



RDF Schema

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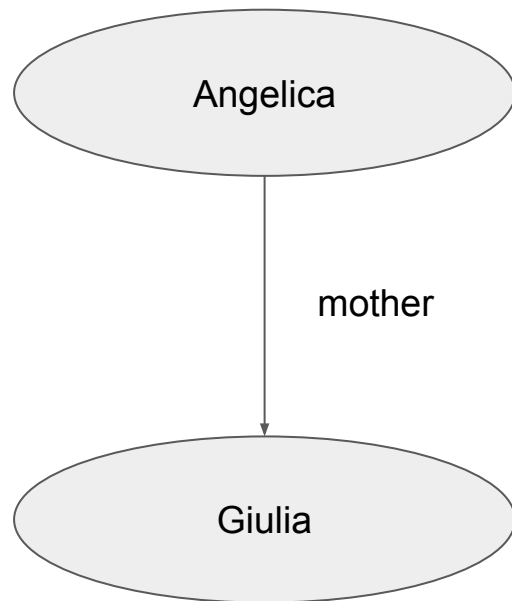
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**Linked Open Data:
a paradigm for the
Semantic Web**

Motivation

- RDF allows to express facts
 - *Angelica is Giulia's mother*
- but RDF does not allow to specify more generic knowledge
 - *mothers are female*
 - *If somebody has a daughter then that person is a parent*
- This kind of knowledge is called **schema** knowledge or **terminological** knowledge



RDF Schema gives us the possibility to model such knowledge

RDF Schema (RDFS)

- **W3C RDF recommendation**
- the Namespace of RDF Schema is <http://www.w3.org/2000/01/rdf-schema#>
 - (common prefix: rdfs)
- generic vocabulary
 - not associated to a specific area

Classes

- Classes are groups of resources
- The members of a class are known as *instances* of the class
- Classes are themselves resources
 - The group of resources that are RDF Schema classes is called `rdfs:Class`
- Classes are identified by URIs
- The membership of a resource to a class is defined using the **rdf:type** property.

Ringo is a dog.

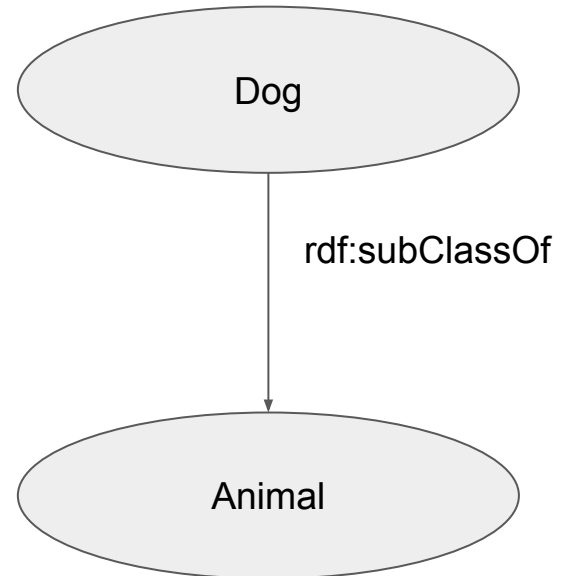
```
ex:Ringo rdf:type ex:Dog .
```

Classes (2)

- Classes can be arranged in hierarchies using the **rdfs:subClassOf** property.

Every dog is an animal.

```
ex:Dog rdfs:subClassOf ex:Animal .
```



Resources

- All things described by RDF are called *resources*, and are instances of the class **rdfs:Resource**
- rdfs:Resource is the class of everything
 - All other classes are subclasses of this class.
 - rdfs:Resource is an instance of rdfs:Class.

Other RDFS classes

- **rdf:Property** is the class of all properties.
- **rdfs:Datatype** is the class of all datatypes.
- **rdfs:Literal** is the class of literal values such as Strings or Integers.
- **rdf:langString** is the class of language-tagged string literals.
- **rdf:XMLLiteral** is the class of XML literal values.
- **rdf:Statement** is the class of the RDF statements. So every RDF triple can be seen as an instance of this class with a *rdf:subject*, *rdf:predicate* and *rdf:object* property.

Range and Domain of a Property

- Every property has a *Domain* and a *Range* that specify which class the subject or the object must have.

ex:Angelica

ex:drives

ex:Car



Domain



Range

```
ex:drives rdfs:domain ex:Person .  
ex:drives rdf:range ex:Vehicle .
```


Statements

How can we state in RDF the following sentence?

"The detective supposes that the butler killed the gardener."

- I solution
 - `ex:detective ex:supposes "the butler killed the gardener" .`
- II solution
 - `ex:detective ex:supposes ex:theButlerKilledTheGardener .`
- III solution
 - `ex:Butler ex:killed ex:Gardener .`

Statements (2)

- `rdfs:Statements` solve the problem
- defined by the following properties
 - **rdf:subject** defining an `rdfs:Resource` which is the subject of the statement
 - **rdf:predicate** defining an `rdf:Property` which is the predicate of the statement
 - **rdf:object** defining an `rdf:Resource` which is the object of the statement

```
ex:Detective    ex:supposes    _:theory .
_:theory       rdf:type      rdf:Statement .
_:theory       rdf:subject   ex:Butler .
_:theory       rdf:predicate ex:hasKilled .
_:theory       rdf:object   ex:Gardener .
_:theory       ex:hasState  "unproved" .
```



Used a blank node to
define the theory

Other information

RDF-Schema gives the possibility to add additional information to resources using the following properties:

- **rdfs:label** can be used to give a human readable name for a resource.
- **rdfs:comment** for adding a longer comment or explanation.
- **rdfs:seeAlso** points to an URI where additional information about the resource can be found.
- **rdfs:isDefinedBy** points to an URI where the resource is defined.
 - (rdfs:isDefinedBy is a subproperty of rdfs:seeAlso)

Limitations of RDFS

RDF Schema does not contain possibilities to make the following Expressions:

- It is not possible to define a negation of an expression.
 - For example it is not possible that the Domain of a property does not contain a certain class.
- It is not possible to define cardinalities.
 - For example it is not possible that a Person has either 0 or 1 ex:isMarriedTo relations.
- It is not possible to define metadata of the schema.
 - We are not able to add important metadata like a version to the schema.

Assignment 1

Write an RDF/RDFS model representing the following statements:

- URI1 and URI2 are classes
- URI3 is a property
- URI4 is an instance of class URI1
- URI5 and URI6 are instances of class URI2
- URI3 has domain URI1 and range URI2
- (URI6,URI4) is an instance of property URI3

Solution

- URI1 and URI2 are classes
- URI3 is a property
- URI4 is an instance of class URI1

```
@prefix rdf:
<http://www.w3.org/1999/02/22-rdf-
syntax-ns#> .
@prefix rdfs:
<http://www.w3.org/2000/01/rdf-sch
ema#> .
@prefix ex:
<http://example.org/myVocabulary/>
.
ex: URI1 rdf:type rdfs:Class .
ex:URI2 rdf:type rdfs:Class .
ex:URI3 rdf:type rdfs:Property .
```

Solution (cont.)

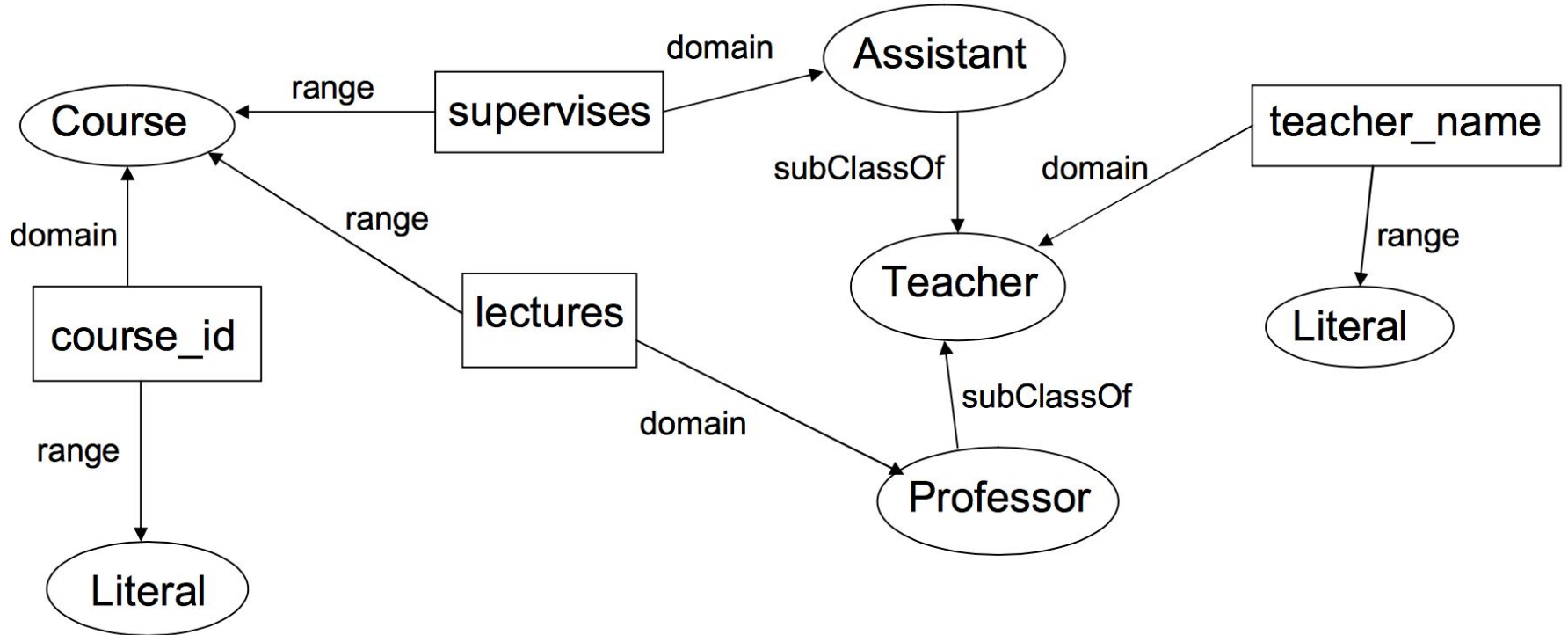
- URI5 and URI6 are instances of class URI2
- URI3 has domain URI1 and range URI2
- (URI6,URI4) is an instance of property URI3

```
ex:URI4 rdf:type ex:URI1 .
ex:URI5 rdf:type ex:URI2 .
ex:URI6 rdf:type ex:URI2 .
ex:URI3 rdfs:domain ex:URI1;
rdfs:range ex:URI2 .
ex:URI6 ex:URI3 ex:URI4 .
```

Assignment 2

- Give a graphical presentation and RDF Schema that describe the following:
 - Professors and assistants are subclasses of teachers.
 - Each teacher has a name.
 - Each course has a `course_id`.
 - Professors lecture courses while assistants supervise courses.

Solution



Assignment 3

- Describe an RDF resource representing yourself, using the properties:
 - `rdfs:label`
 - `rdfs:comment`
 - `rdfs:seeAlso`
 - ...

Solution

ex:Angelica

rdf:type foaf:Person ;

rdfs:label "Angelica Lo Duca" ;

rdfs:SeeAlso <<http://www.iit.cnr.it/angelica.loduca>> .