OWL 2 Web Ontology Language Quick Reference Guide

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

1 Names, Prefixes, and Notation

Names in OWL 2 are IRIs, often written in a shorthand `prefix:localname`, where `prefix:` is a prefix name that expands to an IRI, and `localname` is the remainder of the name. The prefix names in OWL 2 are:

Prefix Name	Expansion
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#

We use notation conventions in the following tables*:

Letters	Meaning	Letters	Meaning
(a1 … an)	RDF list	n	non-negative integer**
_:a	anonymous individual (a blank node label)	ON	ontology name
_:x	blank node	P	object property expression
a	individual	p	prefix name
A	annotation property	PN	object property name
aN	individual name	R	data property
C	class expression	s	IRI or anonymous individual
CN	class name	t	IRI, anonymous individual, or literal
D	data range	U	IRI
DN	datatype name	v	literal
f	facet		

* All of the above can have subscripts.
** As a shorthand for "n"^^xsd:nonNegativeInteger

2 OWL 2 constructs and axioms

In the following tables, the three columns are:

Language Feature	Functional Syntax	RDF Syntax (Turtle)

For an OWL 2 DL ontology, there are additional global restrictions on axioms.

2.1 Class Expressions

Predefined and Named Classes

named class	CN	CN
universal class	owl:Thing	owl:Thing
empty class	owl:Nothing	owl:Nothing

Boolean Connectives and Enumeration of Individuals

intersection	ObjectIntersectionOf (C1…Cn)	_:x rdf:type owl:Class. _:x owl:intersectionOf (C1…Cn).
union	ObjectUnionOf (C1 … Cn)	_:x rdf:type owl:Class. _:x owl:unionOf (C1 … Cn).
complement	ObjectComplementOf (C)	_:x rdf:type owl:Class. _:x owl:complementOf C.
enumeration	ObjectOneOf (a1 … an)	_:x rdf:type owl:Class. _:x owl:oneOf (a1 … an).

Object Property Restrictions

universal	ObjectAllValuesFrom (P C)	_:x rdf:type owl:Restriction. _:x owl:onProperty P. _:x owl:allValuesFrom C
existential	ObjectSomeValuesFrom (P C)	_:x rdf:type owl:Restriction. _:x owl:onProperty P. _:x owl:someValuesFrom C
individual value	ObjectHasValue (P a)	_:x rdf:type owl:Restriction. _:x owl:onProperty P. _:x owl:hasValue a.
local reflexivity	ObjectHasSelf (P)	_:x rdf:type owl:Restriction. _:x owl:onProperty P. _:x owl:hasSelf "true"^^xsd:boolean.
exact cardinality	ObjectExactCardinality (n P)	_:x rdf:type owl:Restriction. _:x owl:onProperty P. _:x owl:cardinality n.
qualified exact cardinality	ObjectExactCardinality (n P C)	_:x rdf:type owl:Restriction. _:x owl:onProperty P. _:x owl:qualifiedCardinality n. _:x owl:onClass C.
maximum cardinality	ObjectMaxCardinality (n P)	_:x rdf:type owl:Restriction. _:x owl:onProperty P. _:x owl:maxCardinality n.
qualified maximum cardinality	ObjectMaxCardinality (n P C)	_:x rdf:type owl:Restriction. _:x owl:onProperty P. _:x owl:maxQualifiedCardinality n. _:x owl:onClass C.
minimum cardinality	ObjectMinCardinality (n P)	_:x rdf:type owl:Restriction. _:x owl:onProperty P. _:x owl:minCardinality n.
qualified minimum cardinality	ObjectMinCardinality (n P C)	_:x rdf:type owl:Restriction. _:x owl:onProperty P. _:x owl:minQualifiedCardinality n. _:x owl:onClass C.

Data Property Restrictions

universal	DataAllValuesFrom (R D)	_:x rdf:type owl:Restriction. _:x owl:onProperty R. _:x owl:allValuesFrom D.
existential	DataSomeValuesFrom (R D)	_:x rdf:type owl:Restriction. _:x owl:onProperty R. _:x owl:someValuesFrom D.
literal value	DataHasValue (R v)	_:x rdf:type owl:Restriction. _:x owl:onProperty R. _:x owl:hasValue v.
exact cardinality	DataExactCardinality (n R)	_:x rdf:type owl:Restriction. _:x owl:onProperty R. _:x owl:cardinality n.
qualified exact cardinality	DataExactCardinality (n R D)	_:x rdf:type owl:Restriction. _:x owl:onProperty R. _:x owl:qualifiedCardinality n. _:x owl:onDataRange D.
maximum cardinality	DataMaxCardinality (n R)	_:x rdf:type owl:Restriction. _:x owl:onProperty R. _:x owl:maxCardinality n.
qualified maximum cardinality	DataMaxCardinality (n R D)	_:x rdf:type owl:Restriction. _:x owl:onProperty R. _:x owl:maxQualifiedCardinality n. _:x owl:onDataRange D.
minimum cardinality	DataMinCardinality (n R)	_:x rdf:type owl:Restriction. _:x owl:onProperty R. _:x owl:minCardinality n.
qualified minimum cardinality	DataMinCardinality (n R D)	_:x rdf:type owl:Restriction. _:x owl:onProperty R. _:x owl:minQualifiedCardinality n. _:x owl:onDataRange D.

Restrictions Using n-ary Data Range

In the following table 'Dn' is an n-ary data range.

n-ary universal	DataAllValuesFrom (R1 … Rn Dn)	_:x rdf:type owl:Restriction. _:x owl:onProperties (R1 … Rn). _:x owl:allValuesFrom Dn.
n-ary existential	DataSomeValuesFrom (R1 … Rn Dn)	_:x rdf:type owl:Restriction. _:x owl:onProperties (R1 … Rn). _:x owl:someValuesFrom Dn.

2.2 Properties

Object Property Expressions

named object property	PN	PN
universal object property	owl:topObjectProperty	owl:topObjectProperty
empty object property	owl:bottomObjectProperty	owl:bottomObjectProperty
inverse property	ObjectInverseOf(PN)	_:x owl:inverseOf PN

Data Property Expressions

named data property	R	R
universal data property	owl:topDataProperty	owl:topDataProperty
empty data property	owl:bottomDataProperty	owl:bottomDataProperty

2.3 Individuals & Literals

named individual	aN	aN
anonymous individual	_:a	_:a
literal (datatype value)	"abc"^^DN	"abc"^^DN

2.4 Data Ranges

Data Range Expressions

named datatype	DN	DN
data range complement	DataComplementOf (D)	_:x rdf:type rdfs:Datatype. _:x owl:datatypeComplementOf D.
data range intersection	DataIntersectionOf (D1…Dn)	_:x rdf:type rdfs:Datatype. _:x owl:intersectionOf (D1…Dn).
data range union	DataUnionOf (D1…Dn)	_:x rdf:type rdfs:Datatype. _:x owl:unionOf (D1…Dn).
literal enumeration	DataOneOf (v1 … vn)	_:x rdf:type rdfs:Datatype. _:x owl:oneOf (v1 … vn).
datatype restriction	DatatypeRestriction (DN f1 v1 … fn vn)	_:x rdf:type rdfs:Datatype. _:x owl:onDatatype DN. _:x owl:withRestrictions (_:x1 ... _:xn). _:xj fj vj. j=1…n

2.5 Axioms

Class Expression Axioms

subclass	SubClassOf(C1 C2)	C1 rdfs:subClassOf C2.
equivalent classes	EquivalentClasses (C1 … Cn)	C_j owl:equivalentClass C_{j+1}. j=1…n-1
disjoint classes	DisjointClasses(C1 C2)	C1 owl:disjointWith C2.
pairwise disjoint classes	DisjointClasses (C1 … Cn)	_:x rdf:type owl:AllDisjointClasses. _:x owl:members (C1 … Cn).
disjoint union	DisjointUnionOf (CN C1 … Cn)	CN owl:disjointUnionOf (C1… Cn).

Object Property Axioms

subproperty	SubObjectPropertyOf (P1 P2)	P1 rdfs:subPropertyOf P2.
property chain inclusion	SubObjectPropertyOf (ObjectPropertyChain (P1 … Pn) P)	P owl:propertyChainAxiom (P1 … Pn).
property domain	ObjectPropertyDomain (P C)	P rdfs:domain C.
property range	ObjectPropertyRange (P C)	P rdfs:range C.
equivalent properties	EquivalentObjectProperties (P1 … Pn)	P_j owl:equivalentProperty P_{j+1}. j=1…n-1
disjoint properties	DisjointObjectProperties (P1 P2)	P1 owl:propertyDisjointWith P2.
pairwise disjoint properties	DisjointObjectProperties (P1 … Pn)	_:x rdf:type owl:AllDisjointProperties. _:x owl:members (P1 … Pn).

inverse properties	InverseObjectProperties (P1 P2)	P1 owl:inverseOf P2.
functional property	FunctionalObjectProperty (P)	P rdf:type owl:FunctionalProperty.
inverse functional property	InverseFunctionalObjectProperty (P)	P rdf:type owl:InverseFunctionalProperty.
reflexive property	ReflexiveObjectProperty (P)	P rdf:type owl:ReflexiveProperty.
irreflexive property	IrreflexiveObjectProperty (P)	P rdf:type owl:IrreflexiveProperty.
symmetric property	SymmetricObjectProperty (P)	P rdf:type owl:SymmetricProperty.
asymmetric property	AsymmetricObjectProperty (P)	P rdf:type owl:AsymmetricProperty.
transitive property	TransitiveObjectProperty (P)	P rdf:type owl:TransitiveProperty.

Data Property Axioms

subproperty	SubDataPropertyOf(R1 R2)	R1 rdfs:subPropertyOf R2.
property domain	DataPropertyDomain(R C)	R rdfs:domain C.
property range	DataPropertyRange(R D)	R rdfs:range D.
equivalent properties	EquivalentDataProperties (R1 … Rn)	R_j owl:equivalentProperty R_{j+1}. j=1…n-1
disjoint properties	DisjointDataProperties (R1 R2)	R1 owl:propertyDisjointWith R2.
pairwise disjoint properties	DisjointDataProperties (R1 … Rn)	_:x rdf:type owl:AllDisjointProperties. _:x owl:members (R1 … Rn).
functional property	FunctionalDataProperty(R)	R rdf:type owl:FunctionalProperty.

Datatype Definitions

datatype definition	DatatypeDefinition(DN D)	DN owl:equivalentClass D.

Assertions

individual equality	SameIndividual(a1 … an)	a_j owl:sameAs a_{j+1}. j=1…n-1
individual inequality	DifferentIndividuals(a1 a2)	a1 owl:differentFrom a2.
pairwise individual inequality	DifferentIndividuals (a1 … an)	_:x rdf:type owl:AllDifferent. _:x owl:members (a1 … an).
class assertion	ClassAssertion(C a)	a rdf:type C.
positive object property assertion	ObjectPropertyAssertion (PN a1 a2)	a1 PN a2.
positive data property assertion	DataPropertyAssertion (R a v)	a R v.
negative object property assertion	NegativeObjectPropertyAssertion (P a1 a2)	_:x rdf:type owl:NegativePropertyAssertion. _:x owl:sourceIndividual a1. _:x owl:assertionProperty P. _:x owl:targetIndividual a2.
negative data property assertion	NegativeDataPropertyAssertion (R a v)	_:x rdf:type owl:NegativePropertyAssertion. _:x owl:sourceIndividual a. _:x owl:assertionProperty R. _:x owl:targetValue v.

Keys

Key	HasKey(C (P1 … Pm) (R1 … Rn))	C owl:hasKey (P1 … Pm R1 … Rn). m+n>0

2.6 Declarations

class	Declaration(Class(CN))	CN rdf:type owl:Class.
datatype	Declaration(Datatype(DN))	DN rdf:type rdfs:Datatype.
object property	Declaration(ObjectProperty(PN))	PN rdf:type owl:ObjectProperty.
data property	Declaration(DataProperty(R))	R rdf:type owl:DatatypeProperty.
annotation property	Declaration (AnnotationProperty(A))	A rdf:type owl:AnnotationProperty.
named individual	Declaration (NamedIndividual(aN))	aN rdf:type owl:NamedIndividual.

2.7 Annotations

Annotations

annotation assertion	AnnotationAssertion (A s t)	s A t.
annotation of an axiom (where the axiom in RDF is one or more triples of the form si U ti, i.e., with the same predicate U.)	AXIOM(Annotation (A t) …)	_:xi A t. si U ti. … _:xi rdf:type owl:Axiom. _:xi owl:annotatedSource si. _:xi owl:annotatedProperty U. _:xi owl:annotatedTarget ti.
annotation of an axiom where the axiom in RDF is _:x U t1	AXIOM(Annotation (A t) …)	_:x A t. _:x U t1. …
annotation of another annotation (the other annotation in RDF starts with s1)	Annotation(Annotation (A t) … A1 t1)	_:x A t. s1 A1 t1. … _:x rdf:type owl:Annotation. _:x owl:annotatedSource s1. _:x owl:annotatedProperty A1. _:x owl:annotatedTarget t1.

Annotation Properties

named annotation property	A	A
human-readable name	rdfs:label	rdfs:label
human-readable comment	rdfs:comment	rdfs:comment
additional information	rdfs:seeAlso	rdfs:seeAlso
defining agent	rdfs:isDefinedBy	rdfs:isDefinedBy
version information	owl:versionInfo	owl:versionInfo
deprecation	owl:deprecated	owl:deprecated
backwards compatibility	owl:backwardCompatibleWith	owl:backwardCompatibleWith
incompatibility	owl:incompatibleWith	owl:incompatibleWith
prior version	owl:priorVersion	owl:priorVersion

Annotation Axioms

annotation subproperties	SubAnnotationPropertyOf(A1 A2)	A1 rdfs:subPropertyOf A2.
annotation property domain	AnnotationPropertyDomain(A U)	A rdfs:domain U.
annotation property range	AnnotationPropertyRange(A U)	A rdfs:range U.

2.8 Ontologies

OWL ontology (importing)[1] [2]	Ontology([ON [U]] Import(ON1)... Annotation(A t) ...)	ON rdf:type owl:Ontology. [ON owl:versionIRI U.] ON owl:imports ON1. ... ON A t. ...
prefix declaration[3]	Prefix(p=U)	@prefix p U.

1. [ ] represents optional constructs
2. In the RDF syntax _:x is used in place of ON if there is no ontology name ON.
3. RDF syntax is in Turtle, other RDF serializations may vary.

3 Built-in Datatypes and Facets

3.1 Built-in Datatypes

Universal Datatype	rdfs:Literal			
Numbers	owl:rational		owl:real	
	xsd:double	xsd:float	xsd:decimal	xsd:integer
	xsd:long	xsd:int	xsd:short	xsd:byte
	xsd:nonNegativeInteger		xsd:nonPositiveInteger	
	xsd:positiveInteger		xsd:negativeInteger	
	xsd:unsignedLong		xsd:unsignedInt	
	xsd:unsignedShort		xsd:unsignedByte	
Strings	rdf:PlainLiteral (RDF plain literals)			
	xsd:string	xsd:NCName	xsd:Name	xsd:NMTOKEN
	xsd:token	xsd:language	xsd:normalizedString	
Boolean Values	xsd:boolean (value space: true and false)			
Binary Data	xsd:base64Binary		xsd:hexBinary	
IRIs	xsd:anyURI			
Time Instants	xsd:dateTime (optional time zone offset)			
	xsd:dateTimeStamp (required time zone offset)			
XML Literals	rdf:XMLLiteral			

3.2 Facets

Facet	Value	Applicable Datatypes	Explanation
xsd:minInclusive xsd:maxInclusive xsd:minExclusive xsd:maxExclusive	literal in the corresponding datatype	Numbers, Time Instants	Restricts the value-space to greater than (equal to) or lesser than (equal to) a value
xsd:minLength xsd:maxLength xsd:length	Non-negative integer	Strings, Binary Data, IRIs	Restricts the value-space based on the lengths of the literals
xsd:pattern	xsd:string literal as a regular expression	Strings, IRIs	Restricts the value space to literals that> match the regular expression
rdf:langRange	xsd:string literal as a regular expression	rdf:PlainLiteral	Restricts the value space to literals with language tags that match the regular expression

A HTML version of the guide is at http://www.w3.org/TR/owl2-quick-reference/

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