

# RDFS: RDF Schema Definition

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Semantic web technologies  
2021

# RDF Schema (RDFS)

A **vocabulary** for structuring RDF graphs

Defined in <https://www.w3.org/TR/rdf-schema/>

Usual prefix: **rdfs** : <[http://www.w3.org/2000/01/rdf-schema#>](http://www.w3.org/2000/01/rdf-schema#)

# Classification

One way to make the world more understandable is to classify its objects, i.e. to put them into classes (the apples, the pears, the cars, the human beings, the ideas, ...)

- RDF objects (resources) can be classified by associating them with classes.
- An **RDF class** is a resource of type

`rdfs:Class`

- A resource `s` is an **instance** of a class `C` if there is a triple

`s rdf:type C`

# Example

# *ex:doc23.doc and ex:d97.doc are articles.*

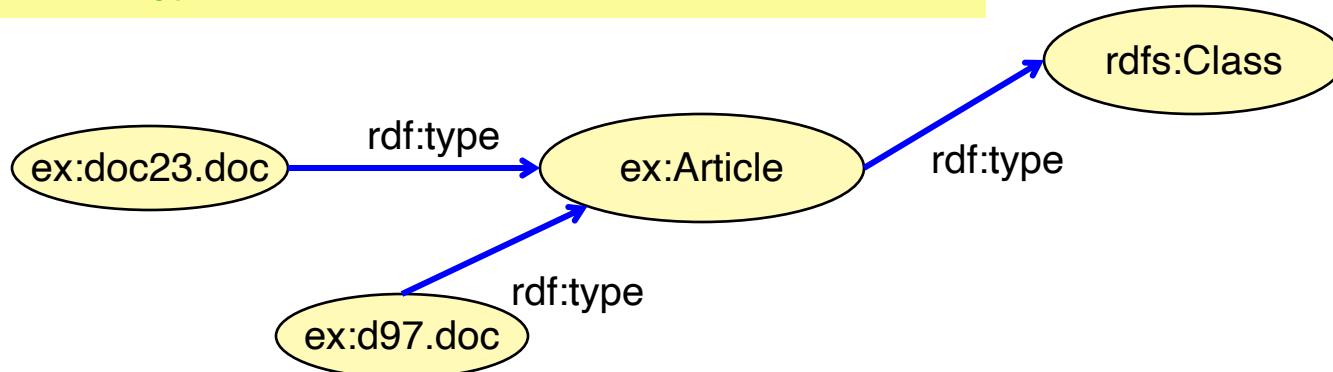
@prefix ex: <<http://cui.unige.ch/isi/cours/tws/rdfs#>>

@prefix rdfs: <<http://www.w3.org/2000/01/rdf-schema#>>

ex:Article rdf:type rdfs:Class

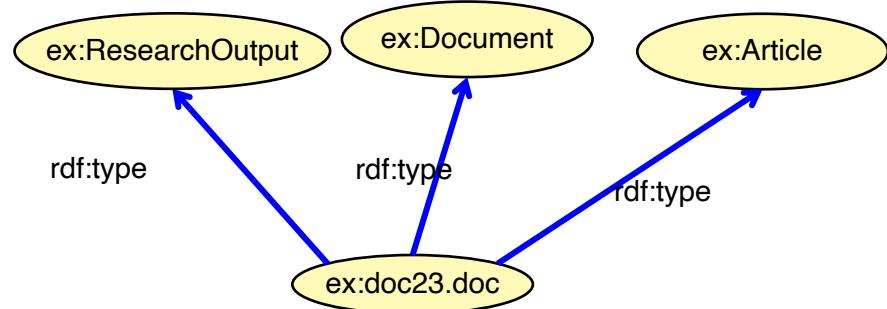
ex:doc23.doc rdf:type ex:Article

ex:d97.doc rdf:type ex:Article



# Multi-classification is allowed

An object may be an instance of several classes



ex:ResearchOutput a rdfs:Class.

ex:Document a rdfs:Class.

ex:Article a rdfs:Class.

ex:doc23.doc a ex:ResearchOutput, ex:Document, ex:Article .

# Structuring the classes : subClassOf

- To better understand the world, organize the classes in a generic/specific hierarchy
- A class C is a subclass of D if every instance of C is also an instance of D

ex:Document a rdfs:Class.

ex:Article a rdfs:Class ; rdfs:subClassOf ex:Document

ex:paper23.html a ex:Article .

ex:report09-12 a ex:Document

# subClassOf is transitive

if a graph contains

C **rdfs:subClassOf** D and D **rdfs:subClassOf** E

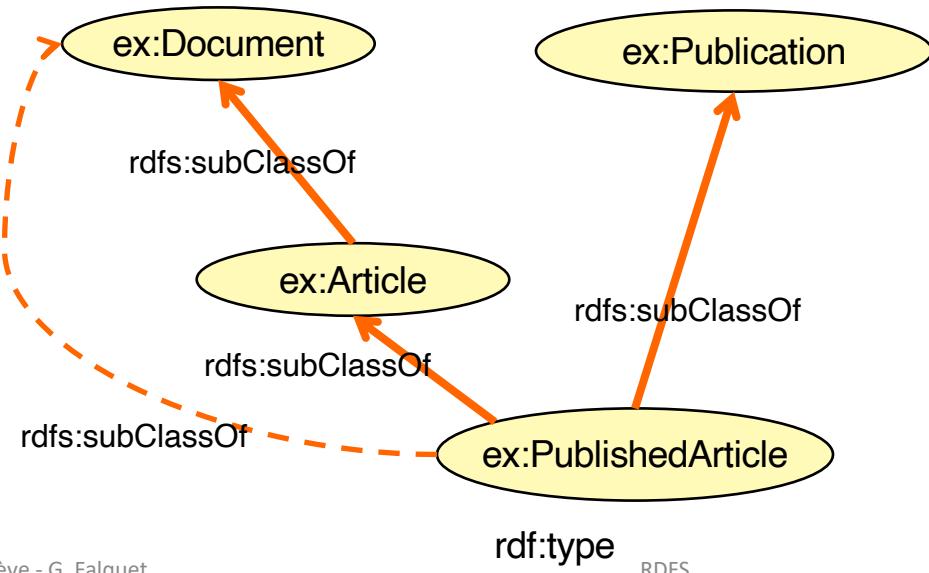
one can infer

C **rdfs:subClassOf** E

Such inferences are generally done by query or reasoning systems.

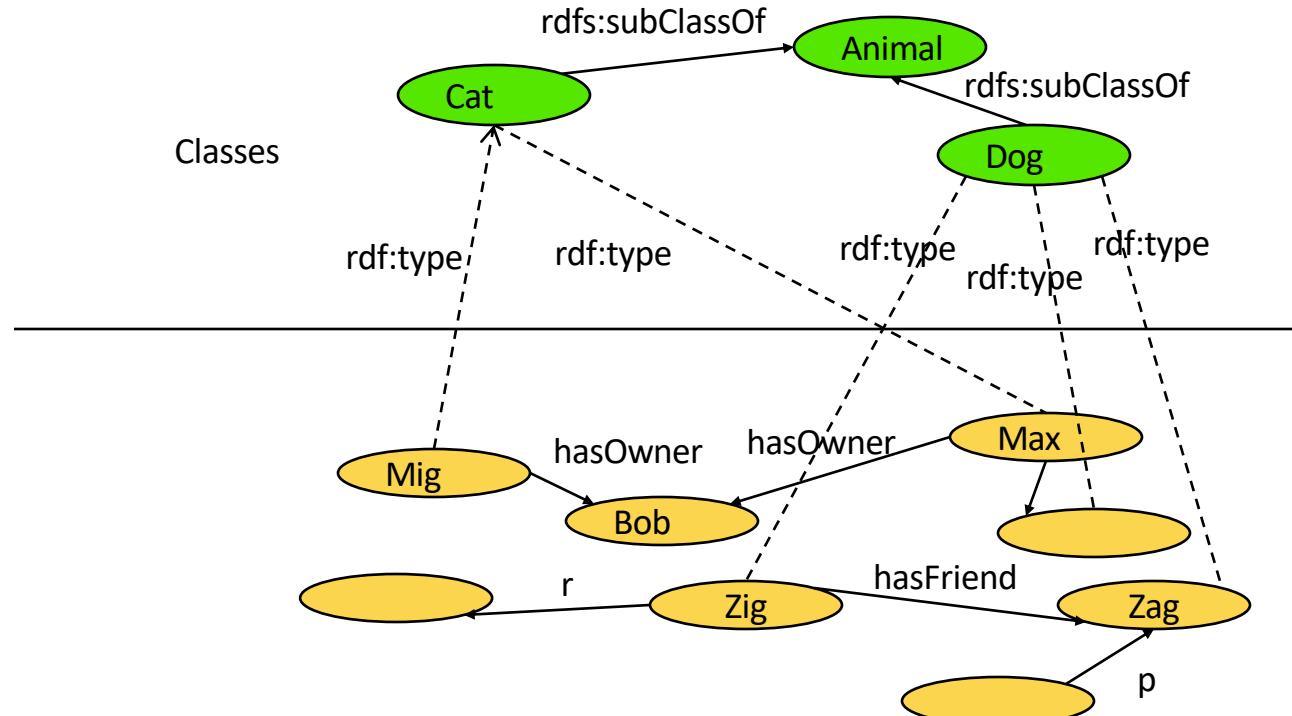
# Example

*every published article is an article and a publication, and an article is a document*

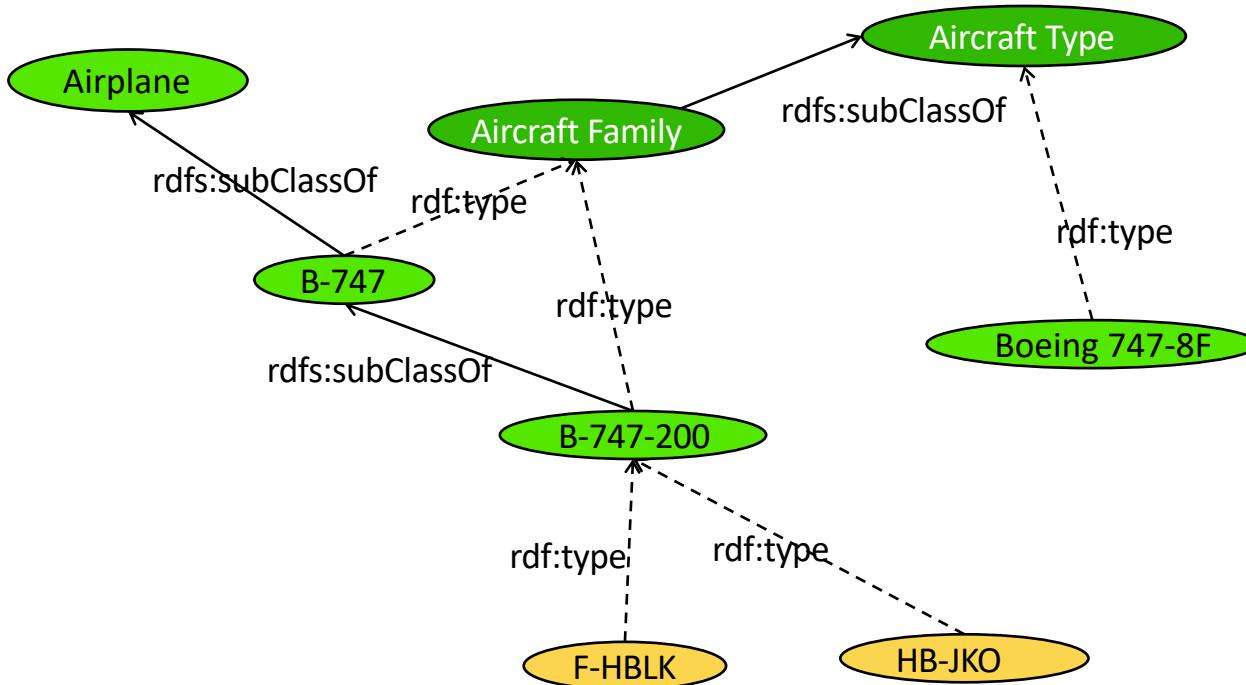


# The class and instance levels

It is generally a good idea to have two separate levels



# However there is no such constraint on RDF graphs



from wikidata.org

# Classes defined in RDFS

<a href="#"><u>rdfs:Resource</u></a>	The class resource, everything.
<a href="#"><u>rdfs:Literal</u></a>	The class of literal values, e.g. textual strings and integers.
<a href="#"><u>rdf:langString</u></a>	The class of language-tagged string literal values.
<a href="#"><u>rdf:HTML</u></a>	The class of HTML literal values.
<a href="#"><u>rdf:XMLLiteral</u></a>	The class of XML literal values.
<a href="#"><u>rdfs:Class</u></a>	The class of classes.
<a href="#"><u>rdf:Property</u></a>	The class of RDF properties.
<a href="#"><u>rdfs:Datatype</u></a>	The class of RDF datatypes.
<a href="#"><u>rdf:Statement</u></a>	The class of RDF statements.
<a href="#"><u>rdf:Bag</u></a>	The class of unordered containers.
<a href="#"><u>rdf:Seq</u></a>	The class of ordered containers.
<a href="#"><u>rdf:Alt</u></a>	The class of containers of alternatives.
<a href="#"><u>rdfs:Container</u></a>	The class of RDF containers.
<a href="#"><u>rdfs:ContainerMembershipProperty</u></a>	The class of container membership properties, rdf:_1, rdf:_2, ...,
<a href="#"><u>rdf:List</u></a>	The class of RDF Lists.

# Structuring properties

- Specify the domain and range of a property

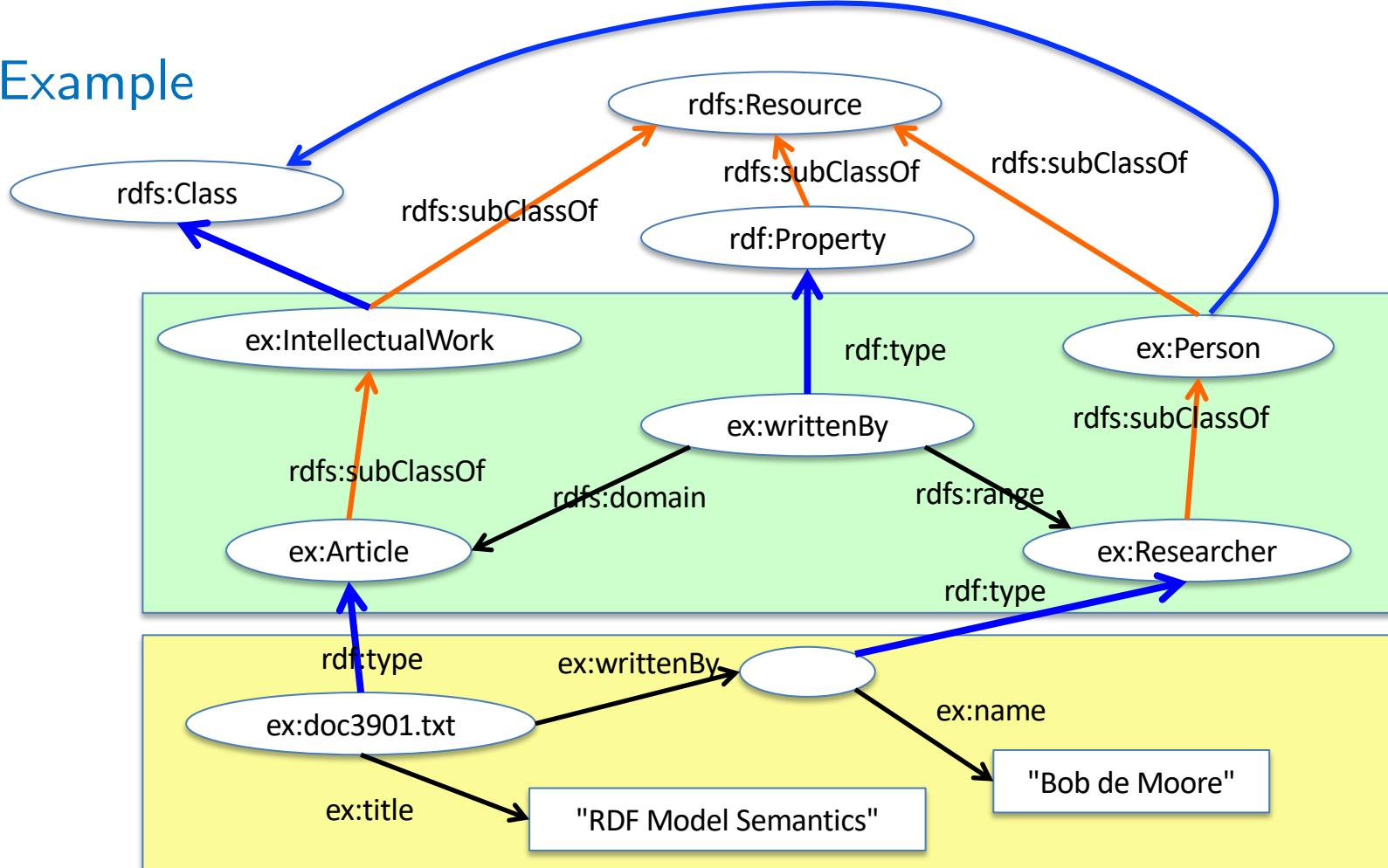
ex:teaches **rdfs:domain** ex:professor

ex:teaches **rdfs:range** ex:course

- Specify subproperties

ex:motherOf **rdfs:subPropertyOf** ex:parentOf

# Example



## # Schema

```
ex:IntellectualWork a rdfs:Class .  
ex:Person a rdfs:Class .  
ex:Article a rdfs:Class ; rdfs:subClassOf ex:IntellectualWork .  
ex:Researcher a rdfs:Class ; rdfs:subClassOf ex:Person .  
  
ex:writtenBy rdfs:domain ex:Article ; rdfs:range ex:Researcher .
```

## # Data

```
ex:doc3901.txt a ex:Article ;  
    ex:writtenBy [a ex:Researcher; ex:name "Bob de Moore"];  
    ex:title "RDF Model Semantics" .
```

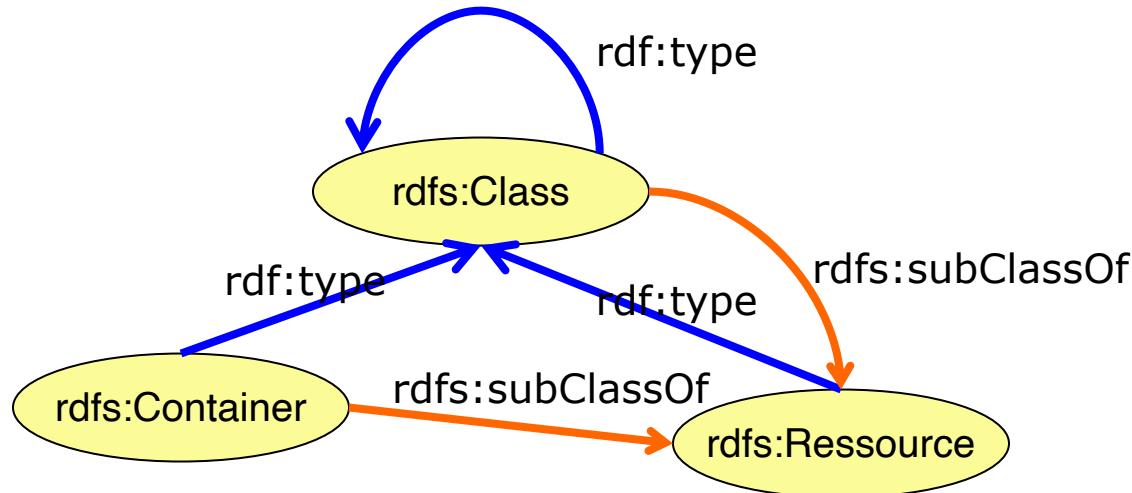
# Properties defined in RDF and RDFS

<a href="#"><u>rdf:type</u></a>	The subject is an instance of a class.	rdfs:Resource	rdfs:Class
<a href="#"><u>rdfs:subClassOf</u></a>	The subject is a subclass of a class.	rdfs:Class	rdfs:Class
<a href="#"><u>rdfs:subPropertyOf</u></a>	The subject is a subproperty of a property.	rdf:Property	rdf:Property
<a href="#"><u>rdfs:domain</u></a>	A domain of the subject property.	rdf:Property	rdfs:Class
<a href="#"><u>rdfs:range</u></a>	A range of the subject property.	rdf:Property	rdfs:Class
<a href="#"><u>rdfs:label</u></a>	A human-readable name for the subject.	rdfs:Resource	rdfs:Literal
<a href="#"><u>rdfs:comment</u></a>	A description of the subject resource.	rdfs:Resource	rdfs:Literal
<a href="#"><u>rdfs:member</u></a>	A member of the subject resource.	rdfs:Resource	rdfs:Resource
<a href="#"><u>rdf:first</u></a>	The first item in the subject RDF list.	rdf:List	rdfs:Resource
<a href="#"><u>rdf:rest</u></a>	The rest of the subject RDF list after the first item.	rdf:List	rdf:List
<a href="#"><u>rdfs:seeAlso</u></a>	Further information about the subject resource.	rdfs:Resource	rdfs:Resource
<a href="#"><u>rdfs:isDefinedBy</u></a>	The definition of the subject resource.	rdfs:Resource	rdfs:Resource
<a href="#"><u>rdf:value</u></a>	Idiomatic property used for structured values.	rdfs:Resource	rdfs:Resource
<a href="#"><u>rdf:subject</u></a>	The subject of the subject RDF statement.	rdf:Statement	rdfs:Resource
<a href="#"><u>rdf:predicate</u></a>	The predicate of the subject RDF statement.	rdf:Statement	rdfs:Resource
<a href="#"><u>rdf:object</u></a>	The object of the subject RDF statement.	rdf:Statement	rdfs:Resource

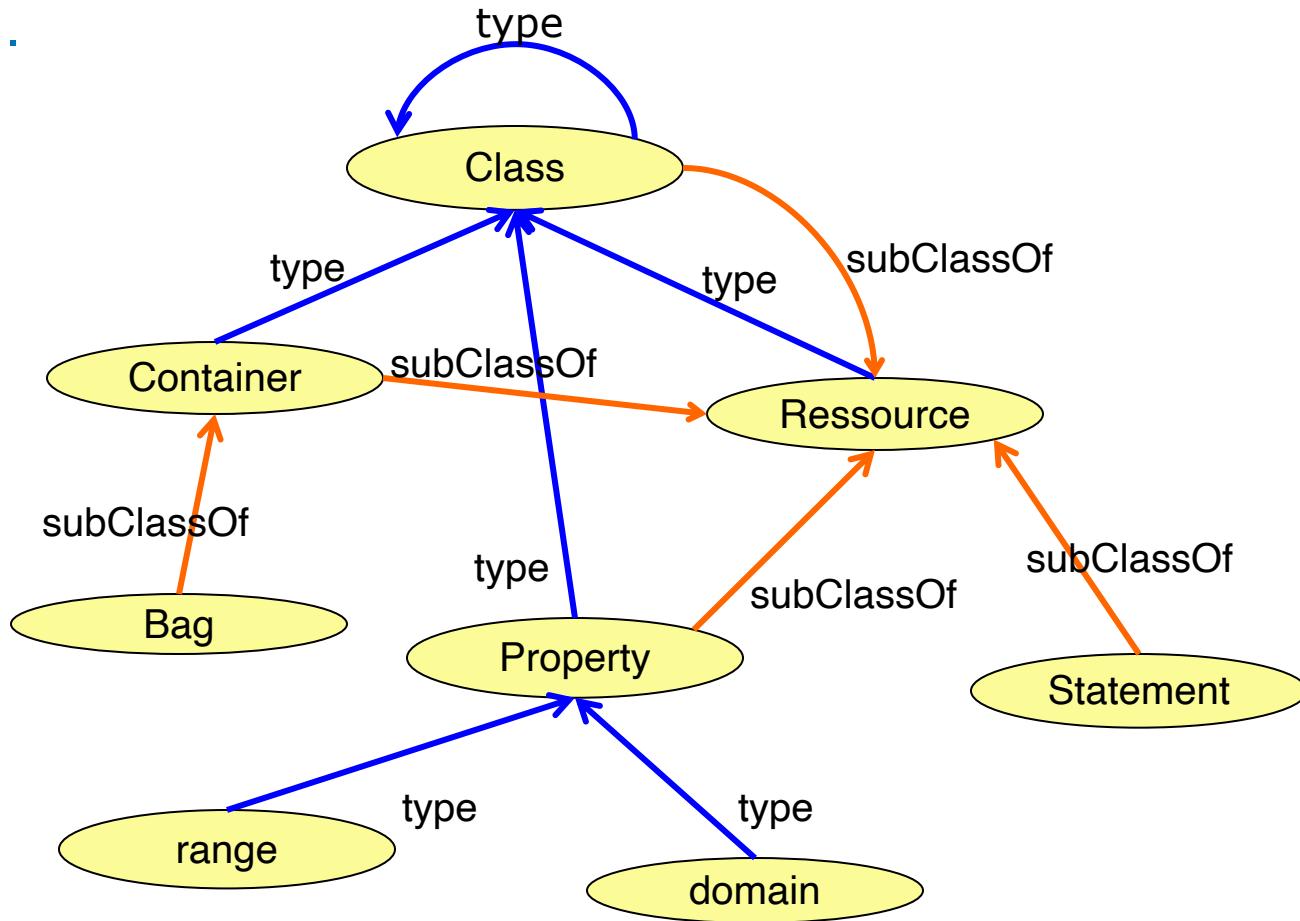
## Usage example

```
ex:Car a rdfs:Class ;  
    rdfs:subClassOf ex:Vehicle ;  
    rdfs:label "car"@en ;  
    rdfs:label "Auto"@de ;  
    rdfs:comment "A car (or automobile) is a wheeled motor vehicle used for  
transportation. Most definitions of car say they run primarily on roads, seat one to eight  
people, have four tires, and mainly transport people rather than goods (Wikipedia)." ;  
    rdfs:seeAlso <https://en.wikipedia.org/wiki/Car> .
```

# The meta-circular top level



more ...



# RDF Schemas and Database Schemas

**Structural independence** in RDF ⇒

RDF schema	Relational schema
data (RDF graph) can exist without a schema	a RDB needs a schema (tables, columns)
the schema does not define the data structure - always possible to add facts without referring to the schema vocabulary	each data element must fit in a table row
the schema can be modified at any time, without loss of data	deleting a column erases its information content
schema design may involve existing data - schema inference from data - data mining ↗ schema elements	schema design is based on a conceptual analysis. It must be completed before creating the first data element

# RDF Schemas and Database Schemas

**RDF schema are for inferring facts, not for constraining values**

```
ex:hasOwner rdfs:range ex:Person  
ex:catToy1 ex:hasOwner ex:Felix  
ex:Felix rdf:type ex:Cat
```

1. this is a legal RDFS graph
2. it entails ex:Felix **rdf:type** ex:Person

⇒ the schema plays a role in query answering

⇒ adding schema elements may add results to a query

# multiple domain/range

```
ex:hasOwner rdfs:domain ex:Cat  
ex:hasOwner rdfs:domain ex:Dog  
ex:hasOwner rdfs:domain ex:Car  
ex:Felix ex:hasOwner ex:Lena
```

entails

```
ex:Felix rdf:type ex:Cat  
ex:Felix rdf:type ex:Dog  
ex:Felix rdf:type ex:Car
```

Probably not the intended semantics