



Publishing Linked Data as Datasets

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Learning Objective

Understand how Linked Data is published on the Web as datasets and SPARQL endpoints to be used for practical applications



Outline



Web of Data: Basic principles

Distributed Approach: Embedding data in HTML pages

Centralized Approach: Standalone data services on servers



Web of Data: Basic Concepts

Basic Concepts Clarified



Linked Data

- Means practical and simple Web of Data using RDF graphs
 - Semantic Web technologies include also more advanced models
- Based on W3C's Semantic Web standards
 - *"Rebranding Semantic Web", focus on simple practical semantics*
- Linked Data is often open but can be closed, too

Open Data

- Openly available data (on the Web), under an open license
 - Cf. Creative Commons Licences: <https://creativecommons.org/>
 - *"Open data and content can be freely used, modified, and shared by anyone for any purpose" – <http://opendefinition.org>*
- Open data is not necessarily free of charge

What is Web of Data?



The Web we see is a network that links pages: Web of Pages

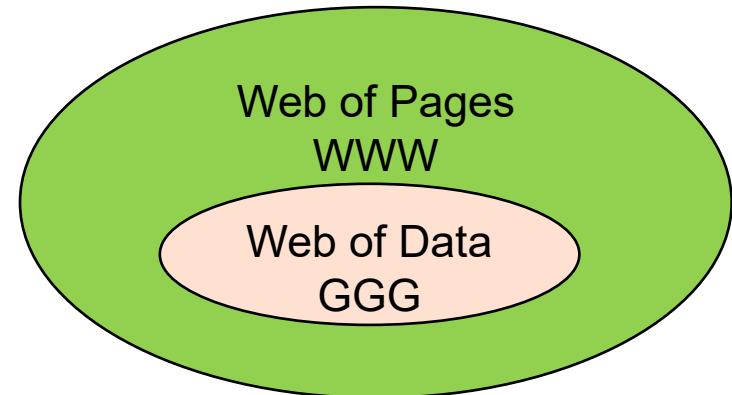
- Can be searched/browsed with a traditional web browser
- Links connect pages

A data network has emerged inside the web: Web of Data

- Can be searched/browsed with a semantic application
- Links in Web of Data connect concepts and data (e.g., eagle → bird)

Semantic Web consists of *both* networks

- Web of Pages (for humans)
 - *WWW World Wide Web*
- Web of Data (for machines to use)
 - *GGG Giant Global Graph*
 - *Examples of knowledge graphs in applications:*
 - Google Knowledge Graph, Microsoft Satori, Facebook Open Graph, ...
 - Lots of domain specific applications



Idea of Linked Data

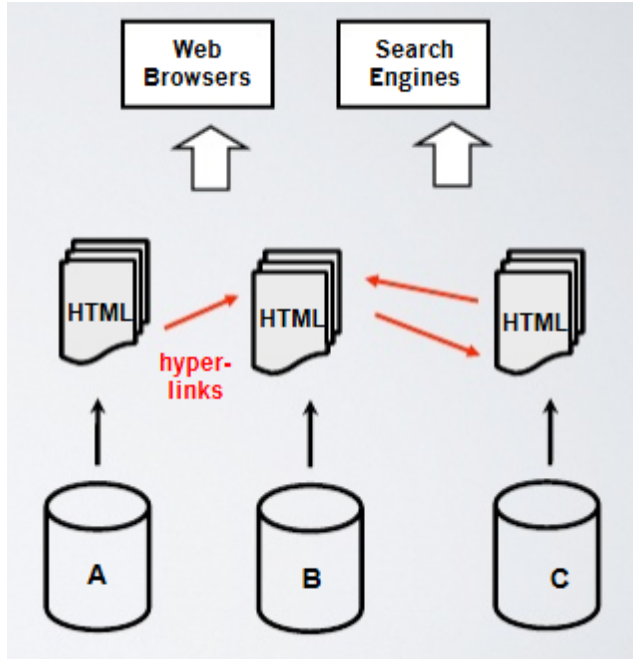


- Datasets are created and published using RDF
 - Embedded in web pages or as data services / data bases
 - Lightweight Semantic Web technologies are used
 - “A Little Semantics Goes a Long Way“ – Jim Hendler
- Datasets are linked together to enrich their content
 - *Cross-referencing data in other datasets*
 - E.g., place ”Finland” in GeoNames.org to president ”Niinistö” in DBpedia.org
 - *Identifying same concepts in different datasets (data alignment)*
 - E.g., ”Helsinki” in GeoNames.org vs. DBpedia.org
- Enriched data is (re-)published as data services for applications
- Coordinated by Linked Open Data (LOD) communities
 - *Application domain specific and global ones*

WWW and GGG coexistence

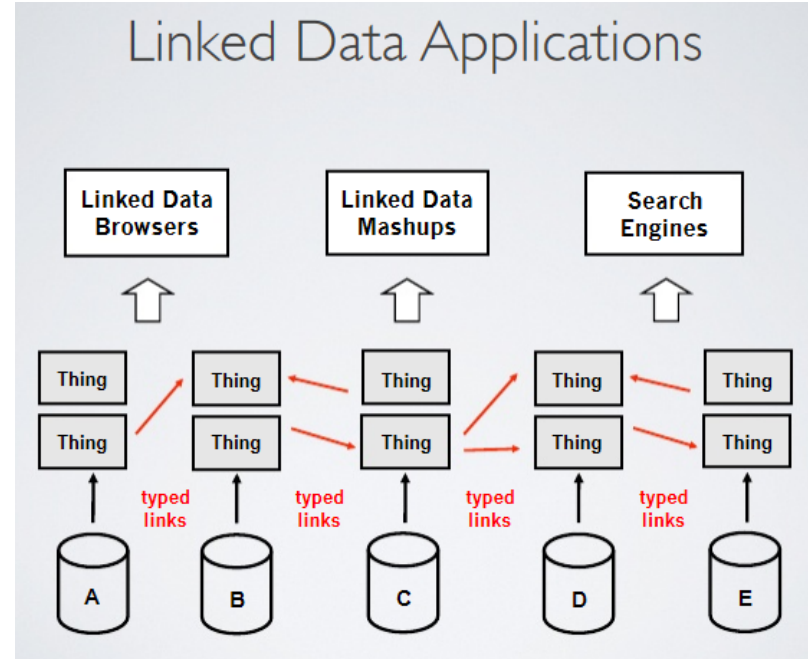


WWW



(Anja Jentzsch, 2012)

GGG

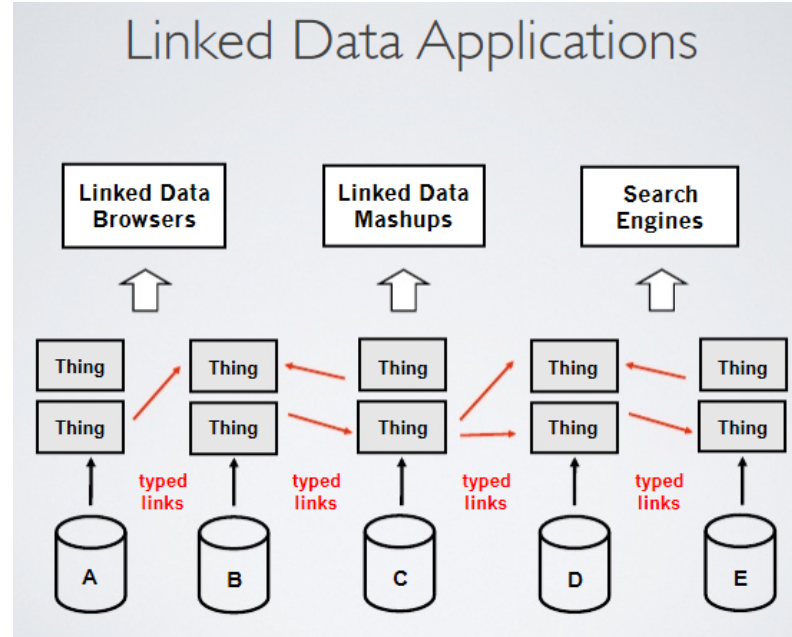


(Anja Jentzsch, 2012)

Dimensions of application development



- Services for
 - Humans
 - Machines
- Data linking
- Data aggregation
- Data harvesting
- Data production



(Anja Jentzsch, 2012)



Publishing Linked Data as Datasets for the Web of Data



Aalto University
School of Science

Department of
Computer Science



Dataset Publishing: two ways

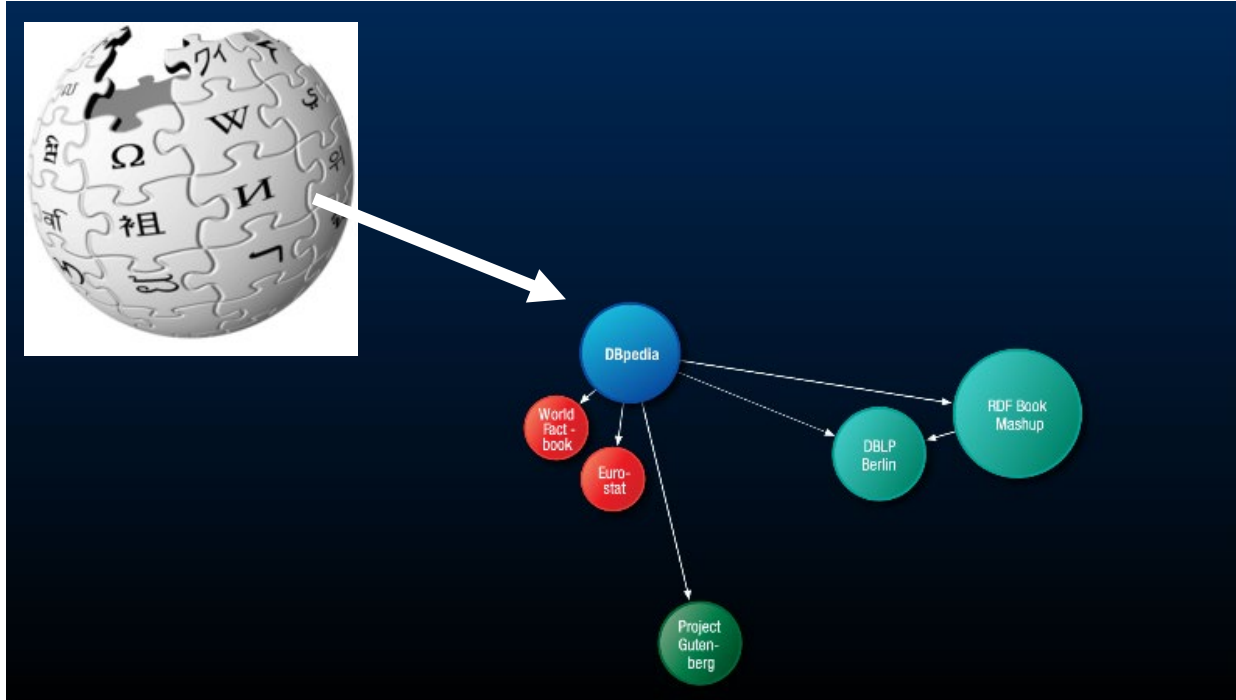


Publish datasets for downloading or via APIs

- **CSV files**
- **RDF files**
- **JSON files**

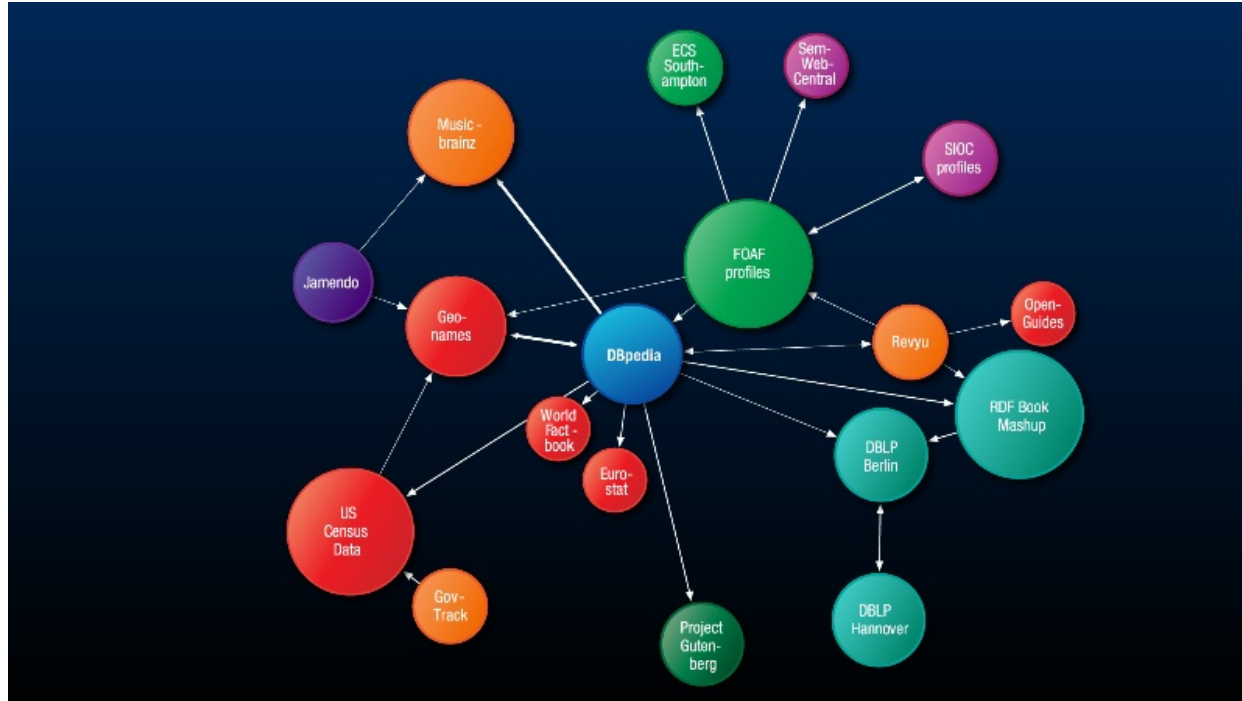
Publish Linked Data in SPARQL endpoints ready for querying

Publishing Linked Open Datasets: Story Starting 2005



(Tim Berners-Lee)

New Datasets Linked with Others

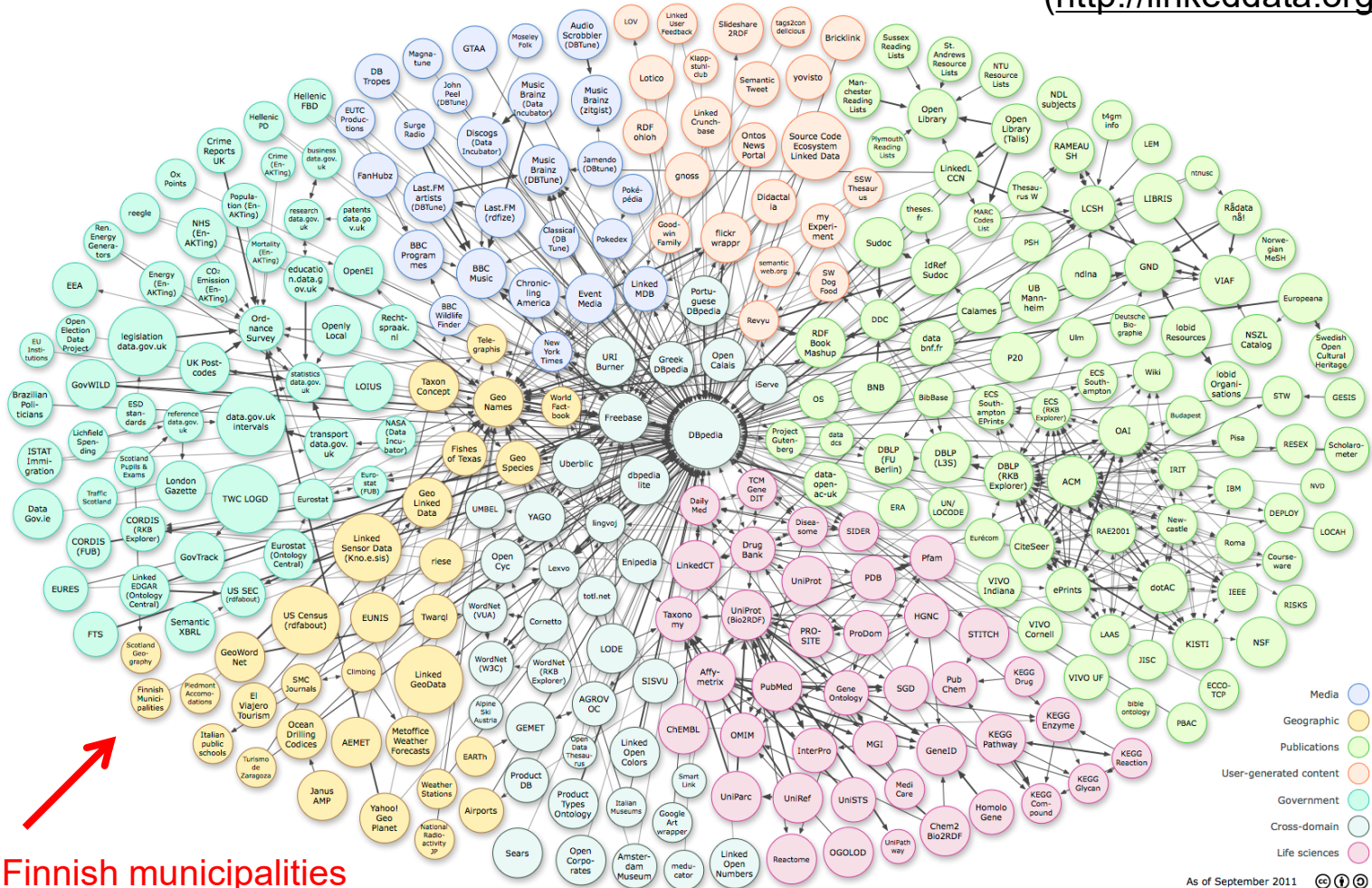


(Tim Berners-Lee)


Linked Open Data cloud 2011



(<http://linkeddata.org>, 2011)



onki.fi: Finnish municipalities

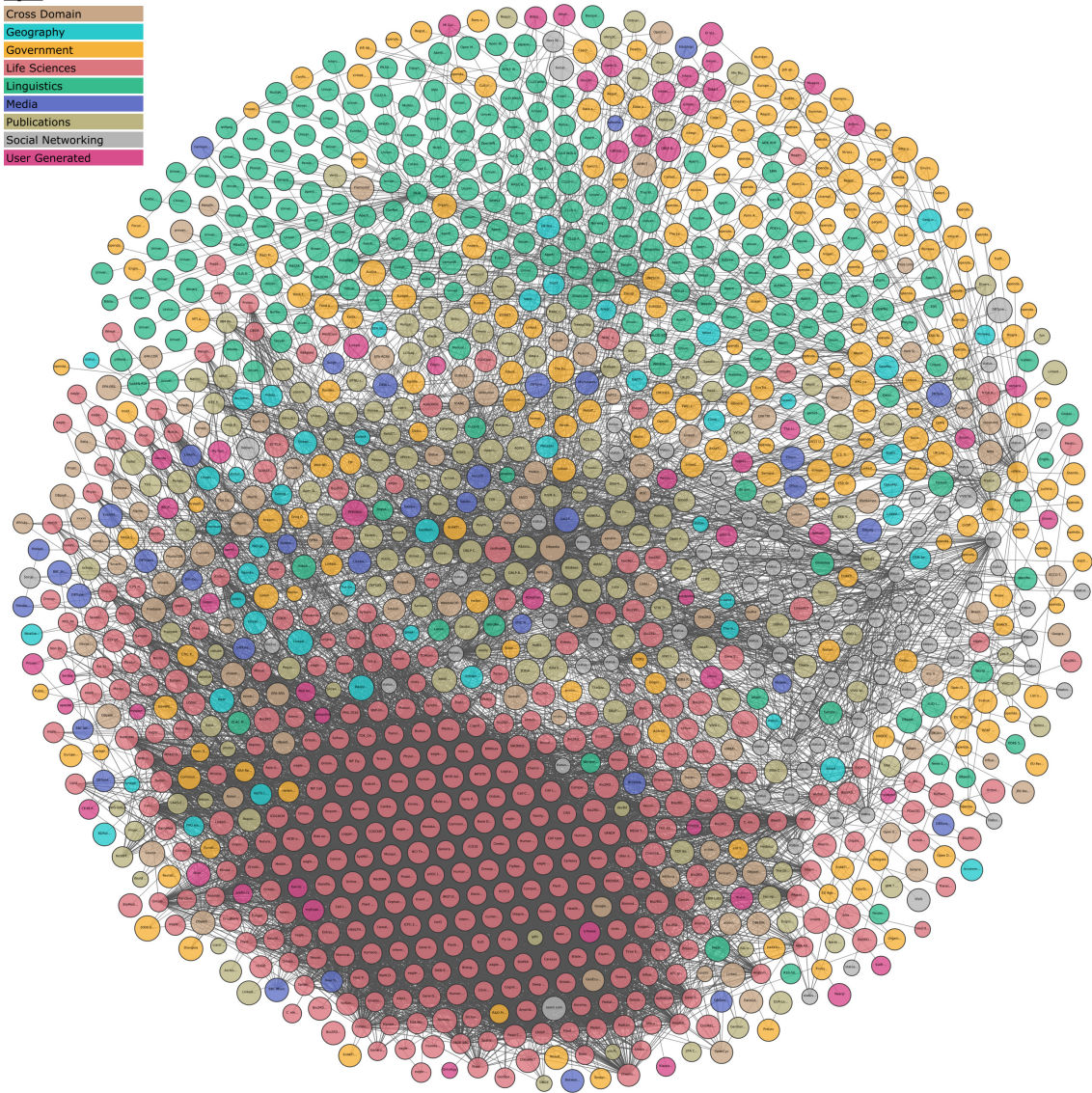
- Media
 - Geographic
 - Publications
 - User-generated content
 - Government
 - Cross-domain
 - Life sciences
- 

2021

<https://lod-cloud.net/>



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There are SPARQL endpoints around

<https://www.w3.org/wiki/SparqlEndpoints>



Page Discussion

Read View source View history Search

SparqlEndpoints

see also: SPARQL

In addition to the list below, Mondeca provides a [SPARQL endpoint uptime service](#) which monitors the availability of all SPARQL endpoints that are cataloged in [CKAN](#). A [similar service](#) is provided by Vienna University.

Currently Alive SPARQL Endpoints

(alphabetical. let's avoid [PoorMansHypertext](#) and in-your-face URIs, please)

Project	status	SPARQL endpoint	Webform	comment
Wikidata	(2017-02-23) alive	endpoint	GUI	See also SPARQL federation input
BBC Programmes and Music	(2010-06-29) alive	endpoint	Ajax based Visual Query Builder	Powered by OpenLink Virtuoso ; also supports Faceted Browsing and Exploration
Bio2RDF	(2010-01-07) alive	List of 40 SPARQL endpoints	n/a	uses OpenLink Virtuoso
BioGateway	(2010-01-07) timeout	endpoint	webform	BioGateway provides many customizable SPARQL queries, both biological as ontological, on RDF graphs that were optimized for querying. The graphs have relational closures. Empowered by OpenLink Virtuoso .
BBC Backstage (HP Labs)	(2010-01-07) server not responding	endpoint	webform	uses joseki 3
BBC John Peel sessions from DBTune (Centre for Digital Music, Queen Mary, University of London)	(2010-01-07) alive	endpoint	n/a	dbtune aims to gather and interlink music-related information.
BBC playcount data from DBTune (Centre for Digital Music, Queen Mary, University of London)	(2010-01-07) alive	endpoint	n/a	dbtune aims to gather and interlink music-related information.
DailyMed	(2010-01-07) alive	endpoint		a D2R endpoint
data.gov	(2010-05-22) alive	endpoint	webform	uses OpenLink Virtuoso
data.gov.uk	(2010-02-04) alive	endpoint	webform	The data.gov.uk endpoint
DBLP Bibliography Database published through D2R Server (Freie Universität Berlin)	(2010-01-07) alive	endpoint	webform (Maybe only Firefox)	The DBLP database provides bibliographic information on major computer science journals and conference proceedings.
DBpedia (University of Mannheim, Universität Leipzig, OpenLink Software)	(2010-01-07) alive	endpoint	SNORQL webform (Firefox/Safari/Opera); Ajax based Visual Query Builder	dbpedia.org is a community effort to extract structured information from periodic Wikipedia dumps and to make this information available on the Web. It is served to the public via a live instance of OpenLink Virtuoso , and also offers Faceted Browsing and Exploration
DBpedia-live (Universität Leipzig, University of Mannheim, OpenLink Software)	(2010-01-07) alive	endpoint	webform	Based on, now parallel to, and soon to replace the existing dbpedia.org data sets, DBpedia-Live is constantly updated, based on Wikipedia change-feeds. It is served to the public via a live instance of OpenLink Virtuoso , and also offers Faceted Browsing and Exploration
German DBpedia (AG Corporate Semantic Web, Freie Universität Berlin)	(2008-10-15) alive	endpoint	site	de.dbpedia.org is the German language chapter of DBpedia
DBpedia Live German (AG Corporate Semantic Web, Freie Universität Berlin)	(2008-10-15) alive	endpoint	site	de.dbpedia.org is the German language chapter of DBpedia
Spanish DBpedia (Universidad Autónoma de Madrid, Universidad Politécnica de Madrid, OpenLink Software)	(2011-04-04) alive	endpoint	site	es.dbpedia.org is the Spanish chapter of DBpedia
Diseasome	(2010-01-07) alive	endpoint		a D2R endpoint
DoapSpace	(2010-01-07) away	endpoint	webform	This is a highly experimental TurboGears with rdfbit triplestore (mysql) SPARQL endpoint.
DrugBank	(2010-01-07) alive	endpoint		a D2R endpoint
EEA (European Environment Agency) Semantic	(2010-01-07) alive	endpoint		a D2R endpoint



- Main Page
- Browse categories
- Recent changes
- Tools
- What links here
- Related changes
- Special pages
- Printable version
- Permanent link
- Page information

An example of an RDF production pipeline: Case WarSampo

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M. Koho et al. / WarSampo Knowledge Graph: Finland in WW2 as Linked Open Data

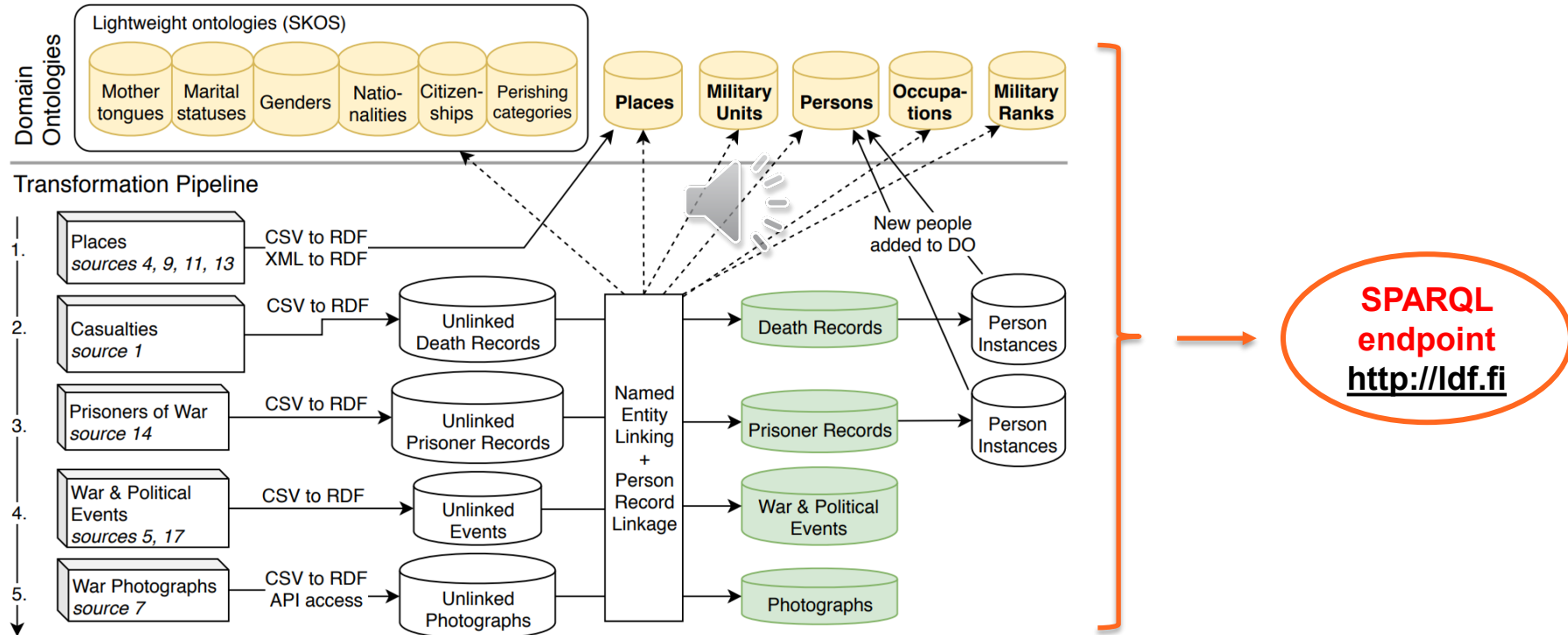
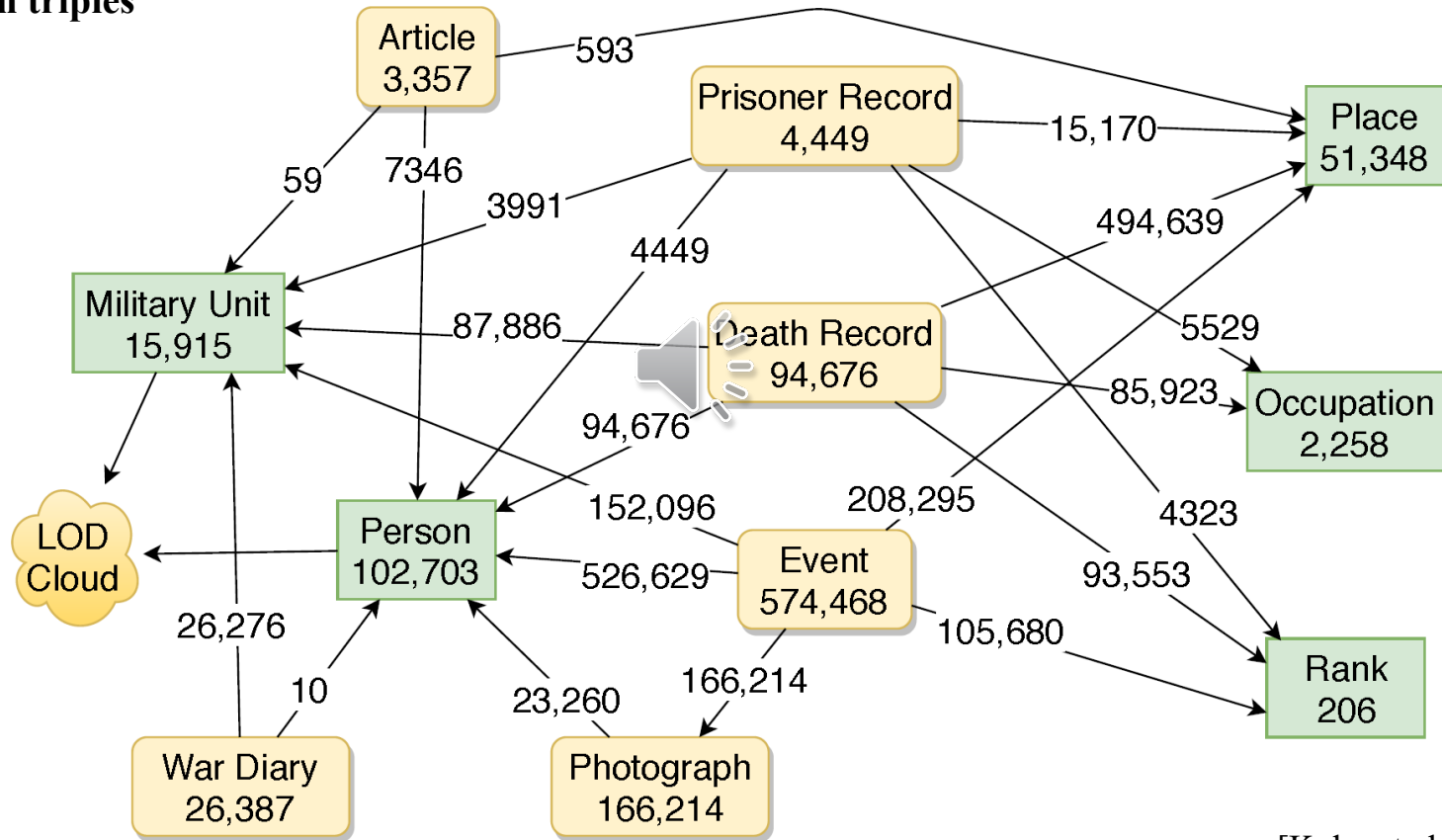


Figure 3. The 5-step WarSampo data transformation process. Dashed arrows represent entity linking, while solid arrows convey data flow.

WarSampo: A Linked Open Data cloud of its own

14 million triples



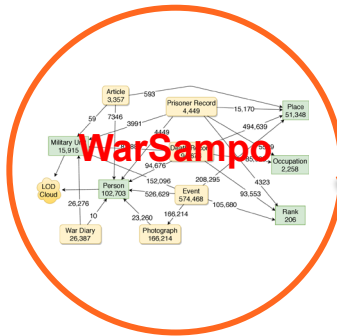
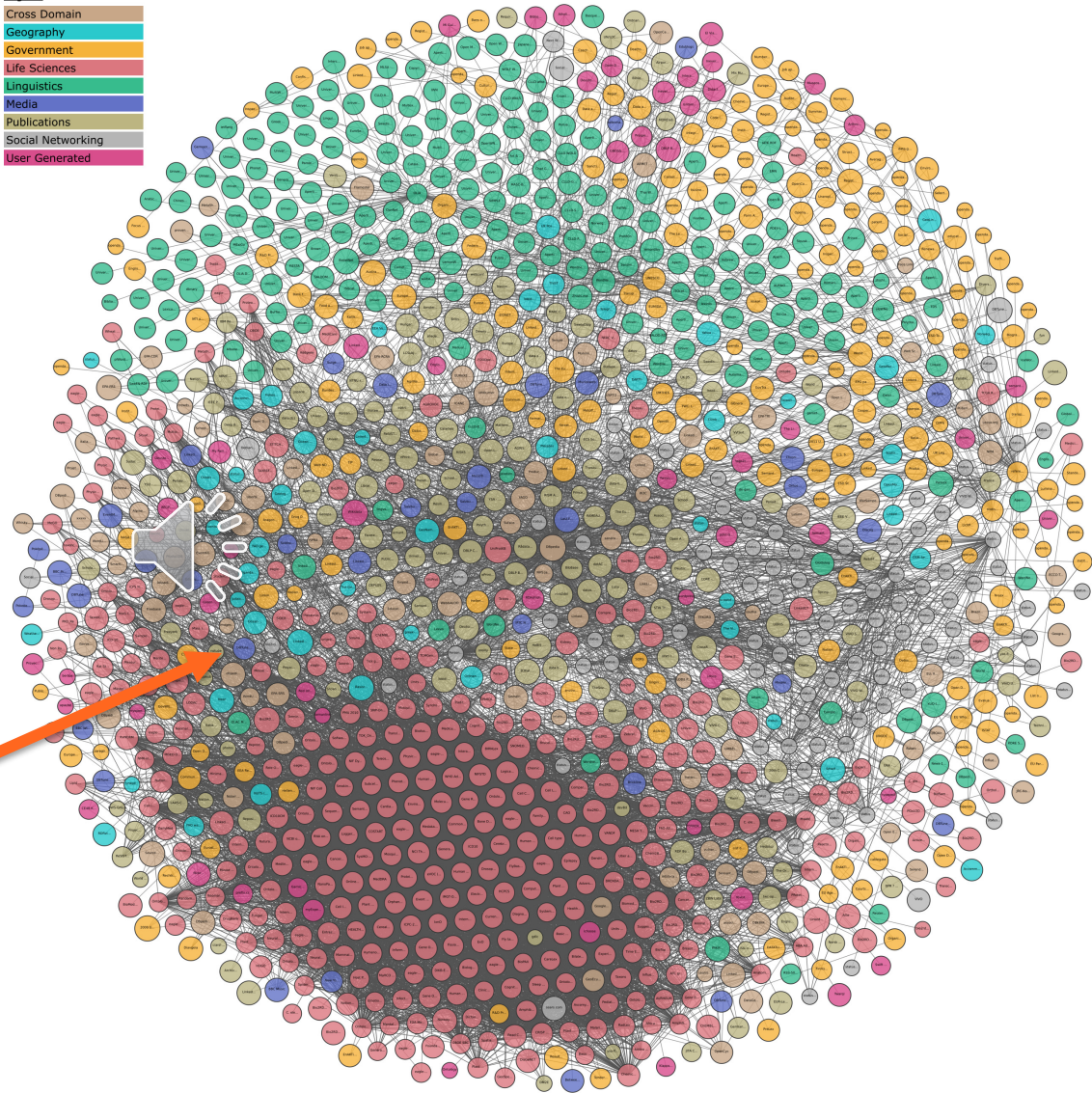
[Koho et al., 2021]

2021

<https://lod-cloud.net/>



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 - User Generated



WarSampo dataset page & SPARQL endpoint: <http://www.ldf.fi/dataset/warsa>



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[Your Data?](#)
[Linked Data School](#)

WarSampo

Sotasampo

Linked Data Finland

★★★★★

WarSampo Knowledge Graph includes harmonized data of different kinds concerning the Second World War in Finland, separated in different subgraphs representing events, actors, places, photographs, and other aspects and documentation of the war. The data covers the Winter War 1939-1940 against the Soviet attack, the Continuation War 1941-1944 where the occupied areas of the Winter War were temporarily regained, and the Lapland War 1944-1945, where the Finns pushed the German troops away from Lapland.

To test and demonstrate its usefulness, this Knowledge Graph is in use in the semantic portal [WarSampo](#), explained in more detail in the [project page](#).

The Knowledge Graph is published on [Zenodo](#) with a version history

Example SPARQL queries for the data:

- [Events, photographs and articles that are situated in Vyborg](#)
- [Casualties of the 1st Division and its subunits in the time interval 13.2.-13.3.1940 by place and date](#)

Data Download

The data can be downloaded at <https://zenodo.org/record/3431122/files/warsampo.zip>.

License

CC BY 4.0 

Licensors: [Kansallisarkisto](#), [Semanttisen laskennan tutkimusryhmä \(SeCo\)](#)

See possible graph-specific licenses below.

Detailed Dataset Contents

Karelian map names 1922-44 (URI: http://ldf.fi/warsa/places/karelian_places)





Information about Linked Data Available and Use Cases

Use cases



W3C's Working Group Note: [Data on the Web Best Practices Use Cases & Requirements](#)

1. Introduction
2. Use Cases
 - 2.1 ASO: Airborne Snow Observatory
 - 2.2 BBC
 - 2.3 Bio2RDF
 - 2.4 BuildingEye: SME use of public data
 - 2.5 Dados.gov.br
 - 2.6 Digital archiving of Linked Data
 - 2.7 Dutch Base Registers
 - 2.8 GS1 Digital
 - 2.9 ISO GEO Story
 - 2.10 The Land Portal
 - 2.11 LA Times' Reporting of Ron Galperin's Infographic
 - 2.12 LusTRE: Linked Thesaurus fRamework for Environment
 - 2.13 Machine-readability and Interoperability of Licenses
 - 2.14 Mass Spectrometry Imaging (MSI)
 - 2.15 OKFN Transport WG
 - 2.16 Open City Data Pipeline
 - 2.17 Open Experimental Field Studies
 - 2.18 Resource Discovery for Extreme Scale Collaboration (RDESC)
 - 2.19 Recife Open Data Portal
 - 2.20 Retrato da Violência (Violence Map)
 - 2.21 Share-PSI 2.0: Uses of Open Data Within Government for Innovation and Efficiency
 - 2.22 Tabulae - how to get value out of data
 - 2.23 UK Open Research Data Forum
 - 2.24 Uruguay Open Data Catalog
 - 2.25 Web Observatory
 - 2.26 Wind Characterization Scientific Study
3. General Challenges
 - 3.1 A Word on Open and Closed Data
 - 3.2 Requirements by Challenge

In the USA:



DATA.CATALOG Organizations / Datasets

Search datasets... Order by: Popular

Datasets ordered by Popular

Formats: RDF x

Filter by location Enter location...

12,018 datasets found

Election Demographics, 1995-2012 [12,238 recent views](#) [CSV](#) [RDF](#) [JSON](#) [XML](#) **State**

State of Illinois - The number of induced pregnancy terminations reported in Illinois by county (if in excess of 50), by age and marital status. Note: Marital status and age are only... [CSV](#) [RDF](#) [JSON](#) [XML](#) **State**

Governor's Children's Cabinet County Crime Rates And Population [16 recent views](#) [CSV](#) [RDF](#) [JSON](#) [XML](#) **State**

State of Illinois - This dataset was compiled by the Illinois Criminal Justice Information Authority (ICJIA) at the request of the Governor's Children's Cabinet. This data contains the...

Most Popular Baby Boy Names, 1980-2013 [13 recent views](#) [CSV](#) [RDF](#) [JSON](#) [XML](#) **State**

State of Illinois - Note: 2010-2013 should be considered provisional data.

Youth Suicide Deaths in Washington State by Gender Age 0-17 Years, from 2008-2012 [11 recent views](#) [CSV](#) [RDF](#) [JSON](#) [XML](#) **State**

State of Washington - Youth Suicide Deaths in Washington State by Gender Age 0-17 Years, from 2008-2012

IDPH Population Projections For Chicago By Age And Sex 2010 To 2025 [1 recent views](#) [CSV](#) [RDF](#) [JSON](#) [XML](#) **State**

State of Illinois - Introduction This report presents projections of population from 2015 to 2025 by age and sex for Illinois, Chicago and Illinois counties produced for the Certificate...

Police Homeless-related Incidents [1 recent views](#) [CSV](#) [RDF](#) [JSON](#) [XML](#) **City**

City of Santa Rosa - Homeless-related Police Incidents in Santa Rosa are identified and counted by any incident relating from a homeless-related call for service.

Leading Causes of Death, 1990-2010 [1 recent views](#) [CSV](#) [RDF](#) [JSON](#) [XML](#) **State**

State of Illinois - Leading causes of death for Illinois residents was compiled by the U. Center for Health...

Map tiles & Data by OpenStreetMap, under CC BY-SA

Topics: Local Government (10279), Older Adults Health... (77), Climate (6), Disasters (3)

Topic Categories: Human Health (6)

Dataset Type: non-geospatial (12016), geospatial (2)

Tags

https://catalog.data.gov/dataset?res_format=RDF&res_format_limit=0



More Information – Questions?



Semantic Web & Linked Data Standards

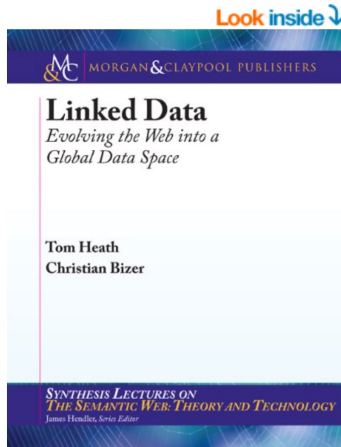
<http://www.w3.org/standards/semanticweb/>

T. Heath, C. Bizer: **Evolving the Web into a Global Data Space**

Free online version: <http://linkeddatabook.com/editions/1.0/>

WarSampo project homepage:

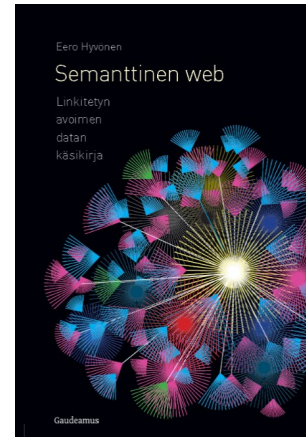
<https://seco.cs.aalto.fi/projects/sotasampo/en/>



In English

2011

<https://www.amazon.com/Linked-Data-Evolving-Global-Space-ebook/dp/B009KC1YM2>



In Finnish

2018

<https://www.gaudeamus.fi/semanttinen-web/>