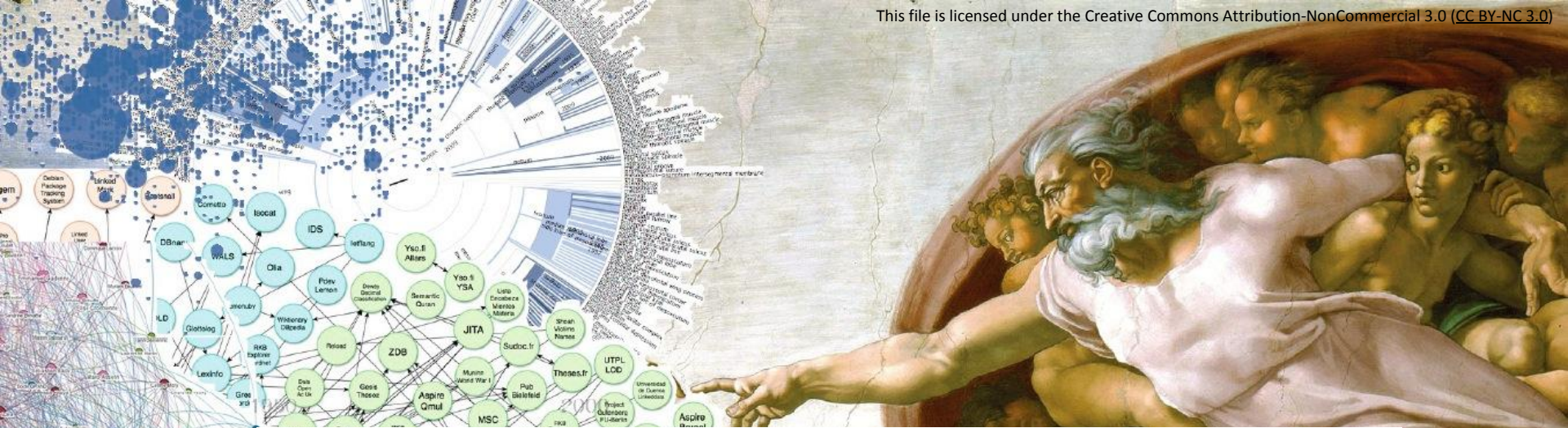




Information Service Engineering

Lecture 3 - Linked Data Engineering I

3.5 RDF Turtle Serialization

 **FIZ Karlsruhe**

Leibniz Institute for Information Infrastructure

 **Hasso Plattner Institut**

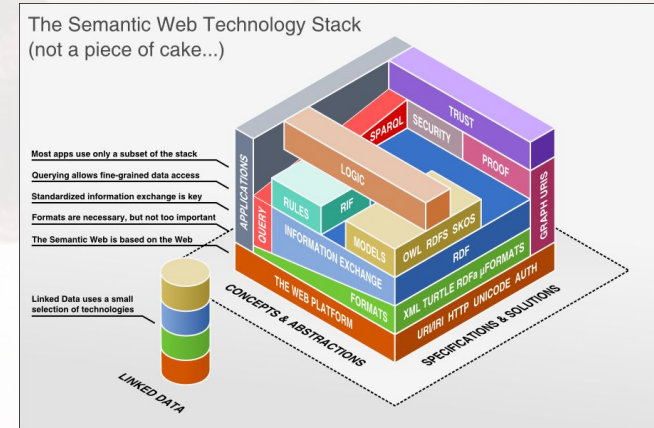
 **KIT**
Karlsruher Institut für Technologie

Prof. Dr. Harald Sack & Dr. Maria Koutraki
FIZ Karlsruhe
Leibniz Institute for Information Infrastructure
Karlsruhe Institute of Technology
Spring 2018

Information Service Engineering

Lecture 3: Linked Data Engineering I

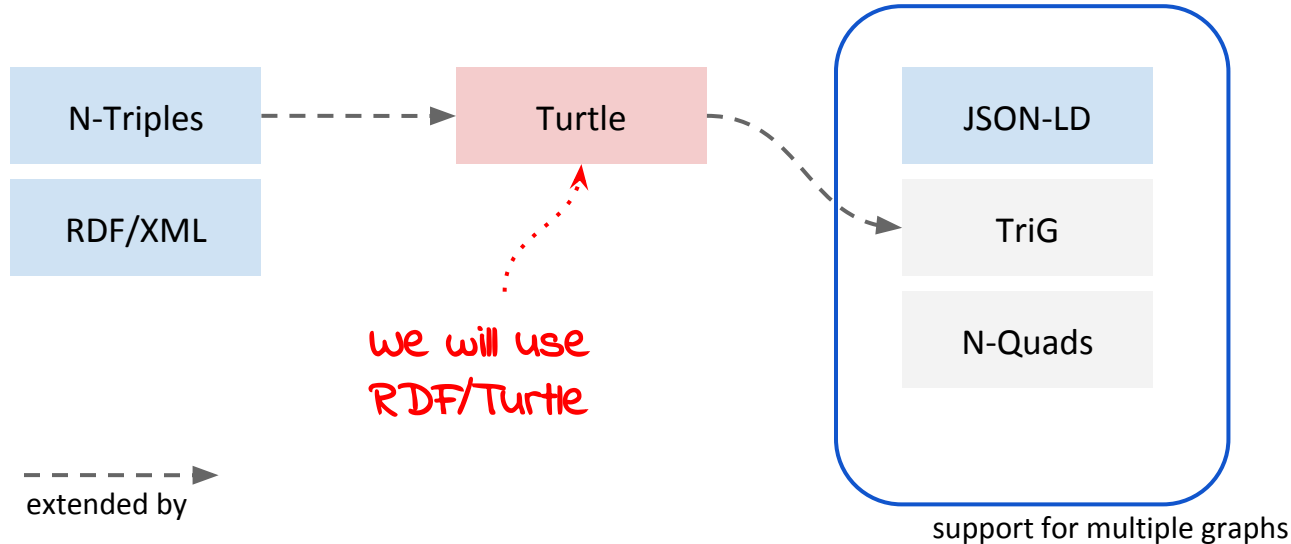
- 3.1 Understanding Data on the Web
- 3.2 Towards a Universal Data Representation
- 3.3 How to Identify and Access Linked Data
- 3.4 Representing Facts with RDF
- 3.5 RDF Turtle Serialization**
- 3.6 Model Building with RDFS
- 3.7 Logical Inference with RDF(S)



RDF Serializations

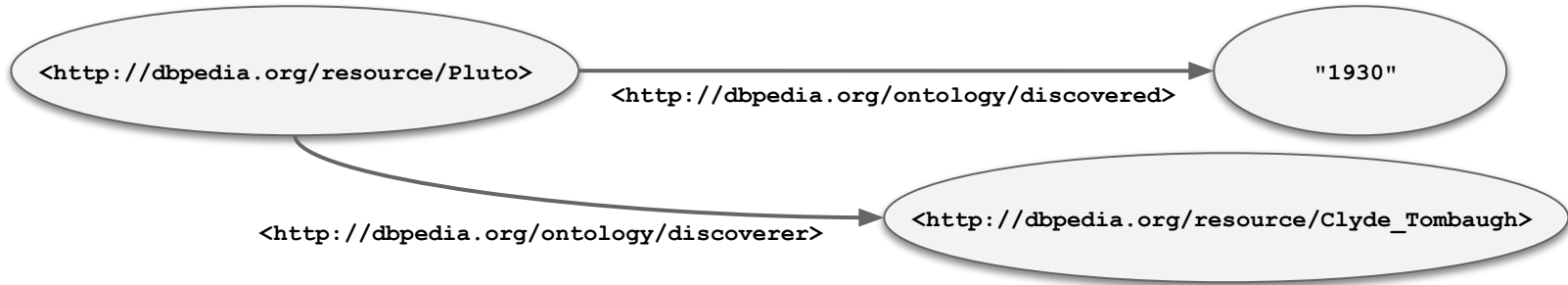
Information Service Engineering - Lecture 3 Linked Data Engineering I - 3.5 RDF Turtle Serialization

- RDF comes with several different **serialization formats**:
 - N-Triples, RDF/XML, JSON, Turtle, TriG, N-Quads, RDFa, ...



RDF N-Triples Notation

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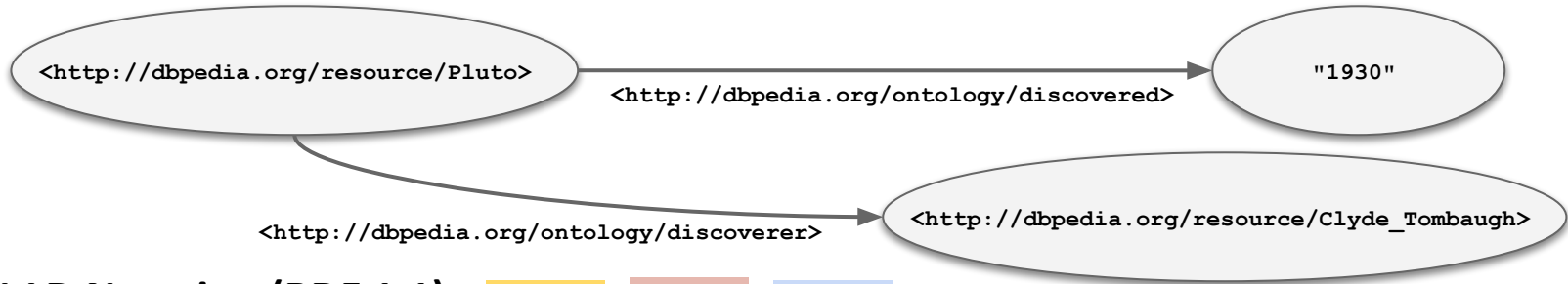
- **N-Triples Notation**

- **URIs/IRIs** in angle brackets
- **Literals** in quotation marks
- Triple ends with a **period**

```
<http://dbpedia.org/resource/Pluto> <http://dbpedia.org/ontology/discovered> "1930" .  
<http://dbpedia.org/resource/Pluto> <http://dbpedia.org/ontology/discoverer>  
<http://dbpedia.org/resource/Clyde_Tombaugh> .
```

RDF JSON-LD Notation

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- JSON-LD Notation (RDF 1.1)

S

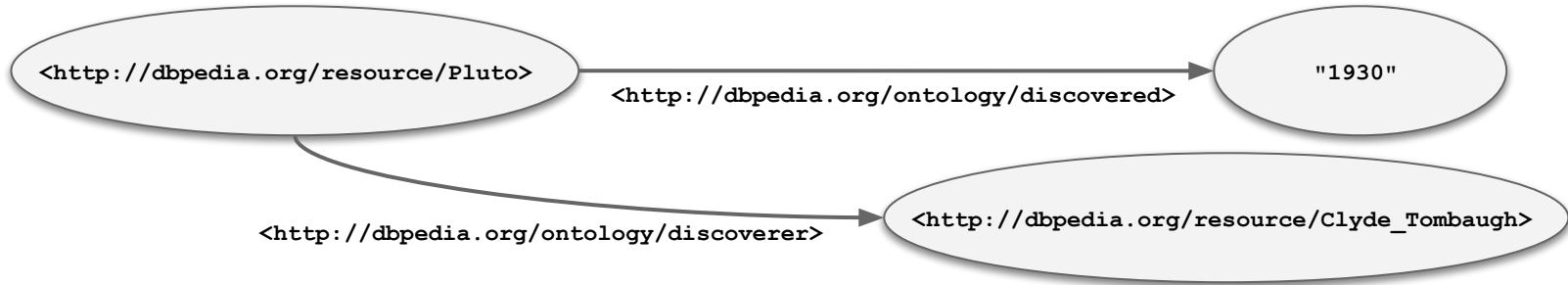
P

O

```
{  "@id" : "http://dbpedia.org/resource/Pluto" ,
  "http://dbpedia.org/ontology/discovered" :
    { "@value" : "1930" }
,
  "http://dbpedia.org/ontology/discoverer" :
    { "@id" : "http://dbpedia.org/resource/Clyde_Tombaugh" }
}
```

RDF Turtle Notation

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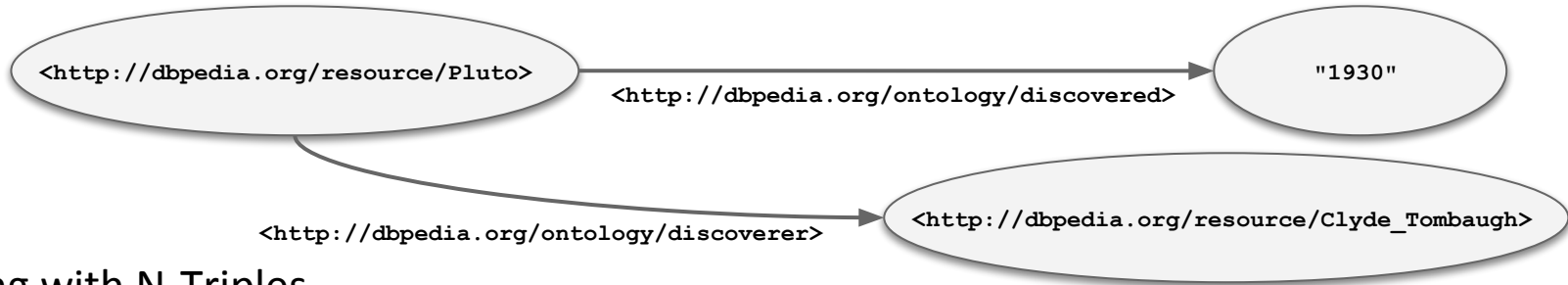
- **Turtle (Terse RDF Triple Language) Notation**
 - extension of N-Triples

```
@prefix dbo: <http://dbpedia.org/ontology/> .  
@base <http://dbpedia.org/resource/> .  
  
<Pluto> dbo:discovered "1930" .  
  
<Pluto> dbo:discoverer <Clyde_Tombaugh> .
```

RDF/Turtle allows
shortcuts and
abbreviations for
readability

RDF Turtle Notation

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- starting with N-Triples

```
<http://dbpedia.org/resource/Pluto> <http://dbpedia.org/ontology/discovered> "1930" .  
<http://dbpedia.org/resource/Pluto> <http://dbpedia.org/ontology/discoverer>  
<http://dbpedia.org/resource/Clyde_Tombaugh> .
```

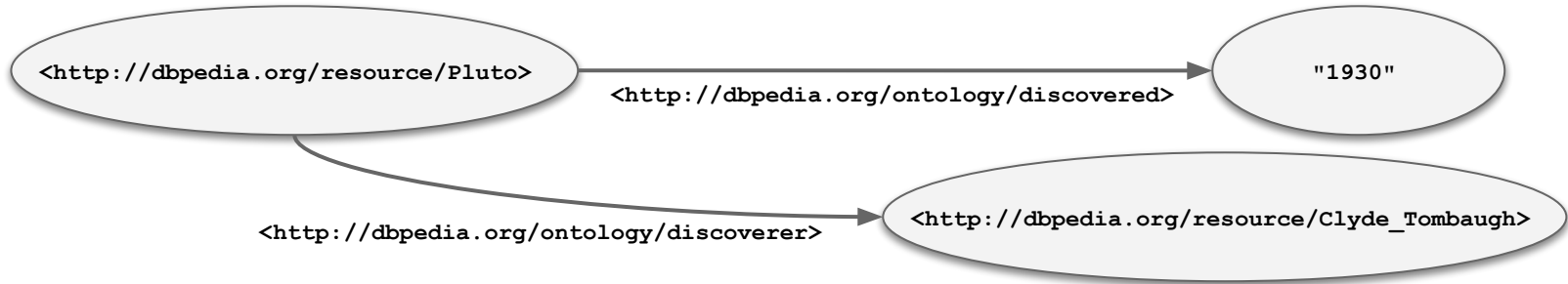
```
@prefix dbo: <http://dbpedia.org/ontology/> .  
@base <http://dbpedia.org/resource/> .  
  
<Pluto> dbo:discovered "1930" .  
  
<Pluto> dbo:discoverer <Clyde_Tombaugh> .
```

@prefix directive associates prefix-label with URI

@base directive provides URI to complement all relative URIs

RDF Turtle Notation

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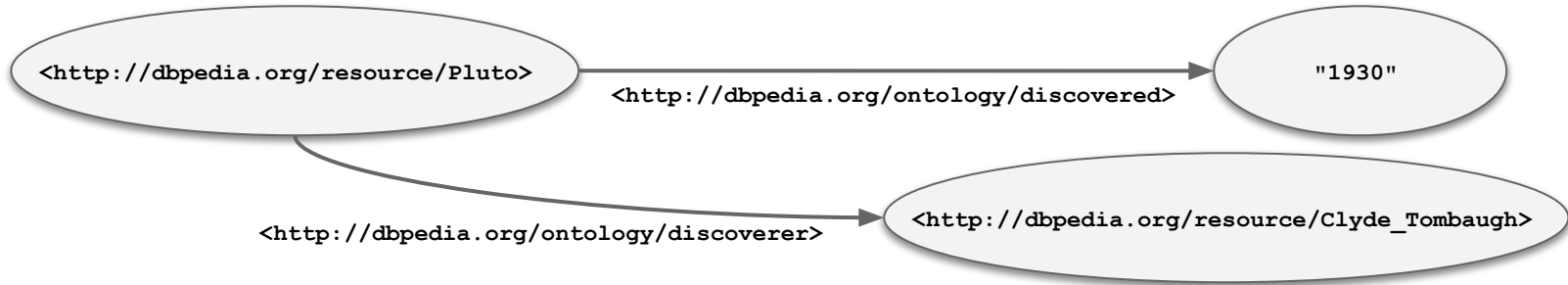
- Abbreviating RDF Triples in Turtle

```
@prefix dbo: <http://dbpedia.org/ontology/> .  
@base <http://dbpedia.org/resource/> .  
  
<Pluto> dbo:discovered "1930" ;  
        dbo:discoverer <Clyde_Tombaugh> .
```

semicolon indicates that subsequent triples have the same subject (**predicate list**)

RDF Turtle Notation

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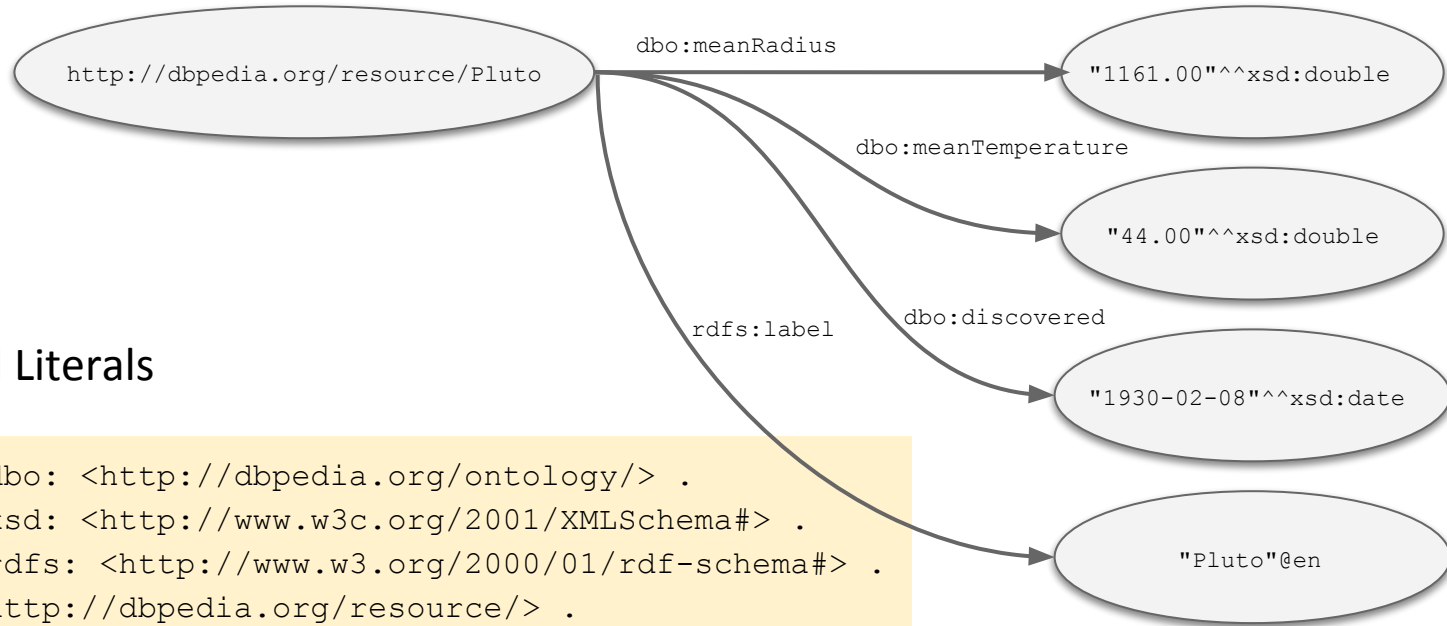
- Abbreviating RDF Triples in Turtle

```
@prefix dbo: <http://dbpedia.org/ontology/> .  
@base <http://dbpedia.org/resource/> .  
  
<Pluto> dbo:satellite <Hydra_(moon)> ,  
                <Nyx_(moon)> ,  
                <Charon_(moon)> .
```

comma indicates that subsequent triples have same subject and property (**object list**)

RDF Turtle Notation

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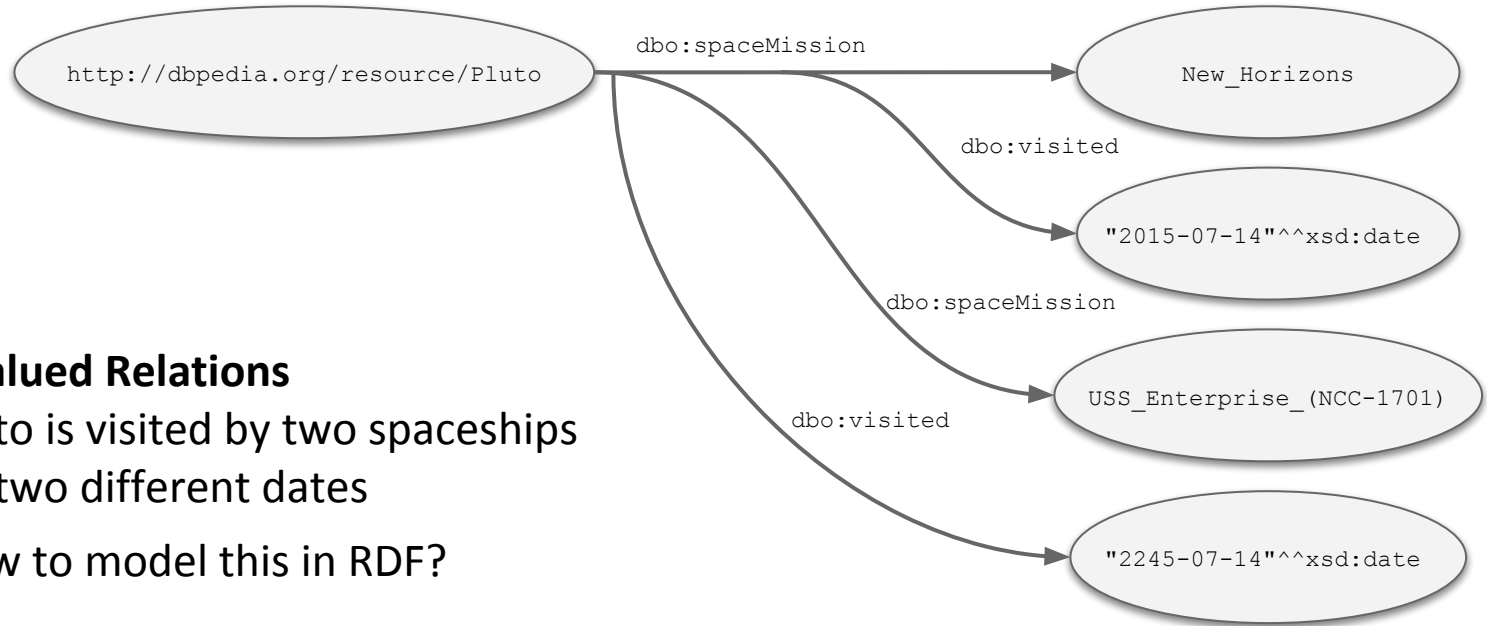
- Typed Literals

```
@prefix dbo: <http://dbpedia.org/ontology/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@base <http://dbpedia.org/resource/> .
```

```
<Pluto> dbo:meanRadius "1161.00"^^xsd:double ;
        dbo:meanTemperature "44.00"^^xsd:double ;
        dbo:discovered "1930-02-18"^^xsd:date ;
        rdfs:label "Pluto"@en .
```

RDF Turtle Notation

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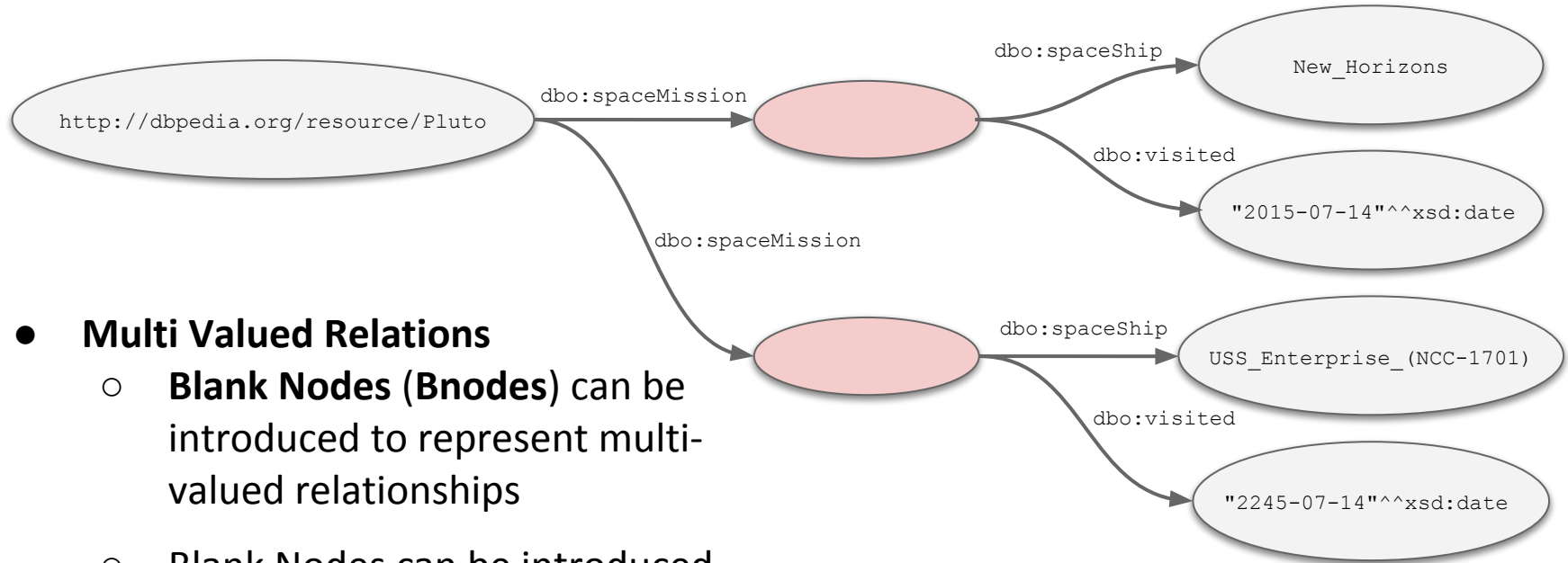


- **Multi Valued Relations**

- Pluto is visited by two spaceships on two different dates
- How to model this in RDF?
- **Problem:** unique association

RDF Turtle Notation

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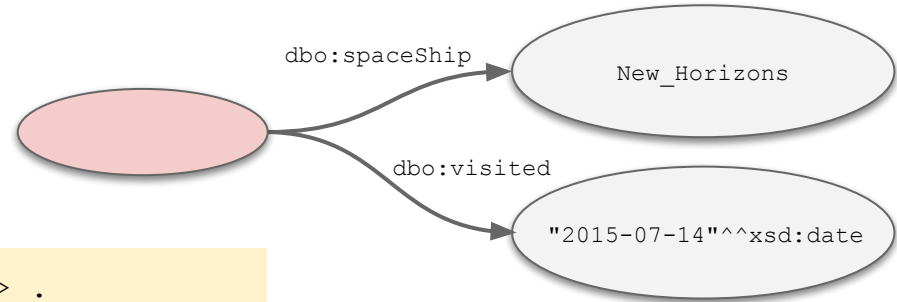


- **Multi Valued Relations**

- **Blank Nodes (Bnodes)** can be introduced to represent multi-valued relationships
- Blank Nodes can be introduced for resources that don't need a name (auxiliary nodes)

RDF Turtle Notation

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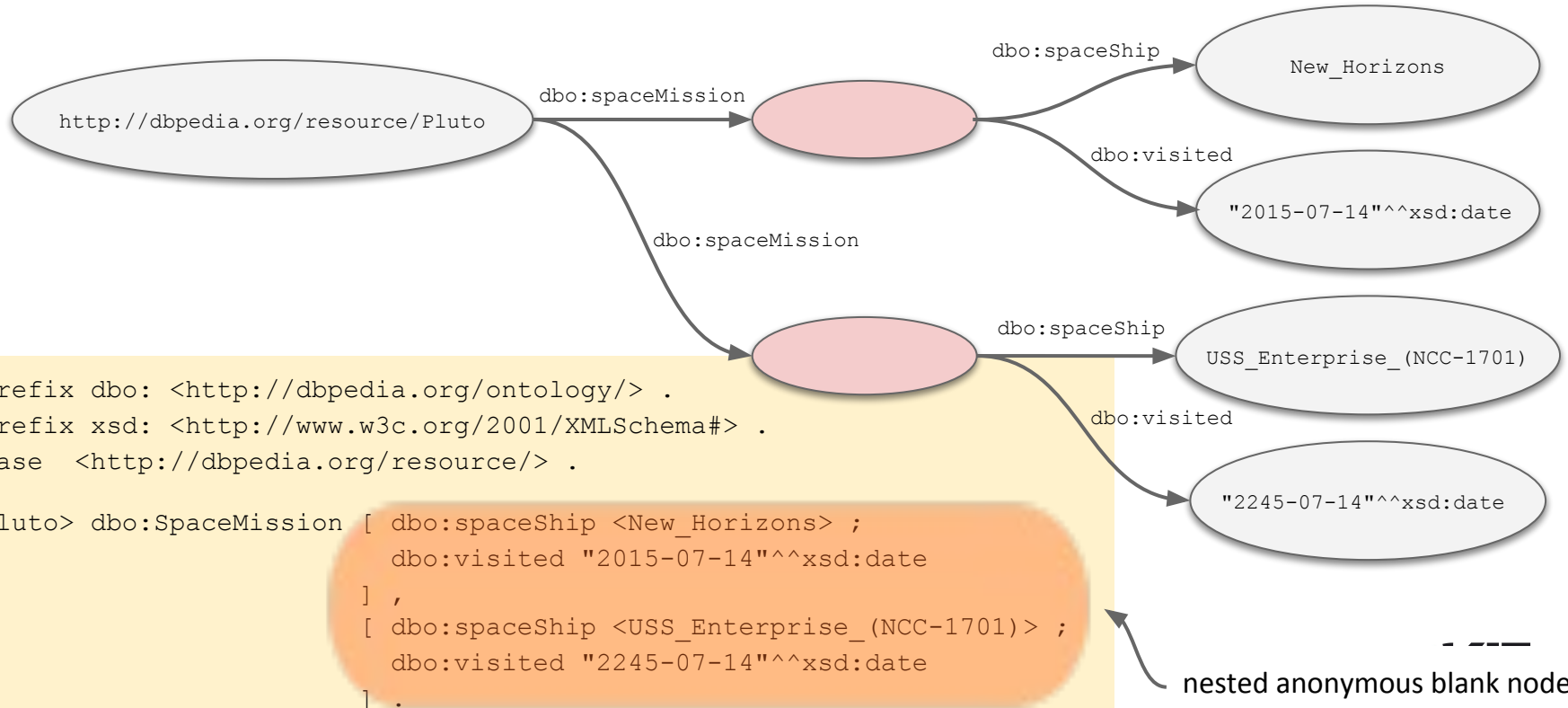
```
@prefix dbo: <http://dbpedia.org/ontology/> .  
@prefix xsd: <http://www.w3c.org/2001/XMLSchema#> .  
@base <http://dbpedia.org/resource/> .
```

```
[ ] dbo:spaceShip <New_Horizons> ;  
    dbo:visited "2015-07-14"^^xsd:date .
```

anonymous blank node as subject

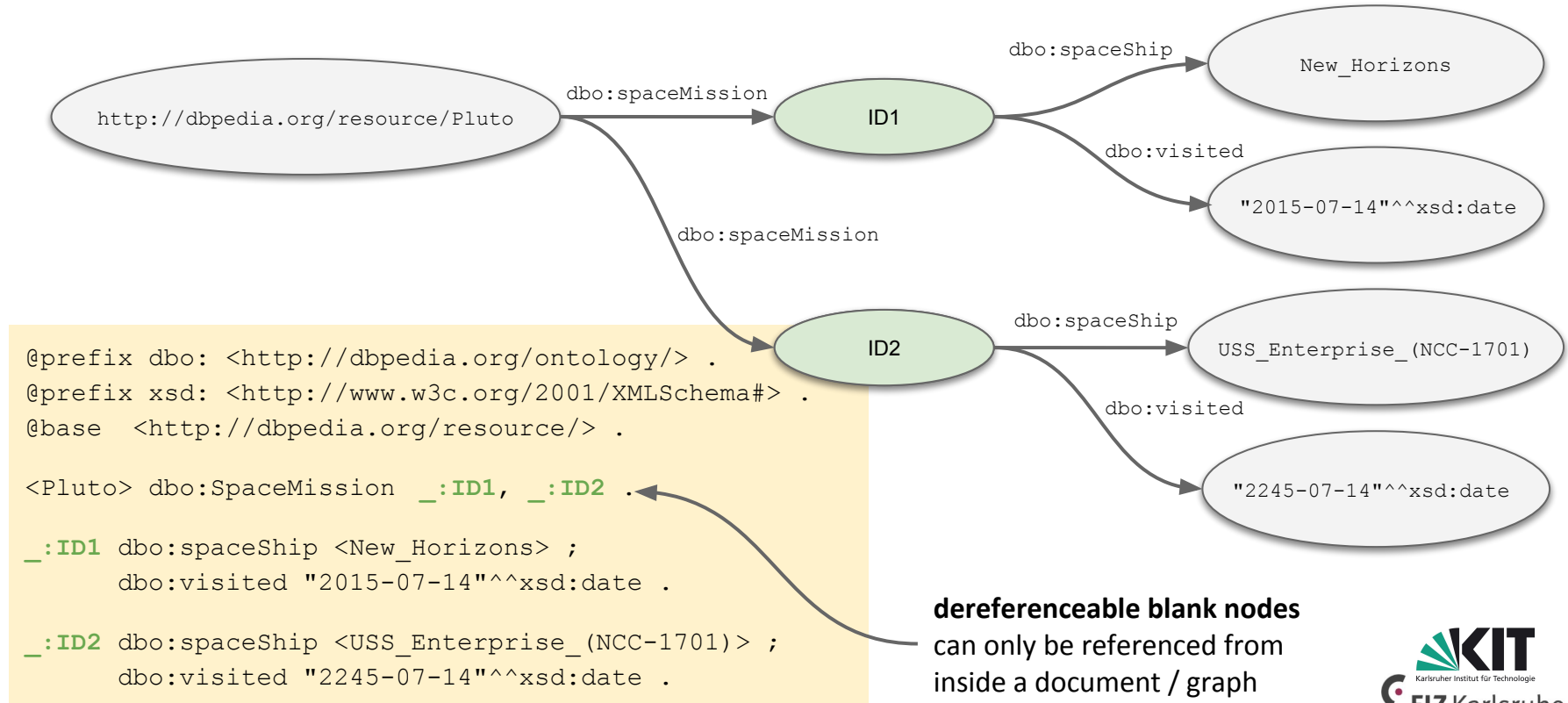
RDF Turtle Notation

Information Service Engineering - Lecture 3 Linked Data Engineering I - 3.5 RDF Turtle Serialization



RDF Turtle Notation

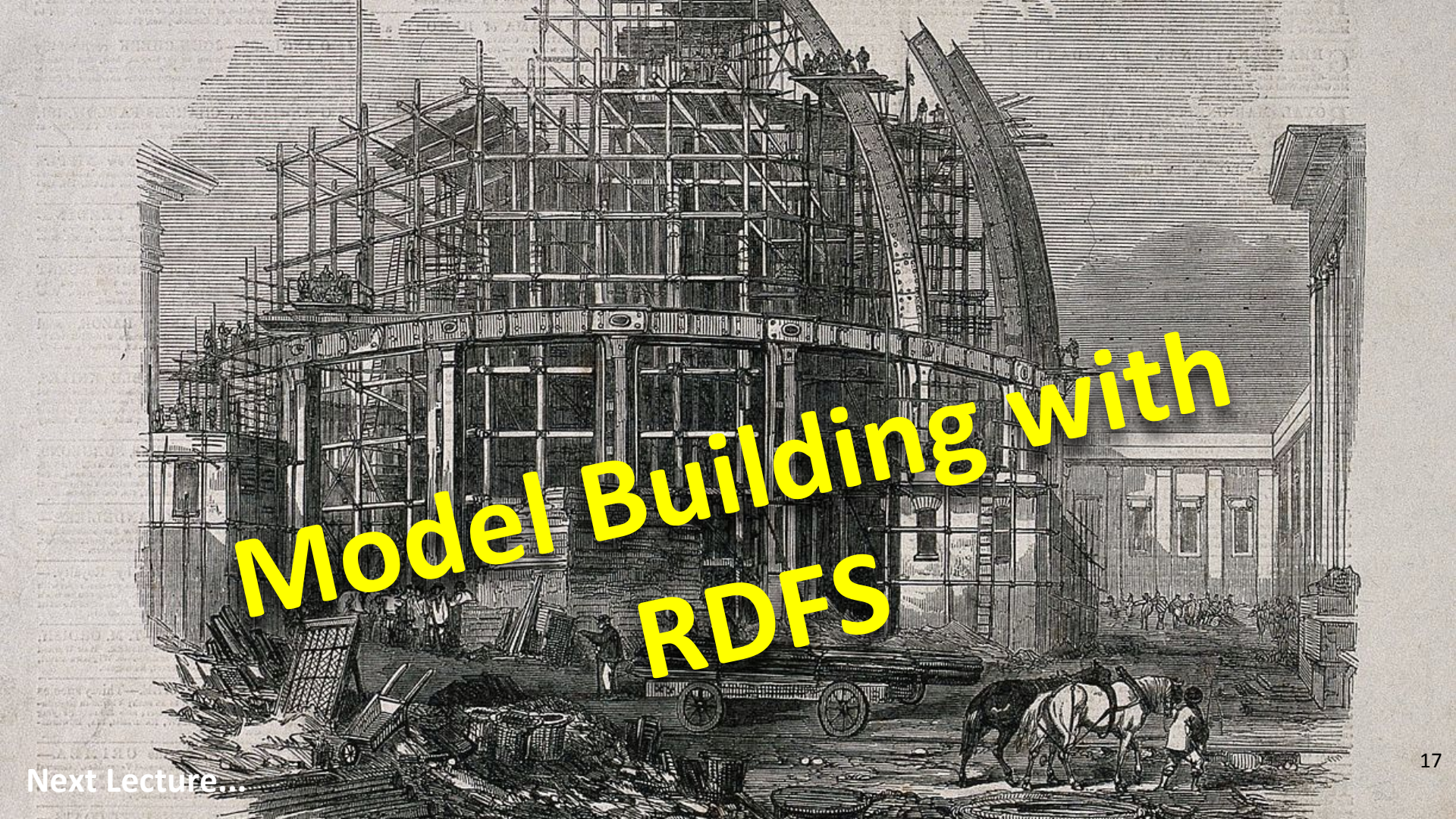
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More RDF Data Structures

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- **RDF Containers and RDF Collections**
 - Data structures to enumerate any resources or literals
 - Open lists (RDF Containers) and closed lists (RDF Collections)
 - No new semantics, just “syntactic sugar”
- **RDF Reification**
 - Abstraction for making “statements about RDF triples”
 - Useful for modeling data provenance
 - e.g. to model
“DBpedia states that Pluto has been discovered in 1930.”



Model Building with RDFS

Next Lecture...

Picture References:

- P.3: Four images from New Horizons' Long Range Reconnaissance Imager (LORRI) were combined with color data from the Ralph instrument to create this enhanced color global view of Pluto, NASA/JHUAPL/SwRI
https://solarsystem.nasa.gov/multimedia/gallery/01_Stern_03_Pluto_Color_TXT.jpg
- P.14: The British Museum: the reading room under construction. Wood engraving by J. Brown after C. W. Sheeres, 1855.
https://commons.wikimedia.org/wiki/File:The_British_Museum;_the_reading_room_under_construction._Woo_Wellcome_V00135_19.jpg