

A Common Terminology Services (CTS) Back-end to Protégé

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Outline

- Purpose of the project
- Characteristics of Terminology Links
- The Common Terminology Services (CTS) specification
- Protégé as a CTS Client
- Protégé as a CTS Server
- Issues, discussion and next steps

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Purpose of the Project

- 1) Use Protégé to create an interface between terminology and the information model**
- 2) Use Protégé to extend standard terminologies and (potentially) author new content.**

Terminology

- **An integrated collection of terms, definitions, annotations, and relationships**
- **Defines the specialized language of a discipline or subject area**

Terminology and Ontology

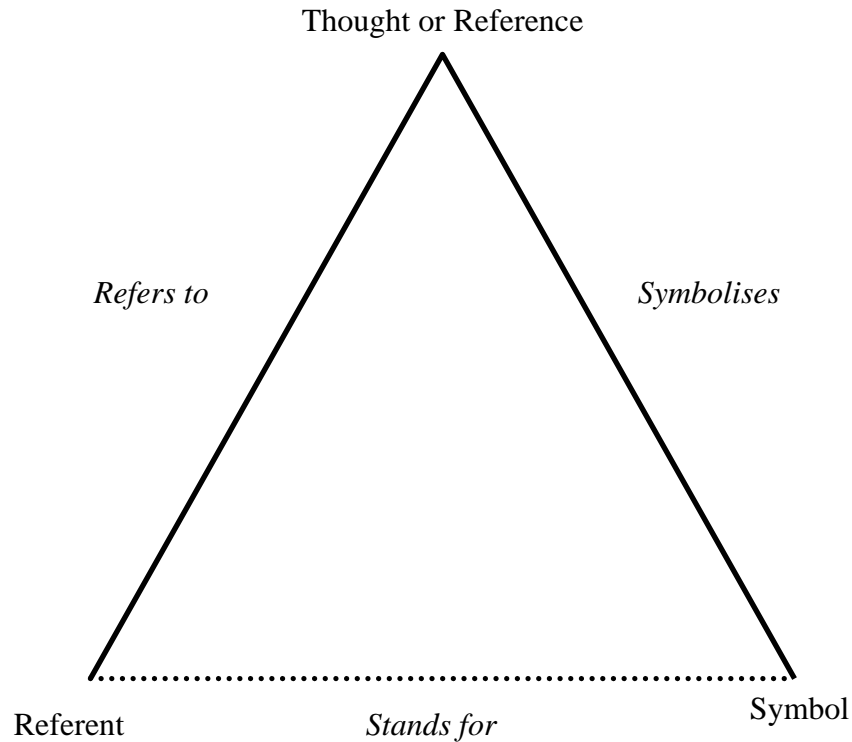
Terminology - *Define* the language / tokens used in a given domain

Ontology - *Describes* domain knowledge in a generic way and provides understanding of a domain*

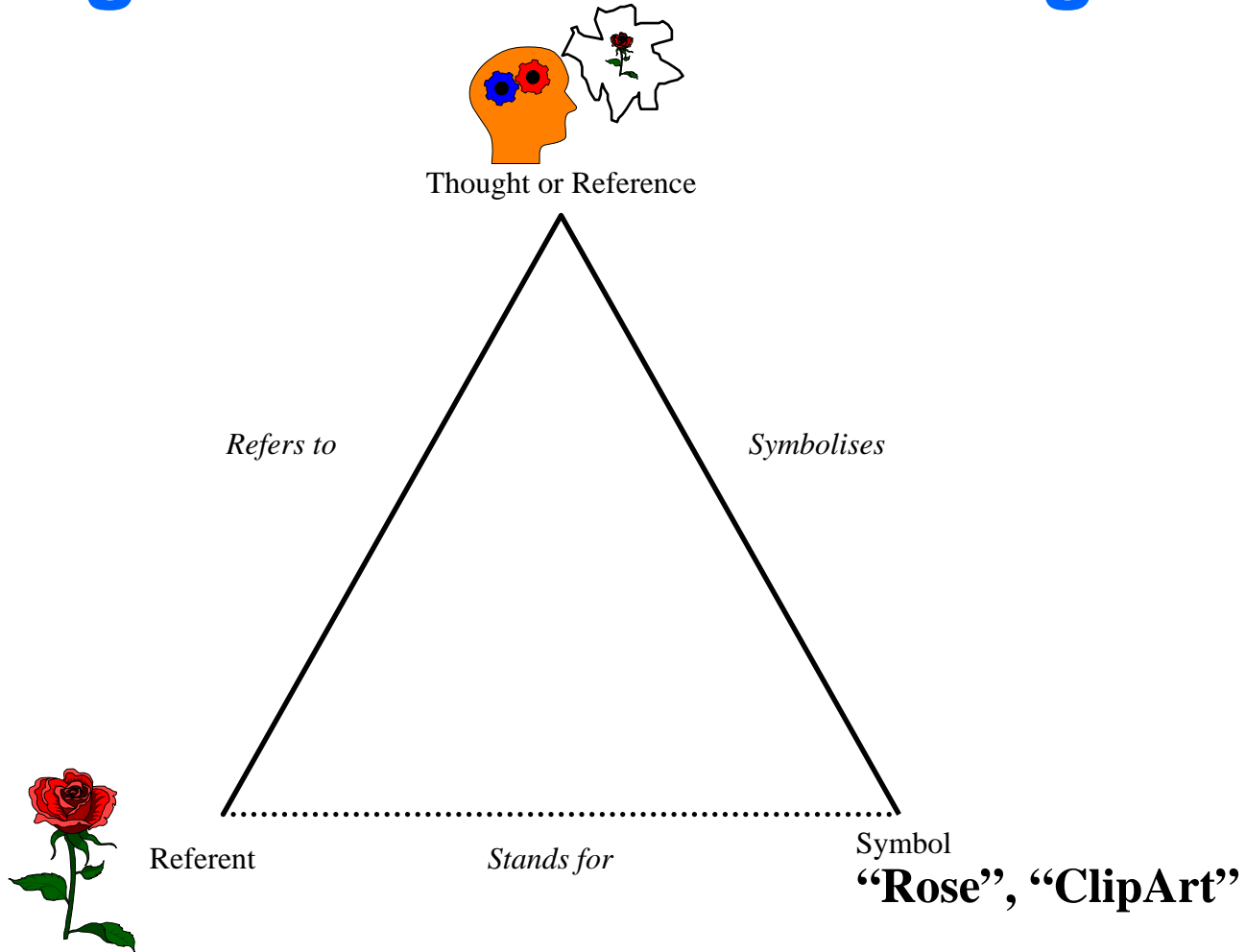
Information Model

- **Describes what information is required to accomplish a particular task or process**
- **Consists of named collections of data elements and their relationships**
- **Typically includes definitions of each of the elements, how they are used, possible values (at least on a conceptual level)**

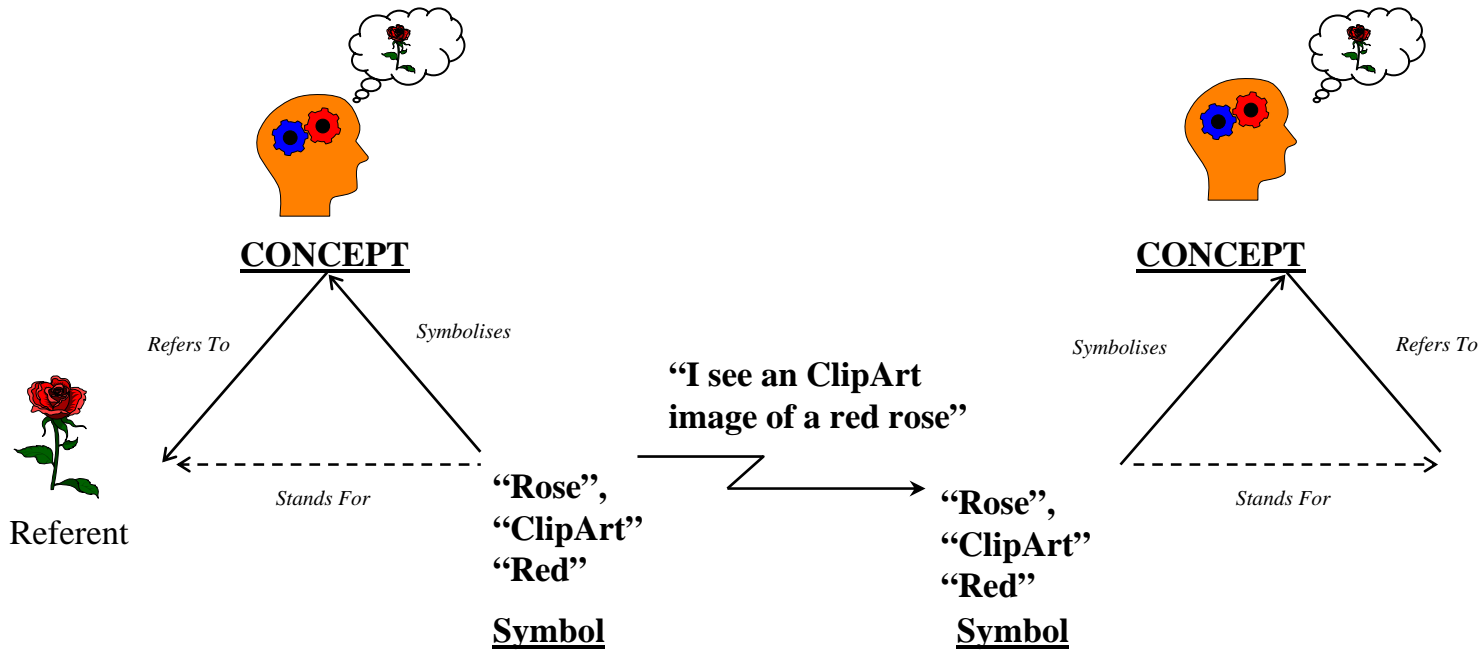
Ogden's Semiotic Triangle



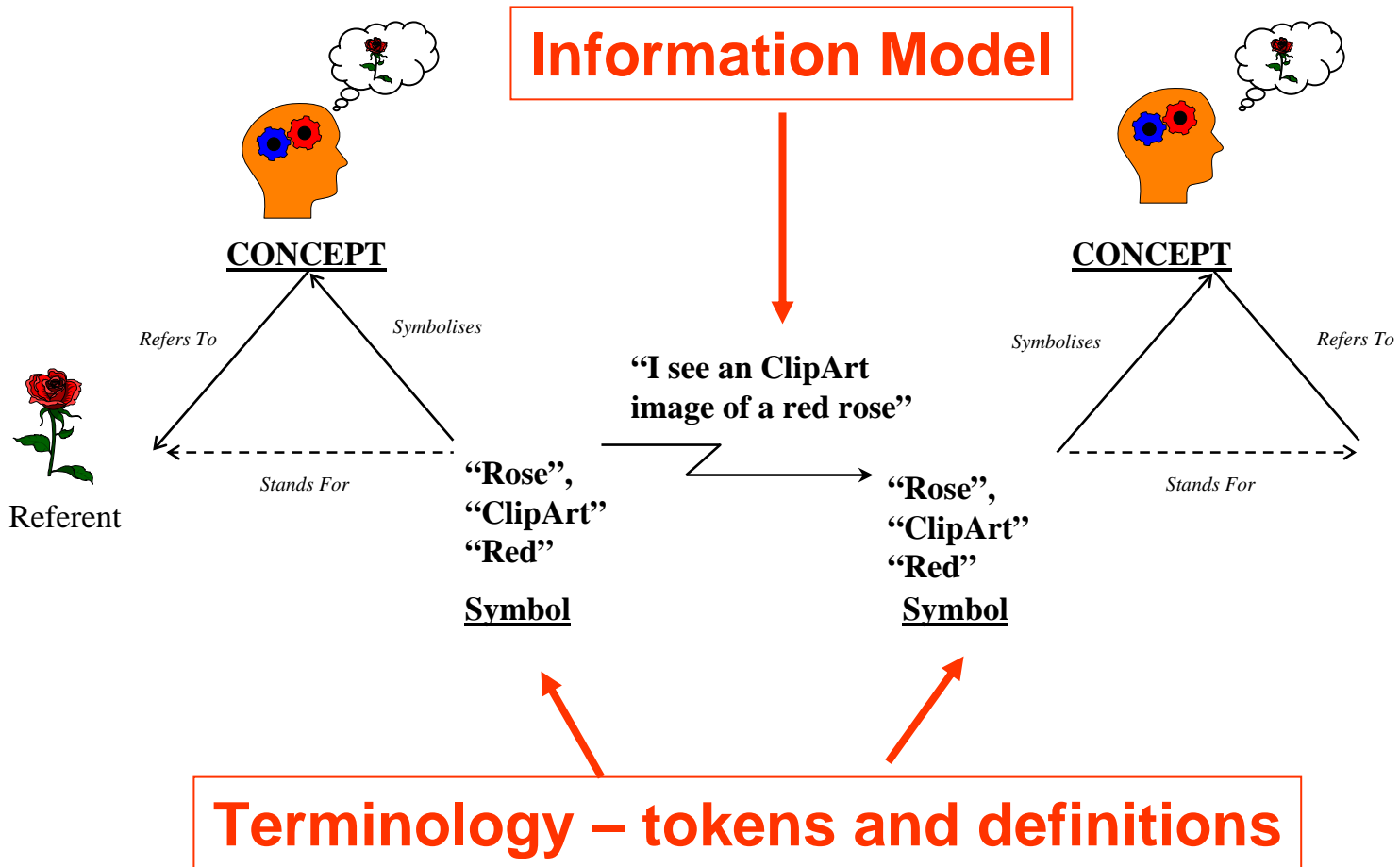
Ogden's Semiotic Triangle



The Communication Process

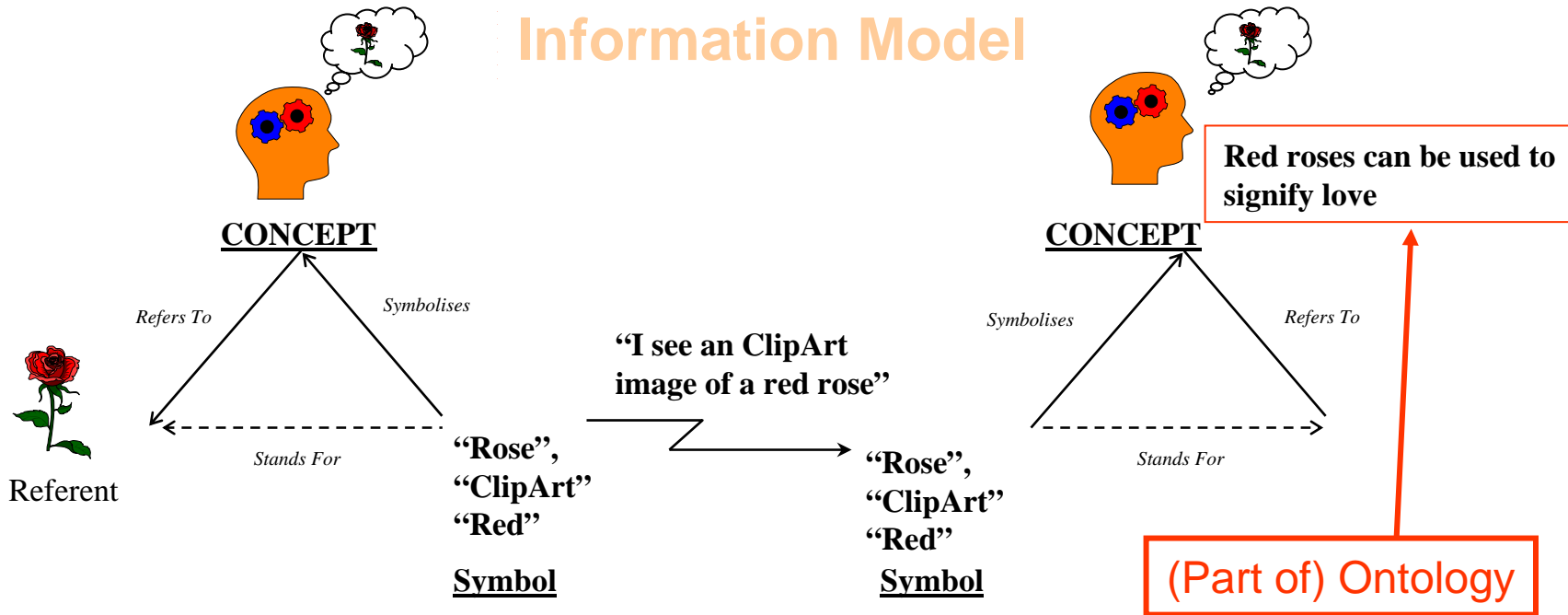


The Communication Process



The Communication Process

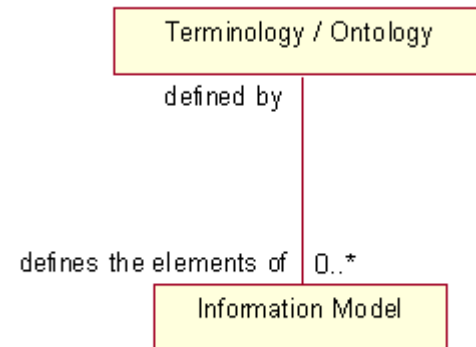
Information Model



Terminology – tokens and definitions

Terminology and Information Models

- There can be many information models that reference the same terminology
- It is the shared terminological references that allows be searched, compared aggregated



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Terminology Links

The screenshot shows the Protégé 2.1.1 interface. On the left, the class hierarchy is visible with **Environmental Observation** and **Horticultural Observation** circled in red. The main window displays the details for the **Horticultural Observation** class. The **Template Slots** table is also shown with the **flower** slot circled in red. The **allowed-values** property for the **flower** slot is circled in red and labeled as **Possible Values**.

Classes

Slots

Name	Type	Cardinality	Other Facets
flower	Symbol	single	allowed-values={Rose,Petunia,Daffodil}
observer	String	single	
observation Date	String	single	

Slots

Possible Values

Concept References

Relationship Superclass

Classes

- :THING A
- :SYSTEM-CLASS A
- :META-CLASS A
- :CLASS A
 - :STANDARD-CLASS D
 - :ExternallyDefined-CLASS**
 - :CodeSystem-CLASS
 - :CodedConcept-CLASS
- :ConceptReference
- :CodeSetReference
- :SymbolReference**

Possible Values

- :SLOT A
- :STANDARD-SLOT D
 - :ExternallyDefined-SLOT**
- :FACET A
- :CONSTRAINT A

Slots

:ExternallyDefined-CLASS (type=:STANDARD-CLASS)

Name: :ExternallyDefined-CLASS

Documentation: A class that derives its definition from an external classification system or coding scheme.

Role: Concrete

Template Slots

Name	Type	Cardinality	Other
S :definedByConcept	Instance	multiple	classes=(:ConceptReference)
S :ROLE	Symbol	single	allowed-values={Abstract,Concrete}
S :DOCUMENTATION	String	multiple	
S :SLOT-CONSTRAINTS	Instance	multiple	classes=(:CONSTRAINT)
S :DIRECT-INSTANCES I	Instance	multiple	classes=(:THING)
S :DIRECT-SUPERCLASSES I	Class	multiple	parents=(:THING)

Concept References

- **Concept resources can include**
 - **Existing taxonomies**
 - **Trade and specialty nomenclature**
 - **Standardized code sets (e.g. country codes)**
 - **Reporting and classification schemes**
 - **Ontologies**
 - **...**

Concept References

- **Resource characteristics**
 - **Format and structure can vary widely**
 - **Availability can vary from simple ASCII lists of code value pairs to complex ontology services such as the Apelon DTS or DIG**

Referencing Concepts

- **Creating a manageable solution**
 - **Create a generic model of terminology content**
 - **Define an interface layer that allows queries to be posed in terms of the generic model**

Concept Code URI

URI:ISO:2.16.840.1.113883.6.94#en

2.16.840.1.113883.6.94

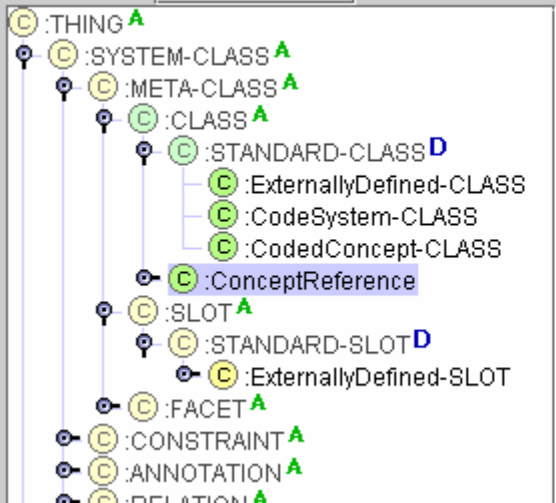
en

Code System

Concept Code

Concept References

Relationship Superclass V C ↕ X C :ConceptReference (type=:STANDARD-CLASS)



Name	Documentation	Constraints
:ConceptReference	The URI of a coded concept along with an optional link to a local image of the concept.	

Role: Concrete

Template Slots

Name	Type	Cardinality	Other Facets
S :referenceConceptCode	String	single	
S :referenceCodeSystem	String	required single	
S :localConceptReference	Instance	single	classes={:CodedConcept-CLASS}
S :DOCUMENTATION	String	multiple	
S :DIRECT-INSTANCES I	Instance	multiple	classes={:THING}
S :DIRECT-SUPERCLASSES I	Class	multiple	parents={:THING}

Template Slots

Name	Type	Cardinality	Other Facets
S :referenceConceptCode	String	single	
S :referenceCodeSystem	String	required single	
S :localConceptReference	Instance	single	classes={:CodedConcept-CLASS}
S :DOCUMENTATION	String	multiple	
S :DIRECT-INSTANCES I	Instance	multiple	classes={:THING}

ConceptReference Example

C _English (type=:ConceptReference) **C** **X**

:NAME	:DOCUMENTATION
<input type="text" value="_English"/>	<input type="text"/>
:referenceCodeSystem	
<input type="text" value="2.16.840.1.113883.6.94"/>	
:referenceConceptCode	
<input type="text" value="en"/>	
:localConceptReference	V C + -
C English (en) A	

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Why Terminology Services?

Terminology Resources are Heterogeneous

- **Structure** - varies from code/value pairs to complex formalisms such as NCI Thesaurus or SNOMED-CT
- **Size** – varies from 3 or 4 entries to well over half a million
- **Format** – can be CSV's, SQL Tables, XML Documents, OWL

Why Terminology Services?

Terminology = content + *software*

- **Sophisticated text search algorithms**
- **DL style inference**
- **Distribution, authoring, performance...**

The Common Terminology Services (CTS) API

- **(Relatively) Simple API**
- **Read-only**
- **A specification on how to do things like**
 - **List supported code systems**
 - **Get code system information**
 - **Search coded concepts by text**
 - **Traverse relationships**
- **Draft HL7 / ANSI Standard**

CTS Example

8.3.5 Determine Whether Two Concept Codes are Related

```
boolean areCodesRelated(  
    in CodeSystemId           codeSystem_id,  
    in ConceptCode           source_code,  
    in ConceptCode           target_code,  
    in RelationshipCode       relationship_code,  
    in RelationQualifierCodeList relationQualifiers,  
    in boolean                directRelationsOnly  
)  
    raises (UnknownConceptCode,  
           UnknownCodeSystem,  
           UnknownRelationshipCode,  
           UnknownRelationQualifier,  
           UnexpectedError);
```

Listing 41: areCod

Determine whether the supplied concept codes are related

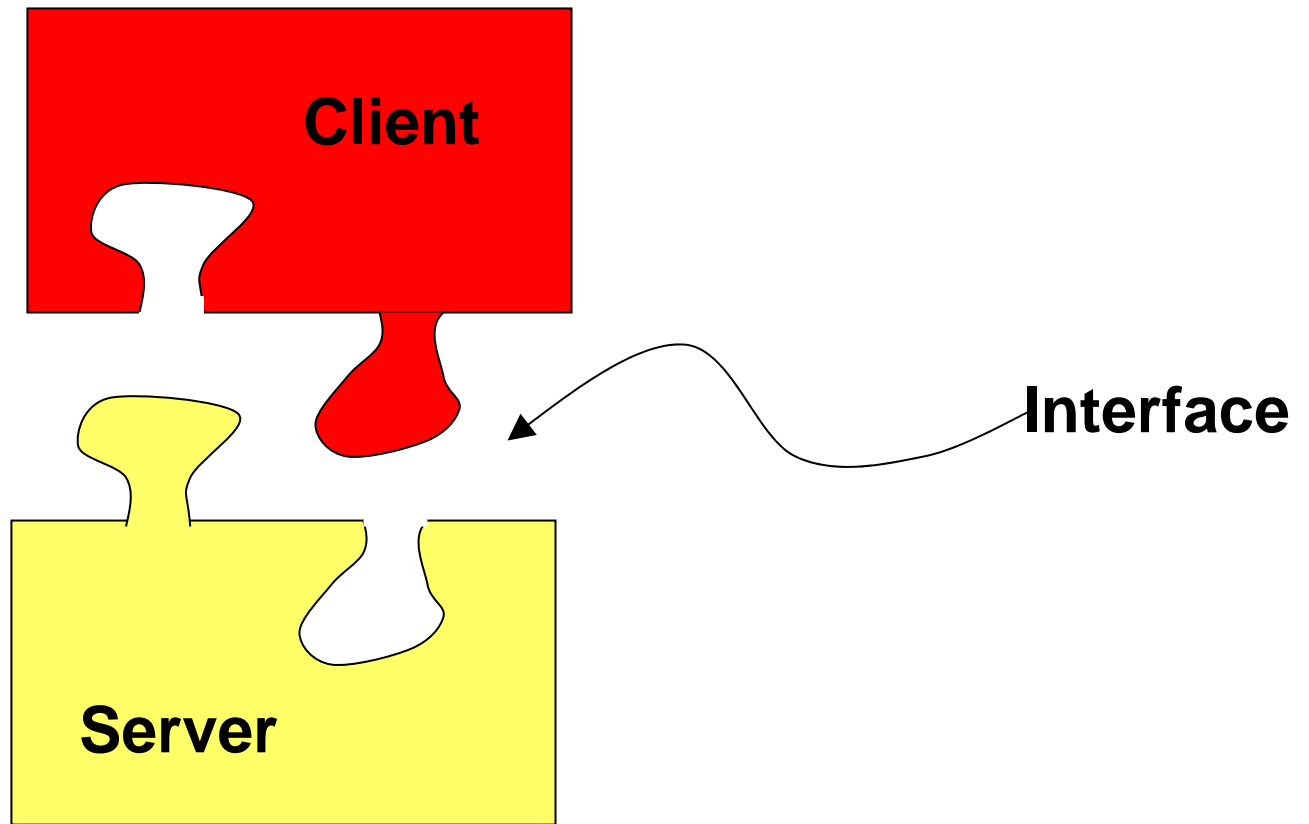
Parameters:

- ◆ **codeSystem_id** - the code system of the parent and child codes
- ◆ **source_code** - the concept code that occurs as the source of the relationship
- ◆ **target_code** - the concept code that occurs as the target of the relationship
- ◆ **relationship_code** - the concept code that identifies the relationship
- ◆ **relationQualifiers** - an optional list of relationship qualifier codes. If the relationQualifiers that match all of the qualifiers in the list will be considered.
- ◆ **directRelationsOnly** - TRUE means test direct relationships only, FALSE means If the relationship is not transitive, the result is the same no matter the setting

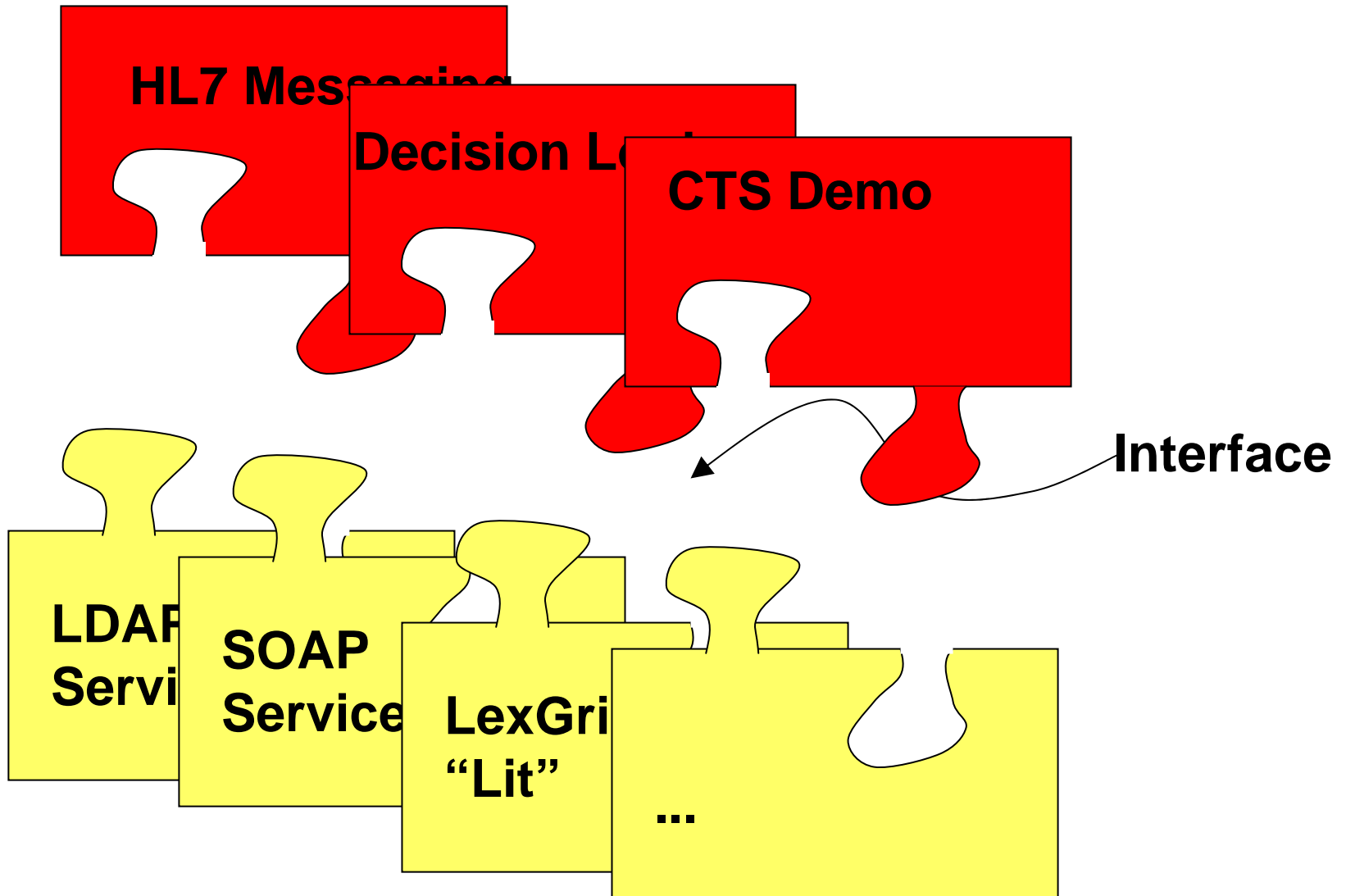
areCodesRelated returns TRUE if one of the following conditions holds:

1. There is a direct relationship of type relationship_code between source_code
2. There is a direct relationship of type relationship_code between target_code symmetric.
3. Source_code equals target code and the relationship is reflexive.
4. directRelationsOnly is FALSE, relationship_code is transitive and there is a relationQualifiers transitive closure of relationship_code starting at source_code.
5. directRelationsOnly is FALSE, relationship_code is transitive and symmetric and

CTS Interface Specification



CTS Interface Specification



File Tools

URL:

Disconnect

Method:

Execute

Result

```
Boolean
|_value - true
```

SOAP Client

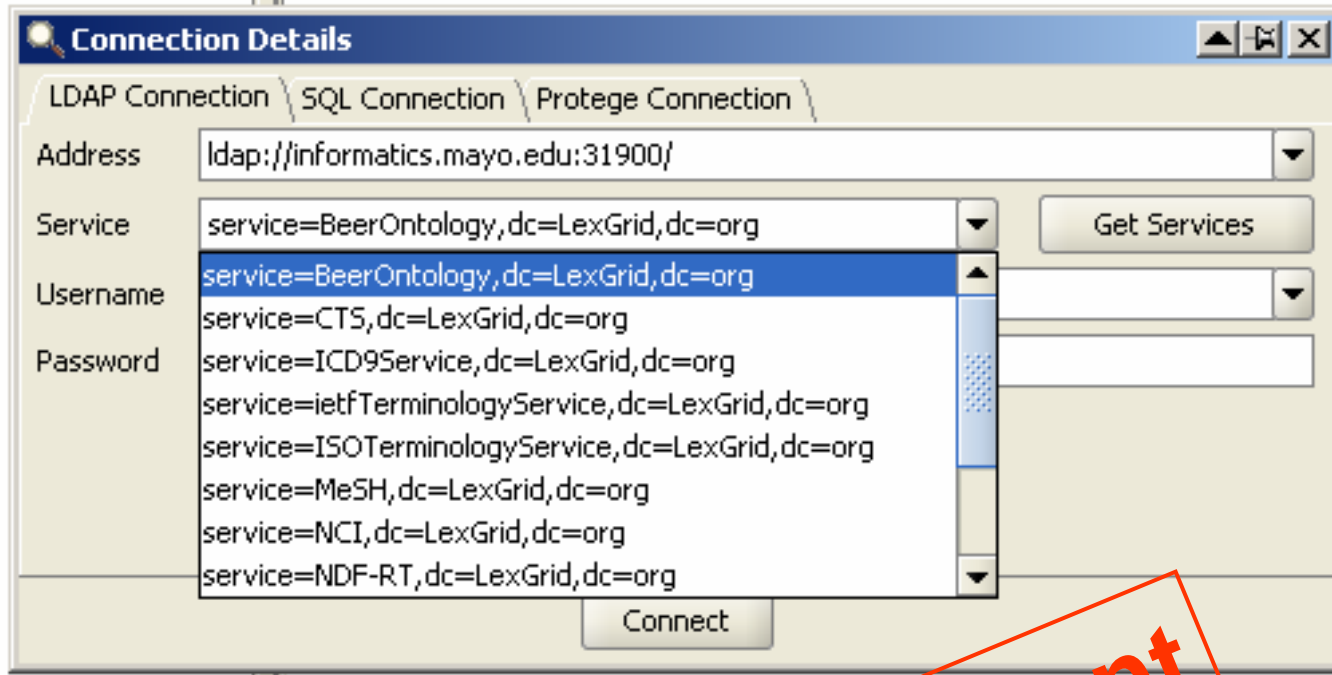
SOAP Server

Message Sent

```
<soap:Envelope xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance' xmlns:xsd='http://www.w3.org/2001/XMLSchema' xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'>
  <soap:Body soap:encodingStyle='http://schemas.xmlsoap.org/soap/encoding/' xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'>
    <n:areCodesRelated>
      <codeSystem_id xsi:type='xsd:string'>2.16.840.1.113883.6.101</codeSystem_id>
      <source_code xsi:type='xsd:string'>2000000000X</source_code>
      <target_code xsi:type='xsd:string'>207ZF0201X</target_code>
      <relationship_code xsi:type='xsd:string'>hasSubtype</relationship_code>
      <relationQualifiers xsi:nil='1'/>
      <directRelationsOnly xsi:type='xsd:boolean'>>false</directRelationsOnly>
    </n:areCodesRelated>
  </soap:Body>
</soap:Envelope>
```

Message Received

```
<soapenv:Envelope xmlns:soapenv='http://schemas.xmlsoap.org/soap/envelope/' xmlns:xsd='http://www.w3.org/2001/XMLSchema' xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'>
  <soapenv:Body>
    <nsl:areCodesRelatedResponse soapenv:encodingStyle='http://schemas.xmlsoap.org/soap/encoding/' xmlns:nsl='urn://hl7.org/CTSVAPI'>
      <areCodesRelatedReturn xsi:type='xsd:boolean'>true</areCodesRelatedReturn>
    </nsl:areCodesRelatedResponse>
  </soapenv:Body>
</soapenv:Envelope>
```



Java Client
LDAP Server



Connection Details

LDAP Connection | **SQL Connection** | Protege Connection

Server: jdbc:odbc:Driver={Microsoft Access Driver (*.mdb)};DBQ=c:\LexGrid.mdb

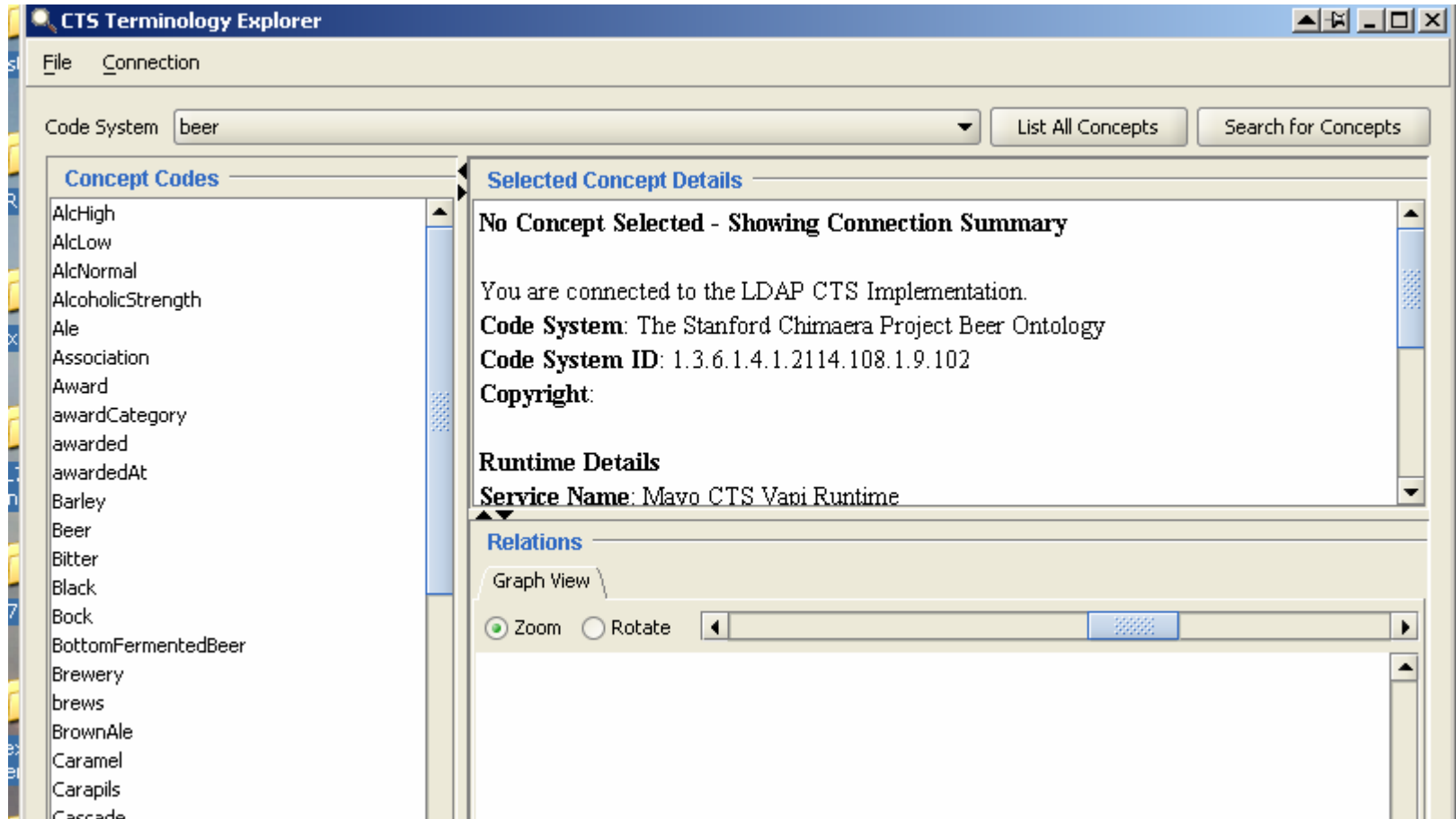
Username:

Password:

Connect

Java Client

SQL Server



The screenshot shows the CTS Terminology Explorer application window. The title bar reads "CTS Terminology Explorer". The menu bar includes "File" and "Connection". Below the menu bar, there is a "Code System" dropdown menu set to "beer", and two buttons: "List All Concepts" and "Search for Concepts".

The main interface is divided into three sections:

- Concept Codes:** A list of terms including AlcHigh, AlcLow, AlcNormal, AlcoholicStrength, Ale, Association, Award, awardCategory, awarded, awardedAt, Barley, Beer, Bitter, Black, Bock, BottomFermentedBeer, Brewery, brews, BrownAle, Caramel, Carapils, and Cascade.
- Selected Concept Details:** A text area displaying connection information:
 - No Concept Selected - Showing Connection Summary**
 - You are connected to the LDAP CTS Implementation.
 - Code System:** The Stanford Chimaera Project Beer Ontology
 - Code System ID:** 1.3.6.1.4.1.2114.108.1.9.102
 - Copyright:**
 - Runtime Details**
 - Service Name:** Mayo CTS Vapi Runtime
- Relations:** A section with a "Graph View" tab and a "Zoom" radio button selected. Below it is a horizontal scrollbar.

File Connection

Code System beer

List All Concepts

Search for Concepts

Concept Codes

- AlcHigh
- AlcLow
- AlcNormal
- AlcoholicStrength
- Ale
- Association
- Award
- awardCategory
- awarded
- awardedAt
- Barley
- Beer**
- Bitter
- Black
- Bock
- BottomFermentedBeer
- Brewery
- brews
- BrownAle
- Caramel
- Carapils
- Cascade
- Chinook
- Chocolate
- DryStout
- Festival
- Galena
- Grain
- Hallertau
- hasAlcoholicStrength
- Hops

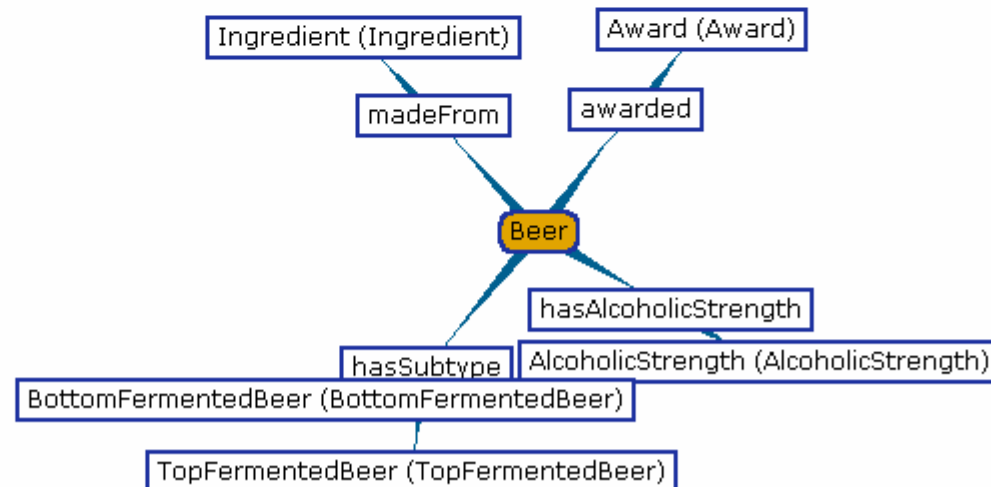
Selected Concept Details

Concept Code: Beer
Designation: Beer (en)
Code System: 1.3.6.1.4.1.2114.108.1.9.102
Code System Version: 0.1
Code Status: true
Property: textualPresentation: Beer (en)

Relations

Graph View

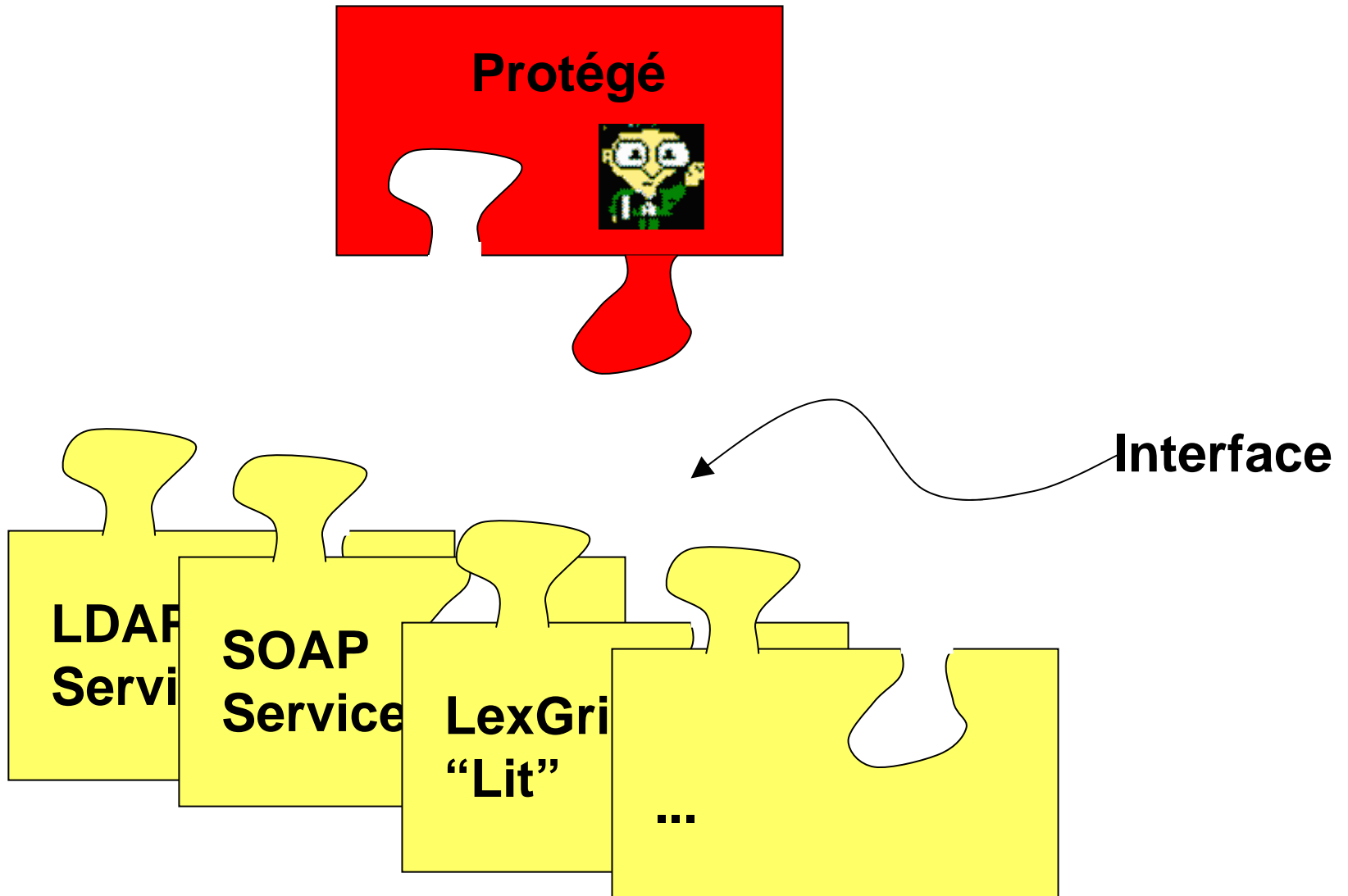
Zoom Rotate



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Protégé as a CTS Client



Protégé as a CTS Client

Need to create a terminology model

- **Code System**
- **Concept Code**
- **Designation**
- **Description**
- **Annotation**
- **Relationship**

Terminology Model

Code System

CodeSystem

(from Logical View)

- ◆codeSystemDescription : String [0:1]
- ◆codeSystemName : String [1:1]
- ◆codeSystemCopyright : String [0:1]
- ◆codeSystemVersions : String [0:n]
- ◆codeSystemFullName : String [1:1]
- ◆codeSystemId : String [1:1]

Terminology Model

Code System

- ⊙ :THING ^A
- ⊙ :SYSTEM-CLASS ^A
- ⊙ TerminologyEntities ^A
- ⊙ CodedConcept ^A
- ⊙ CodeSystem
- ⊙ Term
- ⊙ ConceptDefinition
- ⊙ ConceptAnnotation
- ⊙ ConceptDesignation
- ⊙ ConceptReferences ^A

Name	Documentation	Constraints
CodeSystem	A collection of concept codes from a common namespace that represent a collection of concepts from a particular perspective or view.	
Role		
Concrete		
Template Slots		
Name	Type	Cardinality
S supportedProperties	Instance	multiple
S supportedRelationships	Instance	multiple
S codeSystemDescription	String	single
S codeSystemName	String	required single
S codeSystemCopyright	String	single
S codeSystemVersions	String	multiple
S codeSystemFullName	String	required single
S codeSystemId	String	required single
S supportedLanguages	Instance	required multiple

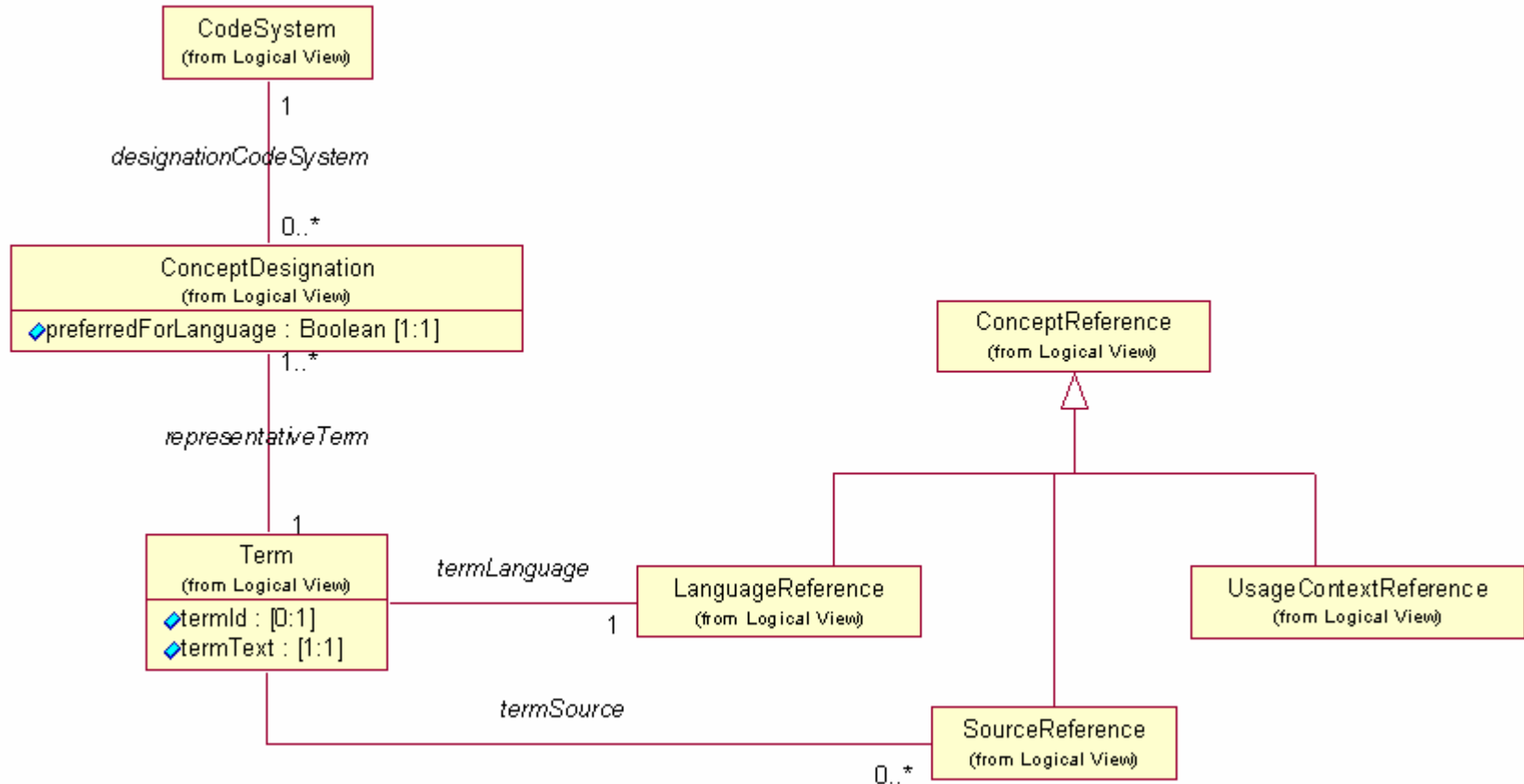
Terminology Model Code System - Example

ISO639-1 [2.16.840.1.113883.6.84] (type=CodeSystem, name=KB_775096_Instance_0) C X

CodeSystemCopyright	CodeSystemVersions V C -	SupportedProper V C + -
<input type="text"/>	2003-09-02	S :conceptDesignations
CodeSystemDescription		
of languages - Part 1: Alpha 2 code		
CodeSystemFullName	SupportedLangu: V C + -	SupportedRelatic V C + -
of languages - Part 1: Alpha 2 code	C _English A C _French A	S sameAs_RELATION
CodeSystemId		
2.16.840.1.113883.6.84		
CodeSystemName		
ISO639-1		

Terminology Model

Terms & Designations



Terminology Model

Terms

Relationship S... V C [Icons]

C Term (type=:STANDARD-CLASS)

C .THING **A**

C :SYSTEM-CLASS **A**

C TerminologyEntities **A**

C CodedConcept **A**

C CodeSystem

C Term

C ConceptDefinition

C ConceptAnnotation

C ConceptDesignation

C ConceptReferences **A**

Name: Term

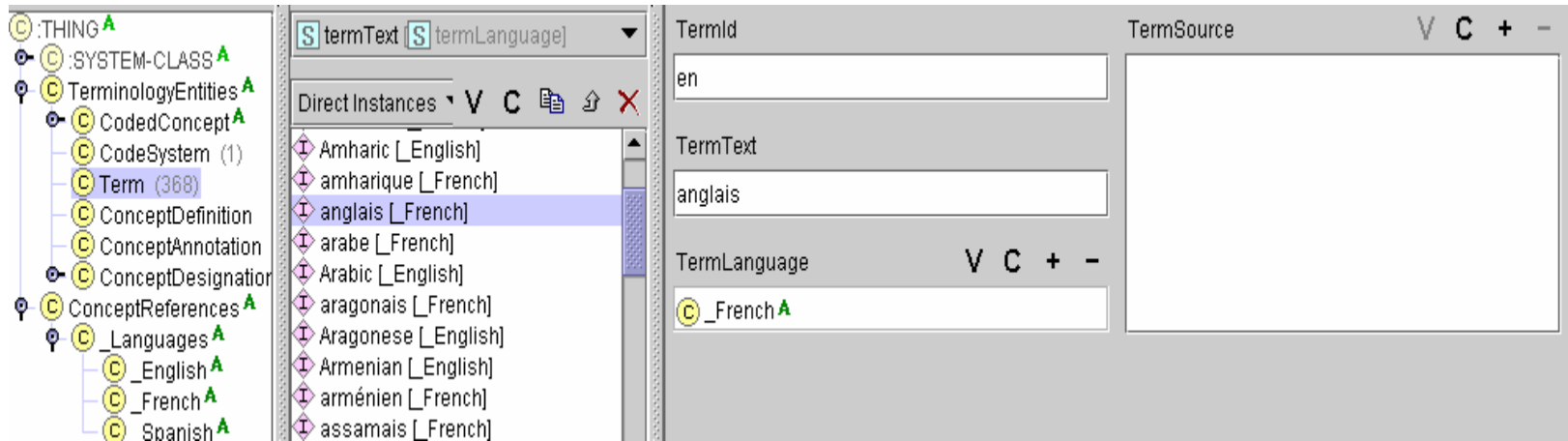
Role: Concrete

Documentation: A string of text that can be used to represent the meaning or intent of a concept code in a given language and (optional) context or contexts.

Template Slots

Name	Type	Cardinality	Other
S termText	String	required single	
S termId	String	single	
S termLanguage	Instance	required single	classes={:LanguageReference}
S termSource	Instance	multiple	classes={:SourceReference}

Terminology Model Terms - Example



The screenshot displays a terminology management application interface. On the left is a hierarchical tree view of the terminology model. The tree structure is as follows:

- :THING A
 - :SYSTEM-CLASS A
 - TerminologyEntities A
 - CodedConcept A
 - CodeSystem (1)
 - Term (368)**
 - ConceptDefinition
 - ConceptAnnotation
 - ConceptDesignation
 - ConceptReferences A
 - _Languages A
 - _English A
 - _French A
 - Spanish A

The middle pane shows the 'Direct Instances' of the selected 'Term (368)'. The list includes various language-specific terms, with 'anglais [French]' currently selected:

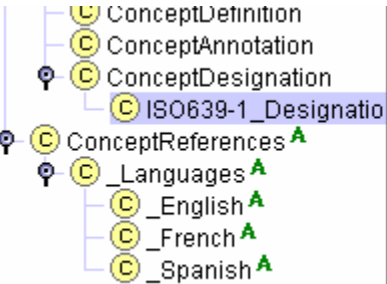
- Amharic [English]
- amharique [French]
- anglais [French]**
- arabe [French]
- Arabic [English]
- aragonais [French]
- Aragonese [English]
- Armenian [English]
- arménien [French]
- assamais [French]

The right pane provides a detailed view of the selected instance, 'anglais [French]'. It contains the following fields:

- TermId: en
- TermText: anglais
- TermLanguage: C_French A

The TermSource field is currently empty.

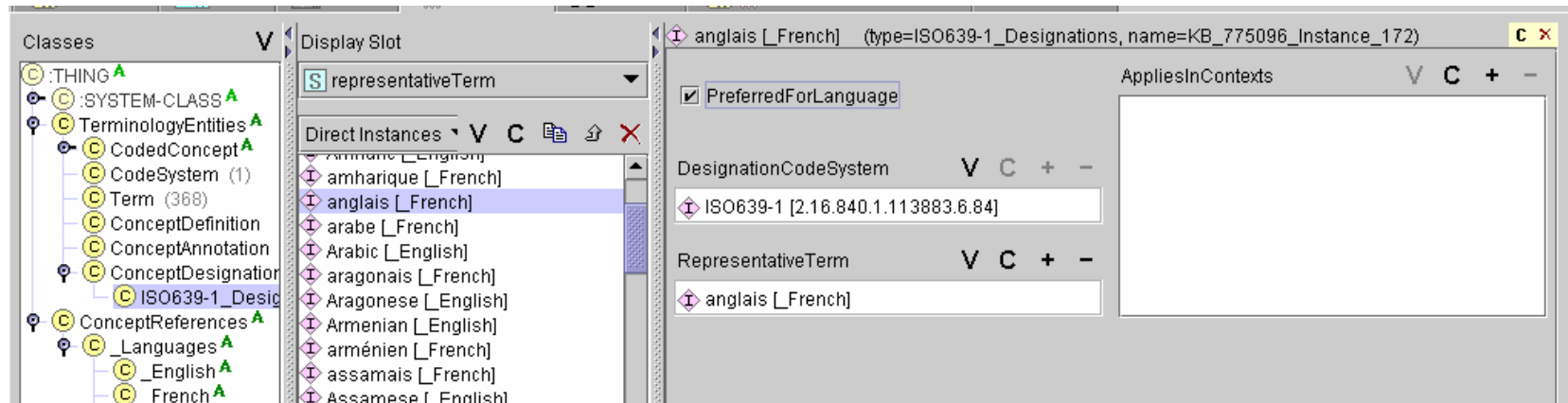
Terminology Model Designations



Template Slots

Name	Type	Cardinality	Other Facets
S appliesInContexts	Instance	multiple	classes={UsageContextReference}
S preferredForLanguage	Boolean	required single	default={false}
S representativeTerm	Instance	required single	classes={Term}
S designationCodeSystem	Instance	required single	classes={CodeSystem} value={ISO639-1 [2.16.840.1.113883.6.84]}

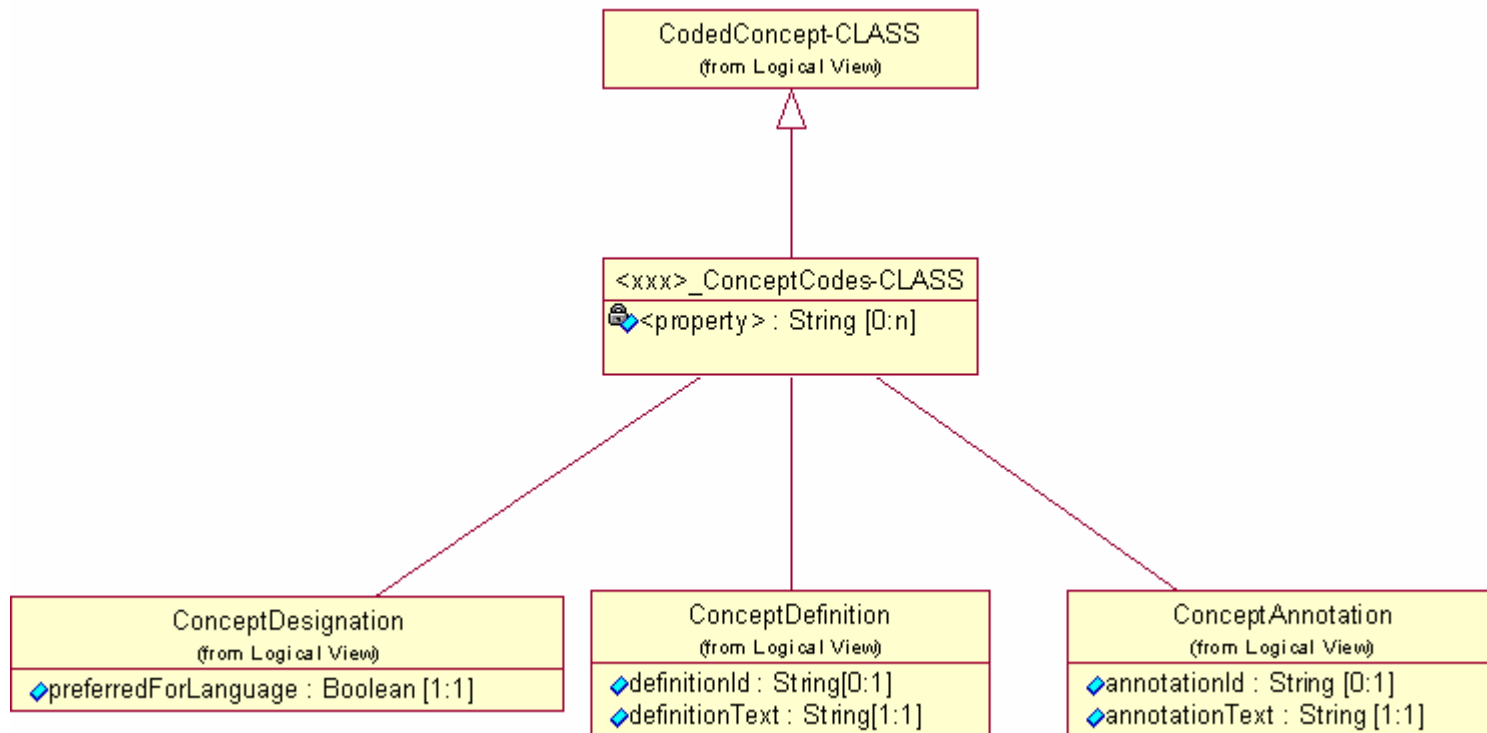
Terminology Model Designations - Example



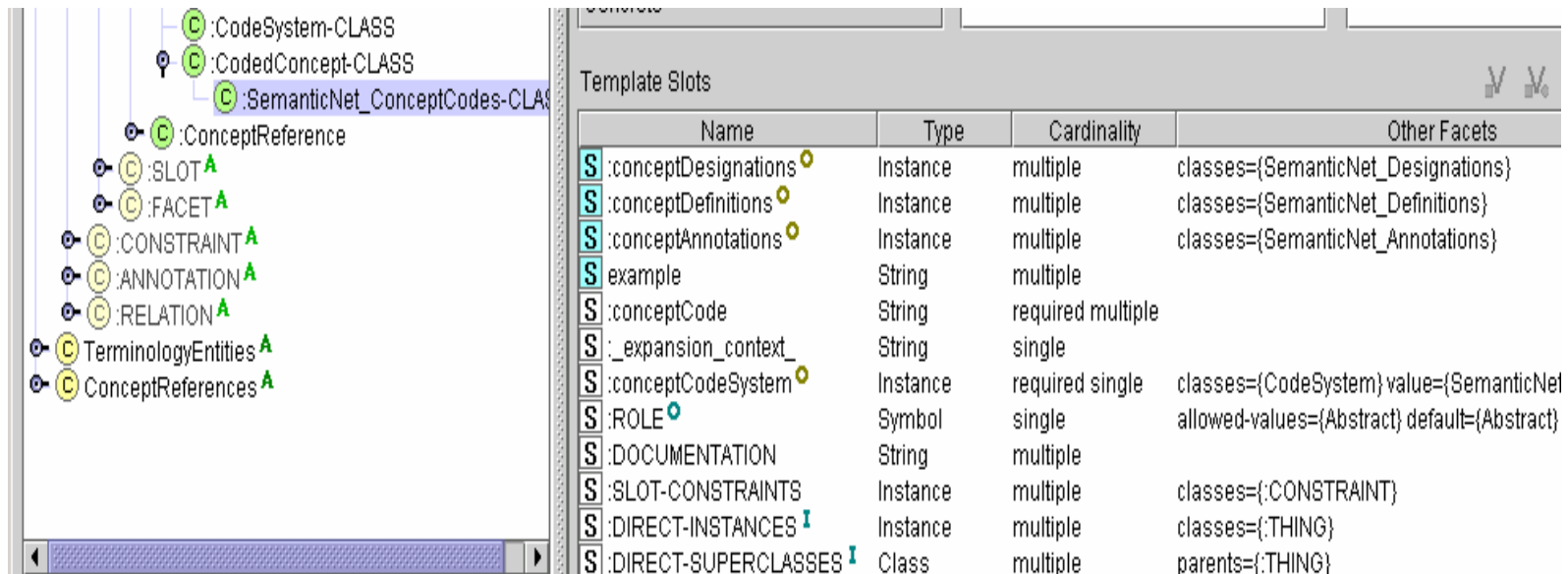
The screenshot displays a terminology model design tool interface. It is divided into three main sections:

- Classes:** A tree view on the left showing a hierarchy of classes. The root is `:THING`, followed by `:SYSTEM-CLASS`, `TerminologyEntities`, `CodedConcept`, `CodeSystem (1)`, `Term (368)`, `ConceptDefinition`, `ConceptAnnotation`, `ConceptDesignation`, `ISO639-1_Designations`, `ConceptReferences`, and `_Languages`. Under `_Languages`, there are sub-classes for `_English` and `_French`.
- Display Slot:** A central pane showing a list of instances under the heading "Direct Instances". The instance `anglais [French]` is selected and highlighted in blue. Other instances include `amharique [French]`, `arabe [French]`, `Arabic [English]`, `aragonais [French]`, `Aragonese [English]`, `Armenian [English]`, `arménien [French]`, `assamais [French]`, and `Assamese [English]`.
- Instance Detail:** A pane on the right titled "anglais [French] (type=ISO639-1_Designations, name=KB_775096_Instance_172)". It shows a checked `PreferredForLanguage` property. Below, there are two lists of associated values:
 - DesignationCodeSystem:** A list containing `ISO639-1 [2.16.840.1.113883.6.84]`.
 - RepresentativeTerm:** A list containing `anglais [French]`.An `AppliesInContexts` section is also present but currently empty.

Terminology Model Definitions, Annotations, etc.



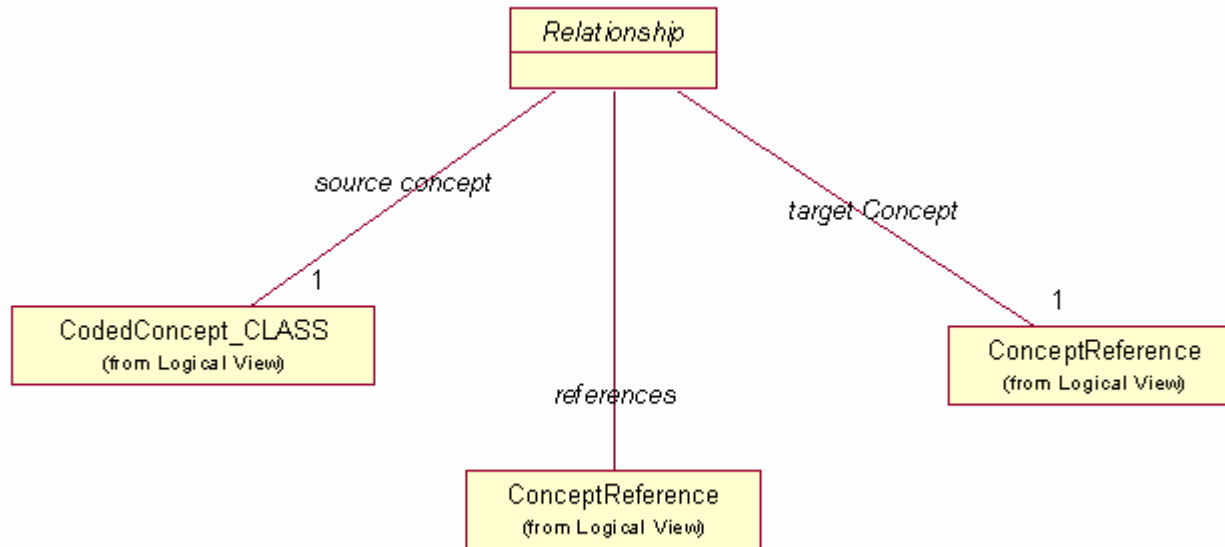
Terminology Model Definitions, Annotations, etc.



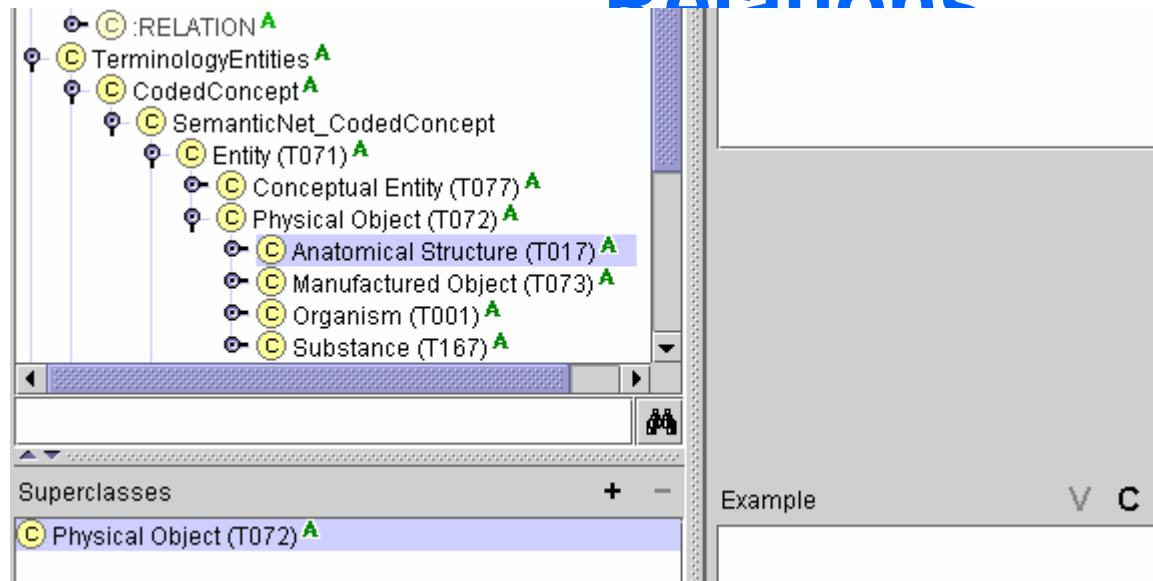
The screenshot displays a terminology model editor. On the left is a tree view showing a hierarchy of classes: CodeSystem-CLASS, CodedConcept-CLASS, SemanticNet_ConceptCodes-CLASS, ConceptReference, SLOT A, FACET A, CONSTRAINT A, ANNOTATION A, RELATION A, TerminologyEntities A, and ConceptReferences A. On the right is a 'Template Slots' table with the following data:

Name	Type	Cardinality	Other Facets
S :conceptDesignations	Instance	multiple	classes={SemanticNet_Designations}
S :conceptDefinitions	Instance	multiple	classes={SemanticNet_Definitions}
S :conceptAnnotations	Instance	multiple	classes={SemanticNet_Annotations}
S example	String	multiple	
S :conceptCode	String	required multiple	
S :_expansion_context_	String	single	
S :conceptCodeSystem	Instance	required single	classes={CodeSystem} value={SemanticNet}
S :ROLE	Symbol	single	allowed-values={Abstract} default={Abstract}
S :DOCUMENTATION	String	multiple	
S :SLOT-CONSTRAINTS	Instance	multiple	classes={:CONSTRAINT}
S :DIRECT-INSTANCES	Instance	multiple	classes={:THING}
S :DIRECT-SUPERCLASSES	Class	multiple	parents={:THING}

Terminology Model Relations



Terminology Model Relations



- :RELATION ^A
- TerminologyEntities ^A
- CodedConcept ^A
- SemanticNet_CodedConcept
- Entity (T071) ^A
- Conceptual Entity (T077) ^A
- Physical Object (T072) ^A
- Anatomical Structure (T017) ^A
- Manufactured Object (T073) ^A
- Organism (T001) ^A
- Substance (T167) ^A

Superclasses

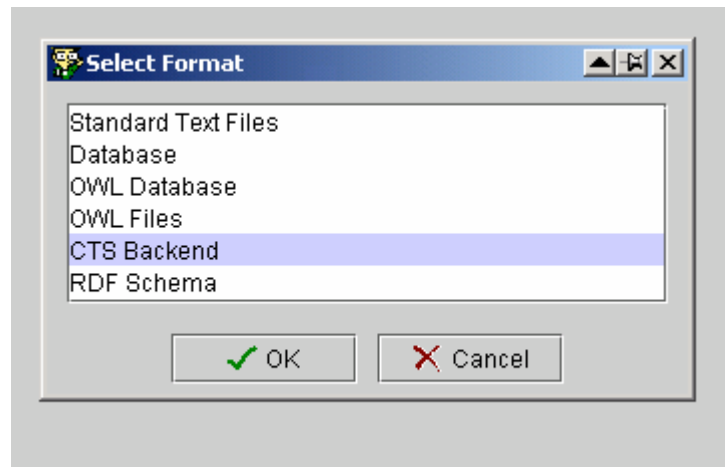
- Physical Object (T072) ^A

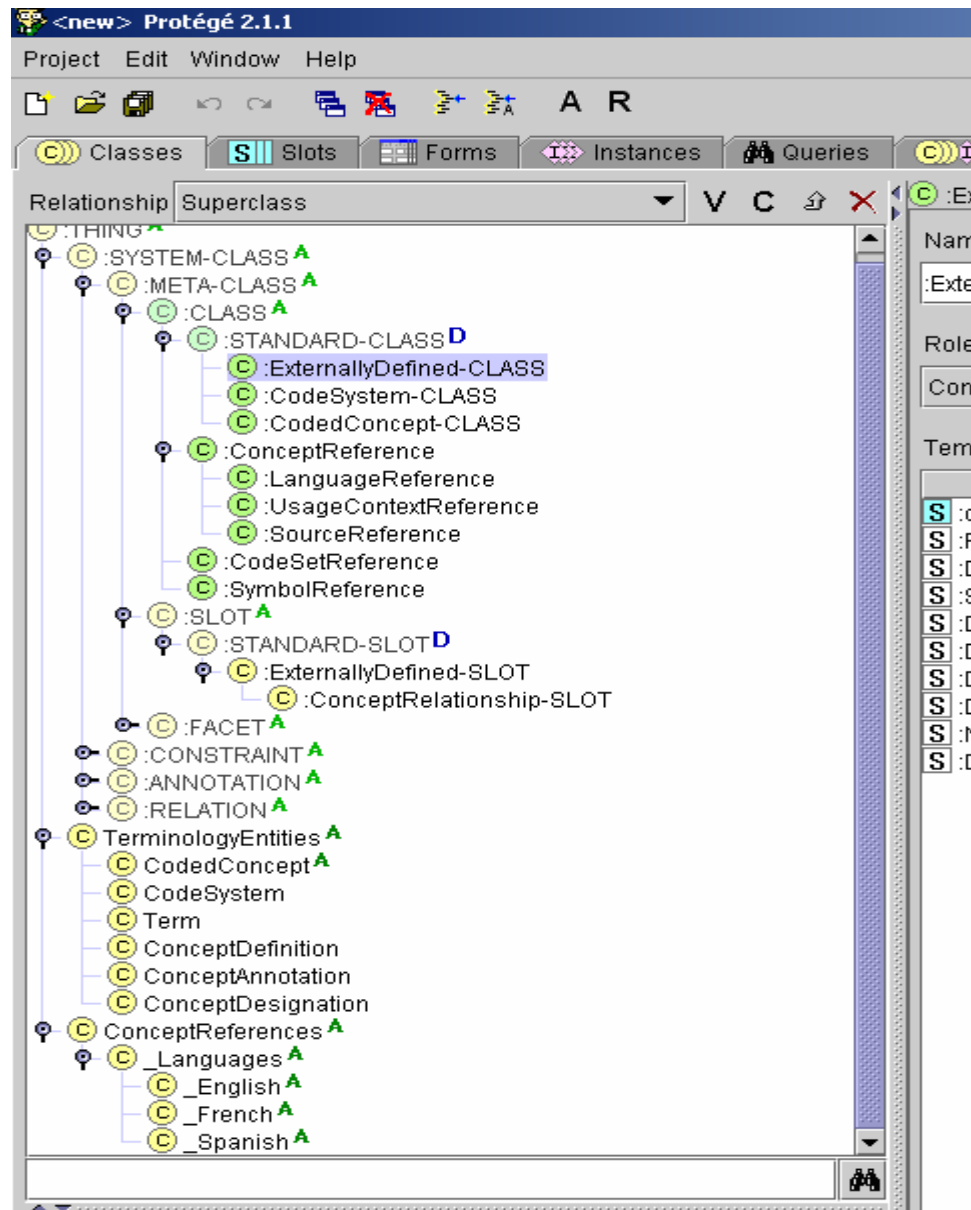
Example

part of the anatomy of an organism.

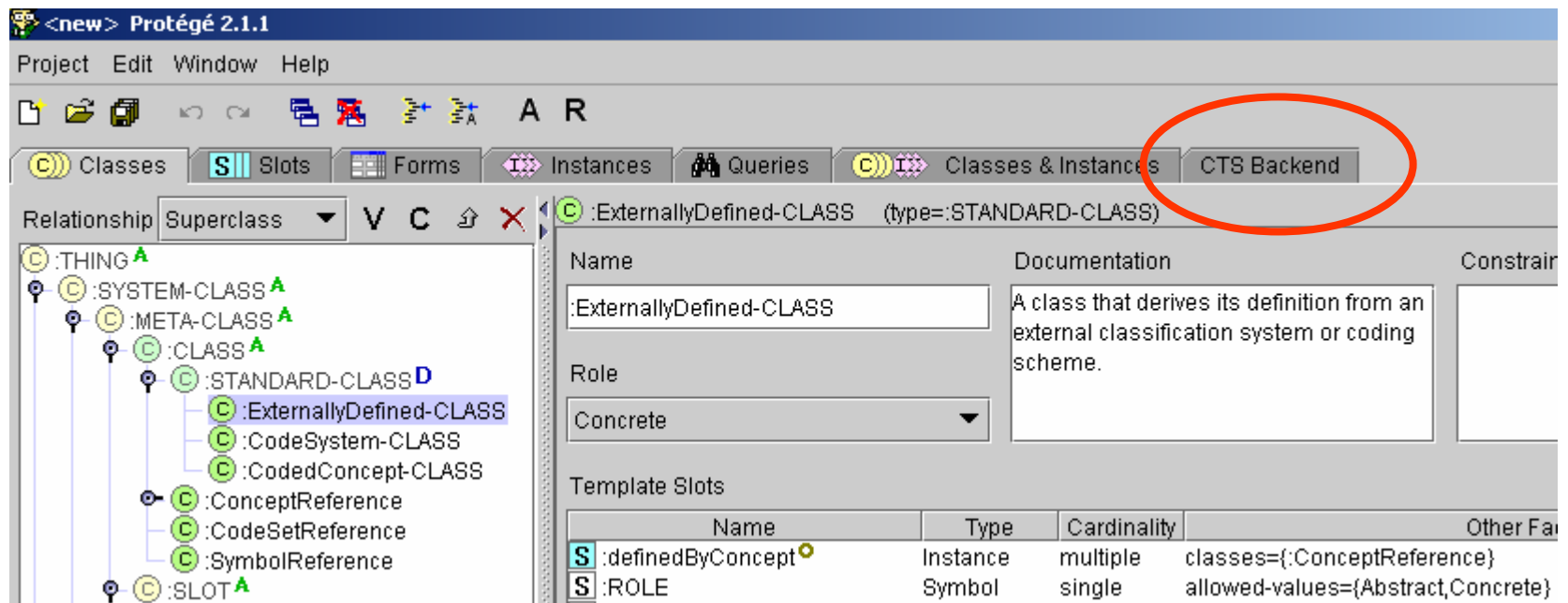
Template Slots				
Name	Type	Cardinality	Other Facets	
S reverse_hasLocation-RELATION ^{o I}	Instance	multiple	classes={Body Location or Region (T029),Body Space or Junction (TC...	
S reverse_hasPart-RELATION ^{o I}	Instance	multiple	classes={Nucleotide Sequence (T086),Embryonic Structure (T018),Bc...	
S reverse_hasIssue-RELATION ^I	Instance	multiple	classes={Occupation or Discipline (T090)}	

CTS Client New File Dialog





CTS Backend



Project Edit Window Help

Classes Slots Forms Instances Queries Classes & Instances **CTS Backend**

Relationship Superclass V C

C :ExternallyDefined-CLASS (type=:STANDARD-CLASS)

Name: :ExternallyDefined-CLASS

Documentation: A class that derives its definition from an external classification system or coding scheme.

Role: Concrete

Template Slots

Name	Type	Cardinality	Other Fa
S :definedByConcept	Instance	multiple	classes={:ConceptReference}
S :ROLE	Symbol	single	allowed-values={Abstract,Concrete}

Class Hierarchy:

- :THING A
 - :SYSTEM-CLASS A
 - :META-CLASS A
 - :CLASS A
 - :STANDARD-CLASS D
 - :ExternallyDefined-CLASS
 - :CodeSystem-CLASS
 - :CodedConcept-CLASS
 - :ConceptReference
 - :CodeSetReference
 - :SymbolReference
 - :SLOT A

CTS Backend Configuration

Select Configuration: hl7 Edit

Properties:

Configuration Name: hl7 Default Configuration

Host Name: informatics.mayo.edu Save

Port No: 31900 Remove

Service: service=CTS,dc=LexGrid,dc=org Reset

User: Append Service

Password: Anonymous

SOAP Service

Load

Select coding schemes to import for hl7 (Total 156): Select All

- AcknowledgementCondition
- AcknowledgementDetailType
- AcknowledgementType
- ActClass
- ActCode
- ActInvoiceElementModifier
- ActMood
- ActPriority
- ActReason
- ActRelationshipCheckpoint
- ActRelationshipJoin
- ActRelationshipSplit
- ActRelationshipType
- ActSite
- ActStatus
- ActUncertainty
- AddressPartType
- AdministrativeGender

User Preferences:

Ignore load errors

Use local copy

Enable lazy load

Locally editable meta classes

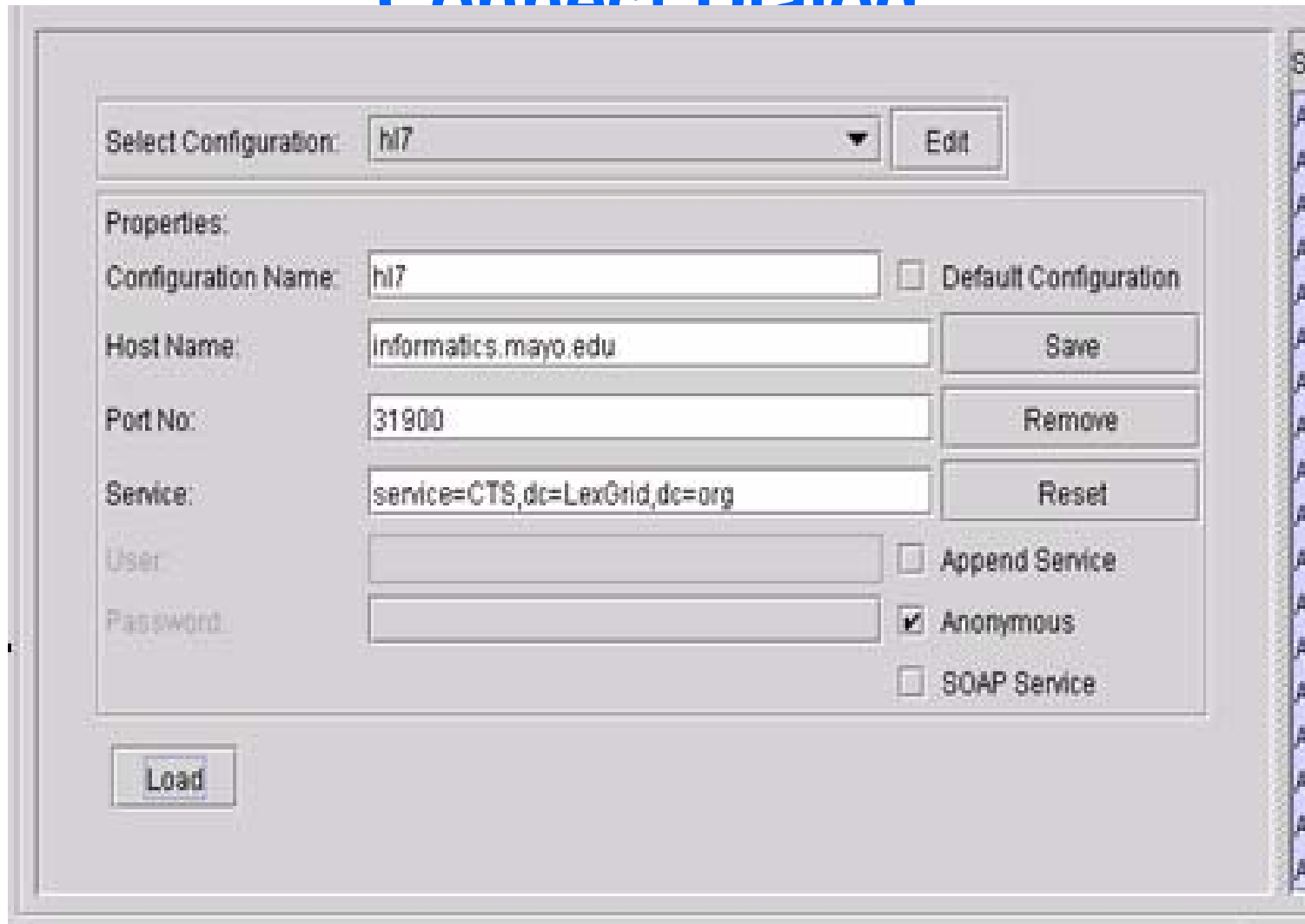
Locally editable terminology classes

Search result limit: 20000

Timeout: 20000

Save

CTS Client Connect Dialog



Select Configuration:

Properties:

Configuration Name: Default Configuration

Host Name:

Port No:

Service:

User:

Password:

Append Service

Anonymous

SOAP Service

CTS Client Preferences

User Preferences:

- Ignore load errors
- Use local copy
- Enable lazy load
- Locally editable meta classes
- Locally editable terminology classes

Search result limit:

Timeout:

CTS Client Coding Scheme Selection

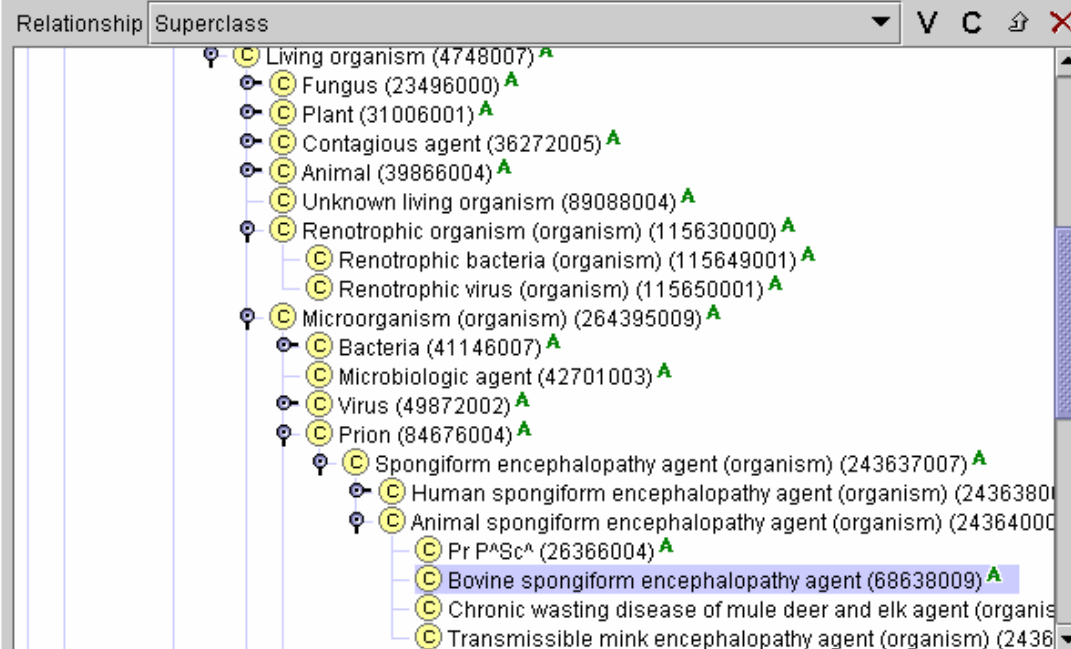
Select coding schemes to import for hl7 (Total 156): Select All

- AcknowledgementCondition
- AcknowledgementDetailType
- AcknowledgementType
- ActClass
- ActCode
- ActInvoiceElementModifier
- ActMood
- ActPriority
- ActReason
- ActRelationshipCheckpoint
- ActRelationshipJoin
- ActRelationshipSplit
- ActRelationshipType
- ActSite
- ActStatus
- ActUncertainty
- AddressPartType
- AdministrativeGender

Project Edit Window Help



Classes Slots Forms Instances Queries Classes & Instances CTS Backend



Bovine spongiform encephalopathy agent (68638009) (typ

Name	Documentation
spongiform encephalopathy agent	
Role	
Abstract	

Template Slots

Name	Type	Cardin
HasCausativeAgent-RELATION	Instance	multiple

Superclasses + -

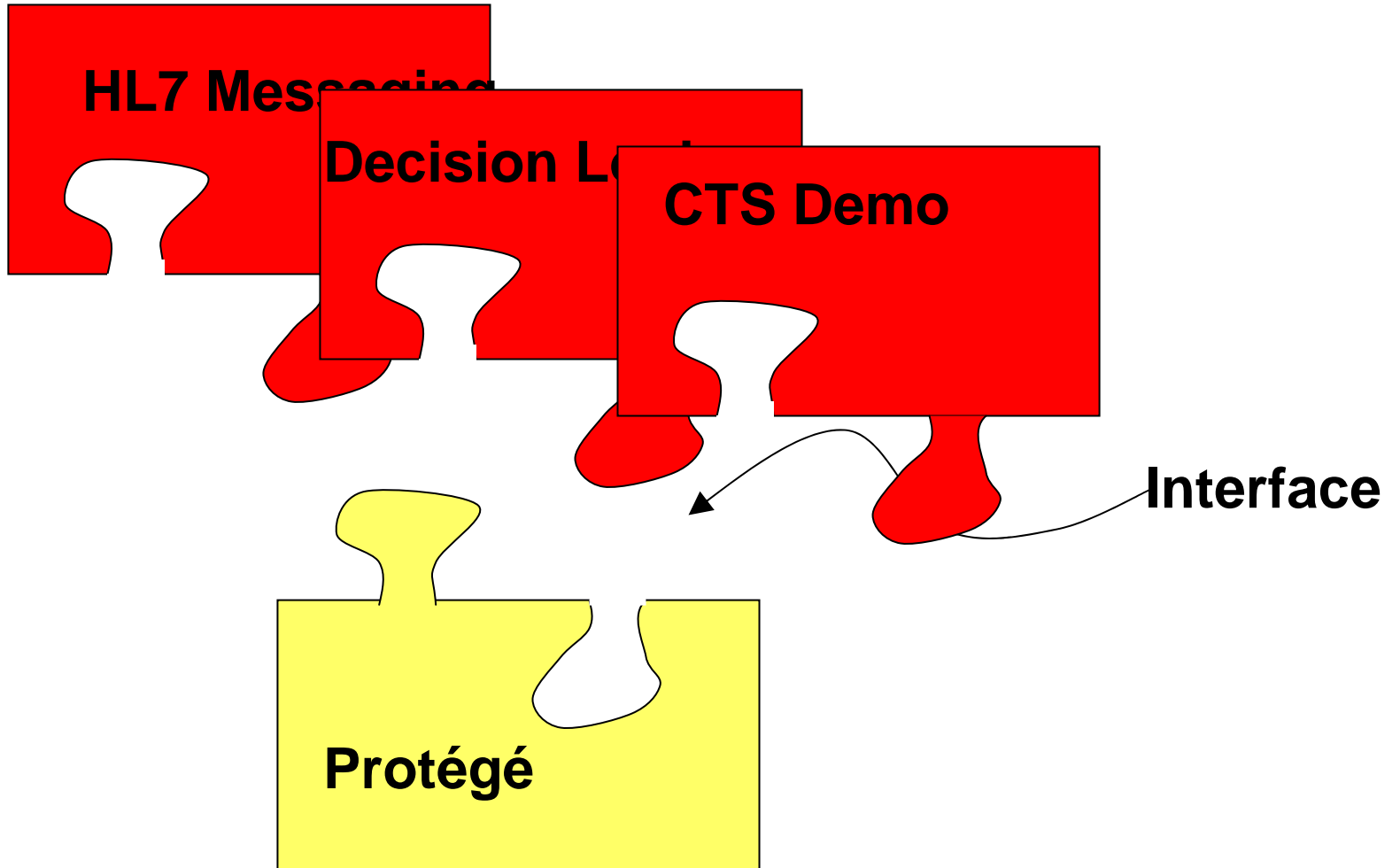
- Animal spongiform encephalopathy agent (organism) (243640007)

: Expansion Context	:conceptAnnotat
	X73mj L-30106
:conceptCodeSy	
SNOMED-CT [2.16.840.1.113...	
:conceptCode	:conceptDesign:
68638009	Bovine spongiform en Bovine spongiform en

Outline

- Purpose of the project
- Characteristics of Terminology Links
- The Common Terminology Services (CTS) specification
- **Protégé as a CTS Client**
- Protégé as a CTS Server
- Issues, discussion and next steps

Protégé as a CTS Service





CTS Terminology Explorer

File Connection

Code System List All Concepts Search for Concepts

Concept Codes Selected Concept Details

LDAP Connection \ SQL Connection \ Protege Connection \

Filename Browse...

Connect

File Connection

Code System beer

List All Concepts

Search for Concepts

Concept Codes

- AlcHigh
- AlcLow
- AlcNormal
- AlcoholicStrength
- Ale
- Award
- awardCategory
- awarded
- awardedAt
- Barley
- Beer**
- Bitter
- Black
- Bock
- BottomFermentedBeer
- Brewery
- brews
- BrownAle
- Caramel
- Carapils
- Cascade
- Chinook
- Chocolate
- DryStout
- Festival
- Galena
- Grain
- Hallertau
- hasAlcoholicStrength

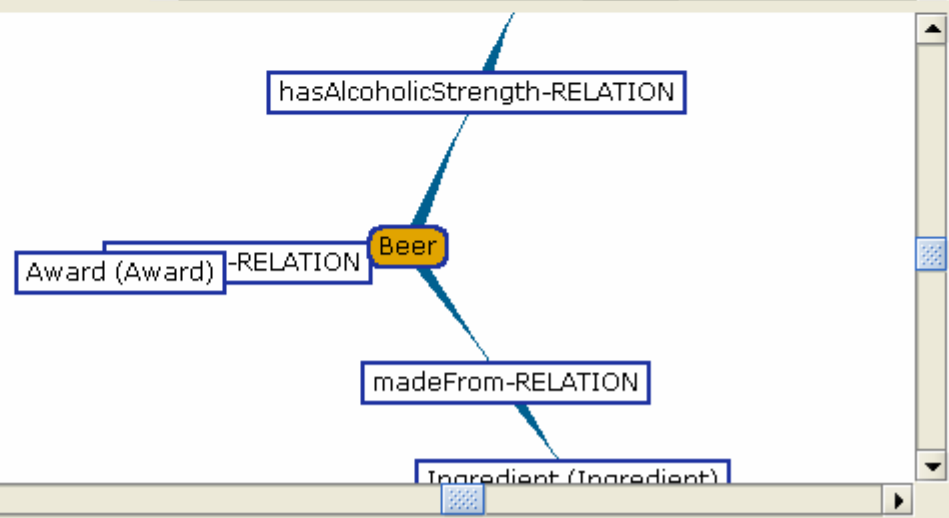
Selected Concept Details

Concept Code: Beer
Designation: Beer (en)
Code System: 1.3.6.1.4.1.2114.108.1.9.102
Code System Version: 0.1
Code Status: true
Property: Instance: :conceptDesignations (en)
Property: String: hasAlcoholicContent (en)

Relations

Graph View

Zoom Rotate



- beer_CodedConcept
 - Saaz (Saaz) A
 - Beer (Beer) A
 - TopFermentedBeer (TopFermentedBeer) A
 - BottomFermentedBeer (BottomFermentedBeer) A
 - PoorlyBrewedBeer (PBB) A
 - Cascade (Cascade) A
 - IndiaPaleAle (IndiaPaleAle) A
 - Gerste (Barley) A
 - Microbrewery (Microbrewery) A
 - Ingredient (Ingredient) A
 - ImperialStout (ImperialStout) A
 - Ale (Ale) A
 - Pilsner (Pilsner) A
 - Region (Region) A
 - Galena (Galena) A
 - White (White) A
 - AlcLow (AlcLow) A
 - Brewery (Brewery) A
 - Willamette (Willamette) A
 - Chocolate (Chocolate) A

Name	Documentation
PoorlyBrewedBeer	Beer that wasn't brewed correctly
Role	
Abstract A	

Template Slots

Name	Type	Cardinality	
S madeFrom-RELATION I	Instance	multiple	clas
S hasAlcoholicStrength-RELATION I	Instance	multiple	clas
S awarded-RELATION I	Instance	multiple	clas
S reverse_brews-RELATION I	Instance	multiple	clas

- Beer (Beer) A

: Expansion Context	HasAlcoholicContent V C -
:conceptCodeSystem V C + -	
beer [1.3.6.1.4.1.2114.108.1.9.102]	
:conceptCode V C -	:conceptDesignations V C + -
PBB	

CTS Terminology Explorer

File Connection

Code System: beer [List All Concepts] [Search for Concepts]

Concept Codes

- Carapils
- Cascade
- Chinook
- Chocolate
- DryStout
- Festival
- Galena
- Grain
- Hallertau
- hasAlcoholicStrength
- Hops
- ImperialStout
- IndiaPaleAle
- Ingredient
- KentGoldings
- Lager
- locatedIn
- madeFrom
- Malt
- Microbrewery
- Mild
- MountHood
- Munich
- Name
- Pale
- PaleAle
- PBB**
- Perle
- Pilsner
- Porter

Selected Concept Details

Concept Code: PBB
Designation: Yuch Beer (en)
Code System: 1.3.6.1.4.1.2114.108.1.9.102
Code System Version: 0.1
Code Status: true
Property: Instance: :conceptDesignations (en)
Property: String: hasAlcoholicContent (en)

Relations

Graph View

Zoom Rotate

```
graph TD; YuchBeer[Yuch Beer] --- madeFrom[madeFrom-RELATION]; YuchBeer --- Award[Award (Award)]; YuchBeer --- hasAlcoholicStrength[hasAlcoholicStrength-RELATION]; YuchBeer --- Award; Award --- awarded[awarded-RELATION];
```

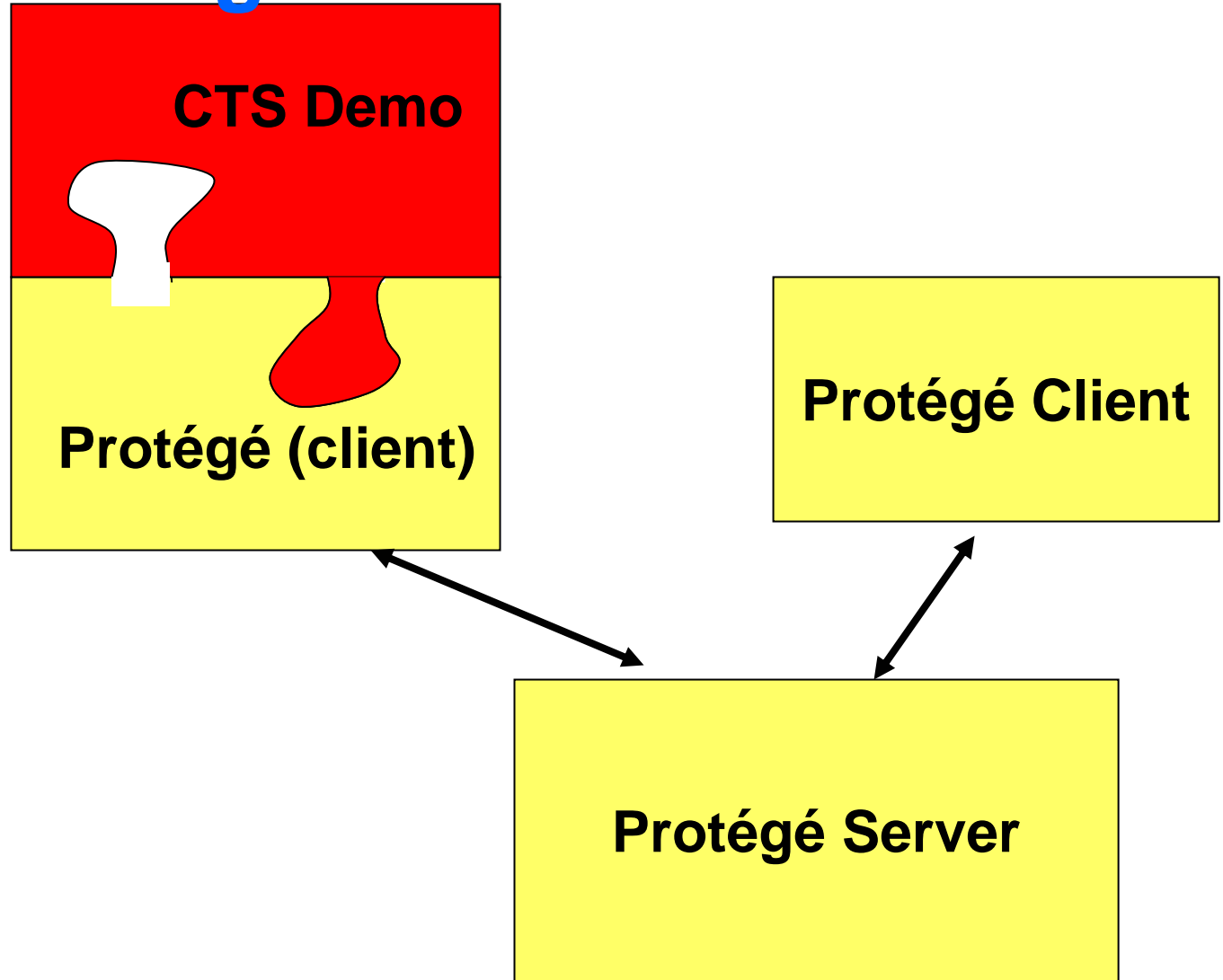
Outline

- Purpose of the project
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- The Common Terminology Services (CTS) specification
- Protégé as a CTS Client
- Protégé as a CTS Server
- **Issues, discussion and next steps**

Issues, etc.

- **Slow load time**
 - Appears comparable w/ OWL
 - Partially resolved w/ lazy loading
- **Need a SymbolReference**
 - Dynamically resolved Symbol
 - Ties in w/ DirectedBinaryRelation
- **Relations**
 - Need to reconcile w/ DirectedBinaryRelation
- **Need to make CTS Server a Protégé Server**

Protégé as CTS Server



Issues, etc. (continued)

- **Need to flesh out lazy loading**
 - **References occur all over**
- **Need to implement a hierarchy trimmer**
 - **Only keep references**
 - **Only keep graph branch points**

Credits

- **Deepak Sharma – author**
- **Dan Armbrust - CTS author**

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