

1. RDF/RDFS Language 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:Resource`] *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` → one or more 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` [datatype 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:Restriction` → `xsd:nonNegativeInteger`]
 - `owl:minCardinality` }
 - `owl:minQualifiedCardinality` }
 - `owl:minQualifiedCardinality` } [`owl:Restriction` → `xsd:nonNegativeInteger`]
 - `owl:qualifiedCardinality` }
 - `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:BottomDataProperty` *the complement of owl:TopDataProperty*
- `owl:TopObjectProperty`
- `owl:BottomObjectProperty` *the complement of owl:TopObjectProperty*

Individuals

- `owl:NamedIndividual`

Axioms and Assertions

Class Expression Axioms

- `rdfs:subClassOf` [`owl:Class` → `owl:Class`]
- `owl:equivalentClass` [`owl:Class` → ≥ 2 `owl:Class`]
- `owl:disjointWith` [`owl:Class` → ≥ 2 `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:propertyDisjointWith` [`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` $(a, p, b) => a \neq b$
- `owl:SymmetricProperty` $(s, p, o) => (o, p, s)$
- `owl:AsymmetricProperty` $(a, p, b) => \text{not } (b, p, a)$
- `owl:TransitiveProperty` $(a, p, b), (b, p, c) => (a, p, c)$
- `owl:hasKey` [`owl:Class` → list of properties p_1, \dots, p_n $(x, p_i, z), (y, p_i, z), \text{ for } i=1, \dots, n => x=y$]

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 → `owl:Thing`]
 - `owl:targetIndividual` [NPA → `rdfs:Datatype`]
- `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]

Non-logical Entit and Axioms

Annotation

- **owl:Axiom**
 - owl:subject
 - owl:predicate
 - owl:object
- owl:AnnotationProperty *range is rdfs:Literal*
- **owl:deprecated**
- owl:DeprecatedClass *domain is owl:Class*
- owl:DeprecatedProperty *domain is owl:ObjectProperty and owl:DatatypeProperty*

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 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	rdfs: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: rdfs: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

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".
```

copyright © 2008 W3C All Rights Reserved.

W3C liability, trademark and document use rules apply.

Designed by Jie Bao, Elisa F. Kendall, Deborah L. McGuinness, and Evan K. Wallace
Contributor: Li Ding
Version 0.06, Sept 2008

Other language versions available: TBA