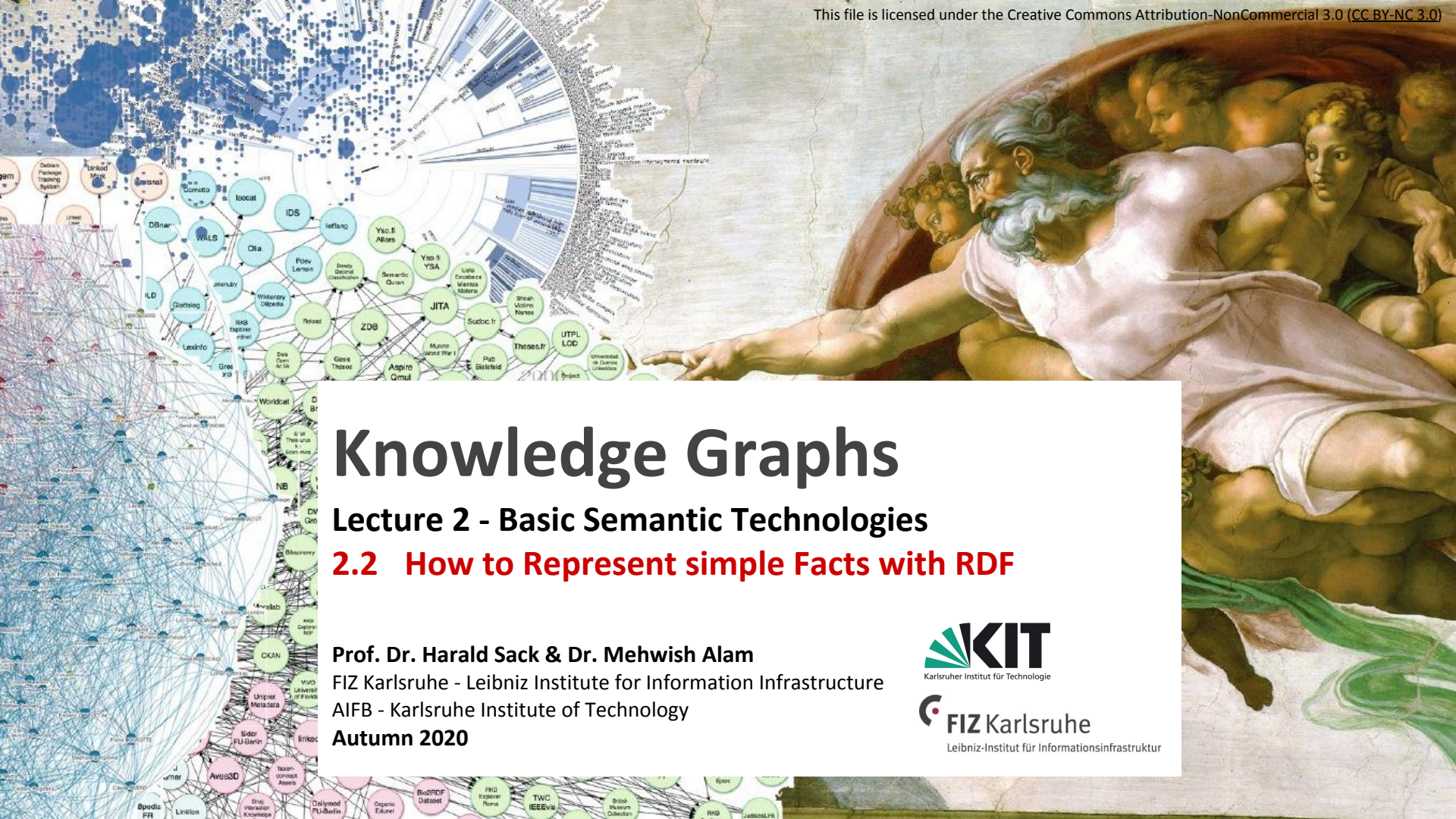


Knowledge Graphs

Lecture 2 - Basic Semantic Technologies

2.2 How to Represent simple Facts with RDF

Prof. Dr. Harald Sack & Dr. Mehwish Alam
FIZ Karlsruhe - Leibniz Institute for Information Infrastructure
AIFB - Karlsruhe Institute of Technology
Autumn 2020

Karlsruher Institut für Technologie

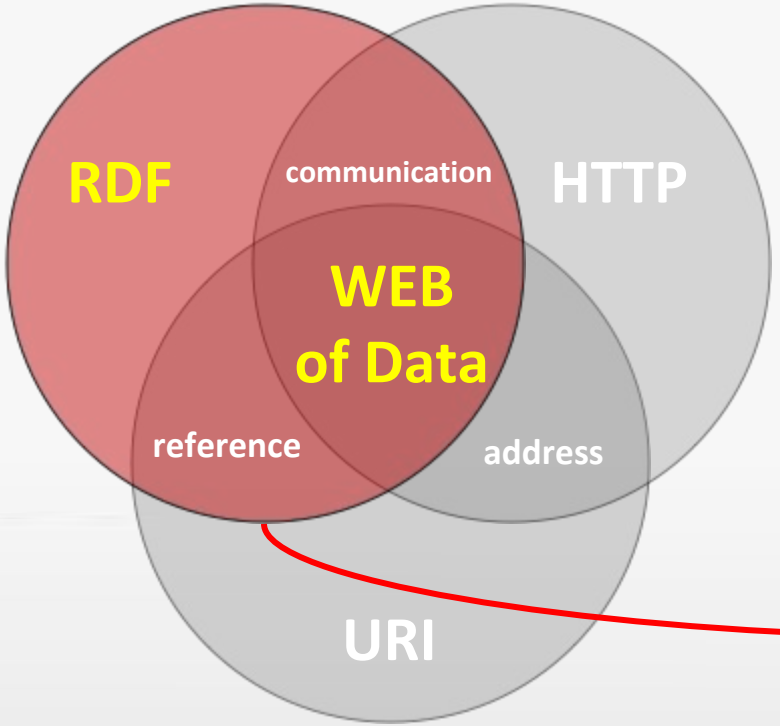
FIZ Karlsruhe
Leibniz-Institut für Informationsinfrastruktur

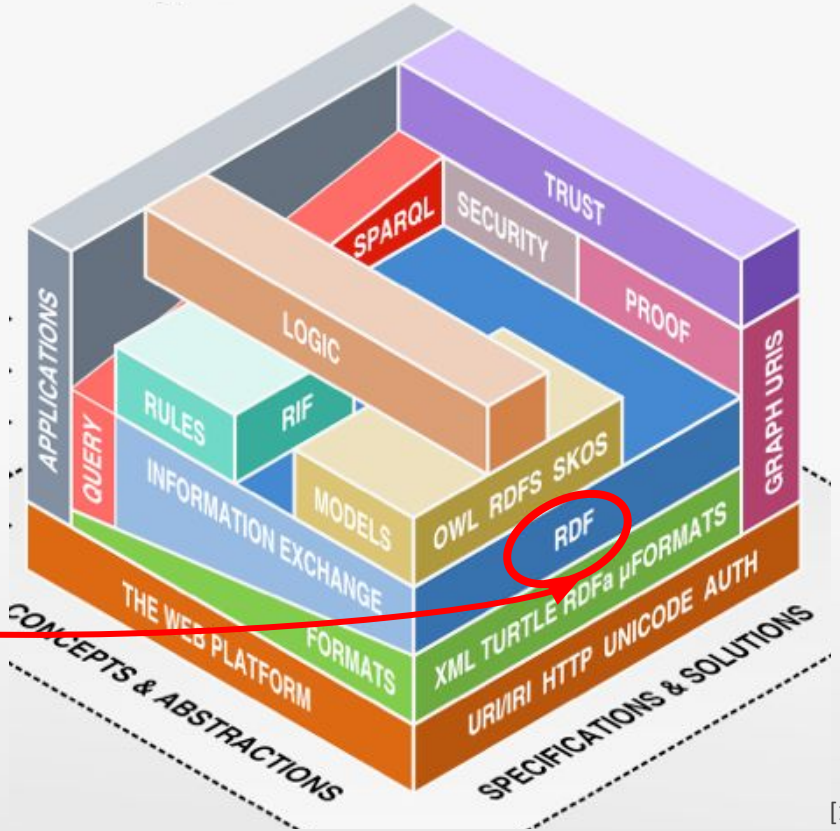
Knowledge Graphs

Lecture 2: Basic Semantic Technologies

Basic Architecture of the Web of Data

Karlsruher Institut für Technologie
FIZ Karlsruhe
Leibniz Institute for Information Infrastructure





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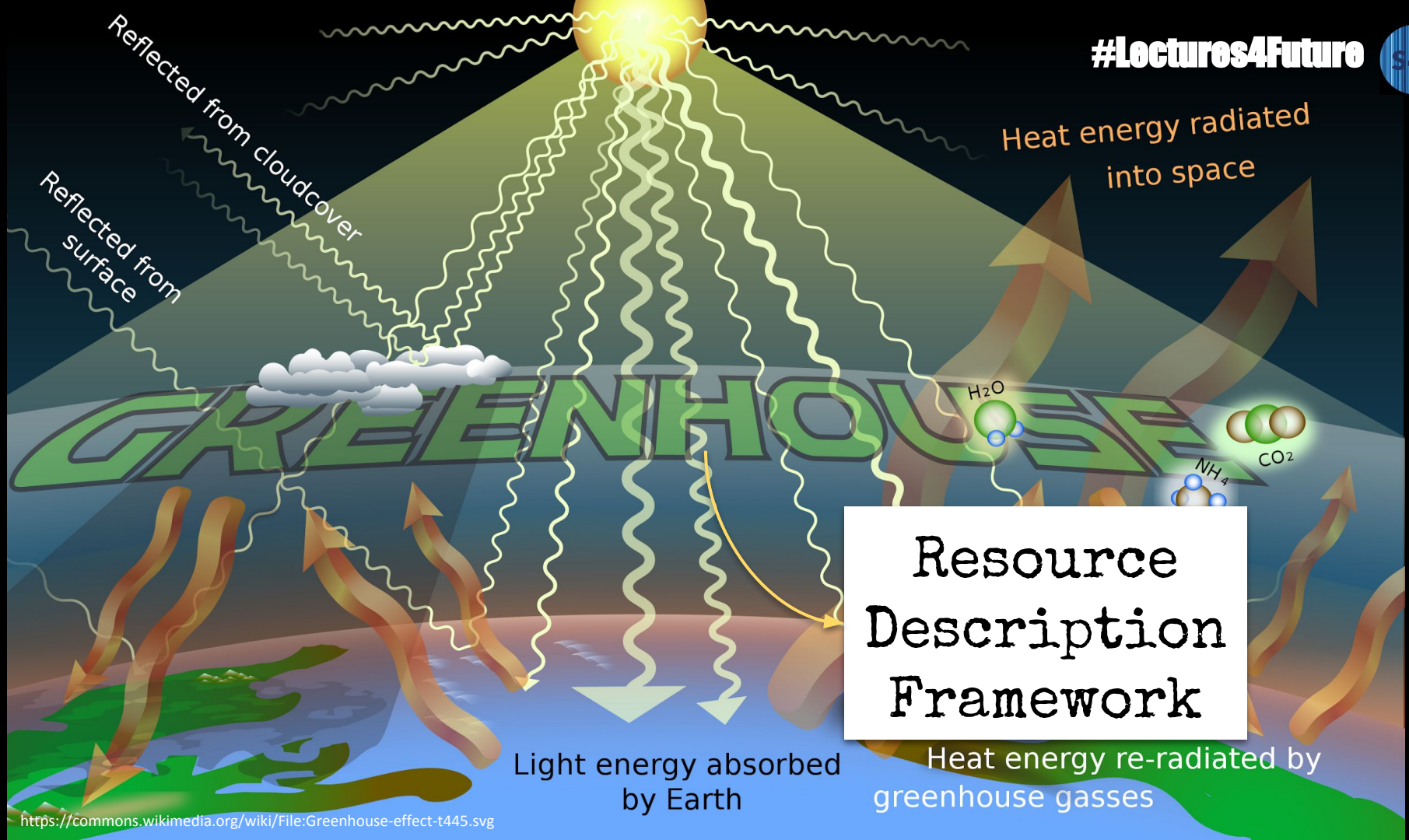
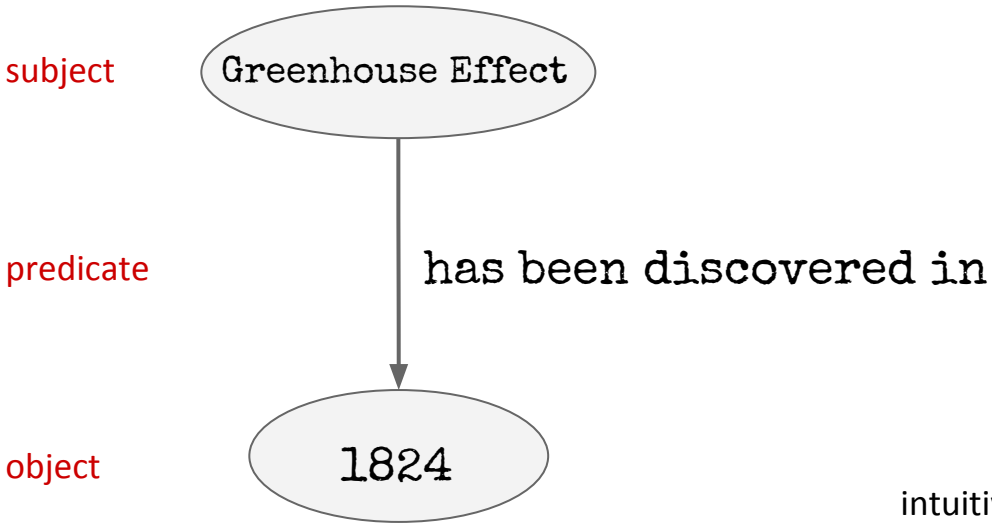


Resource Description Framework

https://commons.wikimedia.org/wiki/File:Greenhouse-effect-t445.svg

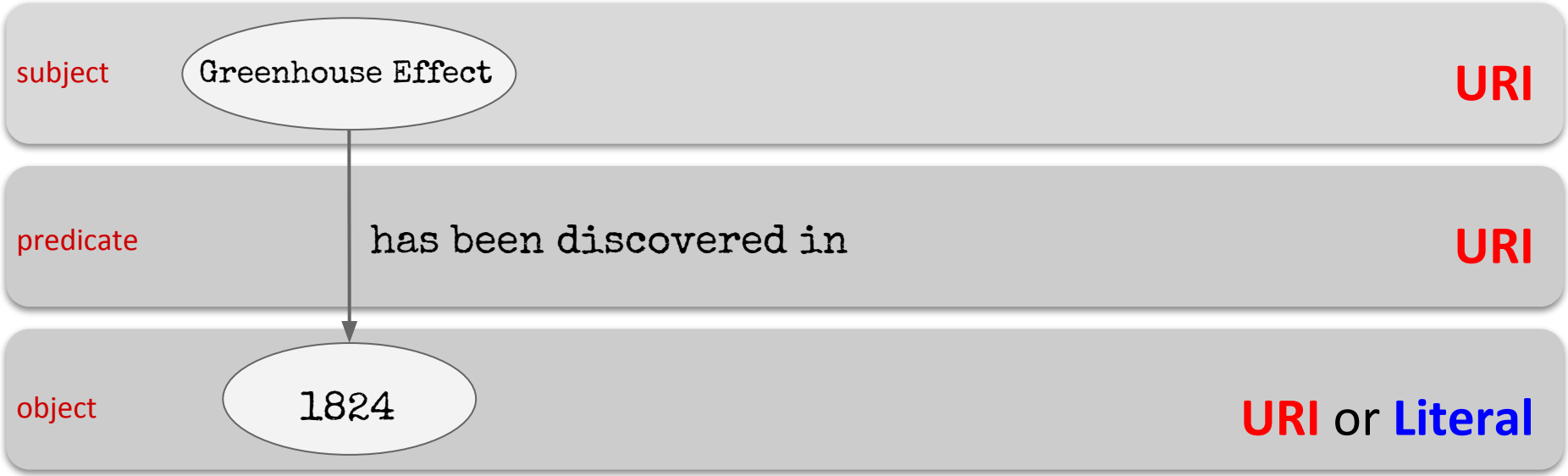
How to represent Knowledge?

- How do I represent the following fact:
  "*The Greenhouse Effect has been discovered in 1824*" in an intuitive way?



intuitive knowledge representation via a **directed graph**

Resource Description Framework



Resource Description Framework

- **RDF Statements (RDF-Triple):**

In RDF the predicate of a statement is referred to as "Property"

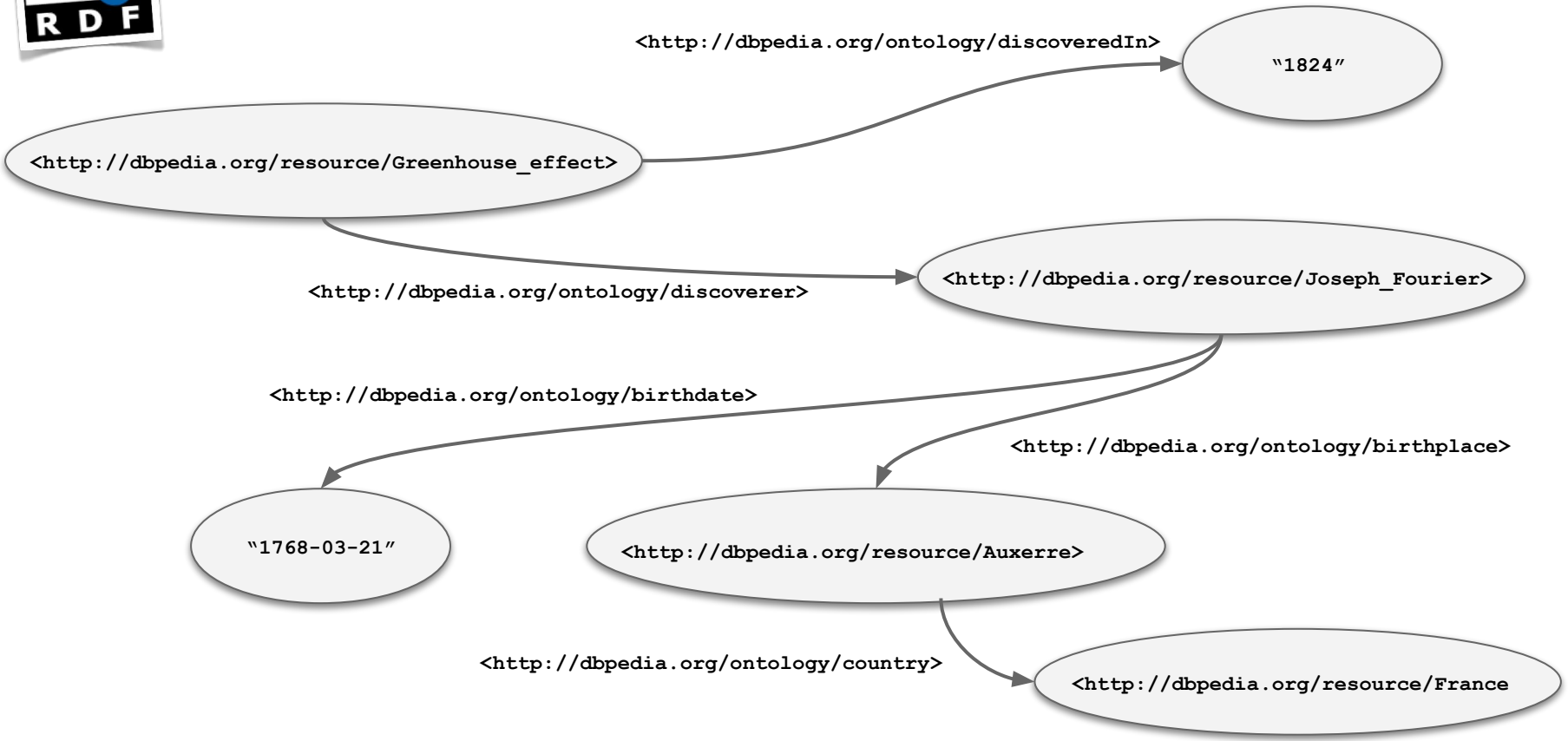
Subject	Property	Object / Value
URI	**URI**	**URI / Literal**

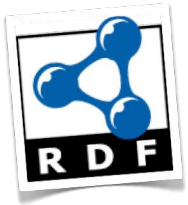
N-Triples Serialization

```
<http://dbpedia.org/resource/Greenhouse_effect>  <http://dbpedia.org/ontology/discoveredIn>  "1824" .
```

Graph Representation

Resource Description Framework





Resource Description Framework

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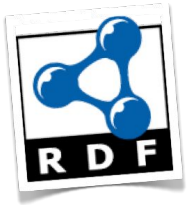
<http://dbpedia.org/resource/Auxerre> <http://www.w3.org/2003/01/geo/wgs84_pos#long> "3.567200"^^xsd:float .
... ...

Subject **Property** **Object**

RDF Triples



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… … …

Individuals (Entities)

Resource Description Framework

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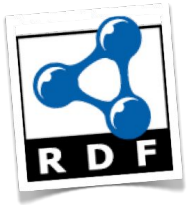
Classes



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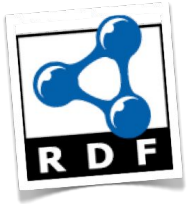
... ...

Literals



Resource Description Framework

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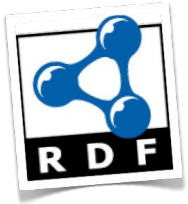
Properties



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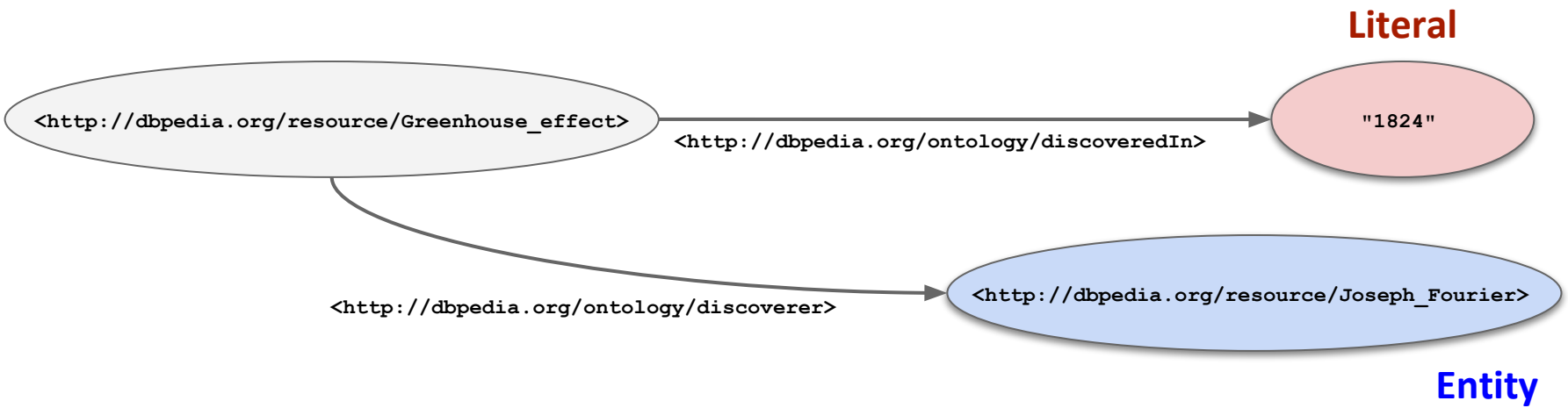
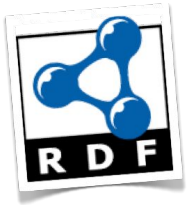
… … …

Vocabularies / Ontologies

Resource Description Framework

- **URIs and Literals**
  - **URIs** identify and reference resources uniquely.
  - **Literals** describe data values that don't have a separate existence.





RDF Literals and Datatypes

- Typed literals can be expressed via **XML Schema datatypes.**
- Namespace for typed literals:
  `http://www.w3.org/2001/XMLSchema#`

- Examples:

```
"Semantics"^^<http://www.w3.org/2001/XMLSchema#string>
"1161.00"^^<http://www.w3.org/2001/XMLSchema#float>
"2015-08-02"^^<http://www.w3.org/2001/XMLSchema#date>
```

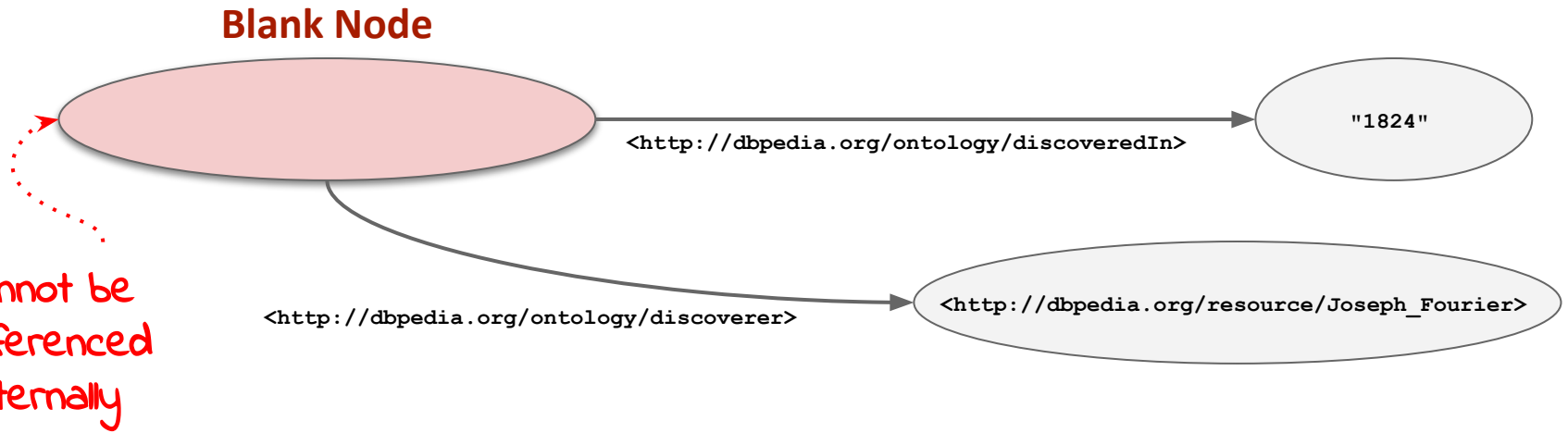
- **Language Tags** denote the (natural) language of the text:
  - Example:
    `"Semantik"@de , "Semantics"@en`

Core types	xsd:string	Character strings
	xsd:boolean	true, false
	xsd:decimal	Arbitrary-precision decimal
	xsd:integer	Arbitrary-size integer numbe
IEEE floating-point numbers	xsd:double	64-bit floating point numbers
	xsd:float	32-bit floating point numbers
Time and date	xsd:date	Dates (yyyy-mm-dd) with or
	xsd:time	Times (hh:mm:ss.sss…) with
	xsd:dateTime	Date and time with or withou
	xsd:dateTimeStamp	Date and time with required
Recurring and partial dates	xsd:gYear	Gregorian calendar year
	xsd:gMonth	Gregorian calendar month
	xsd:gDay	Gregorian calendar day of th
	xsd:gYearMonth	Gregorian calendar year and
	xsd:gMonthDay	Gregorian calendar month a
	xsd:duration	Duration of time
	xsd:yearMonthDuration	Duration of time (months and
	xsd:dayTimeDuration	Duration of time (days, hours
Limited-range integer numbers	xsd:byte	-128…+127 (8 bit)
	xsd:short	-32768…+32767 (16 bit)
	xsd:int	-2147483648…+214748364
	xsd:long	-9223372036854775808…
	xsd:unsignedByte	0…255 (8 bit)
	xsd:unsignedShort	0…65535 (16 bit)
	xsd:unsignedInt	0…4294967295 (32 bit)
	xsd:unsignedLong	0…18446744073709551615
	xsd:positiveInteger	Integer numbers >0
	xsd:nonNegativeInteger	Integer numbers ≥0
	xsd:negativeInteger	Integer numbers <0
	xsd:nonPositiveInteger	Integer numbers ≤0
Encoded binary data	xsd:hexBinary	Hex-encoded binary data
	xsd:base64Binary	Base64-encoded binary dat
Miscellaneous XSD types	xsd:anyURI	Absolute or relative URIs an
	xsd:language	Language tags per [BCP47]
	xsd:normalizedString	Whitespace-normalized strin
	xsd:token	Tokenized strings
	xsd:NMTOKEN	XML NMTOKENs
	xsd:Name	XML Names
	xsd:NCName	XML NCNames

http://www.w3.org/TR/2013/WD-rdf11-concepts-20130115/#xsd-datatypes

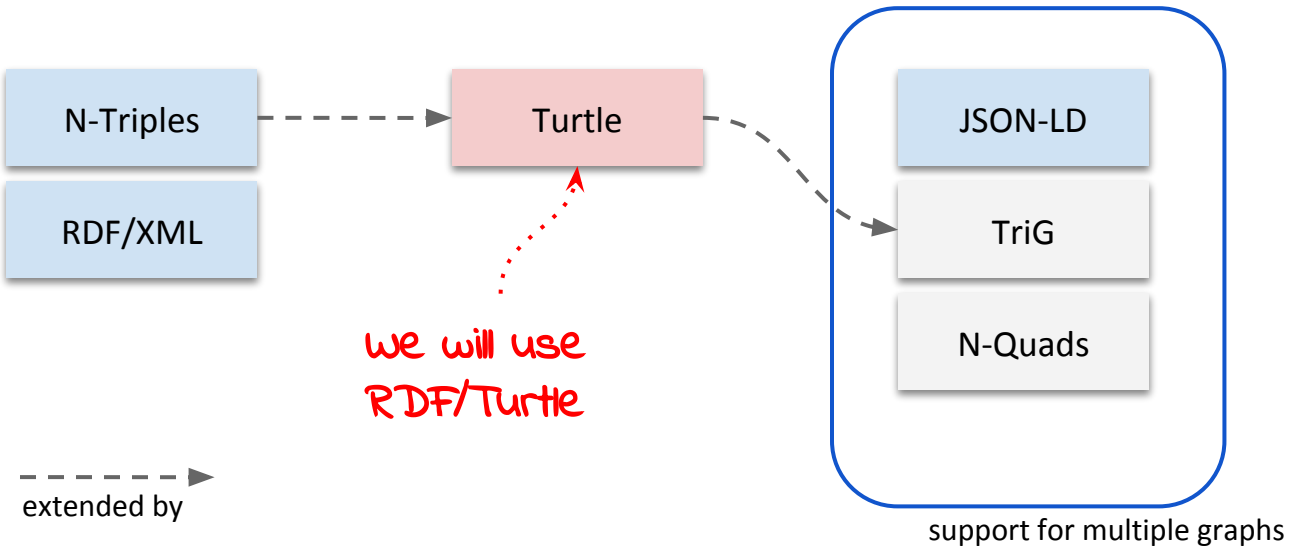
RDF Blank Nodes

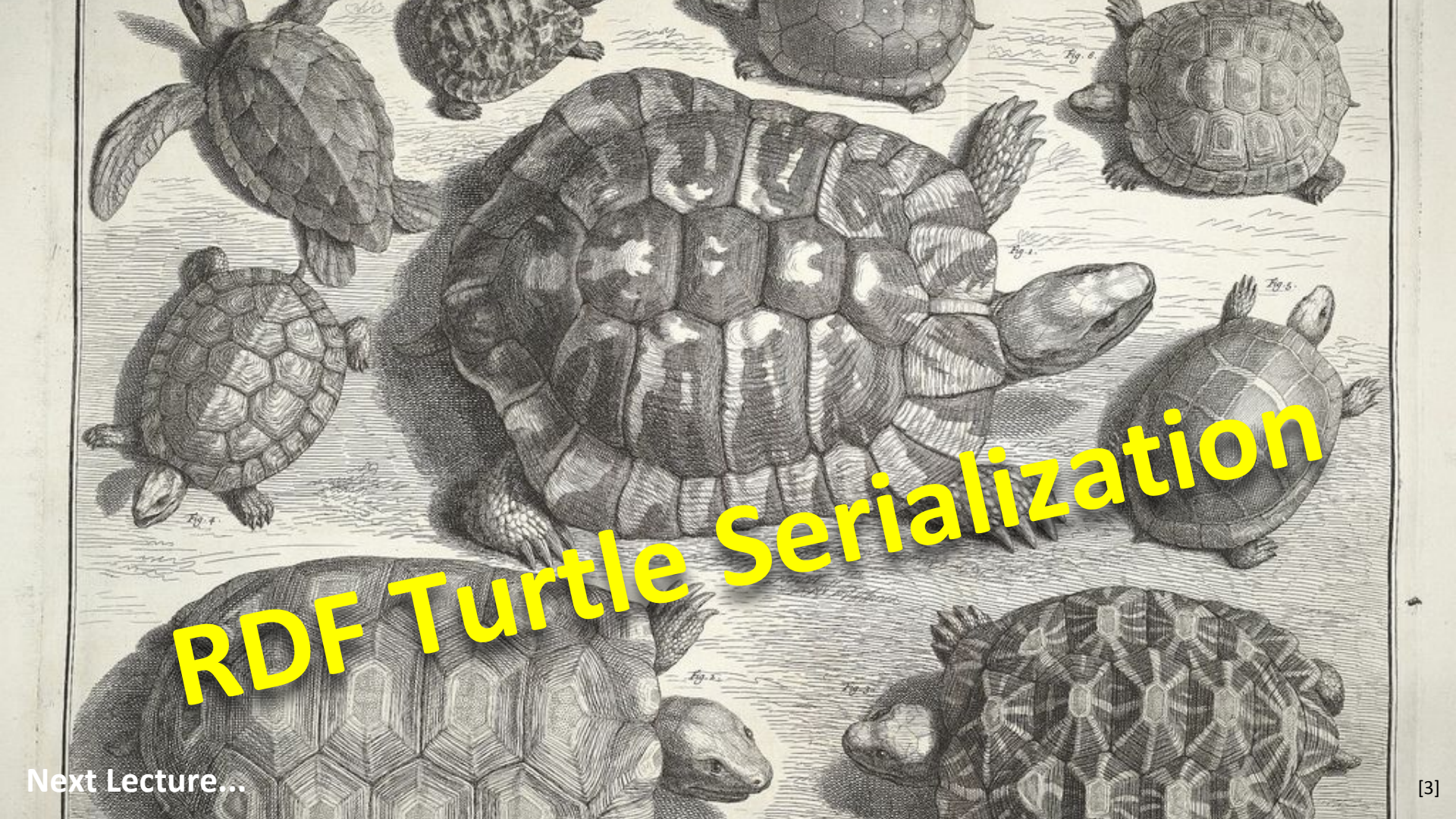
- **Blank Nodes**
  - denote **existence of an individual** with specific attributes, but **without providing an identification or reference.**



RDF Serializations

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





Next Lecture...

Karlsruher Institut für Technologie
FIZ Karlsruhe
Leibniz Institute for Information Infrastructure

Picture References:

- [1] Benjamin Nowack, *The Semantic Web - Not a Piece of cake…*, at bnode.org, 2009-07-08 , [CC BY 3.0]
  http://bnode.org/blog/2009/07/08/the-semantic-web-not-a-piece-of-cake
- [2] The Green House Effect, A loose necktie [CC BY-SA]
  https://commons.wikimedia.org/wiki/File:Greenhouse-effect-t445.svg
- [3] Albertus Seba Thesaurus Tab. LXXX, 18th century, Albertus Seba [Public domain]
  https://commons.wikimedia.org/wiki/File:Albertus_Seba_Thesaurus_Tab._LXXX.jpg