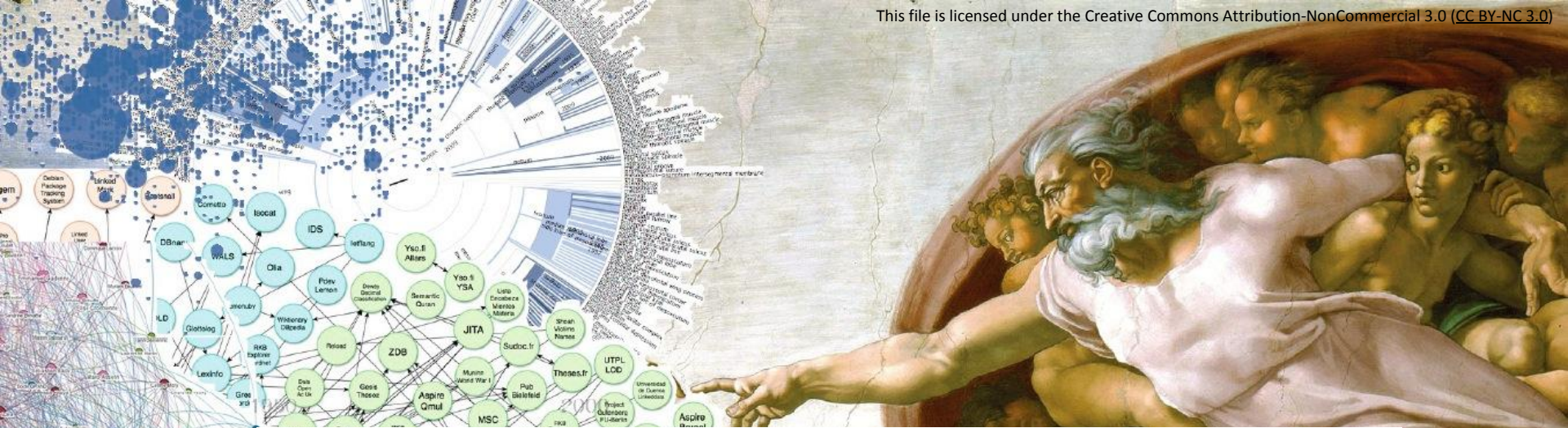




Information Service Engineering

Lecture 3 - Linked Data Engineering I

3.4 Representing Facts with RDF



FIZ Karlsruhe

Leibniz Institute for Information Infrastructure



Hasso
Plattner
Institut



Karlsruher Institut für Technologie

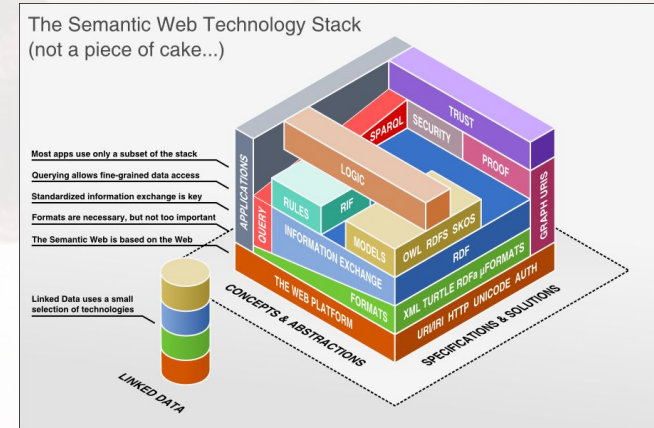
Prof. Dr. Harald Sack & Dr. Maria Koutraki
FIZ Karlsruhe

Leibniz Institute for Information Infrastructure
Karlsruhe Institute of Technology
Spring 2018

Information Service Engineering

Lecture 3: Linked Data Engineering I

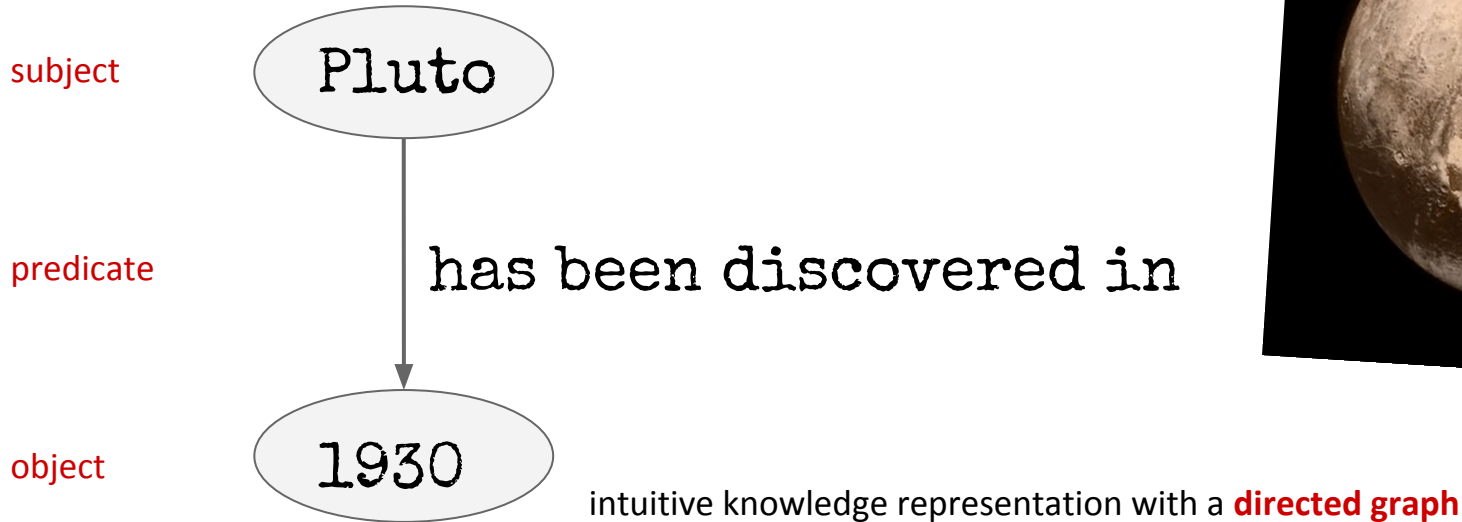
- 3.1 Understanding Data on the Web
- 3.2 Towards a Universal Data Representation
- 3.3 How to Identify and Access Linked Data
- 3.4 Representing Facts with RDF**
- 3.5 RDF Turtle Serialization
- 3.6 Model Building with RDFS
- 3.7 Logical Inference with RDF(S)



How to Represent Knowledge?

Information Service Engineering - Lecture 3 Linked Data Engineering I - 3.4 Representing Facts with RDF

- How do I represent the following fact:
“Pluto has been discovered in 1930” in an intuitive way?



Resource Description Framework

Information Service Engineering - Lecture 3 Linked Data Engineering I - 3.4 Representing Facts with RDF



subject

Pluto

URI

predicate

has been discovered in

URI

object

1930

URI or Literal

Resource Description Framework

Information Service Engineering - Lecture 3 Linked Data Engineering I - 3.4 Representing Facts with RDF

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

Subject
URI

Property
URI

Object / Value
URI / Literal

RDF Building Blocks

N-Triples Serialization

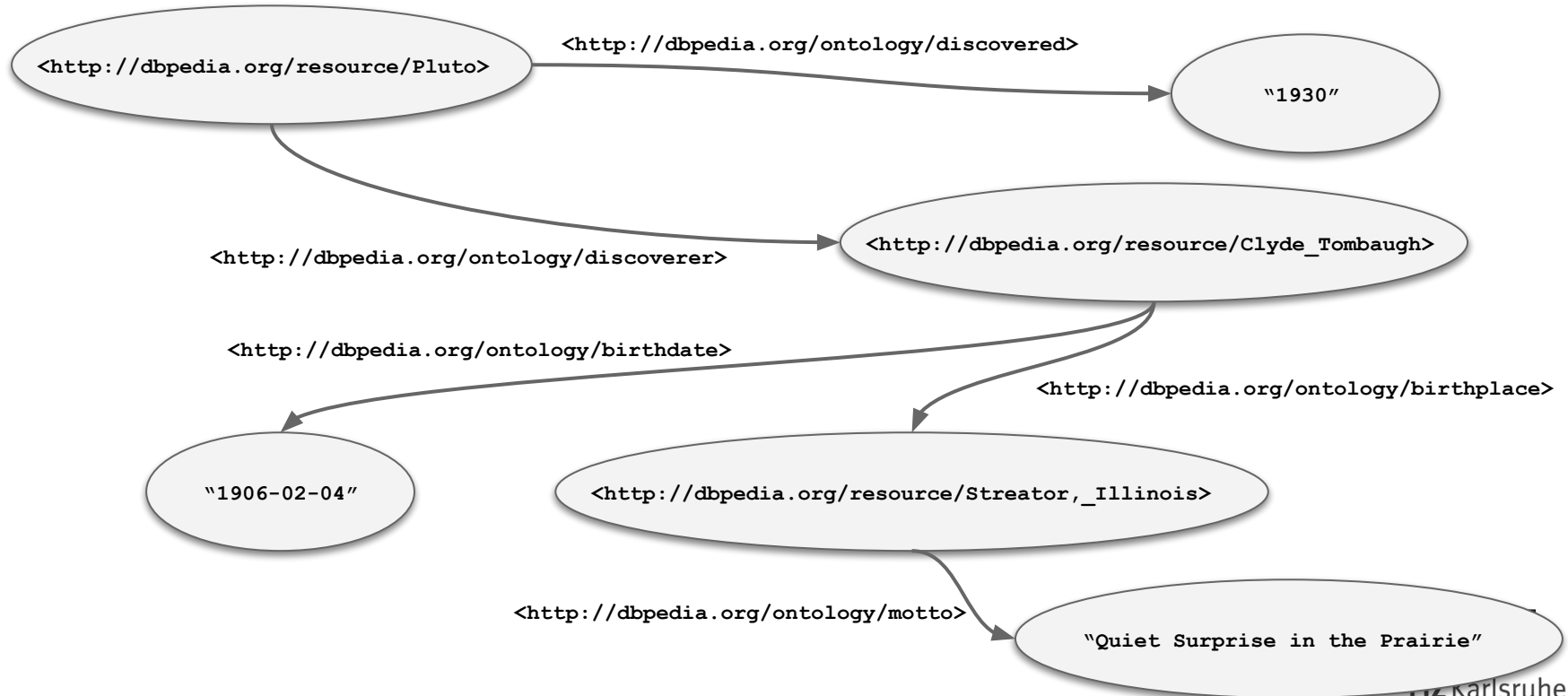
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<http://dbpedia.org/resource/Pluto> <http://dbpedia.org/ontology/discovered> "1930" .
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graph representation



Resource Description Framework

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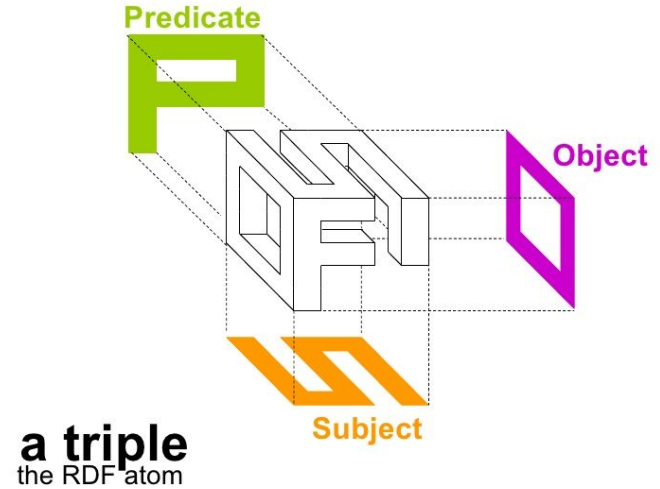


Resource Description Framework

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RDF is a Triple Model

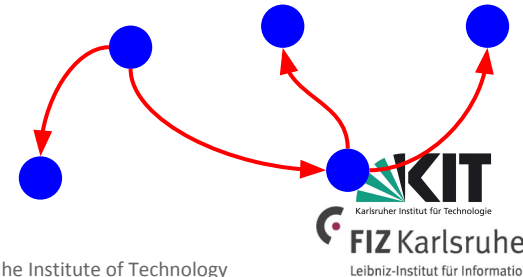
i.e. every piece of knowledge is broken down into
(**subject** , **predicate** , **object**)



http://www.slideshare.net/fabien_gandon

RDF is a Graph Model

i.e. every piece of knowledge is interpreted as
(**vertex** , **edge** , **vertex**)



Resource Description Framework

Information Service Engineering - Lecture 3 Linked Data Engineering I - 3.4 Representing Facts with RDF

<code><http://dbpedia.org/resource/Pluto></code>	<code><http://dbpedia.org/ontology/discovered></code>	<code>"1930"</code>
<code><http://dbpedia.org/resource/Pluto></code>	<code><http://dbpedia.org/ontology/discoverer></code>	<code><http://dbpedia.org/resource/Clyde_Tombaugh></code>
<code><http://dbpedia.org/resource/Pluto></code>	<code><http://www.w3.org/1999/02/22-rdf-syntax-ns#type></code>	<code><http://dbpedia.org/ontology/CelestialBody></code>
<code><http://dbpedia.org/resource/Pluto></code>	<code><http://www.w3.org/1999/02/22-rdf-syntax-ns#type></code>	<code><http://schema.org/Place></code>
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<code><http://dbpedia.org/resource/Clyde_Tombaugh></code>	<code><http://dbpedia.org/ontology/birthdate></code>	<code>"1906-02-04"</code>
<code><http://dbpedia.org/resource/Clyde_Tombaugh></code>	<code><http://dbpedia.org/ontology/birthplace></code>	<code><http://dbpedia.org/resource/Streator,_Illinois></code>
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<code><http://dbpedia.org/resource/Streator,_Illinois></code>	<code><http://dbpedia.org/ontology/motto></code>	<code>"Quiet Surprise in the Prairie"</code>
<code><http://dbpedia.org/resource/Streator,_Illinois></code>	<code><http://www.w3.org/2003/01/geo/wgs84_pos#lat></code>	<code>"41.120834"^^xsd:float</code>
<code><http://dbpedia.org/resource/Streator,_Illinois></code>	<code><http://www.w3.org/2003/01/geo/wgs84_pos#long></code>	<code>"-88.835281"^^xsd:float</code>
...	...	...
Subject	Property	Object

RDF Triples

Resource Description Framework

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<http://dbpedia.org/resource/Pluto> <http://dbpedia.org/ontology/discovered> "1930" .
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Individuals (Entities)

Resource Description Framework

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Classes

Resource Description Framework

Information Service Engineering - Lecture 3 Linked Data Engineering I - 3.4 Representing Facts with RDF

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<http://dbpedia.org/resource/Pluto> <http://dbpedia.org/ontology/discovered> "1930" .
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Literals

Resource Description Framework

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Properties

Resource Description Framework

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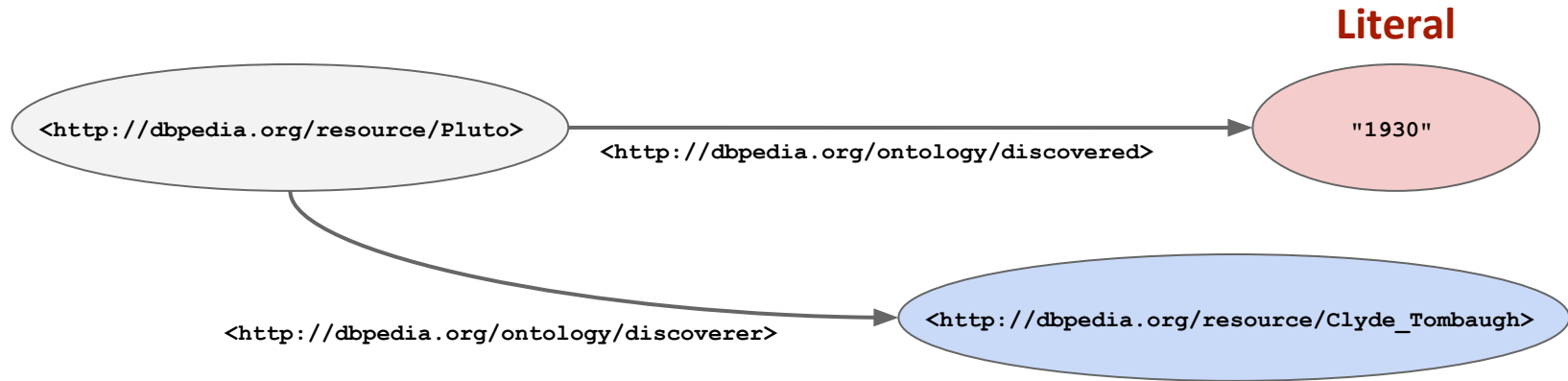
Vocabularies / Ontologies

Resource Description Framework

Information Service Engineering - Lecture 3 Linked Data Engineering I - 3.4 Representing Facts with RDF

- **URIs and Literals**

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



Entity

Resource Description Framework

Information Service Engineering - Lecture 3 Linked Data Engineering I - 3.4 Representing Facts

- 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`

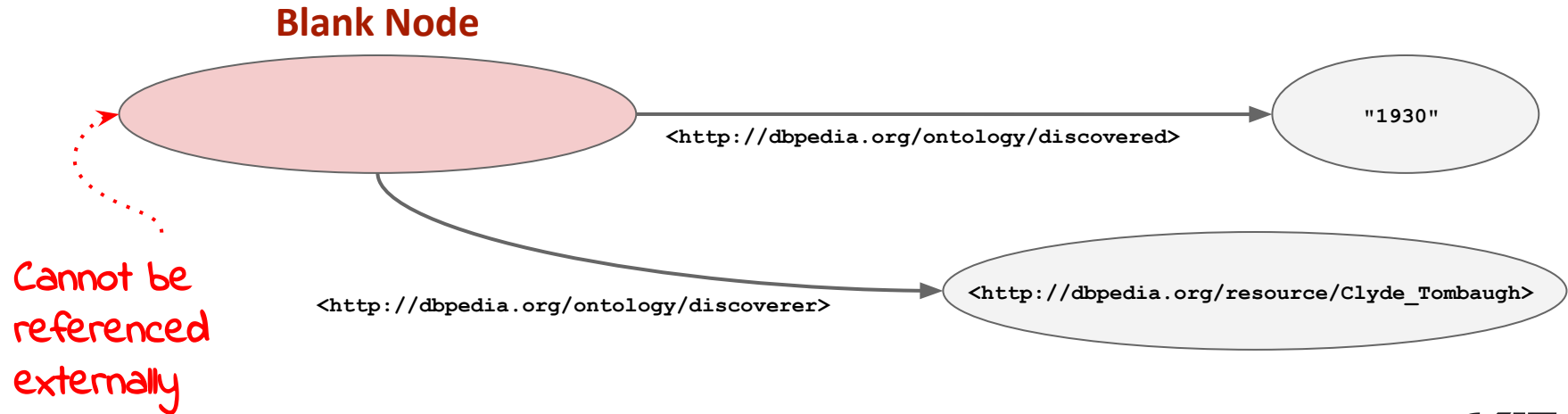
<http://www.w3.org/TR/2013/WD-rdf11-concepts-20130115/#xsd-datatypes>

Core types	xsd:string	Character strings
	xsd:boolean	true, false
	xsd:decimal	Arbitrary-precision decimal
IEEE floating-point numbers	xsd:integer	Arbitrary-size integer 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 without time
	xsd:time	Times (hh:mm:ss.sss...) with or without time zone
	xsd:dateTime	Date and time with or without time zone
	xsd:dateTimeStamp	Date and time with required time zone
Recurring and partial dates	xsd:gYear	Gregorian calendar year
	xsd:gMonth	Gregorian calendar month
	xsd:gDay	Gregorian calendar day of the month
	xsd:gYearMonth	Gregorian calendar year and month
	xsd:gMonthDay	Gregorian calendar month and day
	xsd:duration	Duration of time
	xsd:yearMonthDuration	Duration of time (months and years)
	xsd:dayTimeDuration	Duration of time (days, hours, minutes, seconds)
Limited-range integer numbers	xsd:byte	-128...+127 (8 bit)
	xsd:short	-32768...+32767 (16 bit)
	xsd:int	-2147483648...+2147483647 (32 bit)
	xsd:long	-9223372036854775808...+9223372036854775807 (64 bit)
	xsd:unsignedByte	0...255 (8 bit)
	xsd:unsignedShort	0...65535 (16 bit)
	xsd:unsignedInt	0...4294967295 (32 bit)
	xsd:unsignedLong	0...18446744073709551615 (64 bit)
	xsd:positiveInteger	Integer numbers >0
	xsd:nonNegativeInteger	Integer numbers ≥0
Encoded binary data	xsd:negativeInteger	Integer numbers <0
	xsd:nonPositiveInteger	Integer numbers ≤0
	xsd:hexBinary	Hex-encoded binary data
Miscellaneous XSD types	xsd:base64Binary	Base64-encoded binary data
	xsd:anyURI	Absolute or relative URIs and IRI references
	xsd:language	Language tags per [BCP47]
	xsd:normalizedString	Whitespace-normalized strings
	xsd:token	Tokenized strings
	xsd:NMTOKEN	XML NMTOKENs
	xsd:Name	XML Names
	xsd:NCName	XML NCNames

Resource Description Framework

Information Service Engineering - Lecture 3 Linked Data Engineering I - 3.4 Representing Facts with RDF

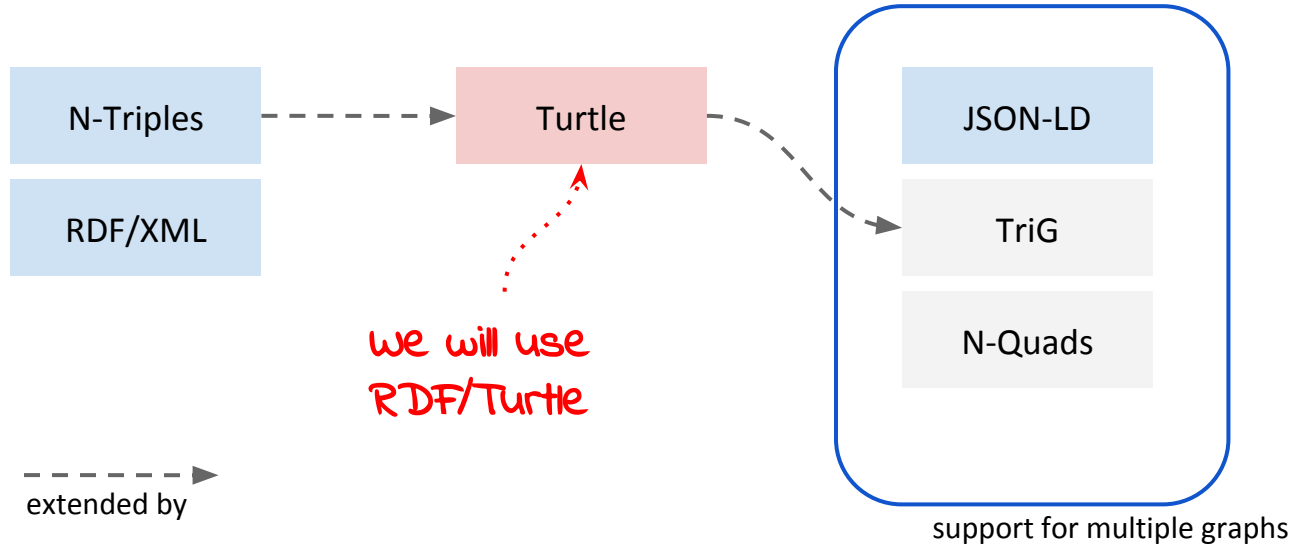
- **Blank Nodes**
 - denote **existence of an individual** with specific attributes, but **without providing an identification or reference**

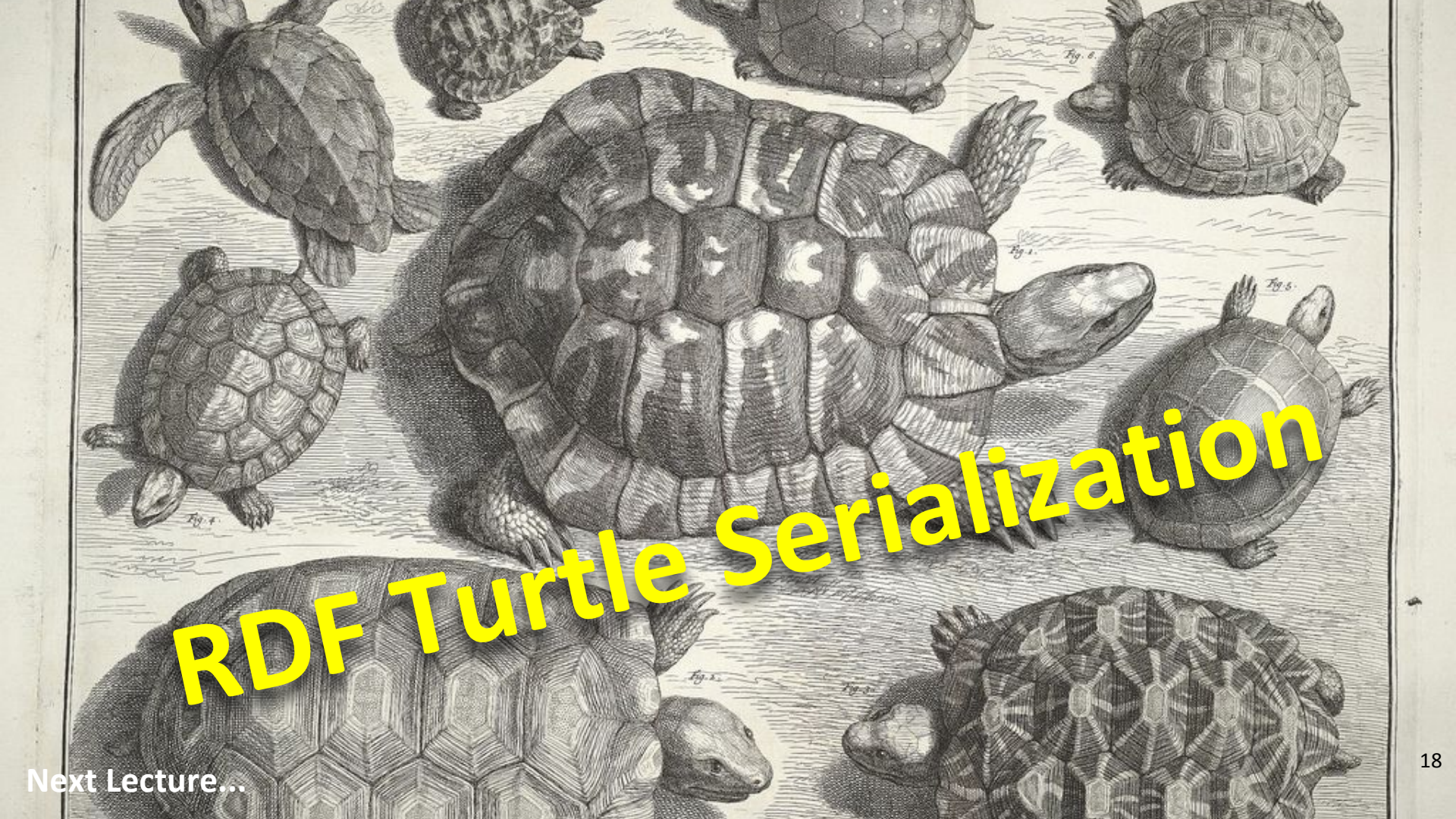


Resource Description Framework

Information Service Engineering - Lecture 3 Linked Data Engineering I - 3.4 Representing Facts with RDF

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





RDF Turtle Serialization

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: Albertus Seba Thesaurus Tab. LXXX, 18th century,
https://commons.wikimedia.org/wiki/File:Albertus_Seba_Thesaurus_Tab._LXXX.jpg