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DTS FHIR Terminology Service: CodeSystem Support

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1 Overview

One of the primary Elements in a FHIR Terminology Service is a FHIR CodeSystem. From the [HL7 v3 Core Principles](#):

“A CodeSystem defines a set of codes with meanings (also known as enumeration, terminology, classification, and/or ontology) - e.g. define which codes (symbols and/or expressions) exist, and how they are understood.”

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

2 What is FHIR

From 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 CodeSystem Functions

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

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

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**
 - Selecting the **Manage** option next to a FHIR CodeSystem will allow updates (PUT) to be made via FHIR API
- 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 CodeSystems

There are two ways to create FHIR CodeSystems using DTS: Via a **POST** request utilizing the FHIR API or using the DTS Editor.

5.1.1 Creating a CodeSystem with the FHIR API

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

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

As a bare minimum, a new CodeSystem must contain a FHIR URL for the **POST** to be successful. A couple of examples of very basic CodeSystems in each format are as follows:

XML

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<CodeSystem xmlns="http://hl7.org/fhir" xmlns:ns2="http://www.w3.org/1999/xhtml">
  <id value="example-codesystem"/>
  <url value="http://apelon.com/fhir/CodeSystem/example-codesystem"/>
  <version value="Version 1"/>
  <concept>
    <code value="e-1"/>
    <display value="Example Code 1"/>
  </concept>
</CodeSystem>
```

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```

    <concept>
      <code value="e-1-1"/>
      <display value="Example Child Code 1"/>
    </concept>
  </concept>
  <concept>
    <code value="e-2"/>
    <display value="Example Code 2"/>
  </concept>
</CodeSystem>

```

JSON

```

{
  "url": "http://apelon.com/fhir/CodeSystem/example-codesystem",
  "id": "example-codesystem",
  "concept": [
    {
      "code": "e-1",
      "display": "Example Code 1",
      "concept": [
        {
          "code": "e-1-1",
          "display": "Example Child Code 1"
        }
      ]
    },
    {
      "code": "e-2",
      "display": "Example Code 2"
    }
  ],
  "version": "Version 1",
  "resourceType": "CodeSystem"
}

```

DTS will generate a FHIR CodeSystem **version**, **status**, and **id** attribute on all FHIR CodeSystems. For example, if version is specified in the FHIR CodeSystem element, this value is respected (as long as it is unique), otherwise DTS will create a version designator of the form “V1”, “V2”, etc. If the specified version or id is non-unique, DTS will return an error upon POST.

5.1.1.1 DTS Namespace Display Name

When Posting a CodeSystem, the DTS Namespace Display Name is determined by the FHIR_Url of the CodeSystem. The following set of rules describes how the DTS Namespace Display Name is determined. For more information on the codeSystemPrefix, please refer to the DTS FHIR Configuration Guide.

1. If the CodeSystem URL string starts with the codeSystemPrefix, then set the DTS Namespace Display Name to the remainder of the URL string unless there is no remainder.
 - a. If there is no remainder but there is a “/” in the URL string, then set the DTS Namespace Display Name to the text after the last “/” in the URL string.
 - i. If there is no text after the last “/” then set the DTS Namespace Display Name to the entire URL string.
 - b. If there is no remainder and there is no “/” in the URL string, then set the DTS Namespace Display Name to the entire URL string.

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2. If the CodeSystem URL string does not begin with the codeSystemPrefix, then:
 - a. If there is a “/” in the URL string, then set the DTS Namespace Display Name to the text after the last “/” in the URL string.
 - i. If there is no text after the last “/” then set the DTS Namespace Display Name to the entire URL string.
 - b. If there is no “/” in the URL string, then set the DTS Namespace Display Name to the entire URL string.

5.1.1.2 CodeSystem Prefix Rules Examples

Rule 1

codeSystemPrefix: http://apelon.com/Prefix1/CodeSystem/

CodeSystem URL: http://apelon.com/Prefix1/CodeSystem/TestCodeSystem

DTS Namespace Display Name: TestCodeSystem

Explanation: This uses Rule 1. The CodeSystem URL string starts with the codeSystemPrefix, so the DTS Namespace Display Name is set to the remainder of the URL string.

Rule 1.i

codeSystemPrefix: http://apelon.com/Prefix1.i/CodeSystem

CodeSystem URL: http://apelon.com/Prefix1.i/CodeSystem

DTS Namespace Display Name: CodeSystem

Explanation: This uses Rule 1.i. The CodeSystem URL string starts with the codeSystemPrefix, but there is no remainder (i.e. the CodeSystem URL string matches the codeSystemPrefix exactly). Since there is a “/” in the URL string, the DTS Namespace Display Name is set to the text after the last “/” in the URL string.

Rule 1.i.a

codeSystemPrefix: http://apelon.com/Prefix1.i.a/CodeSystem/

CodeSystem URL: http://apelon.com/Prefix1.i.a/CodeSystem/

DTS Namespace Display Name: http://apelon.com/Prefix1.i.a/CodeSystem/

Explanation: This uses Rule 1.i.a. The CodeSystem URL string starts with the codeSystemPrefix, but there is no remainder (i.e. the CodeSystem URL string matches the codeSystemPrefix exactly). Since there is a “/” in the URL string and there is no text after the last “/”, the DTS Namespace Display Name is set to the entire URL string.

Rule 1.ii

codeSystemPrefix: Prefix1.iiCodeSystem

CodeSystem URL: Prefix1.iiCodeSystem

DTS Namespace Display Name: Prefix1.iiCodeSystem

Explanation: This uses Rule 1.ii. The CodeSystem URL string starts with the codeSystemPrefix, but there is no remainder (i.e. the CodeSystem URL string matches the codeSystemPrefix exactly). Since there is no “/” in the URL string, the DTS Namespace Display Name is set to the entire URL string.

Rule 2.i

codeSystemPrefix: http://apelon.com/Prefix2.i/CodeSystem/

CodeSystem URL: http://apelon.com/Prefix2.i/TestCodeSystem

DTS Namespace Display Name: TestCodeSystem

Explanation: This uses Rule 2.i. The CodeSystem URL string does not begin with the codeSystemPrefix. Since there is a “/” in the URL string, the DTS Namespace Display Name is set to the text after the last “/” in the URL string.

Rule 2.i.a

codeSystemPrefix: http://apelon.com/Prefix2.i.a/CodeSystem/

CodeSystem URL: http://apelon.com/Prefix2.i.a/TestCodeSystem/

DTS Namespace Display Name: http://apelon.com/Prefix2.i.a/TestCodeSystem/

Explanation: This uses Rule 2.i.a. The CodeSystem URL string does not begin with the codeSystemPrefix. Since there is a “/” in the URL string but there is no text after the last “/” the DTS Namespace Display Name is set to the entire URL string.

Rule 2.ii

codeSystemPrefix: http://apelon.com/Prefix2.ii/CodeSystem/

CodeSystem URL: TestCodeSystem

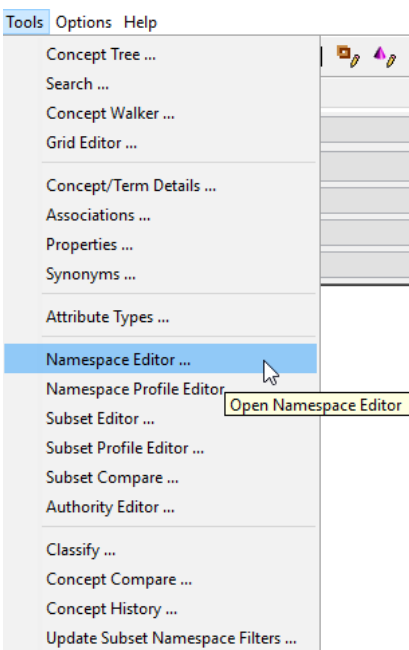
DTS Namespace Display Name: TestCodeSystem

Explanation: This uses Rule 2.ii. The CodeSystem URL string does not begin with the codeSystemPrefix. Since there is not a “/” in the URL string the DTS Namespace Display Name is set to the entire URL string.

5.1.2 Creating a CodeSystem with the DTS Editor

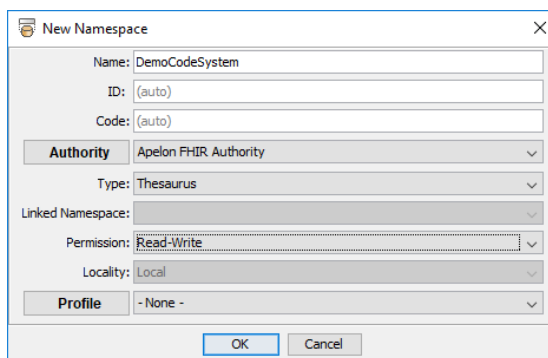
Users may wish to create FHIR CodeSystems using the DTS Editor. This is done by configuring a Namespace, DTS' term for a separate source terminology, with special properties which allow them to be recognized by the FHIR API.

To create a FHIR CodeSystem using the DTS Editor, first create a new Namespace by clicking the **Namespace Editor** under the **Tools** menu.

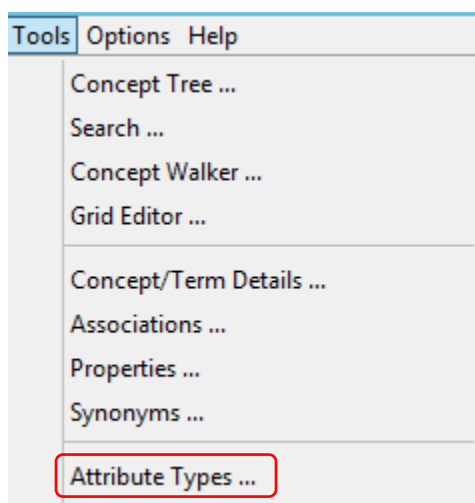


Then click **New** and assign the Namespace a name. The ID and/or code can be specified here, or DTS will auto assign one that is unique to the DTS instance. (*Note: this is the Namespace ID, this is completely separate from the **FHIR CodeSystem ID** discussed above*)

Specify the **Authority** governing the Namespace, if any. The Namespace **Permission** for the purposes of this document is specified as Read-Write so additional edits can be made to it. If a **Profile** has been created it can be applied to the Namespace here, rather than manually adding the property types as described in the following steps.



Once the Namespace has been created, the recommended FHIR URL and FHIR ID property types need to be created. To do this, launch the **Attribute Types** editor from the **Tools** menu.



Select the **Namespace** tab and choose the recently created Namespace in the dropdown menu. Then select the **Property Type** tab, then **New** at the bottom, and enter the required information:

Name: FHIR_Url

ID: (leave this blank, this is automatically managed by DTS)

Namespace: (this should be auto-filled with the Namespace name, ensure this is correct, if not cancel, and select the correct namespace from the dropdown)

Modifies: Namespace

Validator: -None- (not required for FHIR_Url)

The screenshot shows the 'Attribute Type Editor' window. The 'Name' field is set to 'FHIR_Url'. The 'ID' field is empty. The 'Namespace' dropdown is set to 'DemoCodeSystem'. The 'Modifies' dropdown is set to 'Namespace'. The 'Validator' dropdown is set to '- None -'. At the bottom, there are four buttons: 'New', 'Apply' (highlighted with a blue border), 'Restore', and 'Delete'.

Click **Apply** to save this Property Type. Then click **New** to create the next required property type.

Name: FHIR_Id

ID: (leave this blank, this is automatically managed by DTS)

Namespace: (this should be auto-filled with the Namespace name, ensure this is correct, if not cancel, and select the correct Namespace from the dropdown)

Modifies: Version

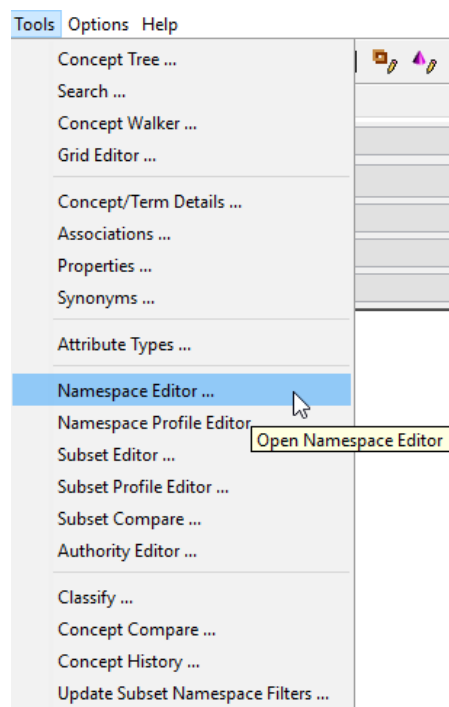
Validator: -None- (not required for FHIR_Id)

The screenshot shows the 'Attribute Type Editor' window. The 'Name' field is set to 'FHIR_Id'. The 'ID' field is empty. The 'Namespace' dropdown is set to 'DemoCodeSystem'. The 'Modifies' dropdown is set to 'Version'. The 'Validator' dropdown is set to '- None -'. At the bottom, there are four buttons: 'New', 'Apply' (highlighted with a blue border), 'Restore', and 'Delete'.

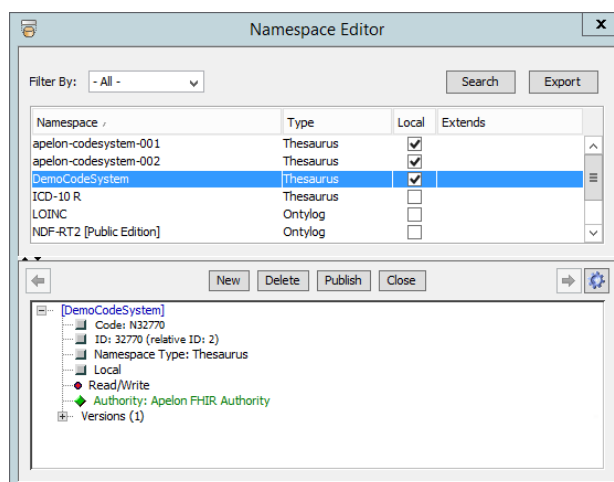
Click **Apply** to save this property. The Editor can now be closed, or click **New** to create additional optional properties (FHIR_Name, FHIR_Date, etc. See *FHIR CodeSystem Attribute Table* below for a complete list of available attributes).

Once the FHIR_Url, FHIR_Id, and all other desired attributes have been added, select **Apply** and close the Attribute Type Editor.

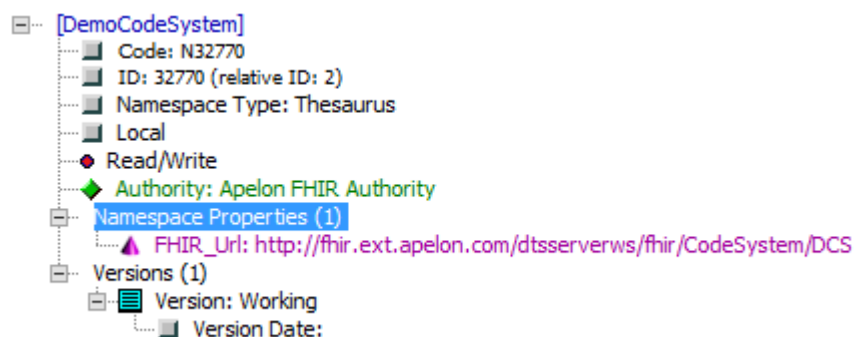
After creating the property types for the Namespace, the values must be assigned. To do this with the DTS Editor, first open the **Namespace Editor** from the **Tools** menu.



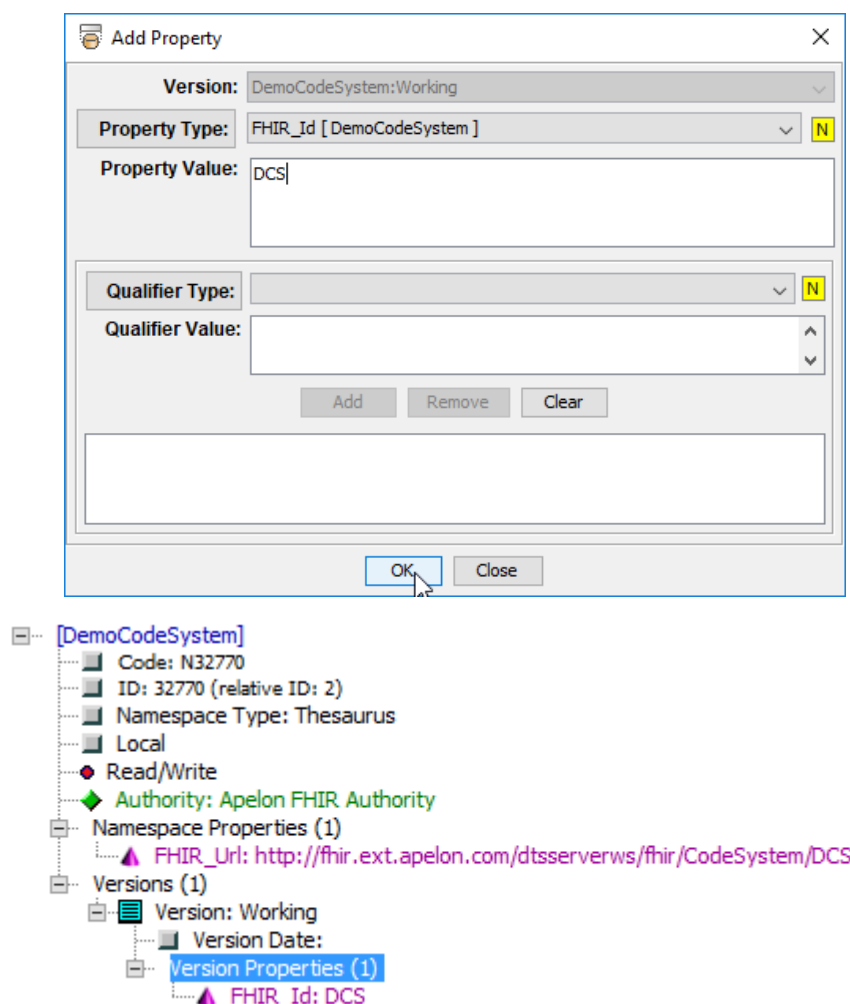
Then, navigate to the new Namespace. Scroll alphabetically or search using the **Search** button at the top to locate it.



To add the **FHIR_Url**, right-click on the namespace name from the lower panel and select **Add Property**. In the Property Value text box, enter the URL for the CodeSystem, and click **OK**. The **FHIR_Url** Namespace Property will be visible when expanded.



To add the **FHIR_Id**, right-click this time on the “Version: Working” item and select **Add Property**. In the Property Value text box, enter the ID for the CodeSystem, and click **OK**. The **FHIR_Id** Namespace Version Property will be visible when expanded.



Adding other FHIR Attributes follows the same process as above. Remember that **FHIR_Url** is a *namespace property*, and not a namespace version property.

5.2 Updating and Publishing FHIR CodeSystems

5.2.1 Updating Existing CodeSystem Versions

Updating an existing FHIR CodeSystem completely replaces the current FHIR CodeSystem version definition. Previous elements are deleted. The version attribute can be updated, as long as it is unique in the FHIR CodeSystem's history. If not specified, the existing version attribute value is maintained.

The process to update a FHIR CodeSystem is similar to creating one. 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 CodeSystem **PUT** is as follows:

base-url/CodeSystem/{FHIR_ID} (i.e. localhost:8080/dtsserverws/fhir/CodeSystem/example-codesystem)

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

5.2.2 Publishing Version Updates to CodeSystems

DTS supports versioning of FHIR CodeSystems, meaning if a user wishes to create an entirely new version of a CodeSystem without altering the previous version, it is possible to do so. This requires a **POST** request where the following conditions must be met:

- CodeSystem FHIR ID and FHIR Version values are different from the previous version
- CodeSystem FHIR URL remains the same

5.3 Retrieving FHIR CodeSystems

Retrieving an existing FHIR CodeSystem 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 CodeSystem **GET** generally follows one of two schemes:

base-url/CodeSystem/{{FHIR_ID}} (i.e. localhost:8080/dtsserverws/fhir/CodeSystem/example-codesystem)

OR

base-url/CodeSystem?{{parameter}}={{value}} (i.e. localhost:8080/dtsserverws/fhir/CodeSystem?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 in the **DTS 4 FHIR Terminology Service Guides** package.

5.4 Deleting Existing CodeSystem Versions

Deleting a FHIR CodeSystem is similar to performing a **PUT** request to update an existing CodeSystem version, except a payload is not required. Performing a **DELETE** request while specifying the ID of the CodeSystem which is being deleted will mark the CodeSystem as deleted. The URL format for performing a FHIR CodeSystem **DELETE** is as follows:

base-url/CodeSystem/{{FHIR_ID}} (i.e. localhost:8080/dtsserverws/fhir/CodeSystem/example-codesystem)

Upon deletion of a FHIR CodeSystem, it can no longer be retrieved via the FHIR API. Only the latest version of a FHIR CodeSystem can be deleted. Published CodeSystems cannot be deleted.

If a **POST** or **PUT** request is made after a FHIR CodeSystem has been deleted, the request payload will overwrite the deleted version.

5.5 FHIR CodeSystem Attribute Table

The table below shows the correspondence between FHIR CodeSystem attributes and DTS Namespace Version Properties. Required DTS Properties are marked with an asterisk (*).

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Table 1. FHIR Element DTS Representation – CodeSystem Attribute

FHIR Element		DTS Representation	
<i>Element</i>	<i>Sub-element</i>	<i>Property/Qualifier</i>	<i>Value (interpreted from FHIR attribute value)</i>
caseSensitive		FHIR_CaseSensitive	caseSensitive.isValue
compositional		FHIR_Compositional	compositional.isValue
contact		FHIR_Contact ³	contact.name
	telecom	FHIR_Telecom ⁴	telecom.system telecom.use telecom.value
content		FHIR_Content	content.value
copyright		FHIR_Copyright	copyright.value
count		FHIR_Count	count
date		FHIR_Date	date
definition		FHIR_Definition ²	concept.definition
description		FHIR_Description	description.value
designation		FHIR_Designation ²	concept.designation.language concept.designation.use concept.designation.value
display		FHIR_Display ²	concept.display
experimental		FHIR_Experimental	experimental.isValue
filter		FHIR_Filter ³	filter.code filter.value filter.description operator.value ...
hierarchyMeaning		FHIR_HierarchyMeaning	hierarchyMeaning.value
id		*FHIR_Id	id.value
identifier		FHIR_Identifier	identifier.value&&identifier.system&&identifier.use&&identifier.type
jurisdiction		FHIR_Jurisdiction	jurisdiction.code1 jurisdiction.code2 ...
meta	lastUpdated	FHIR_Meta	lastUpdated
name		FHIR_Name	name.value
property		FHIR_Property ²	concept.property-value-type concept.property.value
property		FHIR_PropertyDef ³	property.code property.type property.description
publisher		FHIR_Publisher	publisher.value
purpose		FHIR_Purpose	purpose.value
status		FHIR_Status	status.value
title		FHIR_Title	title.value
useContext		FHIR_Use_Context	"FHIR_Use_Context"
		FHIR_Use ⁴	concept.text concept.coding.code@concept.coding.system@concept.coding.display concept.coding.version concept.coding.userSelected
valueSet		FHIR_ValueSet	valueSet.value
version		FHIR_Version	version.value
versionNeeded		FHIR_VersionNeeded	versionNeeded.isValue
url		*FHIR_Url ¹	url.value

NOTE: When required for compound DTS representations, a level 1 delimiter is a "/" and a level 2 delimiters is a "@". Additional Notes:

1. ***FHIR_Url*** is a Namespace Property.
2. *Concept Properties*. Multiple instances may be present.
3. Multiple instances of this property may be present for this attribute.
4. Multiple instances of this qualifier may be present on the property.

5.5.1 FHIR CodeSystem Extensions

FHIR Extensions permit additional and/or locally-defined attributes to the standard FHIR attributes.

An extension has a url (required), a value type, and an associated value. An example of an extension to the *name* attribute is shown below:

```
<name>
  <extension url="http://hl7.org/fhir/StructureDefinition/iso-21090-name-use" >
    <valueCode value="I" />
  </extension>
  <text value="Chief Red Cloud"/>
</name>
```

Extensions are represented as instances of DTS Properties (if the extension is on a Resource) and DTS Qualifiers (if the extension is on a Resource Element). The type name of both of these DTS objects is “FHIR_Ext”. The Property/Qualifier value is:

extension_url|subextension_url|extension_data_type|extension_value

The *extension_url* is the url of the (base) extension. When extensions are nested, the *subextension_url* is the url with a subexpression. If there is no subextension, the *subextension_url* is empty. On XML retrieval via GET, extensions are grouped with common url heads.

The *extension_data_type* is a code that represents FHIR data types. These codes are described in **Table 2** below. The *extension_value* is the DTS serialized representation of the FHIR data type. These representations are described in other DTS FHIR documents.

Table 2. FHIR Extension DTS Representation – Extension Data Types

Data Type	Code	Notes
Boolean	BN	
Canonical	CN	
Code	CD	
CodeableConcept	CC	
Coding	CG	
Date	DA	
DateTime	DT	
Decimal	DC	
Duration	DR	Not currently supported
Instant	IS	
Integer	IT	

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Markdown	MD	Implemented as String
Period	PD	Not currently supported
Reference	RF	Not currently supported
String	ST	
Uri	UR	

Limitations:

1. Extensions are not supported on system-generated attributes such as *version*, *count*, *deleted*, etc.
2. Only two levels of extensions are supported (extension + sub-extension).
3. Search on extensions is not supported.

5.5.2 FHIR CodeSystem Concept Attribute Table

The mapping of other attributes of the CodeSystem.concept element are described in the Table 3 below:

Table 3. FHIR Element DTS Representation – CodeSystem Concept Attribute

FHIR Element		DTS Representation	
<i>Element</i>	<i>Sub-element</i>	<i>Property/Qualifier</i>	<i>Value</i>
display		FHIR_Display	display.value
definition		FHIR_Definition	definition.value
designation		FHIR_Designation ²	designation.language designation.use.code@designation.use.system@designation.use.display designation.value
property		FHIR_Property ²	property.code value ¹

Notes:

1. Value is the string representation of the associated property.value object. For a Coding, the representation is: coding.code@coding.system@coding.display
2. Multiple instances of this property may be present on the concept.

5.6 FHIR CodeSystem Operations

5.6.1 CodeSystem \$lookup

Given a CodeSystem and a code, the \$lookup operation allows retrieval of additional details about the concept, including definition, status, designations, and properties. One of the products of this operation

is a full decomposition of a code from a structured terminology. Performing a **GET** request with the following format would yield the following results:

Request

GET base-url/CodeSystem/\$lookup?system={{value}}&code={{value}}

GET

[http://localhost:8080/dtsserverws/fhir/CodeSystem/\\$lookup?system=http://apelon.com/fhir/CodeSystem/example-codesystem&code=](http://localhost:8080/dtsserverws/fhir/CodeSystem/$lookup?system=http://apelon.com/fhir/CodeSystem/example-codesystem&code=)

Response

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<Parameters xmlns="http://hl7.org/fhir" >
  <parameter>
    <name value="name"/>
    <valueString value="LOINC"/>
  </parameter>
  <parameter>
    <name value="display"/>
    <valueString value="Blood pressure systolic and diastolic"/>
  </parameter>
</Parameters>
```

Below is a table depicting all IN parameters available for CodeSystem \$lookup operations along with information on supported usage within the DTS FHIR Terminology Implementation.

Table 4. CodeSystem \$lookup IN Parameters

Name	Type	Description	Supported?
code	code	A code defined in the code system	yes
system	uri	The system for the code that is to be located	yes
version	string	The version of the system, if one was provided in the source data	yes
coding	Coding	A coding to look up	yes
date	dateTime	The date for which the information should be returned	yes
displayLanguage	code	The requested language for display	yes
property	code	A property that the client wishes to be returned in the output. The following properties are defined for all code systems: url, name,	yes

		version (code system info) and code information: display, definition, designation, parent and child, and for designations, lang.X where X is a designation language code.	
--	--	---	--

5.6.2 CodeSystem \$validate-code Parameters

\$validate-code is a true/false check to determine whether a specified coded value exists in a CodeSystem. Performing a **GET** request with the following format would yield the following results:

Request

GET base-url/CodeSystem/\$validate-code?url={{value}}&code={{value}}

GET [http://localhost:8080/dtsserverws/fhir/CodeSystem/\\$validate-code?url=http://apelon.com/fhir/CodeSystem/example-codesystem&code=e-1](http://localhost:8080/dtsserverws/fhir/CodeSystem/$validate-code?url=http://apelon.com/fhir/CodeSystem/example-codesystem&code=e-1)

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="760fc47f-a509-459c-ab4b-f78a08287442"/>
  </parameter>
  <parameter>
    <name value="display"/>
    <valueString value="Example Code 1"/>
  </parameter>
</Parameters>
```

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

Table 5. CodeSystem \$validate-code IN Parameters

Name	Type	Documentation	Supported?
url	uri	The URL of the CodeSystem	yes
codeSystem	CodeSystem	The codeSystem is provided directly as part of the request. This parameter is used when the client wants the server to check against a code system that is not stored on the server	no
code	code	The code that is to be validated	yes
version	string	The version of the code system, if one was provided in the source data	yes

display	string	The display associated with the code, if provided. If a display is provided a code must be provided	yes
coding	Coding	A coding to validate. The system must match the specified code system	yes
codeableConcept	CodeableConcept	A full codeableConcept to validate.	yes
date	dateTime	The date for which the validation should be checked.	yes
abstract	boolean	If this parameter has a value of true, the client is stating that the validation is being performed in a context where a concept designated as 'abstract' is appropriate/allowed to be used, and the server should regard abstract codes as valid.	no
displayLanguage	code	Specifies the language to be used for description when validating the display property	yes

5.6.3 CodeSystem \$subsumes Parameters

\$subsumes tests the subsumption relationship between two codes, A and B within a CodeSystem. There are four possible outcomes: subsumes, subsumed-by, equivalent, or not-subsumed. Performing a **GET** request with the following format would yield the following results:

Request

GET base-url/CodeSystem/\$subsumes?system={{value}}&codeA={{value}}&codeB={{value}}

GET

[http://localhost:8080/dtsserverws/fhir/CodeSystem/\\$subsumes?system=http://apelon.com/fhir/CodeSystem/example-codesystem&codeA=e-1&codeB=e-1-1](http://localhost:8080/dtsserverws/fhir/CodeSystem/$subsumes?system=http://apelon.com/fhir/CodeSystem/example-codesystem&codeA=e-1&codeB=e-1-1)

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="outcome"/>
    <valueCode value="subsumes"/>
  </parameter>
</Parameters>
```

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

Table 6. CodeSystem \$subsumes IN Parameters

Name	Type	Documentation	Supported?
codeA	code	The "A" code that is to be tested. If a code is provided, a system must be provided	yes
codeB	code	The "B" code that is to be tested. If a code is provided, a system must be provided	yes
system	uri	The code system in which subsumption testing is to be performed	yes
version	version	The version of the code system	yes
codingA	Coding	The "A" Coding that is to be tested. The code system does not have to match the specified subsumption code system, but the relationships between the code systems must be well established	yes
codingB	Coding	The "B" Coding that is to be tested. The code system does not have to match the specified subsumption code system, but the relationships between the code systems must be well established	yes

5.7 Supported CodeSystems

The following table summarizes the direct CodeSystems accessible from the FHIR API.

Table 7. Supported CodeSystems

CodeSystem	Uri/Attribute	Status
CPT	http://www.ama-assn.org/go/cpt	Supported
CVX	http://hl7.org/fhir/sid/cvx	Supported
FDA UNII	http://fdasis.nlm.nih.gov	Supported
HCPCS	https://www.cms.gov/Medicare/Coding/MedHCPCSGenInfo/index.html	Supported
HL7 v2	http://hl7.org/fhir/v2/	Not Currently Supported
HL7 v3	http://hl7.org/fhir/v3/	Not Currently Supported
ICD-10-PCS	https://www.cms.gov/Medicare/Coding/ICD10/index.htm	Supported
ICD-10-R	http://hl7.org/fhir/sid/icd-10-r	Supported
ICD-10-CM	http://hl7.org/fhir/sid/icd-10-cm	Supported
ICD-9-CM	http://hl7.org/fhir/sid/icd-9-cm	Supported
LOINC	http://loinc.org	Supported

NCI Thesaurus	http://ncimeta.nci.nih.gov	Not Currently Supported
NDC	http://hl7.org/fhir/sid/ndc	Not Currently Supported
NDF-RT2	http://hl7.org/fhir/ndf-rt	Supported
Place of Service	https://www.cms.gov/Medicare/Coding/place-of-service-codes/Place_of_Service_Code_Set.html	Supported
RxNorm R	http://www.nlm.nih.gov/research/umls/rxnorm	Supported
SNOMED CT*	http://snomed.info/sct/	Supported
States of the Union	http://apelon.com/states	Supported
UB 04 Revenue Codes (FL)	https://www.cms.gov/Medicare/CMS-Forms/CMS-Forms/CMS-Forms-Items/CMS1196256.html/fl42	Not Currently Supported
UB 04 Types of Bill Codes (FL)	https://www.cms.gov/Medicare/CMS-Forms/CMS-Forms/CMS-Forms-Items/CMS1196256.html/fl4	Not Currently Supported
UCUM	http://unitsofmeasure.org	Not currently supported

* To access different editions of SNOMED CT, specify the following version within the FHIR Request URLs:

International: <http://snomed.info/sct/900000000000207008>

AU Edition: <http://snomed.info/sct/32506021000036107>

CA Edition: <http://snomed.info/sct/20621000087109>

US Edition: <http://snomed.info/sct/731000124108>

By default, <http://snomed.info/sct> refers to SNOMED CT International

6 FHIR CodeSystem Concept – DTS Concept Representation

6.1 FHIR CodeSystem Concept Introduction

A FHIR CodeSystem Concept is represented as a DTS Concept. The name and the code of the concept is the value of the FHIR CodeSystem.concept.code attribute. If concepts are nested, the standard DTS “Parent Of” association is used.

6.2 FHIR CodeSystem Concept Attribute Table

The mapping of other attributes of the CodeSystem.concept element are described in the table below:

Table 8. FHIR Element DTS Representation – CodeSystem Concept Attribute

FHIR Element		DTS Representation	
Element	Sub-element	Property/Qualifier	Value

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This document and implementation of the DTS FHIR Terminology Service are written to R4 sequence (version 4.0.1)

display		FHIR_Display	display.value
definition		FHIR_Definition	definition.value
designation		FHIR_Designation ²	designation.language designation.use.code@design ation.use.system@designation.use.display desi gnation.value
property		FHIR_Property ²	property.code <i>value</i> ¹

Notes:

1. *Value is the string representation of the associated property.value object. For a Coding, the representation is: coding.code@coding.system@coding.display*
2. *Multiple instances of this property may be present on the concept.*

7 Known Limitations and Restrictions

The following are known issues slated to be resolved in a future release:

1. Posting/Publishing additional CodeSystem (namespace) versions in MySQL may result in slower performance compared to other databases.