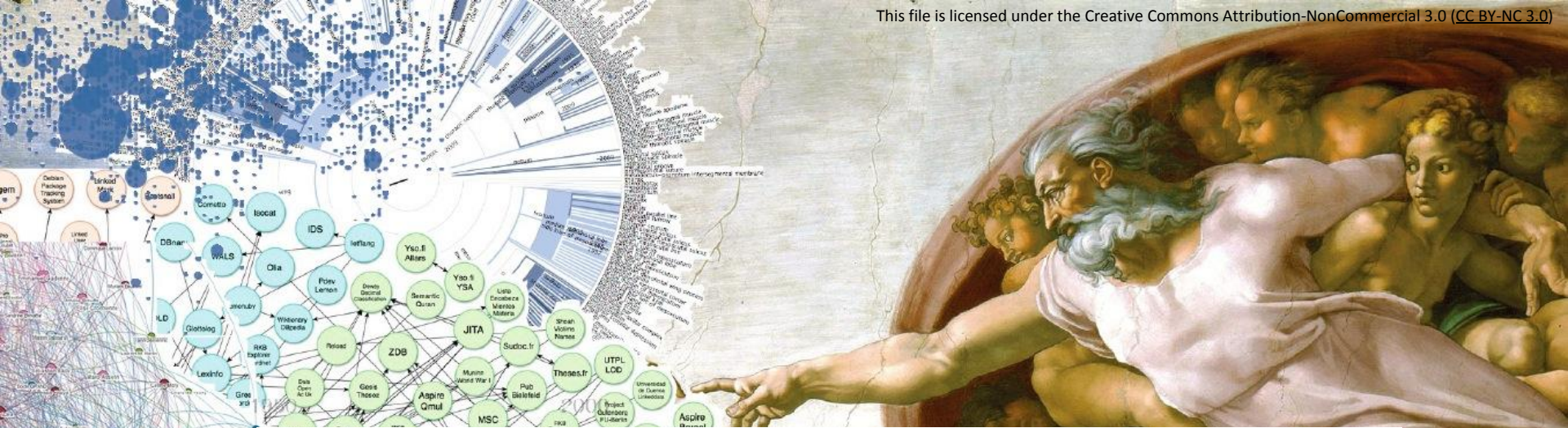




Information Service Engineering

Lecture 4 - Linked Data Engineering II

4.1 Linked Data Principles

 **FIZ Karlsruhe**

Leibniz Institute for Information Infrastructure

 **Hasso Plattner Institut**

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FIZ Karlsruhe
Leibniz Institute for Information Infrastructure
Karlsruhe Institute of Technology
Spring 2018

Information Service Engineering

Lecture 4: Linked Data Engineering II

4.1 Linked Data Principles

4.2 Web Ontology Language OWL

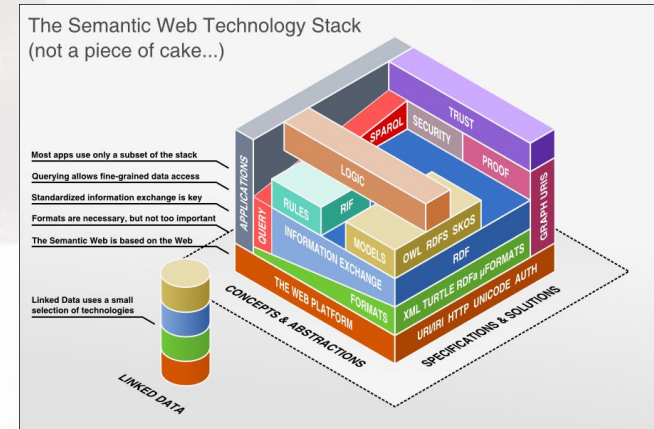
4.3 Web Ontology Language OWL II

4.4 How to Query RDF with SPARQL

4.5 Complex Queries with SPARQL

4.6 More Complex SPARQL Queries

4.7 Linked Data Knowledge Graphs



The Web of Data

Linked Data

- Linked Open Data (LOD) denote publicly available (RDF) Data in the Web, identified via URI and accessible via HTTP. Linked data link to other data via URI.

The Web of Data

- 9,960 datasets
- >149 billion facts
- >800 million links
(Feb 2018)

<http://stats.lod2.eu/>

<http://lod-cloud.net/>

Data Access in the Traditional Web

Information Service Engineering - Lecture 4 Linked Data Engineering II - 4.1 Linked Data Principles

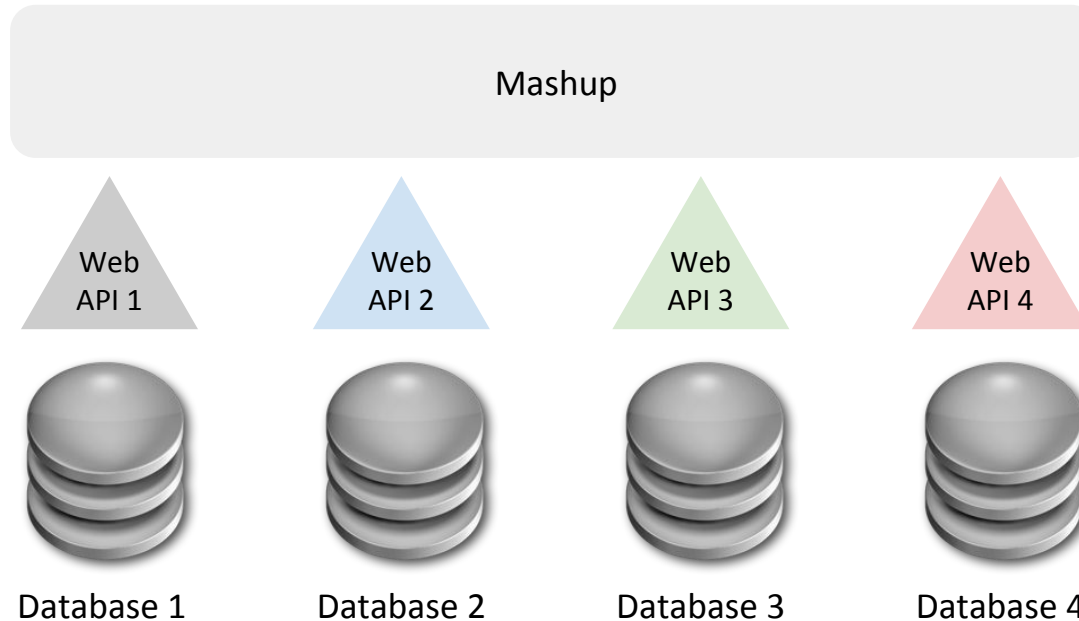
- Data can only be found on the Web, if it is available at some website

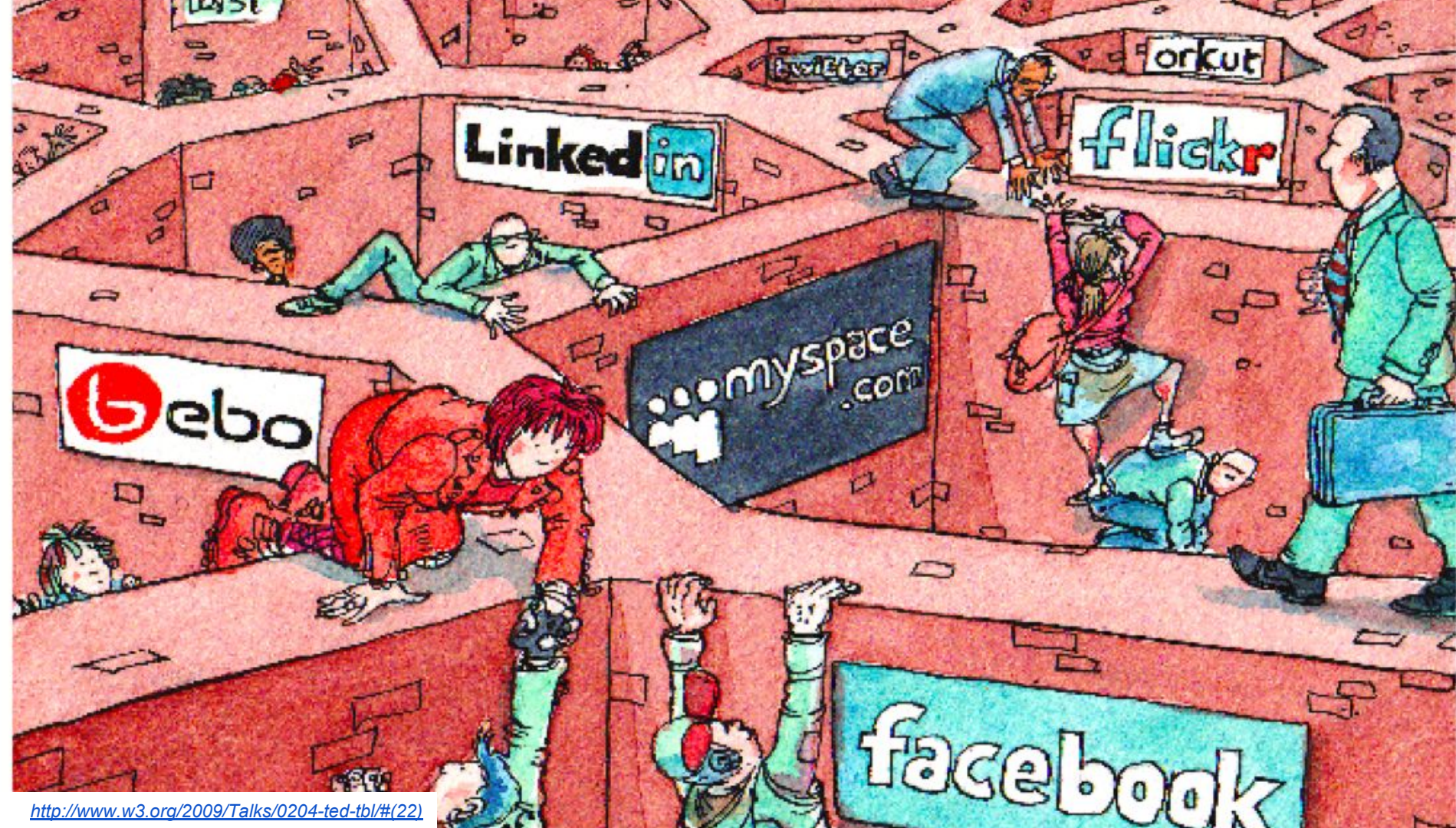


Data Access in the Traditional Web

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- There is a number of different (proprietary) **Web APIs**, data exchange formats, and **Mashups** on top of that

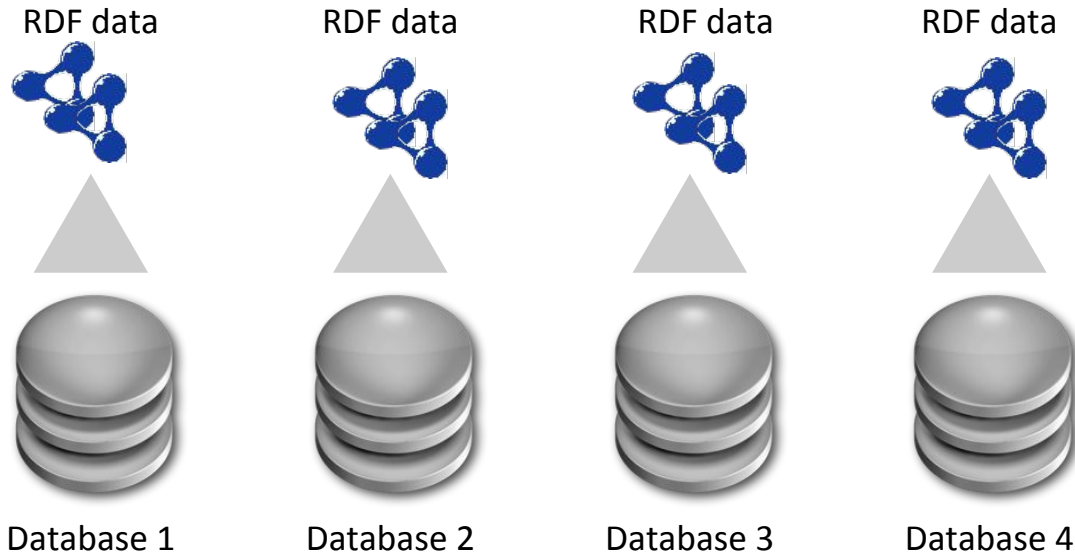




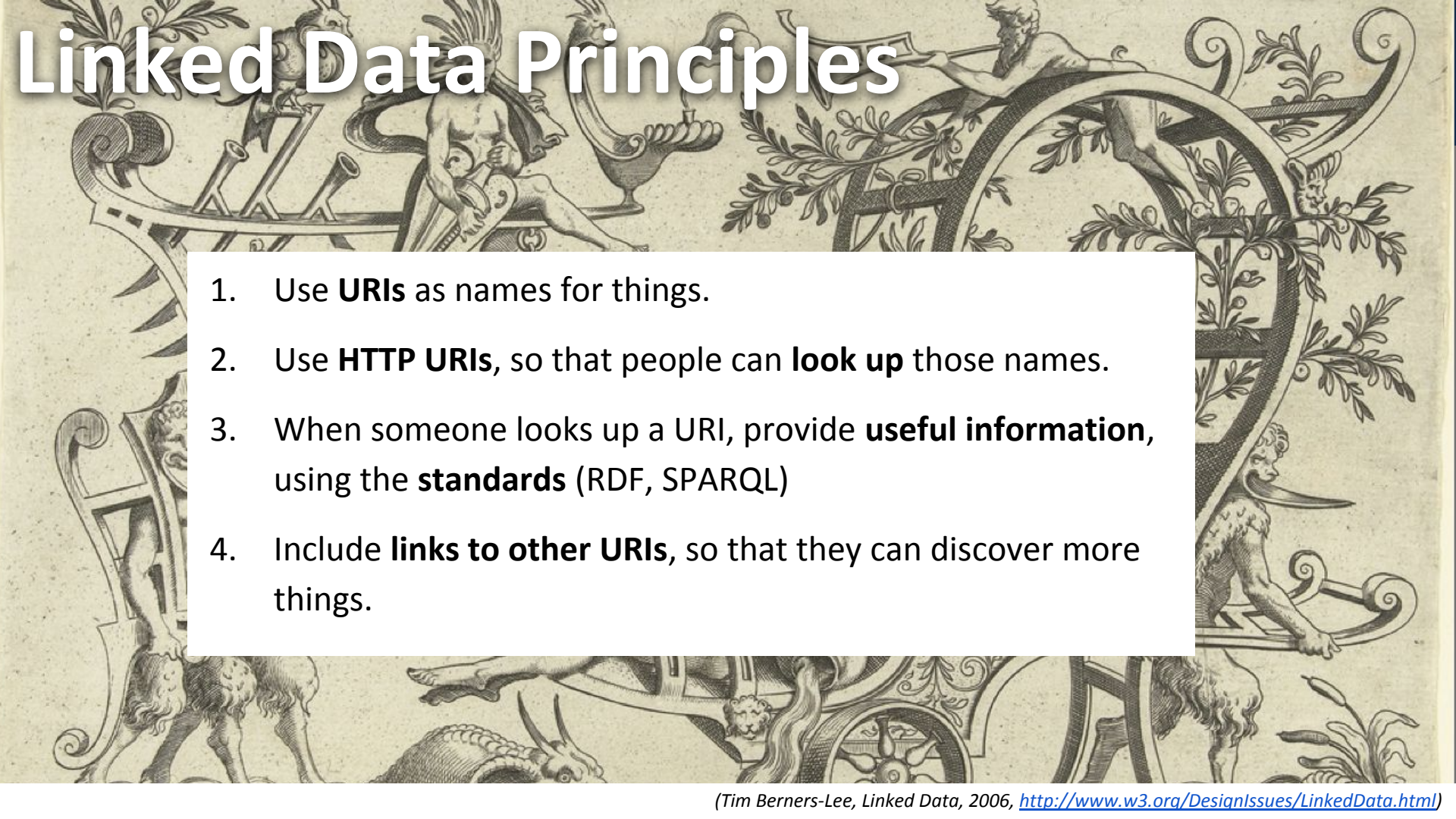
Get Rid of Closed Data Islands

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- **Apply Linked Data technology**
 - to publish (structured) data on the web
 - to draw connections from one data source to data from other data sources



Linked Data Principles

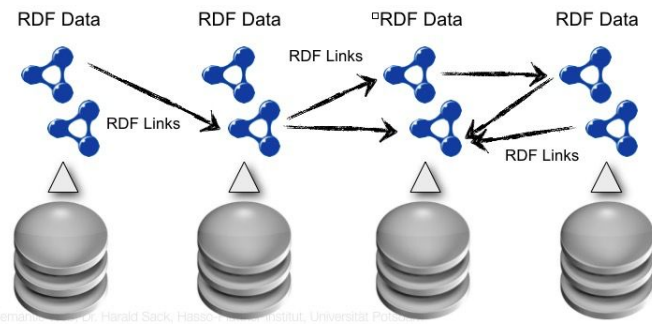


1. Use **URIs** as names for things.
2. Use **HTTP URIs**, so that people can **look up** those names.
3. When someone looks up a URI, provide **useful information**, using the **standards** (RDF, SPARQL)
4. Include **links to other URIs**, so that they can discover more things.

Advantages of Linked Data vs. APIs

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- **Simple** and **generic API** for various heterogeneous data sources enables **simple reuse** and **data sharing** among applications
- **RDF Data model** guarantees (simple) **extensibility**
- **Transport via http**, standard Port 80, prevents firewall adaption
- **Ontologies** enable **meaningful connections** between data sources
- **Reasoning** over Linked Data enables to **generate new knowledge**, i.e. inference from implicit to explicit knowledge



Linked Open Data

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- Public Linked Data resources in the Web, licensed as Creative Common CC-BY
- Tim Berners-Lee's 5-Star Criteria for Linked Open Data:
 - ★ Available on the web (whatever format) but with an **open licence**, to be Open Data
 - ★★ Available as **machine-readable structured data**
(e.g. excel instead of image scan of a table)
 - ★★★ as (2) plus **non-proprietary format** (e.g. CSV instead of excel)
 - ★★★★ All the above plus: use **open standards from W3C**
(RDF and SPARQL) to identify things, so that people can point at your stuff
 - ★★★★★ All the above, plus: **link your data to other people's data** to provide context

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...and what do they mean?

Linked Data Vocabularies

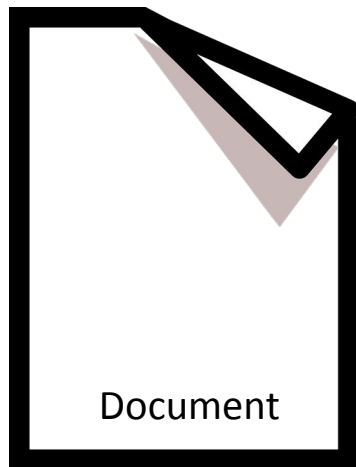
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- A person's **vocabulary** is the set of words within a language that are familiar to that person. (*Wikipedia*)
- = “all the words known and used by a particular person” (*Cambridge Advanced Learners Dictionary*)
- In the Web of Data, **vocabularies** define the concepts and relationships used to describe and represent an area of concern. (W3C)
- **Vocabularies** are used to
 - **classify** the **terms** that can be used in a particular application,
 - **characterize** possible **relationships**, and
 - **define** possible **constraints** on using those terms.

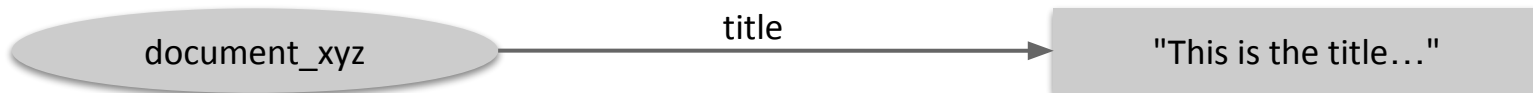
Linked Data Vocabularies - Example

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- The **Dublin Core Vocabulary** (Dublin Core Metadata Element Set)



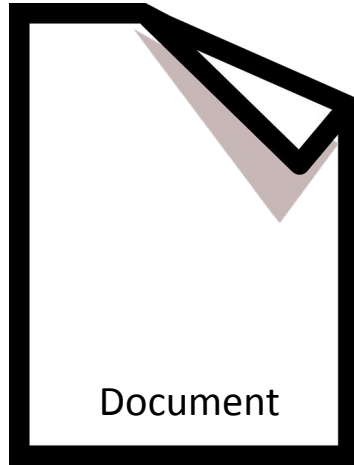
- Title
- Creator
- Subject
- Description
- Publisher
- Contributor
- Date
- Type
- Format
- Identifier
- Source
- Language
- Relation
- Coverage
- Rights



Linked Data Vocabularies - Example

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- The **Dublin Core Vocabulary** (Dublin Core Metadata Element Set)



- Title
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- Language
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- Coverage
- Rights

PREFIX dct: <<http://purl.org/dc/terms/>> .

<http://example.org/document_xyz> dct:title "This is the title..."@en .



Web Ontology Language OWL

Next Lecture...

Picture References:

- P.3: The Linking Open Data Cloud Diagram, <http://lod-cloud.net/>
- P.7: [https://www.w3.org/2009/Talks/0204-ted-tbl/#\(22\)](https://www.w3.org/2009/Talks/0204-ted-tbl/#(22))
- P.13: Chariot of grotesques and scrollwork drawn by two fantasy animals and pushed by a satyr, whose head is trapped in a large shell, by Cornelis Bos (1550s), <https://www.rijksmuseum.nl/nl/zoeken/objecten?q=%22cornelis+bos%22&p=18&ps=12&st=Objects&ii=5#/RP-P-OB-6266,209>
- P.15: O. Von Corven, "The Great Library of Alexandria", 19th century, <https://commons.wikimedia.org/wiki/File:Ancientlibraryalex.jpg>