WWW 2011

29th March 2011, Hyderabad, India

4th Linked Data on the Web Workshop (LDOW 2011)

Christian Bizer, Freie Universität Berlin, Germany

Tom Heath, Talis, UK

Tim Berners-Lee, W3C/MIT, USA

Michael Hausenblas, Richard Cyganiak, DERI, Irland

Programme

Introduction

- 9:00-9:25: **Introduction to the Workshop and Overview of the State of the Web of Data**
  (Christian Bizer, Tom Heath, Tim Berners-Lee, Michael Hausenblas)

Session 1: Publishing Linked Data

- 9:25-9:45: **A Privacy Preference Ontology (PPO) for Linked Data**
  (Owen Sacco, Alexandre Passant)
- 9:45-10:10: **Publishing Provenance Information on the Web using the Memento Datetime Content Negotiation**
  (Sam Coppens, Erik Mannens, Davy Van Deursen, Patrick Hochstenbach, Bart Janssens, Rik Van De Walle)

Coffee Break

- 10:10-10:40

Programme

Session 2: Infrastructure and Architectures

- 10:40-11:00: **Augmenting the Web of Data using Referers**
  (Hannes Mühleisen , Anja Jentzsch)
- 11:00-11:25**: RESTful writable APIs for the web of Linked Data using relational storage solutions**
  (Antonio Garrote, María N. Moreno García)
- 11:25-11:50: **How Caching Improves Efficiency and Result Completeness for Querying Linked Data**
  (Olaf Hartig)
- 11:50-12:15: **A Main Memory Index Structure to Query Linked Data**
  (Olaf Hartig, Frank Huber)

Lunch Break

- 12:15-14:00

Programme

Session 3: Linked Data Applications

- 14:00-14:20: **LiDDM: A Data Mining System for Linked Data**
  (Venkata Narasimha Pavan Kappara, Ryutaro Ichise, Vyas O.P.)
- 14:20-14:45: **Talash: Friend Finding In Federated Social Networks**
  (Ruturaj Dhekane, Brion Vibber)
- 14:45-15:05: **Automatically Annotating Text with Linked Open Data**
  (Delia Rusu, Blaz Fortuna, Dunja Mladenic)

15:05-15:30: Coffee Break

Programme

Session 4: Exploiting the Web of Data as a Whole

- 15:30-15:50**: Identifying Relevant Sources for Data Linking using a Semantic Web Index**
  (Andriy Nikolov, Mathieu D'Aquin)
- 15:50-16:15: **Re-using Cool URIs: Entity Reconciliation Against LOD Hubs**
  (Fadi Maali, Richard Cyganiak, Vassilios Peristeras)
- 16:15-16:40: **Open eBusiness Ontology Usage: Investigating Community Implementation of GoodRelations**
  (Jamshaid Ashraf, Richard Cyganiak, Sean O'Riain, Maja Hadzic)

Discussion

- 16:40-17:40: **Next Steps and Research Challenges for Linked Data**

LOD Gathering / Workshop Dinner

- 19:00: **La Cantina (next to the pool)**

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State of the Web of Data

Christian Bizer, Freie Universität Berlin, Germany
Anja Jentzsch, Freie Universität Berlin, Germany
Richard Cyganiak, DERI, Irland

Statistics based on …

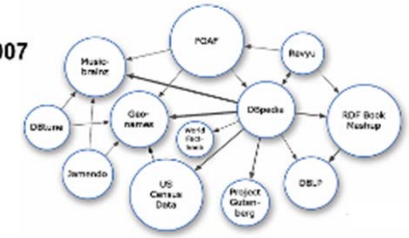
- **LOD Data Set Catalog on CKAN**
  - http://www.ckan.net/group/lodcloud
- **LOD Dataset Page in ESW Wiki**
  - http://esw.w3.org/topic/TaskForces/CommunityProjects/LinkingOpenData/DataSets

- **Detailed statistics available at**
  - http://lod-cloud.net/state/
- **Guidelines for adding your own datasets**
  - http://esw.w3.org/TaskForces/CommunityProjects/LinkingOpenData/DataSets/CKANmetainformation

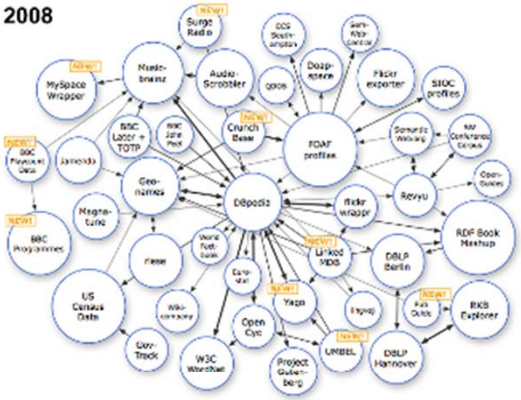
1. Growth

Growth of the Web of Data

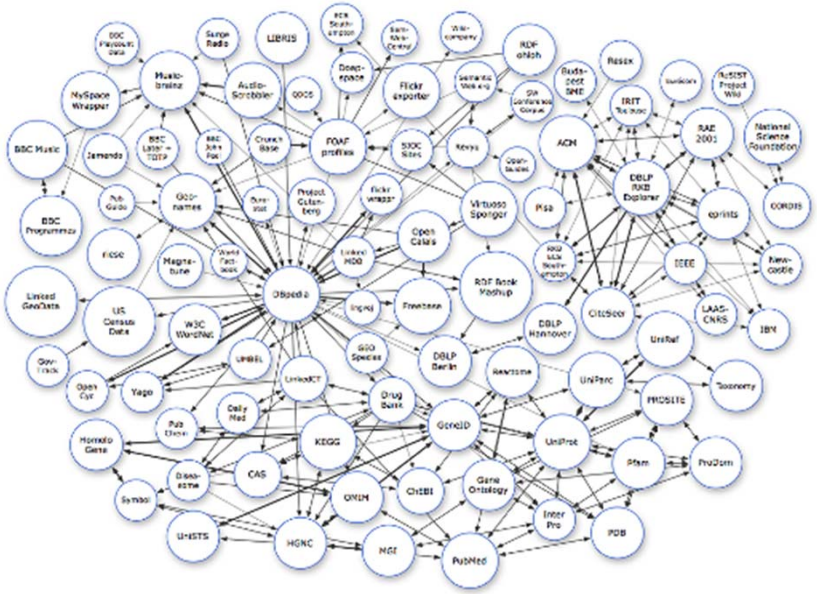
May 2007



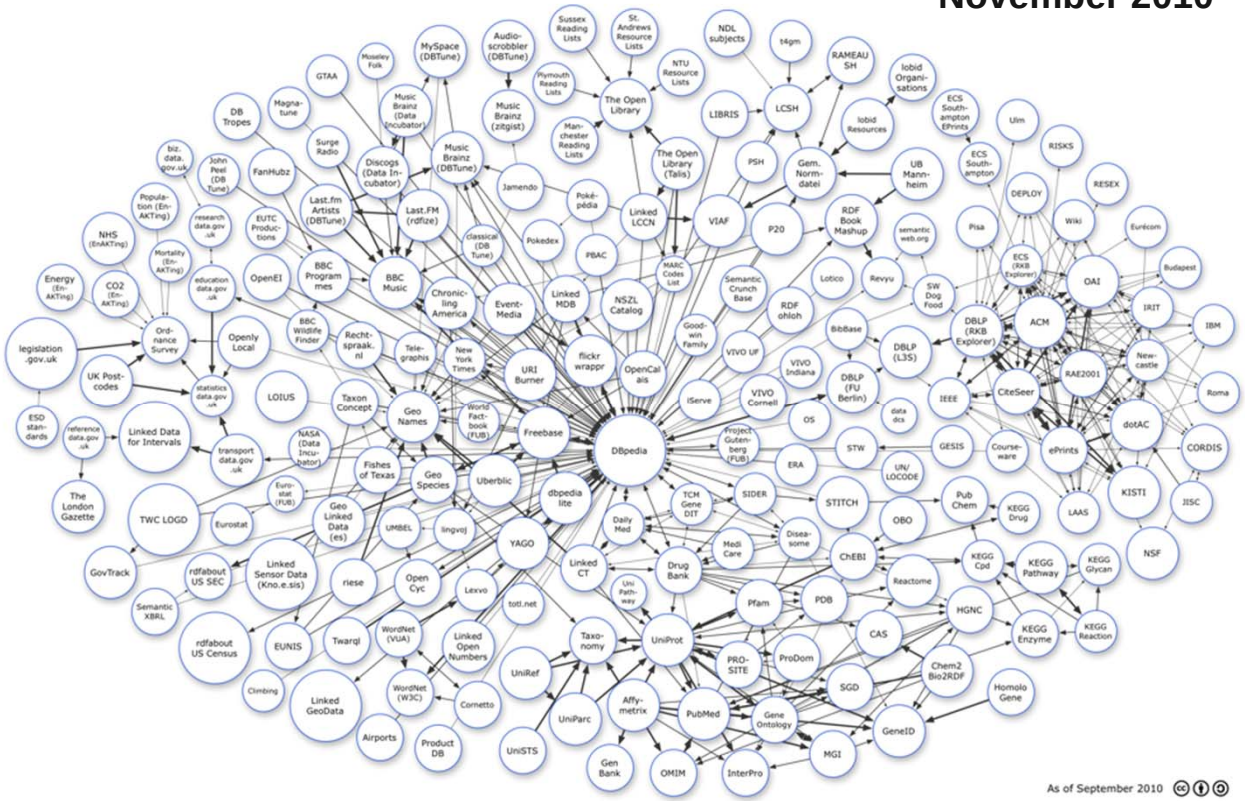
September 2008



July 2009

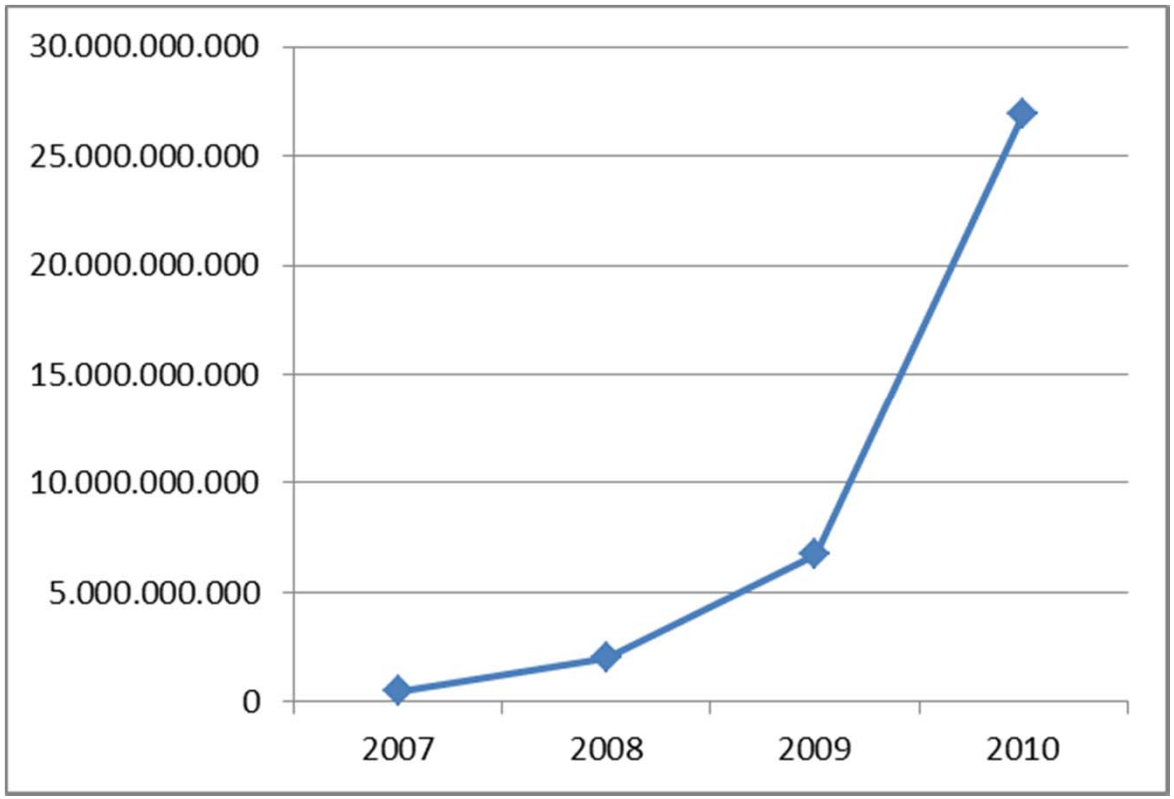


November 2010



The Growth in Numbers

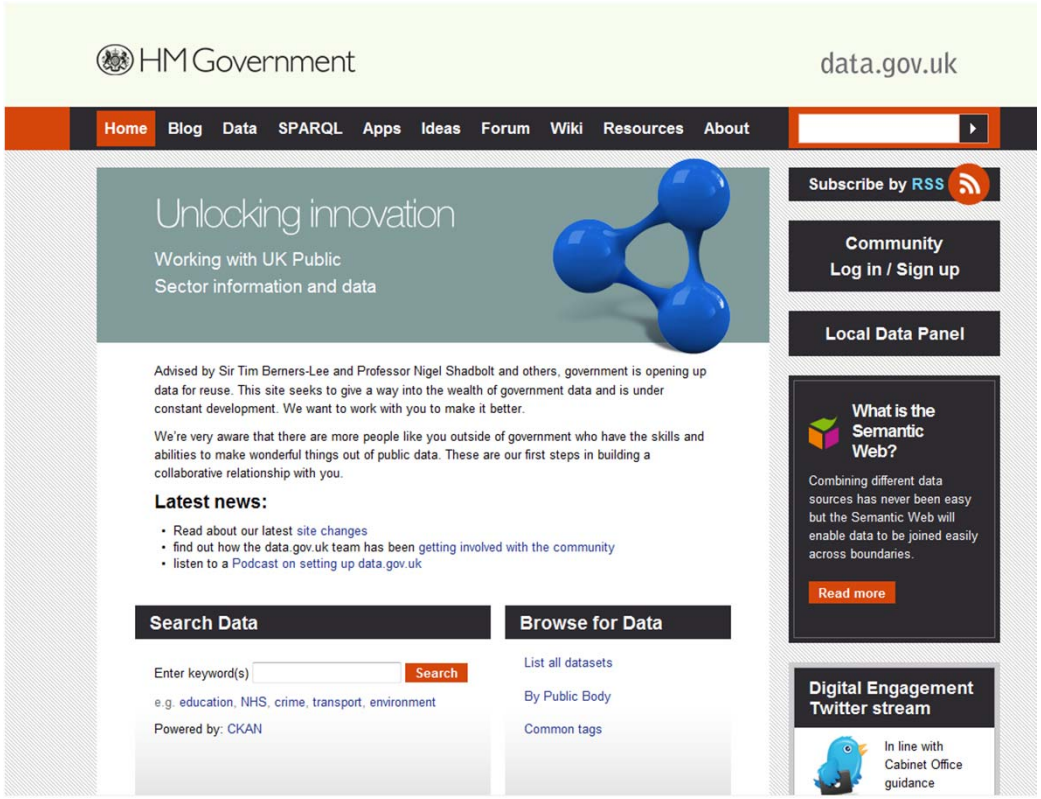
Year	Datasets	Triples	Growth
2007	12	500.000.000	
2008	45	2.000.000.000	300%
2009	95	6.726.000.000	236%
2010	203	26.930.509.703	300%



The Growth by Domain 2009-2010

Domain	Triples (June 2009)	Triples (Nov 2010)	Growth
Geographic	3.097.000.000	5.904.980.833	91%
Libraries	212.000.000	2.237.435.732	**955%**
Media	698.000.000	2.453.898.811	252%
Life sciences	2.429.000.000	2.664.119.184	10%
Cross-domain	214.000.000	1.999.085.950	834%
User-generated	76.000.000	57.463.756	-24%
Government	0	**11.613.525.437**	-
Total	**6.726.000.000**	**26.930.509.703**	**300%**

Uptake in the Government Domain



- The EU is pushing Linked Data (LOD2, LATC, EuroStat)
- W3C eGovernment Interest Group

Uptake in the Libraries Community

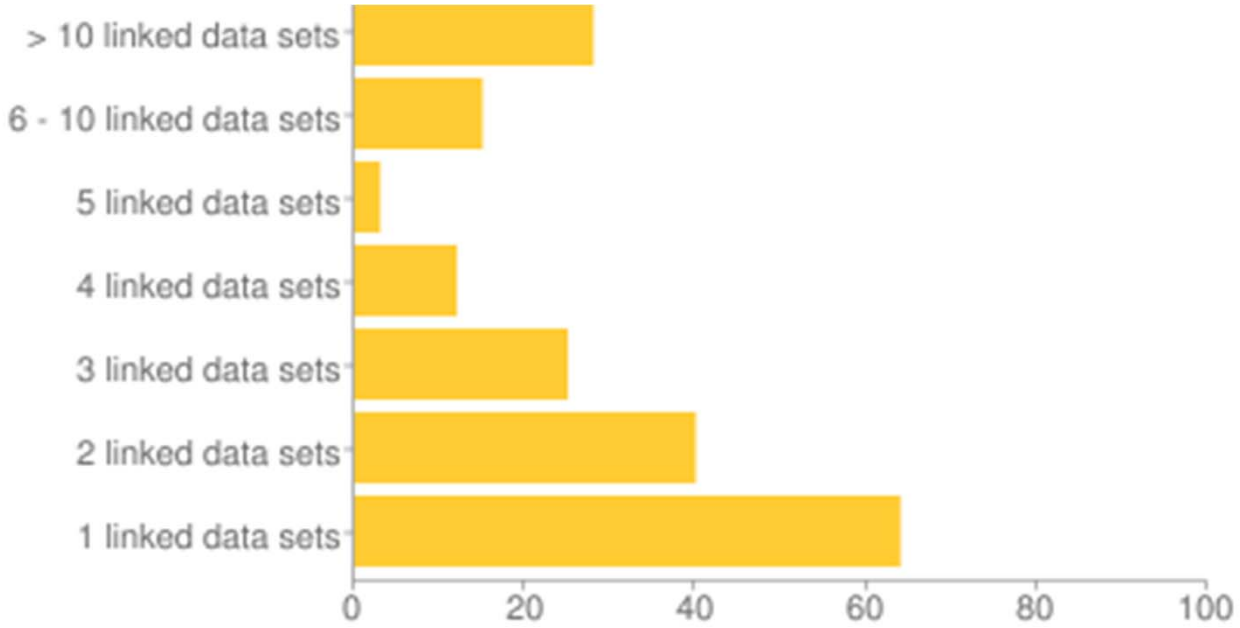
- **Institutions publishing Linked Data**
  - Library of Congress (subject headings)
  - German National Library (PND dataset and subject headings)
  - Swedish National Library (Libris - catalog)
  - Hungarian National Library (OPAC and Digital Library)
  - Deutschen Zentralbibliothek für Wirtschaftswissenschaften (subject headings)
- **The Europeana project is moving towards Linked Data**
- **W3C Library Linked Data Incubator Group**

2. Compliance with Best Practices

RDF Links between Datasets

Number of outgoing links per data set

Number of linked target data sets



Provenance and Licensing Metadata

Licensing Metadata

- 18 (9.05 %) out of the 207 data sources provide machine-readable licensing information.
- 181 (90.95 %) out of the 207 data sources do not provide machine-readable licensing information.

Provenance Metadata

- 50 (25.25 %) out of the 207 data sources provide machine-readable provenance information.
- 148 (74.75 %) out of the 207 data sources do not provide machine-readable provenance information.

Usage of Common Vocabularies

Prefix	Namespace	Used by
dc	http://purl.org/dc/elements/1.1/	66 (31.88 %)
foaf	http://xmlns.com/foaf/0.1/	55 (26.57 %)
dcterms	http://purl.org/dc/terms/	38 (18.36 %)
skos	http://www.w3.org/2004/02/skos/core#	29 (14.01 %)
akt	http://www.aktors.org/ontology/portal#	17 (8.21 %)
geo	http://www.w3.org/2003/01/geo/wgs84_pos#	14 (6.76 %)
mo	http://purl.org/ontology/mo/	13 (6.28 %)
bibo	http://purl.org/ontology/bibo/	8 (3.86 %)
vcard	http://www.w3.org/2006/vcard/ns#	6 (2.90 %)
frbr	http://purl.org/vocab/frbr/core#	5 (2.42 %)
sioc	http://rdfs.org/sioc/ns#	4 (1.93 %)

Publish Vocabulary Mappings on the Web

- **Map proprietary terms to other vocabularies using**
  - owl:equivalentClass, owl:equivalentProperty
  - rdfs:subClassOf, rdfs:subPropertyOf

```
<http://xmlns.com/foaf/0.1/Person>
owl:equivalentClass
<http://dbpedia.org/ontology/Person> .
```

- **Currently 9 (7.32 %) out of the 123 data sources that use proprietary terms provide mappings to other vocabularies for their terms.**

3. Conclusions

For Data Publishers

- **Make your data easily consumable by following Best Practices concerning**
  - RDF Links
  - Licensing and Provenance Metadata
  - Widely-used Vocabularies
  - Publication of Vocabulary Mappings on the Web

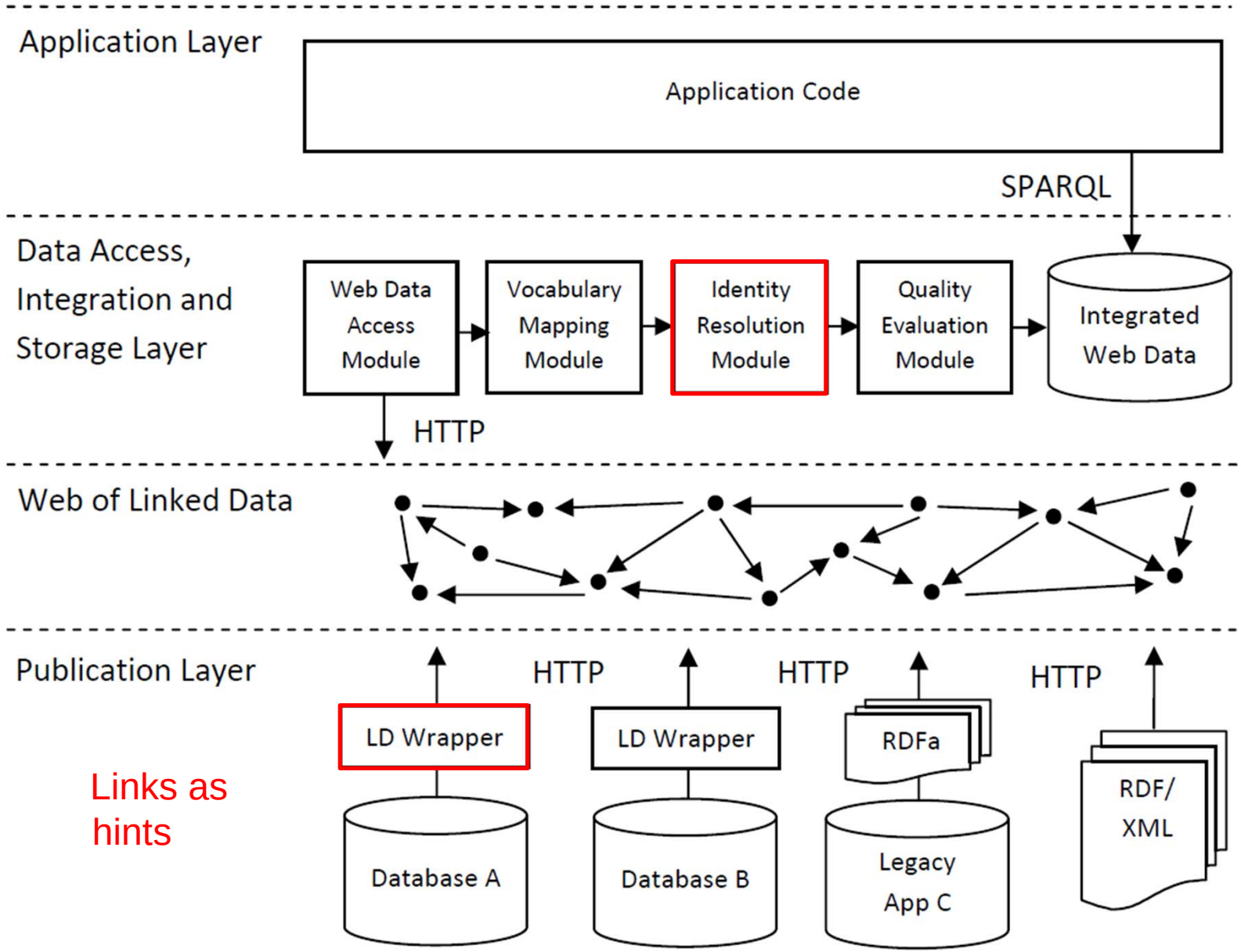
- **Problem: This requires effort ☹**

Effort Distribution between Publisher and Consumer

Consumer data mines links

Effort Distribution

Publisher provides links

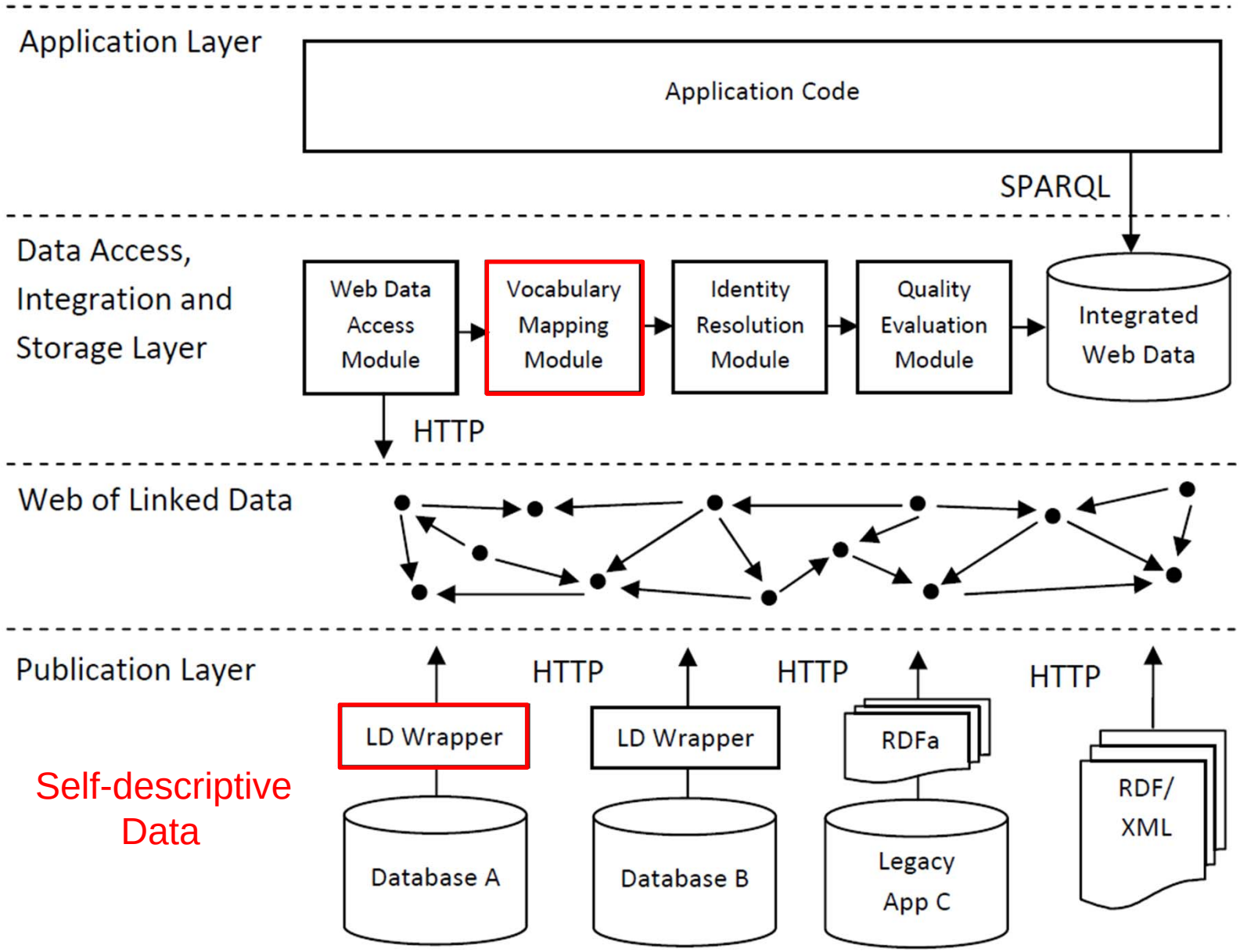


Effort Distribution between Publisher and Consumer

Consumer data mines mappings

Effort Distribution

Publisher reuses vocabularies and provides mappings



Somebody-Pays-As-You-Go

The overall data integration effort is split between the data publisher, the data consumer and third parties.

Data Publisher

- publishes data as RDF
- publishes data in a self-descriptive fashion
- sets links and publishes mappings

Third Parties

- set links pointing at your data
- publish mappings to the Web

Data Consumer

- has to do the rest
- using data mining techniques for identity resolution and schema matching

Thanks!

References

- **State of the LOD Cloud Document**
  http://lod-cloud.net/state/
- **Linked Data - Evolving the Web into a Global Data Space Book**
  http://linkeddatabook.com/

Lessons Learned and Next Steps

Topics

1. **Application Architectures (Summary: Tim)**
   - Lessons Learned
   - Future Directions
2. **Ontology and Vocabulary Deployment (Summary: Ivan)**
   - Lessons Learned
   - Future Directions
3. **Studying the Web of Data (Summary: Nigel)**
   - What approaches should we use?
   - What does Web Science contribute?
4. **Is Linked Data over-engineered and too complicated for the real-world? (Summary: Hugh)**
   - Should the standards be simplified?
   - Should the expectations concerning data providers be lowered?