FHIR ConceptMaps in the DTS implementation of FHIR:

- POST: Creates a new ConceptMap
- PUT: Update an existing ConceptMap
- GET: Retrieve an existing ConceptMap
- DELETE: Remove an existing ConceptMap

A RESTFUL API Client (<https://getpostman.com>, <https://insomnia.rest>, etc.) is recommended for performing FHIR functions. Ensure the following settings are configured prior to performing RESTFUL operations in a RESTFUL API Client:

Headers:

- Accept:  
application/fhir+xml; charset=UTF-8; fhirVersion=4.0  
OR  
application/fhir+json; charset=UTF-8; fhirVersion=4.0
- Content-Type:  
application/fhir+xml; charset=UTF-8; fhirVersion=4.0  
OR  
application/fhir+json; charset=UTF-8; fhirVersion=4.0

Authorization:

- Type: Basic Auth (Use DTS Connection Credentials for User/Password)

Ensure DTS User has necessary permissions to create/delete FHIR CodeSystems:

- In the DTS Editor, navigate to **Options > User Manager**
- Select **New** to create a new role (i.e. FHIR)

- Select the **Namespace Admin**, **Subset Admin**, and **Authority Admin** checkboxes and hit **Save**
- Select the **Roles by User** tab
- Select **New** and create a new user **with the same name as the one used to connect to DTS**
- Under the Roles section, select **Enable** for the new role entry (i.e. FHIR) and hit **Save**

## 5.1 Creating ConceptMaps

Performing a **POST** request with a payload containing a FHIR formatted XML or JSON ConceptMap will create a new ConceptMap against the DTS4 database. The URL format for performing a FHIR ConceptMap **POST** is as follows:

base-url/ConceptMap (i.e. localhost:8080/dtsserverws/fhir/ConceptMap)

A couple of examples of very basic ValueSet in each format are as follows:

### XML

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ConceptMap xmlns="http://hl7.org/fhir">
  <id value="example-conceptmap"/>
  <url value="http://apelon.com/fhir/ConceptMap/example-conceptmap"/>
  <name value="Example ConceptMap"/>
  <status value="active"/>
  <experimental value="true"/>
  <date value="2016-02-04"/>
  <description value="A simple example of a concept map that maps from one codesystem to another"/>
  <group>
    <source value="http://apelon.com/fhir/CodeSystem/example-codesystem"/>
    <target value="http://apelon.com/fhir/CodeSystem/example-codesystem-2"/>
    <element>
      <code value="e-1"/>
      <target>
        <code value="ex-1"/>
      </target>
    </element>
  </group>
</ConceptMap>
```

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```

        </target>
      </element>
    <element>
      <code value="e-1-1"/>
      <target>
        <code value="ex-1-1"/>
      </target>
    </element>
  <element>
    <code value="e-2"/>
    <target>
      <code value="ex-2"/>
    </target>
  </element>
</group>
</ConceptMap>

```

## JSON

```

{
  "resourceType": "ConceptMap",
  "id": "example-conceptmap",
  "url": "http://apelon.com/fhir/ConceptMap/example-conceptmap",
  "name": "Example ConceptMap",
  "status": "active",
  "experimental": "true",
  "date": "2018-01-01",
  "description": "A simple example of a concept map that maps from a codesystem to another codesystem",
  "group": [
    {
      "source": "http://apelon.com/fhir/CodeSystem/example-codesystem",
      "target": "http://apelon.com/fhir/CodeSystem/example-codesystem-2",
      "element": [
        {
          "code": "e-1",
          "target": [
            {
              "code": "ex-1"
            }
          ]
        },
        {
          "code": "e-1-1",
          "target": [
            {
              "code": "ex-1-1"
            }
          ]
        },
        {
          "code": "e-2",
          "target": [
            {
              "code": "ex-2"
            }
          ]
        }
      ]
    }
  ]
}

```

DTS will generate a FHIR ConceptMap **id** attribute on all FHIR ConceptMaps if one is not present (as long as it is unique). If the specified id is non-unique, DTS will return an error upon **POST**.

## 5.2 Updating Existing FHIR ConceptMaps

Updating an existing FHIR ConceptMap completely replaces the current FHIR ConceptMap version definition. Previous elements are deleted.

Performing a **PUT** request with a payload containing a *modified* FHIR formatted XML or JSON CodeSystem will update a CodeSystem version against the DTS4 database. The URL format for performing a FHIR ConceptMap **PUT** is as follows:

base-url/ConceptMap/{FHIR\_ID} (i.e. [localhost:8080/dtsserverws/fhir/ConceptMap/example-concept](http://localhost:8080/dtsserverws/fhir/ConceptMap/example-concept))

With the exception of the ConceptMap FHIR ID and FHIR URL, all ConceptMap FHIR properties can be updated using the aforementioned **PUT** method.

## 5.3 Retrieving FHIR ConceptMaps

Retrieving an existing FHIR ConceptMap is done by performing a **GET** request. This function does not require a RESTFUL API Client and can be completed via most modern web browsers. The URL format for performing a FHIR ConceptMap **GET** generally follows one of two schemes:

base-url/ConceptMap/{FHIR\_ID} (i.e. [localhost:8080/dtsserverws/fhir/ConceptMap/example-conceptmap](http://localhost:8080/dtsserverws/fhir/ConceptMap/example-conceptmap))

OR

base-url/ConceptMap?{parameter}={value} (i.e. [localhost:8080/dtsserverws/fhir/ConceptMap?version=V1](http://localhost:8080/dtsserverws/fhir/ConceptMap?version=V1))

For more information on retrieving FHIR Resources, refer to the **SearchingInDTSFHIR** documentation. This additional document is available for download at the Documentation center on [ApelonDTS.org](http://ApelonDTS.org) in the **DTS 4 FHIR Terminology Service Guides** package.

## 5.4 DELETE a FHIR ConceptMap

To delete a FHIR ConceptMap, perform a **DELETE** request while specifying the ID of the ConceptMap. The URL format for performing a FHIR ConceptMap **DELETE** is as follows:

base-url/ConceptMap/{FHIR\_ID} (i.e. [localhost:8080/dtsserverws/fhir/ConceptMap/example-conceptmap](http://localhost:8080/dtsserverws/fhir/ConceptMap/example-conceptmap))

Upon deletion of a FHIR ConceptMap, it can no longer be retrieved via the FHIR API.

## 5.5 FHIR ConceptMap Attribute Table

The table below shows the correspondence between ConceptMap attributes and DTS Concept Properties.

Table 1. FHIR Element DTS Representation – ConceptMap Attribute

FHIR Element		DTS Representation	
<i>Element</i>	<i>Sub-element</i>	<i>Property/Qualifier</i>	<i>Value (interpreted from FHIR attribute value)</i>
contact		FHIR_Contact	contact.name
	telecom	FHIR_Telecom	telecom.system@ telecom.use@ telecom.value
copyright		FHIR_Copyright	copyright.value
date		FHIR_Date	date
description		FHIR_Description	Description.value
display		FHIR_Display	concept.code [ namespace_name ]
		FHIR_DisplayName	concept.display
experimental		FHIR_Experimental	experimental.isValue
id		FHIR_Id	id.value
identifier		FHIR_Identifier	identifier.value
jurisdiction		FHIR_Jurisdiction	jurisdiction.code1@jurisdiction.code2@...
meta	lastUpdated	FHIR_Meta	lastUpdated
name		FHIR_Name	name.value
publisher		FHIR_Publisher	publisher.value
purpose		FHIR_Purpose	purpose.value
status		FHIR_Status	status.value
text		FHIR_Text	text.status.value
	div	FHIR_DivText	text.div.content
title		FHIR_Title	title.value
version		FHIR_Version	version.value
url		FHIR_Url	url
version		FHIR_Version	version.value

## 5.6 FHIR ConceptMap Operations

### 5.6.1 ConceptMap \$translate

A \$translate request can be used to get a code in a *target* CodeSystem that is mapped from a code in a *source* CodeSystem, based on available ConceptMap resources. Performing a **GET** request with the following format would yield the following results:

#### Request

GET base-url/ConceptMap/\$translate

GET

[http://localhost:8080/dtsserverws/fhir/ConceptMap/\\$translate?system=http://apelon.com/fhir/CodeSystem/example-codesystem&source=http://apelon.com/fhir/CodeSystem/example-codesystem&code=e-1&target=http://apelon.com/fhir/CodeSystem/example-codesystem-2](http://localhost:8080/dtsserverws/fhir/ConceptMap/$translate?system=http://apelon.com/fhir/CodeSystem/example-codesystem&source=http://apelon.com/fhir/CodeSystem/example-codesystem&code=e-1&target=http://apelon.com/fhir/CodeSystem/example-codesystem-2)

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## Response

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<Parameters xmlns="http://hl7.org/fhir" xmlns:ns2="http://www.w3.org/1999/xhtml">
  <parameter>
    <name value="result"/>
    <valueBoolean value="true" id="b3935714-7cac-4130-a409-a6a7caf7eac8"/>
  </parameter>
  <parameter>
    <name value="match"/>
    <part>
      <name value="concept"/>
      <valueCoding>
        <system value="http://apelon.com/fhir/CodeSystem/example-codesystem-2"/>
        <code value="ex-1"/>
      </valueCoding>
    </part>
  </parameter>
</Parameters>
```

Below is a table depicting all IN parameters available for ConceptMap \$translate operations along with whether each IN parameter is supported for usage within the DTS FHIR Terminology service.

Table 2. ConceptMap \$translate IN Parameters

Name	Type	Description	Supported?
url	uri	The URL of the ConceptMap	yes
conceptMap	ConceptMap	The concept map is provided directly as part of the request	yes
conceptMapVersion	string	The version of the ConceptMap	yes
code	code	The code that is to be translated. If a code is provided, a system must be provided	yes
system	uri	The system for the code that is to be translated	yes
version	string	The version of the system, if one was provided in the source data	yes
source	uri	Identifies the codesystem/valueset used when the concept (system/code pair) was chosen.	yes

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coding	Coding	A coding to translate	no
codeableConcept	CodeableConcept	A full codeableConcept to validate	no
target	uri	Identifies the codesystem/valueset in which a translation is sought	yes
targetsystem	uri	Identifies a target codesystem/valueset in which a mapping is sought. This parameter is an alternative to the target parameter - only one is required	yes
dependency		Another element that may help produce the correct mapping	no
dependency.element	uri	The element for this dependency	no
dependency.concept	CodeableConcept	The value for this dependency	no
reverse	boolean	If this is true, then the operation should return all the codes that might be mapped to this code. This parameter reverses the meaning of the source and target parameters	no

### 5.6.2 ConceptMap \$closure

\$closure requests allow for the creation and maintenance of *transitive closure tables*, which are used to integrate terminologically based logic into application searches.

To initialize a closure table, perform a **POST** request with the following:

#### Request

POST base-url/\$closure

```
<Parameters xmlns='http://hl7.org/fhir'>
  <parameter>
    <name value='name' />
    <valueString value='example' />
  </parameter>
</Parameters>
```

#### Response

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```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<Parameters xmlns="http://hl7.org/fhir" xmlns:ns2="http://www.w3.org/1999/xhtml">
  <parameter>
    <name value="outcome"/>
    <valueBoolean value="true" id="a03f0cbb-b9a8-4452-b140-6630382bd0ac"/>
  </parameter>
</Parameters>
```

To add concepts to a closure table, perform a **POST** using the following payload format:

```
<Parameters xmlns='http://hl7.org/fhir'>
  <parameter>
    <name value='name'/>
    <valueString value='example'/>
  </parameter>
  <parameter>
    <name value='concept'/>
    <valueCoding>
      <system value='http://apelon.com/fhir/CodeSystem/example-codesystem'/>
      <code value='e-1'/>
      <display value='Example Code 1'/>
    </valueCoding>
  </parameter>
  <parameter>
    <name value='concept'/>
    <valueCoding>
      <system value='http://apelon.com/fhir/CodeSystem/example-codesystem'/>
      <code value='e-1-1'/>
      <display value='Example Child Code 1'/>
    </valueCoding>
  </parameter>
</Parameters>
```

Due to the nature of closure tables in the FHIR implementation, you can check to ensure no operations are missing by passing the latest version the FHIR server has processed. To perform this check, perform a **POST** with the following payload:

POST base-url/\$closure

```
<Parameters xmlns='http://hl7.org/fhir'>
  <parameter>
    <name value='name'/>
    <valueString value='example'/>
  </parameter>
  <parameter>
    <name value='version'/>
    <valueString value='1'/>
  </parameter>
</Parameters>
```

Versions are obtained by retrieving the number of \$closure requests that are made against a given table minus 1 (i.e. First version = 0, Second version = 1, etc.)

Below is a table depicting all IN parameters available for ConceptMap \$closure operations along with whether each IN parameter is supported for usage within the DTS FHIR Terminology service.

Table 3. ConceptMap \$closure IN Parameters

Name	Type	Documentation	Supported?
name	string	The name that defines the context for the subsumption based closure table	yes
concept	Coding	Concepts to add to the closure table	yes
version	id	A request to resynchronize - request to send all new entries since the nominated version was sent by the server	yes

## 6 DTS Subscription Content ConceptMaps

A number of mappings are provided as part of the DTS Subscription Content including the following:

- GEMS ICD-10 to ICD-9
- Reimbursement ICD-10 to ICD-9
- ICD-9-CM to SNOMED CT US
- SNOMED CT to ICD-9
- SNOMED CT to ICD-10-R
- SNOMED CT CA to ICD-10-R
- SNOMED CT US to ICD-10-R
- SNOMED CT US to ICD-9
- SNOMED CT US to ICD-10-CM

## 7 More information

More information on the DTS implementation of the FHIR Terminology Service can be obtained by contacting us at [info@apelon.com](mailto:info@apelon.com).