W3C

OWL 2 Reference Card

RDF Vocabulary Version v.07

http://www.w3.org/2007/OWL

1. RDF/RDFS Vocabulary Reference

RDF Node

- rdfs:Resource — *the generic class of identified concept*
  - rdf:type [rdfs:Resource → rdfs:Class] *membership*
  - rdfs:label [rdfs:Resource → rdfs:Literal] *annotation*
  - rdfs:comment [rdfs:Resource → rdfs:Literal] *annotation*
  - rdfs:seeAlso [rdfs:Resource → rdfs:Resource] *annotation*
  - rdfs:isDefinedBy [rdfs:Resource → rdfs:Resource] *annotation*
  - rdf:value [rdfs:Resource → rdfs:Resource] *complex values*
- rdfs:Literal — *the generic class of literal values*
- rdf:XMLLiteral — *the class of typed literals (c.f. XMLSchema)*

Class

- rdfs:Class — *the class of rdf classes*
  - rdfs:subClassOf [rdfs:Class → rdfs:Class] *subset relation*

Property

- rdf:Property — *the class of properties(i.e. binary relations)*
  - rdfs:subPropertyOf [rdf:Property→ rdf:Property]
  - rdfs:domain [rdf:Property→ rdfs:Class]
  - rdfs:range [rdf:Property→ rdfs:Class]

Containers

- rdfs:Container — *the generic superclass of rdf resource containers*
  - rdfs:member [rdfs:Resource → rdfs:Resrouce] *membership*
  - rdf:_1, rdf:_2, ... Sub-properties of rdf:member
- rdf:Alt — *container of alternatives*
- rdf:Bag — *unordered container*
- rdf:Seq — *ordered container*
- rdfs:ContainerMembershipProperty — *all sub-properties of rdfs:member*

List

- rdf:List — *the class of RDF Lists*
  - rdf:first [rdf:List → rdfs:Resource] car
  - rdf:rest [rdf:List → rdfs:List] cdr
- rdf:nil — an instance of RDF:List representing the empty list

Datatype

- rdfs:Datatype — *the class of datatypes*

RDF Reification

- rdf:Statement — *the class of RDF statements*
  - rdf:subject [rdf:Statement → rdfs:Resource]
  - rdf:predicate [rdf:Statement → rdfs:Resource]
  - rdf:object [rdf:Statement → rdfs:Resource]

2. OWL Language Reference

Constructs in shadow are only available in OWL 2

Language Elements

Classes, Datatype and Restriction

owl:Class — *all OWL classes, a sub-class of rdfs:Class*

- owl:intersectionOf [owl:Class → ≥ 2 owl:Class]
- owl:unionOf [owl:Class → ≥ 2 owl:Class]
- owl:complementOf [owl:Class → owl:Class]
- owl:oneOf [owl:Class → ≥ 1 individuals]

rdfs:Datatype — *sets of data values, range of data-valued property*

- owl:datatypeComplementOf [rdfs:Datatype → rdfs:Datatype]
- owl:oneOf [rdfs:Datatype → ≥ 1 literals]
- owl:onDatatype [owl:Restriction → rdfs:Datatype]
- owl:withRestrictions [owl:Restriction →≥ 1 literals, list of facets & restriction values]

owl:Restriction — *all OWL restrictions, a sub-class of owl:Class*

- owl:onProperty [owl:Restriction → owl:ObjectProperty| owl:DatatypeProperty]
- owl:onClass [owl:Restriction →owl:Class]
- owl:onDataRange [owl:Restriction →owl: DataRange]
- owl:onProperties [owl:Restriction → ≥ 1 owl:DatatypeProperty]
- owl:cardinality, owl:maxCardinality, owl:minCardinality [owl:Restriction → xsd:nonNegativeInteger]
- owl:minQualifiedCardinality, owl:minQualifiedCardinality, owl:qualifiedCardinality [owl:Restriction → xsd:nonNegativeInteger]
- owl:allValuesFrom [owl:Restriction → owl:Class|rdfs:Datatype]
- owl:someValuesFrom [owl:Restriction → owl:Class|rdfs:Datatype]
- owl:hasValue [owl:Restriction → literal| individual]
- owl:SelfRestriction [owl:Restriction → owl:ObjectProperty]

(Special classes)

- owl:Thing — *all OWL individuals*
- owl:Nothing — *the complement of owl:Thing*

Properties

- owl:DatatypeProperty — *range is instance of rdfs:Datatype*
- owl:ObjectProperty — *range is instance of owl:Class*

(Special properties)

- owl:TopDataProperty — owl:Thing X rdfs:Datatype
- owl:BottomDataProperty — the complement of owl:TopDataProperty
- owl:TopObjectProperty — owl:Thing X owl:Thing
- owl:BottomObjectProperty — the complement of owl:TopObjectProperty

Individuals

- owl:NamedIndividual — A class of all named individuals

Axioms and Assertions

Class Expression Axioms

- rdfs:subClassOf [owl:Class → owl:Class]
- owl:equivalentClass [owl:Class → owl:Class]
- owl:disjointWith [owl:Class → owl:Class]
- owl:disjointUnionOf [owl:Class → ≥ 2 owl:Class]

Property Expression Axioms

- rdfs:subPropertyOf [owl:ObjectProperty → owl:ObjectProperty] or [owl:ObjectProperty → owl:propertyChain of ≥ 2 object properties] or [owl:DatatypeProperty→owl:DatatypeProperty]
- owl:inverseOf [owl:ObjectProperty → owl:ObjectProperty]
- owl:equivalentProperty [owl:ObjectProperty → owl:ObjectProperty] or [owl:DatatypeProperty→owl:DatatypeProperty]
- owl:property DisjointWith [owl:ObjectProperty → owl:ObjectProperty] or [owl:DatatypeProperty → owl:DatatypeProperty]
- rdfs:domain [rdf:Property → owl:Class]
- rdfs:range [owl:ObjectProperty→owl:Class] or [owl:DatatypeProperty → rdfs:Datatype]
- owl:propertyChain [owl:ObjectProperty → two or more object properties]

- owl:FunctionalProperty — *(s,p,o1) , (s, p,o2) => o1= o2*
- owl:InverseFunctionalProperty — *(s1,p,o) , (s2, p,o) => s1= s2*
- owl:ReflexiveProperty — *(a,p,a) for all a*
- owl:IrreflexiveProperty — *(a,p,b) => a≠b*
- owl:SymmetricProperty — *(s,p,o) => (o,p,s)*
- owl:AsymmetricProperty — *(a,p,b) => not (b,p,a)*
- owl:TransitiveProperty — *(a,p,b), (b,p,c) => (a,p,c)*
- owl:hasKey [owl:Class→ list of properties $p_1,\ldots p_n$]

$(x,p_i,z_j),(y,p_i,z_j)$, for $i=1,\ldots,n$ => $x=y$

Individual Axioms

- owl:differentFrom [owl:Thing → owl:Thing]
- owl:sameAs [owl:Thing → owl:Thing]

Assertions

- owl:NegativePropertyAssertion (NPA) *a subclass of owl:class*
  - owl:sourceIndividual [NPA → owl:Thing]
  - owl:assertionProperty [NPA → rdf:Property]
  - owl:targetValue [NPA→ rdfs:Datatype]
  - owl:targetIndividual [NPA → owl:Thing]
- owl:AllDifferent — *a subclass of owl:class*
- owl:AllDisjointClasses — *a subclass of owl:class*
- owl:AllDisjointProperties — *a subclass of owl:class*
- owl:members

  [owl:AllDisjointProperties → ≥ 1 property expressions] or
  [owl:AllDisjointClasses→ ≥ 1 classes] or
  [owl:AllDifferent → list of individuals]

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Non-logical Entities and Axioms

Annotation

- owl:Axiom
  - owl:subject
  - owl:predicate
  - owl:object
- owl:AnnotationProperty — *range is rdfs:Literal*
- owl:deprecated
- owl:DeprecatedClass — *owl:Class version control*
- owl:DeprecatedProperty — *owl:ObjectProperty & owl:DatatypeProperty version control*

Note: OWL 2 supports rich annotation on axioms, entities and ontologies
reference: http://www.w3.org/2007/OWL/wiki/Syntax#Annotations

Ontology

- owl:Ontology — *ontology description*
- owl:imports — *domain/range are owl:Ontology*
- owl:OntologyProperty — *domain/range are owl:Ontology*

owl:backwardCompatibleWith	[owl:Ontology → owl:Ontology]
owl:incompatibleWith	[owl:Ontology → owl:Ontology]
owl:priorVersion	[owl:Ontology → owl:Ontology]
owl:versionInfo	[→] *no domain or range constraint*

Deprecated vocabulary in OWL 2:

- owl:DataRange (replaced by rdfs:Datatype)
- owl:distinctMembers (replaced by owl:members)

Datatypes and Facets

Real	Integer	Strings	Datetime	Others
xsd:decimal	xsd:int	xsd:string	xsd:date	xsd:anyURI
xsd:double	xsd:integer	xsd:normalizedString	xsd:dateTime	xsd:base64Binary
xsd:float	xsd:long	xsd:token	xsd:time	xsd:boolean
owl:real	xsd:short	xsd:language	xsd:gYearMonth	xsd:byte
owl:realPlus	xsd:negativeInteger	xsd:NMTOKEN	xsd:gYear	xsd:hexBinary
	xsd:positiveInteger	xsd:Name	xsd:gMonthDay	xsd:unsignedByte
	xsd:nonPositiveInteger	xsd:NCName	xsd:gDay	owl:dateTime?
	xsd:nonNegativeInteger	xsd:ID	xsd:gMonth	xsd:facet
	xsd:unsignedLong	xsd:IDREF		
	xsd:unsignedInt	xsd:ENTITY		
	xsd:unsignedShort	rdf:text		

Facets: owl:length, owl:minLength, owl:maxLength, owl:pattern, owl:minInclusive, owl:minExclusive, owl:maxInclusive, owl:maxExclusive, owl:totalDigits, owl:fractionDigits

Name Spaces

prefix	URI
rdf	http://www.w3.org/1999/02/22-rdf-syntax-ns#
rdfs	http://www.w3.org/2000/01/rdf-schema#
owl	http://www.w3.org/2002/07/owl#
xsd	http://www.w3.org/2001/XMLSchema#
ox	http://www.w3.org/2006/12/owl2-xml#

3. Profiles

[O]: object property; [D]: data type property; [OC]: object property chain

OWL-EL (EL++)

- Classes: owl:intersectionOf; rdfs:subClassOf; owl:equivalentClass; owl:disjointWith; owl:oneOf – single item only [O,D];owl:Thing; owl:Nothing
- Restrictions: owl:someValuesFrom [O,D] ; owl:hasValue [O,D] ; owl:SlefRestriction
- Properties: rdfs:subPropertyOf [O,D,OC]; owl:equivalentProperty [O,D]; owl:TransitiveProperty [O] ; owl:ReflexiveProperty [O]; owl:FunctionalProperty [D]; owl:hasKey; rdfs:domain and rdfs:range [O,D]; owl:TopObjectProperty, owl:BottomObjectProperty, owl:TopDataProperty, owl:BottomDataProperty
- Assertions: owl:sameAs, owl:differentFrom, owl:Class, owl:ObjectProperty, owl:DataProperty, owl:NegativePropertyAssertion [O,D]

Restriction: if an ontology Ax contains SubPropertyOf(PropertyChain(OP1 ... OPn) OP) and Ax imposes a range restriction to some class expression CE on OP, then Ax MUST impose a range restriction to CE on OPn.

OWL-QL (DL-Lite)

- Classes: rdfs:subClassOf; owl:complementOf [O]; owl:intersectionOf [O]; owl:equivalentClass; owl:disjointWith;
- Restrictions: owl:someValuesFrom[O];
- Properties: owl:inverseOf [O]; rdfs:subPropertyOf [O,D]; owl:equivalentProperty [O,D]; rdfs:domain and rdfs:range [O,D]; owl:property DisjointWith [O,D]; owl:SymmetricProperty [O]
- Assertions: owl:differentFrom; owl:Class; owl:ObjectProperty; owl:DataProperty

Restriction: LHS rdfs:subClassOf RHS, where 1) LHS is a class or existential quantification (owl: someValuesFrom) where the class is limited to owl:Thing; 2) RHS is a class, existential quantification to a class, negation (owl:complementOf) or intersection (owl:intersectionOf)

OWL-RL (DLP)

- Classes: owl:one of; owl:intersectionOf [O];owl:unionOf [O]; owl:disjointWith; owl:Thing
- Restrictions: owl:someValuesFrom[O,D]; owl:allValuesFrom[O,D]; owl:hasValue [O,D]; owl:maxCardinality [O,D] –at most 1;
- Properties: rdfs:domain [O,D] and rdfs:range [O]; owl:hasKey [O,D];
- Assertions: owl:sameAs, owl:differentFrom, owl:Class, owl:ObjectProperty, owl:DataProperty

Restriction: LHS rdfs:subClassOf RHS, where 1) LHS is a class, a nominal class (owl:oneOf), intersection/ union of class expressions (owl:intersectionOf, owl:unionOf), existential quantification (owl:someValuesFrom and owl:hasValue); 2) RHS is a class, existential quantification to a class, intersection of classes, universal quantification to a class expressions (owl:allValuesFrom), at-most 1 cardinality restrictions (owl:maxCardinality), existential quantification to an individual (owl:hasValue)

Datatypes supported by the 3 profiles: rdf:text, rdfs:Literal, xsd:decimal, xsd:integer, xsd:nonNegativeInteger, xsd:dateTime, xsd:date, xsd:string, xsd:normalizedString, xsd:anyURI, xsd:token, xsd:Name, xsd:NCName, xsd:hexBinary, xsd:base64Binary, owl:internationalizedString

http://www.w3.org/2007/OWL

4. Examples

An OWL Ontology in RDF/XML syntax

```
<?xml version="1.0"   encoding="utf-8"?>
<rdf:RDF   xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
           xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
           xmlns:owl="http://www.w3.org/2002/07/owl#"
           xml:base = "http://example.org/ex.owl"
           xmlns = "http://example.org/ex.owl#">
<owl:Ontology rdf:about="">
      <owl:versionInfo>1 October 2008</owl:versionInfo>
    <owl:imports rdf:resource="http://xmlns.com/foaf/0.1/" />
</owl:Ontology>
<owl:Class rdf:ID="RDFDocument">
 <rdfs:subClassOf   rdf:resource="http://xmlns.com/foaf/0.1/Document"/>
 <rdfs:label xml:lang="en-US">RDF Document</rdfs:label>
 <rdfs:comment xml:lang="en-US"> All RDF documents.  </rdfs:comment>
</owl:Class>
</rdf:RDF>
```

An OWL Ontology in RDF/Turtle syntax

```
@prefix rdfs:    <http://www.w3.org/2000/01/rdf-schema#> .
@prefix rdf:     <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix owl:     < http://www.w3.org/2002/07/owl#> .
@prefix foaf:    http://xmlns.com/foaf/0.1/> .
@prefix :        <#> .

< http://example.org/ex.owl > rdf:type owl:Ontology ;
      owl:versionInfo  "1 October 2008";
      owl:imports < http://xmlns.com/foaf/0.1/> .
RDFDocument rdf:type owl:Class;
      rdfs:subClassOf  foaf:Document;
      rdfs:label  '' RDF Document@en-US'';
      rdfs:comment "All RDF documents@en-US".
```

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