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Knowledge Engineering with Semantic Web Technologies

Lecture 2: RDF Based Knowledge Representation

2.2 Model Building with RDFS

Dr. Harald Sack
Hasso-Plattner-Institut for IT Systems Engineering
University of Potsdam
Autumn 2015

HPI Hasso Plattner Institut

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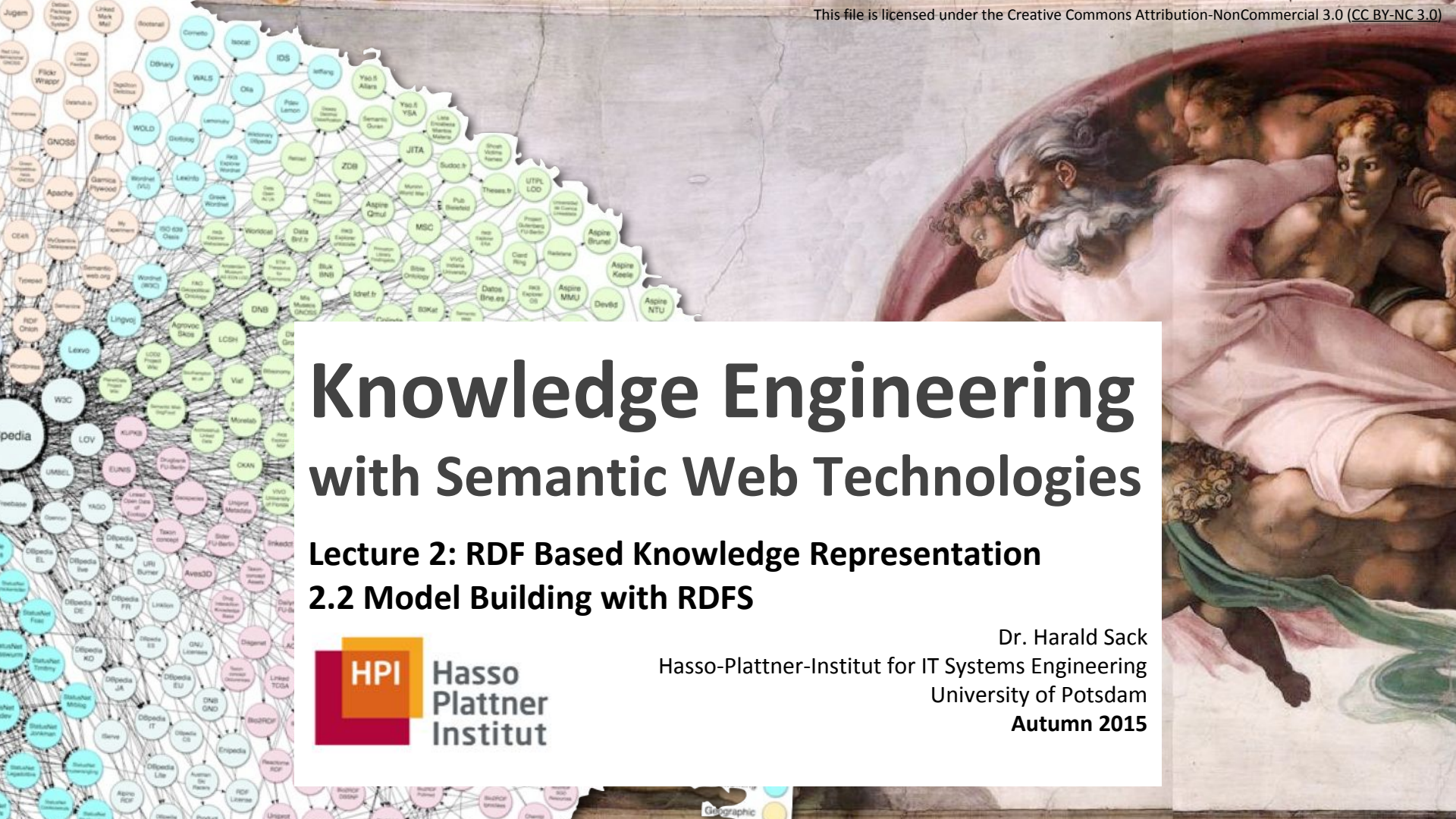
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What does it really mean?

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

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

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

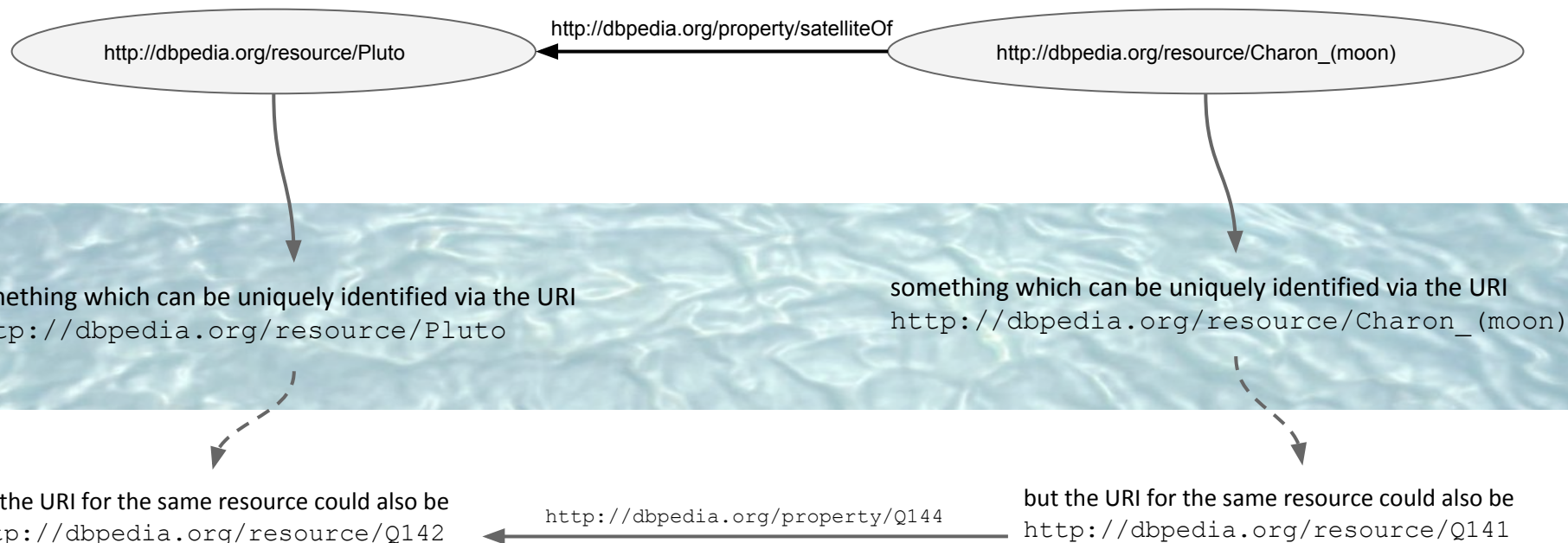
<http://dbpedia.org/ontology/discoverer>

http://dbpedia.org/resource/Clyde_Tombaugh

Where does the intended meaning really come from?



What does it really mean?

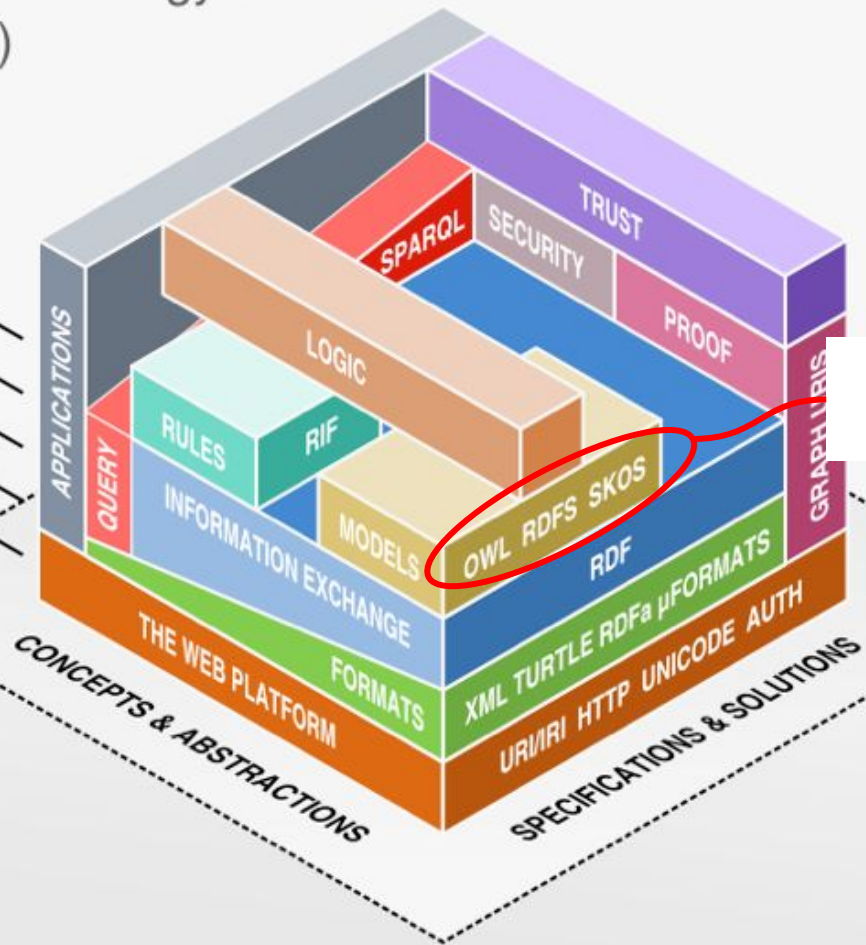
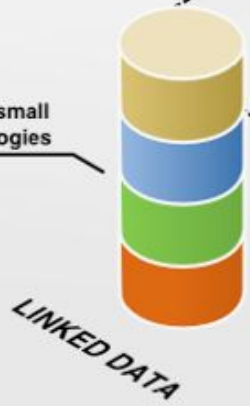


We need more semantic expressivity...

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



RDF Schema

RDF Schema



- 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



- 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



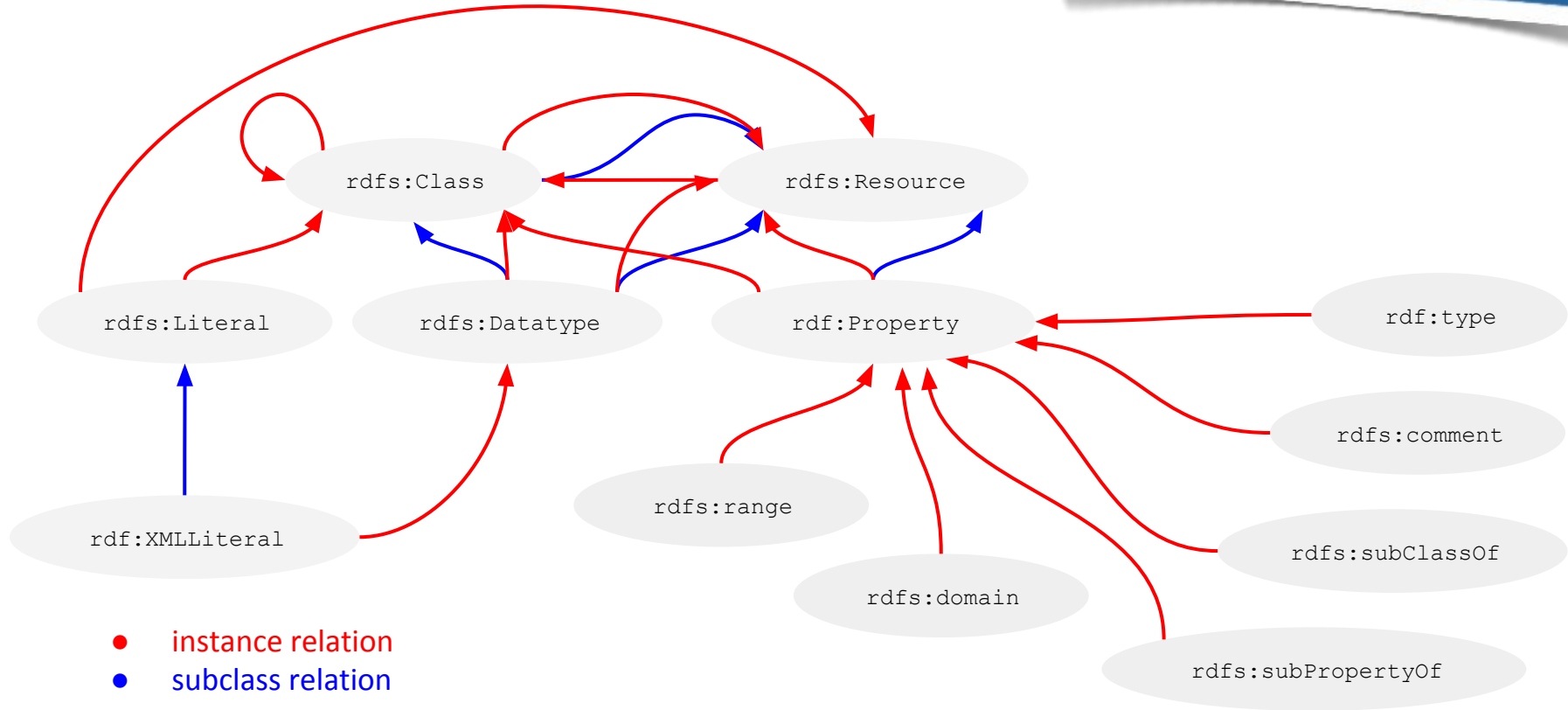
- Everything in the RDF model is a **resource**
 - `rdfs:Class` `rdf:type` `rdfs:Resource` .
 - `rdf:Property` `rdf:type` `rdfs:Resource` .
 - `rdfs:Literal` `rdf:type` `rdfs:Resource` .
 - `rdfs:XMLLiteral` `rdf:type` `rdfs:Resource` .
 - `rdfs:Datatype` `rdf:type` `rdfs:Resource` .
 - `rdfs:Container`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

RDF Schema



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

RDFS Language Model



RDF Schema



- 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)
 - **`rdfs:member`**
super-property of all the container membership properties
(e.g. `rdf:_1`, ...)

RDFS Example

```
@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 .  
:satelliteOf  rdfs:domain  :CelestialBody .  
:satelliteOf  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



Next: 03 - Logical Inference with RDFS

OpenHPI - Course Knowledge Engineering with Semantic Web Technologies

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