LexEVS 6.0 Design Document - Detailed Design - Associations (Mapping)

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Document Information

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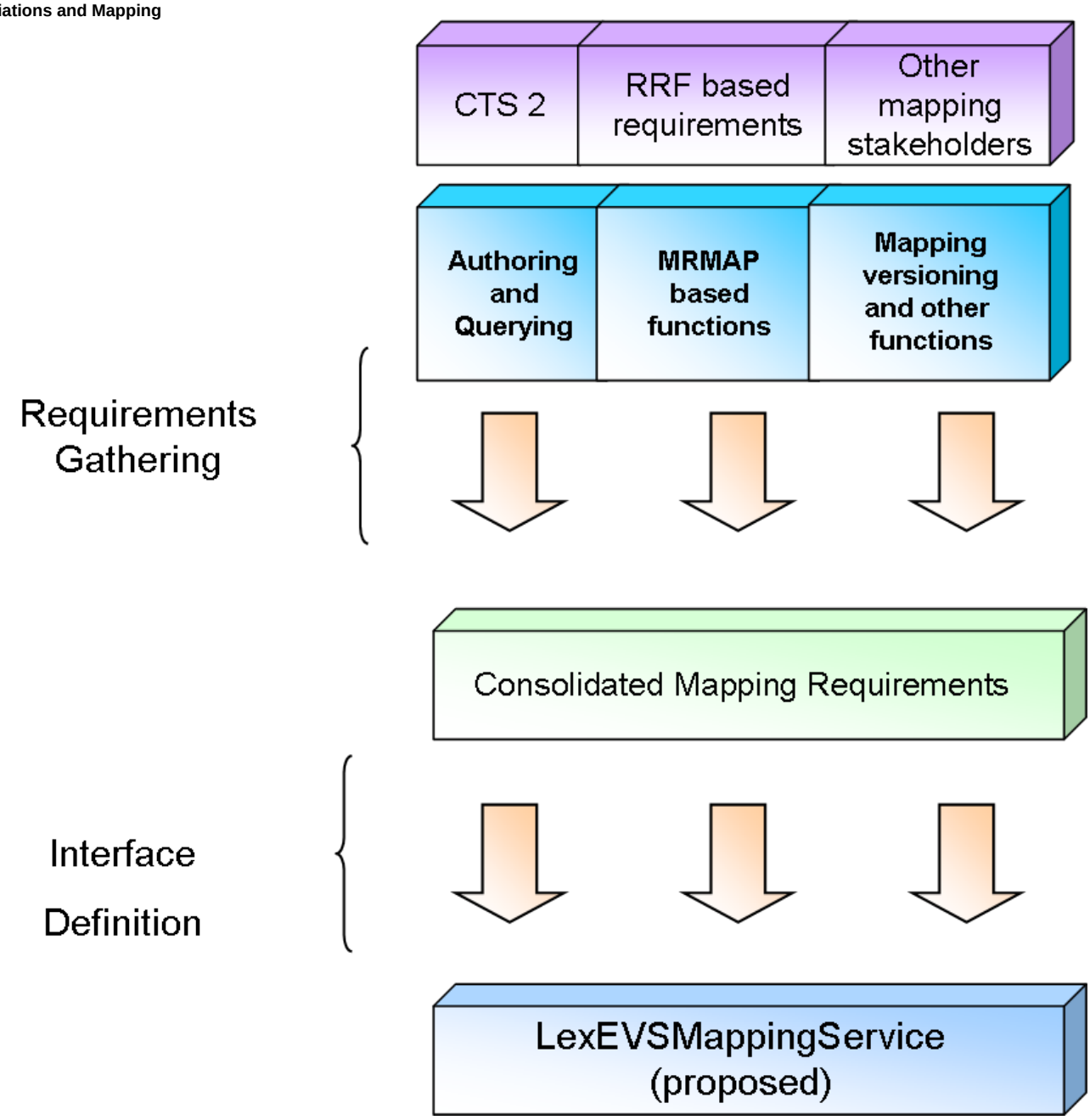
Revision History

Version	Date	Description of Changes	Author
1.0	5/14/10	Initial Version Approved via Design Review	Team

Associations and Mapping



Requirements

Levels of Mapping Implementation implied by current requirements from various stakeholders

There are multiple levels at which mapping, as evaluated here, could be considered to be "supported":

1. The ability to store map sets, look up map sets by id, from, to and other attributes and to look up entries by source, target and/or relationship. We would have to store all of the additional information such as options, rules, categories, advice, etc, but it would be up to external software to interpret and evaluate the contents.
2. Everything in option 1) above plus the ability to query additional fields - give me an ordered, structured list of a mapping entry in a way that someone could write a standard interpreter to evaluate it - this would basically require the addition of a model and would most likely cause us to split from the existing relations model, as it gets into the domain of table driven rule sets.

1. Everything in 1) and, possibly 2) with the added ability to actually interpret the rules - an API that answers questions such as "What information is needed to map 231754000 (poisoning by sodium valproate) correctly?" (answer - whether barbituates, sulfonamides were present, whether combined with various substances, etc). "What does 231754000 in the presence of ... map to?

Evaluation of Levels of Mapping Implementation for CTS 2

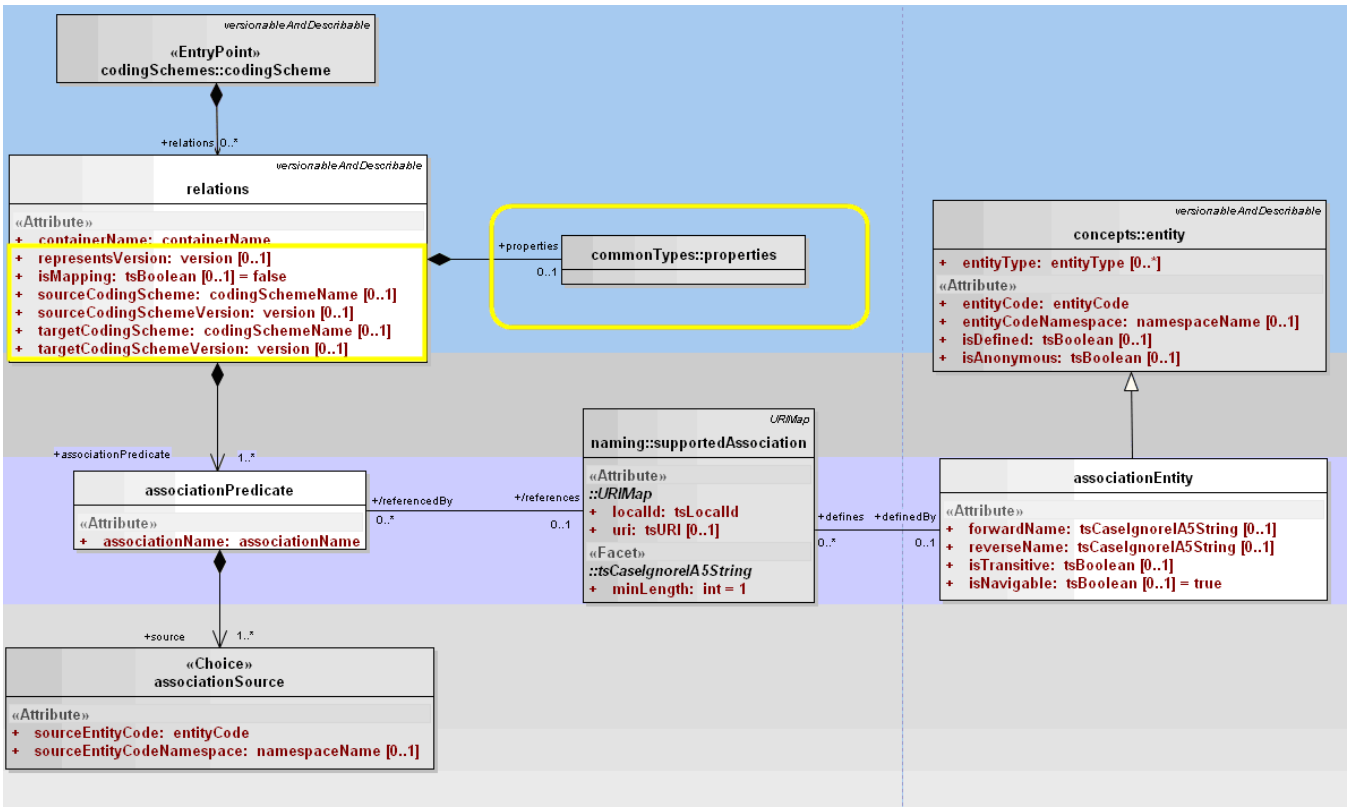
For LexEVS 6.0 (CTS 2), (3) is out of scope. This is the function of a rules engine and the complexities of even the supplied examples are overwhelming. An examination of the DSS RFP may be in order to see whether there is anything there that applies. It appears that (2) is out of scope as well, as, whether the semantics of the rules are interpreted or not, the structure required to represent the rules still lies well within the rule base and DSS space. The question is, then, whether item (1) adds sufficient value to be worth doing. Our proposal is that it is not.

Since trying to fit all of the various aspects of the mapping rules that have been seen to date into the nooks and crannies of the LexGrid mapping model seems to be an exercise with little return. What is needed is to return to the set of use cases, if any, that LexEVS could reasonably resolve. As there *are* simpler use cases, such as those presented by various stakeholders, these use cases will need to be resolved, and if it would be useful, answer the same questions for complex mappings. Once consideration of these issues gets to the point of determining what participates in a particular map the implementation appears to be getting out of our scope - the best that might be done is supply the associationId that could be used as an index into another table.

Implications for CTS 2 Mapping Implementation

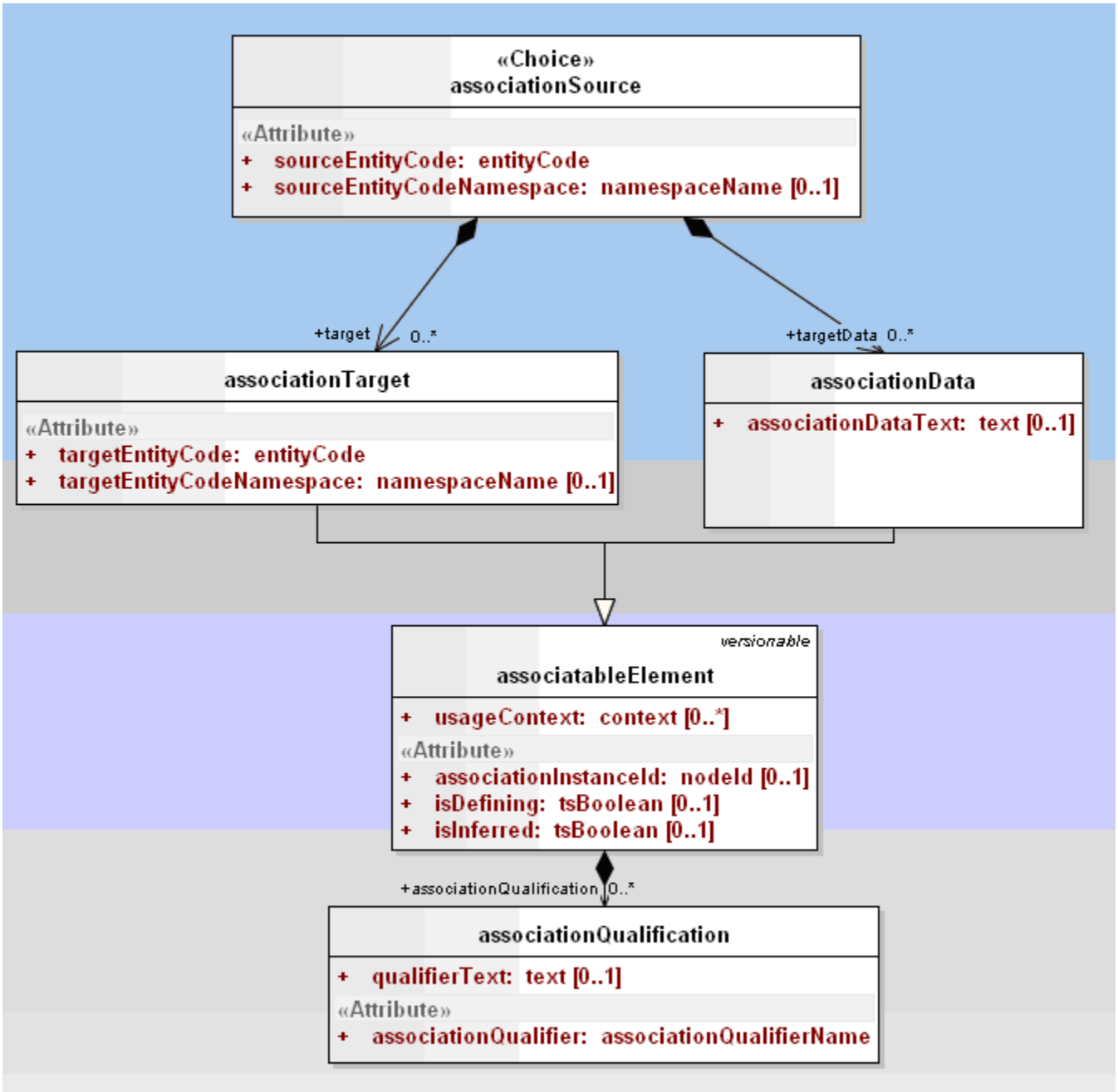
CTS 2 Function	Description	Scope
Update Association Status	Update the status of a association (active, inactive, canceled etc). This allows the ability to activate or inactivate a given association, thus changing its availability for access by other terminology service functions	In scope for authoring API
Create Association	Relates a single specific coded concept within a specified code system (source) to a corresponding single specific coded concept (target) within the same or another code system, including identification of a specified Association type.	In scope for authoring. Querying already supported
Create Lexical Association between Coded Concepts	Relates a set of one or more coded concepts within a specified code system (source)to a corresponding set of one or more coded concepts (target) within that system or another code system using a set of lexical rules (matching algorithms) to generate the Association. The "Source Search Criteria" allows for identification of a subset of the Source Code System to apply the matching algorithm to, if required (this may include limiting the version of the code system).	Not in scope for CTS 2
Create Rules Based Association between Coded Concepts	Relates a set of zero or more coded concepts within a specified code system (source)to a corresponding set of zero or more coded concepts (target) within that system or another code system using a set of description logic or inference rules that either assert or infer Associations. The "Source Search Criteria" allows for identification of a subset of the Source Code System to apply the matching algorithm too, if required (this may include limiting the version of the code system).	Not in scope for CTS 2

Proposed Solution - Model Changes



The relations attribute in the model will have the following elements and attributes added:

- representsVersion - if present, the source asserted version of the collection of relations or mappings
- isMapping - if true, this collection of relations represents a mapping and will be evaluated for "mapping" related queries.
- sourceCodingScheme - if present, the local identifier of the namespace that the sourcEntityCodes are derived from.
- sourceCodingSchemeVersion - the source asserted version identifier of the source coding scheme. If present, this becomes the default for sourceEntityCodeNamespace.
- targetCodingScheme - if present, the local identifier of the namespace that the targetEntityCodes are derived from. If present, this becomes the default for targetEntityCodeNamespace.
- targetCodingSchemeVersion - the source asserted version identifier of the target coding scheme
- properties - all other properties on the "relations bucket" level that don't fit one of the items in the Relations container



There are no additional changes for the second part of the model, shown above.

Content Representation

MRSAT Mappings

MRSAT Column	Function	LexGrid Equivalent

MAPSETVERSION		Relations.representsVersion
FROMVSAB	The from code system version	Relations.fromCodingSchemeVersion
FROMRSAB	The from code system	Relations.FromCodingScheme
TOVSAB	The to code system version	Relations.toCodingSchemeVersion
TORSAB	The to code system	Relations.toCodingScheme
MAPSETRSAB	Source of the value set	Relations.owner
(anything else)		Relations.property[EVS:key]

MRMAP Mappings

There are at least two possibilities for the MRMAP transformations into LexGrid. The first, the "flattened transformation" puts the entire MRMAP row into the table.

MRMAP Flattened Option

MRMAP Column	Function	LexGrid Equivalent
MAPSETCUI		Relations.containerName
MAPID	Row identifier	Target.associationInstanceId
FROMEXPR	Source code or expression	Source.sourceEntityCode
REL	UMLS asserted relationship	associationPredicate (if RELA absent)
RELA	Source asserted relationship	associationPredicate(if not blank)
TOEXPR	Target code or expression	Target.targetEntityCode (if code) TargetData.associationDataText (else)
TOTYPE	Type of the data	targetData.associationDataText.dataType (if target is not code)
(entire MRMAP row		Target(Data).associationQualification[EVS:MRMAP entry]

MRMAP Expanded Option

MRMAP Column	Function	LexGrid Equivalent
MAPSETCUI		Relations.containerName
MAPID	Row identifier	Target.associationInstanceId
FROMEXPR	Source code or expression	Source.sourceEntityCode
REL	UMLS asserted relationship	associationPredicate (if RELA absent)
RELA	Source asserted relationship	associationPredicate(if not blank)
TOEXPR	Target code or expression	Target.targetEntityCode (if code) TargetData.associationDataText (else)
TOTYPE	Type of the data	targetData.associationDataText.dataType (if target is not code)
(anything else)		Target(Data).associationQualification[EVS:associationQualifier]

Expression Issues

One of the requirements for mapping has been the ability to discover what maps a given entity (may) participate in. This will not be completely answerable in situations where the codes are carried in text expressions. One alternativ would be to parse the target expression when possible and to create multiple rows, one for each target. Besides the parsing complexity, however, the other issue is that it is not possible to record the expression operators (AND, OR, ...) in the expansion. This, however, would arguably be the best use of the mappings for this level of complexity.

Sample Mapping XML

```
<?xml version="1.0" encoding="UTF-8" ?>
- <codingScheme xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://LexGrid.org
/schema/2010/01/LexGrid/codingSchemes file:/C:/devel/v6/lexgrid_model/lgModel/master/relations.xsd" xmlns="
http://LexGrid.org/schema/2010/01/LexGrid/codingSchemes" xmlns:lgBuiltin="http://LexGrid.org/schema/2010/01
/LexGrid/builtins" xmlns:lgCS="http://LexGrid.org/schema/2010/01/LexGrid/codingSchemes" xmlns:lgCon="
http://LexGrid.org/schema/2010/01/LexGrid/concepts" xmlns:lgCommon="http://LexGrid.org/schema/2010/01/LexGrid
/commonTypes" codingSchemeName="UMLS" codingSchemeURI="urn:oid:2.16.840.1.113883.6.2" representsVersion="
```

```
http://SharedNames.org/ontology/umls/2009AB">
  <mappings />
- <!--  MRSAT entry
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT115321814||MAPSETVERSION|MTH|2010_2009_08_17|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT115321815||TOVSAB|MTH|MSH2010_2009_08_17|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37361323||FROMRSAB|MTH|MTH|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37361327||FROMVSAB|MTH|MTH|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37361343||MAPSETGRAMMAR|MTH|ATX ::= expr; expr ::=
disj; disj ::= conj , conj "OR" conj; conj ::= unary , unary "AND" unary; unary ::= neg , pos; neg ::= "NOT"
pos; pos ::= "(" expr ")" , slash , atom; slash ::= atom , atom "/" atom; atom ::= "<" (any non ">" character)
">";|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37361355||MAPSETRSAB|MTH|MTH|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37361364||MAPSETTYPE|MTH|ATX|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37361368||MAPSETVSAB|MTH|MTH|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37408395||TORSAB|MTH|MSH|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37424062||SOS|MTH|This map set contains mappings from
Metathesaurus CUIs to MSH associated expressions.|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT56870375||MTH_MAPFROMEXHAUSTIVE|MTH|N|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT56870378||MTH_MAPSETCOMPLEXITY|MTH|ONE_TO_ONE|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT56870384||MTH_MAPTOEXHAUSTIVE|MTH|N|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT65576316||MTH_MAPFROMCOMPLEXITY|MTH|SINGLE CUI|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT65576317||MTH_MAPTOCOMPLEXITY|MTH|BOOLEAN_EXPRESSION
STR|N||
        C1306694|L8923988|S11111536|A17029750|CODE|1000|AT67813929||MAPSETSID|MTH|1000|N||
        C1306694||||CUI||AT116199817||MR|MTH|20090921|N||
        C1306694||||CUI||AT31823722||DA|MTH|20040415|N||
        C1306694||||CUI||AT31952620||ST|MTH|R|N||
  -->
- <!--  OPTION 1: Everything flattened
  -->
- <lgCS:relations containerName="C1306694" isMapping="true" sourceCodingScheme="MTH" sourceCodingSchemeVersion="
MTH" targetCodingScheme="MSH" targetCodingSchemeVersion="MSH2010_2009_08_17" representsVersion="
2010_2009_08_17" xmlns="http://LexGrid.org/schema/2010/01/LexGrid/relations">
- <!--  This should be MAPSETNAME but, curiously, it is missing from the MRSAT list. We are assuming that "SOS"
is the equivalent
  -->
  <lgCommon:entityDescription>This map set contains mappings from Metathesaurus CUIs to MSH associated
expressions.</lgCommon:entityDescription>
- <properties>
- <lgCommon:property propertyName="MAPSETGRAMMER">
  <lgCommon:value>ATX ::= expr; expr ::= disj; disj ::= conj , conj "OR" conj; conj ::= unary , unary "AND"
unary; unary ::= neg , pos; neg ::= "NOT" pos; pos ::= "(" expr ")" , slash , atom; slash ::= atom , atom "/"
atom; atom ::= ">" (any non ">" character) ">";</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MAPSETRSAB">
  <lgCommon:value>MTH</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MAPSETTYPE">
  <lgCommon:value>ATX</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MAPSETVSAB">
  <lgCommon:value>MTH</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MTH_MAPFROMEXHAUSTIVE">
  <lgCommon:value>MTH</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MTH_MAPSETCOMPLEXITY">
  <lgCommon:value>MTH</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MTH_MAPTOEXHAUSTIVE">
  <lgCommon:value>MTH</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MTH_MAPFROMCOMPLEXITY">
  <lgCommon:value>MTH</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MTH_MAPTOCOMPLEXITY">
  <lgCommon:value>MTH</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MR">
  <lgCommon:value>20090921</lgCommon:value>
  </lgCommon:property>
```

```
- <lgCommon:property propertyName="DA">
  <lgCommon:value>20040415</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="ST">
  <lgCommon:value>R</lgCommon:value>
  </lgCommon:property>
  </properties>
- <!--  MAPSETCUI|MAPSAB|MAPSUBSETID|MAPRANK|MAPID      |MAPSID|FROMID
|FROMSID|FROMEXPR|FROMTYPE|FROMRULE|FROMRES|REL|RELA
             C1306694 |MTH   |           |       |AT102971857|      |C0264643|       |C0264643|CUI     |
|       |SY |
             |TOID|TOSID|TOEXPR                                                              |TOTYPE
|TORULE|TORES|MAPRULE|MAPRES|MAPTYPE|MAPATN|MAPATV
             |3026|     |<Hypertension, Renovascular> AND <Hypertension,
Malignant>|BOOLEAN_EXPRESSION_STR|      |     |       |      |ATX    |      |      ||
  -->
- <associationPredicate associationName="SY">
- <!--  MRMAP Option 1 - Expand each non-semantic MRMAP entry
  -->
- <source sourceEntityCode="C0264643">
- <targetData associationInstanceId="AT102971857">
- <associationQualification associationQualifier="FROMTYPE">
  <qualifierText>CUI</qualifierText>
  </associationQualification>
- <associationQualification associationQualifier="FROMID">
  <qualifierText>C0264643</qualifierText>
  </associationQualification>
- <associationQualification associationQualifier="TOTYPE">
  <qualifierText>BOOLEAN_EXPRESSION_STR</qualifierText>
  </associationQualification>
- <associationQualification associationQualifier="TOID">
  <qualifierText>3026</qualifierText>
  </associationQualification>
- <associationQualification associationQualifier="MAPTYPE">
  <qualifierText>ATX</qualifierText>
  </associationQualification>
  <associationDataText dataType="BOOLEAN_EXPRESSION_STR">>Hypertension, Renovascular> AND >Hypertension,
Malignant></associationDataText>
  </targetData>
  </source>
- <!--  MRMAP Option 2 - Keep MRMAP entry as it is
  -->
- <source sourceEntityCode="C0264643">
- <targetData associationInstanceId="AT102971857">
- <associationQualification associationQualifier="MRMAP Entry">
  <qualifierText>C1306694|MTH|||AT102971857||C0264643||C0264643|CUI|||SY||3026||>Hypertension, Renovascular>
AND >Hypertension, Malignant>|BOOLEAN_EXPRESSION_STR|||||ATX||||</qualifierText>
  </associationQualification>
  <associationDataText dataType="BOOLEAN_EXPRESSION_STR">>Hypertension, Renovascular> AND >Hypertension,
Malignant></associationDataText>
  </targetData>
  </source>
- <!--  TARGET Option 2 - Semantic interpretation of the target entry
  -->
- <!--  NOTE That this loses the operators, but (assuming that the target entries were codes), would maintain
the participation
  -->
- <source sourceEntityCode="C0264643">
- <target targetEntityCode="Hyptertension, Renovascular" associationInstanceId="AT102971857.1">
- <associationQualification associationQualifier="MRMAP Entry">
  <qualifierText>C1306694|MTH|||AT102971857||C0264643||C0264643|CUI|||SY||3026||>Hypertension, Renovascular>
AND >Hypertension, Malignant>|BOOLEAN_EXPRESSION_STR|||||ATX||||</qualifierText>
  </associationQualification>
  </target>
- <target targetEntityCode="Hypertension, Malignant" associationInstanceId="AT102971857.2">
- <associationQualification associationQualifier="MRMAP Entry">
  <qualifierText>C1306694|MTH|||AT102971857||C0264643||C0264643|CUI|||SY||3026||>Hypertension, Renovascular>
AND >Hypertension, Malignant>|BOOLEAN_EXPRESSION_STR|||||ATX||||</qualifierText>
  </associationQualification>
  </target>
  </source>
```

```
  </associationPredicate>
  </lgCS:relations>
- <!--
        C2242749|L8609359|S10707041|A16492852|CODE|MTHU000002|AT110721471||FROMVSAB|MDR|MDR12_0|N||
        C2242749|L8609359|S10707041|A16492852|CODE|MTHU000002|AT110721473||MAPSETVERSION|MDR|200903|N||
        C2242749|L8609359|S10707041|A16492852|CODE|MTHU000002|AT110721475||MAPSETVSAB|MDR|MDR12_0|N||
        C2242749|L8609359|S10707041|A16492852|CODE|MTHU000002|AT90562335||FROMRSAB|MDR|MDR|N||
        C2242749|L8609359|S10707041|A16492852|CODE|MTHU000002|AT90562339||MAPSETRSAB|MDR|MDR|N||
        C2242749|L8609359|S10707041|A16492852|CODE|MTHU000002|AT90562341||MAPSETTYPE|MDR|MedDRA to ICD9CM
Mappings|N||
        C2242749|L8609359|S10707041|A16492852|CODE|MTHU000002|AT90580448||MTH_MAPFROMCOMPLEXITY|MDR|SINGLE
CODE|N||
        C2242749|L8609359|S10707041|A16492852|CODE|MTHU000002|AT90580450||MTH_MAPFROMEXHAUSTIVE|MDR|N|N||

C2242749|L8609359|S10707041|A16492852|CODE|MTHU000002|AT90580452||MTH_MAPSETCOMPLEXITY|MDR|ONE_TO_ONE|N||
        C2242749|L8609359|S10707041|A16492852|CODE|MTHU000002|AT90580454||MTH_MAPTOCOMPLEXITY|MDR|SINGLE
CODE|N||
        C2242749|L8609359|S10707041|A16492852|CODE|MTHU000002|AT90580456||MTH_MAPTOEXHAUSTIVE|MDR|N|N||
        C2242749|L8609359|S10707041|A16492852|CODE|MTHU000002|AT91157709||TORSAB|MDR|ICD9CM|N||
        C2242749|L8609359|S10707041|A16492852|CODE|MTHU000002|AT91157711||TOVSAB|MDR|ICD9CM_1998|N||
        C2242749|||CUI||AT101551784||DA|MTH|20081103|N||
        C2242749|||CUI||AT102850765||ST|MTH|R|N||
        C2242749|||CUI||AT116202416||MR|MTH|20090926|N||

  -->
- <!--  Should this be the code or "MTHU000002"?
  -->
- <lgCS:relations containerName="C2242749" sourceCodingScheme="MDR" sourceCodingSchemeVersion="MDR12_0"
targetCodingScheme="ICD9CM" targetCodingSchemeVersion="ICD9CM_1998" representsVersion="200903" xmlns="
http://LexGrid.org/schema/2010/01/LexGrid/relations">
  <lgCommon:owner>MDR</lgCommon:owner>
- <!--  This should be MAPSETNAME but, curiously, it is missing from the MRSAT list
  -->
  <lgCommon:entityDescription>This map set contains mappings from Metathesaurus CUIs to MSH associated
expressions.</lgCommon:entityDescription>
- <properties>
- <lgCommon:property propertyName="MAPSETTYPE">
  <lgCommon:value>MedDRA to ICD9CM Mappings</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MTH_MAPFROMCOMPLEXITY">
  <lgCommon:value>SINGLE CODE</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MTH_MAPFROMEXHAUSTIVE">
  <lgCommon:value>N</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MTH_MAPSETCOMPLEXITY">
  <lgCommon:value>ONE_TO_ONE</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MTH_MAPTOCOMPLEXITY">
  <lgCommon:value>SINGLE CODE</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MTH_MAPTOEXHAUSTIVE">
  <lgCommon:value>MedDRA to ICD9CM Mappings</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MAPSETTYPE">
  <lgCommon:value>N</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="DA">
  <lgCommon:value>20081103</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="ST">
  <lgCommon:value>R</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MR">
  <lgCommon:value>20090926</lgCommon:value>
  </lgCommon:property>
  </properties>
- <!--  MAPSETCUI|MAPSAB|MAPSUBSETID|MAPRANK|MAPID      |MAPSID|FROMID
|FROMSID|FROMEXPR|FROMTYPE|FROMRULE|FROMRES|REL|RELA
            C2242749 |MDR   |           |       |AT91157713 |      |10032725|       |10032725|CODE    |
|       |RQ |mapped_to
```

```
            |TOID |TOSID|TOEXPR |TOTYPE                |TORULE|TORES|MAPRULE|MAPRES|MAPTYPE|MAPATN|MAPATV
            |728.7|     |728.7  |CODE                  |||||||||
  -->
- <associationPredicate associationName="mapped_to">
- <!--  Note that "RQ" gets lost in this approach...
  -->
- <source sourceEntityCode="10032725">
- <target targetEntityCode="728.7" associationInstanceId="AT91157713">
- <associationQualification associationQualifier="FROMTYPE">
  <qualifierText>CODE</qualifierText>
  </associationQualification>
- <associationQualification associationQualifier="FROMID">
  <qualifierText>10032725</qualifierText>
  </associationQualification>
- <associationQualification associationQualifier="TOID">
  <qualifierText>728.7</qualifierText>
  </associationQualification>
  </target>
  </source>
  </associationPredicate>
  </lgCS:relations>
- <!--  C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT106958256||MAPSETRSAB|ICD10PCS|ICD10PCS|N||

C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT106958265||MTH_MAPFROMCOMPLEXITY|ICD10PCS|SINGLE
SDUI|N||
        C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT106958266||MTH_MAPFROMEXHAUSTIVE|ICD10PCS|N|N||

C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT106958268||MTH_MAPSETCOMPLEXITY|ICD10PCS|N_TO_N|N||
        C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT106958270||MTH_MAPTOEXHAUSTIVE|ICD10PCS|N|N||
        C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT106958273||TORSAB|ICD10PCS|ICD10PCS|N||
        C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT112240306||FROMRSAB|ICD10PCS|ICD9CM|N||
        C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT112240309||FROMVSAB|ICD10PCS|ICD9CM_2009|N||
        C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT112240314||MAPSETTYPE|ICD10PCS|ICD-9-CM to ICD-
10-PCS Mappings (GEMs)|N||
        C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT112240316||MAPSETVERSION|ICD10PCS|2009|N||
        C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT112240319||MAPSETVSAB|ICD10PCS|ICD10PCS_2009|N||
        C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT112240322||MAPSETXRTARGETID|ICD10PCS|NoPCS|N||
        C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT112240327||MTH_MAPTOCOMPLEXITY|ICD10PCS|SINGLE
SCUI|N||
        C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT112240330||SOS|ICD10PCS|This set maps ICD-9-CM
codes to ICD-10-PCS. These are "General Equivalence Mappings" (GEMs) and are rule-based.|N||
        C2603385|L8770856|S10872372|A16736317|CODE|MTHU000001|AT112240336||TOVSAB|ICD10PCS|ICD10PCS_2009|N||
        C2603385||||CUI||AT109499260||DA|MTH|20090401|N||
        C2603385||||CUI||AT110315629||ST|MTH|R|N||
        C2603385||||CUI||AT116202419||MR|MTH|20090926|N||
  -->
- <lgCS:relations containerName="C2603385" sourceCodingScheme="ICD9CM" sourceCodingSchemeVersion="ICD9CM_2009"
targetCodingScheme="ICD10PCS" targetCodingSchemeVersion="ICD10PCS_2009" representsVersion="ICD10PCS_2009"
xmlns="http://LexGrid.org/schema/2010/01/LexGrid/relations">
  <lgCommon:owner>ICD10PCS</lgCommon:owner>
  <lgCommon:entityDescription>This set maps ICD-9-CM codes to ICD-10-PCS. These are "General Equivalence
Mappings" (GEMs) and are rule-based.</lgCommon:entityDescription>
- <properties>
- <lgCommon:property propertyName="MTH_MAPFROMCOMPLEXITY">
  <lgCommon:value>SINGLE SDUI</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MTH_MAPFROMEXHAUSTIVE">
  <lgCommon:value>N</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MTH_MAPSETCOMPLEXITY">
  <lgCommon:value>N_TO_N</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MTH_MAPTOEXHAUSTIVE">
  <lgCommon:value>N</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MAPSETVERSION">
  <lgCommon:value>2009</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MAPSETXRTARGETID">
  <lgCommon:value>NoPCS</lgCommon:value>
  </lgCommon:property>
```

```
- <lgCommon:property propertyName="MTH_MAPTOCOMPLEXITY">
  <lgCommon:value>SINGLE SCUI</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="DA">
  <lgCommon:value>20090401</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="ST">
  <lgCommon:value>R</lgCommon:value>
  </lgCommon:property>
- <lgCommon:property propertyName="MR">
  <lgCommon:value>20090926</lgCommon:value>
  </lgCommon:property>
  </properties>
- <!--  MAPSETCUI|MAPSAB  |MAPSUBSETID|MAPRANK|MAPID      |MAPSID|FROMID
|FROMSID|FROMEXPR|FROMTYPE|FROMRULE|FROMRES|REL|RELA
         C2603385 |ICD10PCS|0:0        |       |AT106958276|      |86.63   |       |86.63   |SDUI    |
|       |RO |approximately_mapped_to
         |TOID   |TOSID|TOEXPR |TOTYPE |TORULE|TORES|MAPRULE|MAPRES|MAPTYPE|MAPATN|MAPATV
         |0HR6X73|     |0HR6X73|SCUI   |||||||||
  -->
- <associationPredicate associationName="approximately_mapped_to">
- <!--  Note that "RO" gets lost in this approach...
  -->
- <source sourceEntityCode="86.63">
- <target targetEntityCode="0HR6X73" associationInstanceId="AT106958276">
- <!--  NOTE: This does NOT imply any ordering in the way that map entries are returned !
  -->
- <associationQualification associationQualifier="MAPSUBSETID">
  <qualifierText>0:0</qualifierText>
  </associationQualification>
- <associationQualification associationQualifier="FROMTYPE">
  <qualifierText>SDUI</qualifierText>
  </associationQualification>
- <associationQualification associationQualifier="FROMID">
  <qualifierText>86.63</qualifierText>
  </associationQualification>
- <associationQualification associationQualifier="TOTYPE">
  <qualifierText>SCUI</qualifierText>
  </associationQualification>
- <associationQualification associationQualifier="TOID">
  <qualifierText>0HR6X73</qualifierText>
  </associationQualification>
  </target>
  </source>
  </associationPredicate>
- <associationPredicate associationName="XR">
- <!--  Note that approximately_mapped_to goes away.  This may not be what we want?
  -->
- <!--  MAPSETCUI|MAPSAB  |MAPSUBSETID|MAPRANK|MAPID      |MAPSID|FROMID
|FROMSID|FROMEXPR|FROMTYPE|FROMRULE|FROMRES|REL|RELA
                C2603385 |ICD10PCS|0:0        |       |AT112240364|      |89.03   |       |89.03   |SDUI
|        |       |XR ||||||||||||||
               |TOID   |TOSID|TOEXPR |TOTYPE |TORULE|TORES|MAPRULE|MAPRES|MAPTYPE|MAPATN|MAPATV
               ||||||||||||||
  -->
- <source sourceEntityCode="89.03">
- <target targetEntityCode="NoPCS" associationInstanceId="AT112240364">
- <associationQualification associationQualifier="MAPSUBSETID">
  <qualifierText>0:0</qualifierText>
  </associationQualification>
- <associationQualification associationQualifier="FROMTYPE">
  <qualifierText>SDUI</qualifierText>
  </associationQualification>
- <associationQualification associationQualifier="FROMID">
  <qualifierText>86.63</qualifierText>
  </associationQualification>
- <associationQualification associationQualifier="TOID">
  <qualifierText>NoPCS</qualifierText>
- <!--  This is derived from the MAPSETXRTARGETID property in MRSAT
  -->
  </associationQualification>
```

```
  </target>
  </source>
  </associationPredicate>
  </lgCS:relations>
  </codingScheme>
```

A UMLS Example

Taking the first row in the MRMAP.RRF table (UMLS 2009AB) as an example, we have:

```
C1306694|MTH|||AT102971857||C0264643||C0264643|CUI|||SY||3026||<Hypertension, Renovascular> AND <Hypertension,
Malignant>|BOOLEAN_EXPRESSION_STR|||||ATX||||
```

And the corresponding MRSAT rows for this mapping are:

```
CUI      LUI      SUI       METAUI    STYPE CODE  ATUI           ATN     SAB        ATV        SUPPRESS CVF
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT115321814||MAPSETVERSION|MTH|2010_2009_08_17|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT115321815||TOVSAB|MTH|MSH2010_2009_08_17|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37361323 ||FROMRSAB|MTH|MTH|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37361327 ||FROMVSAB|MTH|MTH|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37361343 ||MAPSETGRAMMAR|MTH|ATX ::= expr; expr ::= disj;
disj ::= conj , conj "OR" conj; conj ::= unary , unary "AND" unary; unary ::= neg , pos; neg ::= "NOT" pos; pos
::= "(" expr ")" , slash , atom; slash ::= atom , atom "/" atom; atom ::= "<" (any non ">" character) ">";|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37361355 ||MAPSETRSAB|MTH|MTH|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37361364 ||MAPSETTYPE|MTH|ATX|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37361368 ||MAPSETVSAB|MTH|MTH|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37408395 ||TORSAB|MTH|MSH|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT37424062 ||SOS|MTH|This map set contains mappings from
Metathesaurus CUIs to MSH associated expressions.|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT56870375 ||MTH_MAPFROMEXHAUSTIVE|MTH|N|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT56870378 ||MTH_MAPSETCOMPLEXITY|MTH|ONE_TO_ONE|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT56870384 ||MTH_MAPTOEXHAUSTIVE|MTH|N|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT65576316 ||MTH_MAPFROMCOMPLEXITY|MTH|SINGLE CUI|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT65576317 ||MTH_MAPTOCOMPLEXITY|MTH|BOOLEAN_EXPRESSION STR|N||
C1306694|L8923988|S11111536|A17029750|CODE|1000|AT67813929 ||MAPSETSID|MTH|1000|N||
C1306694|        |         |         |CUI |    |AT116199817||MR|MTH|20090921|N||
C1306694|        |         |         |CUI |    |AT31823722 ||DA|MTH|20040415|N||
C1306694|        |         |         |CUI |    |AT31952620 ||ST|MTH|R|N||
```

The corresponding Relations container would have the following characteristics

```
containerName:                                              (TBD)
entityDescription:        This map set contains mappings from Metathesaurus CUIs to MSH associated expressions.
representsVersion:                                  2010_2009_07_17
isMapping:                                                                  true
sourceCodingScheme:                                  MTH
sourceCodingSchemeVersion: MTH  (or nothing?)
targetCodingScheme:                                  MSH
targetCodingSchemeVersion: MSH2010_2009_08_17

property:        MAPSETGRAMMAR
value:    ATX ::= expr; expr ::= disj; disj ::= conj , conj "OR" conj; conj ::= unary , unary "AND" unary;
unary ::= neg , pos; neg ::= "NOT" pos; pos ::= "(" expr ")" , slash , atom; slash ::= atom , atom "/" atom;
atom ::= "<" (any non ">" character) ">";
        Note - it might be handy to use the dataType field here to encode the grammer (BNF?))
property: MAPSETRSAB
value:    MTH
property: MAPSETTYPE
value:    ATX
property: MAPSETVSAB
value:    MSH
property: MTH_MAPFROMEXHAUSTIVE
value:    N
property: MTH_MAPSETCOMPLEXITY
value:    N
property: MTH_MAPTOEXHAUSTIVE
value:    N
property: MTH_MAPTOCOMPLEXITY
value:    BOOLEAN_EXPRESSION_STRING
property: MR
value:    20090921
property: DA
value:    20040415
property: ST
value:    R
  Note: it may be that the last couple of fields may map into the versionable characteristics of the relations
container
value:    20090921
```

The MRMAP entry below is an example of a mapping that is complex enough that it can't be completely interpreted by the existing API

```
MAPSETCUI|MAPSETSAB| |MAPSID     ||FROMEXPR||FROMRULE|     RELA
TOSID|TOEXPR                                                    |TOTYPE
C1306694 |MTH      |||AT102971857||C0264643||C0264643|CUI|||SY||3026||<Hypertension, Renovascular> AND
<Hypertension, Malignant>|BOOLEAN_EXPRESSION_STR|||||ATX||||

associationPredicate.associationName:        SY
associationSource.sourceEntityCode:          C0264643

associationTarget.targetEntityCode: Hypertension, Renovascular
        associationQualification.qualifierName: MAPSID
        associationQualification.qualifierText: AT10297857
        associationQualification.qualifierName: FROMRULE
        associationQualification.qualifierText: C026463
  associationQualification.qualifierName: FROMEXPR
        associationQualification.qualifierText: C0264643
        associationQualification.qualifierName: FROMRULE
        associationQualification.qualifierText: C0264643
        associationQualification.qualifierName: FROMTYPE
        associationQualification.qualifierText: CUI
        associationQualification.qualifierName: TOSID
        associationQualification.qualifierText: 3026
        associationQualification.qualifierName: TOEXPR
        associationQualification.qualifierText: <Hypertension, Renovascular> AND <Hypertension, Malignant>
        associationQualification.qualifierName: TOTYPE
        associationQualification.qualifierText: BOOLEAN_EXPRESSION

associationTarget.targetEntityCode: Hypertension, Malignant
        associationQualification.qualifierName: MAPSID
        associationQualification.qualifierText: AT10297857
        associationQualification.qualifierName: FROMRULE
        associationQualification.qualifierText: C026463
  associationQualification.qualifierName: FROMEXPR
        associationQualification.qualifierText: C0264643
        associationQualification.qualifierName: FROMRULE
        associationQualification.qualifierText: C0264643
        associationQualification.qualifierName: FROMTYPE
        associationQualification.qualifierText: CUI
        associationQualification.qualifierName: TOSID
        associationQualification.qualifierText: 3026
        associationQualification.qualifierName: TOEXPR
        associationQualification.qualifierText: <Hypertension, Renovascular> AND <Hypertension, Malignant>
        associationQualification.qualifierName: TOTYPE
        associationQualification.qualifierText: BOOLEAN_EXPRESSION
```

An alternative representation would be:

```
associationTarget.targetEntityCode: Hypertension, Malignant
  associationQualification.qualifierName:  MRMAP_ENTRY
  associationQualification.qualifierText:  C1306694 |MTH
|||AT102971857||C0264643||C0264643|CUI|||SY||3026||<Hypertension, Renovascular> AND <Hypertension,
Malignant>|BOOLEAN_EXPRESSION_STR|||||ATX||||
associationTarget.targetEntityCode: Hypertension, Renovascular
  associationQualification.qualifierName:  MRMAP_ENTRY
  associationQualification.qualifierText:  C1306694 |MTH
|||AT102971857||C0264643||C0264643|CUI|||SY||3026||<Hypertension, Renovascular> AND <Hypertension,
Malignant>|BOOLEAN_EXPRESSION_STR|||||ATX||||
```

Summary of Mapping Implementation for LexEVS 6.0 and CTS 2

CTS 2 Function	Description

Update Association Status	Update the status of a association (active, inactive, canceled etc). This allows the ability to activate or inactivate a given association, thus changing its availability for access by other terminology service functions
Create Association	Relates a single specific coded concept within a specified code system (source) to a corresponding single specific coded concept (target) within the same or another code system, including identification of a specified Association type.
Persist MRMAP data	Creates association and qualifier for the given concept as target establishing a "map entry" with unprocessed text string from MRMAP row as qualifier value. Other values for association predicate and source pulled from MRMAP as required.