Linked Data: the view from 30,000 feet

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CARLI webinar
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Hyperlinks

Paul Otlet's Mundaneum

Vannevar Bush's Memex
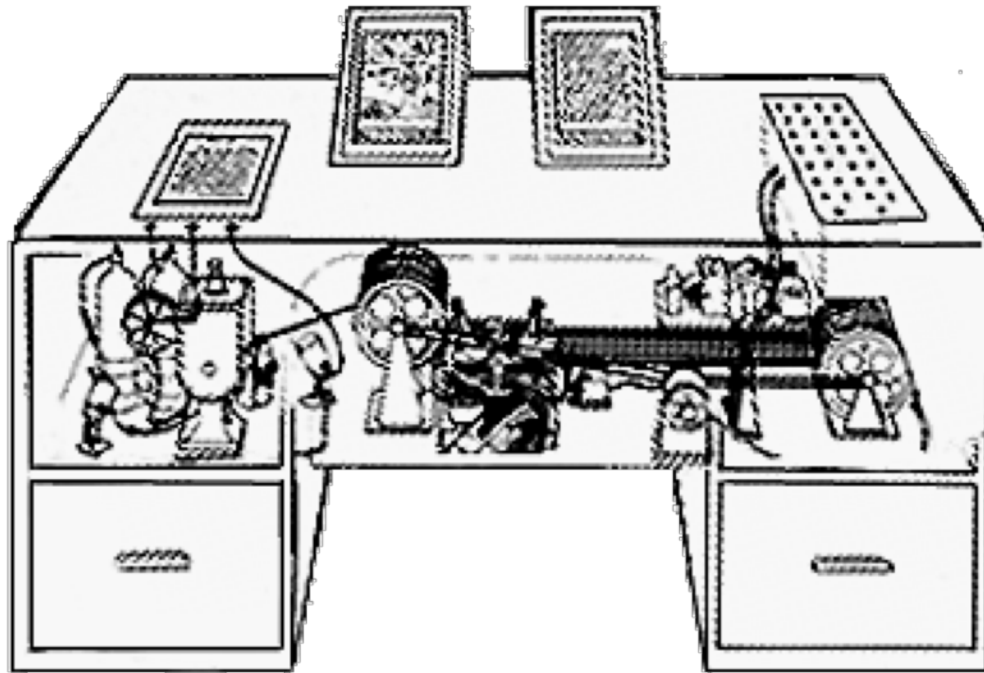
Douglas Engelbart & the Augmentation Research Center

The World Wide Web

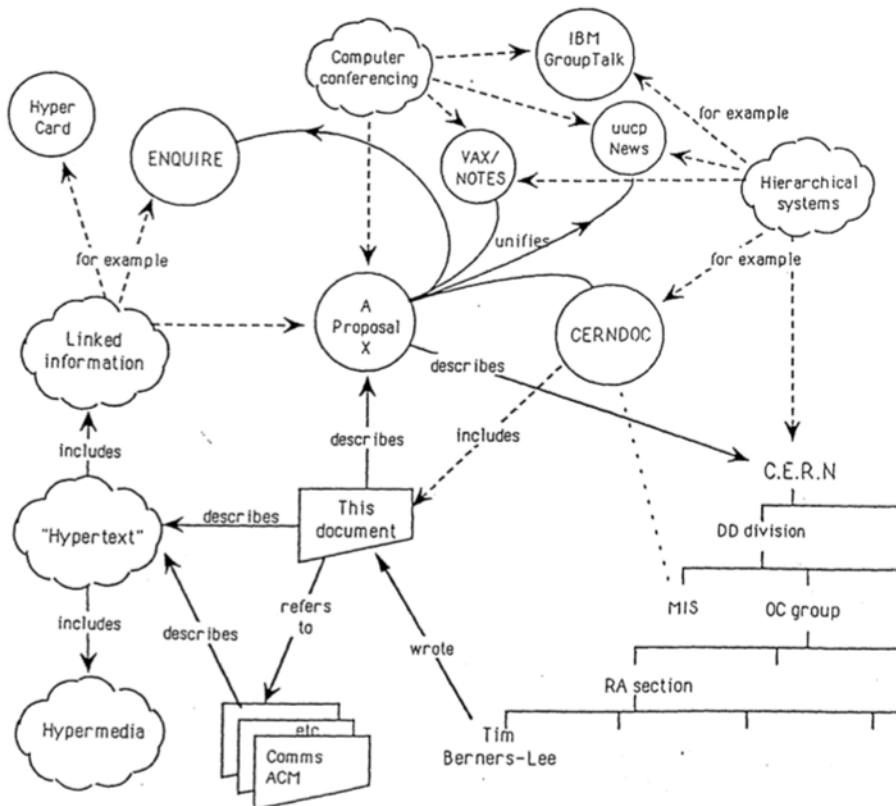# Tim Berners Lee at CERN

Vague but exciting ...
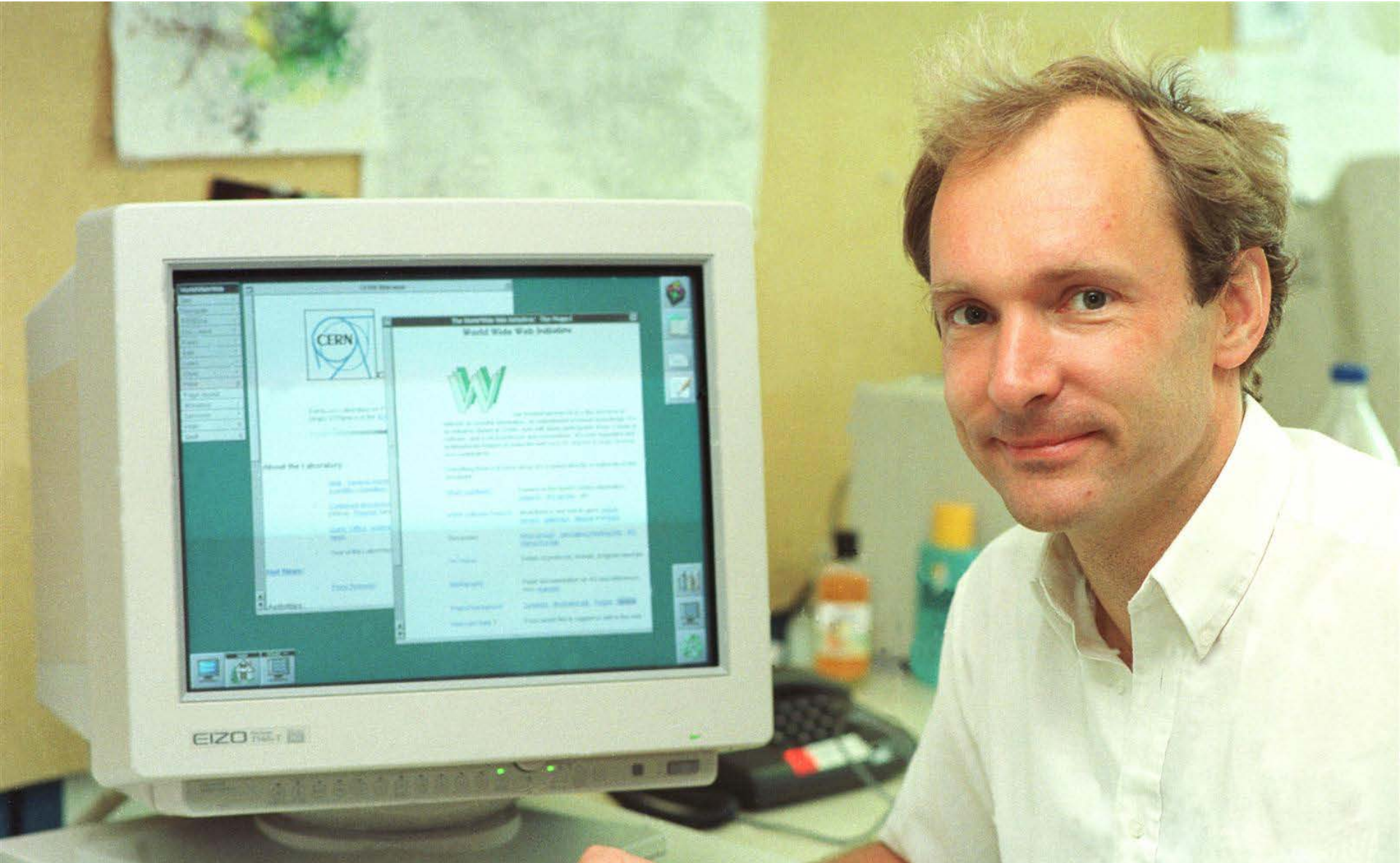
Information Management: A Proposal

Abstract

This proposal concerns the management of general information about accelerators and experiments at CERN. It discusses the problems of loss of information about complex evolving systems and derives a solution based on a distributed hypertext sytstem.

Keywords: Hypertext, Computer conferencing, Document retrieval, Information management, Project control

The Web today

- 5 billion pages indexed
- 200 million domain names
- Largely commercial: 75% .com

Data

Data

Geographical

Cultural

Scientific

Financial

Statistical

Metrological

Natural

Transport

Types of Data

Linked Data

Linked Data: like a bag of chips

Built from many vocabularies

American English

CRUNCHY POTATO CHIPS

"If it was English English, it would say potato crisps"

Built from many vocabularies

Nutrition Facts
Serving Size: 1 oz (28g/about 20 chips)
Servings Per Container: 8

Amount Per Serving	
Calories 150	Calories from Fat 80

	% Daily Value*
Total Fat 9g	**14%**
Saturated Fat 3g	**8%**
Trans Fat 0g	
Polyunsaturated Fat 2g	
Monounsaturated Fat 4.5g	
Cholesterol 0mg	**0%**
Sodium 120mg	**5%**
Potassium 370mg	**11%**
Total Carbohydrate 15g	**5%**
Dietary Fiber 1g	**4%**
Sugars less than 1g	
Protein 2g	

Vitamin A	0%	Vitamin C	10%
Calcium	0%	Iron	2%
Thiamin	2%	Vitamin E	4%
Niacin	6%	Vitamin B$_6$	6%
Phosphorus	4%	Magnesium	4%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than		300mg
Potassium	Less than		3,500mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

"Nutrition facts… are … a little sublanguage understood by… the US food industry."

Data like:
- Serving size
- Servings per container
- Number of calories

Built from many vocabularies

"UPC is a language that is understood by all retailers, not just food industry, globally."

Built from many vocabularies

Information about the bag

"I ignore the stuff I don't understand"

Linked Data: like a bag of chips

- Multiple different vocabularies co-exist
- Shared meaning arises from shared vocabularies
- "Cherry pick" the relevant vocabularies
- Structured data for different audiences, each can use what they recognize

Linked Data: like a bag of chips

Tim Berners-Lee

"Open, Linked Data for a Global Community"

Gov 2.0 Expo 2010

(minutes 4:58-5:51)

https://www.youtube.com/watch?v=ga1aSJX CFe0&feature=youtu.be&t=298

What's different about Linked Data?

Linked Data:

- Can integrate information from multiple sources
- Focuses on bottom up agreement on terms and vocabularies
- Can be used to enrich data
- Can remove silos
- Focuses on linking DATA as opposed to DOCUMENTS

What is Linked Data?

Linked Data principles*

- Use web links to identify things
- Store useful info at the web links
  - info about **the thing** it identifies
  - relationships to **other things**

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Kiwi

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DBpedia   ⊙ Browse using ▾   📄 Formats ▾   ⬀ Faceted Browser   ⬀ Sparql Endpoint
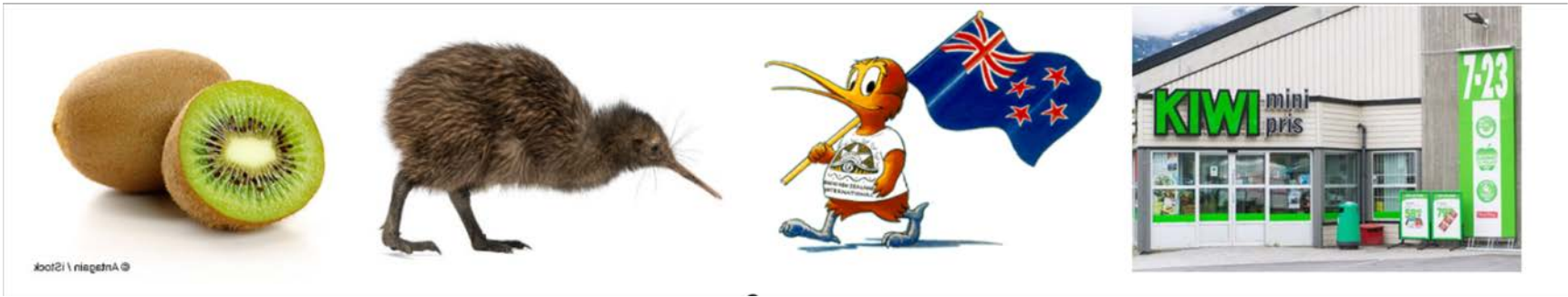
About: Kiwifruit

An Entity of Type : work, from Named Graph : http://dbpedia.org, within Data Space : dbpedia.org

Kiwifruit (often shortened to kiwi) or Chinese gooseberry is the name given to the edible berries of several species of woody vines in the genus Actinidia. The most common cultivar group of kiwifruit ('Hayward') is oval, about the size of a large hen's egg (5–8 cm (2.0–3.1 in) in length and 4.5–5.5 cm (1.8–2.2 in) in diameter). It has a fibrous, dull greenish-brown skin and bright green or golden flesh with rows of tiny, black, edible seeds. The fruit has a soft texture and a sweet but unique flavor. It is a commercial crop in several countries, such as Italy, New Zealand, Chile, Greece, and France.

Property	Value
dbo:abstract	• Kiwifruit (often shortened to kiwi) or Chinese gooseberry is the name given to the edible berries of several species of woody vines in the genus Actinidia. The most common cultivar group of kiwifruit ('Hayward') is oval, about the size of a large hen's egg (5–8 cm (2.0–3.1 in) in length and 4.5–5.5 cm (1.8–2.2 in) in diameter). It has a fibrous, dull greenish-brown skin and bright green or golden flesh with rows of tiny, black, edible seeds. The fruit has a soft texture and a sweet but unique flavor. It is a commercial crop in several countries, such as Italy, New Zealand, Chile, Greece, and France. (en)
dbo:thumbnail	• wiki-commons:Special:FilePath/Actinidia_fruits.jpg?width=300
dbo:wikiPageExternalLink	• http://ndb.nal.usda.gov/ndb/search/list?qlookup=09148&format=Full • http://ndb.nal.usda.gov/ndb/search/list?qlookup=09445&format=Full

WIKIDATA

| Item | Discussion | | | Read | View history | Search Wikidata 🔍 | ▼ |

kiwifruit (Q13194)

edible berry of several species of woody vines in the genus Actinidia, native to China   ✎ edit

kiwi fruit | kiwi | Chinese gooseberry

▼ In more languages Configure

Language	Label	Description	Also known as
English	kiwifruit	edible berry of several species of woody vines in the genus Actinidia, native to China	kiwi fruit kiwi Chinese gooseberry
Spanish	kiwi	fruta comestible	
Traditional Chinese	奇異果	No description defined	
Chinese	奇異果	No description defined	獼猴桃

All entered languages

Statements

instance of	⬍ berry	✎ edit
	▼ 0 references	
		+ add reference

Main page
Community portal
Project chat
Create a new Item
Create a new Lexeme
Recent changes
Random item
Query Service
Nearby
Help
Donate

Tools

What links here
Related changes
Special pages
Permanent link
Page information
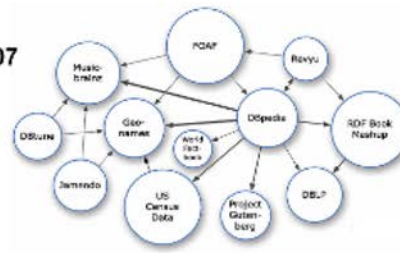Concept URI
Cite this page

Who is using Linked Data?
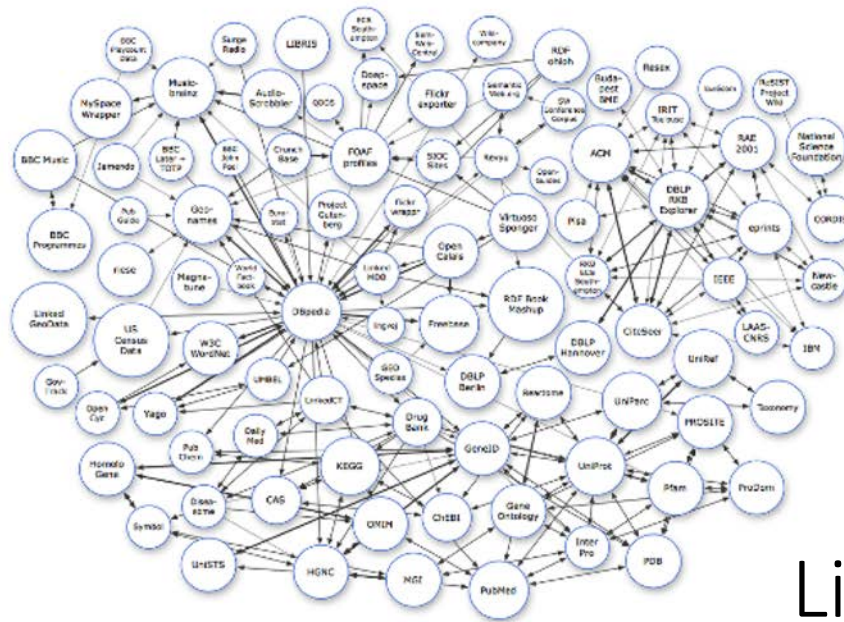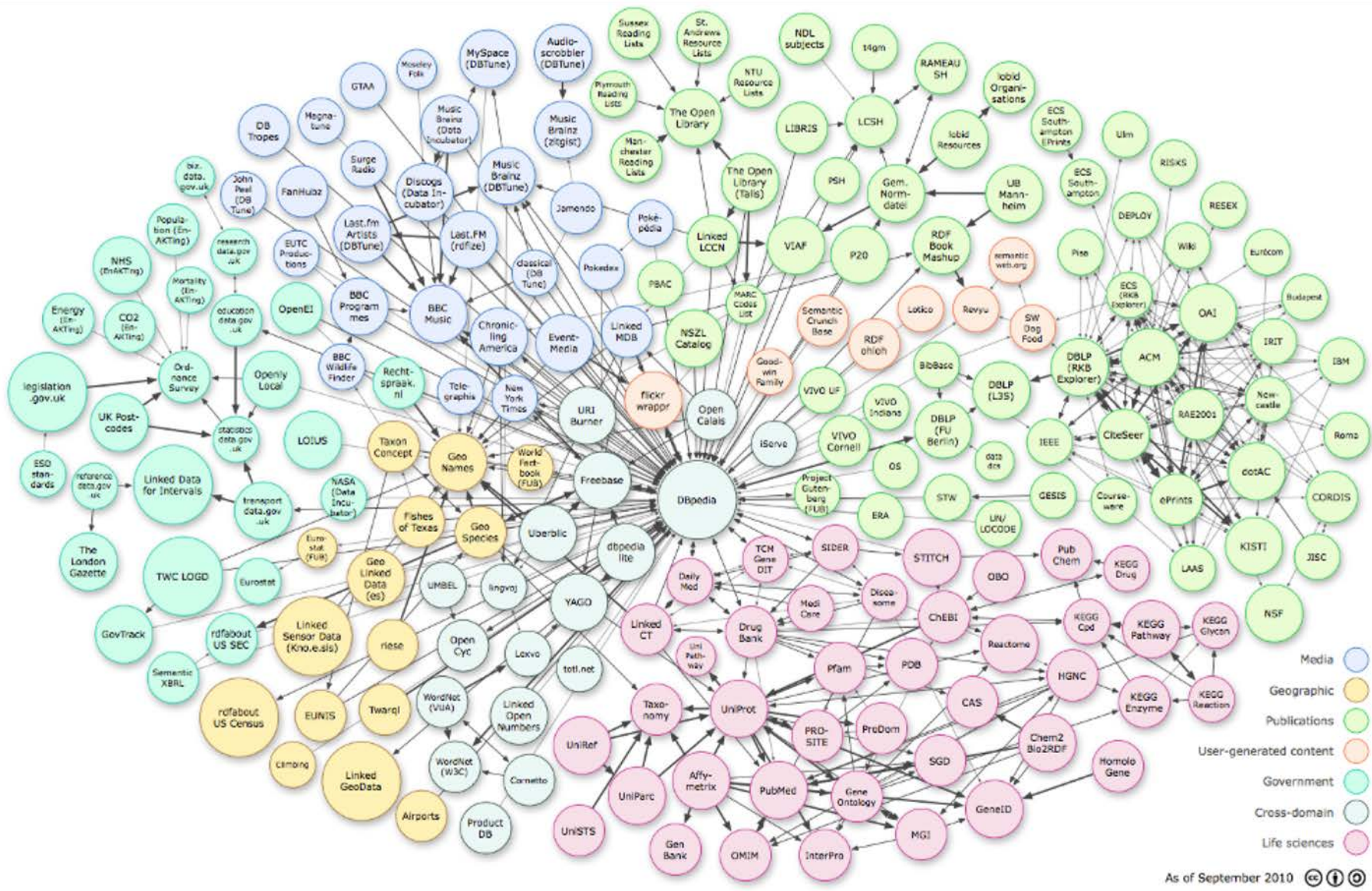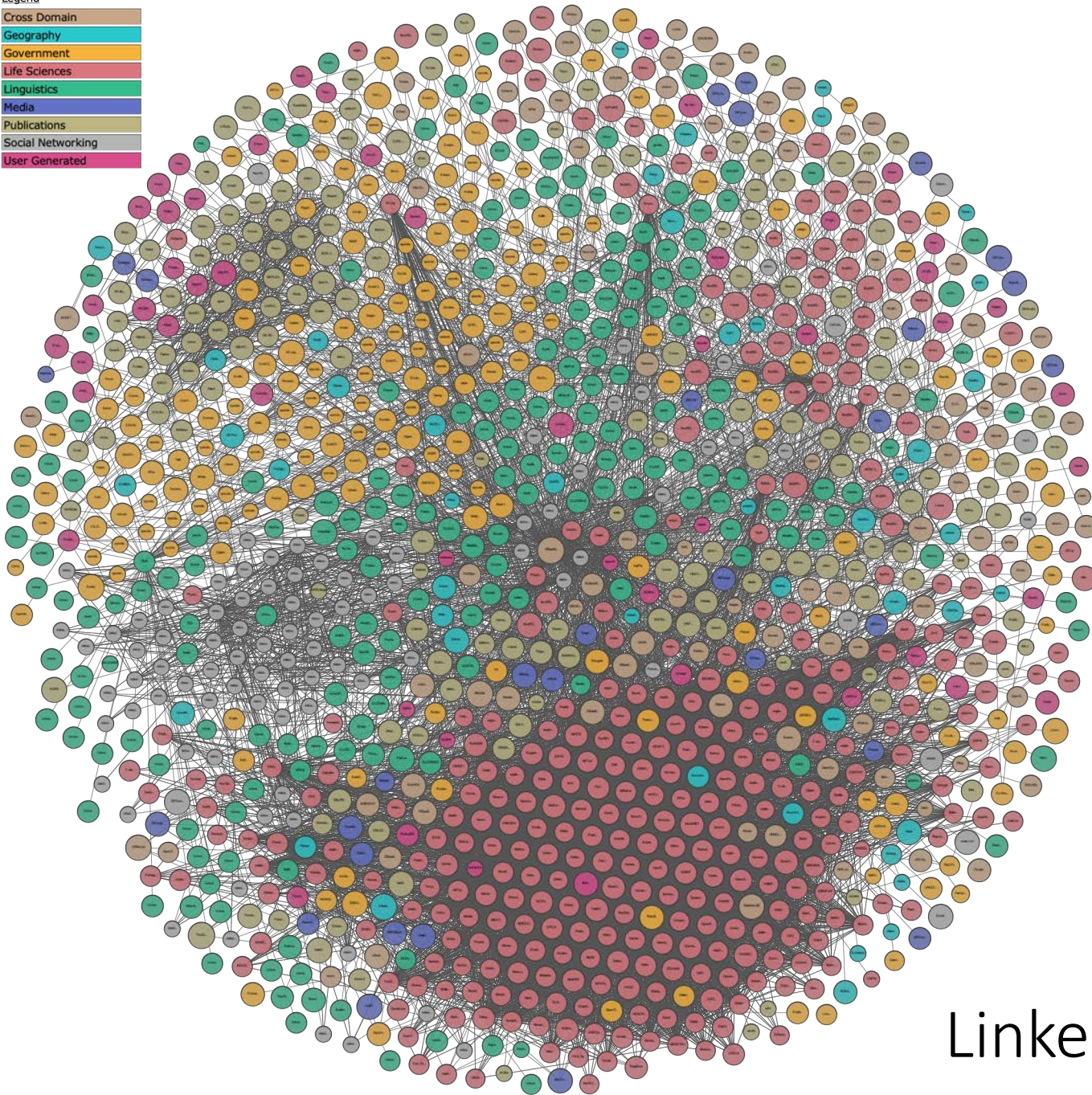
May 2007

September 2008
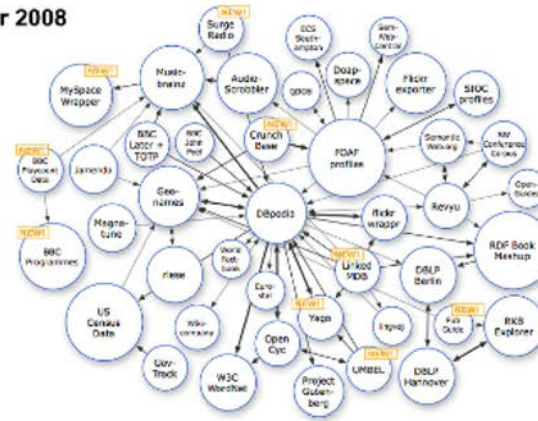
July 2009

Linked Data Cloud

Linked Data Cloud

Legend

- Cross Domain
- Geography
- Government
- Life Sciences
- Linguistics
- Media
- Publications
- Social Networking
- User Generated

Linked Data Cloud

Examples of Linked Data

Mapping and Integrating Data
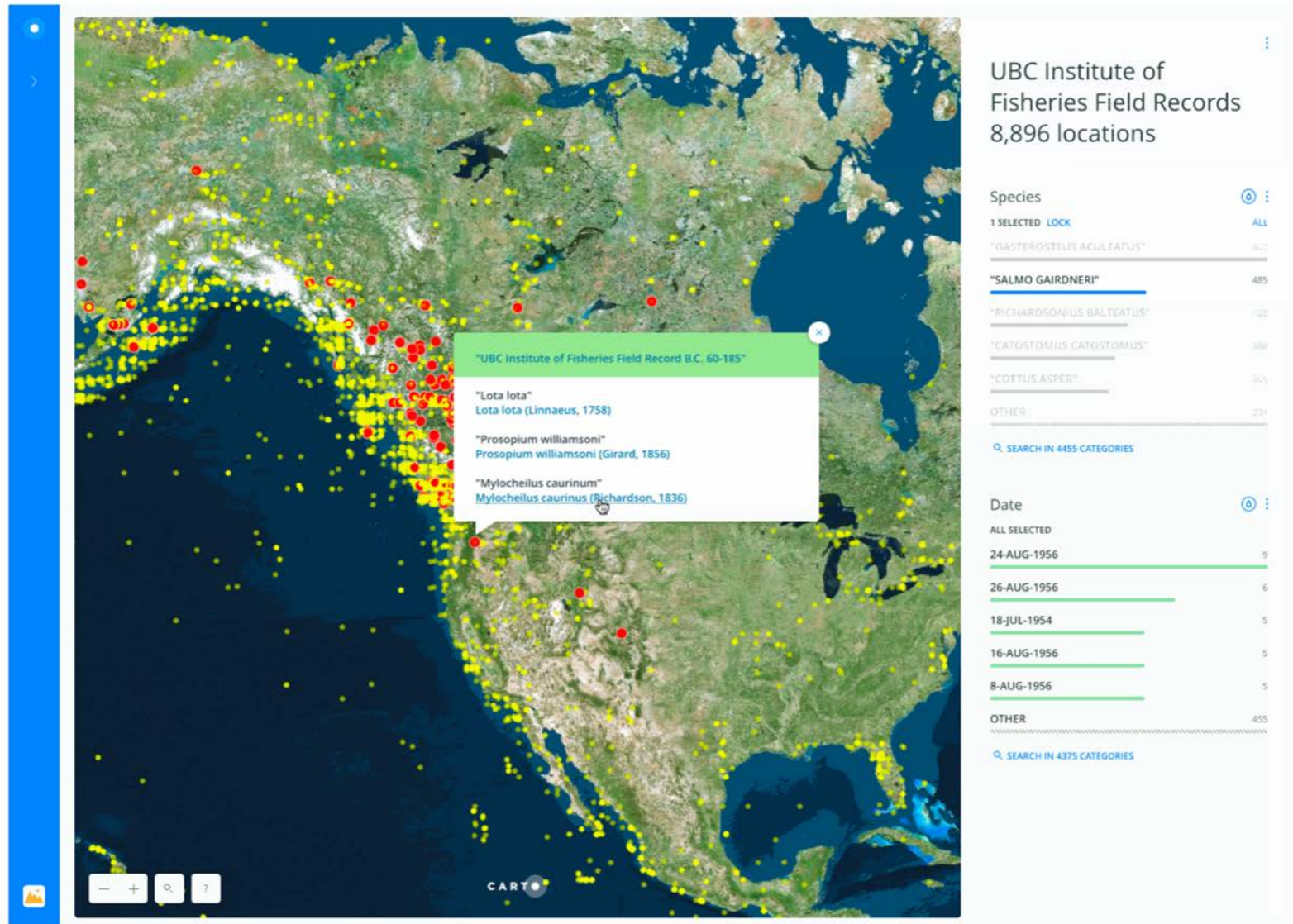
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UBC Institute of Fisheries Field Records

Linked data web application providing a georeferenced visualization of UBC Open Collection Institute of Fisheries Field Records metadata, linked to Encyclopedia of Life.

Link for the application on CARTO.

UBC Institute of
Fisheries Field Records
8,896 locations

Species

1 SELECTED LOCK   ALL

"GASTEROSTEUS ACULEATUS"   562

"SALMO GAIRDNERI"   485

"RICHARDSONIUS BALTEATUS"   428

"CATOSTOMUS CATOSTOMUS"   388

"COTTUS ASPER"   367

OTHER   22+

🔍 SEARCH IN 4455 CATEGORIES

"UBC Institute of Fisheries Field Record B.C. 60-185"

"Lota lota"
Lota lota (Linnaeus, 1758)

"Prosopium williamsoni"
Prosopium williamsoni (Girard, 1856)

"Mylocheilus caurinum"
Mylocheilus caurinus (Richardson, 1836)

Date

ALL SELECTED

24-AUG-1956   9

26-AUG-1956   6

18-JUL-1954   5

16-AUG-1956   5

8-AUG-1956   5

OTHER   455

🔍 SEARCH IN 4375 CATEGORIES

CARTO

Using the Web as a Database

apple pie 🔍 🔍

All   Images   Videos   Maps   News   Shopping | My saves

Easy Apple Lattice Pie | Marie Callender's® Desserts

http://www.mariecallendersmeals.com ▾

Ad Savor The Made-From-Scratch Touches You'll Love To Share With Your Family Today!
Slow Down & Savor The Taste Of Home With Made-From-Scratch Touch Of Marie's!

Recipes

[Total time ▾] [Nutrition ▾]

Total time
<30 mins
30-60 mins
>60 mins

Apple pie
Allrecipes
★★★★★ (7.9k) · 5 pins

Apple Pie
Simply Recipes
★★★★★ (89) · 478 pins

Apple-Pie Cake
Martha Stewart
★★★☆☆ (1.5k) · 2.7k pins

Perfect Apple Pie Recipe - Pillsbury.com

https://www.pillsbury.com/recipes/perfect-apple-pie ▾
Filling*. In large bowl, gently mix filling ingredients; spoon into crust-lined pie plate. Top
with second crust. Wrap excess top crust under bottom crust edge, pressing edges …
4.5/5 ★★★★½ (787)   **Servings:** 8
Category: Dessert   **Total Time:** 3 hrs

How to Make Apple Pie · Easy Cherry Pie · Peach Slab Pie Recipe

See all images

Apple pie   ↪ Share
Pie

An apple pie is a pie or a tart, in which the
principal filling ingredient is apple. It is, on
occasion, served with whipped cream or ice
cream on top, or with cheddar cheese. The
pastry is generally used top-and … +

W Wikipedia

Place of origin: England

Nutrition facts

Apple pie ▾

Amount Per 1 piece (1/6 of 8" pie) (117 g)

Calories 277

	%Daily Value*
Total Fat 12.9 g	20%
Saturated fat 4.4 g	22%
Polyunsaturated fat 2.6 g	

Recipe

Canonical URL: http://schema.org/Recipe

Thing > **CreativeWork** > **HowTo** > **Recipe**

A recipe. For dietary restrictions covered by the recipe, a few common restrictions are enumerated via suitableForDiet. The keywords property can also be used to add more detail.

Usage: Between 10 and 100 domains

[more...]

Property	Expected Type	Description
Properties from Recipe		
cookTime	Duration	The time it takes to actually cook the dish, in ISO 8601 duration format.
cookingMethod	Text	The method of cooking, such as Frying, Steaming, ...
nutrition	NutritionInformation	Nutrition information about the recipe or menu item.
recipeCategory	Text	The category of the recipe—for example, appetizer, entree, etc.
recipeCuisine	Text	The cuisine of the recipe (for example, French or Ethiopian).

https://schema.org/Recipe

Linked Data on Genetic Variation

Monarch   Browse ▾   Analyze ▾   About ▾   Documentation ▾

Search (e.g. Parkinson's)   Go

The Monarch Initiative

Overview

Diseases

Phenotypes

Models

Genes

Diseases described with phenotypes

Gene variations associated with disease

Phenotype comparisons suggest models

Models suggest candidate genes

Plain language for describing human diseases

We have developed the Human Phenotype Ontology (HPO), a vocabulary to describe human disease features (phenotypes). The HPO now includes synonyms that patients, doctors, and machines can all understand.

HPO

Apert's syndrome

	Plain language	Medical term
	Webbed toes	Syndactyly
	Deformity due to premature fusing of skull bones	Cranio-synostosis
	Wide-set eyes	Ocular hypertelorism

View Announcement

Linked Data for Drug Discovery

Linked open drug data for pharmaceutical research and development

GrEDeL: A Knowledge Graph Embedding Based Method for Drug Discovery From Biomedical Literatures

Linked Data in Journalism

BBC

Effortlessly updating the Olympics and elections

Michael Phelps

One to watch

Key Facts

Country
United States

Competed in
SWIMMING
Men's 100m Butterfly
Men's 200m Butterfly
Men's 200m Individual Medley
Men's 400m Individual Medley
Men's 4 x 100m Freestyle Relay
Men's 4 x 200m Freestyle Relay
Men's 4 x 100m Medley Relay

Date of birth
30 Jun 1985
.. . ..

Phelps through after scare

Michael Phelps, the 14-time gold medal winner, comes within 0.07 seconds of being eliminated from the men's 400m individual medley.

1 Jan 13

Best feeling in the world - Phelps
MEN'S 4 X 100M MEDLEY RELAY
5 Aug 12

Olympic great Michael Phelps describes finishing his career at the London Games in front of his family as "the best feeling in the world".

Phelps ends with 18th gold medal
MEN'S 4 X 100M MEDLEY RELAY

Medal Table

Show me: Athletes ▼ GO

Rank	Athlete	🥇	🥈	🥉	Total
1	PHELPS Michael USA	4	2	0	6
2	FRANKLIN Missy USA	4	0	1	5
3	SCHMITT Allison USA	3	1	1	5

View full table

More Athletes in Swimming

Ricky Berens
Swimming

Clark Burckle
Swimming

Nathan Adrian
Swimming

All Athletes from Team USA

The BBC's 2012 Olympics pages were generated using linked data

The BBC powered its delivery of the **2012 London Olympics** with linked data: effortlessly updating hundreds of athlete, sport, and competition pages with all the recent related news.

BBC

We use linked data to curate indexes, such as constituency pages during the **elections** – imagine keeping 650 pages up to date at any given moment – or the massive repository of all our programmes.

BBC

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Events and ontologies

Events can be big events or small events, and some ontologies *nest* these events – as if some of them could contain, or rather be composed of other events.

Take an **election**, for example. That's an event itself, but there are also many smaller, other events that *participate* in the election:

- The **campaign**;
- A candidate saying something at a **press conference**;
- The **results** coming in...

A candidate touring a factory somewhere during their campaign is an event that we humans would see as linked to the bigger one: the election.

But it's also linked to this factory's story, and that's a web again, because there are links everywhere.

Linked Data for Research Repositories

VIVO

Thanks!

- Matthew Short & the CARLI Created Content Committee
- Amy Maroso at the CARLI Office
- Liliana Giusti Serra, UNSP Brazil & University of Illinois at Urbana Champaign

Upcoming Sessions

- **[Linked Data Webinar 2: Linked Data in the Library](#)**
  Tuesday Feb 19th, 10 to 11am

- **[Linked Data Webinar 3: Linked Data Projects](#)**
  Tuesday March 5th, 10 to 11:30am