RDFS Entailments

Data, Information & Knowledge

Continuum

- Data: raw facts
- Information, knowledge: facts with semantics
- Knowledge: deduce new data, information and knowledge

Inference / Entailment

Knowledge + Inference Rules

=>

new Knowledge

INFERENCE / ENTAILMENT

RDFS Entailment

Inference Rule

if A then B

A => B

B :- A

Inference Rule

Hominidae(?x) :- Human(?x)

Mammal(?x) :- Hominidae(?x)

Vertebrate(?x) :- Mammal(?x)

Modus Ponens

B :- A & A

=> B

Modus Ponens

grandParent(?x, ?z) :-

parent(?x, ?y) & parent(?y, ?z)

parent(John, Mary)

parent(Mary, James)

=>

grandParent(John, James)

RDFS ENTAILMENT

RDF

RDF: triples

subject predicate object

```
ex:John  foaf:knows  ex:James ;
         rdfs:label  "John" .
```

RDFS

RDFS: Class Hierarchy & Property definition

foaf:Person rdfs:subClassOf ex:Living

foaf:knows rdfs:domain foaf:Person

RDF(S) Semantics

- RDF 1.1 Semantics
- W3C Recommendation 25 February 2014
- https://www.w3.org/TR/rdf11-mt/

RDFS Entailment

- Type inference
- Class subsumption
- Property subsumption
- Domain & range inference

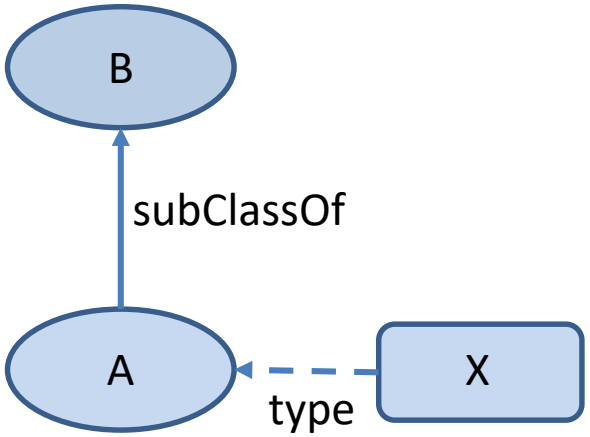
Type

?x rdf:type ?b

:-

?x rdf:type ?a &

?a rdfs:subClassOf ?b



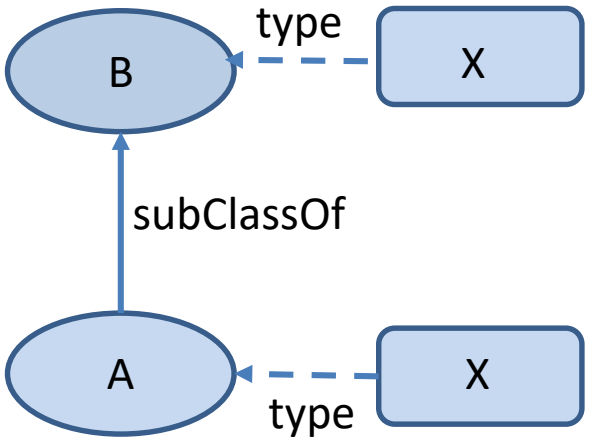
Type

?x rdf:type ?b

:-

?x rdf:type ?a &

?a rdfs:subClassOf ?b



Type

?x rdf:type rdfs:Resource

:-

?x rdf:type ?y

Type

?y rdf:type rdfs:Resource

:-

?x rdf:type ?y

Class subsumption

rdfs:subClassOf is transitive

?x rdfs:subClassOf ?z

:-

?x rdfs:subClassOf ?y &

?y rdfs:subClassOf ?z

Class subsumption

?c rdfs:subClassOf ?c

:-

?c rdf:type rdfs:Class

Class subsumption

?c rdfs:subClassOf rdfs:Resource

:-

?c rdf:type rdfs:Class

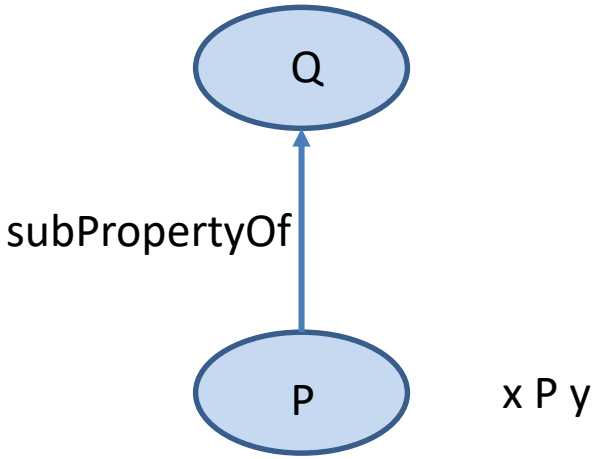
Property subsumption

?x ?q ?y

:-

?x ?p ?y &

?p rdfs:subPropertyOf ?q



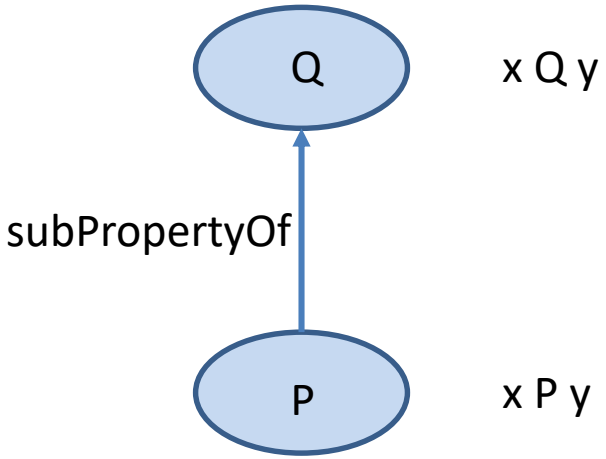
Property subsumption

?x ?q ?y

:-

?x ?p ?y &

?p rdfs:subPropertyOf ?q



Property subsumption

ex:author *rdfs:subPropertyOf* ex:creator

foaf:name *rdfs:subPropertyOf* rdfs:label

foaf:knows *rdfs:subPropertyOf* rdfs:seeAlso

Property subsumption

?p rdfs:subPropertyOf ?p

:-

?p rdf:type rdf:Property

Property subsumption

rdfs:subPropertyOf is transitive

?p rdfs:subPropertyOf ?r

:-

?p rdfs:subPropertyOf ?q &

?q rdfs:subPropertyOf ?r &

Domain

?s rdf:type ?d

:-

?p rdfs:domain ?d &

?s ?p ?o

foaf:name rdfs:domain foaf:Person .

ex:John foaf:name 'John' .

=>

ex:John rdf:type foaf:Person .

Domain

A property may have several domains

ex:speed rdfs:domain ex:Object, ex:Mobile .

ex:soyuz a ex:SpaceCraft ; ex:speed 28000 .

ex:soyuz a ex:Object, ex:Mobile .

Range

?o rdf:type ?r

:-

?p rdfs:range ?r &

?s ?p ?o

foaf:knows rdfs:range foaf:Person .

ex:John foaf:knows ex:Jack .

=>

ex:Jack rdf:type foaf:Person .

Range

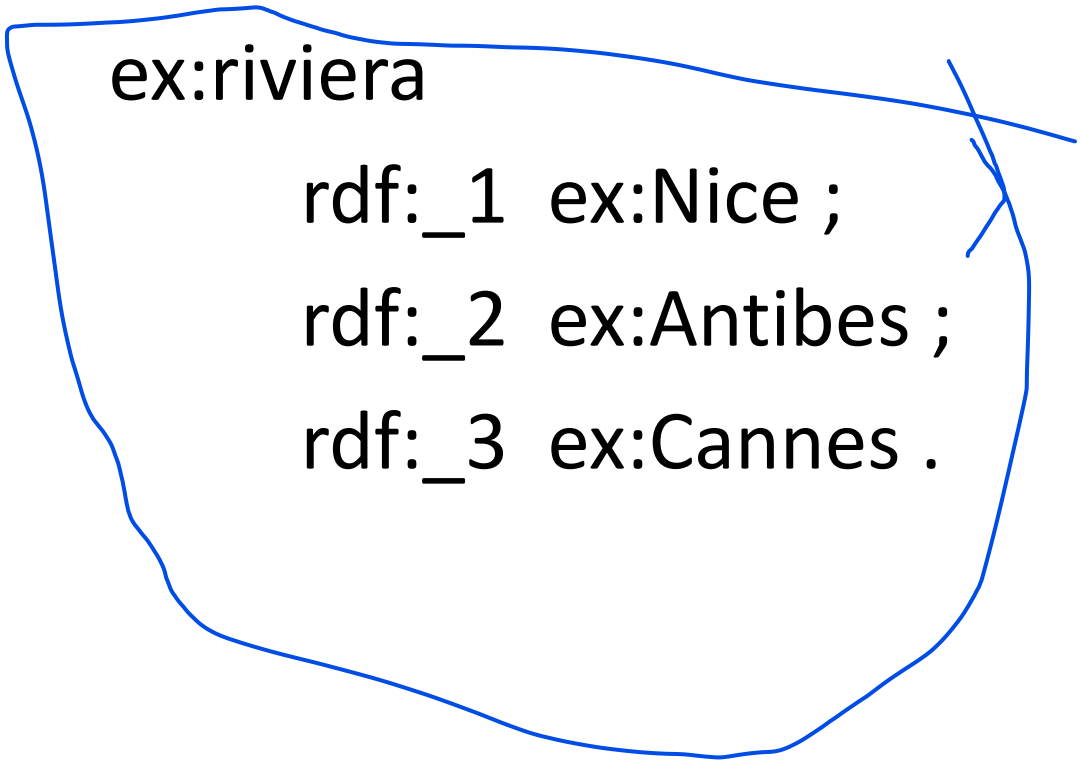
A property may have several ranges

ex:hasVehicule rdfs:range ex:Object, ex:Mobile .

ex:witch ex:hasVehicule ex:broom .

ex:broom a ex:Object, ex:Mobile .

Container (rdf:Bag …)



Container (rdf:Bag …)

rdf:_1 a rdfs:ContainerMembershipProperty

rdf:_2 a rdfs:ContainerMembershipProperty

…

?p rdfs:subPropertyOf rdfs:member

:-

?p a rdfs:ContainerMembershipProperty

Use Case

RDFS Entailments:

- « *complement* » RDF graphs
- used to answer SPARQL queries