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: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 available in OWL 2

Classes and Class Expressions

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:datatypeComplementOf	[owl:DataRange→owl:DataRange]
owl:oneOf	[owl:Class → one or more individuals]

Restrictions

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|owl:DataRange]
owl:someValuesFrom	[owl:Restriction → owl:Class|owl:DataRange]
owl:hasValue	[owl:Restriction → literal| individual]
owl:SelfRestriction	[owl:Restriction → owl:ObjectProperty]

Data Ranges

owl:DataRange* — sets of data values, range of data-valued property

(* deprecated in OWL 2, replaced by rdfs:Datatype)

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

Special classes

- owl:Thing — *all OWL individuals*

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

- owl:Nothing — *the complement of owl:Thing*
- owl:AllDifferent — *a subclass of owl:class*

owl:distinctMembers* [owl:AllDifferent → list of individuals]

(* deprecated in OWL 2, replaced by owl:members)

- 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]

Properties

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

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: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 → owl:DataRange]
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 $p_1,\ldots p_n$]

$(x,p_i,z_i),(y,p_i,z_i)$, for i=1,…,n => x=y

Assertions

- owl:NegativePropertyAssertion — [data property->value]

owl:sourceIndividual
owl:assertionProperty
owl:targetValue
owl:targetIndividual

Special properties

- owl:TopDataProperty
- owl:BottomDataProperty — the complement of owl:TopDataProperty
- owl:TopObjectProperty
- owl:BottomObjectProperty — the complement of owl:TopObjectProperty

Individuals

- owl:NamedIndividual

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*

Datatype 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

TODO:

owl:assertionProperty

owl:onDatatype

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 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

Name spaces

prefix	URI and popular classes/properties
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#