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RDF Schema

COMP6215 Semantic Web Technologies

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Using RDF to define RDFS

RDF by itself lets us express facts (i.e. triples), but it doesn't let us define the vocabulary that's used in those triples – for that we need an ontology language

RDFS is a simple ontology language for use with RDF

RDFS is an RDF vocabulary which contains:

- Classes for defining classes and properties
- Properties for defining basic characteristics of classes and properties
  - Global property domains and ranges
- Some ancillary properties
  - Defined by, see also, label, comment

Notes on RDF and RDFS namespaces

Most terms in RDF Schema are defined as part of the RDFS namespace

- `http://www.w3.org/2000/01/rdf-schema#` , abbreviated here as `rdfs:`

A few terms are defined as part of the RDF namespace: rdf:type, rdf:Property, rdf:List, rdf:first, rdf:rest, rdf:nil

- `http://www.w3.org/1999/02/22-rdf-syntax-ns#` , abbreviated as `rdf:`

This is a historical accident, but can trip up the unwary

Be careful when using these terms in SPARQL queries!

Notes on entailment

The three knowledge representation and ontology languages (RDF, RDFS, OWL) each provide entailments – things that logically follow from what we already know

- RDF provides a very limited entailment relating to datatypes and properties
- RDFS provides a simple entailment relating to classes and properties
- OWL provides a more sophisticated entailment

RDF entailment

RDF defines a small number of axiomatic triples (things which are always true):

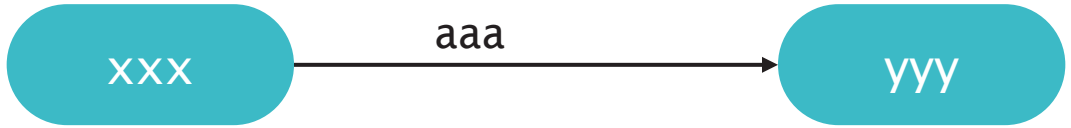
```
rdf:type rdf:type rdf:Property .
rdf:first rdf:type rdf:Property .
rdf:rest rdf:type rdf:Property .
rdf:nil rdf:type rdf:List .
```

RDF entailment

RDF defines the following entailment pattern:

if a graph contains: `xxx aaa yyy .`
then it entails: `aaa rdf:type rdf:Property .`

(i.e. anything used as the predicate of a triple is an instance of an `rdf:Property`)



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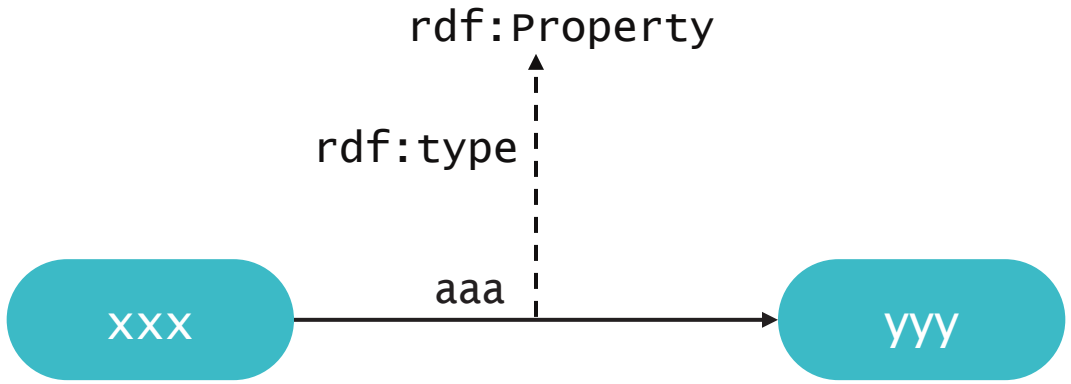

RDF datatype entailment

if a graph contains: `xxx aaa "sss"^^ddd .`
and ddd is a recognised datatype URI
then it entails: `xxx aaa _:nnn .`
`_:nnn rdf:type ddd .`

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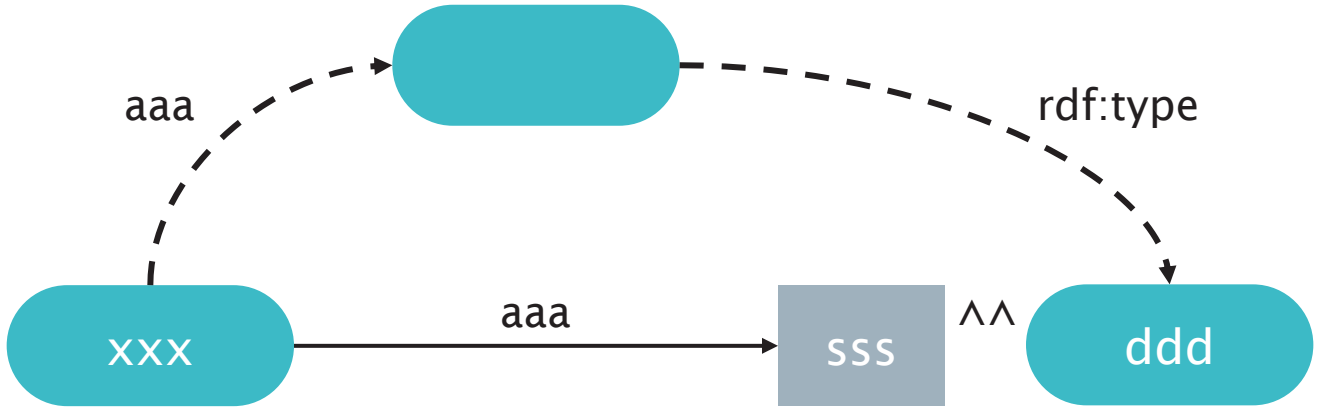

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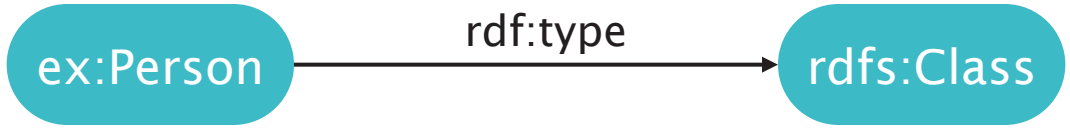
Defining ontologies in RDF Schema

RDF Schema class definitions

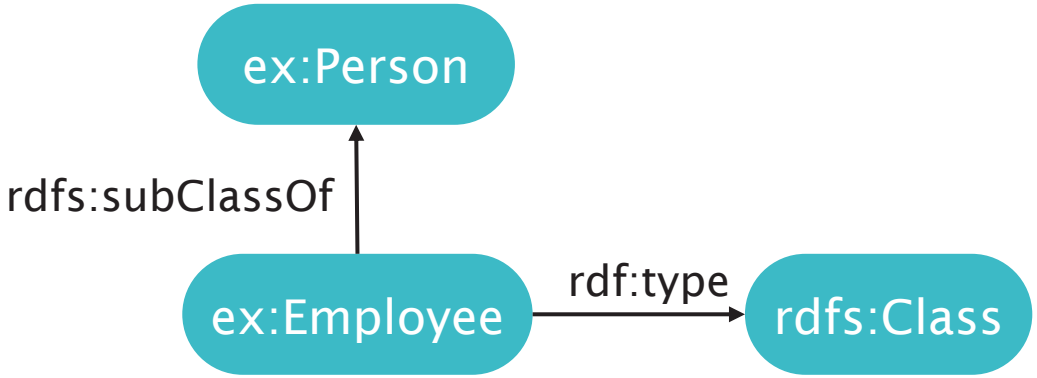
We wish to define the class Person:




```
ex:Person rdf:type rdfs:Class .
```

RDF Schema class definitions

Employee is a subclass of Person

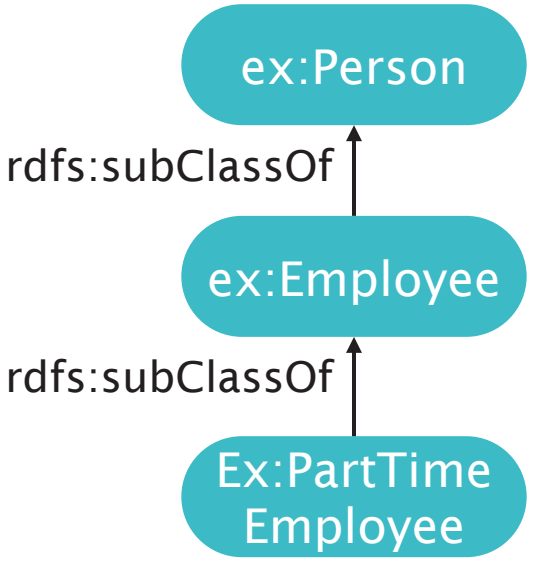



```
ex:Employee rdf:type rdfs:Class ;
            rdfs:subClassOf ex:Person .
```

RDF Schema class semantics

rdfs:subClassOf is transitive

(A rdfs:subClassOf B) and (B rdfs:subClassOf C) implies (A rdfs:subClassOf C)



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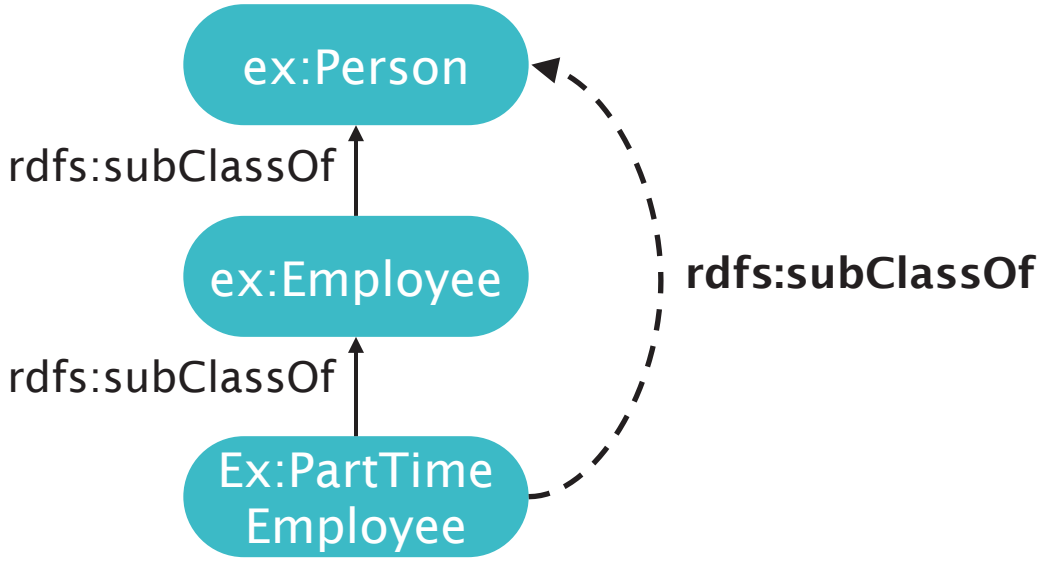

RDF Schema class semantics

rdfs:subClassOf is reflexive

- All classes are subclasses of themselves

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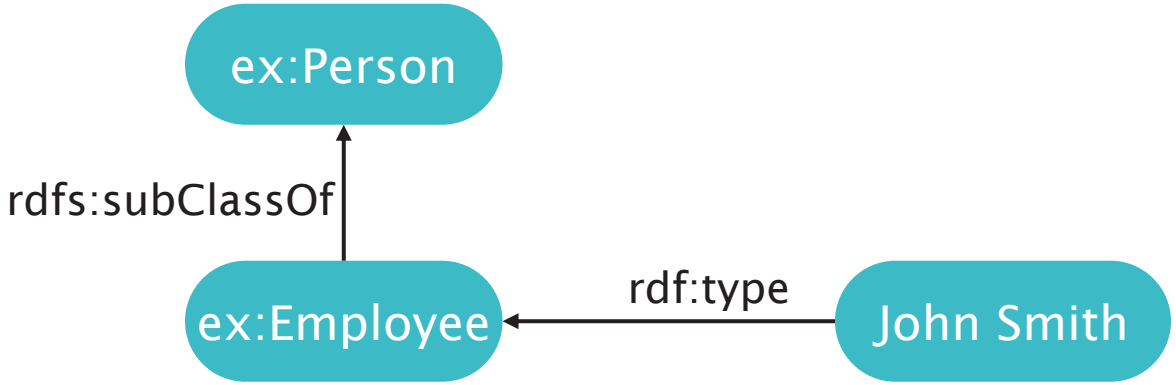
RDF Schema class semantics

rdf:type distributes over rdf:subClassOf

- (A rdfs:subClassOf B) and (C rdf:type A) implies (C rdf:type B)



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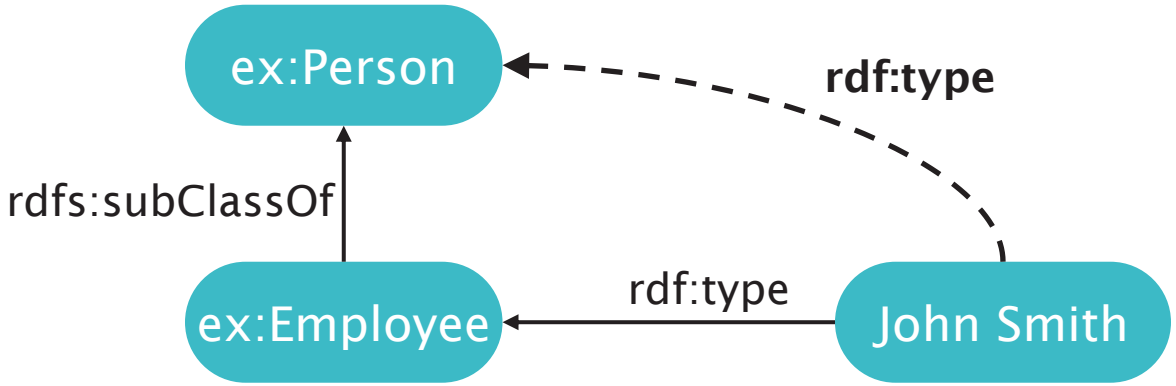
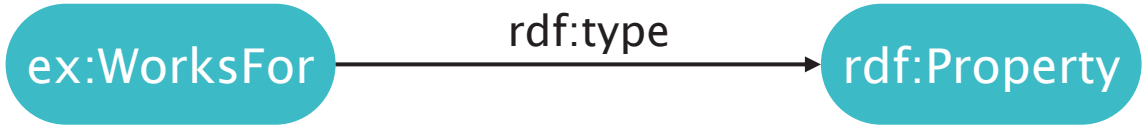


RDF Schema property definitions

We wish to define the property worksFor:




```
ex:WorksFor rdf:type rdf:Property .
```

RDF Schema property definitions

Important difference between RDF and object-oriented programming languages

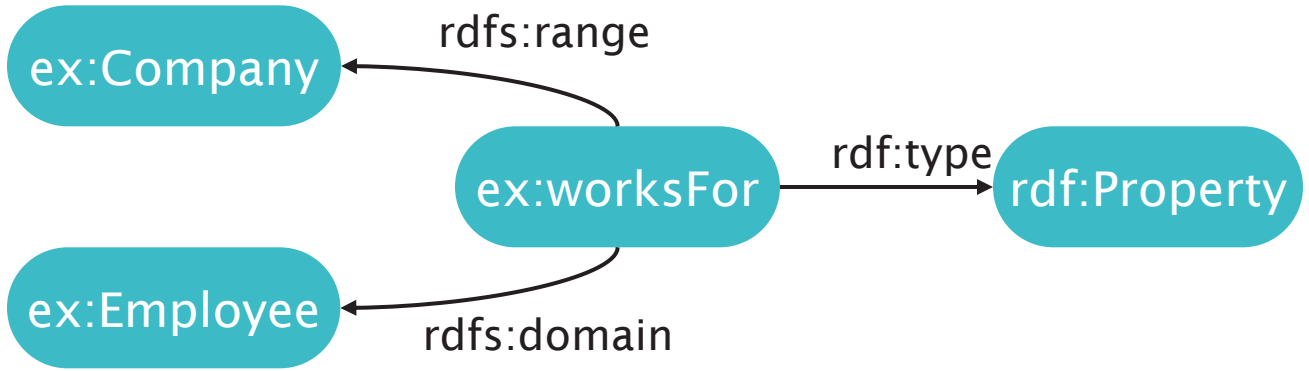
- OO languages define classes in terms of the properties they have
- RDF defines properties in terms of the classes whose instances they relate to each other

The *domain* of a property is the class that the property runs *from*

The *range* of a property is the class that a property runs *to*

RDF Schema property definitions

The property worksFor relates objects of class Employee to objects of class Company

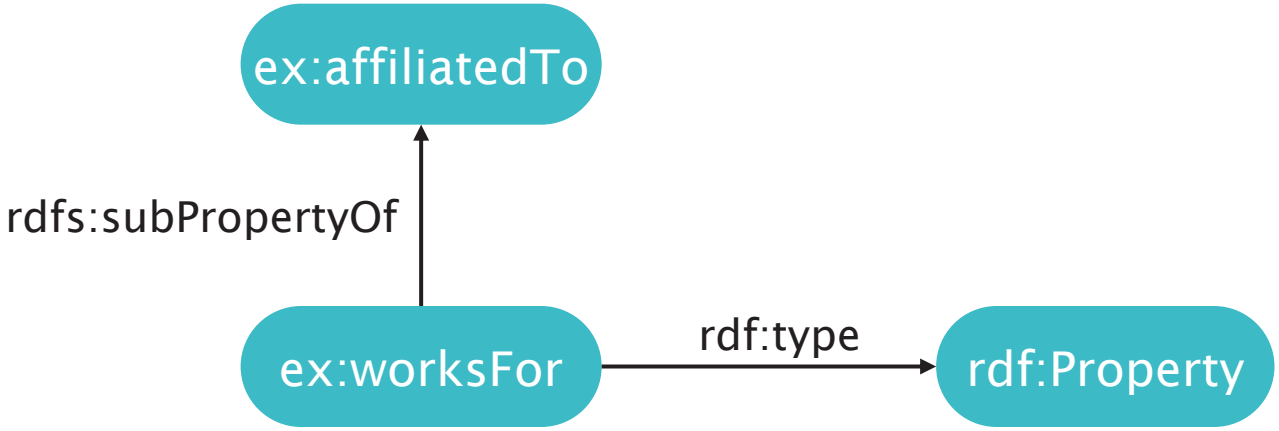



```
ex:worksFor rdf:type rdf:Property ;
            rdfs:domain ex:Employee ;
            rdfs:range ex:Company .
```

RDF Schema property definitions

Specialisation exists in properties as well as classes

- worksFor is a subproperty of affiliatedTo




```
ex:worksFor rdf:type rdf:Property ;
            rdfs:subPropertyOf ex:affiliatedTo
```

RDF Schema property semantics

rdfs:subPropertyOf is transitive and reflexive

- Entailment of superproperties

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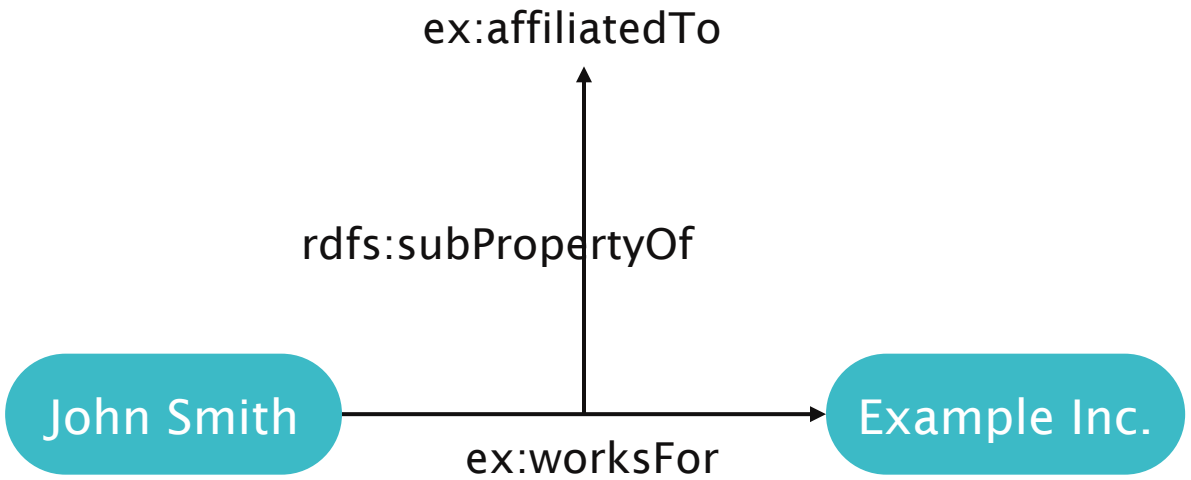
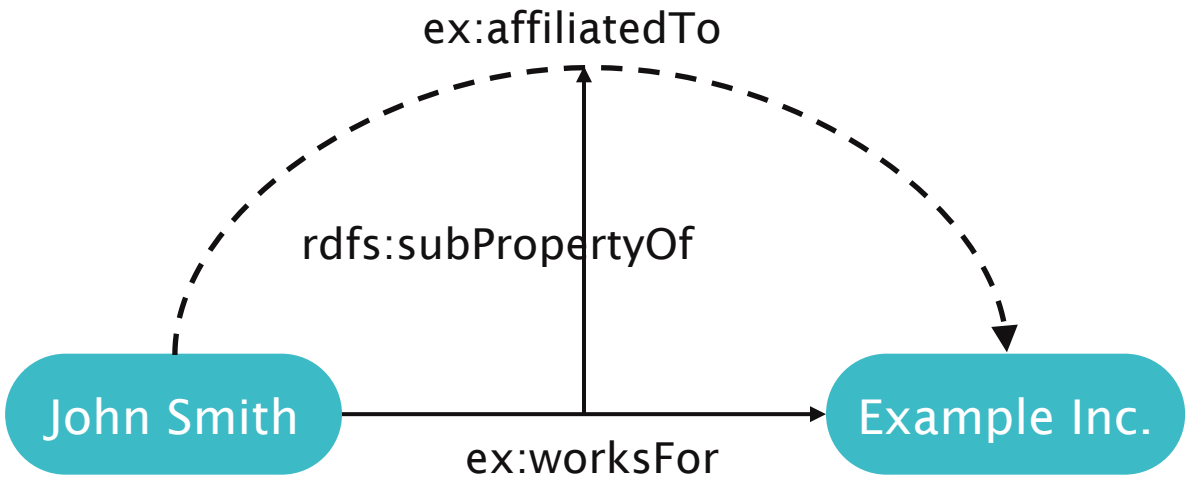


RDF Schema property semantics

rdfs:subPropertyOf is transitive and reflexive

- Entailment of superproperties



RDF Schema property semantics

Type entailments from range and domain constraints

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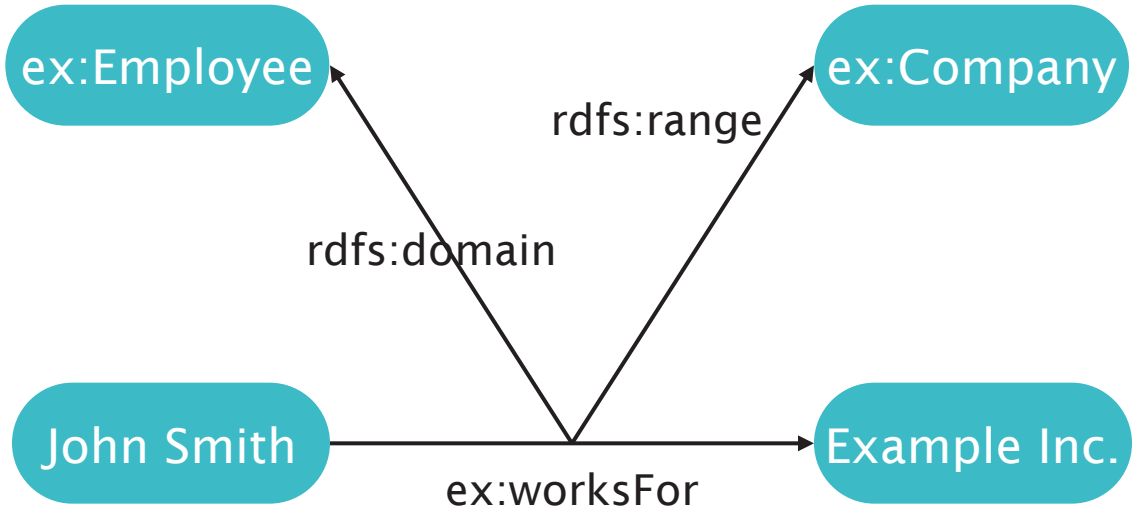
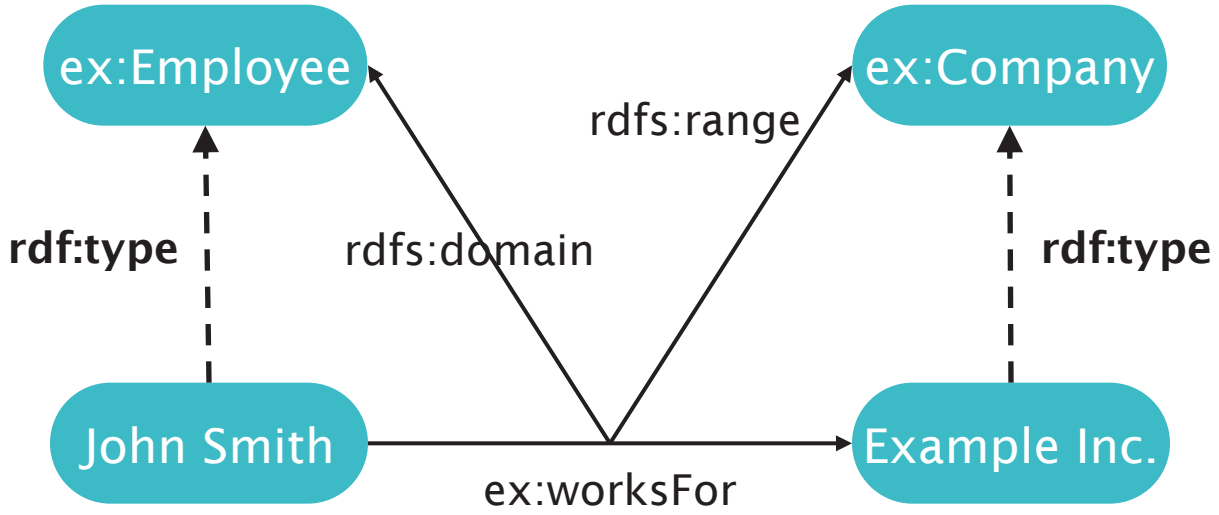


RDF Schema property semantics

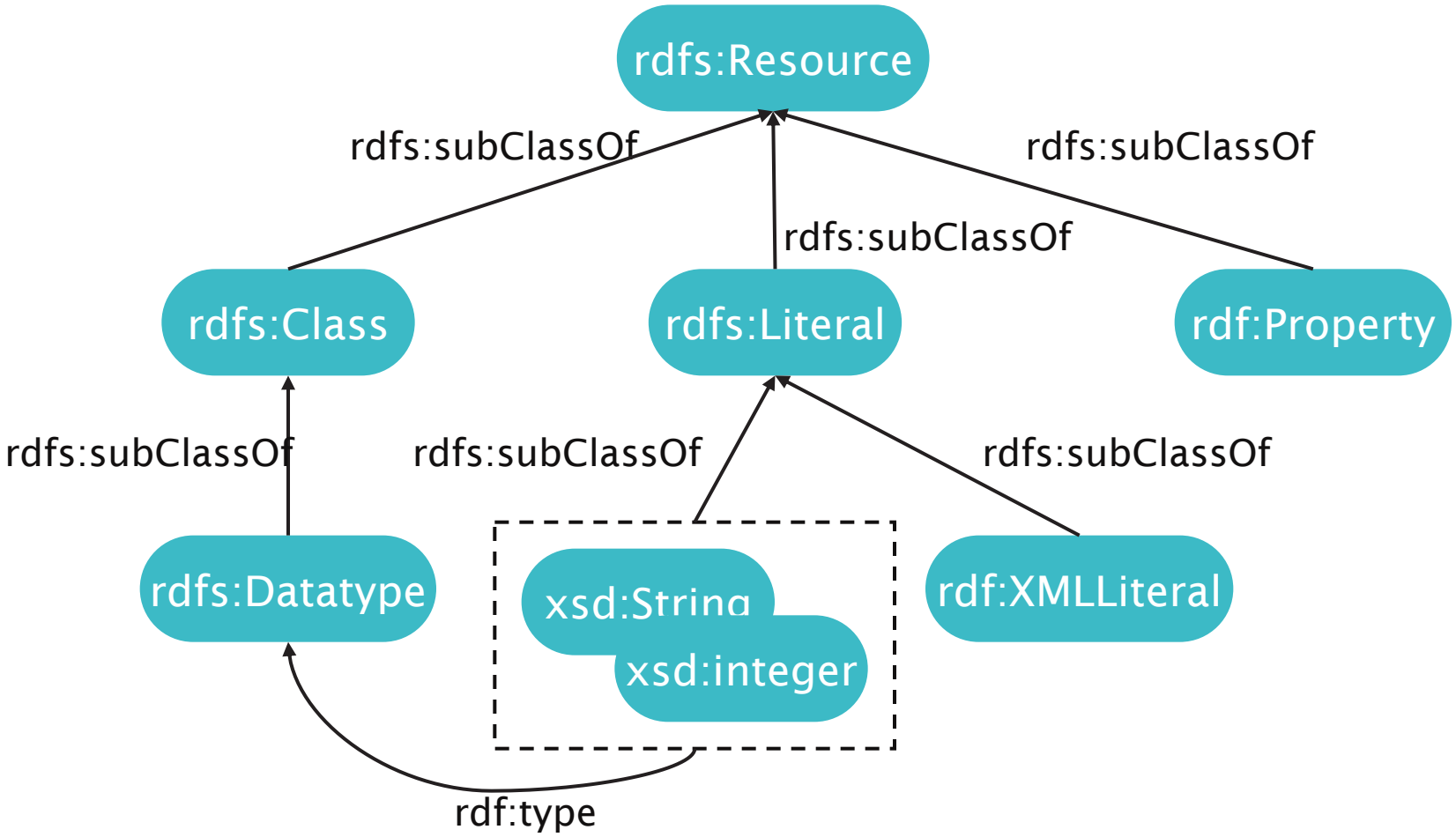
Type entailments from range and domain constraints



RDF Schema predefined classes

- rdfs:Class
- rdf:Property (note different namespace)
- rdfs:Resource
- rdfs:Literal
- rdfs:Datatype
- rdf:XMLLiteral

RDF Schema predefined classes



RDF Schema ancillary features

`rdfs:label` is used to give a human-readable name for a resource

```
<#person-01269> rdfs:label “John Smith” .
```

`rdfs:comment` is used to give a human-readable description for a resource

```
<#Employee> rdfs:comment “A person who works.” .
```

RDF Schema ancillary features

`rdfs:seeAlso` is used to indicate a resource which can be retrieved to give more information about something

`rdfs:isDefinedBy` indicates a resource which is responsible for the definition of something

- A subproperty of `rdfs:seeAlso`

RDFS Axiomatic Triples

```
rdfs:Resource rdf:type rdfs:Class .
rdfs:Class rdf:type rdfs:Class .
rdfs:Literal rdf:type rdfs:Class .
rdf:XMLLiteral rdf:type rdfs:Class .
rdfs:Datatype rdf:type rdfs:Class .
rdf:List rdf:type rdfs:Class .
rdf:Property rdf:type rdfs:Class .


rdfs:domain rdf:type rdf:Property .
rdfs:range rdf:type rdf:Property .
rdfs:subPropertyOf rdf:type rdf:Property .
rdfs:subClassOf rdf:type rdf:Property .
rdfs:member rdf:type rdf:Property .
rdfs:seeAlso rdf:type rdf:Property .
rdfs:isDefinedBy rdf:type rdf:Property .
rdfs:comment rdf:type rdf:Property .
rdfs:label rdf:type rdf:Property .
```

RDF Schema Status

- Original version contemporary with RDF (but never became a W3C Recommendation)
- Revised version published in 2004
- Second revision published in 2014

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Next Lecture: Description Logics