



Sally Lynskey  
Chief Executive



UNIVERSITY OF  
**Southampton**  
School of Electronics  
and Computer Science

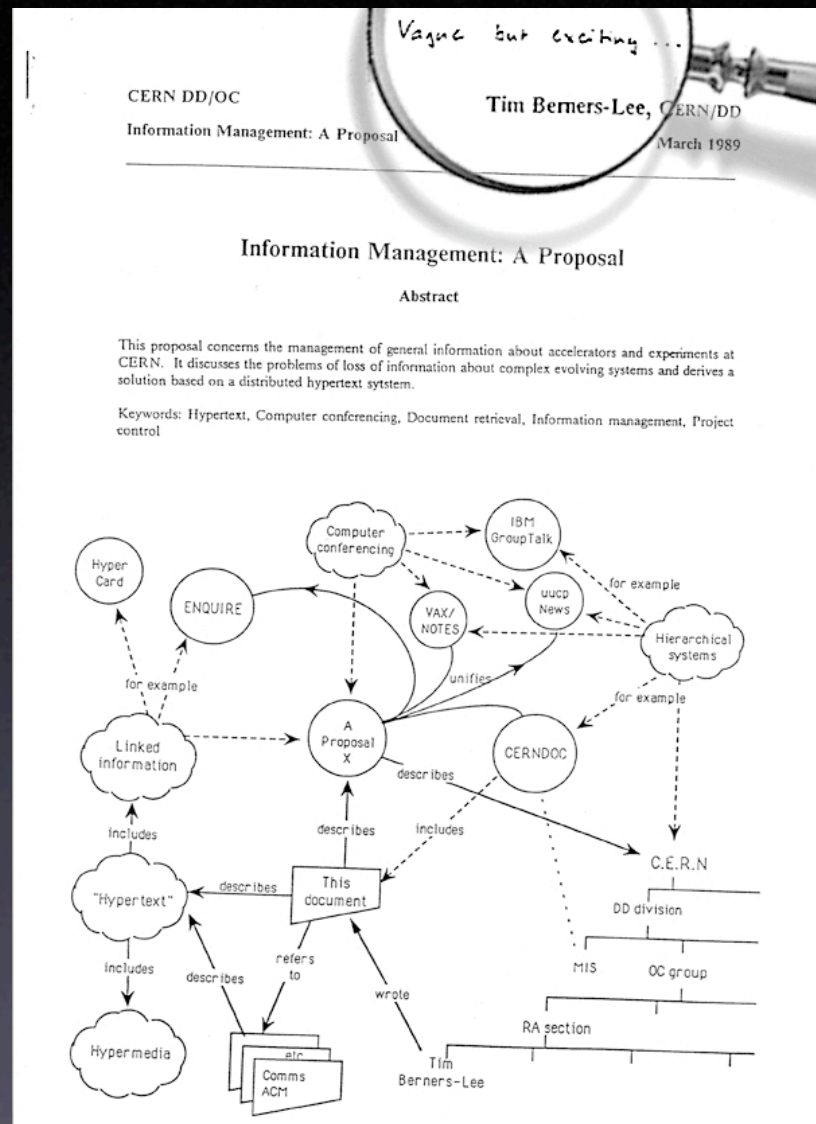
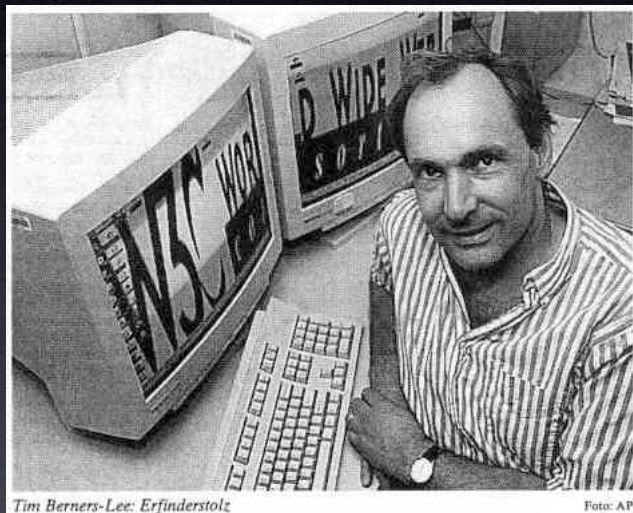


# Here Comes Everything: Preparing for the Linked Web of Data

Wendy Hall  
Nigel Shadbolt

11 January 2010  
Chilworth Manor





Lessons learnt:

Big is beautiful:  
the network is everything (tbl)

Scruffy works: let the links fail to make it scale (tbl)

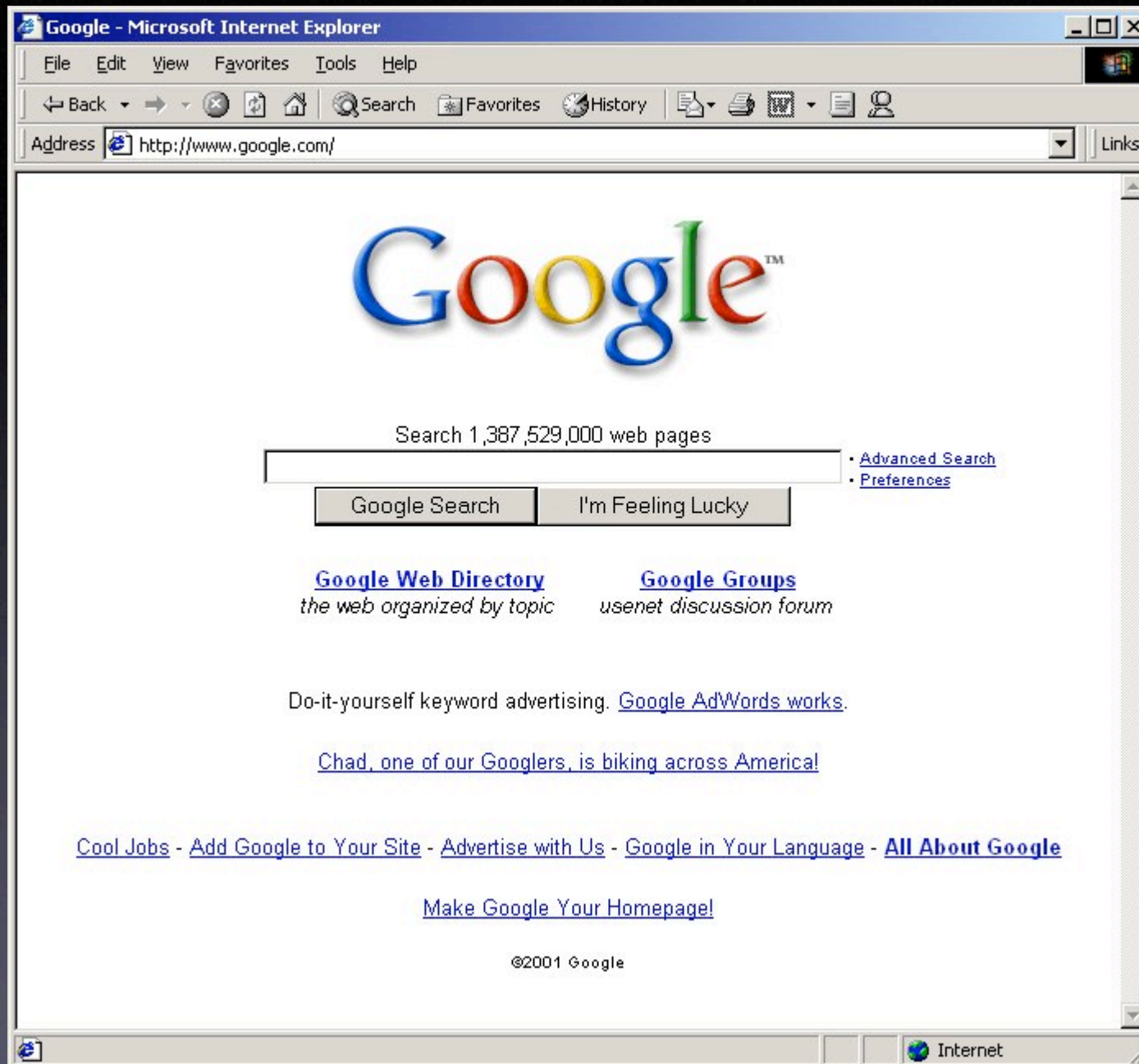
Democracy rules: open and free (tbl)

Open, non-proprietary, universal standards

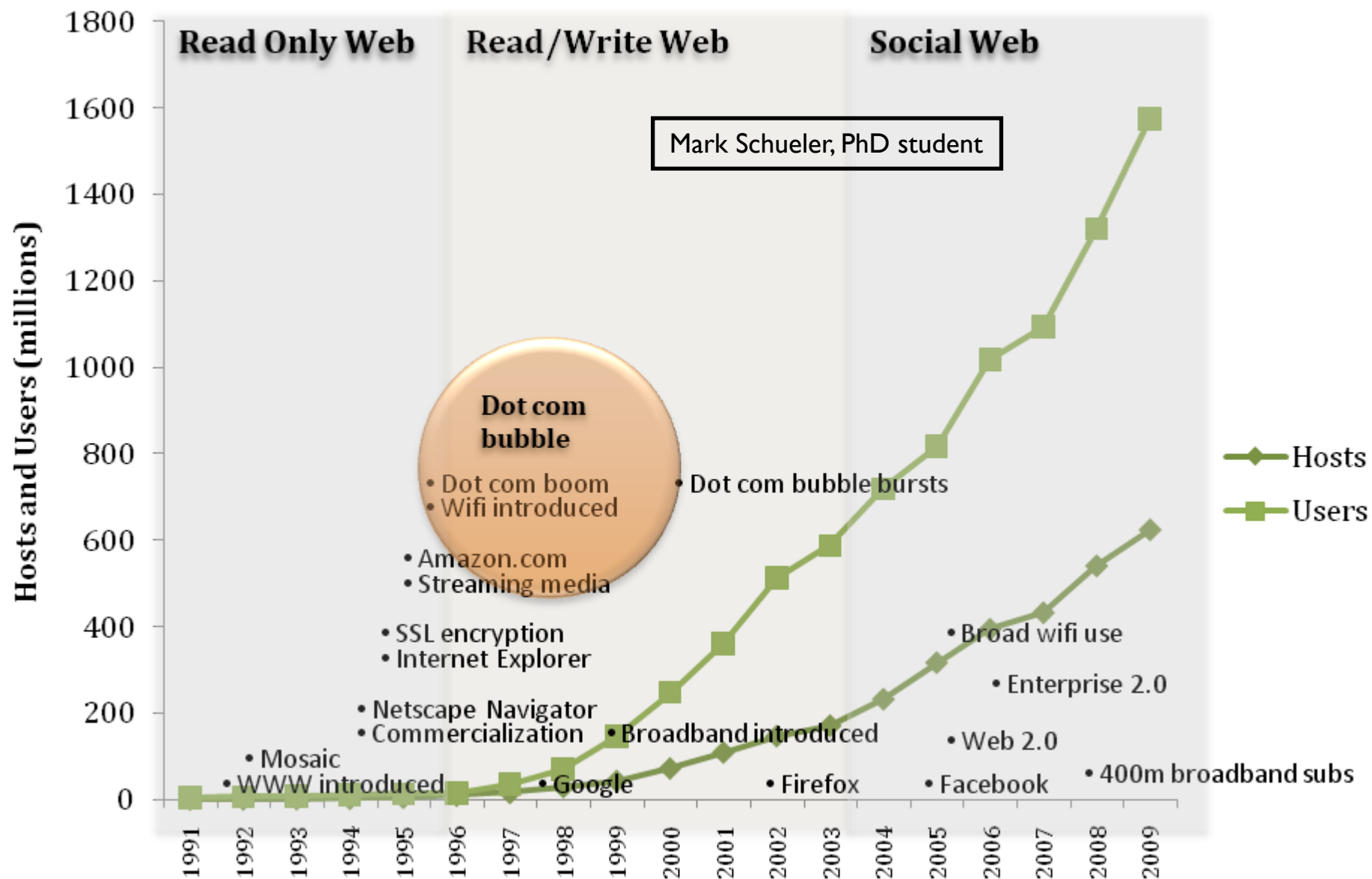
But as the Web got bigger

Couldn't find information easily just by following links





# Internet Growth - Usage Phases - Tech Events



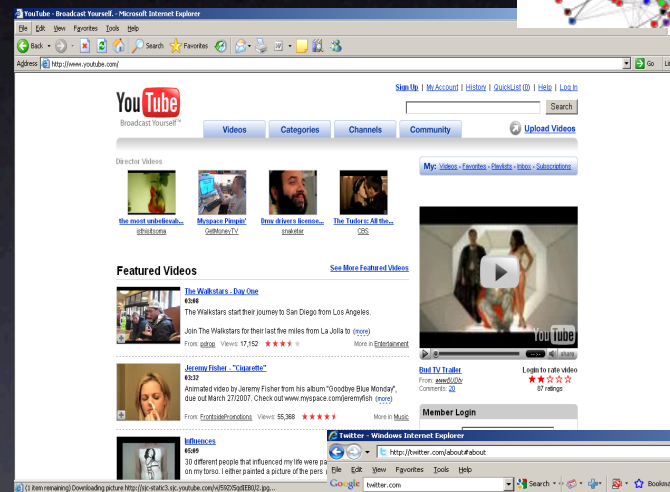
Note - events shown relate to the time axis only.

# Web 2.0



- Wiki's
- Blogs
- Folksonomies
- Flickr
- YouTube
- MySpace
- Facebook
- Second Life
- Twitter

Blogosphere





Wikipedia, the free encyclopedia - Windows Internet Explorer

http://en.wikipedia.org/wiki/Main\_Page

File Edit View Favorites Tools Help

Google Wikipedia Search + - Bookmarks Check Translate AutoFill Wikipedia Sign In

Wikipedia, the free ency... realtimecollisiondetection.ne...

Try Beta Log in / create account

main page discussion view source history

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WELCOME TO WIKIPEDIA,  
the free encyclopedia that anyone can edit.  
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navigation

- Main page
- Contents
- Featured content
- Current events
- Random article

search

Go Search

interaction

- About Wikipedia
- Community portal
- Recent changes
- Contact Wikipedia
- Donate to Wikipedia
- Help


toolbox

- What links here
- Related changes
- Upload file
- Special pages
- Printable version
- Permanent link

Overview · Editing · Questions · Help

Contents · Categories · Featured content · A–Z index

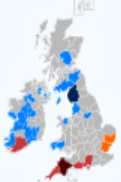
**Today's featured article**

 **Grover Cleveland** (1837–1908) was both the 22nd and 24th President of the United States. Cleveland is the only President to serve two non-consecutive terms (1885–1889 and 1893–1897) and therefore is the only individual to be counted twice in the numbering of the presidents. He was the winner of the popular vote for President three times—in 1884, 1888, and 1892—and was the only Democrat elected to the Presidency in the era of Republican political domination that lasted from 1860 to 1912. Cleveland's admirers praise him for his honesty, independence, integrity, and commitment to the principles of classical liberalism. As a leader of the Bourbon Democrats, he opposed imperialism, taxes, subsidies and inflationary policies, but as a reformer he also worked against corruption, patronage, and bossism. Critics complained that he had little imagination and seemed overwhelmed by the nation's economic disasters—depressions and strikes—in his second term. Even so, his reputation for honesty and good character survived the troubles of his second term. [\(more...\)](#)

Recently featured: [Werner Mölders](#) – [Electron](#) – [Han Dynasty](#)

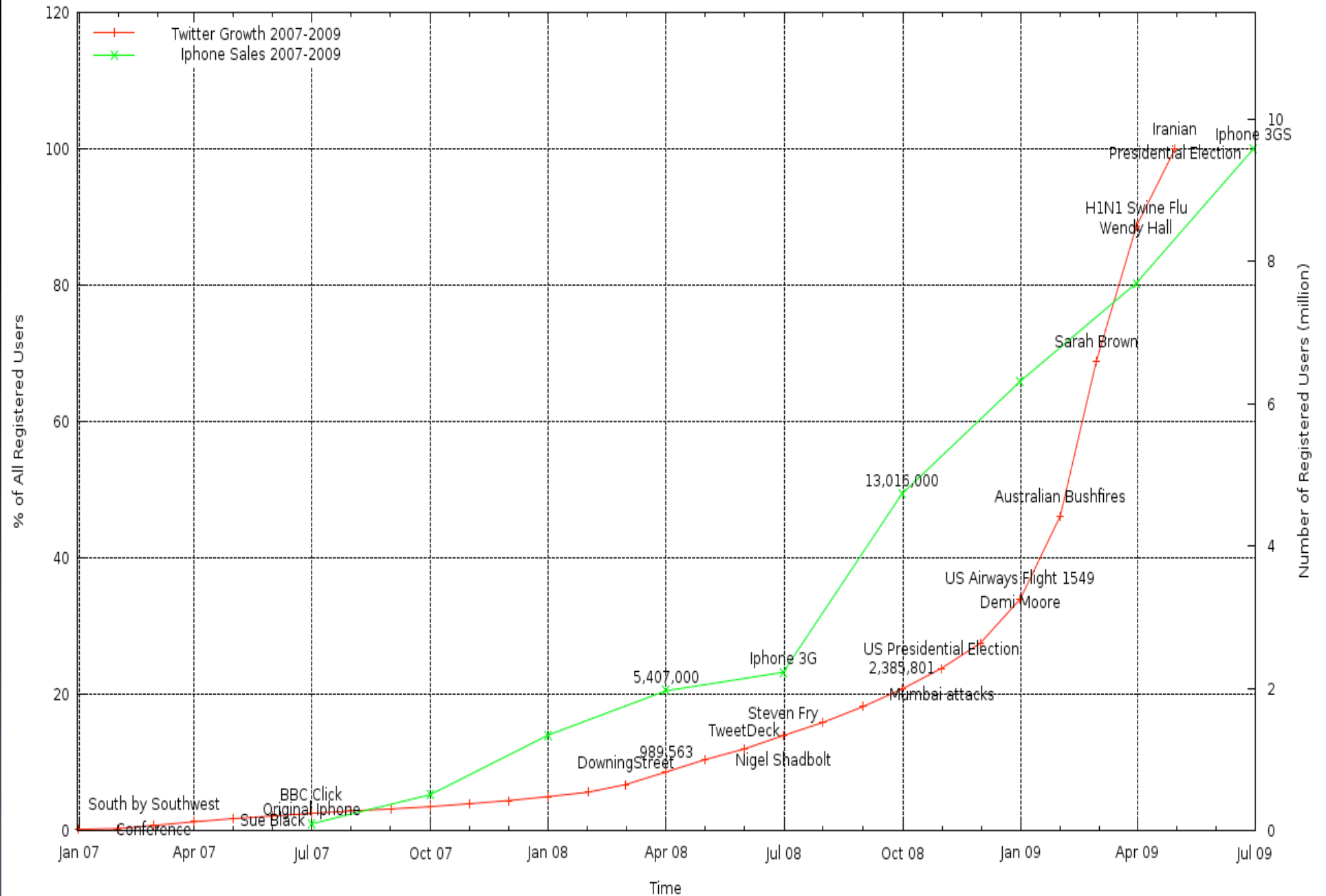
**In the news**

- At least 104 people are killed in a **mine explosion** in Heilongjiang, People's Republic of China.
- Continued flooding** affecting Great Britain and Ireland (*affected areas pictured*) results in two deaths.
- Egypt **recalls** its ambassador to Algeria in a dispute following a qualifying match between the nations for the 2010 FIFA World Cup.
- Prime Minister of Belgium **Herman Van Rompuy** is chosen as the first permanent President of the European Council.
- British politician **Catherine Ashton** is selected as the first High Representative of the European Union for Foreign Affairs and Security Policy.
- A United States district court **finds** the Army Corps of Engineers was negligent in maintaining New Orleans levees that contributed to flooding during Hurricane Katrina.



Internet 100%

Timeline of Twitter Growth

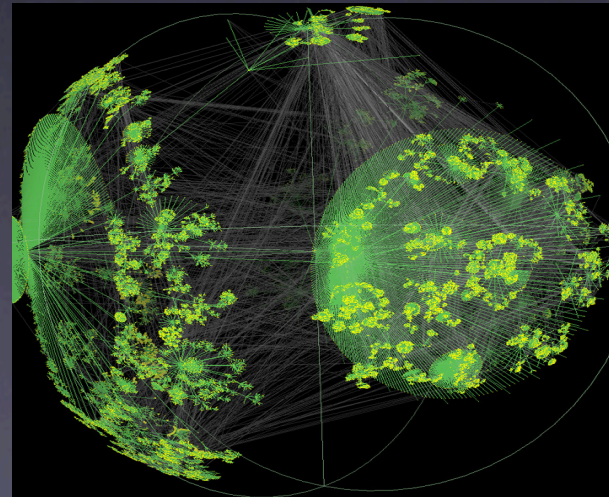






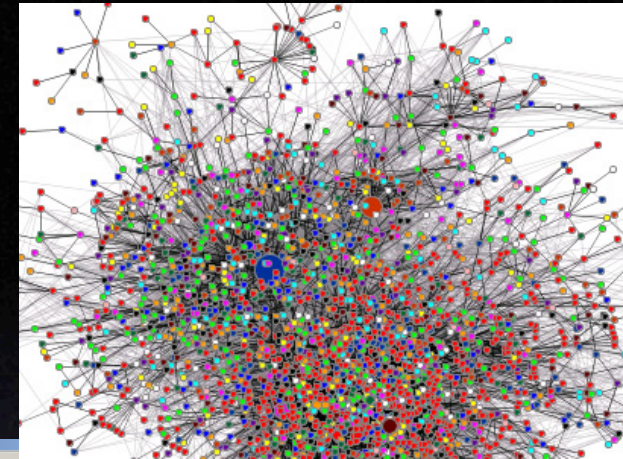
# Web 1.0

## A Web of Documents



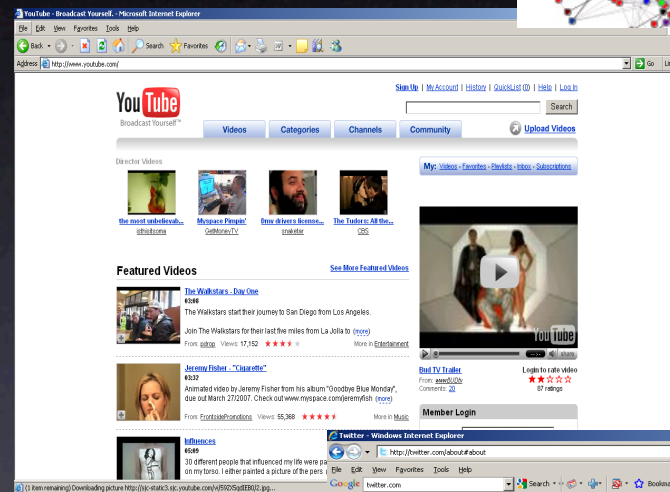


# Web 2.0



- Wiki's
- Blogs
- Folksonomies
- Flickr
- YouTube
- MySpace
- Facebook
- Second Life
- Twitter

Blogosphere



# Tomorrow the Web of Linked Data

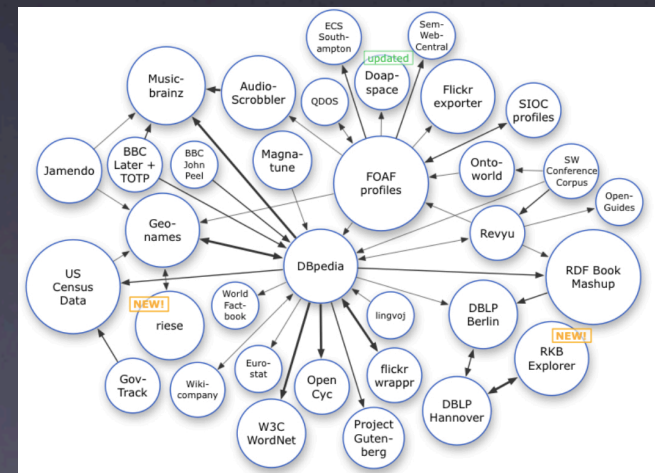
We're eager to share data for all sorts of reasons

What are the implications for business?

What are social and policy implications?

What will we do with it?

Web 3.0?





# Linking Data

<http://www2002.org>



**WWW 2002**  
THE ELEVENTH INTERNATIONAL  
WORLD WIDE WEB CONFERENCE

Sheraton Waikiki Hotel  
Honolulu, Hawaii, USA  
7-11 May 2002



CONFERENCE ORGANIZERS  
International World Wide  
Web Conference Committee

**HAWAII**

**1 LOCATION. 5 DAYS. LEARN. INTERACT.**

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[Call for Participation](#)  
[Program](#)  
[Registration Information](#)  
[Hotel Accommodation](#)  
[Conference Committee](#)  
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[Information about Hawaii](#)  
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**Registered participants coming from:**

Australia · Canada · Chile · Denmark · France · Germany · Ghana · Hong Kong · India · Italy · Ireland · Japan · Malta · New Zealand · The Netherlands · Norway · Singapore · Switzerland · The United States · Vietnam · Zambia

**REGISTER NOW**

On 7-11 May 2002, Honolulu, Hawaii will provide the backdrop for The Eleventh International World Wide Web Conference. This prestigious series of the International World Wide Web Conference Committee (IW<sup>3</sup>C<sup>2</sup>) attracts participants from around the world, and it provides a public forum for the World Wide Web Consortium (W3C) through the annual W3C track.

The conference is being organized by the [International World Wide Web Conference Committee \(IW<sup>3</sup>C<sup>2</sup>\)](#), the [University of Hawaii](#) and the [Pacific Telecommunications Council \(PTC\)](#).

**FEATURED SPEAKERS (CONFIRMED)**



Tim Berners-Lee, inventor of the World Wide Web and Director of the W3C who now holds the 3Com Founders chair at the Laboratory for Computer Science (LCS) at the Massachusetts Institute of Technology (MIT).



Richard A. DeMillo, vice president and chief technology officer for Hewlett-Packard Company.



Ian Foster, guru of "Grid Computing", associate



James S. S. Liu, vice president and chief technology officer for Hewlett-Packard Company.



McArthur Prize Winner



# In a way that machines can “understand”....

<http://www2002.org>

## WWW 2002

### THE ELEVENTH INTERNATIONAL WORLD WIDE WEB CONFERENCE

This is a type of object event and this is its title

This is the URL of the web page for the event

This is a type of object photograph and the photograph is of Tim Berners-Lee

Tim Berners-Lee is an invited speaker at the event

```
<owl:Class rdf:ID="Conference">
<rdfs:subClassOf rdf:resource="#Meeting-Taking-Place"/>
<rdfs:subClassOf rdf:resource="#Publication-Type-Event"/>
-<rdfs:subClassOf>
-<owl:Restriction>
<owl:onProperty rdf:resource="#published-proceedings"/>
<owl:allValuesFrom rdf:resource="#Conference-Proceedings-Reference"/>
</owl:Restriction>
```

1 LOCATION. 5 DAYS.

coming from:

Australia · Canada · Chile · Denmark · France · Germany · Ghana · Hong Kong · India · Italy · Ireland · Japan · Malta · New Zealand · The Netherlands · Norway · Singapore · Switzerland · The United States · Vietnam · Zambia

**REGISTER NOW**

**Conference  
Committee**

**Sponsorship/  
Exhibition  
Opportunities**

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**Previous & Future  
WWW Conferences**

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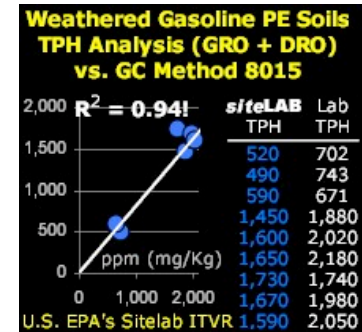
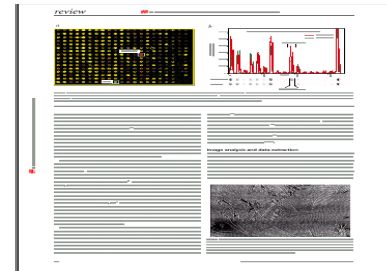
Ian Foster, guru of "Grid Computing", associate



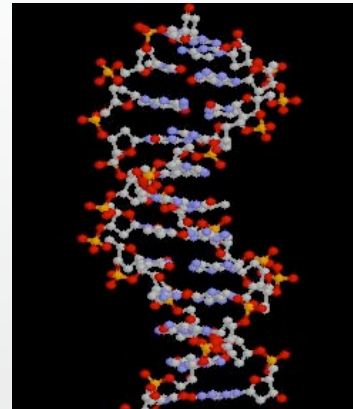
McArthur Prize Winner,

# Can mark up and link any resource...

- Publications...
- Multimedia...
- Databases...
- Scientific structures...
- Workflow...
- People...



Web data set (XHTML)



# Technical Principles

## 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

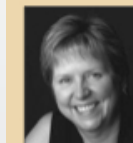
Nigel Shadbolt and Wendy Hall, *University of Southampton*  
Tim Berners-Lee, *Massachusetts Institute of Technology*



**Nigel Shadbolt** is a professor of artificial intelligence in the School of Electronics and Computer Science at Southampton University. Contact him at [nrs@ecs.soton.ac.uk](mailto:nrs@ecs.soton.ac.uk).



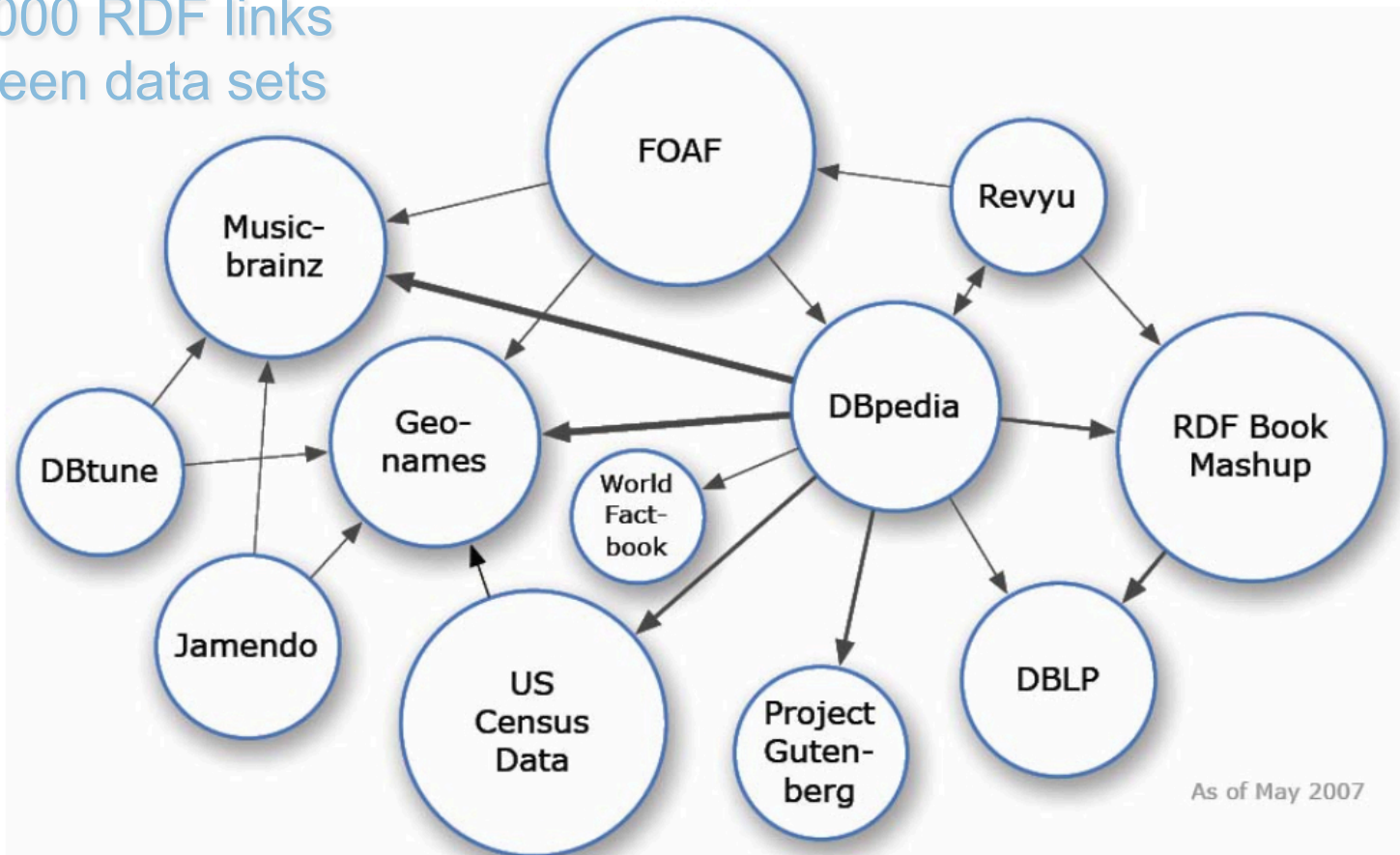
**Tim Berners-Lee** is the director of the World Wide Web Consortium, a senior researcher at the Massachusetts Institute of Technology's Computer Science and Artificial Intelligence Laboratory, and a professor of computer science in the Department of Electronics and Computer Science at Southampton University. Contact him at [timbl@w3.org](mailto:timbl@w3.org).



**Wendy Hall** is a professor of computer science in the School of Electronics and Computer Science at Southampton University. Contact her at [wh@ecs.soton.ac.uk](mailto:wh@ecs.soton.ac.uk).

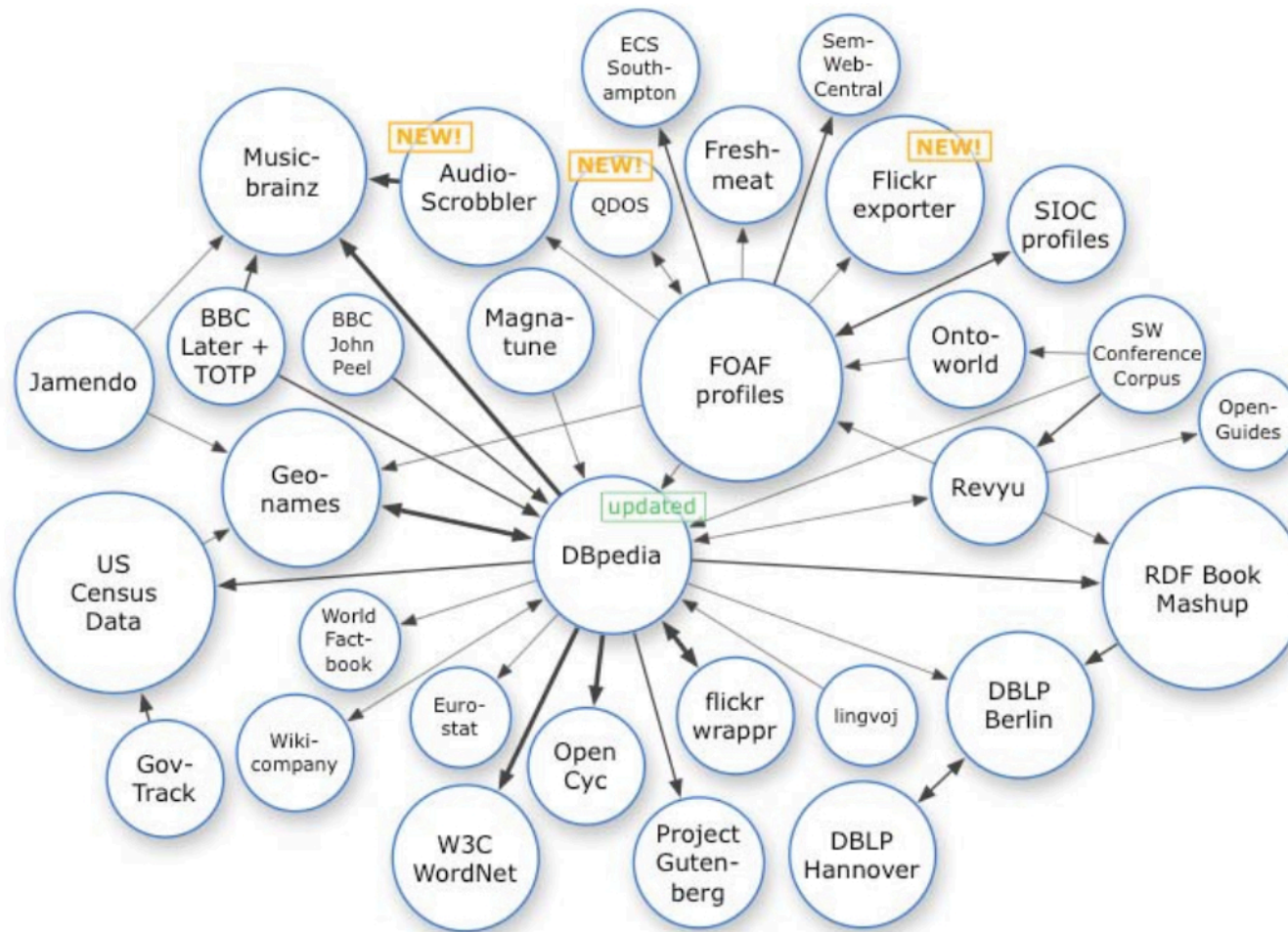
# Linked Data on the Web: May 2007

500 Million RDF Triples  
120,000 RDF links  
between data sets





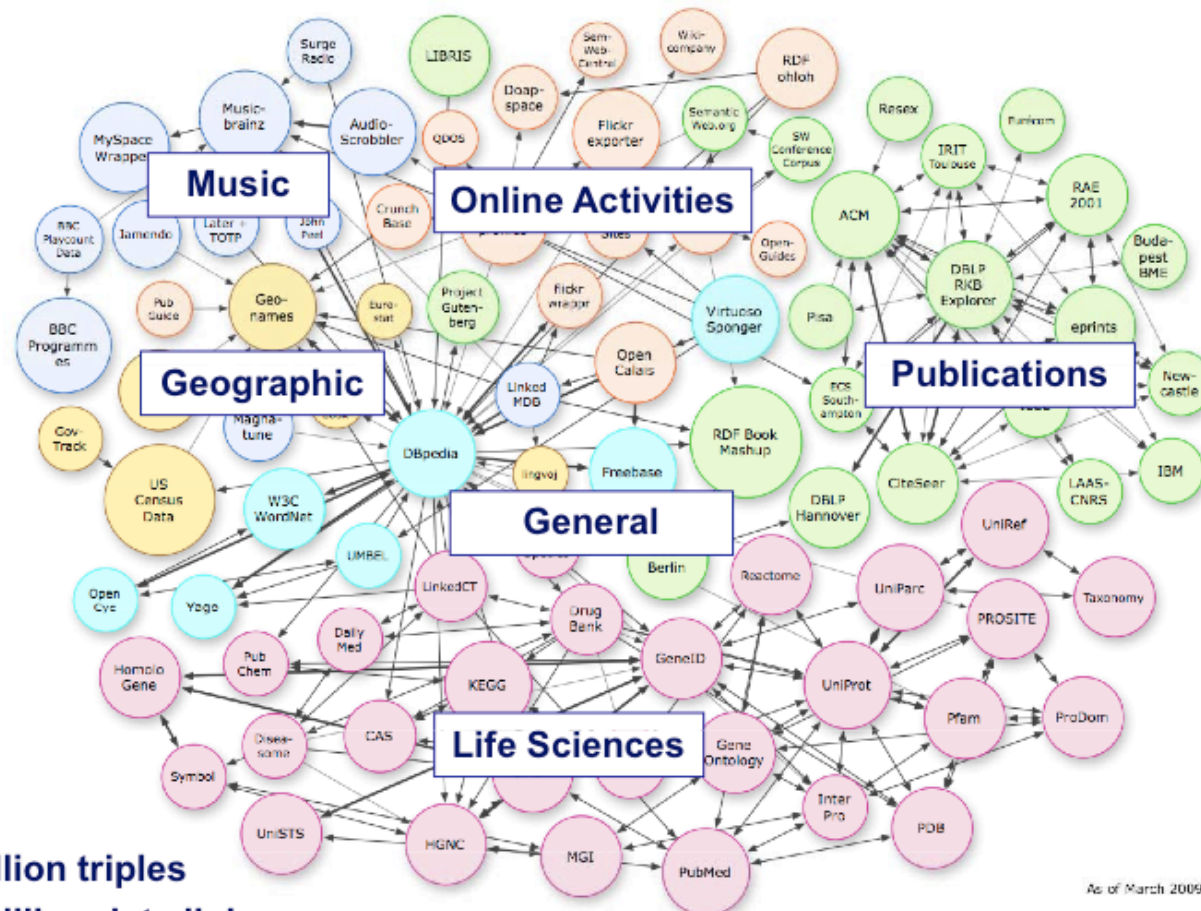
# Linked Data on the Web: February 2008





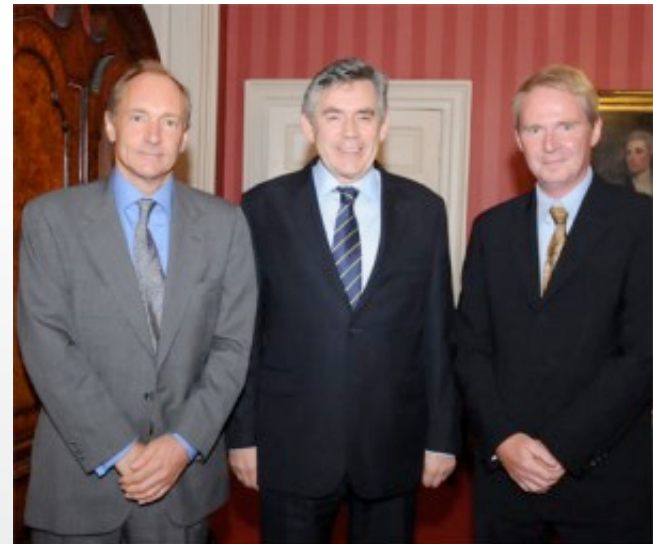
# Linked Data on the Web: March 2009

## LOD Datasets on the Web: March 2009



# Linked Data in Government: A Tipping Point?

- Berners-Lee and Shadbolt - HMG Information Advisors
- Context - PoI Taskforce
- Previous work with OPSI
- Strategic Drivers
  - Transparency and accountability
  - Economic and Social Value
  - Public Service Improvement
  - New Industries New Jobs



# Key Elements of our ToR

1. Establish single point of access for all public UK datasets - [data.gov.uk](https://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

# 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

The screenshot shows the Number10.gov.uk website. The header includes the site name and navigation links: Home, News, Communicate, Meet the PM, History and Tour, and Number 10 TV. A search bar is also present. The main content area features a news article titled "Ordnance Survey to open up data - PM" dated Tuesday 17 November 2009. The article text states that the Prime Minister has announced that the public will have more access to Ordnance Survey maps from next year, as part of a government drive to open up data to improve transparency. It lists two bullet points: "Communities and Local Government website" and "Read more about the Make Public Data Public project". A quote from Mr. Brown is included: "I think we're on the verge of a revolution that can transform public services and the public sector. I'm speaking very specifically about how government can change to meet the needs of the times. I think we are determined to be the first government in the world to open up public information in a way that is far more accessible to the general public." The article also mentions that Gordon Brown said Smarter Government will help secure necessary efficiencies while building on the public services already available. On the left side, there is a calendar for November 2009 and a list of links: Latest News, Speeches and Transcripts, Statements and Articles, Prime Minister's Questions, Press Briefings, Press Notices, and Webchats. On the right side, there is a Newsletter sign-up box, a "Around the Web" section with a Flickr link, and a "Latest Videos" section featuring a video titled "The Cabinet in the East Midlands" from Thursday, November 26, 2009.

# Progress to date

- Top down
  - Ministerial
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  - Civil Servants
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- Bottom up
  - Engaging with developer community
  - Cross Gov URI workshops
  - data.gov.uk
- Dissemination






# data.gov.uk

- Currently under development scrutiny and extension
  - Over 1500 datasets
  - Over 2000 registered developers
  - The beginning of linked data
- Beta service to be released 21st January 2010
- Access to OS from April 2010
- Clear schedule of release from Gov Depts thereafter

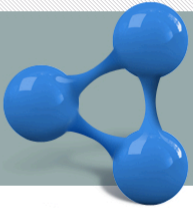
# data.gov.uk

 HM Government hmg.gov.uk/data

[Home](#) [Data](#) [Blog](#) [Apps](#) [Ideas](#) [Resources](#) [About](#)

## Unlocking innovation

Working with UK Public Sector information and data



Advised by Sir Tim Berners-Lee and Professor Nigel Shadbolt and others, we are opening up government data for reuse. This is a preview of what a public site could look like. We want to work with you to make it better.

We're very aware that there are more people like you outside of government who have the skills and abilities to make wonderful things out of public data. These are our first steps in building a collaborative relationship with you.

### Search Data

To list all datasets, search without any keywords.

Enter keyword(s)  [Search](#)

e.g. nhs, traffic, local authority, uk, XML

Powered by: [CKAN](#)


### Featured Data


**Education and training participation: 16-18 year olds**


Continuing participation in education and training by 16 and 17 year olds in each local...

Tags: [education](#) [training](#) [DCSF](#)





### Most Recent Apps

 **PlanningAlerts**  
PlanningAlerts.com is a

 **FillThatHole**  
This site provides a single

 **Where Can I Live?**  
An app to tell you where

[View all apps +](#)


[Subscribe by RSS](#)   
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### What is the Semantic Web?

Combining different data sources has never been easy but the Semantic Web will enable data to be joined easily across boundaries.

[Read more](#)

### Digital Engagement Twitter stream



RT @innovate\_uk  
Innovate 09 today  
- Register for the live webcast of the event here  
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### Featured blogs

# data.gov.uk

 HM Government hmg.gov.uk/data

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## Search Data Feeds

### Search Data

To list all datasets, search without any keywords.

e.g. nhs, traffic, local authority, uk, XML

Powered by: [CKAN](#)

### Packages

#### [alcohol\\_profile\\_-\\_alcohol-attributable\\_hospital\\_admission\\_females\\_2005](#)

**Title:** Alcohol Profile: Alcohol-attributable hospital admission, females  
**Description:** Persons admitted to hospital due to alcohol attributable conditions (females), crude rate per 100,000 population  
**Source:** NWPHO from Hospital Episodes...  
**Tags:** office\_for\_national\_statistics england alcohol hospital

#### [alcohol\\_profile\\_-\\_alcohol-attributable\\_hospital\\_admission\\_males\\_2005](#)


**Title:** Alcohol Profile: Alcohol-attributable hospital admission, males  
**Description:** Persons admitted to hospital due to alcohol attributable conditions (males), crude rate per 100,000 population  
**Source:** NWPHO from Hospital Episodes S...  
**Tags:** office\_for\_national\_statistics england alcohol hospital




#### [alcohol\\_profile\\_-\\_alcohol\\_attributable\\_incapacity\\_benefit\\_claimants\\_2005](#)

**Title:** Alcohol Profile: Alcohol attributable Incapacity Benefit claimants  
**Description:** The number of claimants of Incapacity Benefit or Severe Disablement Allowance whose main medical reason is alcoholism per 100,000 working age populati...  
**Tags:** department\_for\_work\_and\_pensions office\_for\_national\_statistics england benefit alcohol

#### [alcohol\\_profile\\_-\\_alcohol-attributable\\_mortality\\_-\\_females\\_2005](#)

**Title:** Alcohol Profile: Alcohol-attributable mortality - females  
**Description:** Deaths from alcohol-attributable conditions (all ages), directly standardised rate per 100,000 population Source: NWPHO from Office for National Stat...  
**Tags:** office\_for\_national\_statistics england alcohol mortality

[Subscribe by RSS](#) 


[SHARE](#)   

### What is the Semantic Web?

Combining different data sources has never been easy but the Semantic Web will enable data to be joined easily across boundaries.

[Read more](#)

### Digital Engagement Twitter stream



RT @innovate\_uk  
Innovate 09 today  
- Register for the live webcast of the event here  
[#innovate09](http://bit.ly/iZ11d)

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### Submit an app

Developed a great app or visualisation you'd like to share with us?

[Submit your app](#)

### Featured blogs





Alastair Dant (left) / David McCandless (right)



## Massive Outgoings

Cost for average British taxpayer per day

### GOVERNMENTS



### ESSENTIALS

NHS



£9.05

Schools



£2.56

Defence



£3.99

### TRAVEL

Roads



£3.10

LRT



£0.14

### BANKING CHARGES

Recapitalisations



£9.23

### SECURITY

Police



£0.53

Prisons



£0.19

Afghanistan



£0.32

### GOING OUT

Arts



£0.04

Museums



£0.03

### HELPING OTHERS

Child support



£1.86

Job Seekers



£0.25

Housing benefit



£1.52

Disability benefit



£1.44

Pensions



£5.55

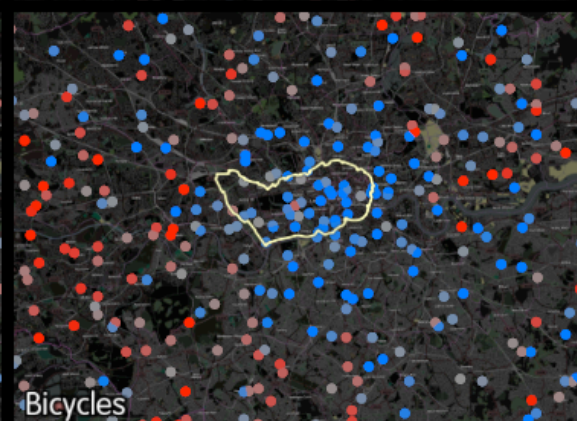
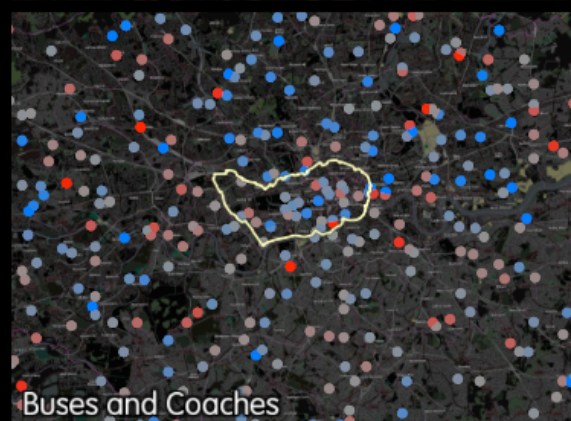
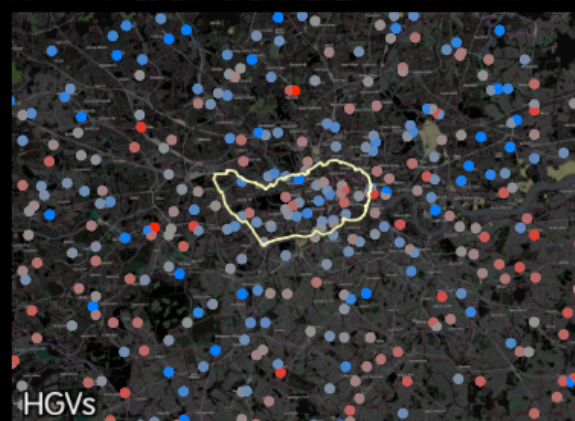
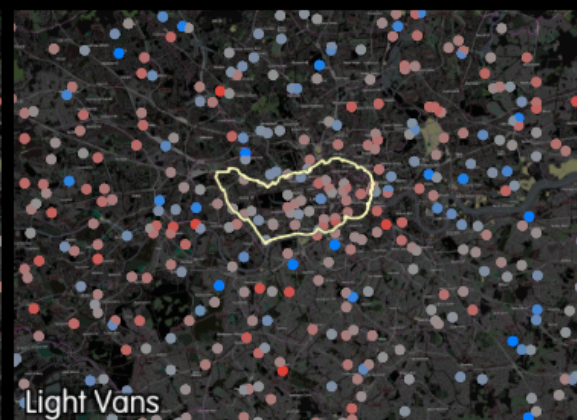
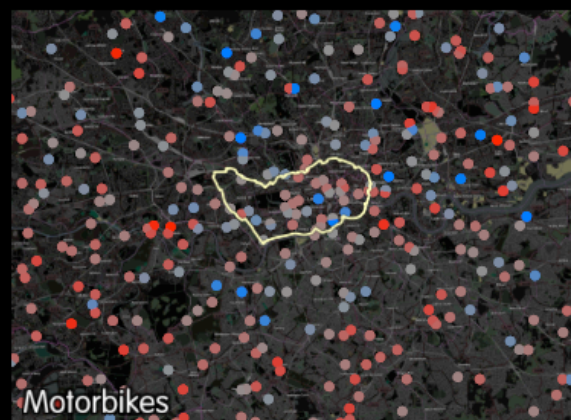
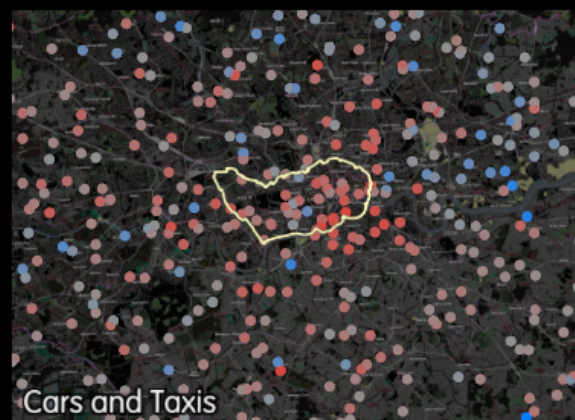
Overseas aid



£0.43

David McCandless

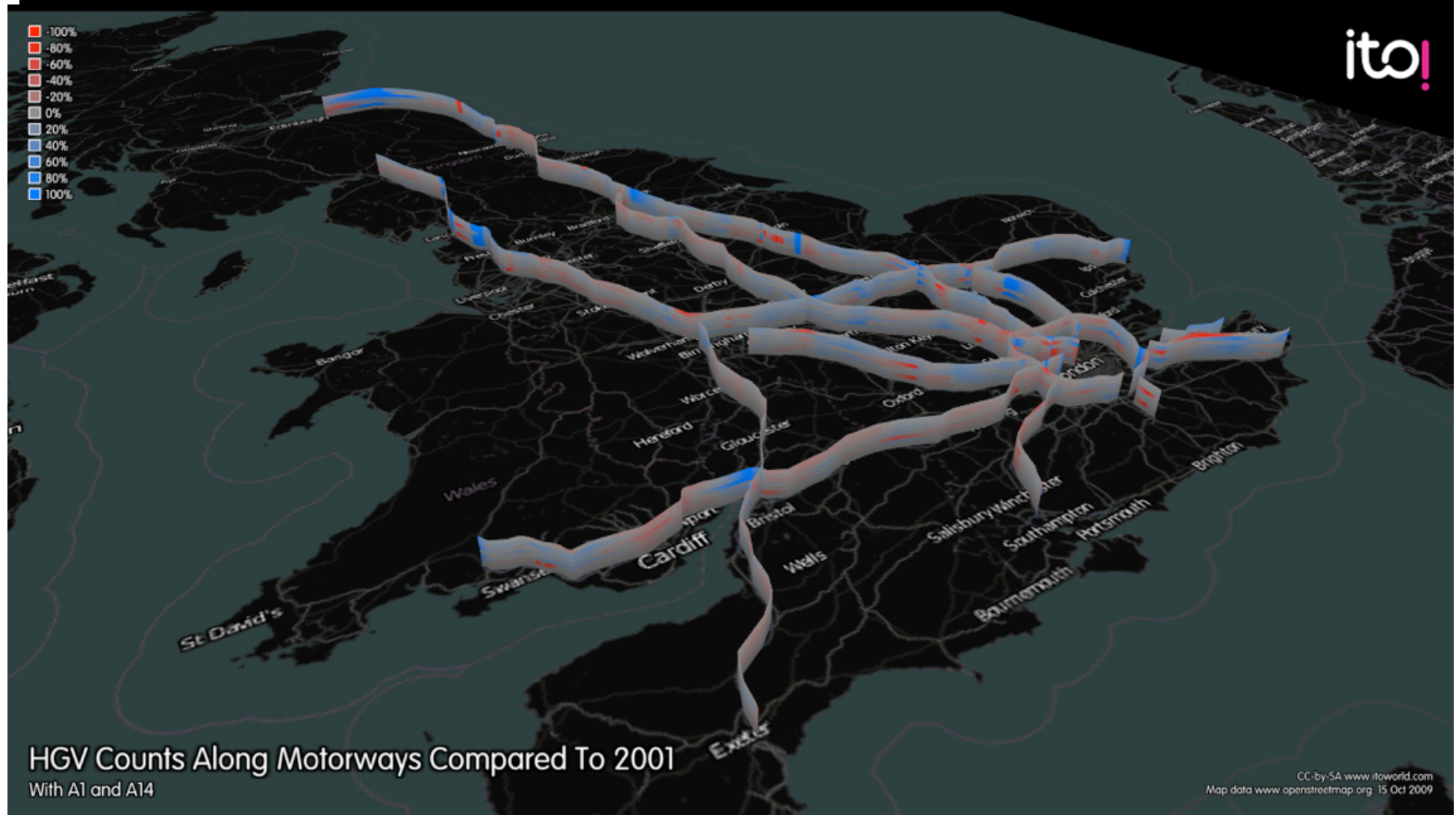




2008 London Counts Compared To 2001

CC-by-SA [www.itoworld.com](http://www.itoworld.com)  
Map data [www.openstreetmap.org](http://www.openstreetmap.org); 15 Oct 2009

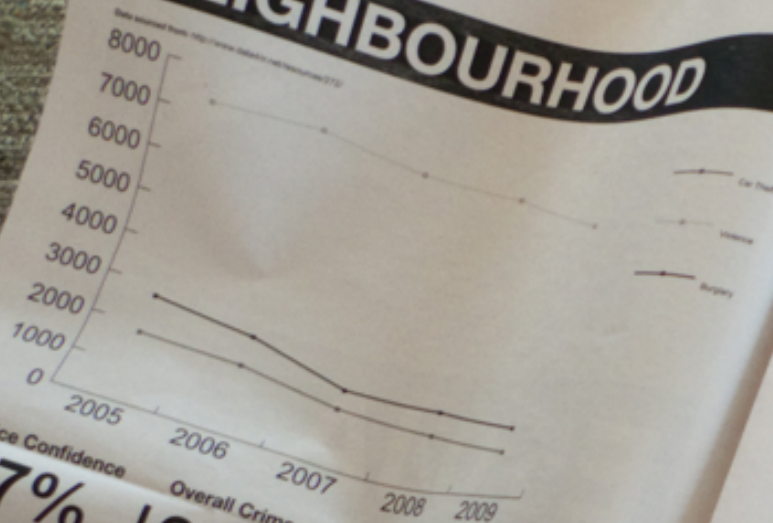
Chris Osborne



Chris Osborne



# NEIGHBOURHOOD



Police Confidence  
**77%**

Overall Crime  
**↓39%**

Gun Crime  
**↓37%**

Knife Crime  
**↓17%**

Robbery  
**↓14%**

Theft  
**↓13%**

Woundings  
**↑220%**

**10000**  
fewer crime victims

## Summary

Hackney Police and the Council work very closely to tackle and prevent crime in the borough. Seventy seven per cent of residents now have confidence in Hackney's Police, according to the British Crime Survey, a rise of 55 per cent in less than two years.

The survey also reveals that crime in Hackney has dropped 36.5 per cent over five years, the second largest drop of all London boroughs. Last year, there were ten thousand fewer victims of crime in Hackney than five years ago.

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

# ALLOTMENTS

- 1 St John's Road  
Entrance at rear of 57 St John's Road
- 2 Asher Terrace  
Entrance at North end of Clarendon Crescent
- 3 Springdale Road  
Entrance between 40 and 44 Springdale Road
- 4 Church Walk  
Entrance at South end of Church Walk
- 5 Queensbridge Road  
At rear of 208 Queensbridge Road
- 6 Manor Gardens  
Station Road
- 7 Queensbury Street  
Corner of Queensbury Street and Russell Road
- 8 Leaside Road  
Entrance at West side of railway bridge over Leaside Road
- 9 Spring Lane  
Entrance on Spring Lane at side of River Lea
- 10 Spring Hill  
North West corner of sports field



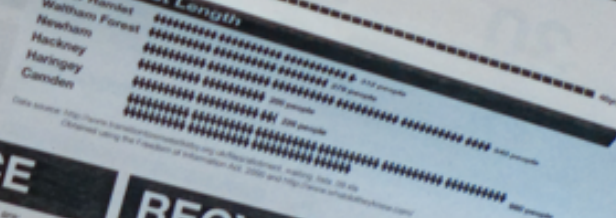
## Allotment Plots

Tower Hamlet	282	Waltham Forest	1,382
Newham	415	Hackney	113
Haringey	1,715	Camden	195

## Waiting List Time

Tower Hamlet	18 1/2 years
Waltham Forest	18 1/2 years
Newham	18 1/2 years
Hackney	18 1/2 years
Haringey	18 1/2 years
Camden	18 1/2 years

## Waiting List Length



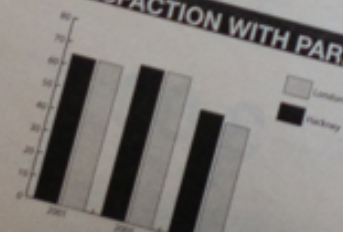
# GREEN SPACE

**23%**  
by land area in Hackney

Your nearest parks are:

- Hackney Marshes (10 mins east)
- Victoria Park (15 mins south west)
- London Fields (20 mins south west)

## % SATISFACTION WITH PARKS



# RECYCLING

Your nearest Recycling and Reuse Center is on South Access Road, Walthamstow, E17 (via Marsh House Avenue, near Low Hall Manor Business Centre).

Open every day of the year, except on 25 December, 26 December and 1 January. Open from 8.30am to 5.15pm. South Access Road is for most, bulky household waste and trade waste. This site does not accept:

If you intend to use a van to bring your waste please call 020 8509 3664 at least 24 hours prior to visiting the site. Vans are only allowed to the site between 8.30am and 4pm Monday to Saturday.

You can recycle the following items at this site:

- Bicycles
- Car batteries
- Cardboard
- Computers and printers
- Cooking oil
- Electrical items
- Engine oil
- Food/drink cans and foil
- Furniture in good condition
- Garden waste
- Gas bottles
- Glass bottles and jars
- Hardcore/rubble
- Household batteries
- Long life light bulbs
- Metal
- Mobile telephones
- Paper
- Plasterboard
- Plastic bottles
- Pneumatic paint
- Tetra packs
- Textiles and shoes
- Tools for reuse



# TRAVEL TIMES

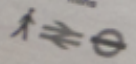
Times are given from 7.15, leaving Paddington, for a journey arriving at 9.30am.

Oxford Circus

41 mins



42 mins

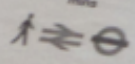


Tottenham Court Road

37 mins



47 mins



King's Cross

30 mins



35 mins



Victoria

51 mins

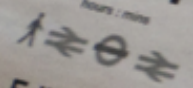


45 mins



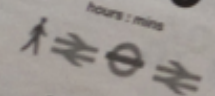
Manchester

2:44 hours : mins



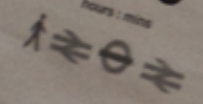
Paris

3:00 hours : mins



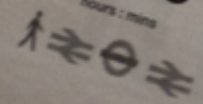
Edinburgh

5:00 hours : mins



Bristol

3:00 hours : mins



# LOCAL TRANSPORT



## Route finder

Start	Destination	Route	Time
W15	Paddington	Circle Line	10 mins
236	Paddington	Circle Line	10 mins
242	Paddington	Circle Line	10 mins
276	Paddington	Circle Line	10 mins
308	Paddington	Circle Line	10 mins
488	Paddington	Circle Line	10 mins

## Destination finder

For free cycle training in Hackney, call 020 8356 2897





# Why does this matter to you

- Supports information interoperability
- The Sum is greater than the parts
- Exploitation of
  - open data
  - open standards
- Can apply to data intranets as well as extranets
- Publishing, news, media, content services, manufacturing, retail, supply chains, finance, all classic examples where there is heterogeneous information that could be shared, linked, mapped and enriched using this approach



# Thank you

- Any further information

[nrs@ecs.soton.ac.uk](mailto:nrs@ecs.soton.ac.uk) or [wh@ecs.soton.ac.uk](mailto:wh@ecs.soton.ac.uk)

- For advice and help on applied and practical linked data projects see also

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[www.seme4.com](http://www.seme4.com)

