Methods and Tools for Management Information Systems

Lecture 5

22. Dezember 2009


Web Ontology Language (OWL)

- Intended to be used when the information contained in documents needs to be processed by *applications* rather than humans
- Explicitly represents the *meaning* of terms in vocabularies and the relationships between those terms
- Representation of terms and their interrelationships is called an *ontology*
- Offers more facilities for expressing meaning and semantics than XML, RDF and RDF Schema

- OWL is part of the growing stack of W3C recommendations related to the *Semantic Web*:
  - XML provides a surface syntax for structured documents, but imposes no semantic constraints on the meaning of these documents
  - XML Schema is a language for restricting the structure of XML documents and also extends XML with datatypes
  - RDF is a datamodel for objects (i. e. resources) and relations between them, provides a simple semantics for this datamodel, and these datamodels can be represented in an XML syntax
  - RDF Schema is a vocabulary for describing properties and classes of RDF resources, with a semantics for generalization-hierarchies of such properties and classes


- OWL adds more vocabulary for describing properties and classes:
  - Relations between classes (e. g. disjointness)
  - Cardinality (e. g. *exactly one*)
  - Equality
  - Richer typing of properties
  - Characteristics of properties (e. g. symmetry)
  - Enumerated classes

- OWL provides three increasingly expressive sublanguages:
  - *OWL Lite* supports classification hierarchies and simple constraints
  - *OWL DL* allows for maximum expressiveness while retaining *computational completeness* (all conclusions are guaranteed to be computable) and *decidability* (all computations will finish in finite time)
  - *OWL Full* allows for maximum expressiveness and the syntactic freedom of RDF with no computational guarantees
- Each of these sublanguages is an extension of its simpler predecessor:
  - Every legal OWL Lite ontology is a legal OWL DL ontology
  - Every legal OWL DL ontology is a legal OWL Full ontology
  - Every valid OWL Lite conclusion is a valid OWL DL conclusion
  - Every valid OWL DL conclusion is a valid OWL Full conclusion

- OWL Lite Overview:

RDF Schema Features:

- ⇒ *Class (Thing, Nothing)*
- ⇒ `rdfs:subClassOf`
- ⇒ `rdf:Property`
- ⇒ `rdfs:subPropertyOf`
- ⇒ `rdfs:domain`
- ⇒ `rdfs:range`
- ⇒ *Individual*

(In)Equality:

- ⇒ *equivalentClass*
- ⇒ *equivalentProperty*
- ⇒ *sameAs*
- ⇒ *differentFrom*
- ⇒ *AllDifferent*
- ⇒ *distinctMembers*

Property Characteristics:

- ⇒ *ObjectProperty*
- ⇒ *inverseOf*
- ⇒ *SymmetricProperty*
- ⇒ *InverseFunctionalProperty*
- ⇒ *DatatypeProperty*
- ⇒ *TransitiveProperty*
- ⇒ *FunctionalProperty*

- OWL Lite Overview (2):

Property Restrictions:
- ⇒ *Restriction*
- ⇒ *onProperty*
- ⇒ *allValuesFrom*
- ⇒ *someValuesFrom*

Header Information:
- ⇒ *Ontology*
- ⇒ *imports*

Restricted Cardinality:
- ⇒ *minCardinality*
- ⇒ *maxCardinality*
- ⇒ *cardinality*

Class Intersection:
- ⇒ *intersectionOf*

Datatypes:
- ⇒ *xsd datatypes*

- OWL Lite Overview (3):

Versioning:

- ⇒ *versionInfo*
- ⇒ *priorVersion*
- ⇒ *backwardCompatibleWith*
- ⇒ *incompatibleWith*
- ⇒ *DeprecatedClass*
- ⇒ *DeprecatedProperty*

Annotation Properties:

- ⇒ `rdfs:label`
- ⇒ `rdfs:comment`
- ⇒ `rdfs:seeAlso`
- ⇒ `rdfs:isDefinedBy`
- ⇒ *AnnotationProperty*
- ⇒ *OntologyProperty*

- OWL DL and Full Overview:

Class Axioms:

⇒ *oneOf*
⇒ *disjointWith*
⇒ *equivalentClass* (applied to class expressions)
⇒ `rdfs:subClassOf` (applied to class expressions)

Arbitrary Cardinality:

⇒ *minCardinality*
⇒ *maxCardinality*
⇒ *cardinality*

Boolean Combinations of Class Expressions:

⇒ *unionOf*
⇒ *complementOf*
⇒ *intersectionOf*

Filler Information::

⇒ *hasValue*

Class:

⇒ A group of individuals that belong together because they share some properties

⇒ Classes can be organized in a specialization hierarchy using `subClassOf`

⇒ There is a built-in most general class named `Thing` that is the class of all individuals and is a superclass of all OWL classes

⇒ There is also a built-in most specific class named `Nothing` that is the class that has no instances and a subclass of all OWL classes

Example:

```
<owl:Class rdf:ID="Winery"/>
<owl:Class rdf:ID="Region"/>
<owl:Class rdf:ID="ConsumableThing"/>
```

rdfs:subClassOf:

⇒ Class hierarchies may be created by making one or more statements that a class is a subclass of another class

⇒ May only be used in conjunction with single class names (as opposed to OWL DL and Full)

Example:

```
<owl:Class rdf:ID="Wine">
  <rdfs:subClassOf rdf:resource="&food;PotableLiquid"/>
  <rdfs:label xml:lang="fr">vin</rdfs:label>
</owl:Class>
<owl:Class rdf:ID="Pasta">
  <rdfs:subClassOf rdf:resource="#EdibleThing"/>
</owl:Class>
```

`rdf:Property:`

⇒ Properties can be used to state relationships between individuals (`owl:ObjectProperty`) or from individuals to XSD data values and RDF literals (`owl:DatatypeProperty`)

⇒ `owl:ObjectProperty` and `owl:DatatypeProperty` are subclasses of the RDF class `rdf:Property`

Example:

```
<owl:ObjectProperty rdf:ID="madeFromGrape">
  <rdfs:domain rdf:resource="#Wine"/>
  <rdfs:range rdf:resource="#WineGrape"/>
</owl:ObjectProperty>
```


rdfs:subPropertyOf:

⇒ Property hierarchies may be created by making one or more statements that a property is a subproperty of one or more other properties

Example:

```
<owl:ObjectProperty rdf:ID="hasWineDescriptor">
  <rdfs:domain rdf:resource="#Wine" />
  <rdfs:range  rdf:resource="#WineDescriptor"/>
</owl:ObjectProperty>

<owl:ObjectProperty rdf:ID="hasColor">
  <rdfs:subPropertyOf rdf:resource="#hasWineDescriptor"/>
  <rdfs:range rdf:resource="#WineColor"/>
</owl:ObjectProperty>
```


`rdfs:domain:`

⇒ A domain of a property limits the individuals to which the property can be applied

Example:

```
<owl:ObjectProperty rdf:ID="madeFromGrape">
  <rdfs:domain rdf:resource="#Wine"/>
  <rdfs:range rdf:resource="#WineGrape"/>
</owl:ObjectProperty>
```

`rdfs:range:`

⇒ The range of a property limits the individuals that the property may have as its value

Example:

```
<owl:ObjectProperty rdf:ID="madeFromGrape">
  <rdfs:domain rdf:resource="#Wine"/>
  <rdfs:range rdf:resource="#WineGrape"/>
</owl:ObjectProperty>
```


Individual:

⇒ Individuals are instances of classes, and properties may be used to relate one individual to another

Example:

```
<owl:Thing rdf:ID="CentralCoastRegion"/>
<owl:Thing rdf:about="#CentralCoastRegion">
   <rdf:type rdf:resource="#Region"/>
</owl:Thing>

<WineGrape rdf:ID="CabernetSauvignonGrape"/>
```

equivalentClass:

⇒ Two classes may be stated to be equivalent

⇒ May only be used in conjunction with single class names (as opposed to OWL DL and Full)

⇒ Equivalent classes have the same instances

⇒ Equality can be used to create synonymous classes

Example:

```
<owl:Class rdf:ID="Wine">
  <owl:equivalentClass rdf:resource="&vin;Wine"/>
</owl:Class>
```

equivalentProperty:

⇒ Two properties may be stated to be equivalent

⇒ Equivalent properties have the same range and domain

⇒ Equality can be used to create synonymous properties

Example:

```
<rdf:Property rdf:ID="weight">
  <owl:equivalentProperty rdf:resource="&ex;weight"/>
</rdf:Property>
```


sameAs:

⇒ Two individuals may be stated to be the same

⇒ These constructs may be used to create a number of different names that refer to the same individual

Example:

```
<Wine rdf:ID="MikesFavoriteWine">
  <owl:sameAs rdf:resource="#TexasWhite"/>
</Wine>
```

differentFrom:

⇒ An individual may be stated to be different from other individuals

Example:

```
<WineSugar rdf:ID="Dry"/>

<WineSugar rdf:ID="Sweet">
  <owl:differentFrom rdf:resource="#Dry"/>
</WineSugar>
```

AllDifferent:

⇒ A number of individuals may be stated to be mutually distinct in one statement

⇒ Particularly useful when there are sets of distinct objects and when modelers are interested in enforcing the unique names assumption within those sets of objects

Example:

```
<owl:AllDifferent>
  <owl:distinctMembers rdf:parseType="Collection">
    <vin:WineColor rdf:about="#Red"/>
    <vin:WineColor rdf:about="#White"/>
  </owl:distinctMembers>
</owl:AllDifferent>
```

distinctMembers:

⇒ All members of a list are distinct and pairwise disjoint

⇒ Can only be used in combination with `owl:AllDifferent`

Example:

```
<owl:AllDifferent>
  <owl:distinctMembers rdf:parseType="Collection">
    <vin:WineColor rdf:about="#Red"/>
    <vin:WineColor rdf:about="#White"/>
  </owl:distinctMembers>
</owl:AllDifferent>
```


inverseOf:

$\Rightarrow$ One property may be stated to be the inverse of another property:

$P_1(x, y) \Rightarrow P_2(y, x)$

Example:

```
<owl:ObjectProperty rdf:ID="hasMaker">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
</owl:ObjectProperty>

<owl:ObjectProperty rdf:ID="producesWine">
  <owl:inverseOf rdf:resource="#hasMaker"/>
</owl:ObjectProperty>
```

TransitiveProperty:

$\Rightarrow$ Properties may be stated to be transitive:

$$P(x, y) \wedge P(y, z) \Rightarrow P(x, z)$$

Example:

```
<owl:ObjectProperty rdf:ID="locatedIn">
  <rdf:type rdf:resource="&owl;TransitiveProperty"/>
  <rdfs:domain rdf:resource="&owl;Thing"/>
  <rdfs:range rdf:resource="#Region"/>
</owl:ObjectProperty>
```

SymmetricProperty:

$\Rightarrow$ Properties may be stated to be symmetric:

$$P(x, y) \Rightarrow P(y, x)$$

Example:

```
<owl:ObjectProperty rdf:ID="adjacentRegion">
  <rdf:type rdf:resource="&owl;SymmetricProperty"/>
  <rdfs:domain rdf:resource="#Region"/>
  <rdfs:range rdf:resource="#Region"/>
</owl:ObjectProperty>
```

FunctionalProperty:

⇒ If a property is a `owl:FunctionalProperty`, then it has no more than one value for each individual (unique property):

$P(x, y) \wedge P(x, z) \Rightarrow y = z$

⇒ Shorthand for stating that the property's minimum cardinality is zero and its maximum cardinality is 1

Example:

```
<owl:ObjectProperty rdf:ID="hasVintageYear">
  <rdf:type rdf:resource="&owl;FunctionalProperty"/>
  <rdfs:domain rdf:resource="#Vintage"/>
  <rdfs:range rdf:resource="#VintageYear"/>
</owl:ObjectProperty>
```

InverseFunctionalProperty:

⇒ If a property is inverse functional then the inverse of the property is functional (unambiguous property):

$P(y, x) \wedge P(z, x) \Rightarrow y = z$

Example:

```
<owl:ObjectProperty rdf:ID="producesWine">
  <rdf:type rdf:resource="&owl;InverseFunctionalProperty"/>
  <owl:inverseOf rdf:resource="#hasMaker"/>
</owl:ObjectProperty>
```

Restriction:

⇒ For placing restrictions on the usage of properties by class instances

⇒ Applies to its containing class definition only

Example:

```
<owl:Class rdf:ID="Wine">
  <rdfs:subClassOf rdf:resource="&food;PotableLiquid"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <!-- .... -->
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```

onProperty:

⇒ Indicates the restricted property

Example:

```
<owl:Class rdf:ID="Wine">
  <rdfs:subClassOf rdf:resource="&food;PotableLiquid"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#hasMaker"/>
      <!-- .... -->
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```

allValuesFrom:

⇒ Stated on a property with respect to a class (local range restriction)

⇒ Values of the property are all members of the class indicated

Example:

```
<owl:Class rdf:ID="Wine">
  <rdfs:subClassOf rdf:resource="&food;PotableLiquid"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#hasMaker"/>
      <owl:allValuesFrom rdf:resource="#Winery"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```


someValuesFrom:

⇒ Stated on a property with respect to a class (local range restriction)

⇒ At least one value for that property is of a certain type

Example:

```
<owl:Class rdf:ID="Wine">
  <rdfs:subClassOf rdf:resource="&food;PotableLiquid"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#hasMaker"/>
      <owl:someValuesFrom rdf:resource="#Winery"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```


minCardinality:

⇒ Stated on a property with respect to a particular class

⇒ Permits the specification of the minimum number of elements in a relation (0 or 1)

Example:

```
<owl:Restriction>
  <owl:onProperty rdf:resource="#hasMother"/>
  <owl:minCardinality rdf:datatype="&xsd;nonNegativeInteger">1
    </owl:minCardinality>
</owl:Restriction>
```

maxCardinality:

⇒ Stated on a property with respect to a particular class

⇒ Permits the specification of the maximum number of elements in a relation (0 or 1)

Example:

```
<owl:Restriction>
  <owl:onProperty rdf:resource="#hasMother"/>
  <owl:maxCardinality rdf:datatype="&xsd;nonNegativeInteger">1
    </owl:maxCardinality>
</owl:Restriction>
```

cardinality:

⇒ Permits the specification of exactly the number of elements in a relation (0 or 1)

Example:

```
<owl:Class rdf:ID="Vintage">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#hasVintageYear"/>
      <owl:cardinality rdf:datatype="&xsd;nonNegativeInteger">1
        </owl:cardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```


Ontology:

⇒ An ontology is a resource and may be described using properties

⇒ If the value of `rdf:about` is empty, the name of the ontology is the base URI of the `owl:Ontology` element

Example:

```
<owl:Ontology rdf:about="">
  <owl:versionInfo>
    v 1.17 2003/02/26 12:56:51 mdean
  </owl:versionInfo>
  <rdfs:comment>
    Comments are used to annotate ontologies.
  </rdfs:comment>
</owl:Ontology>
```


imports:

⇒ References another OWL ontology containing definitions, whose meaning is considered to be part of the meaning of the importing ontology

⇒ `owl:imports` is a property with the class `owl:Ontology` as its domain and range

⇒ Imports are transitive

Example:

```
<owl:Ontology rdf:about="">
  <!-- .... -->
  <owl:imports rdf:resource="http://www.example.org/foo"/>
</owl:Ontology>
```


intersectionOf:

⇒ Allows for intersections of named classes and restrictions

Example:

```
<owl:Class rdf:ID="WhiteWine">
  <owl:intersectionOf rdf:parseType="Collection">
    <owl:Class rdf:about="#Wine"/>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#hasColor"/>
      <owl:hasValue rdf:resource="#White"/>
    </owl:Restriction>
  </owl:intersectionOf>
</owl:Class>
```


xsd datatypes:

⇒ OWL uses most of the built-in XML Schema datatypes

Example:

```
<owl:Class rdf:ID="VintageYear"/>

<owl:DatatypeProperty rdf:ID="yearValue">
  <rdfs:domain rdf:resource="#VintageYear"/>
  <rdfs:range  rdf:resource="&xsd;positiveInteger"/>
</owl:DatatypeProperty>
```


versionInfo:

⇒ A string giving information about the version of the corresponding OWL construct

Example:

```
<owl:Ontology rdf:about="">
  <owl:versionInfo>
    v 1.17 2003/02/26 12:56:51 mdean
  </owl:versionInfo>
</owl:Ontology>
```

priorVersion:

⇒ Reference to another ontology that identifies the specified ontology as a prior version of the containing ontology

Example:

```
<owl:Ontology rdf:about="">
  <owl:priorVersion rdf:resource="http://www.example.org/old"/>
</owl:Ontology>
```

backwardCompatibleWith:

⇒ Reference to another ontology that identifies the specified ontology as a prior version of the containing ontology, and further indicates that it is backward compatible with it

Example:

```
<owl:Ontology rdf:about="">
  <owl:backwardCompatibleWith
      rdf:resource="http://www.example.org/old"/>
</owl:Ontology>
```


incompatibleWith:

⇒ Reference to another ontology that identifies the specified ontology as a prior version of the containing ontology, and further indicates that is not backward compatible with it

Example:

```
<owl:Ontology rdf:about="">
  <owl:incompatibleWith
      rdf:resource="http://www.example.org/old"/>
</owl:Ontology>
```


DeprecatedClass:

⇒ Class is preserved for backward-compatibility purposes, but may be phased out in the future

Example:

```
<owl:DeprecatedClass rdf:ID="Car">
  <rdfs:comment>Automobile is now preferred</rdfs:comment>
  <owl:equivalentClass rdf:resource="#Automobile"/>
</owl:DeprecatedClass>
```


DeprecatedProperty:

⇒ Property is preserved for backward-compatibility purposes, but may be phased out in the future

Example:

```
<owl:DeprecatedProperty rdf:ID="hasDriver">
  <rdfs:comment>inverse property drives is now preferred
    </rdfs:comment>
  <owl:inverseOf rdf:resource="#drives" />
</owl:DeprecatedProperty>
```


AnnotationProperty:

⇒ Declares a property that is used as an annotation

⇒ The object of an annotation property must be either a data literal, a URI reference, or an individual

Example:

```
<owl:AnnotationProperty rdf:about="&dc;creator"/>

<owl:Class rdf:about="#MusicalWork">
  <rdfs:label>Musical work</rdfs:label>
  <dc:creator>N.N.</dc:creator>
</owl:Class>
```


OntologyProperty:

⇒ Properties that apply to the ontology as a whole

⇒ Instances of this class must have the class `owl:Ontology` as their domain and range

Example:

```
<rdf:Property rdf:ID="incompatibleWith">
  <rdfs:label>incompatibleWith</rdfs:label>
  <rdf:type rdf:resource="#OntologyProperty"/>
  <rdfs:domain rdf:resource="#Ontology"/>
  <rdfs:range rdf:resource="#Ontology"/>
</rdf:Property>
```


oneOf:

⇒ Classes can be described by enumeration of the individuals that make up the class, i. e., the members of the class are exactly the set of enumerated individuals

Example:

```
<owl:Class rdf:ID="WineColor">
  <rdfs:subClassOf rdf:resource="#WineDescriptor"/>
  <owl:oneOf rdf:parseType="Collection">
    <owl:Thing rdf:about="#White"/>
    <owl:Thing rdf:about="#Rose"/>
    <owl:Thing rdf:about="#Red"/>
  </owl:oneOf>
</owl:Class>
```

disjointWith:

⇒ Classes may be stated to be disjoint from each other

⇒ Such statements are mainly used to avoid inconsistencies

Example:

```
<owl:Class rdf:ID="Pasta">
  <rdfs:subClassOf rdf:resource="#EdibleThing"/>
  <owl:disjointWith rdf:resource="#Meat"/>
  <owl:disjointWith rdf:resource="#Fowl"/>
  <owl:disjointWith rdf:resource="#Seafood"/>
  <owl:disjointWith rdf:resource="#Dessert"/>
  <owl:disjointWith rdf:resource="#Fruit"/>
</owl:Class>
```

equivalentClass:

⇒ Same meaning as in OWL Lite

⇒ May additionally be complex class definitions

Example:

```
<owl:Class rdf:ID="TexasThings">
  <owl:equivalentClass>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#locatedIn"/>
      <owl:someValuesFrom rdf:resource="#TexasRegion"/>
    </owl:Restriction>
  </owl:equivalentClass>
</owl:Class>
```


`rdfs:subClassOf`:

⇒ Same meaning as in OWL Lite

⇒ May additionally be complex class definitions

Example:

```
<owl:Class rdf:ID="Wine">
  <rdfs:subClassOf rdf:resource="&food;PotableLiquid"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#madeFromGrape"/>
      <owl:minCardinality rdf:datatype="&xsd;nonNegativeInteger">
        1</owl:minCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
```

unionOf:

⇒ Boolean combination of classes and/or restrictions

Example:

```
<owl:Class rdf:ID="Fruit">
  <owl:unionOf rdf:parseType="Collection">
    <owl:Class rdf:about="#SweetFruit"/>
    <owl:Class rdf:about="#NonSweetFruit"/>
  </owl:unionOf>
</owl:Class>
```

complementOf:

⇒ Boolean combination of classes and/or restrictions

Example:

```
<owl:Class rdf:ID="ConsumableThing"/>

<owl:Class rdf:ID="NonConsumableThing">
  <owl:complementOf rdf:resource="#ConsumableThing"/>
</owl:Class>
```


intersectionOf:

⇒ Boolean combination of classes and/or restrictions

Example:

```
<owl:Class rdf:ID="WhiteWine">
  <owl:intersectionOf rdf:parseType="Collection">
    <owl:Class rdf:about="#Wine"/>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#hasColor"/>
      <owl:hasValue rdf:resource="#White"/>
    </owl:Restriction>
  </owl:intersectionOf>
</owl:Class>
```


minCardinality:

⇒ Stated on a property with respect to a particular class

⇒ Specifies the minimum number of elements in a relation

Example:

```
<owl:Class rdf:ID="Tricycle">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#hasWheels"/>
      <owl:minCardinality rdf:datatype="&xsd;nonNegativeInteger">
        3</owl:minCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```


maxCardinality:

⇒ Stated on a property with respect to a particular class

⇒ Specifies the maximum number of elements in a relation

Example:

```
<owl:Class rdf:ID="Tricycle">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#hasWheels"/>
      <owl:maxCardinality rdf:datatype="&xsd;nonNegativeInteger">
        3</owl:maxCardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```


cardinality:

⇒ Permits the specification of exactly the number of elements in a relation

Example:

```
<owl:Class rdf:ID="Tricycle">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#hasWheels"/>
      <owl:cardinality rdf:datatype="&xsd;nonNegativeInteger">
        3</owl:cardinality>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```


hasValue:

⇒ A property can be required to have a certain individual as a value

⇒ Allows for the specification of classes based on the existence of particular property values

Example:

```
<owl:Class rdf:ID="Burgundy">
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#hasSugar"/>
      <owl:hasValue rdf:resource="#Dry"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```


- References:
  - *OWL Web Ontology Language Overview*
  - *OWL Web Ontology Language Guide*
  - *OWL Web Ontology Language Reference*