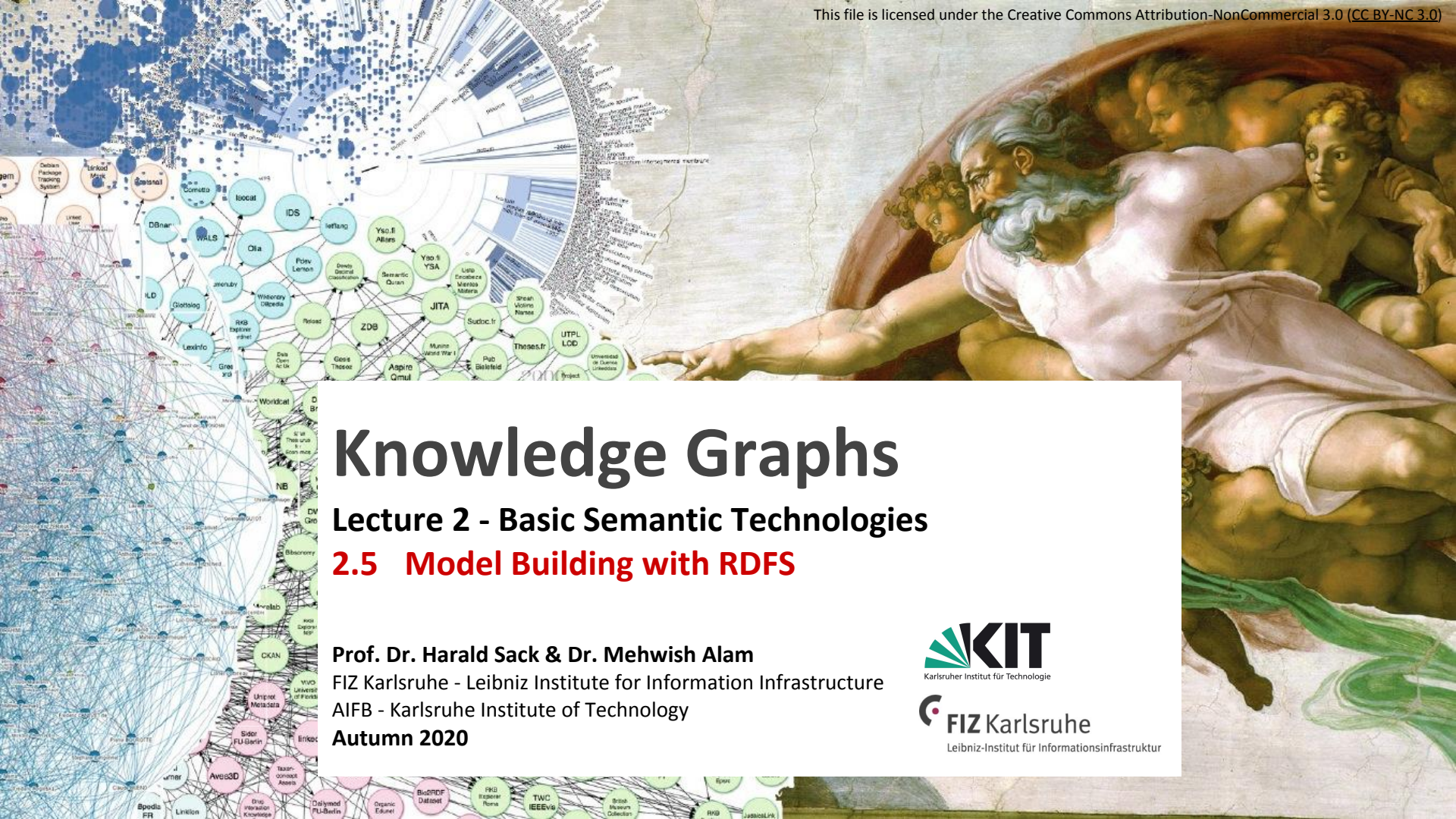

Knowledge Graphs

Lecture 2 - Basic Semantic Technologies

2.5 Model Building with RDFS

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Karlsruher Institut für Technologie

FIZ Karlsruhe
Leibniz-Institut für Informationsinfrastruktur

Knowledge Graphs

Lecture 2: Basic Semantic Technologies

What does it really mean?

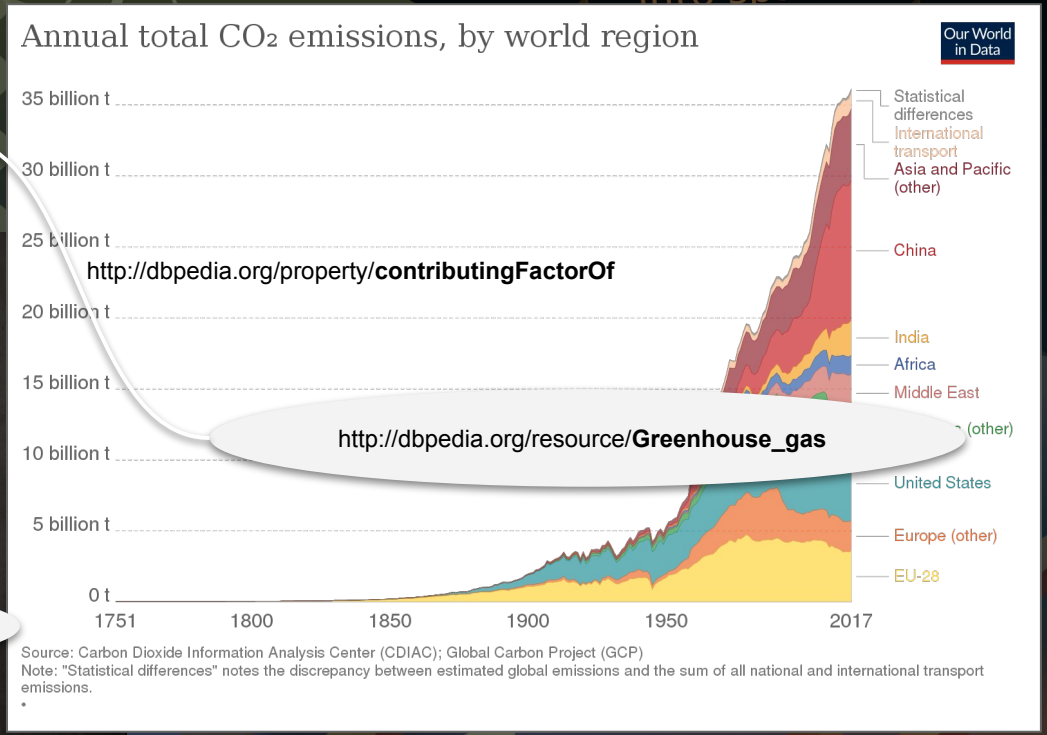
http://dbpedia.org/resource/**Greenhouse_effect**

http://dbpedia.org/property/**contributingFactorOf**

http://dbpedia.org/resource/**Greenhouse_gas**

http://dbpedia.org/ontology/**discoverer**

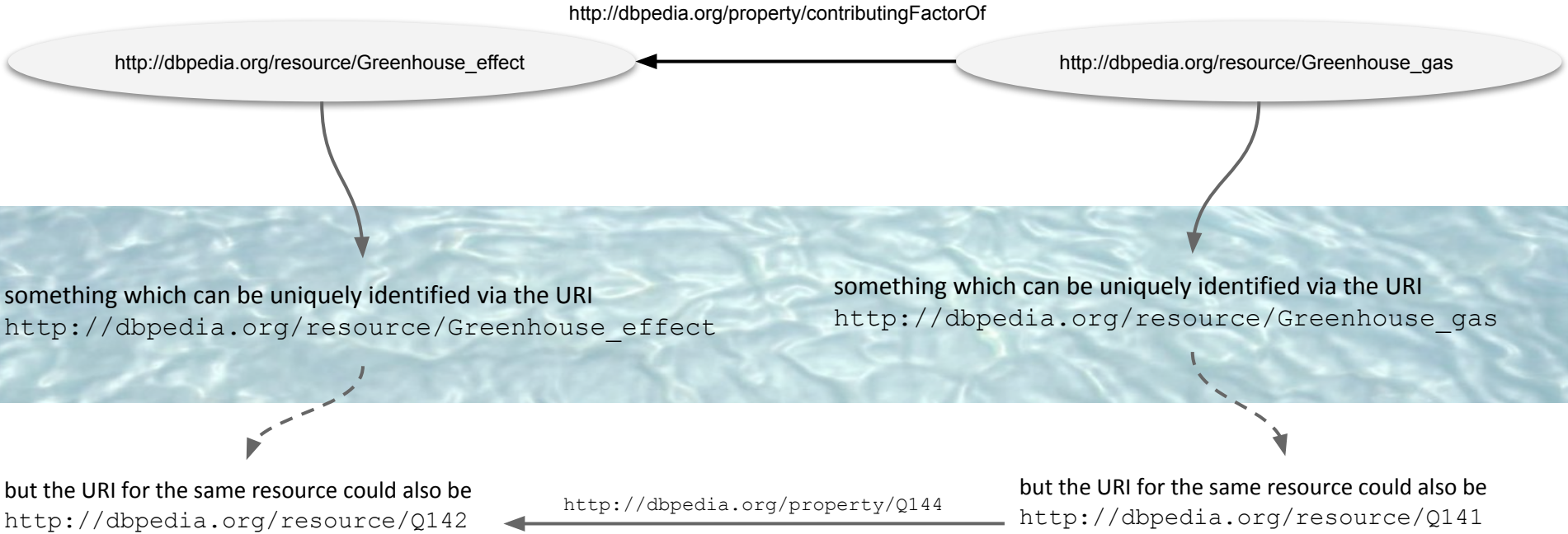
http://dbpedia.org/resource/**Joseph_Fourier**



Where does the intended meaning really come from?

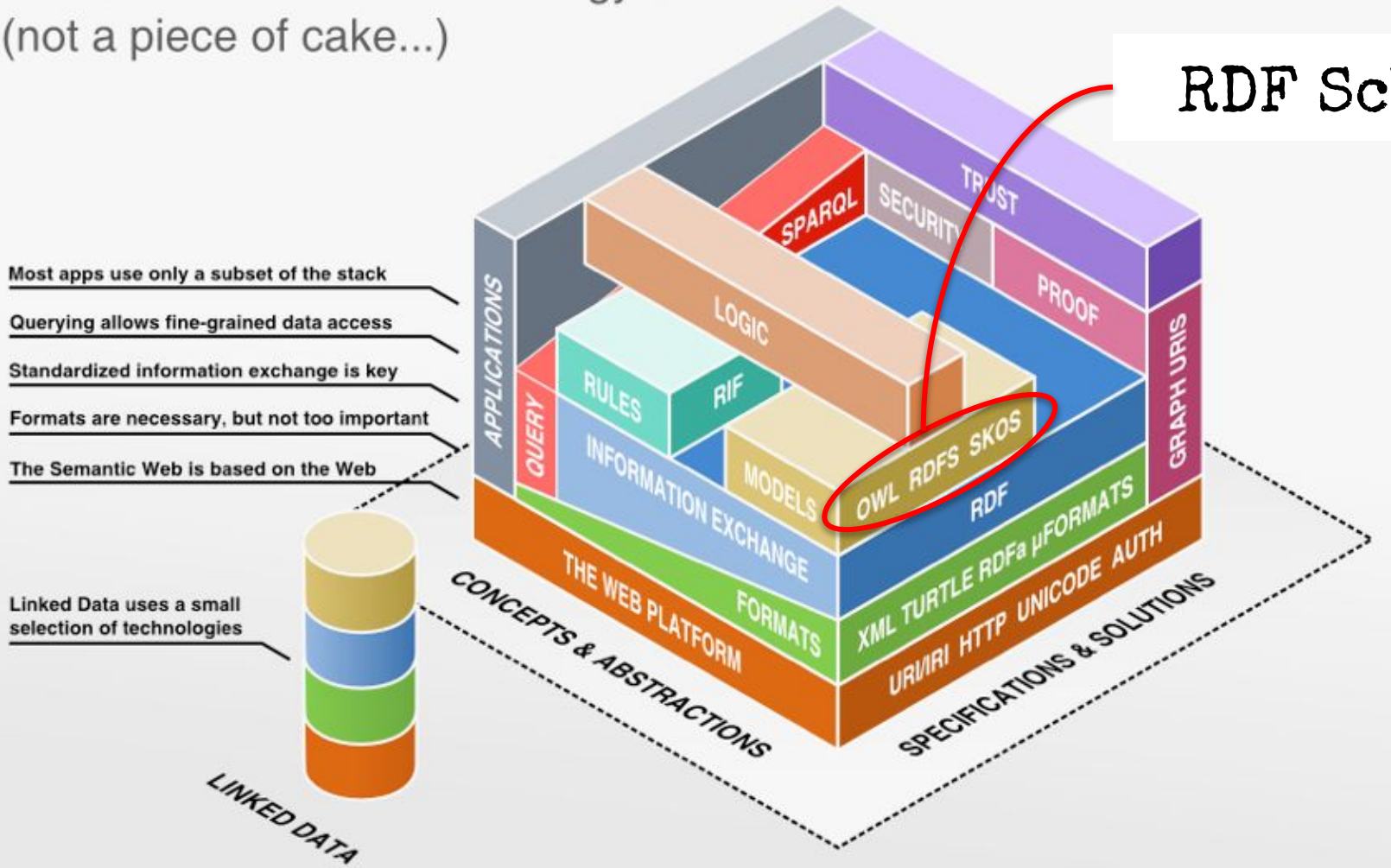
[1,2,3]

What does it really mean?



We need more semantic expressivity...

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



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:

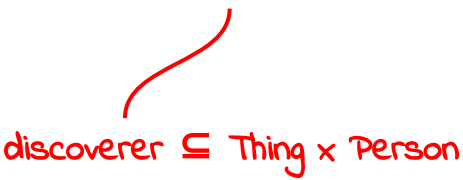
```
:Greenhouse_gas   rdf:type rdfs:Class .
:Carbon_dioxide   rdf:type :Greenhouse_gas .
```


```
@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

```
:Person       rdf:type      rdfs:Class .
:Thing        rdf:type      rdfs:Class .
:discoverer   rdf:type      rdf:Property .
:discoverer   rdfs:domain   :Thing .
:discoverer   rdfs:range    :Person .
```



RDF Schema

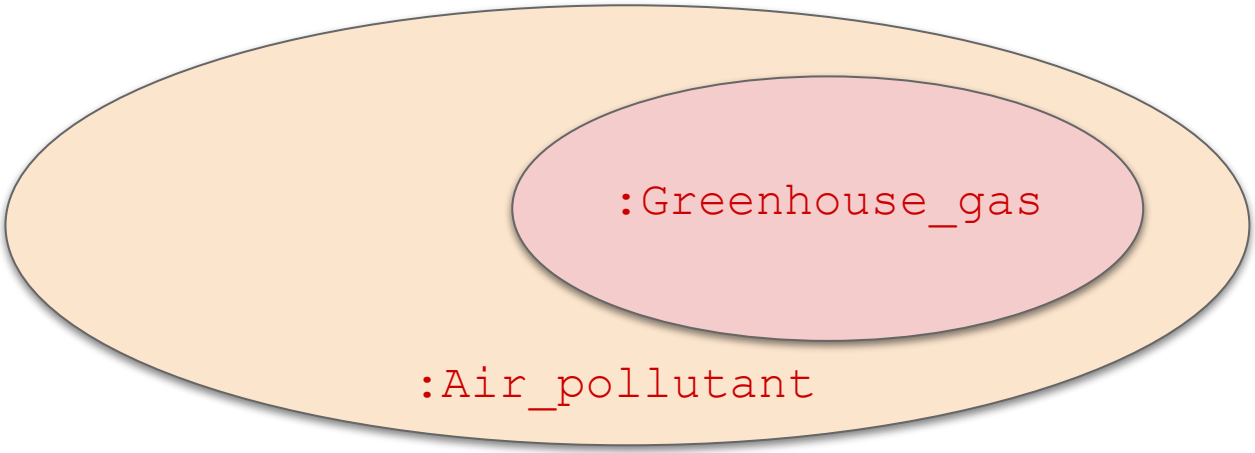
- Everything in the RDF model is a **resource**
  - `rdfs:Class rdf:type rdfs:Resource .`
  - `rdf:Property rdf:type rdfs:Resource .`
  - `rdfs:Literal rdf:type rdfs:Resource .`
  - `rdfs:XMLLiteral rdf:type rdfs:Resource .`
  - `rdfs:Datatype rdf:type rdfs:Resource .`

RDF Schema

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

```
:Greenhouse_gas rdfs:subClassOf :Air_pollutant .
```

Greenhouse_gas ⊆ Air_pollutant



RDF Schema

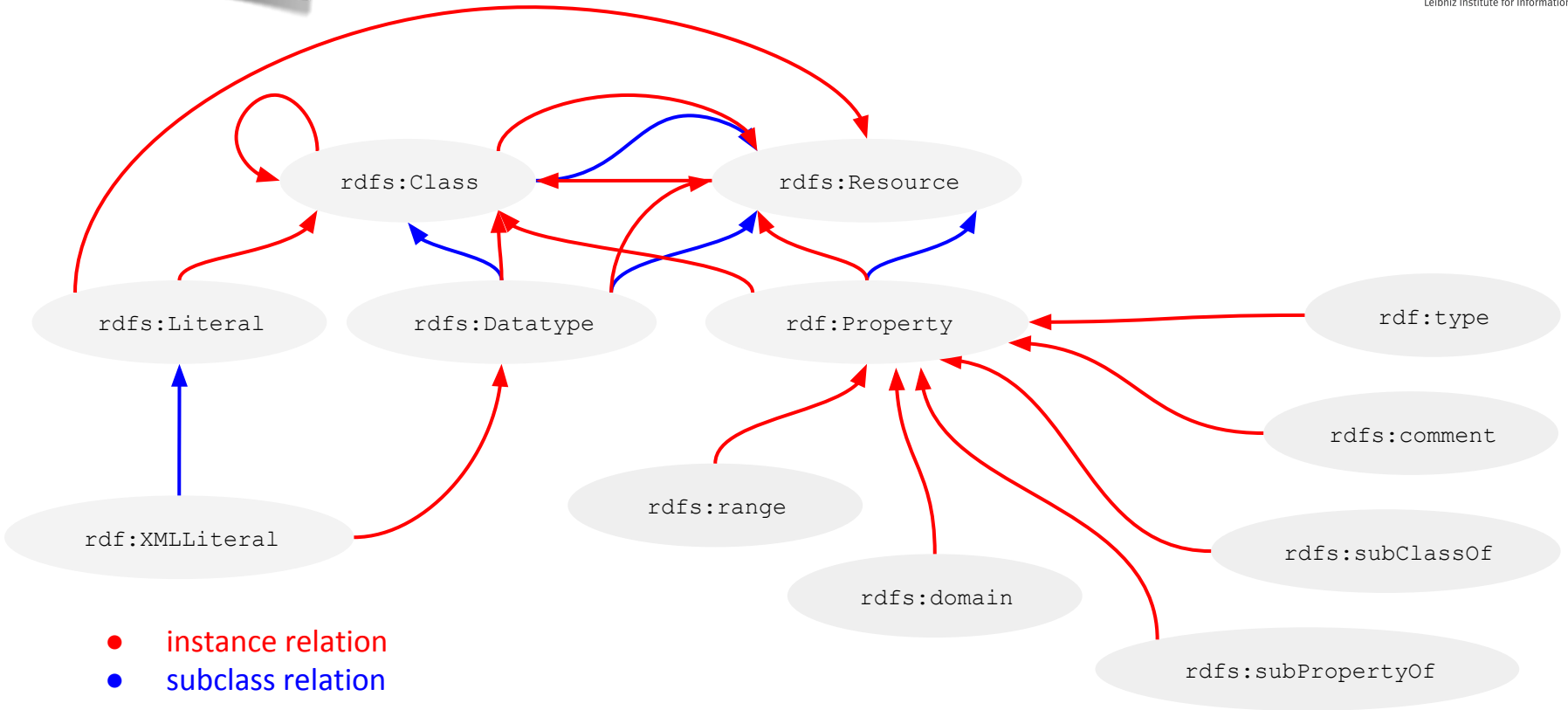
- Definition of **hierarchical relationships**:
  - **Subclasses** and **superclasses** via `rdfs:subClassOf`
  - Example:

```
:Greenhouse_gas rdfs:subClassOf :Air_pollutant .
```

  - **Subproperties** and **superproperties** via `subPropertyOf`
  - Example:

```
:sublimationTemperature rdfs:subPropertyOf
:temperature .
```

(Simplified) RDF Schema Language Model



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

Some more RDF Schema

- Further RDFS 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 Example

```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix rdf:  <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix owl:  <http://www.w3.org/2002/07/owl#>
@prefix :     <http://example.org/Climate#> .
```

```
:Greenhouse_gas       rdf:type         rdfs:Class ;
                      rdfs:subClassOf  :Air_pollutant .
:Person               rdf:type         rdfs:Class .
:Scientist            rdfs:subClassOf  :Person .
:Physicist            rdfs:subClassOf  :Scientist .
:Chemist              rdfs:subClassOf  :Scientist .
```

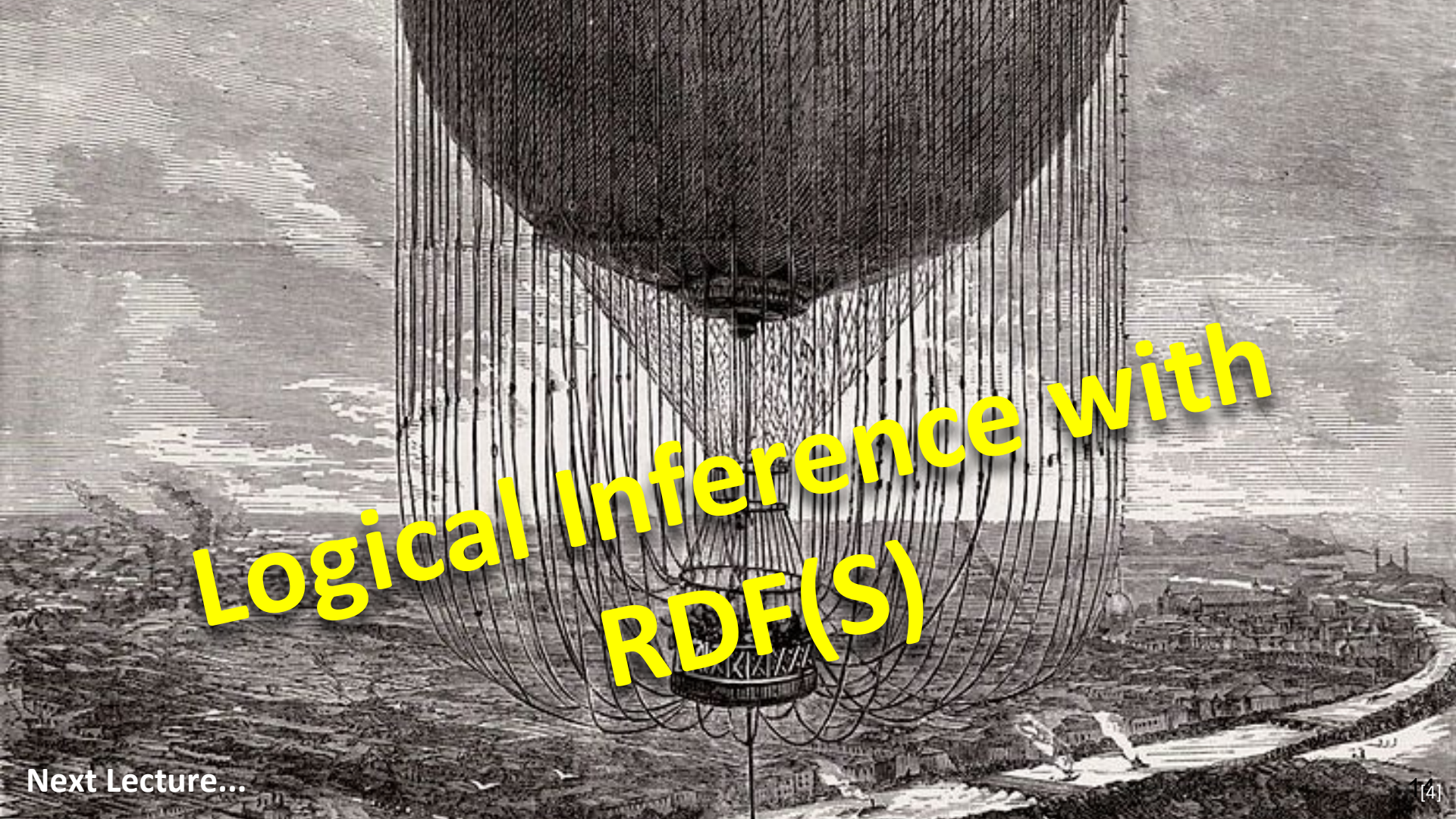
Class Definitions

```
:discoverer     rdf:type     rdf:Property ;
                rdfs:domain  owl:Thing .
                rdfs:range   :Person .
```

Property Definitions

```
:Carbon_dioxide             rdf:type      :Greenhouse_gas ;
                            :discoverer   :Jan_Baptist_van_Helmont ;
                            :discoverer   :Joseph_Black .
:Jan_Baptist_van_Helmont    rdf:type      :Physicist .
:Joseph_Black               rdf:type      :Chemist ;
                            rdfs:label    "Joseph Black"@en ;
                            rdfs:comment  "co-discovered CO2" .
```

Instance Definitions



Next Lecture...

Karlsruher Institut für Technologie
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Picture References:

- [1] The Green House Effect, A loose necktie [CC BY-SA]
  https://commons.wikimedia.org/wiki/File:Greenhouse-effect-t445.svg
- [2] Fourier, in his prefect's garb, Pierre-Claude Gautherot, (1806), [Public Domain]
  https://commons.wikimedia.org/wiki/File:Fourier_in_his_coat_of_prefect.jpg?uselang=de
- [3] Shown are the annual global total carbon dioxide emissions by world region since 1750, Hannah Ritchie, Max Roser [CC-BY 4.0]
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- [4] Benjamin Nowack, *The Semantic Web - Not a Piece of cake…*, at bnode.org, 2009-07-08 , [CC BY 3.0]
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- [5] Trichon, Le grand ballon captif de la cour des Tuileries, 1879, Brown University Library, [Public Domain]
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