

Lecture 5

Knowledge Base Design & Applications

COMP 474/6741, Winter 2021

[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

René Witte
Department of Computer Science
and Software Engineering
Concordia University

- 1 Linked Open Data (LOD)**

- 2 Knowledge Base Construction**

- 3 Knowledge Base Applications**

- 4 Notes and Further Reading**

[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

[Linked Open Data \(LOD\)](#)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

[Knowledge Base Construction](#)

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

[Knowledge Base Applications](#)

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

Slides Credit

- Includes slides by Ivan Herman, W3C [Her]

1 Linked Open Data (LOD)

Queries Review

The Linked Open Data Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

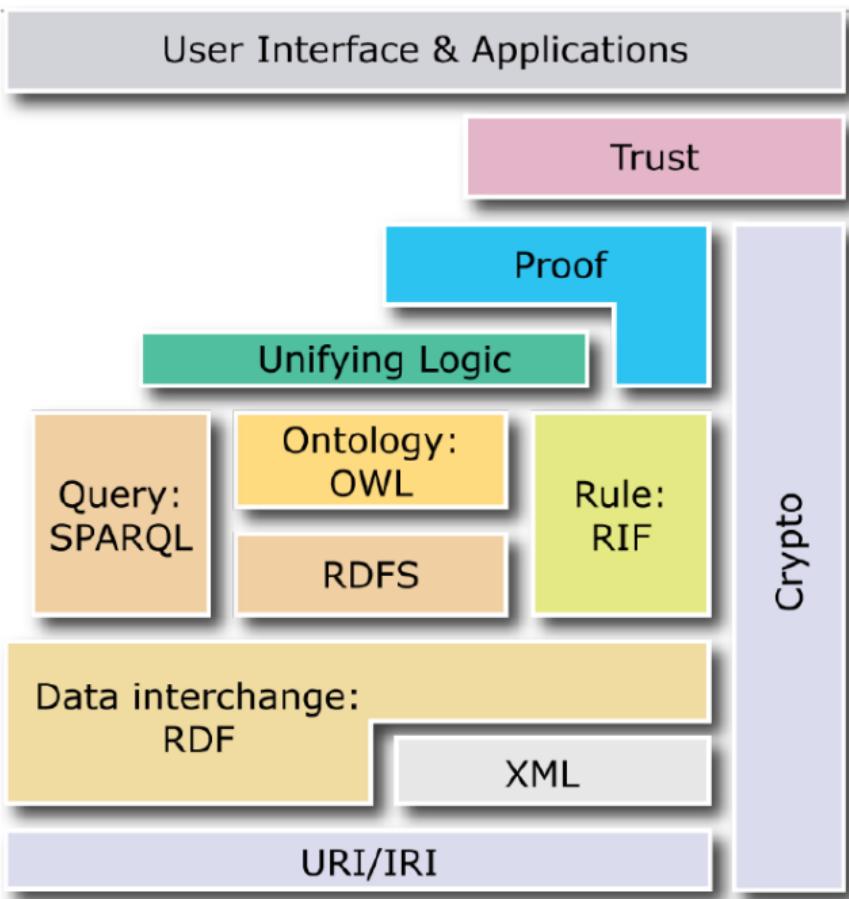
2 Knowledge Base Construction

3 Knowledge Base Applications

4 Notes and Further Reading

The W3C “Layer Cake”

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Linked Open Data (LOD)

Queries Review

- The LOD Initiative
- DBpedia
- The LOD Cloud
- Linked Data Design Issues
- Summary

Knowledge Base Construction

- Some History
- Freebase, DBpedia & Wikidata
- Publishing Options and Workflows
- Relational Databases and RDF
- Competency Questions

Knowledge Base Applications

- Linking Documents and Knowledge Graphs
- Structured Data on the Web
- Open Graph Protocol
- Google's Knowledge Graph
- Summary

Notes and Further Reading

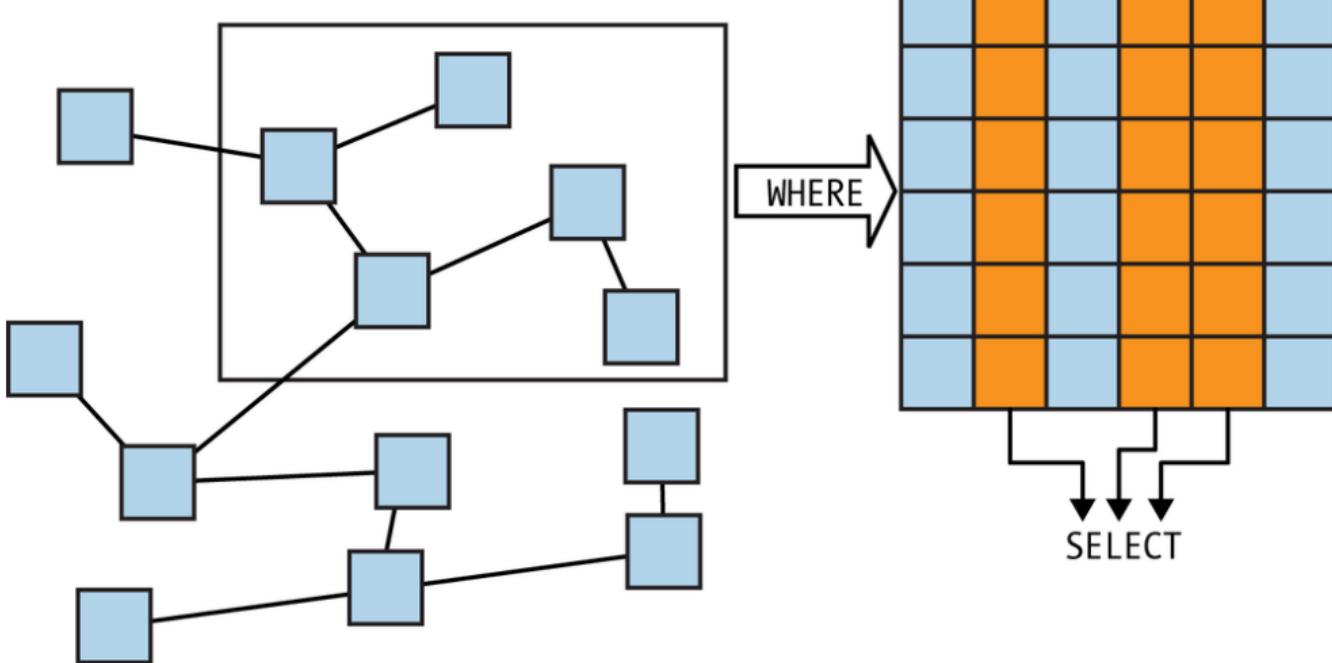


```

graph TD
    A[Declare prefix  
shortcuts  
(optional)] --- B[PREFIX foo: <...>  
PREFIX bar: <...>  
...]
    A --- C[SELECT ...]
    A --- D[FROM <...>  
FROM NAMED <...>]
    A --- E[WHERE {  
...  
}]
    A --- F[ORDER BY ...  
LIMIT ...  
OFFSET ...]
    C --- G[Query result  
clause]
    E --- H[Triple patterns]
  
```

Select... where

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→ Worksheet #4: Tasks 1, 2

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph

Summary

Notes and Further Reading

TBL at TED on “The year open data went worldwide” (2010)

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The globe shows a concentration of light in Europe and North America, indicating high levels of open data availability in those regions.

OpenStreetMap TED
CC BY-SA www.openstreetmap.org

Map data © OpenStreetMap contributors

4.00 / 6.03

Tim Berners-Lee: The year open data went worldwide

<https://www.youtube.com/watch?v=3YcZ3Zqk0a8>



ito!

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

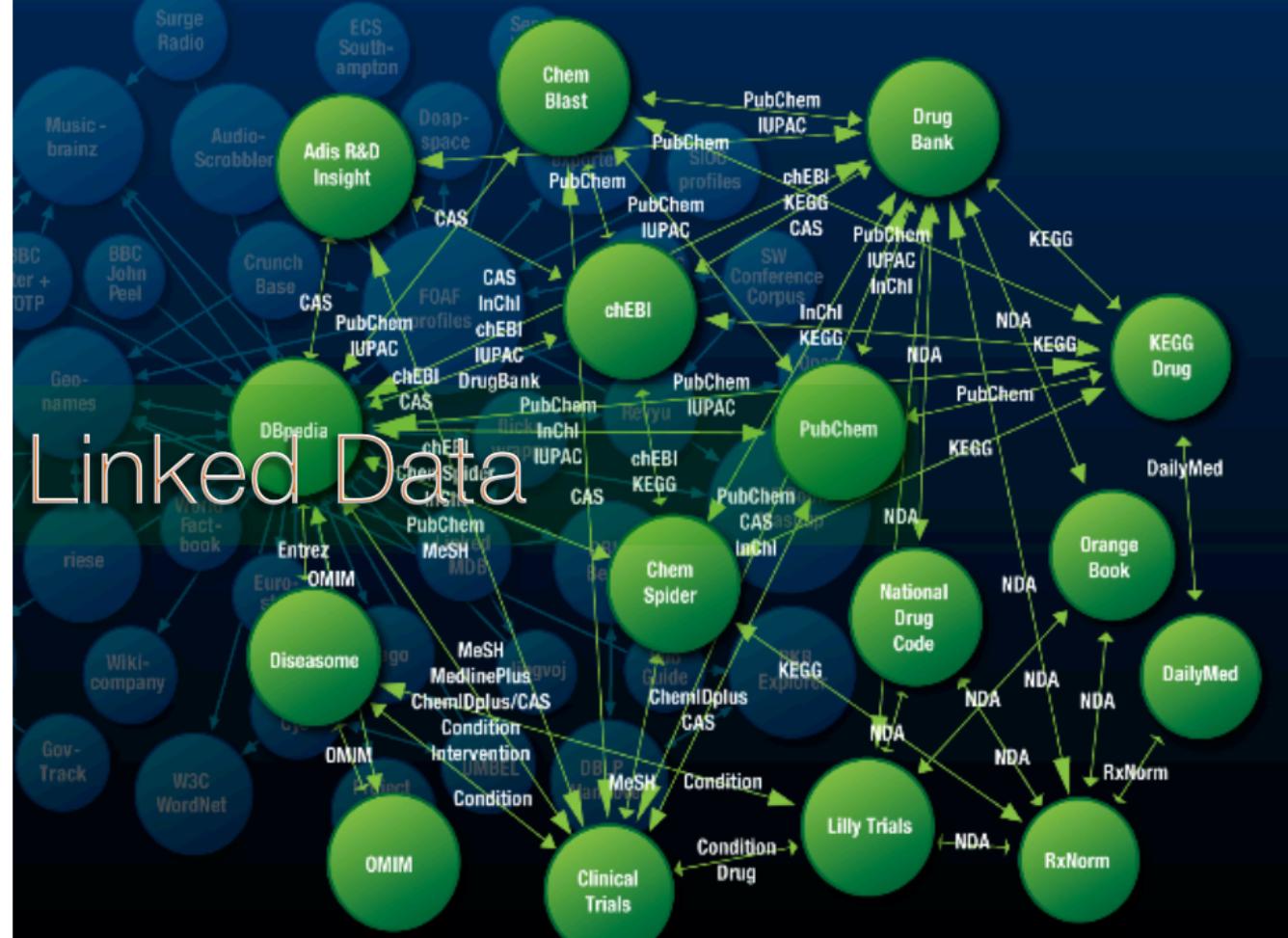
Open Graph Protocol

Google's Knowledge Graph

Summary

Notes and Further Reading

Linked Data



Linked Data “Project”

- ▶ Goal: “expose” datasets on the Web
 - remember the importance of data!
- ▶ Set links among the data items from different datasets
 - we want to avoid the silo effects

[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

Is your data 5 Star?



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[Linked Open Data \(LOD\)](#)

Queries Review

[The LOD Initiative](#)

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

[Knowledge Base Construction](#)

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

[Knowledge Base Applications](#)

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

- ★ Available on the web (whatever format), but with an open license
- ★★ Available as machine-readable structured data (e.g., excel instead of an image scan)
- ★★★ As before, but using a non-proprietary format (e.g., CSV instead of excel)
- ★★★★ All the above, plus use open standards (RDF & Co.) to identify things, so that people could point at your stuff
- ★★★★★ All the above, plus link your data to other people's data to provide context

Example data source: DBpedia

- ▶ DBpedia is a community effort to
 - extract structured (“infobox”) information from Wikipedia
 - provide a query endpoint to the dataset
 - interlink the DBpedia dataset with other datasets on the Web



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[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

Extracting structured data from Wikipedia

```
@prefix dbpedia <http://dbpedia.org/resource/>.  
@prefix dbterm <http://dbpedia.org/property/>.
```

dbpedia:**Amsterdam**

```
dbterm:officialName "Amsterdam" ;  
dbterm:longd "4" ;  
dbterm:longm "53" ;  
dbterm:longs "32" ;  
dbterm:website <http://www.amsterdam.nl> ;  
dbterm:populationUrban "1364422" ;  
dbterm:areaTotalKm "219" ;  
...  
...
```

dbpedia:**ABN_AMRO**

```
dbterm:location dbpedia:Amsterdam ;  
...  
...
```

Amsterdam	
- Municipality / City -	
	
Coordinates:	52°22'23"N 4°53'32"E
Country	Netherlands
Province	North Holland
COROP	Amsterdam
Boroughs	Boroughs
Government	
- Mayor	Eberhard van der Laan (PvdA)
- Aldermen	Carolin Gijssels Hans Gerson Maarten van Poeleest Freek Ossel Marjke Vos
- Secretary	Henk de Jong
Area ^{[1][2]}	
- Municipality / City	219 km ² (84.6 sq mi)
- Land	166 km ² (64.1 sq mi)
- Water	53 km ² (20.5 sq mi)
- Urban	1,003 km ² (387.3 sq mi)
- Metro	1,815 km ² (700.8 sq mi)
Elevation ^[3]	2 m (7 ft)
Population (June 2009) ^{[4][5]}	
- Municipality / City	762,057
- Density	4,459/km ² (11,548.8/sq mi)
- Urban	1,364,422
- Metro	2,158,372
- Demonym	Amsterdammer
Time zone	CET (UTC+01)
- Summer (DST)	CEST (UTC+02) (UTC)
Postal codes	1011–1109
Area code(s)	020
Website	www.amsterdam.nl

Automatic links among open datasets

```
<http://dbpedia.org/resource/Amsterdam> ←  
owl:sameAs <http://rdf.freebase.com/ns/...> ;  
owl:sameAs <http://sws.geonames.org/2759793> ;  
...
```

```
<http://sws.geonames.org/2759793>  
owl:sameAs <http://dbpedia.org/resource/Amsterdam>  
wgs84_pos:lat "52.3666667" ;  
wgs84_pos:long "4.8833333" ;  
geo:inCountry <http://www.geonames.org/countries/#NL> ;  
...
```

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

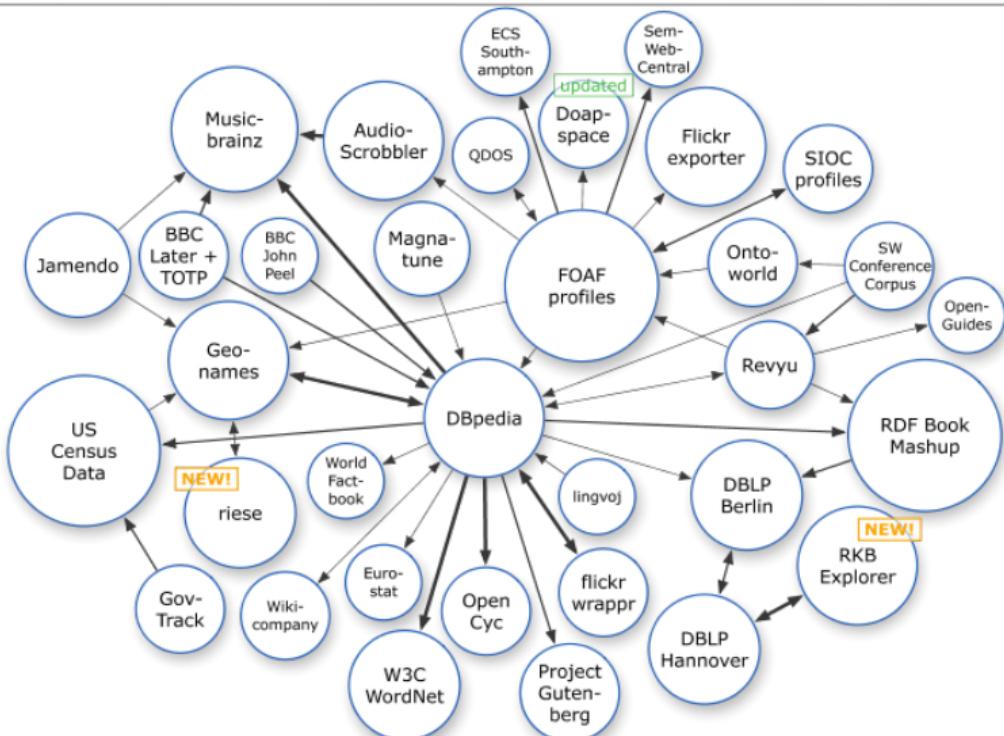
Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

Processors can switch automatically from one to the other...

The LOD “cloud”, March 2008



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

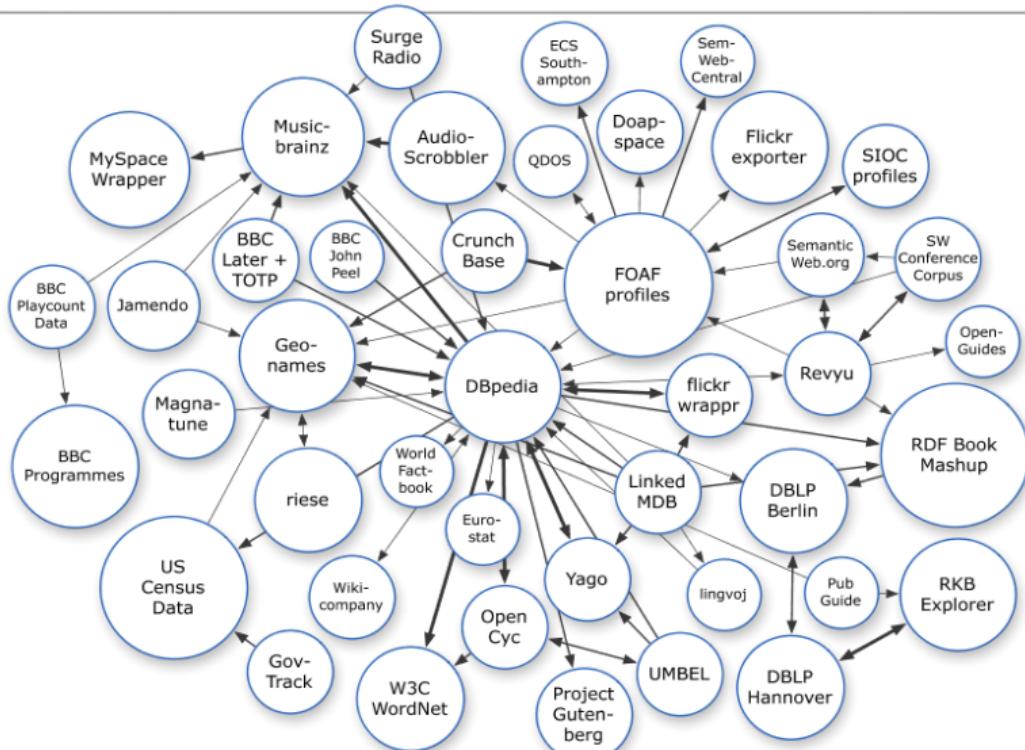
[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

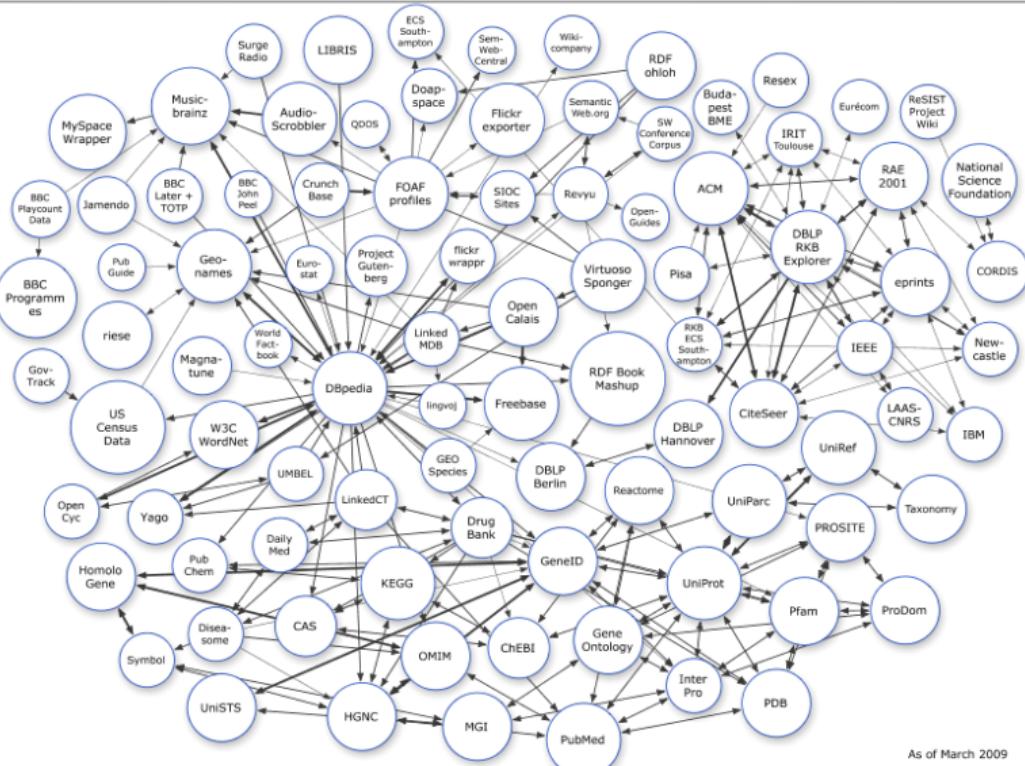
[Notes and Further Reading](#)

The LOD “cloud”, September 2008



As of September 2008

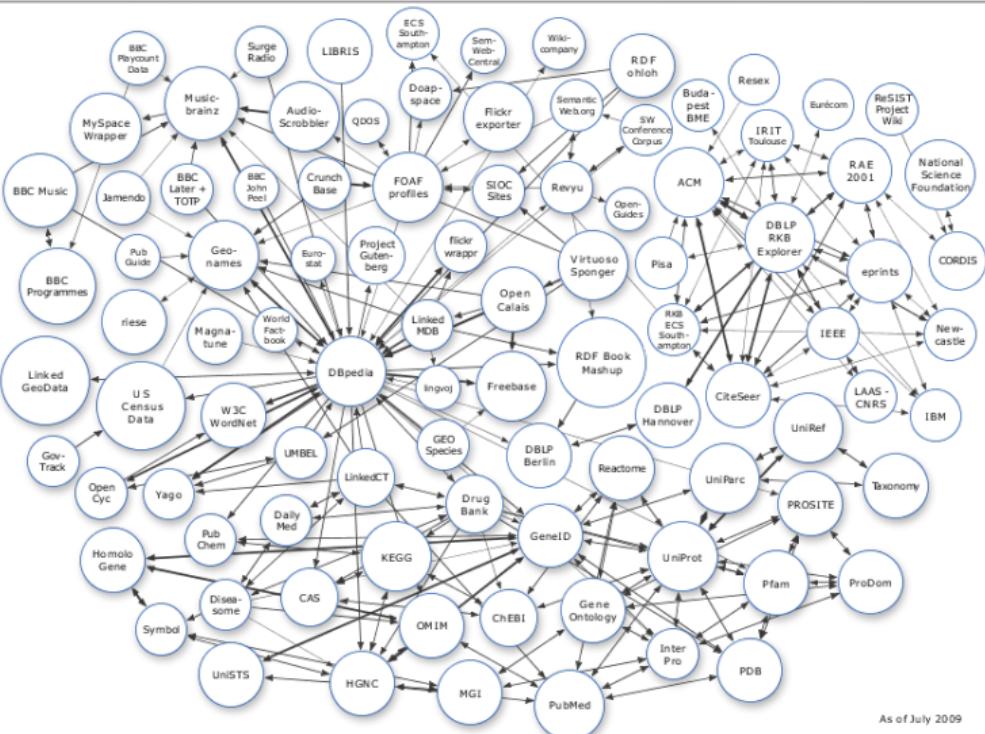
The LOD “cloud”, March 2009



As of March 2009

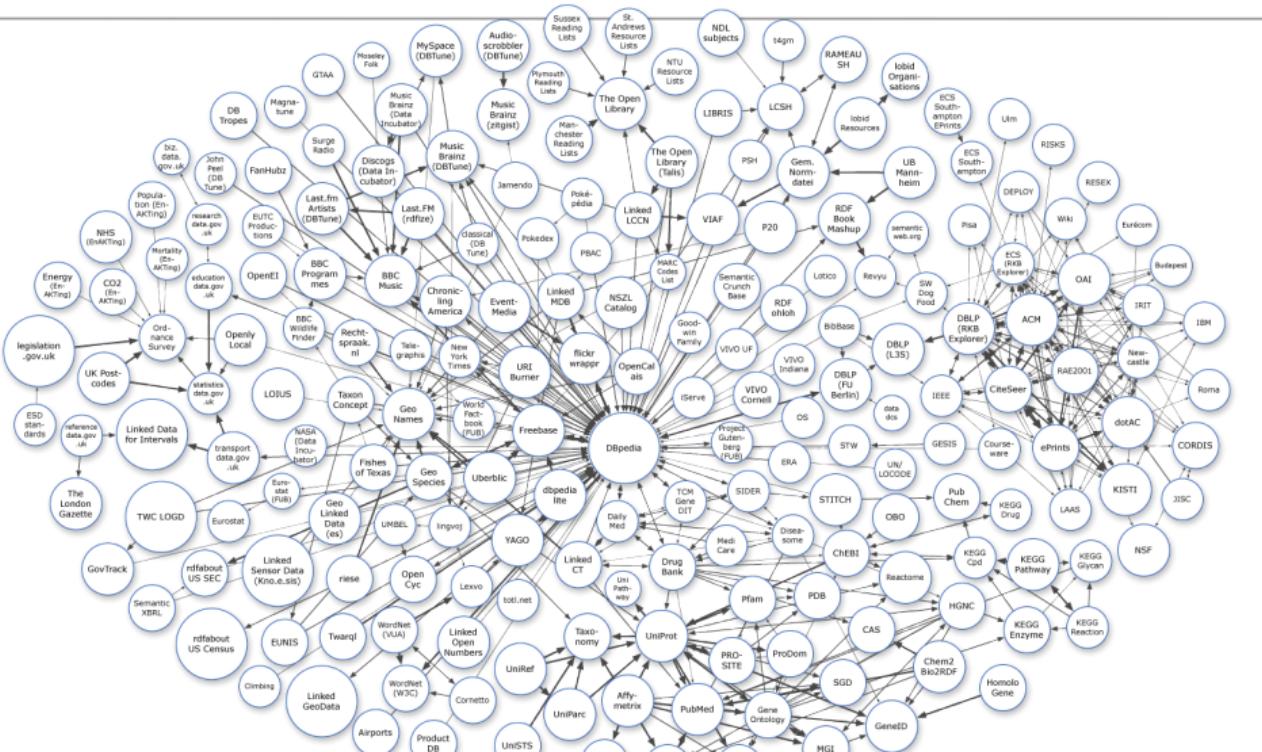
The LOD “cloud”, June 2009

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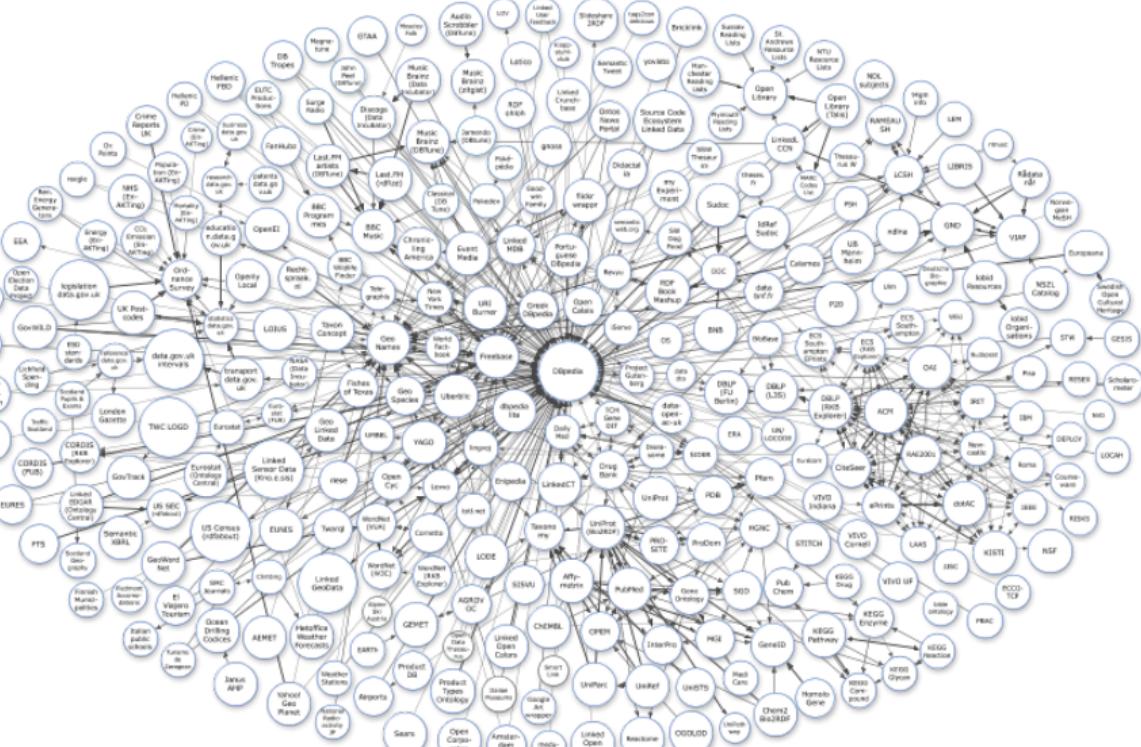
As of July 2009

The LOD “cloud”, September 2010



As of September 2010

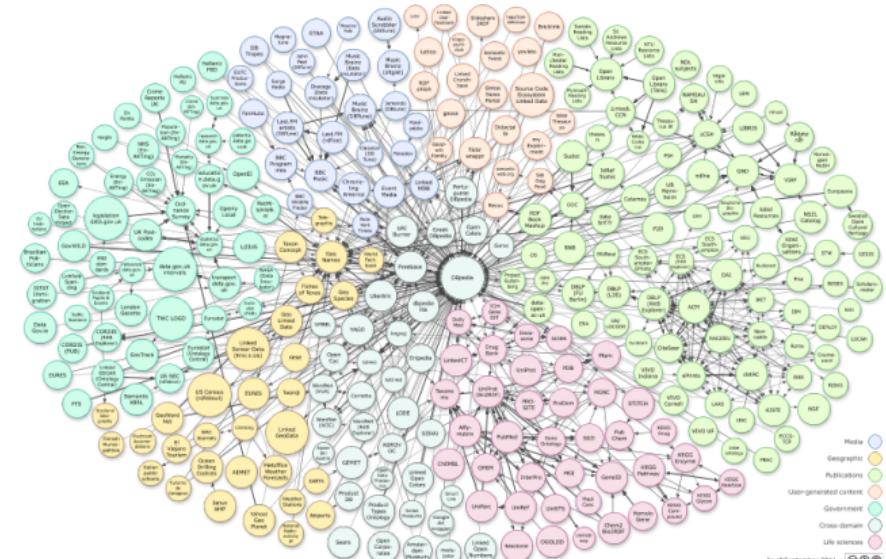
The LOD “cloud”, September 2011



Courtesy of Richard Cyganiak and Anja Jentzsch

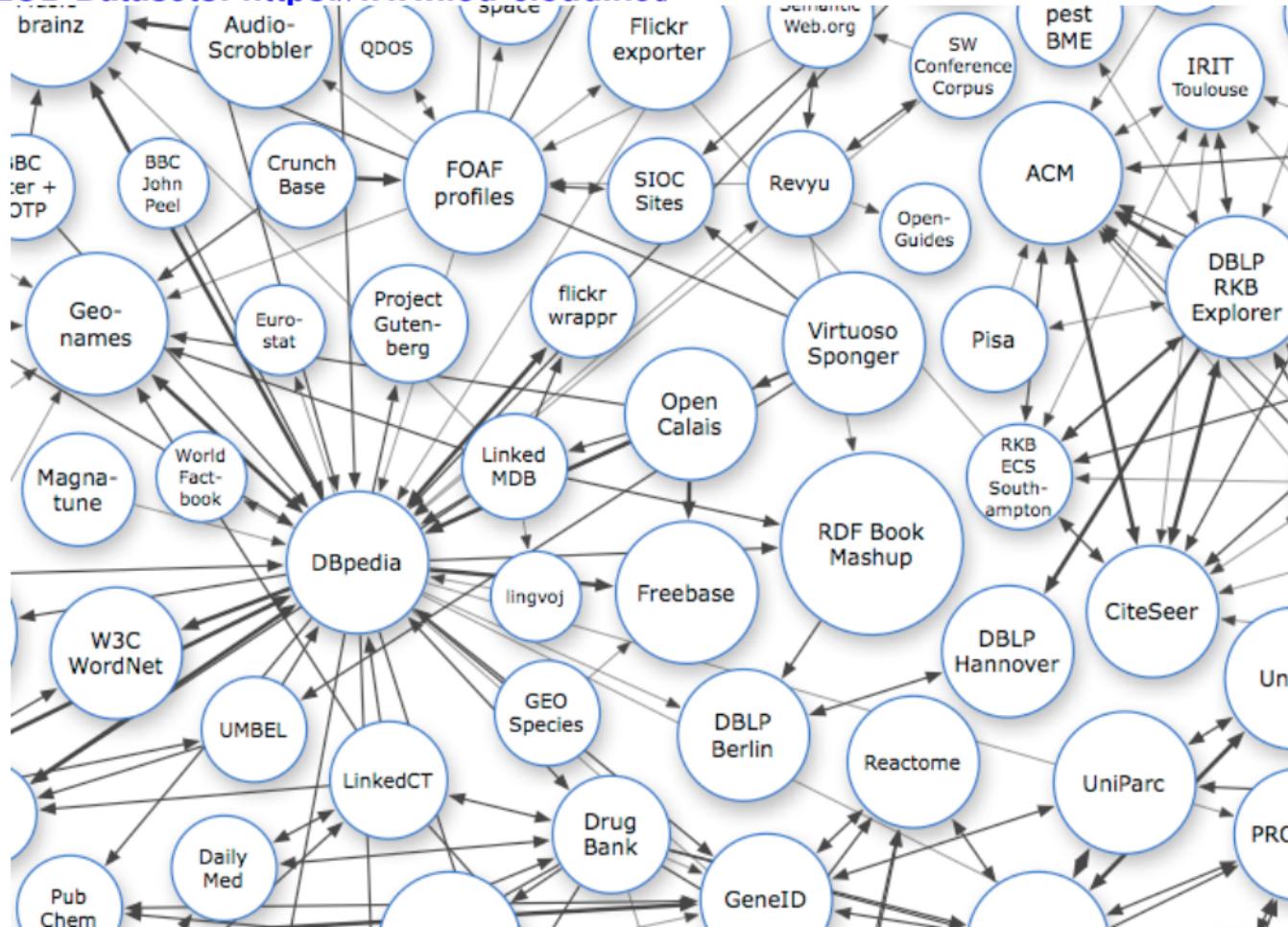
Application specific portions of the cloud

- ▶ Eg, “bio” related datasets
 - done, partially, by the “Linking Open Drug Data” task force of the HCLS IG at W3C



Courtesy of Richard Cyganiak and Anja Jentzsch

LOD Datasets: <https://www.lod-cloud.net/>



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Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph

Summary

Notes and Further Reading

Origin

First proposed by Tim Berners-Lee in 2006

<https://www.w3.org/DesignIssues/LinkedData.html>

What's a "link"?

Technically, a **link** is a triple where

- the **subject** IRI is in one graph (namespace) and
- the **predicate** and/or **object** are in a different graph (namespace)

Types of Links

Identity Link: points to the same object or concept in another knowledge graph
(e.g., Canada in DBpedia and Wikidata)

Relationship Link: points to other objects related to a given one (e.g., from a person to the city they live in)

Vocabulary Link: between data and their vocabulary term

(e.g., IRI is a `foaf:Person`) or between vocabulary terms
(e.g., `ex:Student rdfs:subClassOf foaf:Person`)

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

Instance Level

Creating links on the **instance level** (IRIs):

`owl:sameAs` Most widely used, but makes strong assumptions about both IRIs being identical (it is *symmetric* and *transitive*)

`rdfs:seeAlso` Just a reference, makes no claim about the IRIs being identical (no specific semantics)

using vocabularies e.g., `skos:exactMatch`, `foaf:knows`

Schema Level

Two graphs can also be linked on the **schema level**:

- Using `owl:equivalentClass` and `owl:equivalentProperty`
- Using `rdfs:subClassOf` and `rdfs:subPropertyOf`
- Using vocabularies, e.g., `skos:broadMatch` or `skos:narrowMatch`

[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

Linked Open Data
(LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base
Construction

Some History

Freebase, DBpedia &
Wikidata

Publishing Options and
Workflows

Relational Databases and
RDF

Competency Questions

Knowledge Base
Applications

Linking Documents and
Knowledge Graphs

Structured Data on the Web
Open Graph Protocol

Google's Knowledge Graph
Summary

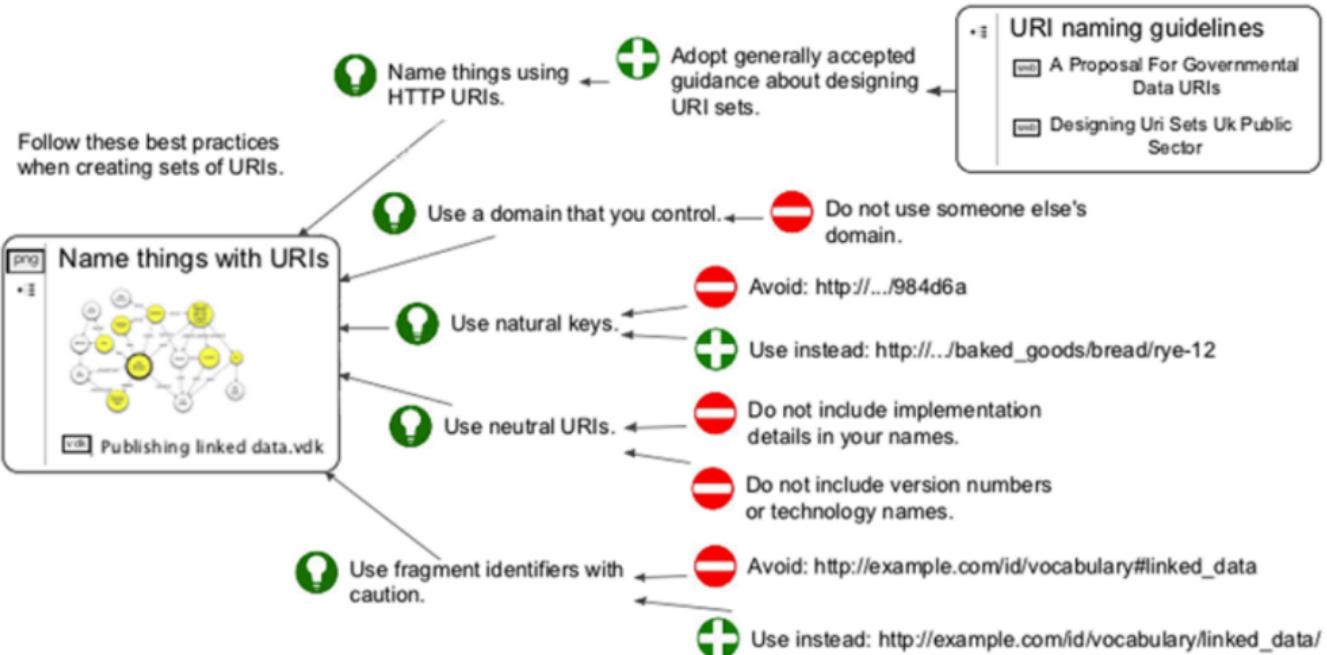
Notes and Further
Reading

The “four rules”

- 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.

How to create your own URIs

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Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

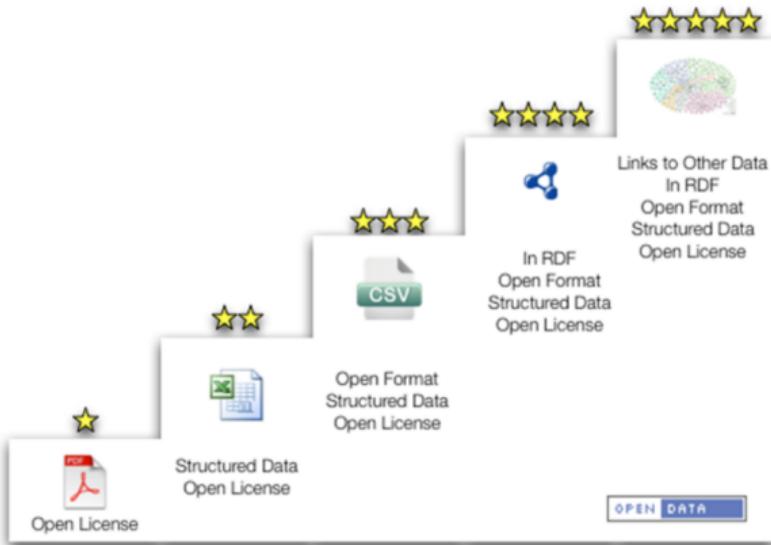
Google's Knowledge Graph Summary

Notes and Further Reading

Major Points

To create a knowledge base in LOD-compliant format:

- ① Make your data “5-star”
- ② Create URIs following the guidelines
- ③ Select appropriate vocabularies
- ④ Extend existing vocabularies if necessary
- ⑤ Link your data to other knowledge graphs
- ⑥ Publish your knowledge graph on the web



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

Knowledge Base Construction

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

Knowledge Base Applications

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph](#)

[Summary](#)

Notes and Further Reading

1 Linked Open Data (LOD)

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

2 Knowledge Base Construction

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

3 Knowledge Base Applications

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph

Summary

4 Notes and Further Reading

Notes and Further Reading

Knowledge Bases: Timeline

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Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

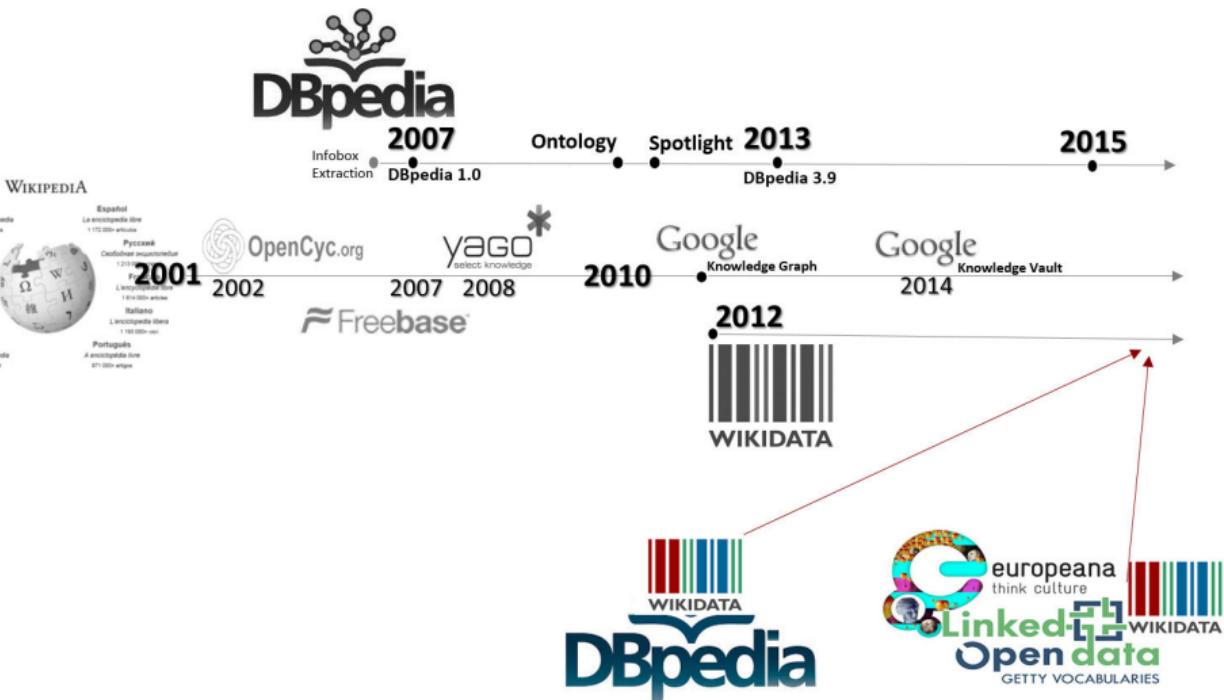
Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph

Summary

Notes and Further Reading



Freebase

- One of the first major public knowledge graphs, started in 2007
- Startup *Metaweb* bought by Google in 2010
- Shutdown in 2016...
- ...but data was donated to [Wikidata](#)

	Freebase™
Type of site	Online database
Available in	English
Owner	Metaweb Technologies (Google)
URL	www.freebase.com ↗
Commercial	No
Registration	Optional
Launched	3 March 2007; 13 years ago
Current status	Offline (since 2 May 2016), succeeded by Wikidata ^[1] ^[2]
Content license	Creative Commons Attribution License

 [Browse using](#) ▾ [Formats](#) ▾

rdfs:label	■ Kobe Bryant (en)
rdfs:seeAlso	■ dbr>List_of_career_achievements_by_Kobe_Bryant
owl:sameAs	■ http://data.europa.eu/euodp/jrc-names/Kobe_Bryant ■ dbpedia-sq:Kobe Bryant ■ dbpedia-ka:Kobe Bryant ■ freebase:Kobe Bryant

[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

[RESOURCES](#) [MEMBERS](#) [COMMUNITY](#)

Global and Unified Access to Knowledge Graphs

[DBPEDIA BLOG](#)

Tutorial at September 1, 2021

DBpedia Tutorial at LDK 2021

January 14, 2021 by Julia Holze

We are happy to announce that we will organize a DBpedia Tutorial on September 1, 2021 in Zaragoza, Spain. This DBpedia tutorial will be part of the Language, Data and Knowledge conference 2021. Building upon the success of the previous events held in Galway, Ireland in 2017, and in Leipzig, Germany in 2019, this conference will bring together researchers from across disciplines concerned with the acquisition, curation and use of language data in the context of data science and knowledge-based applications.

[Read more](#)

DBpedia Tutorial at LDK 2021



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

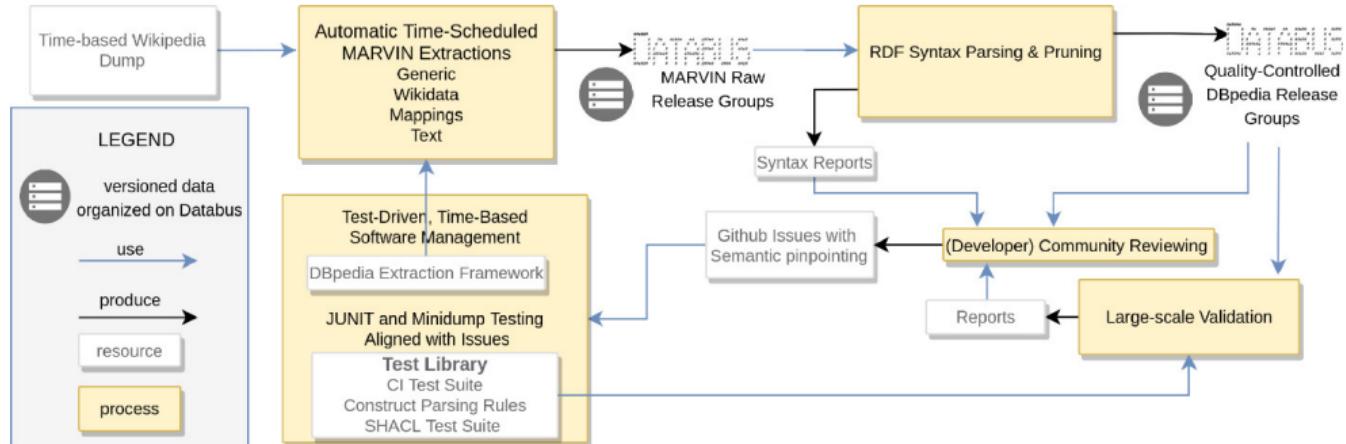
[Google's Knowledge Graph](#)

[Summary](#)

[Notes and Further Reading](#)

DBpedia Release Cycle

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"The New DBpedia Release Cycle: Increasing Agility and Efficiency in Knowledge Extraction Workflows" [HHDF20]

→ Worksheet #4: Task 3

Linked Open Data (LOD)

- Queries Review
- The LOD Initiative
- DBpedia
- The LOD Cloud
- Linked Data Design Issues
- Summary

Knowledge Base Construction

- Some History
- Freebase, DBpedia & Wikidata
- Publishing Options and Workflows
- Relational Databases and RDF
- Competency Questions

Knowledge Base Applications

- Linking Documents and Knowledge Graphs
- Structured Data on the Web
- Open Graph Protocol
- Google's Knowledge Graph
- Summary

Notes and Further Reading



[dismiss]

Main page
Community portal
Project chat
Create a new item
Recent changes
Random item
Query Service
Nearby
Help
Donate

Lexicographical data
Create a new Lexeme
Recent changes
Random Lexeme

Tools

What links here
Related changes
Special pages
Permanent link
Page information
Wikidata item

In other projects

Wikimedia Commons

MediaWiki

Meta-Wiki

Wikispecies

Wikibooks

Wikimania

Wikinews

Wikidata

Wikiquette

Wikisource

Wikiversity

Wikivoyage

Wiktionary

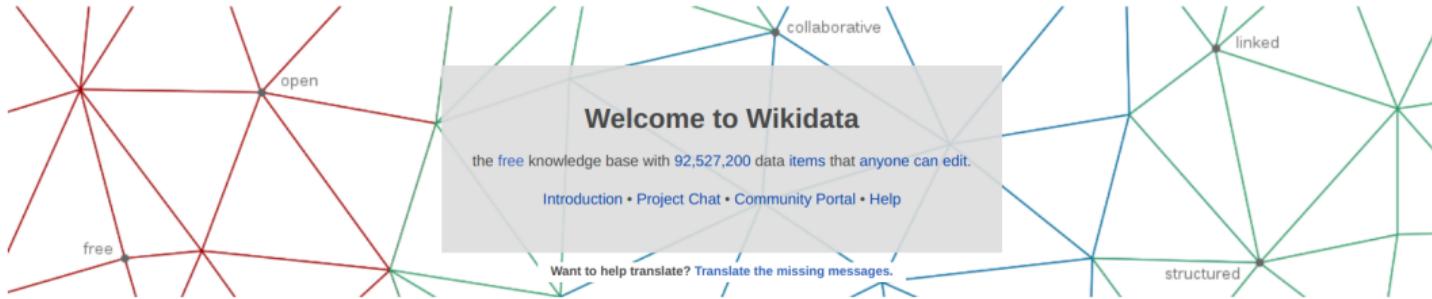
In Pictures

Atikamekw

Néhiyawewin /
ᓈᐎᐤ

Deutsch

Join the consultation about the Universal Code of Conduct and take the online survey!



Welcome!

Wikidata is a free and open knowledge base that can be read and edited by both humans and machines.

Wikidata acts as central storage for the **structured data** of its Wikimedia sister projects including Wikipedia, Wikivoyage, Wiktionary, Wikisource, and others.

Wikidata also provides support to many other sites and services beyond just Wikimedia projects! The content of Wikidata is available under a free license, exported using standard formats, and can be interlinked to other open data sets on the linked data web.

Get involved

For a complete starters' guide, visit the [community portal](#).

Learn about Wikidata

- What is Wikidata? Read the [Wikidata introduction](#).
- Explore Wikidata by looking at a featured showcase item for author [Douglas Adams](#) (Q42).
- Get started with Wikidata's [SPARQL query service](#).

Contribute to Wikidata

- Learn to edit Wikidata: follow the [tutorials](#).
- Work with other volunteers on a subject that interests you: [join a WikiProject](#).
- Individuals and organizations can also [donate data](#).

Learn about data

New to the wonderful world of data? Develop and improve your data literacy through content designed to get you up to speed and feeling comfortable with the fundamentals in no time.



Item: [Earth](#) (Qz)



Property: [highest point](#) (P610)



custom value:
[Mount Everest](#)
(Q513)

Current highlights

- 2021 Clásica de Almería (Q103950409)
- Tour de la Provence 2021 (Q101085154)
- 2021 Grand Prix Gazipaşa (Q105321988)
- Britten-Norman BN-2 Islander (Q921019) (pictured)
- Mary Wilson (Q2302368)



Wikidata: Wiki principle applied to structured data

X English ▾



Item Discussion

Read View history

Search Wikidata

Concordia University (Q326342)

university in Montreal, Quebec, Canada

edit

Sir George Williams University | Loyola College, Montreal | Concordia university (Montréal, Canada) | Concordia

▼ In more languages

Configure

Language	Label	Description	Also known as
English	Concordia University	university in Montreal, Quebec, Canada	Sir George Williams University Loyola College, Montreal Concordia university (Montréal, ... Concordia
German	Concordia University	Universität in Kanada	Concordia-Universität
French	Université Concordia	université québécoise née de la fusion de l'Université Sir George Williams et du Collège Loyola à Montréal, en août 1974	Université Sir George Williams Université Concordia (Montréal, ...
Italian	Università Concordia	No description defined	Concordia University

All entered languages

Statements

instance of

university

edit

▼ 0 references

+ add reference

+ add value

Wikipedia (25 entries) edit

ar جامعه کونکورڈیا

ast Universidá Concordia

atj Université Concordia

azb کونکورڈیا بیلگیم بوردو

de Concordia University

el Πανεπιστήμιο Κονκόρδια

en Concordia University

eo Universitato Concordia

es Universidad Concordia

et Concordia ülikool (Kanada)

fa کونکوردیا کالج

fi Concordia-Yliopisto

fr Université Concordia

he אוניברסיטת קונקורדייה

it Università Concordia

ja コンカルディア大学

ko 콘코디아 대학교

nl Concordia-universiteit (Montreal)

pl Uniwersytet Concordia

pt Universidade Concórdia

ru Университет Конкордия

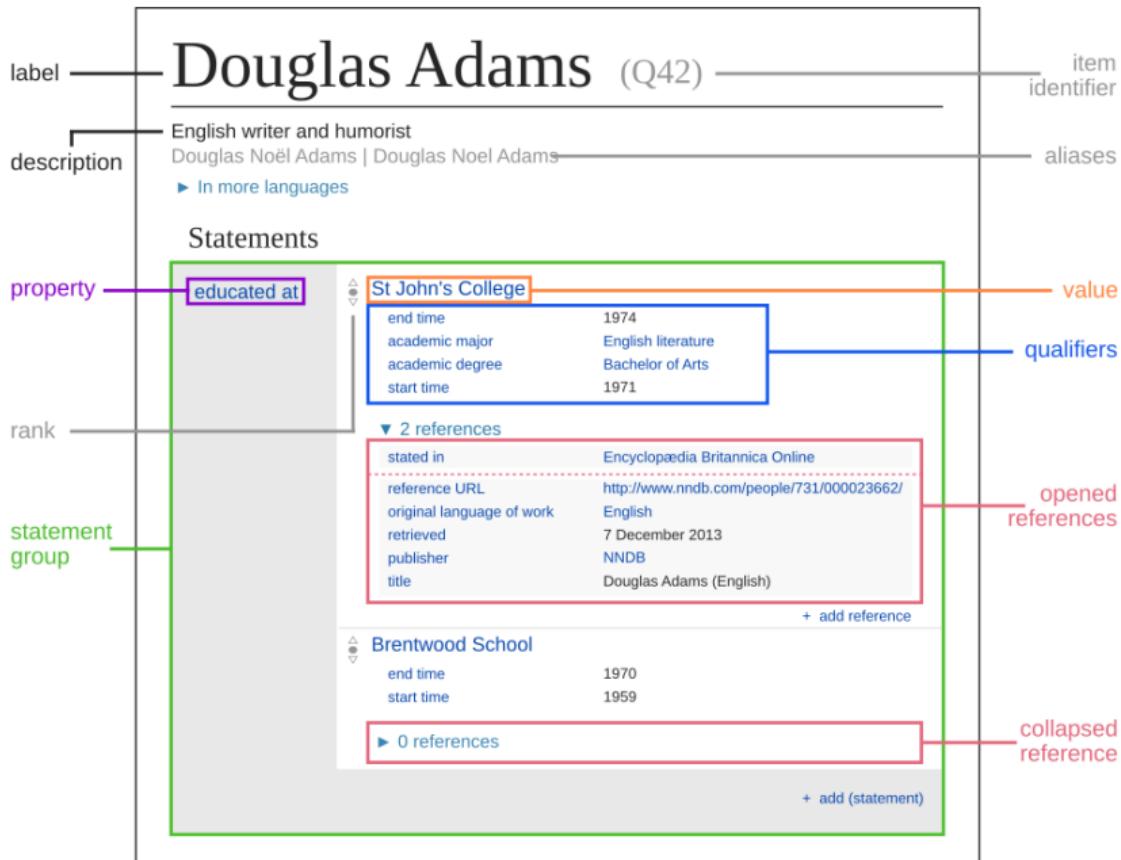
sv Concordia University

ti Pamantasan ng Concordia

→ Worksheet #4: Task 4

Wikidata: Data Model

René Witte



<https://en.wikipedia.org/wiki/Wikidata>

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

Approaches

- Community-constructed (e.g., Freebase, Wikidata)
- (Semi-)Automatically constructed (e.g., DBpedia, BabelNet)
- Exported from other data sources (e.g., MusicBrainz)



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

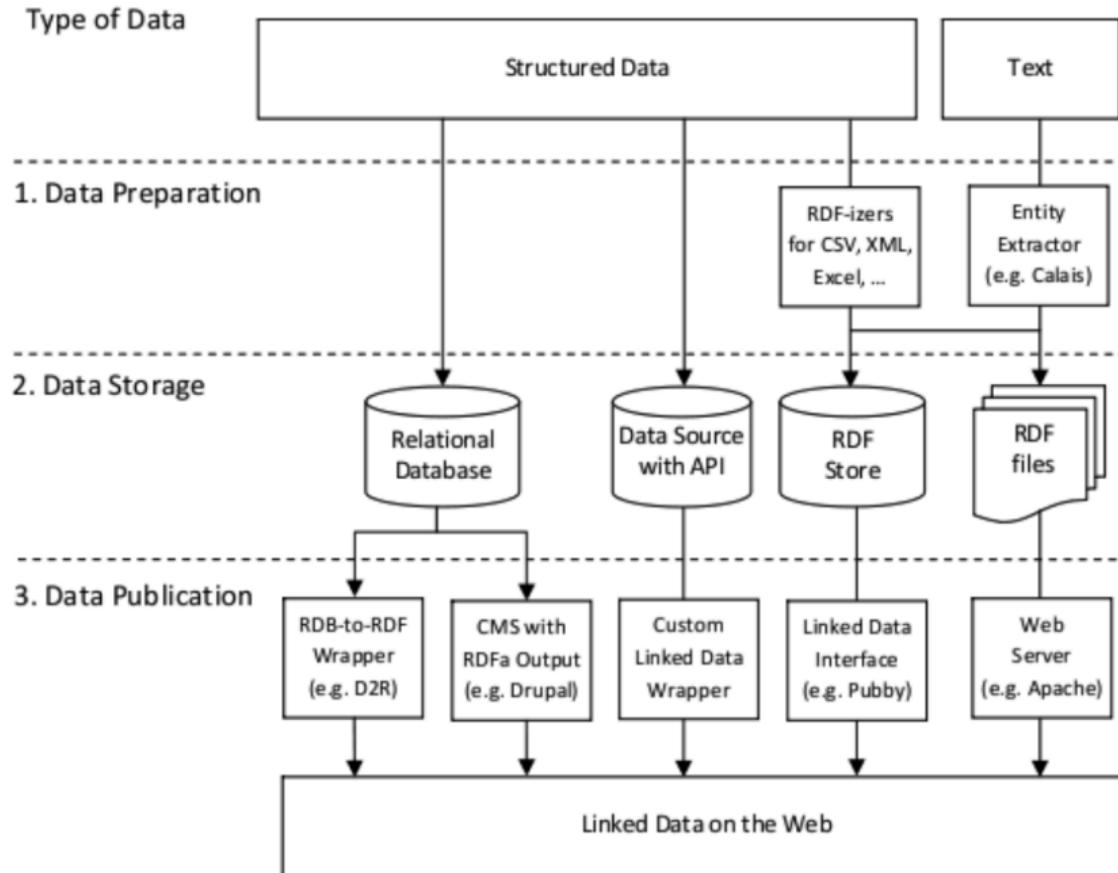
[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

Linked Data Publishing Options and Workflows

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[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph](#)

[Summary](#)

[Notes and Further Reading](#)

1 Linked Open Data (LOD)

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Relational Databases and RDF

Competency Questions

3 Knowlege Base Applications

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph

Summary

Notes and Further Reading

4 Notes and Further Reading

[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

Access to Relational Databases (Direct Mapping, R2RML)

Relational Databases and RDF

- ▶ Most of the data on the Web is, in fact, in RDB-s
- ▶ Proven technology, huge systems, many vendors...
- ▶ Data integration on the Web must provide access to RDB-s

[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

What is “export”?

- ▶ “Export” does not *necessarily* mean physical conversion
 - for very large databases a “duplication” would not be an option
 - systems may provide SQL “bridges” to make queries on the fly
- ▶ Result of export is a “logical” view of the RDB content

[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia &](#)

[Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

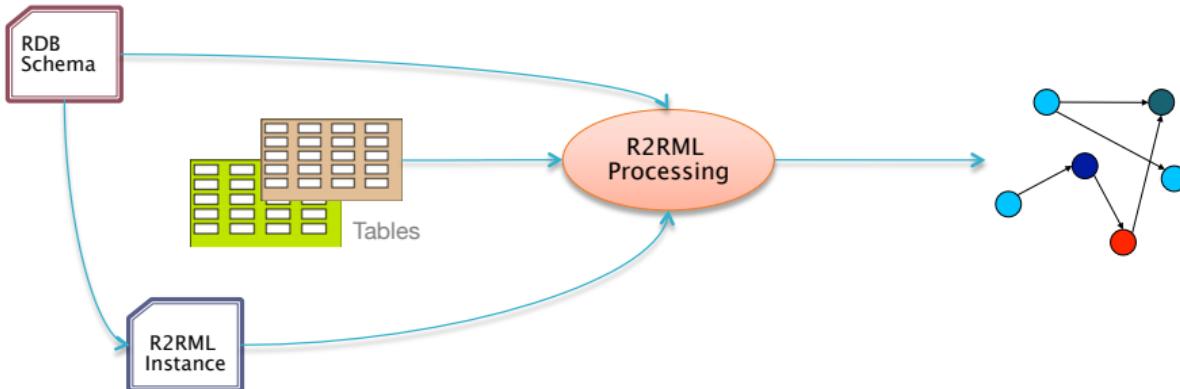
[Open Graph Protocol](#)

[Google’s Knowledge Graph Summary](#)

[Notes and Further Reading](#)

What R2RML processor does

- ▶ An R2RML processor has access to:
 - an RDB schema
 - an R2RML instance
 - a database governed by the schema
- ▶ ... and produces an RDF graph



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

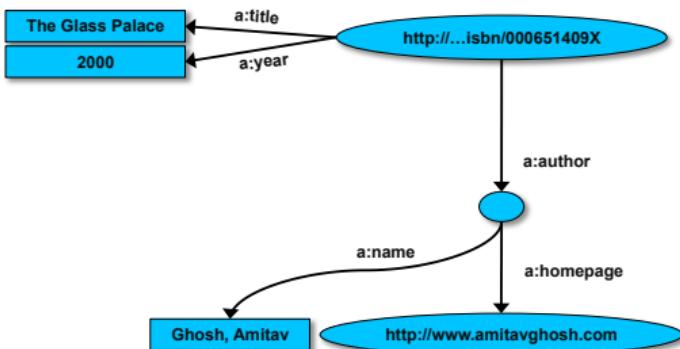
[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

Back to the bookshop example

ISBN	Author	Title	Publisher	Year
0006511409X	id_xyz	The Glass Palace	id_qpr	2000

ID	Name	Homepage
id_xyz	Ghosh, Amitav	http://www.amitavghosh.com



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

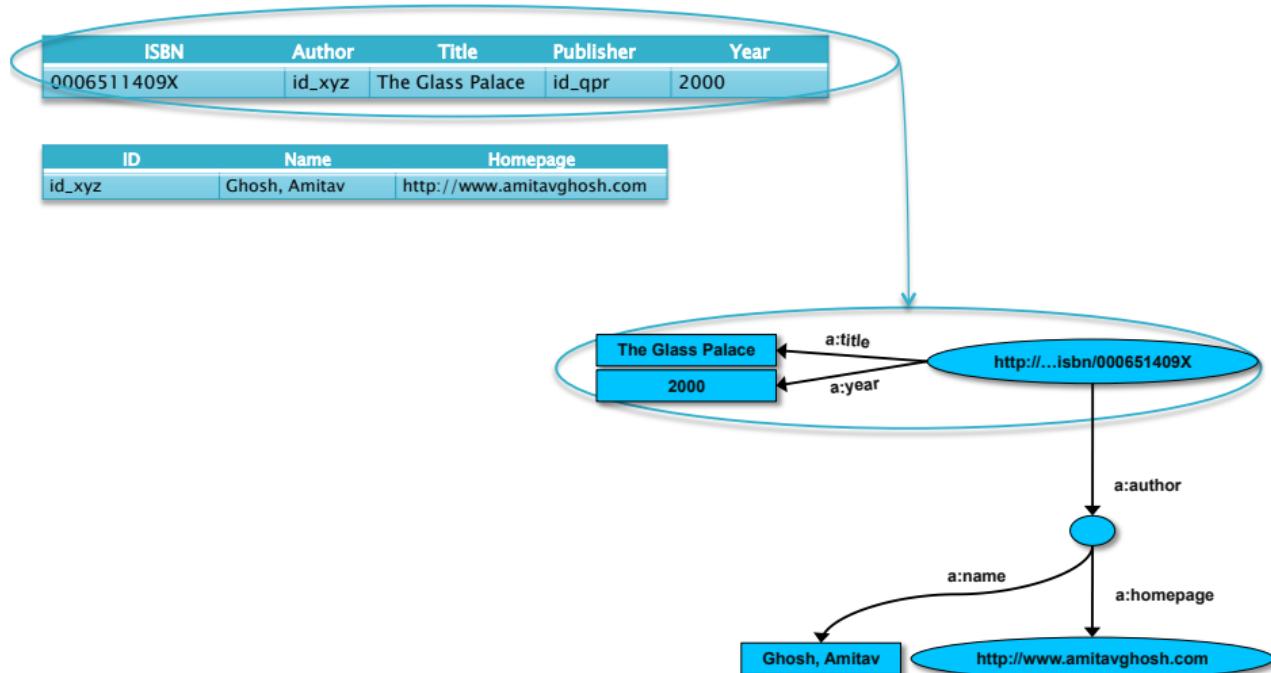
[Open Graph Protocol](#)

[Google's Knowledge Graph](#)

[Summary](#)

[Notes and Further Reading](#)

Back to the bookshop example



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

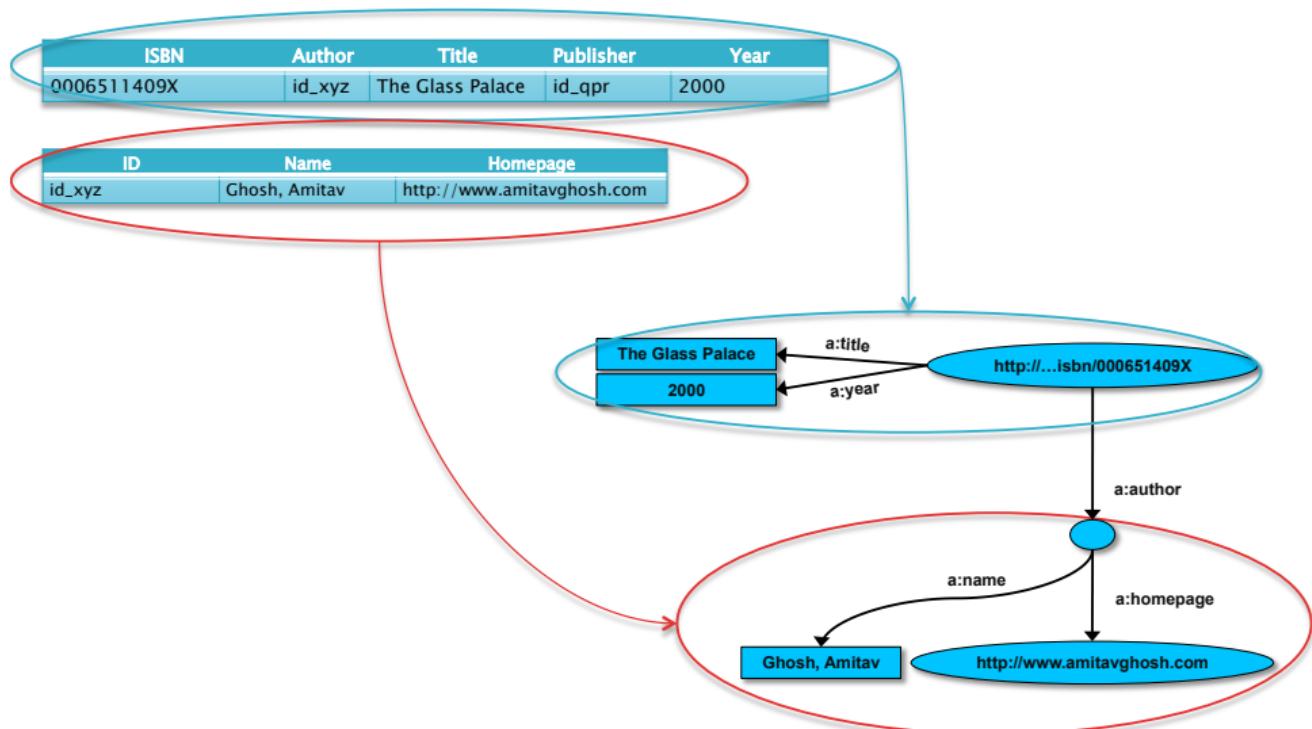
[Open Graph Protocol](#)

[Google's Knowledge Graph](#)

[Summary](#)

[Notes and Further Reading](#)

Back to the bookshop example



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

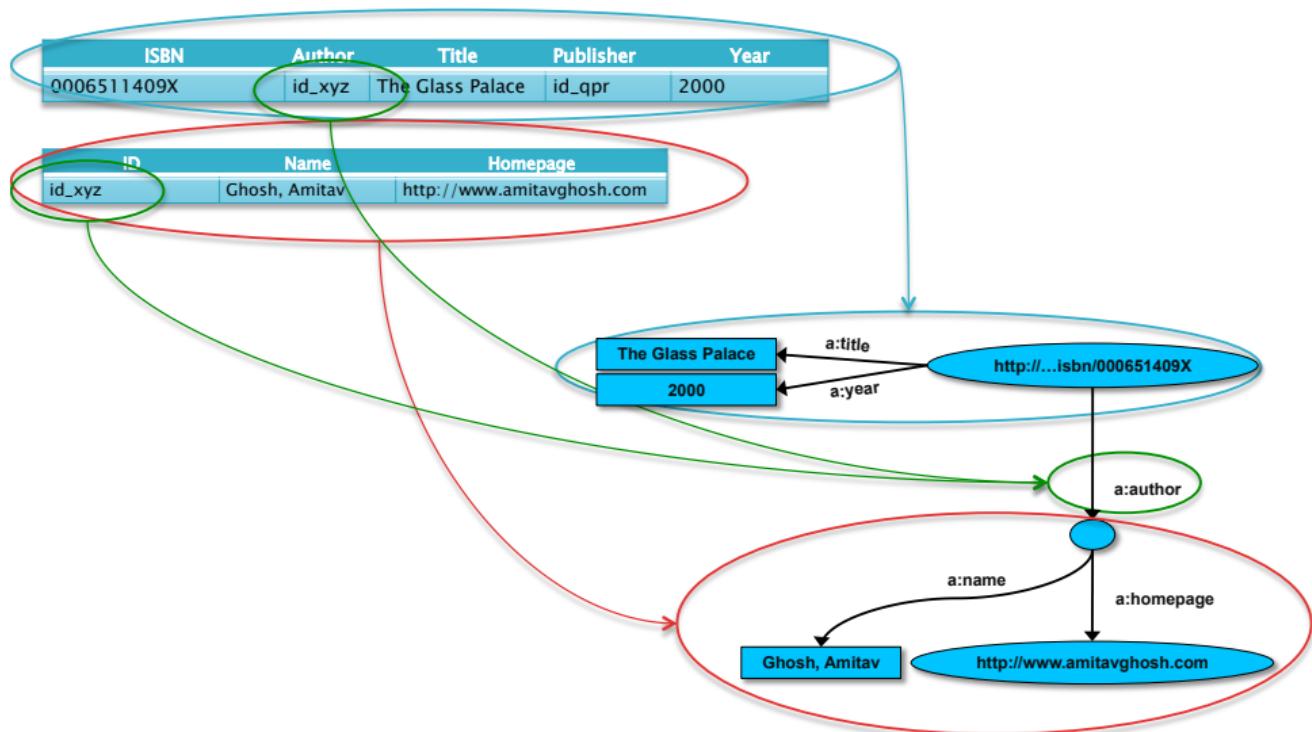
[Open Graph Protocol](#)

[Google's Knowledge Graph](#)

[Summary](#)

[Notes and Further Reading](#)

Back to the bookshop example



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph](#)

[Summary](#)

[Notes and Further Reading](#)

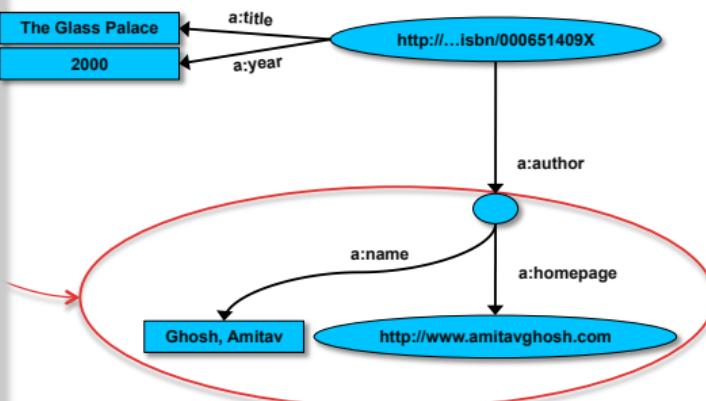
Step 1: transform “Person Table”

ISBN	Author	Title	Publisher	Year
0006511409X	id_xyz	The Glass Palace	id_qpr	2000

ID	Name	Homepage
id_xyz	Ghosh, Amitav	http://www.amitavghosh.com

```
<Person>
  rr:tableName "Person_Table" ;
  rr:subjectMap [
    rr:termtype rr:BlankNode ;
  ] ;
  rr:predicateObjectMap [
    rr:predicate a:name
    rr:objectMap [
      rr:column "Name"
    ]
  ] ;
  rr:predicateObjectMap [
    rr:predicate a:homepage ;
    rr:objectMap [
      rr:column "Homepage" ;
      rr:termtype "IRI"
    ]
  ] ;

```



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph](#)

[Summary](#)

[Notes and Further Reading](#)

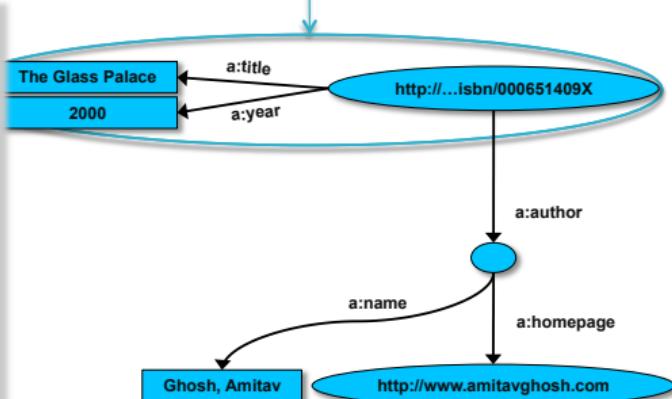
Step 2: transform “Book Table”

ISBN	Author	Title	Publisher	Year
0006511409X	id_xyz	The Glass Palace	id_qpr	2000

ID	Name	Homepage
id_xyz	Ghosh, Amitav	http://www.amitavghosh.com

```
<Book>
  rr:tableName "Book_Table" ;
  rr:subjectMap [
    rr:template "http://...isbn/{ISBN}" ;
  ];
  rr:predicateObjectMap [
    rr:predicate a:title ;
    rr:objectMap [
      rr:column "Title"
    ]
  ];
  rr:predicateObjectMap [
    rr:predicate a:year ;
    rr:objectMap [
      rr:column "Year" ;
    ]
  ];

```



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph](#)

[Summary](#)

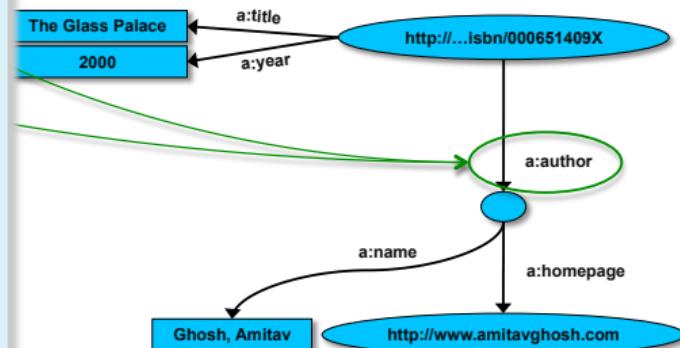
[Notes and Further Reading](#)

Step 3: “bind” the two tables

ISBN	Author	Title	Publisher	Year
0006511409X	id_xyz	The Glass Palace	id_qpr	2000

ID	Name	Homepage
id_xyz	Ghosh, Amitav	http://www.amitavghosh.com

```
<Book>
...
rr:refPredicateObjectMap [
  rr:predicate a:author ;
  rr:objectMap [
    rr:parentTriplesMap <Person> ;
    rr:joinCondition
      rr:child "Author" ;
      rr:parent "ID"
  ]
].
]
```



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph](#)

[Summary](#)

[Notes and Further Reading](#)

1 Linked Open Data (LOD)

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Competency Questions

3 Knowlege Base Applications

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph

Summary

4 Notes and Further Reading

Notes and Further Reading

Knowledge Base Design

Unlike (relational) databases, knowledge bases do no have a rigid, pre-defined design for a specific application

- Encourage inter-connection of knowledge
- Still helpful to have an idea of possible use cases

Design Method

- Start with a set of **questions** to guide the design of the vocabulary and data triples
- It must be possible to answer the questions when the knowledge base has been constructed
- These **competency questions** can be seen as a *requirements specification* for a vocabulary or knowledge base

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

Examples

Some possible competency questions for a university knowledge graph:

- Q1: Which courses are offered at University X ?
- Q2: Which topics are covered by a course C ?
- Q3: Which professors teach at university X ?
- Q4: What are the prerequisites for a given course C ?
- Q5: Which universities offer courses that cover topic T ?

Note

These mostly follow a single pattern

Which [CE1] [OPE] [CE2] ?

[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

Competency Question: Patterns

René Witte



ID	Pattern	Example	PA	RT	M	DE
1	Which [CE1] [OPE] [CE2]?	Which pizzas contain pork?	2	obj.		
2	How much does [CE] [DP]?	How much does Margherita Pizza weigh?	2	data.		
3	What type of [CE] is [I]?	What type of software (API, Desktop application etc.) is it?	1			
4	Is the [CE1] [CE2]?	Is the software open source development?	2			
5	What [CE] has the [NM] [DP]?	What pizza has the lowest price?	2	data.	num.	
6	What is the [NM] [CE1] to [OPE] [CE2]?	What is the best/fastest/most robust software to read/edit this data?	3	both	num.	
7	Where do I [OPE] [CE]?	Where do I get updates?	2	obj.		spa.
8	Which are [CE]?	Which are gluten free bases?	1			
9	When did/was [CE] [PE]?	When was the 1.0 version released?	2	data.		tem.
10	What [CE1] do I need to [OPE] [CE2]?	What hardware do I need to run this software?	3	obj.		
11	Which [CE1] [OPE] [QM] [CE2]?	Which pizza has the most toppings?	2	obj.	quan.	
12	Do [CE1] have [QM] values of [DP]?	Do pizzas have different values of size?	2	data.	quan.	

Towards Competency Question-Driven Ontology Authoring, https://link.springer.com/chapter/10.1007/978-3-319-07443-6_6

CQ Archetypes (PA = Predicate Arity, RT = Relation Type, M = Modifier, DE = Domain-independent Element; obj. = object property relation, data. = datatype property relation, num. = numeric modifier, quan. = quantitative modifier, tem. = temporal element, spa. = spatial element; CE = class expression, OPE = object property expression, DP = datatype property, I = individual, NM = numeric modifier, PE = property expression, QM = quantity modifier)

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

Testing Competency Questions

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Example: African Wildlife Ontology (AWO)

Competency question awo_6 “Which plants eat animals?”

Verify using a SPARQL query:

```
SELECT DISTINCT ?eats
WHERE {
    ?eats rdfs:subClassOf awo:plant, [
        a owl:Restriction ;
        owl:onProperty awo:eats;
        owl:someValuesFrom awo:animal
    ] .
    FILTER(?eats != owl:Nothing)
}
```

See https://www.researchgate.net/publication/338424817_Dataset_of_ontology_competency_questions_to_SPARQL-OWL_queries_translations

Another approach: SHACL

There is also a separate standard, the *Shapes Constraint Language (SHACL)* (<https://www.w3.org/TR/shacl/>), see [HHDF20] for an example.

→ Worksheet #4: Task 5

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

1 Linked Open Data (LOD)

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

2 Knowledge Base Construction

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

3 Knowlege Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Facebook's Open Graph Protocol

Google's Knowledge Graph

Summary

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph

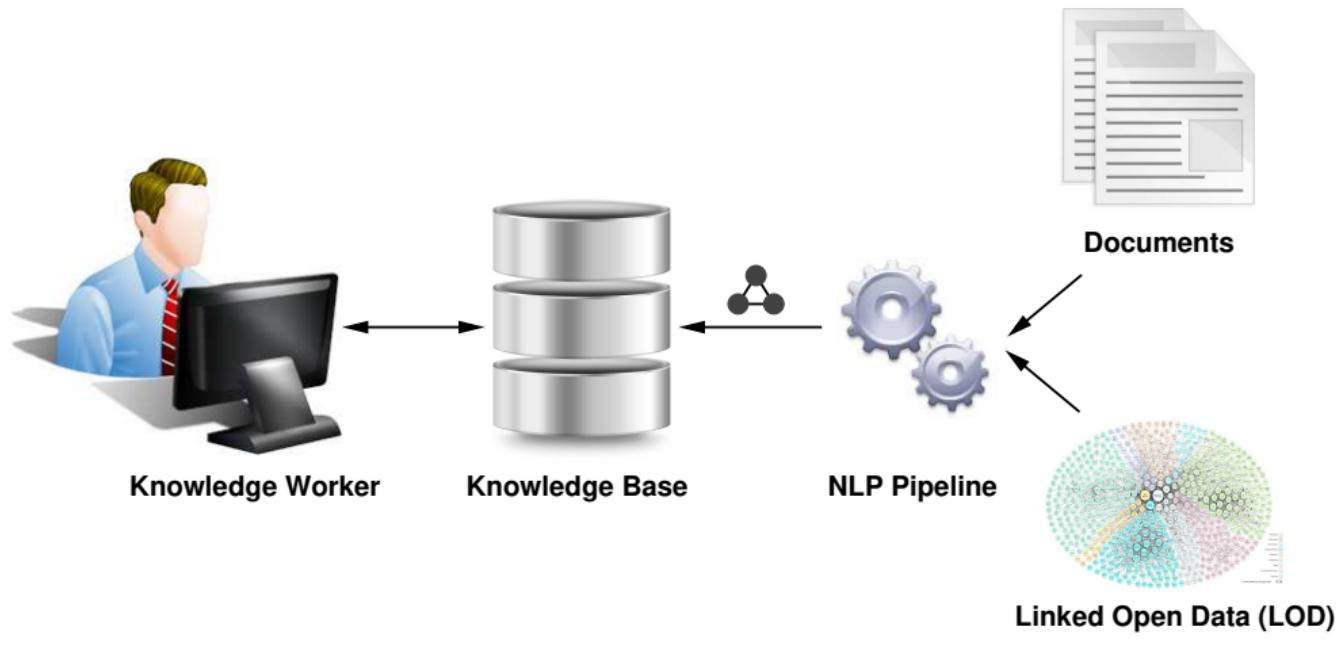
Summary

4 Notes and Further Reading

Notes and Further Reading

Knowledge Management Architecture 3.0

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[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

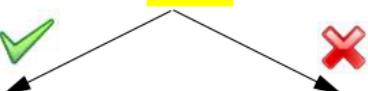
[Open Graph Protocol](#)

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[Summary](#)

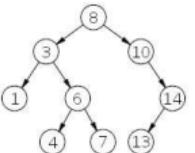
[Notes and Further Reading](#)

"The proposed approach takes advantage of both the efficient computation of the tree architecture ..."



[http://dbpedia.org/resource/Tree_\(data structure\)](http://dbpedia.org/resource/Tree_(data%20structure))

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



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[Dbpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, Dbpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

“What is a group of moose”

tap to edit

It's Jared Padalecki.

Jared Padalecki

American actor

Jared Tristan Padalecki (born July 19, 1982) is an American actor. He is best known for his role as Sam Winchester on *Supernatural*. He grew up in Texas and rose to fame in the early 2000s after appearing on the



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

TEXT ANALYTICS SERVICE

Intelligent Tagging

Making data smarter: using natural language processing, text analytics, and data-mining technologies, Intelligent Tagging turns large amounts of unstructured data into precise advantage.

[Request product details](#)

Intelligent Tagging enables quicker and smarter search of information that is important and relevant to your business

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Why choose Intelligent Tagging?

Intelligent Tagging uses natural language processing, text analytics and data-mining technologies to derive meaning from vast amounts of unstructured content. It's the fastest, easiest and most accurate way to tag the people, places, facts and events in your data, and then assign financial topics and themes to increase your content's value, accessibility and interoperability.

USEFUL LINKS

[Live demo](#)[Developer support](#)

Worksheet #4: Task 6



DBpedia Spotlight

Shedding light on the web of documents

It is a tool for automatically annotating mentions of DBpedia resources in text, providing a solution for linking unstructured information sources to the Linked Open Data cloud through DBpedia.



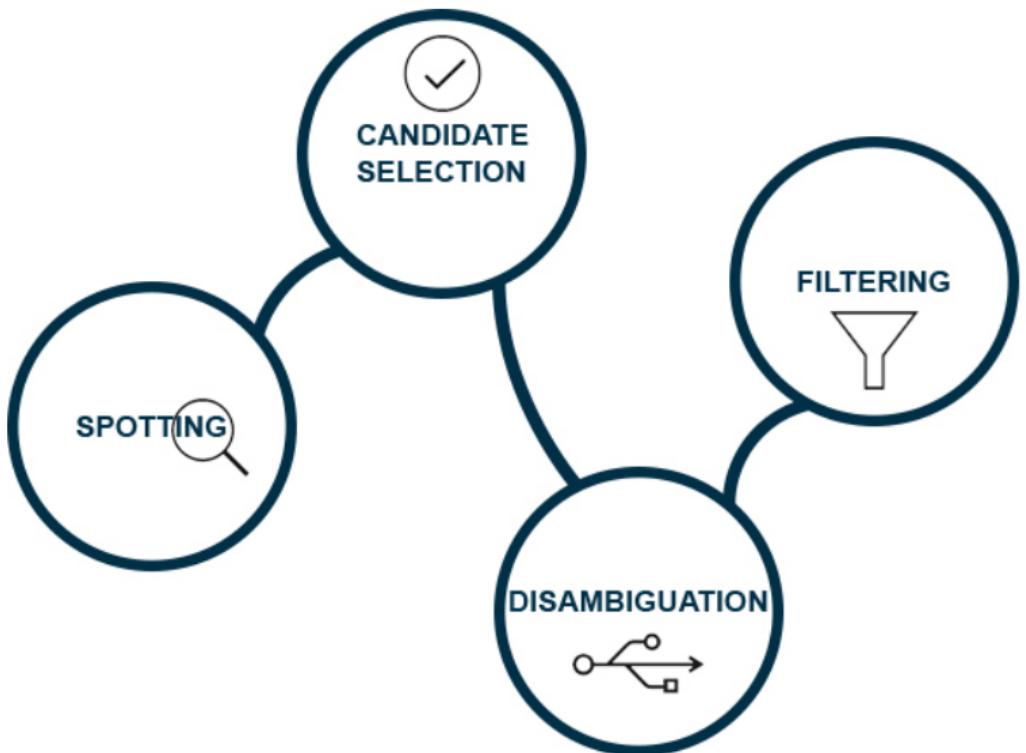
[About](#) [Documentation](#) [Acknowledgements](#) [Publications](#) [Contact](#)



How Does the Tool Work?

With a four step approach, DBpedia Spotlight performs named entity extraction, including [entity detection](#) and [name resolution](#). It can also be used for [named entity recognition](#), amongst other [information extraction](#) tasks.

[Learn More](#)



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

DBpedia Spotlight: Disambiguation

René Witte



The screenshot shows the DBpedia Spotlight interface. At the top is the logo with a yellow lightbulb icon. Below it are configuration options: a 'Confidence' slider set to 0.15, a 'Language' dropdown set to English, and a checked checkbox for 'n-best candidates'. There are also 'SELECT TYPES...' and 'ANNOTATE' buttons. The main area displays the text 'Paris Hilton is visiting the Hilton in Paris.' with each word in a separate box, indicating entities found by the service. A 'BACK TO TEXT' button is at the bottom right. A note at the bottom states: 'This demo uses the statistical DBpedia Spotlight web service at <https://api.dbpedia-spotlight.org/en>'.

→ Worksheet #4: Task 7

[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

Approach

Spotlight uses a [statistical model](#) for disambiguation

- Using the context of a word/phrase
- Learned from the Wikipedia pages including the links (for multiple languages)

A 2012 paper reports a 85.1% accuracy for English (with 7.4% missing links)

Discussion

- Modern approaches for disambiguation use [word embeddings](#) (discussed later in the course), with better performance
- However, *Spotlight* is a stable, easy-to-install tool and useful for first experiments

Improving Efficiency and Accuracy in Multilingual Entity Extraction,
<https://doi.org/10.1145/2506182.2506198>

[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

1 Linked Open Data (LOD)

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

2 Knowledge Base Construction

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

3 Knowlege Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Facebook's Open Graph Protocol

Google's Knowledge Graph

Summary

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph

Summary

4 Notes and Further Reading

Notes and Further Reading

[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph Summary](#)

[Notes and Further Reading](#)

RDF Data and Web Pages? (RDFa, microdata, microformats, GRDDL)



Photo credit "shetladd", Flickr

www.ivan-herman.net/foaf-rdfa-1.1/foaf.html

Delicious LocalData TR 2012 My Mercurial Private Mailing lists Social SW Python RDFa it! Bookmarks

Ivan Herman +



Ivan Herman

Who am I?

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Before joining W3C I worked in quite different areas (distributed and dataflow programming, language design, system programming), but I spend most of my research years in computer graphics and information visualization. I also participated in various graphics related ISO standardization activities and software developments. My "professional" home page contains a list of [my publications](#) (see also [my Mendeley account](#)), [my public presentations](#), and details of the various projects I participated in the past. There is also a [dblp entry](#) for my publications generated automatically (although I am not sure it is complete...). (B.t.w., based on my publications, my Erdős number is ≤4...)

In my previous life (i.e., before joining W3C...) I was member of the Executive Committee of the [Eurographics Association](#) for 15 years, and I was vice-chair of the Association between 2000 and 2002. I was the co-chair of the 9th [World Wide Web Conference](#), in Amsterdam, May 2000; since then, I have also been member of [IW3C2](#) ([International World Wide Web Conference Committee](#)), responsible for the World Wide Web Conference series. Since autumn 2007 I am also member of [SWSA \(Semantic Web Science Association\)](#), the committee responsible for the International Semantic Web Conferences (better known as "ISWC") series.

Some personal data

- The Hungarian spelling of my full name is Herman Iván. Ie, my name is Ivan (well, spelled properly: Iván) and my surname is Herman (many in the Netherlands and in Germany mix it up, and use "Herman" as my name... this is aggravated by the fact that, uniquely in Europe, the Hungarian custom is to put surname first).
- Nationalities: French and Hungarian
- Gender: male
- Family: I am married and have a son, David.
- Date and city of birth: 24th February, 1955, [Budapest](#), Hungary
- Email addresses: 'ivan' on my own ivan-herman.net domain, 'ivan' on the w3.org domain, or 'ivan.herman' on the cwi.nl domain
- (Mobile) Phone: +31-641044153
- Skype ID: ivan_herman
- I live in [Amstelveen](#) (see also [geonames](#)), the Netherlands (lat: 52.302063, long: 4.87397). This is a suburb of [Amsterdam](#). The closest airport is Amsterdam Schiphol
- I am the administrator of the Semantic Web Activity Blog at W3C which can either be [accessed directly](#) or via its



some links

- [personal homepage](#)
- more data on me
- [personal blog \(RSS feed\)](#)
- [homepage at W3C](#)
- "professional" homepage
- "official" CV
- [more about me](#)
- [my photos](#)

"social" links

- [facebook](#)
- [flickr](#)
- [picasa web](#)
- [linkedin](#)
- [IW3C2](#)
- [tripit](#)
- [twitter](#)
- [Mendeley](#)
- [Google+](#)
- [freebase](#)

www.ivan-herman.net/foaf-rdfa-1.1/foaf.html

Ivan Herman

- Delicious
- LocalData
- TR
- 2012
- My Mercurial
- Private
- Mailing lists
- Social
- SW
- Python
- RDFa it!
- Bookmarklets



Ivan Herman

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- Email addresses: 'ivan' on my own ivan-herman.net domain, 'ivan' on the w3.org domain, or 'ivan.herman' on the cwi.nl domain
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some links

- [personal homepage](#)
- [more data on me](#)
- [personal blog \(RSS feed\)](#)
- [homepage at W3C](#)
- ["professional" homepage](#)
- ["official" CV](#)
- [more about me](#)
- [my photos](#)

"social" links

- [facebook](#)
- [flickr](#)
- [picasa web](#)
- [linkedin](#)
- [IWIW](#)
- [tripit](#)
- [twitter](#)
- [Mendeley](#)
- [Google+](#)
- [freebase](#)



Ivan Herman

Who am I?

I graduated as mathematician at the **Eötvös Loránd University of Budapest**, Hungary, in 1979. After the Université Paris VI I joined the Hungarian research institute in computer science (**SZTAKI**) (and turned into a computer scientist...). I left Hungary in 1986 and, after a few years¹ joined the **Centre Mathematics and Computer Sciences (CWI)** in Amsterdam where I received a PhD degree in Computer Science in 1990 at the **University of Leiden**.
Web Consortium (W3C) Team as Head of W3C Offices in January 2006.
Head of Offices until June 2006, when I was asked to take
principal work at W3C.

```
<div>
  <h1> ...
  <meta ...>
  <h2>Who am I?
  <p>I graduated ...
  I joined the <a rel="dc:contributor">
    <span property="dc:title">
      </a> Team as Head of <a rel="dc:subject"> ...
  <link rel="owl:sameAs" href="..."/>
  <link rel="owl:sameAs" href="http://www.w3.org/2000/01/rdf-schema#label"/>
  <link rel="foaf:workplaceHomepage" href="http://www.w3.org/"/>
  <meta property="schema:jobTitle" content="...
  <p>Before joining W3C I worked in quite different ...
  </p>
```

<p>In my previous life (i.e., before joining W3C...)

```
</p>
<h2>
Some personal data
</h2>
<ul>
```

```
<li>The Hungarian spelling of my full name is <span prop-  
    ie, my name is <span property="foaf:givenname schema:givenName">  
        <span property="foaf:surname schema:familyName">Herman</span>  
(many in the Netherlands and in Germany mix it up, and use  
</li>
```

name is Ivan (well, spelled properly: Iván) and my mix it up, and use "Herman" as my name... this is custom is to put surname first).

I am a member of the Eurographics Association as the co-chair of the 9th World Wide Web of IW3C2 (International World Wide Web). Since autumn 2007 I am also member of the International Semantic Web Conferences.

language design, system information visualization. I also implement My "professional" home [presentations](#), and details of the various automated (although I am not

After receiving scholarship at worked for 6 years Munich, Germany, I position since 1988. I joined the World Wide position at CWI. I served as position, which is now my



some links

- personal homepage
 - more data on me
 - personal blog (RSS feed)
 - homepage at W3C
 - "professional" homepage
 - "official" CV
 - more about me
 - my photos

"social" links

- facebook
 - flickr
 - picasa web
 - linkedin
 - IWIW
 - tripit
 - twitter
 - Mendeley
 - Google+
 - firebase



```
<meta property="foaf:accountName" content="ivan-herman" />
</a>
</li>
<li>
  <a href="https://plus.google.com/u/0/113268051484517627727" typeof="foaf:OnlineAccount">
    <span property="foaf:accountServiceHomepage" href="http://www.mendeley.com/">Google+</span>
    <meta property="foaf:accountName" content="113268051484517627727" />
  </a>
</li>
<li>
  <a about="http://www.ivan-herman.net/foaf#me" rel="owl:sameAs" resource="http://rdf.freebase.com/ns/en.113268051484517627727" type="foaf:Person">
    <span property="foaf:name" href="http://www.ivan-herman.net/foaf#me">Ivan Herman</span>
    <span property="foaf:title" href="http://www.ivan-herman.net/foaf#me">Dr.</span>
    <span property="foaf:workplaceHomepage" href="http://www.ivan-herman.net/foaf#me">Who am I?</span>
    <span property="foaf:alumniOf" href="http://www.elte.hu/">I graduated as mathematician at the World Wide Web Consortium (W3C)</span>
    <span property="foaf:pastProject" href="http://www.w3.org/Consortium/Offices">Team as Head of Team as Head of</span>
    <span property="foaf:givenName" href="http://www.ivan-herman.net/foaf#me">Ivan</span>
    <span property="foaf:familyName" href="http://www.ivan-herman.net/foaf#me">Herman</span>
    <span property="foaf:accountName" href="https://plus.google.com/u/0/113268051484517627727">Google+</span>
  </a>
</li>
</ul>
</div>

<div id="content" >
  <h1 property="schema:name foaf:name">Ivan Herman</h1>
  <meta property="foaf:title" content="Dr." />
  <h2>Who am I?</h2>
  <p>I graduated as mathematician at the <a rel="foaf:schoolHomepage schema:alumniOf" href="http://www.elte.hu/"><span>World Wide Web Consortium (W3C)</span></a> Team as Head of <a rel="foaf:pastProject" href="http://www.w3.org/Consortium/Offices"><span property="dc:title">Team as Head of</span><span property="foaf:givenName" href="http://www.ivan-herman.net/foaf#me">Ivan</span><span property="foaf:familyName" href="http://www.ivan-herman.net/foaf#me">Herman</span></a> Team as Head of</p>
  <link rel="owl:sameAs" href="http://www.ivan-herman.net/Ivan_Herman" />
  <link rel="foaf:workplaceHomepage" href="http://www.w3.org/">
  <meta property="schema:jobTitle" content="Semantic Web Activity Lead" />

  <p>Before joining W3C I worked in quite different areas (distributed and dataflow programming, language design, system design, ...)</p>
  <p>In my previous life (i.e., before joining W3C...) I was member of the Executive Committee of the <a rel="foaf:pastProject" href="http://www.w3.org/Consortium/Offices"><span property="dc:title">Executive Committee</span></a> Team as Head of</p>
  <h2>Some personal data</h2>
  <ul>
    <li>The Hungarian spelling of my full name is <span property="foaf:name" lang="hu">Herman Iván</span>. Ie, my name is <span property="foaf:givenName schema:givenName" href="http://www.ivan-herman.net/foaf#me">Ivan</span> (well, spelled properly: <span property="foaf:givenName schema:givenName" lang="hu">Iván</span>) and my surname is <span property="foaf:familyName schema:familyName" href="http://www.ivan-herman.net/foaf#me">Herman</span>. Many in the Netherlands and in Germany mix it up, and use "Herman" as my name... this is aggravated by the fact that I have two surnames</li>
  </ul>
</div>
```

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBped

The LOD Cloud

Linked Data De

Summary

Knowledge B

Construction

Some History

Freebase, DBpedia &

WIKIDATA

Publishing Options and Workflows

Relational Databases and

RDF

Competency Question

Knowledge Base
Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open-Source Protocol

REFERENCES

ANSWER MESSAGE

Summary

Notes and Further Reading

In a slightly more readable format...

```
<html>
  ...
<body prefix="schema: http://schema.org/
            foaf:   http://xmlns.com/foaf/0.1/"

<div about="http://www.ivan-herman.net/foaf#me" ... >
  ...
  <p>I graduated as mathematician at the
    <a rel="foaf:schoolHomepage schema:alumniOf"
       href="http://www.elte.hu/">
      <span property="dc:title">Eötvös Loránd University of
        Budapest</span>
    </a>, ...
  ...
</div>
```

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

In a slightly more readable format...

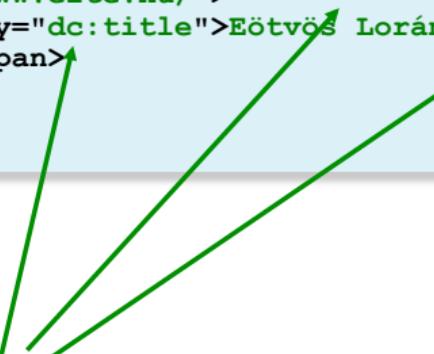
```

<html>
  ...
<body prefix="schema: http://schema.org/
            foaf:  http://xmlns.com/foaf/0.1/">
  ...
  <div about="http://www.ivan-berman.net/foaf#me" ... >
    ...
    <p>I graduated as mathematician at the
      <a rel="foaf:schoolHomepage schema:alumniOf"
         href="http://www.elte.hu/">
        <span property="dc:title">Eötvös Loránd University of
          Budapest</span>
      </a>, ...
    ...
  ...

```

Triple

Triple



[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google's Knowledge Graph](#)

[Summary](#)

[Notes and Further Reading](#)

Yielding...

```
<http://www.ivan-herman.net/foaf#me>
    schema:alumniOf      <http://www.elte.hu> ;
    foaf:schoolHomePage <http://www.elte.hu> ;
    schema:worksFor     <http://www.w3.org/W3C#data> ;
    ...
<http://www.elte.hu>
    dc:title "Eötvös Loránd University of Budapest" .
...
<http://www.w3.org/W3C#data>
    dc:title "World Wide Web Consortium (W3C)" 
...
```

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

Extracting Structured Data

René Witte



Google Structured Data Testing Tool



Sign in

Test your structured data



FETCH URL

CODE SNIPPET



Enter a URL

RUN TEST

Explore the [Search Gallery](#).

Find out more about this tool.

→ Worksheet #4: Task 8

NEW TEST



Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

1 Linked Open Data (LOD)

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

2 Knowledge Base Construction

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

3 Knowlege Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Facebook's Open Graph Protocol

Google's Knowledge Graph

Summary

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph

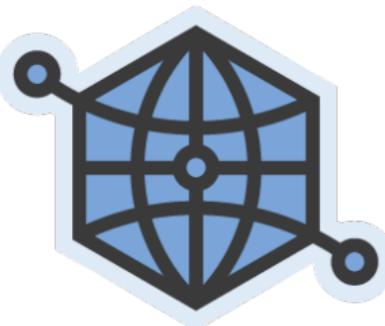
Summary

4 Notes and Further Reading

Notes and Further Reading

Idea

- Turn web page into graph object
- Provide rich information when pages are “shared”
- Similar idea to schema.org, except now Facebook is the consumer (instead of search engines)
- Vocabulary at <http://ogp.me/ns#>



Used together with the “Like” button

- When clicked, Facebook creates a connection in its graph between the page and the user
- If the user was logged in, add information to user’s profile

Facebook Graph Search

- Facebook provided public graph search functionality from 2013–2019
- These have been largely removed, most likely due to privacy reasons

[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

[Google’s Knowledge Graph Summary](#)

[Notes and Further Reading](#)

Example

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Page with OGP annotations

- Simple vocabulary for title, description, images, videos, music, etc.
- Added to meta-tags in HTML page
- Not using full RDF

```
<meta property="og:url" content="http://www.nytimes.com/2015/02/19/arts/international/when-great-minds-don't-think-alike.html" />
<meta property="og:type" content="article" />
<meta property="og:title" content="When Great Minds Don't Think Alike" />
<meta property="og:description" content="How much does culture influence creative thinking?" />
<meta property="og:image" content="http://static01.nyt.com/images/2015/02/19/arts/international/19iht-btnumbers19A/19iht-btnumbers19A-facebookJumbo-v2.jpg" />
```

See <https://developers.facebook.com/docs/sharing/webmasters/>

→ Worksheet #4: Task 9



Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

Google's Knowledge Graph

René Witte



Introducing the Knowledge Graph

<https://www.youtube.com/watch?v=mmQI6VGvX-c>

Linked Open Data (LOD)

- Queries Review
- The LOD Initiative
- DBpedia
- The LOD Cloud
- Linked Data Design Issues
- Summary

Knowledge Base Construction

- Some History
- Firebase, DBpedia & Wikidata
- Publishing Options and Workflows
- Relational Databases and RDF
- Competency Questions

Knowledge Base Applications

- Linking Documents and Knowledge Graphs
- Structured Data on the Web
- Open Graph Protocol

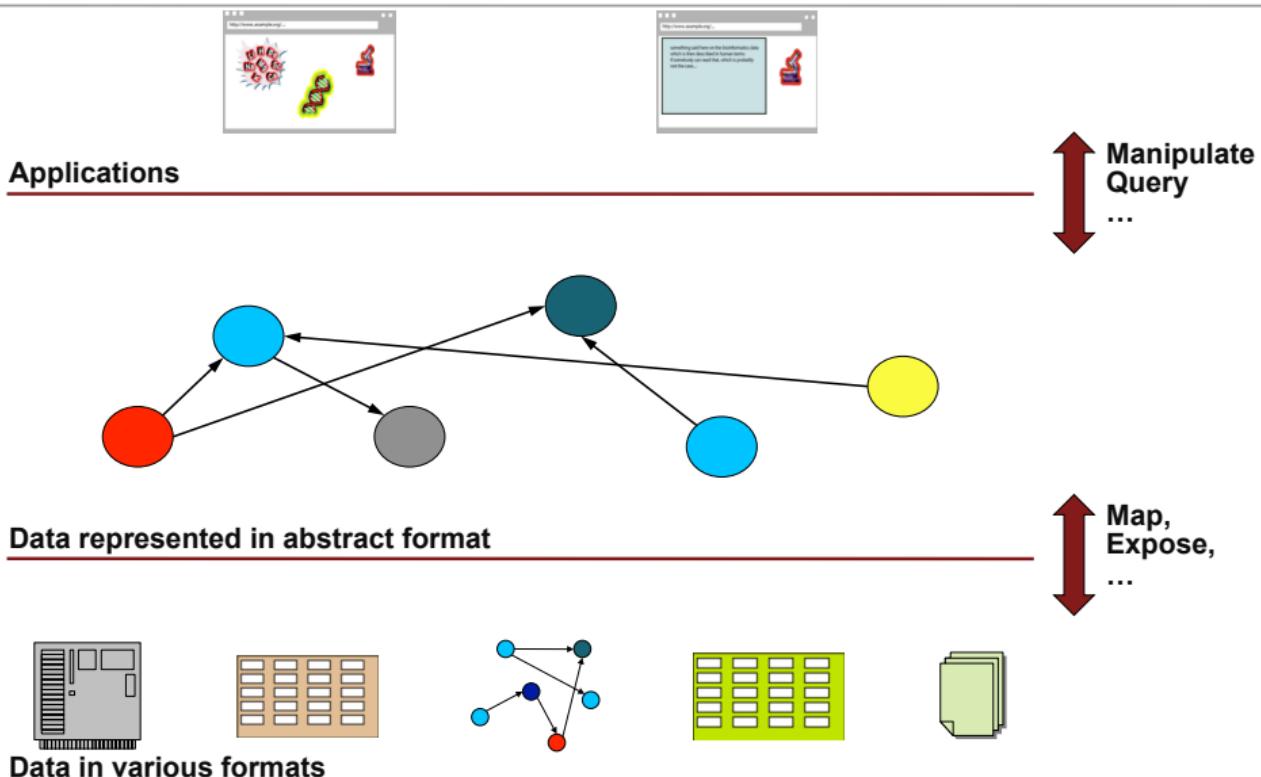
Google's Knowledge Graph

- Summary

Notes and Further Reading

What did we do?

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[Linked Open Data \(LOD\)](#)

[Queries Review](#)

[The LOD Initiative](#)

[DBpedia](#)

[The LOD Cloud](#)

[Linked Data Design Issues](#)

[Summary](#)

[Knowledge Base Construction](#)

[Some History](#)

[Freebase, DBpedia & Wikidata](#)

[Publishing Options and Workflows](#)

[Relational Databases and RDF](#)

[Competency Questions](#)

[Knowledge Base Applications](#)

[Linking Documents and Knowledge Graphs](#)

[Structured Data on the Web](#)

[Open Graph Protocol](#)

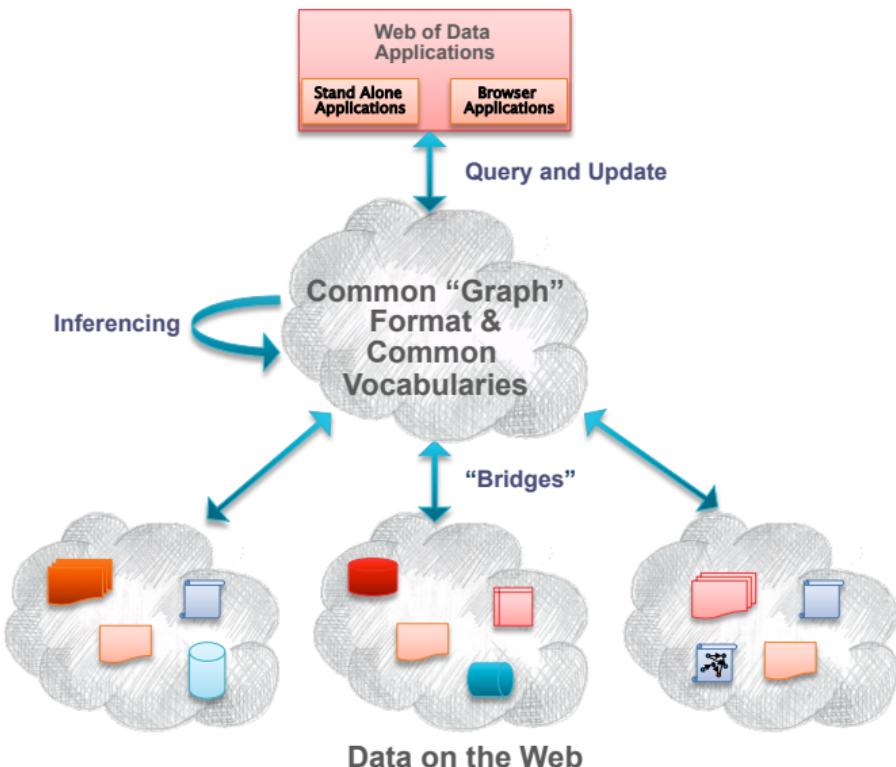
[Google's Knowledge Graph](#)

[Summary](#)

[Notes and Further Reading](#)

What did we do? (alternate view)

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Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph

Summary

Notes and Further Reading

- 1 Linked Open Data (LOD)
- 2 Knowledge Base Construction
- 3 Knowledge Base Applications
- 4 Notes and Further Reading

Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

Required

- [Yu14, Chapter 9] (Linked Open Data)
- [Yu14, Chapter 11.2] (Facebook's Open Graph Protocol)

Supplemental

- [HB11, WZRH14] (Books on Linked Data)
- [Yu14, Chapter 3.3] (RDFa)
- [Yu14, Chapter 8] (DBpedia)
- [Yu14, Chapter 12] (Wikidata)
- [HHDF20] (DBpedia Release Cycle)

Linked Open Data
(LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base
Construction

Some History

Freebase, DBpedia &
Wikidata

Publishing Options and
Workflows

Relational Databases and
RDF

Competency Questions

Knowledge Base
Applications

Linking Documents and
Knowledge Graphs

Structured Data on the Web
Open Graph Protocol

Google's Knowledge Graph
Summary

Notes and Further
Reading

References I

René Witte



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Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading

References II

René Witte



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Linked Open Data (LOD)

Queries Review

The LOD Initiative

DBpedia

The LOD Cloud

Linked Data Design Issues

Summary

Knowledge Base Construction

Some History

Freebase, DBpedia & Wikidata

Publishing Options and Workflows

Relational Databases and RDF

Competency Questions

Knowledge Base Applications

Linking Documents and Knowledge Graphs

Structured Data on the Web

Open Graph Protocol

Google's Knowledge Graph Summary

Notes and Further Reading