ELISE action
Webinar Series

Improving knowledge transfer across organisations by knowledge graphs

Application and experimentation within the ELISE Action

Danny VANDENBROUCKE, KU Leuven
Marc Olijslagers, KU Leuven
Lorena HERNANDEZ, European Commission JRC
Simon VREČAR, European Commission JRC (consultant)
Lily PANIAGUA, European Commission JRC (consultant)

07/04/2022 at 14:00 CEST (UTC+2)

European Location Interoperability Solutions for e-Government

Enabling Digital Government through Geospatial and Location Intelligence

ISA²

What is ELISE?

A BIT OF HISTORY...

2004
IDABC: Interoperable Delivery of European eGovernment Services

2010
ISA: Interoperability solutions for public administrations

Actions:
EULF
ARE3NA

2016
ISA²: Interoperability Solutions for European Public Administrations, Businesses and Citizens

ELISE

2021
DIGITAL: Digital Europe Programme

ELISE builds upon the outcomes of the former ISA actions EULF and ARE3NA. It is the only action of the ISA² Programme, aiming to improve Digital Government through Location Interoperability.

WHAT?

ELISE stands for **E**uropean **L**ocation **I**nteroperability **S**olutions for e-Government. It is one of the more than 50 actions in the European Interoperability Programme ISA2

WHAT FOR?

To support Digital Government Transformation by making the best use of location data and technologies in an interoperable manner

FOR WHOM?

For all: citizens, businesses and public administrations

Location-enabled Digital Government Transformation

ELISE action objectives

ELISE action

Policy support

Supporting different policy initiatives at European and national levels

Emerging trends and technologies

Discovering how emerging trends and technologies enable more effective use of location data for policy and digital public services

Interoperable frameworks and solutions

Providing reusable interoperable cross-border and cross-sector frameworks and solutions for public administrations, business and citizens

Building a Knowledge base

Building a Geo-Knowledge base to inform and train stakeholders and promote the adoption of good practices and innovations in location data

ELISE outputs and topics

- Collaboration models
- Data access and sharing
- Data ecosystems
- Data models
- Data protection
- Evolution of Spatial Data Infrastructures
- Impact location-enablement
- Knowledge Transfer
- Location intelligence
- Location interoperability components
- Location interoperability governance
- Location technologies
- Location-enabled innovation
- Location -enabled public services

Our speakers

Danny VANDENBROUCKE

Senior Researcher

KU Leuven

Marc OLIJSLAGERS

Senior Researcher

KU Leuven

Oscar CORCHO

(guest speaker)

Professor

UPM

André SKUPIN

(guest speaker)

CTO

BigKnowledge

The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

linkedin.com

Improving knowledge transfer across organisations using knowledge graphs

What we will cover today

1. Introduction: key concepts and definitions (10')
2. Knowledge Graphs: what are they and how can they be used? (20')
3. Managing key concepts in a glossary or vocabulary (10')
4. Experimenting with Knowledge Graph in ELISE Action(20')
5. Conclusions and future outlook (15')
6. Discussion, Q&A (15')

Key messages

1. The **ELISE universe** contains a rich portfolio of resources of different kind: studies and its reports; events and its announcements, recordings and summary reports; webinars and e-learning modules, and much more

2. These resources must be managed and used to **transfer knowledge** and experience. The can be treated as semantic assets and represented as **Knowledge Graphs**. Such graphs can be queried and analysed to better understand the universe.

3. Exploiting the ELISE universe using **semantic, Machine Learning, Natural Language Processing** and other techniques can provide powerful insights and guide learners to understand and exploit

bigthink.com

stangardfield.medium.com

Objectives of the work on the ELISE Knowledge Graphs

Objective 1

To **investigate and experiment** with **Knowledge Graph** methodologies and techniques in order to get results and formulate recommendations that any organization or initiative can apply

Several JRC teams involved XX organisations

digital-skills-jobs.europa.eu

falconfastening.com

searchenginejournal.com

ISA²

Objective 2

To perform a consolidated exercise at the moment of ELISE closure of which the results can be taken into account in the activities under the **Digital Europe Programme**.

1

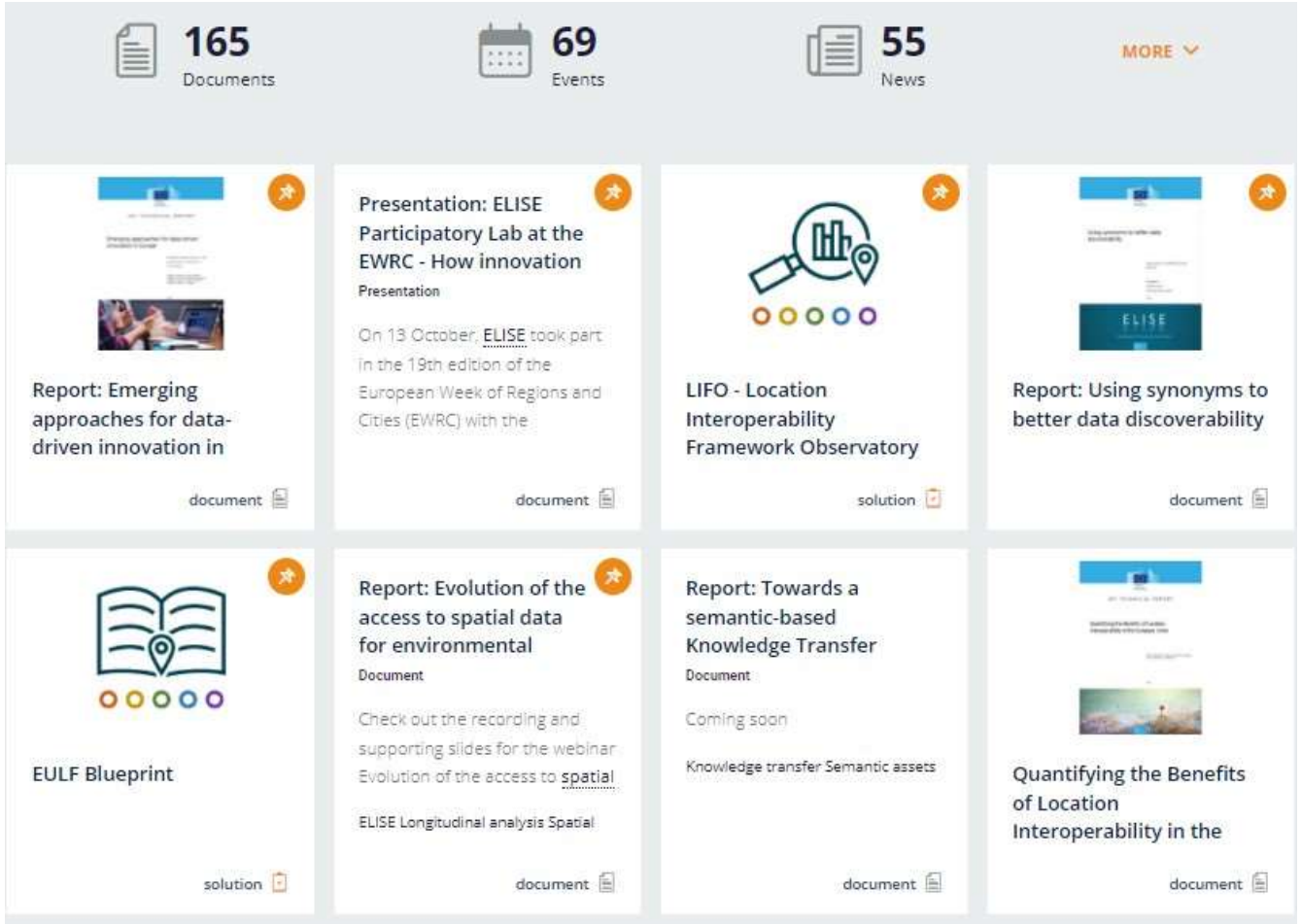
Introduction

Exploring the ELISE universe
Key concepts and definitions

What is the ELISE universe?

The ELISE Action has generated and made available a **portfolio of studies, guidelines, tools, webinars, training materials** … The Action has organized events and brought together partners and stakeholders to co-create and **share knowledge** to location-enable decision making, to improve interoperability and to create innovative public services … ELISE covers many technological and technological aspects of DGT

How can I find my way throughout this rich universe?



Exploring the ELISE universe

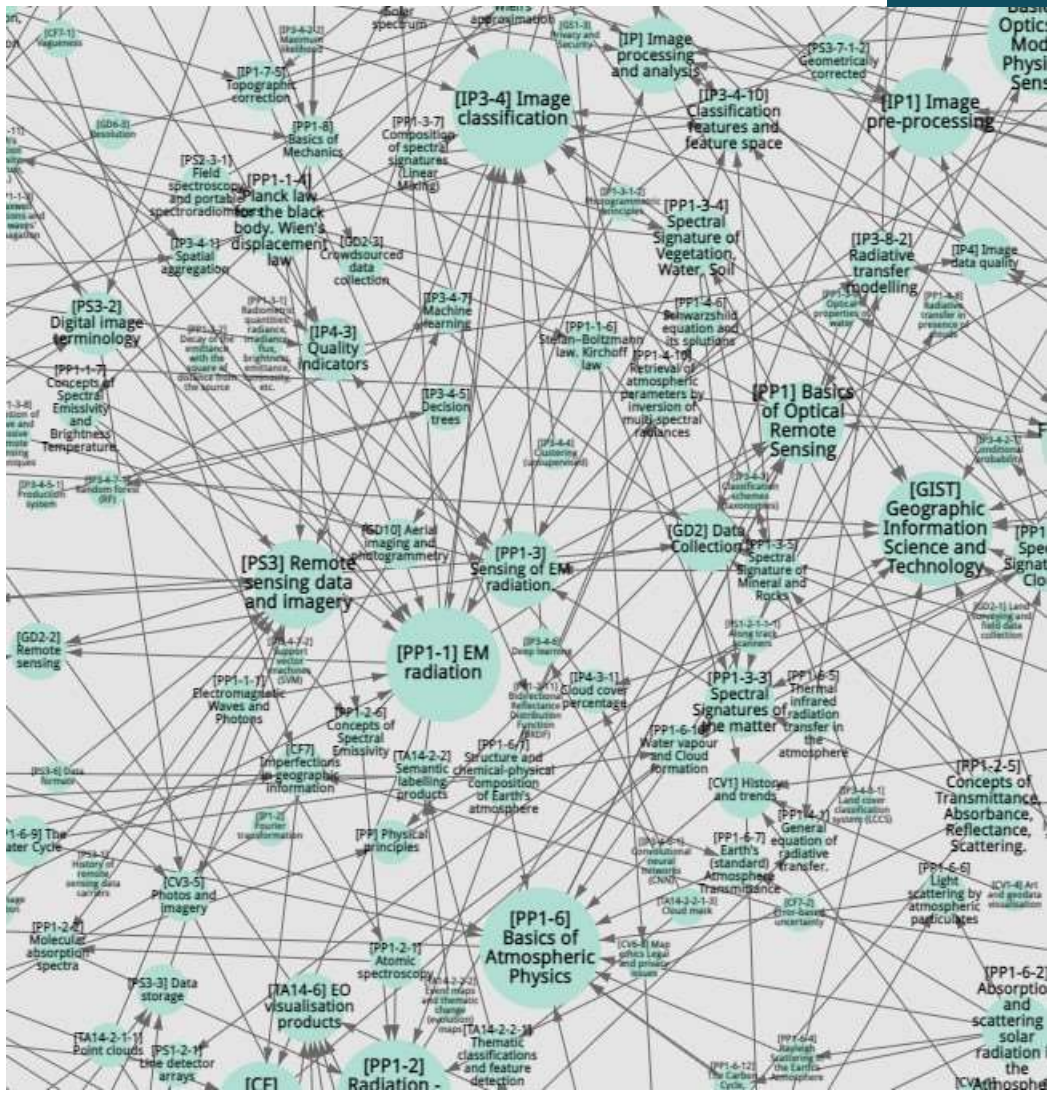
I am interested in GeoAI

Which ELISE resources are available?

What is the optimal learning path

What are related concepts?

What will I learn?



hae-ino.org; coe.int; drugmonitoringcentre.org; thenounproject.com

ELISE concepts and resources

ELISE concepts. Are single or multiple words describing a theory, method, technology, solution, service … They are well-defined and/or described, might have an acronym and are used consistently throughout one or more ELISE resources.

ELISE resources. any output/result from ELISE activities under the ELISE Action. Examples are reports, videos, webinar presentations, infographics, tools, etc.

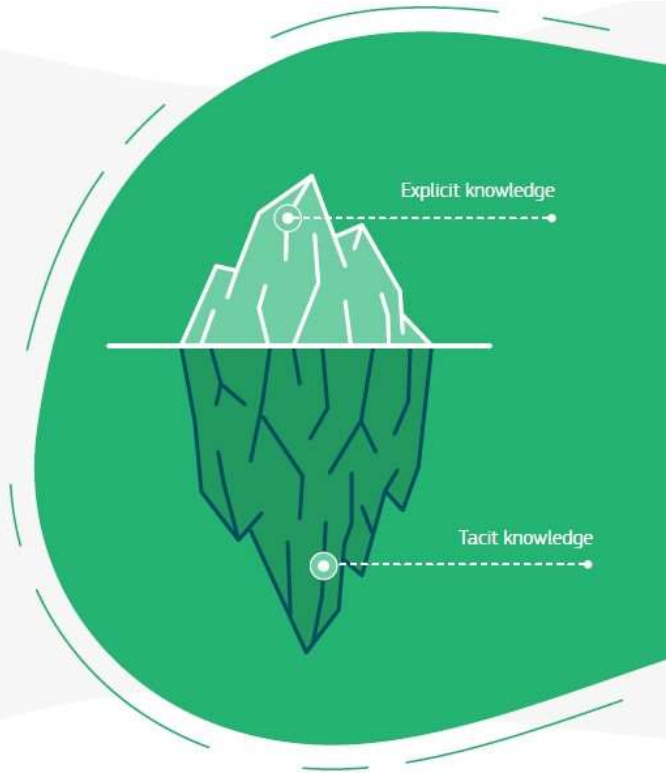
Knowledge management and transfer

Knowledge Transfer. A process by which knowledge, ideas and experience move from the source of knowledge to the recipient of that knowledge. Knowledge transfer and knowledge sharing are often used interchangeably in literature.

Schwartz and Te'eni, 2011

In the context of EQF, knowledge is described as theoretical and/or factual

<> Skills, Competences



Knowledge Management is the process of capturing, distributing, and effectively using knowledge.

Davenport, 1994

2

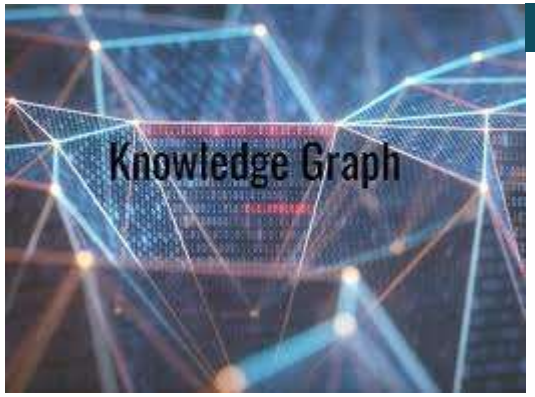
Knowledge Graphs: what are they and how can they be used?

Semantic web, semantic assets and KG

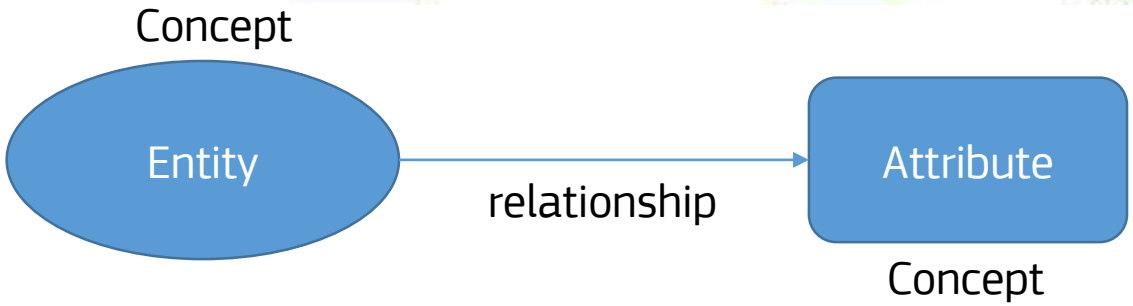
thetechbrook.com

The heart of the **knowledge graph** is a knowledge model: a collection of interlinked descriptions of **concepts, entities, relationships and events**. Knowledge graphs put data in context via linking semantic metadata and provide a framework for data integration, unification, analytics and sharing

ontotext.com



dataversity.net



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Examples of Knowledge Graphs (KG's)

DBpedia

Freebase

YAGO

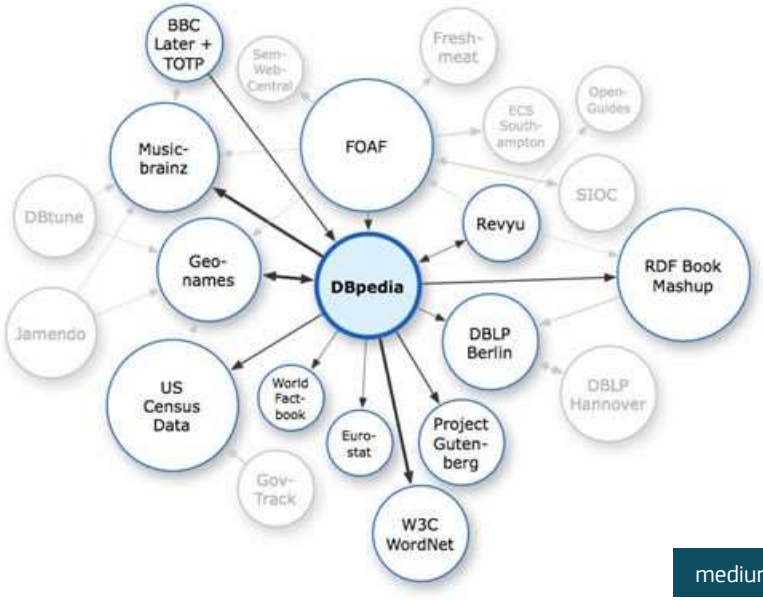
NELL

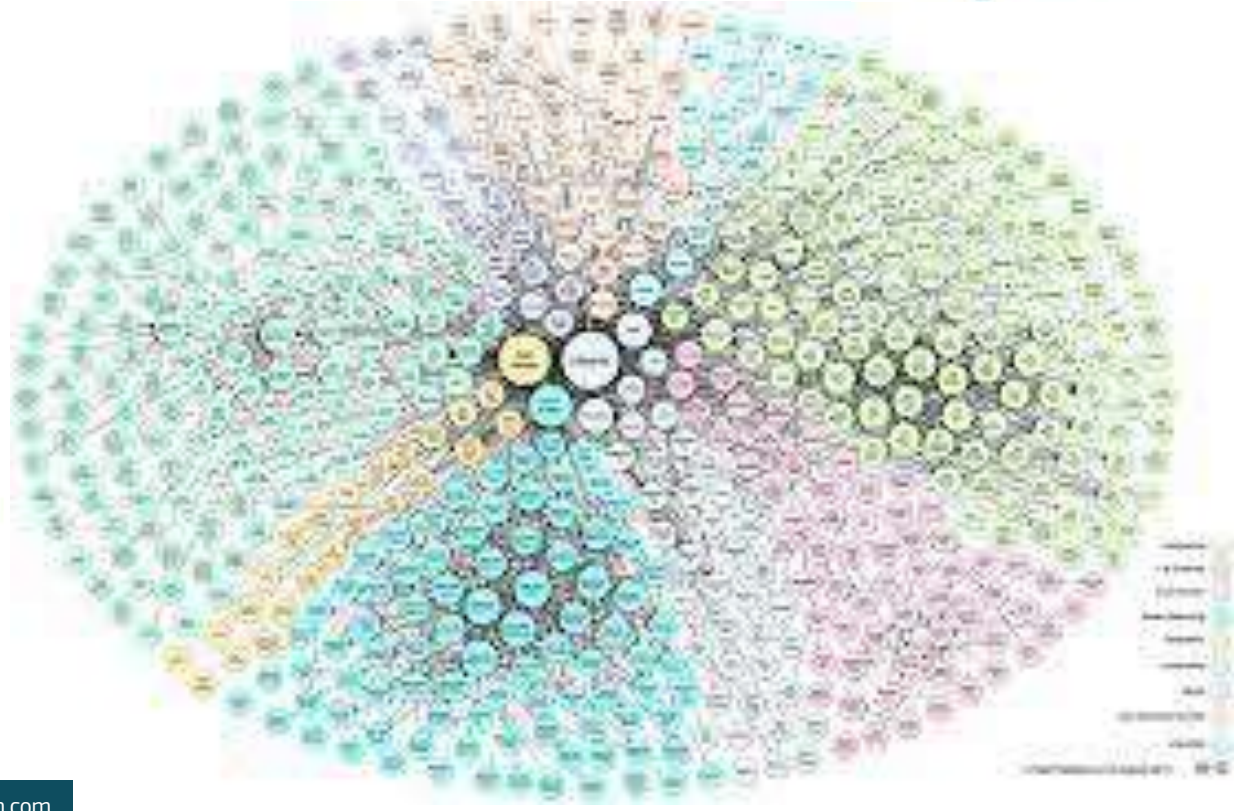
Wikidata

Wordnet

Geonames

...





medium.com

Architecture of KG's

Knowledge acquisition

a set of concepts and categories in a subject area or domain that shows their properties and the relations between them

from published raw data to interlinked semantic data

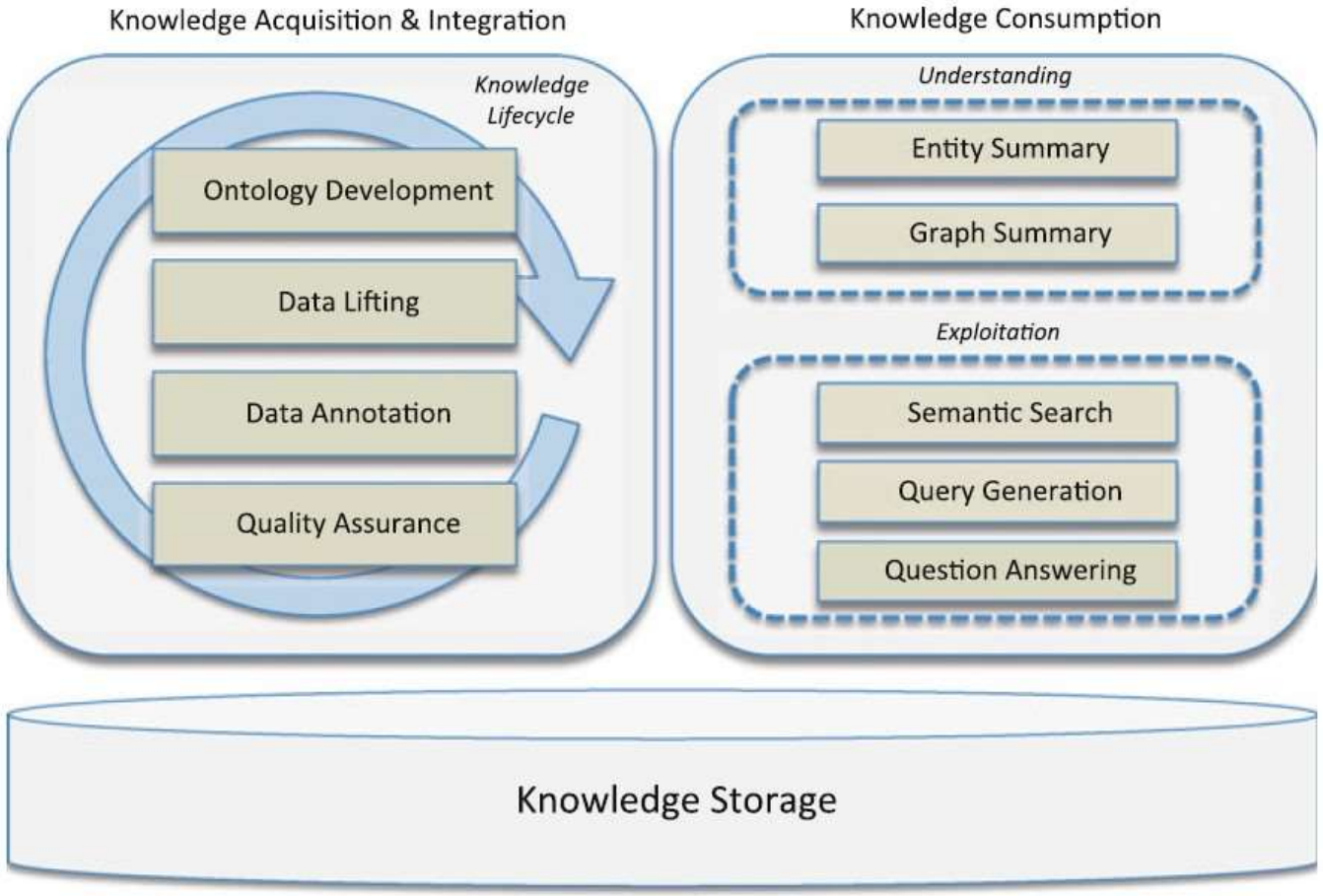
Oxford Dictionary

Knowledge consumption

Overviews in the form of lists and graphs

Knowledge graphs can be used for a large number of tasks — be it for logical reasoning, explainable recommendations, complex analysis or just being a better way to store information

Pan et al., 2017



Case Study:

City of Zaragoza – KG's supporting public services

By Oscar Corcho (UPM)

Knowledge Graphs for Digital Transformation in Spanish municipalities: Ciudades Abiertas and the Zaragoza's knowledge graph

Oscar Corcho

Ontology Engineering Group
Centro de I+D en Inteligencia Artificial (AI.nnovation Space)
Universidad Politécnica de Madrid

With inputs from the teams involved in Ciudades Abiertas and from the city of Zaragoza

ocorcho@fi.upm.es @ocorcho

Open Government and Interoperability

July 2018 – November 2021

CIUDADES ABIERTAS

INICIATIVA PLATAFORMA DE GOBIERNO ABIERTO, COLABORATIVA E INTEROPERABLE (121/17-SP)

Details at http://www.ciudadesabiertas.es/ (Spanish)

Esta presentación ha sido elaborada en el marco de la iniciativa 'Plataforma de Gobierno Abierto, Colaborativa e Interoperable' cofinanciada por el Ministerio de Economía y Empresa, a través de la Entidad Pública Empresarial Red.es, y por los ayuntamientos de A Coruña, Madrid, Santiago de Compostela y Zaragoza y con la cofinanciación del Fondo Europeo de Desarrollo Regional (FEDER), dentro de la 'II Convocatoria de Ciudades Inteligentes'.

Fondo Europeo de Desarrollo Regional
"Una manera de hacer Europa"

Open Government: Areas of work

Public participation of citizens in local decisions and in the creation of legislation, based on open data

Transparency in all activities done by the local administration, based on open data

Technical and conceptual means to support the open data policies of the local administrations, including open data publication

+

Catalogue of vocabularies and common data structures to homogeneise open data published by local administrations

Why do we need ontologies for open data publication?

- However, when we provide open data, wouldn't it be good to publish following the same data structures?

I want to publish my data

I use GTFS

_id	stop_id	stop_code	stop_na...	lat	lon	stop_url
1	101	101	Alameda ...	36.716872	-4.424393	http://ww...

GroupNumber	DateFirst	DateEnd	Line	Label	NameA
110	21/11/2014	31/12/2999	001	1	PLAZA DE CRISTO REY

paradas_bus

```
1 "ayto:foto";"ayto:numero";"ayto:parada";"ayto:sentido";"dc:identifier";"dc:modified";"gn:coordX";"gn:co
2 "/9j/4AAQSkZJRgABAQEASABIAAD/2wBDACgcHiMeGSgjISMtKygwPGRBPDc3PHtYXUlkkYCZlo+AjIqgtObDoKrarYqMyP/L2u71//
3 "/9j/4AAQSkZJRgABAQEASABIAAD/2wBDAAYEBQYFBAYGBQYHBwYICHAKCgkJChQODwwQFxQYGBcUFhYaHSUfGhsjHBYWICwgIyYnKS
```

I use CSVs with my own data structure

I use Web services

```
  link: "http://www.urbanosdezaragoza.es/frm_esquemaparadatime.php?poste=1",
  title: "(1) Principio de Línea Líneas: 501",
  icon: "//www.zaragoza.es/contenidos/iconos/bus.png",
- geometry: {
      type: "Point",
    - coordinates: [
          675945,
          4613286
```

Develop once, deploy everywhere

Source: Esther Minguela (Localidata)

A bit of history... Open Data Guide by FEMP

First edition: 2017
Second edition: 2019

http://datos.gob.es/es/noticia/la-femp-elabora-una-guia-de-datos-abiertos-para-ayuntamientos-y-entidades-locales
http://femp.femp.es/files/3580-1617-fichero/Guía%20Datos%20Abiertos.pdf
https://datos.gob.es/es/documentacion/datos-abiertos-femp-2019-40-conjuntos-de-datos-publicar-por-las-entidades-locales
http://femp.femp.es/files/3580-1938-fichero/DATOS%20ABIERTOS%20FEMP%202019.pdf

A bit of history… FEMP – 40 datasets (2019)

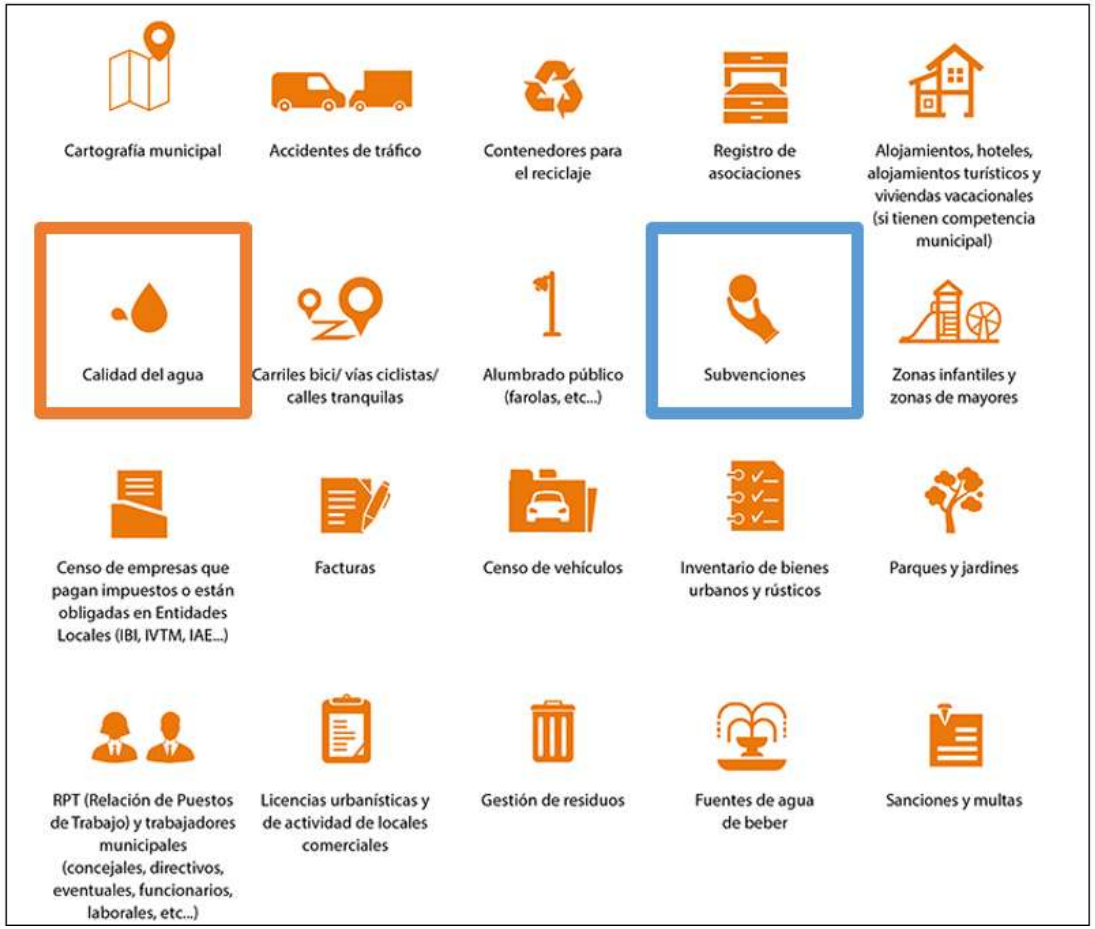
Red temática española de Open Data y Smart Cities

https://github.com/opencitydata

CIUDADES ABIERTAS

http://vocab.ciudadesabiertas.es/

A bit of history… FEMP – 40 datasets (2019)



Red temática española de Open Data y Smart Cities

https://github.com/opencitydata

CIUDADES ABIERTAS

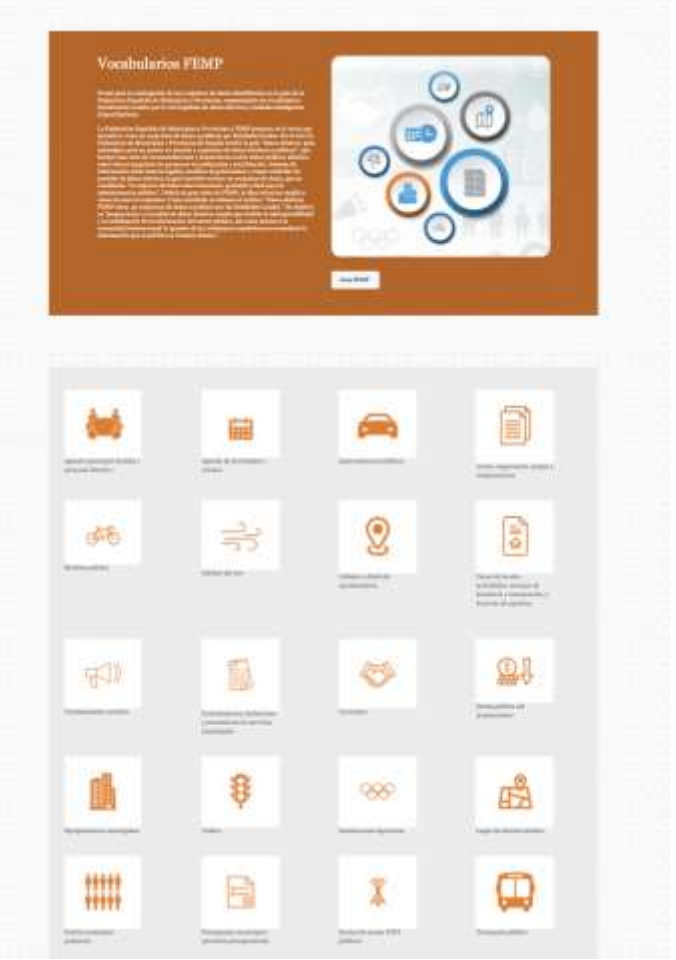
http://vocab.ciudadesabiertas.es/

Up to date information at:
https://opencitydata.github.io/CatalogoFEMP/

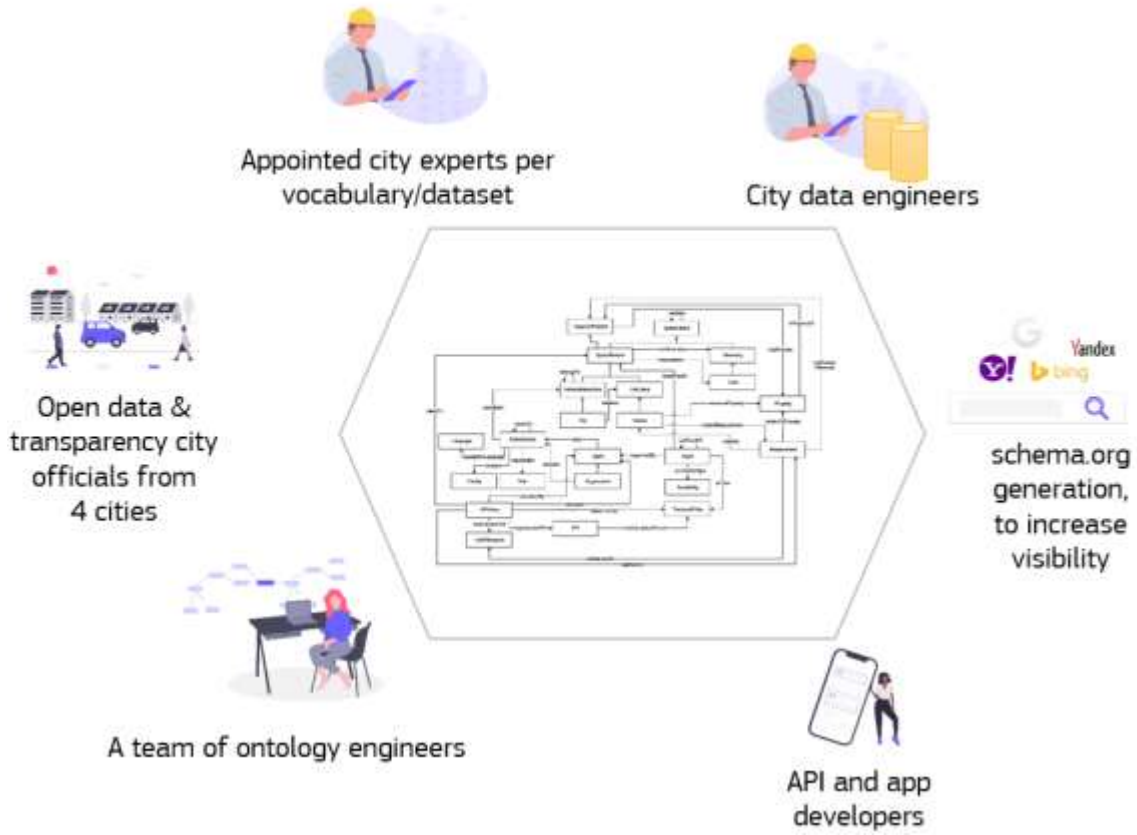
A bit of history… FEMP data catalogue in GitHub

- Available at
  - https://github.com/opencitydata
  - https://opencitydata.github.io/CatalogoFEMP/ (website)

- Ongoing work on specific vocabularies and dataset transformations (on MSc theses co-supervised by officials from the city of Madrid)

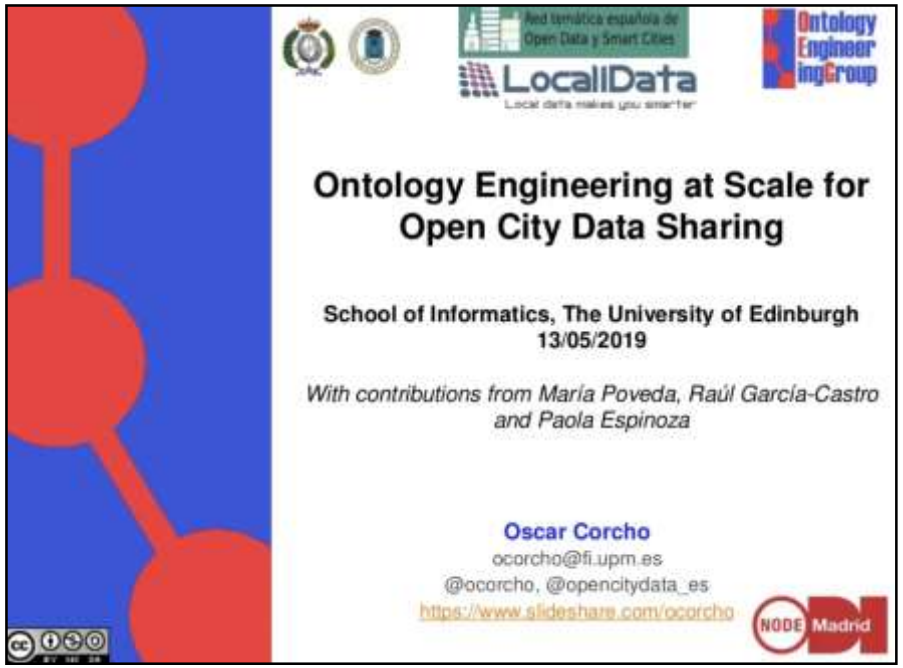


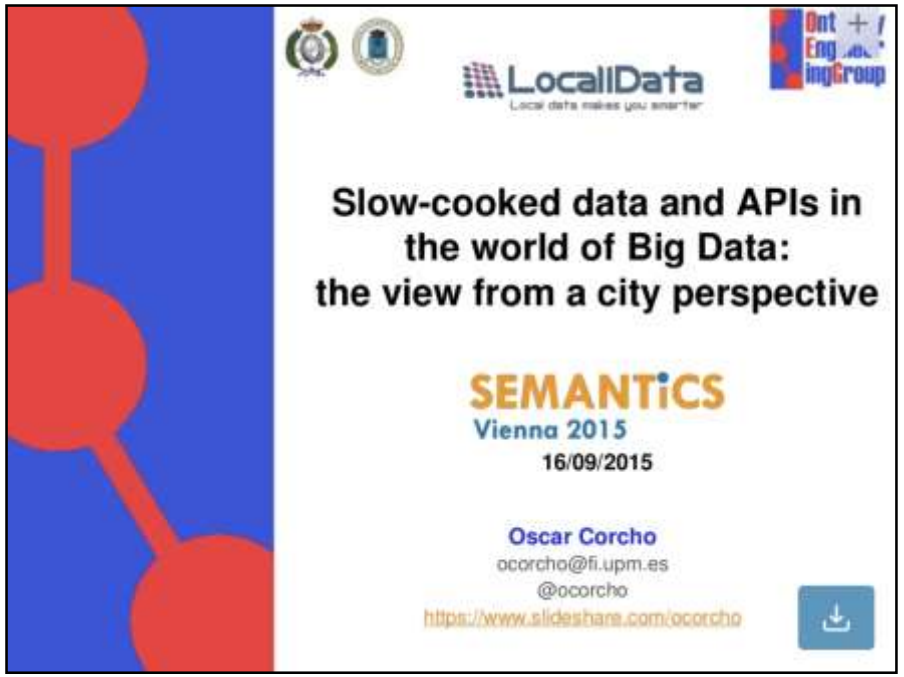
How did we do it? The stakeholders



Honorio Enrique Crespo Díaz-Alejo - Ayuntamiento de Madrid
María Carmen Ruiz Moreno - Ayuntamiento de Madrid
María Jesús Fernández Ruiz - Ayuntamiento de Zaragoza
María Jesús Gallego San Miguel - Ayuntamiento de Madrid
María del Mar Arribas de Andrés - Ayuntamiento de Madrid
Víctor Morlán Plo - Ayuntamiento de Zaragoza
Antonio Bermejo Aguña - Ayuntamiento de Madrid
Francisco Javier Catalina Celaya - Ayuntamiento de Madrid
Andrés Iglesias Pardo – EMT Madrid
Andrés Recio Martín – EMT Madrid
José Antonio Chanca Cáceres - Ayuntamiento de Zaragoza
Ana Bajo Prieto - Ayuntamiento de Madrid
Juan Antonio López López - Ayuntamiento de A Coruña
Laura Gris Pérez - Ayuntamiento de Madrid
Fernando París Roche - Ayuntamiento de Zaragoza
Araceli Rollán Arrojo - Ayuntamiento de Madrid
Carmen Hervás Bautista - Ayuntamiento de Madrid
Manuel Alejandro Pose Pose - Ayuntamiento de A Coruña
Ángel Pueyo Campos - Universidad de Zaragoza
Sergio Valdivielso Pardos - Universidad de Zaragoza
Antonio Herrero Martínez – Ayuntamiento de Zaragoza
Rubén Notivol Bezares – Ayuntamiento de Zaragoza
Francisco Javier Martínez – Ayuntamiento de Zaragoza
...

A few recommendations for other lectures…





https://es.slideshare.net/ocorcho/ontology-engineering-at-scale-for-open-city-data-sharing

https://es.slideshare.net/ocorcho/slowcooked-data-and-apis-in-the-world-of-big-data-the-view-from-a-city-perspective

Recommendations for ontology governance

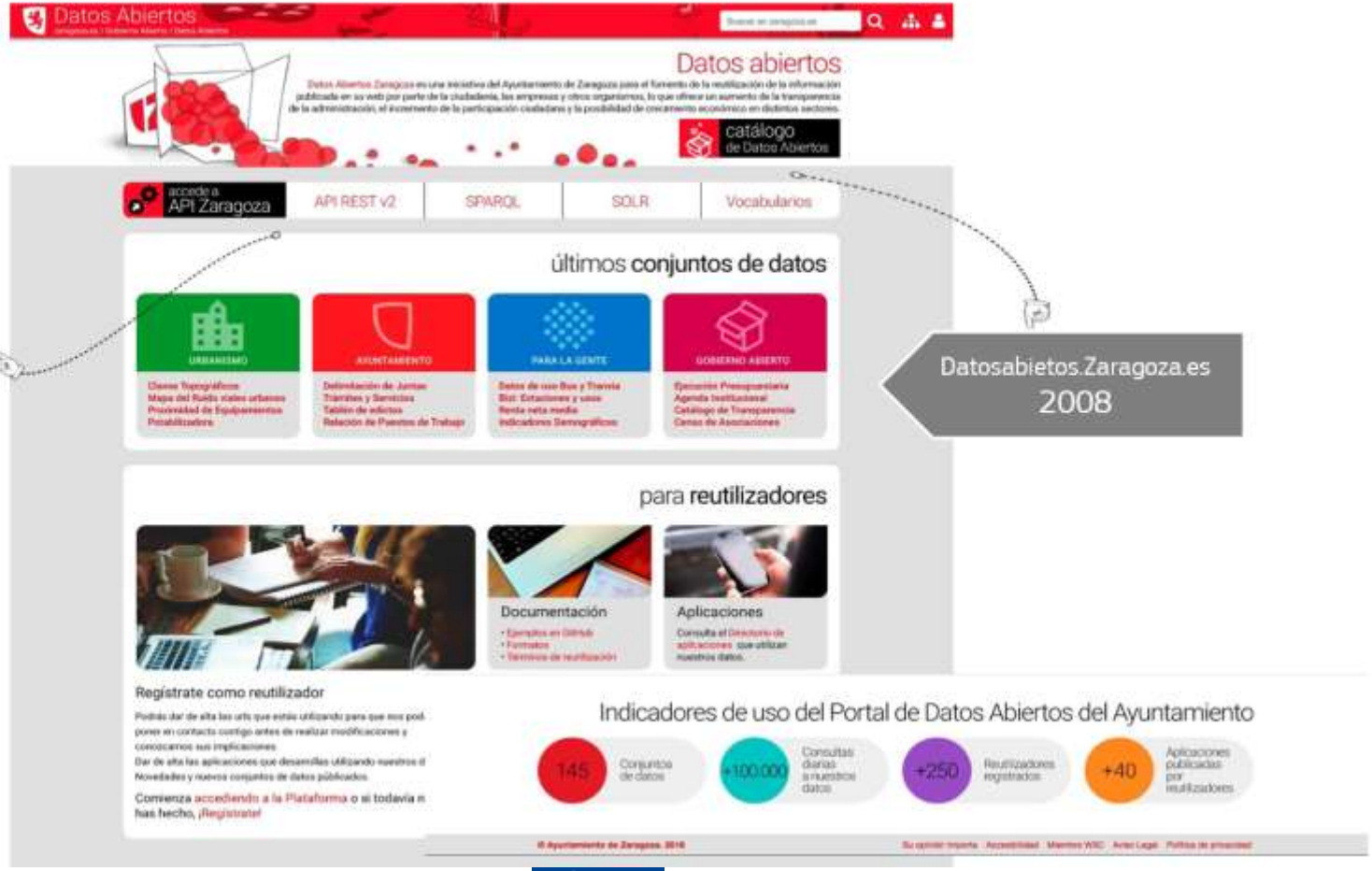
Recommendations for open data governance

What about Zaragoza's knowledge graph?

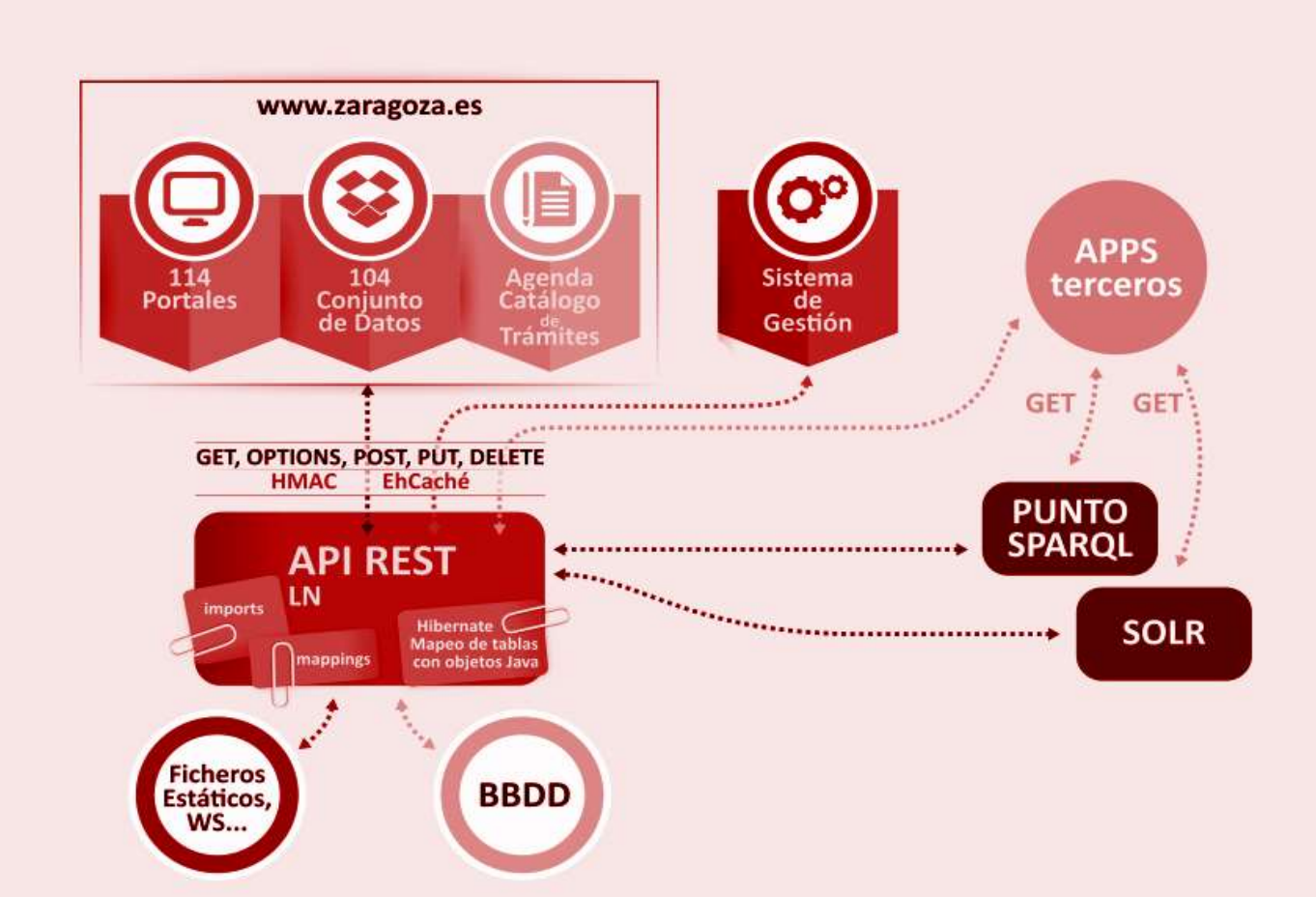
Espinoza-Arias, P.; Fernández-Ruiz, M.J.; Morlán-Plo, V.; Notivol-Bezares, R.; Corcho, O. The Zaragoza's Knowledge Graph: Open Data to Harness the City Knowledge. *Information* **2020**, *11*, 129. https://doi.org/10.3390/info11030129

Where can open data be found in Zaragoza?

Data API (consensuated and normalised)



Technical architecture

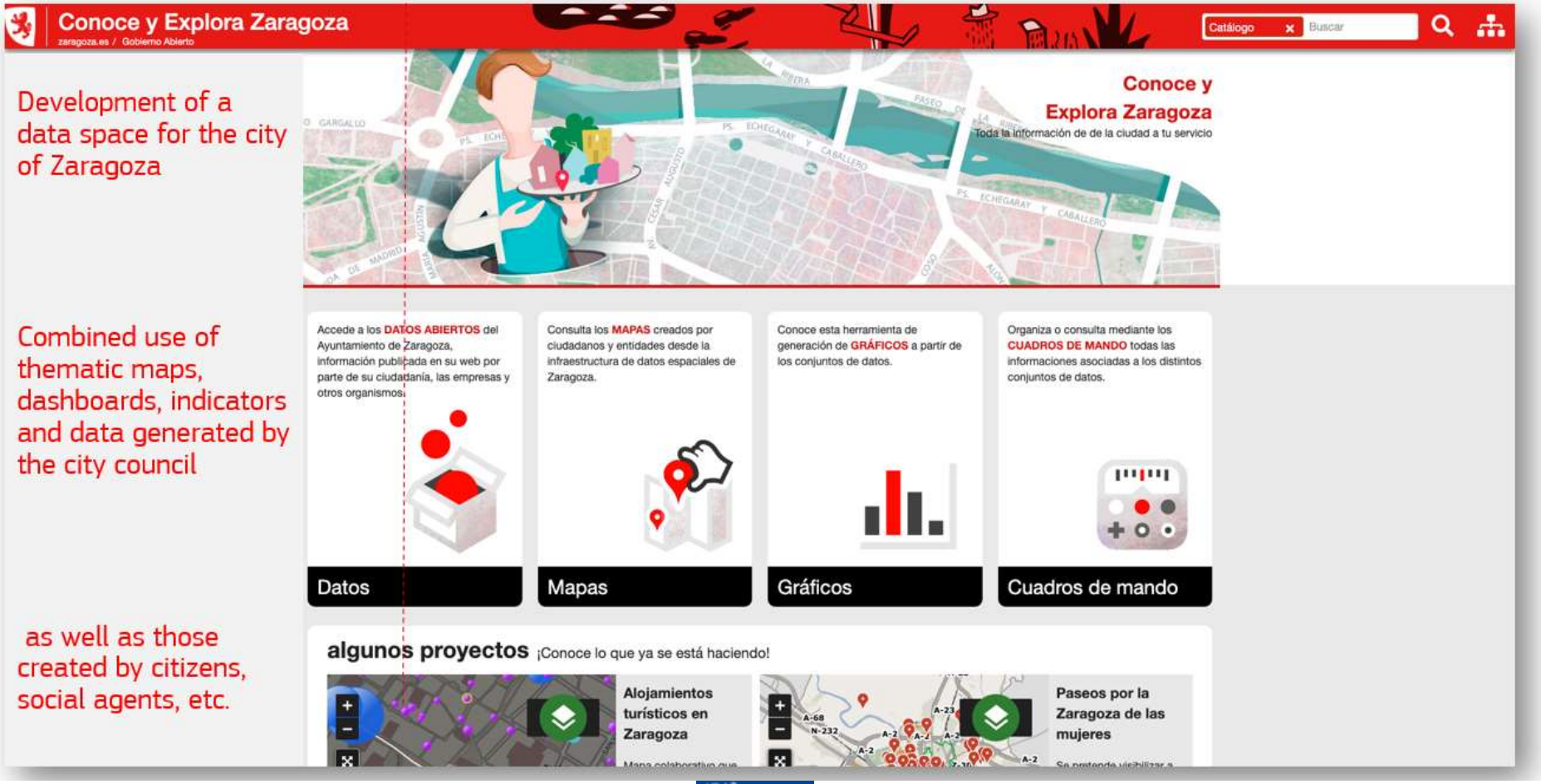


A knowledge graph: what for?

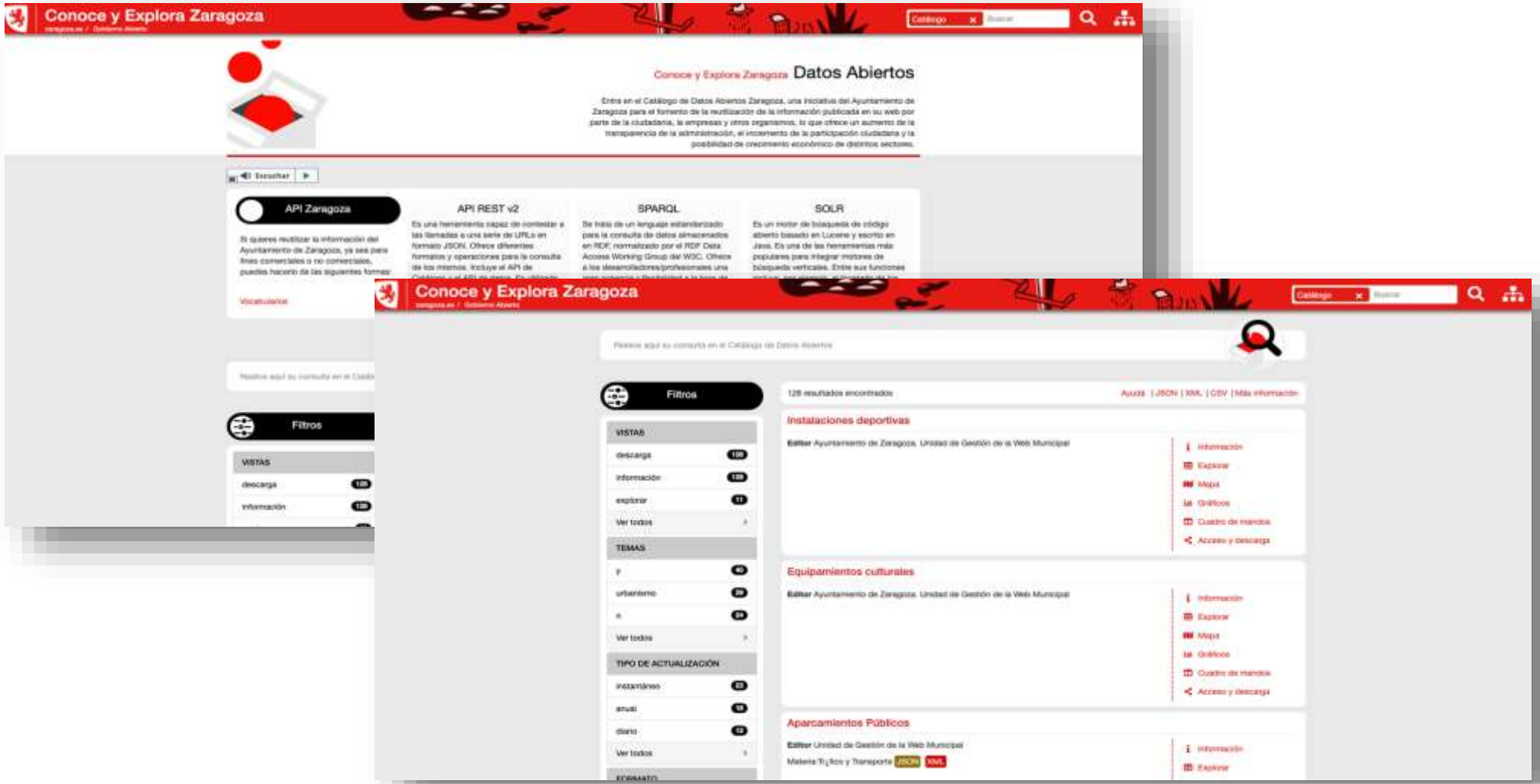
Development of a data space for the city of Zaragoza

Combined use of thematic maps, dashboards, indicators and data generated by the city council

as well as those created by citizens, social agents, etc.



European Commission



ISA²

Main messages for other municipalities

- Open data by default
  - The municipality services are the first reusers of open data
  - The open data portal is not a data graveyard
  - Datasets + APIs

- A proper open data governance
  - Avoid duplication of data across your information systems
    - Knowledge graph principles are key for this (unique identifiers)
  - Processes and people (multidisciplinary teams are essential)
  - Combine data with maps, dashboards, indicators…

- Homogenisation
  - Inside the city (common patterns)
  - Across cities (e.g., as in Ciudades Abiertas and on the FEMP catalogue)

3

Managing key concepts in a glossary or vocabulary

and linking it to others

Glossaries, vocabularies and ontologies

Location-enabled public service:

Public services provided by public authorities which depend on effective management or use of location information

Leveraging the Power of Location Information and Technologies to Improve Public Services at the Local Level: State of the Art Report (Barker et al., 2021)

ELISE Resource
Definition
Example(s)
…

Glossary

A list of terms in a particular domain of knowledge with their definitions.

diffSense

Vocabulary

A usually alphabetized and explained collection of words e.g. of a particular field, or prepared for a specific purpose, often for learning

stackoverflow

Ontology

The word “ontology” is used for more complex, and possibly quite formal collection of terms, whereas “vocabulary” is used when such strict formalism is not necessarily used or only in a very loose sense

The ELISE glossary

Results of the glossary dataset

- 502 ELISE resources processed
- Originally 349 concepts with 410 definitions
- 254 concepts retained in two levels
- 127 core concepts, 181 definitions
- 122 concepts at the second level and 129 definitions

towardsdatascience.com

surveyinggroup.com

navexglobal.com

Core glossary

Application Programming Interface (API)

Location data privacy

Organisational interoperability

Data quality

Second level terms

API gateway

Authorisation

Centralised governance

Data Quality Positional Accuracy

ISA²

The ELISE glossary

Text mining techniques

FiveFilters

Syn-Tactic

T-Manager

TaaS

TerMine

Sketch Engine and OneClick terms

shubscience.com

Can be used to identify key concepts and terms used, and their respective definitions and descriptions (or as part of Quality Control)

YOUR RESULTS

SINGLE-WORDS | MULTI-WORDS

Show stati

Term	Frequency	Rel. frequency	Ref. frequency	Rel. ref.
digital public service	186	3,093.967	359	
location datum	175	2,910.990	24,419	
location information	144	2,395.329	37,004	
digital government	80	1,330.738	2,260	
data ecosystem	79	1,314.104	1,811	
data infrastructure	60	998.054	7,357	
data space	50	831.711	4,334	
location intelligence	44	731.906	1,724	
data policy	46	765.175	4,487	
strategy alignment	40	665.369	291	
use of location	38	632.101	730	
process owner	36	598.832	2,760	
public administration	64	1,064.591	40,737	
data quality	64	1,064.591	44,238	
european data	30	499.027	764	
public service	239	3,975.581	328,352	
european public service	28	465.758	116	
use of location information	27	449.124	62	
short description	47	781.809	38,910	
open datum	39	648.735	29,280	
information in digital public services	23	382.587	0	
interoperability framework	23	382.587	1,299	

Linking to other glossaries

Glossaries, manual scan

OECD glossary

ESTAT glossaries

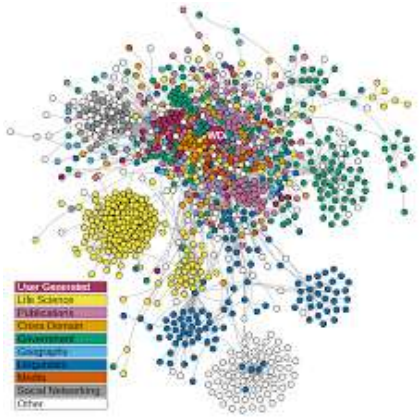
Several W3C glossaries

INSPIRE glossary

OGC & OSGeo

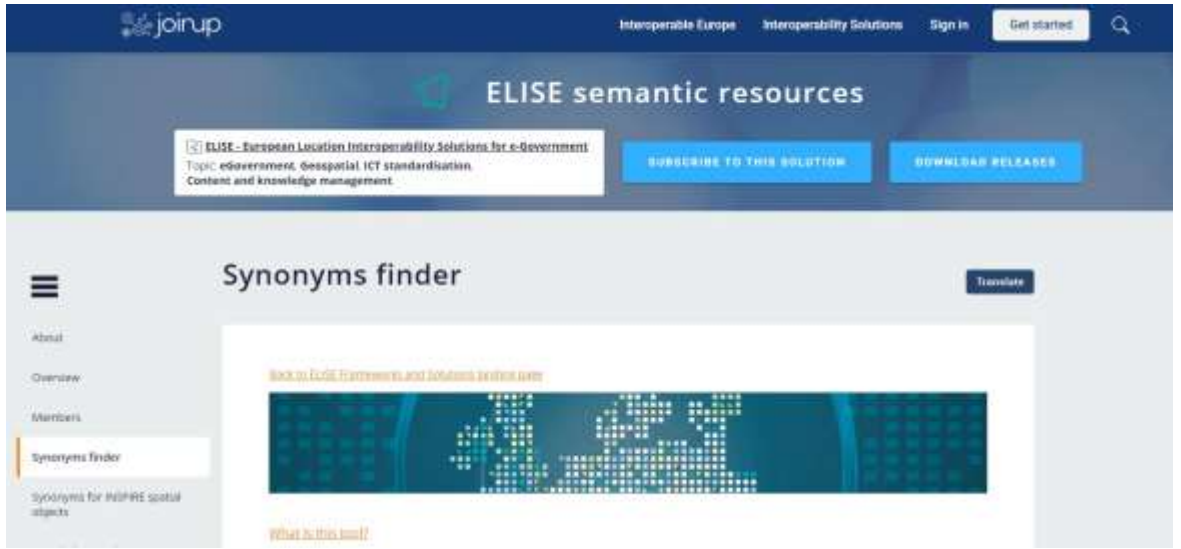
World Bank

…



Looking for:
Synonyms
Hypernyms
Hyponyms
Similarity

Glossary / Vocabulary	# terms
Eurovoc	7500
Digital Europe Thesaurus (DET)	1600+
General Multilingual Environmental Thesaurus (GEMET)	5500
NIST glossary	9199
Body of Knowledge on EO*GI	900
World Bank Glossary	360128
Wikidata	96 million



Linking to other glossaries

Organisations contacted

UN-GGIM

OECD

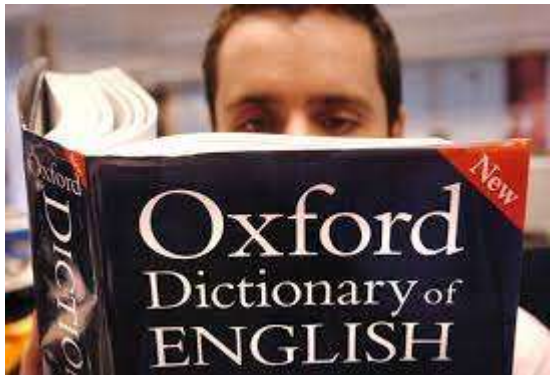
OGC

DG ESTAT

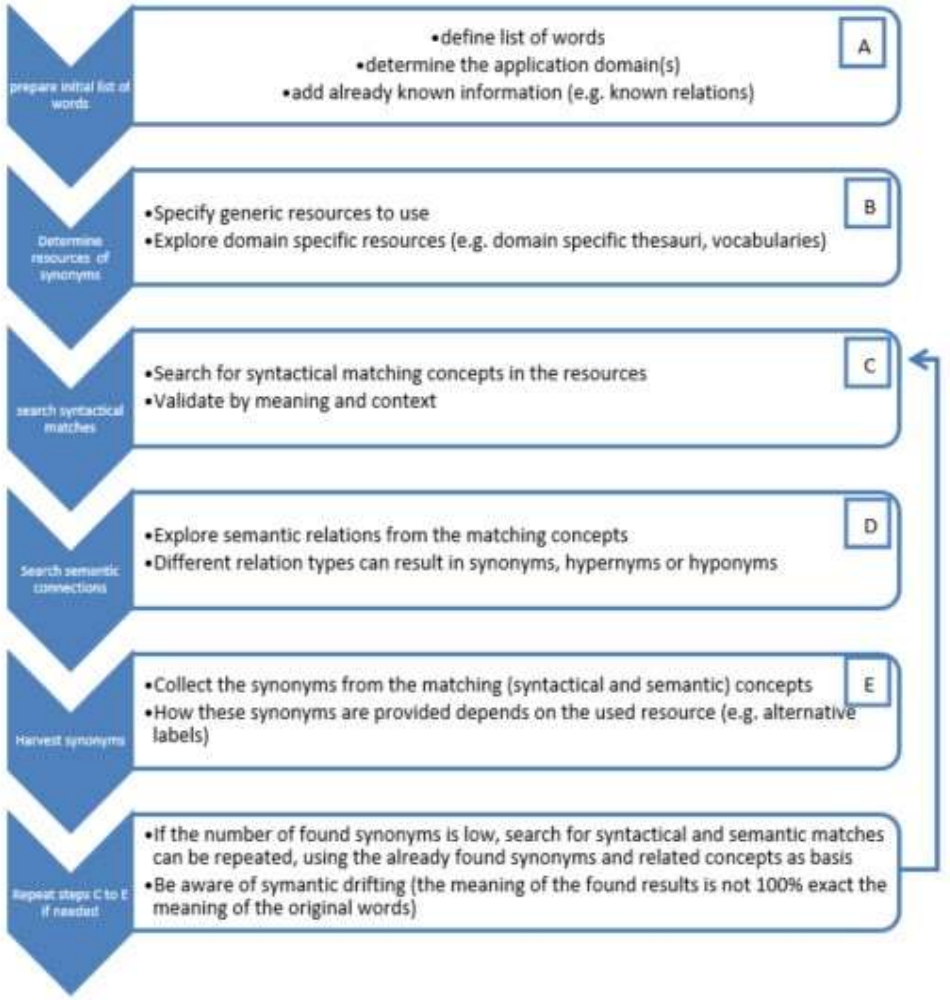
ISA², Joinup

ANZLIC

Australian Government



Looking for:
Original 32 sources
Finally 23 used
16 manually processed
7 automatically
102 synonyms



4

Experimenting with Knowledge Graph in ELISE Action

The Knowledge Matrix

Excel file:
Different sheets,
sheets to link
Multi-value cells
…

	D	E	F	G	H	I	J	K	L
1	[4]ID	[5]ELISE output	[6]Output subtype	[7]URC publication type	[8]URC identifier	[9]Output name	[10]Public title	[11]Activity (alias)	[12]Topic/Subject area
107	106	Knowledge Geo	Workshop	N/A	N/A	ISO/TC211 Standards in Action Seminar: INSPIRE Directive and Location Interoperability	ISO/TC211 Standards in Action Seminar: INSPIRE Directive and	Action Stakeholder engagement | Re3gistry software | Reusing INSPIRE - Phase II	Location interoperability
108	107	Knowledge Geo	Workshop	N/A	N/A	KT2 - Cross border dataflows	ELISE Workshop on Cross-border Data Flows (closed event)	Knowledge Transfer 2	Location-enabled public services
109	108	Knowledge Geo	Webinar	N/A	N/A	KT2 WP2D2 synonyms	ELISE Webinar: Using synonyms to improve discovery of geospatial data	Knowledge Transfer 2	Data models
110	109	Knowledge Geo	Workshop	N/A	N/A	AI Watch 1st Peer Learning Workshop on the use and impact of AI in public services	AI Watch - Artificial Intelligence for the public sector	AI WATCH support	Location technologies
111	110	Knowledge Geo	E-learning course	N/A	N/A	Monitoring and understanding emerging geospatial technologies	Training: Monitoring and understanding emerging geospatial	INSPIRE training II	Location technologies
112	111	Knowledge Geo	E-learning course	N/A	N/A	From INSPIRE to e-Government	Training: From INSPIRE to e-Government	INSPIRE training II	Data access and sharing
113	112	Knowledge Geo	E-learning course	N/A	N/A	Principles for Data and Metadata Harmonisation according to INSPIRE	Training: Principles for Data and Metadata Harmonisation according to INSPIRE	INSPIRE training II	Data models
114	113	Knowledge Geo	E-learning course	N/A	N/A	INSPIRE Network Services (UPDATE)	Training: INSPIRE Network Services (UPDATE)	INSPIRE training II	Location technologies
115	114	Knowledge Geo	Webinar	N/A	N/A	KT2 RS07 Geodata Marketplaces	Geodata Marketplaces supporting Location Intelligence	Knowledge Transfer 2	Location intelligence
116	115	Knowledge Geo	Webinar	N/A	N/A	KT2 RS08 Modelling Simulations Predictions	Geospatially enabled modelling, simulation and prediction	Knowledge Transfer 2	Location technologies
117	116	Knowledge Geo	Webinar	N/A	N/A	KT2 WP3 Evolution Spatial Data Environment	Evolution of the access to spatial data for environmental purposes – Study	Knowledge Transfer 2	Data access and sharing
118	117	Knowledge Geo	Workshop	N/A	N/A	Smart Data Loader and Templating for GeoServer	Smart Data Loader and Templating for GeoServer	API4INSPIRE - Facilitating access to INSPIRE data through APIs- Study	Location interoperability
119	118	Knowledge Geo	Webinar	N/A	N/A	KT2 RS09 Blockchain	Blockchain and proof of location supporting digital government	Knowledge Transfer 2	Location technologies
120	119	Knowledge Geo	Workshop	N/A	N/A	ELISE Knowledge Transfer Workshop for ISA² WG GS and national stakeholders	N/A N/A	Action Stakeholder engagement | Knowledge Transfer 2 | Knowledge Transfer 1	Location interoperability
121	120	Knowledge Geo	Webinar	N/A	N/A	The EULF Blueprint – its role and how to use it	The EULF Blueprint – its role and how to use it	EULF Blueprint	Location interoperability
122	121	Knowledge Geo	Webinar	N/A	N/A	KT2 RS10 Immersive realities	Immersive realities and location for better public services	Knowledge Transfer 2	Location-enabled innovation
123	122	Knowledge Geo	Workshop	N/A	N/A	ELISE enabling the interoperability of digital government from a location perspective	ELISE enabling the interoperability of digital government from a location perspective	Action Stakeholder engagement | INSPIRE Reference validator | EULF Blueprint | LFO 2 | Knowledge Transfer 2	Location-enabled innovation
124	123	Knowledge Geo	Webinar	N/A	N/A	Supporting Policy Initiatives	ELISE action support to Policy Initiatives	Knowledge Transfer 2	Location interoperability
125	124	Knowledge Geo	Webinar	N/A	N/A	Interoperable Frameworks and Solutions for cross-border and cross-sector services	Interoperable Frameworks and Solutions for cross-border and cross-sector services	Knowledge Transfer 2	Location-enabled public services
126	125	Knowledge Geo	Webinar	N/A	N/A	KT2 WP4 Emerging trends webinar	Monitoring and understanding emerging geospatial technologies	Knowledge Transfer 2	Location technologies
127	126	Knowledge Geo	Webinar	N/A	N/A	An example of a digital platform for the smart management of infrastructures - The Public lighting case	ELISE webinar: Digital platform for the smart management of	Energy & Location Applications	Data ecosystems
128	127	Knowledge Geo	Tool	N/A	N/A	Digital Transformation Game	GeoSwapGame	Knowledge Transfer 2	Collaboration models

2. Knowledge Matrix | 4. Metadata values | 3. Metadata | 5. Keywords | 6. Case studies | 7. Contributors | 8. Organisations | 10.Policie…

All ELISE outputs

+ information on:

Contributors

Organisations

Case studies

Policies

…

+ code lists:

EIF layers

Subject areas

…

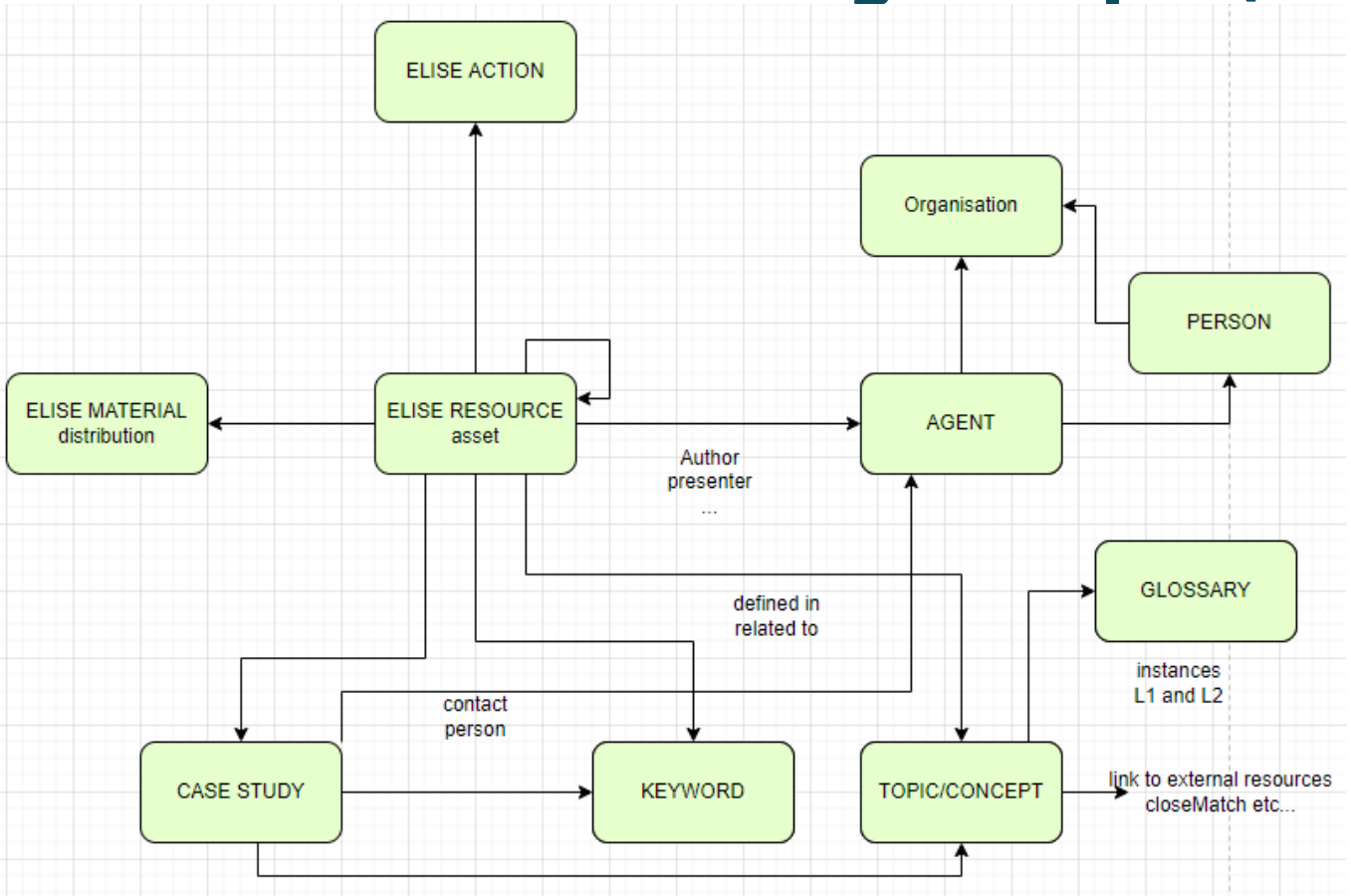
Develop the model for the Knowledge Graph (prototype)

Define classes, properties and relations

Adms as base

Extended with existing classes and properties,

Code lists reused or values linked to external resources



Use existing vocabularies:
foaf,
dcat
dc
dct
org
...
Subclassing for new elements
isSubClassOf
isSubPropertyOF

Data lifting: From (semi-)structured data to Knowledge Graph

Define mapping

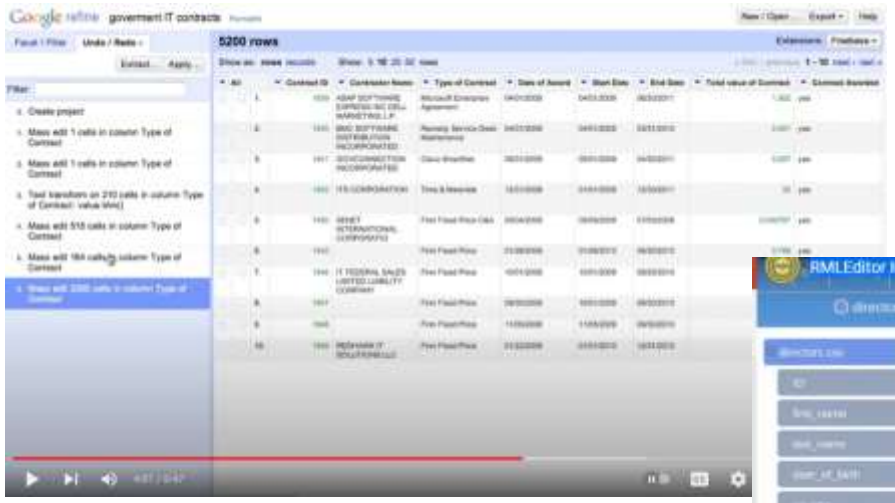
Xlsx -> RDF

Create class instances

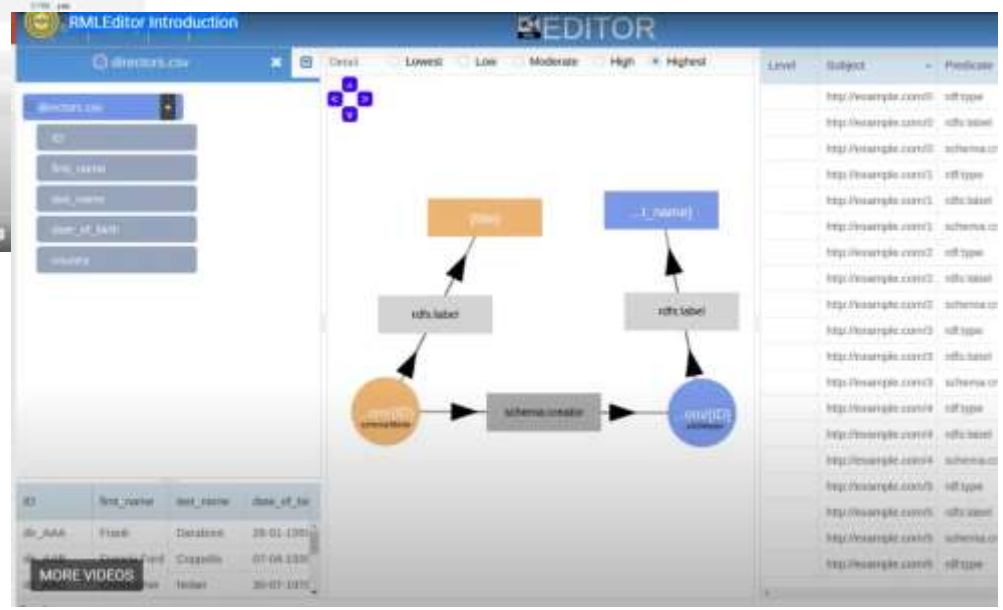
Add properties

Create relations

Using a replicable workflow



GUIs, e.g.:
OpenRefine (or OntoRefine)
RMLEditor, RMLWorkbench



Define mapping rules:
YARRRML, RML, R2RML

Apply rules (creation of the KG)
RMLMapper, SDM-RDFizer,...

The Knowledge Graph

Outputs: 508

Contributors: 357

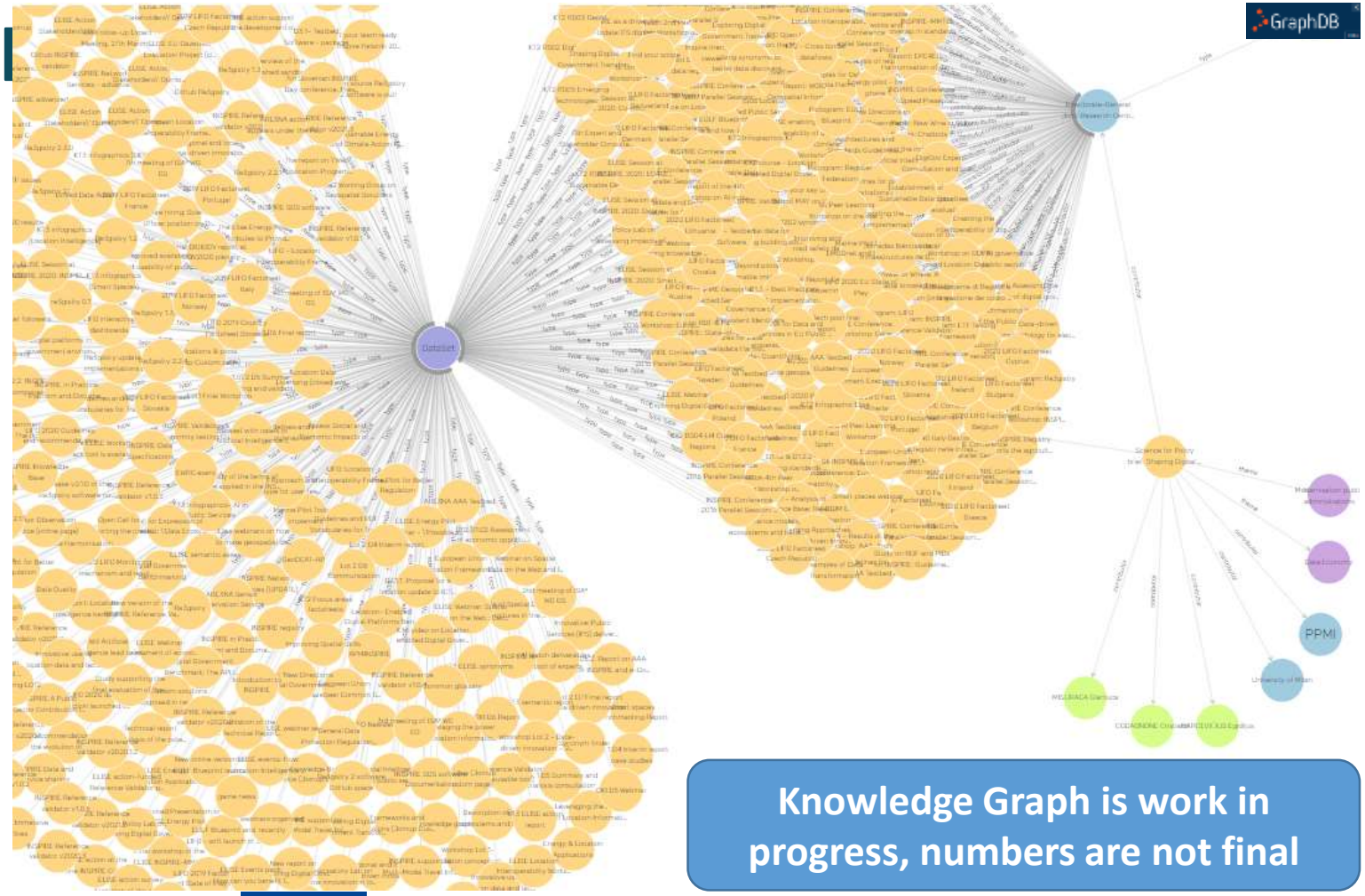
Organisations: 191

Topics/Subject areas: 14

Activity types: 53

Case studies: 307

Methodological approaches: 27



Knowledge Graph is work in progress, numbers are not final

Use cases for the Knowledge Graph

Quality assurance	**Get all duplicates of contributors or organisations** **Get ELISE Outputs without a public name**
Entity and Graph summaries	**Get number of webinars** **Get case studies related to more than one ELISE Output** **Get count of Outputs by EIF Layer**
Question answering	**To what outputs did organisation X contribute** **What were the most active Topics in 2020** **What policies are not covered by ELISE outputs**
Further exploitation	**Link to external Knowledge Graphs** **Use inference to create new knowledge** **Apply ML techniques to further enrich the Knowledge Graph**

Example 1

Get outputs without a contributing organisation

Use case: Data validation

Query for missing attributes

SPARQL: query language for Graphs

```
PREFIX skos: <http://www.w3.org/2004/02/skos/core#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX dct: <http://purl.org/dc/terms/>
PREFIX dcat: <http://www.w3.org/ns/dcat#>
PREFIX org: <http://www.w3.org/ns/org#>


 SELECT  ?output ?label
      WHERE
        { ?output a dcat:DataSet .
          ?output dct:title ?label .
    FILTER(NOT EXISTS {?output dct:contributor ?
contributor .
        ?contributor a org:Organization})
        }
```

Run

https://joinup.ec.europa.eu/collection/elise-european-location-interoperability-solutions-e-government/kg/output/10	1st meeting of ISA² WG GS
https://joinup.ec.europa.eu/collection/elise-european-location-interoperability-solutions-e-government/kg/output/20	ELISE Energy Pilot Seminar - \'Possible synergies between energy smart meters, SensorThings API and INSPIRE\'
https://joinup.ec.europa.eu/collection/elise-european-location-interoperability-solutions-e-government/kg/output/22	Webinar on Spatial Data on the Web and INSPIRE
https://joinup.ec.europa.eu/collection/elise-european-location-interoperability-solutions-e-government/kg/output/23	ELISE Webinar: Spatial Data on the Web : GeoNetwork´s User feedback form - How to make geospatial data more accessible for e-government applications
https://joinup.ec.europa.eu/collection/elise-european-location-interoperability-solutions-e-government/kg/output/24	2nd meeting of ISA² WG GS
https://joinup.ec.europa.eu/collection/elise-european-location-interoperability-solutions-e-government/kg/output/25	Digital platforms in government environments (Closed event)
https://joinup.ec.europa.eu/collection/elise-european-location-interoperability-solutions-e-government/kg/output/27	Location Data Licensing (closed event)
https://joinup.ec.europa.eu/collection/elise-european-location-interoperability-solutions-e-government/kg/output/28	Pan-European Authoritative Gazetteer Developments (closed event)
https://joinup.ec.europa.eu/collection/elise-european-location-interoperability-solutions-e-	3rd meeting of ISA² WG GS

Queries can also create additional data

Persons are linked to outputs

Persons are linked to an organisation

Use to create link output - organisation

Example 2

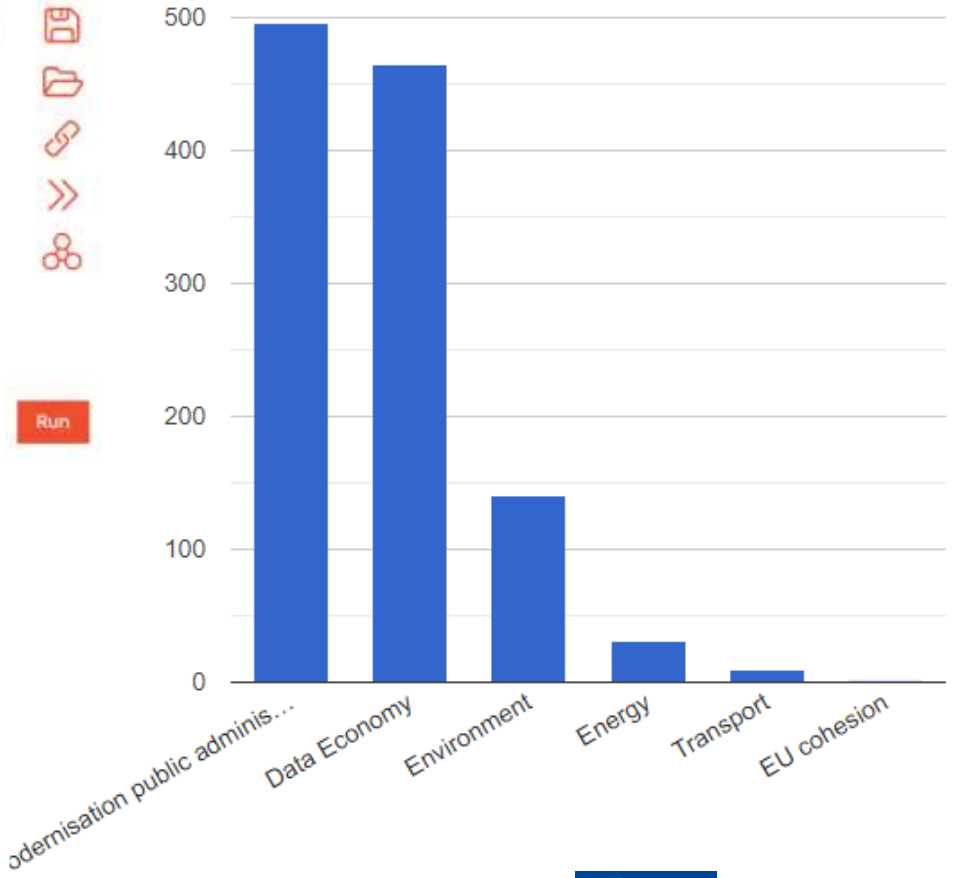
Get the number of outputs grouped by policy domain

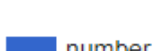
```
PREFIX skos: <http://www.w3.org/2004/02/skos/core#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX dcat: <http://www.w3.org/ns/dcat#>
PREFIX demo: <http://www.example.com/demo#>

SELECT ?label (COUNT(?r) AS ?number)
    WHERE
      { ?r dcat:theme ?theme .
        ?theme rdfs:label ?label .
      }
      GROUP BY ?label ORDER BY DESC (?number)
```

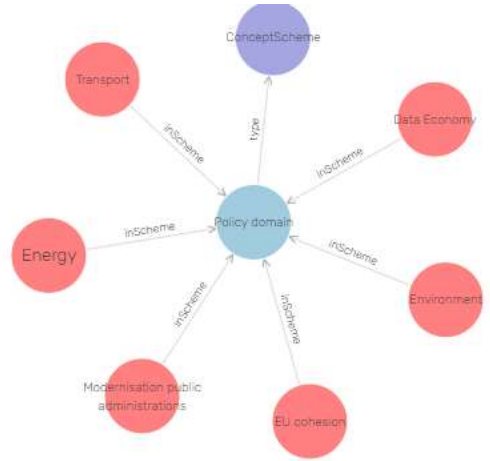
Run

Count by policy domain

An output can have multiple policy domains







	label	number
1	"Modernisation public administrations"@en	"496"^^xsd:integer
2	"Data Economy"@en	"465"^^xsd:integer
3	"Environment"@en	"141"^^xsd:integer
4	"Energy"@en	"31"^^xsd:integer
5	"Transport"@en	"10"^^xsd:integer
6	"EU cohesion"@en	"1"^^xsd:integer

Example 3

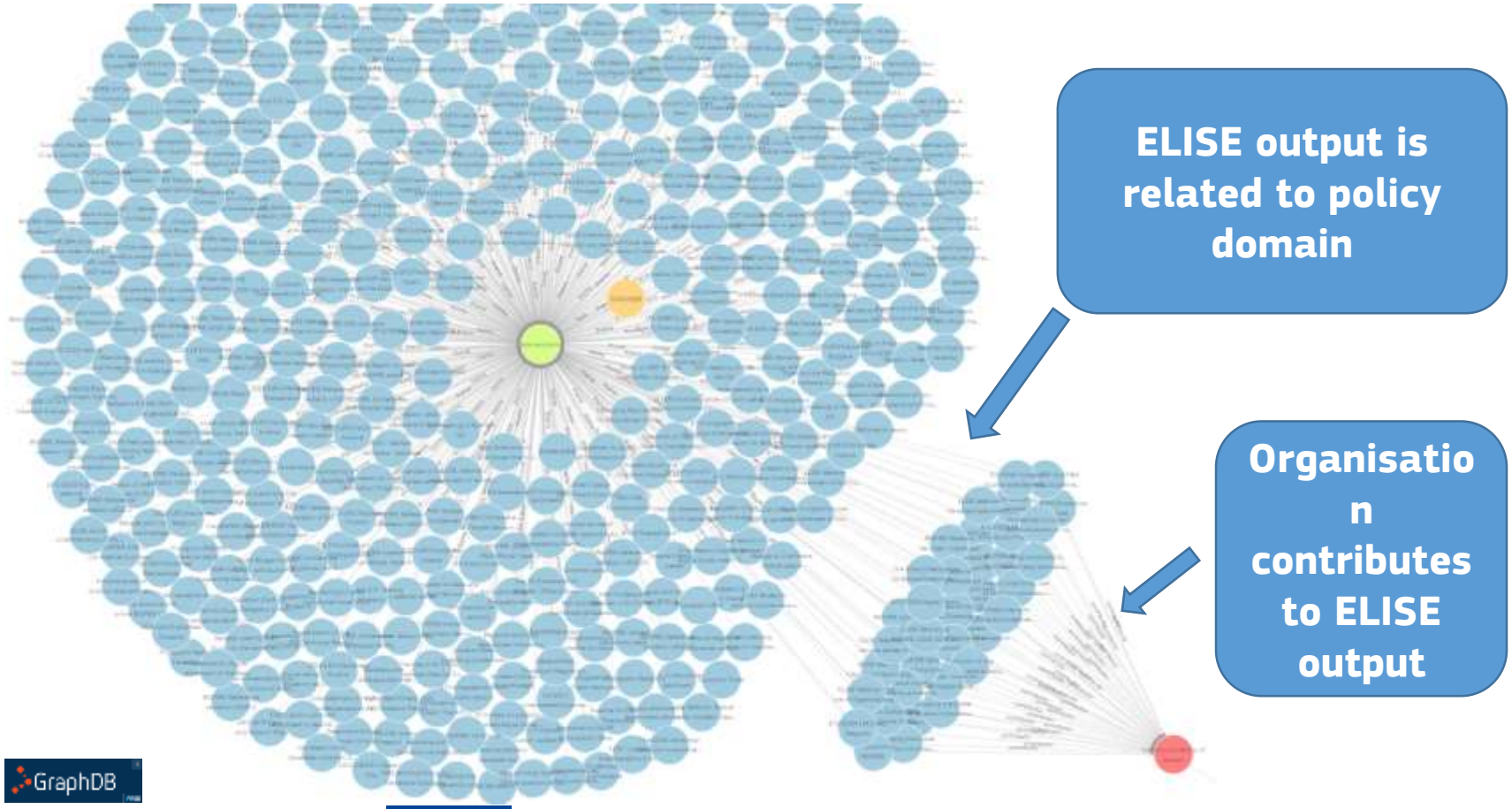
Get the topics covered by organisation X related to policy domain y

Visualisation, (no query executed)

Blue: ELISE output

Green: Policy domain (example: data-economy)

Red: Organisation (example: KU Leuven)



5

Conclusions and future outlook

Concluding remarks

For organisations and individuals alike it is a big **challenge to find** their **way through the rich portfolio of** resources generated by **the ELISE Action**. Therefore the use of Knowledge Graphs (KG) for ELISE Knowledge Transfer was investigated and experimented with

Knowledge Graphs can provide an **overview of the ELISE universe**, both graphically and in the form of summary lists. Moreover, KG also allow to **query** the universe, both its content (concepts) as well as the ELISE resources themselves. In that sense they can **support the Knowledge Transfer process**

Ongoing and **future developments** show a huge potential to exploit even better location-enabled digital government – see the **Zaragoza case** - by including more semantic web, as well as Machine Learning and Natural Language Processing techniques – see the **BigKnowledge case**

Future outlook:

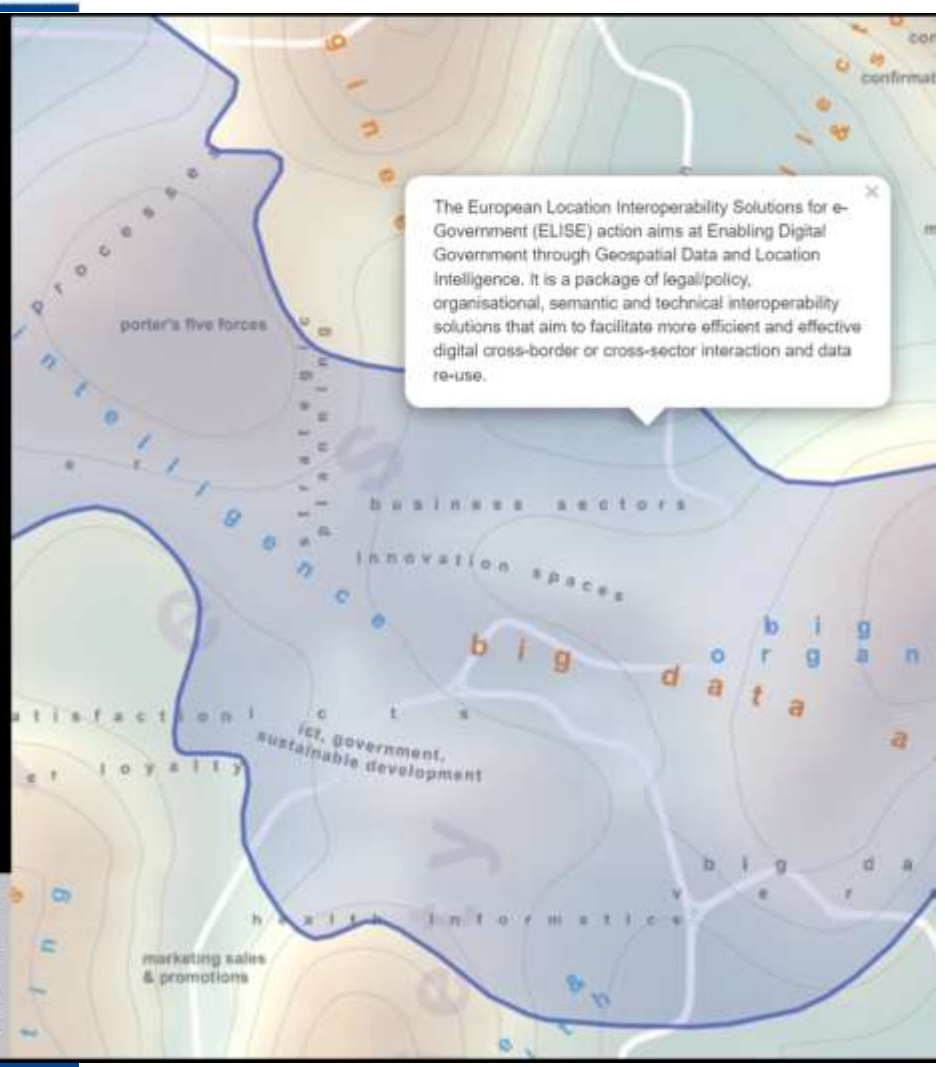
Using Machine Learning and Natural language processing for Knowledge Transfer

By André Skupin (BigKnowledge)

European Commission

André Skupin

Knowledge Representation for Contextual Intelligence



Acknowledgements
Sean Ahearn, BigKnowledge
Tommy Martindale, SDSU TTO
George Percivall, GeoRoundtable

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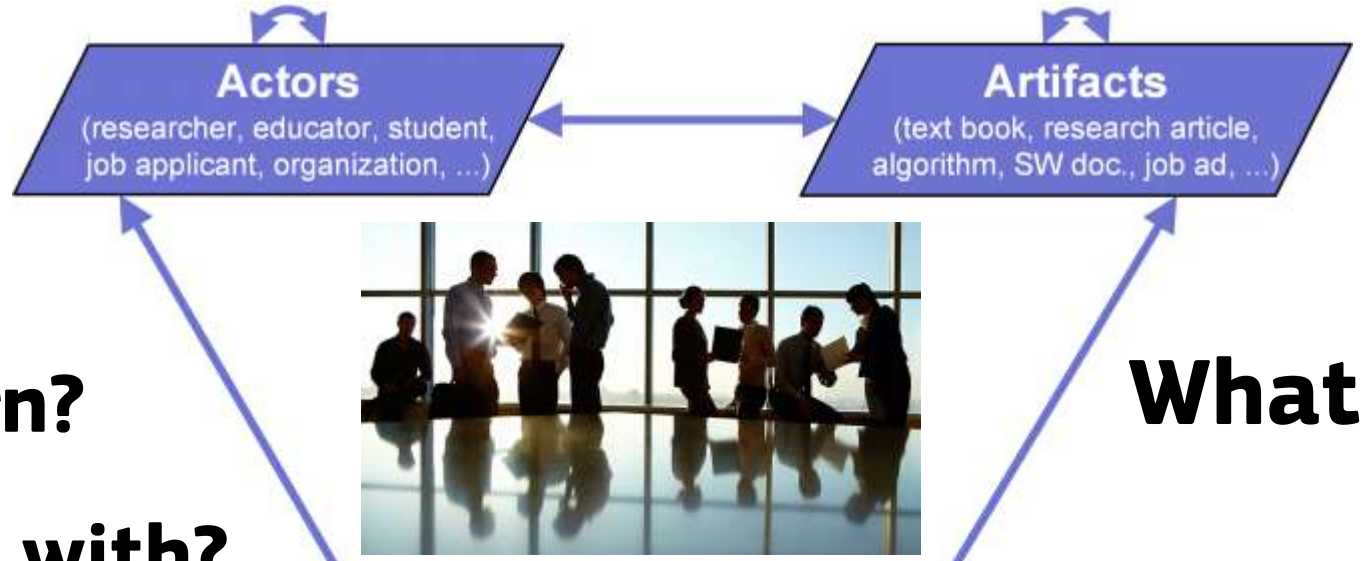
Knowledge Management – Recurring Questions

How efficient is your knowledge ecosystem?



What to teach?

What to learn?

Who to partner with?

Who should be on this team?

What to read?

What's emerging?

Which tool for this task?

What's fading?

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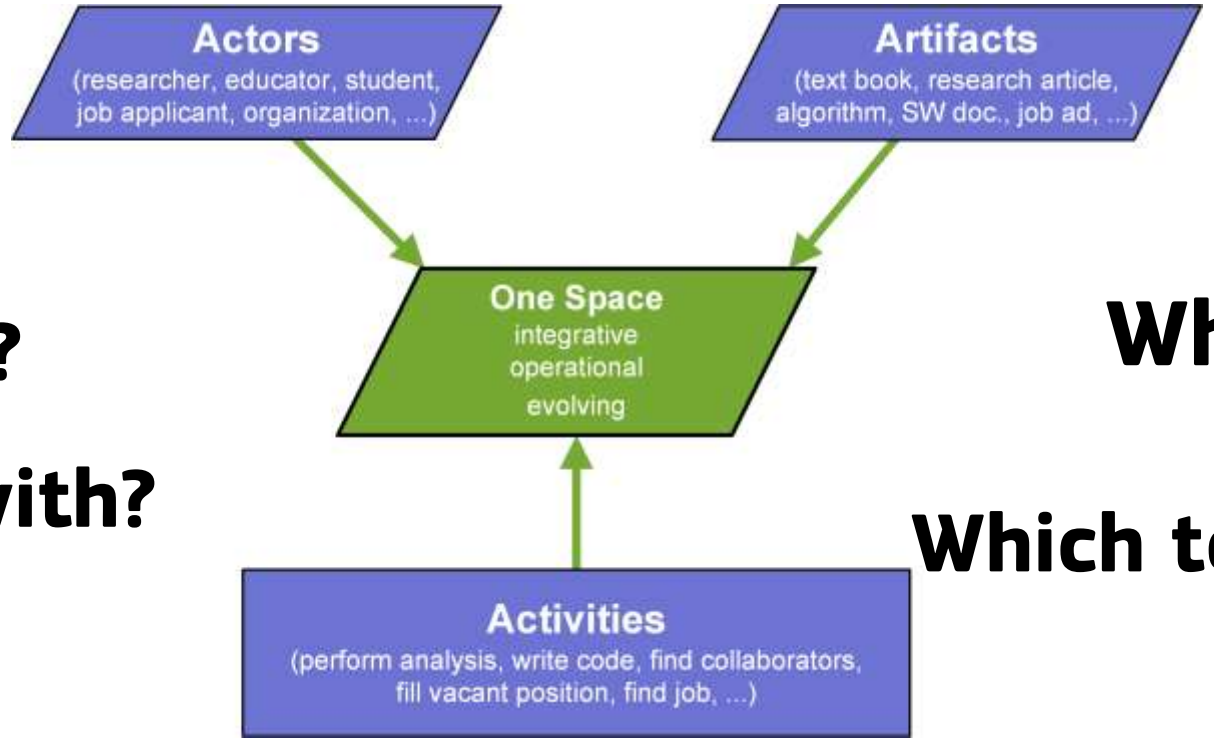
Knowledge Management – Spatial Approach

What if there was a reference system & common space?



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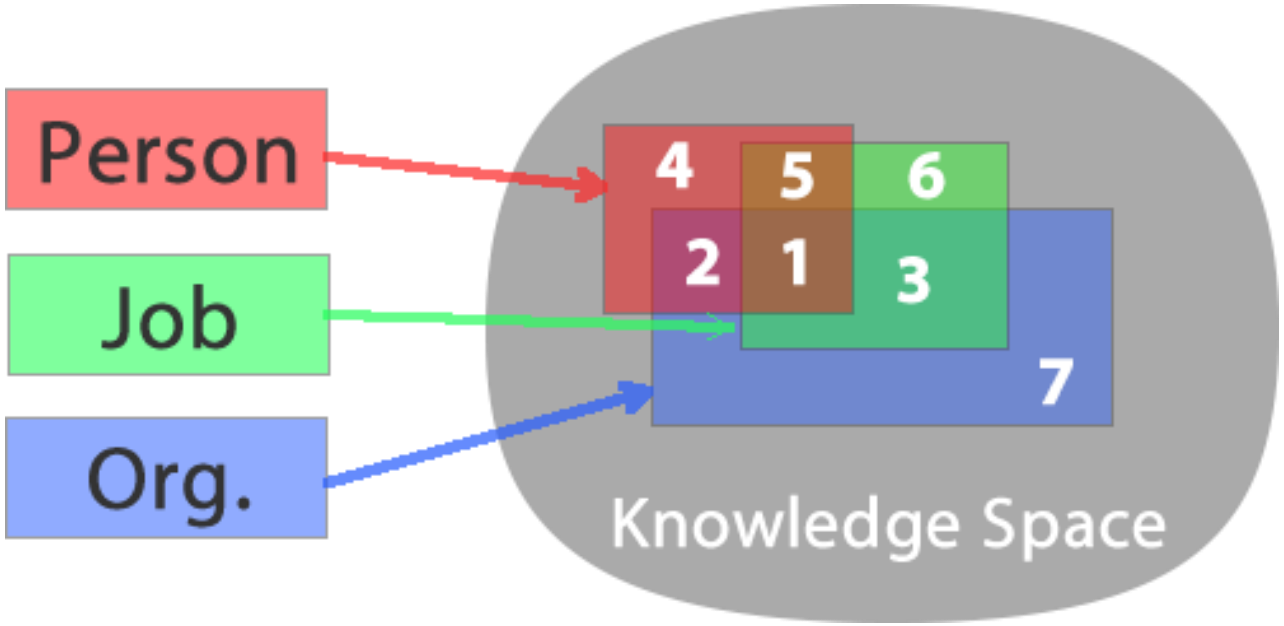

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Knowledge Management – Spatial Approach

Inspiration from Geographic Information Science

“People Manipulate Objects (but Cultivate Fields)”

Helen Couclelis - 1992

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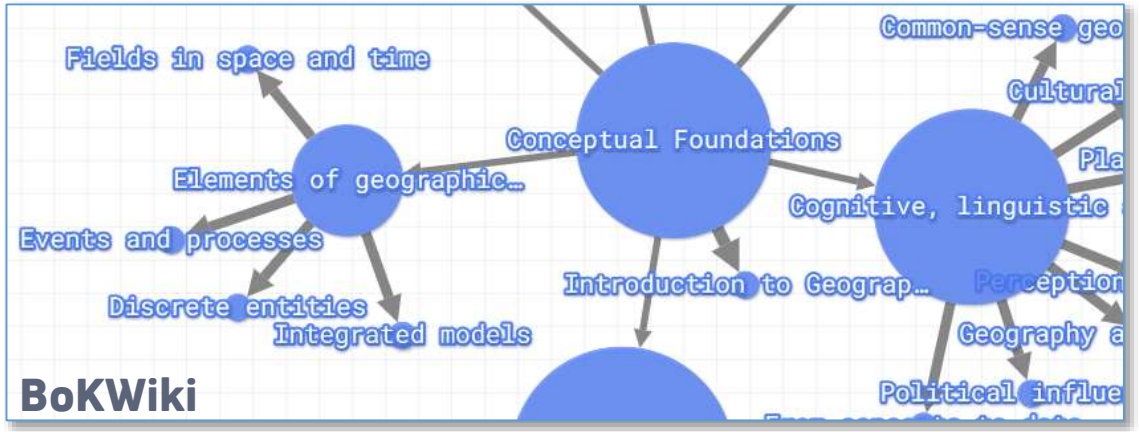
Knowledge Management – Spatial Approach

Inspiration from Geographic Information Science

- Discrete Objects

- Ontology
- Knowledge graph
- Subject-Predicate-Object
- Triple store
- Graph database
- Community detection
- Graph layout



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Knowledge Management – Spatial Approach

Inspiration from Geographic Information Science

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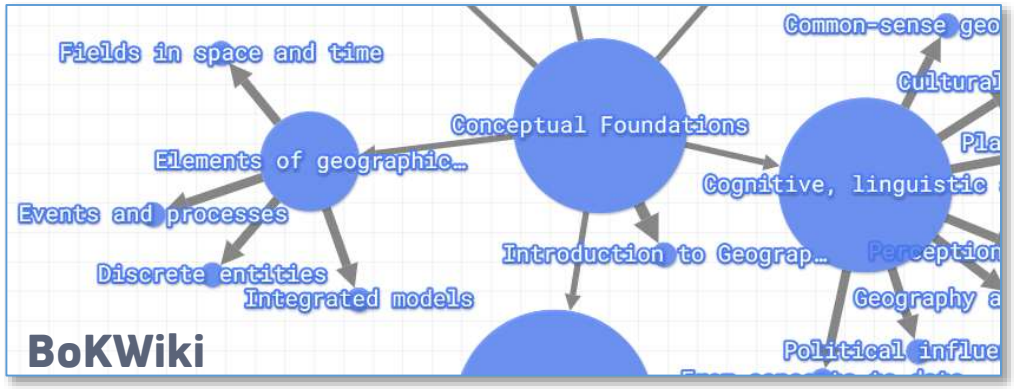


- Continuous fields
  - Feature space
  - High-dimensional space
  - Natural language processing
  - Machine learning
  - Multivariate clustering
  - Dimensionality reduction
  - Projection

Knowledge Management – Spatial Approach

Context through Spatial Intelligence

1. those objects or entities which ***surround*** a focal event.

2. the circumstances that form the ***setting*** for an event, statement, or idea, and in terms of which it can be fully **understood and assessed**.

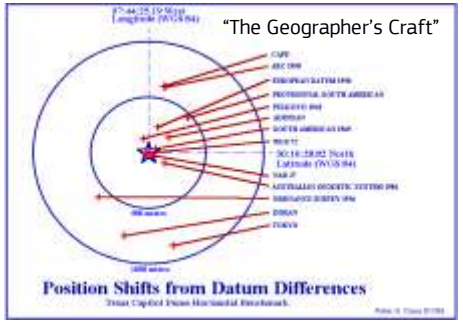
3. a ***frame*** that surrounds the event and provides resources for its ***appropriate interpretation***

BoKMap Knowledge Mapping Platform

Characteristics

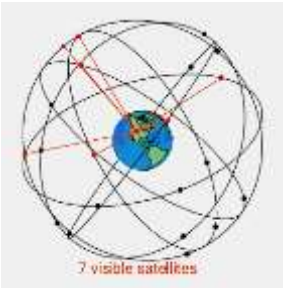
(1) *detailed, high-dimensional reference system of a domain*

(2) *multi-scale base map, inspired by topographic base mapping, but depicting the knowledge space*



(3) *inference engine allowing any artifact to be integrated; a "GPS for knowledge"*

(4) *knowledge analytics framework to support knowledge management tasks,*
incl. recommenders, gap detection, etc.

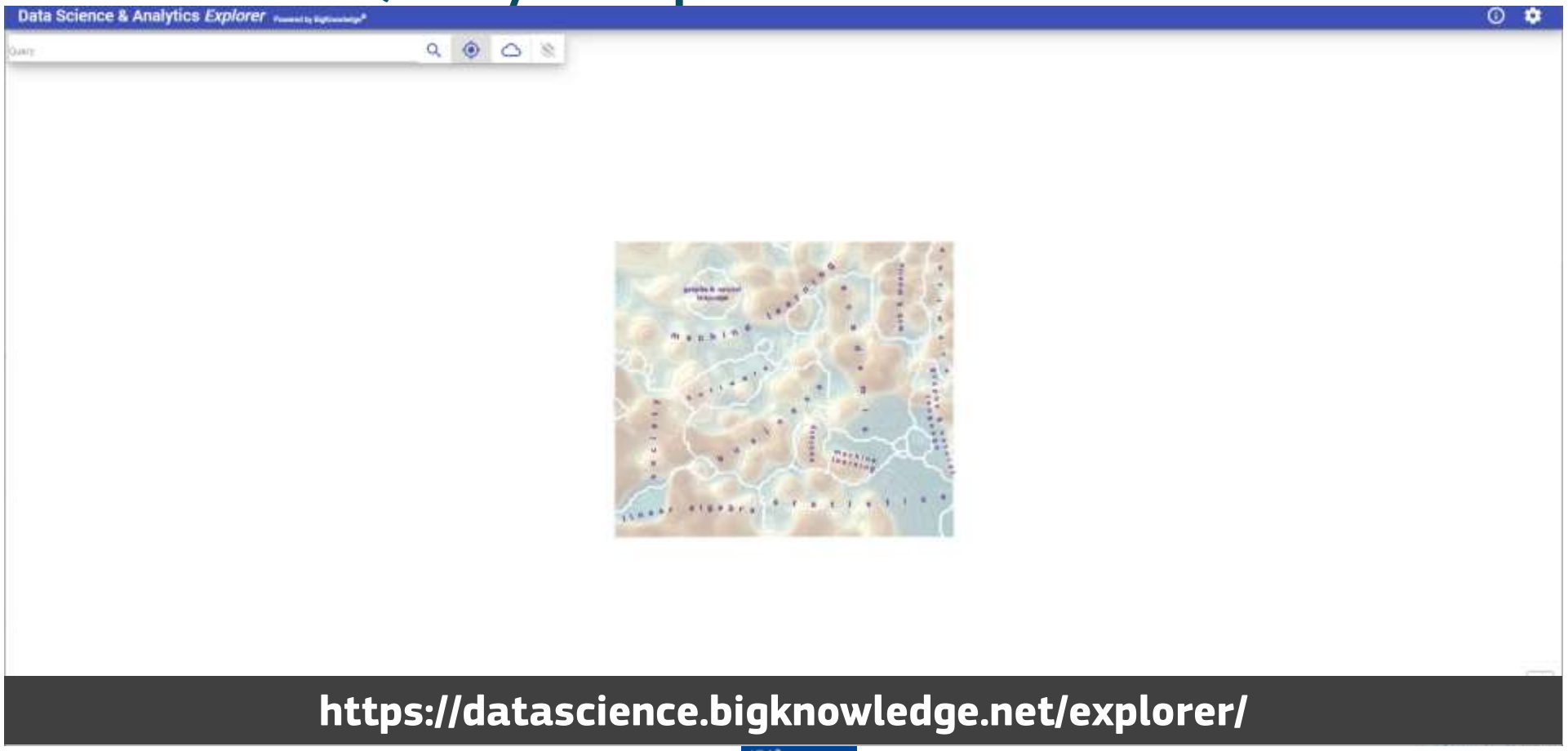


https://commons.wikimedia.org/wiki/File:GPS24goldenSML.gif

Kimerling et al (2021) Map Use: Reading, Analysis, Interpretation (8th ed.)

BoKMap Knowledge Mapping Platform

Example: Data Science & Analytics Explorer



https://datascience.bigknowledge.net/explorer/

BoKMap Knowledge Mapping Platform

Example: Data Science & Analytics Explorer

https://datascience.bigknowledge.net/explorer/

BoKMap Knowledge Mapping Platform

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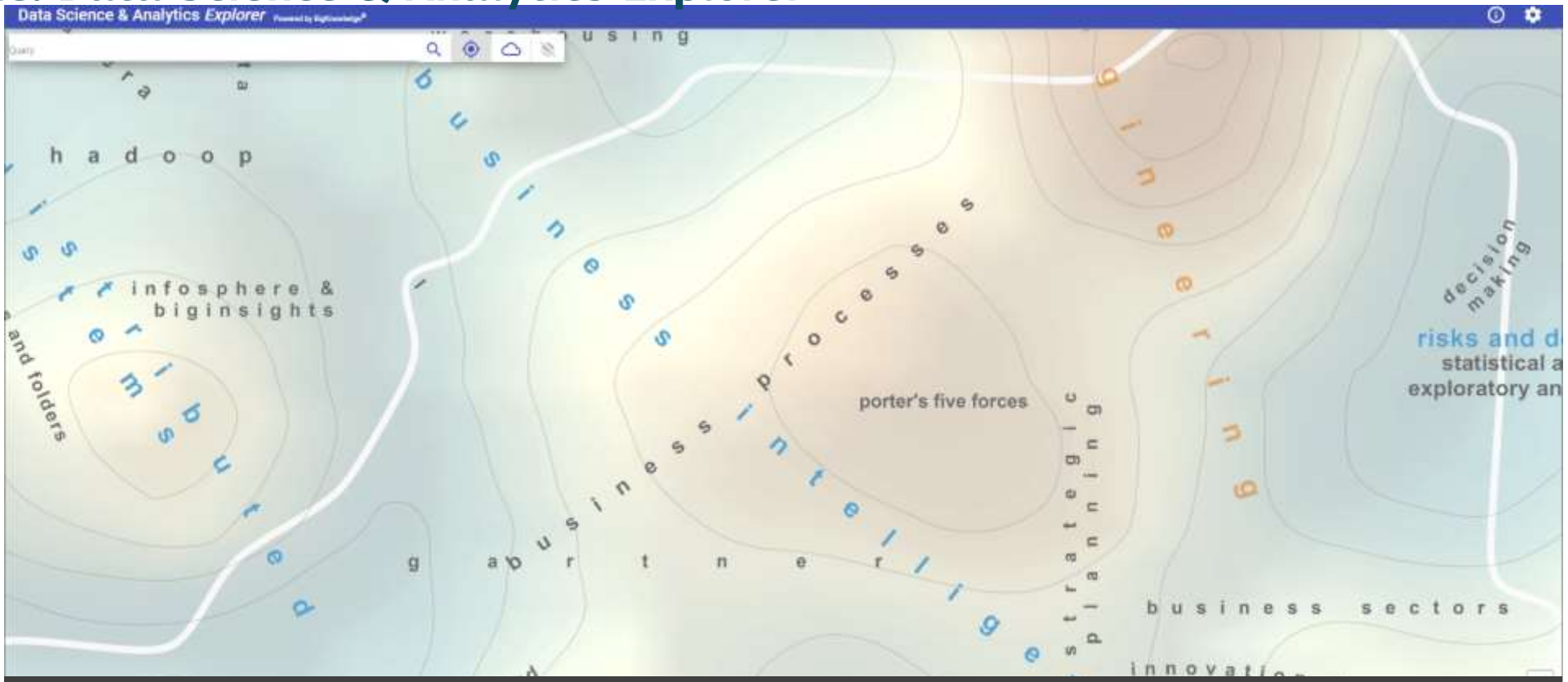
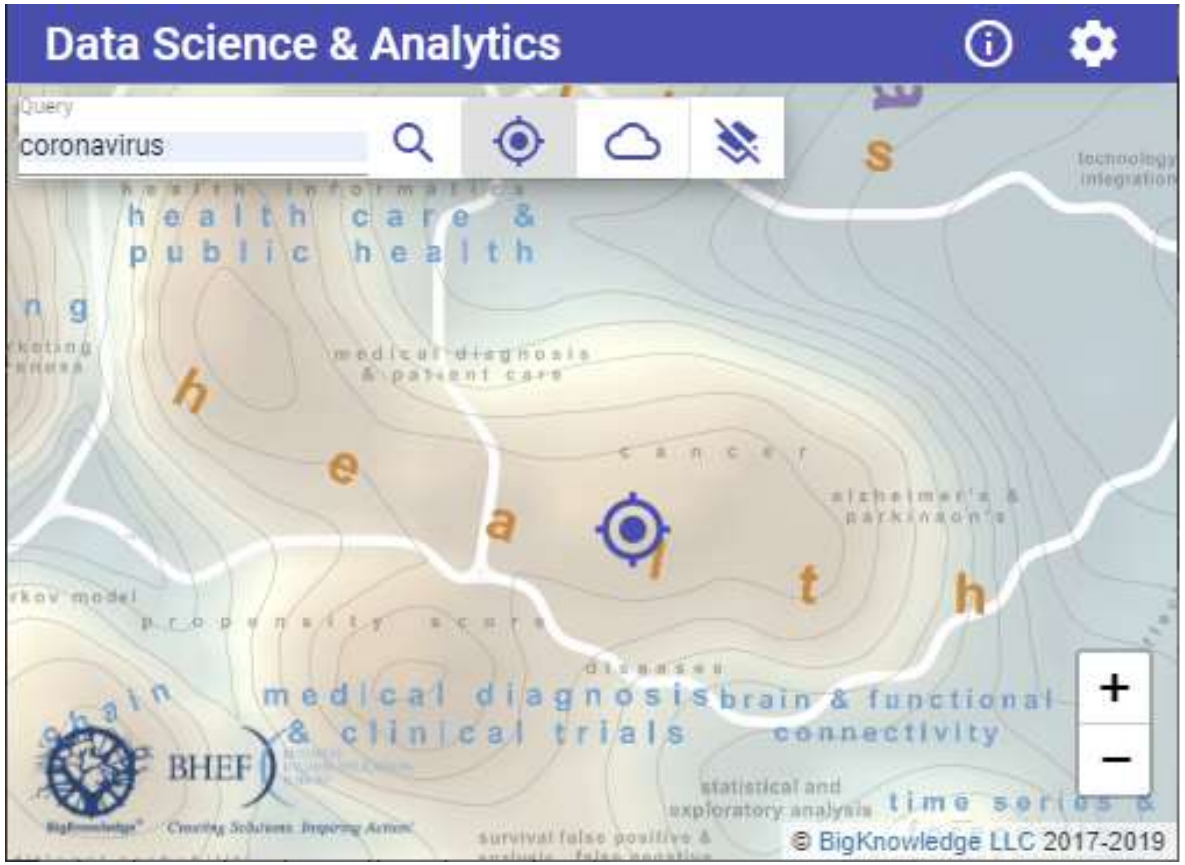


https://datascience.bigknowledge.net/explorer/

BoKMap Knowledge Mapping Platform

Built on Deep Domain Language Models



BoKMap Knowledge Mapping Platform

Built on Deep Domain Language Models

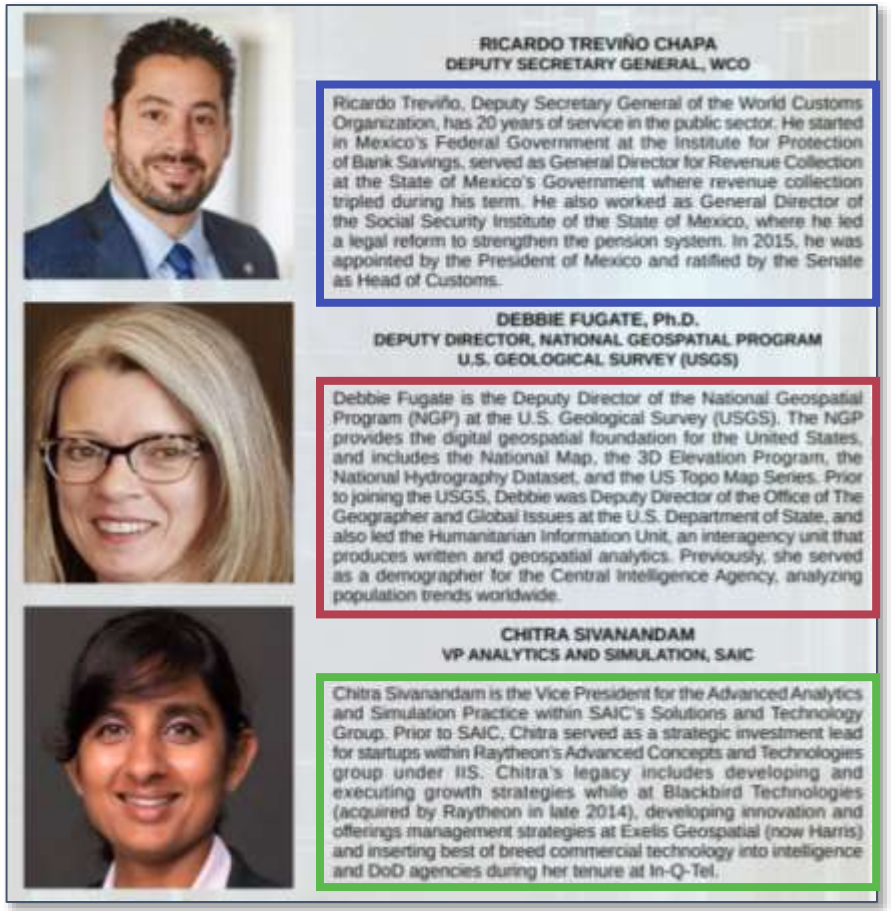
BoKMap Knowledge Mapping Platform

Scenarios

- Learn
- Contextualize
- Find Overlaps
- Find Gaps
- Find Outliers
- Recommend
- Align
- Monitor
- …

BoKMap Knowledge Mapping Platform

Scenario: Conference Speakers projected into Management Consulting & Accounting



RICARDO TREVIÑO CHAPA
DEPUTY SECRETARY GENERAL, WCO

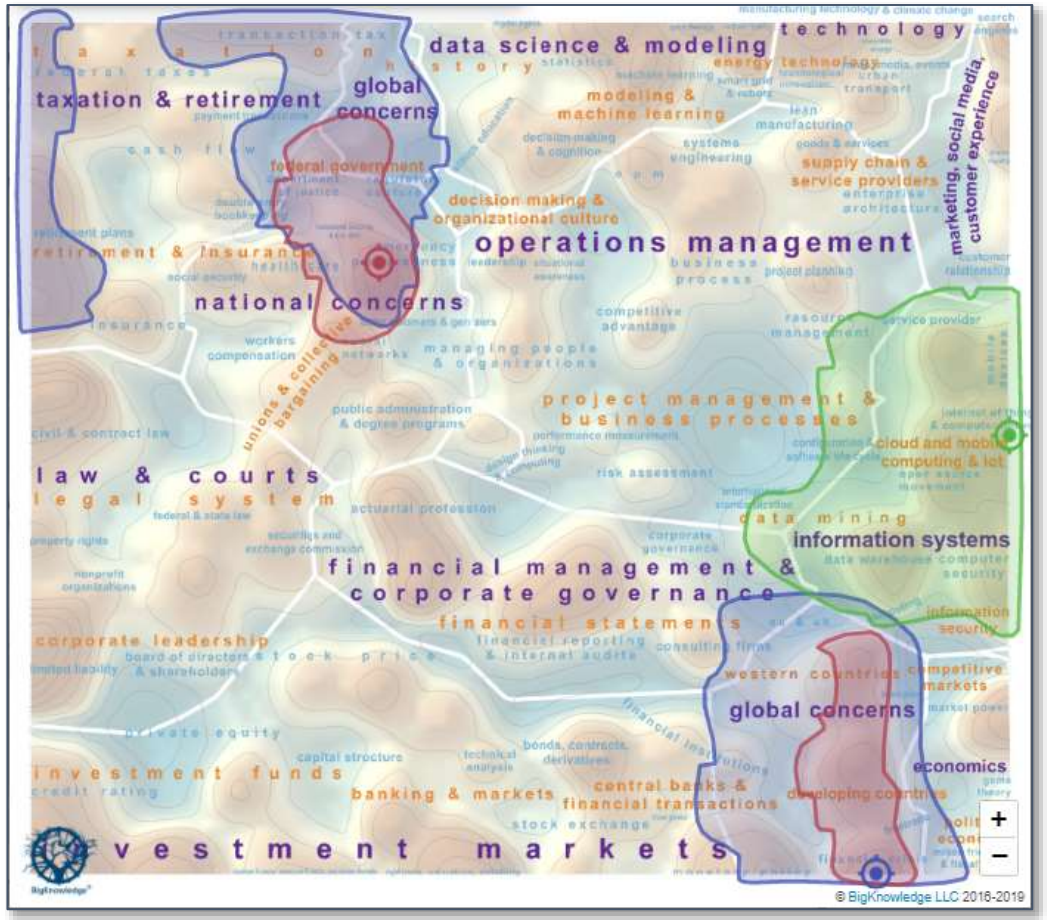
Ricardo Treviño, Deputy Secretary General of the World Customs Organization, has 20 years of service in the public sector. He started in Mexico's Federal Government at the Institute for Protection of Bank Savings, served as General Director for Revenue Collection at the State of Mexico's Government where revenue collection tripled during his term. He also worked as General Director of the Social Security Institute of the State of Mexico, where he led a legal reform to strengthen the pension system. In 2015, he was appointed by the President of Mexico and ratified by the Senate as Head of Customs.

DEBBIE FUGATE, Ph.D.
DEPUTY DIRECTOR, NATIONAL GEOSPATIAL PROGRAM
U.S. GEOLOGICAL SURVEY (USGS)

Debbie Fugate is the Deputy Director of the National Geospatial Program (NGP) at the U.S. Geological Survey (USGS). The NGP provides the digital geospatial foundation for the United States, and includes the National Map, the 3D Elevation Program, the National Hydrography Dataset, and the US Topo Map Series. Prior to joining the USGS, Debbie was Deputy Director of the Office of The Geographer and Global Issues at the U.S. Department of State, and also led the Humanitarian Information Unit, an interagency unit that produces written and geospatial analytics. Previously, she served as a demographer for the Central Intelligence Agency, analyzing population trends worldwide.

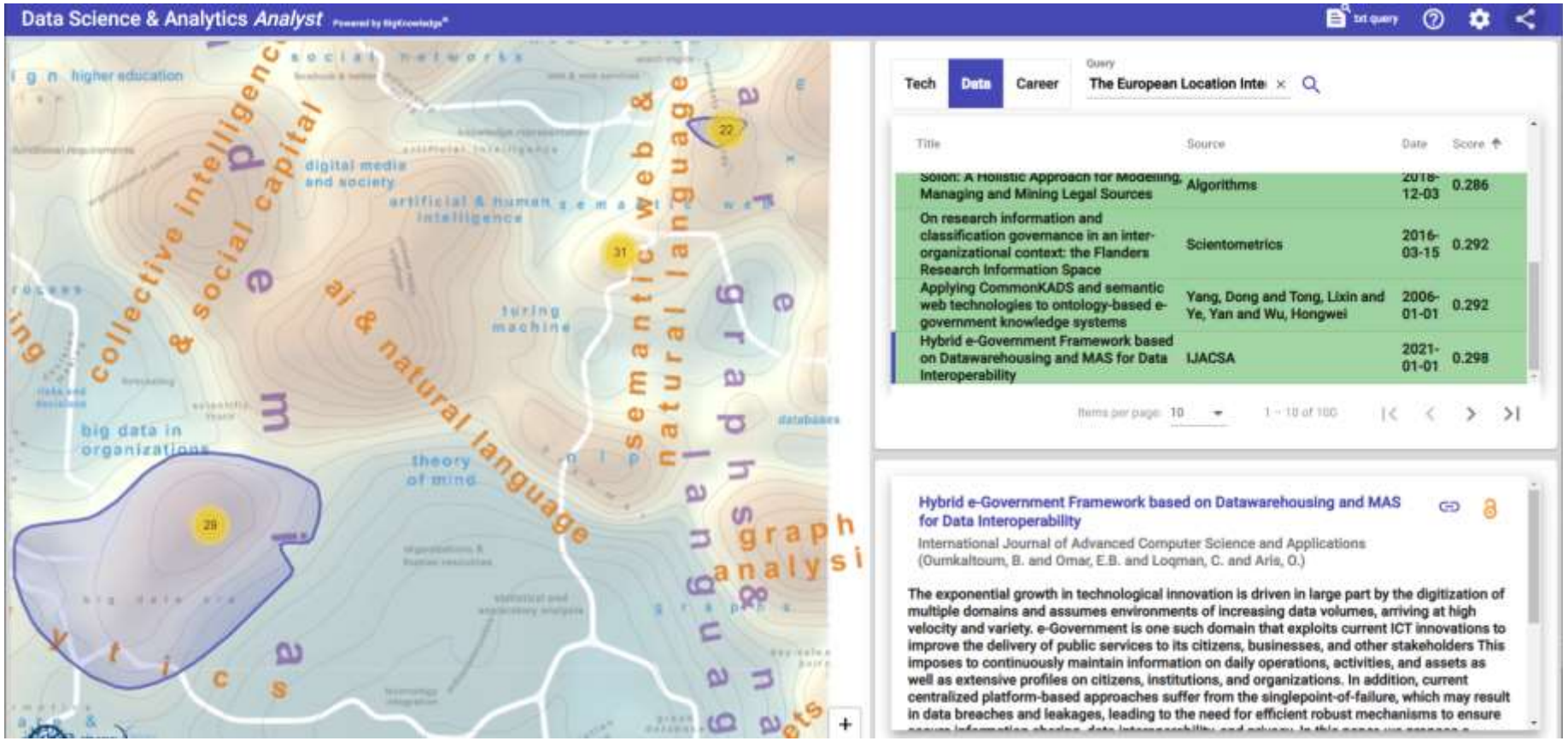
CHITRA SIVANANDAM
VP ANALYTICS AND SIMULATION, SAIC

Chitra Sivanandam is the Vice President for the Advanced Analytics and Simulation Practice within SAIC's Solutions and Technology Group. Prior to SAIC, Chitra served as a strategic investment lead for startups within Raytheon's Advanced Concepts and Technologies group under IIS. Chitra's legacy includes developing and executing growth strategies while at Blackbird Technologies (acquired by Raytheon in late 2014), developing innovation and offerings management strategies at Exelis Geospatial (now Harris) and inserting best of breed commercial technology into intelligence and DoD agencies during her tenure at In-Q-Tel.



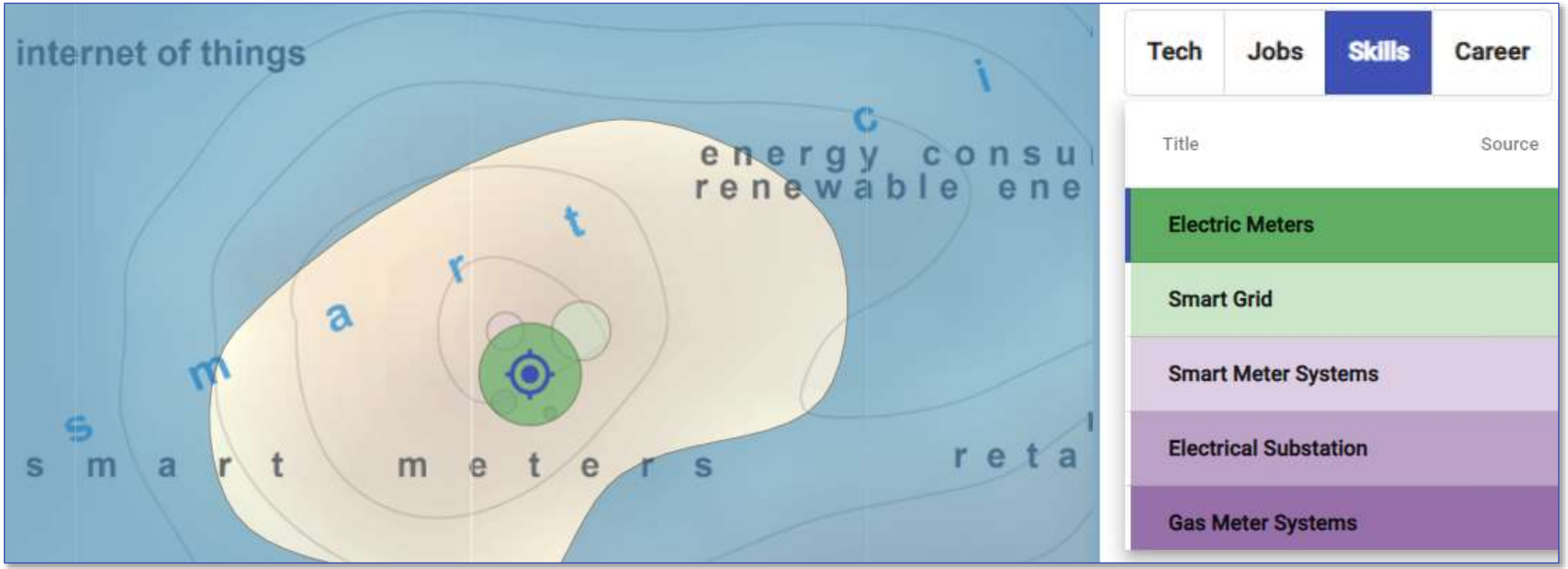
BoKMap Knowledge Mapping Platform

Scenario: Semantic enrichment of ELISE from 320k computing articles



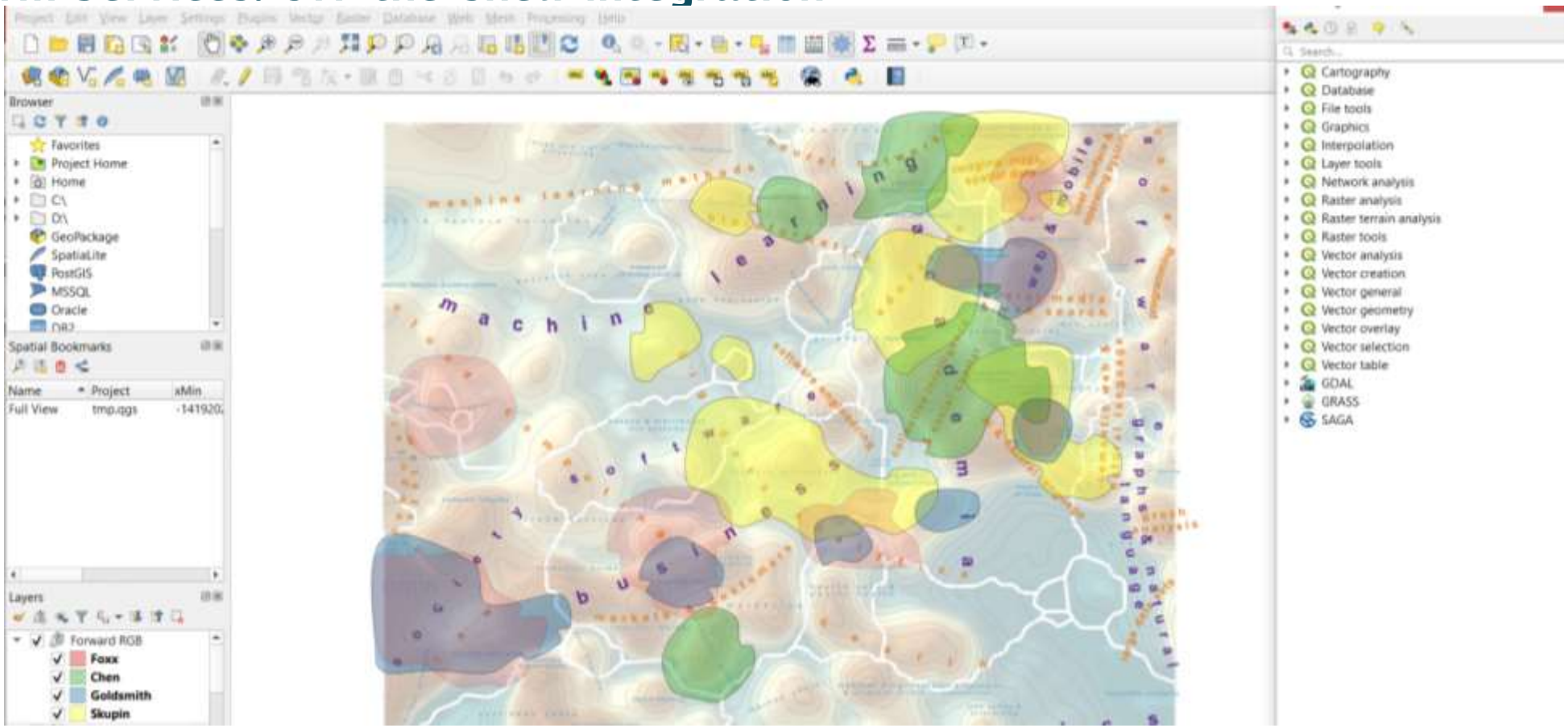
BoKMap Knowledge Mapping Platform

Scenario: Find Skill Gaps – Fill Skill Gaps



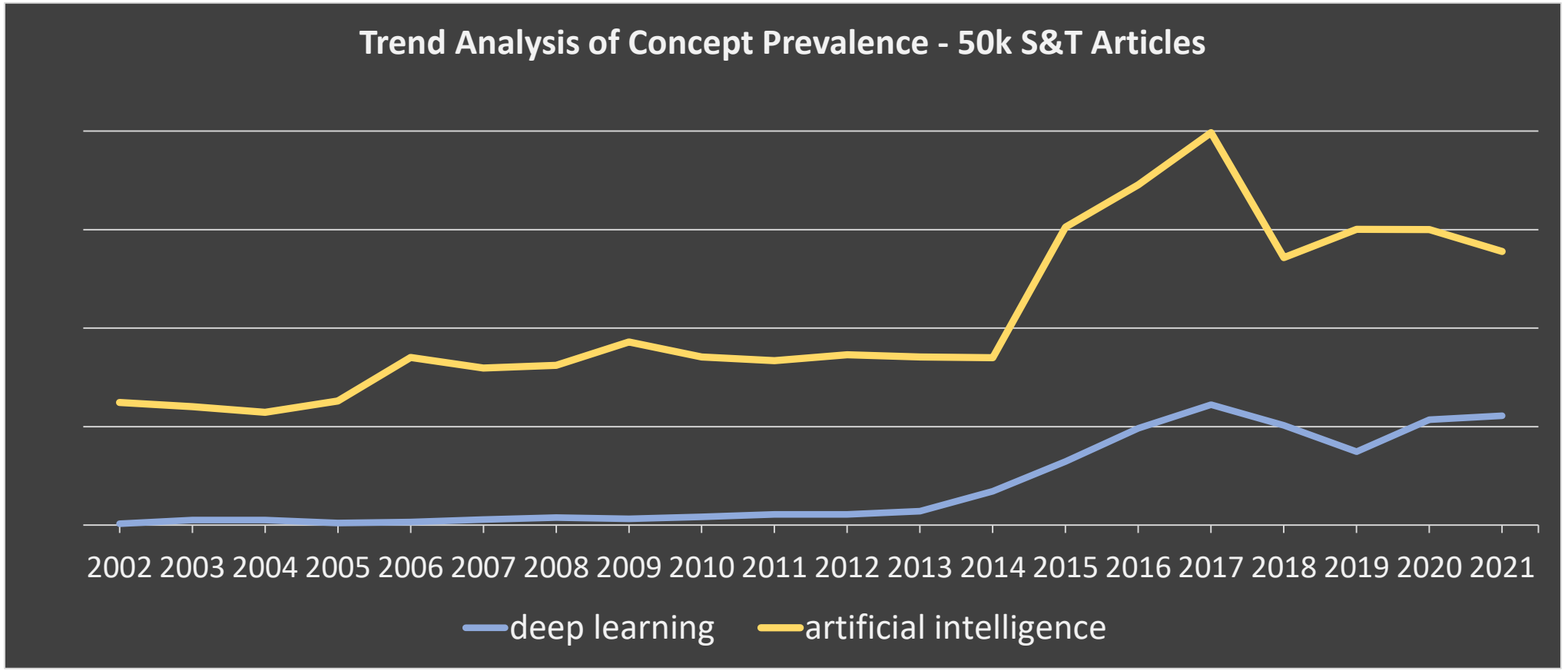
BoKMap Knowledge Mapping Platform

Platform Services: Off-the-shelf integration



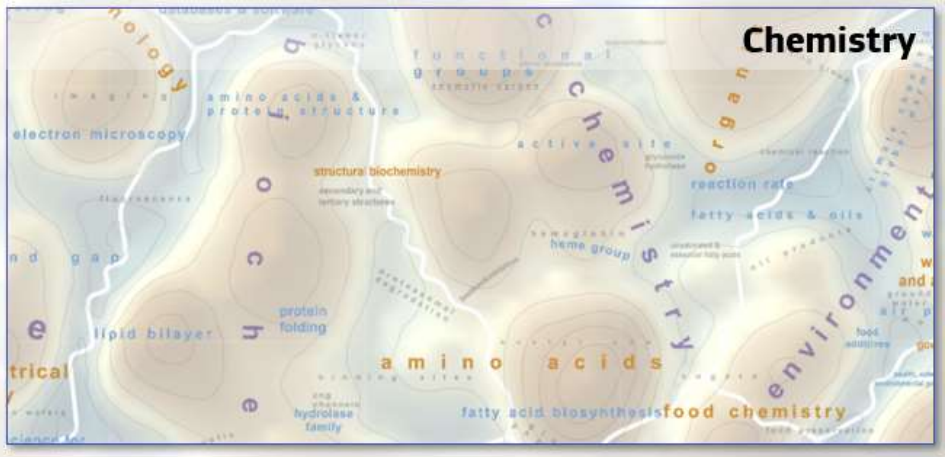
BoKMap Knowledge Mapping Platform

Platform Services: Trends over time and knowledge space



BoKMap Knowledge Mapping Platform

Current Deployments



BoKMap Knowledge Mapping Platform

Deployment Example: Open Geospatial Consortium (OGC)

Context is the New Gold!

Demo?

datascience.bigknowledge.net/{explorer | analyst}
management.bigknowledge.net/{explorer | analyst}

www.ogc.org/techexplorer

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Discussion, Q&A

Comments and takeaways

- Seth VAN HOOLAND, *European Commission, DG DIGIT*
- Rob LEMMENS, *University of Twente*
- Anikó GERENCSÉR, *Publications Office of the European Union*
- *Sven SCHADE, European Commission, JRC*

Next ELISE webinars…

- **28 April at 14:00 CEST (UTC+2)**

Achieving Location Interoperability

Lessons learnt in ELISE Action and future perspectives

Registation available soon!

Photo by Simon Abrams on Unsplash

Stay tuned

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ELISE channel

Thank you

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