



TECHNISCHE  
UNIVERSITÄT  
DRESDEN

# FOUNDATIONS OF SEMANTIC WEB TECHNOLOGIES

## Linked Data and Applications

Sebastian Rudolph



DRESDEN  
concept  
Institute for  
Knowledge  
and Data

# Agenda

- 1 Linked (Open) Data
- 2 Semantic Web and HTML
  - RDFa
  - Microformats
  - Google Knowledge Graph
- 3 OWL Applications
  - OWL DL Application EDF Energy
  - OWL Profile Application BBC World Cup
  - Semantic Technologies in the Pharmaceutical Industry
- 4 Summary

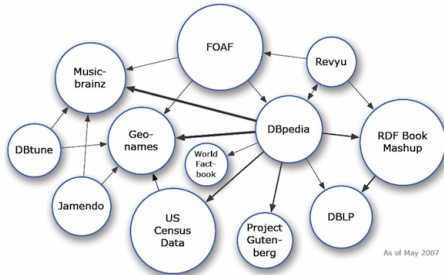
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## Data in the Web

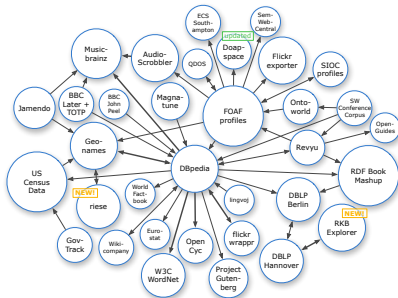
- more and more data is available in the Web for programmatic access
- often specified using Semantic Web Standards, e.g., the following Linking Open Data (LOD) Initiative  
`http://www.w3.org/wiki/SweoIG/TaskForces/CommunityProjects/LinkingOpenData`
- using APIs, e.g. via JSON/REST
- Semantic Web technologies simplify the integration of data from different sources
- combination of data leads to deeper insights

# Linked Data in the Web 01.05.2007



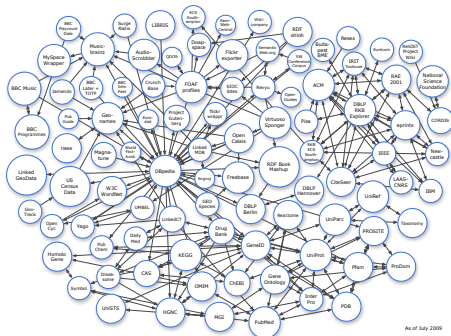
Linking Open Data cloud diagram, by Richard Cyganiak and Anja Jentsch. <http://lod-cloud.net/>

# Linked Data in the Web 31.03.2008



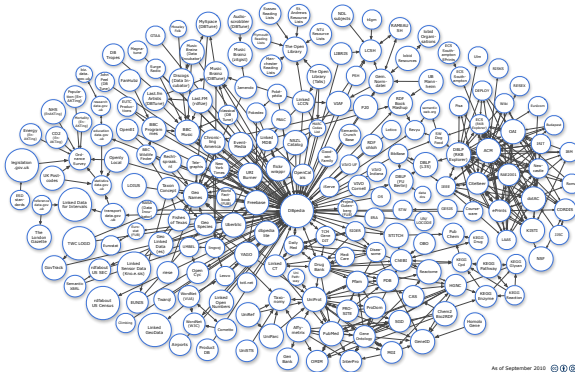
Linking Open Data cloud diagram, by Richard Cyganiak and Anja Jentzsch. <http://lod-cloud.net/>

# Linked Data in the Web 14.07.2009



Linking Open Data cloud diagram, by Richard Cyganiak and Anja Jentzsch. <http://lod-cloud.net/>

# Linked Data in the Web 22.09.2010

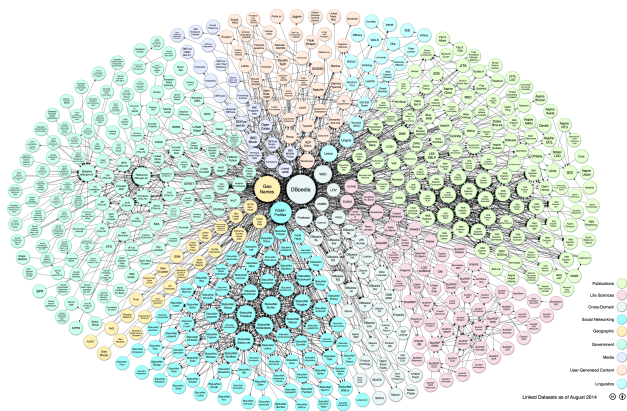


Linking Open Data cloud diagram, by Richard Cyganiak and Anja Jentzsch. <http://lod-cloud.net/>





# Linked Data in the Web 30.08.2014



Linking Open Data cloud diagram, by Richard Cyganiak and Anja Jentzsch. <http://lod-cloud.net/>

# Linked Data Principles\*

Linked Data consists mainly of a number of principles for publishing data in the Web:

- 1 Use URIs as names for things
  - documents, people, locations, concepts, etc.
- 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.

\*<http://www.w3.org/DesignIssues/LinkedData.html>

## 5 Star Linked (Open) Data

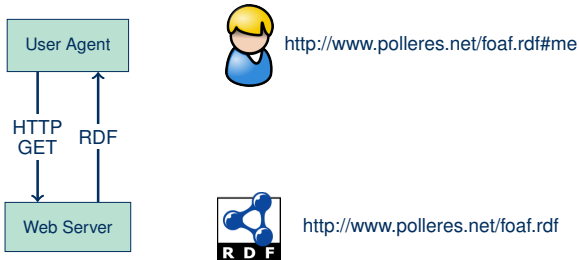
- ★ Available on the web (whatever format) but with an open licence, to be Open Data
- ★★ Available as machine-readable structured data (e.g. excel instead of image scan of a table)
- ★★★ as (2) plus non-proprietary format (e.g. CSV instead of excel)
- ★★★★ All the above plus, use open standards from 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

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

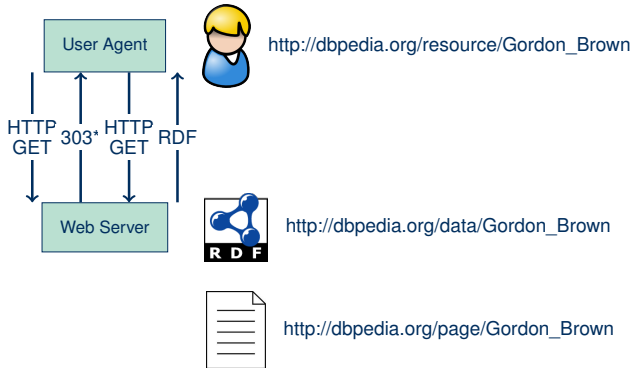
## De-Referencing of an IRI

- These IRIs can then be used also in other documents
- For example in the document `<http://ex.org/jones>`:  
`<#denise> fam:child <#edwin>`,  
`<http://ex.org/smith#carol> .`
- One can then extract the URL `<http://ex.org/smith>` from  
`<http://ex.org/smith#carol>` and find information about `#carol`  
from there

# Connection between the IRI of a Thing and IRI of a Source



# Connection between the IRI of a Thing and IRI of a Source



\*HTTP Response Code 303: See Other

# Representations

- Information resources can have different representations
- A representation is a stream of bytes in a certain format such as HTML, RDF/XML or JPEG
- Example: an invoice is an information resource that might be represented as printable PDF or as RDF document
- A single resource can have many different representations, e.g., in different formats, resolutions or languages



# HTTP Content Negotiation

- Content Negotiation (CN, conneg) is the process of selecting the best representation for a query if several representations are available

```
$ curl -I -H "Accept: application/rdf+xml"  
http://dbpedia.org/resource/Gordon_Brown
```

```
$ curl -I -H "Accept: text/html"  
http://dbpedia.org/resource/Gordon_Brown
```

`curl` – Tool to send requests to a server or receive responses  
-H Custom header to pass to server  
-I Show document info only

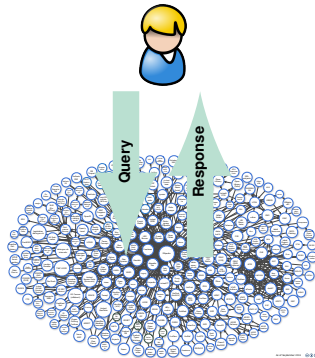
# HTTP Content Negotiation

```
$ curl -I -H "Accept: text/html"  
  http://dbpedia.org/resource/Gordon_Brown  
HTTP/1.1 303 See Other  
Date: Mon, 04 Feb 2013 10:37:10 GMT  
Content-Type: text/html; charset=UTF-8  
Content-Length: 0  
Connection: keep-alive  
Server: Virtuoso/06.04.3132 (Linux) [...]  
Accept-Ranges: bytes  
Location: http://dbpedia.org/page/Gordon_Brown
```

## HTTP Content Negotiation

```
$ curl -I -H "Accept: application/rdf+xml"  
  http://dbpedia.org/resource/Gordon_Brown  
HTTP/1.1 303 See Other  
Date: Mon, 04 Feb 2013 10:36:59 GMT  
Content-Type: application/rdf+xml; qs=0.95  
Content-Length: 0  
Connection: keep-alive  
Server: Virtuoso/06.04.3132 (Linux) [...]  
Accept-Ranges: bytes  
TCN: choice  
Vary: negotiate,accept  
Content-Location: /data/Gordon_Brown.xml  
Link: <http://mementoarchive.lanl.gov/dbpedia[...]  
Location: http://dbpedia.org/data/Gordon_Brown.xml
```

# Linked Data Applications: Minimal Architecture



# Linked Data Summary

Semantic technologies simplify the access to data:

- Facts regarding Berlin?
  - <http://de.dbpedia.org/resource/Berlin>
- Information about Queen
  - BBC Music: <http://www.bbc.co.uk/music/artists/0383dadf-2a4e-4d10-a46a-e9e041da8eb3>
  - MusicBrainz: <http://musicbrainz.org/artist/0383dadf-2a4e-4d10-a46a-e9e041da8eb3.html>
- Data integration gives additional benefits

## Linked Data Tools

- **Tabulator Browser PlugIn/Ajax Scripts:**  
<http://www.w3.org/2005/ajar/tab>
- **Semantic Web Client Library (Querying the complete Semantic Web with SPARQL):** <http://wifo5-03.informatik.uni-mannheim.de/bizer/ng4j/semwebclient/>
- **D2R Server: Accessing databases with SPARQL and as Linked Data:**  
<http://d2rq.org/d2r-server>
- **Data cleaning & linking to Freebase:**  
<https://github.com/OpenRefine> (was Google Refine)
- **RDF Export for Google Refine:** <http://lab.linkeddata.deri.ie/2010/grefine-rdf-extension/>

# Agenda

1

Linked (Open) Data

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Semantic Web and HTML

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- Google Knowledge Graph

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OWL Applications

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- Semantic Technologies in the Pharmaceutical Industry

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Summary

## RDFa Example

- Integration of RDF in (X)HTML documents

All content on this site is licensed under `<a href="http://creativecommons.org/licenses/by/3.0/"> a Creative Commons License</a>.`

### versus

All content on this site is licensed under `<a rel="license" href="http://creativecommons.org/licenses/by/3.0/"> a Creative Commons License</a>.`





## RDFa Example 2

```
<div>
  <h2>The trouble with Bob</h2>
  <h3>Alice</h3>
  ...
</div>
```

**versus**

```
<div xmlns:dc="http://purl.org/dc/elements/1.1/">
  <h2 property="dc:title">The trouble with Bob</h2>
  <h3 property="dc:creator">Alice</h3>
  ...
</div>
```

## RDFa Example 3

```
<div>
  <p>Alice Birpemschwick</p>
  <p>Email:  <a href="mailto:alice@example.com">
    alice@example.com</a></p>
  <p>Phone:  <a href="tel:+1-617-555-7332">
    +1 617.555.7332</a></p>
</div>
```

versus

```
<div typeof="foaf:Person"
  xmlns:foaf="http://xmlns.com/foaf/0.1/">
  <p property="foaf:name">Alice Birpemschwick</p>
  <p>Email:  <a href="mailto:alice@example.com"
    rel="foaf:mbox">alice@example.com</a></p>
  <p>Phone:  <a href="tel:+1-617-555-7332"
    rel="foaf:phone">+1-617-555-7332</a></p>
</div>
```

# Applications of RDFa

- Google filters, for example, RDFa terms and uses them to improve the presentation of search results

## [New York Pizza Suprema](#)

[www.nypizzasuprema.com/](http://www.nypizzasuprema.com/) - [Diese Seite übersetzen](#)

**NY Pizza Suprema** was established in 1964 Salvatore Riggio, an Italian immigrant. The pizzeria was here before Madison Square Garden moved here. At that ...

★★★★☆ 40 Google-Bewertungen - [Bericht schreiben](#)



413 8th Ave New York, NY 10001, Vereinigte Staaten  
(212) 594-8939

[Menu](#) - [Location](#) - [Contact](#) - [History](#)

## [New York Pizza Suprema - Menu](#)

[www.nypizzasuprema.com/menu.html](http://www.nypizzasuprema.com/menu.html) - [Diese Seite übersetzen](#)

**NY Pizza Suprema** was established in 1964 Salvatore Riggio, an Italian immigrant. The pizzeria was here before Madison Square Garden moved here. At that ...

## [New York Pizza Suprema - Chelsea - New York, NY](#)

[www.yelp.com](http://www.yelp.com) › ... › [Pizza](#) - [Diese Seite übersetzen](#)

★★★★☆ 215 Erfahrungsberichte - Preisspanne: \$

215 Reviews of **New York Pizza Suprema** "i grew up going here my family always have gotten pizza here except a few times. i remember there was once they ...

# Applications of RDFa

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215 Reviews of **new York Pizza Suprema** I grew up going here my family always have gotten pizza here except a few times. i remember there was once they ...

# Microformats

Microformats are simple and open data formats based on existing standards (XHTML)

- Uses POSH (Plain Old Semantic HTML), i.e., HTML Tags that do not specify the presentation (`bold`, `i`), but that have semantics (`abbr`, `acronym`, `title`, ...)
- Use of semantic CSS class names
  - not: `<span class="blueText">...</span>`
  - but: `<span class="submenu">...</span>`
- Special vocabularies for the markup in some domains
- Considers the roles and semantics of the elements

# hRecipe – Microformat for Recipes

- For the semantic annotation of web pages for recipes
- Allows for
  - searching for recipes with certain ingredients
  - automatic grouping of recipes
  - finding quick recipes (short preparation time)
- Mapping into RDFa exists (hrecipe-rdf)

## Example

```
<div class="hrecipe">
  <h1 class="fn">French Fries</h1>
  <p class="summary">French Fries ...</p>
  <p>
    Contributed by <span class="author">Tom</span>
    and the <span class="author vcard">
      <a class="url fn" href="...">Cooky Gang</a>
    </span>.
  </p>
  ...
</div>
```

# hRecipe – Microformat for Recipes

## Example

```
...
<p>Published <span class="published">
  <span class="value-title"
    title="2008-10-14T10:05:37-01:00"/>
  14. Oct 2008</span>
</p>
<h2>Ingredients</h2>
<ul>
  <li class="ingredient">
    <span class="value">500</span>
    <span class="type">gr</span> potatoes.
  </li>
  ...
</ul>
...
</div>
```

## Example in the Web

- The Recipe Depository <http://www.therecipedepository.com/>
- SAPO Sabores <http://sabores.sapo.pt/>
- ITV Food <http://www.itv.com/food/>
- Epicurious.com <http://www.epicurious.com/>
- <http://foodnetwork.com/>
- Plan to Eat [http://www.plantoeat.com/recipe\\_book](http://www.plantoeat.com/recipe_book)
- essen & trinken <http://www.essen-und-trinken.de/>  
hRecipe-conform meta data in RDF
- ...



Search

About 2,700 results (0.24 seconds)

Everything

[Recipes without zucchini](#) › [Recipes without yeast](#) › [Recipes with ricotta cheese](#)


Images

Maps

Videos

News

Shopping

**Recipes**

More

**Ingredients** Yes No

 zucchini  

 yeast  

 ricotta  

 cheese  

 marinara  

 sauce  

 mozzarella  

 grated  

 parmesan  

 broccoli  

 spinach  
**Any cook time**

Less than 15 min

### Vegetarian Lasagna Loaf Recipe

[www.tasteofhome.com](http://www.tasteofhome.com) › [Recipes](#)


★★★★★ 2 reviews - 50 mins

 Find recipes for **Vegetarian Lasagna Loaf** and other Baked Pasta recipes. Get all the best recipes at Taste of Home. Recipe directions: Break the noodles in half ...

 Ingredients: **ricotta cheese**, garlic, milk, sour cream

### VEGETARIAN LASAGNA

[www.cooks.com](http://www.cooks.com) › [Recipes](#) › [Vegetables](#)

 While sauce cooks, cook lasagna noodles following label directions until ... Recipes related to **Vegetarian Lasagna ...** MEDITERRANEAN VEGETABLE SOUP ...  
 Ingredients: **ricotta cheese**, tomatoes, oregano, pepper, olive oil, mushrooms

### Vegetarian Lasagna Alfredo Recipe

[www.tasteofhome.com](http://www.tasteofhome.com) › [Recipes](#)


★★★★★★ 1 review - 1 hr 35 mins

 Find recipes for **Vegetarian Lasagna Alfredo** and other Baked Pasta recipes. Get all the best recipes at Taste of Home. Recipe directions: Cook noodles ...  
 Ingredients: **ricotta cheese**, broccoli, eggs, tomatoes, mozzarella

### Slow Cooker Vegetarian Lasagna

[www.food.com/recipe/slow-cooker-vegetarian-lasagna-204366](http://www.food.com/recipe/slow-cooker-vegetarian-lasagna-204366)

★★★★★★ 7 reviews - 3 hrs 20 mins - 240.3 cal

 In college, choosing macaroni and cheese or juniorettes is always a first choice- But sometimes, it just doesn't cut it. Home cooked meals are very necessary ...  
 Ingredients: **ricotta cheese**, marinara sauce, tomatoes, mozzarella, spinach

Vegetarian Lasagna

# Micro Data and schema.org

- Joint project of Google, Microsoft and Yahoo!
- Compromise between the extensibility of RDFa and the simplicity of microformats
- Goal: better understanding of the contents of web pages and, as a result, a better presentation of search results

# Google Knowledge Graph

- The US version of Google now also uses structured data (from Freebase)
- For the disambiguation of search terms and direct presentation of relevant information
- Considers search terms no longer as simple strings (but as designator for things)

**Search**

10 personal results, 77,400,000 other results.


**Web**
**Images**
**Maps**
**Videos**
**News**
**Shopping**
**More**

Show search tools

**[The University of Louisiana at Monroe](#)**
[www.ulm.edu/](http://www.ulm.edu/)

Degree programs are offered by the seven Colleges and the Graduate School.

 ↳ [myULM - Academics and Majors - ULM Gateway to Online Degrees - Apply Now](#)
**[Ulm - Wikipedia, the free encyclopedia](#)**
[en.wikipedia.org/wiki/Ulm](http://en.wikipedia.org/wiki/Ulm)
**Ulm** is a city in the federal German state of Baden-Württemberg, situated on the River Danube. The city, whose population is estimated at 120000 (2006), forms ...

 ↳ [Battle of Ulm - Ulm Minster - Ulm School of Design - University of Ulm](#)
**[ULM Warhawks Athletics](#)**
[www.ulmwarhawks.com/](http://www.ulmwarhawks.com/)

 The official athletics site for the University of Louisiana Monroe Warhawks. The home for all **ULM** sports schedules, news, rosters and stats: football, men's ...

**[english - Stadt Ulm - Start](#)**
[www.ulm.de/start.3080.htm](http://www.ulm.de/start.3080.htm)

 14 Jul 2005 - City of **Ulm** online. Jump to: To mainnavigation - to content - to change language - to search - to "much asked for:" ...


**[Images for Ulm](#)** - Report images

**[Homepage - Universität Ulm](#)**
[www.uni-ulm.de/en/](http://www.uni-ulm.de/en/)

 Die Fakultät für Naturwissenschaften der Universität **Ulm** hat am Freitag Professor Jürgen Mynek, Präsident der Helmholtz-Gemeinschaft und damit der größten ...

**[Ulm Photos](#)**
**University of Louisiana at Monroe**


ulm.edu

 The University of Louisiana at Monroe is a educational public university in Monroe, Louisiana, United States and part of the University of Louisiana System. [Wikipedia](#)
**Nickname:** Warhawks

**Address:** 700 University Avenue, Monroe, Louisiana, 71209

**Mascot:** Ace the Warhawk

**Enrollment:** 8,811 (2010)

**Acceptance rate:** 72.9% (2010)

**Colors:** Gold, Maroon

**People also search for**

[University of Louisiana at Lafayette](#)  
[Louisiana Tech University](#)  
[Louisiana State University](#)  
[Northwestern State University](#)  
[Grambling State University](#)

[Feedback](#)
**See results about**

**Ulm**

Ulm is a city in the federal German state of Baden-Württemberg, situated on the River Danube. ...


**University of Ulm**

The Ulm University is a public university in the city of Ulm, in the South German state of ...

### University of Louisiana at Monroe



ulm.edu

The University of Louisiana at Monroe is a coeducational public university in Monroe, Louisiana, United States and part of the University of Louisiana System. [Wikipedia](#)

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[Feedback](#)

#### See results about



##### Ulm

Ulm is a city in the federal German state of Baden-Württemberg, situated on the River Danube. ...



##### University of Ulm

The Ulm University is a public university in the city of Ulm, in the South German state of ...

## Web

[Taj Mahal - Wikipedia, the free encyclopedia](#)
[en.wikipedia.org/wiki/Taj\\_Mahal](https://en.wikipedia.org/wiki/Taj_Mahal)

The **Taj Mahal** is a white marble mausoleum located in Agra, India. It was built by Mughal emperor Shah Jahan in memory of his third wife, Mumtaz Mahal.

↳ [Origins and architecture of the ... - Mumtaz Mahal - Shah Jahan - Agra](#)

## Images

## Maps

## Videos

## News

## Shopping

## More

Show search tools

[Taj Mahal \(musician\) - Wikipedia, the free encyclopedia](#)
[en.wikipedia.org/wiki/Taj\\_Mahal\\_\(musician\)](https://en.wikipedia.org/wiki/Taj_Mahal_(musician))

Henry Saint Clair Fredericks (born May 17, 1942), who uses the stage name **Taj Mahal**, is an American Grammy Award winning blues musician. He often ...

[Atlantic City New Jersey Casino Hotels | Trump Taj Mahal, Atlantic ...](#)
[www.trumptaj.com/](http://www.trumptaj.com/)


For five star Atlantic City Casino hotels, Trump **Taj Mahal** Casino Hotel offers restaurants, nightlife and a casino floor you can't resist. Explore our Atlantic City ...

[Images for Taj Mahal - Report images](#)

[Welcome To Official WebSite of Taj Mahal-U.P.Tourism](#)
[www.tajmahal.gov.in/](http://www.tajmahal.gov.in/)

**Taj Mahal** at Agra, India is one of the wonders of the world. Find information related to **Taj Mahal** travel and tourism in this article.

Score: **27** / 30 - 326 Google reviews - [Write a review](#)

 Agra, Uttar Pradesh 282001 India  
0562 222 6431

[Taj Mahal](#)
[www.tajmahal.org.uk/](http://www.tajmahal.org.uk/)

**Taj Mahal** at Agra, India is one of the wonders of the world. Find information related to **Taj Mahal** travel and tourism in this article.

[Taj Mahal - Welcome to tajblues.com HOME](#)
[www.tajblues.com/](http://www.tajblues.com/)

## Taj Mahal


[en.wikipedia.org](https://en.wikipedia.org)

The Taj Mahal is a white marble mausoleum located in Agra, India. It was built by Mughal emperor Shah Jahan in memory of his third wife, Mumtaz Mahal. [Wikipedia](#)

**Height:** 561 feet (171 m)

**Address:** Agra, Uttar Pradesh 282001, India

**Architectural style:** Mughal architecture

**Phone:** 0562 222 6431

**Function:** Mausoleum

**Architect:** Ustad Ahmad Lahouri

## People also search for



Great Wall of China



Agra Fort



Machu Picchu



The Red Fort



Qutub Minar

[Feedback](#)

## See results about



**Taj Mahal**

Musician

Henry Saint Clair Fredericks, who uses the stage name Taj Mahal, is an American Grammy Award ...

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# Application Areas of OWL

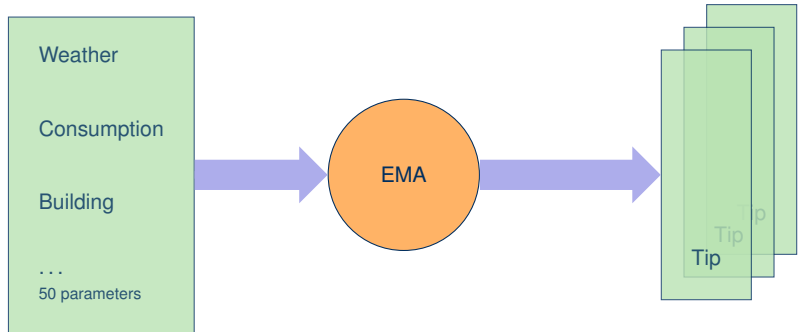
- OWL DL mainly is used outside the Semantic Web
- Many applications in medicine and life sciences
- Terminologies are traditionally popular there
- Keyword indexing of documents
- Semantic annotations of research data (e.g., gene sequences)
- Classification used in health records and for statistics



## Example Ontologies in OWL

- OBO Foundry: The Open Biological and Biomedical Ontologies
- BioPortal ontologies
  - Terms for the electronic patient record
  - Annotation of gene sequences
  - Research into new drugs
- GO Gene Ontology
- ICD International Classification of Diseases
- FMA Formal Model of Anatomy
- ...

# Use of OWL in the EDF Energy Management Advisor



# EMA Ontology

- Ontology models the domain and situation of customers
- First modelling was strictly following existing binary decision diagrams (simplified)
- Reasoner “recognises” the situation of a customer
- Certain situations correspond to tips
- Original ontology used nominals and role chains
- Was difficult to comprehend and reasoner performance was not optimal

# EMA Ontology Improvements

- Customers are directly modelled in an ABox
- Per customer only simple ABox facts are loaded
- Constructors that are problematic for reasoning are avoided: nominals, role chains
- TBox modelling was simplified
- Ontology now allows incremental reasoning
- Customers can be classified independent of each other in different reasoner instances
- Used for about 30.000 customers in France

# BBC Website for the Football World Cup 2010

- Ontology describes how facts about the world cup relate to each other
- Such meta data are saved as RDF triples
- For example, “Frank Lampard” is part of “England Squad” or “England Squad” competed in “Group C” of the “FIFA World Cup 2010”

# BBC Website for the Football World Cup 2010

“The underlying publishing framework does not author content directly; rather it publishes data about the content - metadata. The published metadata describes the world cup content at a fairly low-level of granularity, providing rich content relationships and semantic navigation. By querying this published metadata we are able to create dynamic page aggregations for teams, groups and players.”

Jem Rayfield, Senior Technical Architect, BBC News and Knowledge

[http://www.bbc.co.uk/blogs/bbcinternet/2010/07/bbc\\_world\\_cup\\_2010\\_dynamic\\_sem.html](http://www.bbc.co.uk/blogs/bbcinternet/2010/07/bbc_world_cup_2010_dynamic_sem.html)

# BBC Website for the Football World Cup 2010

- OWL inference used to enrich the data (forward chaining) and SPARQL used for queries
- Ontology contains texts contributed by journalists: stories, blogs, profiles, pictures, videos and statistics
- Journalistic contributions are automatically classified (NLP techniques) and manually tagged
- Statistics and game results from other sources are imported from XML and mapped to ontological concepts
- Web pages are automatically assembled and contain relevant links
- Approach also used for Olympia 2012

Text only | Help

**BBC** Home News Sport Weather iPlayer TV Radio More... Search

# SPORT WORLD CUP 2010

SPORT FOOTBALL WORLD CUP 2010 GROUPS & TEAMS FIXTURES & RESULTS VIDEO BBC COVERAGE

## England

[England 1-1 United States](#) Match report  
 Saturday, 12 June

[England 0-0 Algeria](#) Match report  
 Friday, 18 June

[Slovenia 0-1 England](#) Match report  
 Wednesday, 23 June

[Germany 4-1 England](#) Match report  
 Sunday, 27 June

A	B	C	D	E	F	G	H
<b>Group C Teams</b>							
	<b>USA</b>		<b>W</b>	<b>D</b>	<b>L</b>	<b>GD</b>	<b>PTS</b>
	USA		1	2	0	1	5
	<b>England</b>		1	2	0	1	5
	Slovenia		1	1	1	0	4
	Algeria		0	1	2	-2	1

### Latest matches

**NED 2-1 BRA**  
  
[Highlights & report](#)

**URU 1-1 GHA**  
  
[Highlights & report](#)

**ARG 0-4 GER**  
  
[Highlights & report](#)

**PAR 0-1 ESP**

### Latest stories

**Gerrard commits future to England** **NEW**

- England sponsorship likely to end
- Capello to remain England manager
- Mueller blames England imbalance
- Capello receives Gartside backing

**Pressure got to Rooney - Ferguson**

- FA unfit for purpose says Caborn
- England's fear of crossing borders
- England duo bypass London event
- Barwick baffled by dismal England

### Features

**German lessons**  
 Jurgen Klinsmann on how to revolutionise England

- A German view on English football
- Redknapp backs England to shine
- BBC pundits on England
- Roy Hodgson Q&A
- World Cup goals analysis

### Around the web

- BBC Search+ country page
- England Fifa Profile



# Semantic Web Technologies Meet Pharmaceutical Data

Phil Ashworth presents at the 2. European Semantic Technology Conference:  
`http://videlectures.net/estc08_ashworth_swtpdi/`

# Agenda

- 1 Linked (Open) Data
- 2 Semantic Web and HTML
  - RDFa
  - Microformats
  - Google Knowledge Graph
- 3 OWL Applications
  - OWL DL Application EDF Energy
  - OWL Profile Application BBC World Cup
  - Semantic Technologies in the Pharmaceutical Industry
- 4 Summary

# Summary

- The amount of available machine processable data grows continuously
- Semantics is needed to integrate data from different sources
- Query and visualisation of data provides added value
  
- The processing and querying data from different sources increases the transparency and facilitate research (tests of hypotheses becomes easier)