RDF Schema, RDFa

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Semantic Web Layer Cake

Trust

Proof

Logic Framework

OWL   Rules

SPARQL

DLP bit of OWL/Rules

RDF Schema

RDF Core

Digital Signature   Encryption

XML   Namespaces

URI   Unicode

Components from Last Lecture

- Unicode
  - Standard for encoding international characters
- URI
  - String of standardized form to uniquely identify resources
    - URL: http://www.example.org
    - URN: urn:isbn:0-123-45678-9
  - IRI: international variant of URI (with unicode)
- XML
  - So that we have a common syntax for Semantic Web
- XML schema
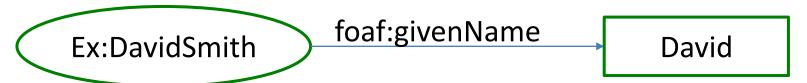 - Define types, e.g., USAddress, for a particular set of XML documents, e.g., Invoices
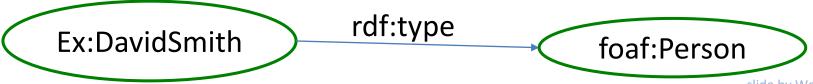
and ...

- Namespace
  - So that we can have different markup vocabularies in one document
- RDF (resource description framework)
  - Was used to represent metadata of Web resources
    - E.g., title, author, modification date
  - Generally, a graph representation of any resources
    - Triple: resource-property-value or subject-predicate-object
  - Anyone can define vocabulary of terms

RDF Recap

- ## FOAF (friend of a friend)

    - Terms for describing people and Social Web

    - Classes, e.g., Person, OnlineAccount

    - Properties, e.g., name, homepage, accountname

- ## Using FOAF

    Ex:DavidSmith ──foaf:givenName──> David

- ## RDF predefine some classes (e.g., rdf:Property) and properties (e.g., rdf:type)

    Ex:DavidSmith ──rdf:type──> foaf:Person
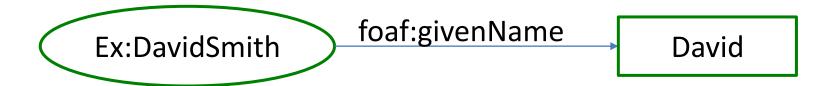
RDF Serialization: RDF/XML

Ex:DavidSmith —— foaf:givenName ——> David

```
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
        xmlns:Ex=http://www.example.org/person#>
  <rdf:Description rdf:about=http://www.example.org/person#DavidSmith>
        <foaf:givenName>David</foaf:givenName>
  </rdf:Description>
</rdf:RDF>
```

RDF Serialization: Turtle

- Terse RDF triple language
  - RDF in compact text format

@prefix Ex: <http://www.example.org/person#>

Ex:DavidSmith foaf:givenName "David".

Limited Vocabulary in RDF

- RDF vocabulary
  - Classes: rdf:Property, rdf:XMLLiteral, rdf:HTML, rdf:langString (language-tagged string values)
  - Properties, e.g., rdf:type
    - allow you to state "instance-of" relationship
- Use rdf:type to explicitly define new properties
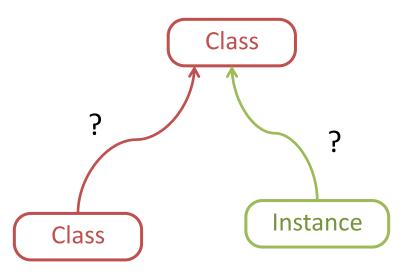 - Ex:title rdf:type rdf:Property

    or simply:

    Ex:title a rdf:Property

  ('a' is a syntactic shortcut for rdf:type)

RDF Schema or RDFS

- Add new vocabulary for describing
  - Classes
    - e.g., rdfs:Class
  - Taxonomy of classes
    - e.g., rdfs:subClassOf
  - Taxonomy of properties
    - e.g., rdfs:subPropertyOf
  - Domain and range of properties
    - rdfs:domain, rdfs:range

New properties

Class

?

?

Class

Instance

@prefix : <http://www.example.org/sample.rdfs#> .

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

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

:Dog rdfs:subClassOf :Animal.

:Person rdfs:subClassOf :Animal.

:hasChild rdfs:range :Animal;

       rdfs:domain :Animal.
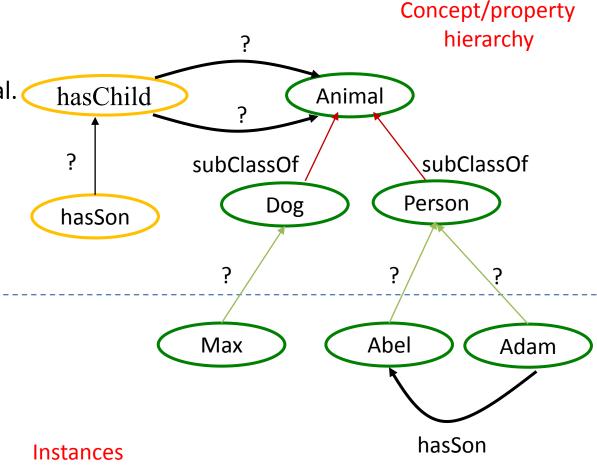
:hasSon rdfs:subPropertyOf

       :hasChild.

:Max a :Dog.

:Abel a :Person.

:Adam a :Person;

       :hasSon :Abel.

Concept/property hierarchy

Instances

slide by Wensheng Wu

RDFS: New Predefined Classes

- Major ones:
  - rdfs:Resource – a top-level class
  - rdfs:Class – a class of all classes
  - rdfs:Literal – a class of literals, e.g., strings and integers
    - A literal may have 3 components: "David"^^xsd:string@en
      - Lexical form: "David"
      - Data type IRI: ^^xsd:string
      - Language tag (for string only): @en
    - RDFS reuses XML schema built-in data types
      - xsd:string, xsd:boolean, xsd:decimal, xsd:integer, etc
    - Note rdf:XMLLiteral is a subclass of rdfs:Literal
      - XMLLIteral: XML fragment as a literal

More ...

- rdfs:DataType – a class of all data types, including
  - Built-in data types in XSD
  - rdf:HTML
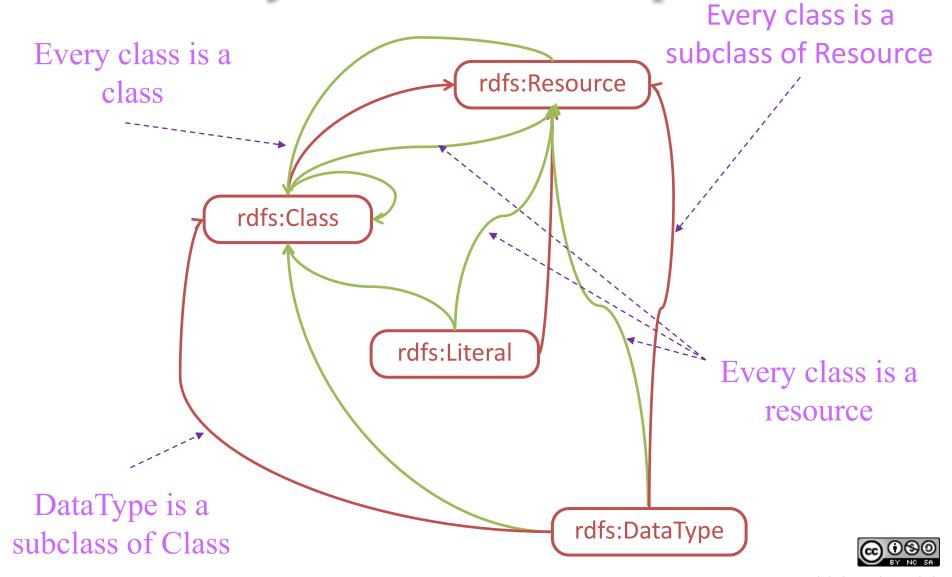 - rdf:XMLLiteral

  Notes:
  - Every instance of rdfs:DataType (e.g., rdf:XMLLiteral) is a subclass of rdf:Literal
  - rdfs:DataType is a subclass of rdfs:Class, since it contains a set of classes (data types)
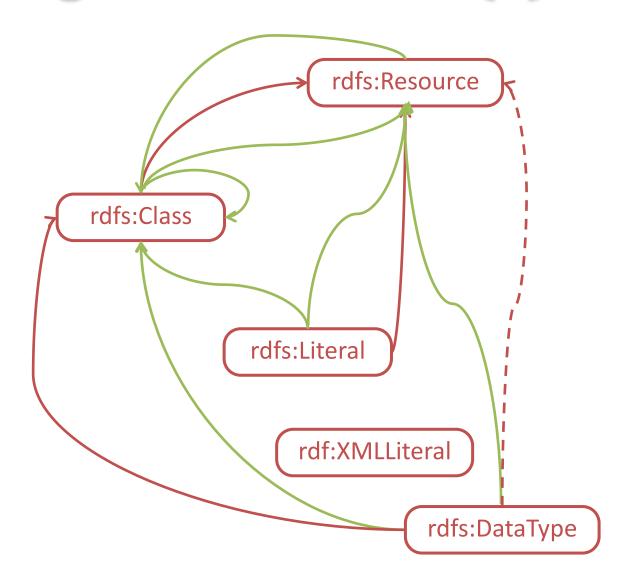
Summary of Classes in RDF(S)

Class	Represent	SubClassOf	InstanceOf
rdfs:Resource	All resources	rdfs:Resource	rdfs:Class
rdfs:Class	All classes	rdfs:Resource	rdfs:Class
rdfs:Literal	Literal values	rdfs:Resource	rdfs:Class
rdfs:DataType	Data types	rdfs:Class	rdfs:Class
rdf:XMLLiteral/ rdf:langString/ rds:HTML	XML/ language-tagged/ HTML literal values	rdfs:Literal	rdfs:DataType
rdf:Property	All properties	rdfs:Resource	rdfs:Class
…	…	…	…

Note: Properties are resources too

Summary in an RDF Graph

Every class is a
subclass of Resource

Every class is a
class

rdfs:Resource

rdfs:Class

rdfs:Literal

Every class is a
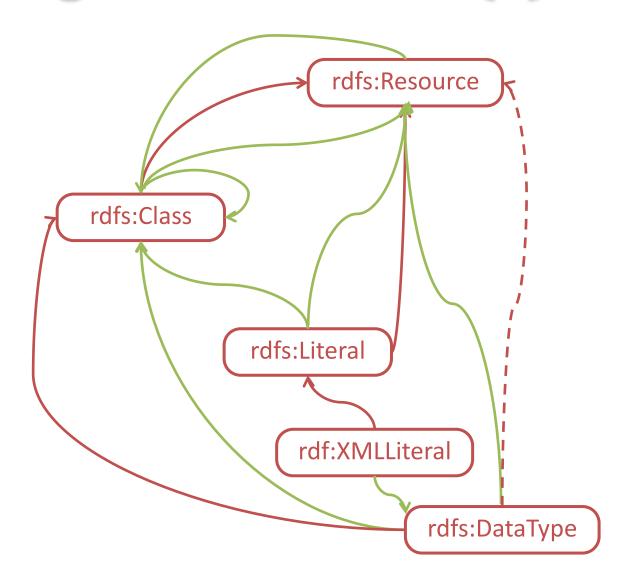resource

DataType is a
subclass of Class
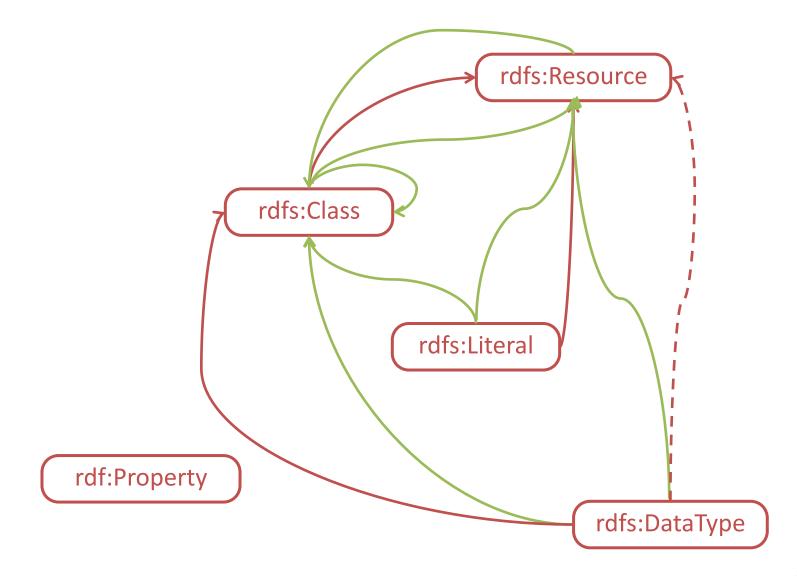
rdfs:DataType

Adding rdf:XMLLiteral (1)
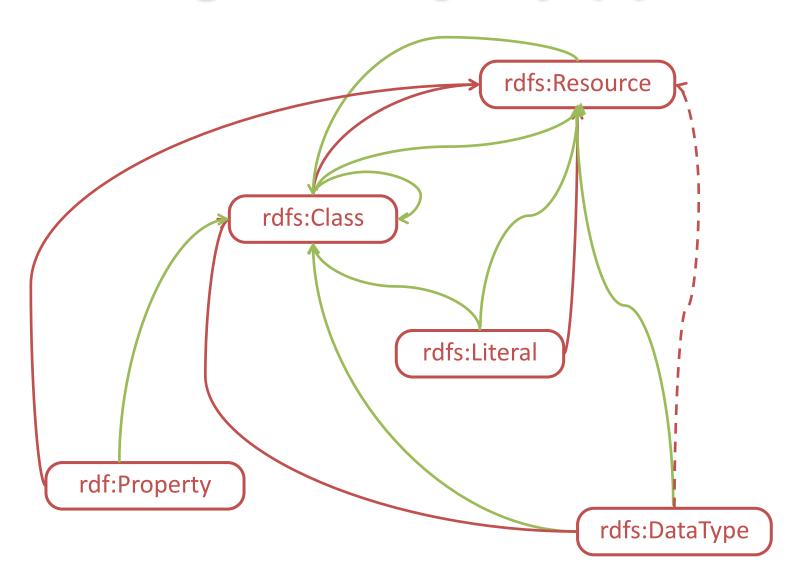
Adding rdf:XMLLiteral (2)

Adding rdfs:Property (1)

Adding rdfs:Property (2)
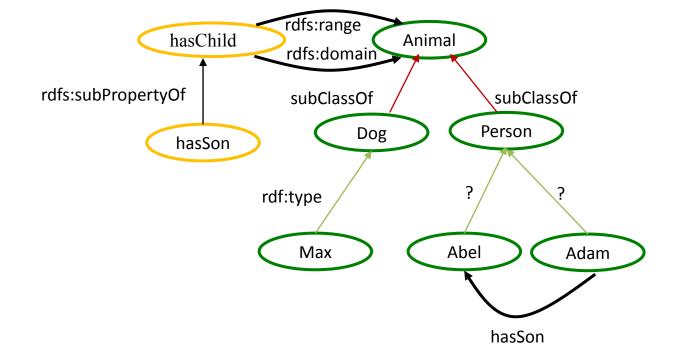
Summary of Properties in RDF(S)

- Defined in RDF
  - rdf:type, rdf:value

- Defined in RDFS
  - rdfs:domain, rdfs:range
  - rdfs:subClassOf, rdfs:subPropertyOf
  - rdfs:label (human-readable name of resource), rdfs:comment, rdfs:seeAlso, rdfs:definedBy

- All theses are instances of rdf:Property
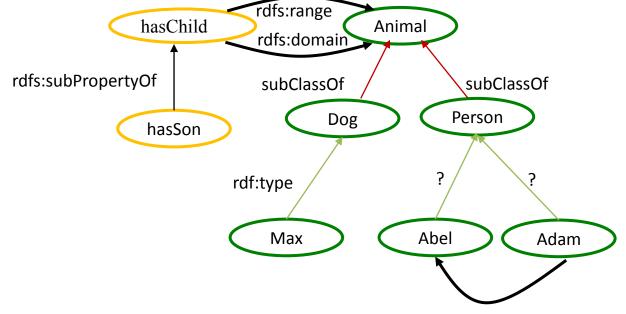
Summary of Properties in RDF(S)

Property	Relates	Domain (rdfs:domain)	Range (rdfs:range)
rdfs:domain	Restricts subjects	?	?
rdfs:range	Restricts objects	?	?
rdfs:subPropertyOf	Subproperty	?	?
rdfs:subClassOf	Subclass of	?	?
rdf:type	Instance of	?	?

Summary of Properties in RDF(S)

Property	Relates	Domain (rdfs:domain)	Range (rdfs:range)
rdfs:domain	Restricts subjects	rdfs:Property	rdfs:Class
rdfs:range	Restricts objects	rdfs:Property	rdfs:Class
rdfs:subPropertyOf	Subproperty	rdfs:Property	rdfs:Property
rdfs:subClassOf	Subclass of	rdfs:Class	rdfs:Class
rdf:type	Instance of	rdfs:Resource	rdfs:Class

RDF in Attributes

RDFa

RDFa:
Resource Description Framework – in – attributes

Plain XHTML

```
<p>
  In his latest book
  <cite>Wikinomics</cite>,
  <span>Don Tapscott</span>
  explains deep changes in technology,
  demographics and business.
  The book is due to be published in
  <span>October 2006</span>.
</p>
```

Browser shows

In his latest book *Wikinomics*, Don Tapscott explains deep changes in technology, demographics and business. The book is due to be published in October 2006.

RDFa: Namespaces

```
<p xmlns:dc="http://purl.org/dc/elements/1.1/">
  In his latest book
  <cite>Wikinomics</cite>,
  <span>Don Tapscott</span>
  explains deep changes in technology,
  demographics and business.
  The book is due to be published in
  <span>October 2006</span>.
</p>
```

Browser shows

In his latest book *Wikinomics*, Don Tapscott explains deep changes in technology, demographics and business. The book is due to be published in October 2006.

RDFa: Resources

```
<p xmlns:dc="http://purl.org/dc/elements/1.1/"
   about="http://www.example.com/books/wikinomics">
   In his latest book
   <cite>Wikinomics</cite>,
   <span>Don Tapscott</span>
   explains deep changes in technology,
   demographics and business.
   The book is due to be published in
   <span>October 2006</span>.
</p>
```

Browser
shows

In his latest book *Wikinomics*, Don Tapscott explains deep changes in technology, demographics and business. The book is due to be published in October 2006.

RDFa: Property

property declaration

```
<p xmlns:dc="http://purl.org/dc/elements/1.1/"
   about="http://www.example.com/books/wikinomics">
   In his latest book
   <cite property="dc:title">Wikinomics</cite>,
   <span>Don Tapscott</span>
   explains deep changes in technology,
   demographics and business.
   The book is due to be published in
   <span>October 2006</span>.
</p>
```

Browser shows

In his latest book *Wikinomics*, Don Tapscott explains deep changes in technology, demographics and business. The book is due to be published in October 2006.

RDFa: Property

```
<p xmlns:dc="http://purl.org/dc/elements/1.1/"
   about="http://www.example.com/books/wikinomics">
   In his latest book
   <cite property="dc:title">Wikinomics</cite>,
   <span>Don Tapscott</span>
   explains deep changes in technology,
   demographics and business.
   The book is due to be published in
   <span>October 2006</span>.
</p>
```

RDF-enabled computer sees:

http://www.example.com/books/wikinomics ——dc:title——▸ "Wikinomics"

What's the Difference?

```
<p xmlns:dc="http://purl.org/dc/elements/1.1/"
  about="http://www.example.com/books/wikinomics">
  In his latest book
  <cite property="dc:title">Wikinomics</cite>,
  <span>Don Tapscott</span>
  …
</p>
```

```
<p xmlns:dc="http://purl.org/dc/elements/1.1/"
  about="http://www.example.com/books/wikinomics">
  In his latest book
  <cite property="title">Wikinomics</cite>,
  <span>Don Tapscott</span>
  …
</p>
```

What's the Difference?

```
<p xmlns:dc="http://purl.org/dc/elements/1.1/"
   about="http://www.example.com/books/wikinomics">
   In his latest book
   <cite property="dc:title">Wikinomics</cite>,
   <span>Don Tapscott</span>
   …
</p>
```
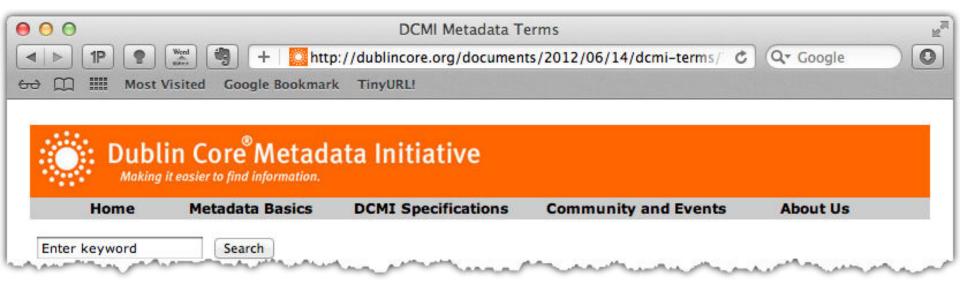
```
<p xmlns:dc="http://purl.org/dc/elements/1.1/"
   about="http://www.example.com/books/wikinomics">
   In his latest book
   <cite property="title">Wikinomics</cite>,
   <span>Don Tapscott</span>
   …
</p>
```

what does title mean?

I Can Look Up the Meaning on the Web

```
<p xmlns:dc="http://purl.org/dc/elements/1.1/"
   about="http://www.example.com/books/wikinomics">
   In his latest book
   <cite property="dc:title">Wikinomics</cite>,
   <span>Don Tapscott</span>
   …
</p>
```

I Can Look Up the Meaning on the Web

I Can Look Up the Meaning on the Web

DCMI Metadata Terms	
http://dublincore.org/documents/2012/06/14/dcmi-terms/	

Term Name: title

URI:	http://purl.org/dc/terms/title
Label:	Title
Definition:	A name given to the resource.
Type of Term:	Property
Refines:	http://purl.org/dc/elements/1.1/title
Version:	http://dublincore.org/usage/terms/history/#titleT-002
Has Range:	http://www.w3.org/2000/01/rdf-schema#Literal
Term Name: type	
URI:	http://purl.org/dc/terms/type

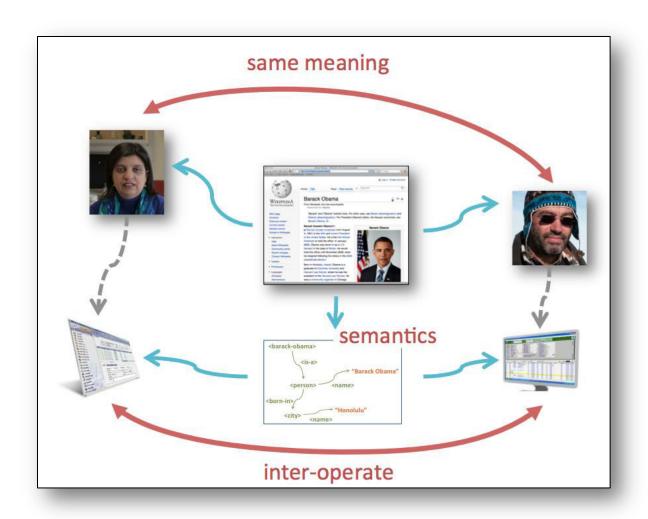Humans can look up what it means

Computers Can Look It Up Too

```xml
<rdf:RDF>
  <rdf:Description rdf:about="http://purl.org/dc/elements/1.1/">
    <dcterms:title xml:lang="en-US">Dublin Core Metadata Element Set, Version 1.1</dcterms:title>
    <dcterms:publisher rdf:resource="http://purl.org/dc/aboutdcmi#DCMI"/>
    <dcterms:modified>2010-10-11</dcterms:modified>
  </rdf:Description>
  <rdf:Property rdf:about="http://purl.org/dc/elements/1.1/title">
    <rdfs:label xml:lang="en-US">Title</rdfs:label>
    <rdfs:comment xml:lang="en-US">A name given to the resource.</rdfs:comment>
    <rdfs:isDefinedBy rdf:resource="http://purl.org/dc/elements/1.1/"/>
    <dcterms:issued>1999-07-02</dcterms:issued>
    <dcterms:modified>2008-01-14</dcterms:modified>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
    <dcterms:hasVersion rdf:resource="http://dublincore.org/usage/terms/history/#title-006"/>
    <skos:note xml:lang="en-US">
      A second property with the same name as this property has been declared in the dcterms: names
      "DCMI Metadata Terms" (http://dublincore.org/documents/dcmi-terms/) for an explanation.
    </skos:note>
  </rdf:Property>
  <rdf:Property rdf:about="http://purl.org/dc/elements/1.1/creator">
    <rdfs:label xml:lang="en-US">Creator</rdfs:label>
```

What's the Big Deal?

Claudia, Pedro & the computers can all agree on the meaning of dc:title

Where Were We?

RDFa: Property

```
<p xmlns:dc="http://purl.org/dc/elements/1.1/"
   about="http://www.example.com/books/wikinomics">
   In his latest book
   <cite property="dc:title">Wikinomics</cite>,
   <span>Don Tapscott</span>
   explains deep changes in technology,
   demographics and business.
   The book is due to be published in
   <span>October 2006</span>.
</p>
```

RDF-enabled computer sees:

http://www.example.com/books/wikinomics ⟶ dc:title ⟶ "Wikinomics"

What's Wrong Here?

```
<p xmlns:dc="http://purl.org/dc/elements/1.1/"
   about="http://www.example.com/books/wikinomics">
   In his latest book
   <cite property="dc:title">Wikinomics</cite>,
   <span property="dc:creator">Don Tapscott</span>
   explains deep changes in technology,
   demographics and business.
   The book is due to be published in
   <span property="dc:date">October 2006</span>.
</p>
```

Not a computer understandable date
e.g., an xsd:date

RDFa: Content Attribute

```
<p xmlns:dc="http://purl.org/dc/elements/1.1/"
   about="http://www.example.com/books/wikinomics">
   In his latest book
   <cite property="dc:title">Wikinomics</cite>,
   <span property="dc:creator">Don Tapscott</span>
   explains deep changes in technology,
   demographics and business.
   The book is due to be published in
   <span property="dc:date"
         content="2006-10-01"
         datatype="xsd:date">October 2006</span>.
</p>
```

RDFa:
Resource Description Framework – in – attributes

XHTML
+
RDFa

```
<p xmlns:dc="http://purl.org/dc/elements/1.1/"
   about="http://www.example.com/books/wikinomics">
  In his latest book
  <cite property="dc:title">Wikinomics</cite>,
  <span property="dc:creator">Don Tapscott</span>
  explains deep changes in technology,
  demographics and business.
  The book is due to be published in
  <span property="dc:date"
        content="2006-10-01"
        datatype="xsd:date">October 2006</span>.
</p>
```

Extracted
RDF

```
@prefix dc: http://purl.org/dc/elements/1.1/ .

<http://www.example.com/books/wikinomics>
  dc:title "Wikinomics"@en ;
  dc:creator "Don Tapscott"@en ;
  dc:date "2006-10-01"^^xsd:date .
```
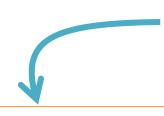
Browser
shows

In his latest book *Wikinomics*, Don Tapscott explains deep changes in technology, demographics and business. The book is due to be published in October 2006.

More RDFa

RDFa: vocab and typeof

Define default vocabulary
for an HTML element

```
<div vocab="http://xmlns.com/foaf/0.1/">
  <ul>
    <li typeof="Person">
      <a href="http://example.com/bob/">Bob</a>
    </li>
    <li typeof="Person">
      <a href="http://example.com/eve/">Eve</a>
    </li>
  </ul>
</div>
```

Nested elements don't need
vocabulary URI

RDFa: property and href

```
<div vocab="http://xmlns.com/foaf/0.1/">
  <ul>
    <li typeof="Person">
      <a property="homepage" href="http://example.com/bob/">Bob</a>
    </li>
    <li typeof="Person">
      <a property="homepage" href="http://example.com/eve/">Eve</a>
    </li>
</ul>
</div>
```

When href is present, it supplies the value for the property

RDFa: Using Extra Span Tags

```
<div vocab="http://xmlns.com/foaf/0.1/">
 <ul>
    <li typeof="Person">
     <a property="homepage" href="http://example.com/bob/">
        <span property="name">Bob</span></a>
    </li>
    <li typeof="Person">
     <a property="homepage" href="http://example.com/eve/">
        <span property="name">Eve</span></a>
    </li>
</ul>
</div>
```

Need a span tag to contain the
property="name" tag
of my friends

Putting It All Together

```
<div vocab="http://xmlns.com/foaf/0.1/" typeof="Person">
    <p>
        <span property="name">Alice Birpemswick</span>,
            Email: <a    property="mbox"
                         href="mailto:alice@example.com">alice@example.com</a>,
            Phone: <a    property="phone"
                         href="tel:+1-617-555-7332">+1 617.555.7332</a>
    </p>
    <ul>
        <li property="knows" typeof="Person">
            <a property="homepage" href="http://example.com/bob/">
                <span property="name">Bob</span></a>
        </li>
        <li property="knows" typeof="Person">
            <a property="homepage" href="http://example.com/eve/">
                <span property="name">Eve</span></a>
        </li>
    </ul>
</div>
```

RDF properties: e.g., phone
RDF objects: e.g., Eve

Resulting RDF

```
<div vocab="http://xmlns.com/foaf/0.1/" typeof="Person">
    <p>
        <span property="name">Alice Birpemswick</span>,
            Email: <a property="mbox"
                href="mailto:alice@example.com">alice@example.com</a>,
            Phone: <a property="phone"
                href="tel:+1-617-555-7332">+1 617.5
    </p>
    <ul>
        <li property="knows" typeof="Person">
            <a property="homepage href="http://ex
                <span property="name">Bob</span>
        </li>
        <li property="knows" typeof="Person">
            <a property="homepage" href="http://e
                <span property="name">Eve</span>
        </li>
    </ul>
</div>
```

```
[   a   foaf:Person ;
    foaf:name      "Alice" ;
    foaf:mbox      <mailto:alice@example.com> ;
    foaf:phone     <tel:+1-617-555-7332> ;
    foaf:knows     [
        a       foaf:Person ;
        foaf:homepage     <http://example.com/bob/> ;
        foaf:name         "Bob"
    ] ;
    foaf:knows     [
        a       foaf:Person ;
        foaf:homepage     <http://example.com/eve/> ;
        foaf:name         "Eve"
    ] ;
]
```

Facebook OpenGraph

RDF used by the "Like" button

```
<html>
 <head prefix="og: http://ogp.me/ns#" >
  ...
  <meta property="og:title" content="The Trouble with Bob" />
  <meta property="og:type"  content="text" />
  <meta property="og:image" content="http://example.com/alice/ugly.jpg" />
  ...
 </head>
 <body>
  ...
 </body>
</html>
```

RDFa: rel Attribute

```
<div vocab="http://xmlns.com/foaf/0.1/" resource="#me">
  <ul>
    <li property="knows" resource="http://example.com/bob/#me" typeof="Person">
     <a property="homepage" href="http://example.com/bob/"><span property="name">Bob</span></a>
    </li>
    <li property="knows" resource="http://example.com/eve/#me" typeof="Person">
     <a property="homepage" href="http://example.com/eve/"><span property="name">Eve</span></a>
    </li>
</ul>
</div>
```

```
<div vocab="http://xmlns.com/foaf/0.1/" resource="#me">
  <ul rel="knows">
    <li resource="http://example.com/bob/#me" typeof="Person">
     <a property="homepage" href="http://example.com/bob/"><span property="name">Bob</span></a>
    </li>
    <li resource="http://example.com/eve/#me" typeof="Person">
     <a property="homepage" href="http://example.com/eve/"><span property="name">Eve</span></a>
    </li>
</ul>
</div>
```

rel looks down for values

Benefits of RDFa

Navigation bar
(from RDFa?)

Reviews from RDFa
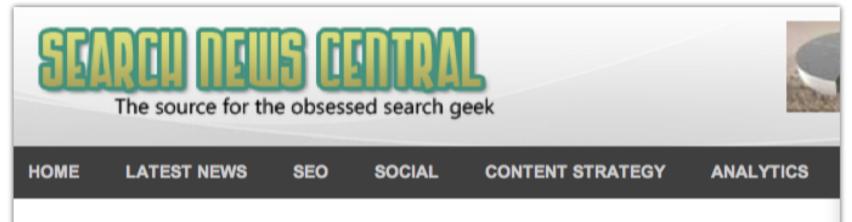
Google understands the page content

http://www.data-vocabulary.org/Review-aggregate/

4.0 of 5 (30 reviews)

```html
<div class="rating"
   typeof="v:Review-aggregate"
   about="#review_3505047">
   <span
     property="v:itemreviewed"
     content=""></span>
   <span rel="v:rating">
     <span typeof="v:Rating">
     <img src="http://images.bestbuy.com/BestBuy_US/images…/>
     <span
         property="v:rating"
         datatype="xsd:string">4.0</span> of
   <span property="v:best">5</span>
   <span
     property="v:count"
     datatype="xsd:string"
     content="30">
   </span>
   (<a class="customer-review"
     href="#tabbed-customerreviews">30 reviews</a>)
   </span>
 </span>
</div>
```

http://searchnewscentral.com/20110207129/Technical/rdfa-the-inside-story-from-best-buy.html

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RDFa: The Inside Story from Best Buy

Written by Doc Sheldon
Monday, 07 February 2011 14:08

An Interview with Jay Myers

Late last year, I approached Jay Myers, **Lead Development Engineer for Best Buy**, and asked him if he'd be willing to be interviewed about his project of implementing RDFa on Best Buy's web site. He accepted, and we began exchanging information, a process that culminated in a voice interview last Monday.

Who Uses RDFa?

RDFa is the fastest growing data markup format on the Web, and is used on more than 430 million web pages.

It accounts for roughly 3.6% of the all of the Web pages on the Internet.

How much did RDFa grow last year? 510% (2010)

… will show even stronger growth as people start to realize the search engine advantage that RDFa gives web content publishers.

http://rdfa.info/2011/01/26/rdfa-grows/

"You use the schema.org vocabulary, along with the microdata format, to add information to your HTML content."

non-RDFa microdata even though RDF vocabulary was defined

```
<div
   itemscope
   itemtype="http://schema.org/Movie">
   <h1 itemprop="name">Avatar</h1>
   <span>Director:
     <span itemprop="director">James Cameron</span>
       (born August 16, 1954)
   </span>
   <span itemprop="genre">Science fiction</span>
   <a href="../movies/avatar-theatrical-trailer.html"
     itemprop="trailer">Trailer</a>
</div>
```

http://schema.org/

Backup slides

RDF Schema

RDFS Vocabulary

xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"

Classes	Properties	Utility Properties
rdfs:Resource	rdfs:range	rdfs:seeAlso
rdfs:Class	rdfs:domain	rdfs:isDefinedBy
rdfs:Literal	rdf:type	rdf:value
rdfs:Datatype	rdfs:subClassOf	
rdf:XMLLiteral	rdfs:subPropertyOf	
rdf:Property	rdfs:label	
	rdfs:comment	

Notation and Conventions

subclass relationship

Things that are Classes

Class

instance relationship

Class

Instance

"Literal"

Things that are literals

Things that are instances

Meaning of Subclass

instances of A

A

B

instances of B
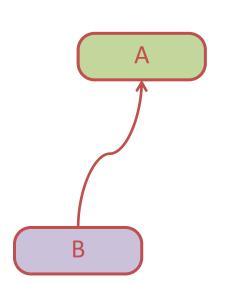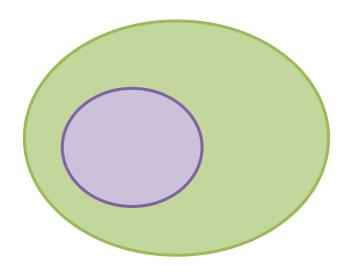
Meaning of Subclass

if B is a subclass of A,
the instances of B are a subset of the instances of A
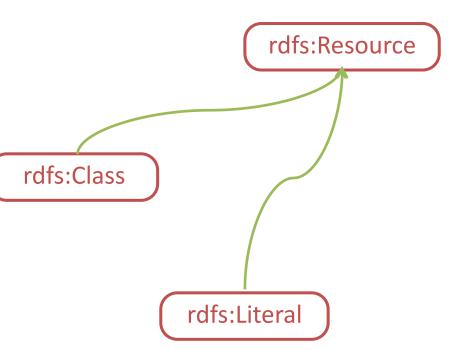
rdfs:Resource

All things described by RDF are called *resources*, and are instances of the class rdfs:Resource

This is similar to Object class in Java class hierarchy
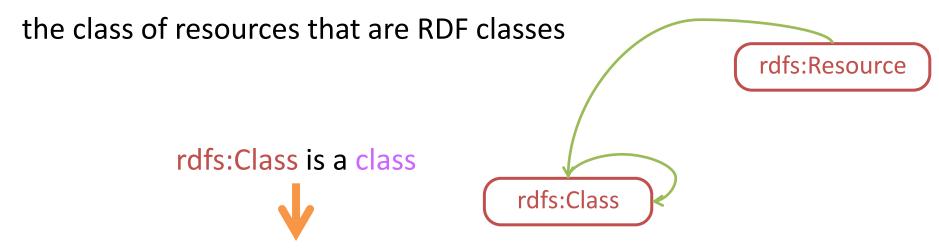
Implications
- Every class/property is a resource too
- Properties can themselves have properties

rdfs:Resource

rdfs:Class

rdfs:Literal

rdfs:Class

the class of resources that are RDF classes

rdfs:Class is a class

rdfs:Class is an instance of rdfs:Class

In fact, every class, including rdfs:Resource,
is an instance of rdfs:Class

rdfs:Resource

rdfs:Class

rdfs:Literal, rdfs:Datatype

class rdfs:Literal is the class of literal
values such as strings and integers

typed literals

class rdfs:Datatype is the class of
typed literals
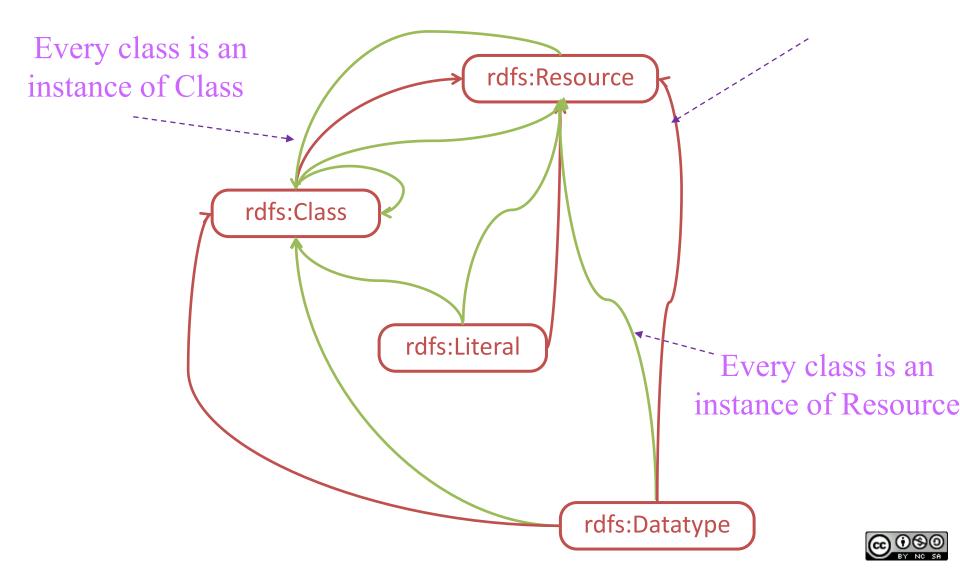
plain literals

there is no class for
plain literals?
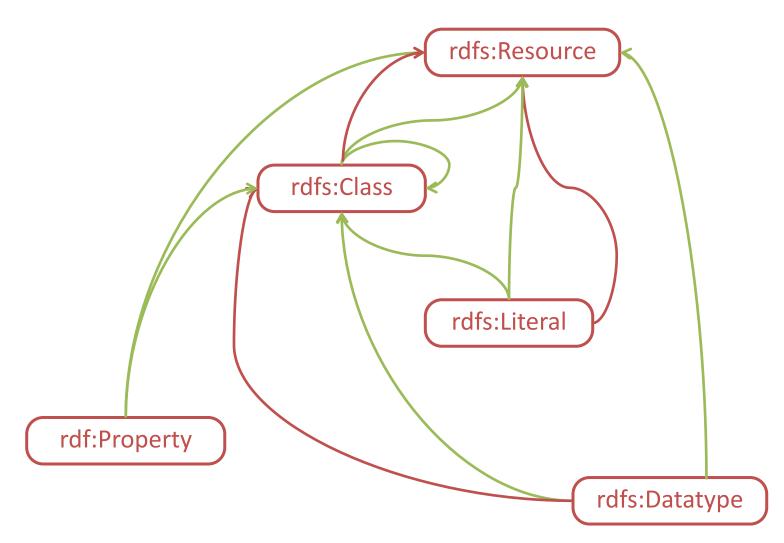
The Story So Far

Every class is an
instance of Class

Every class is
subclass of Resource

rdfs:Resource

rdfs:Class

rdfs:Literal

Every class is an
instance of Resource

rdfs:Datatype

rdfs:Property

the class of resources that are RDF properties

RDF Schema Vocabulary

Classes

rdfs:Resource

rdfs:Class

rdfs:Literal

rdfs:Datatype

rdf:XMLLiteral

rdf:Property

Properties

rdfs:range

rdfs:domain

rdf:type

rdfs:subClassOf

rdfs:subPropertyOf

rdfs:label

rdfs:comment

Utility Properties
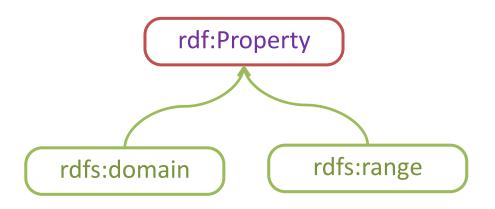
rdfs:seeAlso

rdfs:isDefinedBy

rdf:value

Every property is an instance of rdf:Property
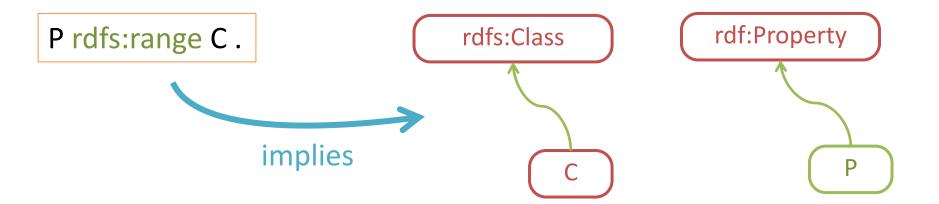
rdfs:domain, rdfs:range

rdfs:domain and rdfs:range are
instances of rdf:property

Semantics of rdfs:range

P rdfs:range C .

implies

rdfs:Class

C

rdf:Property

P

Semantics of rdfs:range

P rdfs:range C .

x P y .

rdfs:Class

rdf:Property

C

P

y
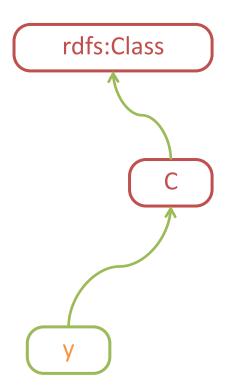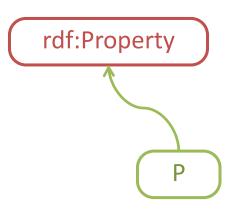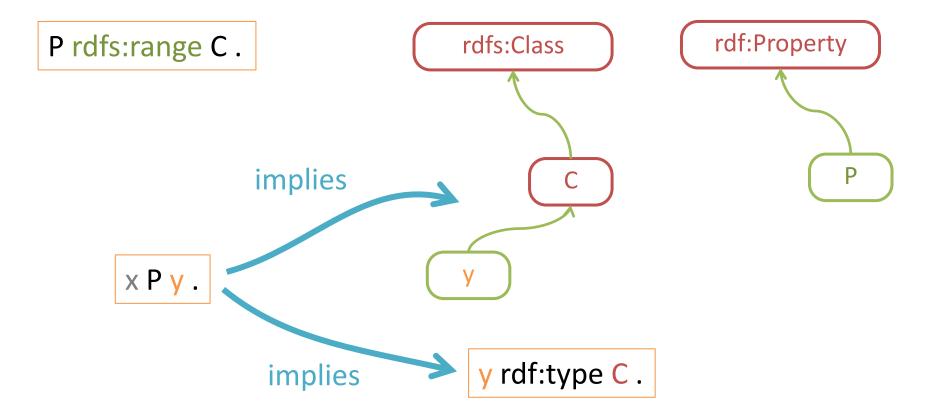
Semantics of rdfs:range

rdfs:range Example

foaf:based_near   rdf:type rdf:Property;
         rdfs:domain   foaf:Person;
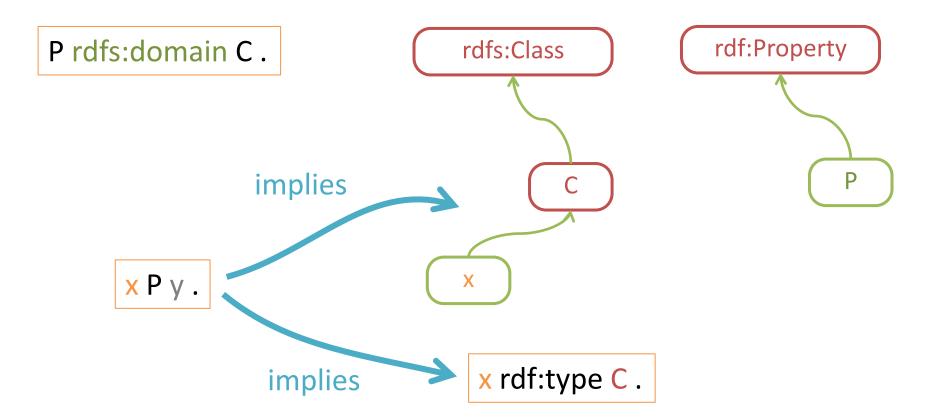   rdfs:range   wgs84:SpatialThing .

ex:pedro   foaf:based_near   dbpedia:Los_Angeles .

⬇ implies

dbpedia:Los_Angeles   rdf:type   wgs84:SpatialThing .

Semantics of rdfs:domain

Multiple rdfs:domain, rdfs:range

P rdfs:domain C1 .

P rdfs:domain C2 .

x P y . ➔ x rdf:type C1 .   x rdf:type C2 .
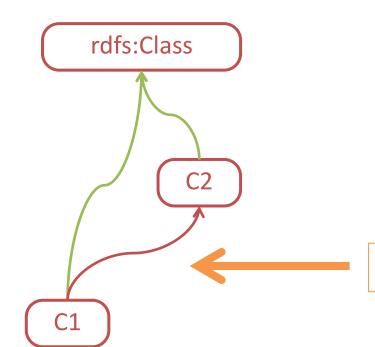
P rdfs:range C1 .

P rdfs:range C2 .

x P y . ➔ ? rdf:type C1 .   ? rdf:type C2 .

rdfs:subClassOf

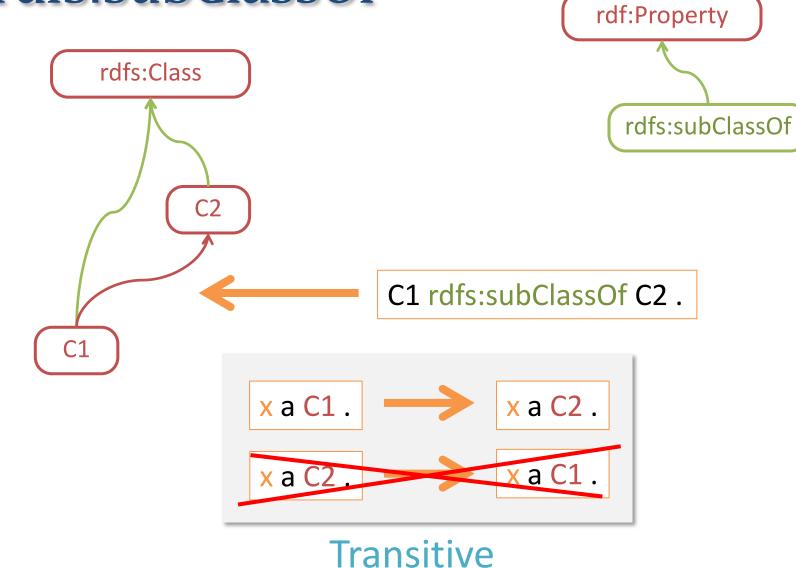rdf:Property

rdfs:Class

rdfs:subClassOf

C2

C1

C1 rdfs:subClassOf C2 .

C1 rdfs:subClassOf C2 .
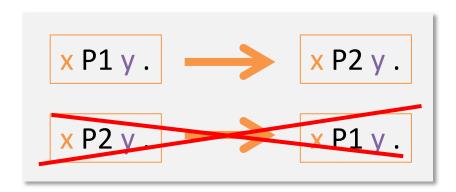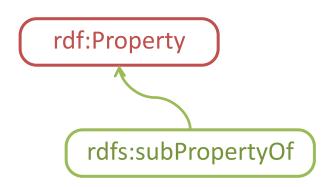C2 rdfs:subClassOf C3 .

Transitive

rdfs:subClassOf

rdf:Property

rdfs:Class

rdfs:subClassOf

C2

C1

C1 rdfs:subClassOf C2 .

x a C1 . → x a C2 .

x a C2 . → x a C1 .

Transitive

rdfs:subPropertyOf

rdf:Property

rdfs:subPropertyOf

P1 rdfs:subPropertyOf P2 .

x P1 y . → x P2 y .

x P2 y . → x P1 y .

Transitive
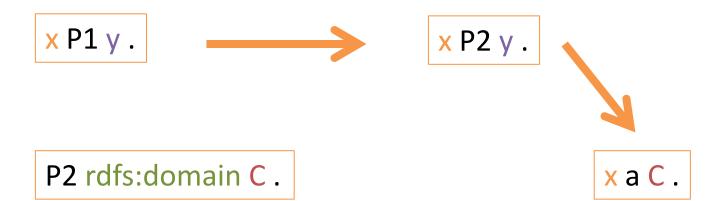
Multiple Assertions

P1 rdfs:subPropertyOf P2 .

x P1 y . → x P2 y .

P2 rdfs:domain C .

x a C .

rdfs:label, rdfs:comment

rdfs:label is an instance of rdf:Property

used to provide a human-readable version of a resource's name

every resource should have a label   in multiple languages

because browsers show the label when they show a resource

rdfs:label, rdfs:comment

rdfs:label is an instance of rdf:Property

used to provide a human-readable version of a resource's name

every resource should have a label   in multiple languages

because browsers show the label when they show a resource

rdfs:comment is an instance of rdf:Property

used to provide a human-readable description of a resource

rdfs:seeAlso

rdfs:seeAlso is an instance of rdf:Property

used to indicate a resource that might provide additional information about the subject resource

rdfs:seeAlso

```
<http://schema.rdfs.org/all> a owl:Ontology;
    dct:title              "The schema.org terms in RDFS+OWL"@en;
    dct:description        "This is a conversion of the terms defined at schema.org to RDFS and
OWL."@en;
    foaf:page              <http://schema.rdfs.org/>;
    rdfs:seeAlso           <http://schema.org/>;
    rdfs:seeAlso           <http://github.com/mhausenblas/schema-org-rdf>;
    dct:hasFormat          <http://schema.rdfs.org/all.ttl>;
    dct:hasFormat          <http://schema.rdfs.org/all.rdf>;
    dct:hasFormat          <http://schema.rdfs.org/all.nt>;
    dct:hasFormat           <http://schema.rdfs.org/all.json>;
    dct:hasFormat          [
                             dct:hasPart <http://schema.rdfs.org/all-classes.csv>;
                             dct:hasPart <http://schema.rdfs.org/all-properties.csv>;
                           ];
    dct:source <http://schema.org/>;
    dct:license <http://schema.org/docs/terms.html>;
    dct:valid "2012-06-16"^^xsd:date;
    .
```

rdfs:isDefinedBy

rdfs:isDefinedBy is an instance of rdf:Property
a subproperty of rdf:seeAlso

used to indicate a resource defining the subject resource

this property may be used to indicate an RDF vocabulary in which a resource is described

Example

... from the schema.org vocabulary definition

```
schema:ContactPage        a rdfs:Class;
    rdfs:label            "Contact Page"@en;
    rdfs:comment          "Web page type: Contact page."@en;
    rdfs:subClassOf       schema:WebPage;
    rdfs:isDefinedBy      <http://schema.org/ContactPage>;
    .
```

```
schema:cookTime           a rdf:Property;
    rdfs:label            "Cook Time"@en;
    rdfs:comment          """The time it takes to actually cook the dish, in ISO
8601 duration format. """@en;
    rdfs:domain           schema:Recipe;
    rdfs:range            schema:Duration;
    rdfs:isDefinedBy      <http://schema.org/Recipe>;
    .
```

RDF/XML for an XML Literal

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-
syntax-ns#" xmlns:dc="http://purl.org/dc/elements/1.1/"
xml:base="http://www.example.com/books">

<rdf:Description rdf:ID="book12345">
        <dc:title rdf:parseType="Literal">
                <span xml:lang="en"> The <em>&lt;br
/&gt;</em> Element Considered Harmful. </span>
        </dc:title>
</rdf:Description>
</rdf:RDF>
```