



# CTS2 Code System and Code System Version Catalog Services

*Version 1.1*

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# Table of Contents

1. Introduction .....	1
1.1 Notation .....	1
1.2 Identifiers .....	1
1.3 Stereotypes .....	1
1.4 Read Only Attributes .....	2
2. Code System Information Model .....	3
2.1 Code System Catalog Entry .....	3
2.1.1 Class CodeSystemCatalogEntry .....	3
2.1.2 Code System Directory and List .....	5
3. Code System Catalog Services .....	7
3.1 Code System Catalog Read Service .....	7
3.1.1 Interface CodeSystemCatalogReadService .....	7
3.2 Code System Catalog Query Service .....	9
3.2.1 Interface CodeSystemCatalogQueryService .....	9
3.3 Code System Catalog History Service .....	12
3.3.1 Interface CodeSystemCatalogHistoryService .....	12
3.4 Code System Catalog Maintenance Service .....	14
3.4.1 Interface CodeSystemCatalogMaintenanceService .....	15
4. Code System Version Information Model .....	17
4.1 Code System Version Catalog Entry .....	17
4.1.1 Class CodeSystemCatalogEntry .....	17
4.2 Code System Version Directory and List .....	19
4.2.1 Class CodeSystemVersionCatalogEntryDirectory .....	19
4.2.2 Class CodeSystemVersionCatalogEntryList .....	20
5. Code System Version Catalog Services .....	21
5.1 Code System Version Catalog Read Services .....	21
5.1.1 Interface CodeSystemVersionCatalogReadService .....	21
5.2 Code System Version Catalog Query Services .....	25
5.2.1 Interface CodeSystemVersionCatalogQueryService .....	26
5.3 Code System Version Catalog History Services .....	29

5.3.1 Interface CodeSystemVersionCatalogHistoryService .....	29
5.4 Code System Version Catalog Maintenance Services .....	31
5.4.1 Interface CodeSystemVersionCatalogMaintenanceService .....	31
5.4.2 Class UpdateCodeSystemVersionRequest .....	33

# 1 Introduction

The CTS2 specification is divided into a number of separably implementable profiles. This profile describes Code System Catalog Services and Code System Version Catalog Services, which represent metadata about abstract code systems and/or specific versions (releases) of these code systems.

## 1.1 Notation

Model elements are referenced using `Typewriter` font.

## 1.2 Identifiers

- Class names are capitalized camel case (`CodeSystemCatalog`, `String`).
- Attribute and role names are lower camel case (`version`, `sourceAndRole`).
- Enumeration values are all capital letters with underscores ('\_') introduced as needed for clarity. (`EMPTY`, `STOP_ON_ERROR`).
- Method names are `lowerCamelCase`.

## 1.3 Stereotypes

The following stereotypes are used throughout the model:

- `dataType` - UML `dataType` semantics.
- `enumeration` - UML enumeration semantics.
- `interface` - UML interface semantics.
- `mixin` - a class that provides a certain functionality to be inherited by a subclass, while not meant for instantiation.
- `opt` - an optional parameter in a method call. This stereotype should always be accompanied by a 0.. 1 cardinality and is provided to make optionality visible in the modeling tool.
- `optparam` - an optional attribute in a class instance. This indicates that an implementation must be able to distinguish three alternatives: (1) add or change the attribute to whatever is in the class, (2) remove the attribute if its minimum cardinality is zero, and (3) leave the attribute unchanged.
- `delta` - a method call that changes the state of the service. Note that the semantics of this stereotype is the inverse of the `is query model attribute`.
- `exception` - an exception.
- `exceptionSet` - a set of exceptions, the members of which are represented by aggregation.

## 1.4 Read Only Attributes

The CTS2 PIM is based on a RESTful architectural style. Resources can be created, updated, read, and/or deleted, and every resource has one or more immutable characteristics - characteristics that, if changed, would change the identity of the resource itself. In the information model we distinguish these characteristics from those that can be modified by declaring the identifying characteristics as *ReadOnly*. The computational model utilizes a pattern based on this information where the *create* operation(s) supply the identifying characteristics plus any of the non-optional mutable characteristics. The *update* operations then supply a unique identifier and a set of one or more mutable characteristics to be changed.



## 2 Code System Information Model

### 2.1 Code System Catalog Entry



Figure 2.1 - Code System Catalog Entry

A code system is a resource that is maintained by individuals and/or organizations, typically has a specific goal or purpose and is published and/or updated at periodic intervals. Its purpose is to declare a collection of codes or identifiers that represent classes, categories, or individuals that are used for reporting, organizing, and/or reasoning about knowledge in some discipline, specialty, or domain. The `CodeSystemCatalogEntry` model carries metadata about the code system itself, while `CodeSystemVersionCatalogEntry` carries information about the content of a code system.

#### 2.1.1 Class CodeSystemCatalogEntry

Metadata and access information about a code system.

##### Superclasses

- Every instance of `CodeSystemCatalogEntry` is also an instance of `AbstractResourceDescription`.

## Attributes

- **codeSystemName** - the local identifier that uniquely identifies the code system within the context of the implementing service. Note that the `about` URI is the globally unique identifier.
- **codeSystemCategory** - the category or type of resource that the code system represents.
- **ontologyDomain** - the subject domain of the ontology.
- **ontologyType** - the nature of the content of the ontology.
- **designedForOntologyTask** - the purpose for which the ontology was originally designed.
- **hasOntologyLanguage** - the formal ontology language.
- **includes** - a reference to an external code system that is included as a component of the referenced code system. The Wine Ontology, as an example, includes the Food Ontology as one of its components. Similarly, the US Edition of SNOMED-CT includes the international edition.
- **versions** - a `DirectoryURI` that references the known versions of this code system.
- **currentVersion** - a reference to the code system version marked as `CURRENT` in the service instance.
- **usedOntologyEngineeringTool** - information about a tool used to create the ontology.

## Invariants

1. The `resourceID` of a `CodeSystem` is the `codeSystemName`.
2. The described `ResourceType` of a `CodeSystem` is `CODE_SYSTEM`.
3. One of the resource types must be `owl:Ontology` or `skos:ConceptScheme`.
4. `CodeSystems` cannot have workflow status.

## 2.1.2 Code System Directory and List

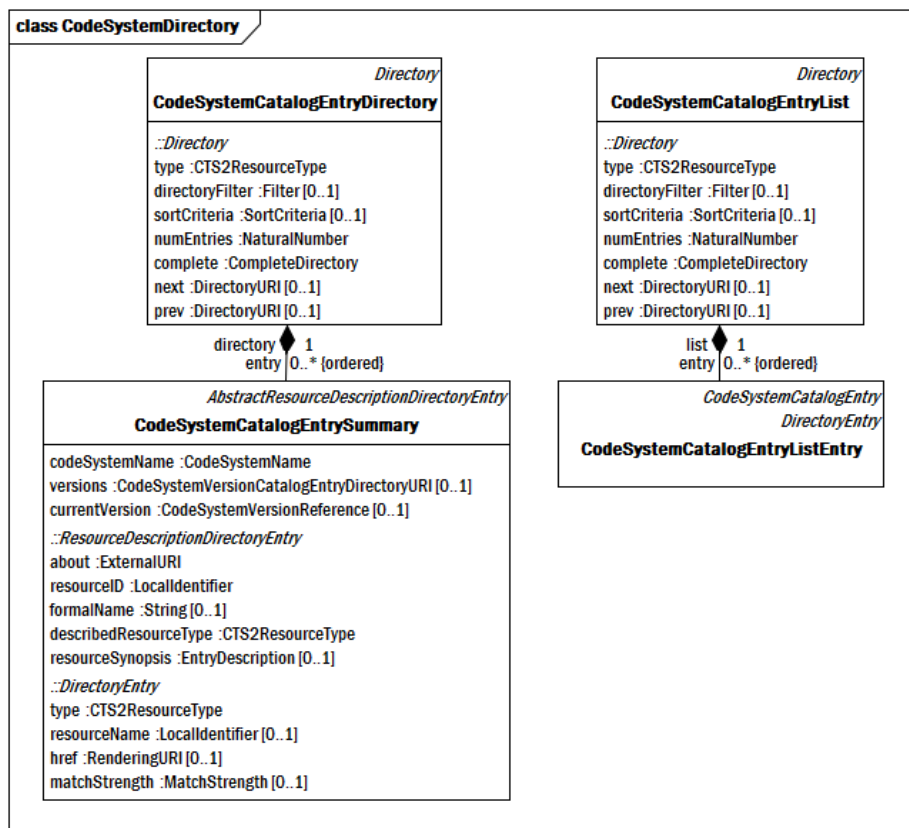


Figure 2.2 - Code System Directory

A directory of all or some of the code systems known to the CTS2 service.

### 2.1.2.1 Class CodeSystemCatalogEntryDirectory

A directory that summarizes a set of catalog entries.

#### Superclasses

- Every instance of `CodeSystemCatalogEntryDirectory` is also an instance of `Directory`.

#### Attributes

- **entry** - an entry in the directory.

#### Invariants

1. The type of a `CodeSystemDirectory` must always be `CODE_SYSTEM`.
2. All entries in a code system directory must be type `CODE_SYSTEM`.

### 2.1.2.2 Class `CodeSystemCatalogEntryList`

A set of code system catalog entries.

#### Superclasses

- Every instance of `CodeSystemCatalogEntryList` is also an instance of `Directory`.

#### Attributes

- **entry**- an entry in the list.

#### Invariants

1. The type of a `CodeSystemList` must be `CODE_SYSTEM`.
2. All entries in a `CodeSystemList` must be type `CODE_SYSTEM`.

### 2.1.2.3 Class `CodeSystemCatalogEntryListEntry`

An instance of `CodeSystem` that meets a specified filter criteria.

#### Superclasses

- Every instance of `CodeSystemCatalogEntryListEntry` is also an instance of `DirectoryEntry`.
- Every instance of `CodeSystemCatalogEntryListEntry` is also an instance of `CodeSystemCatalogEntry`.

#### Invariants

1. The type of a `CodeSystemListEntry` must be `CODE_SYSTEM`.

### 2.1.2.4 Class `CodeSystemCatalogEntrySummary`

A synopsis of a `CodeSystem` along with information about how to access the complete resource.

#### Superclasses

- Every instance of `CodeSystemCatalogEntrySummary` is also an instance of `AbstractResourceDescriptionDirectoryEntry`.

#### Attributes

- **codeSystemName** - the local identifier that uniquely identifies the code system within the context of the implementing service. Note that the about URI is the globally unique identifier.
- **versions** - a directory URI that resolves to an ordered list of code system versions associated with this code system. Versions may only be present if the service supports the `CODESYSTEMVERSION QUERY` profile.
- **currentVersion** - a reference to the code system version marked as `CURRENT` in the service instance.

#### Invariants

1. The type of a `CodeSystemDirectoryEntry` must be `CODE_SYSTEM`.

## 3 Code System Catalog Services

### 3.1 Code System Catalog Read Service

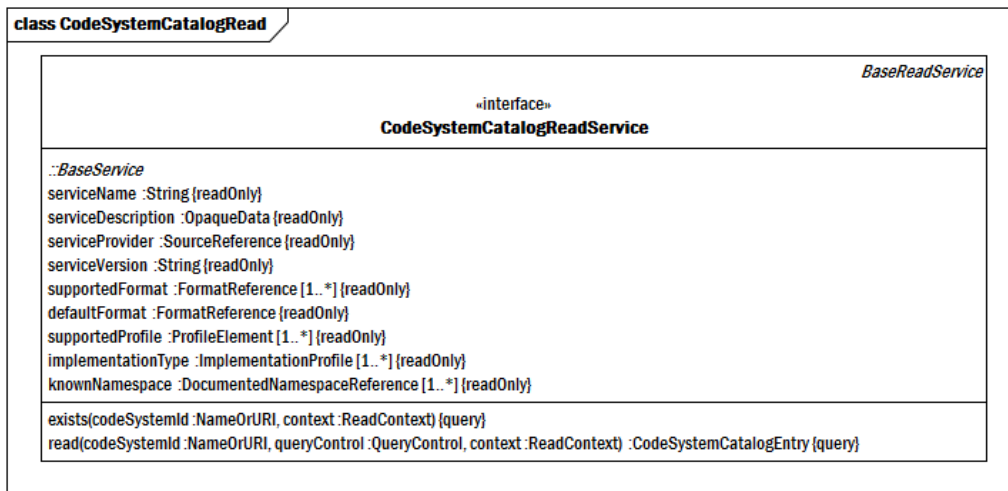


Figure 3.1 - Code System Catalog Read

The `CodeSystemCatalogReadService` provides basic access to the CTS2 code system catalog via a locally unique name or a primary or alternative URI.

#### 3.1.1 Interface `CodeSystemCatalogReadService`

A service that provides direct read access to the contents of the code system catalog.

##### Superclasses

- Every instance of `CodeSystemCatalogReadService` is also an instance of `BaseReadService`.

##### Invariants

1. Service must be present in `supportedProfile` list.
2. Every code system name and uri must be unique at a given point in time.
3. The service does not know about change sets unless either the update or authoring profile is supported.
4. The service can never represent a point in time in the future.
5. If the service doesn't support the temporal profile, there can be at most one reference date represented in the service.

##### 3.1.1.1 Operation: `exists`

Determine whether a catalog entry exists that has an `about` or `alternate` `Id` that matches the supplied URI or that has a `codeSystemName` that matches the supplied name that is (was) applicable in the supplied `context`.

### Input Parameters

- **codeSystemId** - the local name, about URI, OID or alternateID of the resource to check for existence. (Type: NameOrURI).
- **context<sub>OPT</sub>** - the context in which the check is performed. (Type: ReadContext).

**Return Type: Boolean**

### Exceptions

- **UnsupportedLanguage** - The `referenceLanguage` is not supported by the service
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.
- **ChangeSetIsNotOpen** - The `changeSetContext` is recognized by the service, but its state is not OPEN.
- **UnsupportedContext** - One or more `changeSetContext` is not supported by the service.

### Preconditions

1. profile and dates are set to SP\_CODE\_SYSTEM and the known service dates.

### Postconditions

1. The return is true if there was a matching code system at the reference time that met the appropriate activity criteria.

### 3.1.1.2 Operation: read

Return the catalog entry that has an `about` or `alternate` Id that matches the supplied URI or that has a `codeSystemName` that matches the supplied name that is (was) applicable in the supplied `context`.

### Input Parameters

- **codeSystemId** - the local name, about URI, OID or alternateID of the resource to read (Type: NameOrURI).
- **queryControl<sub>OPT</sub>** - parameters that control the ordering, timeout and query behavior (Type: QueryControl).
- **context<sub>OPT</sub>** - parameters that control the language, date and other contextual variables (Type: ReadContext).

**Return Type: CodeSystemCatalogEntry**

### Exceptions

- **UnknownCodeSystem** - The referenced `CodeSystem` is not recognized by the service.
- **UnsupportedLanguage** - The `referenceLanguage` is not supported by the service.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.
- **ChangeSetIsNotOpen** - The `changeSetContext` is recognized by the service, but its state is not OPEN.
- **UnsupportedContext** - One or more `changeSetContext` is not supported by the service.
- **UnsupportedMatchAlgorithm** - The `matchAlgorithm` is not supported by the service.
- **UnsupportedPredicate** - The predicate name or URI is not recognized by the service.

- **UnsupportedNamespaceName** - The supplied namespace name is not one that is known to the service.
- **UnsupportedModelAttribute** - The name or URI of a CTS2 model attribute is not recognized and/or supported by the service implementation.
- **MatchValueFormatException**-The match value does not meet the format or syntax required or the supplied match algorithm.
- **UnsupportedFormat** - The `format` is not supported by the service implementation.
- **QueryTimeout** - The `timeLimit` was exceeded by the service.

## 3.2 Code System Catalog Query Service

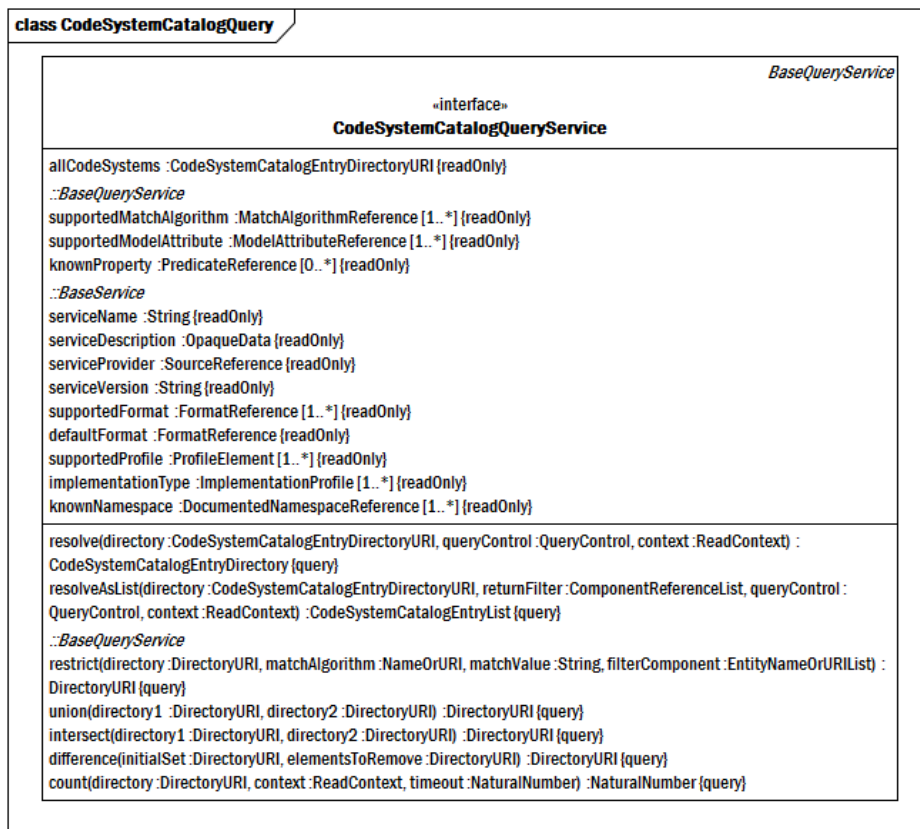


Figure 3.2 - Code System Catalog Query

The `CodeSystemCatalogQueryServices` provides the ability to query code system catalogs based on the contents of the catalog entries.

### 3.2.1 Interface CodeSystemCatalogQueryService

A service that allows the query and filtering of entries in the code system catalog.

## Superclasses

- Every instance of `CodeSystemCatalogQueryService` is also an instance of `BaseQueryService`.

## Attributes

- **allCodeSystems** - A `DirectoryURI` that references all of the code system catalog entries known to the service implementation.

### 3.2.1.1 Operation: resolve

Resolve a `DirectoryURI` that references a set of code system catalog entries and return a summary of the references.

#### Input Parameters

- **directory** - a `DirectoryURI` that resolves to a set of `CodeSystemCatalogEntries` (Type: `CodeSystemCatalogEntryDirectoryURI`).
- **queryControl**<sub>OPT</sub> - parameters that control the ordering, timeout and query behavior (Type: `QueryControl`).
- **context**<sub>OPT</sub> - parameters that control the language, date and other contextual variables (Type: `ReadContext`).

#### Return Type: `CodeSystemCatalogEntryDirectory`

#### Exceptions

- **UnsupportedLanguage** - The `referenceLanguage` is not supported by the service.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.
- **ChangeSetIsNotOpen** - The `changeSetContext` is recognized by the service, but its state is not `OPEN`.
- **UnsupportedContext** - One or more `changeSetContext` is not supported by the service.
- **UnsupportedMatchAlgorithm** - The `matchAlgorithm` is not supported by the service.
- **UnsupportedPredicate** - The predicate name or URI is not recognized by the service.
- **UnsupportedNamespaceName** - The supplied namespace name is not one that is known to the service.
- **UnsupportedModelAttribute** - The name or URI of a CTS2 model attribute is not recognized and/or supported by the service implementation.
- **MatchValueFormatException** - The match value does not meet the format or syntax required or the supplied match algorithm.
- **UnsupportedFormat** - The `format` is not supported by the service implementation.
- **QueryTimeout** - The `timeLimit` was exceeded by the service.
- **InvalidDirectoryURI** - The supplied `directory` URI is not valid.
- **InvalidDirectoryType** - The type represented by the supplied `directory` URI is not the one required by the service invocation.



### 3.2.1.2 Operation: resolveAsList

Resolve a `DirectoryURI` that references a set of code system catalog entries and return the set of corresponding catalog entries.

#### Input Parameters

- **directory** - a `DirectoryURI` that resolves to a set of `CodeSystemCatalogEntries` (Type: `CodeSystemCatalogEntryDirectoryURI`).
- **returnFilter**<sub>OPT</sub> - a list of zero or more component references. If present, the returned `CodeSystemCatalogEntry` entries in the returned `CodeSystemCatalogList` will contain only the required elements and attributes plus any elements or attributes named in the filter. If absent, the complete `CodeSystemCatalogEntry` will be returned. (Type: `ComponentReferenceList` )
- **queryControl**<sub>OPT</sub> - parameters that control the ordering, timeout and query behavior (Type: `QueryControl`).
- **context**<sub>OPT</sub> - parameters that control the language, date and other contextual variables (Type: `ReadContext`).

#### Return Type: `CodeSystemCatalogEntryDirectory`

#### Exceptions

- **UnsupportedLanguage** - The `referenceLanguage` is not supported by the service.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.
- **ChangeSetIsNotOpen** - The `changeSetContext` is recognized by the service, but its state is not `OPEN`.
- **UnsupportedContext** - One or more `changeSetContext` is not supported by the service.
- **UnsupportedMatchAlgorithm** - The `matchAlgorithm` is not supported by the service.
- **UnsupportedPredicate** - The predicate name or URI is not recognized by `UnsupportedNamespaceName` - The supplied namespace name is not one that is known to the service.
- **UnsupportedModelAttribute** - The name or URI of a CTS2 model attribute is not recognized and/or supported by the service implementation.
- **MatchValueFormatException** - The match value does not meet the format or syntax required or the supplied match algorithm.
- **UnsupportedFormat** - The `format` is not supported by the service implementation.
- **QueryTimeout** - The `timeLimit` was exceeded by the service.
- **InvalidDirectoryURI** - The supplied `directory` URI is not valid.
- **InvalidDirectoryType** - The type represented by the supplied `directory` URI is not the one required by the service invocation.

## 3.3 Code System Catalog History Service

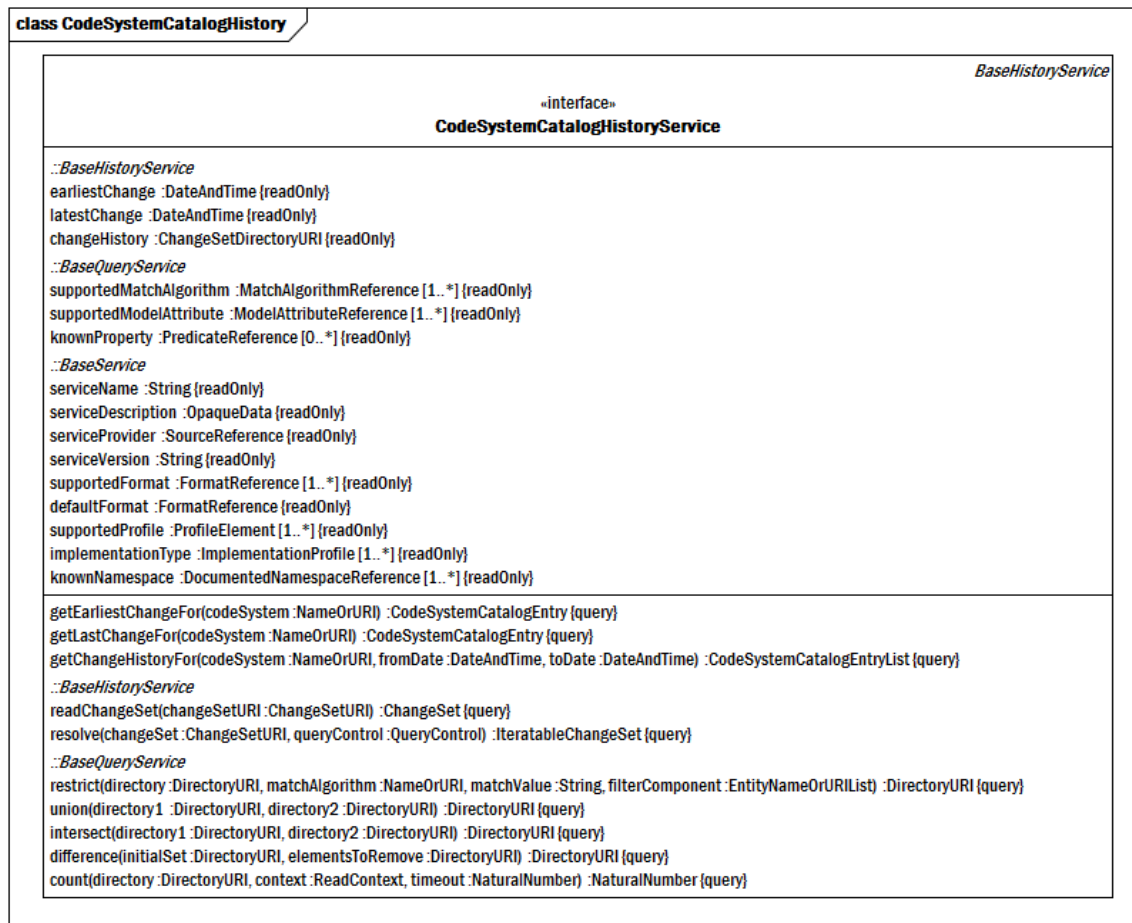


Figure 3.3 - Code System Catalog History

The `CodeSystemCatalogHistoryService` provides the ability to determine how a catalog entry has evolved over time.

### 3.3.1 Interface `CodeSystemCatalogHistoryService`

A service that allows access to the history of changes on a code system catalog.

#### Superclasses

- Every instance of `CodeSystemCatalogHistoryService` is also an instance of `BaseHistoryService`.

#### 3.3.1.1 Operation: `getEarliestChangeFor`

Return a catalog entry that reflects the state of the entry when it first appeared in the service.

#### Input Parameters

- **codeSystem** - the name or URI of the code system described by the catalog entry (Type: NameOrURI).

**Return Type: CodeSystemCatalogEntry**

#### Exceptions

- **UnknownCodeSystem** - The referenced CodeSystem is not recognized by the service.

### 3.3.1.2 Operation: getLastChangeFor

Return an entry that reflects the result of the last change that was made to the catalog.

#### Input Parameters

- **codeSystem** - the name or URI of the code system that the entry describes (Type: NameOrURI).

**Return Type: CodeSystemCatalogEntry**

#### Exceptions

- **UnknownCodeSystem** - The referenced CodeSystem is not recognized by the service.

### 3.3.1.3 Operation: getChangeHistoryFor

Return a list of records that reflects the change in the catalog entry over the specified time span. Records will be sorted from earliest to latest if (a) *fromDate* is omitted, or (b) *toDate* is omitted, or (c) *fromDate* is earlier than *toDate*. In all other cases, records will be sorted from latest to earliest.

#### Input Parameters

- **codeSystem** - a *codeSystemName* or URI that uniquely identifies the code system in question (Type: NameOrURI).
- **fromDate<sub>OPT</sub>** - the earliest to return changes for. If omitted, the history starts at the first known entry. (Type: DateAndTime).
- **toDate<sub>OPT</sub>** - the last date to return changes for. If omitted, all changes up to the last one made are returned. (Type: DateAndTime).

**Return Type: CodeSystemCatalogEntryList**

#### Exceptions

- **UnknownCodeSystem** - The referenced CodeSystem is not recognized by the service.

## 3.4 Code System Catalog Maintenance Service

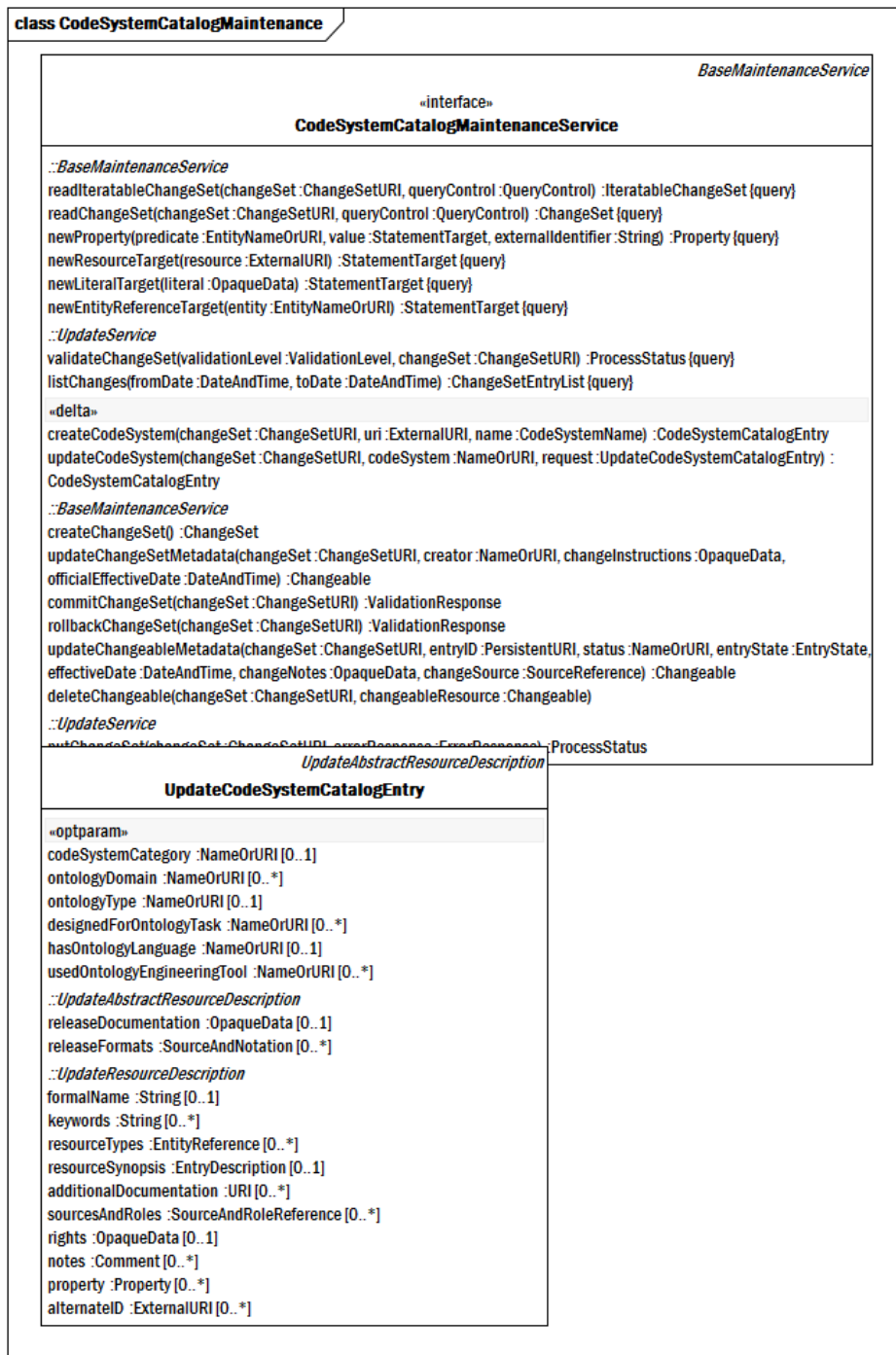


Figure 3.4 - Code System Catalog Maintenance Service

The `CodeSystemCatalogMaintenanceService` allows the creation, modification, and removal of entries in the service catalog.

### 3.4.1 Interface `CodeSystemCatalogMaintenanceService`

A service that allows the creation and maintenance of entries in a code system catalog.

#### Superclasses

- Every instance of `CodeSystemCatalogMaintenanceService` is also an instance of `BaseMaintenanceService`.

#### 3.4.1.1 Operation: `createCodeSystem`

Create a new entry in the code system catalog.

This operation may alter the state of the service.

##### Input Parameters

- **changeSet** - the URI of an OPEN change set to record the changes (Type: `ChangeSetURI`).
- **uri** - the about URI of the catalog entry to be created (Type: `ExternalURI`).
- **name** - the local identifier of the catalog entry in the context of the service (Type: `CodeSystemName`).

##### Return Type: `CodeSystemCatalogEntry`

##### Exceptions

- **AlternateURINotUnique** - One of the supplied `alternateIDs` is not unique - it appears as an `entryID` or `alternateID` for a different resource of the same type.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.
- **ResourceNameAlreadyExists** - The local identifier for the resource already exists in the service.
- **ResourceURIAAlreadyExists** - The URI (`entityID`) of the supplied resource already exists in the service.
- **ChangeSetIsNotOpen** - The `changeSetContext` is recognized by the service, but its state is not OPEN.

#### 3.4.1.2 Operation: `updateCodeSystem`

Update the contents of an existing catalog entry.

This operation may alter the state of the service.

##### Input Parameters

- **changeSet** - the URI of an OPEN change set to record the changes (Type: `ChangeSetURI`).
- **codeSystem** - the name or URI of the code system to update (Type: `NameOrURI`).
- **request** - the parameters to update (Type: `UpdateCodeSystemCatalogEntry`).

**Return Type:** `CodeSystemCatalogEntry`

### **3.4.1.3 Class `UpdateCodeSystemCatalogEntry`**

The set of attributes that can be updated in an existing code system catalog entry.

#### **Superclasses**

- Every instance of `UpdateCodeSystemCatalogEntry` is also an instance of `UpdateAbstractResourceDescription`.

#### **Attributes**

- **`codeSystemCategory`** - the category or type of resource that the code system represents.
- **`ontologyDomain`** - the subject domain of the code system or ontology.
- **`ontologyType`** - the nature of the content of the code system or ontology.
- **`designedForOntologyTask`** - the purpose for which the code system or ontology was originally designed.
- **`hasOntologyLanguage`** - the formal language used to express the code system or ontology.
- **`usedOntologyEngineeringTool`** - The name or URI of an ontology engineering tool.

## 4 Code System Version Information Model

### 4.1 Code System Version Catalog Entry



Figure 4.1 - Code System Version Catalog Entry

### 4.1.1 Class `CodeSystemCatalogEntry`

`CodeSystemVersion` is a collection of assertions about one or more entities. If the state of a `CodeSystemVersion` is `Final`, the set of assertions made the resource is fixed, meaning that if one knows the `documentURI` assigned to the version and the specific `sourceAndNotation` from which the version instance was derived, the set of assertions is known as well.

#### Superclasses

- Every instance of `CodeSystemVersionCatalogEntry` is also an instance of `ResourceVersionDescription`.

#### Attributes

- **`codeSystemVersionName`** - an identifier that uniquely names this particular code system version within the context of the CTS2 service instance.
- **`versionOf`** - the name, URI and, if supported by the service, link to the code system that this version represents.
- **`imports`** - a reference to a code system version whose assertions are included as part of this code system version.
- **`defaultLanguage`** - the default spoken or written language used in this version.
- **`supportedLanguage`** - all languages recognized by this particular code system version
- **`associations`** - a `DirectoryURI` that resolves to a list of all associations asserted by this particular code system version.
- **`entityDescriptions`** - a `DirectoryURI` that resolves to the set of all entities and their descriptions asserted by this code system version. This attribute will only be present if and only if the service implementation supports the `ENTITYQUERY` service profile.
- **`classes`** - a `DirectoryURI` that resolves to the set of `EntityDescriptions` that are of type `owl:Class` within this code system. Will only be present in code systems that represent ontologies.
- **`roles`** - a `DirectoryURI` that resolves to the set of `EntityDescriptions` that are of type `owl:ObjectProperty` or `owl:DataProperty` within this code system. Will only be present in code systems that represent ontologies.
- **`individuals`** - a `DirectoryURI` that resolves to the set of `EntityDescriptions` that are of type `owl:Individual` within this code system. Will only be present in code systems that represent ontologies.

#### Invariants

1. The `codeSystemVersionName` is the unique local identifier of the resource.
2. The `describedResourceType` of `CodeSystemVersion` is `CODE_SYSTEM_VERSION`.
3. A code system version cannot import itself - either directly or indirectly, although this constraint only reflects the direct option.
4. A code system version cannot import another version of the same code system.
5. Every `CodeSystemVersion` must be an instance of `owl:Ontology` and/or `skos:ConceptSystem`.



## 4.2 Code System Version Directory and List

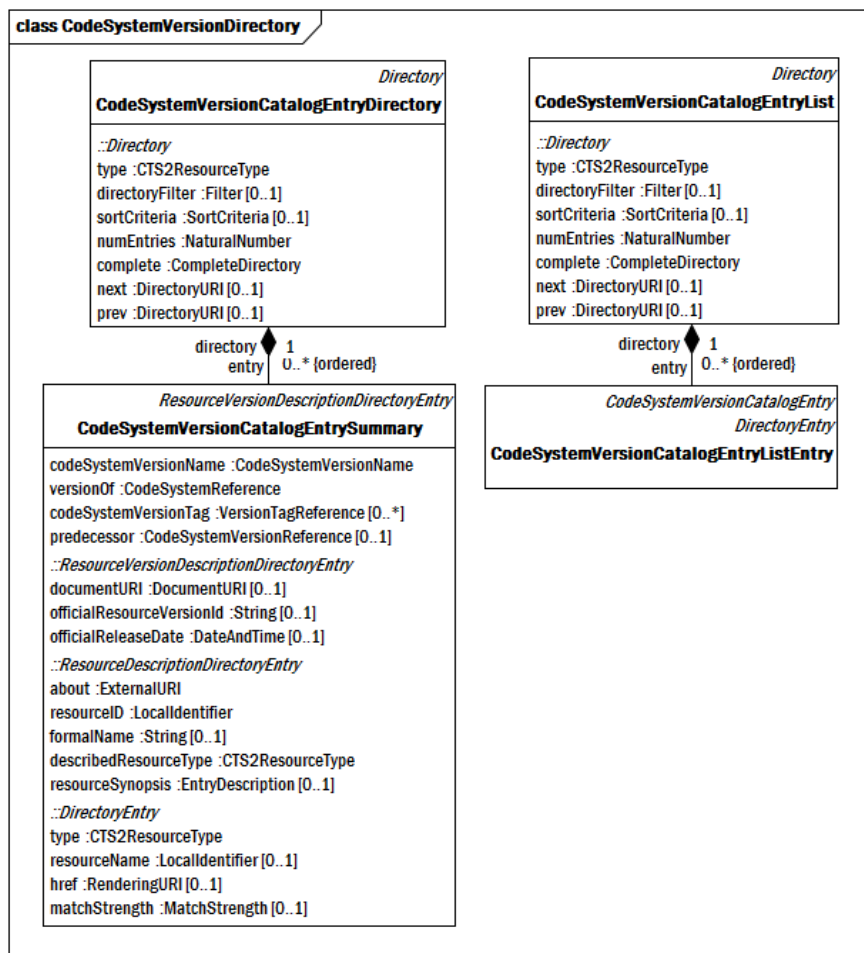


Figure 4.2 - Code System Version Directory

### 4.2.1 Class CodeSystemVersionCatalogEntryDirectory

A directory of **CodeSystemVersion** resources that meet a specified criteria.

#### Superclasses

- Every instance of **CodeSystemVersionCatalogEntryDirectory** is also an instance of **Directory**.

#### Attributes

- **entry** - an entry in a catalog

#### Invariants

1. The directory type must be **CODE\_SYSTEM\_VERSION**.
2. All of the entries in the directory must be of type **CODE\_SYSTEM\_VERSION**.

## 4.2.2 Class `CodeSystemVersionCatalogEntryList`

A collection of complete `CodeSystemVersion` resources that meet a specified criteria.

### Superclasses

- Every instance of `CodeSystemVersionCatalogEntryList` is also an instance of `Directory`.

### Attributes

- **entry** - an entry in a catalog list.

### Invariants

1. The resource type must be `CODE_SYSTEM_VERSION`.
2. All entries in a code system version list must be type `CODE_SYSTEM_VERSION`.

### 4.2.2.1 Class `CodeSystemVersionCatalogEntryListEntry`

An instance of `CodeSystemVersion` that meets a specified filter criteria.

### Superclasses

- Every instance of `CodeSystemVersionCatalogEntryListEntry` is also an instance of `DirectoryEntry`.
- Every instance of `CodeSystemVersionCatalogEntryListEntry` is also an instance of `CodeSystemVersionCatalogEntry`.

### Invariants

1. The type of a `CodeSystemVersionListEntry` must be `CODE_SYSTEM_VERSION`.

### 4.2.2.2 Class `CodeSystemVersionCatalogEntrySummary`

A synopsis of a `CodeSystemVersion` along with information about how to access the complete resource.

### Superclasses

- Every instance of `CodeSystemVersionCatalogEntrySummary` is also an instance of `ResourceVersionDescriptionDirectoryEntry`.

### Attributes

- **codeSystemVersionName** - an identifier that uniquely names this particular code system version within the context of the CTS2 service instance.
- **versionOf** - the name, URI, and, if supported by the service, link to the code system that this version represents.
- **codeSystemVersionTag** - the tag(s) assigned to this version by the service provider. `codeSystemVersionTag` identifies any roles that this version plays within the workflow of the current provider. As an example, a provider might assign the tags of “production” and “current” to a given code system version. With the exception of `CURRENT` the semantics of `VersionTag` are determined by the service provider.
- **predecessor** - a reference to the code system version that immediately preceded the one described here.

### Invariants

1. The type of a `CodeSystemVersionDirectoryEntry` must be `CODE_SYSTEM_VERSION`.

## 5 Code System Version Catalog Services

### 5.1 Code System Version Catalog Read Services

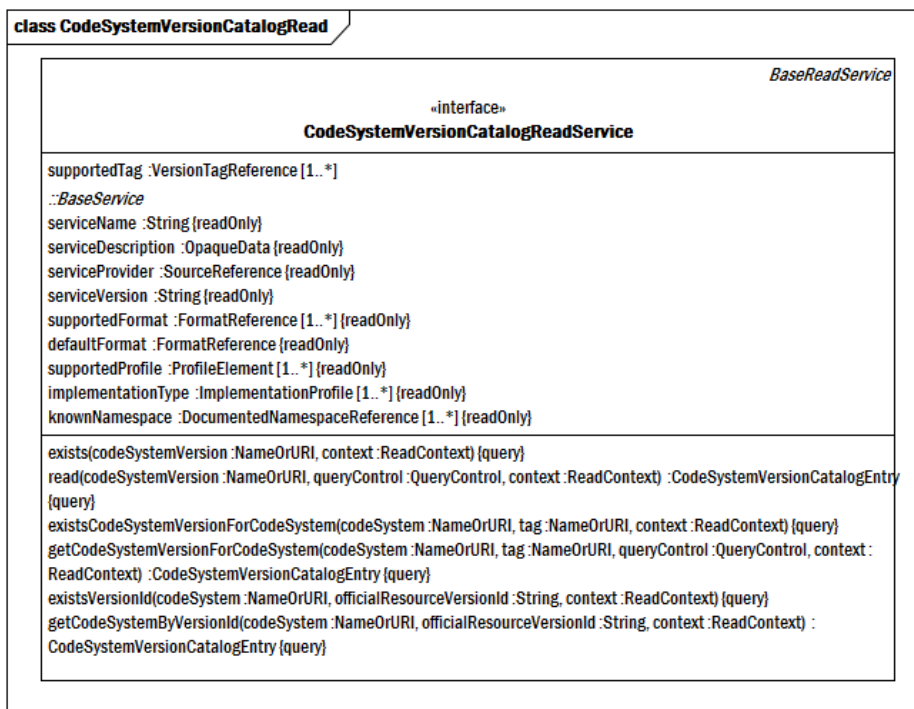


Figure 5.1 - Code System Version Catalog Read

#### 5.1.1 Interface CodeSystemVersionCatalogReadService

A service that provides direct read access to metadata about specific versions of code systems.

##### Superclasses

- Every instance of `CodeSystemVersionCatalogReadService` is also an instance of `BaseReadService`.

##### Attributes

- **supportedTag** - The set of version tags known to the service. All services must recognize the `CURRENT` tag, although interpretation is service specific.

##### Invariants

1. All services must support the CTS2 `CURRENT` tag, which is the default that will be used when a tag is not supplied in a function call.
2. Every code system version represented in the service must have a unique `codeSystemName` and a unique `documentURI`.

3. Every supported tag name must be unique.
4. Every tag in `taggedVersion` must have an entry in `supportedTag`.
5. There can be at most one version of a given code system associated with a given tag.

#### 5.1.1.1 Operation: exists

Return TRUE if the `CodeSystemVersion` is known to the service with a matching name or URI.

##### Input Parameters

- **codeSystemVersion** - the local name, about URI, OID or alternateID of the resource to check for existence. (Type: `NameOrURI`).
- **context** - parameters that control the language, date, and other contextual variables (Type: `ReadContext`).

**Return Type:** `Boolean`

##### Exceptions

- **UnsupportedLanguage** - The `referenceLanguage` is not supported by the service.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.
- **ChangeSetIsNotOpen** - The `changeSetContext` is recognized by the service, but its state is not OPEN.
- **UnsupportedContext** - One or more `changeSetContext` is not supported by the service.

#### 5.1.1.2 Operation: read

Retrieve the specified code system version details from the service.

##### Input Parameters

- **codeSystemVersion** - the local name, about URI, OID or alternateID of the resource to read. (Type: `NameOrURI`).
- **queryControl<sub>OPT</sub>** - parameters that control the ordering, timeout, and query behavior (Type: `QueryControl`).
- **context** - parameters that control the language, date, and other contextual variables (Type: `ReadContext`).

**Return Type:** `CodeSystemVersionCatalogEntry`

##### Exceptions

- **UnknownCodeSystem** - The referenced `CodeSystem` is not recognized by the service.
- **UnsupportedLanguage** - The `referenceLanguage` is not supported by the service.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.
- **ChangeSetIsNotOpen** - The `changeSetContext` is recognized by the service, but its state is not OPEN.
- **UnsupportedContext** - One or more `changeSetContext` is not supported by the service.
- **UnsupportedMatchAlgorithm** - The `matchAlgorithm` is not supported by the service.
- **UnsupportedPredicate** - The predicate name or URI is not recognized by the service.

- **UnsupportedNamespaceName** - The supplied namespace name is not one that is known to the service.
- **UnsupportedModelAttribute** - The name or URI of a CTS2 model attribute is not recognized and/or supported by the service implementation.
- **MatchValueFormatException** - The match value does not meet the format or syntax required or the supplied match algorithm.
- **UnsupportedFormat** - The `format` is not supported by the service implementation.
- **QueryTimeout** - The `timeLimit` was exceeded by the service.

#### Postconditions

- Returns the unique value in `knownSystemVersion` whose `codeSystemVersionName` matches the supplied name or whose `uri` matches the supplied URI.

#### 5.1.1.3 Operation: **existsCodeSystemVersionForCodeSystem**

Determine if the specified version of the code system exists for the specified code system on the service.

##### Input Parameters

- **codeSystem** - the local name, about URI, OID or alternateID of the target code system. (Type: `NameOrURI`).
- **tag<sub>OPT</sub>** - the name or URI of a version tag that connects a code system to a code system version. Defaults to `CURRENT` (Type: `NameOrURI`).
- **context<sub>OPT</sub>** - parameters that control the language, date, and other contextual variables (Type: `ReadContext`).

**Return Type:** `Boolean`

##### Exceptions

- **UnsupportedVersionTag** - The `versionTag` is not recognized by the service.
- **UnsupportedLanguage** - The `referenceLanguage` is not supported by the service.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.
- **ChangeSetIsNotOpen** - The `changeSetContext` is recognized by the service, but its state is not `OPEN`.
- **UnsupportedContext** - One or more `changeSetContext` is not supported by the service.

#### 5.1.1.4 Operation: **getCodeSystemVersionForCodeSystem**

Retrieve the specified code system version details for the specified code system from the service.

##### Input Parameters

- **codeSystem** - the local name, about URI, OID or alternateID of the target code system (Type: `NameOrURI`).
- **tag<sub>OPT</sub>** - The version tag of the resource. Defaults to the URI for `CURRENT` if not supplied. (Type: `NameOrURI`)
- **queryControl** - Operation timeout setting (Type: `QueryControl`).
- **context** - Context of the access (Type: `ReadContext`).

**Return Type: `CodeSystemVersionCatalogEntry`**

**Exceptions**

- **UnsupportedVersionTag** - The `versionTag` is not recognized by the service.
- **UnknownCodeSystem** - The referenced `CodeSystem` is not recognized by the service.
- **UnsupportedMatchAlgorithm** - The `matchAlgorithm` is not supported by the service.
- **UnsupportedPredicate** - The predicate name or URI is not recognized by the service.
- **UnsupportedNamespaceName** - The supplied namespace name is not one that is known to the service.
- **UnsupportedModelAttribute** - The name or URI of a CTS2 model attribute is not recognized and/or supported by the service implementation.
- **MatchValueFormatException** - The match value does not meet the format or syntax required or the supplied match algorithm.
- **UnsupportedFormat** - The `format` is not supported by the service implementation.
- **QueryTimeout** - The `timeLimit` was exceeded by the service.

**5.1.1.5 Operation: `existsVersionId`**

Determine if the specified version of the code system exists for the specified external identifier.

**Input Parameters**

- **codeSystem** - the local name, about URI, OID or alternateID of the target code system (Type: `NameOrURI`).
- **officialResourceVersionId** - the official external version identifier assigned to the target version (Type: `String`).
- **context<sub>OPT</sub>** - parameters that control the language, date and other contextual variables (Type: `ReadContext`).

**Return Type: `Boolean`**

**Exceptions**

- **UnknownCodeSystem** - The referenced `CodeSystem` is not recognized by the service.
- **UnsupportedLanguage** - The `referenceLanguage` is not supported by the service.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.
- **ChangeSetIsNotOpen** - The `changeSetContext` is recognized by the service, but its state is not `OPEN`.
- **UnsupportedContext** - One or more `changeSetContext` is not supported by the service.

**5.1.1.6 Operation: `getCodeSystemByVersionId`**

Retrieve the specified version of the code system exists for the specified external identifier.

**Input Parameters**

- **codeSystem** - the local name, about URI, OID or alternateID of the target code system (Type: `NameOrURI`).

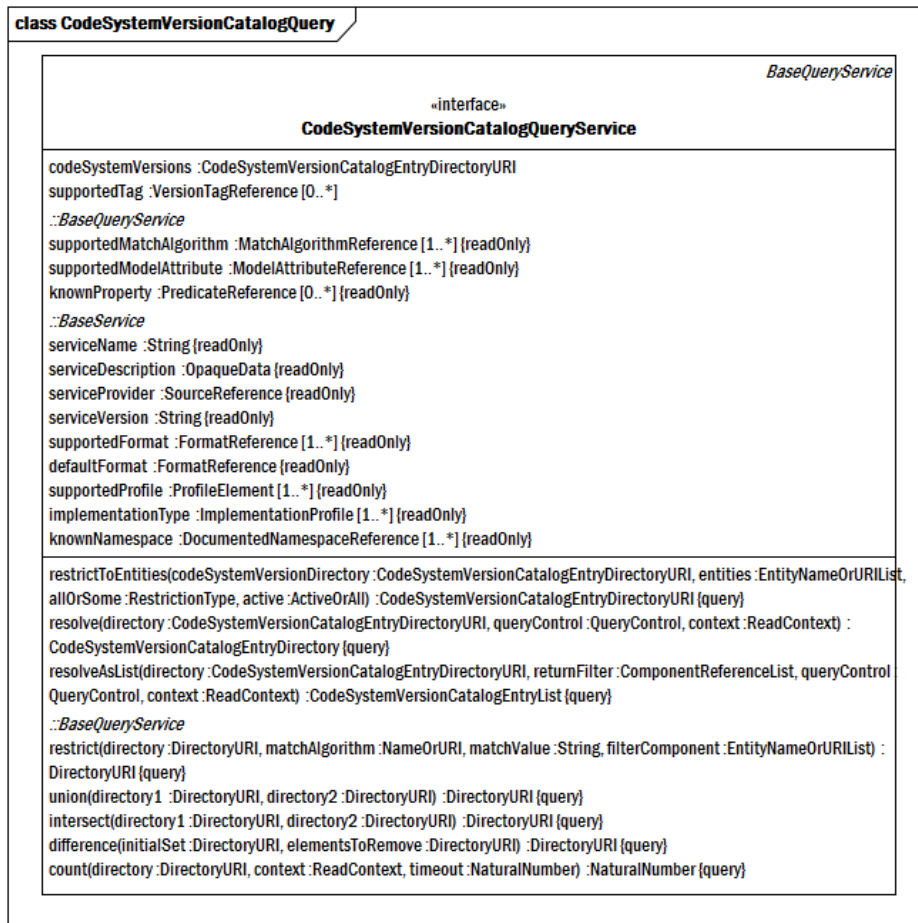
- **officialResourceVersionId** - the official external version identifier assigned to the target version (Type: String).
- **context<sub>OPT</sub>** - parameters that control the language, date, and other contextual variables (Type: ReadContext).

**Return Type: CodeSystemVersionCatalogEntry**

#### Exceptions

- **UnknownCodeSystemVersion** - The referenced CodeSystemVersion is not recognized by the service.
- **UnknownCodeSystem** - The referenced CodeSystem is not recognized by the service.
- **UnsupportedLanguage** - The referenceLanguage is not supported by the service.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.
- **ChangeSetIsNotOpen** - The changeSetContext is recognized by the service, but its state is not OPEN.
- **UnsupportedContext** - One or more changeSetContext is not supported by the service.

## 5.2 Code System Version Catalog Query Services



**Figure 5.2 - Code System Version Catalog Query**

## **5.2.1 Interface CodeSystemVersionCatalogQueryService**

### **Superclasses**

- Every instance of `CodeSystemVersionCatalogQueryService` is also an instance of `BaseQueryService`.

### **Attributes**

- **codeSystemVersions** - a `DirectoryURI` that resolves to the set of versions known to the service.
- **supportedTag** - a version tag that is supported by this service instance.

### **5.2.1.1 Operation: restrictToEntities**

Retrieve a code system version directory containing the specified entities.

#### **Input Parameters**

- **codeSystemVersionDirectory** - a `DirectoryURI` that resolves to a set of code system version catalog entries (Type: `CodeSystemVersionCatalogEntryDirectoryURI`).
- **entities** - a set of namespace/names or URIs for the filter entities (Type: `EntityNameOrURIList`).
- **allOrSome** - an indicator that determines whether any or all of the entities must be included in the code system for it to qualify (Type: `RestrictionType`).
- **active** - an indicator that determines whether just active entities count as a filter or any entity qualifies (Type: `ActiveOrAll`).

**Return Type: CodeSystemVersionCatalogEntryDirectoryURI**

#### **Exceptions**

- **UnsupportedNamespaceName** - The supplied namespace name is not one that is known to the service.
- **UnknownEntity** - The `EntityNameOrURI` is not known to the service.
- **InvalidDirectoryURI** - The supplied `directory` URI is not valid.
- **InvalidDirectoryType** - The type represented by the supplied `directory` URI is not the one required by the service invocation.

### **5.2.1.2 Operation: resolve**

Retrieve the specified code system version directory.

#### **Input Parameters**

- **directory** - a `DirectoryURI` that resolves to a set of code system versions (Type: `CodeSystemVersionCatalogEntryDirectoryURI`).
- **queryControl<sub>OPT</sub>** - parameters that control the ordering, timeout, and query behavior (Type: `QueryControl`).



- **context<sub>OPT</sub>** - parameters that control the language, date, and other contextual variables (Type: ReadContext).

**Return Type: CodeSystemVersionCatalogEntryDirectory**

#### Exceptions

- **UnsupportedLanguage** - The referenceLanguage is not supported by the service.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.
- **ChangeSetIsNotOpen** - The changeSetContext is recognized by the service, but its state is not OPEN.
- **UnsupportedContext** - One or more changeSetContext is not supported by the service.
- **UnsupportedMatchAlgorithm** - The matchAlgorithm is not supported by the service.
- **UnsupportedPredicate** - The predicate name or URI is not recognized by the service.
- **UnsupportedNamespaceName** - The supplied namespace name is not one that is known to the service.
- **UnsupportedModelAttribute** - The name or URI of a CTS2 model attribute is not recognized and/or supported by the service implementation.
- **MatchValueFormatException** - The match value does not meet the format or syntax required or the supplied match algorithm.
- **UnsupportedFormat** - The format is not supported by the service implementation.
- **QueryTimeout** - The timeLimit was exceeded by the service.
- **InvalidDirectoryURI** - The supplied directory URI is not valid.
- **InvalidDirectoryType** - The type represented by the supplied directory URI is not the one required by the service invocation.

### 5.2.1.3 Operation: resolveAsList

Resolve the supplied DirectoryURI and return the set of catalog entries it represents.

#### Input Parameters

- **directory** - a DirectoryURI that resolves to a set of code system versions (Type: CodeSystemVersionCatalogEntryDirectoryURI).
- **returnFilter<sub>OPT</sub>** - a list of zero or more component references. If present, the returned list entries will contain only the required elements and attributes plus any elements or attributes named in the filter. If absent all elements and attributes will be returned. (Type: ComponentReferenceList )
- **queryControl<sub>OPT</sub>** - parameters that control the ordering, timeout, and query behavior (Type: QueryControl).

**context<sub>OPT</sub>** - parameters that control the language, date, and other contextual variables (Type: ReadContext). **Return Type: CodeSystemVersionCatalogEntryList**

#### Exceptions

- **UnsupportedLanguage** - The referenceLanguage is not supported by the service.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.

- **ChangeSetIsNotOpen** - The `changeSetContext` is recognized by the service, but its state is not `OPEN`.
- **UnsupportedContext** - One or more `changeSetContext` is not supported by the service.
- **UnsupportedMatchAlgorithm** - The `matchAlgorithm` is not supported by the service.
- **UnsupportedPredicate** - The predicate name or URI is not recognized by the service.
- **UnsupportedNamespaceName** - The supplied namespace name is not one that is known to the service.
- **UnsupportedModelAttribute** - The name or URI of a CTS2 model attribute is not recognized and/or supported by the service implementation.
- **MatchValueFormatException** - The match value does not meet the format or syntax required or the supplied match algorithm.
- **UnsupportedFormat** - The `format` is not supported by the service implementation.
- **QueryTimeout** - The `timeLimit` was exceeded by the service.
- **InvalidDirectoryURI** - The supplied `directory` URI is not valid.
- **InvalidDirectoryType** - The type represented by the supplied `directory` URI is not the one required by the service invocation.

## 5.3 Code System Version Catalog History Services

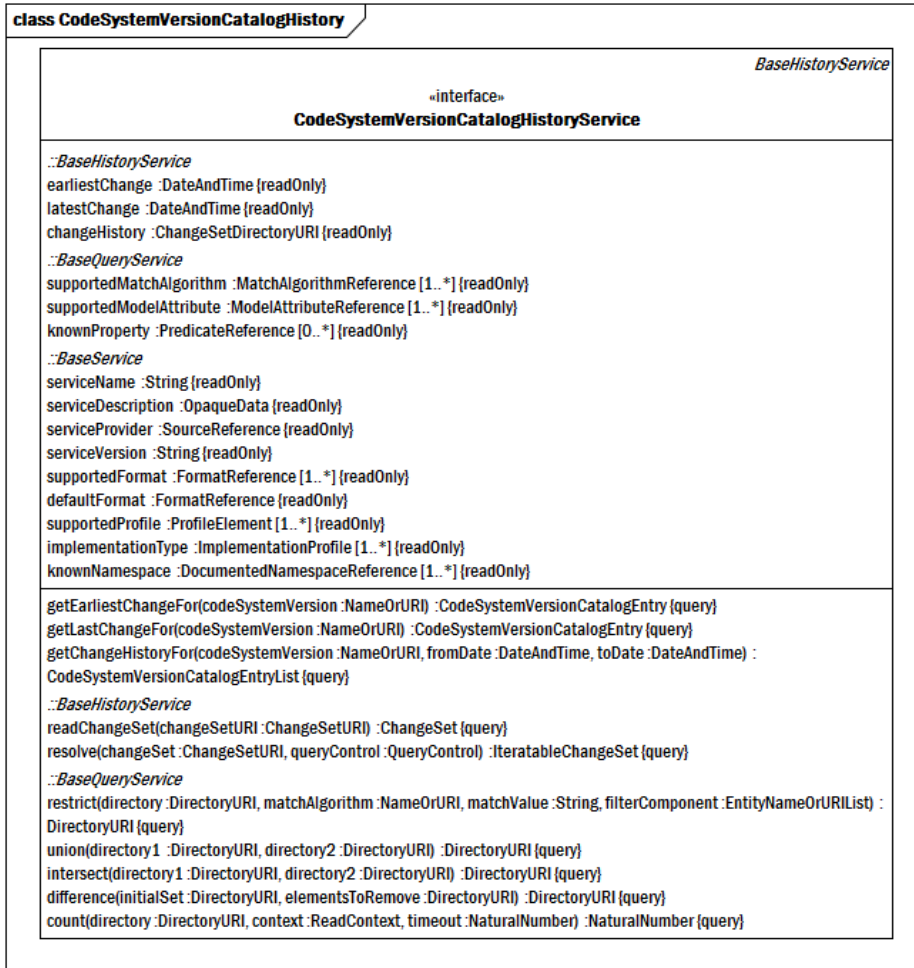


Figure 5.3 - Code System Version Catalog History

### 5.3.1 Interface CodeSystemVersionCatalogHistoryService

A service that allows the viewing of changes that have occurred to a `CodeSystemVersionCatalogEntry` over time.

#### Superclasses

- Every instance of `CodeSystemVersionCatalogHistoryService` is also an instance of `BaseHistoryService`.

#### 5.3.1.1 Operation: getEarliestChangeFor

Return the catalog entry that reflects the state of the entry when it first became available to the service.

#### Input Parameters

- **codeSystemVersion** - the local name or URI of a code system version known to the system (Type: NameOrURI).

**Return Type: CodeSystemVersionCatalogEntry**

#### Exceptions

- **UnknownCodeSystemVersion** - The referenced `CodeSystemVersion` is not recognized by the service.

#### 5.3.1.2 Operation: getLastChangeFor

Return the catalog entry that reflects the result of the last change that was made to the referenced entry.

#### Input Parameters

- **codeSystemVersion** - the local name or URI of a code system version (Type: NameOrURI).

**Return Type: CodeSystemVersionCatalogEntry**

#### Exceptions

- **UnknownCodeSystemVersion** - The referenced `CodeSystemVersion` is not recognized by the service.

#### 5.3.1.3 Operation: getChangeHistoryFor

Return a list of records that reflects changes in the catalog entry over the specified time span. Records will be sorted from earliest to latest if (a) `fromDate` is omitted or (b) `toDate` is omitted or (c) `fromDate` is earlier than `toDate`. In all other cases, records will be sorted from the latest to the earliest.

#### Input Parameters

- **codeSystemVersion** - then name or URI of a code system version. (Type: NameOrURI)
- **fromDate<sub>OPT</sub>** - the date and time that the historical record begins. If omitted, the history starts at the earliest change. (Type: DateAndTime)
- **toDate<sub>OPT</sub>** - the date and time that the historical record ends. If omitted, the history continues to the latest change. (Type: DateAndTime)

**Return Type: CodeSystemVersionCatalogEntryList**

#### Exceptions

- **UnknownCodeSystemVersion** - The referenced `CodeSystemVersion` is not recognized by the service.

## 5.4 Code System Version Catalog Maintenance Services

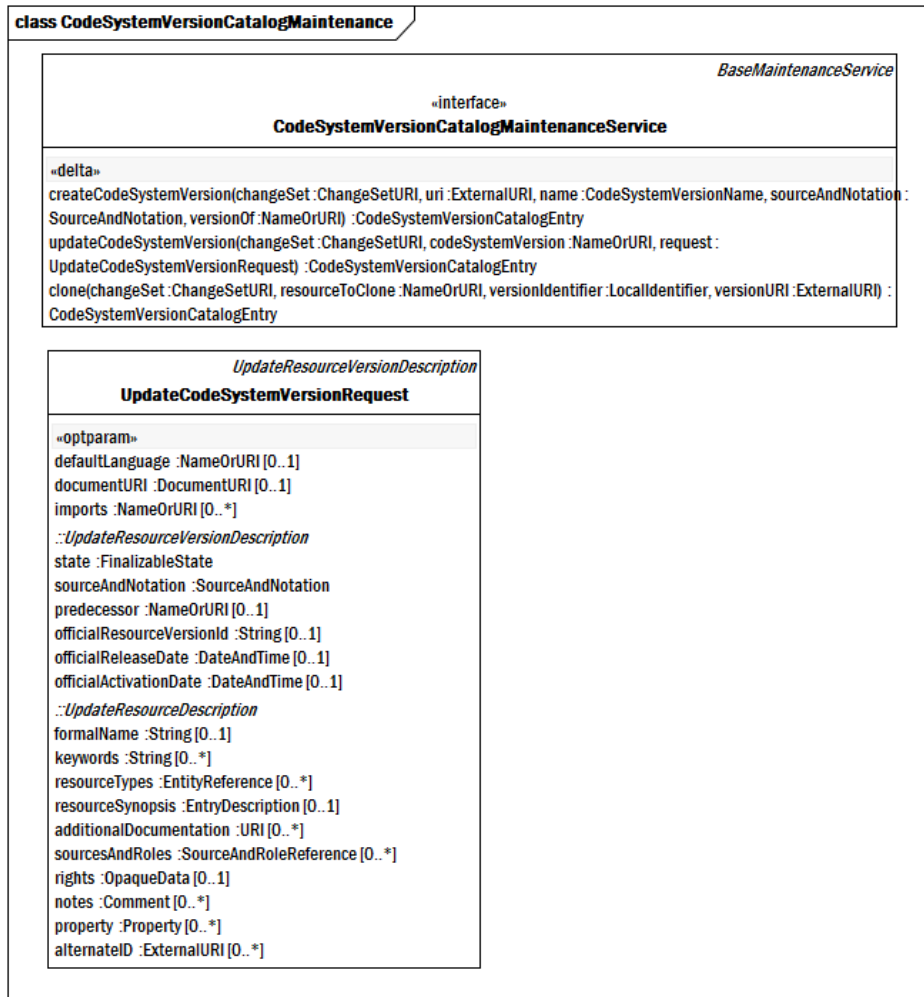


Figure 5.4 - Code System Version Catalog Maintenance

This diagram describes the services that are used to create, update and remove code system catalog entries. Note: the inherited methods and attributes have been excluded from the diagram.

### 5.4.1 Interface CodeSystemVersionCatalogMaintenanceService

#### Superclasses

- Every instance of `CodeSystemVersionCatalogMaintenanceService` is also an instance of `BaseMaintenanceService`.

#### 5.4.1.1 Operation: createCodeSystemVersion

Create a new code system version catalog entry. Note that the `versionOf` parameter does not have to be validated as there is no service level requirement that code system catalogs be complete or even present.

This operation may alter the state of the service.

#### Input Parameters

- **changeSet** - the URI of an `OPEN` change set that will record this change. (Type: `ChangeSetURI`)
- **uri** - the URI that uniquely identifies the new code system version (Type: `DocumentURI`).
- **name** - a name that uniquely identifies this version in the context of the implementing service. (Type: `CodeSystemVersionName`)
- **sourceAndNotation** - the source and notation used in this code system version. (Type: `SourceAndNotation`)
- **versionOf** - the name or URI of the code system that this is a version of. (Type: `NameOrURI`)

#### Return Type: `CodeSystemVersionCatalogEntry`

#### Exceptions

- **UnsupportedSource** - The supplied source is not recognized by the service.
- **ChangeSetIsNotOpen** - The `changeSetContext` is recognized by the service, but its state is not `OPEN`.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.
- **UnsupportedOntologyLanguage** - The supplied ontology language is not supported by the service.
- **DuplicateCodeSystemVersionName** - The supplied code system version name is already used for another entry.
- **DuplicateCodeSystemVersionURI** - The supplied code system version URI is already an `about` or `alternateID` for an existing code system version.

#### 5.4.1.2 Operation: `updateCodeSystemVersion`

Update an existing code system version catalog entry.

This operation may alter the state of the service.

#### Input Parameters

- **changeSet** - the URI of an `OPEN` change set where the update will be recorded. (Type: `ChangeSetURI`)
- **codeSystemVersion** - the name or URI of the code system version to be updated. (Type: `NameOrURI`)
- **request** - the parameters to be updated. (Type: `UpdateCodeSystemVersionRequest`)

#### Return Type: `CodeSystemVersionCatalogEntry`

#### Exceptions

- **ChangeSetIsNotOpen** - The `changeSetContext` is recognized by the service, but its state is not `OPEN`.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.
- **UnknownCodeSystemVersion** - The referenced `CodeSystemVersion` is not recognized by the service.
- **UnsupportedLanguage** - The `referenceLanguage` is not supported by the service.
- **ResourceIsNotOpen** - The target resource version description has been finalized and cannot be updated.

- **UnsupportedOntologyLanguage** - The supplied ontology language is not supported by the service.
- **UnsupportedStatus** - The name or URI of the `ChangeableStatus` property is not recognized by the service.
- **UnsupportedSource** - The supplied source is not recognized by the service.
- **UnsupportedPredicate** - The predicate name or URI is not recognized by the service.
- **UnsupportedRole** - The role name or URI is not recognized by the service.
- **UnsupportedOntologySyntax** - The supplied ontology syntax is not supported by the service.
- **CycleInPredecessor** - The predecessor resource directly or indirectly precedes the resource being updated.
- **WrongPredecessorType** - The predecessor URI is not of the same type as its successor.

#### 5.4.1.3 Operation: clone

Create an copy of the existing `CodeSystemVersion` and any known `Associations` and `EntityDescriptions`, assigning a new version identifier and about URI. The cloned resource will be marked as `OPEN`, allowing incremental changes to occur..

This operation may alter the state of the service.

##### Input Parameters

- **changeSet** - the URI of an `OPEN` change set where the clone operation will be recorded (Type: `ChangeSetURI`)
- **resourceToClone** - the name or about URI of the `CodeSystemVersionCatalogEntry` to be cloned (Type: `NameOrURI`)
- **versionIdentifier** - the local identifier of the new resource version. If absent, the service is expected to assign the identifier. (Type: `LocalIdentifier`)
- **versionURI<sub>OPT</sub>** - The URI of the new cloned resource. If absent, it is assumed that the service will generate the new URI. (Type: `ExternalURI`)

##### Return Type: `CodeSystemVersionCatalogEntry`

##### Exceptions

- **ChangeSetIsNotOpen** - The `changeSetContext` is recognized by the service, but its state is not `OPEN`.
- **UnknownChangeSet** - The change set specified could either not be read or located by the service.

#### 5.4.2 **UnknownCodeSystemVersion** - The referenced `CodeSystemVersion` is not recognized by the service. **Class UpdateCodeSystemVersionRequest**

##### Superclasses

- Every instance of `UpdateCodeSystemVersionRequest` is also an instance of `UpdateResourceVersionDescription`.

##### Attributes

- **defaultLanguage** - the name or URI of the default language used in this version.
- **documentURI** - The URI of the particular document/format where this resource was retrieved.

- **imports** - the name or URI of a code system version whose content is imported and “asserted by” this code system version.