

Knowledge Graphs

Linking Data to Knowledge

Michelin Research Center, Clermont Ferrand – May 2019



Thomas N. Burg

poolparty.biz

thomas.burg@semantic-web.com

Business Solution Architect
Semantic Web Company

ViaMichelin: Michelin route planner and maps, restaurants, traffic ...

<https://www.viamichelin.com/>

World maps, city maps, driving directions, Michelin-starred restaurants, hotel booking, traffic news and weather forecast with ViaMichelin.

Route planner

Michelin Route planner – Europe and worldwide driving ...

[More results from viamichelin.com »](#)

Maps

The Michelin maps are available online on ViaMichelin. Search ...

Michelin (@Michelin) · Twitter

<https://twitter.com/Michelin>

Launched in 2013, the Belt and Road Initiative (BRI) aims to alter the socio-economic landscape along the Silk Road linking Asia and Europe. N. Beaumont during his speech this morning at @ITF_Forum . #MichelinTakesAction #SustainableTransport pic.twitter.com/uQTtLAj...

20 hours ago

[View on Twitter](#)

The official impulsion to the #ZeroEmissionValley project was given yesterday at @EVS32_ with the creation of #HYmpulsion! ☺ It will set up and exploit the #electrolyzers and charging stations. @auvergnerhalpes @Michelin @ENGIEgroup @calssedesdepots @CreditAgricole pic.twitter.com/qHLYQBr...

2 days ago

What is #ZeroEmissionValley? A private/public project with @auvergnerhalpes @ENGIEgroup @Michelin to equip the region by the end of 2021 with 20 charging stations, 15 electrolyzers, 1000 light-duty vehicles for professional use (private and public sectors). @EVS32_ pic.twitter.com/JLhXGVI...

2 days ago

Itinéraires ViaMichelin : calcul d'itinéraire fiable et précis

<https://www.viamichelin.fr/web/Itinéraires> [Translate this page](#)

Vos vacances avec Michelin Voyage Sites touristiques étoilés, circuits, reportages, hôtels, restaurants et activités, tout pour voyager sereinement ! Accueil ...

Michelin

Entreprise



michelin.fr

Michelin est un fabricant de pneumatiques français dont le siège social est à Clermont-Ferrand, en France. Ses produits sont destinés à tous types de véhicules : automobiles, camions, deux roues, avions, engins de génie civil et agricoles. [Wikipédia](#)

PDG : [Jean-Dominique Senard](#) (11 mai 2012–)

Siège social : [Clermont-Ferrand](#)

Cours de l'action : [ML \(EPA\)](#) €103.65 -2.20 (-2.08%)

May 23, 09:40 GMT+2 - [Clause de non-responsabilité](#)

Filiales : [ViaMichelin](#), [Bookatable](#), [Camso](#), [Tigar Pirot](#), [Blackcircles](#), PLUS

Fondateurs : [André Michelin](#), [Édouard Michelin](#)

Profiles



Instagram



Facebook



LinkedIn



YouTube



Twitter

Recherches associées

[Voir d'autres éléments \(plus de 10\)](#)



Bridgestone



Pirelli



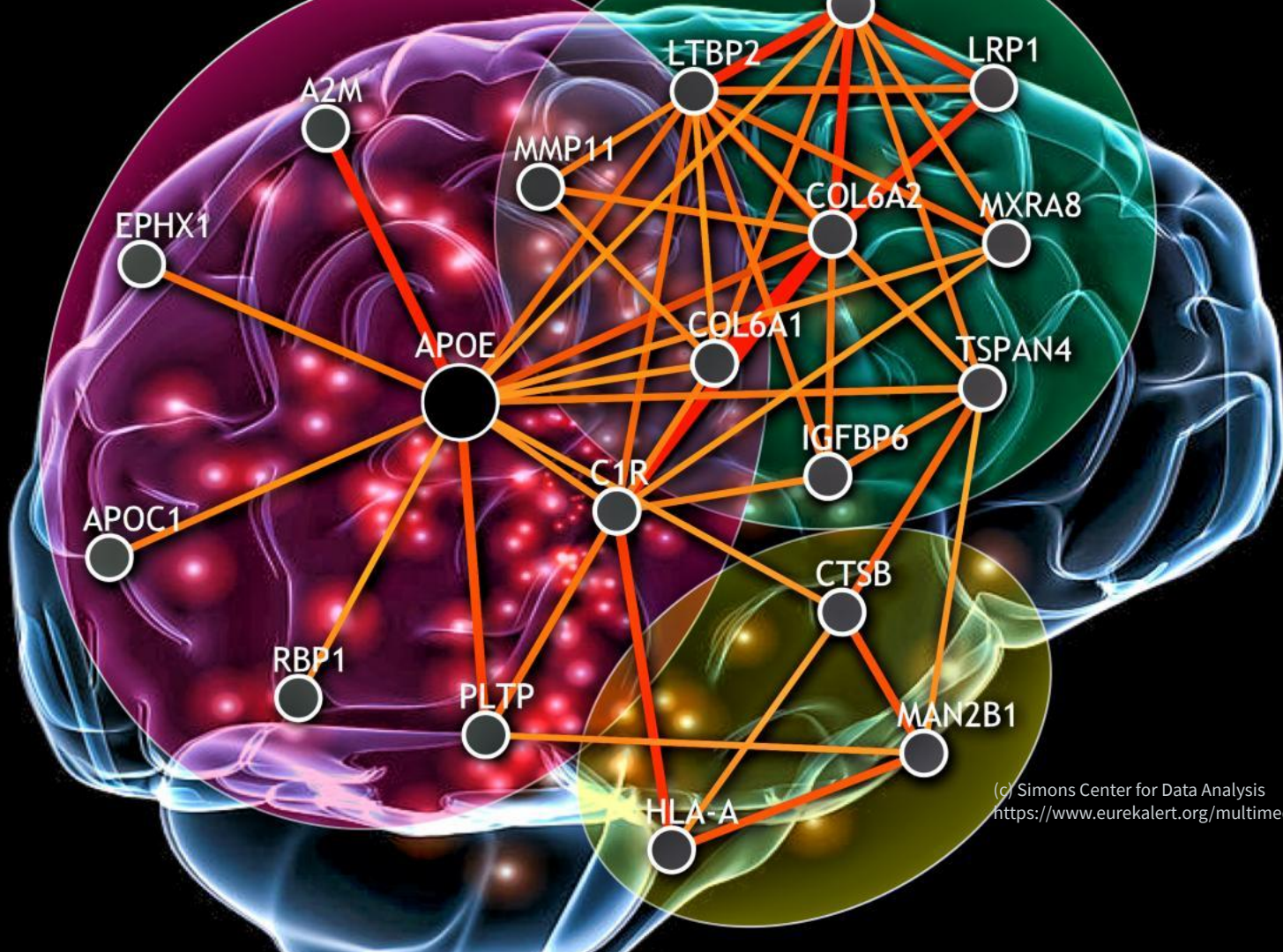
Goodyear
Tire &



Continental
AG



Dunlop

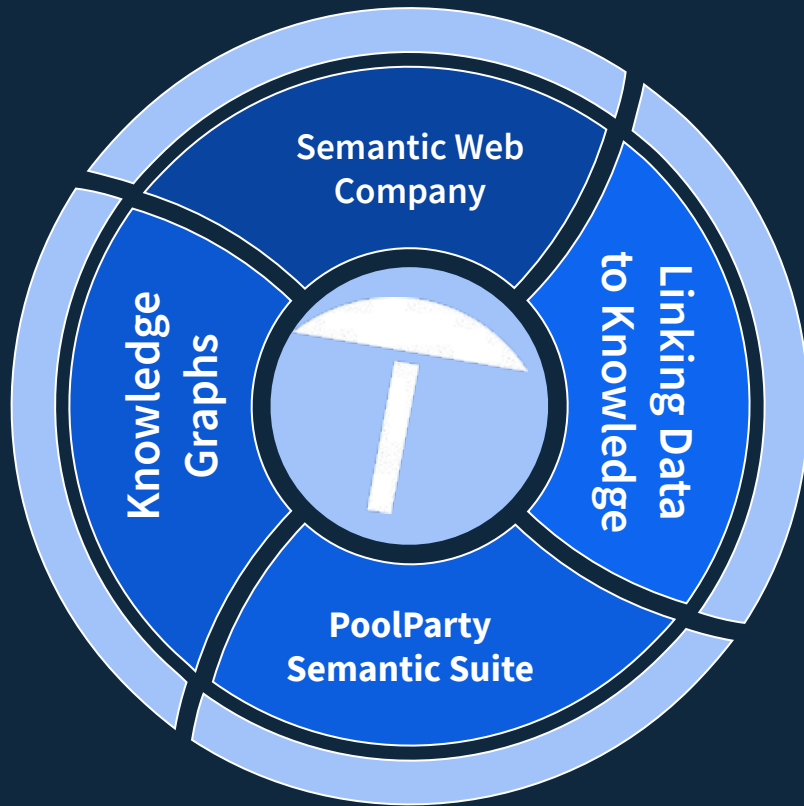


(c) Simons Center for Data Analysis
<https://www.eurekaalert.org/multimedia/pub/90698.php>

Entity-Centricity over Document-Centricity



Roadmap for today



Introducing Semantic Web Company



Founded in **2004**

Based in Vienna

Privately held

50+ **FTE**

Software Engineers &
Consultants for **NLP**,
Semantics and **Machine**
learning

Developer & Vendor of
PoolParty Semantic Suite



Participating in
projects with
€2.5 million
funding for **R&D**



~35%
revenue growth/year



SWC named to
KMWorld's
**'100 Companies
That Matter in
Knowledge
Management'** from
2016 until 2019



ISO 27001:2013
certified

Fact sheet: PoolParty Semantic Suite



Most complete and secure
Semantic Middleware on
the Global Market



Semantic AI:

Fusing Graphs, NLP,
and Machine Learning

ISO 27001:2013 certified
W3C standards compliant

First release in **2009**

Current version **7.0**

On-premise or
cloud-based



Over **200** installations
world-wide



Named as Sample
Vendor in
**Gartner's Hype
Cycle for AI 2018**



Named as
Representative
Vendor in **Gartner's
Market Guide for
Hosted AI Services
2018**



KMWorld listed
PoolParty as
**Trend-Setting
Product** 2015, 2016,
2017, and 2018

“PoolParty brings the power of Google into the enterprise environment through Knowledge Graphs.”

Knowledge Architect at a Top 3 Oil & Gas company

Knowledge Graphs



Generic Use Cases for Knowledge Graphs

- ▶ **Loosely connected data**
- ▶ **Too simplistic, disconnected data models**
- ▶ **Data models don't keep pace with market dynamics**
- ▶ **Too abstract data models**



Add Context to Data



Make Decisions with Confidence



Strengthen AI Strategy



Gain Augmented Analytics



Connect Data Silos



Scale Data Governance

Solutions based on PoolParty



Process Automation

- ▶ Enhanced Machine Learning
- ▶ Text Mining & NLP
- ▶ Document Classification
- ▶ Document & Text Validation



Customer Experience

- ▶ Recommender Systems
- ▶ SEO
- ▶ Smart Helpdesk Solutions
- ▶ Chatbots and Q&A engines



Knowledge Management

- ▶ Semantic Search
- ▶ Personalization
- ▶ Knowledge Discovery Portals
- ▶ Skills Management



Information Management

- ▶ Semantic Content Management
- ▶ Metadata Management
- ▶ Masterdata Management



Knowledge Engineering

- ▶ Taxonomy Management
- ▶ Ontology Management
- ▶ Knowledge Graph Management
- ▶ Data Visualization



Agile Data Integration

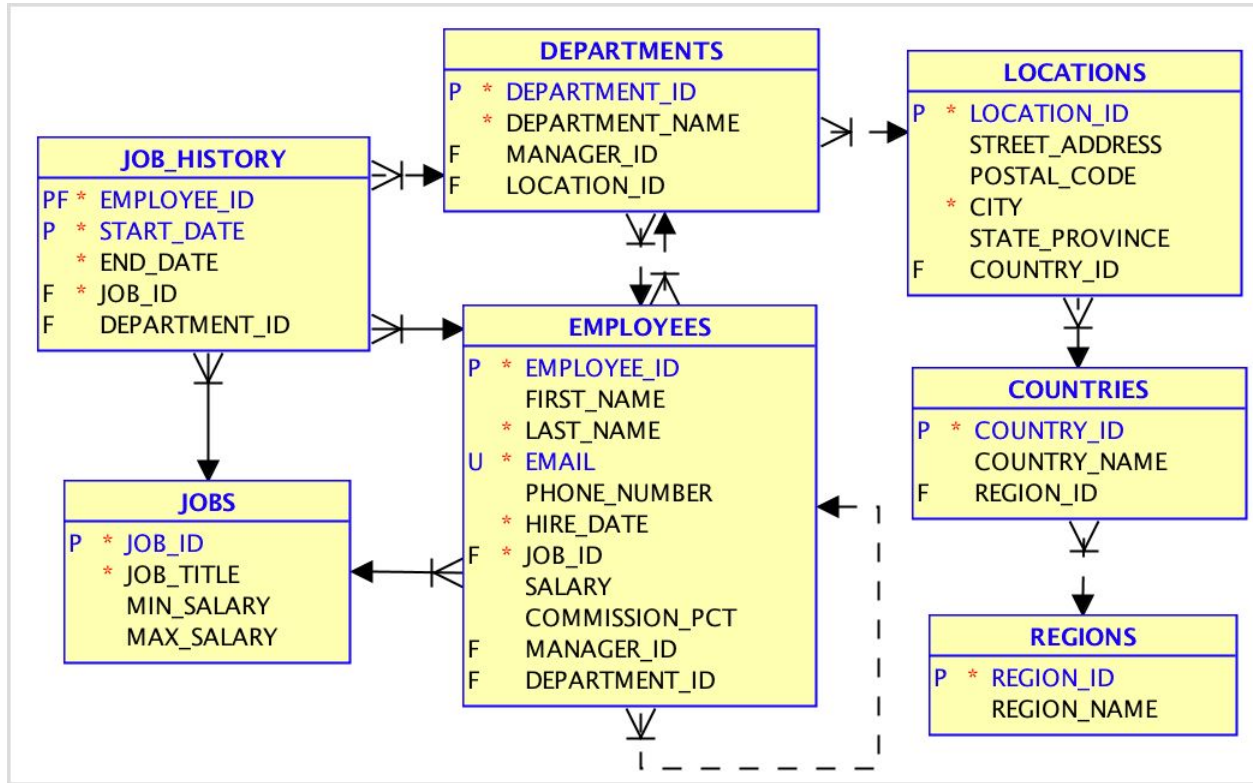
- ▶ Linked Data
- ▶ Integrating heterogeneous data
- ▶ Entity Linking

Graphs are a 2019 TREND and “*Graph DBMSs will grow at **100 percent annually** through 2022*”...

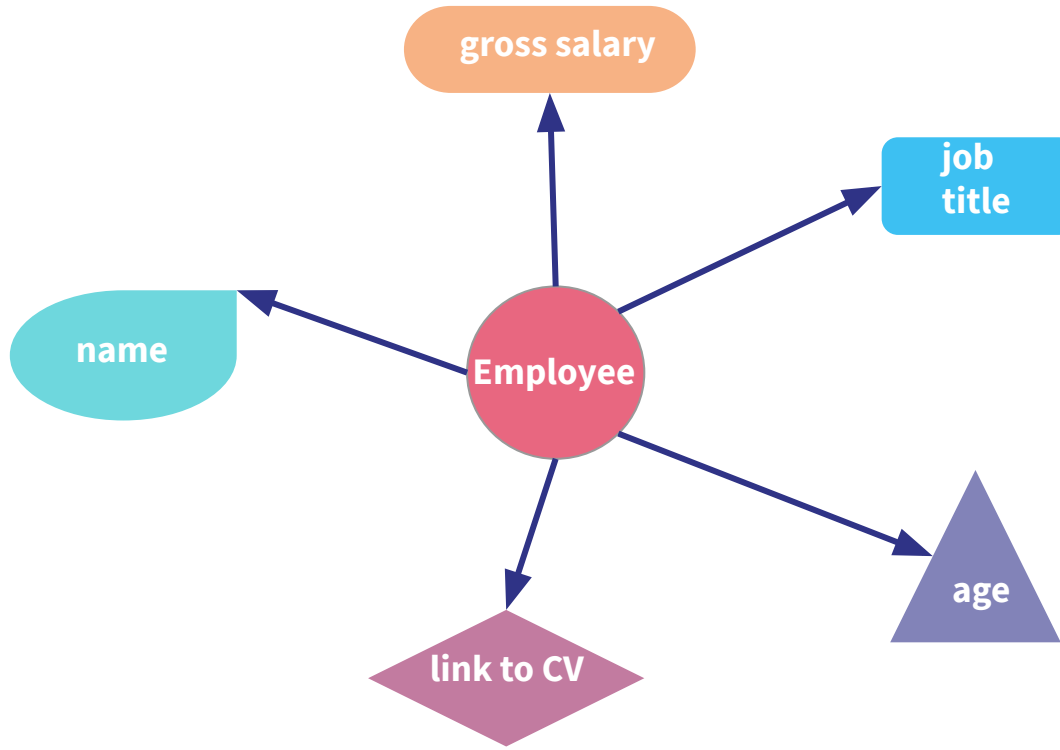
...because we “*need to ask **complex** questions across complex data*”

Source: [Gartner.com](https://www.gartner.com)

HR Analytics - relational data model



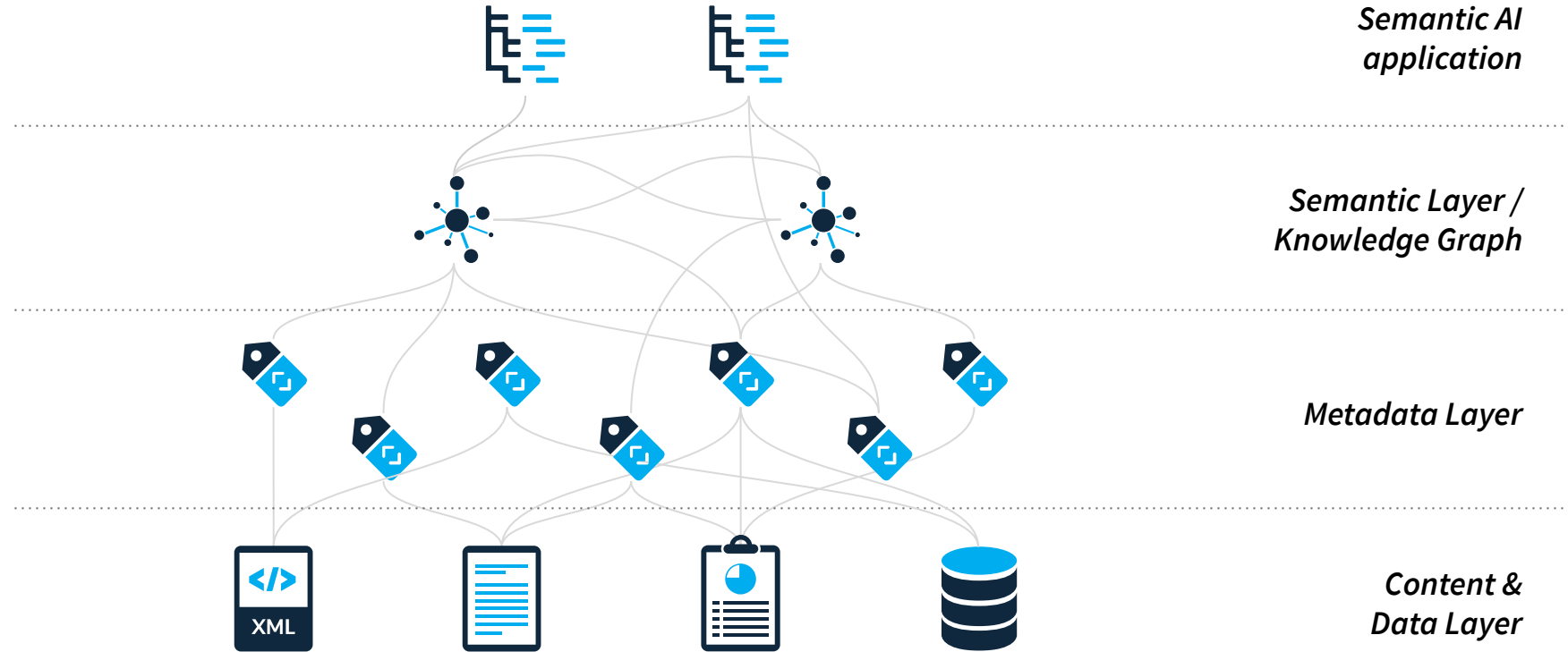
HR Analytics - graph data model



Governed by Knowledge

Where does Semantics sit in your information architecture?

Four-layered Information Architecture



Things, Not Strings

What is it and why should you care?

From keywords to entities.

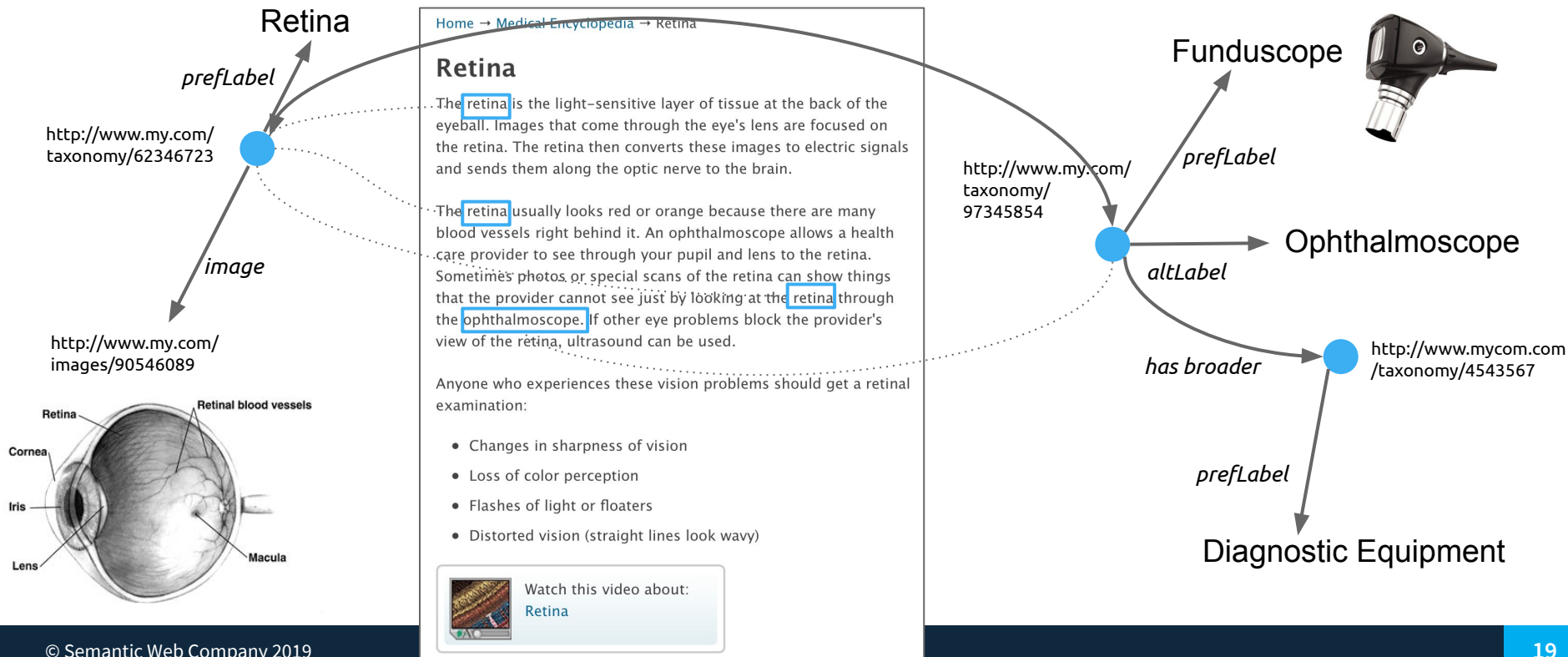
From the words that are used to describe things to the things being described.

It changes [web pages | silos] from isolated islands, to islands joined by billions of bridges.

Aaron Bradley, EA - <http://www.seoskeptic.com/semantic-seo-making-shift-strings-things/>

‘Things’ but not Strings:

Using a ‘Semantic Knowledge Graph’



The standards compliant THING

TheCheese2WineHarmoniser

Cheese (2)

Flavours and characteristics (2)

Wine (5)

Fortified wine (1)

Red wine (5)

Sweet wine (1)

White wine (12)

Chardonnay (1)

Uibel Chardonnay Reserve 2013 (0)

Field blend (1)

Grüner Veltliner (8)

Neuburger (1)

Pinot blanc (2)

Pinot gris (1)

Riesling (3)

Roter Veltliner (1)

Rotgipfler (2)

Sauvignon blanc (2)

Traminer (2)

Zierfandler (2)

Wine by country (1)

Lists

Collections

GraphEditors

Chardonnay

<http://vocabulary.semantic-web.at/cheese-wine/66c3875d-76b9-4292-b1ad-93299ce3d966>

Wine

Details

Notes

Documents

Linked Data

Triples

Visualization

Quality Management

History

SKOS

Harmonizer-Schema

Varieties definitions

+

Broader Concepts

[White wine](#)

Narrower Concepts

Uibel Chardonnay Reserve 2013

Related Concepts

Medium acidity

Top Concept of Concept Schemes

Exact Matching Concepts

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

Preferred Label

Chardonnay

Alternative Labels

Arboisier

Armaison

Armaison Blanc

Armoison

Aubain

Auvergnat Blanc

Auvernas

Auvernas Blanc

Auvernmat Blanc

Auvernmat blanc

Auxeras

Auxerras Blanc

Auxois Blanc

Bargeois

Bargeois Blanc

Link to LOD

Link to PP

LOD Source: EnDBPedia

The standards compliant THING

Chardonnay



<http://vocabulary.semantic-web.at/cheese-wine/66c3875d-76b9-4292-b1ad-93299ce3d966>



Wine

Subject (resource, entity, thing)

Predicate

Object

<http://www.w3.org/2004/02/skos/core#exactMatch>

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

<http://www.w3.org/2004/02/skos/core#narrower>

<http://vocabulary.semantic-web.at/cheese-wine/912c97a4-ce16-40db-b85c-e751b8b1f7cd>

<http://www.w3.org/2004/02/skos/core#prefLabel>

Chardonnay en

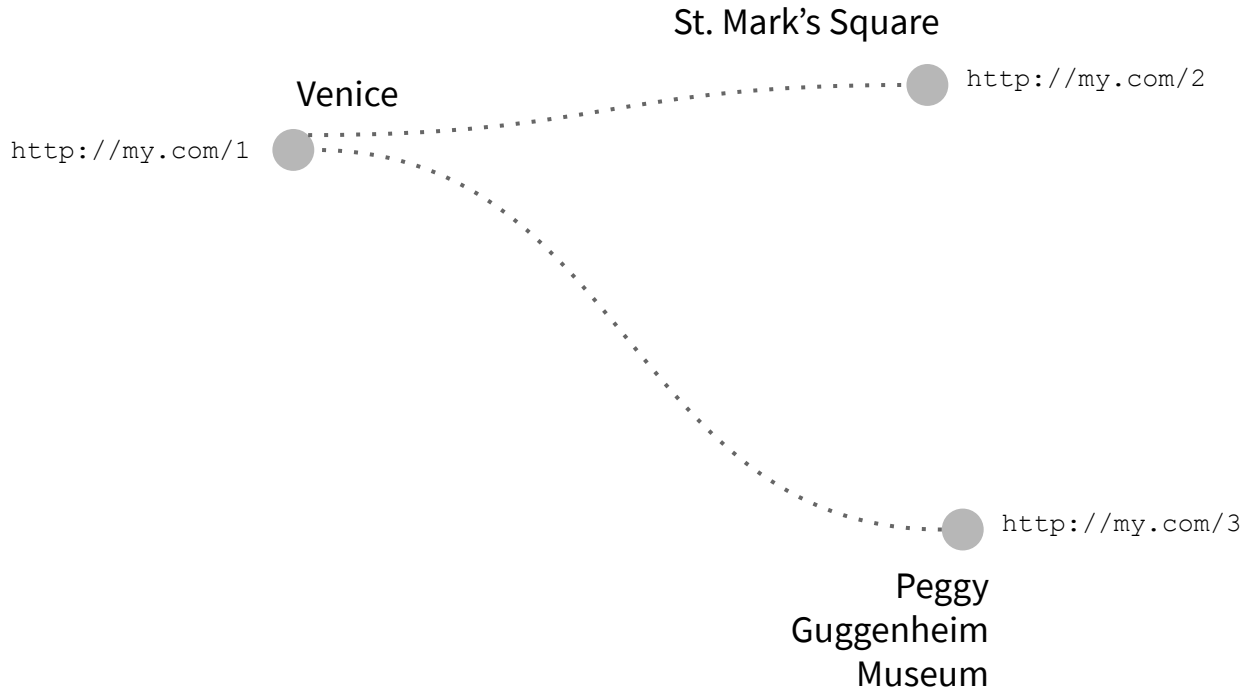
KNOWLEDGE GRAPHS

What is it and why should you care?

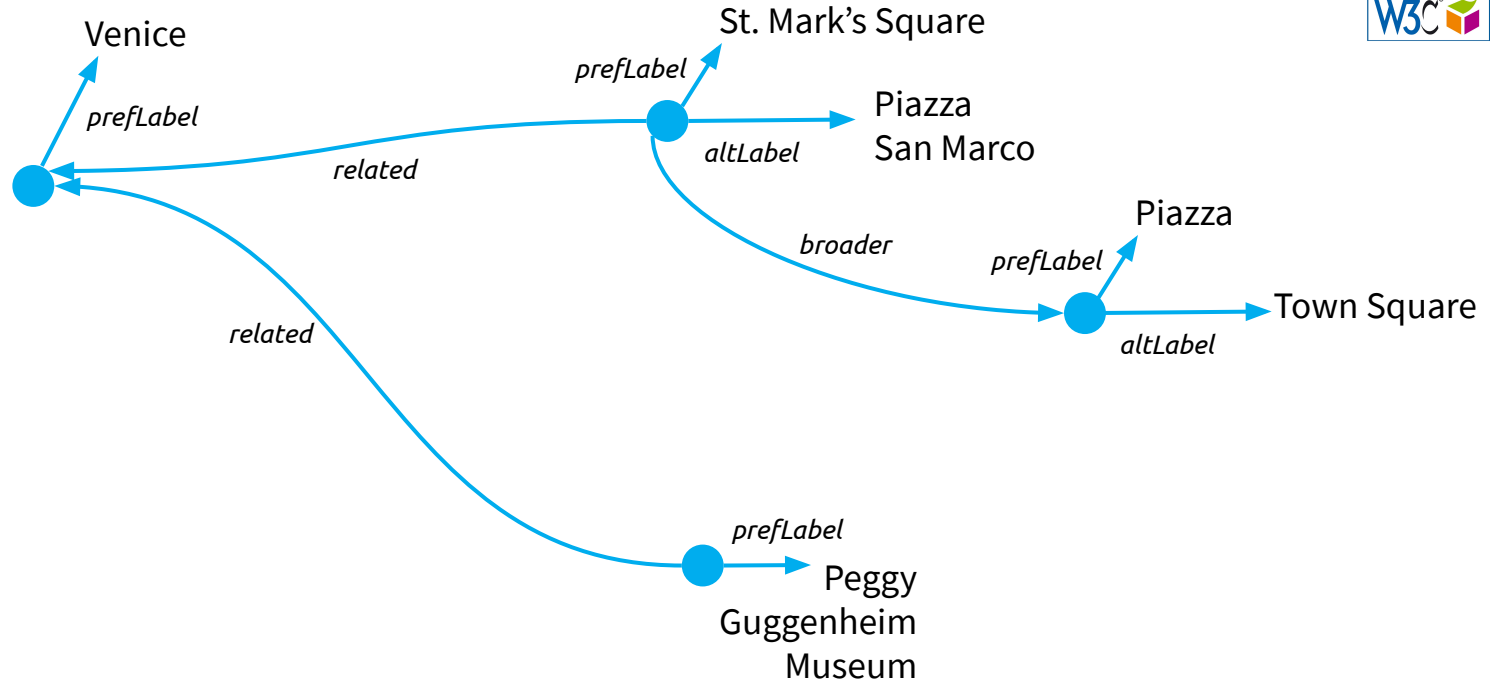
Standards-based KNOWLEDGE GRAPHS

Building Blocks

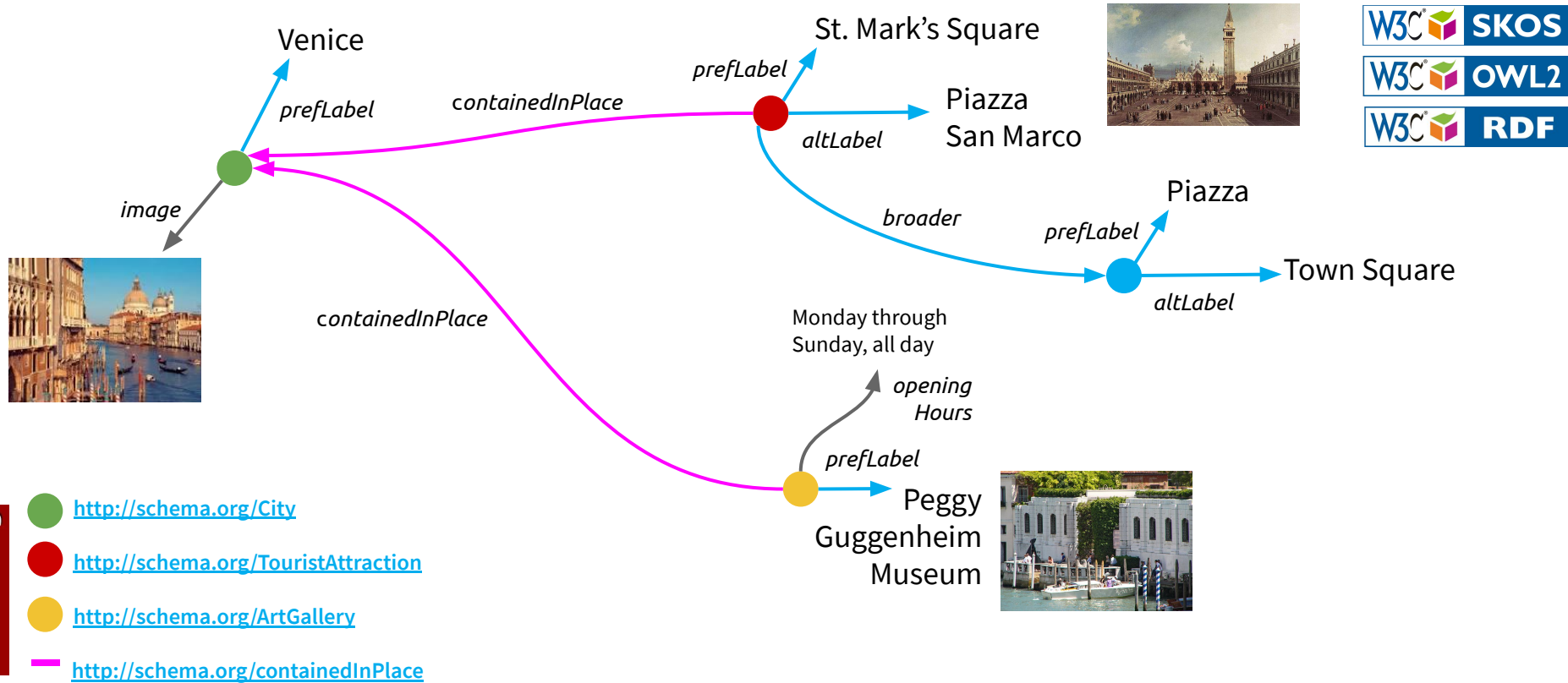
Things and URIs



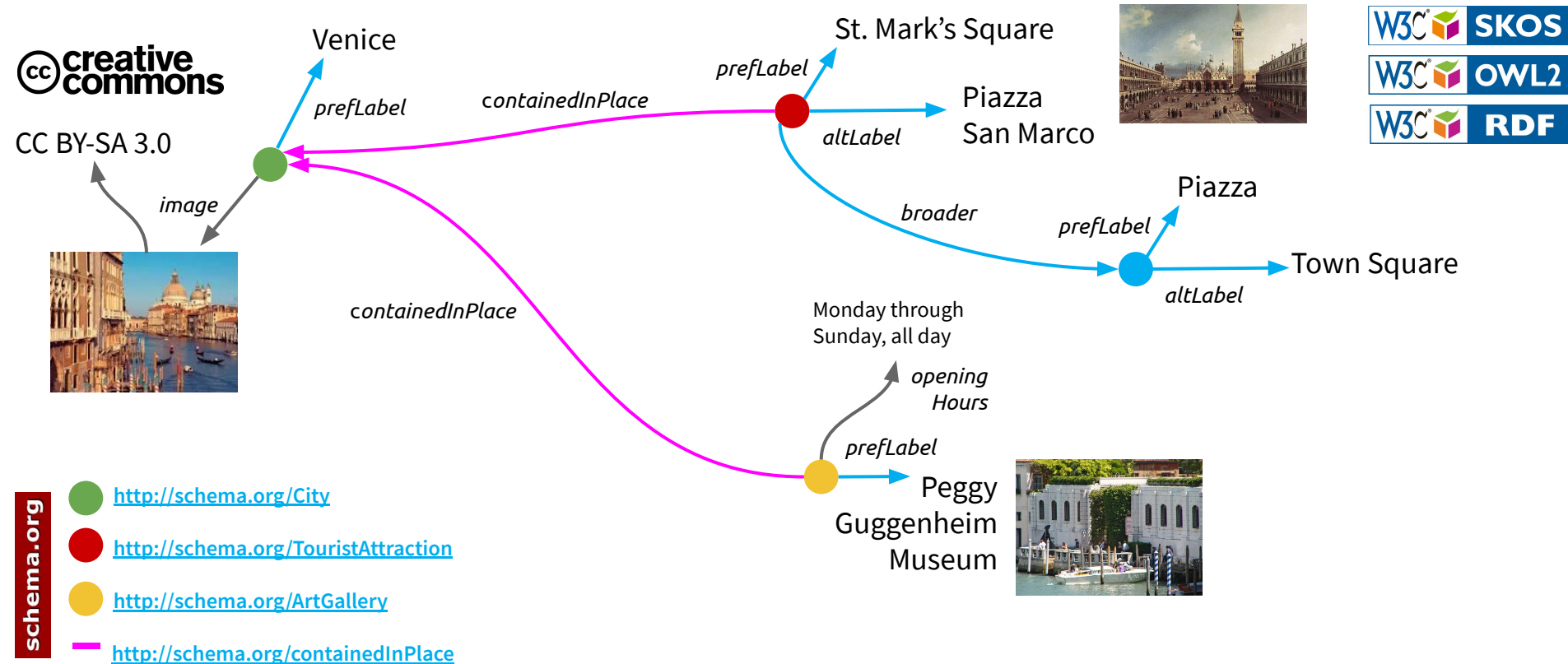
Labels and basic relations



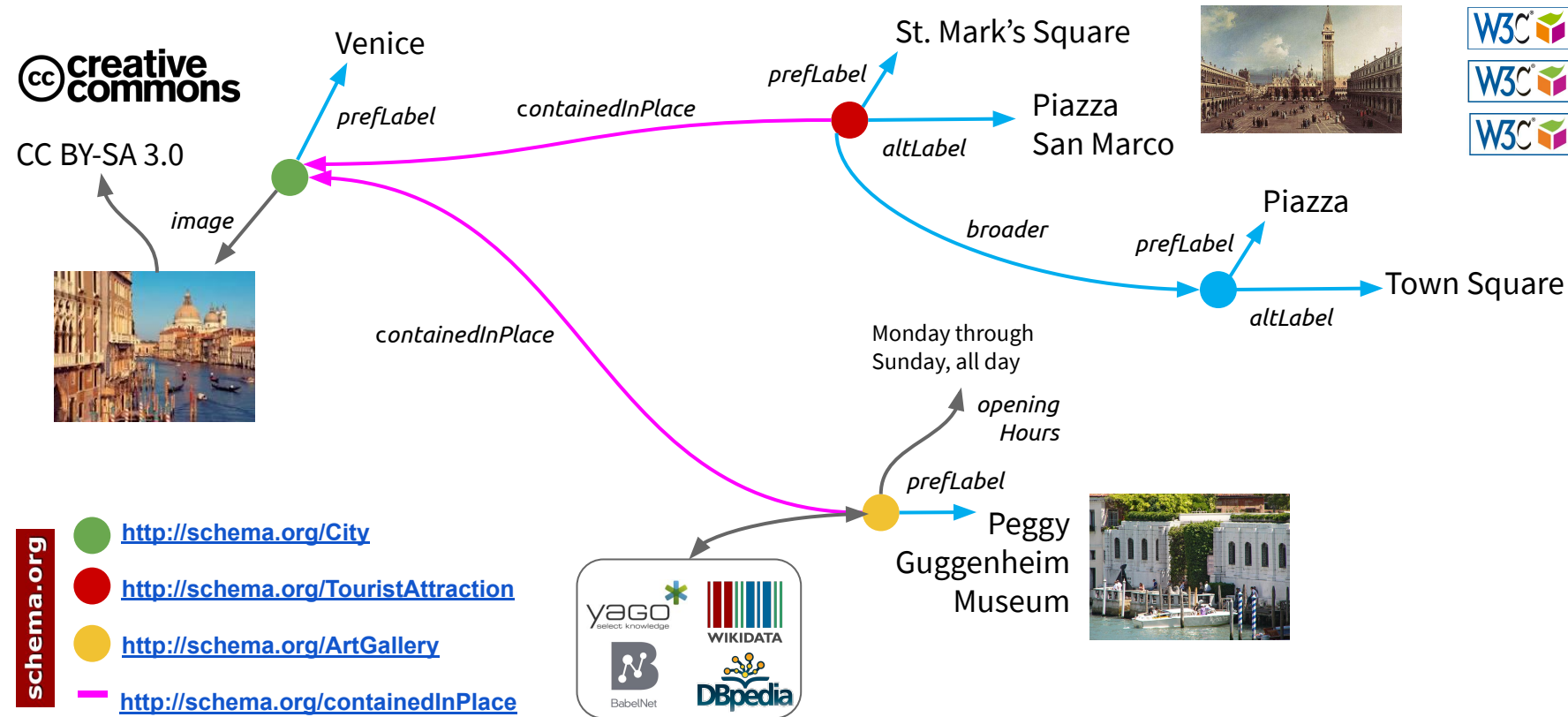
Classes, specific relations, restrictions



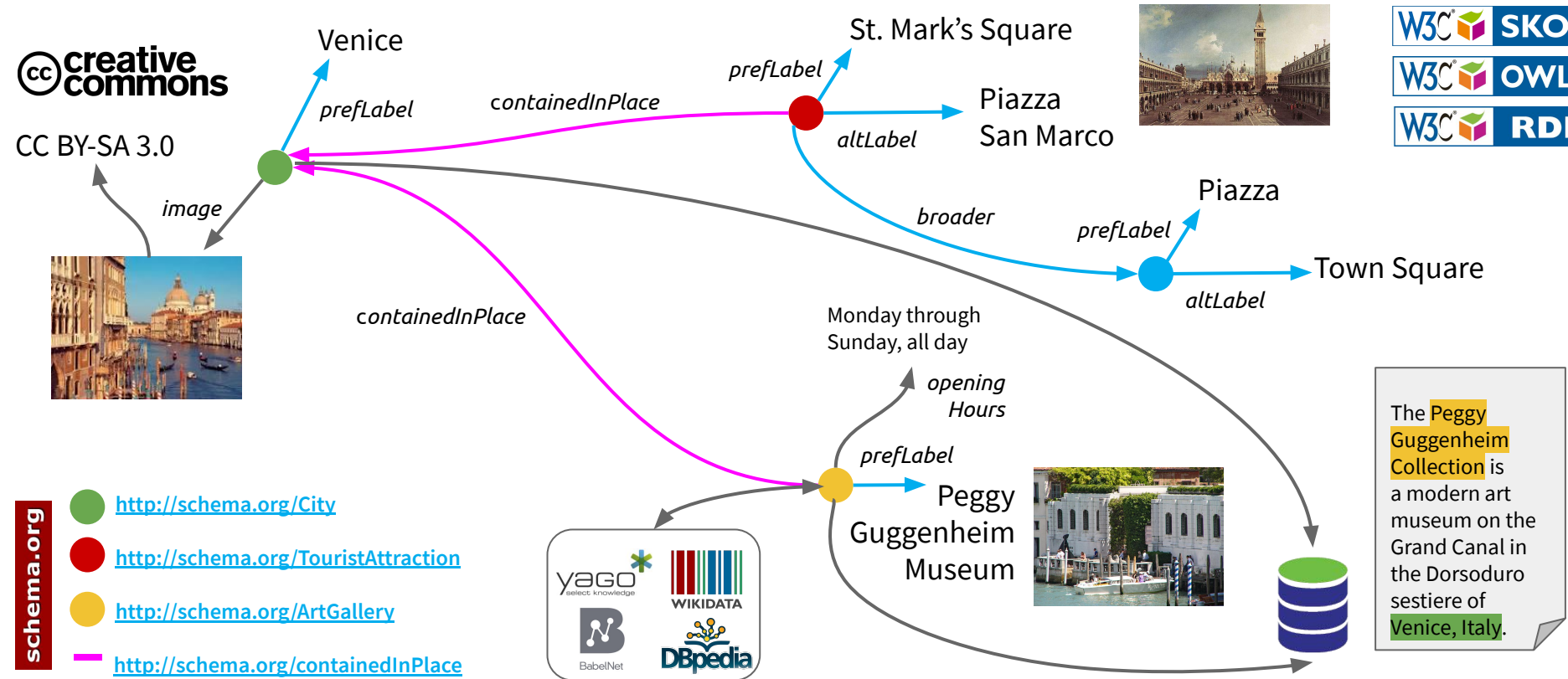
Metadata and Graph annotations



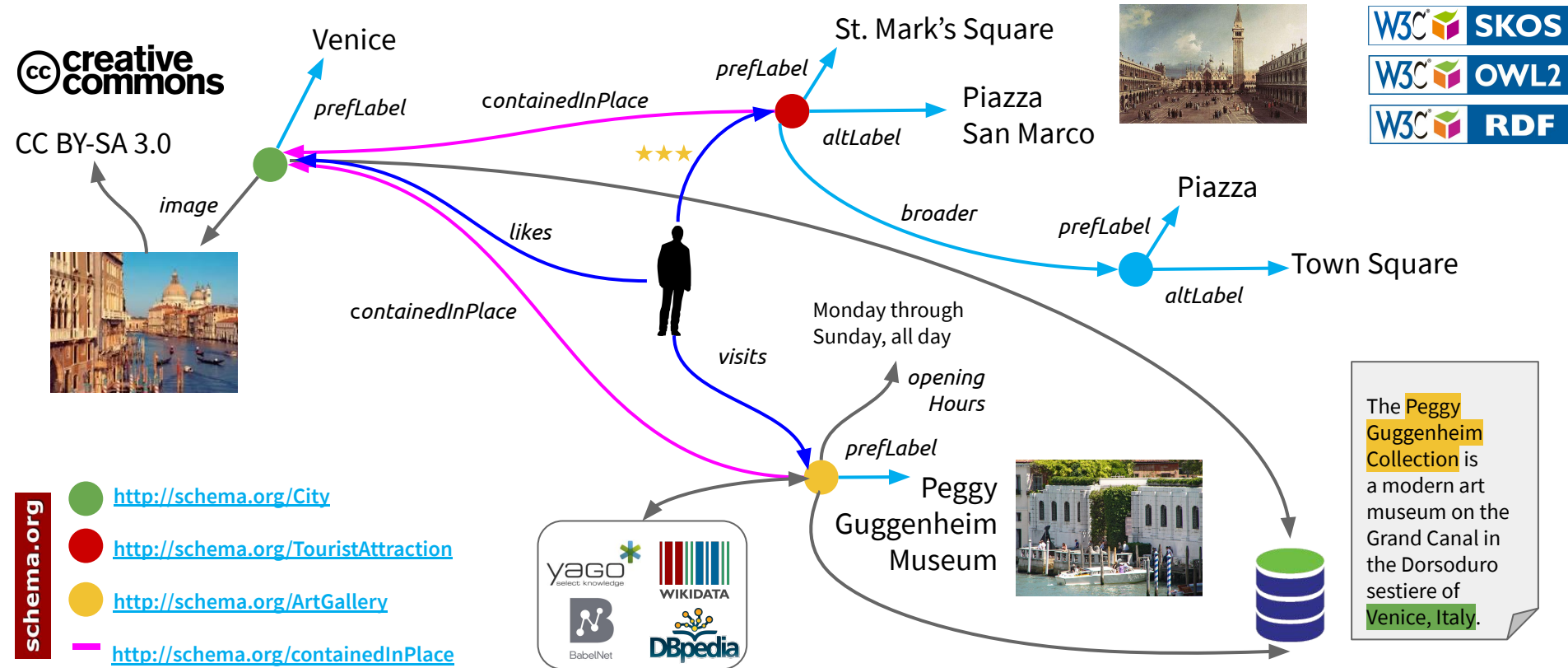
Entity linking and schema mappings



Linking to data and document stores



Putting the user into the graph



PowerSearch in Office 365 based on a Knowledge Graph

Renewable Energy Glossary


- ☐ **energy** (7)
- ☐ **wind** (3)
- ☐ **hydropower** (2)
- ☐ **wind turbines** (2)
- ☐ **windmills** (2)

[More](#)


Climate Compatible Development Glossary

- ☐ **energy efficiency** (2)
- ☐ **impacts on systems and sectors** (2)
- ☐ **water resources** (2)

☐ Show tagged content only



Reegle - Wiki Pages [SHOW PARENT](#)




building_b [SHOW PARENT](#)

COLLECTION rainwater collection system windmill RAINWATER COLLECTION cistern
windmill roof drain SOLAR COLLECTOR FOR ...

[BUILDING TYPES](#)
[EFFICIENT CONSTRUCTION OF BUILDINGS](#)
[ENERGY](#)
[ENERGY EFFICIENCY](#)

[ENVIRONMENTAL IMPACTS](#)
[HVAC](#)
[LIGHTING](#)
[SUSTAINABILITY](#)
[WASTE](#)



assessment lesotho highlands wate... [SHOW PARENT](#)

An Institutional Assessment of the Impact Of The Lesotho Highlands Water Project and Hydropower Development By: Lucy Khalema Redeby 'Mankhetse Makume Alphonso Khalema No.277 ...

windmills



Description

Traditional use of windpower - often seen at old mills.

More general

[windpower concepts](#)

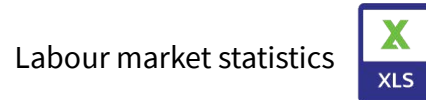
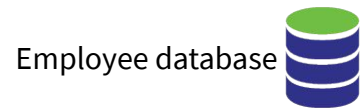
Related

[stand-alone wind power turbines](#)

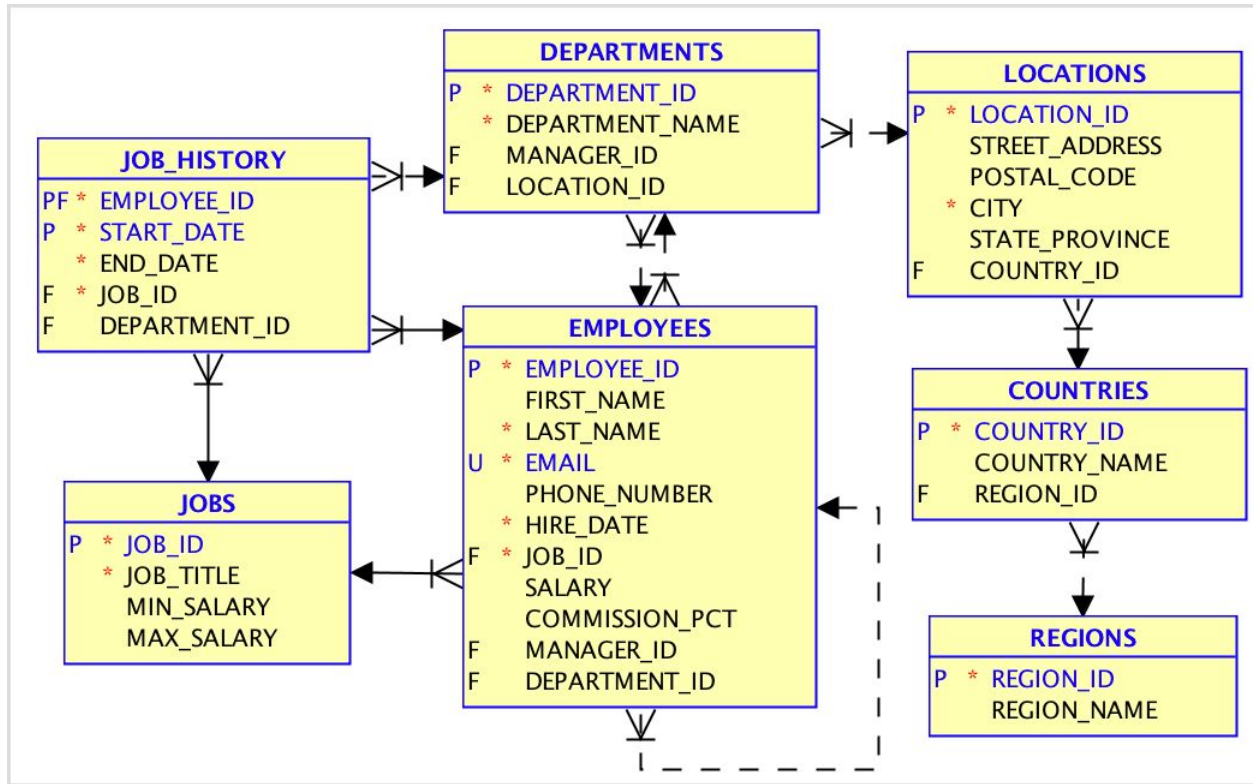
Establishing the KNOWLEDGE GRAPH DEMO

As an HR manager, for upcoming training programmes, I want to identify employees who:

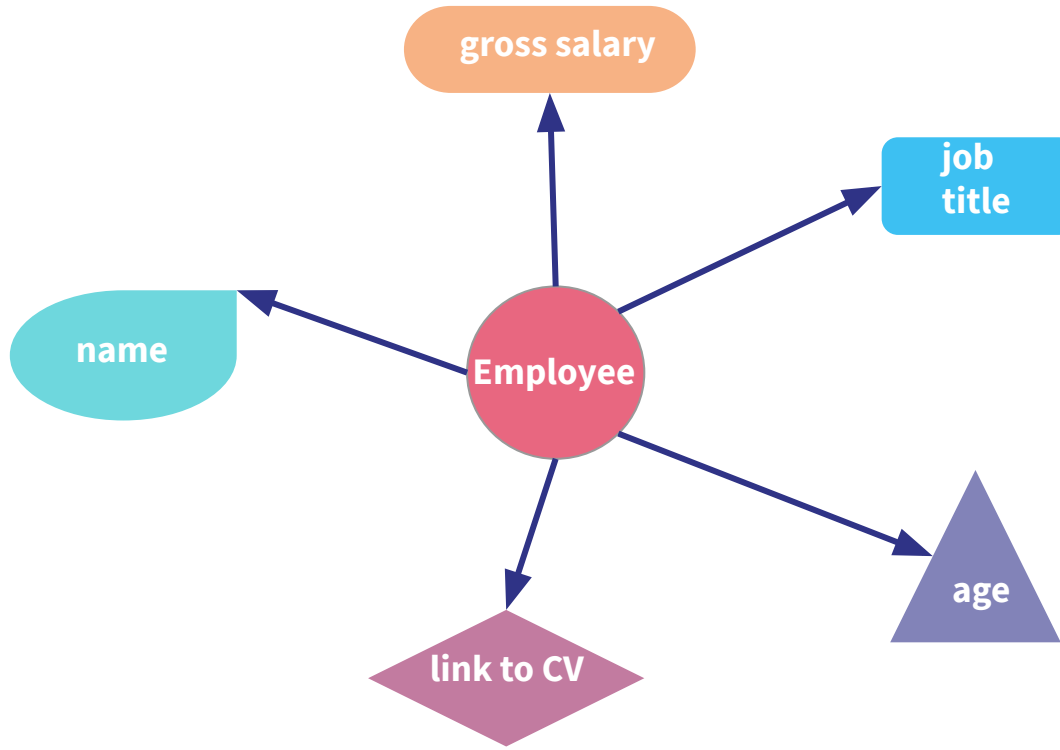
- have a certain skill set
- have a specific degree
- have skills that are increasingly important on the labour market
- fall into a specific salary range

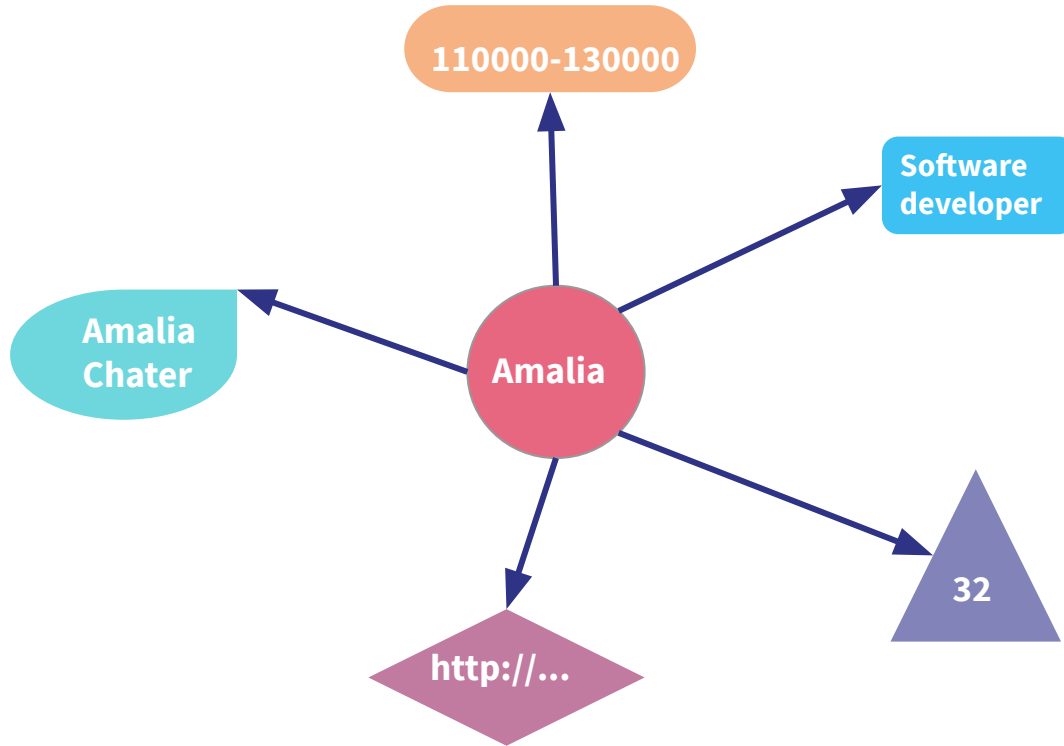


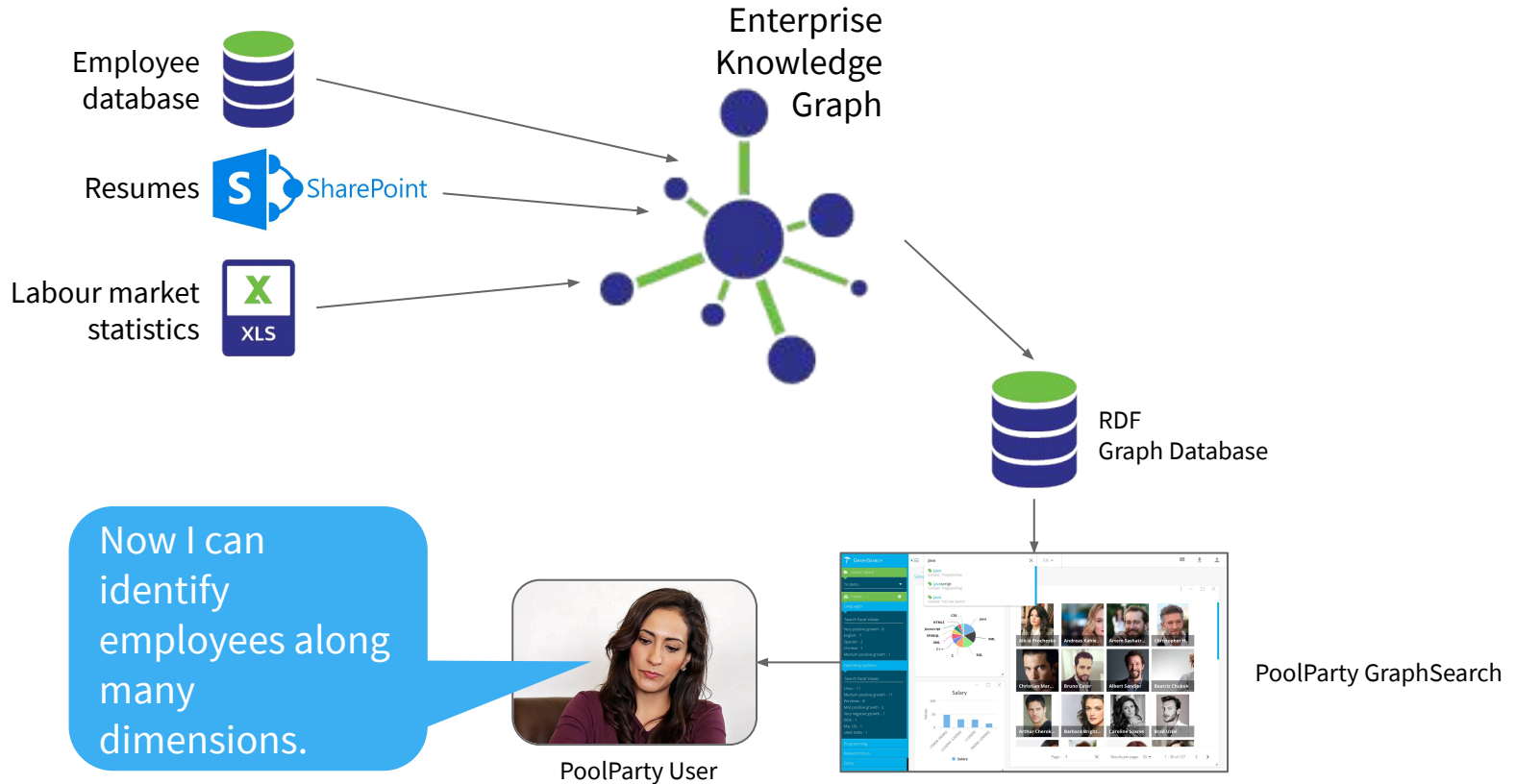
HR Analytics - relational data model



HR Analytics - graph data model







What do you need? And who's in charge?

- ▶ Taxonomy
 - ▷ Domain Expert
- ▶ Ontology
 - ▷ Domain Expert
- ▶ Data Orchestration
 - ▷ Knowledge engineer
- ▶ Data
 - ▷ Organization / IT
- ▶ Settings
 - ▷ Domain Expert

Job Roles

<http://vocabulary.semantic-web.at/jobs-skills/15>

Metadata

 Skills Facets

Triples

Visualization

History



Jobs and Skills Demo Application

Company Type (5)

Employees (1)

Job Roles (6)

IT (7)

Knowledge Engineering Experts (3)

Management (6)

Research (3)

Teaching (2)

Writing (2)

Location (3)

Skills (6)

Languages (4)

Chinese (0)

English (0)

Japanese (0)

Spanish (0)

Operating Systems (6)

DOS (0)

Linux (0)

Mac OS (0)

Solaris (0)

UNIX SVR4 (0)

Windows (0)

Programming (17)

Research Focus (13)

Technology Domains (19)

Tools (15)

Studies (3)

Lists

Collections

GraphEditors



- Freebase
- GEO
- Geo
- H2020 Project
- Harmonizer
- Informa Custom Ontology
- Jobs-Skills
 - Classes
 - Employee
 - Relations
 - Languages
 - Operating Systems
 - Programming
 - Research focus
 - Salary
 - Technology domains
 - Tools
 - Attributes
 - age
 - empID
 - gross salary
 - job title
 - link to cv
 - name

Jobs-Skills

<http://schema.semantic-web.at/jobs-skills>

 Export
  Delete
  Create Scheme

Title

 Jobs-Skills



Languages

English
No Language



Description





User Groups

Stardog
SWC



Statistics

 Classes - 1

 Relations - 7

 Attributes - 6

Usages

<http://schema.semantic-web.at/Skills-Facets>
<http://schema.semantic-web.at/Employees-Details>

URI Generation

<http://schema.semantic-web.at/jobs-skills/{element}>

LINKED DATA Orchestration

Pipeline: 'HR demo' ↓

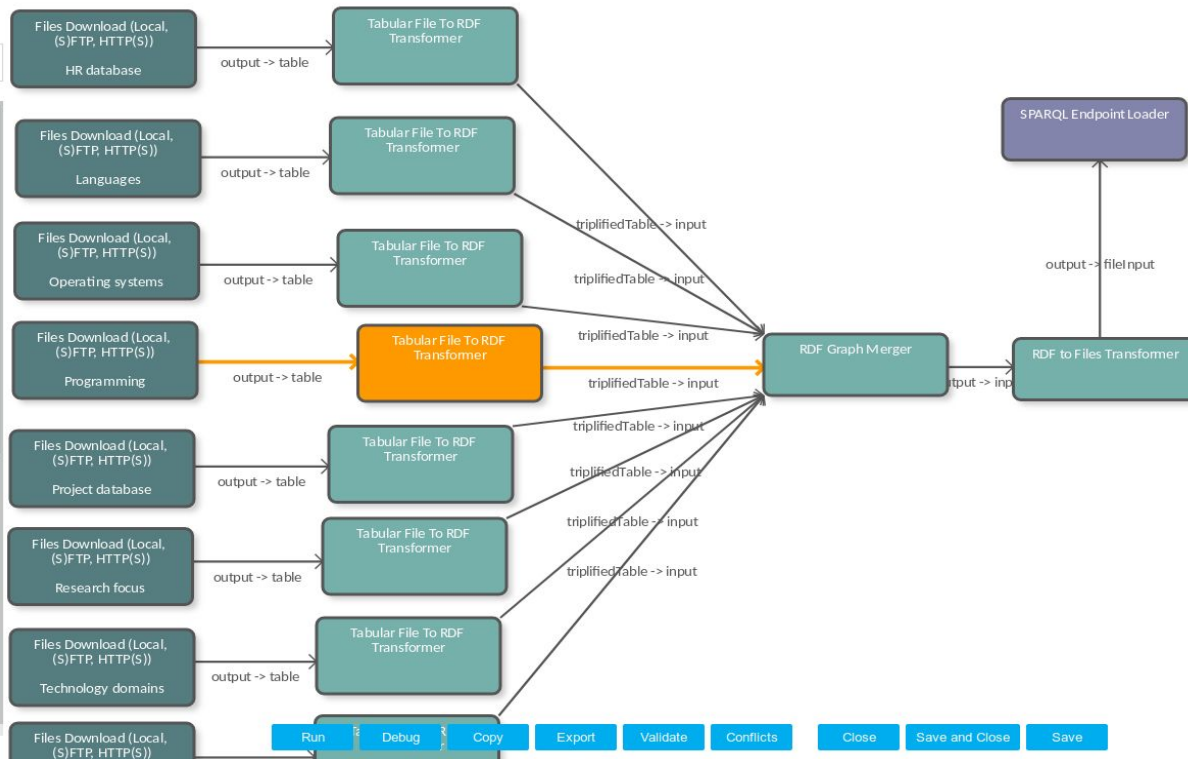
Pipeline Designer

List of Available DPUs ↑

☐ Only Private DPU Templates

Type to Filter Tree

- Extractors
 - Confluence Attachments Extractor
 - Copy Of e-Confluence-Attachments
 - Files Download
 - HTTP API Request
 - Relational Database
 - Shell Script
 - Silk RDF Link Discovery
 - SPARQL Endpoint
- Loaders
 - Files Upload
 - Relational Database
 - SPARQL Endpoint
 - Virtuoso Specific (Files)
 - Virtuoso Specific (RDF)
- Quality
 - SPARQL Ask Validator
- Transformers
 - Excel to CSV
 - File Filter
 - File Merger
 - File Renamer
 - Files to RDF
 - GZIP File Compressor
 - GZIP File Decompressor
 - JSON to XML
 - Open Calais Entity Extractor
 - PoolParty Concept Extractor
 - PoolParty GraphSearch Index Constructor



Name: Tabular File To RDF Transformer

Parent: Tabular File To RDF Transformer

Description:

☒ Use Custom Description ☐ Use Template Configuration

DPU configuration | RDF Validator | RDF Profiler | About | Mapping Import/Export | Copy&Paste

☒ Full column mapping
 ☐ Ignore blank cells
 ☐ Use static row counter
 ☐ Advanced key column
 ☒ Generate row column
☐ Generate subject for table
 ☐ Auto type as string
 ☐ Generate table/row class
 ☐ Generate labels
 ☒ Remove trailing spaces
☐ Ignore missing columns

Mapping

Simple mapping | Advanced mapping with templates | XLS mapping

Column name	Output type	Language	Use Dbf types	Property URI
Skill	Auto		<input type="checkbox"/>	https://sharepoint-demo/hr/skill-name
2015 Annual average gross demand	Auto		<input type="checkbox"/>	https://sharepoint-demo/hr/2015-annual-avg-gross-demand
2016 Annual average gross demand	Auto		<input type="checkbox"/>	https://sharepoint-demo/hr/2016-annual-avg-gross-demand
Growth Rate	Auto		<input type="checkbox"/>	https://sharepoint-demo/hr/growth-rate
Category	Auto		<input type="checkbox"/>	https://sharepoint-demo/hr/category

Add mapping


Copy From DPU Template Save as new DPU template Cancel Save


Enable Domain Experts


View and edit Knowledge Graphs easily

Adah Punjabi.docx

Employee	
10	177
129	117
159	33
Skill01	
178	184
179	22
180	
192	193
119	118
194	2
17	6
	7
37	4
121	129
122	Skill01
	47
60	age
116	39
bin-salary	
70000	
gross-salary-per-year	
80,000.00	
jobTitle	
Research Assistant	
title	
Adah Punjabi	

 Edit

 Delete

 Tree Browser

description

 ASP.NET, IIS, C#, Java, C, C++, PHP, Perl, MySQL, Windows, Unix, Database, Six Sigma, Software Development, Telecommunication, EVDO, UML, CVD, SVN, DDD, Object Maker, JSCS, JNS, Sablime, Clear Case, Visual Basic, ASP, TCPVIP, CDMA, Ontologies, Protégé, OWL Page of

image

<https://drive.google.com/thumbnail?id=1QT54B9WgRIFN3a92CzpaB...>

link-to-cv

<https://docs.google.com/document/d/1v9Q505VC4rUm9VW897vX41U6ofDXVBrsqblXhCjJ80A/edit>

we need a more supportive environment

HR Demo

Company Type (5)

Job Roles (6)

Location (3)

Skills (6)

Studies (3)

Lists

Collections

GraphEditors

Employee w/ Job Title

Employees with
Machine Learning
focus

Employees with Machine Learning focus

rdfEditor:baaaaf83-89cb-46cd-8e78-42657c08e3bc

Metadata

Search & Edit

Configuration

T title ▾ ×













T job title ▾ ×

🔗 Research focus ▾ ×

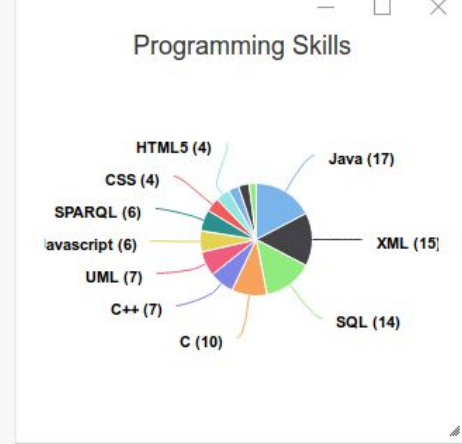
Filters

Search

Showing 11 to 20 of 28 results.

<input type="checkbox"/>	▼	title ⚡	job title ⚡	Research focus ⚡
▶	<input type="checkbox"/>	 Arthur Cherokee	Software Developer	Machine Learning en 
▶	<input type="checkbox"/>	 Jefferson Rulestone	Business Analyst	Machine Learning en 
▶	<input type="checkbox"/>	 Luis Toledo	Senior Software Developer	Machine Learning en 
▶	<input type="checkbox"/>	 Xiaoxi Chen	Senior Software Developer	Machine Learning en 
▶	<input type="checkbox"/>	 Kumar Parmodi	Artificial Intelligence Expert	Machine Learning en 
▶	<input type="checkbox"/>	 Amy Geller	Artificial Intelligence Expert	Machine Learning en 

Selected facet values: empty



128 results

Brad Uziel

Bob Todler

Amber Smith

Anika Ferrero

Albert Sandler

Arthur Cherok...

Alina Dawson

Amy Willson

Belyse Karan

Artem Sashatr...

Beatriz Chukok

Bruno Cater

Page: 1
Results per page: 20
1 - 20 of 128

Search Space

HR Demo

Facets

Entity types

Languages

Operating Systems

Search Facet Values

Windows - 2

Mild positive growth - 1

Medium positive growth - 1

Linux - 1

Mac OS - 1

Programming

Research focus

Search Facet Values

Data Mining - 2

Mild positive growth - 2

Machine Learning - 1

Medium positive growth - 1

Information retrieval - 1

Image Processing - 1

Salary

Selected facet values:

Windows (Operating Systems) X

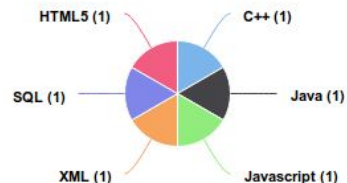
Data Mining (Research focus) X

Clear all X

Gross Salary per Year



Programming Skills



2 results



Page: 1

X

Results per page: 20

1 - 2 of 2

<

>

Chen Yuang



← → Chen Yuang



LANGUAGES



OPERATING SYSTEMS



- Mild positive growth
- Medium positive growth
- Linux
- Windows
- Mac OS

PROGRAMMING



RESEARCH FOCUS



- Data Mining
- Mild positive growth
- Machine Learning
- Medium positive growth
- Information retrieval
- Image Processing

See Also



Graph Similarity



Diana Flores



Andy Hubs



Luis Toledo



Charles Ro...



Amalia Ch...



Elena Santos



Similarities: 10 ▼

CLOSE



Thank You!

Email: thomas.burg@semantic-web.com

Website: poolparty.biz

(c) Simons Center for Data Analysis
<https://www.eurekalert.org/multimedia/pub/90698.php>