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Usage of Linked Data

Introduction and Application Scenarios

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research

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Agenda

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1. **Motivation Scenario**
2. **Linked Data Foundations**
3. **Introduction to Linked Data**
4. **Linked Data use case scenarios**

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MOTIVATION SCENARIO

Music!

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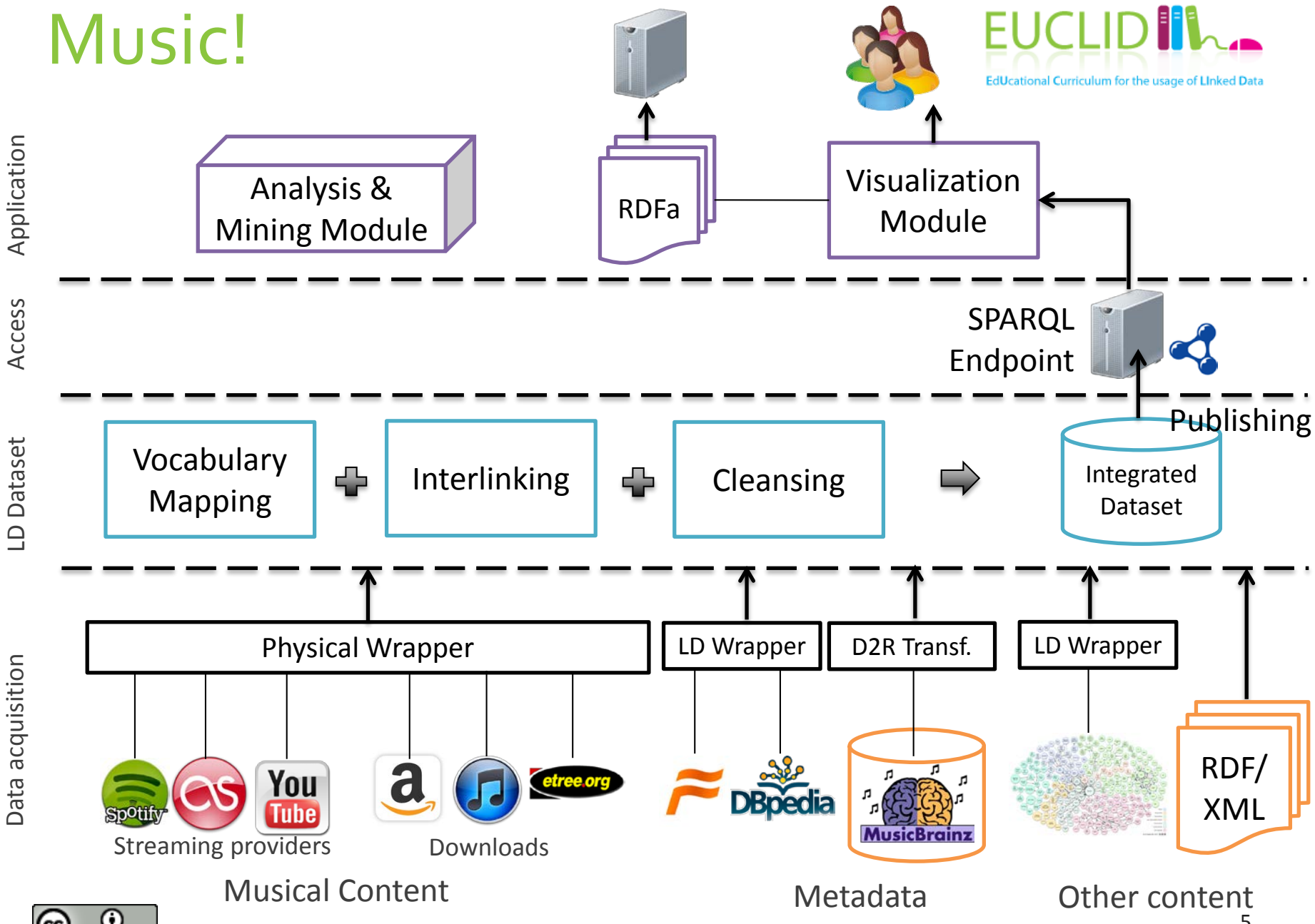
- Provision of a music-based portal.
- Bring together a number of disparate components of data-oriented content:

1. **Musical content** (streaming data & downloads)
2. **Music and artist metadata**
3. **Review content**
4. **Visual content** (pictures of artists & albums)

Music!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Application
Access
LD Dataset
Data acquisition
Analysis & Mining Module
RDFa
Visualization Module
SPARQL Endpoint
Publishing
Vocabulary Mapping
Interlinking
Cleansing
Integrated Dataset
Physical Wrapper
LD Wrapper
D2R Transf.
LD Wrapper
Spotify
YouTube
etree.org
DBpedia
MusicBrainz
RDF/ XML
Streaming providers
Downloads
Musical Content
Metadata
Other content

Music!

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Expected Results

- The developer will contribute back the aggregated and interlinked content to the Linked Open Data Cloud.
- Linking of artists will be improved.
- Metadata, visual content and reviews will be improved.
- Links to emerging Web technologies that inherit from semantics: Google RichSnippets, Facebook OpenGraph and schema.org annotation.

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LINKED DATA FOUNDATIONS

Internet

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- Extension of the technology of **computer networks**.
- The technology supporting the Internet includes the **Internet Protocol** (IP) .
- Each computer on the Internet is assigned an **IP number**.
- Messages can be **routed** from one computer to another.

Internet

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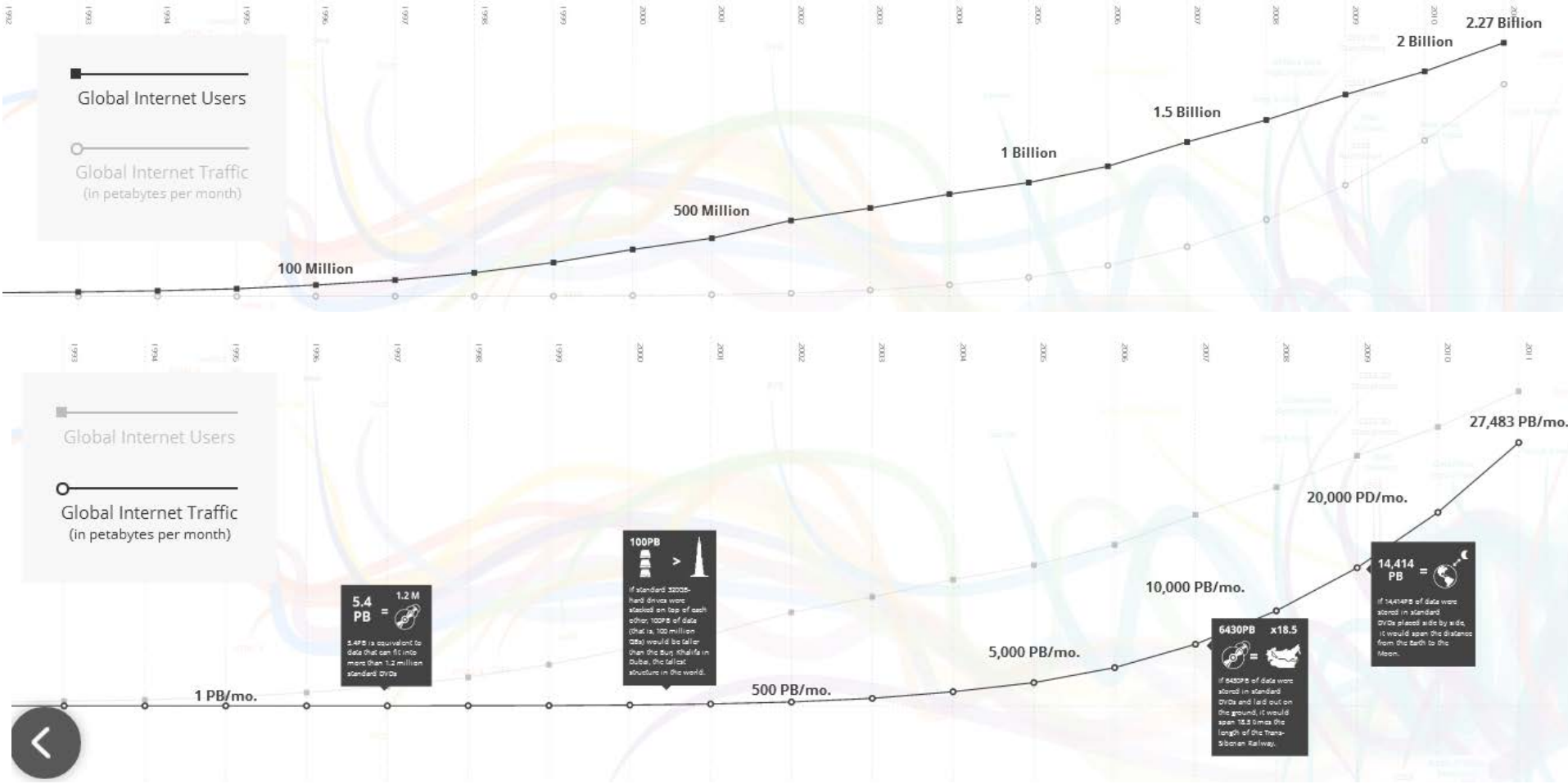
The growth of the Internet



Source: http://www.evolutionoftheweb.com

The Web

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- There is a wealth of information on the Web.
- It is aimed mostly towards consumption by **humans** as end-users:
  - Recognize the meaning behind content and draw conclusions,
  - Infer new knowledge using context and
  - Understand background information.

The Web

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- Billions of diverse documents online, but it is not easily possible to automatically:
  - Retrieve relevant documents.
  - Extract information.
  - Combine information in a meaningful way.
- Idea:
  - Also publish machine processable data on the web.
  - Formulate questions in terms understandable for a machine.
  - Do this in a standardized way so machines can interoperate.

- The Web becomes a **Web of Data**
  - This provides a common framework to share knowledge on the Web across application boundaries.

The Web: Evolution

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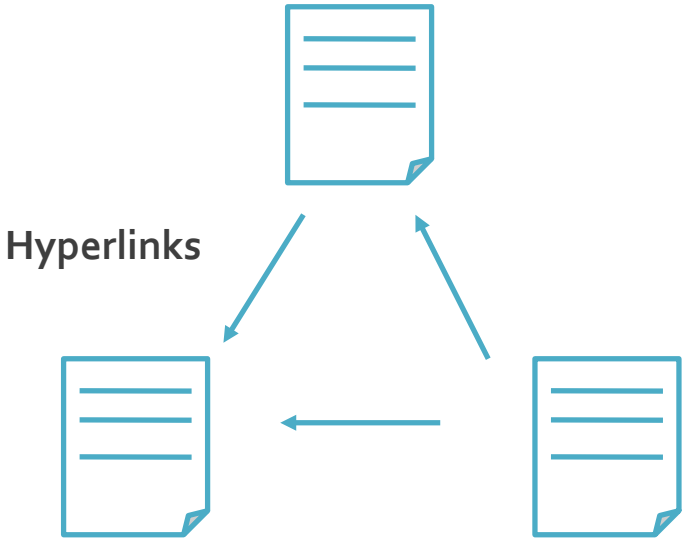
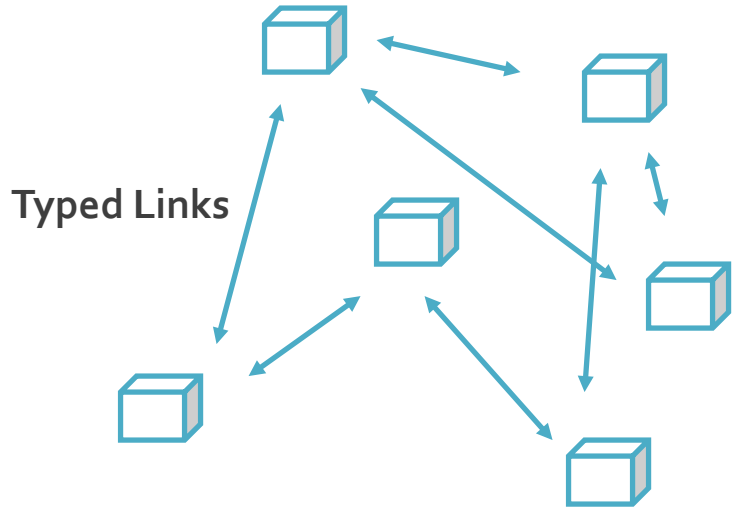
Web of Documents → Web of Data



"Documents"



"Things"

The Web: Evolution

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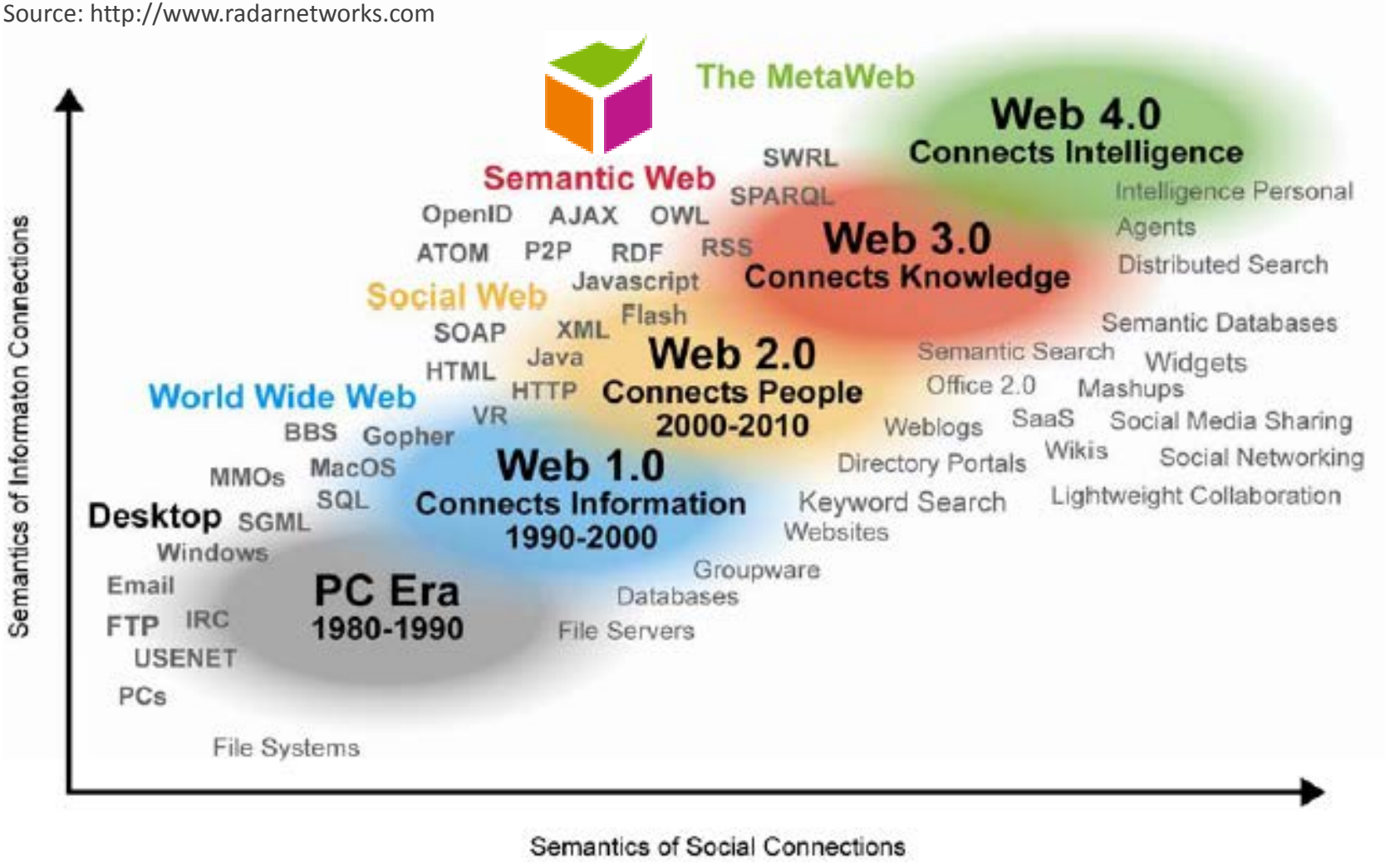
Source: http://www.radarnetworks.com



Web Technology Basics

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HTML – HyperText Markup Language

- Language for displaying web pages and other information in a web browser.
- HTML elements consist of **tags** (enclosed in angle brackets), **attributes** and **content**.

HTTP – Hypertext Transfer Protocol

- Foundation of data communication for the WWW.
- Client-server protocol.
- Every interaction is based on: **request** and **response**.

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Uniform Resource Identifier (URI)

- Compact sequence of characters that identifies an abstract or physical resource.
- **Examples:**

```
ldap://[2001:db8::7]/c=GB?objectClass?one

mailto:John.Doe@example.com

news:comp.infosystems.www.servers.unix

tel:+1-816-555-1212

telnet://192.0.2.16:80/

urn:oasis:names:specification:docbook:dtd:xml:4.1.2

http://dbpedia.org/resource/Karlsruhe
```

Describing Data

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Vocabularies

- Collections of defined **relationships** and **classes** of resources.
  - Classes group together similar resources.
- Terms from well-known vocabularies should be **reused** wherever possible.
- New terms should be define only if you can not find required terms in existing vocabularies.

Describing Data

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Vocabularies

A set of well-known vocabularies has evolved in the Semantic Web community. **Some** of them are:

Vocabulary	Description	Classes and Relationships
Friend-of-a-Friend **(FOAF)**	Vocabulary for describing people.	foaf:Person, foaf:Agent, foaf:name, foaf:knows, foaf:member
Dublin Core **(DC)**	Defines general metadata attributes.	dc:FileFormat, dc:MediaType, dc:creator, dc:description
Semantically-Interlinked Online Communities **(SIOC)**	Vocabulary for representing online communities.	sioc:Community, sioc:Forum, sioc:Post, sioc:follows, sioc:topic
Music Ontology **(MO)**	Provides terms for describing artists, albums and tracks.	mo:MusicArtist, mo:MusicGroup, mo:Signal, mo:member, mo:record
Simple Knowledge Organization System **(SKOS)**	Vocabulary for representing taxonomies and loosely structured knowledge.	skos:Concept, skos:inScheme, skos:definition, skos:example

Describing Data

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Vocabularies

More extensive lists of well-known vocabularies are maintained by:

- W3C SWEO Linking Open Data community project
  http://www.w3.org/wiki/TaskForces/CommunityProjects/LinkingOpenData/CommonVocabularies
- Mondeca: Linked Open Vocabularies
  http://labs.mondeca.com/dataset/lov
- Library Linked Data Incubator Group: Vocabularies in the library domain
  http://www.w3.org/2005/Incubator/lld/XGR-lld-vocabdataset-20111025

Semantics on the Web

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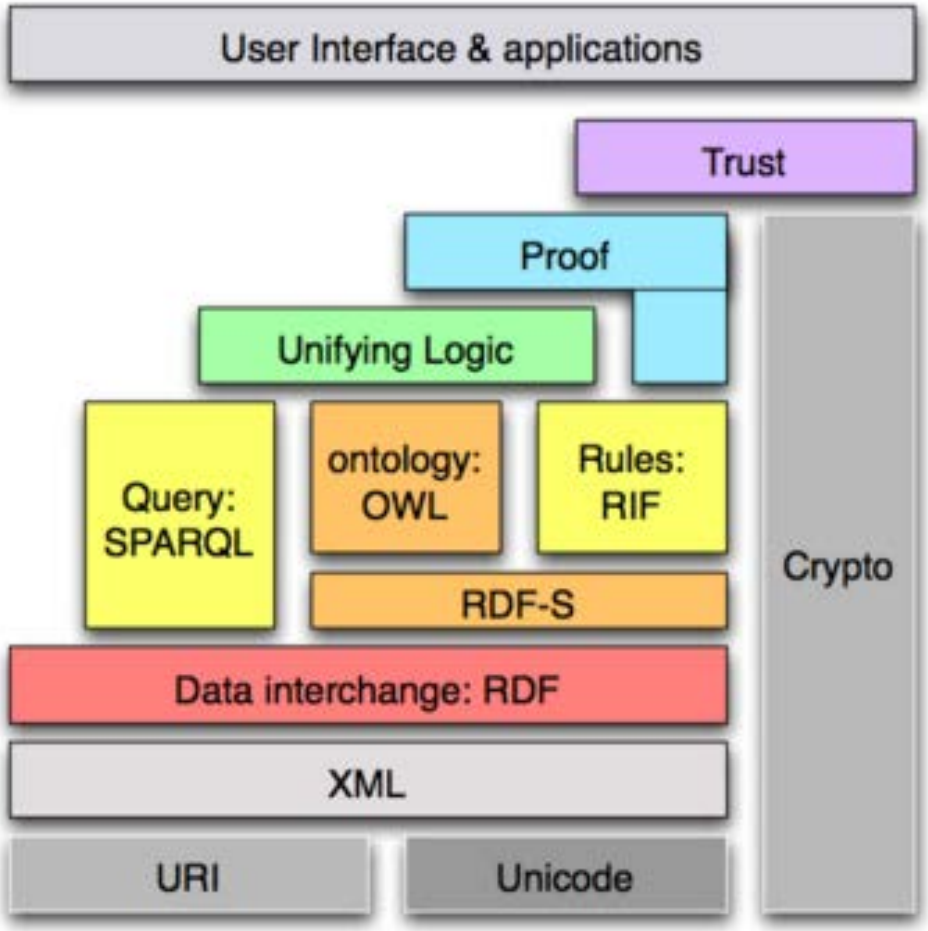

Semantic Web Stack
Berners-Lee (2006)

Semantics on the Web

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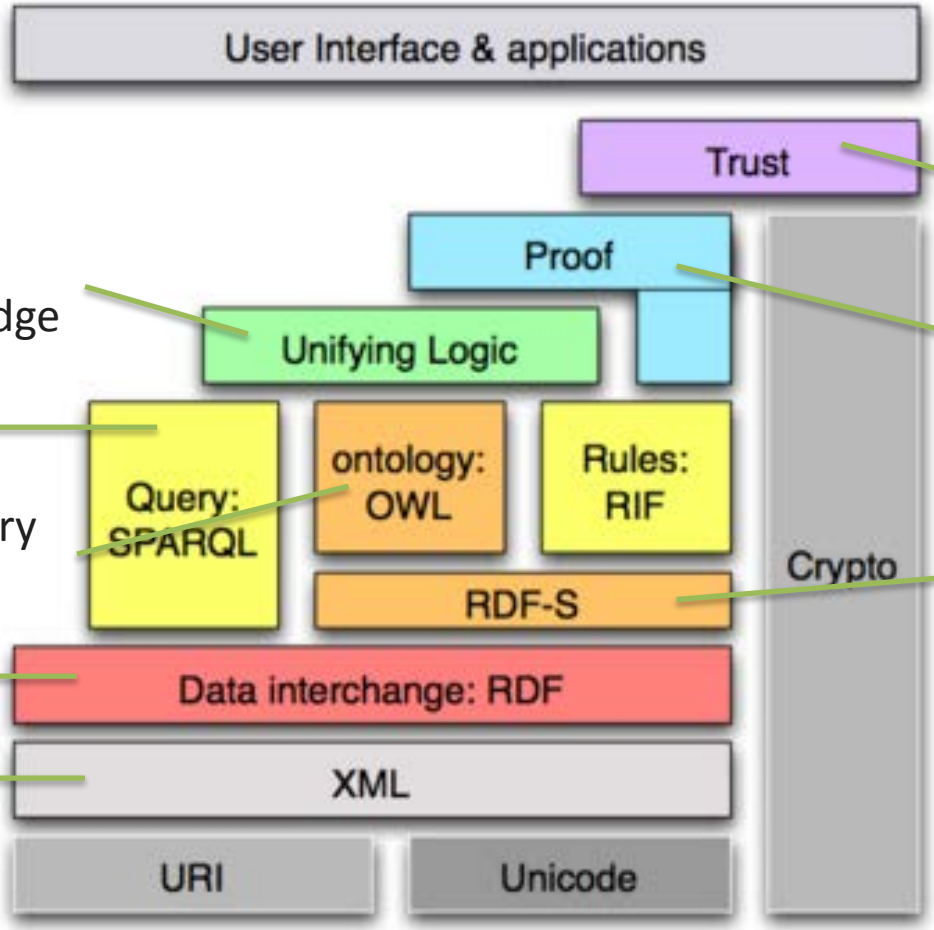

Application specific declarative-knowledge

Query language

Expressive vocabulary (ontology) language

Basic data model

Syntatic basis

Digital signatures, recommendations

Proof generation, exchange, validation

Simple vocabulary (schema) language

Semantic Web Stack
Berners-Lee (2006)

Semantics on the Web

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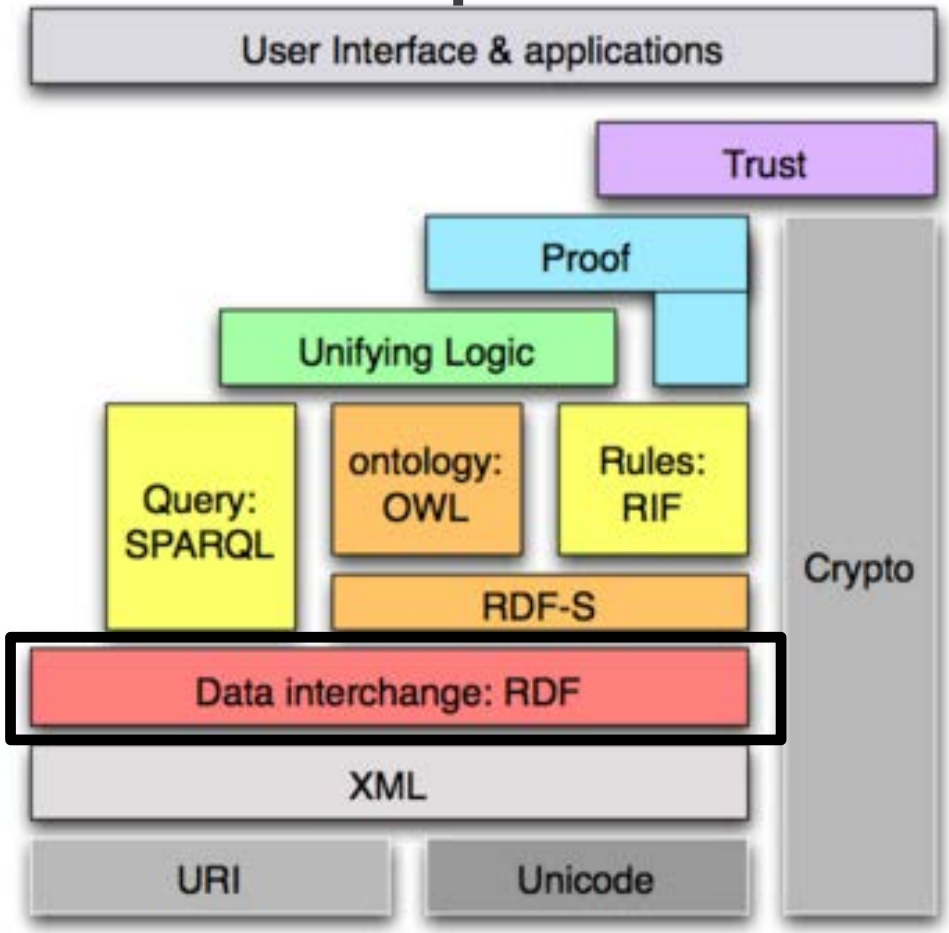
RDF – Resource Description Framework



Semantic Web Stack
Berners-Lee (2006)

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RDF – Resource Description Framework

- RDF is the basis layer of the Semantic Web stack ‘layer cake’.

- Basic building block: RDF triple.
  - **Subject** – a resource, which may be identified with a URI.
  - **Predicate** – a URI-identified reused specification of the relationship.
  - **Object** – a resource or literal to which the subject is related.

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RDF – Resource Description Framework (Example)

```
<http://musicbrainz.org/artist/b10bbbfc-
cf9e-42e0-be17-e2c3e1d2600d#_>
<http://www.w3.org/2002/07/owl#sameAs>
<http://dbpedia.org/resource/The_Beatles>.

<http://musicbrainz.org/artist/b10bbbfc-
cf9e-42e0-be17-e2c3e1d2600d#_>
<http://xmlns.com/foaf/0.1/name>
"The Beatles" .
```

URIs are given in angle brackets in N-Triples.

In N-Triples every statement is terminated with a full stop.

Literals are given in quotes in N-Triples.

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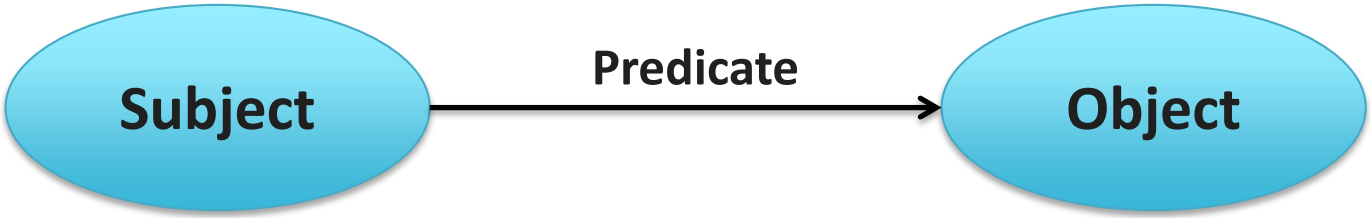
RDF Graphs

- Every set of RDF assertions can then be drawn and manipulated as a (labelled directed) graph:
  - **Resources** – the subjects and objects are nodes of the graph.
  - **Predicates** – each predicate use becomes a label for an arc, connecting the subject to the object.



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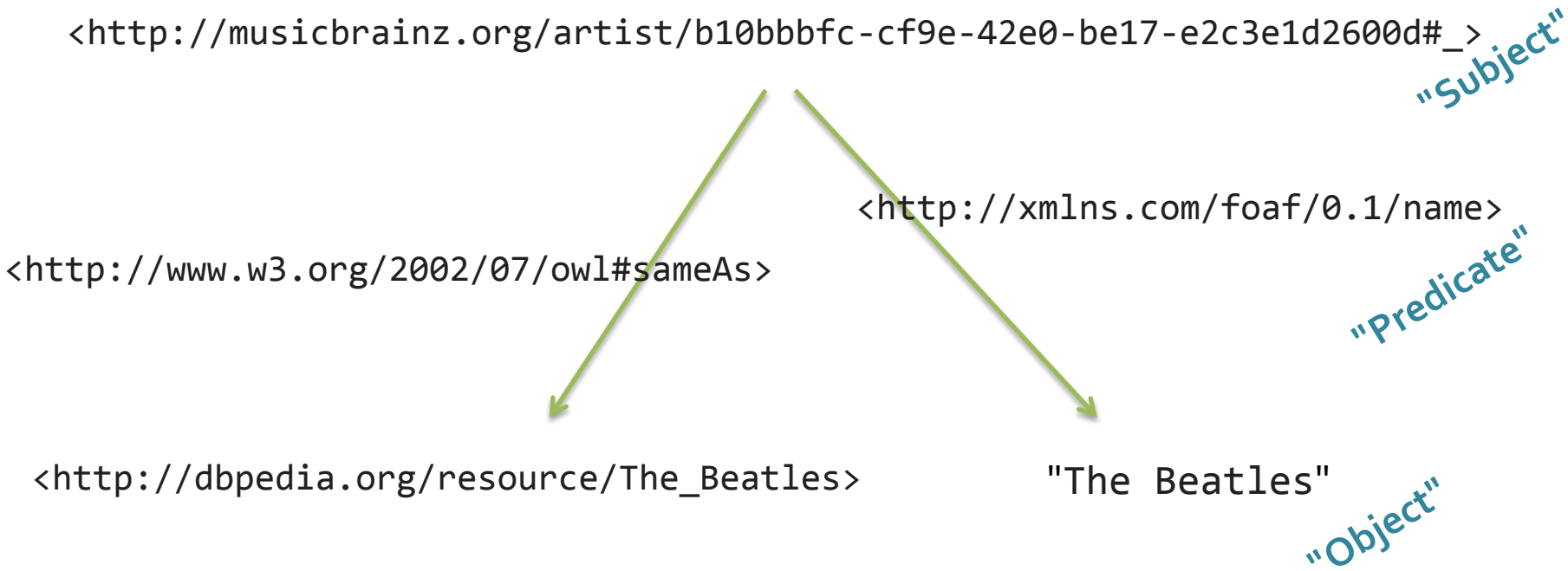
RDF Graphs (Example)



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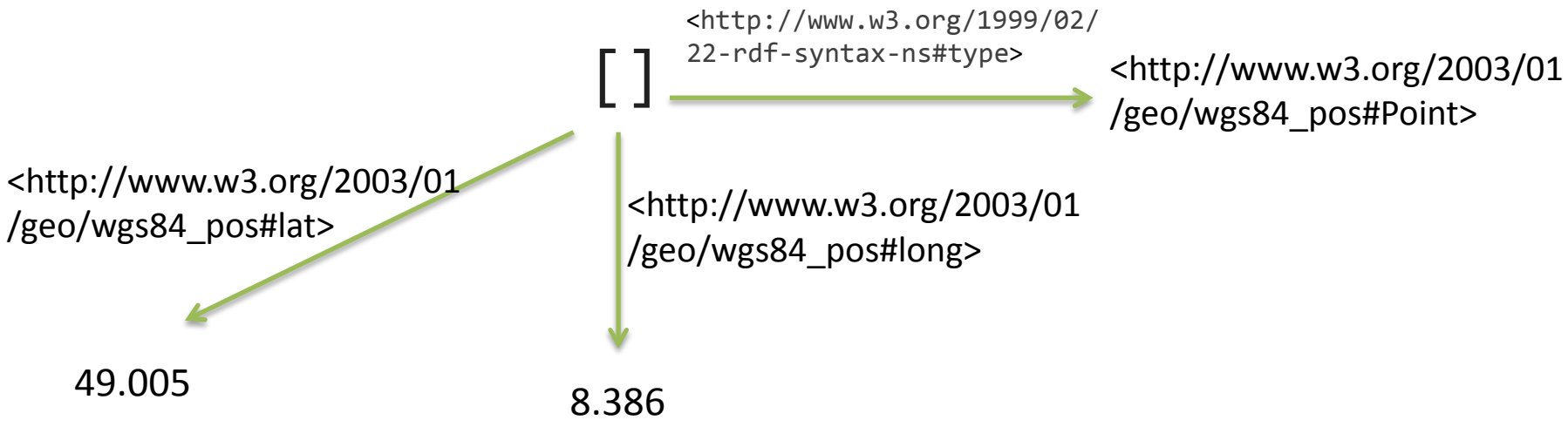
RDF Blank Nodes

- RDF graphs can also contain unidentified resources, called *blank nodes:*



- Blank nodes can group related information, but their use in Linked Data is discouraged.

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RDF Turtle

- Turtle is a syntax for RDF more readable.
- Since many URIs share same basis we use **prefixes**:

```
@prefix rdf:<http://www.w3.org/1999/02/22-rdf-syntax-ns#>.
@prefix rdfs:<http://www.w3.org/2000/01/rdf-schema#>.
@prefix owl:<http://www.w3.org/2002/07/owl#>.
@prefix mo:<http://purl.org/ontology/mo/>.
@prefix dbpedia:<http://dbpedia.org/resouce/>.
```

And (sometimes) a unique base:

```
@base <http://musicbrainz.org/>.
```

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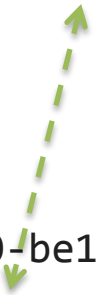
RDF Turtle

- Also has a simple *shorthand* for class membership:

```
@base <http://musicbrainz.org/>.
@prefix mo:<http://purl.org/ontology/mo/>.
<artist/b10bbbfc-cf9e-42e0-be17-e2c3e1d2600d#_> a mo:MusicGroup.
```



Is **equivalent** to:

```
<http://musicbrainz.org/artist/b10bbbfc-cf9e-42e0-be17-e2c3e1d2600d#_>
  <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
  <http://purl.org/ontology/mo/MusicGroup>.
```

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RDF Turtle

- When multiple statements apply to **same subject** they can be abbreviated as follows:

```
<artist/b10bbbfc-cf9e-42e0-be17-e2c3e1d2600d#_>
    rdfs:label "The Beatles";
    owl:sameAs dbpedia:The_Beatles ,
               <http://www.bbc.co.uk/music/artists/
                 b10bbbfc-cf9e-42e0-be17-e2c3e1d2600d#artist> .
```

Same subject

Same subject & predicate

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RDF Turtle

- Turtle also provides a simple syntax for **datatypes and language tags** for literals, respectively:

```
<recording/5098d0a8-d3c3-424e-9367-1f2610724410#_> a mo:Signal;
        rdfs:label "All You Need Is Love" ;
        mo:duration "PT3M48S"^^xsd:duration .

dbpedia:The_Beatles dbpedia-owl:abstract
        "The Beatles were an English rock band formed (…) "@en,
        "The Beatles waren eine britische Rockband in den (…) "@de .
```

Semantics on the Web

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RDF/XML

- This is most useful for inter-machine communication.
- The primary (recurring) element in encoding assertions (thereby triples) is `rdf:Description`, e.g.:

```
<rdf:Description
   rdf:about="http://musicbrainz.org/artist/b10bbbfc-cf9e-42e0-be17-e2c3e1d2600d#_">
   <foaf:name>The Beatles</foaf:name>
   <owl:sameAs rdf:resource="http://dbpedia.org/resource/The_Beatles">
</rdf:Description>
<rdf:Description
   rdf:about="http://musicbrainz.org/artist/4d5447d7-c61c-4120-ba1b-d7f471d385b9#_">
   <foaf:name>John Lennon</foaf:name>
</rdf:Description>
```

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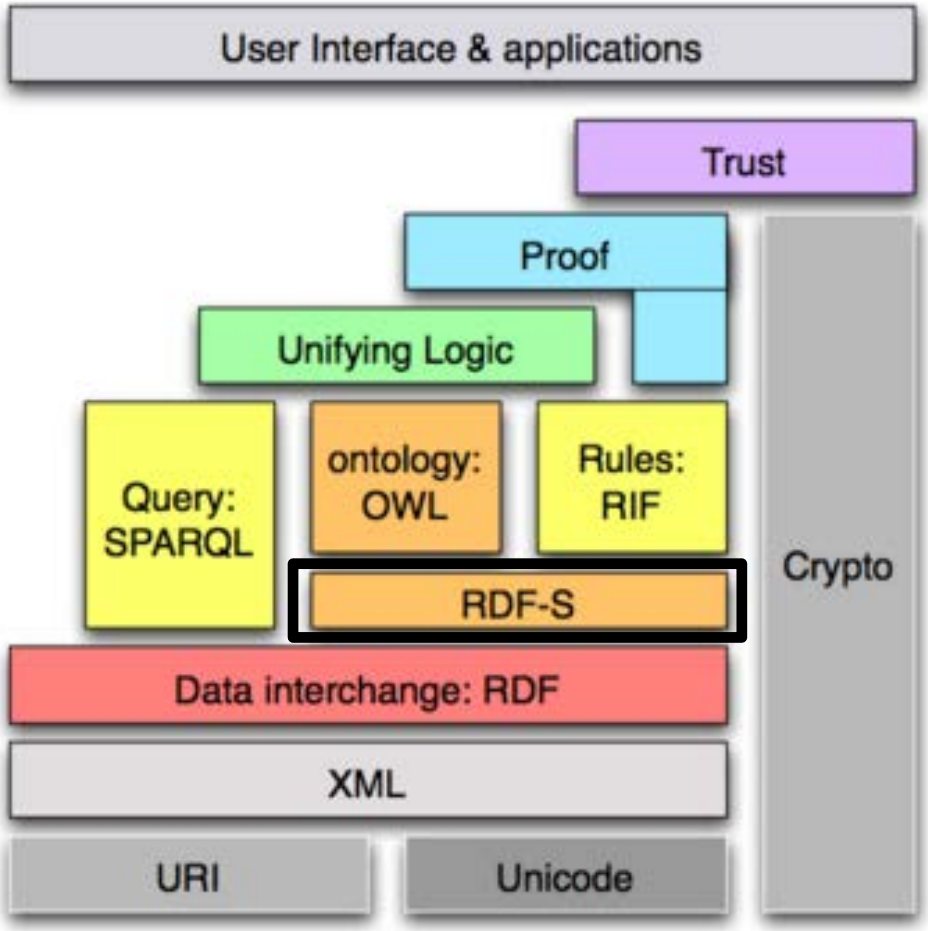
RDF-S – RDF Schema



Semantic Web Stack
Berners-Lee (2006)

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RDF-S – RDF Schema

Language for two tasks w.r.t. the RDF data model:

- **Expectation** – nominate:
  - the 'types', i.e., *classes*, of things we might make assertions about, and
  - the *properties* we might apply, as predicates in these assertions, to capture their relationships.
- **Inference** – given a set of assertions, using these classes and properties, specify what should be inferred about assertions that are *implicitly* made.

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RDF-S – RDF Schema

- **rdf:Property -** Class of RDF properties. Example:

  `mo:member` - *Indicates a member of a musical group.*

- **rdfs:domain -** States that any resource that has a given property is an instance of one or more classes.

```
mo:member rdfs:domain mo:MusicGroup .
```

- **rdfs:range -** States that the values of a property are instances of one or more classes.

```
mo:member rdfs:range foaf:Agent .
```

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RDF-S – RDF Schema

Schema

```
mo:MusicGroup
rdfs:subClassOf
foaf:Group .
```

Existing fact

```
<artist/b10bbbfc-cf9e-42e0-be17-e2c3e1d2600d#_>
rdf:type
mo:MusicGroup .
```

Inferred fact

```
<artist/b10bbbfc-cf9e-42e0-be17-e2c3e1d2600d#_>
rdf:type
foaf:Group .
```

We *expect* to use this vocabulary to make assertions about music groups.

Having made such an assertion...

Inferences can be drawn that we did not explicitly make

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RDF-S – RDF Schema

Resources and predicates with (limited) **inferences**:

`rdfs:Resource`

`rdfs:Literal, rdfs:Datatype`

`rdfs:Class, rdfs:subClassOf`

`rdfs:subPropertyOf`

`rdfs:range, rdfs:domain`

`rdf:Property` (an instance of rdfs:Class)

Some predicates with **NO inferences**:

`rdfs:comment`

`rdfs:label`

`rdfs:seeAlso`

`rdfs:isDefinedBy`

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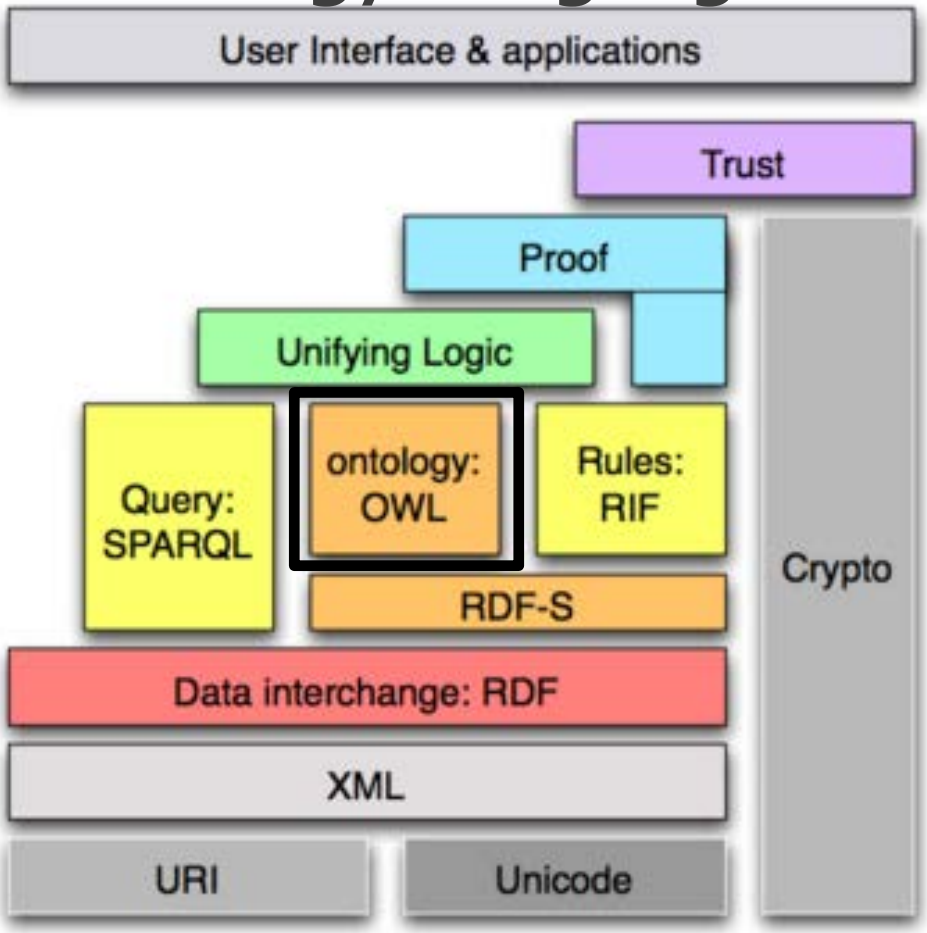
OWL – Web Ontology Language



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OWL – Web Ontology Language

- RDFS provides a simplified ontological language for defining vocabularies about specific domains.
- Sometimes it is necessary to have access to a wider range of ontological constructs.
- **Web Ontology Language (OWL)** provides more ontological constructs and avoids some of the potential confusion in RDF-S.

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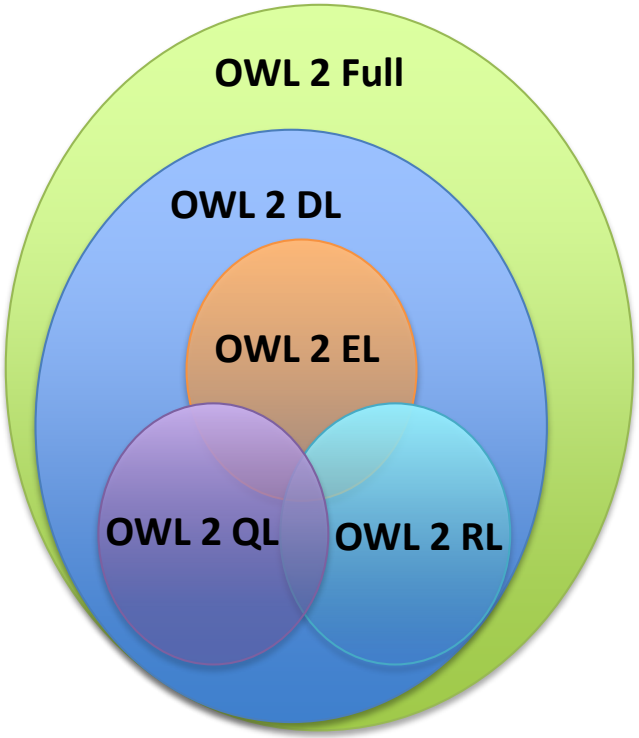
OWL 2.0 – Web Ontology Language 2.0

Extends the DL further, but has three more computable fragments (profiles).



OWL 2 Full

- Used informally to refer to RDF graphs considered as OWL 2 ontologies and interpreted using the RDF-Based Semantics.

OWL 2 DL

- Used informally to refer to OWL 2 DL ontologies interpreted using the Direct Semantics.

OWL 2 EL

- Limited to basic classification, but with polynomial-time reasoning.

OWL 2 QL

- Designed to be translatable to relational database querying.

OWL 2 RL

- Designed to be efficiently implementable in rule-based systems.

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OWL – Web Ontology Language

OWL is made up of **terms** which provide for:

- **Class construction:** forming new classes from membership of existing ones (e.g., unionOf, intersectionOf, etc.).
- **Property construction:** distinction between OWL ObjectProperties (resources as values) and OWL DatatypeProperties (literals as values).
- **Class axioms:** sub-class, equivalence and disjointness relationships.
- **Property axioms:** sub-property relationship, equivalence and disjointness, and relationships between properties.
- **Individual axioms:** statements about individuals (sameIndividual, differentIndividuals).

Semantics on the Web

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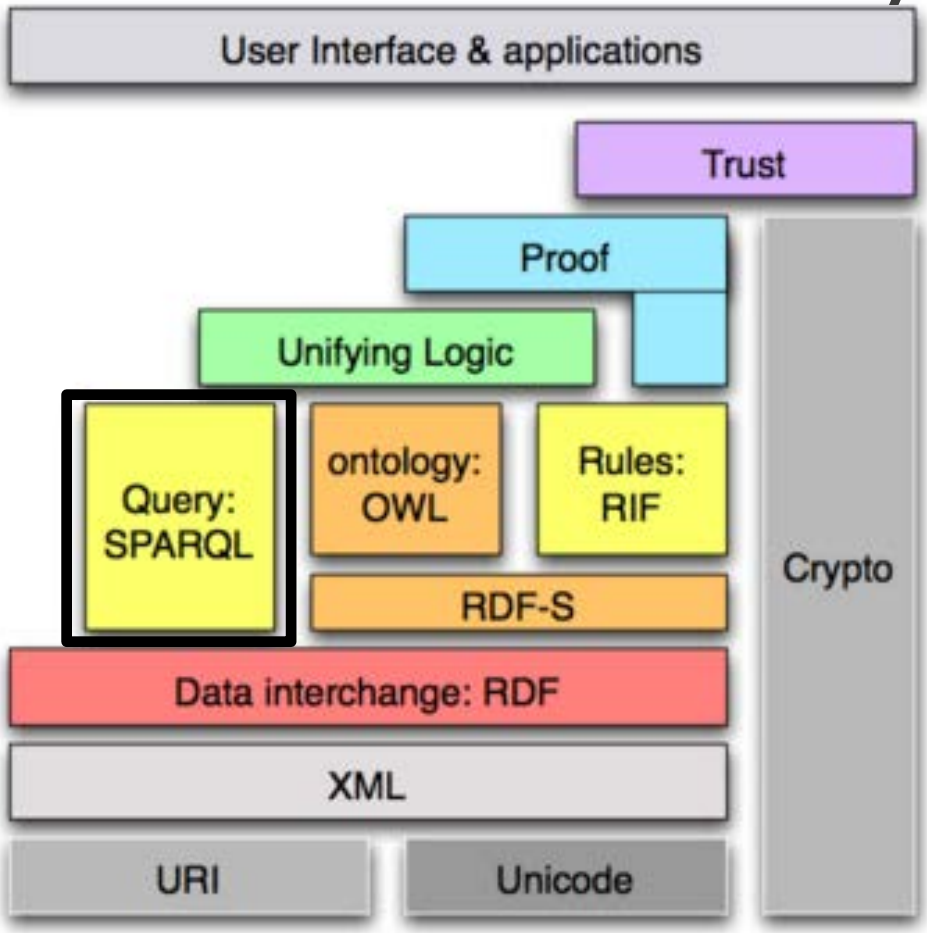
SPARQL – * Protocol and RDF Query Language



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SPARQL – * Protocol and RDF Query Language

- Query language designed to use a syntax similar to SQL for retrieving data from relational databases.
- Different query forms:
  - **SELECT** returns variables and their bindings directly.
  - **CONSTRUCT** returns a single RDF graph specified by a graph template.
  - **ASK** test whether or not a query pattern has a solution. Returns yes/no.
  - **DESCRIBE** returns a single RDF graph containing RDF data about resources.

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SPARQL – * Protocol and RDF Query Language

- The syntax of a **SELECT** query is as follows:
  - **SELECT** nominates which components of the matches made against the data should be returned.
  - **FROM** (optional) indicates the sources for the data against which to find matches.
  - **WHERE** defines patterns to match against the data.
  - **ORDER BY** defines a means to order the selected matches.

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SPARQL – * Protocol and RDF Query Language

Retrieve the names of the albums and tracks recorded by The Beatles.

```
PREFIX dc: <http://purl.org/dc/elements/1.1/>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX music-ont: <http://purl.org/ontology/mo/>

SELECT ?album_name ?track_title
WHERE {
  <http://musicbrainz.org/artist/b10bbbfc-cf9e-42e0-be17-e2c3e1d2600d#_>
   foaf:made ?album .
  ?album dc:title ?album_name ;
         music-ont:track ?track .
  ?track dc:title ?track_title . }
```

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SPARQL – * Protocol and RDF Query Language

SQL	SPARQL
Based on relations (tables).	Based on labelled directed graphs.
The relations (tables) to be matched over should be indicated.	Assumes a default graph. (The FROM clause populates this with specific identified subgraphs).
(Retrieval) queries produce a relation from a relation.	SPARQL SELECT queries produce a relation from a graph. CONSTRUCT queries (considered later) produce a graph from a graph.

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SPARQL – * Protocol and RDF Query Language

- SPARQL 1.1 provides graph update operations:
  - **INSERT DATA:** adds explicit triples, given inline.
  - **DELETE DATA:** removes explicit triples, given inline.
  - **DELETE/INSERT WHERE:** updates based on triples calculated from WHERE clause (as in SELECT and CONSTRUCT).
  - **LOAD:** reads the content of a document into a graph.
  - **COPY/MOVE/APPEND:** manipulates at named graph level.
  - **CLEAR/DROP:** removes all triples in one or more graph.

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SPARQL – * Protocol and RDF Query Language

__Insert__ the following albums recorded by The Beatles into the graph http://myFavGroups/The_Beatles

```
PREFIX dc: <http://purl.org/dc/elements/1.1/>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>

INSERT DATA { GRAPH <http://myFavGroups/The_Beatles> {
<http://musicbrainz.org/artist/b10bbbfc-cf9e-42e0-be17-e2c3e1d2600d#_>
    foaf:made <http://musicbrainz.org/release/3a685770-7326-34fc-9f18-e5f5626f3dc5#_> ,
              <http://musicbrainz.org/release/cb6f8798-d51e-4fa5-a4d1-2c0602bfe1b6#_> .

<http://musicbrainz.org/release/3a685770-7326-34fc-9f18-e5f5626f3dc5#_>
    dc:title "Please Please Me".

<http://musicbrainz.org/release/cb6f8798-d51e-4fa5-a4d1-2c0602bfe1b6#_>
    dc:title "Something New". } }
```

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SPARQL – * Protocol and RDF Query Language

__Delete__ all the information about the album Casualities of The Beatles.

```
PREFIX dc: <http://purl.org/dc/elements/1.1/>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>

DELETE { ?album ?predicate ?object . }
WHERE {
<http://musicbrainz.org/artist/b10bbbfc-cf9e-42e0-be17-e2c3e1d2600d>
   foaf:made ?album .
?album dc:title "Casualities";
       ?predicate ?object .}
```

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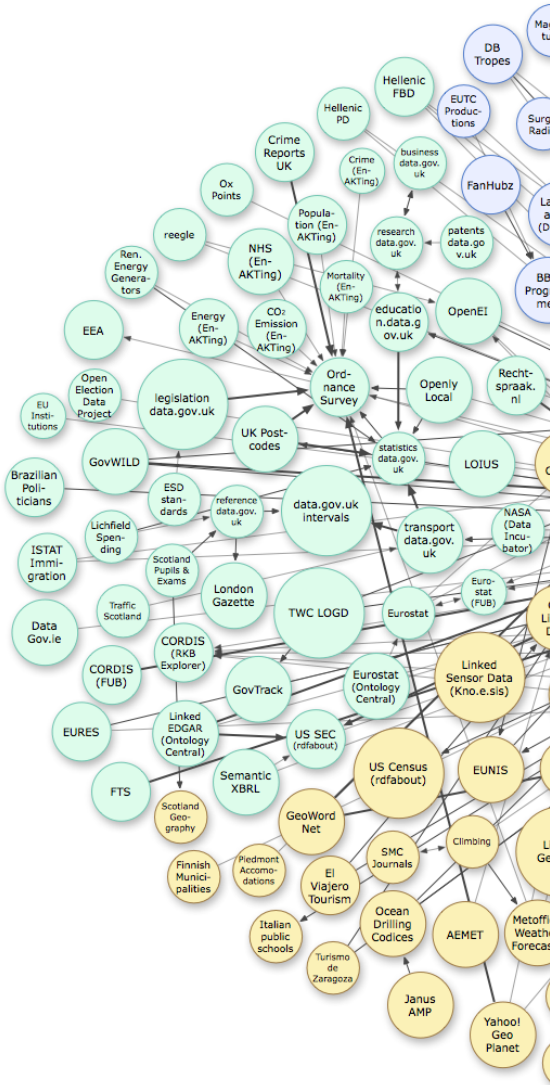
INTRODUCTION TO: LINKED DATA



Linked Data

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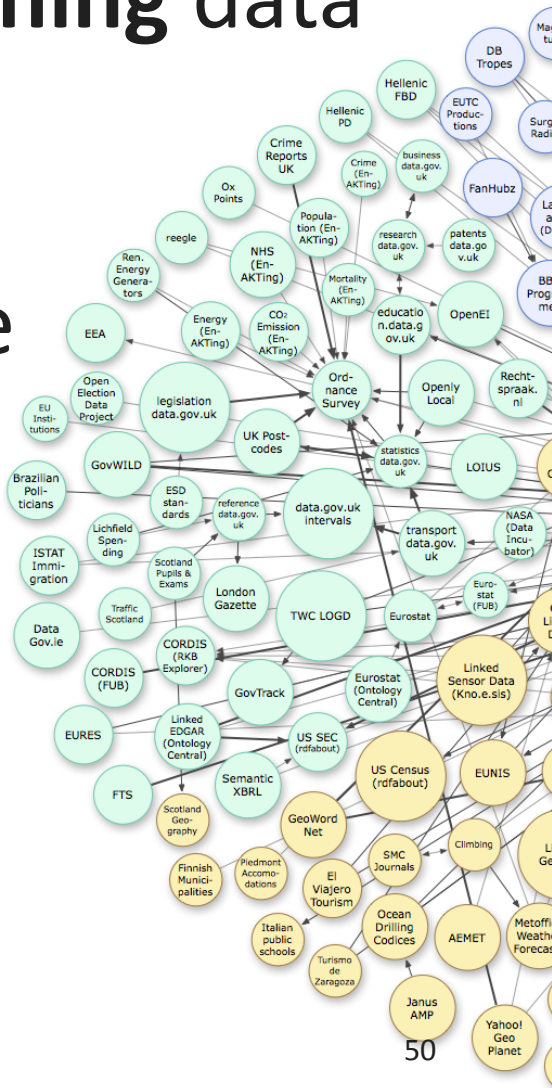
- Set of best practices for **publishing** data on the Web.
- Data from different knowledge domains, self-described, linked and accessible.
- Follows 4 simple principles…



Linked Data Principles

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

Linked Data Principles

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1. Use URIs as **names** for things.

- A foundational issue in Linked Data was the distinction of URIs for **object documents** that might describe them.

Linked Data Principles

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2. Use HTTP URIs so user can **look up** those names.

- HTTP allows a second way to distinguish real-world objects from documents.
- Best practice says HTTP 303 and Location header should be used.

Linked Data Principles

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3. When someone looks up a URI, **provide <u>useful</u> information**, using the standards (RDF*, SPARQL, Turtle[1]).

- While RDF/XML should be the default for look-up.
  - RDFa annotations in HTML are now also standard.
- SPARQL endpoint for queries are encouraged, or a dump of the whole dataset.

[1] To become a standard.

Linked Data Principles

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3. When someone looks up a URI, **provide <u>useful</u> information**, using the standards (RDF*, SPARQL, Turtle[1]).

What to return for a URI?

- **Immediate description:** triples where the URI is the subject.
- **Backlinks:** triples where the URI is the object.
- **Related descriptions:** information of interest in typical usage scenarios.
- **Metadata:** information as author and licensing information.
- **Syntax:** RDF descriptions as RDF/XML and human-readable formats.

Source: *How to Publish Linked Data on The Web* - Chris Bizer, Richard Cyganiak, Tom Heath.

Linked Data Principles

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4. Include links to other URIs, so that users can **discover** more things.

There are several ways to reuse URIs:

- direct **reuse**
- (OWL) **sameAs**
- (RDFS) **seeAlso**

} Instance Level

- direct **reuse** of class/property
- (RDFS) **sub**-class/-property
- (OWL) **equivalent** class/property
- SKOS **broad match**

} Schema Level

Linked Data 5 Star

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 Data is available on the Web.

 Data is available as machine-readable structured data.

 Non-propietary formats are used.

 Individual data identified with open standards.

 Data is linked to other data provider.

Linked Data 5 Star

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Example:

My Data

THE BEATLES

"John Lennon"

"Paul McCartney"

"George Harrison"

"Ringo Starr"

Please Please Me - 1963 • With The Beatles - 1963
A Hard Day's Night - 1964 • Beatles For Sale - 1964
Help! - 1965 • Rubber Soul - 1965
Revolver - 1966
Sgt. Pepper's Lonely Hearts Club Band - 1967
White Album - 1968
Abbey Road - 1969
Magical Mystery Tour - 1967
Yellow Submarine - 1969
Let It Be - 1970
Past Masters - 1988

Linked Data 5 Star

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Data is available on the Web

My Data

THE BEATLES

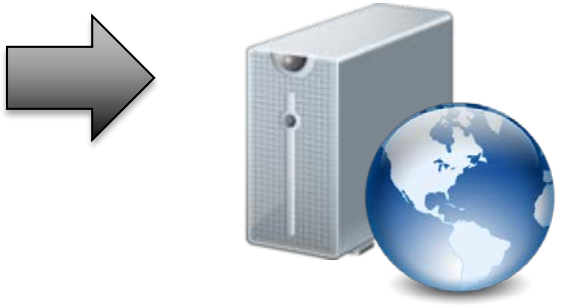
"John Lennon"

"Paul McCartney"

"George Harrison"

"Ringo Starr"

Please Please Me - 1963 • With The Beatles - 1963
A Hard Day's Night - 1964 • Beatles For Sale - 1964
Help! - 1965 • Rubber Soul - 1965
Revolver - 1966
Sgt. Pepper's Lonely Hearts Club Band - 1967
White Album - 1968
Abbey Road - 1969
Magical Mystery Tour - 1967
Yellow Submarine - 1969
Let It Be - 1970
Past Masters - 1988



It can be retrieved using HTTP.

Linked Data 5 Star

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Data is available as machine-readable structured data

My Data

"The Beatles"

http://upload.wikimedia.org/wikipedia/commons/thumb/d/df/The_Fabs.JPG/600px-The_Fabs.JPG

"John Lennon"

"Paul McCartney"

Please Please Me – 1963
A Hard Day's Night – 1964
Help! – 1965
Revolver – 1966
…

"George Harrison"

"Ringo Starr"

Machine-readable data:

 Images

 Scanned Information

 Plain text or …
(to continue on the next slide)

Linked Data 5 Star

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Non-propietary formats are used

My Data

```
<schema "http://www.example.com/2012/XMLMyMusic"
version= "1.0" >
<band>
  <name>The Beatles</name>
  <member>John Lennon</member>
  <member>Paul McCartney</member>
  <member>George Harrison</member>
  <member>Ringo Starr</member>
<picture>http://upload.wikimedia.org/wikipedia/common
s/thumb/d/df/The_Fabs.JPG/600px-
The_Fabs.JPG</picture>
  <album year=1963>Please Please Me</album>
  <album year=1964>A Hard Day's Night</album>
  <album year=1965>Help!</album>
  <album year=1966>Revolver</album>
  …
</band>
```

Linked Data 5 Star

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Individual data identified with open standards

My Data

```
<schema
"http://www.example.com/2012/XMLMyMusic"
version= "1.0" >
<band>
  <name>http://musicbrainz.org/artist/b10bbbfc-cf9e-
42e0-be17-e2c3e1d2600d</name>
<member>http://musicbrainz.org/artist/4d5447d7-
c61c-4120-ba1b-d7f471d385b9</member>
...

  <album
year=1963>http://musicbrainz.org/release/5f3ba07b-
4a24-4cd5-b8ad-95ba0fcebec1</album>
...
</band>
```

URI: Uniform Resource Identifier

- Data is uniquely **identified**

The Beatles
John Lennon
Revolver

- **Dissambiguation**

In this context, "Revolver" is an album! Not a gun.

Linked Data 5 Star

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Data is linked to other data provider

```
<schema
"http://www.example.com/2012/XMLMyMusic"
version= "1.0" >
<band>
  <name>http://musicbrainz.org/artist/b10bbbfc-cf9e-
42e0-be17-e2c3e1d2600d</name>
<member>http://musicbrainz.org/artist/4d5447d7-
c61c-4120-ba1b-d7f471d385b9</member>
…

  <album
year=1963>http://musicbrainz.org/release/5f3ba07b-
4a24-4cd5-b8ad-95ba0fcebec1</album>
…
 <seeAlso>http://dbpedia.org/resource/The_Beatles
 </seeAlso>
</band>
```

http://dbpedia.org/resource/
The_Beatles

Linked Data Cloud

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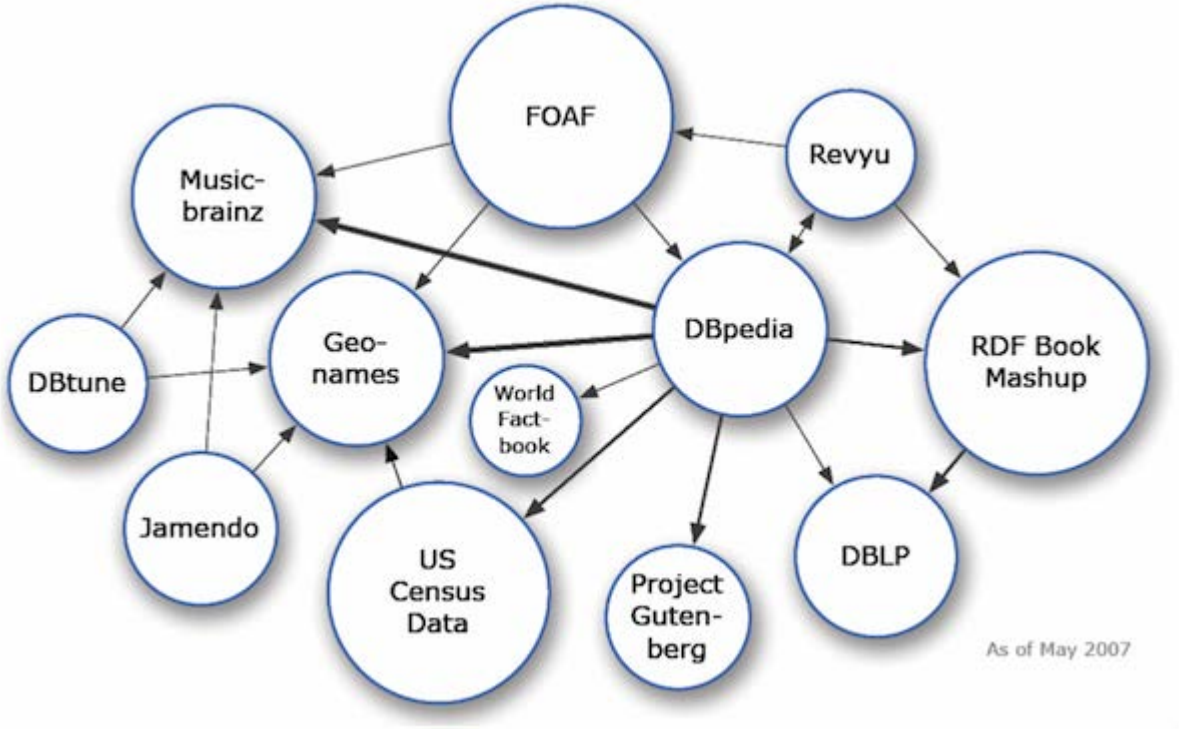
2007



Linked Data Cloud

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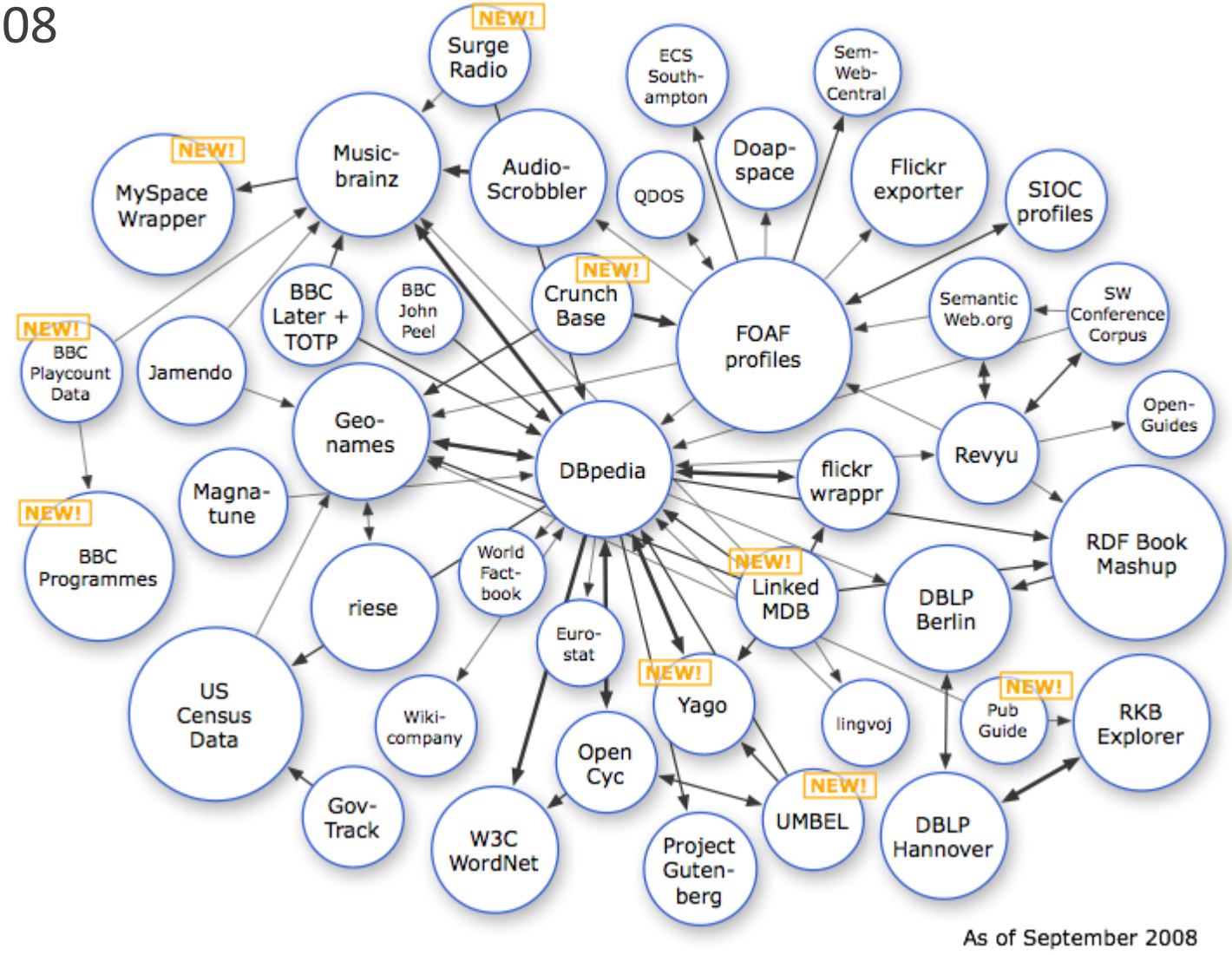
2008



Linked Data Cloud

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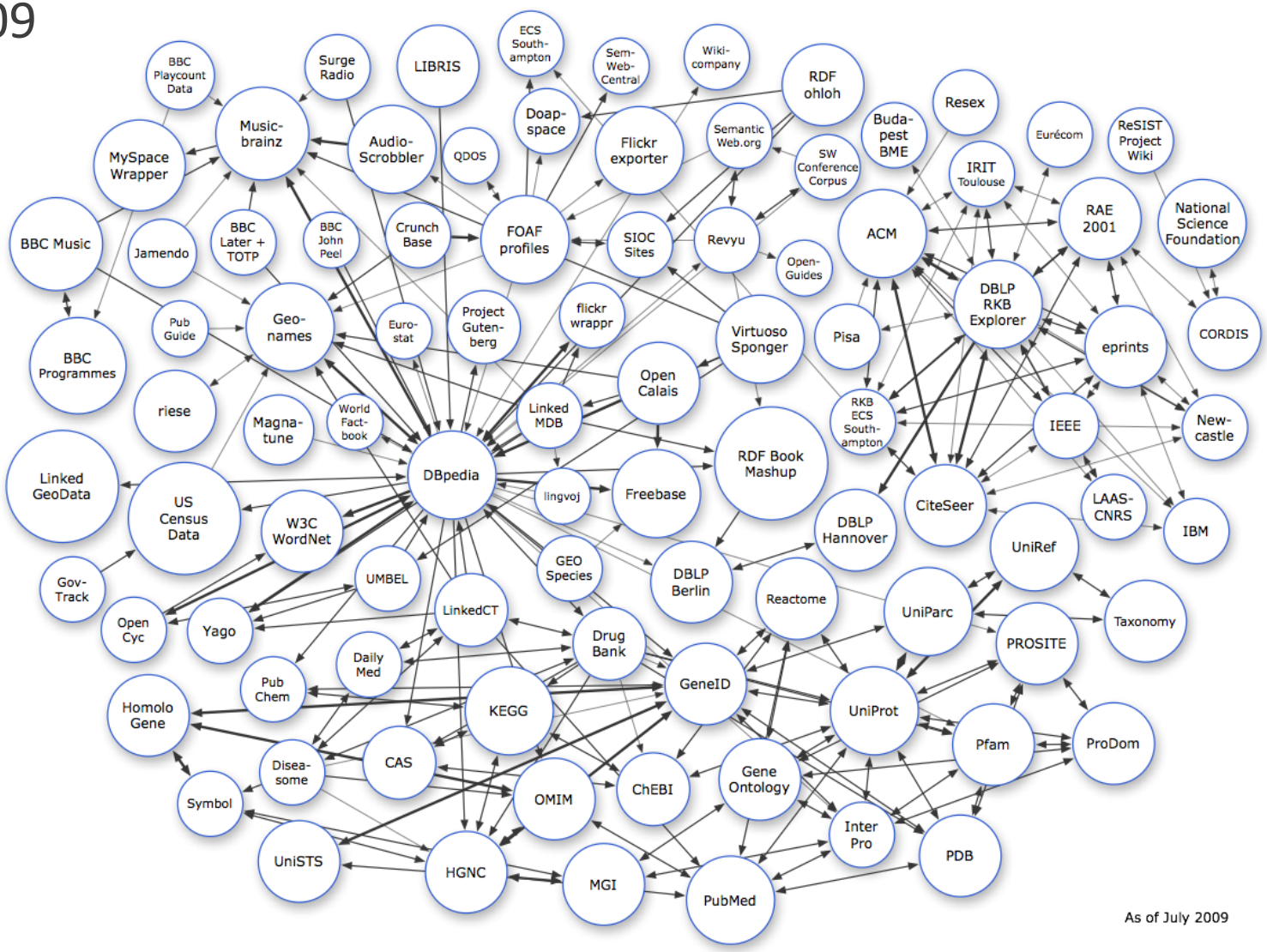
2009



Linked Data Cloud

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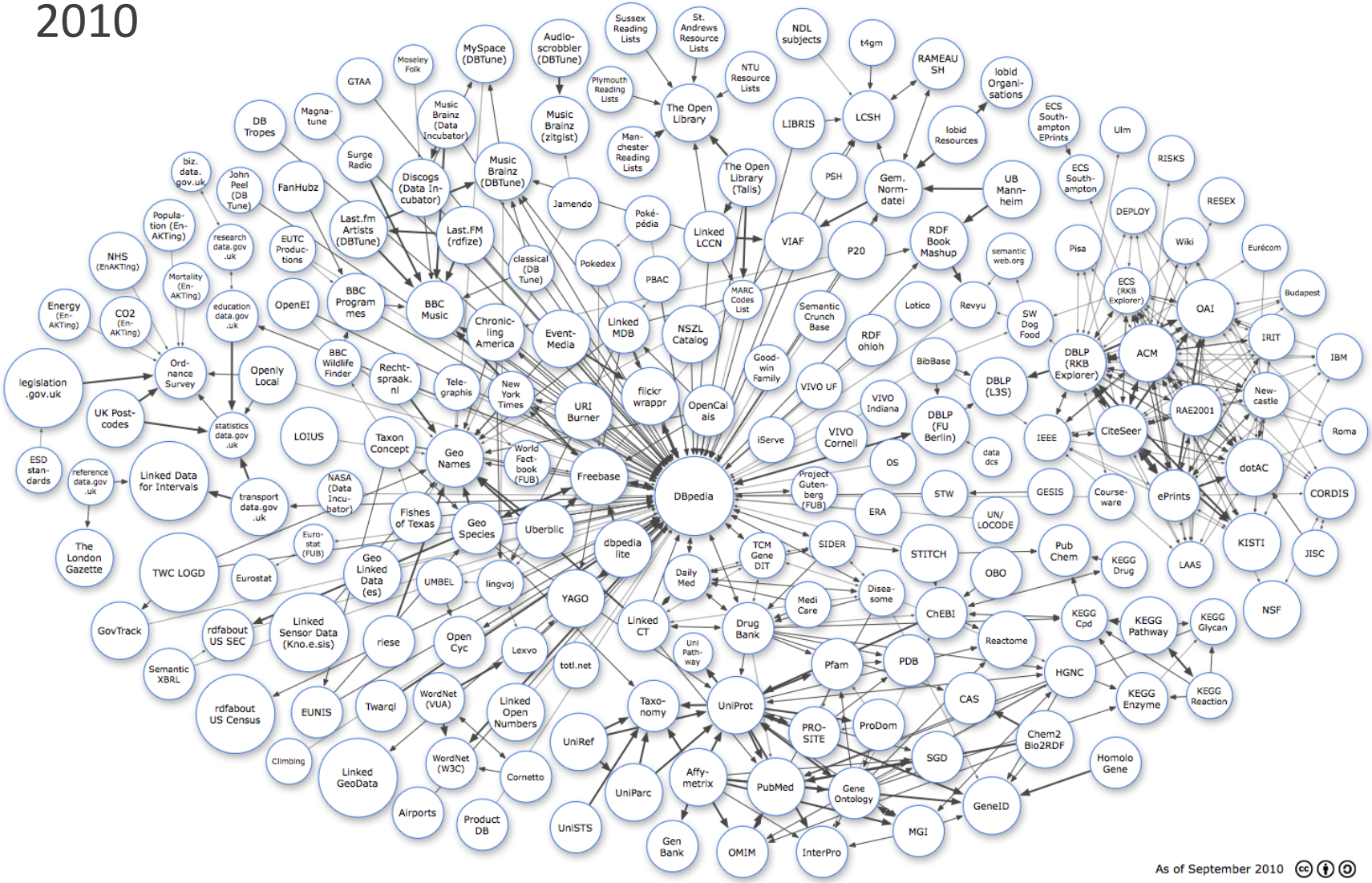
2010



As of September 2010

Linked Data Cloud

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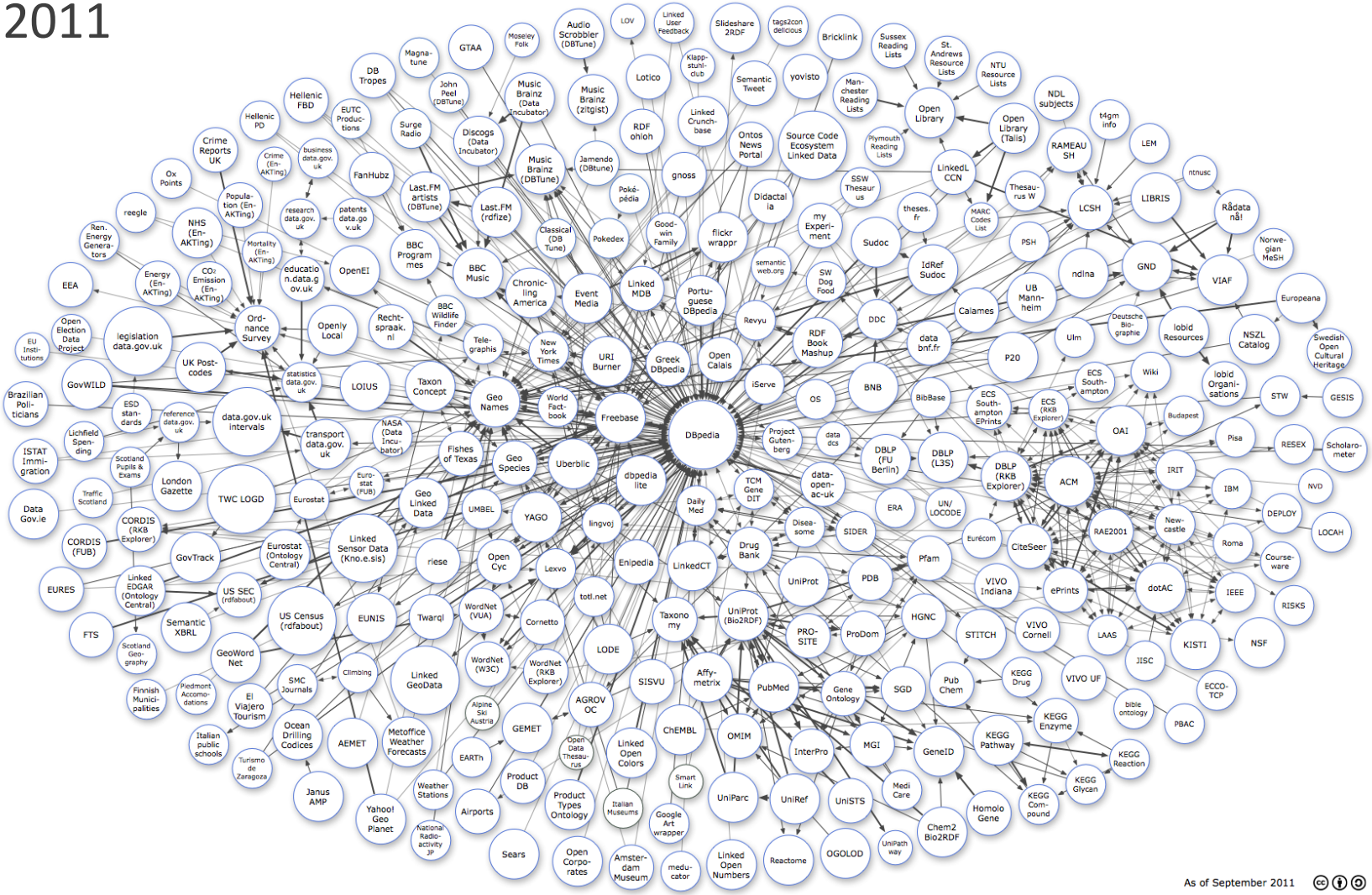
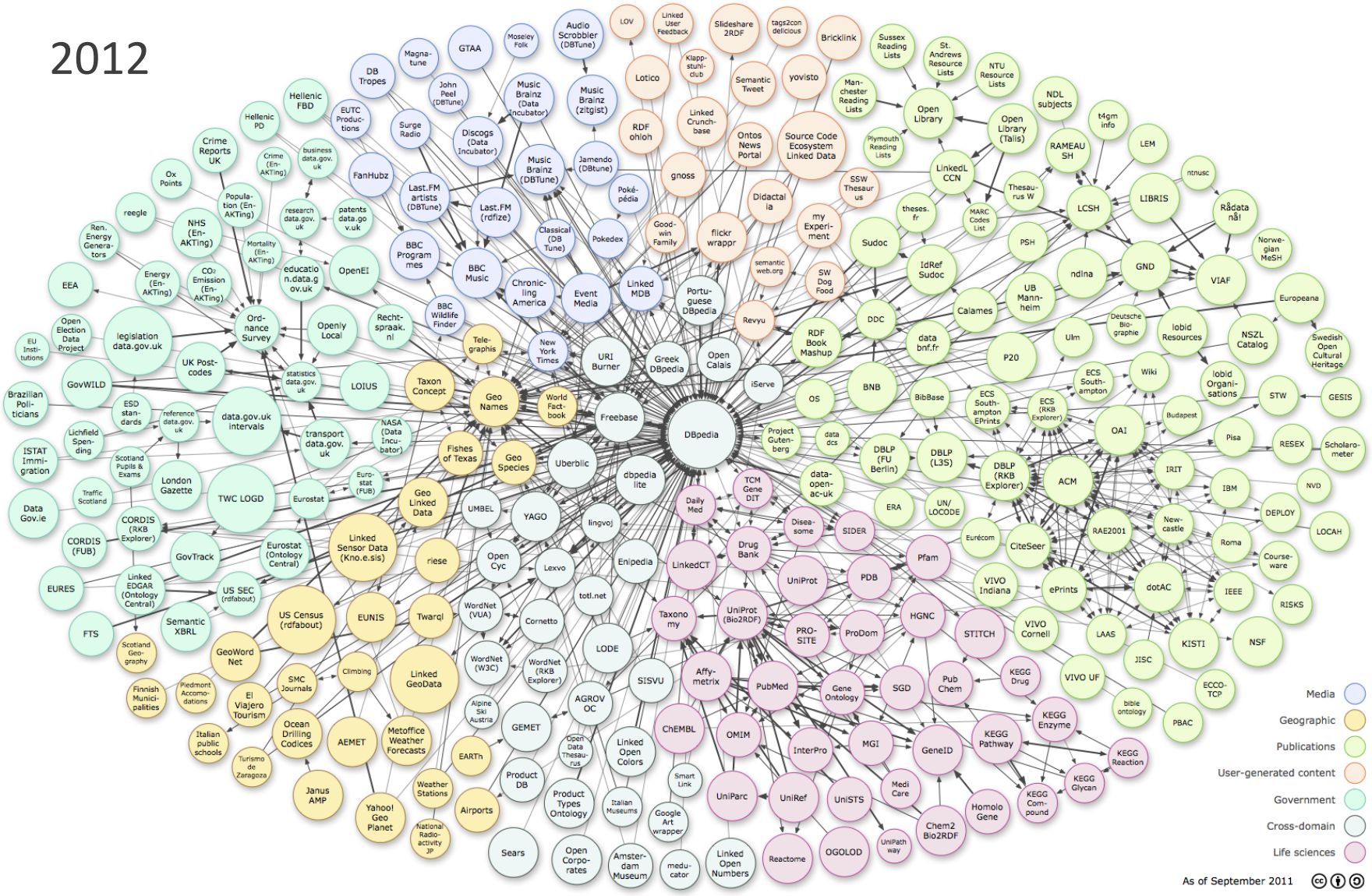
2011



As of September 2011

Linked Data Cloud

2012



State of the LOD Cloud[1]

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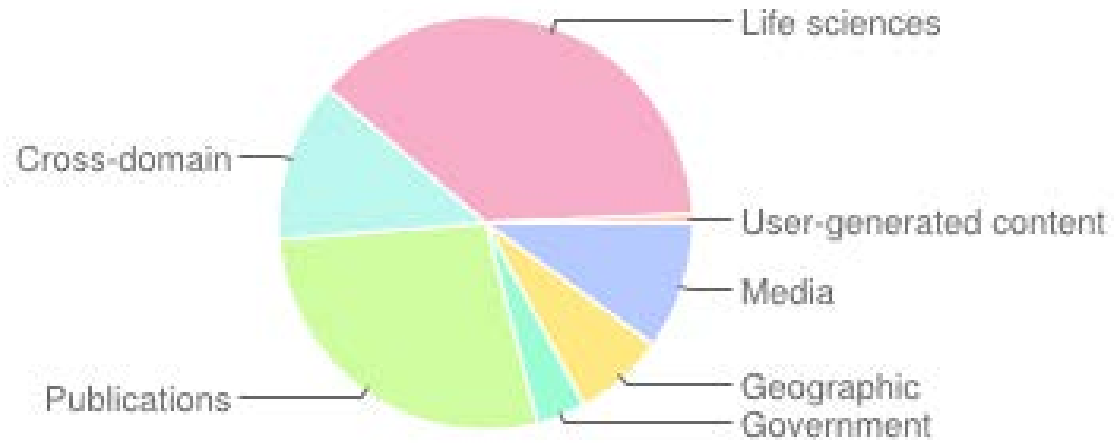
- Total Datasets:

  295

- Total Triples:

  31,634,213,770



Distribution of triples by domain

[1] Version 0.3, 09/19/2011
http://www4.wiwiss.fu-berlin.de/lodcloud/state

State of the LOD Cloud[1]

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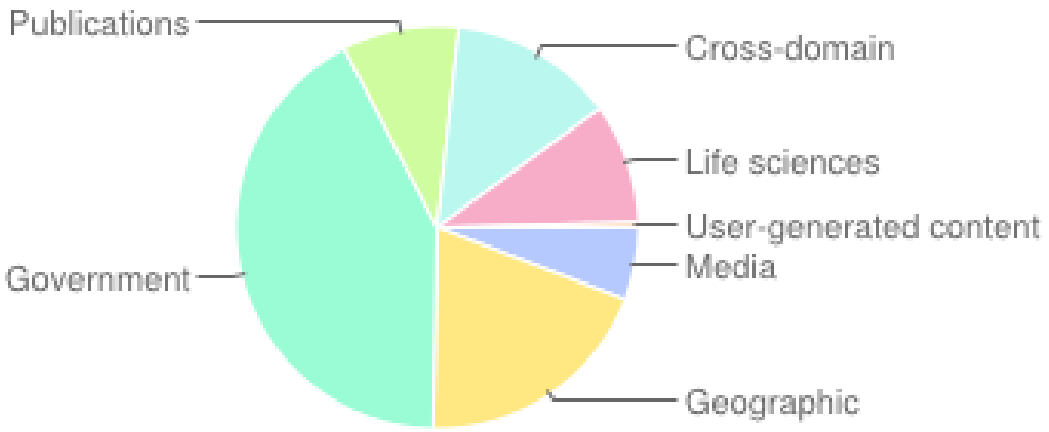
- Total (Out-)Links:

  503,998,829



Distribution of links by domain

[1] Version 0.3, 09/19/2011
http://www4.wiwiss.fu-berlin.de/lodcloud/state

Exploring the Web of Data

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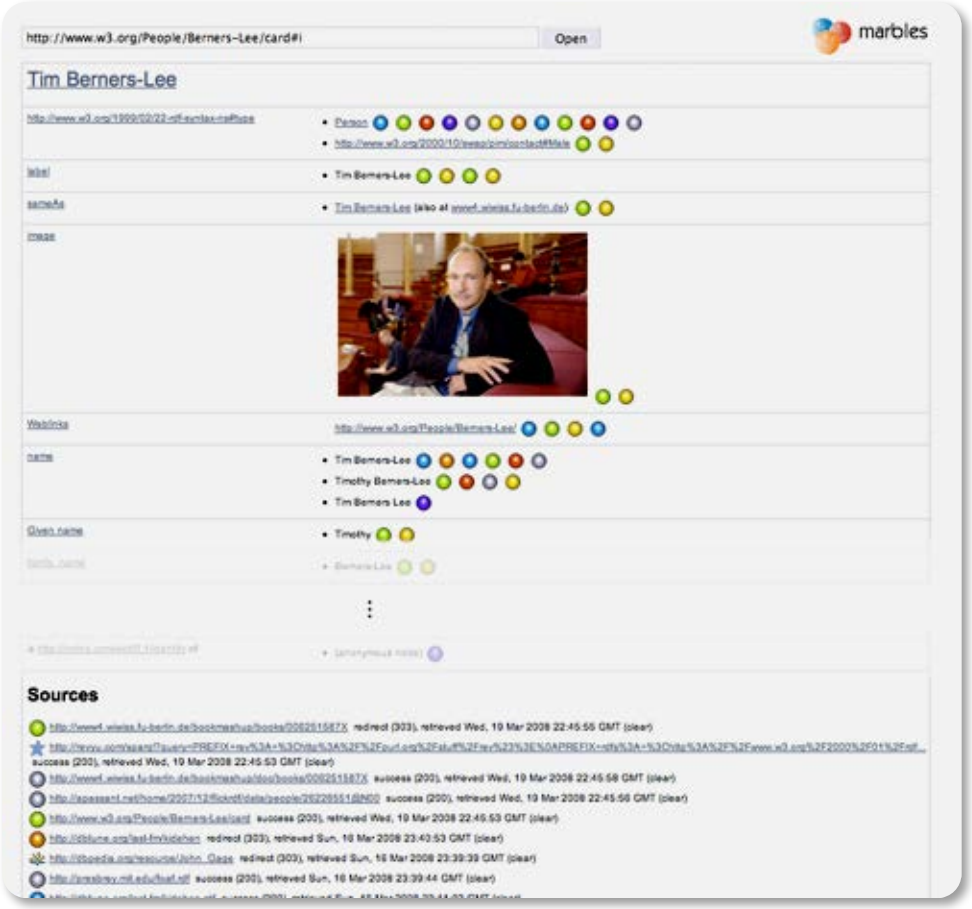
- **Linked Data browsers**
- **Linked Data mashups**
- **Search engines**

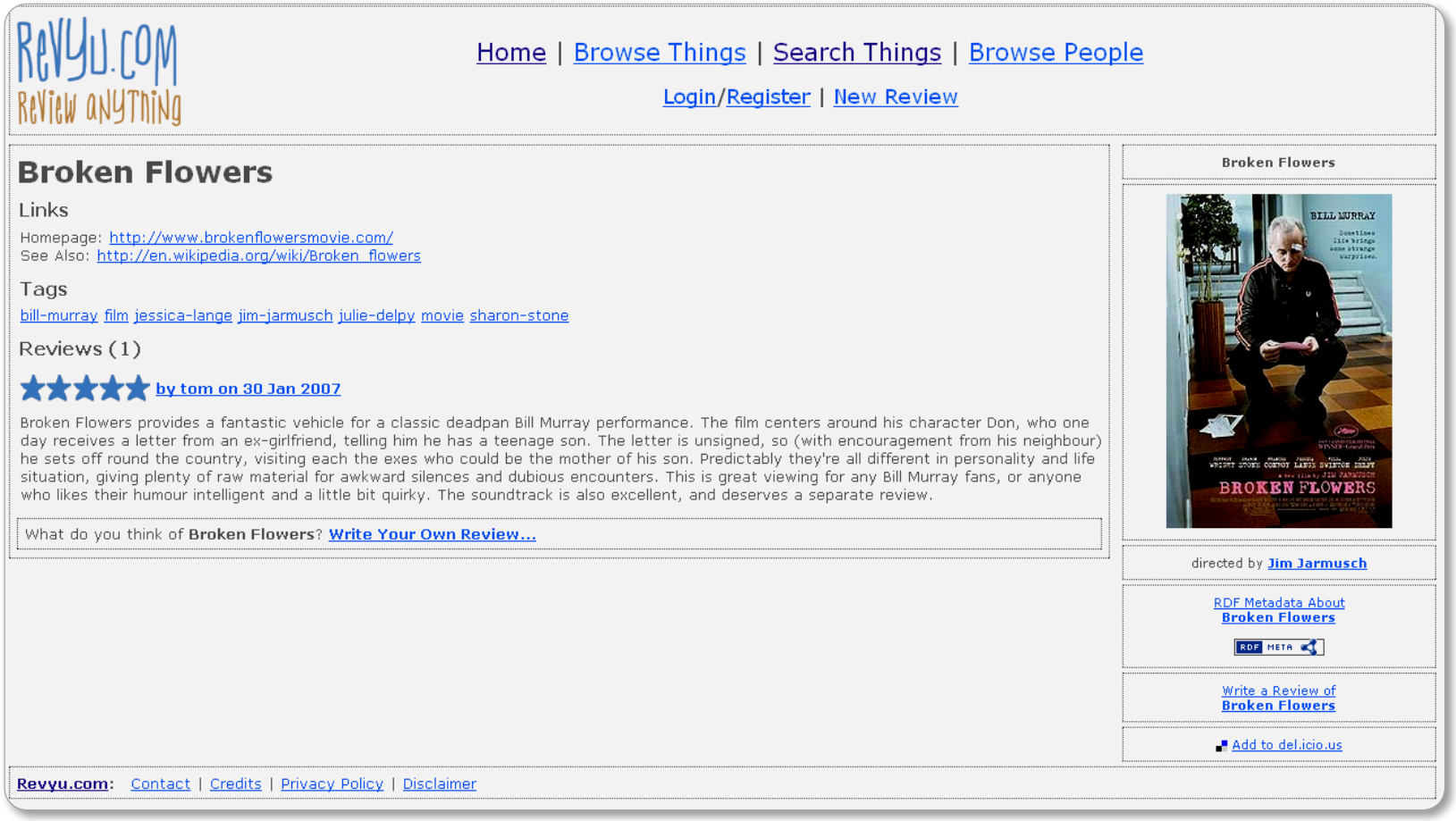
Linked Data Browsers
Marbles



http://marbles.sourceforge.net

Linked Data Mashup

Revyu.com



http://revyu.com

Linked Data Mashup
DBPedia Mobile

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Pictures from revyu.com

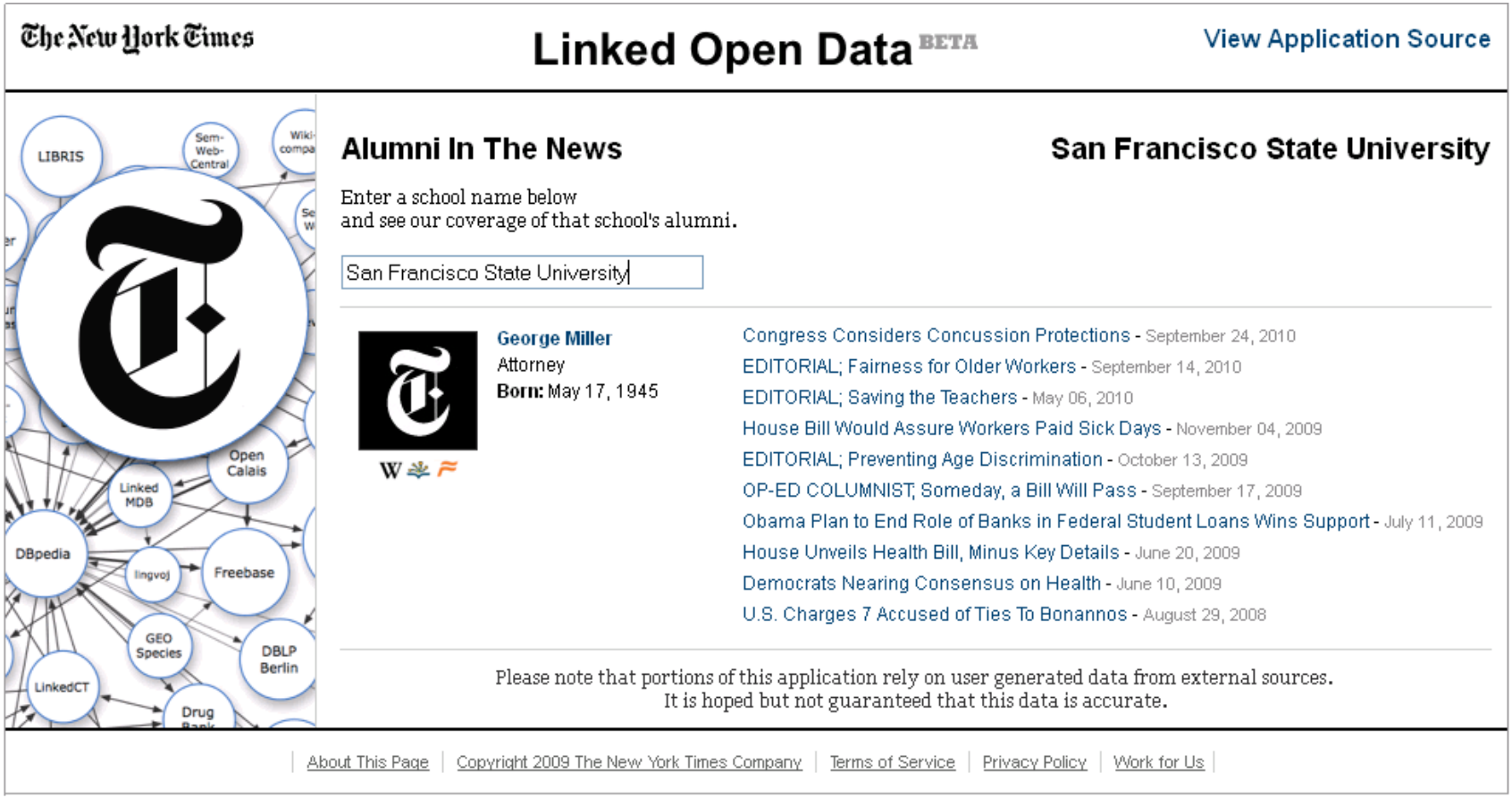
http://wiki.dbpedia.org/DBPediaMobile

Linked Data Mashup
SIGMA

http://sig.ma

Linked Data Search Engines

NYTimes



http://data.nytimes.com/schools/schools.html

Some Application Scenarios

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BBC

Some Application Scenarios

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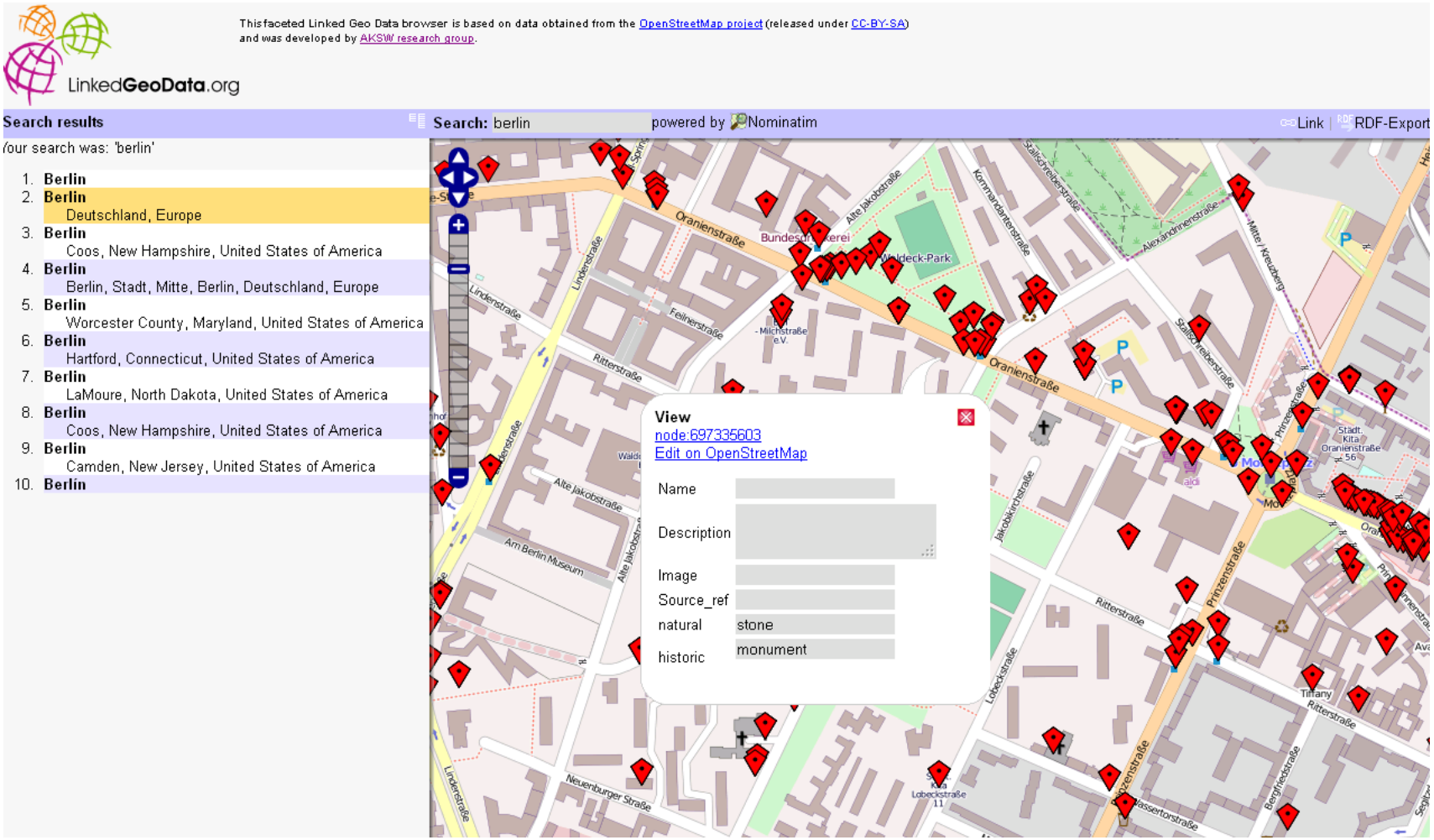
LinkedGeoData.org



Some Application Scenarios

Linked Government Data: USA

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Some Application Scenarios

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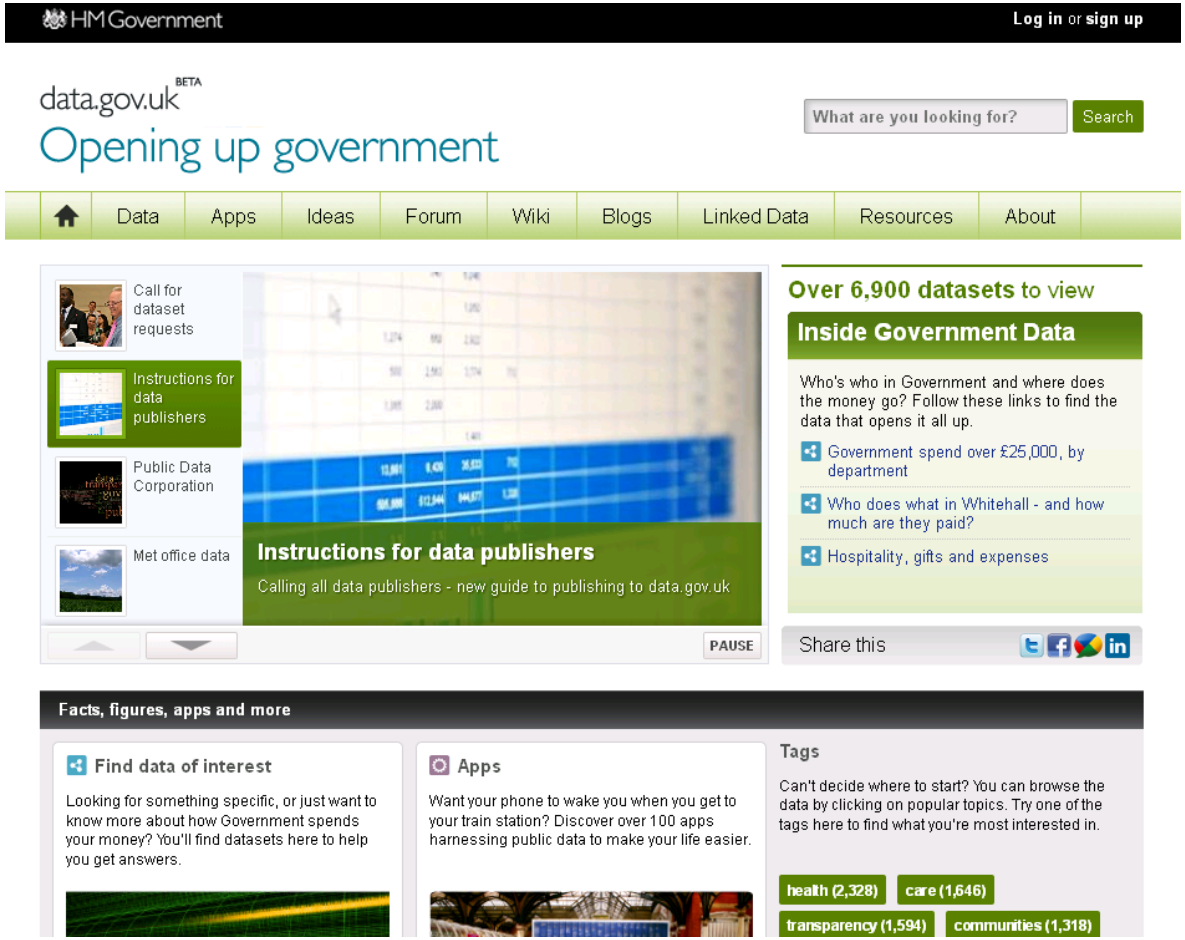
Linked Government Data: UK



Summary

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In this chapter we studied:

- **The Web** and its evolution.
- Web technology basics: **HTTP, HTML, URI**.
- **Vocabularies** to describe data.
- The **Semantic Web stack**: RDF, RDF-S, OWL, SPARQL.
- **Linked Data** concept and principles.
- Evolution of the **LOD cloud**.
- Browsers, mashups and search engines to **explore the Web of Data**.
- Some **application** scenarios.

For **exercises**, **quiz** and further **material** visit our website:

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http://www.euclid-project.eu

eBook

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Course

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