RDFS: RDF Schema Definition

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Semantic web technologies

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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#>

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

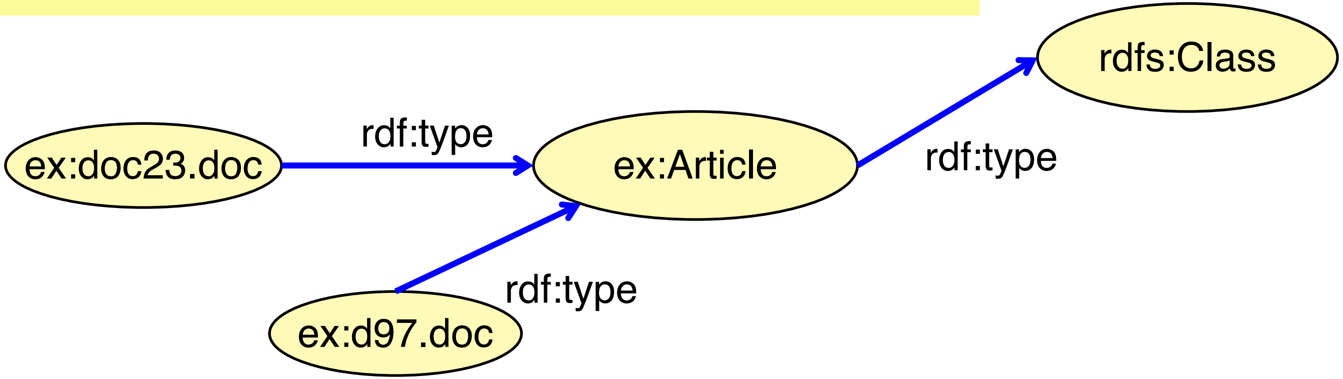
  C rdf:type rdfs:class → C est une classe

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

  s rdf:type C

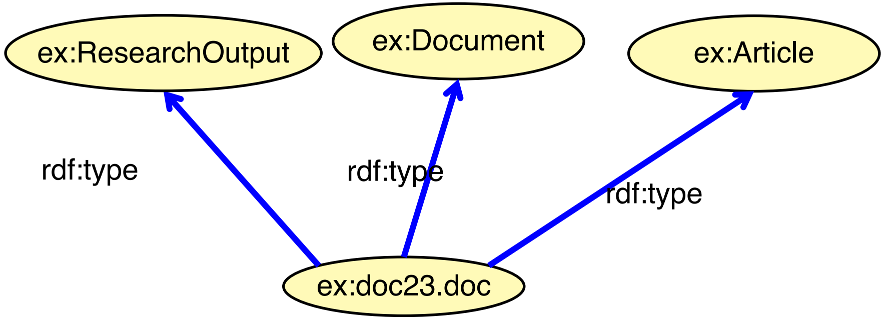
Example

```
# 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



turtle

→ rdf type

```
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

pas héritage → plutot sous ensemble

- 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

turtle

```
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

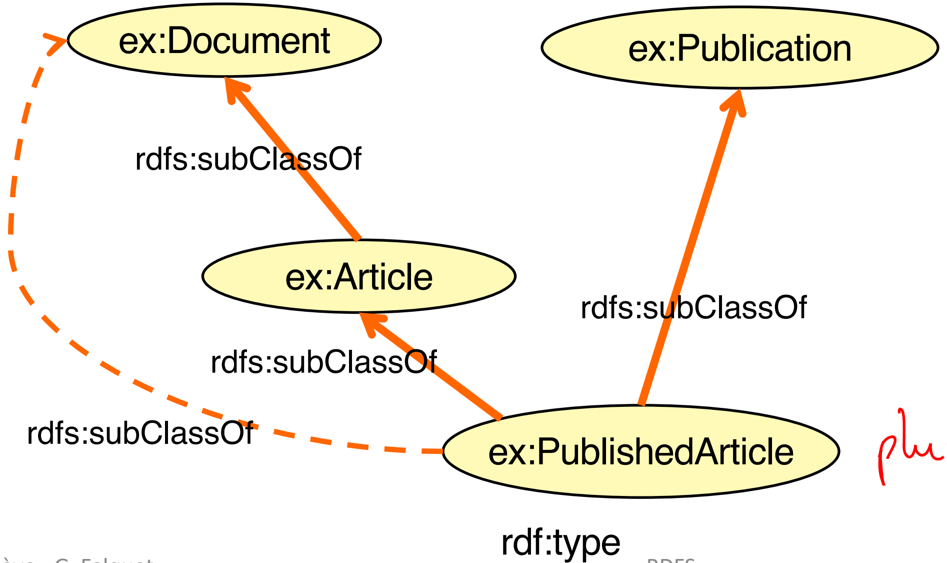
one can infer

C **rdfs:subclassOf** E

Such inferences are generally done by query or reasoning systems.

Example

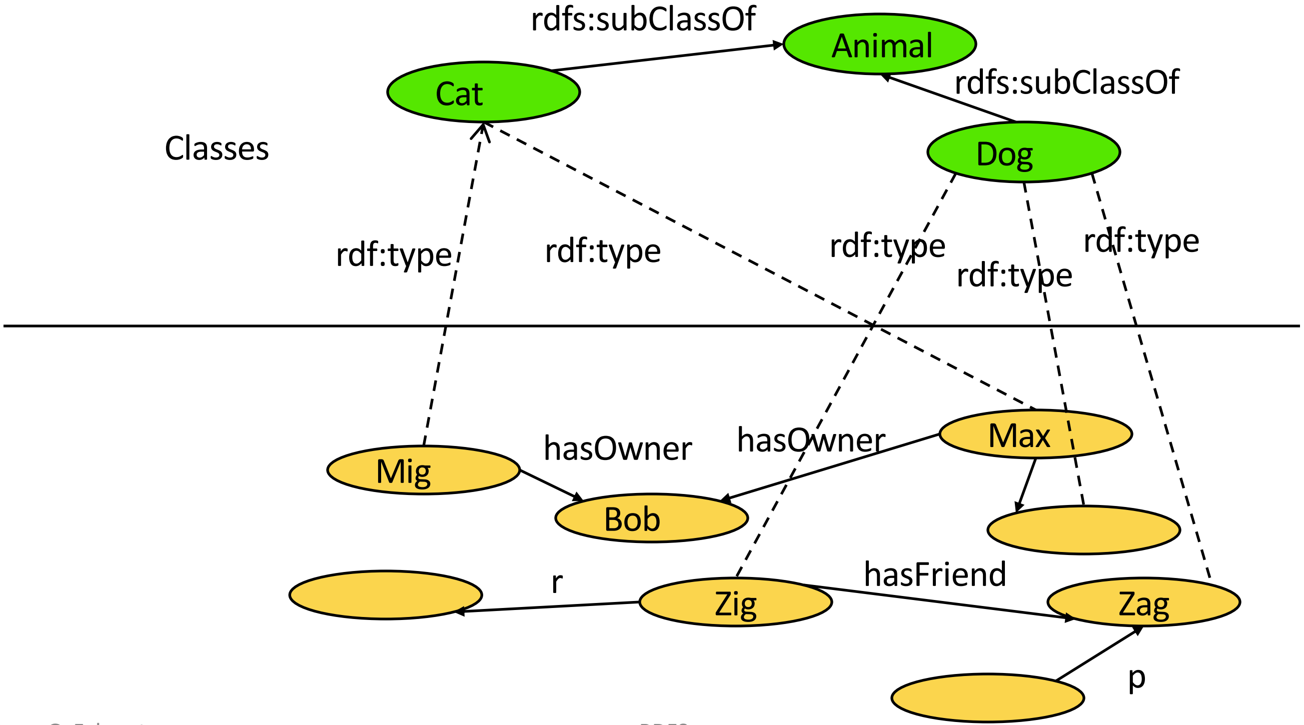
every published article is an article and a publication, and an article is a document



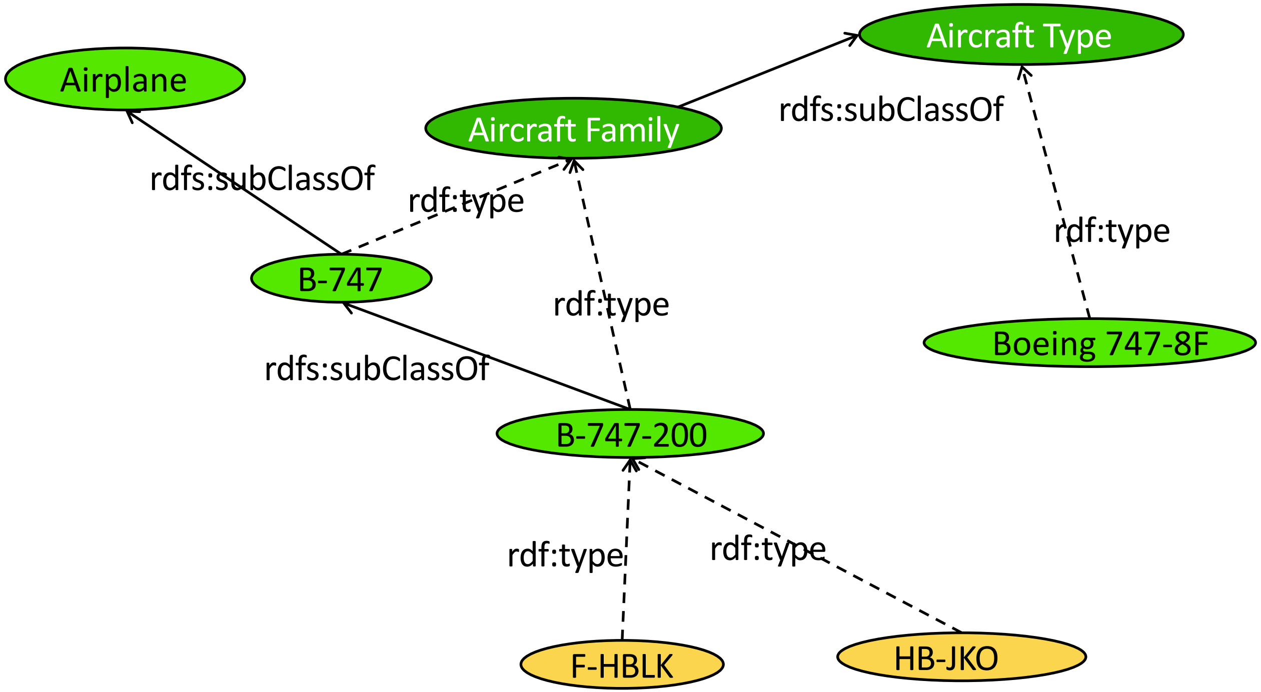
plusieur 'heritages'

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

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

Structuring properties

si qq'un teach ⇒ est un professeur

- Specify the domain and range of a property

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

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

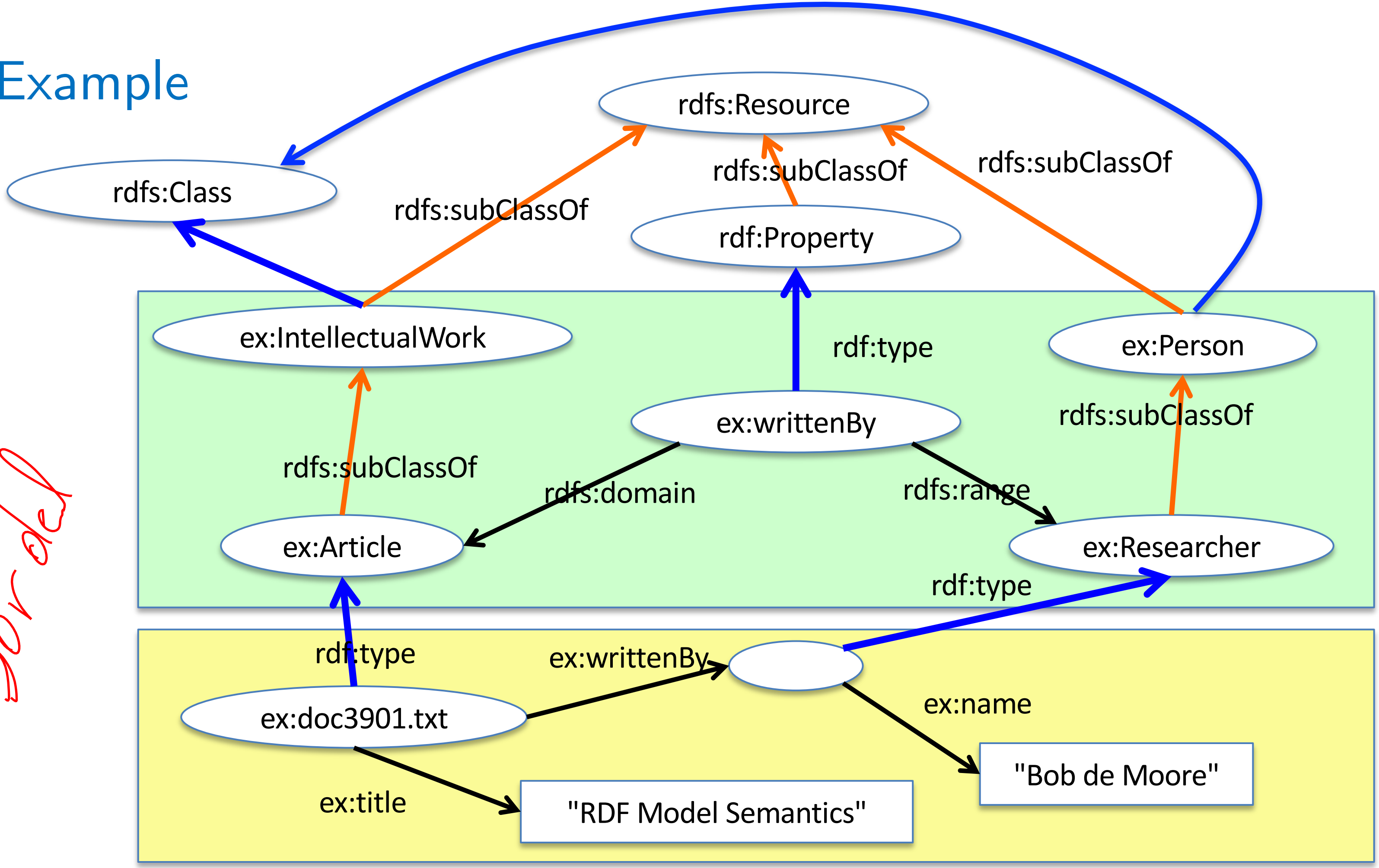
⇒ ce qui est enseigné est un cours

- Specify subproperties

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

X mère y → x parent y

Example



rdfs:Resource

rdfs:Class

rdfs:subClassOf

rdfs:subClassOf

rdfs:subClassOf

rdf:Property

rdfs:subClassOf

ex:IntellectualWork

rdf:type

ex:Person

ex:writtenBy

rdfs:subClassOf

rdfs:subClassOf

rdfs:domain

rdfs:range

ex:Article

ex:Researcher

rdf:type

rdf:type

ex:writtenBy

ex:name

ex:doc3901.txt

"Bob de Moore"

ex:title

"RDF Model Semantics"

bordel

turtle d'avant

```
# 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" .
```

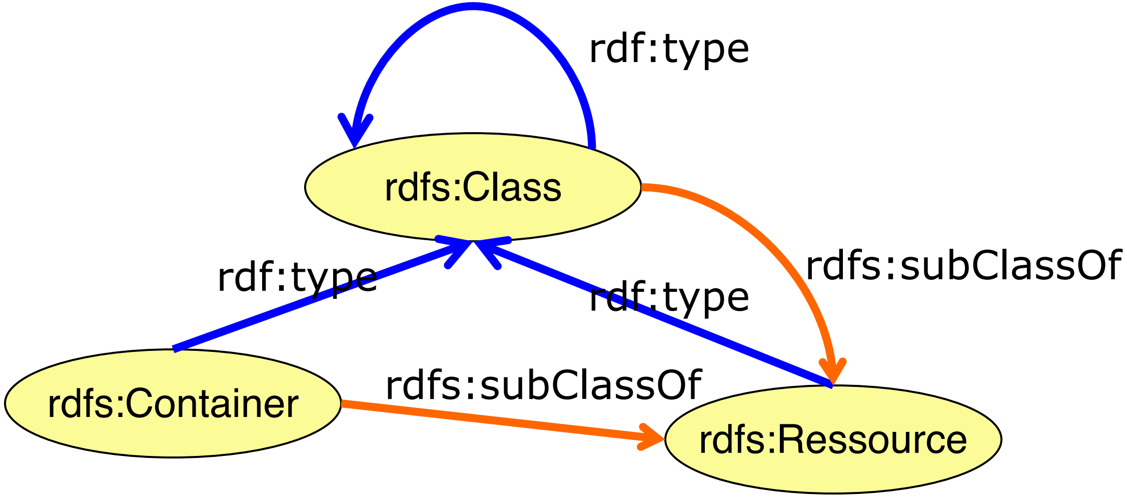
Properties defined in RDF and RDFS

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

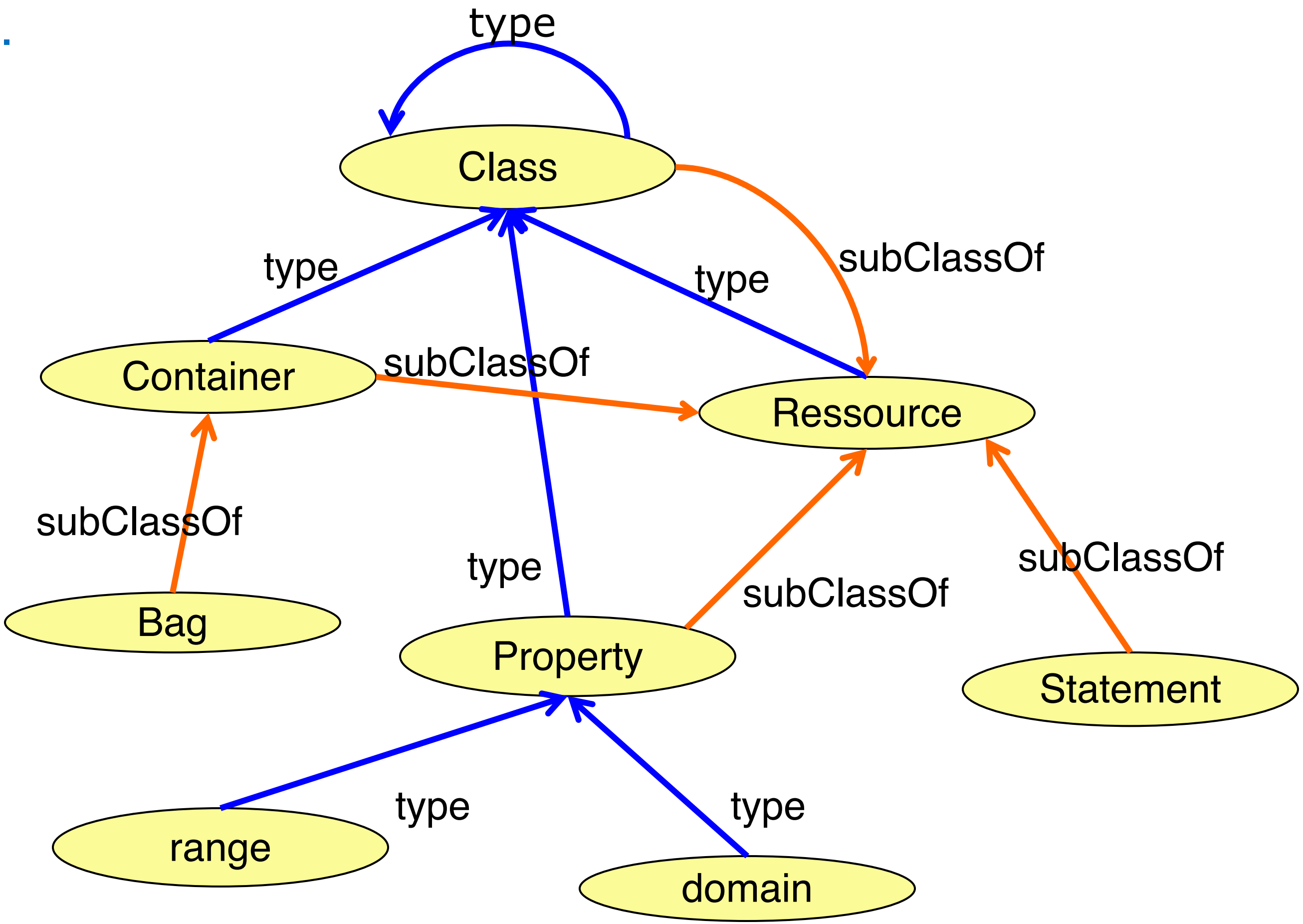
Usage example

```
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 ...


type
Class
type
subClassOf
type
Container
subClassOf
Ressource
subClassOf
type
subClassOf
subClassOf
Bag
Property
Statement
type
type
range
domain

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
```

↳ Felix peut être un chat / chien / voiture

entails

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

on évite de définir plusieurs domaines pour la même propriété.

Probably not the intended semantics