

Semantic Technologies

These materials are developed
in cooperation with



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14 December 2019, Sofia



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DATA
IS THE NEW OIL



Outline

- Demonstration
 - NOW
- Introduction to Semantic Technologies
- Semantic Technology Success Stories
- Introduction to RDF, RDFS
- Ontologies
- Demonstrations
 - RANK
 - FactForge

- Let us see the power of semantic technologies through a demonstration
- NOW – News On the Web

<http://now.ontotext.com>

- Smart way to read news
- Discover quickly what and who the news are talking about
- Find trends in the news
- Get content recommendations – similar news to read
- Find out more about the entities of interest – people, locations, organisations

- We do advanced analytics:
We predicted BREXIT

- ✓ 14 Jun 2016 whitepaper:
#BRExit Twitter Analysis: More Twitter Users Want to Split with EU and Support #Brexit
<https://ontotext.com/white-paper-brexit-twitter-analysis/>

- But most of the time we do the heavy lifting of data preparation and information extraction

- ✓ Enabling data scientists to do fancy things



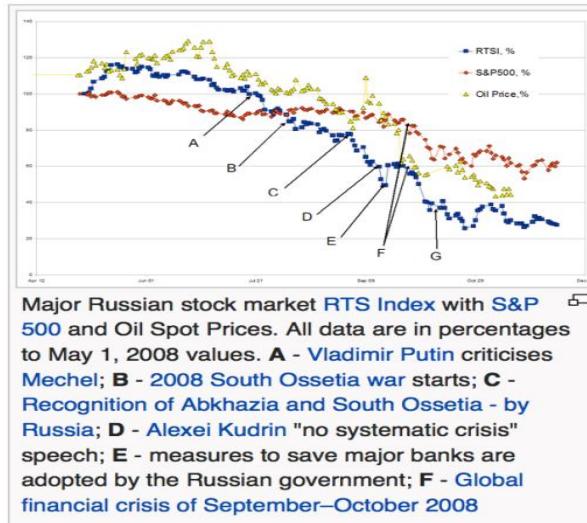
4:32 PM - 14 Jun 2016

Semantic Technologies

- “Semantic technologies” (ST) is a general term for any software that involves **some kind and level of understanding** the meaning of the information it deals with
- Examples:
 - A search engine that can match a query for “*bird*” with a document mentioning “*eagle*”
 - A database that will return Ivan as a result of a query for “*?x relativeOf Maria*”, when the fact asserted was “*Maria motherOf Ivan*”
 - A navigation system that is *more intelligent than what we are already used to*

The Web

- There is a wealth of information on the Web
- It is aimed mostly towards consumption by **humans** as end-users:
 - Recognize the meaning behind content and draw conclusions
 - Infer new knowledge using context and
 - Understand background information



WIKIPEDIA



Just on 8 August 2008, the day the war started, six billion dollars left Russia, according to the finance minister.^[1]

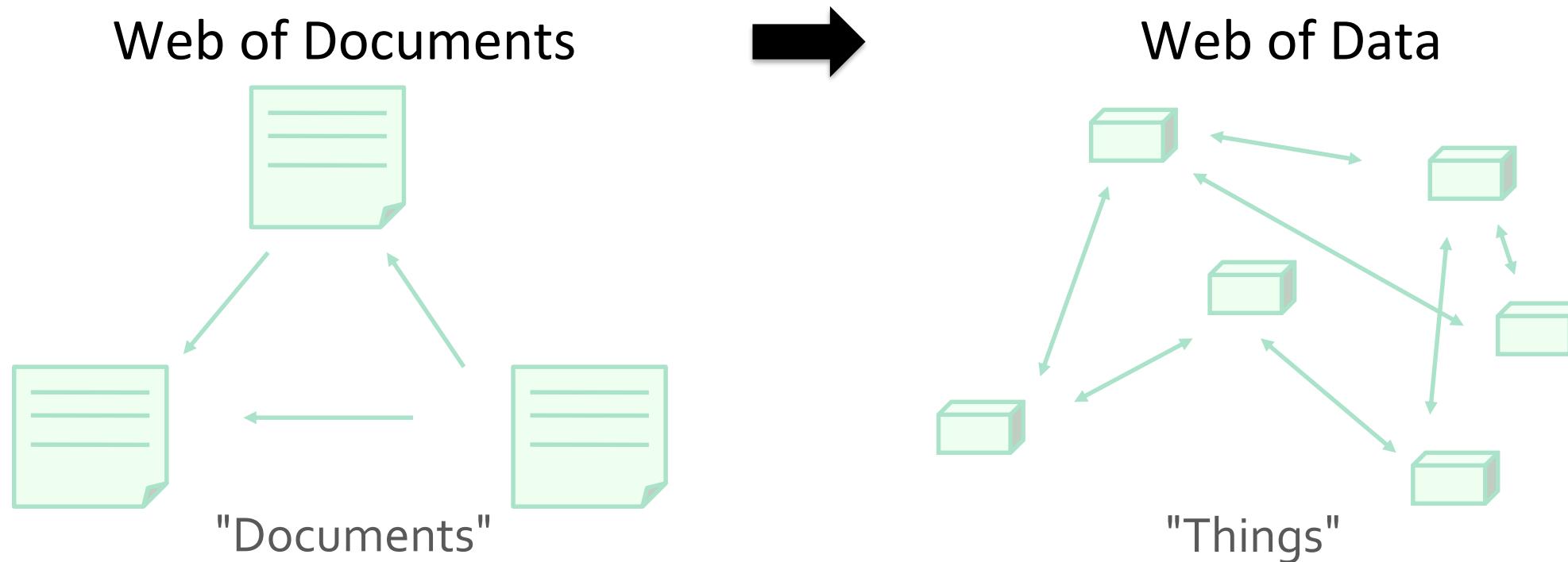
On 8 August 2008, Fitch Ratings lowered Georgia's sovereign debt ratings from BB- to B+, commenting that there were "increased downside risks to Georgia's sovereign creditworthiness". Standard and Poor's also lowered Georgia's ratings.^[2]

While Georgia has no significant oil or gas reserves on its own, it is an important transit route that supplies the West, and journalists expressed fear that the war may damage the Baku–Tbilisi–Ceyhan pipeline (BTC pipeline), 30% of which was owned by BP.^[3] The BTC pipeline was shut down before the conflict because of the blast in Turkey on 6 August 2008. The responsibility for it was claimed by the PKK.^[4] On 8 August 2008, light sweet crude for September delivery settled down \$4.82 to \$115.20 on the New York Mercantile Exchange.^[5] The war created further problems for BP.^[6]

The Web

- Billions of diverse documents online, but it is not easily possible to automatically:
 - Retrieve relevant documents.
 - Extract information.
 - Combine information in a meaningful way.
- Idea:
 - Also publish machine processable data on the web.
 - Formulate questions in terms understandable for a machine.
 - Do this in a standardized way so machines can interoperate.
- The Web becomes a **Web of Data**
 - This provides a common framework to share knowledge on the Web across application boundaries.

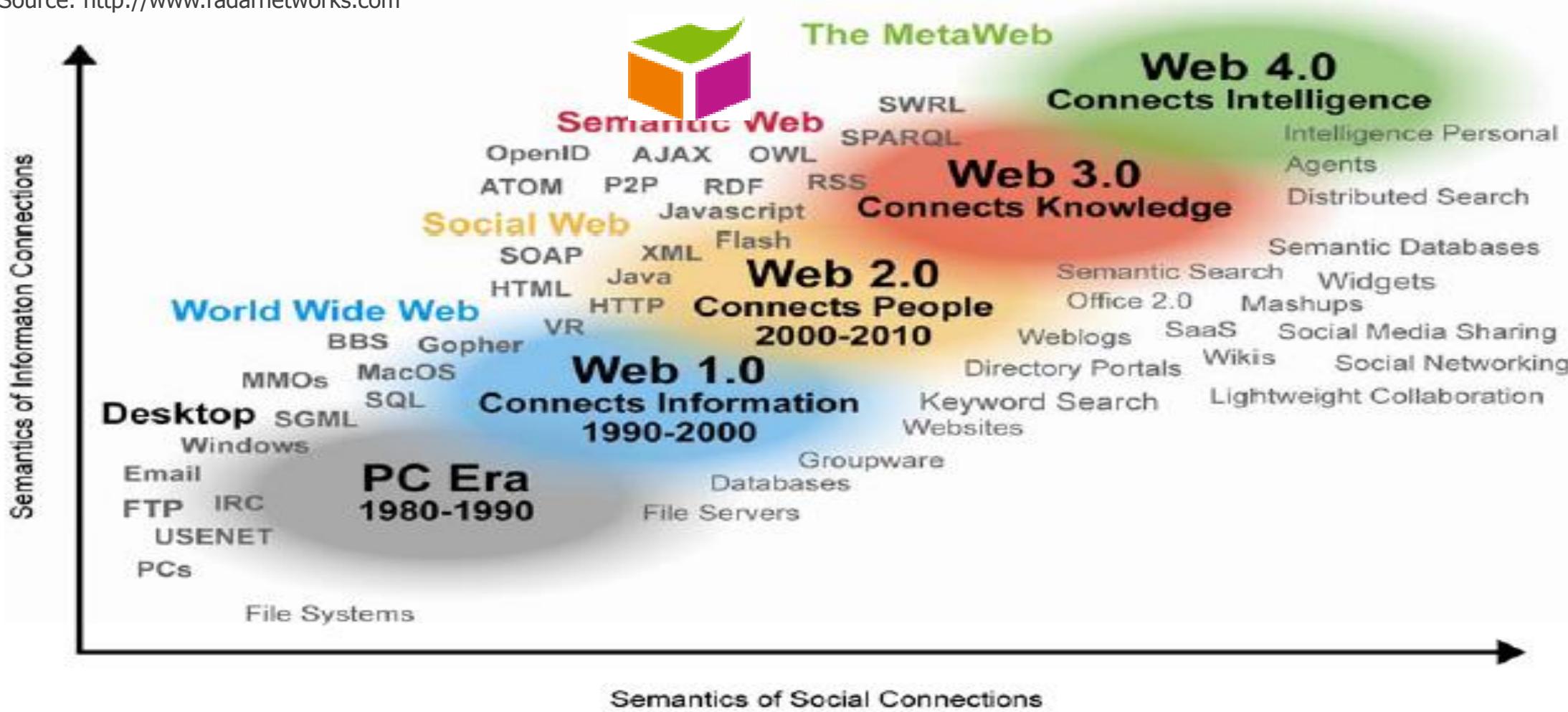
The Web: Evolution



*"PricewaterhouseCoopers believes a Web of data will develop that fully augments the document Web of today. You'll be able to **find pieces of data sets from different places, aggregate them without warehousing, and analyze them in a more straightforward, powerful way than you can now.**" (PWC, May 2009)*

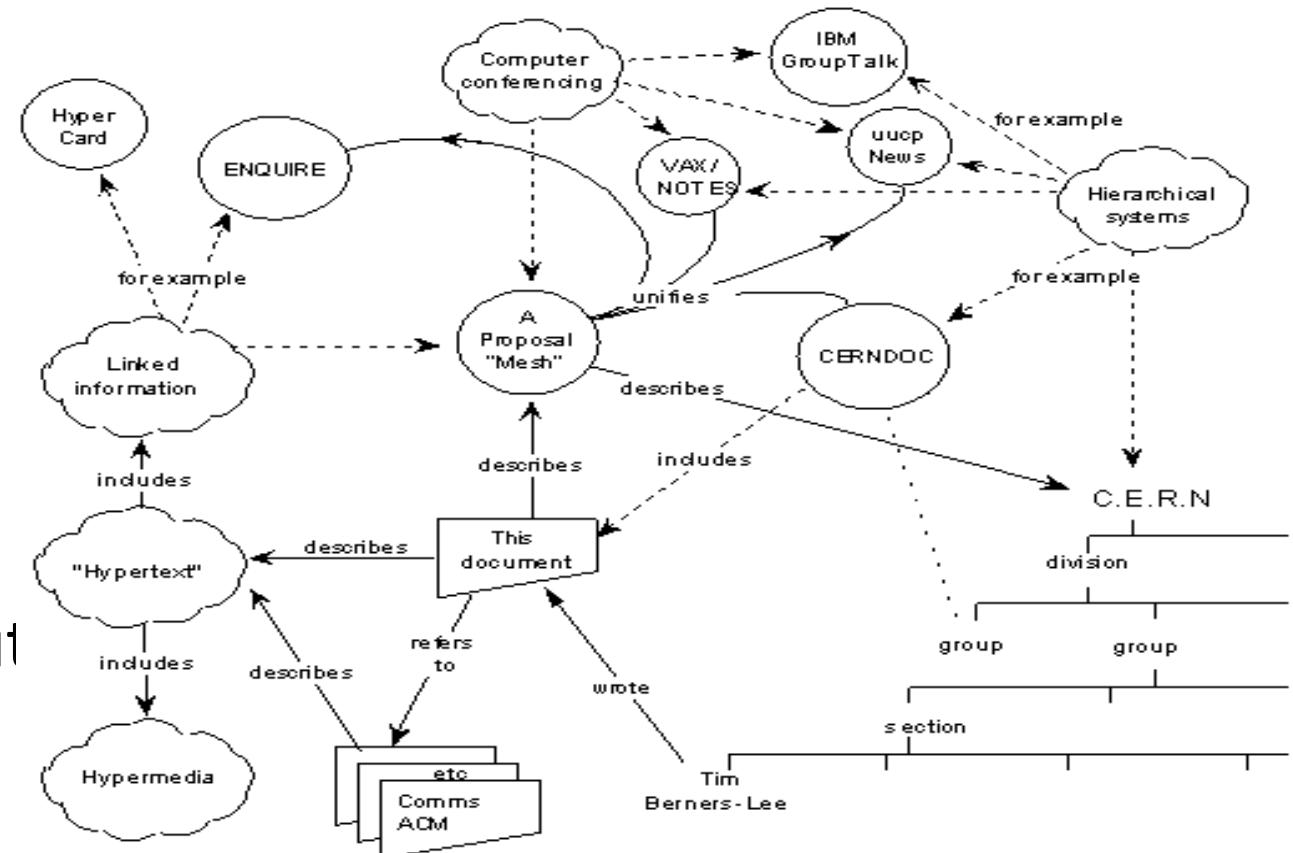
The Web: Evolution

Source: <http://www.radarnetworks.com>



Genesis of the Semantic Web

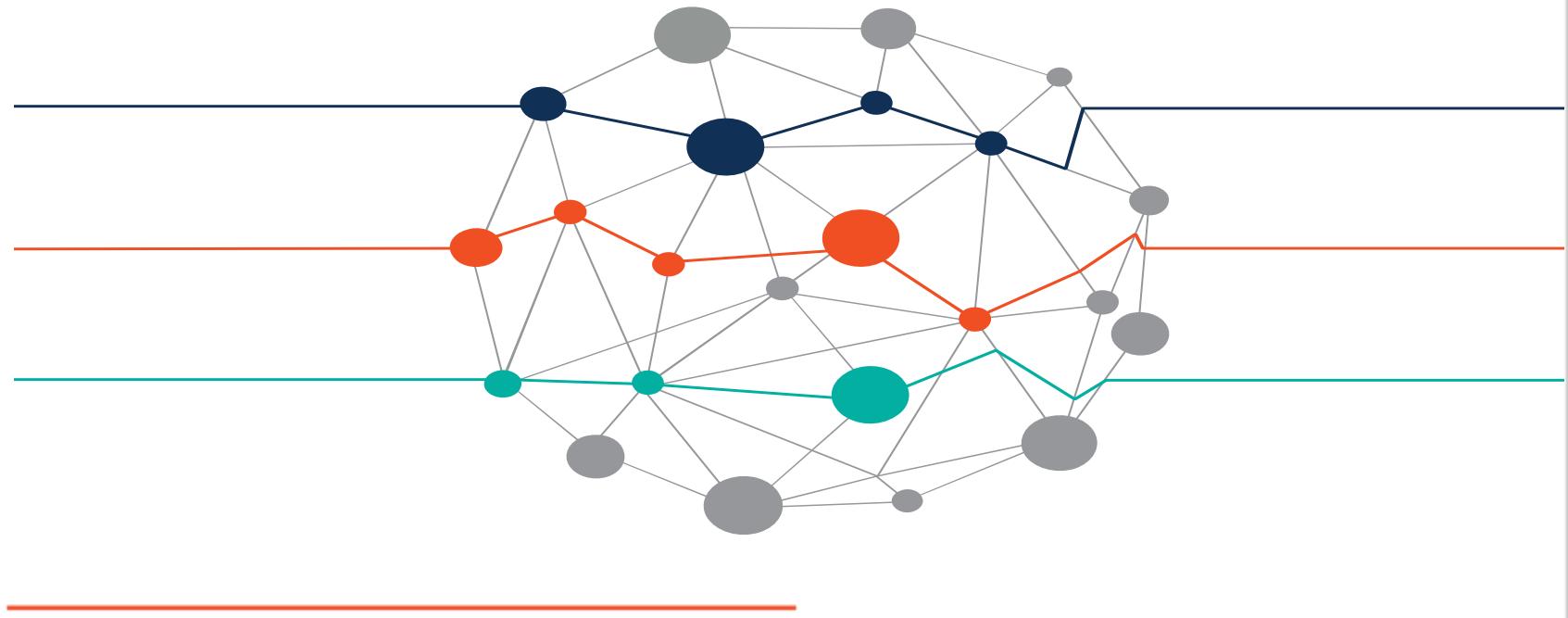
- Invented by Tim Berners-Lee who also invented the WWW
- Standardized by the W3C
- Part of the original proposal to CERN about the WWW
- Has been in development for about as long as the web itself

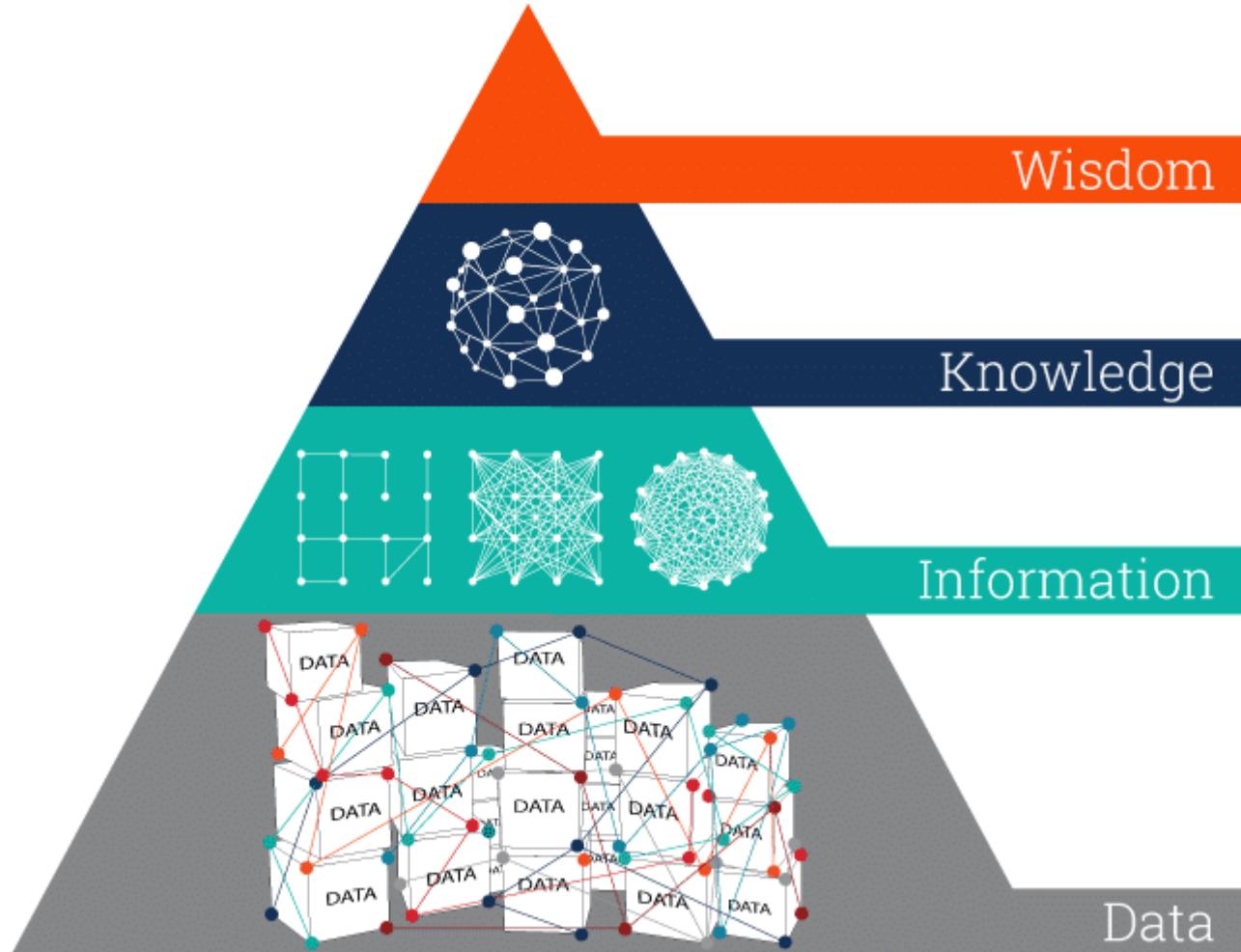


The Semantic Web vision (W3C)

- Extend principles of the Web from documents to data
- Data should be accessed using the general Web architecture
 - e.g. URI-s, protocols, ...
- Data should be related to one another just as documents are already
- Creation of a common framework that allows:
 - Data to be easily shared and reused across applications
 - Data to be processed automatically
 - New relationships between pieces of data to be inferred

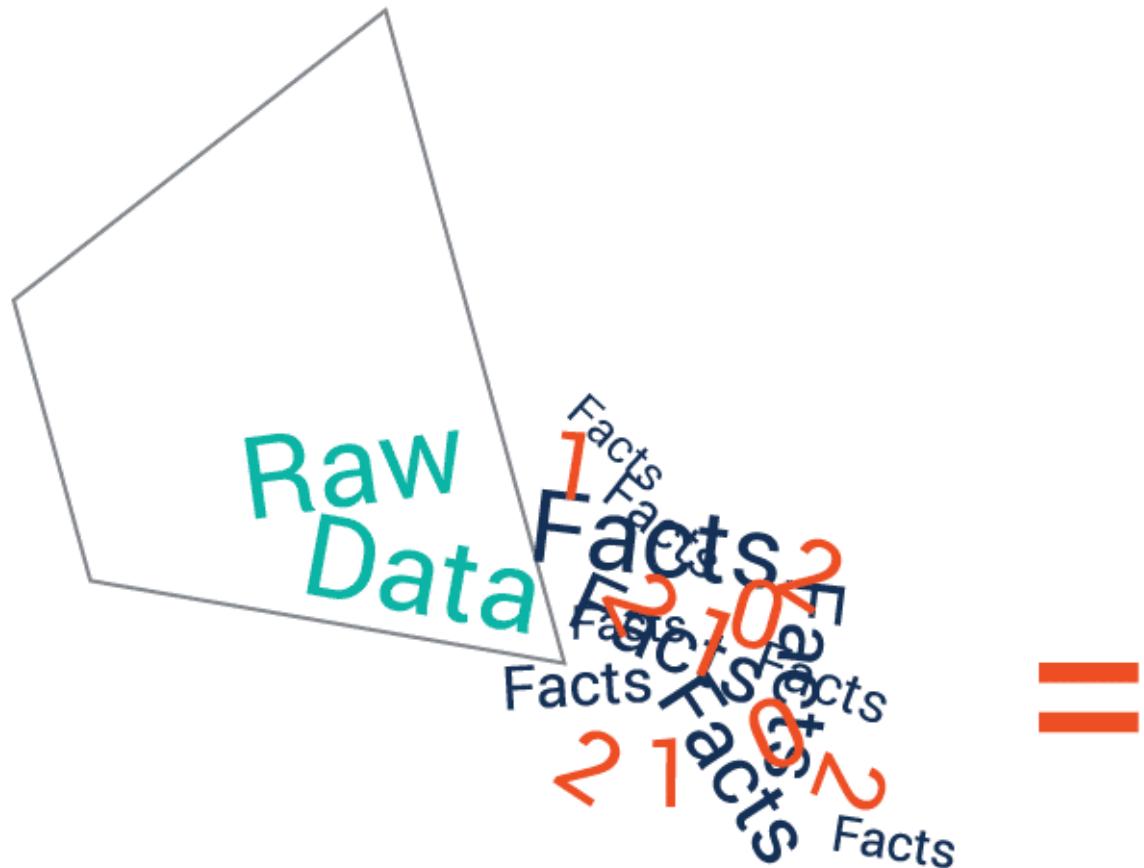
ADDED VALUE





Each step up
the pyramid
answers
questions
about and
adds value
to the initial data.

Data



a collection of
facts in a raw or
unorganized form

Base building block - Raw **Data**

Information

4W

who

what

when

where



easier to measure,
visualize and analyze
data for a specific purpose

Second building block - Derived **Information**

Knowledge



Third building block - Relevant **Knowledge**

Wisdom

why
do
something?

what is best?

Wisdom is knowledge applied in action



The top of the DIKW hierarchy - Guiding **Wisdom**

Google Dataset Search Beta

Search for Datasets



Try [boston education data](#) or [weather site:noaa.gov](#)

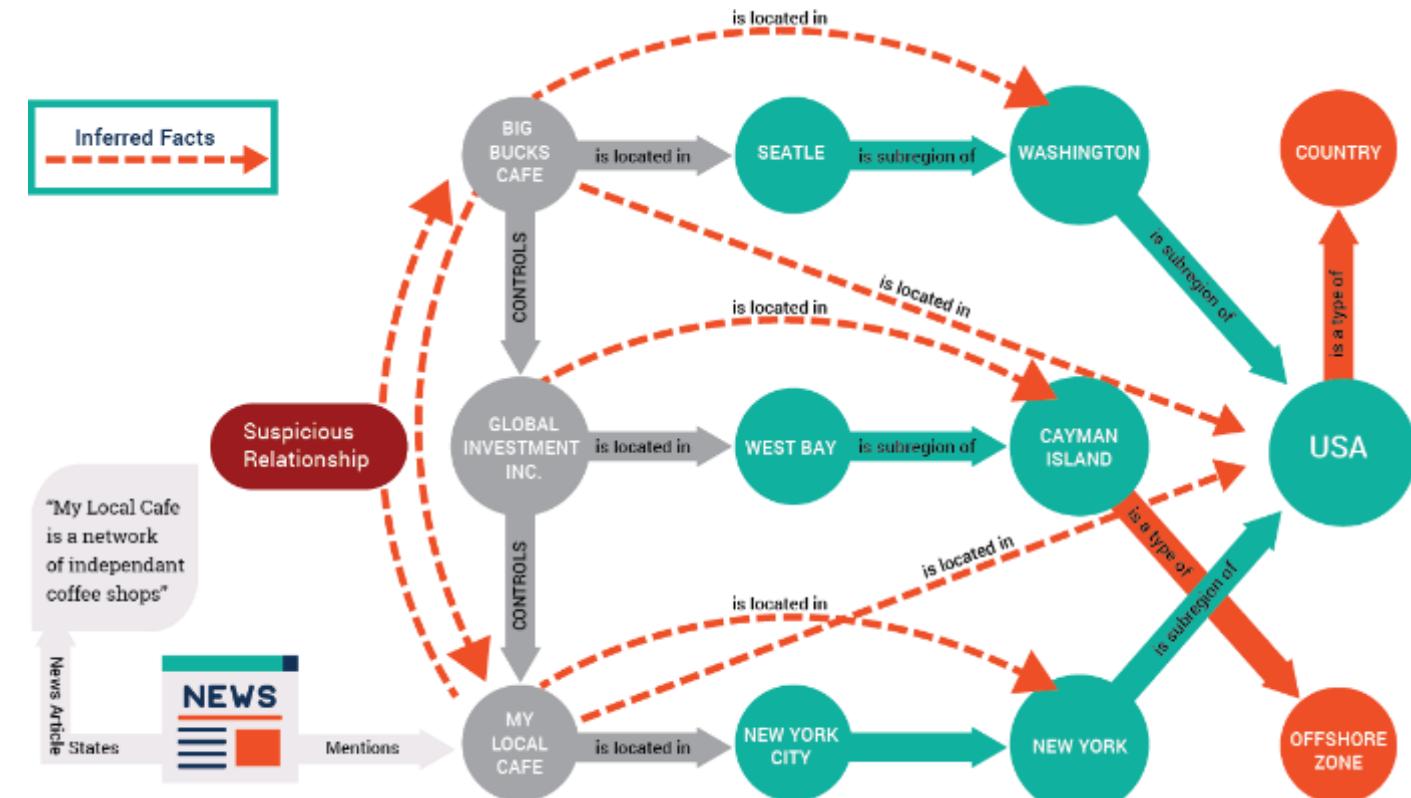
[Learn more](#) about including your datasets in Dataset Search.

Semantics add value

- Use big volumes of diverse structured data to enable better information discovery, exploration and analytics
- Better end-user experience: Know more!
 - Get more answers in less time
 - Discover relationships by linking facts across different datasets and across domains
 - Get better recommendations and exploration experience
- Better for enterprises: More efficient information management!
 - Integrate rich open data in your information architecture – more data with less effort
 - Get more efficient in using commercial data sources and integrating them with proprietary data
 - Better leverage for your data and content through dynamic and linked data publishing

What is Knowledge Graph?

- KG represents a collection of interlinked descriptions of concepts and entities
 - ✓ Concepts describe each other
 - ✓ Connections provide context
 - ✓ **Context helps comprehension!**
- A KG can be used as:
 - ✓ **Database:** can be queried
 - ✓ **Graph:** can be analyzed as network
 - ✓ **Knowledge base:** new facts can be inferred



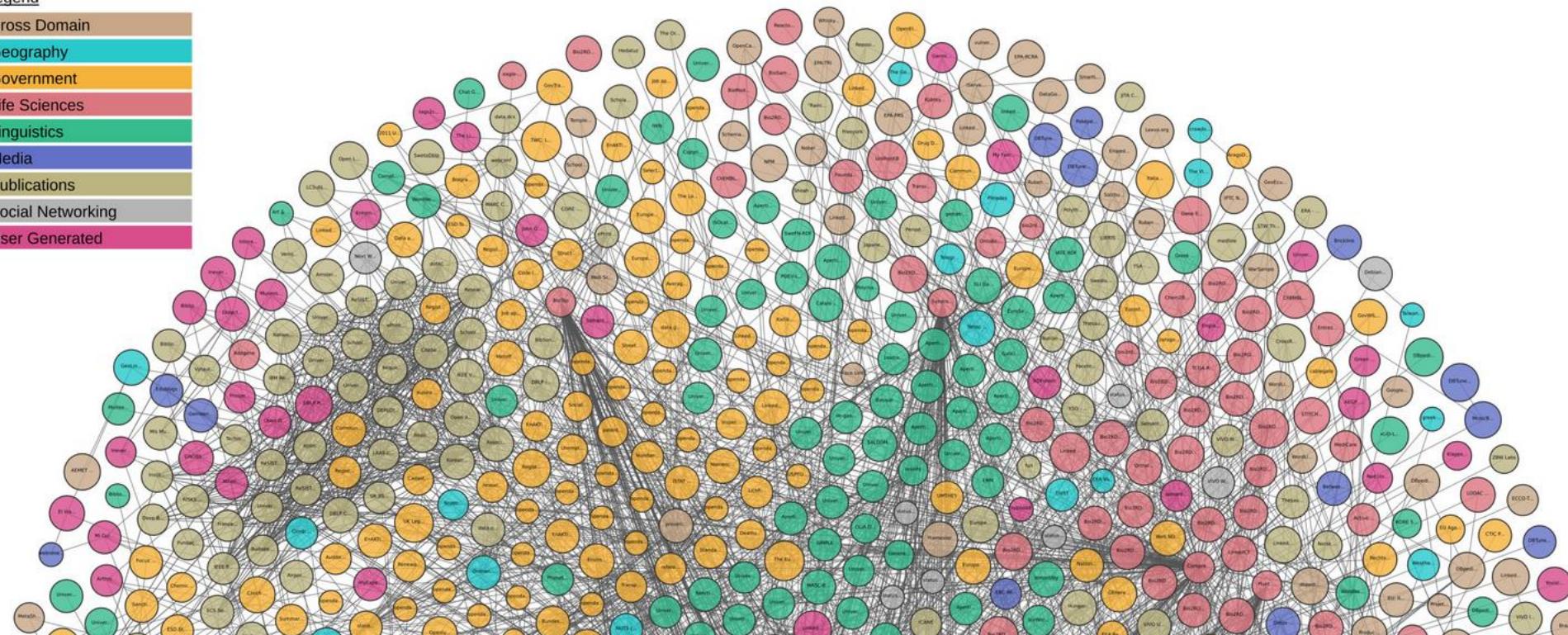
Massive number of knowledge bases

[Browse](#) [Submit a dataset](#) [Diagram](#) [Subclouds](#) [About](#)

The Linked Open Data Cloud

Legend

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





Main Page Discussion

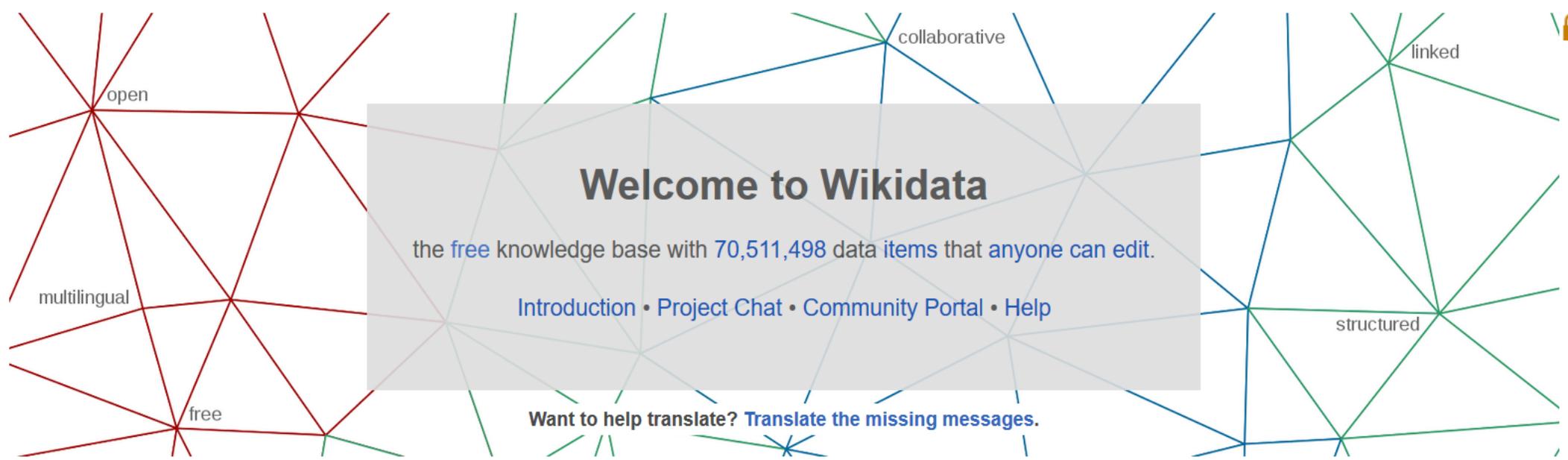
Read View source View history

Search Wikidata



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

Wikimedia Commons
MediaWiki
Meta-Wiki
Wikispecies
Wikibooks
Wikimania
Wikinews
Wikipedia
Wikiquote
Wikisource



Welcome to Wikidata

the free knowledge base with 70,511,498 data items that anyone can edit.

[Introduction](#) • [Project Chat](#) • [Community Portal](#) • [Help](#)

Want to help translate? [Translate the missing messages.](#)

Welcome!

Wikidata is a free and open knowledge base that can be read and edited by both humans and machines.

Wikidata acts as central storage for the **structured data** of its Wikimedia sister projects including Wikipedia, Wikivoyage, Wiktionary, Wikisource, and others.

Wikidata also provides support to many other sites and services beyond just Wikimedia projects! The content of Wikidata is available under a free license, exported using

Learn about data

New to the wonderful world of data? [Develop and improve your data literacy through content](#) designed to get you up to speed and feeling comfortable with the fundamentals in no time.



[login](#)



GeoNames

The GeoNames geographical database covers all countries and contains over eleven million placenames that are available for download free of charge.

 [\[advanced search\]](#)

enter a location name, ex: "Paris", "Mount Everest", "New York"

[Text Search](#)[Entity Label Lookup](#)[Entity URI Lookup](#)[Featured](#) | [Demo Queries](#) | [About](#)

Precision Search & Find

Search TextHint: You can [add this engine](#) in search

Faceted Search & Find service

[OpenLink Virtuoso](#) version 07.20.3232 as of Aug 9 2019, on Linux (x86)Data on this page is owned by
Virtuoso Faceted Browser Copyright[Browse using](#)[Formats](#)[Faceted Browser](#)[Sparql Endpoint](#)

About: Sofia University

An Entity of Type : [organisation](#), from Named Graph : <http://dbpedia.org>, within Data Space : [dbpedia.org](#)

The University of Sofia (St. Kliment Ohridski) or simply Sofia University (Bulgarian: Софийски университет „Св. Климент Охридски“, Sofiyski universitet „Sv. Kliment Ohridski“) is the oldest higher education institution in Bulgaria, founded on 1 October, 1888. The edifice of the university was constructed between 1924 and 1934 with the financial support of the brothers Evlogi Georgiev and Hristo Georgiev, whose sculptures are now featured on its façade, and has an area of 18,624 m² and a total of 324 premises.

Property**Value**[dbo:abstract](#)

- The University of Sofia (St. Kliment Ohridski) or simply Sofia University (Bulgarian: Софийски университет „Св. Климент Охридски“, Sofiyski universitet „Sv. Kliment Ohridski“) is the oldest higher education institution in Bulgaria, founded on 1 October, 1888. The edifice of the university was constructed between 1924 and 1934 with the financial support of the brothers Evlogi Georgiev and Hristo Georgiev, whose sculptures are now featured on its façade, and has an area of 18,624 m² and a total of 324 premises. The university has 16 faculties and three departments, where over 21,000 students receive their education. In addition, it also has a university library, a university press, a computer centre, a sports centre and several other structures. The current rector is Anastas Gerdzhikov. Sofia University has been consistently ranked as the top university in Bulgaria according to national and international rankings, and is constantly among the best 4 percent of world universities according to QS World University Rankings. (en)

[dbo:affiliation](#)

- [dbr:European_University_Association](#)

[dbo:campus](#)

- [dbr:Urbanization](#)

Commercial providers of data

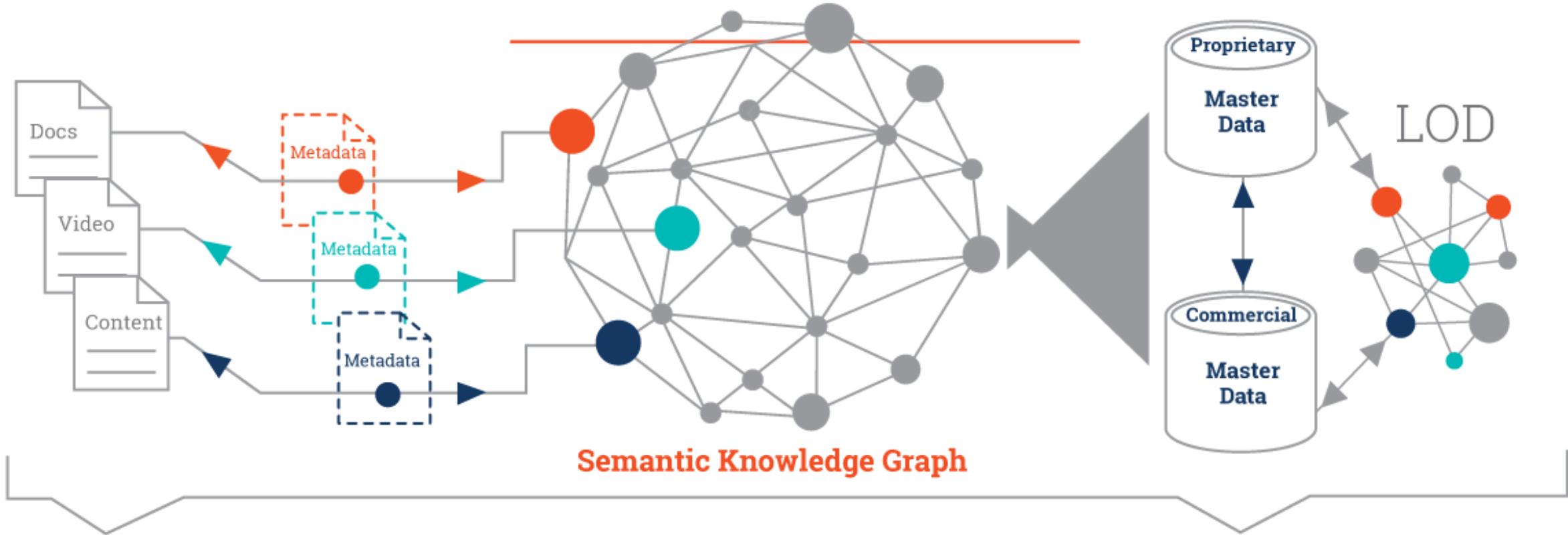
- POL is the most common type of master / reference data
- POL data available in vast quantities
 - Geonames covers locations exhaustively; DBpedia covers well popular entities; Wikidata
 - Open company data grows: OpenCorporates, Offshore leaks DB, GLEI, open national registers
 - Within 5 years exhaustive global POL data will be considered commodity!

Sweet spot for semantic technology

- Integration of deep and diverse data
 - Complex domain models
 - Instance data reconciliation
- Development of enterprise knowledge platforms
 - Integration of data silos applications
 - Establish enterprise-level data standards
- Content enrichment and retrieval based on deep data
 - Analyze unstructured textual information
 - Recommend content based on semantic fingerprints

Content Analytics & Exploration Platform

GraphDB

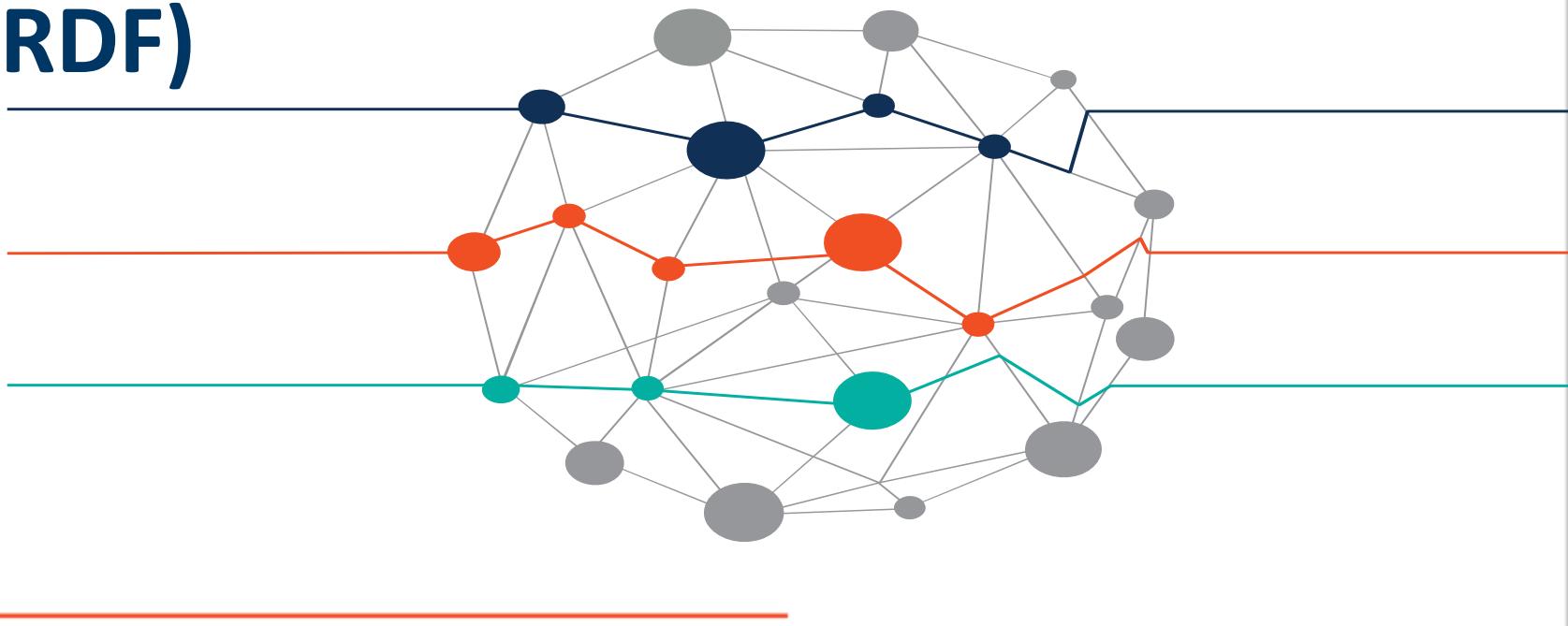


Automated Tagging
Content Publishing
Personalized Recommendation
Regulatory Compliance

**Professional Services
Consultancy**

Data Integration
Master Data Management
Information Discovery
Open Data Publishing

RESOURCE DESCRIPTION FRAMEWORK (RDF)



Example

Thor (film)

From Wikipedia, the free encyclopedia



Thor is a 2011 American superhero film based on the Marvel Comics character of the same name, produced by Marvel Studios and distributed by Paramount Pictures.^[a] It is the fourth film in the Marvel Cinematic Universe. The film was directed by Kenneth Branagh, written by Ashley Edward Miller & Zack Stentz and Don Payne, and stars Chris Hemsworth, Natalie Portman, Tom Hiddleston, Stellan Skarsgård, Colm Feore, Ray Stevenson, Idris Elba, Kat Dennings, Rene Russo and Anthony Hopkins. The film sees Thor, the crown prince of Asgard, banished to Earth and stripped of his powers after he reignites a dormant war. As his brother, Loki, plots to take the throne for himself, Thor must prove himself worthy and reclaim his hammer Mjolnir.

Information can be described through relationships between things, e.g.

- The relationship between the movie Thor and Kenneth Branagh is that Kenneth directed the movie.
- The relationship between the movie Thor and the date May 6, 2011 is that the movie was released (in the US) on that date.

Such descriptions are formalized using the Resource Description Framework.

Thor	
Directed by	Kenneth Branagh
Produced by	Kevin Feige
Screenplay by	Ashley Edward Miller Zack Stentz Don Payne
Story by	J. Michael Straczynski Mark Protosevich
Based on	Thor by Stan Lee Larry Lieber Jack Kirby
Starring	Chris Hemsworth Natalie Portman Tom Hiddleston Stellan Skarsgård Colm Feore Ray Stevenson Idris Elba Kat Dennings Rene Russo Anthony Hopkins
Music by	Patrick Doyle
Cinematography	Haris Zambarloukos ^[1]
Edited by	Paul Rubell ^[1]
Production company	Marvel Studios
Distributed by	Paramount Pictures ^[a]
Release dates	April 17, 2011 (Sydney) May 6, 2011 (United States)
Running time	114 minutes ^[5]
Country	United States
Language	English
Budget	\$150 million ^[6]
Box office	\$449.3 million ^[7]

What is RDF?

Resource Description Framework (RDF) is a graph data model that

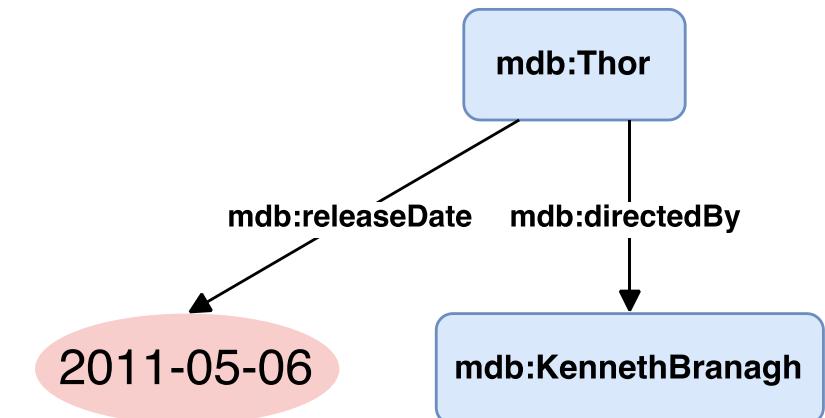
- Formally describes the semantics, or meaning, of information
- Represents metadata, i.e., data about data

RDF data model consists of triples

- That represent links (or edges) in an RDF graph
- Where the structure of each triple is Subject, Predicate, Object

Example triples:

Subject	Predicate	Object
<code>mdb:Thor</code>	<code>mdb:directedBy</code>	<code>mdb:KennethBranagh</code> .
<code>mdb:Thor</code>	<code>mdb:releaseDate</code>	<code>2011-05-06</code> .



'mdb:' refers to the namespace '<http://example.org/movieDB/>' so that 'mdb:Thor' expands to <http://example.org/movieDB/Thor> a Universal Resource Identifier (URI).

What is RDF and what is it for?

- Resource Description Framework (RDF)
 - A general method for describing data
 - By defining relationships between things
- Simple, yet flexible & powerful data model
 - Easily merge data from multiple sources
 - Even if the underlying schemas differ
- Built around existing Web standards
 - XML
 - URL (URI)



Resources, properties and literals

- **Resources** can be anything you want to describe
 - Information resources can be found on the Web
 - Non-information resources are anything else, e.g. people, places, things, events...
- Uniquely identified by a URI/IRI
 - IRI is an internationalised URI
- Or can be identified by a blank node
 - A unique anonymous value scoped to the current RDF document

Resources, properties and literals

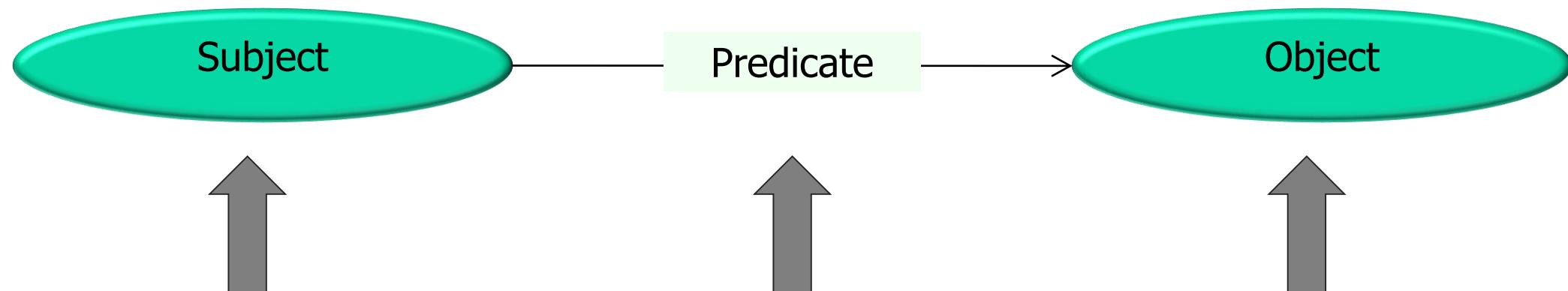
- **Properties** are the relationships between resources
 - e.g. X fatherOf Y (where X and Y are URIs)
 - Or attributes X rdfs:label “X”
- RDF schemas can define the types of things that properties apply to
- Properties are always identified by a URI

Resources, properties and literals

- **Literals** are instances of datatypes
 - e.g. string, integer, date
- Can have a language tag
 - e.g. "Mass spectrometer"@EN
- Can have an XML schema datatype
 - "1976-00-00T00:00:00Z"^^xsd:dateTime
- Can have no specific type, i.e. just a piece of text
 - rdf:plainLiteral

RDF Statements (Triples)

- RDF Statements are formed of three parts



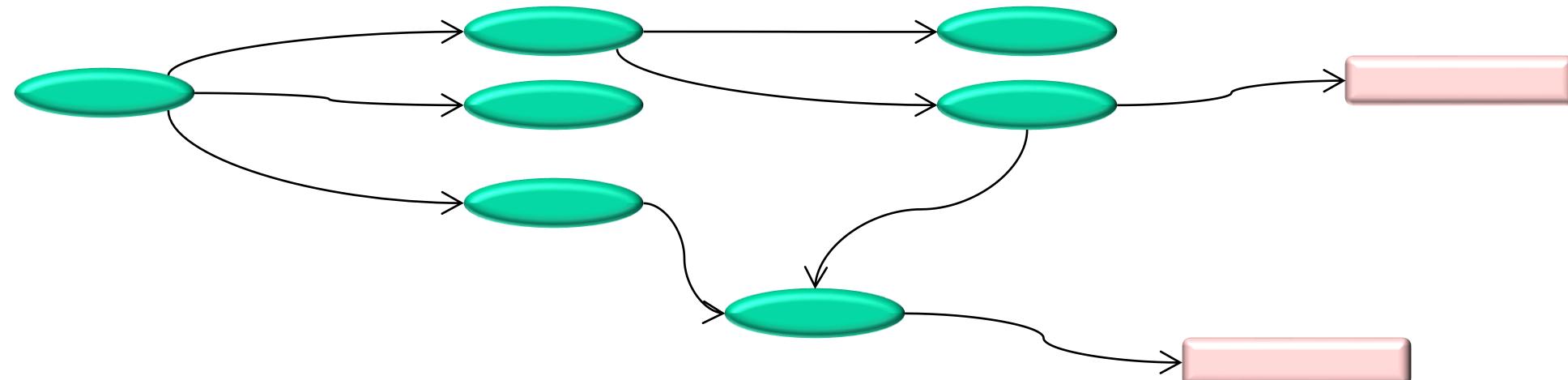
This is the **resource** that
the statement is about:
URI or blank node

The **property** that relates
the subject and object:
URI

Either a **resource** (URI or
blank node) or a **literal**

Graphs

- Resources can be both subjects and objects
- Literals can only be objects
- A collection of statements makes a directed graph



Syntaxes

- The abstract structure of RDF is a collection of statements (triples)
- This can be written down in many ways
 - RDF/XML

```
<?xml version="1.0" encoding="utf-8" ?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
           xmlns:ns0="http://example.org/elements#">

  <rdf:Description rdf:about="http://en.wikipedia.org/wiki/Helium">
    <ns0:atomicNumber rdf:datatype="http://www.w3.org/2001/XMLSchema#integer">2</ns0:atomicNumber>
    <ns0:atomicMass rdf:datatype="http://www.w3.org/2001/XMLSchema#decimal">4.002602</ns0:atomicMass>
    <ns0:specificGravity rdf:datatype="http://www.w3.org/2001/XMLSchema#double">1.663E-4</ns0:specificGravity>
  </rdf:Description>

</rdf:RDF>
```

Syntaxes

- The abstract structure of RDF is a collection of statements (triples)
- This can be written down in many ways
 - RDF/XML
 - Turtle

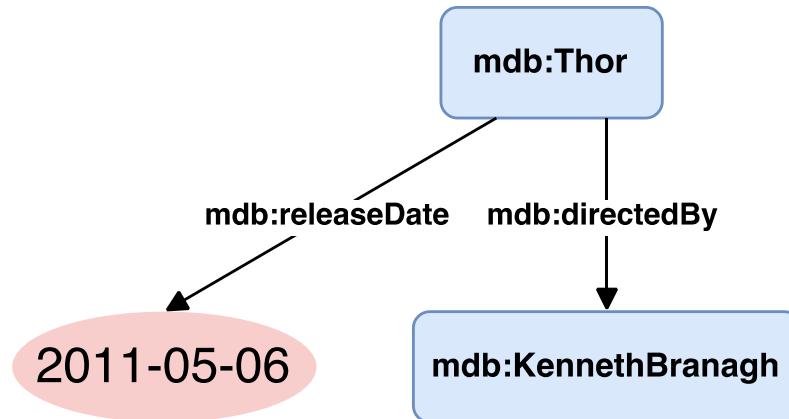
```
@prefix : <http://example.org/elements#> .  
  
<http://en.wikipedia.org/wiki/Helium> :atomicNumber 2 ;  
                                :atomicMass    4.002602 ;  
                                :specificGravity 1.663E-4 .
```

Syntaxes

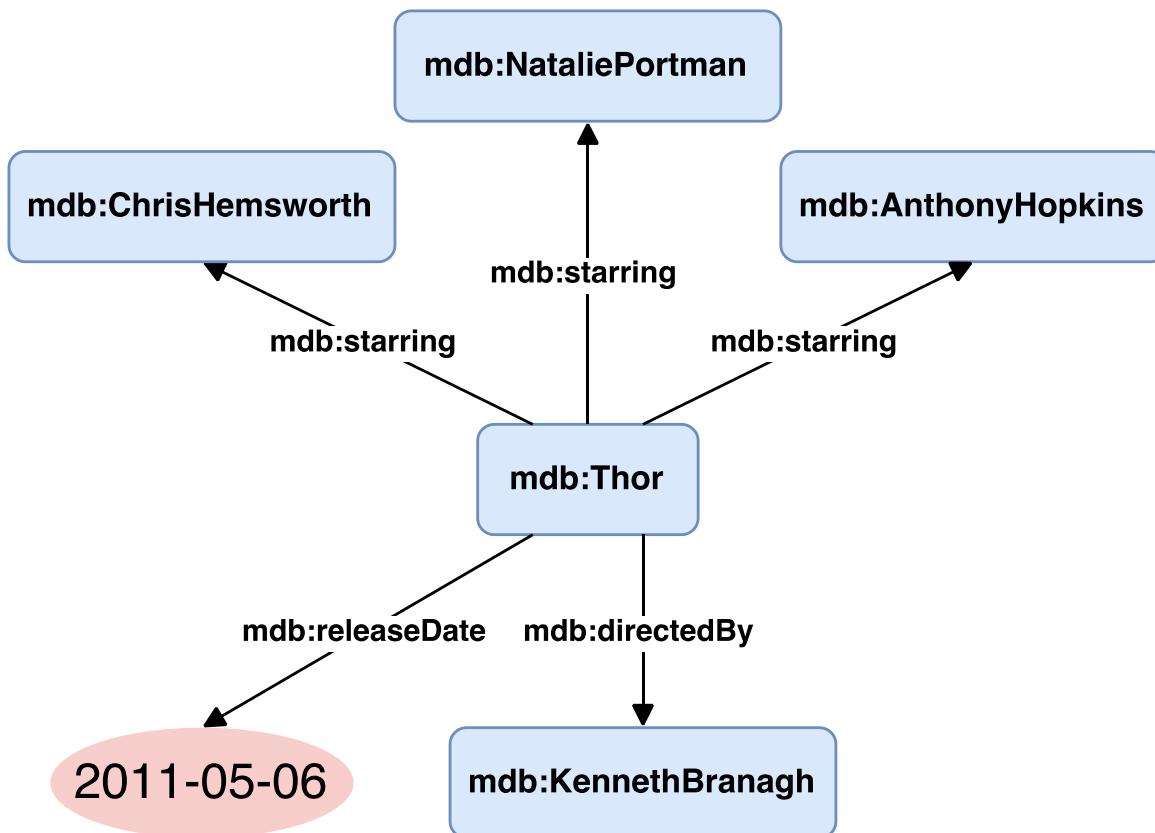
- The abstract structure of RDF is a collection of statements (triples)
- This can be written down in many ways
 - RDF/XML
 - Turtle
 - JSON-LD
 - ...

```
[{"@id": "http://en.wikipedia.org/wiki/Helium", "http://example.org/elements#atomicNumber": [{"@value": 2}], "http://example.org/elements#atomicMass": [{"@value": "4.002602", "@type": "http://www.w3.org/2001/XMLSchema#decimal"}], "http://example.org/elements#specificGravity": [{"@value": "0.0001663"}]}]
```

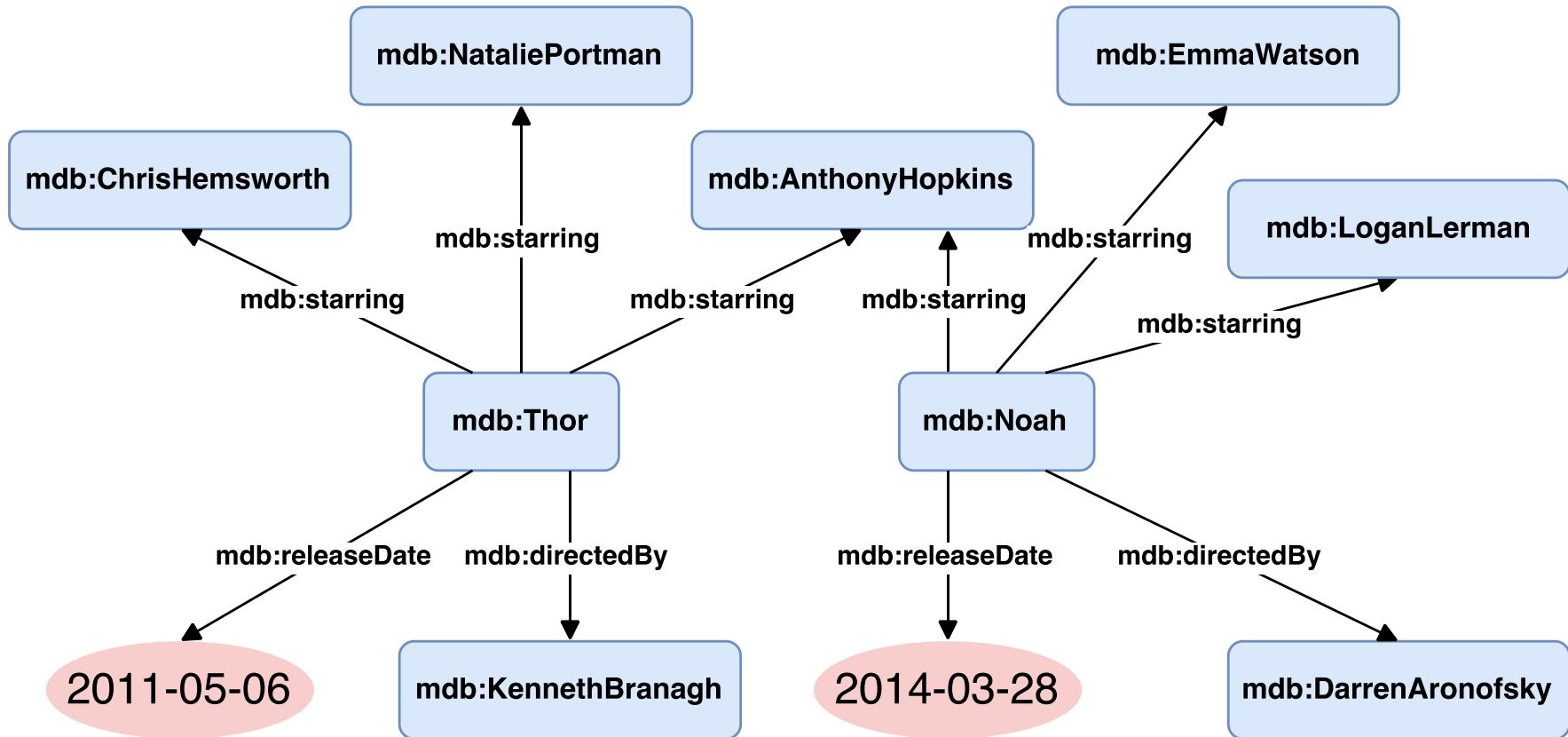
An Example of an RDF Model



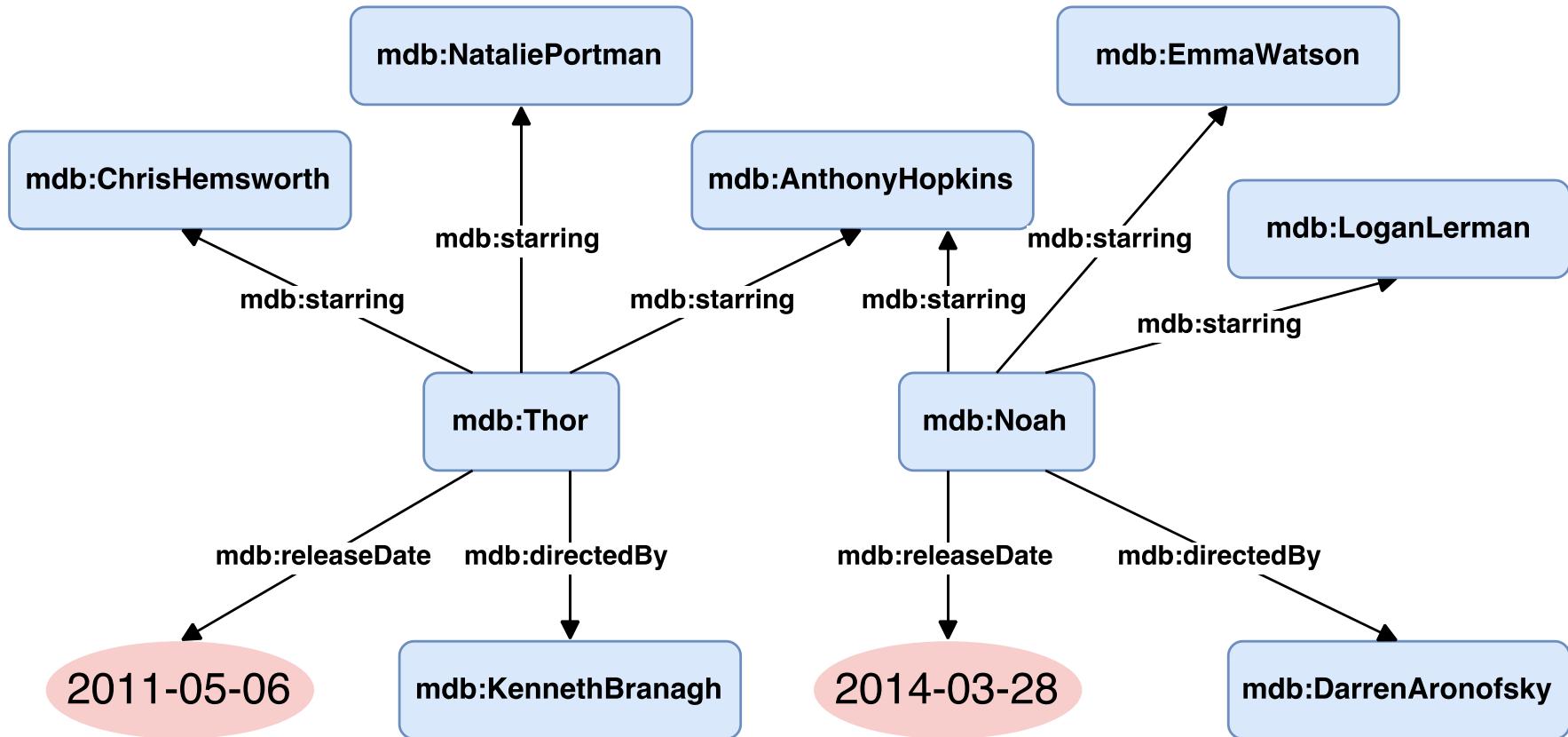
An Example of an RDF Model



An Example of an RDF Model

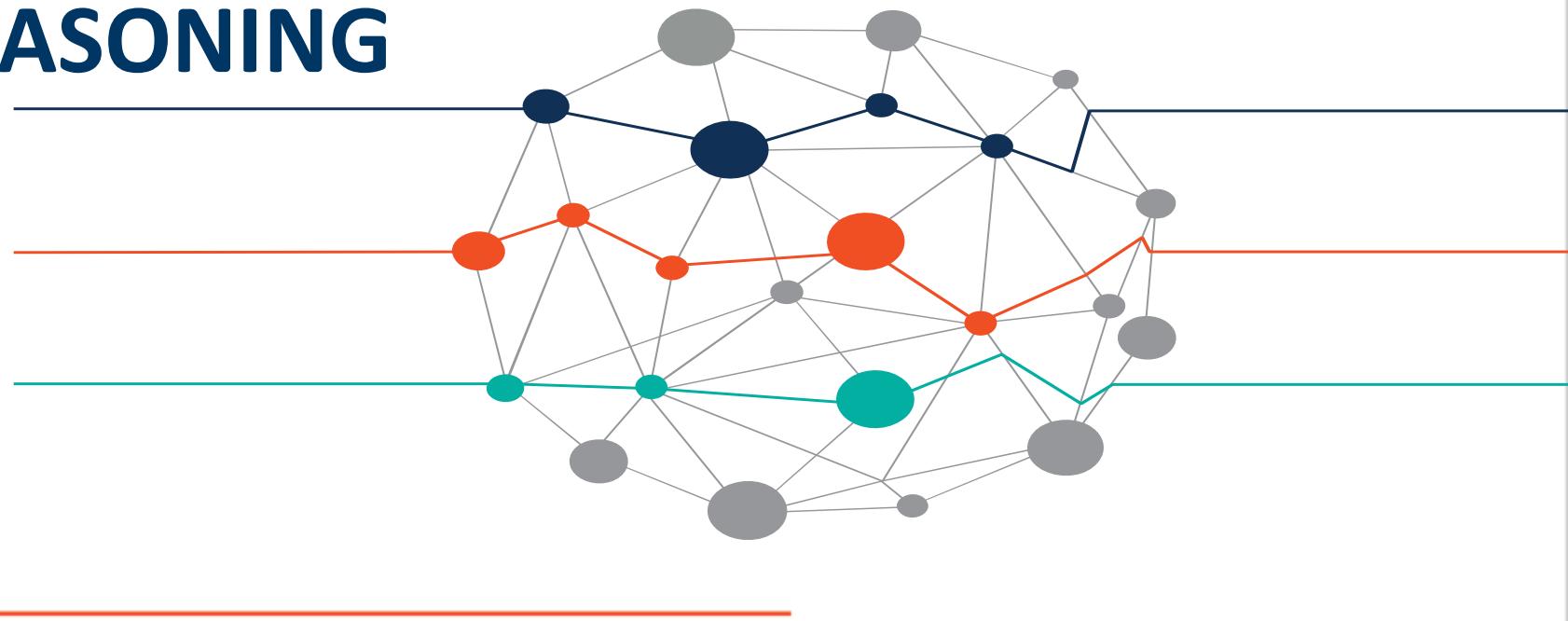


An Example of an RDF Model



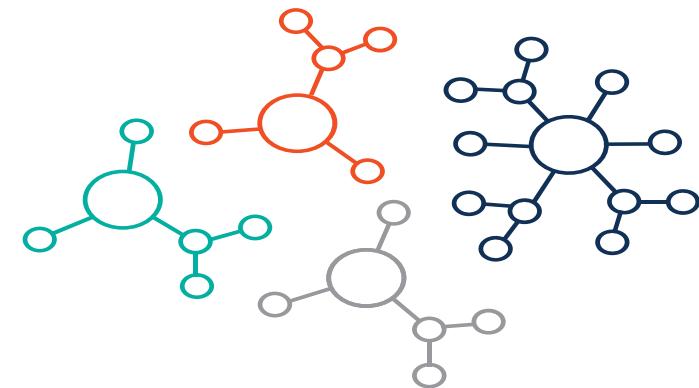
But RDF is more than just a tool for representing information that we already know!

FLEXIBLE SCHEMA & AUTOMATED REASONING



What is RDF Schema?

- RDFS provides means for
 - Defining *Classes* and *Properties*
 - Defining hierarchies (of classes and properties)
 - Defining domain and range of properties
- RDFS differs from XML Schema (XSD)
 - Open World Assumption vs. Closed World Assumption
 - RDFS is about describing resources, not about validation
- Entailment rules (axioms)
 - Infer new triples from existing ones



RDFS entailment rules

1: $s \ p \ o$ (if o is a literal)		$\Rightarrow \exists :n \ \text{rdf:type} \ \text{rdfs:Literal}$
2: $p \ \text{rdfs:domain} \ x$	& $s \ p \ o$	$\Rightarrow s \ \text{rdf:type} \ x$
3: $p \ \text{rdfs:range} \ x$	& $s \ p \ o$	$\Rightarrow o \ \text{rdf:type} \ x$
4a: $s \ p \ o$		$\Rightarrow s \ \text{rdf:type} \ \text{rdfs:Resource}$
4b: $s \ p \ o$		$\Rightarrow o \ \text{rdf:type} \ \text{rdfs:Resource}$
5: $p \ \text{rdfs:subPropertyOf} \ q \ \& \ q \ \text{rdfs:subPropertyOf} \ r$		$\Rightarrow p \ \text{rdfs:subPropertyOf} \ r$
6: $p \ \text{rdf:type} \ \text{rdf:Property}$		$\Rightarrow p \ \text{rdfs:subPropertyOf} \ p$
7: $s \ p \ o$	& $p \ \text{rdfs:subPropertyOf} \ q$	$\Rightarrow s \ q \ o$
8: $s \ \text{rdf:type} \ \text{rdfs:Class}$		$\Rightarrow s \ \text{rdfs:subClassOf} \ \text{rdfs:Resource}$
9: $s \ \text{rdf:type} \ x$	& $x \ \text{rdfs:subClassOf} \ y$	$\Rightarrow s \ \text{rdf:type} \ y$
10: $s \ \text{rdf:type} \ \text{rdfs:Class}$		$\Rightarrow s \ \text{rdfs:subClassOf} \ s$
11: $x \ \text{rdfs:subClassOf} \ y \ \& \ y \ \text{rdfs:subClassOf} \ z$		$\Rightarrow x \ \text{rdfs:subClassOf} \ z$
12: $p \ \text{rdf:type} \ \text{rdfs:ContainerMembershipProperty}$		$\Rightarrow p \ \text{rdfs:subPropertyOf} \ \text{rdfs:member}$
13: $o \ \text{rdf:type} \ \text{rdfs:Datatype}$		$\Rightarrow o \ \text{rdfs:subClassOf} \ \text{rdfs:Literal}$

Applying RDFS To Infer New Triples

```
mdb:directedBy rdfs:domain mdb:Movie ;  
rdfs:range mdb:Director .
```

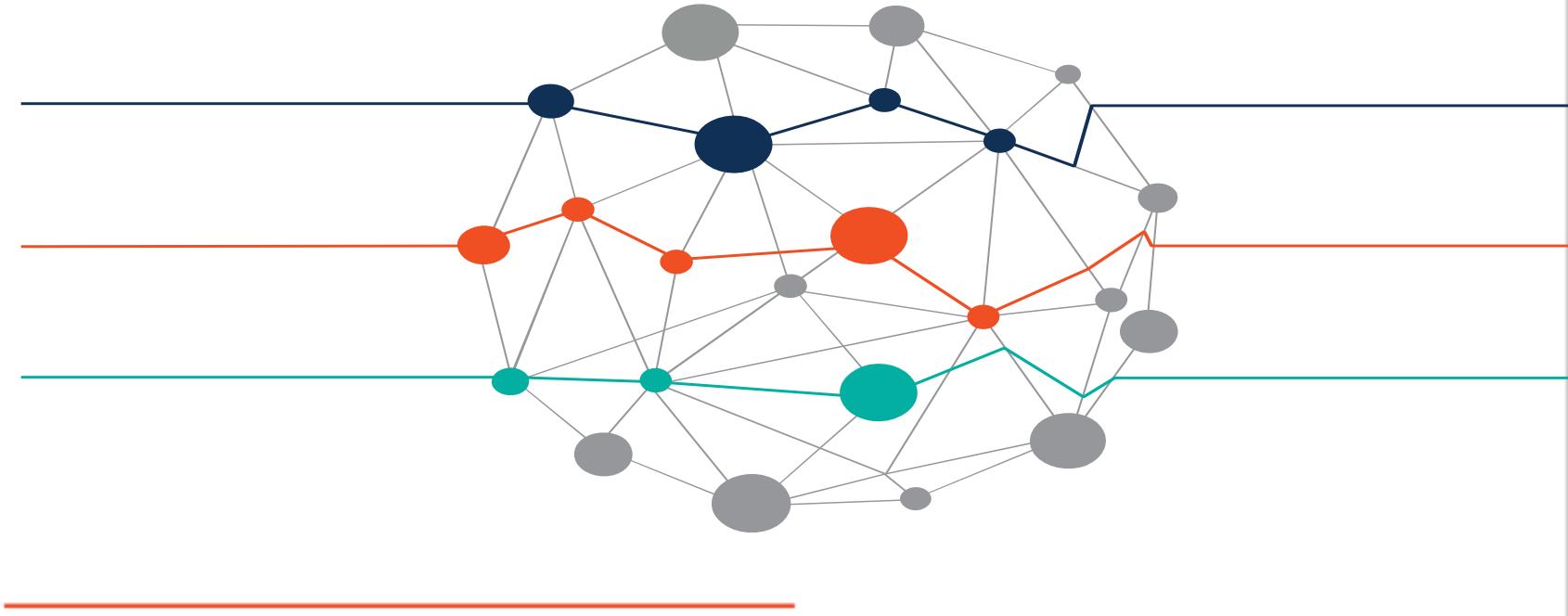
```
mdb:Thor mdb:directedBy mdb:KennethBranagh .
```

```
mdb:Director rdfs:subClassOf mdb:Human .
```

→ mdb:Thor a mdb:Movie .
→ mdb:KennethBranagh a mdb:Director .

→ mdb:KennethBranagh a mdb:Human .

ONTOLOGIES

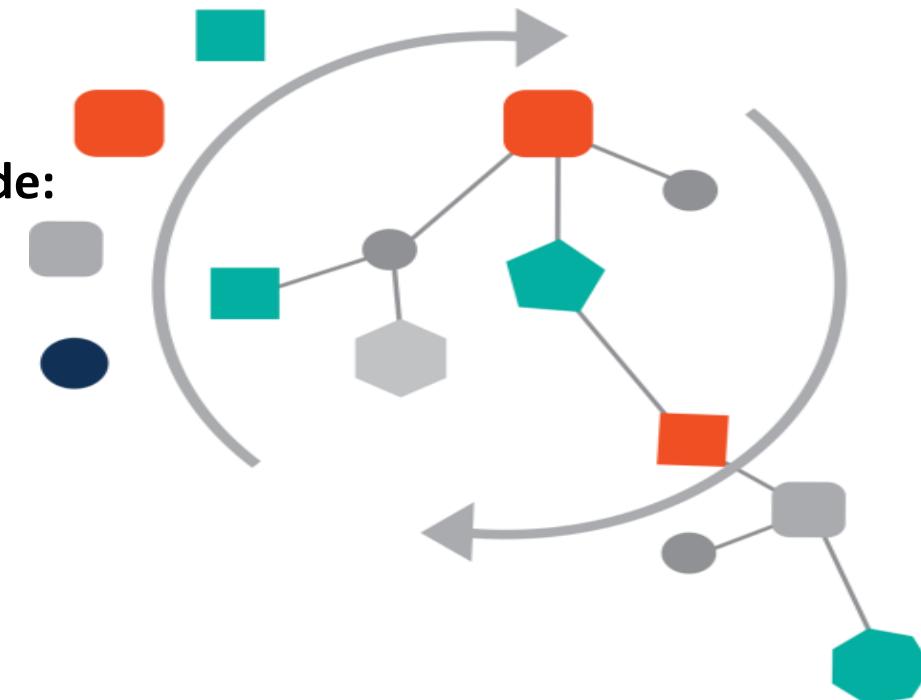


What is in an Ontology?

An ontology is a formal specification that provides sharable and reusable knowledge representation.

Other examples of such formal specifications include:

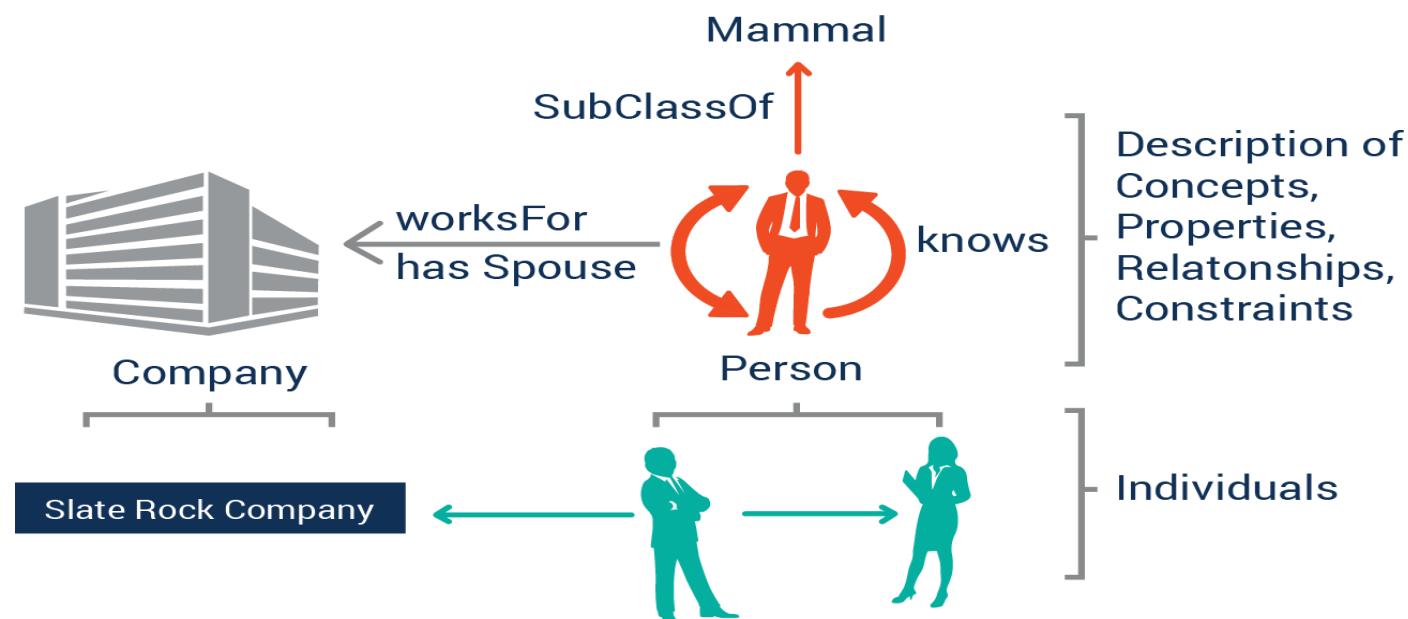
- Taxonomies
 - Vocabularies
 - Thesauri
 - Topic Maps
 - Logical Models



What is in an Ontology?

An ontology specification includes descriptions of

- Concepts and properties in a domain
- Relationships between concepts
- Constraints on how the relationships can be used
- Individuals as members of concepts



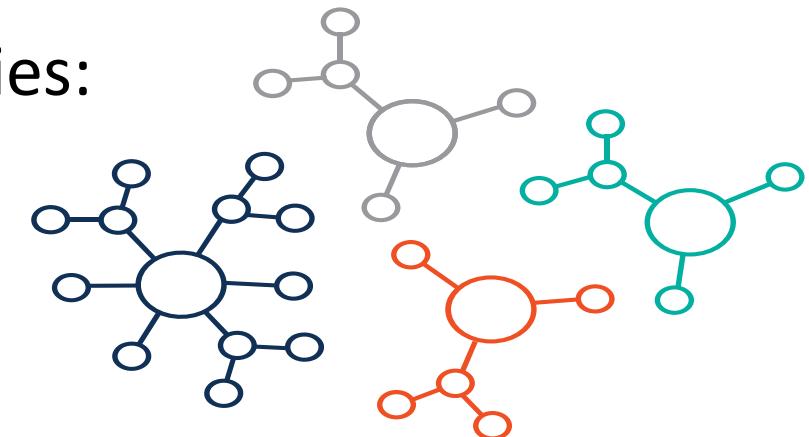
The Benefits of an Ontology

Ontologies provide:

- A common understanding of information
- Explicit domain assumptions

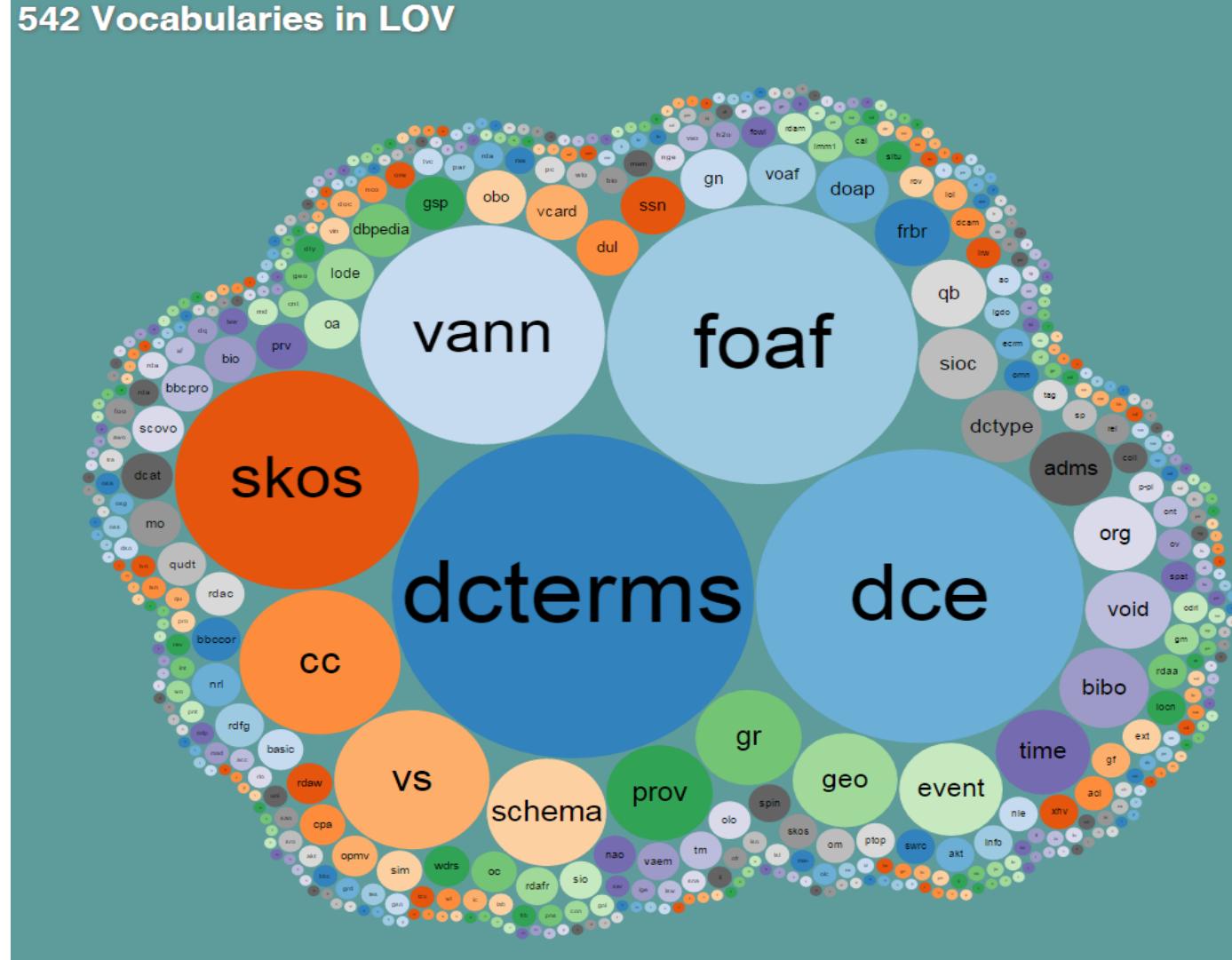
These provisions are valuable because ontologies:

- Support data integration for analytics
- Apply domain knowledge to data
- Support interoperation of applications
- Enable model-driven applications
- Reduce the time and cost of application development
- Improve data quality, i.e., metadata and provenance



Linked Open Vocabularies

542 Vocabularies in LOV



- A portal where you can search for ontologies (vocabularies), classes and properties (terms)
 - View vocab metadata
 - Relations between vocabs
 - Versions, dates, descriptions
 - Most popular vocabs by use in LOD datasets
 - (This uses a limited subset of LOD, so is no fully representative)

DO YOU REALLY KNOW WHAT YOU ARE EATING?

Tomato, mozzarella and basil pizza

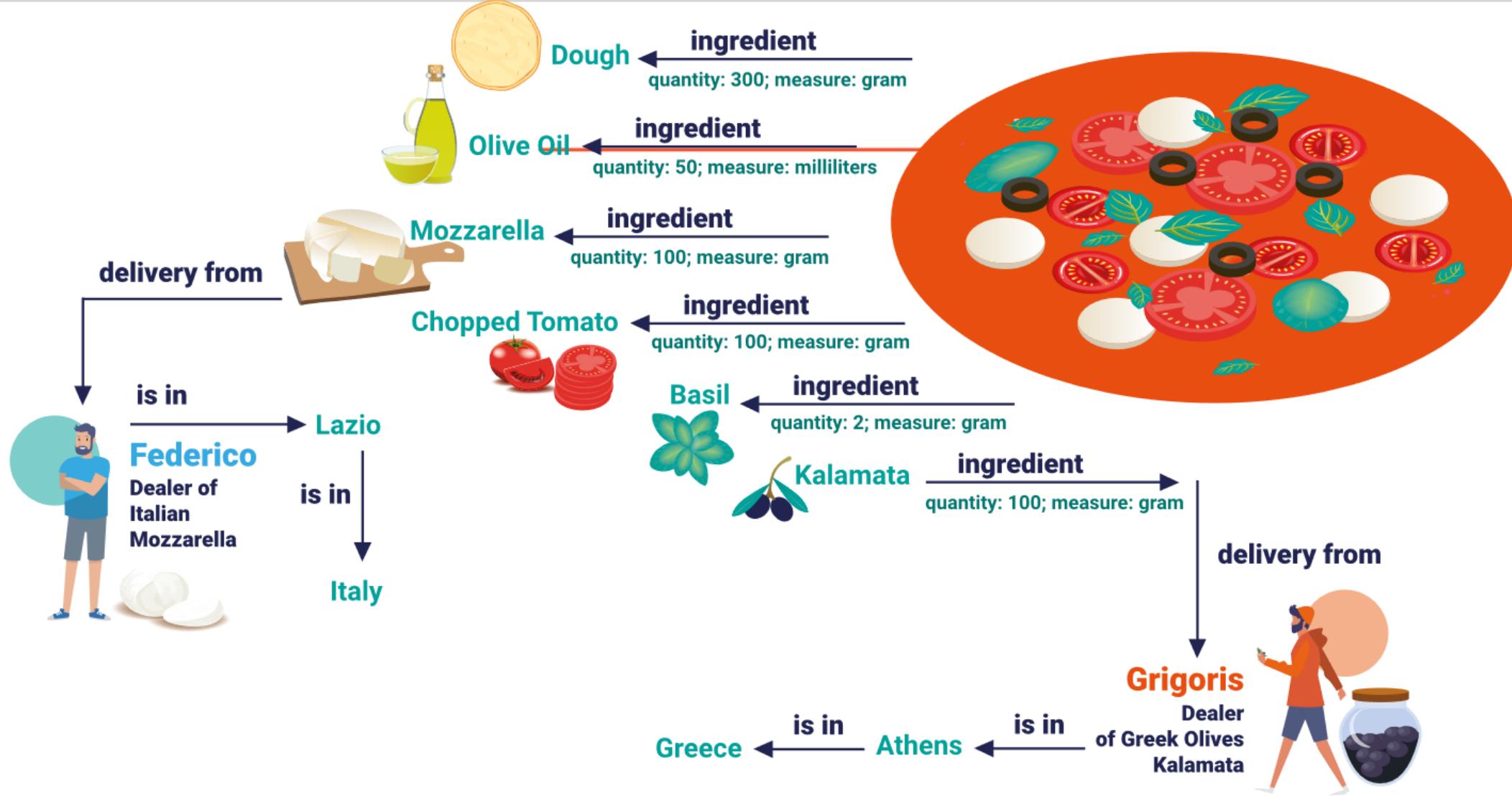
When you eat *Relational Data Pizza* you learn that ...



r_id recipe	r_id ingredients	r_id product	
	quantity	measure	
Tomato, mozzarella and basil pizza	300	gram	Dough
	50	milliliters	Olive Oil
	100	gram	Mozzarella
	100	gram	Chopped Tomato
	2	gram	Basil
	50	gram	Olive

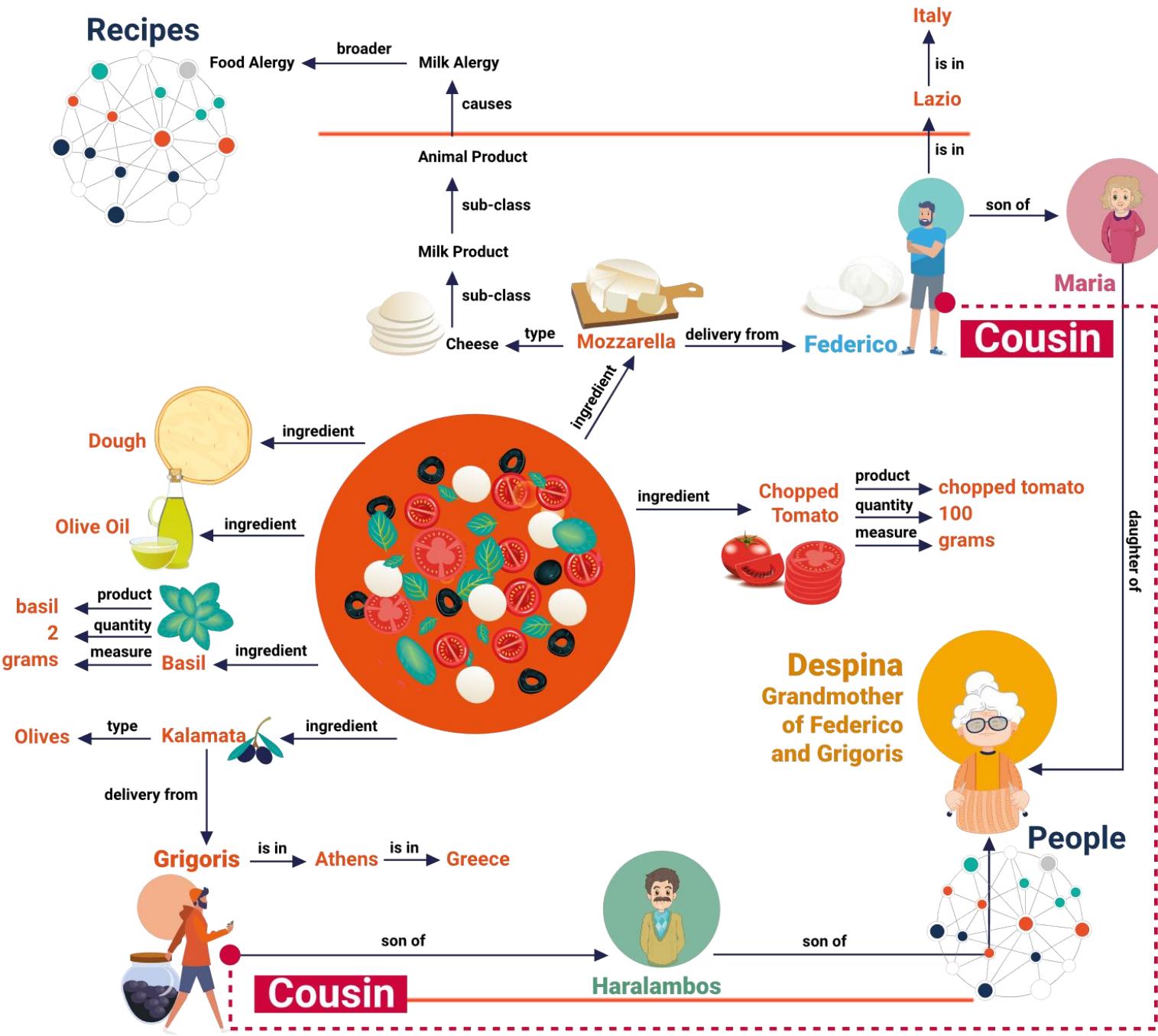
A vertical column of icons representing the ingredients listed in the table. From top to bottom: a slice of pizza, a bottle of olive oil, a block of mozzarella cheese, two ripe tomatoes, a sprig of basil, and a bunch of olives.

When you eat *Property Graph Pizza* you learn that ...



When you eat RDF Triplestore Pizza you learn that ...

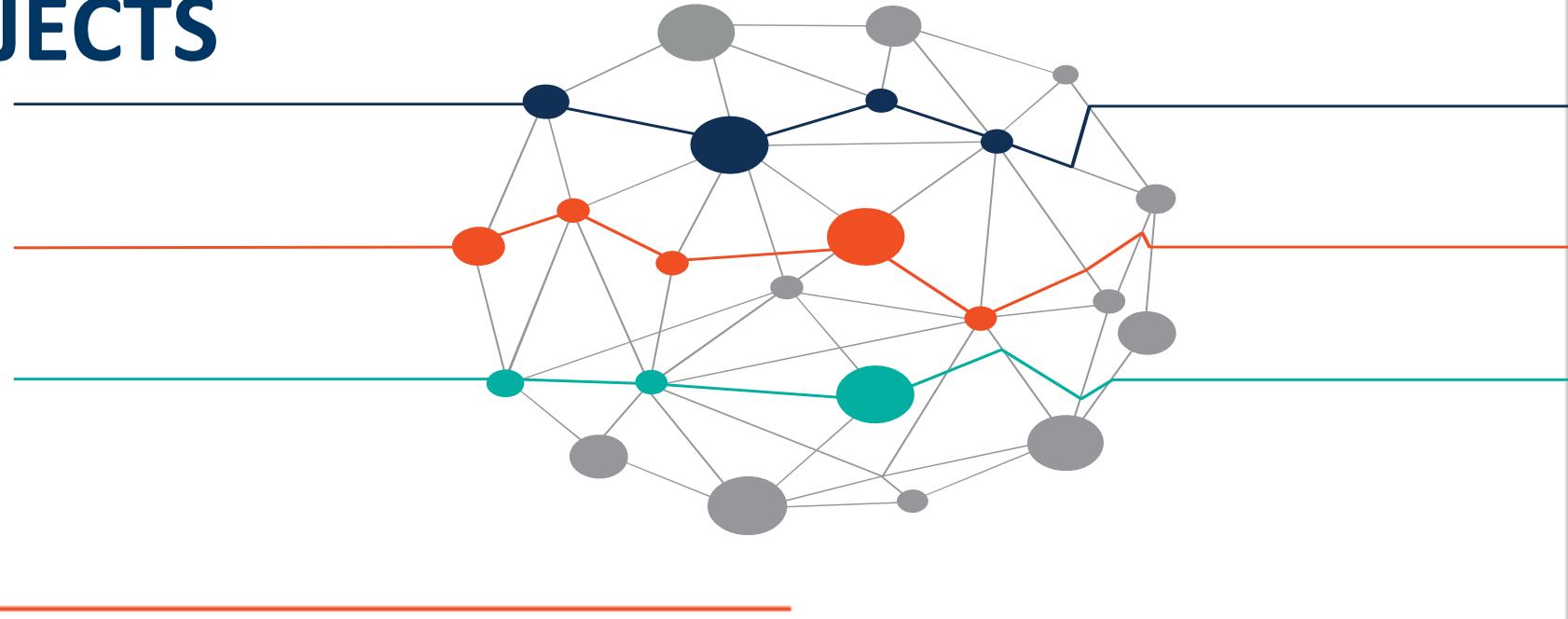
Recipes



Common characteristics of the knowledge graphs

	Data model	Size of the graph	Development stage
Microsoft	The types of entities, relations, and attributes in the graph are defined in an ontology.	~2 billion primary entities, ~55 billion facts	Actively used in products
Google	Strongly typed entities, relations with domain and range inference	1 billion entities, 70 billion assertions	Actively used in products
Facebook	All of the attributes and relations are structured and strongly typed, and optionally indexed to enable efficient retrieval, search, and traversal.	~50 million primary entities, ~500 million assertions	Actively used in products
eBay	Entities and relation, well-structured and strongly typed	Expect around 100 million products, >1 billion triples	Early stages of development and deployment
IBM	Entities and relations with evidence information associated with them.	Various sizes. Proven on scales documents >100 million, relationships >5 billion, entities >100 million	Actively used in products and by clients

REFERENCE PROJECTS



Profile

- Mass media broadcaster founded in 1922
- 23,000 employees and over 5 billion pounds in annual revenue.

Goals

- Create a ***dynamic semantic publishing*** platform that assembled web pages on-the-fly using a variety of data sources
- Deliver highly relevant data to web site visitors with sub-second response

Challenges

- BBC journalists author and publish content which is then statistically rendered. The costs and time to do this were high.
- Diverse content was difficult to navigate, content re-use was not flexible
- User experience needed to be improved with relevant content



The screenshot shows the BBC Sport homepage for the 2010 World Cup. It features a large banner for the tournament. Below it, there's a section for 'England' with recent match results (NED 2-1 BRA, URU 1-1 GHA, ARG 0-4 GER, PAR 0-1 ESP) and a summary for Frank Lampard. The Frank Lampard summary includes his position (Midfielder), squad number (8), date of birth (20 June, 1978), and height (6'0" / 184cm). There are also sections for 'Latest matches', 'Latest stories', and 'Tournament totals' for England, including stats for goals, assists, and cards.

"The goal is to be able to more easily and accurately aggregate content, find it and share it across many sources. From these simple relationships and building blocks you can dynamically build up incredibly rich sites and navigation on any platform."

John O'Donovan
Chief Technical Architect



10 000+ Dynamic Aggregations



BBC SPORT FOOTBALL

Home Football Formula 1 Cricket Rugby U Rugby L Tennis Golf Olympics

All Teams Chelsea Results Fixtures Live Scores All Teams

Chelsea

Suspended Terry can lift trophy

Chelsea captain John Terry can lift the Champions League trophy if they win the final against Bayern Munich.

Last Match Sun 24 April 2012 PREMIER LEAGUE vs Barcelona (Away) Drawn 2 - 2 (Agg 2 - 3)

Next Match Sun 29 April 2012 PREMIER LEAGUE vs Queens Park Rangers (Home) 13:30

Latest Video & Audio

Chelsea will not beat Bayern - Savage The story of Chelsea's triumph Chelsea win horribly to watch - Cahill

Comment & Analysis

Chelsea rediscover resolve to reach Champions League final Pat Nevin and Danny Mills on how Chelsea managed to overcome Barcelona to reach...

FOOTBALL TACTICS

ALISTAIR MAGOWAN - BBC SPORT Chelsea can prey on Barcelona's weaknesses Chelsea midfielder Ramires was rightly lauded for his display in the first leg...

BBC SPORT BLOG EDITOR Ranieri relishes return to England It is eight years since Claudio Ranieri managed in the Premier League - but he...

BBC SPORT BLOG EDITOR

BBC SPORT FOOTBALL

More Headlines

QPR set to act over handshake row Mourinho wants Chelsea final win Lampard 'gutted' for banned Terry Terry apologises for sending-off Chelsea chief warns over stadium Di Matteo 'deserves to stay on' Di Matteo revels in Blues heroics Barcelona 2-2 Chelsea (agg 2-3) Chelsea can defeat Barca - Torres Chelsea have to score - Di Matteo Chelsea to defy odds - Gudjohnsen Spurs need four wins - Redknapp

Latest Football

PREVIOUS RESULTS UPCOMING FIXTURES

SUN 29 APRIL 2012 Chelsea WED 2 MAY 2012 Chelsea SAT 5 MAY 2012 Chelsea TUE 8 MAY 2012 Liverpool

All times UK

League Table

Show me: Prem

Pos	Team
1	Man Utd
2	Man City
3	Arsenal
4	Newcast...
5	Tottenham
6	Chelsea
7	Everton
8	Liverpool
9	Fulham
10	West Br...
11	Sunderla...
12	Swansea
13	Norwich
14	Stoke
15	Aston Vi...
16	QPR
17	Wigan
18	Bolton
19	Blackbur...
20	Wolves

Competitions

Domestic PREMIER LEAGUE European CHAMPIONS LEAGUE

In Pictures

Tuesday's Champions league photos

Around the web

Anton Ferdinand advised to snub Terry hand QPR Soccermet Bayern Munich take long road to final where history awaits | Richard Williams

BBC SPORT FOOTBALL

News Sport Weather iPlayer TV Radio More

BBC SPORT OLYMPICS

THE OLYMPIC BROADCASTER

Home Football Formula 1 Cricket Rugby U Rugby L Tennis Golf Olympics

Countries Team GB Athletes

Team GB

Olympic Stadium test event in May

A test event at the Olympic Stadium is scheduled for early May, allowing athletes an opportunity to compete inside the arena.

Wiggins retains lead in Romandie

Medals demand sacrifice - Dempsey

Latest Video & Audio

A necessary sacrifice - Dempsey Archers do battle for Olympic places GB impress at synchro test event

Athletes from Team GB

Show me: All sports GO

Alistair Brownlee Triathlon Zac Purchase Rowing Dai Greene Athletics

In Pictures

London 2012 from above the Park

Sir Chris Hoy

Biography

Competes in: CYCLING - TRACK

Chris Hoy was knighted after becoming the first Briton for a century to win three gold medals at one Olympics. View Sir Chris Hoy's profile

One to watch

Key Facts

Country Great Britain & N. Ireland

Competes in CYCLING - TRACK

Men's Sprint

Men's Keirin

Men's Team Sprint

Date of birth 23 Mar 1976

Height 1.85m

Weight 92.0kg

Sir Chris on Twitter Sir Chris on Facebook

Medals

Beijing 2008

Medal	Count
Gold	3
Silver	0
Bronze	0

All Time

Medal	Count
Gold	4
Silver	1
Bronze	0

Brailsford ponders sprint options

British Cycling performance director Dave Brailsford refuses to reveal his sprint selection strategy for Sir Chris Hoy and Jason Kenny.

9 Apr 12

Hoy's mum can't watch kierin win

MEN'S KEIRIN

8 Apr 12

Sir Chris Hoy's mother covers her eyes for the closing seconds of his keirin race at the World Track Cycling in Melbourne. (UK users only)

Year ban hurt me - champion Bauge

MEN'S SPRINT

8 Apr 12

Gregory Bauge, who beat Jason Kenny to track cycling's sprint world title in Melbourne, says the fallout from his year-long ban still 'hurts'.

Bemused Hoy admits lack of desire

MEN'S SPRINT

7 Apr 12

Sir Chris Hoy tells BBC Sport he "wasn't up for it" as much as earlier in the year after finishing behind Jason Kenny in the World Track Cycling sprint in Melbourne.

Olympics Countdown

92 days to go

Olympics starts: Friday, July 27

More Athletes in Cycling - Track

Bradley Wiggins Cycling - Track

Ed Clancy Cycling - Track

Geraint Thomas Cycling - Track

All Athletes from Team GB

Team GB

OUR GREATEST TEAM 100 ATHLETES 40 MILLION SPONSORS TEAM GB

Learn more about the athletes representing Great Britain and Northern Ireland in the 2012 Olympic Games, and catch up on the latest news and gossip surrounding Team GB

Meet Team GB

Olympics Coverage

Radio

Fri 27 April 2012 16:30 Olympic Dreams BBC Radio Berkshire

Mon 30 April 2012 16:00 Gail Emms BBC Three Counties Radio

Tue 1 May 2012 09:00 Children of the Olympic Bid

Profile

- Top 3 business media
- Focused both on B2C publishing and B2B services

Goals

- Create a horizontal platform for both data and content based on semantics and serve all functionality through it

Challenges

- Critical part of the entire workflow
- Multiple development projects in parallel with up to 2 months time between inception and go live
- GraphDB used not only for data, but for content storage as well

WORLD

Sep 23, 2014
Manuel Valls demands end to Air France strike as economy stalls



PM's call for an end to the pilots' strike that has crippled the national carrier comes as figures suggest a contraction in French business activity

Sep 23, 2014
EU antitrust chief says Google case may be bigger than Microsoft



The company that was once the icon of Japan's postwar success has now come to

COMPANIES

Sep 23, 2014
Austria's Raiffeisen Bank hit by Ukraine conflict



Austrian bank's shares fall as it increases provisions for bad loans by 15%-30%, a month before the European Central Bank publishes the results of its stress tests

Sep 19, 2014
Kazuo Hirai struggles to reignite Sony's spark



The positive market reaction may be premature. Democracy has plenty more hurdles for markets in the months and years ahead

MARKETS

Sep 23, 2014
Stocks slide as eurozone worries build

FTSE Eurofirst 300 falls as shares in companies once considered takeover targets of US groups seeking tax inversion deals come under pressure

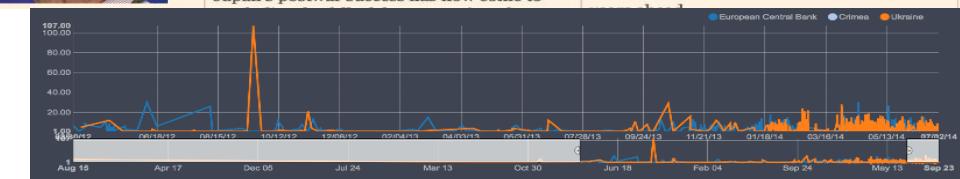
Sep 19, 2014
Over \$1bn pulled from UK equity funds

European funds experienced their strongest outflows in more than three years in the week before the Scotland poll

Sep 19, 2014
Market boost from Scots 'no' could be shortlived



The positive market reaction may be premature. Democracy has plenty more hurdles for markets in the months and years ahead



- Horizontal platform with focus on organizations, people, GPEs and relations between them
- Automatic extraction of all these concepts and relationships
- Separate stream of work for a **user behavior based recommendation** of relevant content and data across the entire media

Profile

- Established in 1961; help gvmt managers; non-profit
- Consulting in logistics, financial, infrastructure & information management

Goals

- Unlock large collections of complex documents
- Improve analyst productivity
- Create an application they can sell to US Federal agencies

Challenges

- Analysts taking hours to find, download and search documents, using inaccurate keyword searches
- Needed a knowledge base to search quickly and guide the analysts – highly relevant searches



The screenshot shows a web-based application interface for managing large document collections. On the left, there's a sidebar with a 'Search' button, a 'Browse' button, and a user email 'gcreedon@lmi.org'. Below these are buttons for 'CLEAR', 'maintenance', and 'operations'. The main area has tabs for 'Related Concepts', 'Concepts Also Searched', '10 results per page', 'Page 1 of 1', 'Prev', and 'Next'. A search bar contains the query 'DFARS / Part 225 - Foreign... repair'. Below the search bar, a result for 'DFARS / Part 225 - Foreign...' is shown, with the word 'repair' highlighted in green. The result text discusses the use of clause 252.246-7004 for safety of facilities, infrastructure, and equipment for military operations. Another result for 'DFARS / Part 246 - Qualit...' is also visible. The bottom of the interface includes links for 'Privacy Policy', 'Feedback', and 'Powered by Ontotext'.

- Extracts knowledge from collection of documents
- Uses GraphDB to intuitively search and filter
- Knowledge base used to suggest searches
- Hyper speed performance
- Huge savings in analyst time
- Accurate results



Profile

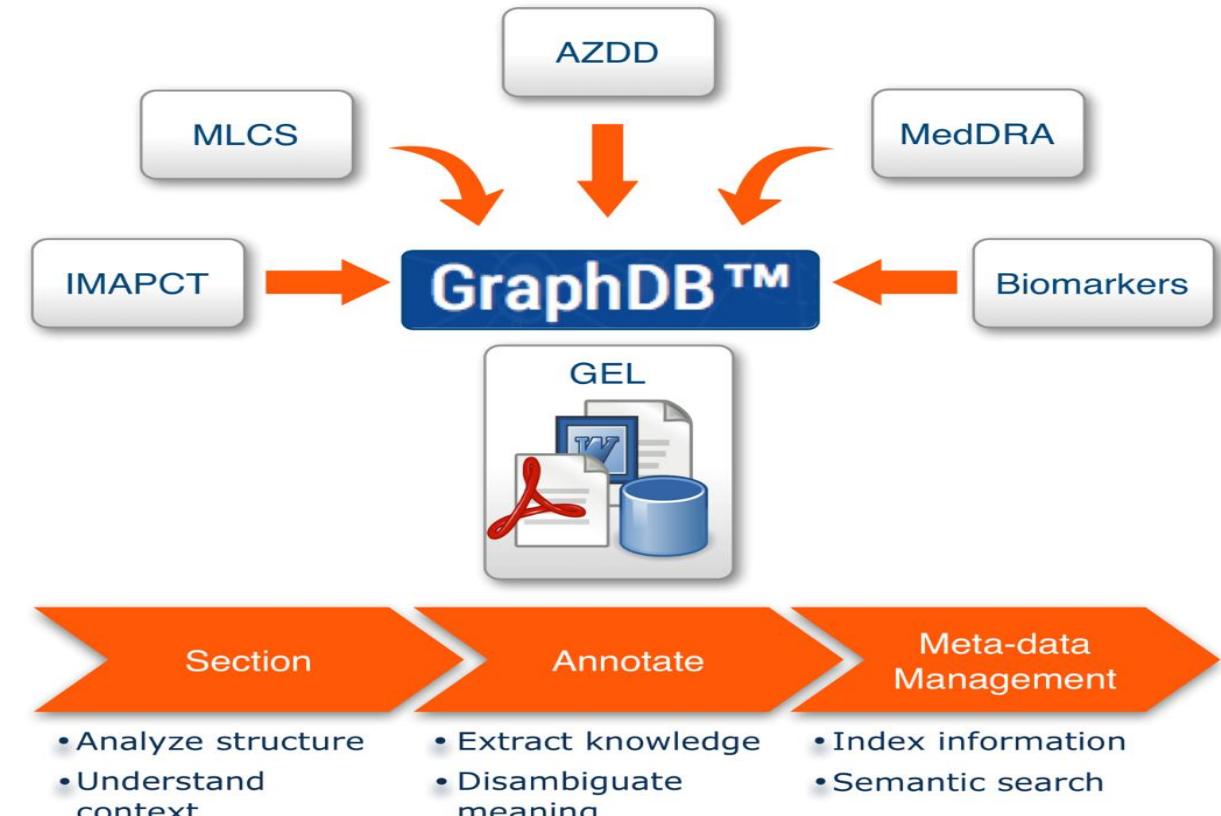
- Global, Bio-pharma company
- \$28 billion in sales in 2012
- \$4 billion in R&D across three continents

Goals

- Efficient design of new clinical studies
- Quick access to all of the data
- Improved evidence based decision-making
- Strengthen the knowledge feedback loop
- Enable predictive science

Challenges

- Over 7,000 studies and 23,000 documents are difficult to obtain
- Searches returning 1,000 – 10,000 results
- Document repositories not designed for reuse
- Tedious process to arrive at evidence based decisions



AstraZeneca 

Profile

- Euromoney Institutional Investor PLC; products focused on asset management, capital markets and commodities

Goals

- Create a horizontal platform to serve 100 different publications
- create a new publishing and information platform which would include the latest authoring, storing, and display technologies including, **semantic annotation, search and a triple store repository**

Challenges

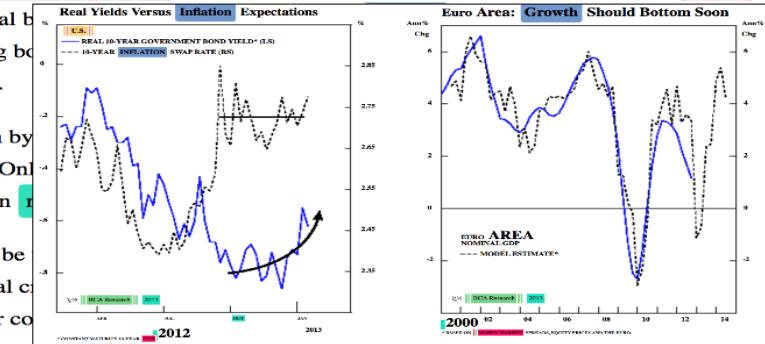
- Different domains covered
- Sophisticated content analytics incl. Relation, template and scenario extraction

Fourth, recent bond market action is bullish for stocks.

has been driven solely by a backup in real bond yields. In theory, either rising stock prices or rising bond yields. The behavior of the bond market is critical.

If a selloff in bonds is primarily driven by inflation concerns, because equities could react negatively. Only time will tell. Fortunately, this has been the case in recent months.

Finally, international developments will be critical. The world has suffered repeated recessions and financial crises. The political establishments within the major countries have been unable to come up with effective solutions.



Already, the meltdown in sovereign spreads has eased the financial pain on the European periphery - particularly in Spain and Italy. Our model shows a pickup in nominal GDP in 2013 (Chart 6). In the meantime, the Chinese economy clearly reached a bottom late last year and is on an accelerating path. Japan is also on the cusp of a major reflationary drive and Japanese stocks are rising.

- Analytics of reports and news of various domains
- Extraction of sophisticated macro economic views on markets and market conditions; trades, condition and trade horizons, assets, asset allocations, etc.
- Multi-faceted search
- Completely new content and data infrastructure



- Let us see another demonstration powered by semantic technologies
- RANK

<http://rank.ontotext.com>

- Rank companies in a given industry according to their mentions in news
- Discover popularity by company subsidiaries
- Find similarities between companies
- Explain the similarities between companies

Company Profile

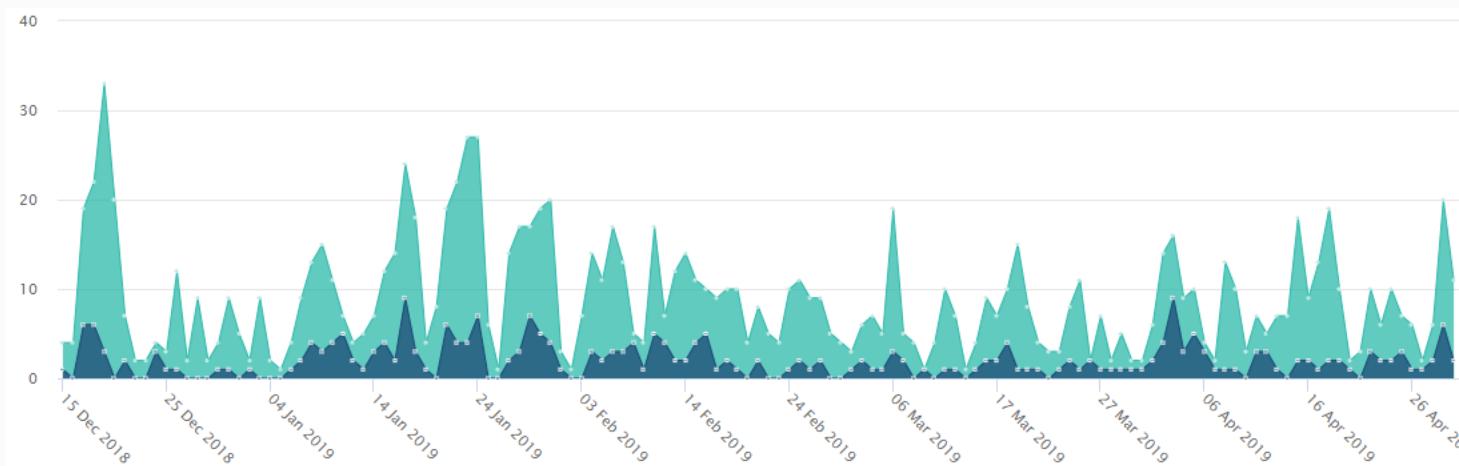
Microsoft



Microsoft Corporation /'mɑɪkroʊsɒft, -rəʊ-, -sɔ:f/t/ (commonly referred to as Microsoft or MS) is an American multinational technology company headquartered in Redmond, Washington, that develops, manufactures, licenses, supports and sells computer software, consumer electronics and personal computer... [Show more](#)

[Statistical Profile](#)[Profile in NOW](#)[Explore in FactForge](#)[Wikipedia](#)

Electronics
Consumer electronics
Computer hardware
Business software
Mobile device
Digital distribution
Cloud computing

[POPULARITY CHART](#)For: [Past Year](#) ▾[SIMILAR COMPANIES](#)

Companies

[Apple Inc.](#)

Score

12.41

[Explain](#)[Facebook](#)

8.86

[Explain](#)[Intel](#)

8.45

[Explain](#)[Google](#)

7.13

[Explain](#)[Dell](#)

6.05

[Explain](#)[IBM](#)

5.96

[Explain](#)[Oracle Corporation](#)

5.78

[Explain](#)[AOL](#)

5.10

[Explain](#)

- Let us see another demonstration powered by semantic technologies
- FactForge

<http://factforge.net/>

Open Data and News about People, Organizations and Locations

FactForge

Open Data and News about People, Organizations and Locations

[Hide info](#)

People and Organizations Data

FactForge is a hub for open data and news about people, organizations and locations.

The sample queries below demonstrate:

- Media monitoring
- Tracing company control
- Industry trends and statistics

The Data and the News

FactForge offers above 1 billion facts. It includes:

- Popular LOD datasets: DBpedia, Geonames, WorldFacts and Wordnet
- People and organizations data: Panama Papers and GLEI
- Live stream of news metadata, linking the articles to entities and concepts: about 2000 news per day tagged by [News](#)

Access and Services

Data is available as RDF graph stored in GraphDB. Applications can access the repository via SPARQL end-point.

People can explore and query the data with GraphDB's Workbench. One can search entities by name, explore the graph, the class hierarchy and run SPARQL queries.

Thank you!

