Government Linked Data: A Tipping Point for the Semantic Web

Professor Nigel Shadbolt FREng
UK Government Information Advisor

ASWC 2009, Shanghai 8 December 2009
Structure

• Review the principles of Linked Data
• The growing Web of Linked Open Data
• Describe the UK Making Public Data Public Project
• Lessons Learnt
• Implications and opportunities
From a Web of documents...
To a Web of data...
The four micro principles of the Semantic Web

1. All entities of interest, such as information resources, real-world objects, and vocabulary terms should be identified by URI references.
2. URI references should be dereferenceable, meaning that an application can look up a URI over the HTTP protocol and retrieve RDF data about the identified resource.
3. Data should be provided using the RDF/XML syntax
4. Data should be interlinked with other data.

The Semantic Web Revisited

Nigel Shadbolt and Wendy Hall, University of Southampton
Tim Berners-Lee, Massachusetts Institute of Technology
Can mark up and link any resource...

- Publications...
- Multimedia...
- Databases...
- Scientific structures...
- Workflow...
- People...
Principle 1: URIs

- Uniform Resource identifier
- A Web based identifier
- You can dereference them – get something back
- Information about objects, relations, properties and values

http://id.ecs.soton.ac.uk/person/2686
http://rdf.ecs.soton.ac.uk/person/2686
http://rdf.ecs.soton.ac.uk/project/464
http://rdf.ecs.soton.ac.uk/publication/11065
http://education.data.gov.uk/doc/school/120805
http://southampton.rkbexplorer.com/id/person-02686
http://dbpedia.org/resource/Nigel_Shadbolt
Principle 2: Dereferencable

- Uniform Resource identifier
- A Web based identifier
- You can dereference them – get something back
- Information about objects, relations, properties and values
Principle 3: RDF back

- Uniform Resource identifier
- A Web based identifier
- You can dereference them – get something back
- Information about objects, relations, properties and values
Essential RDF

- Statements about resources in the form of subject-predicate-object
- A knowledge representation language for the Web
- Represents information as sets of triples
- Every element of a triple can be a URI or literal
- Sets of RDF triples can be represented as graphs

rc:cygri rdf:type foaf:Person.
rc:cygri foaf:name "Richard Cyganiak".

dbpedia:Berlin dp:population "3,405,259"
dbpedia:Berlin skos:subject dp:Cities_in_Germany.
Essential RDF

- Statements about resources in the form of subject-predicate-object
- A knowledge representation language for the Web
- Represents information as sets of triples
- Every element of a triple can be a URI or literal
- Sets of RDF triples can be represented as graphs
Principle 4: Link data
Principle 4: Link data

http://rdf.ecs.soton.ac.uk/person/2686

http://southampton.rkbexplorer.com/id/person-02686

http://dbpedia.org/resource/Nigel_Shadbolt
Linked Data on the Web: May 2007

500 Million RDF Triples
120,000 RDF links
between data sets
Linked Data on the Web: February 2008
SPARQL

- A data access language for RDF triples on the Web
- Queries across diverse data sources, whether the data is stored natively as RDF or viewed as RDF via middleware
- SPARQL contains capabilities for querying required and optional graph patterns along with their conjunctions and disjunctions
Using advanced knowledge management technology to improve the delivery of policy and public services across Government.
The proof of concept

Unlocking the Potential of Public Sector Information with Semantic Web Technology

Harith Alani\textsuperscript{1}, David Dupplaw\textsuperscript{1}, John Sheridan\textsuperscript{2}, Kieron O’Hara\textsuperscript{1}, John Darlington\textsuperscript{1}, Nigel Shadbolt\textsuperscript{1}, and Carol Tullo\textsuperscript{2}

\textsuperscript{1} Intelligence, Agents, Multimedia
School of Electronics and Computer Science
University of Southampton, Southampton, UK
\{h.alani, dpd, jd, kmo, nrs\}@ecs.soton.ac.uk

\textsuperscript{2} Office Of Public Sector Information
Admiralty Arch, The Mall
London, UK
\{john.sheridan, carol.tullo\}@opsi.x.gsi.gov.uk

ISWC 2007
The proof of concept

**Fig. 2.** Google Maps mashup of the Camden Food Premises dataset made possible by mapping the data to the OS Address Layer II and PointX dataset
The approach became embedded

AKTive PSI: Leading by Example

4.20 The UK public sector is a source of rich, high quality and sought after data. While much of this information is published and available for re-use by others, it is often trapped by poor data structures, locked up in legacy data formats or in fragmented databases.

4.21 To explore the issues more fully, in 2005-6, OPSI worked with Advanced Knowledge Technologies (AKT), an inter-disciplinary research project led by the University of Southampton. OPSI’s work with AKT, in a research project called AKTive PSI, had two aims:

- to raise awareness about and disseminate the capabilities of semantic web technologies amongst government departments, agencies and local authorities;
- to show what is possible using this technology.

4.22 OPSI brought together a diverse collection of public sector information assets to experiment with. A number of public sector organisations were involved in the project, including Ordnance Survey, the Met Office, the Department for Communities and Local Government, the Office for National Statistics, the Department for Environment, Food and Rural Affairs, the Environment Agency and the London Boroughs of Camden and Lewisham. The project underlined the potential for the use of semantic web technology in large scale integration of public sector information and the benefits such aggregation would bring. Semantic Web technology provides the best model for a range of Interoperability issues. If widely adopted it would do much to harness the re-use of public sector information.

4.23 AKTive PSI has spawned further work in government using Semantic Web technology. OPSI is using this technology in the following ways:
And then the unanticipated Information Advisors to HMG
The Context

- Berners-Lee and Shadbolt - Information Advisors
- Context - PoI Taskforce
- Previous work with OPSI
- Why do this?
  - Transparency and accountability
  - Economic and Social Value
  - Public Service Improvement
  - New Industries New Jobs
Transparency and Accountability

MPs Travel Expenses

This map shows the relative total travel expenses of the 100 MPs with the lowest majorities. The largest/darker circles indicate higher expenses.

These charts show the highest 25 expense claims in the three main parties.
Social and Economic Value

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[Google Map Image]
Social and Economic Value
Social and Economic Value
Improving Public Services

- Hazards
  - Report a hazard
- Map
- List
- Monthly Totals
- Authorities
  - List
  - League Table
  - Information
  - Pothole News
  - Search
  - Help
  - Contact

User login
Username:
Password:
Log in
- Create new account
- Request new password

CTC Websites
- Main CTC Site
- Accident Line
- Cycle Insurance
- Forum
- Holidays
- Maps
- Shop
- Travel Insurance

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CTC Main Site | Contact
Improving Public Services

### League Table

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#### Site Statistics
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- Fixed reports: 8,927
- Percent fixed: 36%
- Reports per day: 22.1
# Improving Public Services

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</table>
Our ToR

1. Establish single point of access for all public UK datasets - data.gov.uk

2. Specific proposals to implement and extend to wider public sector PSI principle
   - Select and implement common standards for release of public data
   - Select, develop and implement common terms for data where necessary
   - Develop licenses - CC variants
   - Support exploitation and publication of distributed and decentralised information assets
   - Potential for reform of info regulatory framework

3. Drive use of internet to improve Gov consultation process

4. Engage with International dimension

5. Drive culture change in Whitehall - total publication of non-personal data using open standards
Progress to date

- Top down
  - Ministerial
  - CIO/CTOs
  - Engaged key data holders
- Middle Out
  - Civil Servants
  - Inventory of Information Assets
- Bottom up
  - Engaging with developer community
  - Cross Gov URI workshops
  - data.gov.uk
- Dissemination
Progress to date

- Top down
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- Bottom up
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- Dissemination
data.gov.uk

- Currently under development scrutiny and extension
  - Over 1100 datasets
  - Over 1000 registered developers
  - The beginning of linked data

- Beta service to be released January 2010
- Access to OS from April 2010
- Clear schedule of release thereafter
### Massive Outgoings

Cost for average British taxpayer per day

<table>
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<tr>
<th>GOVERNMENTS</th>
<th>ESSENTIALS</th>
<th>TRAVEL</th>
<th>BANKING CHARGES</th>
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<td><strong>Pensions</strong></td>
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<td><strong>£0.04</strong></td>
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</table>

**David McCandless**
2008 London Counts Compared To 2001

Chris Osborne
data.gov.uk Education data demo
Pipe Web Address: http://pipes.yahoo.com/pipes/pipe.info?_id=baae2049e88831992c57d6c486bec

Query: SELECT ?school ?name

Map

Forge Valley Community School
Opening date: Closure date:
Neighbourhood

77% ↓ 39%

Gun Crime ↓ 37% ↓ 17%

Robbery ↓ 14% ↓ 13%

Theft

Overall Crime

Police Confidence

In 2008-09, gun crime was reduced by over 37 per cent and knife crime by 17 per cent. Youth crime also fell by 10 per cent. Satisfaction with the Police and the Fire Brigade are six per cent above the London average.

Hackney Council

Neighbourhood

Summary

Hackney Police and the Council work very closely to help prevent crime in the borough. Seventy-seven per cent of residents now have confidence in Hackney Police, according to the British Crime Survey. A rise of 15 per cent in less than two years.

Summary

The survey also reveals that crime in Hackney has dropped 18.5 per cent over five years, the second largest drop of all London boroughs. Last year, there were 10,100 fewer victims of crime in Hackney than five years ago.

Allotments

Allotment Flots

Tower Hamlets

282

Newham

Waltham Forest

Waiting List Time

1,382

Tower Hamlets

Newham

Waltham Forest

You are here

Haringey

Green Space

23%

by land area in Hackney

Your nearest parks are:

Hoxton Marshes (15 min walk)
Victoria Park (15 min walk)
London Fields (20 min walk)

Recycling

% Satisfaction with Parks

Shires End Recycling Centre, 17 James Road, Shires End, E5 9PY, 020 8806 7443.

If you intend to use a van to bring your waste to the recycling centre, please note that there are only parking spaces available between 8am and 4pm. Outhouse storage and mailboxes are not accepted.

If you are unable to use your own vehicle, please book your collection in advance.

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You can recycle the following items at the site:

- Books
- CDs
- Magazines
- Newspapers
- Bottles and jars
- Cans
- Glass bottles and jars
- Cardboard
- Food and drink containers
- Bottles
- Cans
- Insulated boxes
- Toys and games
- Kitchen equipment
- Clothing
- Electrical appliances
- Furniture
- Garden furniture
- Garden tools
TRAVEL TIMES

Oxford Circus
41 min
Tottenham Court Road
42 min
37 min
47 min

King’s Cross
30 min
35 min
51 min
45 min

Victoria

Manchester

2:44

Paris

3:00

Edinburgh

5:00

Bristol

3:00

LOCAL TRANSPORT

For free cycle training in Hackney, call 020 8356 2897
David Peterson

David Peterson has been a web developer since the early years - 1995. He works in the steamy tropics and is trying to kick start the Semantic Web down under. Not only that, but he is an Advisory Committee representative to the W3C, wow. His wonderful family, making lovely photographs and searching for the perfect espresso keeps him happy.

Does your system cater for SMS alerts?

SMS enable your system alerts and enjoy the mobility of push technology, simple set-up and rapid integration.

SMS alerts can reach over 712 mobile networks using a range of API connections including HTTP/S, FTP, SMTP, SMTP, XML, COM Object & SOAP connections.

FIND OUT HOW TO SMS ENABLE YOUR SYSTEM IN 5 EASY STEPS:

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---

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- SitePoint Design View
- SitePoint Market Watch
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Subscribe!

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Obama’s Groundbreaking use of the Semantic Web

by David Peterson

In a revolutionary move, Obama’s administration is set to utilise next generation web technologies to bring an unprecedented level of transparency to government. In this case it will shed light on how the roughly US $800 billion dollar economic stimulus will be spent. The recently launched recovery.gov website (powered by nothing other then Drupal) brought with it the promise that citizens would be able to view where the money was going and how it was going to be spent.

To enable the citizen masher to do their wizardry, the administration will be opening up a veritable candy store of goodies: Semantic Web, RDF, Linked Data, SPARQL, RDFa, SIOC, ATOM, RESTful APIs, JSON, Widgets, Wikis, XForms, P2P Networks. Wow. They only forgot the lions and tigers and bears oh my... This is an unbelievable stack of technology. I didn’t think the government even knew what an RSS feed was :)

---

Blog » Web Tech » Obama’s Groundbreaking use of the Semantic Web

« Microsoft SuperPreview: a New Way to Test Web Sites
Open Source Image Editors ... for Designers? »
Semantic Web Architecture for Government Data

Data Processors
(Web Services & Analyzers)

- XSLT Service
- Diff Service
- Link Annotator
- RSS Generator

GOV data (RDF)

Convert Data

Link & Enrich Data

View & Use Data

Li Ding, Dominic DiFranzo, Sarah Magidson, and Jim Hendler · Tetherless World Constellation · Rensselaer Polytechnic Institute · Aug 7 2009 · http://data-gov.tw.rpi.edu/
Data.gov + epa.gov

Castnet Ozone Map

Ozone Stations

Land Use
- 27 Agric
- 1 Coastal/Marsh
- 3 Desert
- 40 Forest
- 1 Forest/Arid
- 2 Forest/Marsh

Terrain
- 37 Rolling
- 4 Mountain top
- 1 Flat/Water
- 14 Flat
- 27 Complex
- 1 Coastal

Agency
- 59 EPA
- 25 NPS

Wind Cave NP from NPS
53ppb (Average Ozone level)
Land Use: Prairie
See Data
More Information

Ozone order
- 30
- 36
- 42
- 48
- 54
- 60
Linking outside data.gov.uk

- Example from one of our education datasets
- A SPARQL query against data.gov.uk
- A transformation into KML
- A representation on Google Maps
- A link to the dbpedia URI for one of our schools
- This is information enrichment
Linking outside data.gov.uk

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Challenges to free Public Data

- The ubiquity of spreadsheets
  - Large amount of data is in spreadsheets
  - The challenge of implicit and variable semantics in these
- The importance of good URI schemes
- Publish the raw data
  - The perfect is the enemy of the good
  - Don’t get into format wars
- Praise the data holders and appreciate their challenges
- The importance of location and time
Challenges to free Public Data

- Cultural & Organisational
  - Data hugging
  - We have released it - sort of...
  - License impediments
- Worries about
  - Confidentiality
  - How it will be Interpreted
  - QoI
  - Lost value
  - Disrupted workflow
  - New IT procurement
- Importance of local authority and other public bodies

- Capability
  - What assets have we got (no duty to hold register of public non-personal datasets)
  - Who can do this work
  - How to share best practice
  - Minting URIs

- Policy
  - Extending the principle to all public sector bodies
  - Consistency in what is published, how it is licensed and its format
  - Range of exceptions do need to be appreciated
  - Confidentiality, accuracy, liability and reputation
Why this matters to us

- More governments, municipalities, cities and media getting machine readable mark up
- The sum is greater than the parts
- Exploitation of
  - open data
  - open standards
- Can apply to data intranets as well as extranets
- Government linked data is showing how heterogeneous information can be shared, linked, mapped and enriched