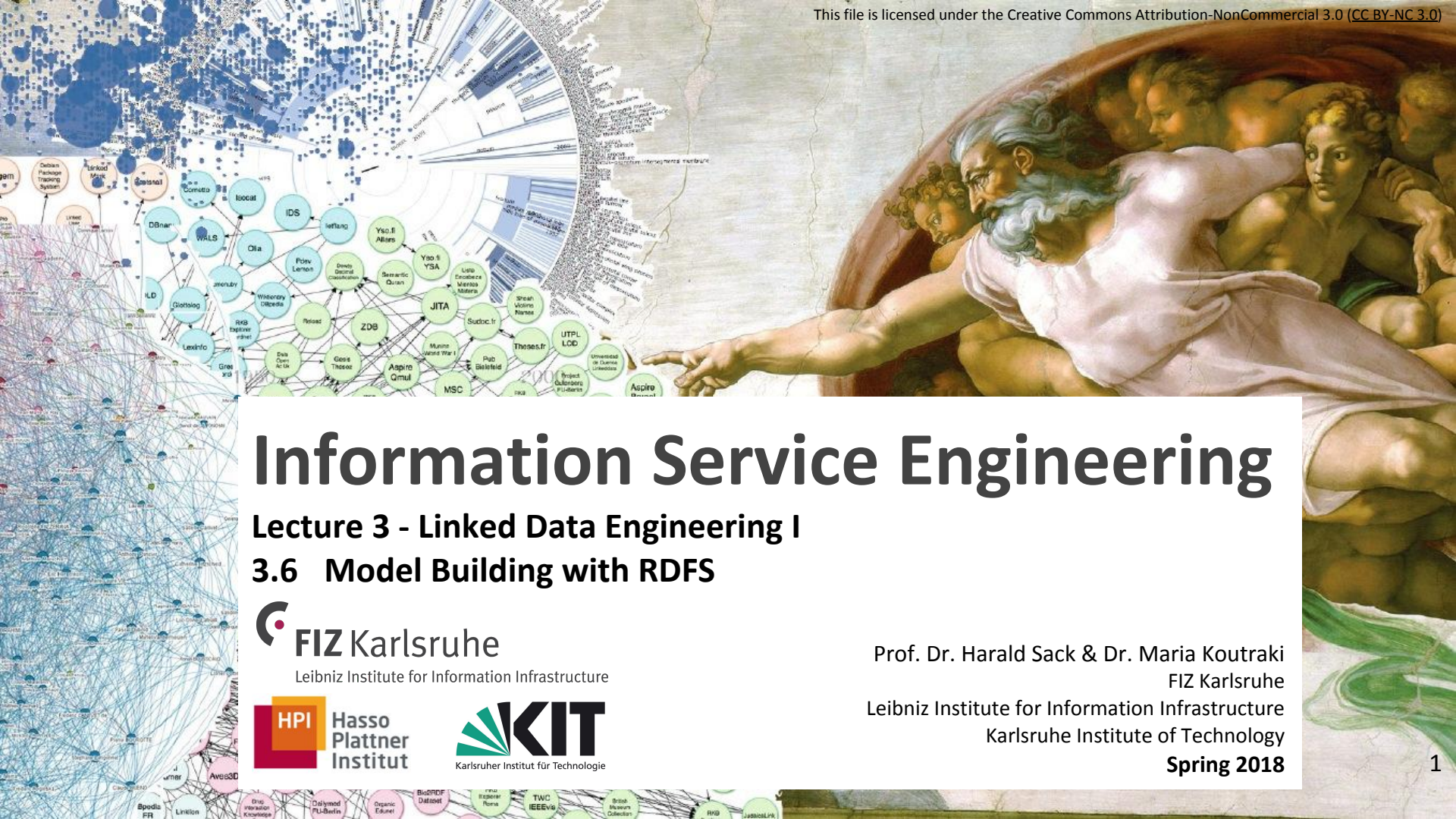




Information Service Engineering

Lecture 3 - Linked Data Engineering I

3.6 Model Building with RDFS



FIZ Karlsruhe

Leibniz Institute for Information Infrastructure



Hasso
Plattner
Institut



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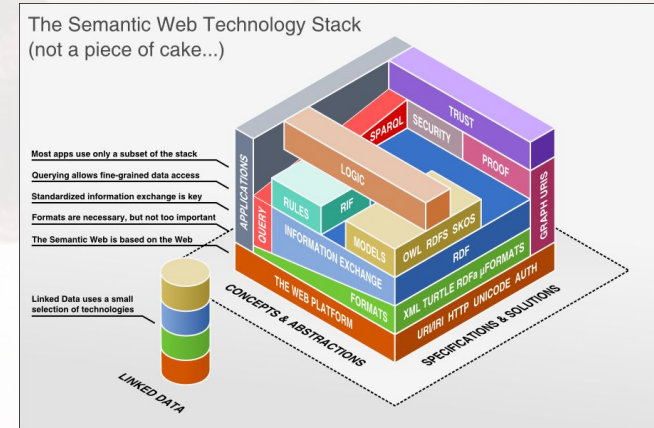
Prof. Dr. Harald Sack & Dr. Maria Koutraki
FIZ Karlsruhe

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)



What does it really mean?

<http://dbpedia.org/resource/Pluto>

<http://dbpedia.org/property/satelliteOf>

[http://dbpedia.org/resource/Charon_\(moon\)](http://dbpedia.org/resource/Charon_(moon))

<http://dbpedia.org/ontology/discoverer>

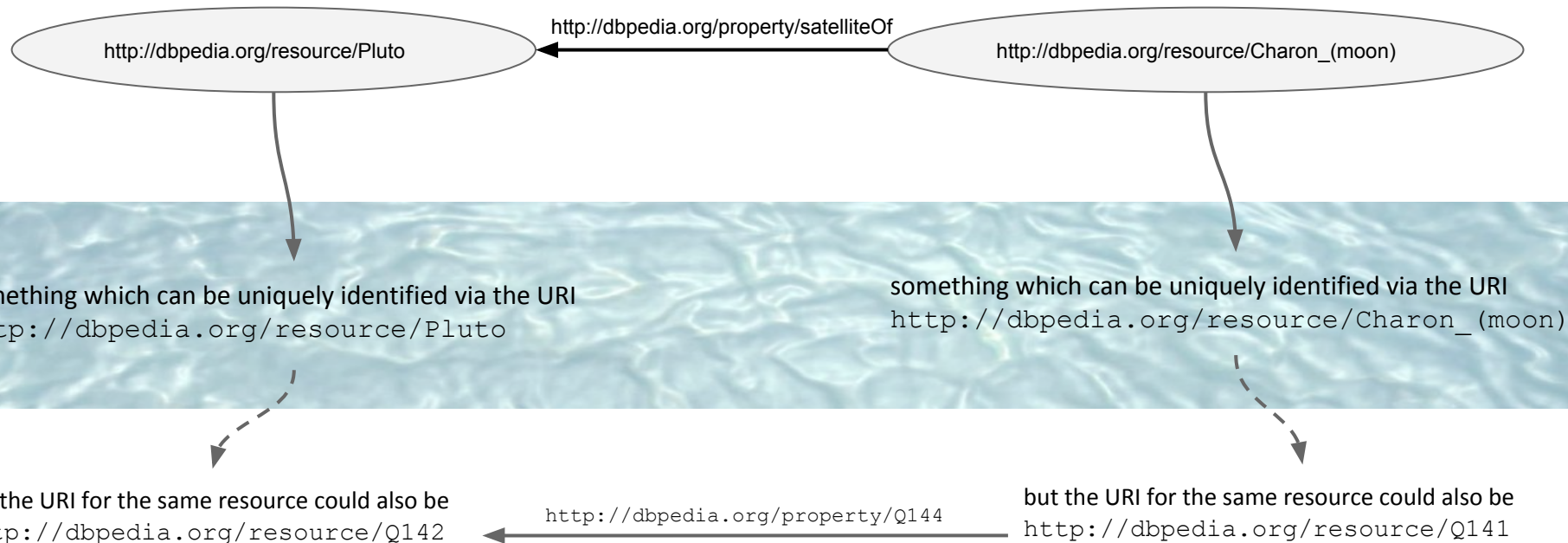
http://dbpedia.org/resource/Clyde_Tombaugh

Where does the intended meaning really come from?



What does it really mean...?

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We need more semantic expressivity...

The Semantic Web Technology Stack (not a piece of cake...)

Most apps use only a subset of the stack

Querying allows fine-grained data access

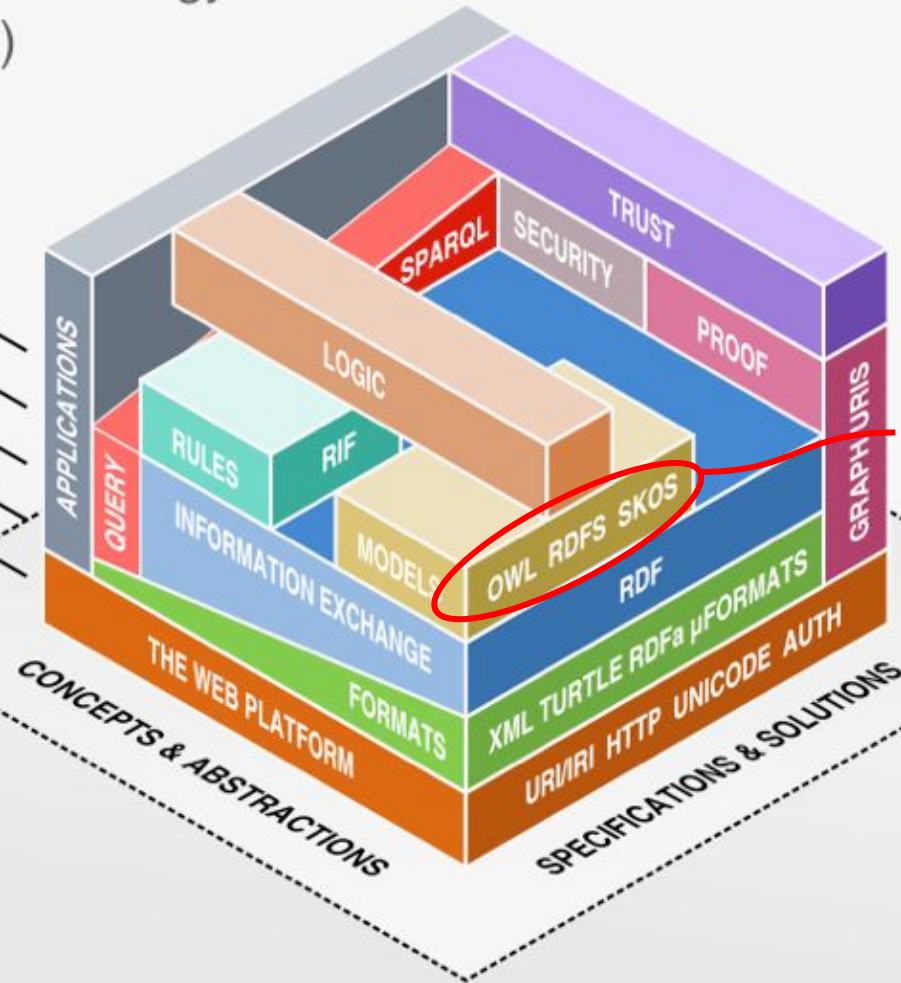
Standardized information exchange is key

Formats are necessary, but not too important

The Semantic Web is based on the Web

Linked Data uses a small
selection of technologies

LINKED DATA



RDF Schema

RDF Schema

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- **RDF Schema**, officially called “**RDF Vocabulary Description Language**”
- RDF Schema allows:
 - Definition of **classes** via **`rdfs:Class`**
 - Class instantiation in RDF via **`rdf:type`**
 - Example:
`:Planet rdf:type rdfs:Class .`
`:Earth rdf:type :Planet .`

```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .  
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .  
@prefix : <http://example.org/Space#> .
```

RDF Schema

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- Definition of **properties** via `rdf:Property`
- Definition of **property restrictions on domain and range** via `rdfs:domain` and `rdfs:range`
- Example

```
:CelestialBody rdf:type      rdfs:Class .  
:satelliteOf    rdf:type      rdf:Property .  
:satelliteOf    rdfs:domain    :CelestialBody .  
:satelliteOf    rdfs:range     :CelestialBody .
```

RDF Schema

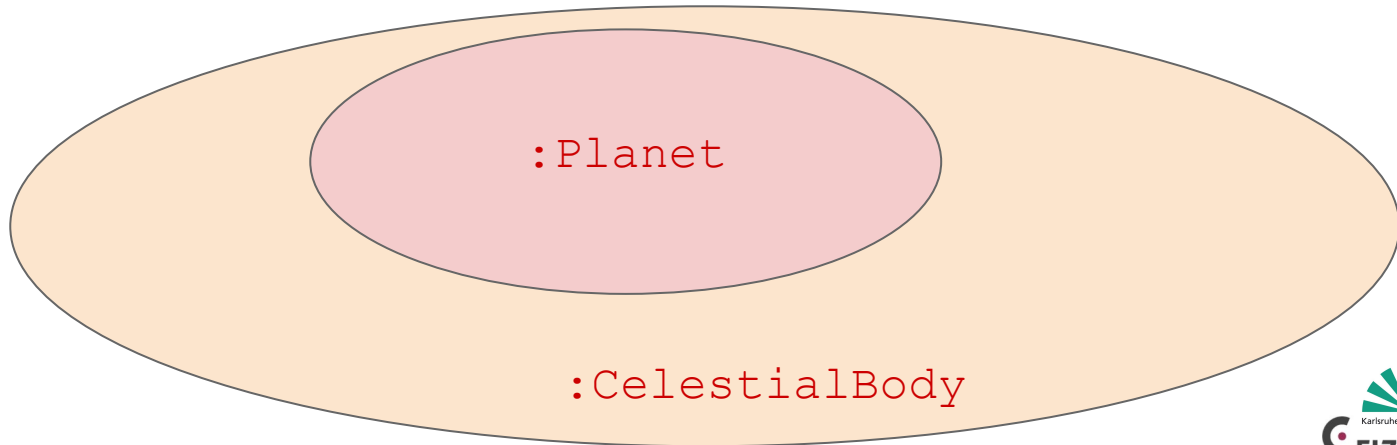
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- Everything in the RDF model is a **resource**
 - `rdfs:Class` `rdf:type` `rdfs:Resource` .
 - `rdf:Property` `rdf:type` `rdfs:Resource` .
 - `rdfs:Literal` `rdf:type` `rdfs:Resource` .
 - `rdfs:XMLLiteral` `rdf:type` `rdfs:Resource` .
 - `rdfs:Datatype` `rdf:type` `rdfs:Resource` .

RDF Schema

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- Definition of **hierarchical relationships**:
 - **Subclasses** and **superclasses** via `rdfs:subClassOf`
 - Example:
`:Planet rdfs:subClassOf :CelestialBody .`

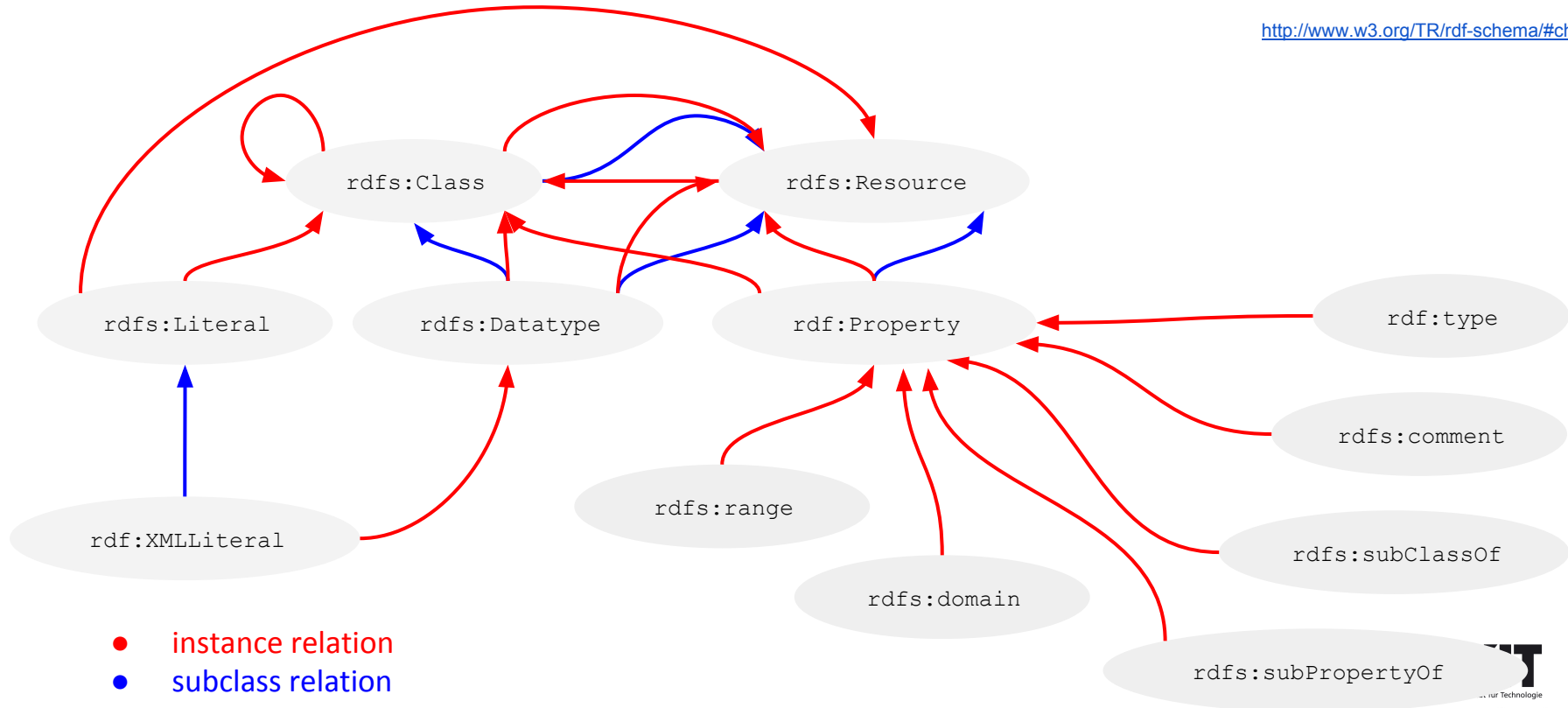


- Definition of **hierarchical relationships**:
 - **Subclasses** and **superclasses** via `rdfs:subClassOf`
 - Example:
`:Planet rdfs:subClassOf :CelestialBody .`
 - **Subproperties** and **superproperties** via `rdfs:subPropertyOf`
 - Example
`:artificialSatelliteOf rdfs:subPropertyOf
:satelliteOf .`

RDF Schema

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http://www.w3.org/TR/rdf-schema/#ch_classes



RDF Schema

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- Some more properties:
 - **rdfs:seeAlso**
defines a relation of a resource to another, which explains it
 - **rdfs:isDefinedBy**
subproperty of `rdfs:seeAlso`, defines the relation of a resource to its definition
 - **rdfs:comment**
comment, usually as text
 - **rdfs:label**
„readable“ name of a resource (contrary to ID)

RDF Schema

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```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .  
@prefix rdf:  <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .  
@prefix :    <http://example.org/Space#> .
```

```
:Planet rdf:type      rdfs:Class ;  
        rdfs:subClassOf :CelestialBody .  
:Satellite rdf:type    rdfs:Class ;  
           rdfs:subClassOf :CelestialBody .  
:ArtificialSatellite rdf:type      rdfs:Class ;  
                    rdfs:subClassOf :Satellite .
```

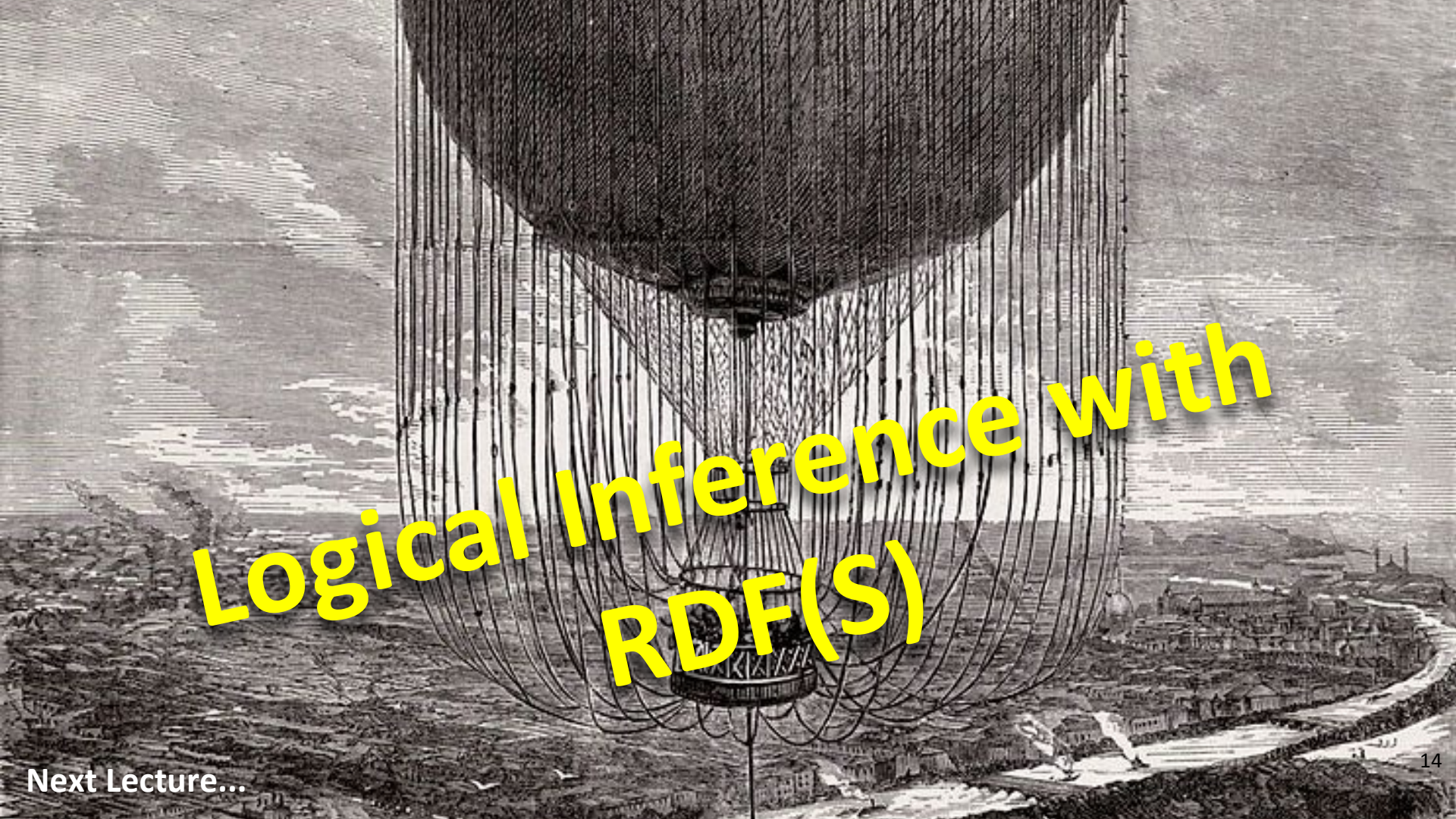
Class Definitions

```
:satelliteOf rdf:type    rdf:Property ;  
             rdfs:domain :CelestialBody ;  
             rdfs:range  :CelestialBody .
```

Property Definitions

```
:Earth    rdf:type      :Planet .  
:Moon     rdf:type      :Satellite ;  
          :satelliteOf :Earth .  
:Sputnik1 rdf:type      :ArtificialSatellite ;  
          :satelliteOf :Earth ;  
          rdfs:label    "Sputnik 1"@en ;  
          rdfs:comment  "the first artificial Earth satellite in 1957" .
```

Instance Definitions



Logical Inference with RDF(S)

Next Lecture...

Picture References:

- P.3: Pluto and Charon, NASA, <https://www.nasa.gov/feature/pluto-s-big-moon-charon-reveals-a-colorful-and-violent-history>
The astronomer Clyde Tombaugh, discoverer of Pluto here shown with his homemade 9-inch telescope. (1930)
https://commons.wikimedia.org/wiki/File:Clyde_W._Tombaugh.jpeg
- P.5: The Semantic Web Technology Stack, via http://bnode.org/media/2009/07/08/semantic_web_technology_stack.png
- P.14: Trichon, Le grand ballon captif de la cour des Tuileries, 1879
https://commons.wikimedia.org/wiki/File:Le_grand_ballon_captif_de_la_cour_des_Tuileries.jpg