Linked Data

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Talis Systems Ltd

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http://tomheath.com/id/me

September 2010

KRDB School: Trends in the Web of Data

Overview

- Part 1: The Story So Far
  - Linked Data: What and Why
  - Web of Data: Current Status
  - Publishing in a Nutshell
- Part 2: What Happens Next?
  - Putting the Links in Linked Data
  - Consuming Linked Data
  - Implications of Linked Data for Applications
  - The 'Killer App' Question

Linked Data: Part 1
The Story So Far

Linked Data: What and Why

About Me (In A Nutshell)

About Me (In A Nutshell)

Tom lives in Bristol

Tom works for Talis

Talis is based in Birmingham

OpenStreetMap

The Free Wiki World Map

OpenStreetMap is a free editable map of the whole world. It is made by people like you.

OpenStreetMap allows you to view, edit and use geographical data in a collaborative way from anywhere on Earth.

OpenStreetMap's hosting is kindly supported by the UCL VR Centre and bytemark. Other supporters of the project are listed in the wiki.

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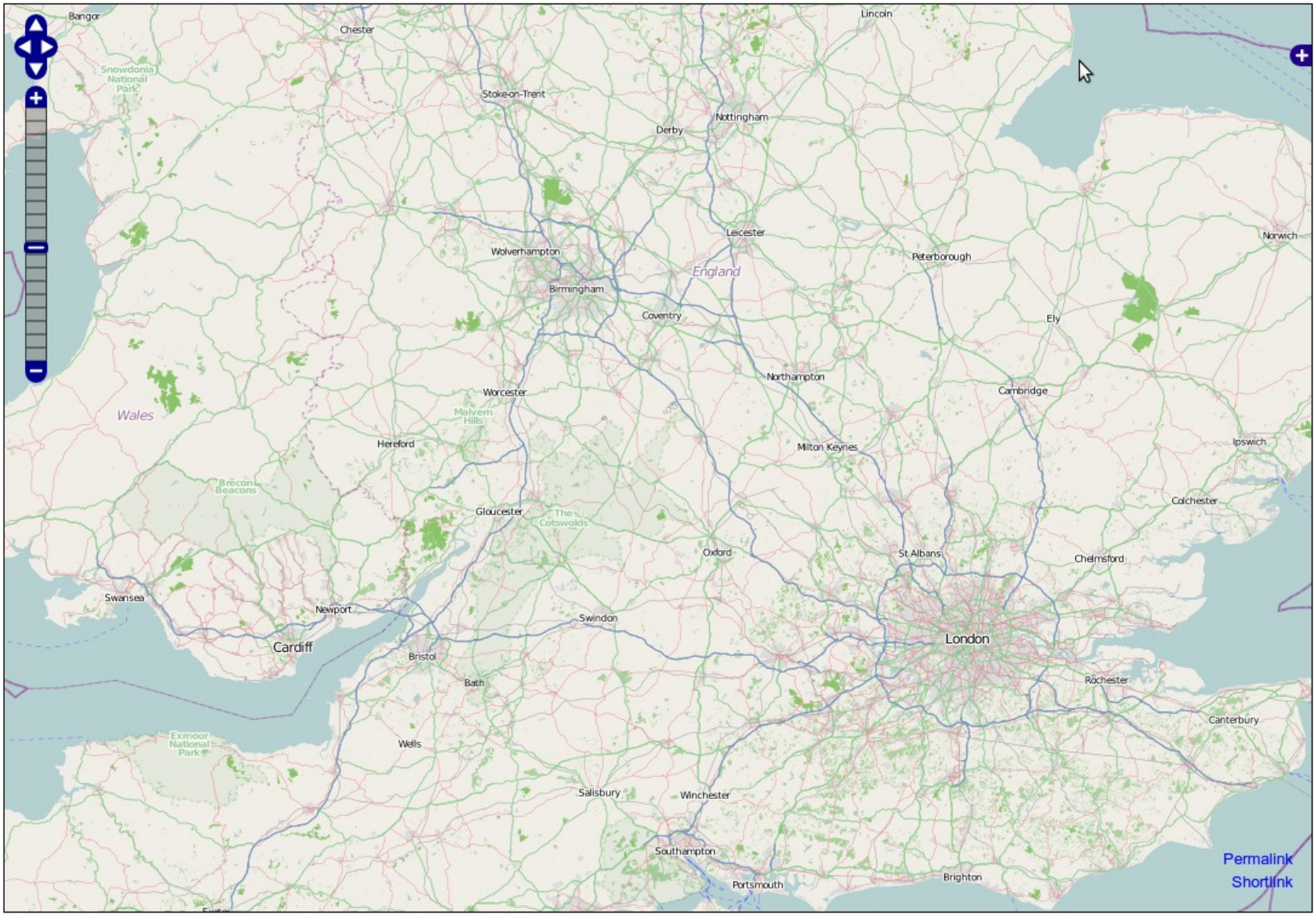
News blog
Shop
Map key

Search Where am I?

Go

examples: 'Alkmaar', 'Regent Street, Cambridge', 'CB2 5AQ', or 'post offices near Lünen'
more examples...

Make a Donation



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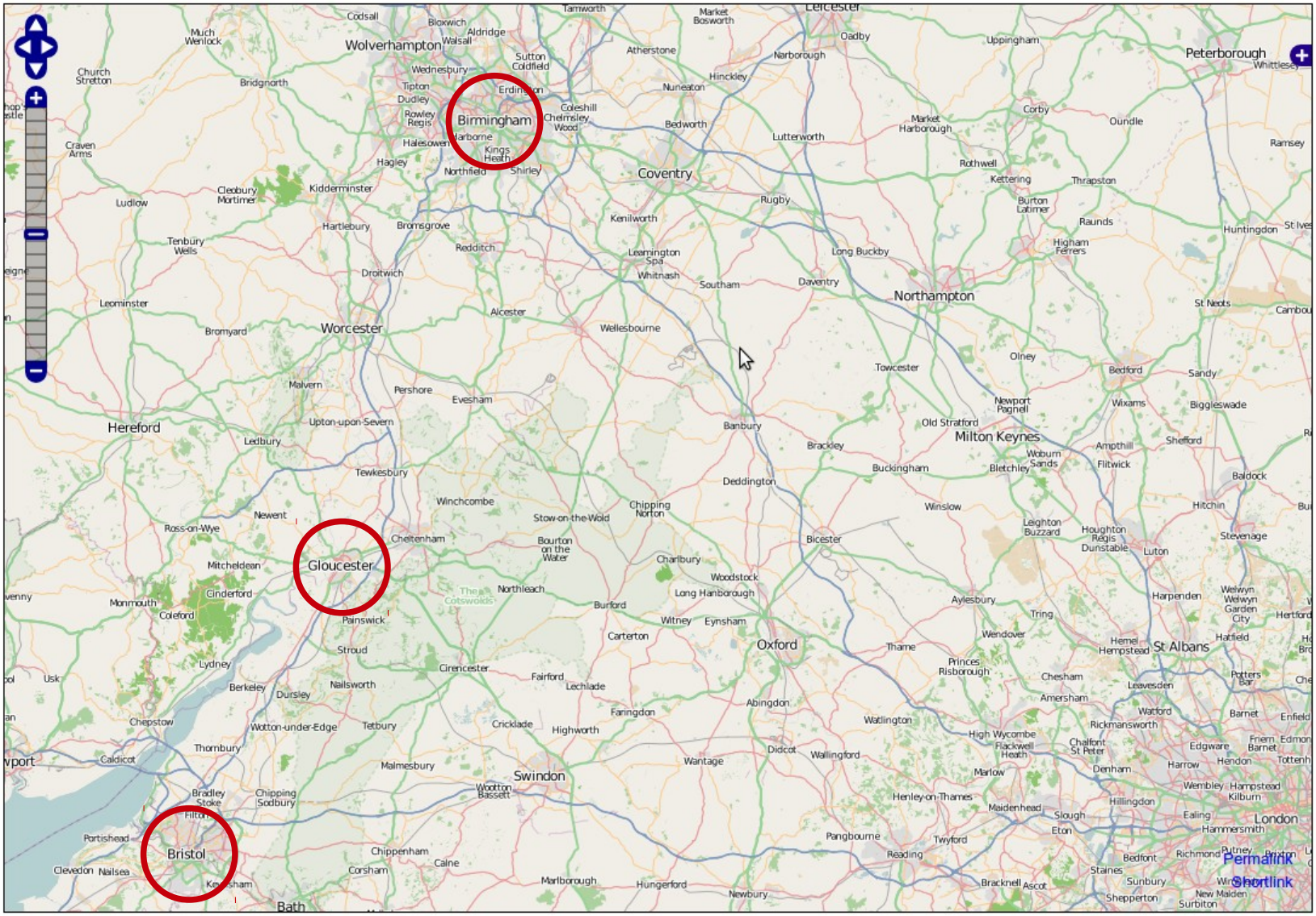

Let's go to Work!

Edward W. Godwin
1833 - 1886
Bristol born architect, furniture and fabric designer. His work includes the Carriageworks, Stokes Croft and Highbury Chapel, St. Michael's Hill.
Lived here from 1862 to 1865

Jazz

http://www.flickr.com/photos/_mia/
BY NC ND
Bristol Temple Meads
TAXI
M902 MKL
TAXI

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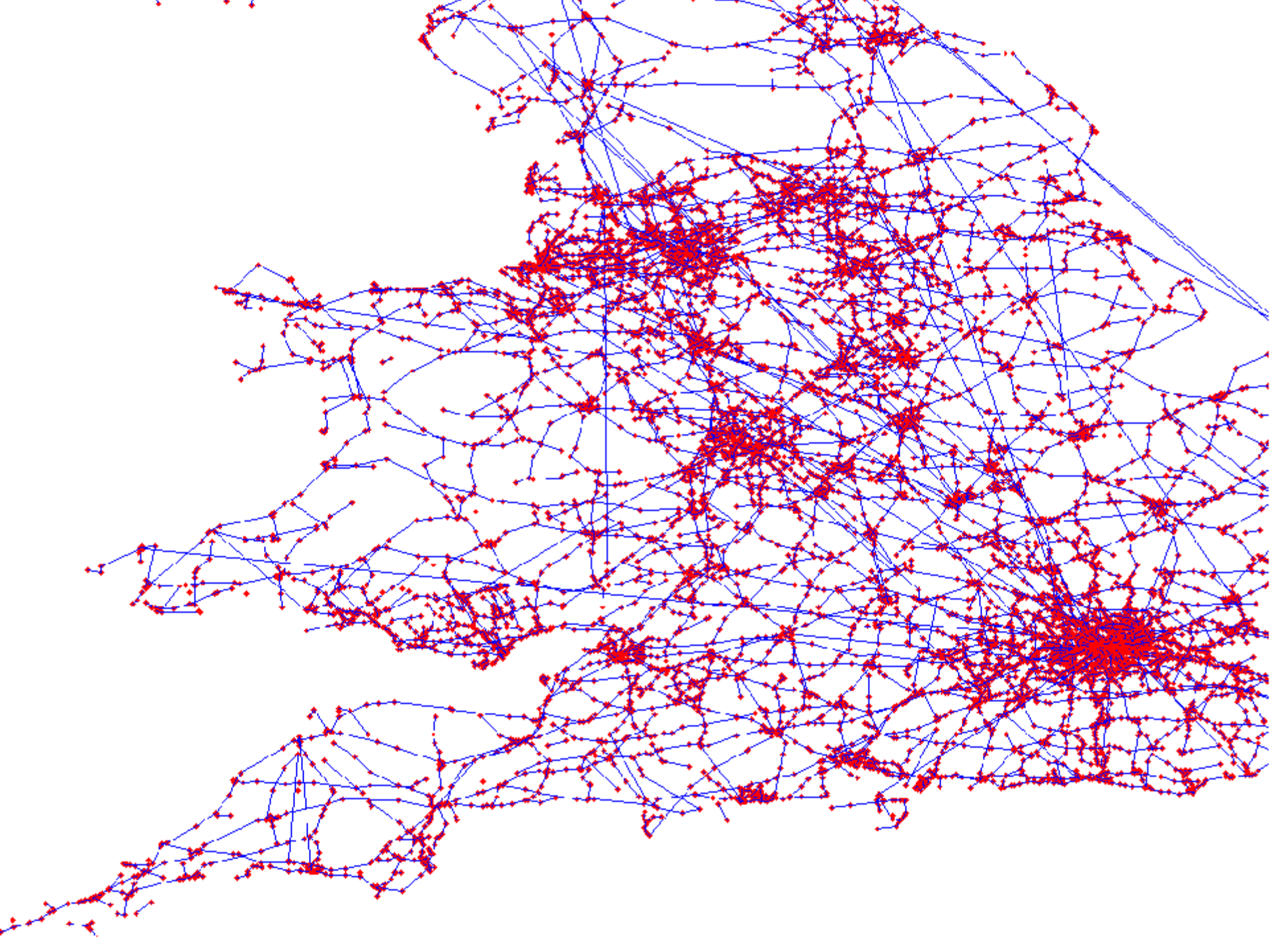
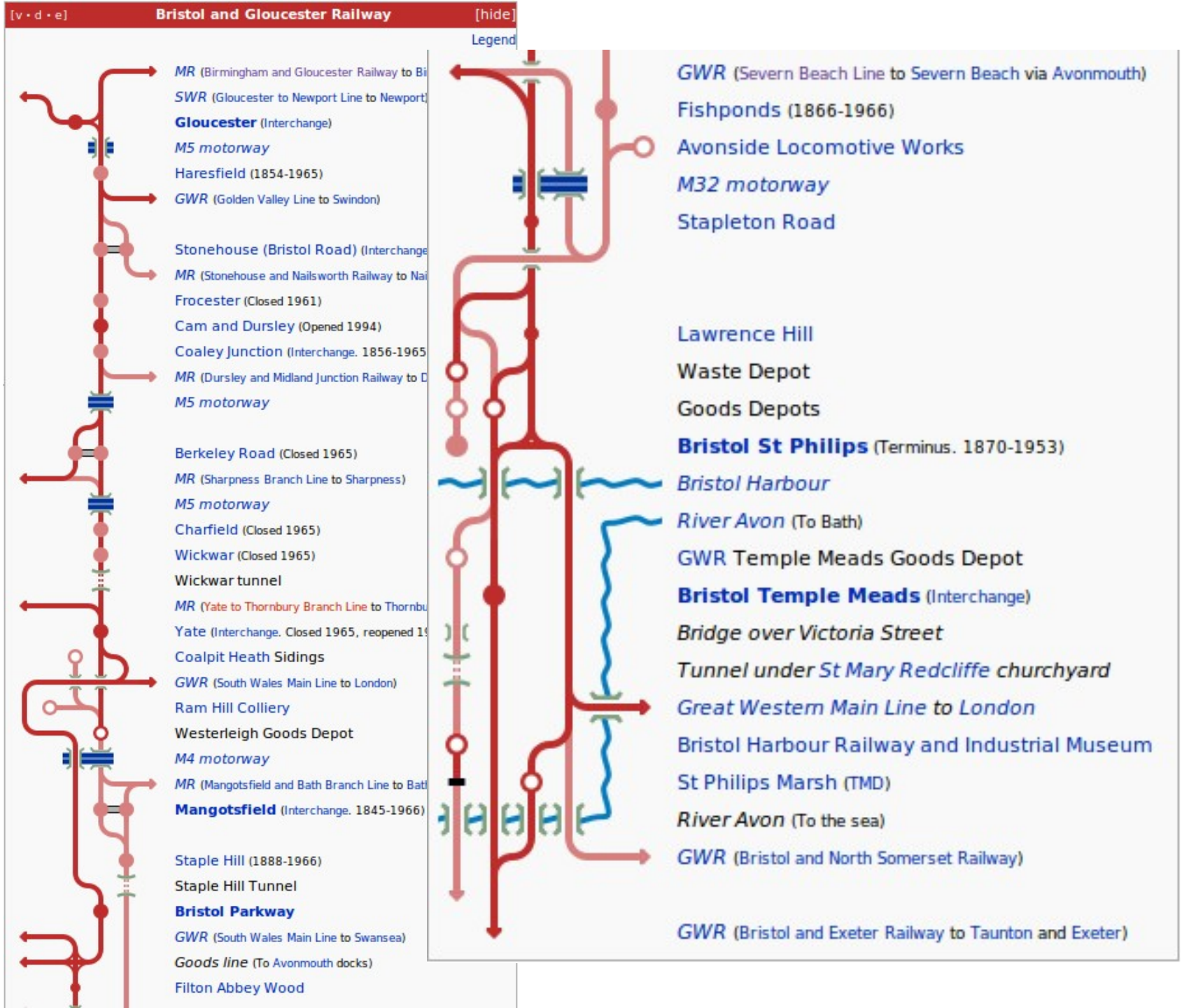
- Corporate Overview
- Board Members
- Management Team
- Contact Us
- Location
- Talis Intranet
- Site Map
- Legal

How to find Talis

What Makes This Possible?




[v • d • e]
Bristol and Gloucester Railway
[hide]
Legend
MR (Birmingham and Gloucester Railway to Bi
SWR (Gloucester to Newport Line to Newport)
Gloucester (Interchange)
M5 motorway
Haresfield (1854-1965)
GWR (Golden Valley Line to Swindon)
Stonehouse (Bristol Road) (Interchange
MR (Stonehouse and Nailsworth Railway to Nai
Frocester (Closed 1961)
Cam and Dursley (Opened 1994)
Coaley Junction (Interchange. 1856-1965
MR (Dursley and Midland Junction Railway to D
M5 motorway
Berkeley Road (Closed 1965)
MR (Sharpness Branch Line to Sharpness)
M5 motorway
Charfield (Closed 1965)
Wickwar (Closed 1965)
Wickwar tunnel
MR (Yate to Thornbury Branch Line to Thornbu
Yate (Interchange. Closed 1965, reopened 19
Coalpit Heath Sidings
GWR (South Wales Main Line to London)
Ram Hill Colliery
Westerleigh Goods Depot
M4 motorway
MR (Mangotsfield and Bath Branch Line to Batl
Mangotsfield (Interchange. 1845-1966)
Staple Hill (1888-1966)
Staple Hill Tunnel
Bristol Parkway
GWR (South Wales Main Line to Swansea)
Goods line (To Avonmouth docks)
Filton Abbey Wood
GWR (Severn Beach Line to Severn Beach via Avonmouth)
Fishponds (1866-1966)
Avonside Locomotive Works
M32 motorway
Stapleton Road
Lawrence Hill
Waste Depot
Goods Depots
Bristol St Philips (Terminus. 1870-1953)
Bristol Harbour
River Avon (To Bath)
GWR Temple Meads Goods Depot
Bristol Temple Meads (Interchange)
Bridge over Victoria Street
Tunnel under St Mary Redcliffe churchyard
Great Western Main Line to London
Bristol Harbour Railway and Industrial Museum
St Philips Marsh (TMD)
River Avon (To the sea)
GWR (Bristol and North Somerset Railway)
GWR (Bristol and Exeter Railway to Taunton and Exeter)

http://www.flickr.com/photos/_mia/
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Bristol Temple Meads
TAXI
M902 MKL
TAXI

The Historical Perspective

The Historical Perspective

"At that time, the **canal journey** from Birmingham to Bristol took **almost a week**, and the **road journey**, which due to **expense** and **road quality** was only really suitable for passengers, took the **best part of four days**."

http://en.wikipedia.org/wiki/Birmingham_and_Gloucester_Railway

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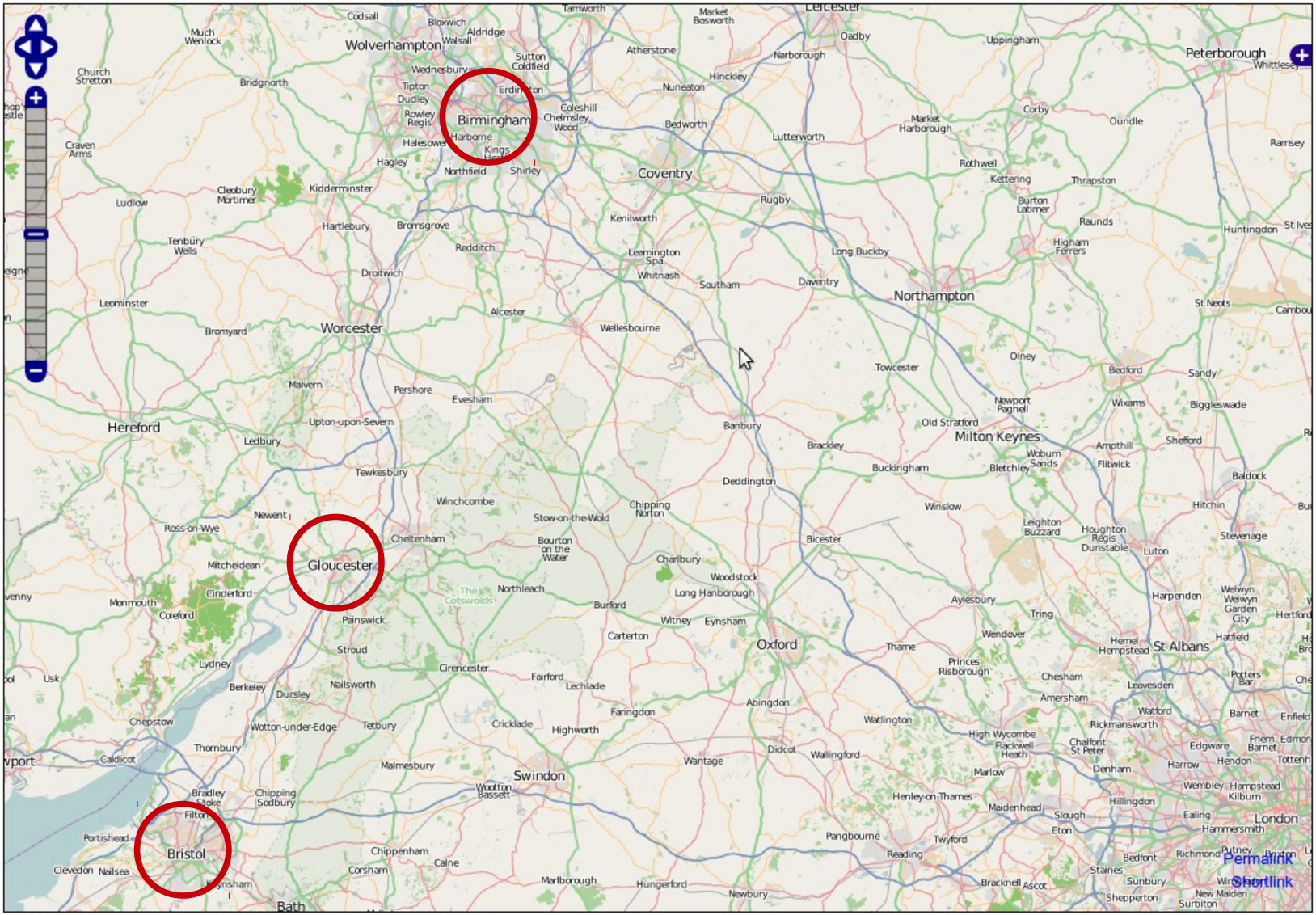

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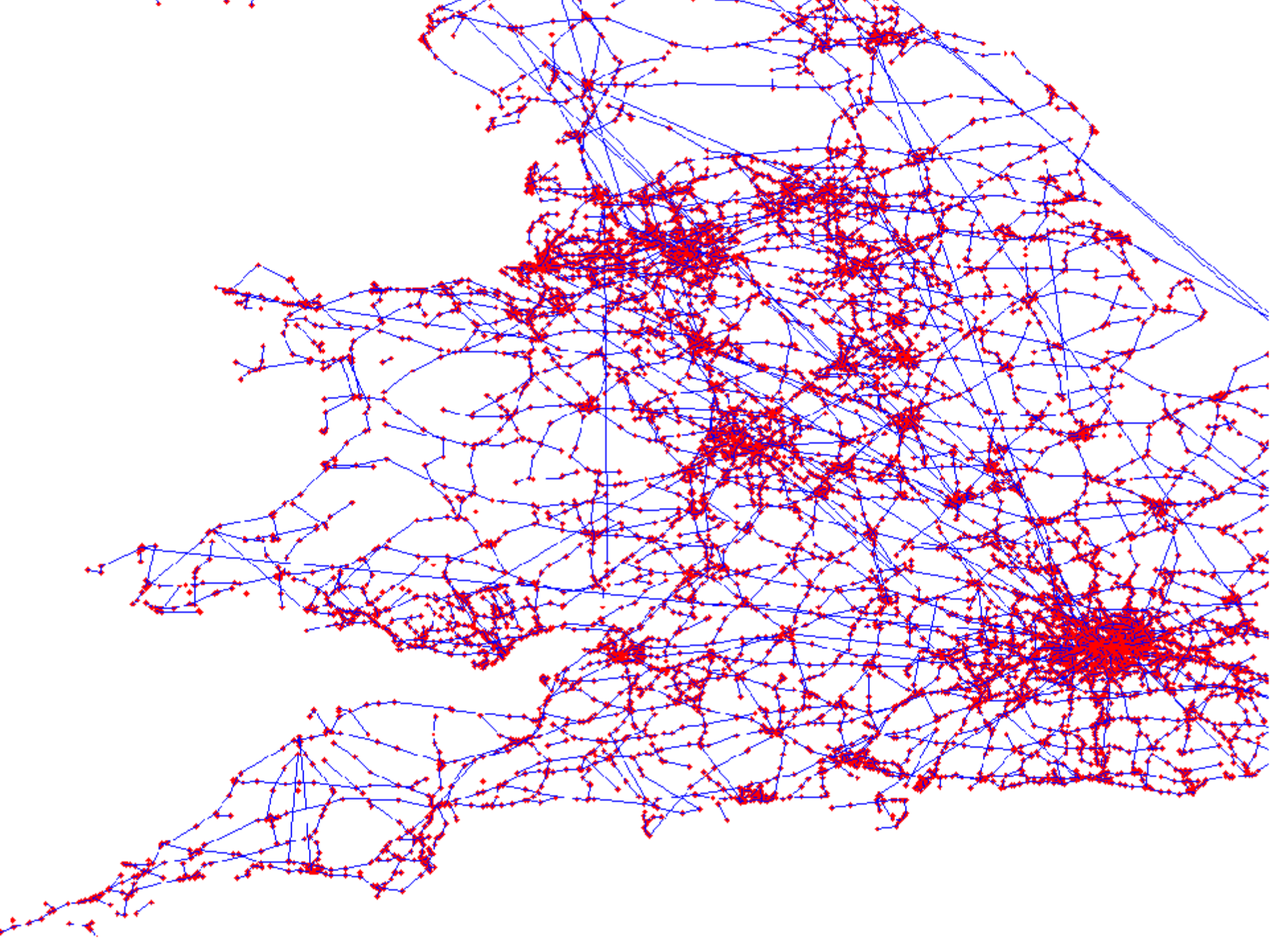
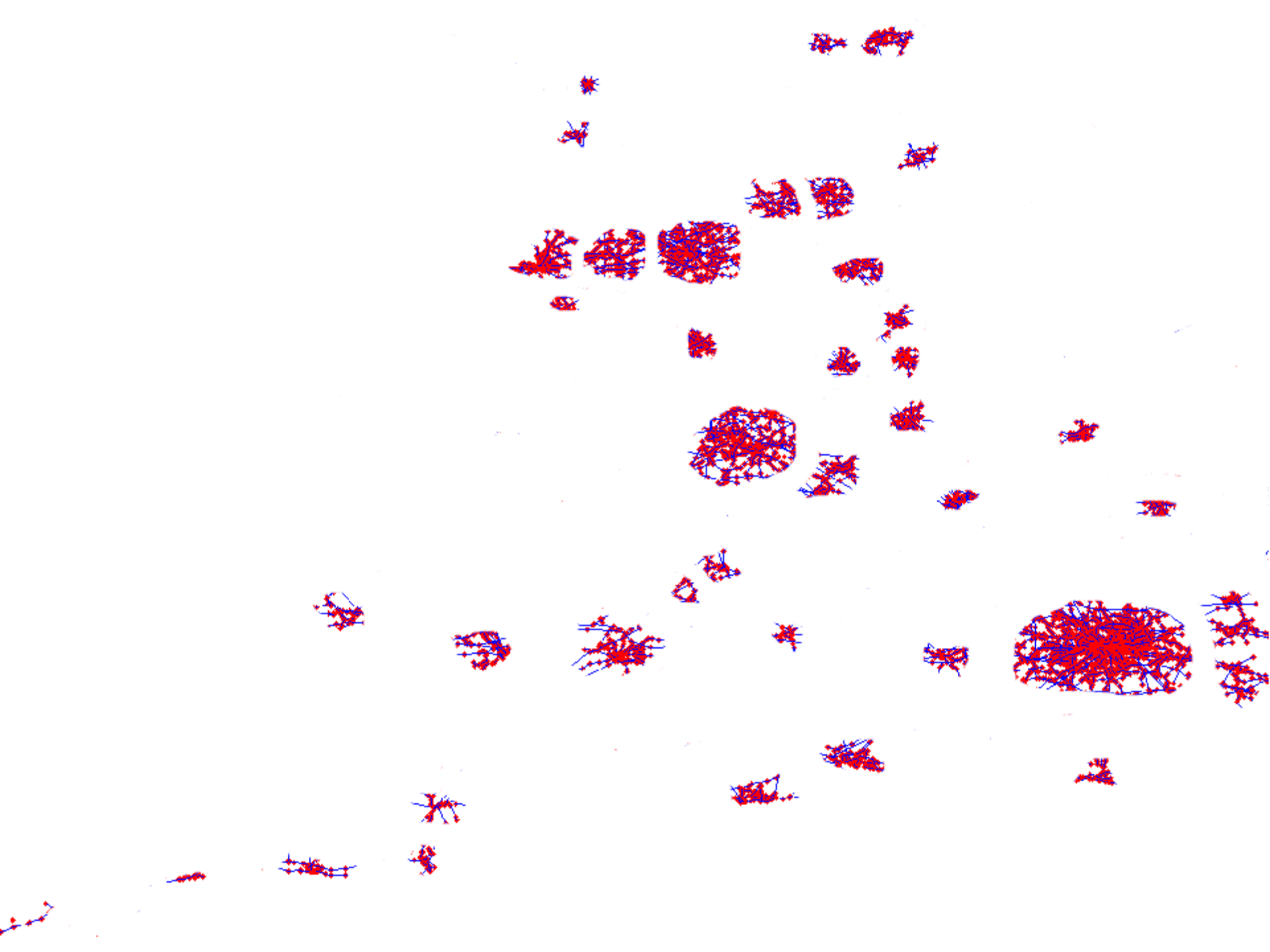
http://en.wikipedia.org/wiki/Birmingham_and_Gloucester_Railway

"The **'break-of-gauge'** at **Gloucester** was a **major problem**. It **caused pandemonium** as **whole trainloads** of passengers, and their luggage, **changed from one to another**, together with the transshipment of goods."

http://en.wikipedia.org/wiki/Birmingham_and_Bristol_Railway

If Cities Were Data



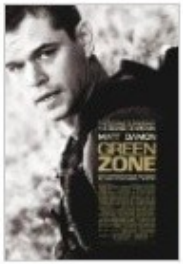


Films, Actors
and Directors
Cinemas and
Showing Times

Now Playing

U.S. Openings

MARCH 12th: Opening This Week | **Top 10** Mar | Apr | May | Jun | Jul | Aug | Sept | Oct



Green Zone

Director: Paul Greengrass
Stars: Matt Damon, Jason Isaacs, Greg Kinnear (Full Cast)
Studio: Universal Pictures
The Plot: Discovering covert and faulty intelligence causes a U.S. Army officer (Damon) to go rogue as he hunts for Weapons on Mass Destruction in an unstable region.

Photos (see all 31 | slideshow)

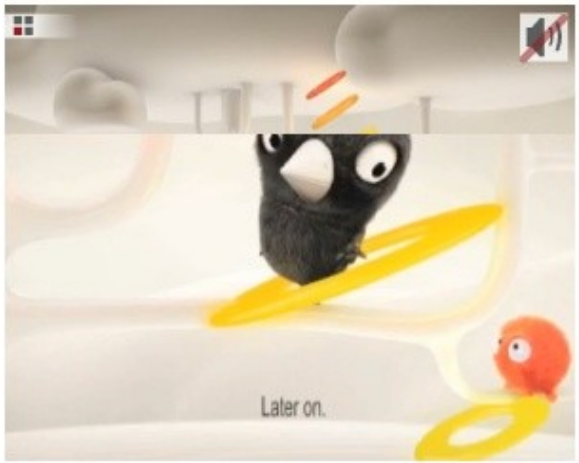
Videos (see all 7)

THE BUZZ: Entertainment writers are worked up about (1) Universal's box-office slump and (2) the studio's decision to move *Green Zone* out of the 2009 Oscar zone. To me, this is a sign that the movie *actually might be*

Movie Showtimes

Today Go

Enter ZIP or town, state *Powered by Zap2it*



Coming Soon

MARCH 19th:

The Bounty Hunter

add/change photo

Add Resume

Matt Damon products
Shop at Amazon

Quicklinks
categorized

Top Links
- biography
- by votes
- awards
- NewsDesk
- message board

Filmographies
categorized
- by type
- by year

Matt Damon

More at IMDbPro »

Photos (see all 468 | slideshow | add photos)

Videos (see all 101)

Overview

Date of Birth: 8 October 1970, Boston, Massachusetts, USA more

Contact: View agent, publicist and legal contact info on IMDbPro.

Mini Biography: Matt Damon was born in 1970. His father, Kent Damon, a tax preparer... more

Trivia: Lives with his family in Florida (2007). more

STARmeter: **Up 72%** in popularity this week. See why on IMDbPro.

Awards: Won Oscar. Another 19 wins & 53 nominations more

NewsDesk: (3183 articles)

2010 Academy Awards: The Show, The Winners
(From GossipCenter. 8 March 2010, 2:05 AM, PST)

'The Hurt Locker' Tops the 2010 Oscars Taking Home Six Awards
(From Rope Of Silicon. 8 March 2010, 1:35 AM, PST)

Motherhood

15

Ents24 Rating: ★★★★★

Shot entirely on location in New York's West Village, this bittersweet comedy distils the dilemmas of the maternal state (marriage, work, self, and...

» More Info

New Releases

Motherhood

Chloe

Alice In Wonderland (2010)

Case 39

Legion

Bristol Cinema Showtimes » change town

Cinemas closest to you

Odeon Bristol
0.1 miles from your location

Union Street, Bristol, BS1 2DS

Showcase Cinema De Lux (CDL Bristol)
0.2 miles from your location

Cabot Circus, Bristol, BS1 3AG

The Cube
0.3 miles from your location

4 Princess Row, King Square, Bristol, Avon, BS2 8NQ

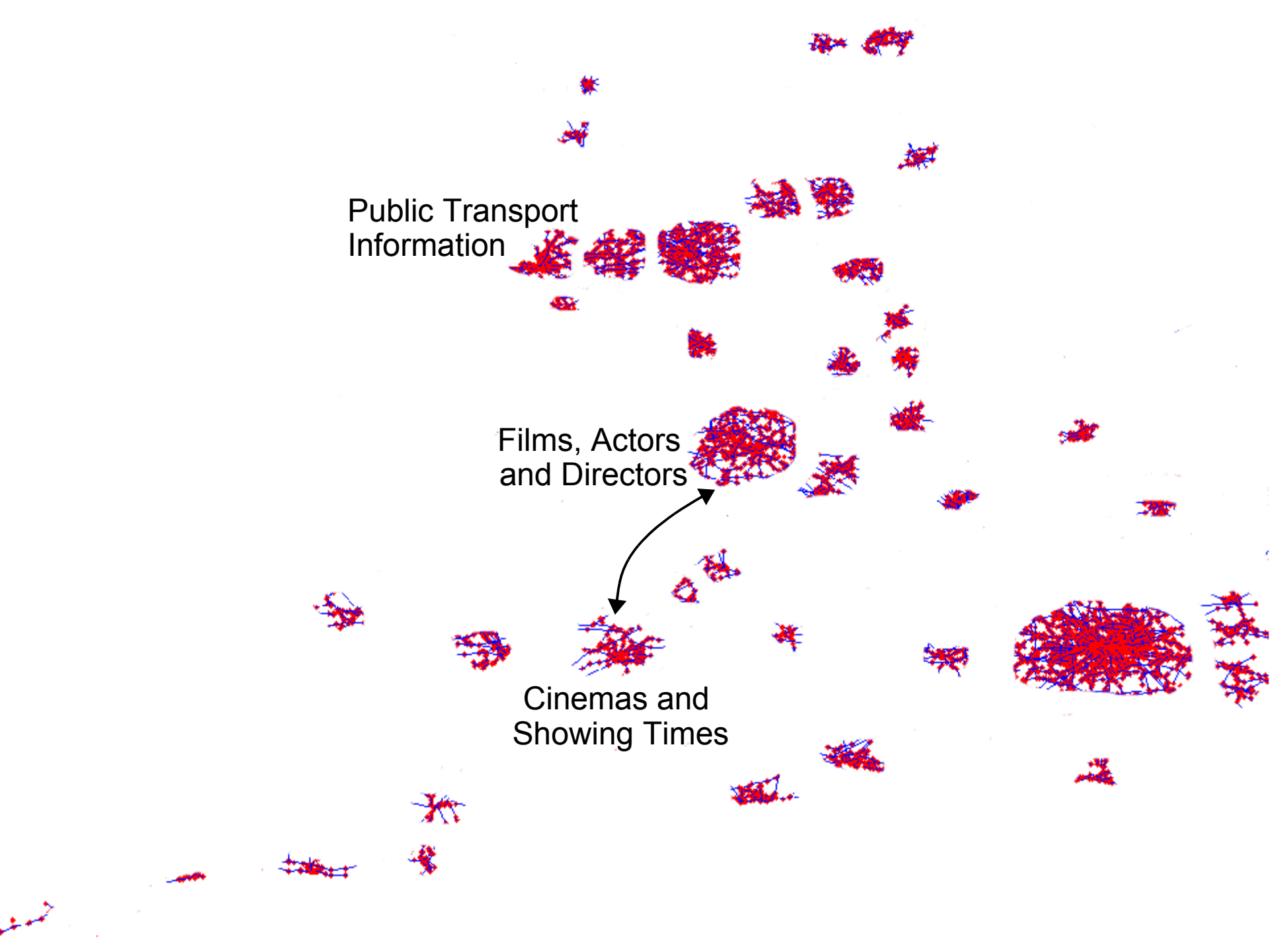
Top Films

- A Single man
- Alice In Wonderland (2010)
- Alvin And The Chipmunks 2: The Squeakquel
- An Education
- Astro Boy
- Avatar
- Blind Side with Have A Heart, The
- Capitalism: A Love Story
- Case 39
- Chloe
- Crazies, The
- Crazy Heart
- Did You Hear About the Morgans?

This Week's Top 5

Avatar (12A)

1. Avatar (12A)
2. The Lovely Bones (12A)


Public Transport
Information
Films, Actors
and Directors
Cinemas and
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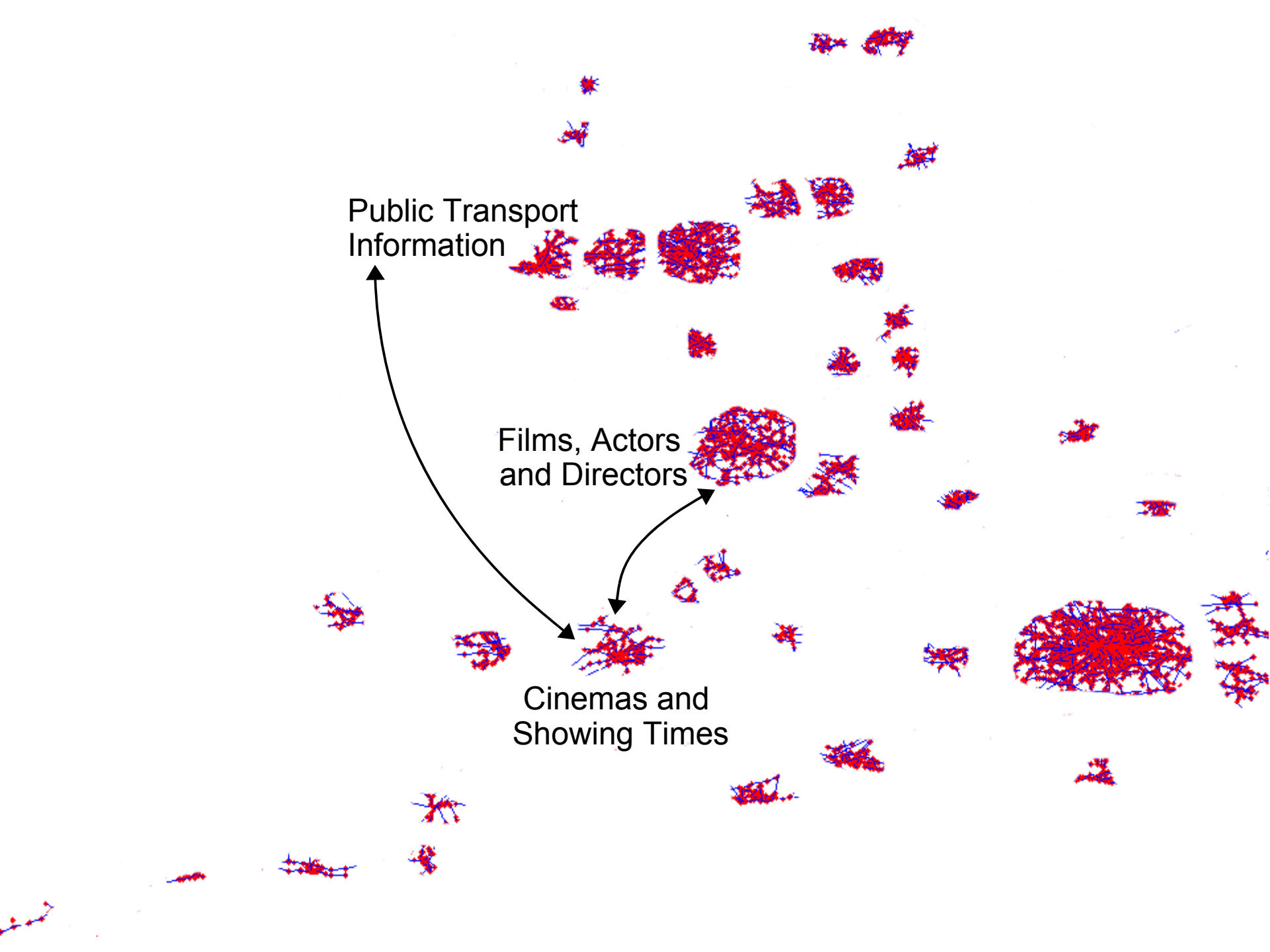
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Gloucester is a Mashup

Linked Data is the Web

From Linked Places to Linked Data

- Building physical networks adds value to the places which are connected
  - Why was the Birmingham and Bristol Railway built?

From Linked Places to Linked Data

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  - Why was the Birmingham and Bristol Railway built?
- Building virtual networks adds value to the things which are connected

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  - Adds value to the connected data sets

From Linked Places to Linked Data

- Building physical networks adds value to the places which are connected
  - Why was the Birmingham and Bristol Railway built?
- Building virtual networks adds value to the things which are connected
- Linked Data enables us to build a network or Web of data sets
  - Adds value to the connected data sets
- Using the Web infrastructure means no 'break of gauge' at Gloucester
  - Cheaper, faster journeys between data sets

Linked Data Principles (TimBL, 2006)

- Use URIs as names for things
  - not just for documents
    - http://dbpedia.org/resource/Talis_Group
  - you are not your homepage
    - http://tomheath.com/id/me
- Use HTTP URIs
  - globally unique names, distributed ownership
  - allows people to look up those names
- Provide useful information in RDF
  - when someone looks up a URI
- Include RDF links to other URIs
  - to enable discovery of related information

“Talis is Based Near Birmingham”

<http://dbpedia.org/resource/Talis_Group>

<http://xmlns.com/foaf/0.1/Person#based_near>

<http://sws.geonames.org/3333125/>

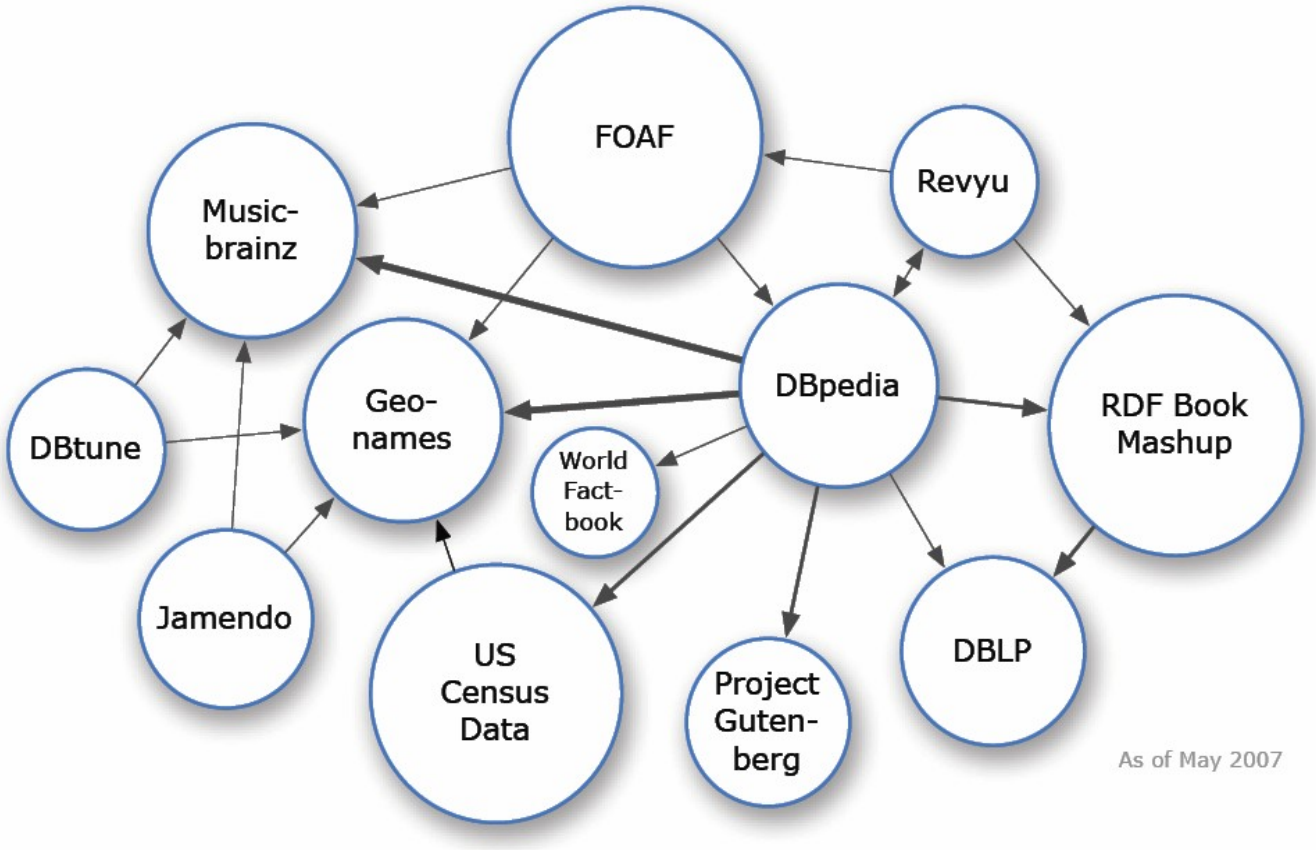
Linked Data...

- ...is not just structured data published on the Web
  - not equivalent to CSV files, (plain) XML, database dumps
- ...is a way of putting data *into* the Web
- ...is based on well-established Web standards
- ...adds value
  - less redundancy, greater discoverability, network effects
- ...is experiencing rapid adoption

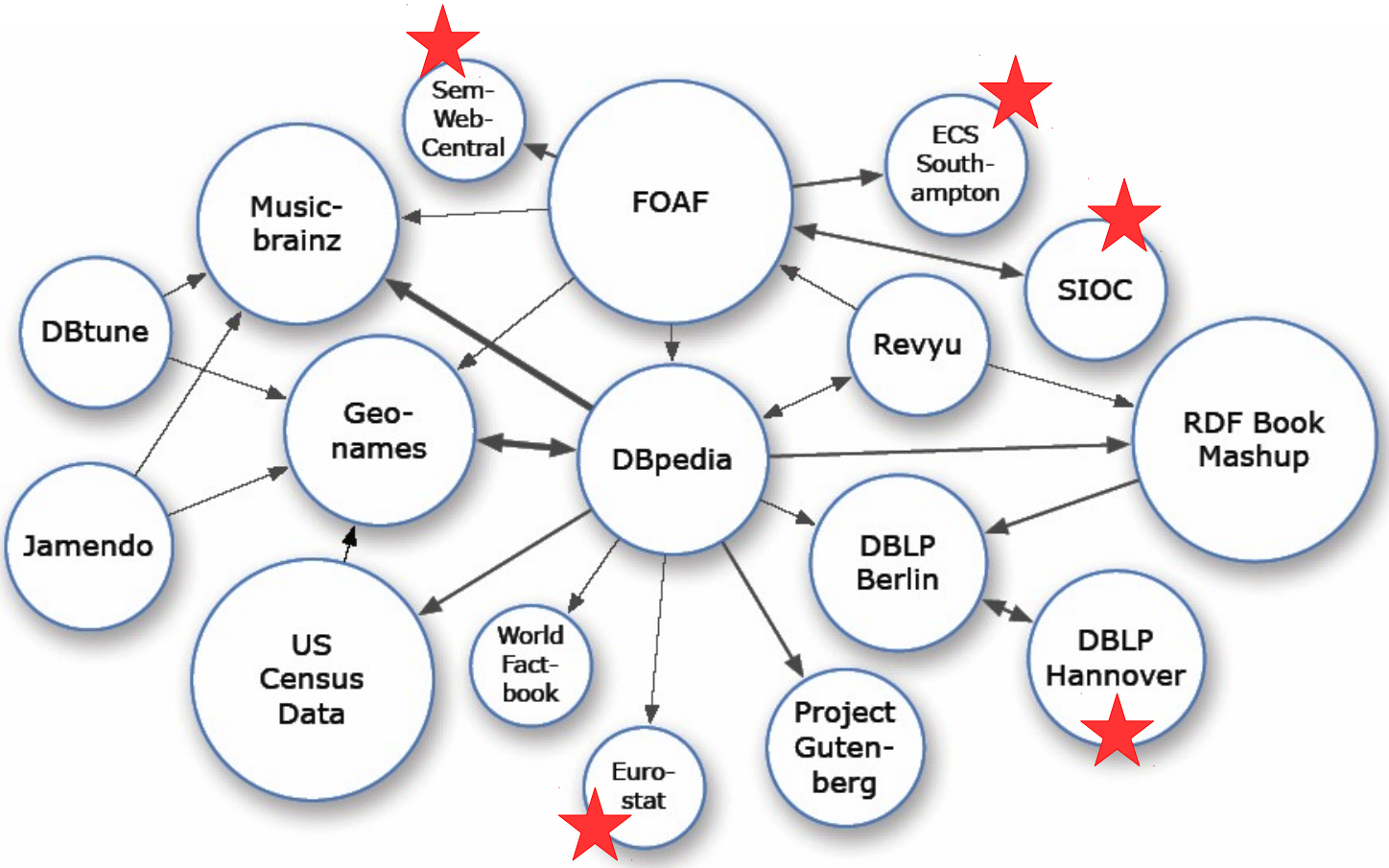
Web of Data: Current Status

LINKINGOPENDATA
W3C SWEO Community Project

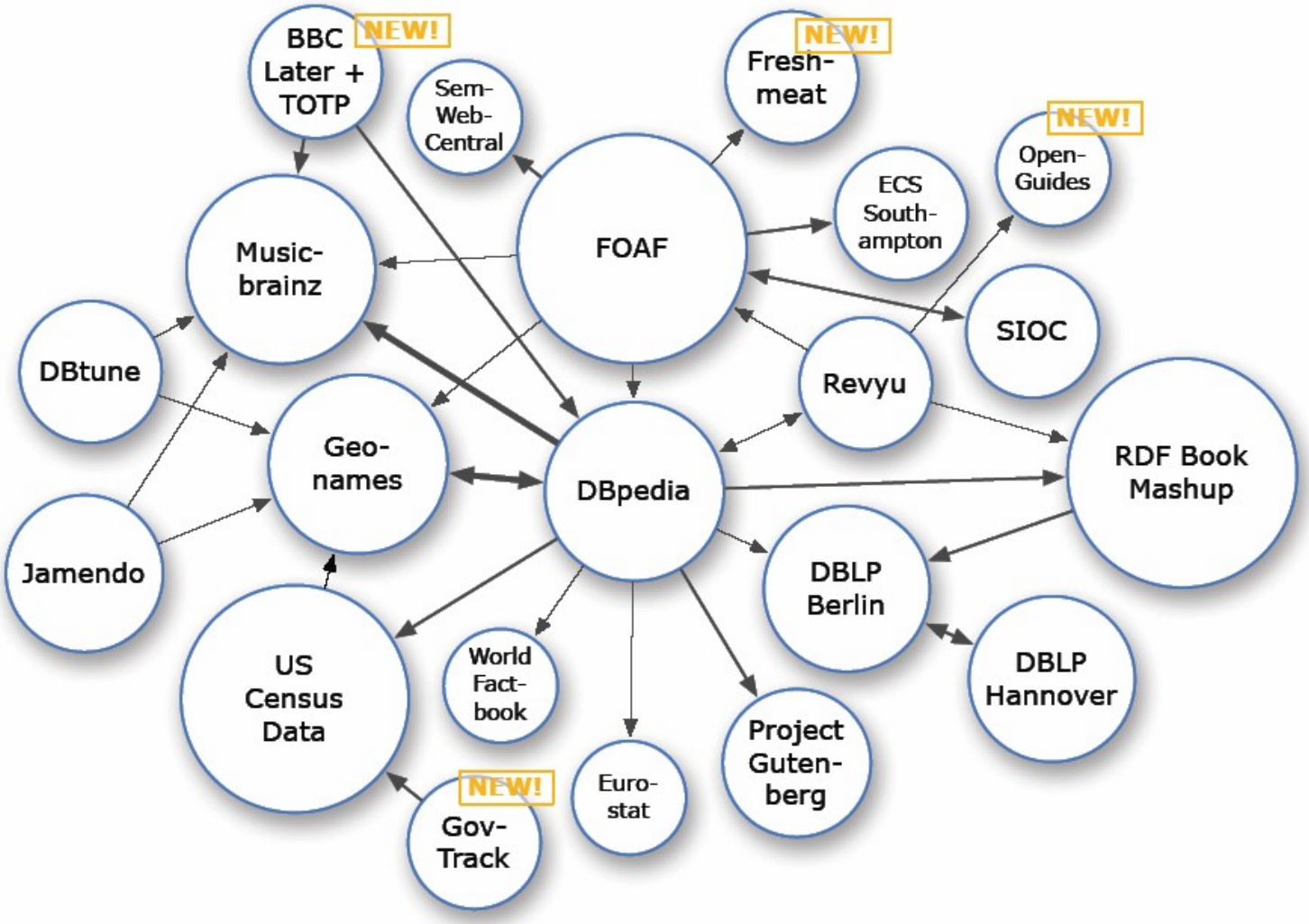
The LOD "Cloud" - May 2007



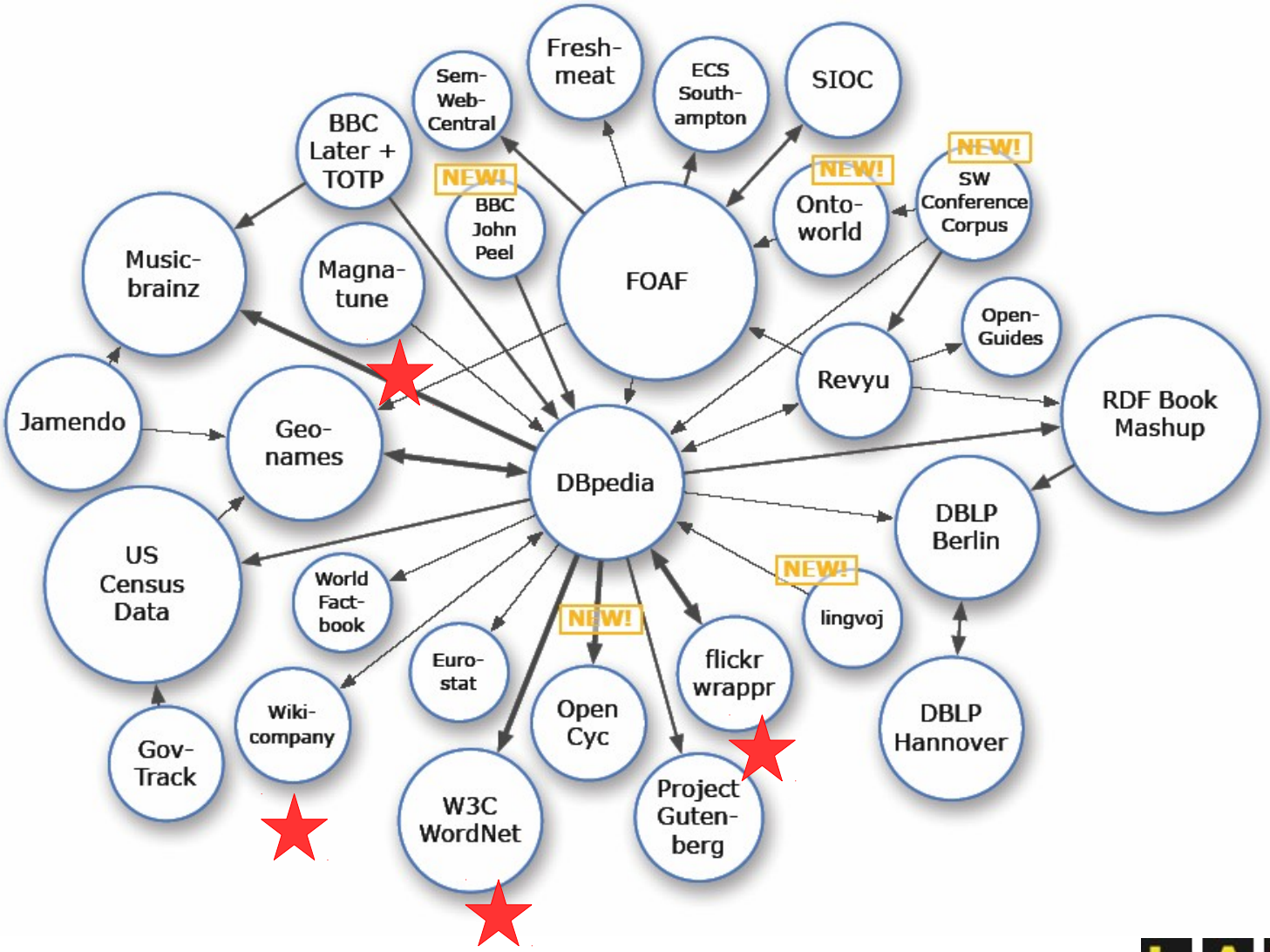
The LOD "Cloud" - July 2007



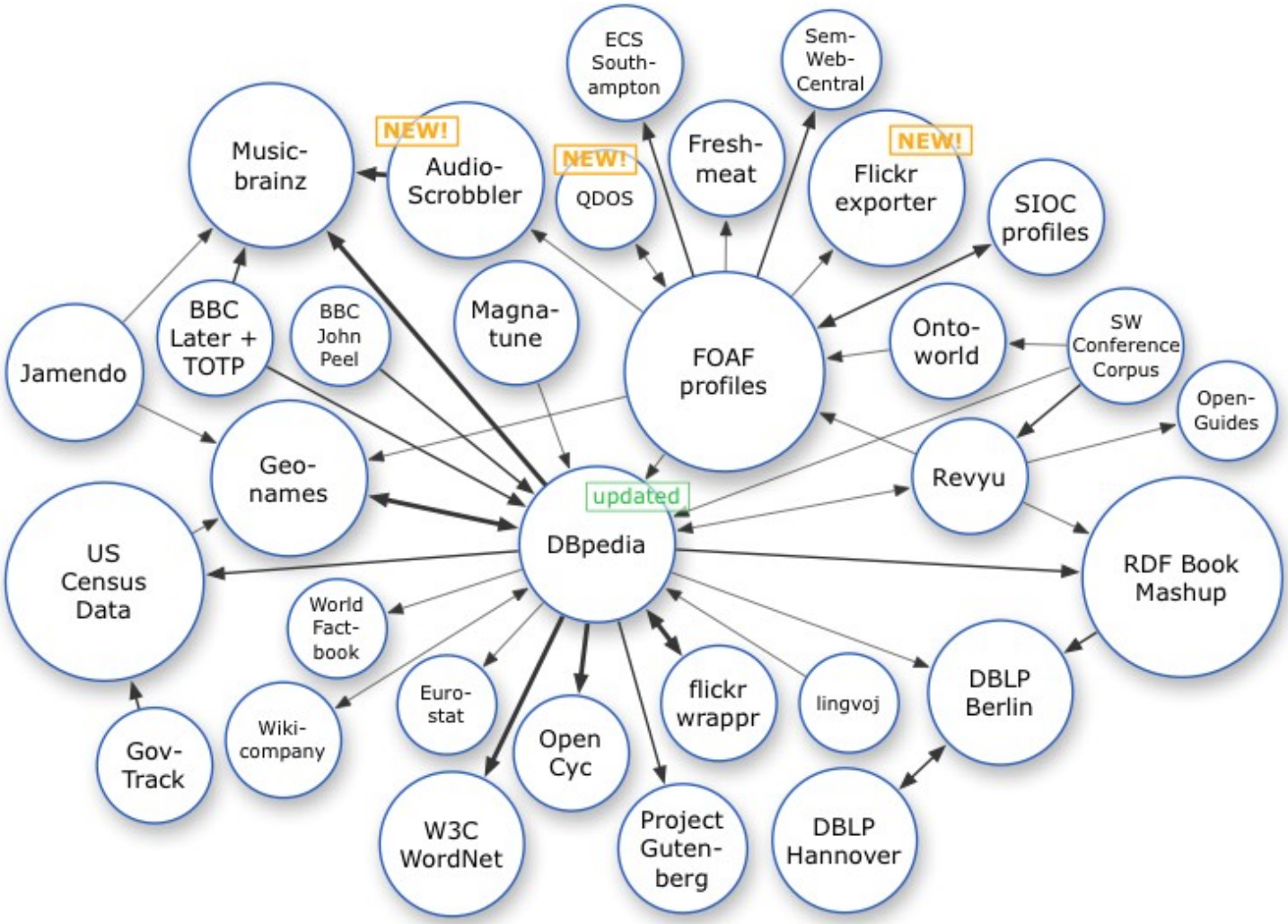
The LOD "Cloud" - August 2007



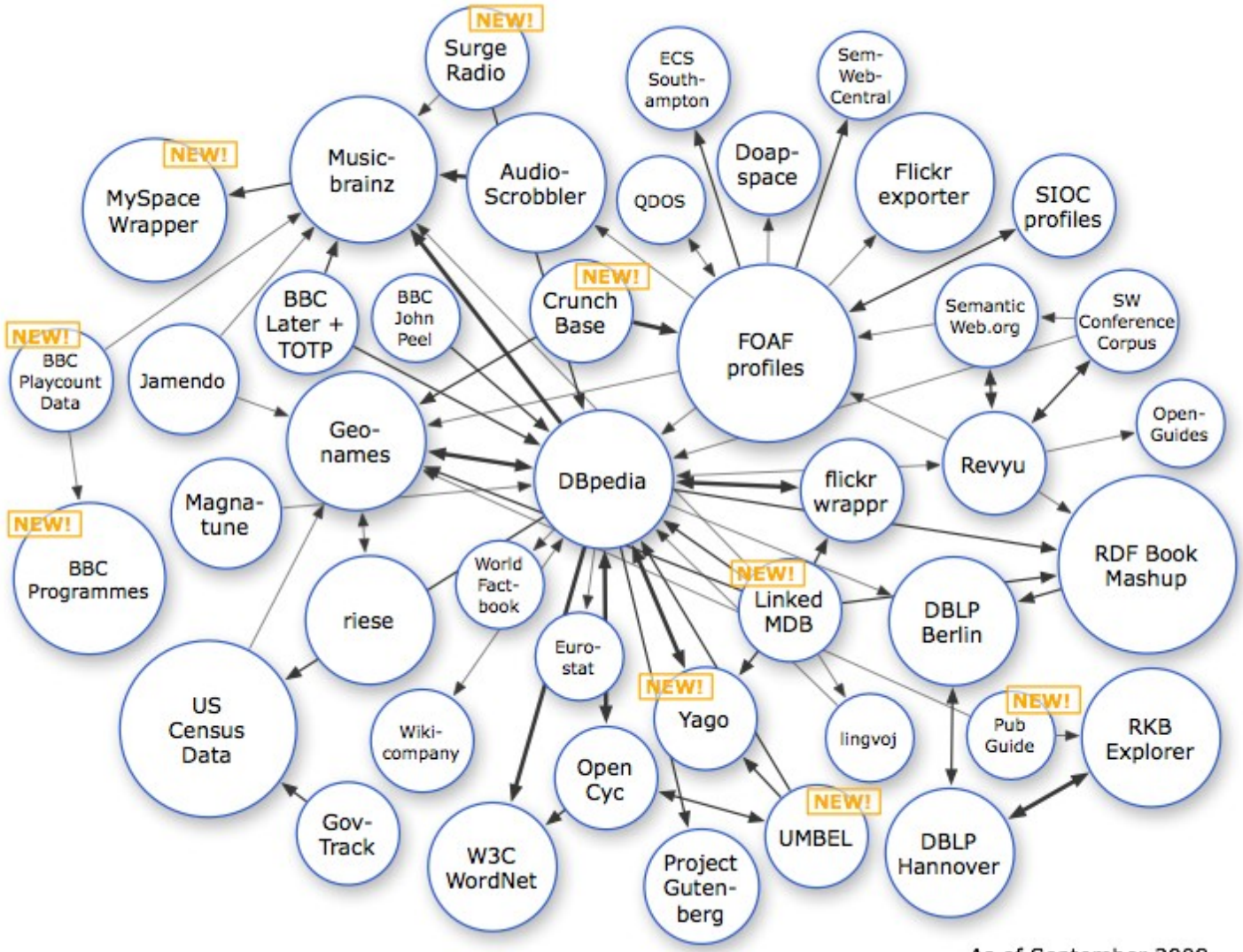
The LOD "Cloud" - November 2007

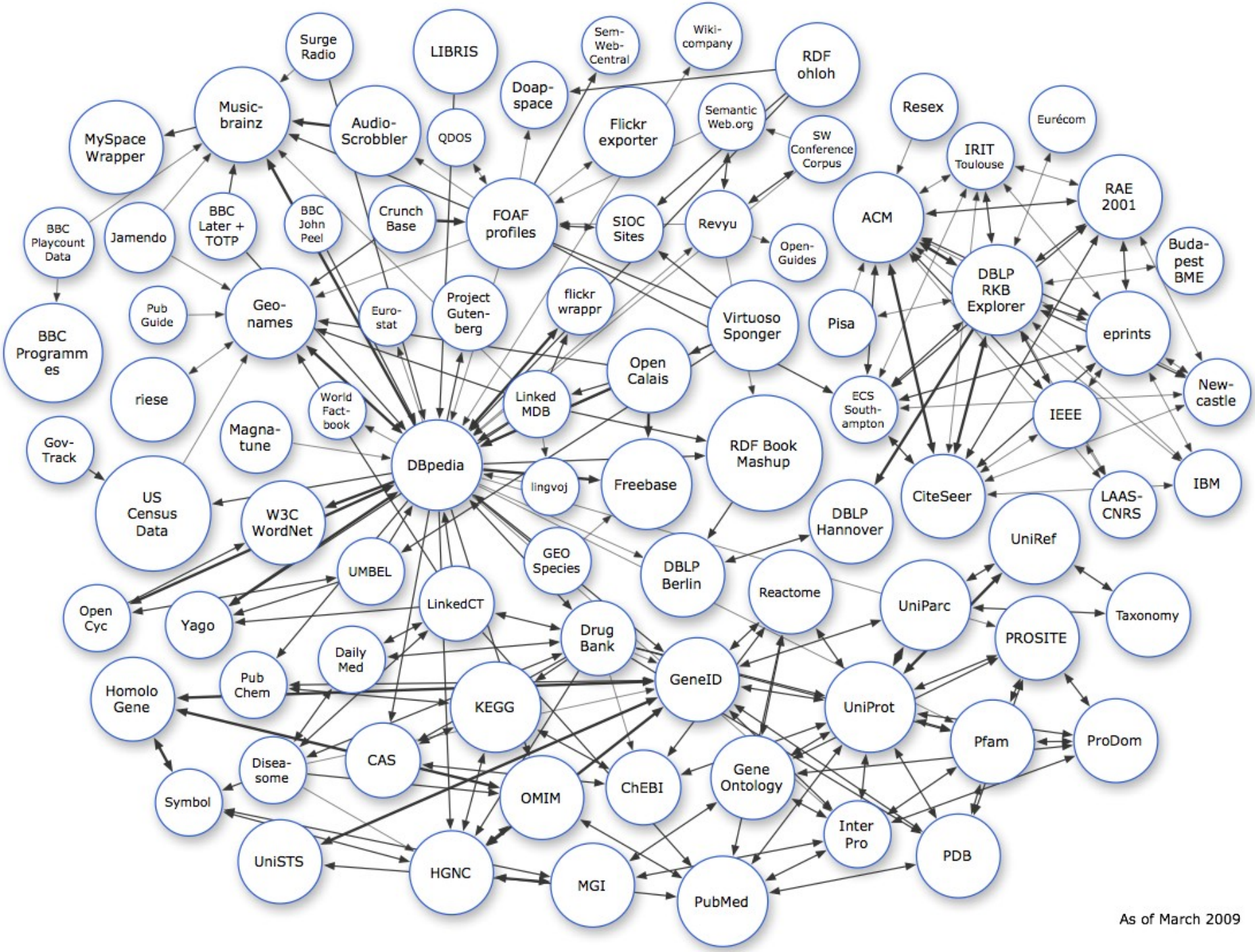


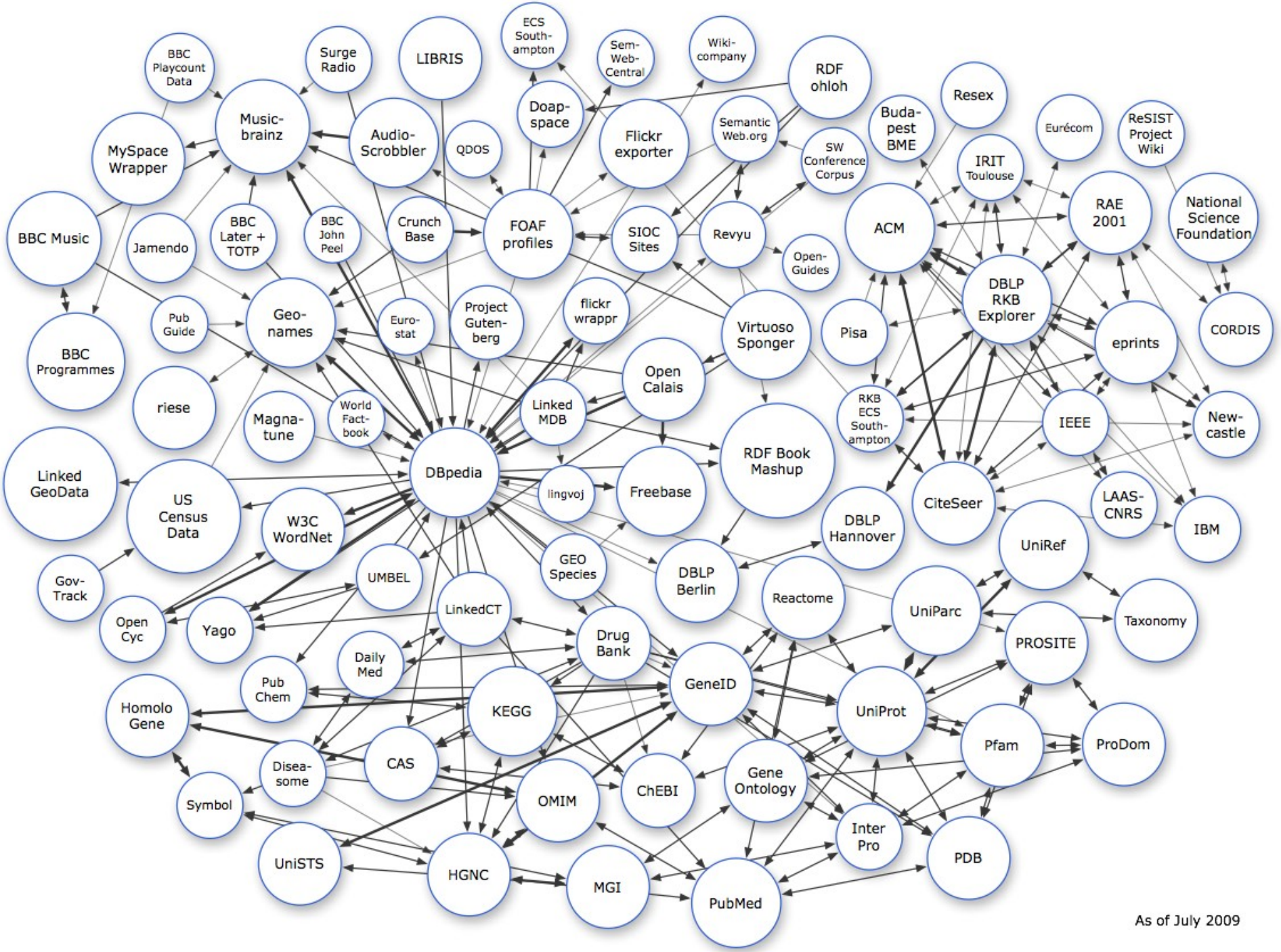
The LOD "Cloud" – Feb 2008



The LOD "Cloud" – Sept 2008




Surge Radio
LIBRIS
Sem-Web-Central
Wiki-company
RDF ohloh
Doap-space
Music-brainz
Audio-Scrobbler
QDOS
Flickr exporter
Semantic Web.org
SW Conference Corpus
Resex
Eurécom
IRIT Toulouse
MySpace Wrapper
BBC Playcount Data
Jamendo
BBC Later + TOTP
BBC John Peel
Crunch Base
FOAF profiles
SIOC Sites
Revyu
Open-Guides
ACM
RAE 2001
Buda-pest BME
BBC Programm es
Pub Guide
Geo-names
Euro-stat
Project Guten-berg
flickr wrappr
Virtuoso Sponger
Pisa
DBLP RKB Explorer
eprints
riese
World Fact-book
Linked MDB
Open Calais
ECS South-ampton
IEEE
New-castle
Gov-Track
Magna-tune
DBpedia
RDF Book Mashup
US Census Data
W3C WordNet
lingvoj
Freebase
CiteSeer
LAAS-CNRS
IBM
DBLP Hannover
UniRef
UMBEL
GEO Species
DBLP Berlin
Reactome
UniParc
Taxonomy
Open Cyc
Yago
LinkedCT
Drug Bank
PROSITE
Daily Med
Pub Chem
GeneID
Homolo Gene
KEGG
UniProt
Pfam
ProDom
Disea-some
CAS
Gene Ontology
Symbol
OMIM
ChEBI
Inter Pro
UniSTS
HGNC
MGI
PubMed
PDB
As of March 2009


BBC Playcount Data
Surge Radio
LIBRIS
ECS South-ampton
Sem-Web-Central
Wiki-company
RDF ohloh
Resex
Buda-pest BME
Eurécom
ReSIST Project Wiki
Music-brainz
Audio-Scrobbler
QDOS
Doap-space
Flickr exporter
Semantic Web.org
SW Conference Corpus
IRIT Toulouse
MySpace Wrapper
BBC Music
Jamendo
BBC Later + TOTP
BBC John Peel
Crunch Base
FOAF profiles
SIOC Sites
Revyu
Open-Guides
ACM
RAE 2001
National Science Foundation
Pub Guide
Geo-names
Euro-stat
Project Guten-berg
flickr wrappr
Virtuoso Sponger
Pisa
DBLP RKB Explorer
eprints
CORDIS
BBC Programmes
riese
Magna-tune
World Fact-book
Linked MDB
Open Calais
RKB ECS South-ampton
IEEE
New-castle
Linked GeoData
US Census Data
DBpedia
lingvoj
Freebase
RDF Book Mashup
CiteSeer
LAAS-CNRS
IBM
Gov-Track
W3C WordNet
UMBEL
GEO Species
DBLP Berlin
DBLP Hannover
UniRef
Reactome
UniParc
Taxonomy
Open Cyc
Yago
LinkedCT
Drug Bank
PROSITE
Daily Med
GeneID
Pub Chem
KEGG
UniProt
Homolo Gene
Pfam
ProDom
Disea-some
CAS
Gene Ontology
Symbol
OMIM
ChEBI
Inter Pro
UniSTS
HGNC
MGI
PubMed
PDB
As of July 2009

Draft
Goodwin Family
Poképédia
Events and Media descriptions
MySpace Wrapper
The London Gazette
P20
RAMEAU STITCH
Gem. Norm-datei
VIAF
lobid-Resources
lobid-organisations
VIVO Cornell
ECS EPrints
OAI
STW
Moseley Folk
Pokedex (Data Incubator)
DBTune Artists: Last.fm
Music Brainz (DBtune)
New York Times
PSSHS
LCSH
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NDL subjects
semanticweb.org
BibBase
VIVO UF
VIVO Indiana
ECS South-ampton
Courseware
DEPLOY
GESIS
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Surge Radio
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LinkedLCCN
ERA
Resex
Buda-pest BME
RISKS
ReSIST Project Wiki
JISC
KISTI
Discogs in RDF
Music Brainz (Data Incubator)
Music Brainz (zitgist)
FanHubz
Audio-Scrobbler
Lotico
DB Tropes
Semantic Web.org
RDF ohloh
IRIT
Roma
ESD standards
Linked Data for Intervals
Our Airports in RDF
EUTC Productions
BBC John Peel
Crunch Base
FOAF profiles
SIOC Sites
Revyu
RAE 2001
National Science Foundation
UN/LOCODE
OS
Ordnance Survey
OpenEI.org
Jamendo
Ulm
NSZL Catalog
Iolus
BBC Programmes
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CORDIS
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education.data.gov.uk
dotAC
statistics.data.gov.uk
BBC Wildlife Finder
World Fact-book
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IEEE
New-castle
Twarql
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US Securities & Exchange
API
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Berlin)
Chem2 Bio2RDF
TWC LOGD
Open Cyc
Yago
Lexvo
LinkedCT
Drug Bank
Reactome
UniParc
Taxonomy
PROSITE
EUNIS
GeoLinkedData (.es)
Daily Med
Pub Chem
KEGG Glycan
KEGG Drug
GeneID
UniProt
Affymetrix
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WordNet (VUA)
TCMGeneDIT
Disea-some
CAS
OMIM
ChEBI
Gene Ontology
Uni Pathway
KEGG Pathway
Cornetto
Homolo Gene
UniSTS
Medi Care
HGNC
MGI
Inter Pro
PDB
OBO
SIDER
PubMed
KEGG Cpd
SGD
KEGG Reaction
KEGG Enzyme
As of September 2010

The Sky at Night

Reporting on the latest cosmological events and the people who observe them

WEBSITE: **Go to the homepage for 'The Sky at Night'**
PREVIOUS PROGRAMMES: **by year** (78)

Coming up

Sorry, no programmes coming up.

More from BBC One

- Factual > Science & Nature

Last on

Star Birth
MORE: **programme information** | **related links**
Broadcast **Saturday, 14:10** on **BBC Two (except Northern Ireland (Analogue), Wales (Analogue))** but **no longer available** on BBC iPlayer.
A look at new images of star-forming areas of our galaxy from the Herschel telescope.

BBC © MMX
The BBC is not responsible for the content of external sites. Read more.

BBC RADIO 1

ROBYN | BBC RADIO 1

Robyn In The Live Lounge

Robyn brought a touch of heartbreak to the Live Lounge as she performed her new single, 'Dancing On My Own', and a cover of Alicia Keys' 'Sleeping With A Broken Heart'.

MORE MUSIC ON THE BBC *1-3 OF 20*

ROBYN IN THE LIVE LOUNGE

DOVES - ROCKNESS PERFORMANCE

NERINA PALLOT: WEEKEND WOGAN PERFORMANCE

BROWSE BY GENRE • Classic Pop & Rock • Classical • Country • Dance & Electronica • Desi • Easy Listening, Soundtracks & Musicals • Folk • Hip Hop, RnB & Dancehall • Jazz & Blues • Pop & Chart • Rock & Indie • Soul & Reggae • World

Most Played Artists On The BBC

14-20 JUNE 2010

Tinie Tempah	K'naan	Mumford & Sons	Big Boi	Scissor Sisters	Eminem	Drake	The Che
1	2	3	4	5	6	7	8

1 40 80 120 160 200

Information displayed about artists played on BBC programmes is incomplete at present. Find out more about this artist play count information.

More Artists »

Text only | Help

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

WILDLIFE FINDER

WATCH THE MOST AMAZING ANIMALS IN THE WORLD

BBC Nature

LATEST WILDLIFE

3 programmes
they perch upright
16 June 2010

Gharial
1 sound 1 programme
Gharials are once again on the verge of extinction in the wild. After 30 years of conservation effort and restocking, there may still be fewer than 200 breeding adults left in the wild.
16 June 2010

Mute swan
Mute swans are a familiar
and other urban areas.

COLLECTIONS

Collections offer a new perspective on the vast catalogue of clips showcasing presenter favourites, aspects of wildlife film-making, and gathering content together in illuminating ways.

Brilliant bees
Bees are amazing - not only do they fulfil a vital role in our ecosystem, they are one of the most complex and sophisticated living things in the history of evolution.

Wildlife wind-ups

EDITOR'S CHOICE

Spotted any ravens lately? Or a black red fox? Take a look at who's featuring on Springwatch.

Raven 3 videos

Otter 11 videos

WELCOME TO WILDLIFE FINDER

Explore a wealth of video, sounds, stories and breaking news on your favourite animals, and find out more about how and where they live.

Wildlife Finder gives you access to an ever growing catalogue of BBC natural history programmes, with video clips from series such as: Planet Earth, Blue Planet, Life on Earth, Natural World, Life and many more.

WHAT'S NEW?

10 June 2010

HIGHLIGHTS

Ivory Coast 0-0 Portugal

Highlights and report

Brazil 2-1 North Korea

Highlights and report

Honduras 0-1 Chile

Highlights and report

Spain 0-1 Switzerland

Highlights and report

COMING UP

Blogs

James Pearce

Beckham grafts for England

But ex-captain keen to remain away from World Cup spotlight

Phil McNulty

Is Beckenbauer right about England?

Swiss secure shock win over Spain

Switzerland provide the first surprise result of the 2010 World Cup by beating 2008 European champions Spain 1-0 in Group H.

- World Cup day six photos
- Enhanced match stats

Wednesday's matches

Honduras 0-1 Chile	Full-time
Spain 0-1 Switzerland	Full-time
South Africa v Uruguay	19:30 BST

Group tables

A | B | C | D | E | F | G | H

GROUP H TEAMS	W	D	L	GD	PTS
Chile	1	0	0	1	3
Switzerland	1	0	0	1	3
Honduras	0	0	1	-1	0
Spain	0	0	1	-1	0

Video choice

Mokoena aims to harness

DATA.GOV
EMPOWERING PEOPLE

Most Popular Datasets

1. US Topo 7.5-minute map for Imperial, TX
2. U.S. Overseas Loans and Grants (Greenbook)
3. Worldwide M1+ Earthquakes, Past 7 Days
4. Latest Volumes of Foreign Relations of the...
5. Import/Export Price Indexes

SEARCH OUR CATALOGS

Search our catalogs.. SEARCH

APPS

With so much government data to work with, developers are creating a wide variety of applications, mashups, and visualizations. From crime statistics by neighborhood to the best towns to find a job to seeing the environmental health of your community–these applications arm citizens with the information they need to

COMMUNITY

Data.gov is leading the way in democratizing public sector data and driving innovation. The data is being surfaced from many locations making the Government data stores available to researchers to perform their own analysis. Developers are finding good uses for the datasets, providing interesting and useful applications that allow for new views and public analysis. This is a work in progress, but this movement is spreading to cities, states, and other countries. After just one year a community is born around open government data.

Just look at the numbers:

6 Other nations establishing open data
8 States now offering data sites

SEMANTIC WEB

As the Web of linked documents evolves to include the Web of linked data, we're working to maximize the potential of Semantic Web technologies to realize the promise of Linked Open Government Data.

Thanks to our collaboration with the **Tetherless World Constellation** at the **Rensselaer Polytechnic Institute**, Data.gov is now hosting one of the largest open collections of RDF datasets in the world! Check out some of their

HM Government

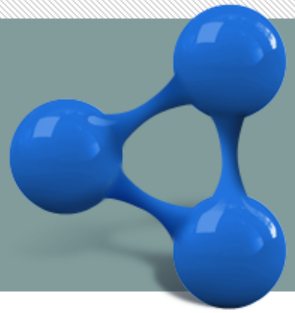
data.gov.uk

BETA

Home | Blog | Data | SPARQL | Apps | Ideas | Forum | Wiki | Resources | About

Unlocking innovation

Working with UK Public Sector information and data



Subscribe by RSS

Community
Log in / Sign up

Local Data Panel

Latest datasets

14 June	More COINS public spending data: now covers 2005 to 2010
10 June	Lists of all Special Advisers and Cabinet Office staff
4 June	COINS database of Public Spending
2 June	NHS Weekly MRSA and C-Difficile dataset
1 June	Senior Civil Servants with salaries over £150,000

What we do

data.gov.uk is a key part of the Government's Transparency programme for the UK public sector as a whole. Working with Sir Tim Berners-Lee, Professor Nigel Shadbolt and Tom Steinberg and other members of the Cabinet Office Minister's new Public Sector Transparency Board this site seeks to give a way into the wealth of government data becoming available. It's under constant development and we want to work with you to make it better.

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

LATC

Datasets: energy

Keyword search

Search within results

Search More options

Current search

[×] energy

Guided search

Click a term to refine your current search.

Nation
England (111)
Scotland (106)
Wales (105)
Northern Ireland (93)

Public body
Department of Energy and Climate Change (45)
Department for Business (13)
Innovation and Skills (13)
Scottish Government (9)
Northern Ireland Executive (5)
Department for Communities and Local Government (4)
Department for Environment (2)
Food and Rural Affairs (2)
Her Majesty's Revenue and Customs (2)
Home Office (2)
more...

Tags
business-and-energy (91)

Results 1 - 10 of 128

Energy Consumption in the UK

This publication brings together **energy** consumption data for previous year from a variety of different sources in order to give a comprehensive view of how **energy** has been used in the UK since the 1970s. The publication is divided ...

Tags: energy transport

UK Energy Sector Indicators: key and supporting indicators

... of the gas and electricity markets; the structure of the **energy** market; and fuel poverty. Supporting indicators, explain in more detail ... by the key indicators, as well as covering carbon and **energy** intensity; gas and electricity capacity; the diversity of fuels used in ...

Tags: electricity emissions energy fuel gas green greenhouse-gas housing

High Level Indicators of Energy Use at Regional and Local Authority Level

Indicators of regional **energy** use compared with a variety of socio-economic variables Source agency: **Energy** and Climate Change Designation: Official Statistics not designated ... Language: English Alternative title: Regional **energy** high level indicators Overview ...

Tags: business-and-energy business-and-industry energy energy-and-fuel energy-production-and-consumption indicator regional

Energy Trends

Provides statistics on **energy** in the United Kingdom which provides a

Community
Log in / Sign up

Local Data Panel

What is the Semantic Web?

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Read more

Digital Engagement Twitter stream

RT

@RosslynAnalytic We'll have #COINS ready in web analytics for everyone in hours. bit.ly/9Z5Etp <-and they did: well done

Follow us on Twitter

Tell us your idea

Ordnance Survey Linked Data

A description of the resource identified by **http://data.ordnancesurvey.co.uk/**

Title	Ordnance Survey Linked Data
Description	Ordnance Survey is Great Britain's national mapping agency, providing the most accurate and up-to-date geographic data, relied on by government, business and individuals. OS OpenData is the opening up of Ordnance Survey data as part of the drive to increase innovation and support the "Making Public Data Public" initiative. As part of this initiative Ordnance Survey has published a number of its products as Linked Data. Linked Data is a growing part of the Web where data is published on the Web and then linked to other published data in much the same way that web pages are interlinked using hypertext. The term Linked Data is used to describe a method of exposing, sharing, and connecting data via URIs on the Web. To find more Linked Data published as part of this initiative please go to data.gov.uk . If you are not familiar with Linked Data, OS OpenData products are also available in alternative formats from the OS OpenData website. Ordnance Survey can provide support for the Ordnance Survey OpenData products, but cannot give advice or support on using RDF, SPARQL or SPARQL Endpoints. Ordnance Survey has published two separate linked data resources: the 1:50 000 Scale Gazetteer and the administrative gazetteer for Great Britain.
Creator	Ordnance Survey
Date issued	2010-04-01
Example resource	Southampton Portswood Southampton, Itchen The County of Hampshire The City of Southampton Southampton Common
SPARQL endpoint	Sparql
URI lookup point	Meta?about=
Vocabulary used	Spatial Relations Ontology Administrative Geography Ontology WGS84 Geo Positioning FOAF OWL Gazetteer Ontology
URI regex pattern	http://data.ordnancesurvey.co.uk/id/.+
See also	data.gov.uk

The Open Graph Protocol

Introduction

The Open Graph protocol enables any web page to become a rich object in a social graph. For instance, this is used on Facebook to enable any web page to have the same functionality as a Facebook Page.

While many different technologies and schemas exist and could be combined together, there isn't a single technology which provides enough information to richly represent any web page within the social graph. The Open Graph protocol builds on these existing technologies and gives developers one thing to implement. Developer simplicity is a key goal of the Open Graph protocol which has informed many of the technical design decisions.

Basic metadata

To turn your web pages into graph objects, you need to add basic metadata to your page. We've based the initial version of the protocol on RDFa which means that you'll place additional `<meta>` tags in the `<head>` of your web page. The four required properties for every page are:

- `og:title` - The title of your object as it should appear within the graph, e.g., "The Rock".
- `og:type` - The type of your object, e.g., "movie". Depending on the type you specify, other properties may also be required.
- `og:image` - An image URL which should represent your object within the graph.

Publishing in a Nutshell

6 Steps to Publishing Linked Data

1. Understand the Principles
2. Understand your Data
3. Choose URIs for Things in your Data
4. Setup Your Infrastructure
5. Link to other Data Sets
6. Describe and Publicise your Data

Scenario

- Online whisky shop: *Wiskii.com*
- New business venture, founded by *Jeff*
- For the whisky connoisseur
- Detailed background information from experts
- Contributions from customers
- Custom web app, relational database backend
- Simultaneous publication in HTML and RDF

1. Understand the Principles

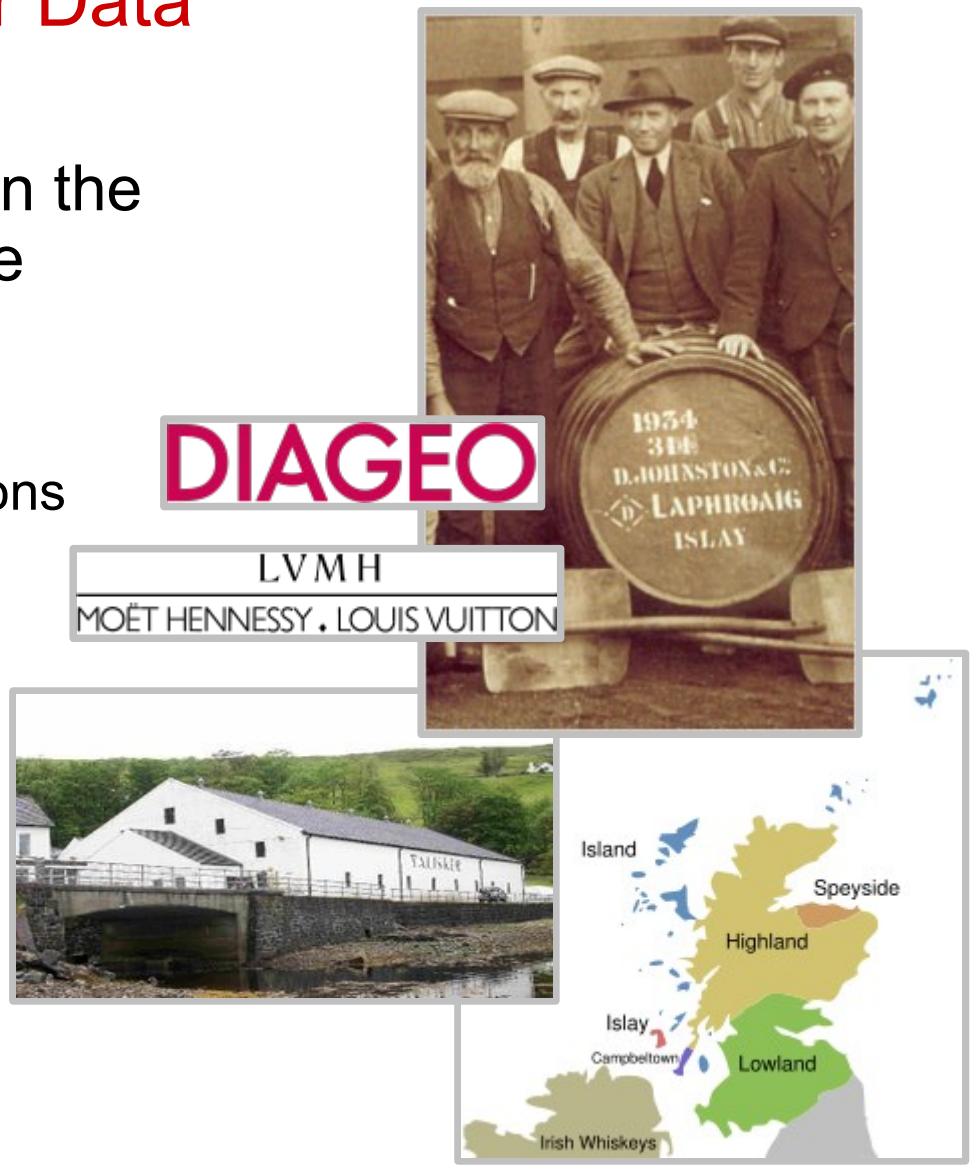
Linked Data Principles: Redux

- Use URIs as names for things
- Use HTTP URIs
- Provide useful information in RDF
- Include RDF links to other URIs

2. Understand your Data

2. Understand Your Data

- Key things present in the *Wiskii.com* database
  - Distilleries
  - Regions and Locations
  - Founders
  - Owners
  - Brands
  - Products
  - Photos
  - Reviews
  - Comments
  - Prices/Offers



2. Understand Your Data

- What vocabularies can be used to describe these?
  - Potential Ontologies/Vocabularies
    - Geo
    - GoodRelations
    - FOAF
    - Review
    - SIOC
    - Whisky
  - Principles
    - Reuse, don't reinvent
    - Mix liberally

3. Choose URIs for Things in Your Data

3. Choosing URIs: Principles

- Use HTTP URIs
- Keep out of other peoples' namespaces
  1. http://www.imdb.com/title/tt0441773/
  2. http://www.imdb.com/title/tt0441773#thing
  3. http://myfilms.com/tt0441773
  4. http://myfilms.com/tt0441773.html
- Abstract away from implementation details
  1. http://dbpedia.org/resource/Berlin
  2. http://www4.wiwiss.fu-berlin.de:2020/demos/dbpedia/cgi-bin/resources.php?id=Berlin
- Hash or Slash
  1. http://mydomain.com/foaf.rdf#me
  2. http://mydomain.com/id/me

3. Choosing URIs: Common Patterns

- http://dbpedia.org/resource/New_York_City ← Thing
- http://dbpedia.org/data/New_York_City ← RDF data
- http://dbpedia.org/page/New_York_City ← HTML page

- http://mydomain.com/thing ← Thing
- http://mydomain.com/thing.rdf ← RDF data
- http://mydomain.com/thing.html ← HTML page

3. Choosing URIs: Wiskii.com

- http://wiskii.com/regions/speyside

- http://wiskii.com/distilleries/talisker
- http://wiskii.com/brands/talisker

- http://wiskii.com/products/talisker-10-yo
- http://wiskii.com/products/glenmorangie-lasanta

- http://wiskii.com/people/william-matheson

- http://wiskii.com/photos/58

- http://wiskii.com/reviews/271

3. Choosing URIs: Wiskii.com

- http://wiskii.com/distilleries/talisker
- http://wiskii.com/distilleries/talisker.rdf
- http://wiskii.com/distilleries/talisker.html

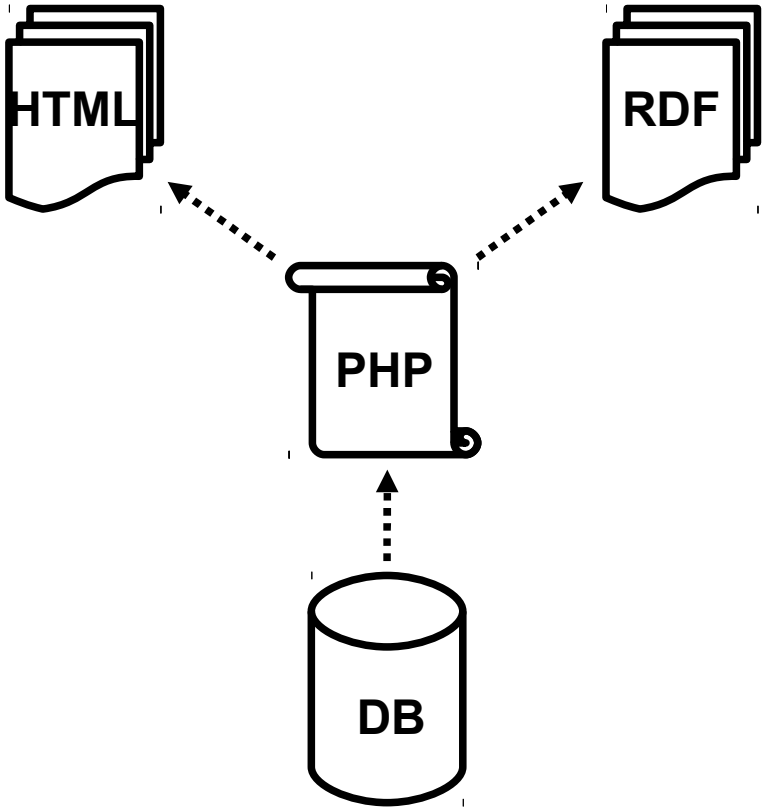
- http://wiskii.com/brands/talisker
- http://wiskii.com/brands/talisker.rdf
- http://wiskii.com/brands/talisker.html

- http://wiskii.com/people/william-matheson
- http://wiskii.com/people/william-matheson.rdf
- http://wiskii.com/people/william-matheson.html

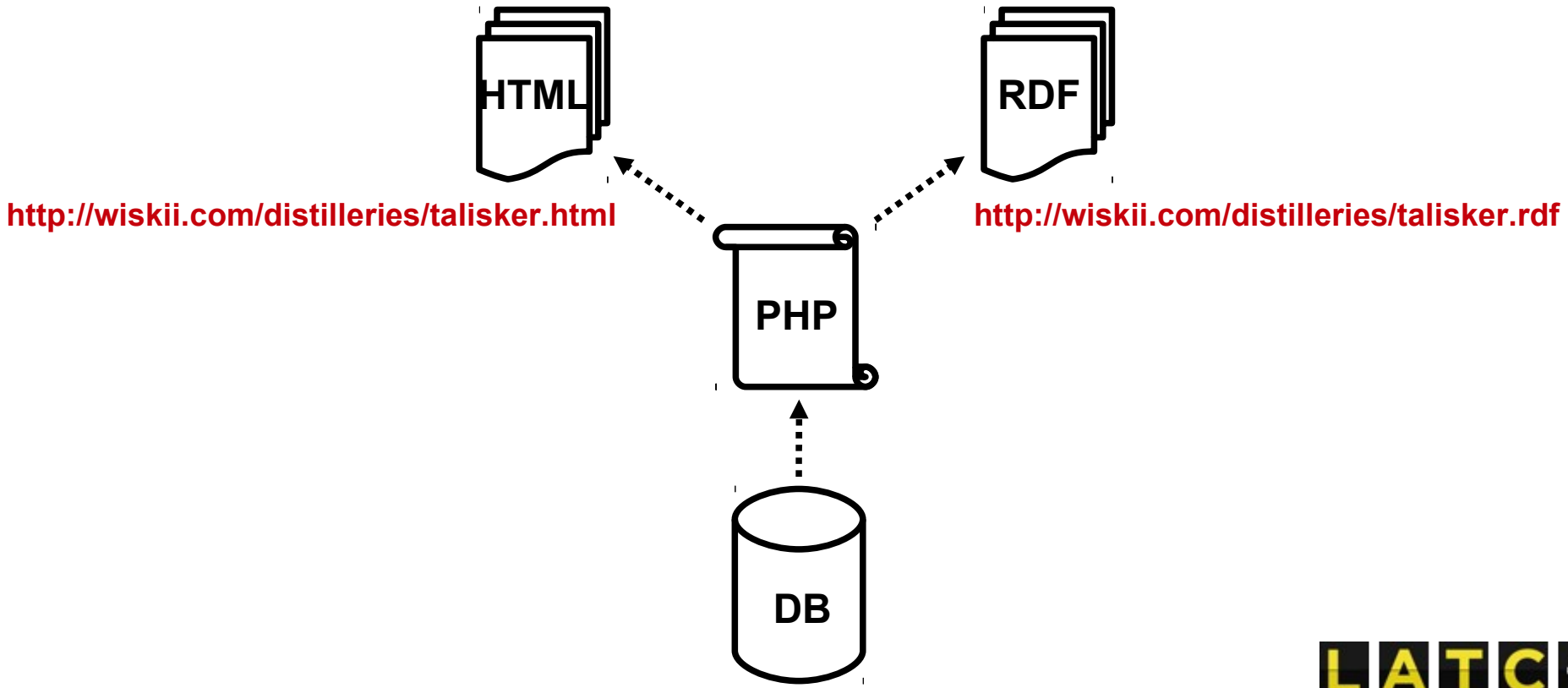
- http://wiskii.com/photos/58

4. Setup Your Infrastructure

4. Setup Your Infrastructure

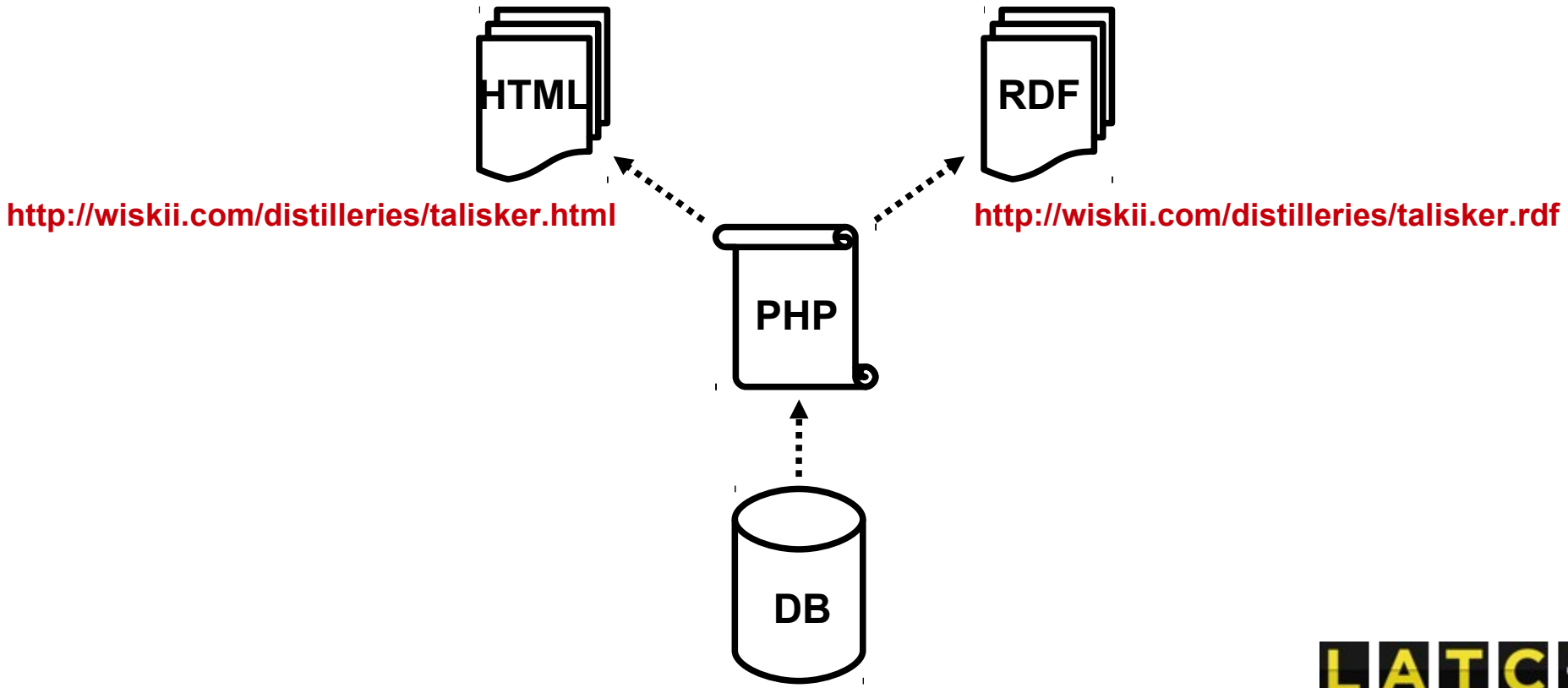


4. Setup Your Infrastructure

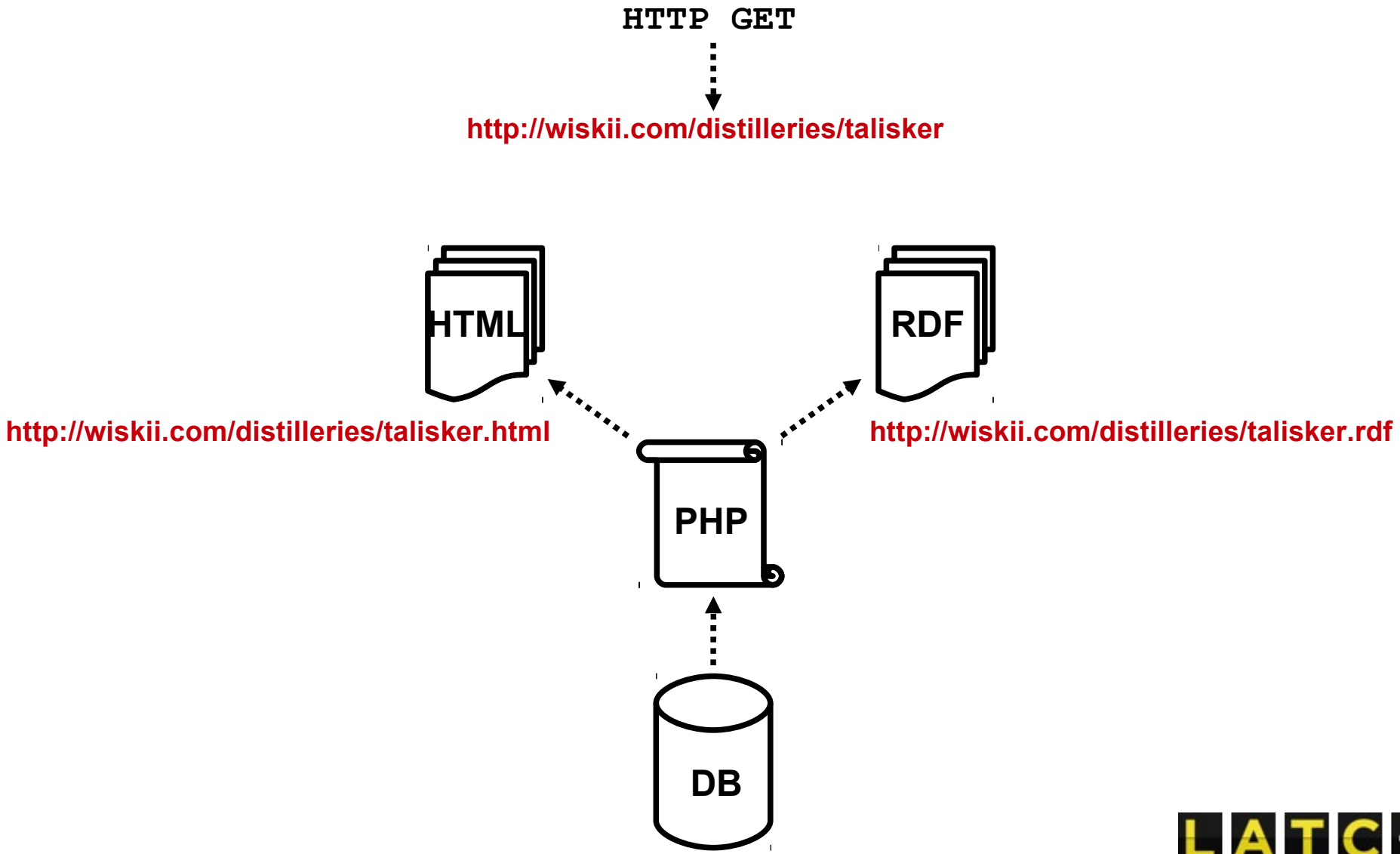


4. Setup Your Infrastructure

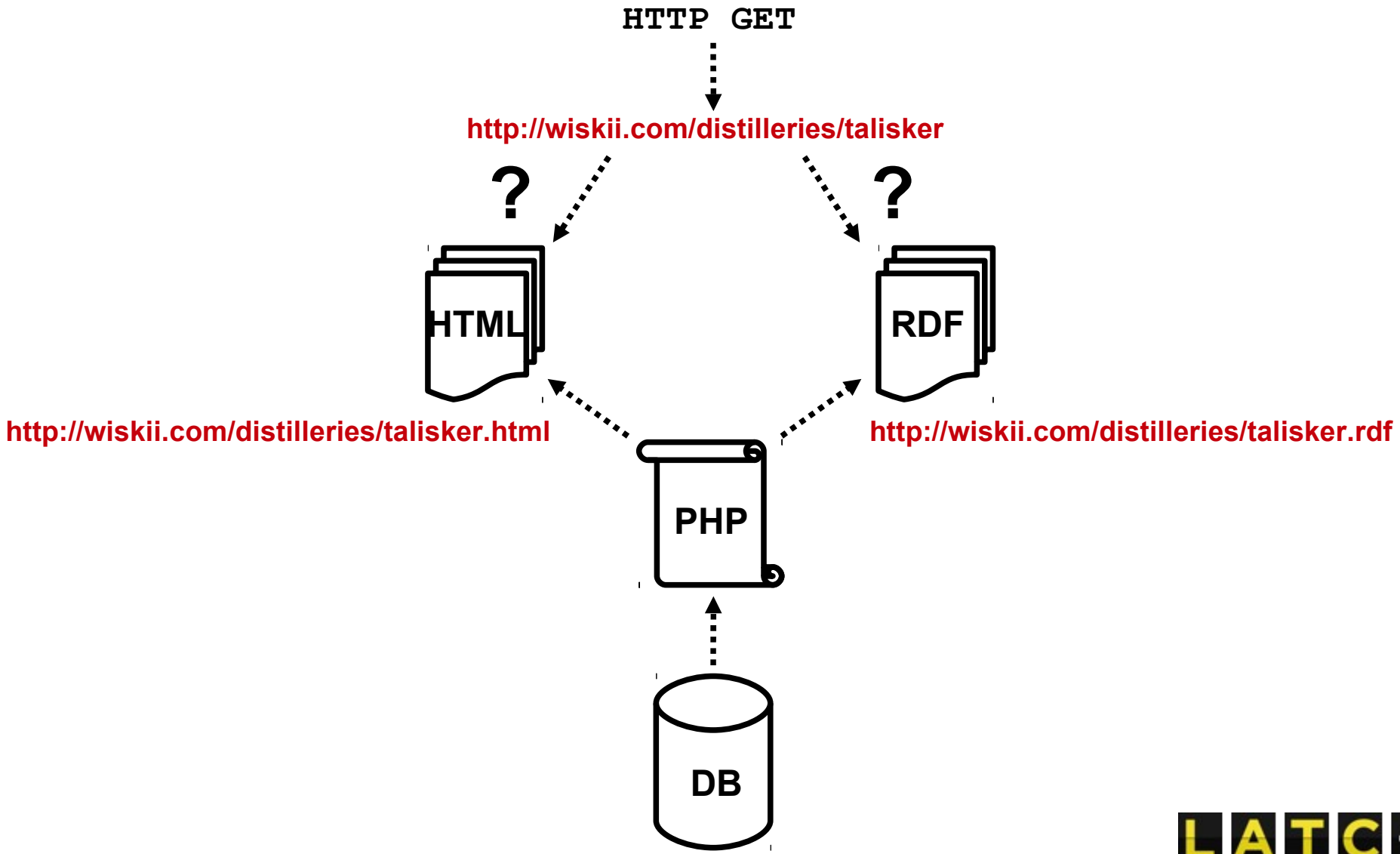
http://wiskii.com/distilleries/talisker



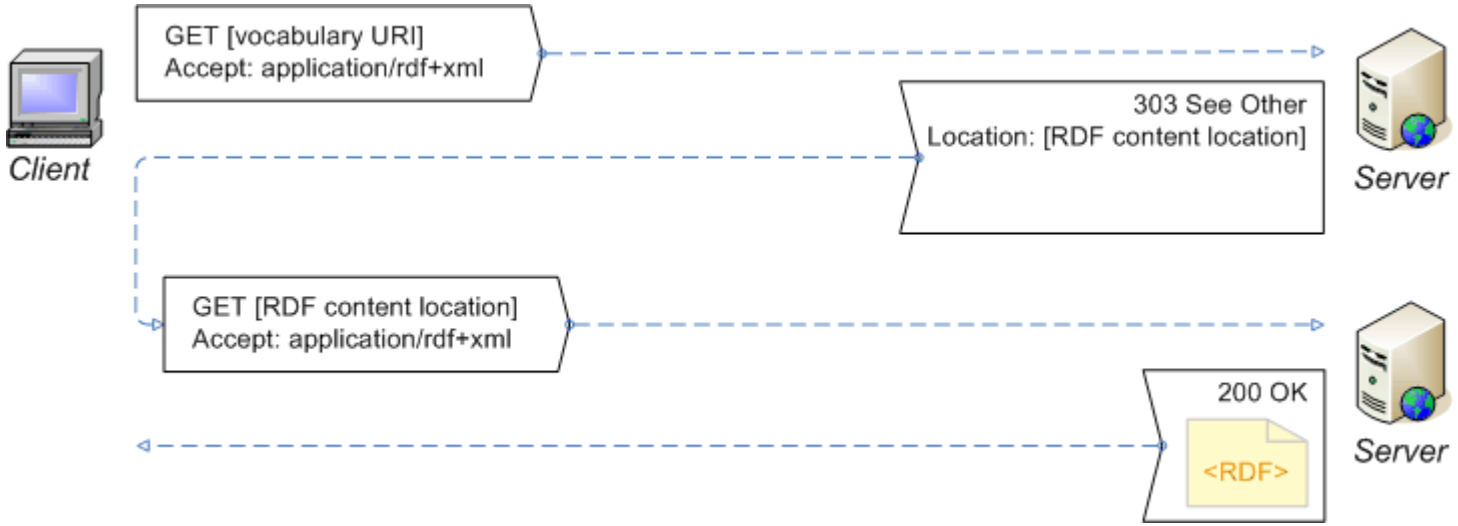
4. Setup Your Infrastructure



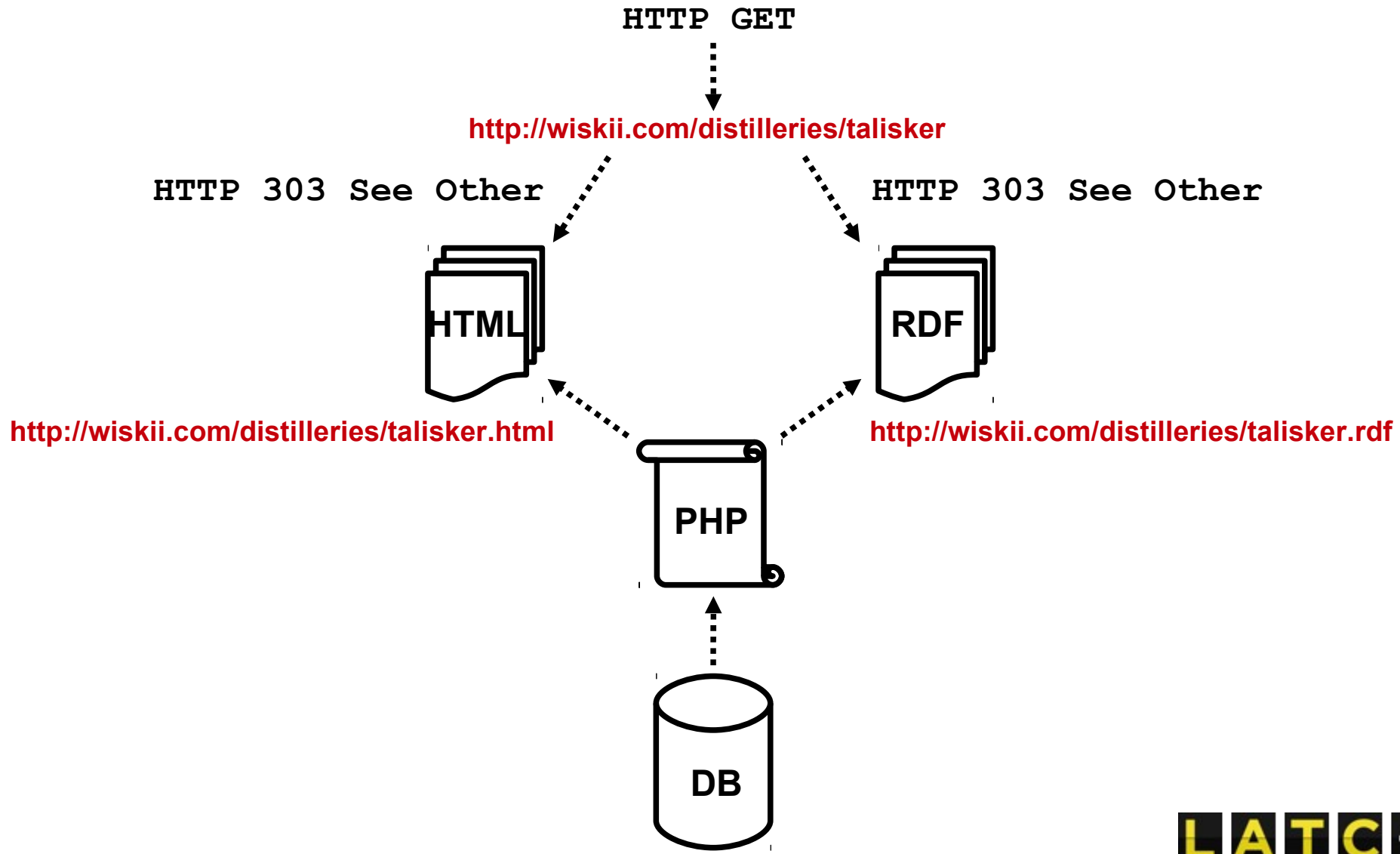
4. Setup Your Infrastructure



Content Negotiation



4. Setup Your Infrastructure



4. Setup Your Infrastructure

- Code samples for ConNeg and 303 Redirects
  - http://linkeddata.org/tools
- Useful tools for debugging
  - Firefox Extensions
    - Modify Headers
    - LiveHTTPHeaders
  - cURL
    - http://dowhatimean.net/2007/02/debugging-semantic-web-sites-with-curl
- You don't have to 'roll your own'!
  - See Toolbox section below

5. Link to Other Data Sets

Draft
RAMEAU STITCH
Gem. Norm-datei
VIAF
Events and Media descripti ons
MySpace Wrapper
The London Gazette
P20
Open Library
lobid-Resource s
lobid-organisa tions
VIVO Cornell
ECS EPrints
Goodwi n Family
Poképéd ia
Moseley Folk
Pokedex (Data Incubat or)
STW
GESIS
Last.FM
DBTune Artists: Last.fm
Music Brainz (DBtune)
DBTune. org/ classical
New York Times
PSSHS
LCSH
NDL subjects
LinkedL CCN
semanti cweb.or g
BibBase
VIVO UF
VIVO Indiana
ECS South-ampton
OAI
Coursew are
DEPLOY
KISTI
Resex
RISKS
ReSIST Project Wiki
JISC
Roma
UN/ LOCODE
Buda-pest BME
IRIT
RAE 2001
National Science Foundation
Ulm
NSZL Catalog
Surge Radio
LIBRIS
t4gm.inf o
Music Brainz (Data Incubator)
FanHubz
Audio-Scrobbler
Lotico
ERA
Semantic Web.org
RDF ohloh
DB Tropes
Discogs in RDF
Music Brainz (zitgist)
EUTC Producti ons
BBC John Peel
Crunch Base
FOAF profiles
SIOC Sites
Revyu
ESD standar ds
Linked Data for Intervals
Our Airports in RDF
OS
OpenEI. org
Ordnanc e Survey
transport .data.gov .uk
educatio n.data.g ov.uk
statistic s.data.g ov.uk
UK Postcode s
Openly Local
UK Legislation
TWC LOGD
US Securities & Exchange
Gov-Track
API
Iolus
BBC Programmes
BBC Wildlife Finder
Linked GeoData
World Fact-book
RDF Bo Mashu
ECS South-ampton (RKB)
IEEE
New-castle
Twarql
eprints
CORDIS
dotAC
dbpedia lite
LAAS-CNRS
IBM
DBLP (L3S)
CiteS
data.dc
lingvoj
DBpe
UMBEL
LinkedCT
Yago
Lexvo
Open Cyc
Drug Bank
Reactome
UniParc
PROSITE
Taxonomy
Chem2 Bio2RDF
Affymetrix
EUNIS
GeoLinke dData (.es)
Rechtsp raak.nl
Fishes of Texas
TaxonCo ncept
Linked Sensor Data (Kno.e.sis)
Daily Med
Pub Chem
KEGG Glycan
KEGG Drug
GeneID
UniProt
Pfam
ProDom
MARC Codes
WordNet (VUA)
TCMGen eDIT
Disea-some
CAS
OMIM
ChEBI
Gene Ontology
Inter Pro
Uni Pathwa y
KEGG Pathway
Cornett o
Homolo Gene
UniSTS
Medi Care
HGNC
MGI
PubMed
KEGG Cpd
PDB
SGD
OBO
SIDER
KEGG Reaction
KEGG Enzyme
As of September 2010

LATC

5. Link to other Data Sets (Popular Predicates)

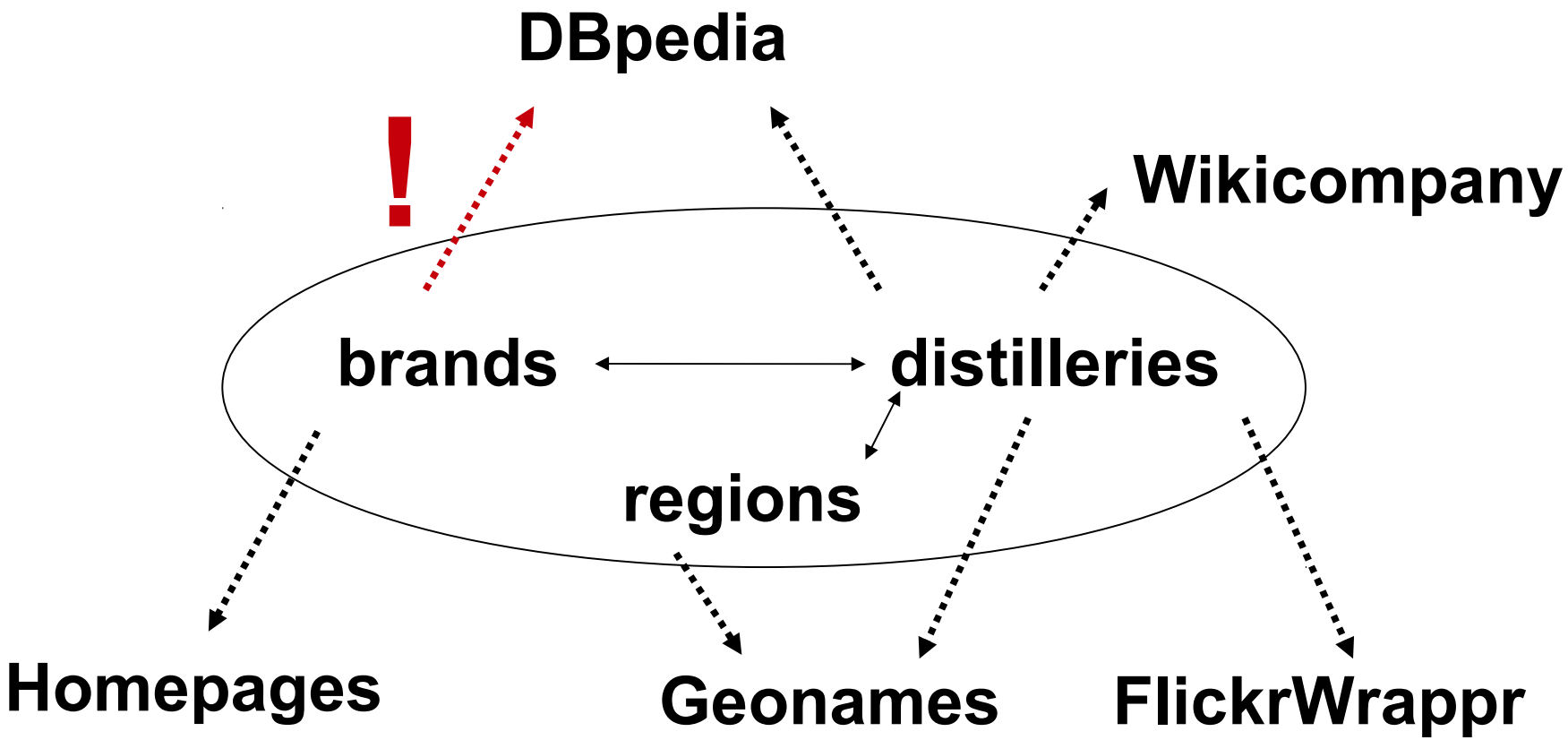
- owl:sameAs (thing to thing)
- foaf:based_near / ov:near (thing to thing)

- foaf:homepage (thing to document)
- foaf:page (thing to document)
- foaf:made (thing to document)
- foaf:depiction (thing to document)

- foaf:primaryTopic (document to thing)
- foaf:topic (document to thing)
- foaf:maker (document to thing)

- rdfs:seeAlso (document to document)

5. Link to other Data Sets (Wiskii.com)



5. Link to other Data Sets

- 'Roll Your Own' Linking Approaches
  - String Matching
    - e.g. comparing labels using similarity metrics
  - Common Key Matching
    - e.g. ISBN, Musicbrainz IDs
  - Graph Matching
    - Do these two things have the same label, type and coordinates
- Linking Frameworks
  - See later
- Aim for reciprocal links

6. Describe and Publicise your Data

- Help others discover and index your data
  - Send pings to Sindice.com and pingthesemanticweb.com
  - Provide a Semantic Sitemap for your Data Set
  - Provide a voiD description of your Data Set
    - http://rdfs.org/ns/void-guide
- Apply a license or waiver to your data set
  - Protects consumers of your data => encourages reuse
  - Creative Commons is probably **not** applicable
  - Use the Open Database License (ODbL) or release into the public domain by applying PDDL or CC0 waivers
    - http://opendatacommons.org/

Linked Data Toolbox

Linked Data Storage/Publishing Layers

- RDB → RDF Middleware
  - D2R Server
- Native RDF Storage (manage it yourself)
  - 4Store
  - AllegroGraph
  - Bigdata
  - BigOWLIM
  - Jena TDB
  - Neo4j
  - Sesame
  - Virtuoso
- Native RDF Storage (managed)
  - Talis Platform

Linked Data Publishing Frameworks/Tools

- Pubby
  - Linked Data front-end for SPARQL Endpoints
    - http://www4.wiwiss.fu-berlin.de/pubby/

- Paget Framework
  - publishing framework for Linked Data
  - serves up RDF according to Linked Data principles
  - reduces configuration overhead
  - can serve up data from static files or SPARQL endpoints
    - http://code.google.com/p/paget

Linked Data: Part 2
What Happens Next?

Putting the Links in Linked Data

Draft
RAMEAU STITCH
Gem. Norm-datei
VIAF
Events and Media descripti ons
MySpace Wrapper
The London Gazette
P20
LCSH
Open Library
lobid-Resource s
lobid-organisa tions
VIVO Cornell
ECS EPrints
Goodwi n Family
Poképéd ia
Moseley Folk
Pokedex (Data Incubat or)
Music Brainz (DBtune)
New York Times
PSSHS
NDL subjects
semanti cweb.or g
BibBase
VIVO Indiana
ECS South-ampton
OAI
STW
DBTune Artists: Last.fm
DBTune. org/ classical
Surge Radio
LIBRIS
LinkedL CCN
VIVO UF
Coursew are
DEPLOY
GESIS
Last.FM
t4gm.inf o
Music Brainz (Data Incubator)
Resex
KISTI
Discogs in RDF
FanHubz
Audio-Scrobbler
Lotico
ERA
Semantic Web.org
RDF ohloh
Buda-pest BME
RISKS
ReSIST Project Wiki
JISC
ESD standar ds
Linked Data for Intervals
Our Airports in RDF
Music Brainz (zitgist)
EUTC Producti ons
BBC John Peel
Crunch Base
FOAF profiles
DB Tropes
SIOC Sites
Revyu
IRIT
RAE 2001
National Science Foundation
Roma
UN/ LOCODE
OS
OpenEI. org
Ordnanc e Survey
Ulm
NSZL Catalog
transport .data.gov .uk
educatio n.data.g ov.uk
loius
BBC Programmes
eprints
CORDIS
dotAC
statistic s.data.g ov.uk
BBC Wildlife Finder
World Fact-book
RDF Bo Mashu
ECS South-ampton (RKB)
IEEE
New-castle
Twarql
UK Postcode s
reference.data.g ov.uk
Linked GeoData
lingvoj
CiteS
LAAS-CNRS
dbpedia lite
UK Legislation
US Census Data
data.dc
DBLP (L3S)
IBM
Openly Local
US Securities & Exchange
API
Gov-Track
UMBEL
LinkedCT
Berlin)
Reactome
UniParc
Taxonomy
Chem2 Bio2RDF
TWC LOGD
Open Cyc
Yago
Lexvo
Drug Bank
PROSITE
EUNIS
GeoLinkedData (.es)
Daily Med
KEGG Glycan
KEGG Drug
GeneID
UniProt
Affymetrix
Fishes of Texas
Rechtsp raak.nl
MARC Codes
Pub Chem
Pfam
ProDom
TaxonCo ncept
Linked Sensor Data (Kno.e.sis)
WordNet (VUA)
TCMGen eDIT
Disea-some
CAS
OMIM
ChEBI
Gene Ontology
Uni Pathwa y
Cornett o
Homolo Gene
UniSTS
Medi Care
HGNC
MGI
Inter Pro
PDB
KEGG Pathway
OBO
SIDER
KEGG Reaction
PubMed
KEGG Cpd
KEGG Enzyme
SGD
As of September 2010

Putting the Links in Linked Data

- Generating Links
  - Silk: Link Discovery Framework
    - http://www4.wiwiss.fu-berlin.de/bizer/silk/
  - LinQL
    - http://www2009.org/proceedings/pdf/p1101.pdf
  - Roll Your Own
    - ...

Data Linking: Who Pays?

- Data Publishers
  - lowers the cost of consumption

http://tomheath.com/blog/2010/06/why-carry-the-cost-of-linked-data/

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Data Linking: Who Pays?

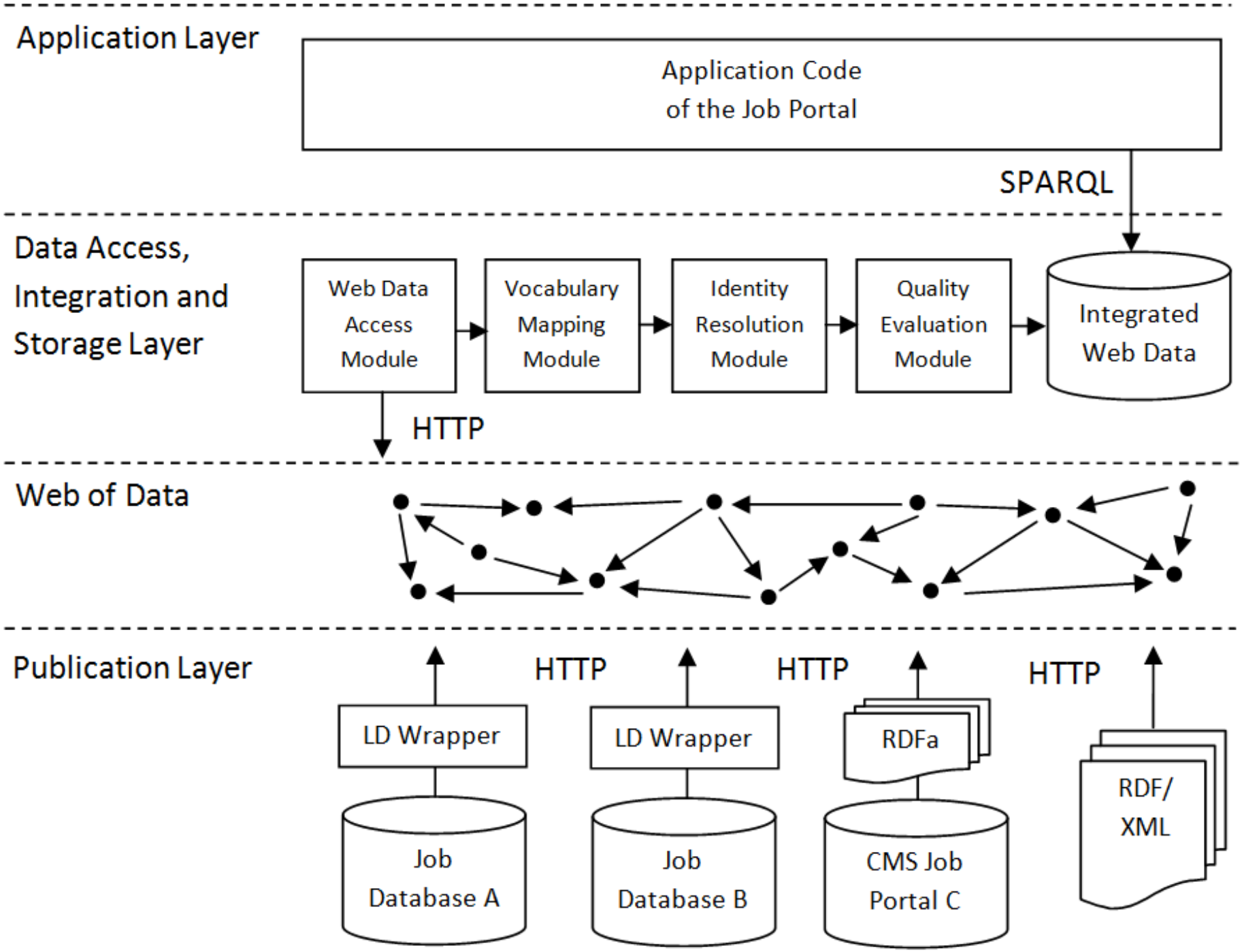
- Data Publishers
  - lowers the cost of consumption
- Data Consumers
  - when then benefits outweigh the costs
- Third Parties
  - when there is a gap in the market

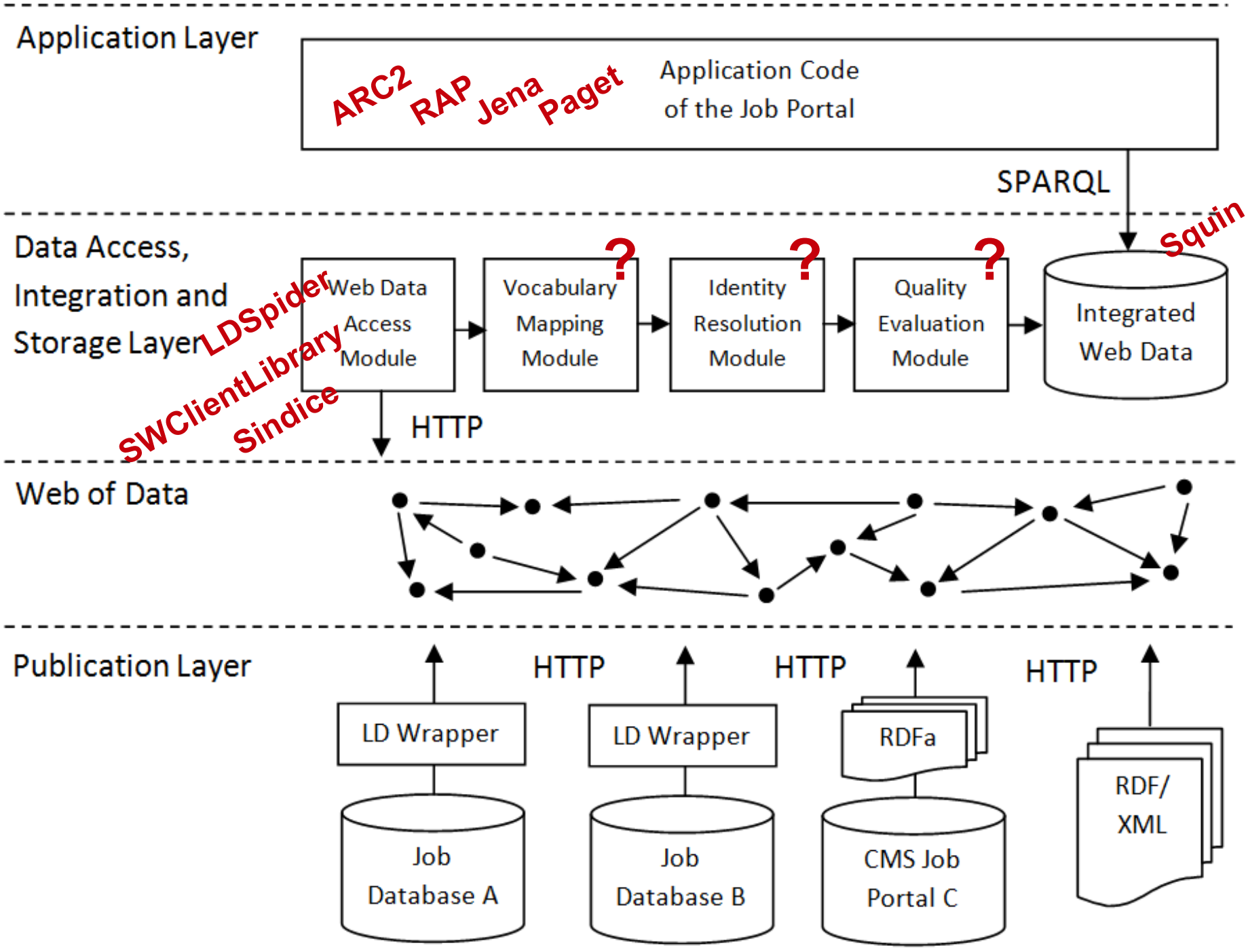
http://tomheath.com/blog/2010/06/why-carry-the-cost-of-linked-data/

Putting the Links in Linked Data

- Types of Links
  - Not just about owl:sameAs
  - Links are just claims about the world
- LATC Project
  - http://latc-project.eu/

Consuming Linked Data


Application Layer
Application Code of the Job Portal
SPARQL
Data Access, Integration and Storage Layer
Web Data Access Module
Vocabulary Mapping Module
Identity Resolution Module
Quality Evaluation Module
Integrated Web Data
HTTP
Web of Data
Publication Layer
HTTP
HTTP
HTTP
LD Wrapper
LD Wrapper
RDFa
RDF/ XML
Job Database A
Job Database B
CMS Job Portal C


Application Layer
ARC2
RAP
Jena
Paget
Application Code of the Job Portal
SPARQL
Data Access, Integration and Storage Layer
LDSpider
SWClientLibrary
Sindice
Web Data Access Module
Vocabulary Mapping Module
?
Identity Resolution Module
?
Quality Evaluation Module
?
Integrated Web Data
Squin
HTTP
Web of Data
Publication Layer
HTTP
HTTP
HTTP
LD Wrapper
LD Wrapper
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RDF/ XML
Job Database A
Job Database B
CMS Job Portal C

Implications of Linked Data for the Applications we Build

CC BY

http://www.flickr.com/photos/khouri/

LATC

The Document Metaphor is Everywhere!

- "*I'd better clear all those messy **files** off my **desktop** before I connect to the projector*"
- "*Damn, I sent the **email** without attaching the **file***"
- "<sigh> *I really must update my home **page***"

Linked Data is not about...

- Searching for a specific document
- Visiting a particular Web site
- Browsing from one (RDF) document to the next

Linked Data is about Things

- Describe any aspect you like...
  ...of any *thing* you like!
- Give identifiers (URIs) to those things
- Interact with those things directly!

cc BY NC ND

http://www.flickr.com/photos/25831000@N08/

LATC

CC BY

http://www.flickr.com/photos/kathycsus/

LATC

10 Tasks for Potential Linked Data Applications

T. Heath (in press) A Taskonomy for the Semantic Web. Semantic Web Journal

10 Tasks for Potential Linked Data Applications

Locating

Exploring

Monitoring

Notifying

Sharing

Transacting

Asserting

Discussing

Evaluating

Arranging

10 Tasks for Potential Linked Data Applications

Actions on single things?

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Adding Linked Data to the Web?

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10 Tasks for Potential Linked Data Applications

Actions on single things?

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- Exploring
- Monitoring
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Adding Linked Data to the Web?

- Asserting
- Discussing

Aggregation and analysis of Linked Data from the Web?

- Evaluating
- Arranging

Linked Document vs Linked Data Applications

- A document-centric perspective hides things inside documents, and constrains our imagination

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- If you don't feel constrained, then you're not thinking hard enough :)
- Linked Data promotes all things to first class Web citizens
- We need apps for direct actions on things, not just on documents about things

The 'Killer App' Question

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- No more obsessing or speculation allowed, principled analysis only!

Where do we Focus our Efforts?

- Sustaining innovation
- Disruptive innovation
  - Low-end disruption
  - New-market disruption

(Christensen and Raynor, *The Innovator's Solution*, 2003)

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- Risky business ideas?
  - A new search engine that exploits structured data
  - A reviewing and rating site that publishes data in RDF
  - A new CMS with Linked Data support

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  - What can we do less well with Linked Data, but at significantly less cost than with existing approaches?

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Where do we Focus our Efforts?

- New-Market Disruption
  - “Compete against non-consumption”
  - “New-market disruptive products are so much more affordable to own and simpler to use that they enable a whole new population of people to begin owning and using the product, and to do so in a more convenient setting.”
  - What can we enable with Linked Data that a large number of people aren't doing right now because it's too hard, expensive or inconvenient?

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- Growth in data volumes is very rapid
- The nature of applications consuming Linked Data needs discussion / research
- Principled analysis may reveal gaps for potential killer apps

Further Reading and Events

- Bizer, Heath and Berners-Lee (2009) Linked Data – The Story So Far, IJSWIS, 5(3), 1-22.
  - available from http://tomheath.com/publications
- Tutorial on Publishing Linked Data
  - http://linkeddata.org/docs/how-to-publish
- Synthesis e-Book on Linked Data
  - coming later this year
- CoLD2010 workshop at ISWC2010
- LDOW2011 workshop at WWW2011?

Questions?

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  - http://www.talis.com/
  - @tommyh (twitter)

- Slides
  - http://tomheath.com/slides/2010-09-brixenbressanone-linked-data.pdf

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