

Appendix B: OIL Syntax in RDF

This appendix provides an RDF-Schema definition for OIL. RDF relies on Namespaces and Namespace prefixes: RDF-vocabulary is prefixed with a Namespace prefix, which is resolved to a complete URI by an RDF processor. We are using the following namespace prefixes: “oil:” for OIL, “rdf:” and “rdfs:” for RDF and RDF-Schema, “dc:” and “dcq:” for Dublin Core Vocabulary and Qualifiers, respectively. The usual RDF-Dublin Core encoding, which can be obtained at [Dublin Core] is used for Dublin Core. OIL relies heavily on RDF-Schema itself, since OIL is defined as an extension of RDF-Schema and reuses concepts of RDF-Schema as much as possible. This strategy was taken to facilitate the reuse of existing RDF-Schema-based applications and tools. However, certain extensions of RDF-schema were required. For example, OIL allows implicit definitions of classes in the form of boolean operators (AND, OR, NOT) as value of the subclass-of relation, whereas in RDFS the value of the subclassOf statement is always an explicit class. We introduced oil:ClassExpression as a placeholder class for the three boolean operators, which are also modeled as classes, to allow their use as value for the subclassOf statement.

Several extensions in this vein have been made, a full listing can be found in Table 1 and Table 2 and in [Broekstra et al., to appear] a detailed analysis is made of this extension. The resulting RDF Schema for OIL can be found in appendix B.1 and an example ontology in RDFS syntax is presented in appendix B.2.

Table 1: Class-definitions in OIL and the corresponding RDF(S) constructs

OIL primitive	RDFS syntax	type
class-def	rdfs:Class	class
subclass-of	rdfs:subclassOf	property
class-expression	<i>oil:ClassExpression</i> (placeholder only)	class
AND	oil:AND (subclass of ClassExpression)	class
OR	oil:OR (subclass of ClassExpression)	class
NOT	oil:NOT (subclass of ClassExpression)	class
slot-constraint	<i>oil:SlotConstraint</i> (placeholder only)	class
	oil:hasSlotConstraint (rdf:type of rdfs:ConstraintProperty)	property
	<i>oil:NumberRestriction</i> (placeholder only) (subclass of oil:SlotConstraint)	class

OIL primitive	RDFS syntax	type
has-value	oil:HasValue (subclass of oil:SlotConstraint)	class
value-type	oil:ValueType (subclass of oil:SlotConstraint)	class
max-cardinality	oil:MaxCardinality (subclass of oil:NumberRestriction)	class
min-cardinality	oil:MinCardinality (subclass of oil:NumberRestriction)	class
cardinality	oil:Cardinality (subclass of oil:NumberRestriction)	class

Table 2: Slot definitions in OIL and the corresponding RDFS constructs

OIL primitive	RDFS syntax	type
slot-def	rdf:Property	class
subslot-of	rdfs:subPropertyOf	property
domain	rdfs:domain	property
range	rdfs:range	property
inverse	oil:inverseRelationOf	property
transitive	oil:TransitiveRelation	class
symmetric	oil:SymmetricRelation	class

Appendix B.1 RDF-Schema for OIL

```

<?xml version='1.0' encoding='ISO-8859-1'?>

<rdf:RDF

  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#">

  <rdfs:Class rdf:ID="RuleBase">
    <rdfs:comment>A user-defined rulebase possibly described by an external RDF-Schema</rdfs:comment>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/2000/01/rdf-schema#Resource"/>
  </rdfs:Class>

  <!-- Begin Class & Properties Expressions Ontology -->

  <rdfs:Class rdf:ID="ClassExpression">
    <rdfs:comment>An ontology class expression</rdfs:comment>

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<rdfs:subClassOf rdf:resource="http://www.w3.org/2000/01/rdf-schema#Resource"/>
</rdfs:Class>

<rdfs:Class rdf:about="http://www.w3.org/2000/01/rdf-schema#Class">
  <rdfs:comment>An additional statement about rdfs:Class</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#ClassExpression"/>
</rdfs:Class>

<rdfs:Class rdf:ID="SlotConstraint">
  <rdfs:comment>An ontology slot constraint</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#ClassExpression"/>
</rdfs:Class>

<rdfs:Class rdf:ID="NumberRestriction">
  <rdfs:comment>A generic number restriction expression.</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#SlotConstraint"/>
</rdfs:Class>

<rdfs:Class rdf:ID="ClassType">
  <rdfs:comment> an abstract class of class types </rdfs:comment>
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
</rdfs:Class>

<rdfs:Class rdf:ID="PrimitiveClass">
  <rdfs:comment> The class of primitive classes</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#ClassType"/>
</rdfs:Class>

<rdfs:Class rdf:ID="DefinedClass">
  <rdfs:comment>The class of defined classes</rdfs:comment>
  <rdfs:subClassOf rdf:resource="#ClassType"/>
</rdfs:Class>

<!-- End Class & Properties Expressions Ontology -->

<!-- Begin Helper Properties -->

<rdf:Property rdf:ID="hasClass">
  <rdfs:comment>A property connection between two class expressions</rdfs:comment>
  <rdfs:domain rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
  <rdfs:range rdf:resource="#ClassExpression"/>
</rdf:Property>

<rdf:Property rdf:ID="hasSlotConstraint">
  <rdfs:comment> A property connection between a class definition and a slot constraint </rdfs:comment>
  <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#ConstraintProperty"/>
  <rdfs:domain rdf:resource="#ClassExpression"/>
  <rdfs:range rdf:resource="#SlotConstraint"/>
</rdf:Property>

<rdf:Property rdf:ID="hasOperand">
  <rdfs:comment>A property connection between an operator class expression and an operand class expression </
rdfs:comment>
  <rdfs:domain rdf:resource="#AND"/>
  <rdfs:domain rdf:resource="#OR"/>
  <rdfs:domain rdf:resource="#NOT"/>
  <rdfs:range rdf:resource="#ClassExpression"/>
</rdf:Property>

<rdf:Property rdf:ID="hasProperty">
  <rdfs:comment>A property connection between a class expression and a slot expression</rdfs:comment>
  <rdfs:domain rdf:resource="#SlotConstraint"/>
  <rdfs:range rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
</rdf:Property>

<rdf:Property rdf:ID="number">
  <rdfs:comment>A property connection between a class expression and a cardinality (integer)</rdfs:comment>
  <rdfs:domain rdf:resource="#NumberRestriction"/>
  <rdfs:domain rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
  <rdfs:range rdf:resource="http://www.w3c.org/xml/xmlschema#integer"/>
</rdf:Property>
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<!-- End Helper Properties -->

<!-- Begin Class Expressions -->

  <rdfs:Class rdf:ID="AND">
    <rdfs:comment>An expression corresponding to the conjunction of (two) class expressions</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#ClassExpression"/>
  </rdfs:Class>

  <rdfs:Class rdf:ID="OR">
    <rdfs:comment>An expression corresponding to the disjunction of (two) class expressions</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#ClassExpression"/>
  </rdfs:Class>

  <rdfs:Class rdf:ID="NOT">
    <rdfs:comment>An expression corresponding to the negation of a class expression</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#ClassExpression"/>
  </rdfs:Class>

  <rdfs:Class rdf:ID="HasValue">
    <rdfs:comment>An expression corresponding to an existential slot constraint</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#SlotConstraint"/>
  </rdfs:Class>

  <rdfs:Class rdf:ID="ValueType">
    <rdfs:comment>An expression corresponding to a universally quantified value restriction</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#SlotConstraint"/>
  </rdfs:Class>

  <rdfs:Class rdf:ID="MaxCardinality">
    <rdfs:comment>An ontology property expression corresponding to a (qualified) number restriction.</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#NumberRestriction"/>
  </rdfs:Class>

  <rdfs:Class rdf:ID="MinCardinality">
    <rdfs:comment>An ontology property expression corresponding to a (qualified) number restriction.</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#NumberRestriction"/>
  </rdfs:Class>

  <rdfs:Class rdf:ID="Cardinality">
    <rdfs:comment>An ontology property expression corresponding to a (qualified) number restriction.</rdfs:comment>
    <rdfs:subClassOf rdf:resource="#NumberRestriction"/>
  </rdfs:Class>

<!-- End Class Expressions -->

<!--Begin Property Qualities-->

  <rdf:Property rdf:ID="inverseRelationOf">
    <rdfs:comment>A property connection between a property and the inverse property</rdfs:comment>
    <rdfs:domain rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <rdfs:range rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
  </rdf:Property>

  <rdfs:Class rdf:ID="TransitiveProperty">
    <rdfs:comment>The class of all transitive relations.</rdfs:comment>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
  </rdfs:Class>

  <rdfs:Class rdf:ID="SymmetricProperty">
    <rdfs:comment>The class of all symmetric relations.</rdfs:comment>
    <rdfs:subClassOf rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
  </rdfs:Class>

<!--End Property Qualities-->

</rdf:RDF>
```

Appendix B.2 The Example in RDF syntax

```
<?xml version='1.0' encoding='ISO-8859-1'?>
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:rdfs="http://www.w3.org/TR/1999/PR-rdf-schema-19990303#"
  xmlns:oil="http://www.ontoknowledge.org/oil/rdfschema"
  xmlns:dc="http://purl.org/dc/elements/1.1/"
  xmlns:dcq="http://purl.org/dc/qualifiers/1.1/"
  xmlns:ont2="http://www.semanticweb.org/oil/ontology-example">

  <rdf:Description about = "">
    <dc>Title>"African Animals"</dc>Title>
    <dc:Creator>"Ian Horrocks"</dc:Creator>
    <dc:subject >"animal, food, vegetarians"</dc:subject >
    <dc:Description>"A didactic example ontology describing African animals"</dc:Description>
    <dcq:description.release> "1.01"</dcq:description.release>
    <dc:publisher> "I. Horrocks"</dc:publisher>
    <dc:type> "ontology"</dc:type>
    <dc:format> "oil"</dc:format>
    <dc:format> "pdf"</dc:format>
    <dc:identifier> "http://www.cs.vu.nl/~dieter/oil/TR/oil.pdf"</dc:identifier>
    <dc:source> "http://www.africa.com/nature/animals.html"</dc:source>
    <dc:language> "OIL"</dc:language>
    <dc:language> "en-uk"</dc:language>
  </rdf:Description>

  <rdf:Description xmlns:syllogism="http://old.greece/syllogism/">
    <rdf:type resource="http://www.ontoknowledge.org/oil/rdfschema#RuleBase"/>
    <syllogism:premise>if it rains, you get wet</syllogism:premise>
    <syllogism:fact>it rains</syllogism:fact>
    <syllogism:conclusion>you get wet</syllogism:conclusion>
  </rdf:Description>

  <rdf:Property rdf:ID="eats">
    <oil:inverseRelationOf rdf:resource="#is-eaten-by"/>
  </rdf:Property>

  <rdf:Property rdf:ID="is-eaten-by"/>

  <rdf:Property rdf:ID="has-part">
    <oil:inverseRelationOf rdf:resource="#is-part-of"/>
  </rdf:Property>

  <rdf:Property rdf:ID="is-part-of"/>

  <rdfs:Class rdf:ID="animal"/>

  <rdfs:Class rdf:ID="plant">
    <rdfs:subClassOf>
      <oil:NOT>
        <oil:hasOperand rdf:resource="#animal"/>
      </oil:NOT>
    </rdfs:subClassOf>
  </rdfs:Class>

  <rdfs:Class rdf:ID="tree">
    <rdfs:subClassOf rdf:resource="#plant"/>
  </rdfs:Class>

  <rdfs:Class rdf:ID="branch">
    <oil:hasSlotConstraint>
      <oil:has-value>
        <oil:hasProperty rdf:resource="#is-part-of"/>
        <oil:hasClass rdf:resource="#tree"/>
      </oil:has-value>
    </oil:hasSlotConstraint>
  </rdfs:Class>

  <rdfs:Class rdf:ID="leaf">
    <oil:hasSlotConstraint>
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<oil:has-value>
  <oil:hasProperty rdf:resource="#is-part-of"/>
  <oil:hasClass rdf:resource="#branch"/>
</oil:has-value>
</oil:hasSlotConstraint>
</rdfs:Class>

<rdfs:Class rdf:ID="carnivore">
  <rdfs:subClassOf rdf:resource="#animal"/>
  <oil:hasSlotConstraint>
    <oil:valueType>
      <oil:hasProperty rdf:resource="#eats"/>
      <oil:hasClass rdf:resource="#animal"/>
    </oil:valueType>
  </oil:hasSlotConstraint>
</rdfs:Class>

<rdfs:Class rdf:ID="herbivore">
  <rdf:type rdf:resource="http://www.ontoknowledge.org/oil/rdfs-schema/#DefinedClass"/>
  <rdfs:subClassOf rdf:resource="#animal"/>
  <rdfs:subClassOf>
    <oil:NOT>
      <oil:hasOperand rdf:resource="#carnivore"/>
    </oil:NOT>
  </rdfs:subClassOf>
  <oil:hasSlotConstraint>
    <oil:valueType>
      <oil:hasProperty rdf:resource="#eats"/>
      <oil:hasClass>
        <oil:OR>
          <oil:hasOperand rdf:resource="#plant"/>
          <oil:hasOperand>
            <oil:has-value>
              <oil:hasProperty rdf:resource="#is-part-of"/>
              <oil:hasClass rdf:resource="#plant"/>
            </oil:has-value>
          </oil:hasOperand>
        </oil:OR>
      </oil:hasClass >
    </oil:valueType>
  </oil:hasSlotConstraint>
</rdfs:Class>

<rdfs:Class rdf:ID="giraffe">
  <rdfs:subClassOf rdf:resource="#animal"/>
  <oil:hasSlotConstraint>
    <oil:valueType>
      <oil:hasProperty rdf:resource="#eats"/>
      <oil:hasClass rdf:resource="#leaf"/>
    </oil:valueType>
  </oil:hasSlotConstraint>
</rdfs:Class>

<rdfs:Class rdf:ID="lion">
  <rdfs:subClassOf rdf:resource="#animal"/>
  <oil:hasSlotConstraint>
    <oil:valueType>
      <oil:hasProperty rdf:resource="#eats"/>
      <oil:hasClass rdf:resource="#herbivore"/>
    </oil:valueType>
  </oil:hasSlotConstraint>
</rdfs:Class>

<rdfs:Class rdf:ID="tasty-plant">
  <rdfs:subClassOf rdf:resource="#plant"/>
  <oil:hasSlotConstraint>
    <oil:has-value>
      <oil:hasProperty rdf:resource="#eaten-by"/>
      <oil:hasClass>
        <oil:AND>
          <oil:hasOperand rdf:resource="#herbivore"/>
          <oil:hasOperand rdf:resource="#carnivore"/>
        </oil:AND>
      </oil:hasClass>
    </oil:has-value>
  </oil:hasSlotConstraint>
</rdfs:Class>
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```
        </oil:hasClass>
      </oil:has-value>
    </oil:hasClassConstraint>
  </rdfs:Class>

</rdf:RDF>
```