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Linguistic Linked Data: Paving the Way Towards Maximising (Re)Usability of Linguistic Resources



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**Acknowledgements: Jorge Gracia, Victor Rodríguez Doncel,
LIDER Consortium members**

Directors: A. Gómez-Pérez, O. Corcho

Position: 8th in the UPM ranking (200 groups)

Research Group (30 people)

- 2 Full Professors
- 5 Associate Professors
- 3 Assistant Professors
- 7 Senior Postdocs
- 6 PhD Students
- 2 MSc and BSc Students
- 2 software engineers
- 1 system administrator
- 2 project managers

170+ Past Collaborators

50+ Past Visitors



<http://www.oeg-upm.net/>

<https://github.com/oeg-upm>



@oeg-upm

Ontology Engineering Group at a glance

- Created in 1995
- World-wide known in the research areas
 - Ontologies
 - Semantic Web and Linked Data
 - Multilingual linked Data
 - Open Data
 - eScience
- **Projects (> 12M€)**
 - 27 EU projects (7 as coordinator)
 - 54 National Projects
 - 27 contracts with companies
 - **Awards: SUR IBM Watson**
- **Publications**
 - 106 journals
 - 362 International conferences and book chapters
 - 7 Books
- **Impact of publications H-index**
 - Asunción Gómez-Pérez (h:52, citations 16254)
 - Oscar Corcho García (h: 38, citations 9087)
- **Services to the Spanish community**
 - Host esDbpedia
 - Host linkeddata.es
 - vocab.linkeddata.es
- **Awards and Prizes**
 - Aritmel, UPM, Ada Byron, Fujitsu, Open data, ISWC
 - SUR Awards Watson for Tech. Watch
- **Supervision of students**
 - 28 Ph.D thesis (9 awarded best thesis prize)
 - >150 MS.C thesis and BS.C
- **Events organization**
 - 11 editions of the International Summer School on Ontological Engineering and the Semantic Web
 - > 50 WS and tutorials
- **Standardization activities**
 - >25 @ W3C, ISO, OASIS, etc.
- **Mobility**
 - PhD students: 3-6 months abroad
 - Postdocs: 1 month every 2 years
- **Visibility**
 - Program chairs of ESWC, ISWC, KCAP, EKAW, TKE, TIA
 - Editorial board of Journals
 - Invited talks at conferences and events
 - Programme Committee presence
- **Collaboration with COM (Center Open Middleware)**



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- You are free:



to Share — to copy, distribute and transmit the work



to Remix — to adapt the work

- Under the following conditions

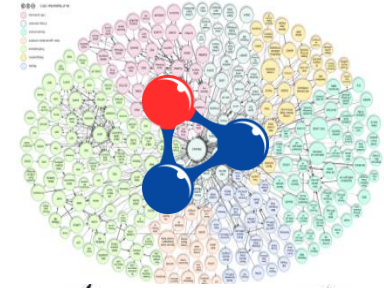


- Attribution — You must attribute the work by inserting

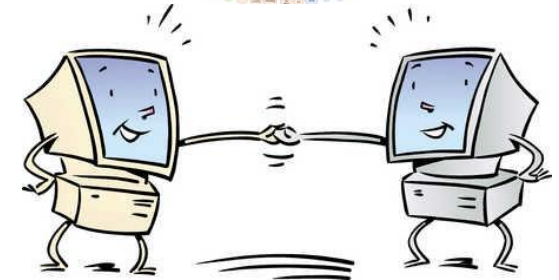
- “[source <http://www.oeg-upm.net/>]” at the footer of each reused slide

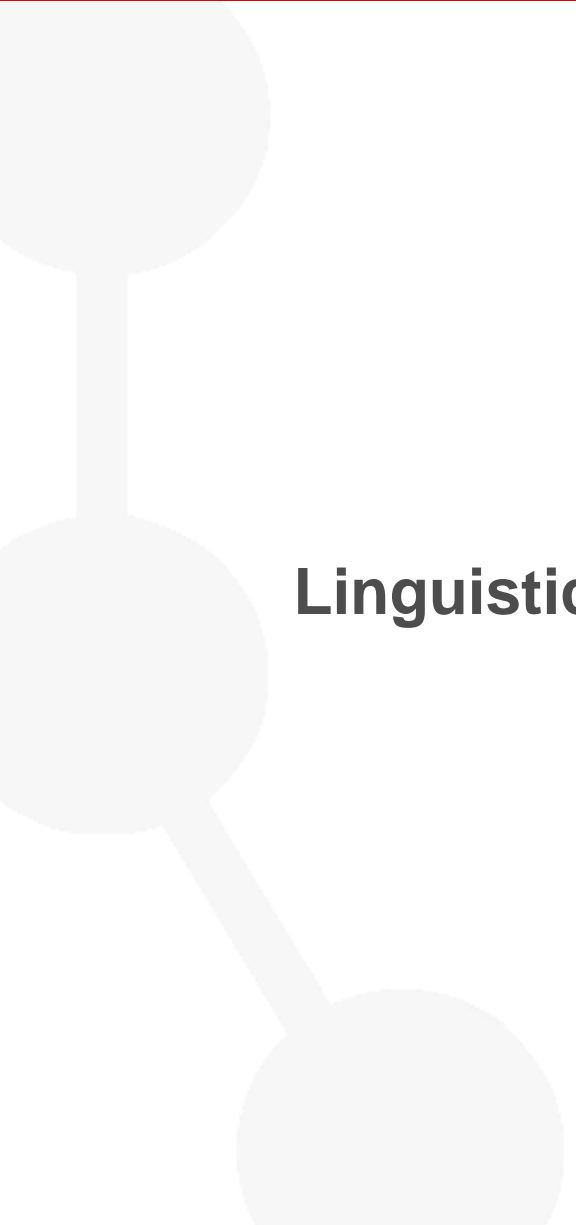
- a credits slide stating: “Linguistic Linked Data: Paving the Way Towards Maximising (Re)Usability of Linguistic Resources ” by A. Gómez-Pérez ”

- Non-commercial
- Share-Alike



El hemisferio geográfico **Elas de nod es**
 Autor: Edou. Toranzo Adués
 REGULADOR GEOGRÁFICO
 INTRODUCCIÓN
 Rección geográfica
 Capital de Rección
 Estación geográfica
 Economía geográfica
 Clavura/Mapa
 Sistema con estatuto de Autonomía
 Capital de comunidad Autónoma
 Acciense costera
 provincia
 Acciense marítimo
 Capital de provincia
 Acciense hidrográfico
 Cooperativo
 Corriente Fluvial
 Capital de cooperativo
 Comarca
 delatse
 Capital de Comarca
 Cooperativo
 Capital de tela
 Isla Fluvial
 Municipio
 Isla delina
 Capital de Municipio
 Argenta/Mapa
 Cooperativo
 Capital de A.T.I.M.
 República A.T.I.M.
 Población
 Comunidad de montaña
 Comunidad de municipios
 Puerto comercial
 Isla
 Puerto comercial
 Territorio anexo
 Territorio autonómico
 Estación de Ferrocarril
 Zona neutral





Open Data

Linked Open Data

Linked Licensed Data

Linguistic Linked Licensed Data

Outcomes of the LIDER project

Linguistic Linked Data permits multilingual Data Integration

Methods and Reference Architecture

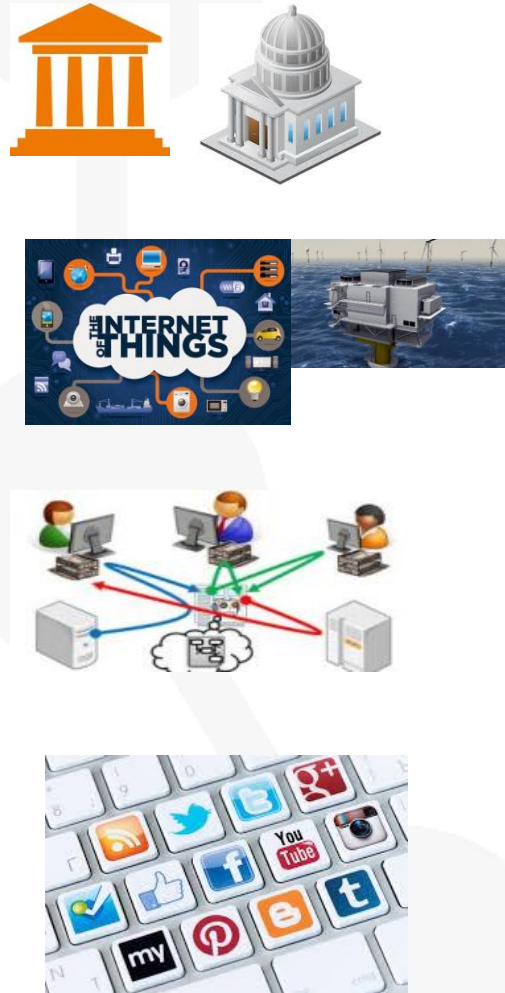


PRESENT

Open Data

A world of digital data

Providers



Domains



Heterogeneous Formats



Languages



Licenses



The Open Data stars



★ Make your stuff available on the Web (whatever format) under an open license

★ ★ Make it available as structured data (e.g., Excel instead of image scan or a table)

★ ★ ★ Use non-proprietary formats (e.g., CSV instead of Excel)

★ ★ ★ ★ Use URIs to identify things, so that people can point at your stuff

★ ★ ★ ★ ★ Link your data to other data to provide context



REAL ACADEMIA ESPAÑOLA

La institución Obras académicas Biblioteca y Archivo Consultas lingüísticas

Inicio » Recursos » Diccionarios » Diccionario de la lengua española

Diccionario de la lengua española

El *Diccionario de la lengua española (DRAE)* es la obra de referencia de la Academia. La edición actual —la 22.^a, publicada en 2001— incluye más de 88 000 entradas.



á é í ó ú ü ñ

■ Ayuda

red.

Artículo enmendado

(Del lat. *rete*).

1. f. Aparejo hecho con hilos, cuerdas o alambres trabados en forma de mallas, y convenientemente dispuesto para pescar, cazar, cercar, sujetar, etc.
2. f. Labor o tejido de mallas.
3. f. [redecilla](#) (II prenda de malla para el pelo).
4. f. Lugar donde se vende pan u otras cosas que se dan por entre verjas.



Apertium RDF EN-ES

Dataset Groups Activity Stream Related

Followers
0

Organization



Ontology Engineering Group (UPM)

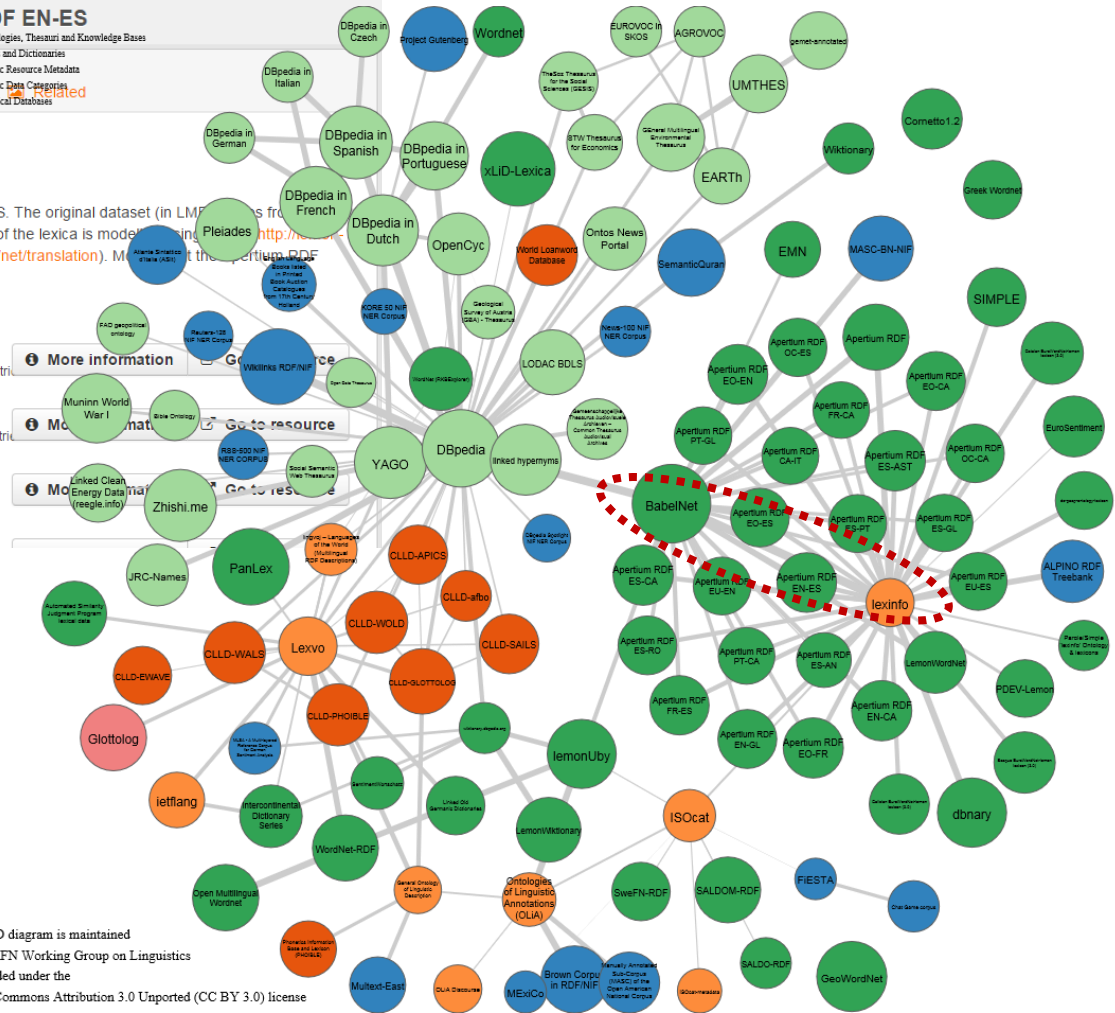
The Ontology Engineering Group (OEG) is based at the

Apertium RDF EN-ES

RDF version of the Apertium bilingual dictionary EN-ES. The original dataset (in LMF format) is available from <http://hdl.handle.net/10230/17110>. The RDF version of the lexica is modelled using <http://www.w3.org/ns/lexml> (<http://model.net/>) and the translation module (<http://purl.org/net/translation>). More information about the Apertium RDF dictionaries at <http://linguistic.linkeddata.es/apertium/>

Data and Resources

- English lexicon URI**
This online lexicon not only contains the EN lexical entries...
- Spanish lexicon URI**
This online lexicon not only contains the ES lexical entries...
- EN-ES translation set URI**
No description for this resource
- SPARQL endpoint**



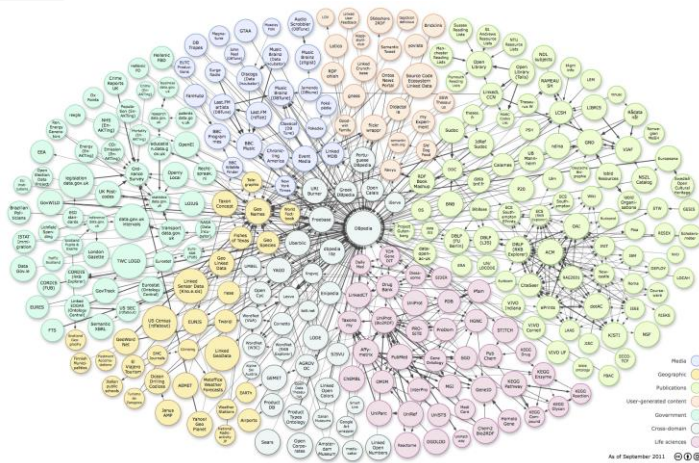
The LLOD diagram is maintained by the OKFN Working Group on Linguistics and provided under the Creative Commons Attribution 3.0 Unported (CC BY 3.0) license



Open Data Linked Open Data

Linked Data: why it is important?

- Facilitate data integration
 - From heterogeneous sources
 - In different formats
 - Different granularity
 - In different languages
 - From different countries



W3C

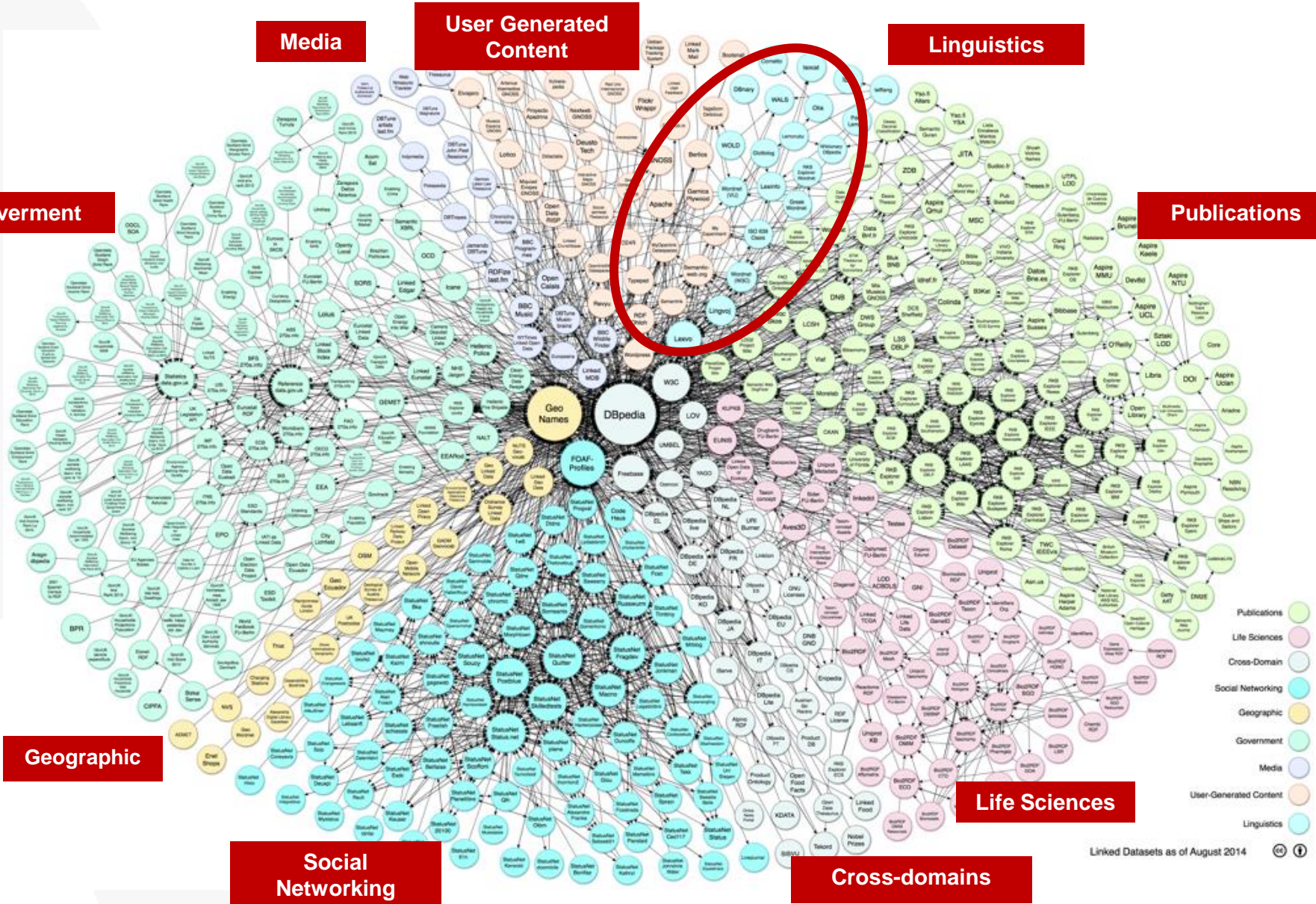
Choosing *How* to Publish

The diagram features a central blue background. On the left, there are silhouettes of four people. On the right, there are vertical columns of binary code (0s and 1s). A double-headed arrow labeled 'BOTH' connects the human silhouettes to the machine-readable data. Above the arrow is the W3C logo.

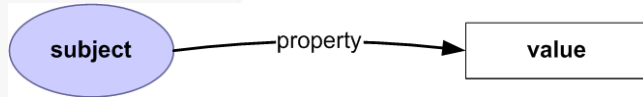
Human-readable ↔ BOTH ↔ Machine-readable

© Slide adapted from “5min Introduction to Linked Data”- Olaf Hartig

LD domains in August 2014



RDF(S) models

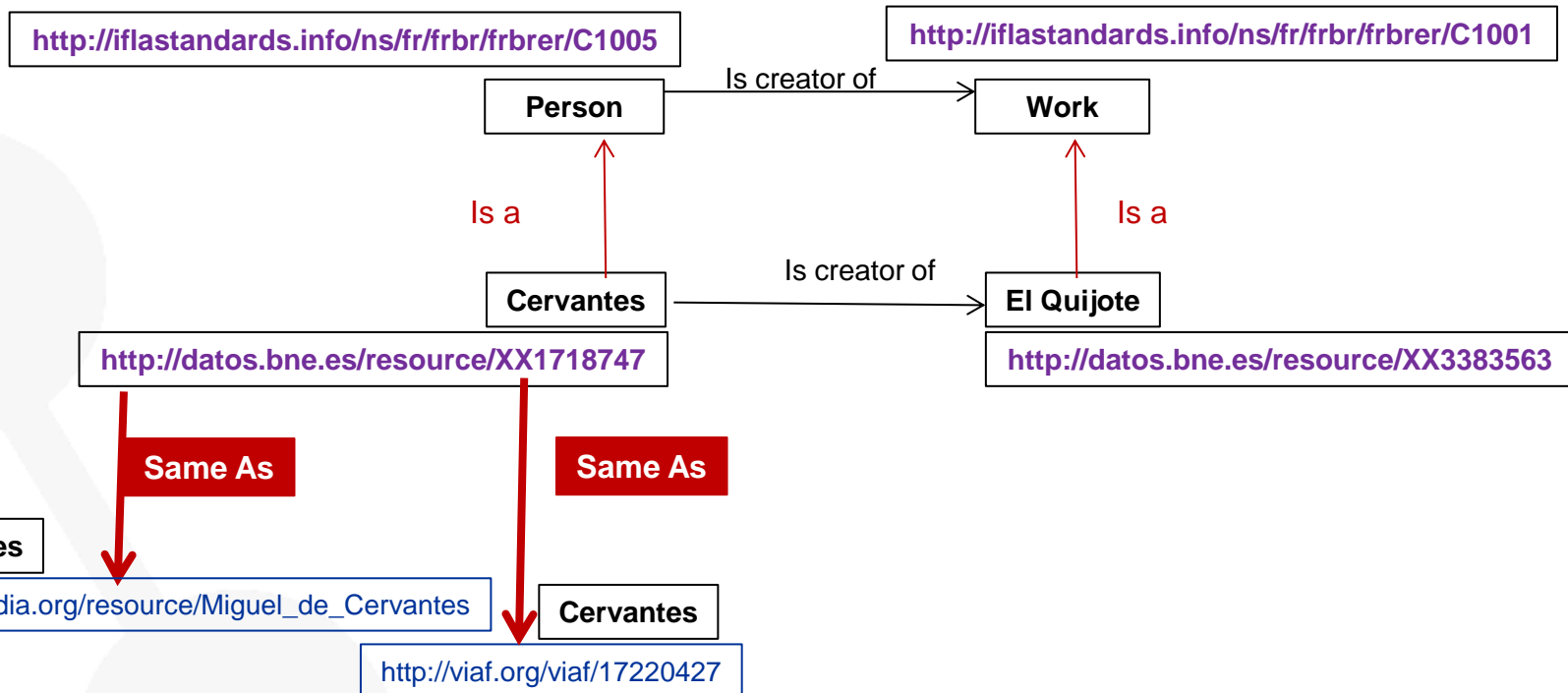


Unique identifiers: URI
identify or name a resource

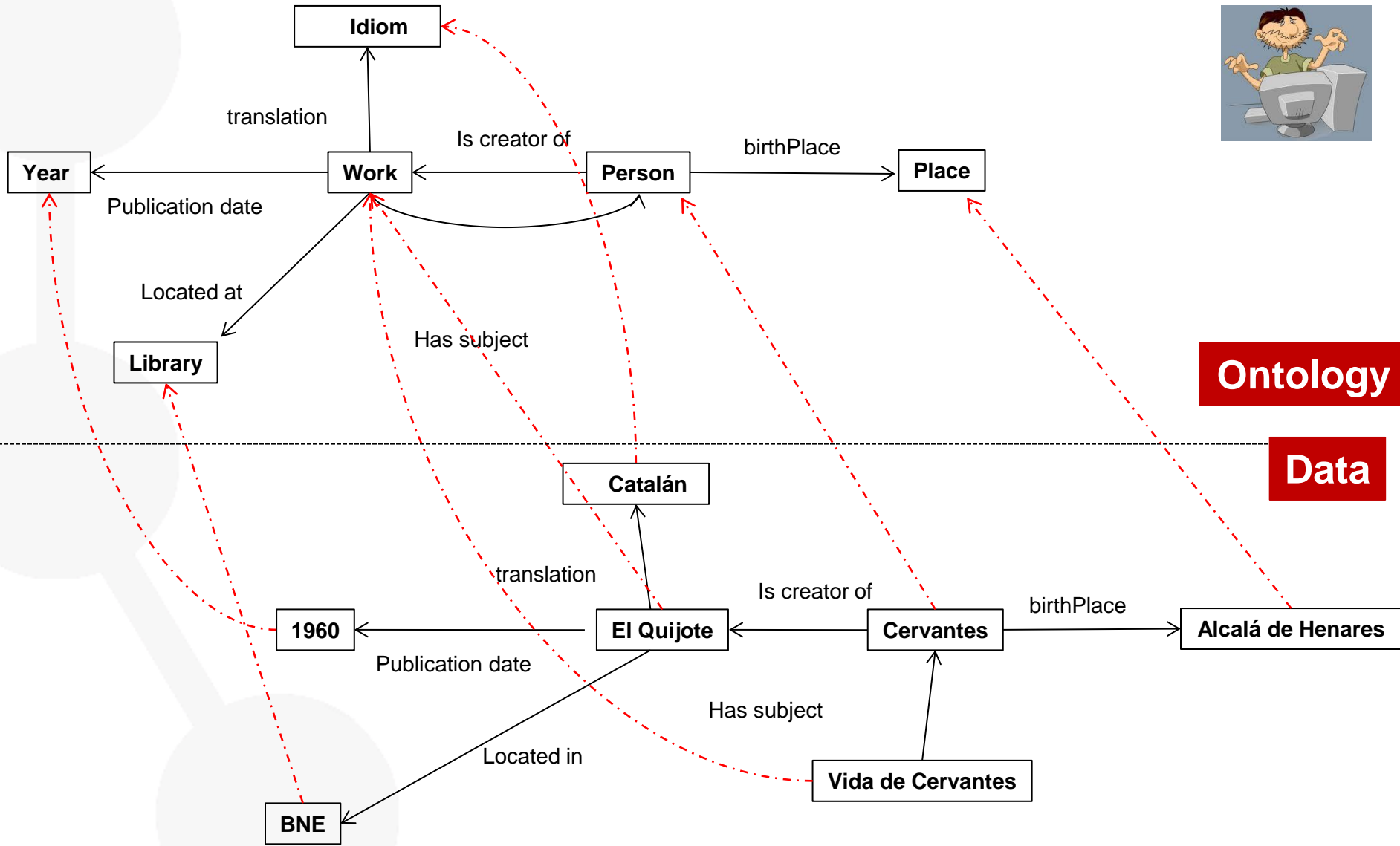
Equivalence links to other datasets

Same As

Data navigation



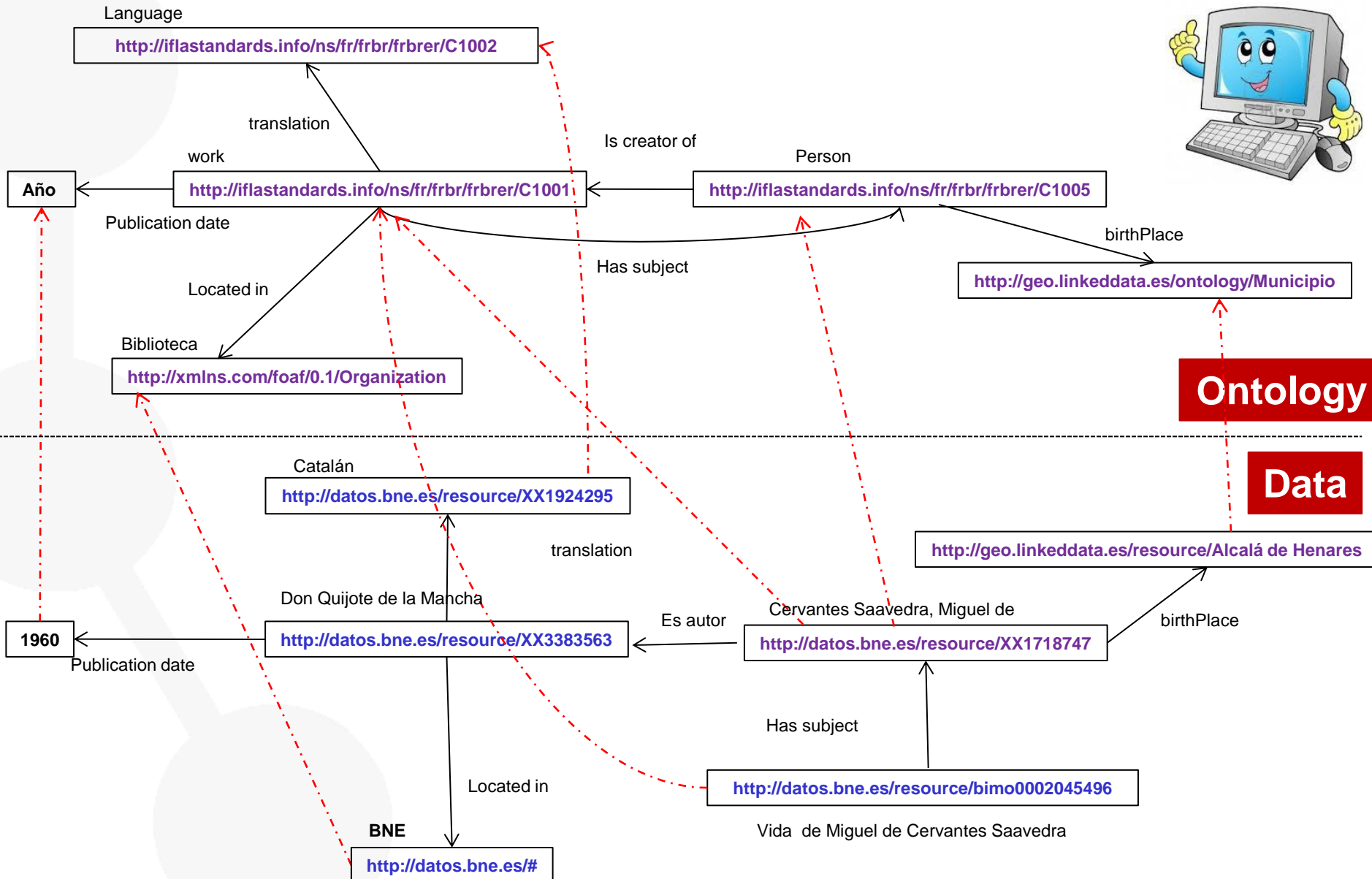
The model (Ontology) and the data



Ontology

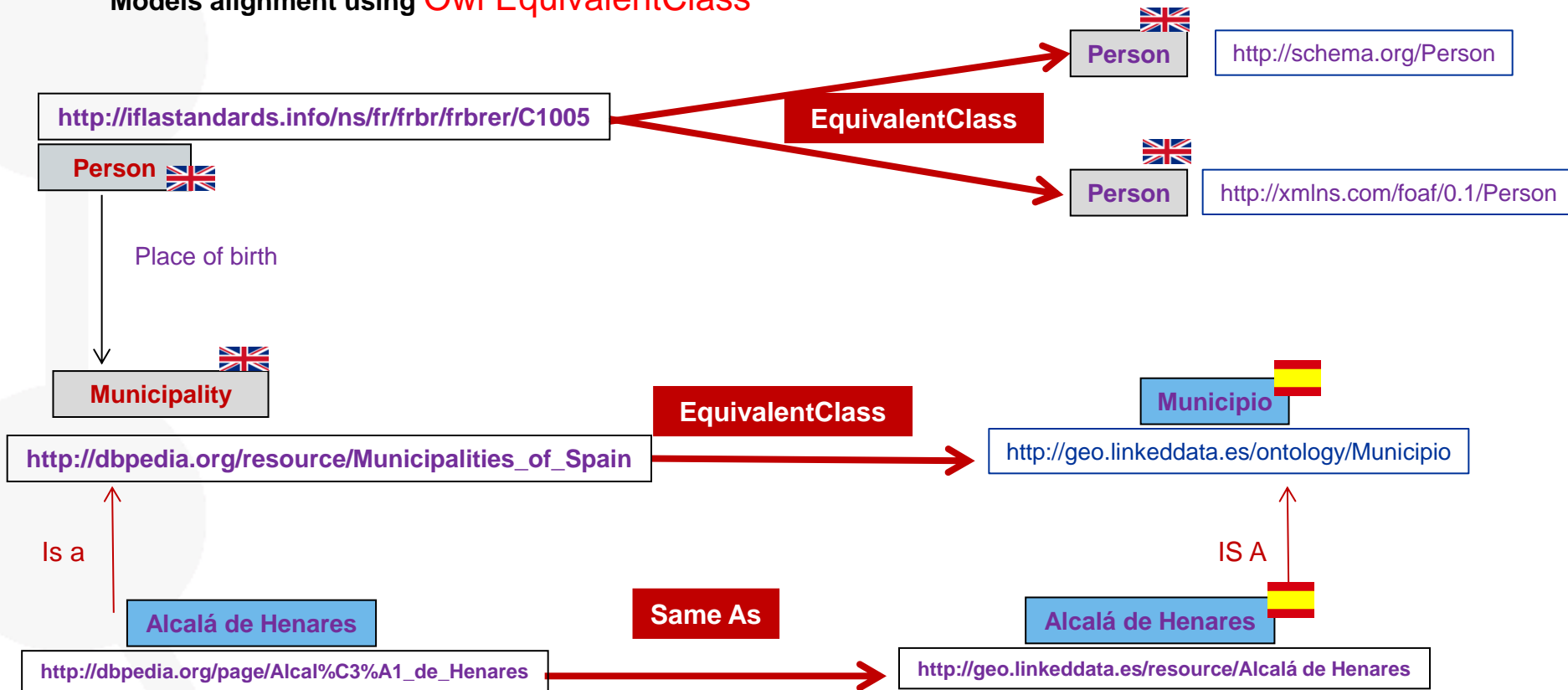
Data

Linked data is full of URIs



Foundations: Linking

Models alignment using Owl EquivalentClass



Linked Data without ontologies



<http://www.server1.org/resource/Cervantes>

Same as

<http://d-nb.info/gnd/11851993X>

Same as

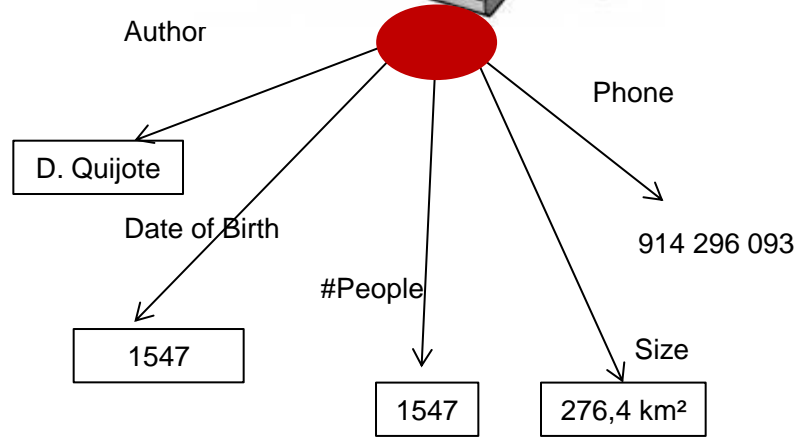
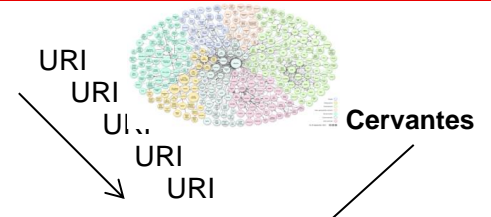
<http://datos.bne.es/resource/XX1718747>

Same as

<http://www.server2.es/resource/Cervantes>

Same as

<http://geo.linkeddata.es/page/resource/Municipio/Cervantes>



Linked Data and ontologies

Cerveceria Cervantes



<http://www.server1.org/resource/Cervantes>

rdf:type

Restaurant

<http://d-nb.info/gnd/11851993X>

rdf:type

Person

Same as

<http://datos.bne.es/resource/XX1718747>

rdf:type

<http://www.server2.es/resource/Cervantes>

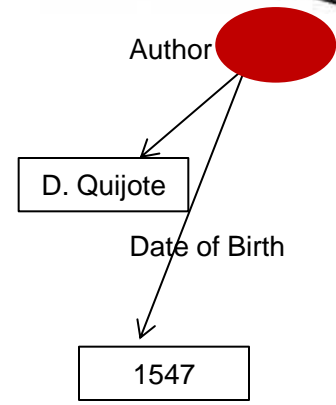
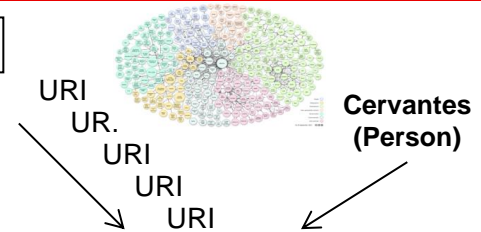
rdf:type

Street

rdf:type

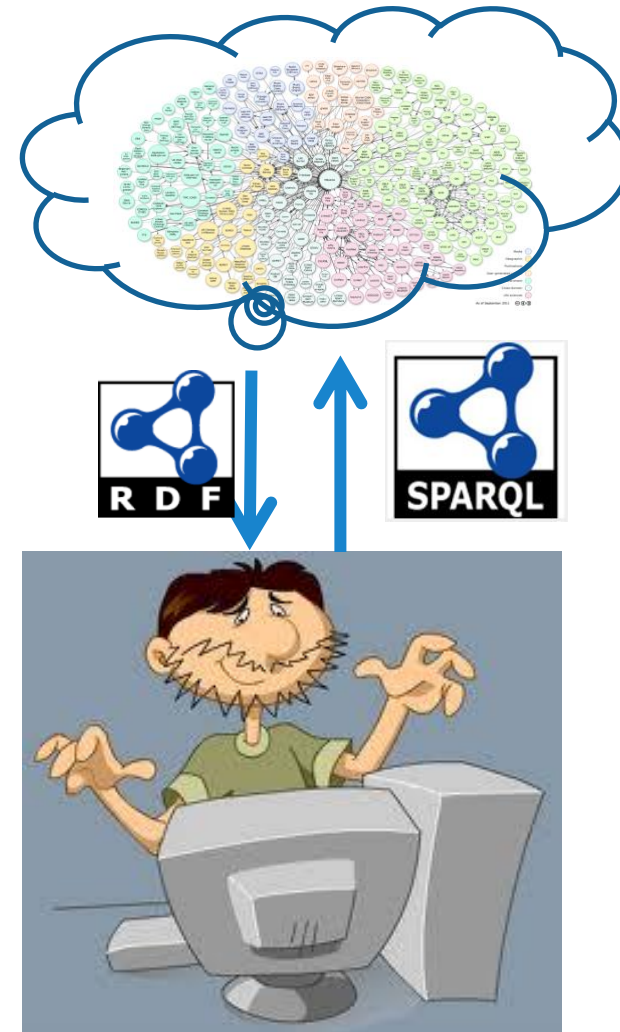
Municipality

<http://geo.linkeddata.es/page/resource/Municipio/Cervantes>



Linked Data allows uniform access

1. **Agree on vocabularies** for describing metadata and domain data
2. Unified and standardized **language** for describing resources (**RDF(S)**)
3. Unified and standardized **query language** (SPARQL)
4. Standardized **non-proprietary APIs**
5. **Links** to other resources





Open Data

Linked Open Data

Linguistic Linked Data

Linked data

Linguistic
Linked Data

Finding and reusing LR in third party applications is manual and time consuming



Lack of interoperability of Language resources

- Ecosystem of
 - Open and Closed resources
 - Silos of LRs
 - Complementary resources
 - Lexicon, Corpora, Dictionaries, Grammars,
 - Heterogeneous formats
 - E.g, for Lexicons: Lexinfo, LMF, LIR, Lemon, ...
 - Several repositories with different metadata and schemas
 - Many APIs and services for querying



Discovery and reuse LR in third party applications is hard, manual and time consuming

Use cases for LR Discovery

- **Language metadata content**
 - Give me bilingual dictionaries in Spanish, German , that accounts for grammatical number and gender with Creative Common licenses
- **Language Resources content**
 - Give me all occurrences in corpora of the token “bank” disambiguated as the WorNet synset <http://wordnet-rdf.princeton.edu/wn31/108437235-n>
- **Language Services**
 - Give me all RESTfull services that can extract terms from text in Latvian.





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Inicio » Recursos » Diccionarios » Diccionario de la lengua española

Diccionario de la lengua española

El *Diccionario de la lengua española (DRAE)* es la obra de referencia de la Academia. La edición actual —la 22.ª, publicada en 2001— incluye más de 88 000 entradas.

red

á é í ó ú ü ñ

red.

(Del lat. *rete*).

1. f. Aparajo hecho con hilos, cuerdas o alambres trabados en forma de mallas, y convenientemente dispuesto para pescar, cazar, cercar, sujetar, etc.
2. f. Labor o tejido de mallas.
3. f. [redecilla](#) (ll prenda de malla para el pelo).
4. f. Lugar donde se vende pan u otras cosas que se dan por entre verjas.

Artículo enmendado

[Ayuda](#)



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4. f. Lugar donde se vende pan u otras cosas que se dan por entre verjas.



<http://es.wiktionary.org>



red

- **Pronunciación:** [red] (AFI)
- **Etimología:** del latín *rete*

Sustantivo femenino [\[editar\]](#)

Singular	Plural
red	redes

1

Malla cosa que fue creada para unir o sostener algo

2

Sistema interconectado

- **Ejemplos:** (...)

Véase también [\[editar\]](#)

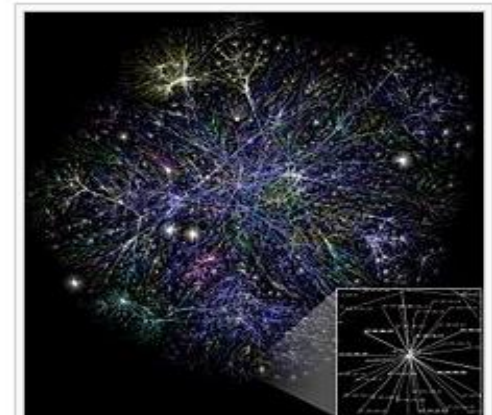
- [Wikipedia](#) tiene un artículo sobre **red**.

Traducción [\[editar\]](#)

- Alemán: **Netz** ^(de)



[1] malla Raschel



[2] la red en 2005



<http://es.wiktionary.org>



Terminesp:red

Wikilengua

Entrada de Terminesp

Este artículo es una entrada de la base terminológica [Terminesp](#). No se puede modificar, pero se pueden hacer comentarios y puede servir de base para un artículo en la *Wikilengua*.

Búsqueda en Terminesp

Norma UNE

[Norma UNE \(Terminesp\)::UNE 21302-131](#)

Título de la norma

Vocabulario electrotécnico: parte 131. Teoría de circuitos

Término en español:

red ([artículo](#))

Término en alemán:

Netzwerk (in der Netzwerktopologie)

Término en inglés:

network

Término en francés:

réseau

Definición

En topología de redes, conjunto de elementos ideales de circuito y de sus interconexiones, considerado como un todo.



<http://es.wiktionary.org>

REAL ACADEMIA
ESPAÑOLA

red



LISTEN:

ESPAÑA

[definición](#) | [en inglés](#) | [en francés](#) | [conjugar verbos](#) | [en contexto](#) | [imágenes](#)

Inflexiones de 'red' (n): **fpl**: redes

Diccionario de sinónimos y antónimos © 2005 Espasa-Calpe:

red

- malla, urdimbre, trama, tejido
- aparejo, almadraba, jábega, boliche
- trampa, ardid, celada, estratagema, artimaña, engaño
- organización, sistema, servicio, distribución

'red' aparece también en las siguientes entradas:

[alambrada](#) - [conducto](#) - [entramado](#) - [lazo](#) - [nasa](#) - [plexo](#) - [retículo](#) - [telaraña](#) - [trampa](#) - [tubería](#) - [urdimbre](#)



[verbos](#) | [en contexto](#) | [imágenes](#)

en Calpe

artimaña, engaño

redes

redes - lazo - nasa - plexo - retículo - telaraña

reference.

s/



<http://es.wiktionary.org>



Red de computadoras

(Redirigido desde «[Redes de computadoras](#)»)

Una **red de computadoras**, también llamada **red de ordenadores**, **red de comunicaciones de datos** o **red informática**, es un conjunto de **equipos informáticos** y **software** conectados entre sí por medio de **dispositivos físicos** que envían y reciben **impulsos eléctricos**, **ondas electromagnéticas** o cualquier otro medio para el transporte de **datos**, con la finalidad de compartir información, recursos y ofrecer **servicios**.¹

Como en todo proceso de **comunicación** se requiere de un **emisor**, un **mensaje**, un **medio** y un **receptor**. La finalidad principal para la creación de una red de computadoras es compartir los recursos y la información en la distancia, asegurar la **confiabilidad** y la disponibilidad de la información, aumentar la **velocidad de transmisión de los datos** y reducir el costo general de estas acciones.² Un ejemplo es **Internet**, la cual es una gran red de millones de computadoras ubicadas en distintos puntos del planeta interconectadas básicamente para compartir información y recursos.

La estructura y el modo de funcionamiento de las redes informáticas actuales están definidos en varios **estándares**, siendo el más importante y extendido de todos ellos el modelo **TCP/IP** basado en el modelo de referencia **OSI**. Este último, estructura cada red en siete capas con funciones concretas pero relacionadas entre sí; en TCP/IP se reducen a cuatro capas. Existen multitud de protocolos repartidos por cada capa, los cuales también están regidos por sus respectivos estándares.³

Índice [ocultar]

- 1 Historia
- 2 Descripción básica
- 3 Componentes básicos de las redes
 - 3.1 Software
 - 3.2 Hardware
 - 3.2.1 Tarjeta de red
 - 3.3 Dispositivos de usuario final
 - 3.3.1 Servidores

WIKIPEDIA

<http://es.wikipedia.org>

<http://www.wordreference.com/sinonimos/>

An example

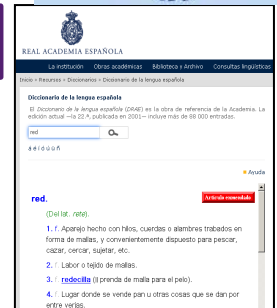


Wikcionario
[wik.sjo'na.rjo]
El diccionario en castellano
de contenido libre

<http://es.wiktionary.org>



<http://rae.es>



“Red”
(computer network)

Wikilengua del español

<http://www.wikilengua.org/index.php/Terminesp:red>



<http://www.wordreference.com/sinonimos/>



WIKIPEDIA

<http://es.wikipedia.org>





“Red”

Pronunciation: [red]

Grammar category: sustantivo femenino

Singular: “red”

Plural: “redes”



“Red”

Etimology: Del latin “rete”

Gender: “f”

Definition: “Conjunto de ordenadores o de equipos informáticos conectados entre sí....”

Complementary but not connected

Wikilengua del español

“Red”

Norm: UNE 21302-131

English: network

German: Netzwerk



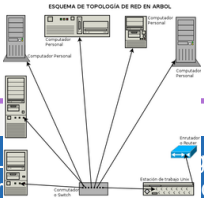
“Red”

Synonyms: “sistema”, “malla”, “distribución”

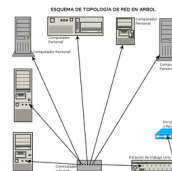
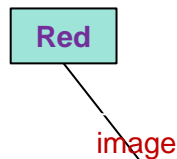
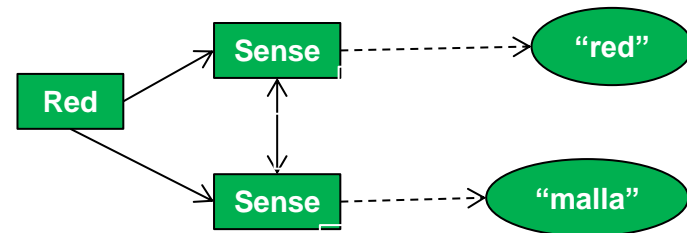
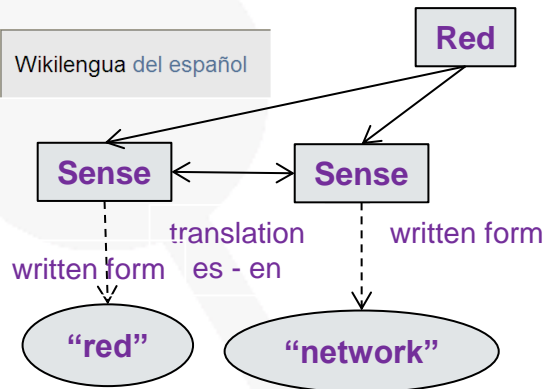
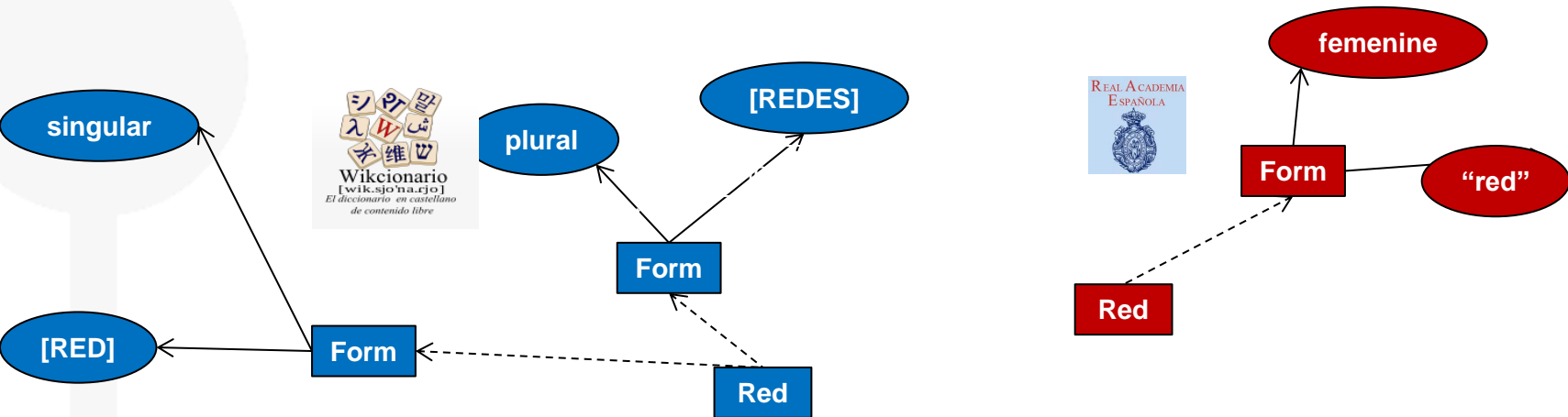
“Red_de_computadores”

Category: redes informáticas

Image



LD allows linguistic data integration



Linguistic Linked Licensed Data



www.lider-project.eu

3LD



Linguistic Linked Licensed Data

Language resources

such as:

- Lexica
- Corpora
- Dictionaries ..

*Using **RDF** and
standard data
models*



(vocabularies):

- Lexica lemon
- Corpora NIF

NLP Interchange Format

*Published along with
a machine-readable
license.*

ODRL

Open Digital Rights Language

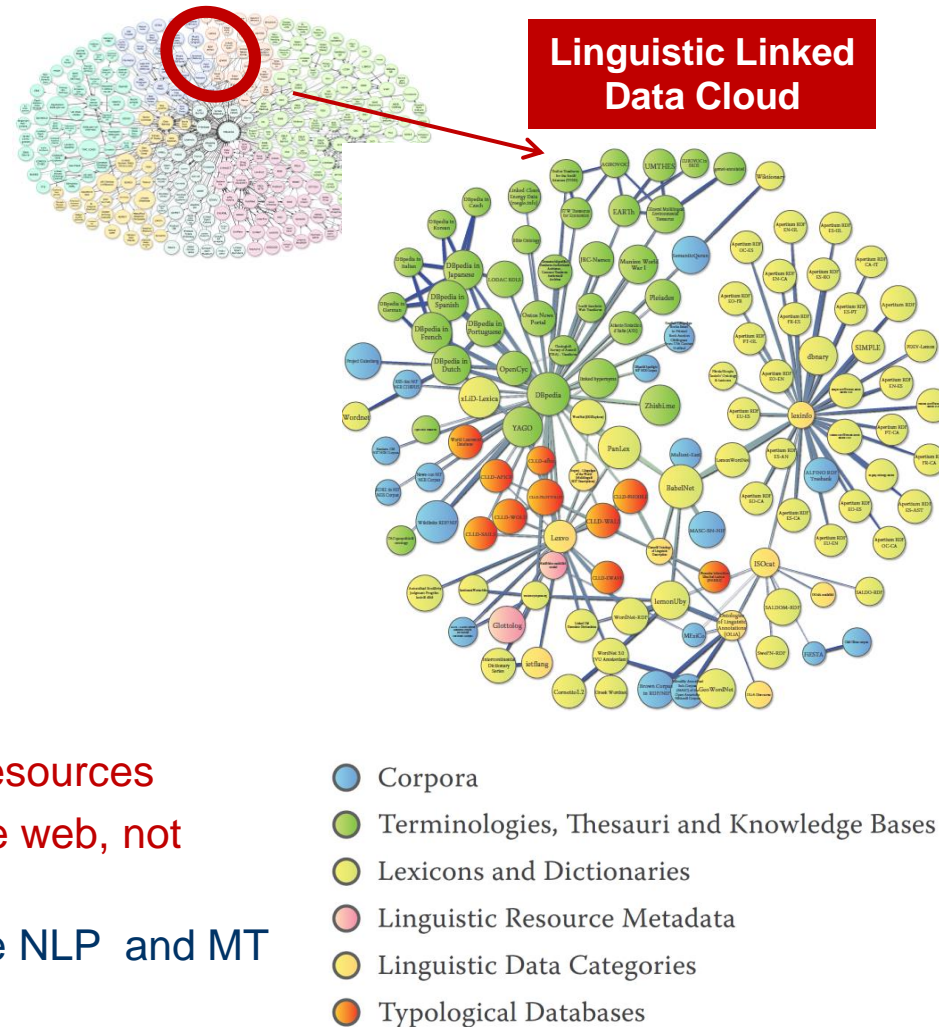


Linked Data interconnects data from resources

- In many domains
- In many languages
- Open and closed License
- Links with other datasets

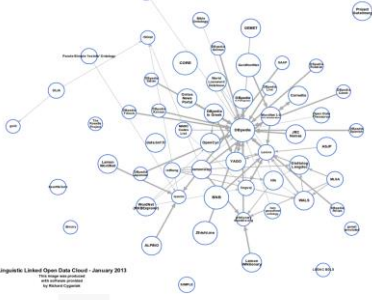
Linguistic Linked Data Cloud

- Subset of LOD
- Linguistic domain
- Many type of resources
- Interconnected with other Language Resources
- Enables the lexicalization of data on the web, not necessarily data in the LD format
- Enables a new generation of LD-aware NLP and MT Services

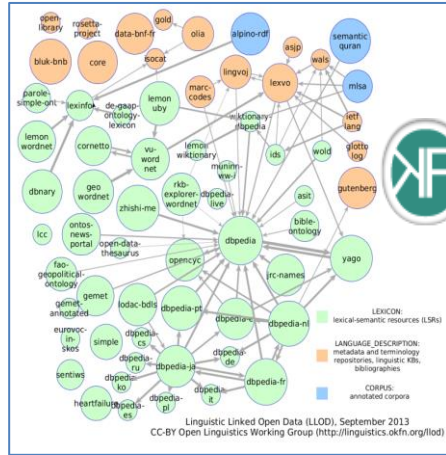


Linguistic Linked Data Evolution

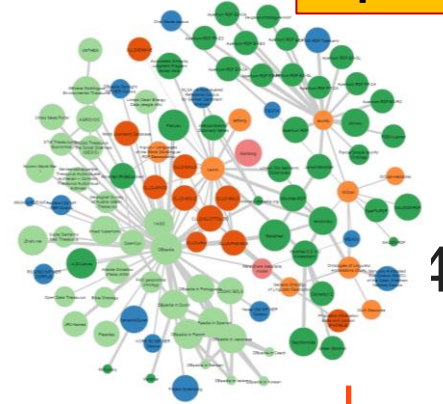
Jan. 2013



Sept. 2013

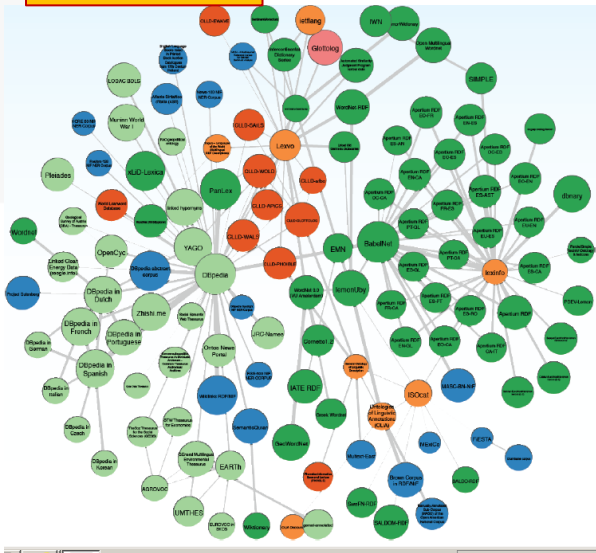


Sept. 2014

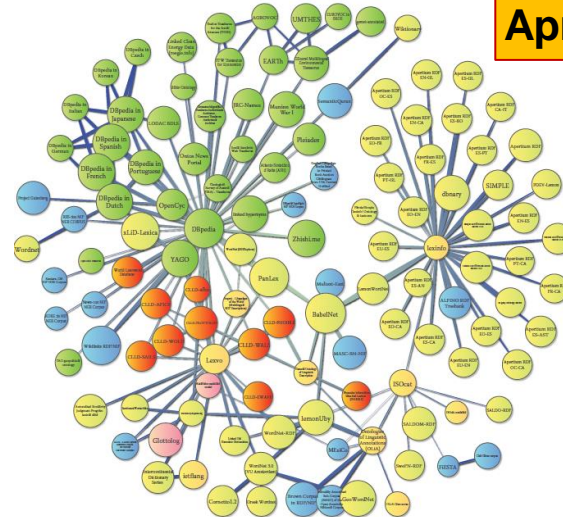


4

Nov. 2015



April. 2015

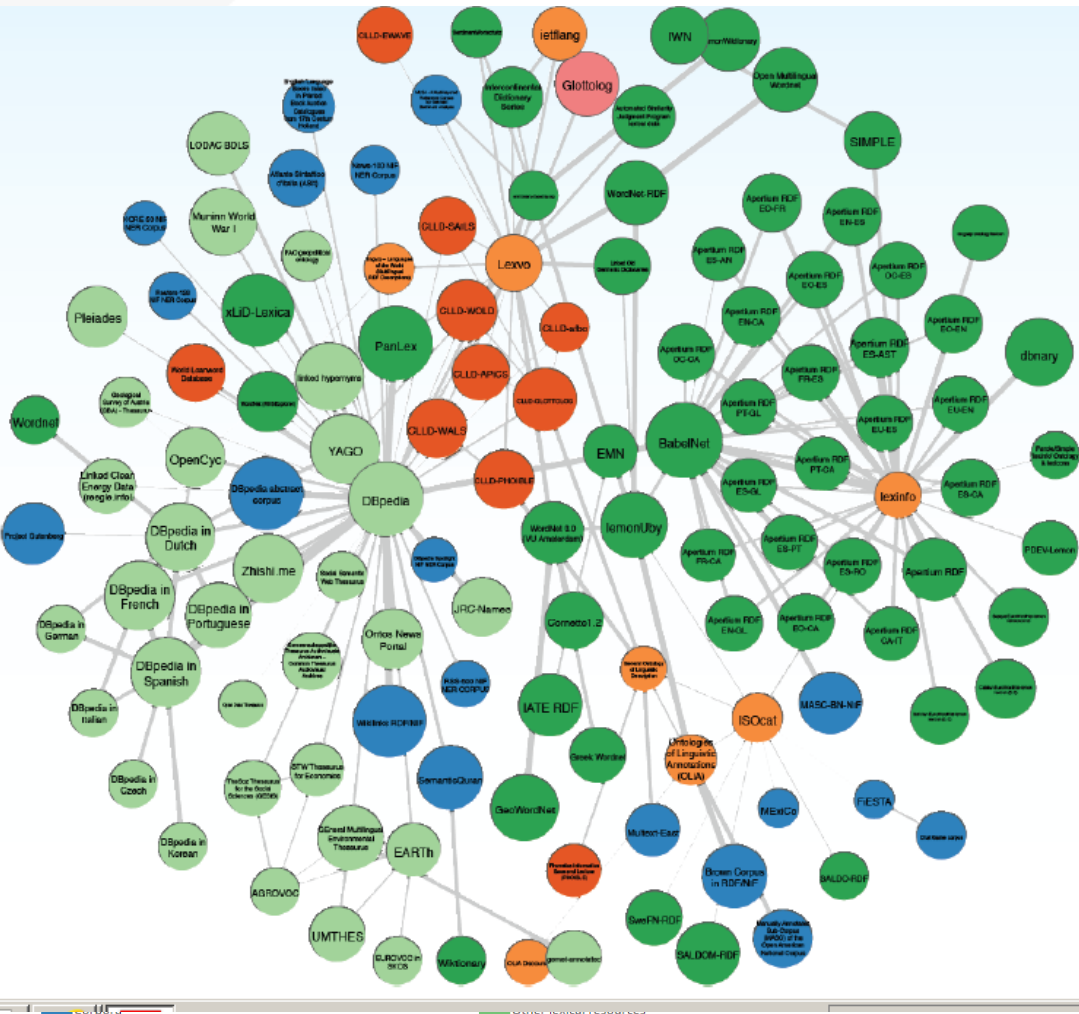


Linguistic Linked Licensed Data @ Nov 2014



www.lider-project.eu

- Corpora
- Terminologies, Thesauri and Knowledge Bases
- Lexicons and Dictionaries
- Linguistic Resource Metadata
- Linguistic Data Categories
- Typological Databases



LLOD Cloud in November 2015

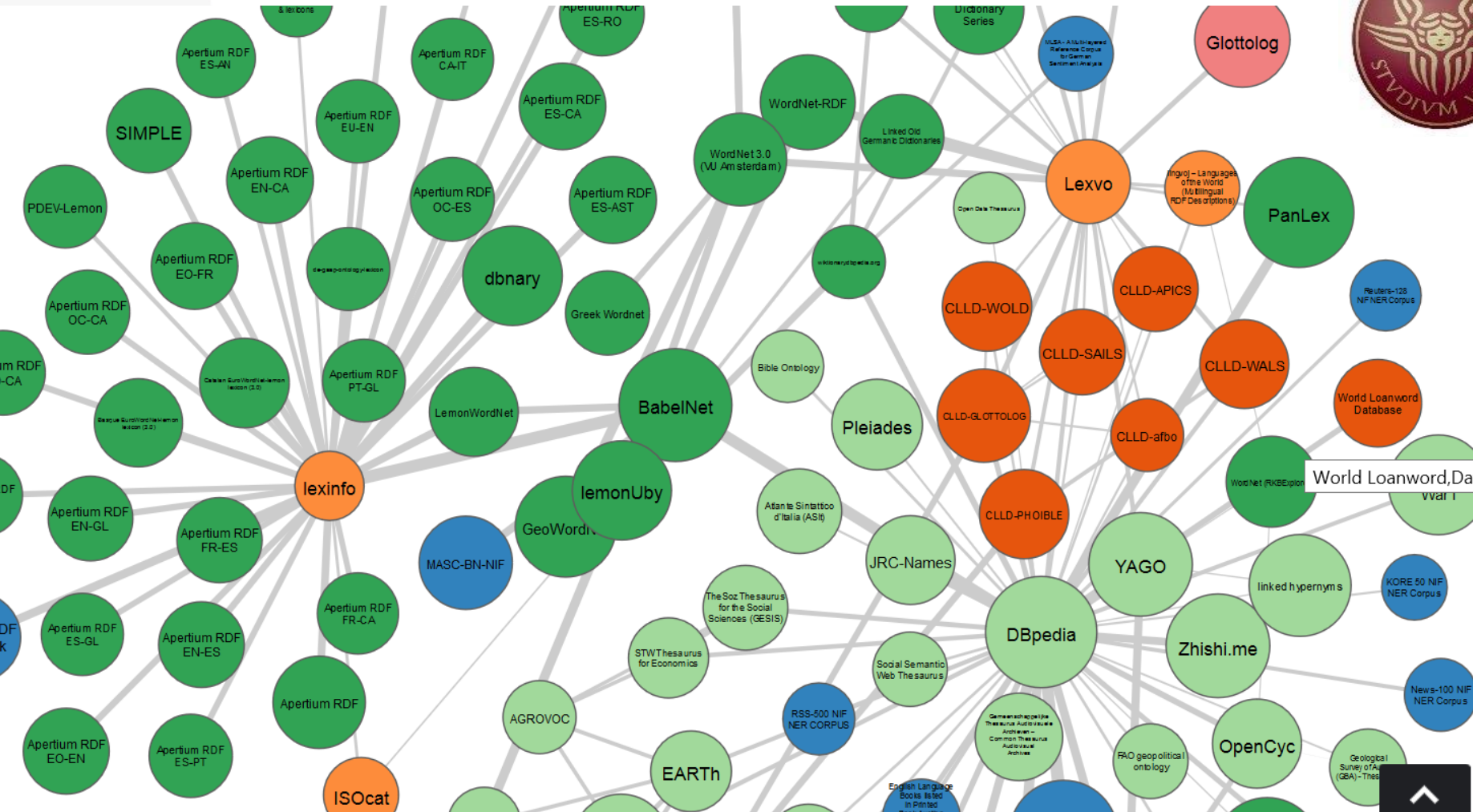
- 126 Resources
- 203 Links
- 20 Corpora

Less Centralized: Babelnet, LexVo and LexInfo new hubs

Criteria for inclusion:

- **Resolvable:** URLs that resolve
- **RDF:** resolve to RDF
- **1000 Triples:** self-explaining
- **Links:** to one resource from the cloud or other 50 links
- **Crawlable:** get the whole resource by crawling
- **Linguistic:** data must be a language resources
- **Registered:** at CKAN

The core of the Linguistic Linked Open Data cloud!



From Roberto Navigli (Sapienza University)



Linguistic Linked Data: Paving the Way Towards Maximising (Re)Usability of Linguistic Resources

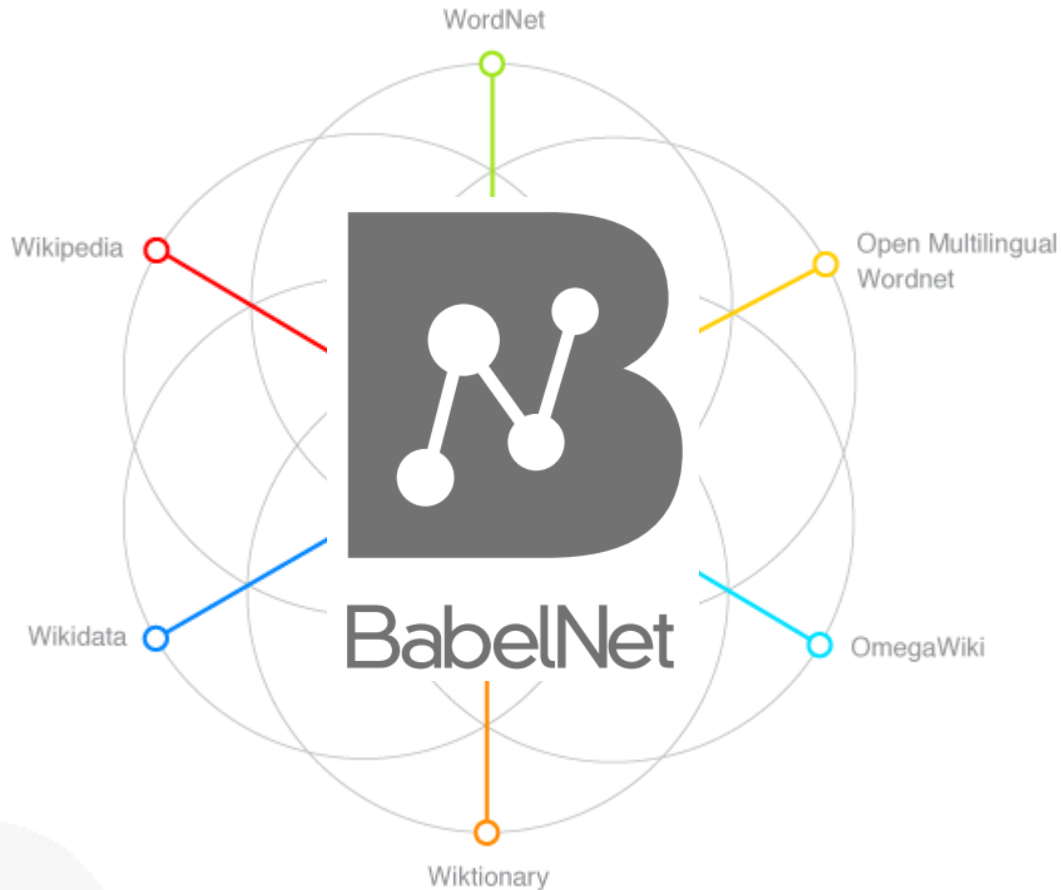
© Asunción Gómez-Pérez

Escuela de Verano de Inteligencia Artificial, 17 de Junio de 2016, Carmona, Sevilla, Spain

What is BabelNet?



- A merger of resources of different kinds:



From Roberto Navigli (Sapienza University)

Why do we need BabelNet?



- **Multilinguality:** the same concept is expressed in terms of different languages
- **Coverage:** 272 languages and 14 million entries!
 - **6M** concepts and **7.7M** named entities
 - **119M** word senses
 - **378M** semantic relations (27 relations per concept on avg.)
 - **11M** images associated with concepts
 - **41M** textual definitions
 - **2M** concepts with domains associated



From Roberto Navigli (Sapienza University)

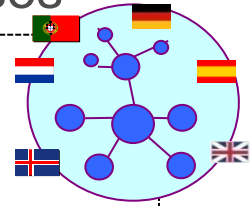
Multilingualism and the Linked Data



How to *represent* language in Linked Data?

- Traditional **annotation** properties for most cases

```
dbpedia:Ateneo_de_Madrid
rdfs:label "Ateneo de Madrid"@es .
"Athénée de Madrid"@fr.
"атенео-де-мадрид"@ru.
```



- Richer models** for more demanding applications

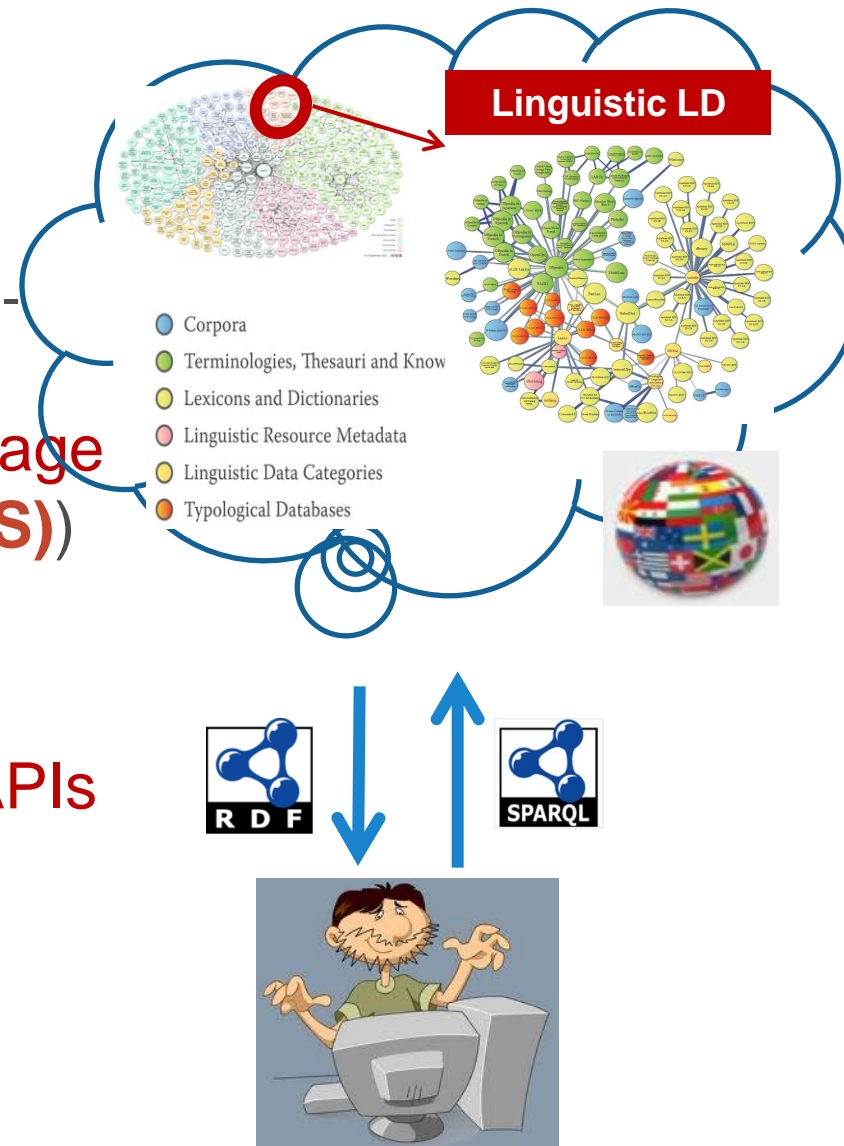
Association of the vocabulary to an external lexicon model

```
# LEMON
isbd:T1001 lemon:isReferenceOf [lemon:isSenseOf :cartographic].
      :cartographic a lemon:LexicalEntry;
lemon:form [lemon:writtenRep "cartográfico"@es;
      isocat:grammaticalGender isocat:masculine];
lemon:form [lemon:writtenRep "cartográfica"@es;
      isocat:grammaticalGender isocat:feminine].
isocat:grammaticalGender rdfs:subPropertyOf lemon:property.
```

lemon

Linked Data and Linguistic Linked Data

1. **Agree on vocabularies** for describing
 - Domain vocabularies
 - LR metadata and content (Lemon-Ontolex, NIF, ...)
2. Unified and standardized **language** for describing resources (**RDF(S)**)
3. Unified and standardized **query language** (SPARQL)
4. Standardized **non-proprietary APIs**
5. **Links** to other resources





Open Data
Linked Open Data
Linguistic Linked Data
Linguistic Linked **Licensed** Data

Linguistic Linked Licensed Data

How do we represent license information?



Lexvo.org - Resource: x
www.lexvo.org/linkeddata/resources.html

Lexvo.org
Started FAQ Details Downloads References Legal Co

Resources

Download machine-readable data

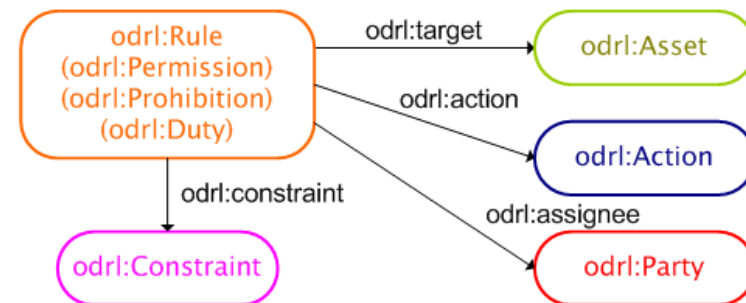
We offer a machine-readable [RDF](#) file with information about languages and other entities provided on [Lexvo.org](#). This dump file can be downloaded to your local computer and distributed in accordance with the [Creative Commons Attribution-ShareAlike \(CC-BY-SA\) 3.0 Unported license](#):

- [Lexvo dump \(2013-02-09\)](#)
- [Lexvo dump \(direct link to latest version 2013-02-09\)](#)

We are grateful to a number of people for providing the [original data sources](#) that were used to create Lexvo.org.

Rights expression in ODRL:

Who [can|cannot|must] act what in which resource how



Example of a license

The reproduction of a dataset is limited until the end of this year after paying 15€.

```
@prefix gr:    <http://purl.org/goodrelations/> .
@prefix dcat: <http://www.w3.org/ns/dcat#> .
<http://samplepolicy/1234>
  a odrl:Offer ;
  rdfs:label "License Offering Paid Linked Data" ;
  odrl:permission [
    odrl:target <http://example.org/dataset/ds01> ;
    odrl:action odrl:reproduce ;
    odrl:duty [
      rdfs:label "Pay" ;
      gr:UnitOfMeasurement dcat:Dataset ;
      gr:amountOfThisGood "1" ;
      odrl:action odrl:pay ;
      odrl:target "15,00 EUR"
    ] ;
  ] ;
  odrl:constraint [
    odrl:operator odrl:lt ;
    odrl:dateTime "2015-12-31"^^xsd:date ]
  ] ;
]
```



<http://conditional.linkeddata.es>

Using Policies to govern conditional access to Linked Data

Example of access to Linked Data for a price (15EUR for the dataset or 0.01EUR for a triple thereof)

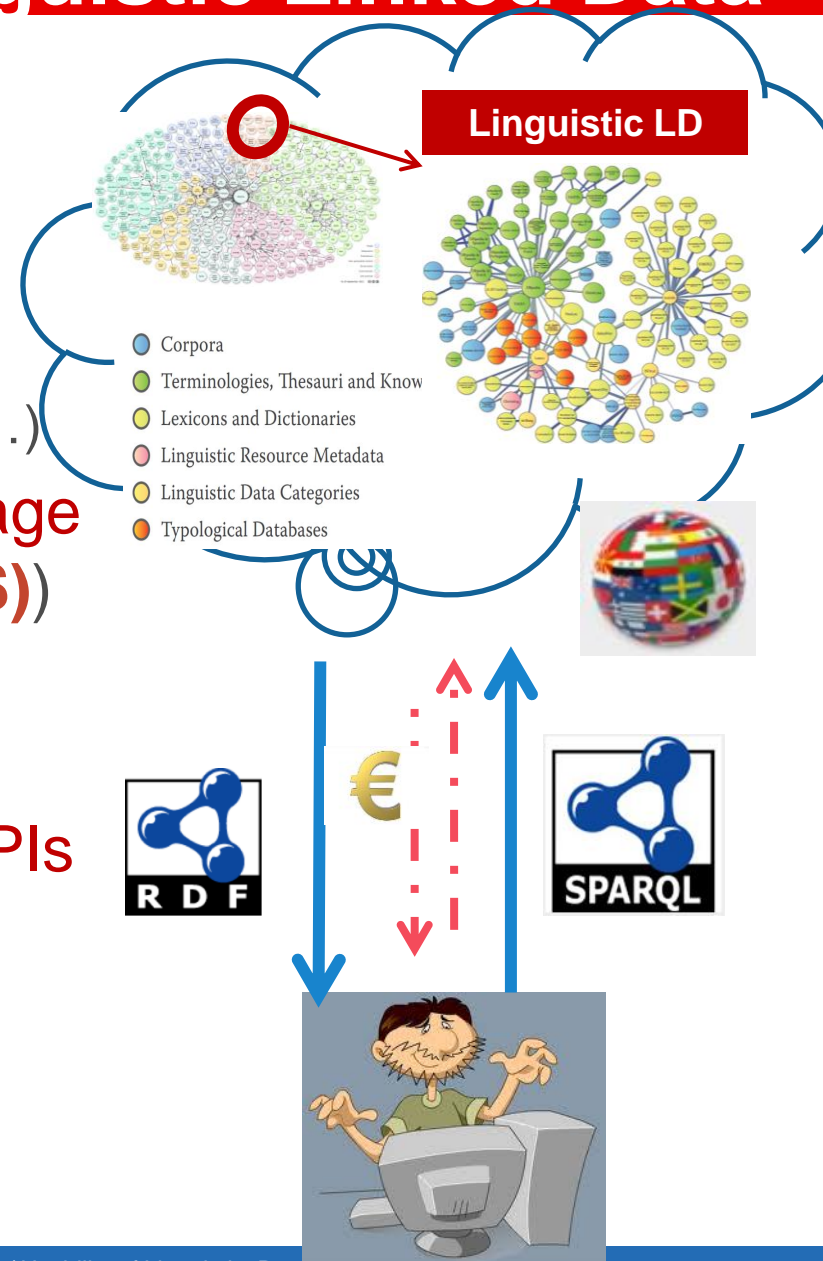
```
@prefix gr:      <http://purl.org/goodrelations/> .
@prefix dcat:    <http://www.w3.org/ns/dcat#> .
<http://salonica.dia.fi.upm.es/ldr/policy/cdaddba4-fc2e-4ee0-a784-e62f1db259bf>
  a
  rdfs:label     "License Offering Paid Linked Data" ;
  odrl:permission [ a
                    odrl:Permission ;
                    odrl:target   <http://example.org/dataset/ds01> ;
                    odrl:action   odrl:reproduce ;
                    odrl:duty     [ a
                                    odrl:Duty ;
                                    rdfs:label       "Pay" ;
                                    gr:UnitOfMeasurement dcat:Dataset ;
                                    gr:amountOfThisGood "1" ;
                                    odrl:action       odrl:pay ;
                                    odrl:target       "15,00 EUR"
                                ]
                  ] , [ a
                    odrl:Permission ;
                    odrl:action   odrl:reproduce ;
                    odrl:target   <http://example.org/dataset/ds01> ;
                    odrl:duty     [ a
                                    odrl:Duty ;
                                    rdfs:label       "Pay" ;
                                    gr:UnitOfMeasurement rdf:Statement ;
                                    gr:amountOfThisGood "1" ;
                                    odrl:action       odrl:pay ;
                                    odrl:target       "0,01 EUR"
                                ]
                  ] ..
```



<http://conditional.linkeddata.es>

Linked Data and Linguistic Linked Data

1. **Agree on vocabularies** for describing
 - Domain datasets
 - LR metadata
 - LR content (Lemon-Ontolex, NIF, ...)
2. Unified and standardized **language** for describing resources (**RDF(S)**)
3. Unified and standardized **query language** (SPARQL)
4. Standardized **non-proprietary APIs**
5. **Links** to other resources



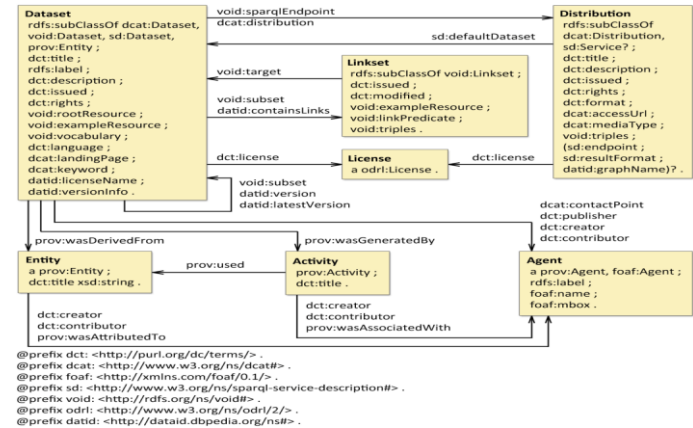
mlider
www.lider-project.eu

Open Data
Linked Open Data
Linguistic Linked Data
Linguistic Linked Licensed Data
Outcomes of the LIDER project

Discovery LRs metadata with LingHub

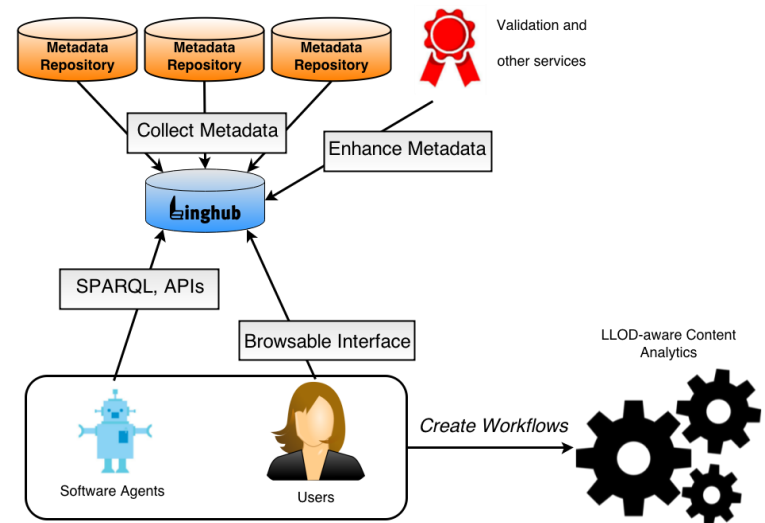
Language resource metadata transformation and aggregation

- Metadata OWL ontology @ LD4LT W3C group
- Exposure of Metashare, Clarin, LREMap, datahub metadata as LD



LingHub

- Collect and Homogenise metadata
- Enhance metadata
- Helps you to search LRs



mylider

www.lider-project.eu

<http://linghub.lider-project.eu/>

Conversion of 86 LR's data into LD

86 Resources transformed:

- Princeton WordNet,
- BabelNet
- IATE
- Wikipedia Bitaxonomy
- Terminesp (spanish)
- Termcat
- 22 Apertium bilingual dictionaries
- the Brown Corpus
- Wikilinks Corpus
- 27 wordnets from the Open Multilingual Wordnet
- 22 lexical resources for Swedish, including SALDO

Use of models and guidelines from WP4 standardization activities

- Use of **Ontolex-lemon** Model from the Ontolex group at W3C
- **BPMLOD@W3C guidelines**

NIF Refinement by the community

Resources transformed by the community

- LDL 2014
- Summer datathon on LLD



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8 Guidelines for Linguistic Linked License Data

- Generation of
 - Multilingual Dictionaries (BabelNet)
 - Bilingual Dictionaries
 - Multilingual Terminologies (TBX)
 - WordNets
- Corpus creation using NIF
- NIF-based NLP Web Services
- LLD Exploitation
- LLOD aware services

<http://www.lider-project.eu/guidelines>

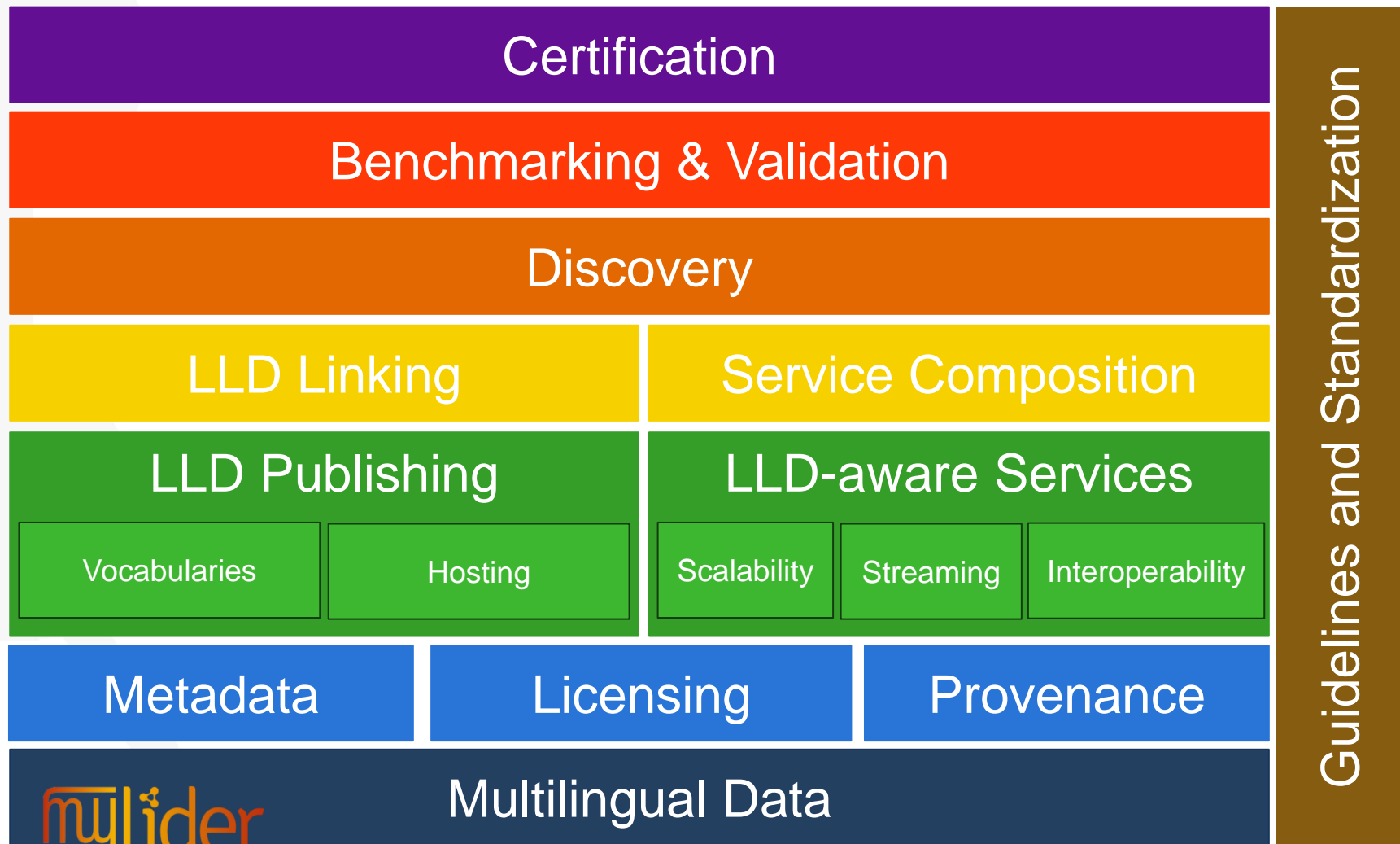
Best practices for Multilingual Linked Data Publication

- Practices for Naming (URIs)
- Practices for Dereferencing
- Practices for Textual Information
- Practices for Linking
- Practices for Language Identification

The logo for the MLIDER project, featuring the word "mlider" in a stylized font where the "m" and "l" are connected and the "i" has a dot above it.

www.lider-project.eu

Reference Architecture



www.lider-project.eu

Reference Architecture and Reference Cards

Ce

Dataset description with DataID

Benchm

Contributing to the Linguistic Linked Open Data Cloud

This card describes how you can contribute to the Linguistic Linked Open Data Cloud

LLD Linking

Documenting metadata of language resources in Datahub

LLD Publishing

This card explains how to add some basic metadata to resources documented in Datahub

Vocabularies

Ho

Target audience and Scope

The card is intended for people who have a dataset in linked data and wish to document it in Datahub. This card extends the card "Contributing to the Linguistic Linked Open Data Cloud" by adding more details on how to document some basic metadata. See also, as an alternative, the "Dataset description with DataID" card.

Metadata

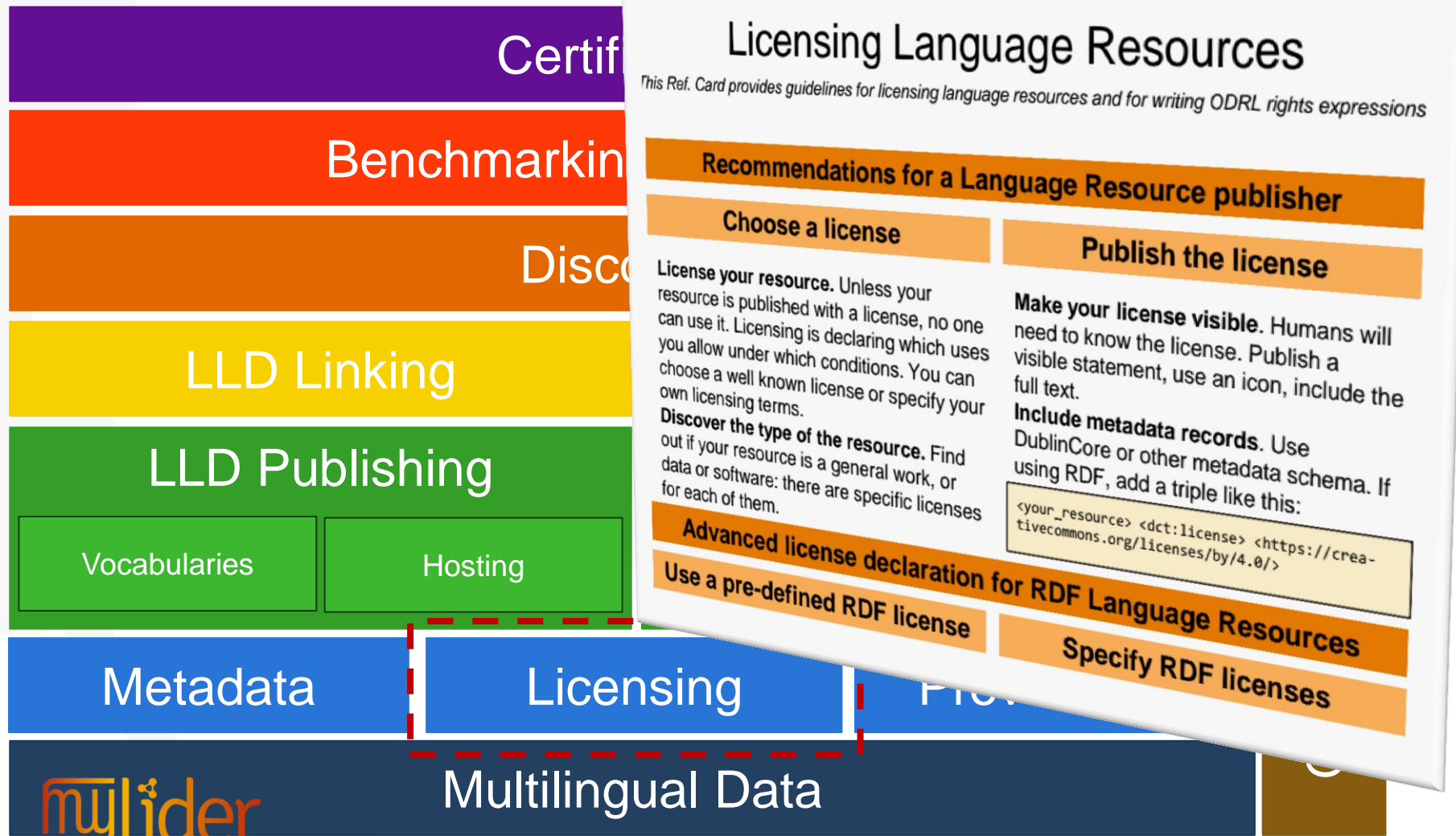
Registering with Datahub

Go to <http://datahub.io> and follow the steps in the "Contributing to the Linguistic Linked Open Data Cloud" reference card. As result, Datahub automatically creates an RDF metadata file for the dataset, based on the Data Catalogue Vocabulary (DCAT). This metadata file is accessible at http://datahub.io/dataset/DATASET_ID where DATASET_ID is the identifier of the dataset.

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Reference Architecture and Reference Cards



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Reference Architecture and Reference Cards



GUIDELINES

- **Multilingual Dictionaries (BabelNet)**
 - Bilingual Dictionaries
- **Multilingual terminologies (TBX)**
 - WordNets

LLD Linking

LLD Publishing

Vocabularies

Hosting

Metadata

Licen



Multilingu

www.lider-project.eu

How to publish Linguistic Linked Data

Publishing data on the Web in a way that it can be easily consumed is a daunting task. The Web community has converged on the idea that Linked Data provides the best practices for publishing highly interoperable data. This card explains in detail...

Linked Data Corpus Creation with NIF

This document describes best practices to follow for the generation of Linked Data text corpora, using the NLP Interchange Format (NIF).

Target audience

Corpus creators and users seeking to make corpora interoperable and to publish them as linked data. Basic knowledge of RDF is mandatory for conversion. Basic knowledge of linked data and web server access is needed for publication.

Scope

Conversion of existing corpora into RDF using NIF, as well as creation of linked data corpora from textual data.

Core concepts

Corpus

We understand a corpus as a collection of documents. Documents contain text, represented as strings...

Reference Architecture and Reference Cards

The diagram illustrates the Reference Architecture and Reference Cards for Multilingual Data. It features a vertical stack of colored bars representing different components: Certification (purple), Benchmarking (orange), Discovery (brown), LLD Linking (yellow), LLD Publishing (green), Metadata (blue), Licensing (blue), and Multilingual Data (dark blue). The LLD Publishing bar contains sub-components for Vocabularies and Hosting. A white card titled 'How to represent cross-lingual LD links' is overlaid on the right side, providing details on target audience, scope, and core concepts. The card includes a diagram showing cross-lingual mappings between Concept A 'river' and Concept B 'riviere'/'fleuve'.

Certification

Benchmarking

Discovery

LLD Linking

LLD Publishing

Vocabularies Hosting

Metadata **Licensing**

Multilingual Data

How to represent cross-lingual LD links

This card explains the basic mechanisms available to represent links between linked data in different natural languages.

Target audience

Data publishers and developers with basic acquaintance of RDF and LD who need to interlink data in different languages in the linked data cloud.

Scope

The card review the different types of cross-lingual LD links. It does not discuss the methods/techniques needed to infer the links, but deals with representation mechanisms only. This cards extends the card "How to publish Linguistic Linked Data".

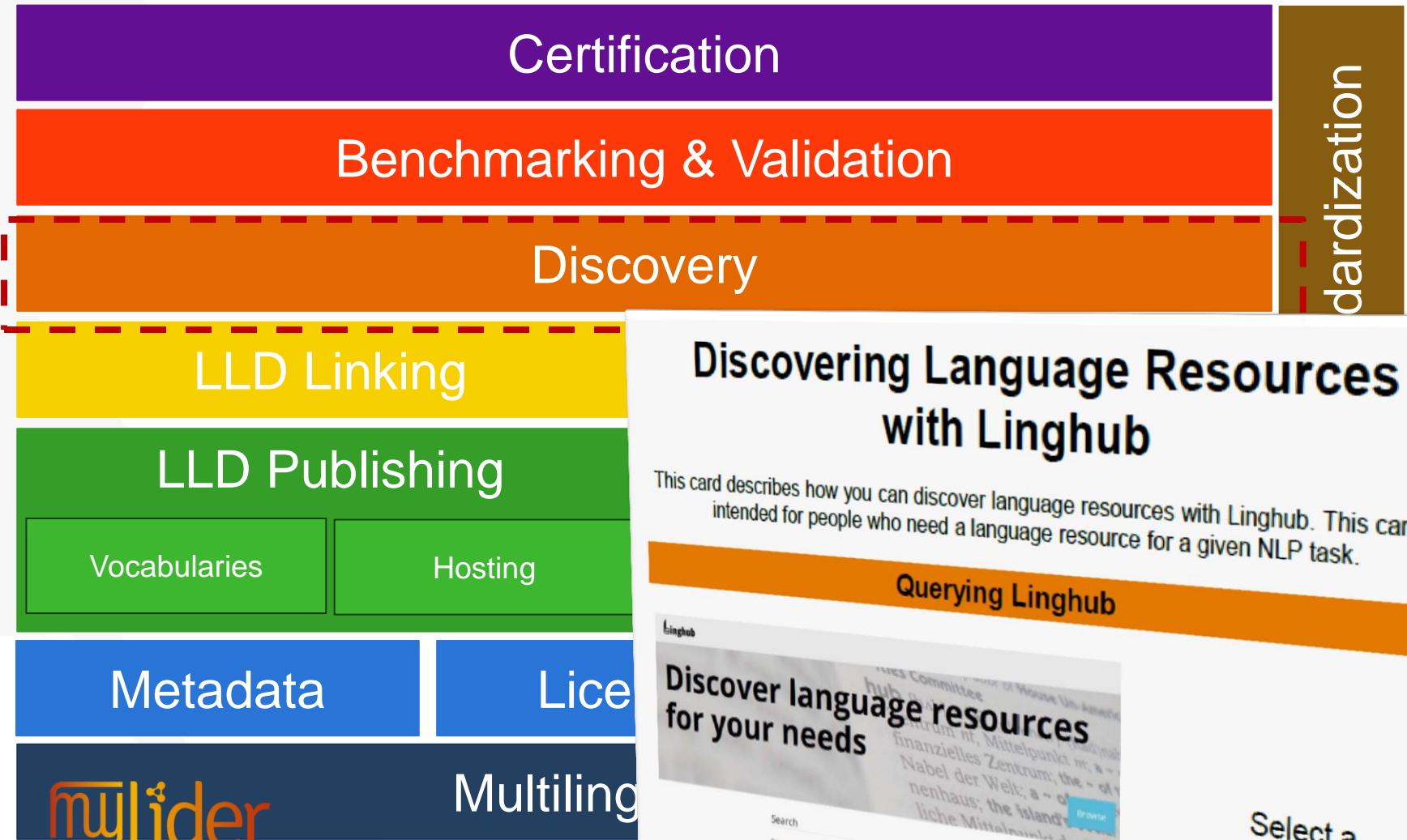
Core concepts

Cross-lingual mappings can be established at two different levels: **conceptual level** and **linguistic level**. In the first case, links are

The diagram shows two triangles representing concepts. The left triangle is labeled 'Concept A' with the example 'river'. The right triangle is labeled 'Concept B' with two examples: 'riviere' and 'fleuve'. Dashed lines connect 'Concept A' to both 'Concept B' examples, illustrating cross-lingual mappings.

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Reference Architecture and Reference Cards



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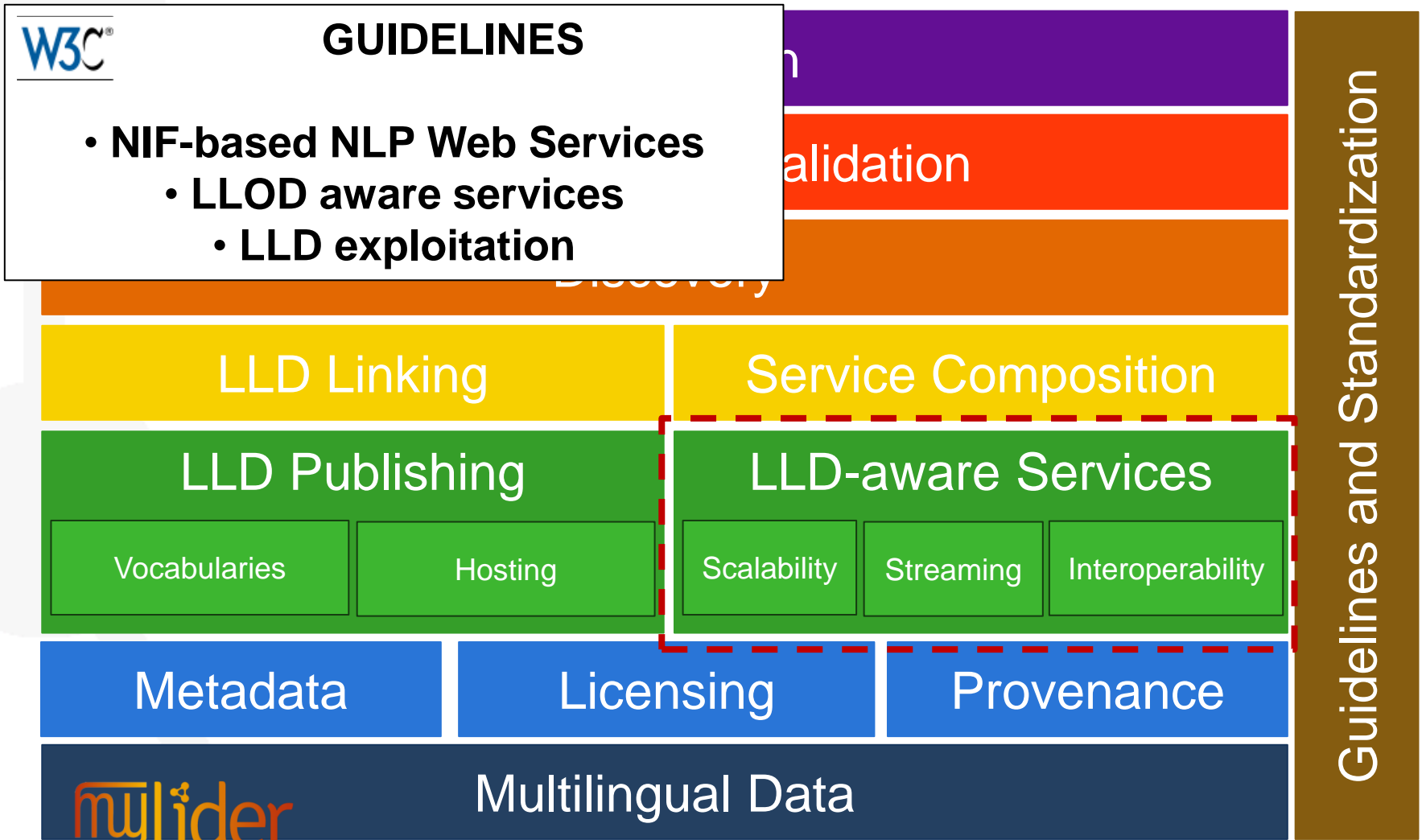
Discovering Language Resources with Linghub

This card describes how you can discover language resources with Linghub. This card is intended for people who need a language resource for a given NLP task.

Querying Linghub

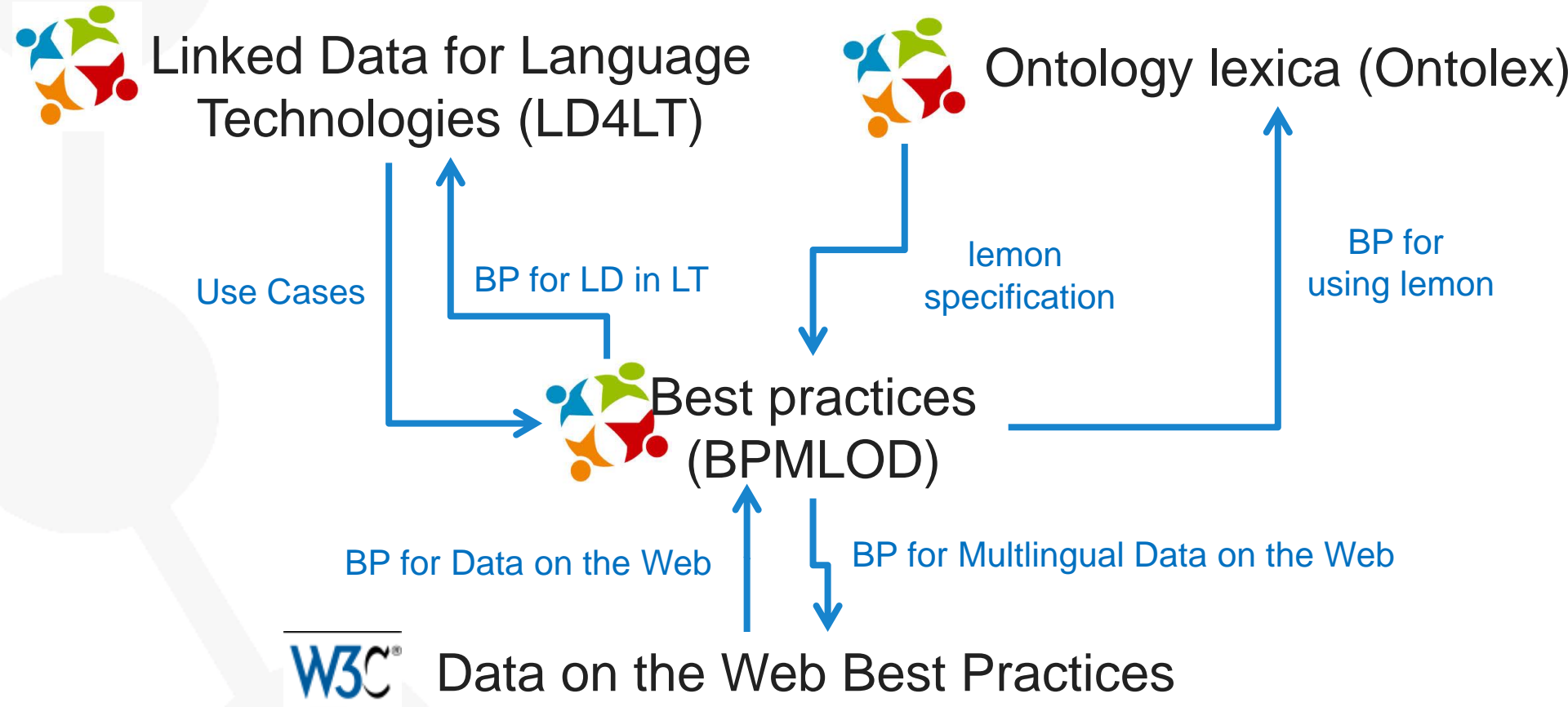
The screenshot shows the Linghub search interface. It includes a search bar with the text "Discover language resources for your needs" and a "Search" button. Below the search bar is a dropdown menu labeled "Select a property".

Reference Architecture and Reference Cards



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Relation between W3C groups





Open Data

Linked Open Data

Linguistic Linked Data

Linguistic Linked Licensed Data

Linguistic Linked Data permits multilingual Data Integration



Linked Data are multilingual

Multilingual data integration



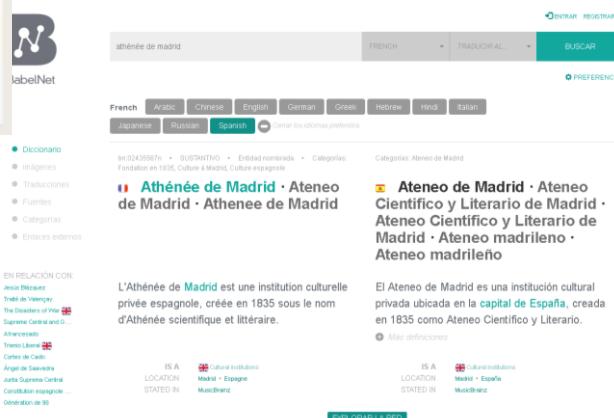
data.bnf.fr

Multilingual
complementary
information



search results for "Athénée de Madrid"

There were no results matching the query. You can also search Athénée de Madrid in :
Le Catalogue général de la BnF
La base BnF Archives et Manuscrits
La bibliothèque numérique Gallica



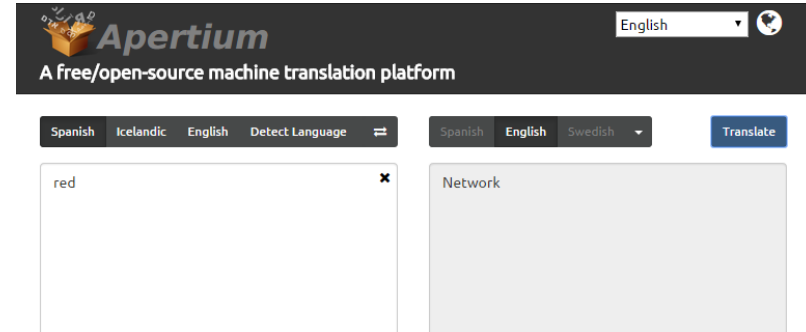
Language Resources
The need of connecting licensed Language Resources
Linked Data foundations
Linguistic Linked Licensed Data
Outcomes of the LIDER project

THE APERTIUM RDF CASE AND THEIR LINKS



Apertium Platform: Machine Translation.

> 40 bilingual dictionaries available in XML.

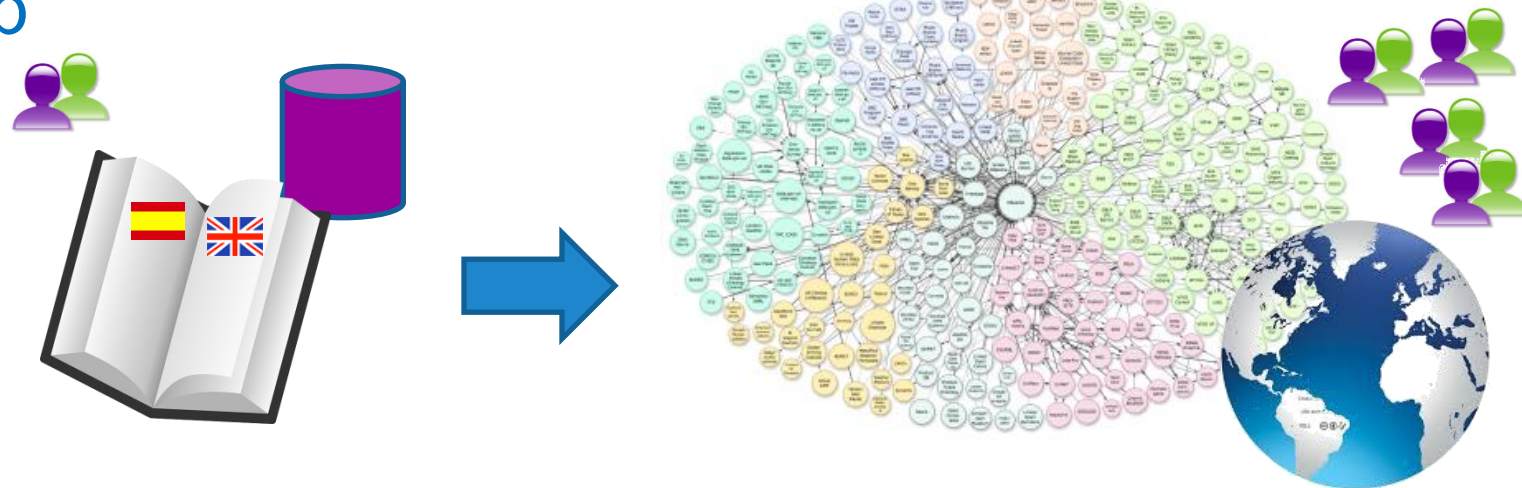


Afrikaans <-> Dutch
 Breton --> French
 Catalan <-> Italian
 Welsh <-> English
 Danish <-> Norwegian
 English <-> Catalan
 English <-> Spanish
 English <-> Galician
 Esperanto <-> Catalan
 Esperanto <-> English
 Esperanto <-> Spanish
 Esperanto <-> French
 Spanish <-> Aragonese
 Spanish <-> Asturian
 Spanish <-> Catalan
 Spanish <-> Galician

Spanish <-> Italian
 Spanish <-> Portuguese
 Spanish <-> Romanian
 Basque --> English
 Basque --> Spanish
 French <-> Catalan
 French <-> Spanish
 Serbo-Croatian <-> English
 Serbo-Croatian <-> Macedonian
 Serbo-Croatian <-> Slovenian
 Indonesian <-> Malaysian
 Icelandic <-> Swedish
 Icelandic --> English
 Kazakh <-> Tatar
 Macedonian <-> Bulgarian
 Macedonian --> English

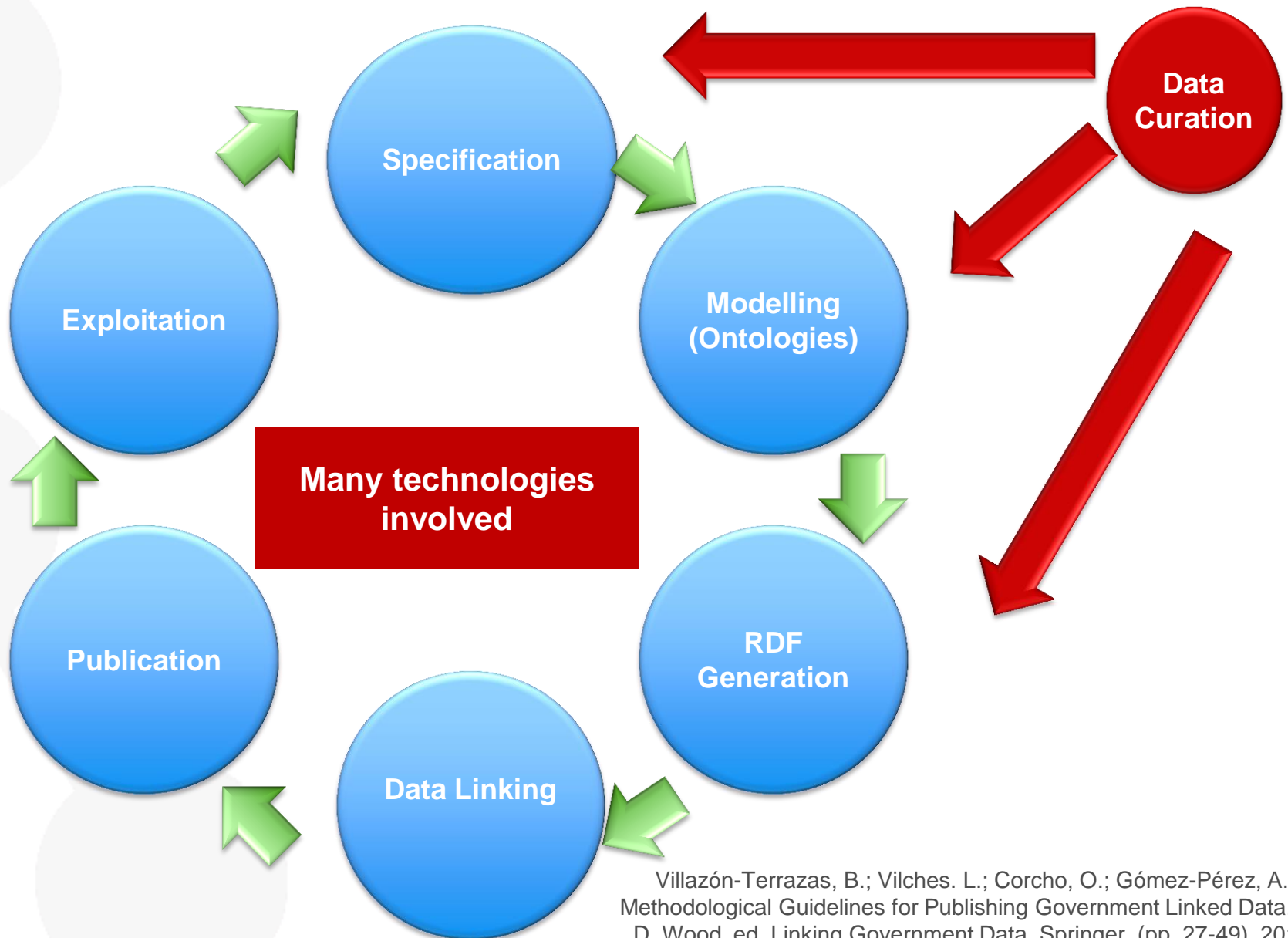
Norwegian Nynorsk <-> Norwegian
 Bokmål
 Occitan <-> Catalan
 Occitan <-> Spanish
 Portuguese <-> Catalan
 Portuguese <-> Galician
 Northern Sami --> Norwegian
 Bokmål
 Swedish <-> Danish

GOAL: to expose **translations** contained in bilingual dictionaries as **Linked Data** on the **Web**



Joint effort by





Villazón-Terrazas, B.; Vilches, L.; Corcho, O.; Gómez-Pérez, A. Methodological Guidelines for Publishing Government Linked Data. In D. Wood, ed. Linking Government Data. Springer. (pp. 27-49). 2011

Approach for Apertium RDF



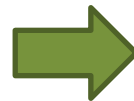
Specification



Apertium LMF



EN-ES



Monolingual
lexicons

Lexicon ES

Lexicon EN

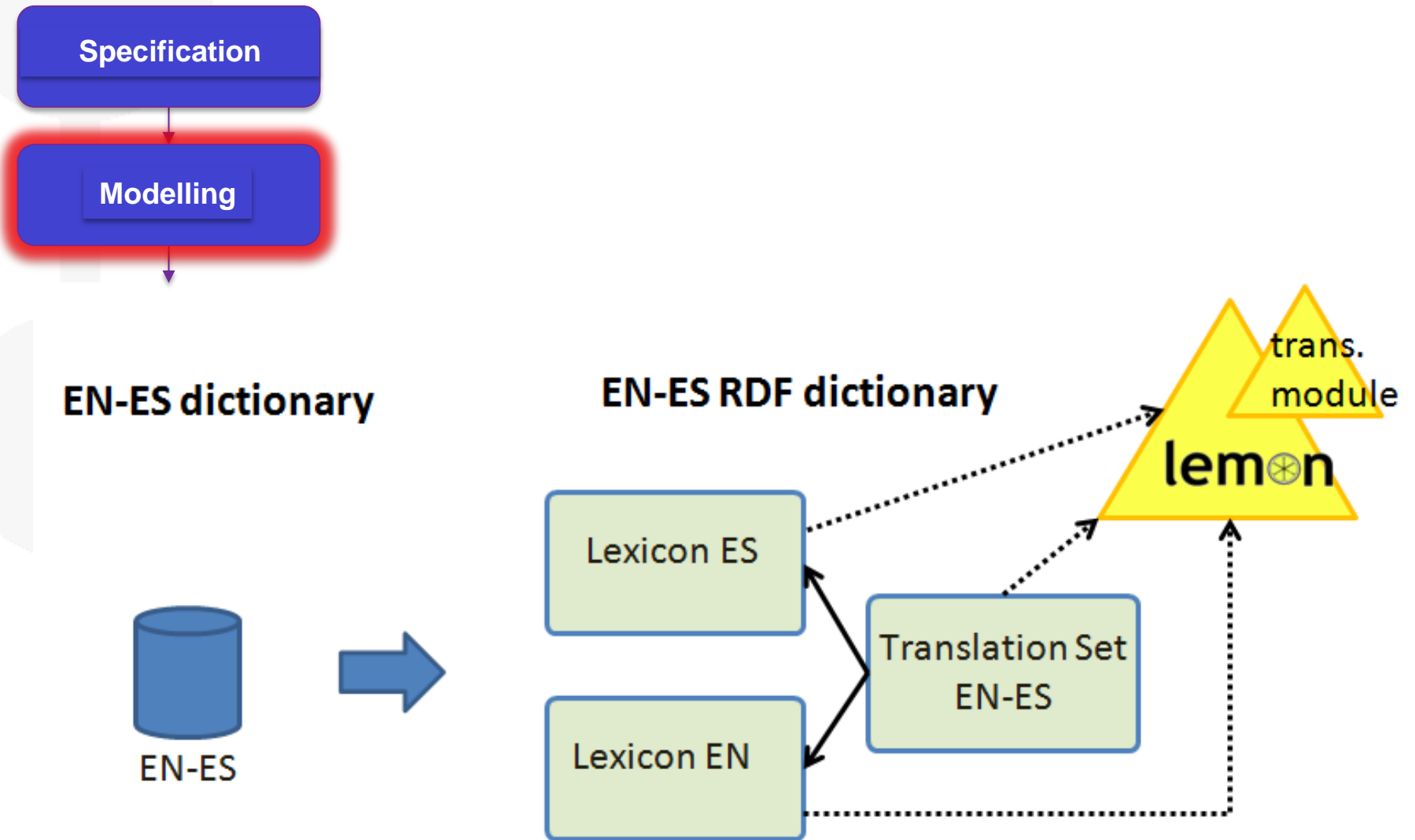
Translation sets

Translation
Set EN-ES

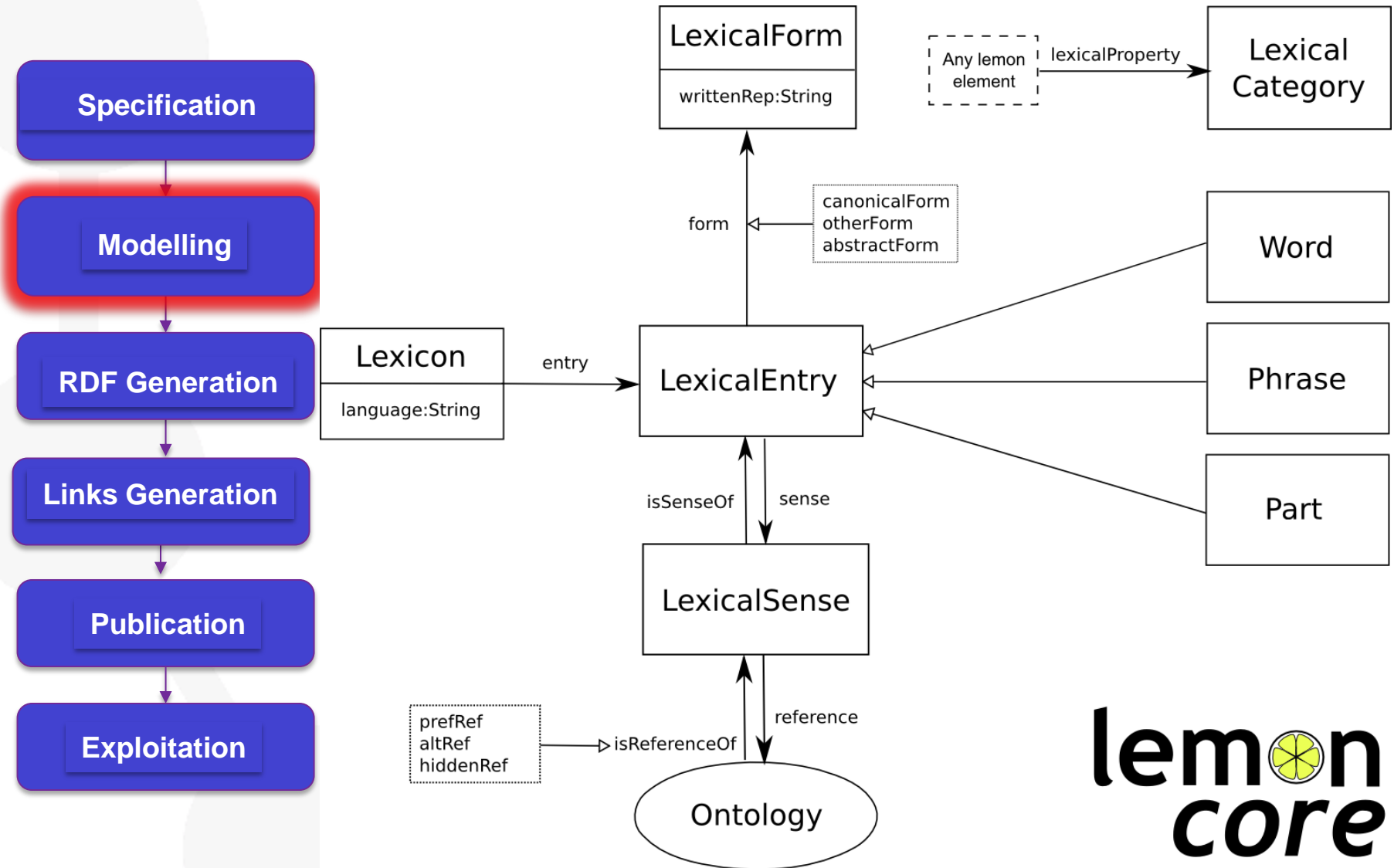
URI Design

```
# Apertium English lexicon:  
http://linguistic.linkeddata.es/id/apertium/lexiconEN  
  
# Apertium Spanish lexicon:  
http://linguistic.linkeddata.es/id/apertium/lexiconES  
  
# Apertium English-Spanish translation set:  
http://linguistic.linkeddata.es/id/apertium/tranSetEN-ES
```

Modelling: for each bilingual dictionary....

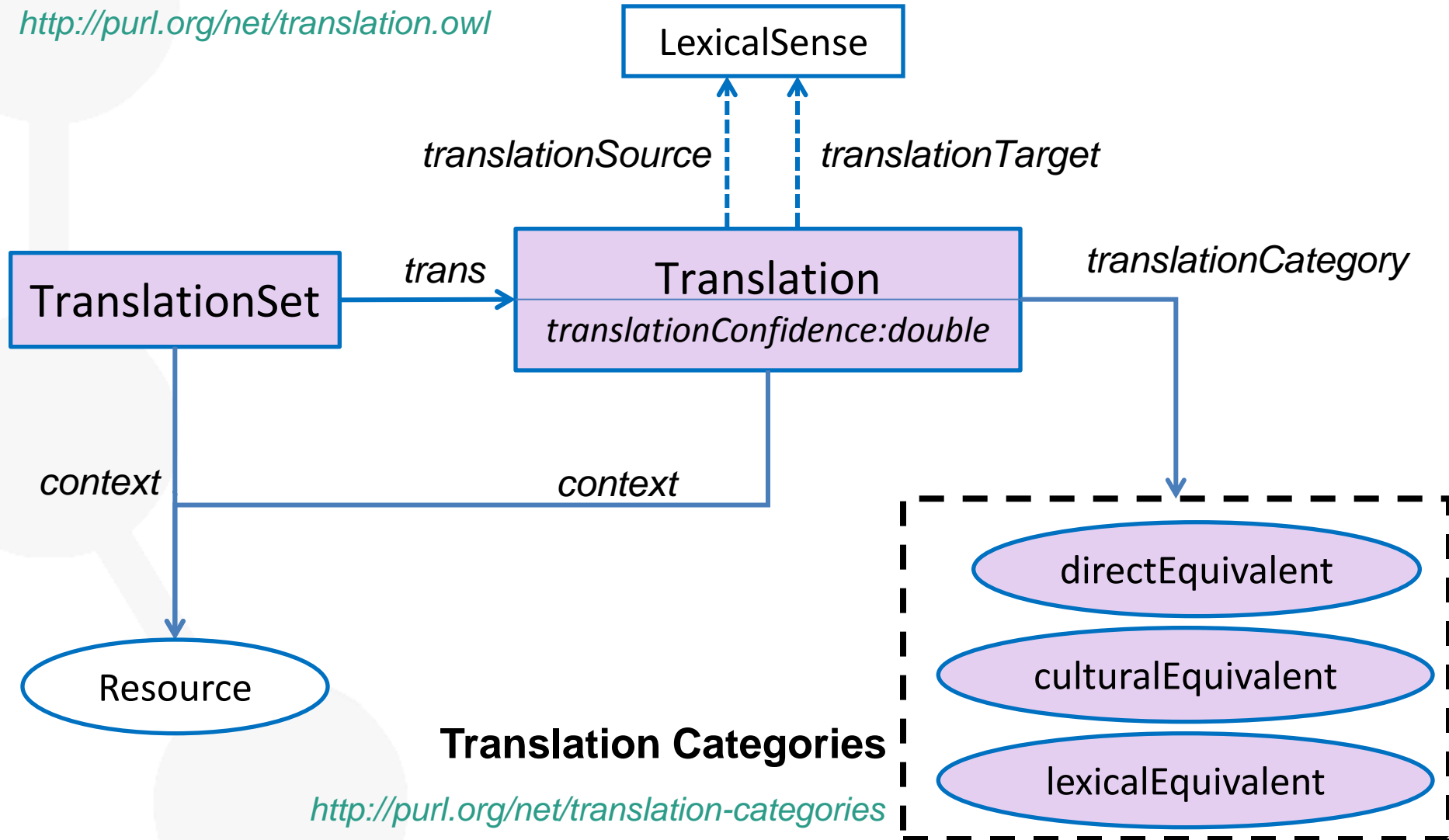


Modeling lexicons with Lemon

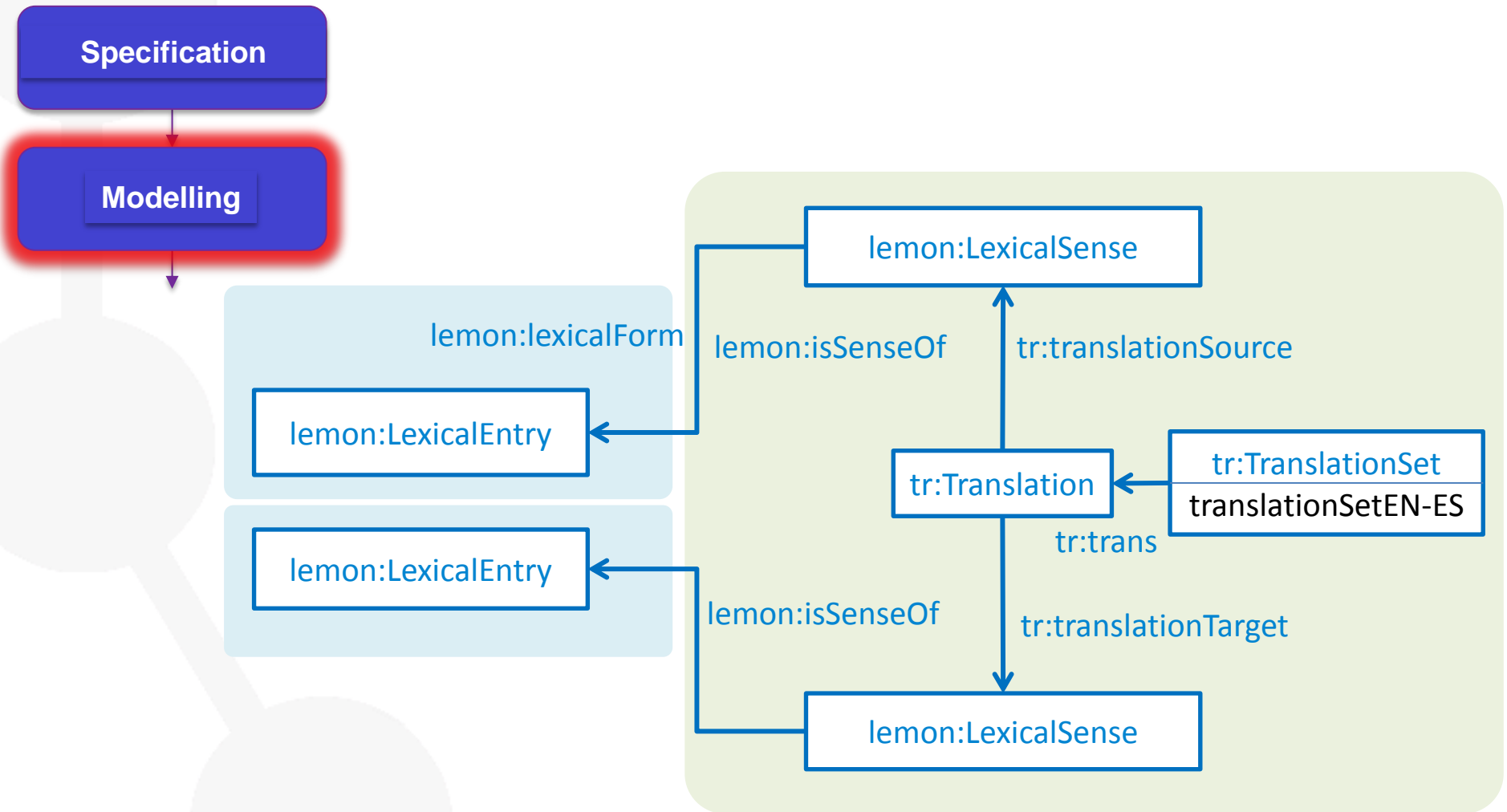


Translation Module

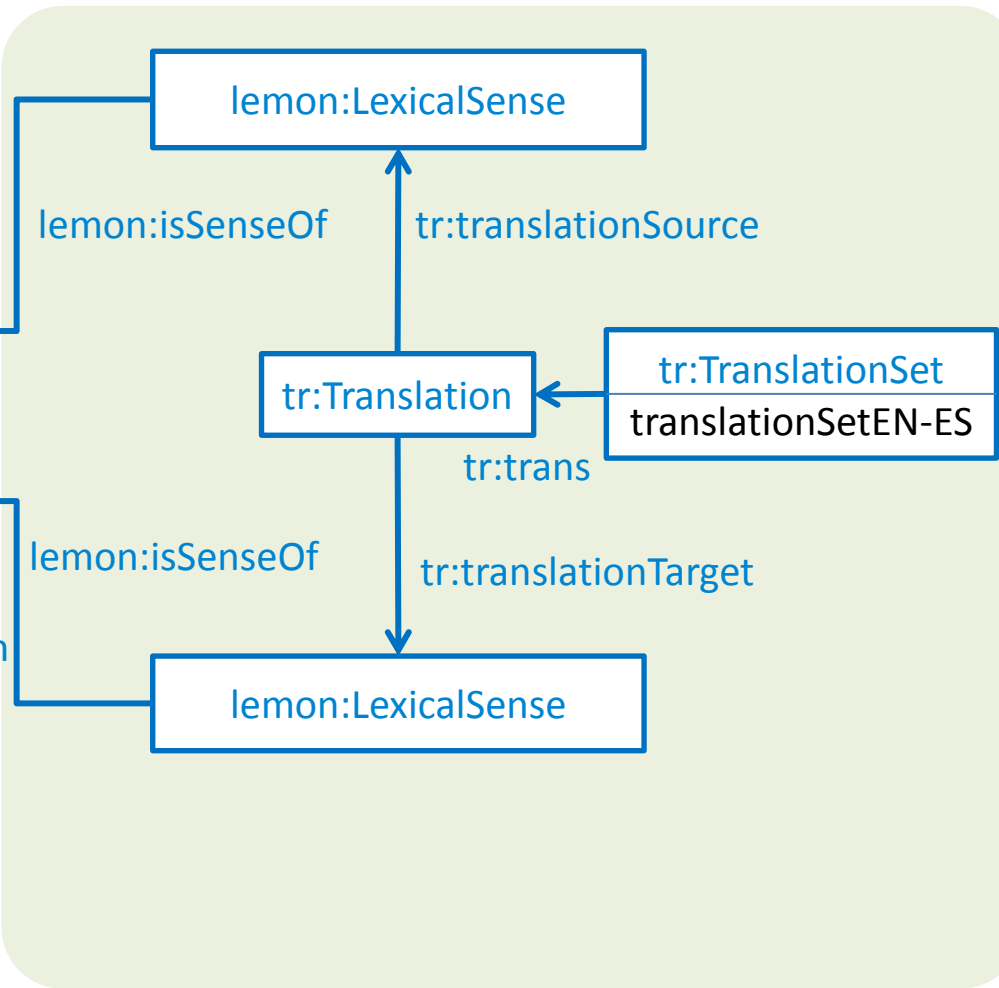
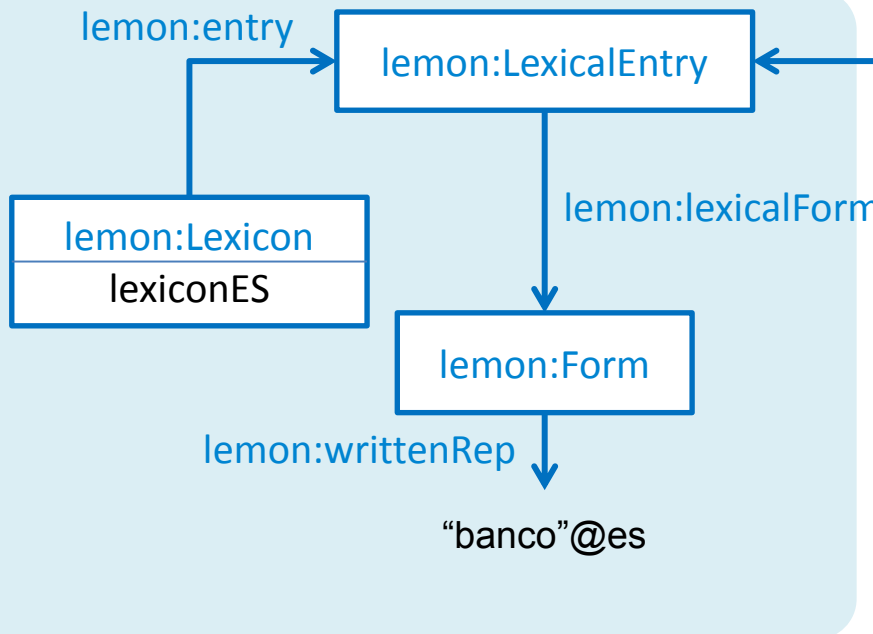
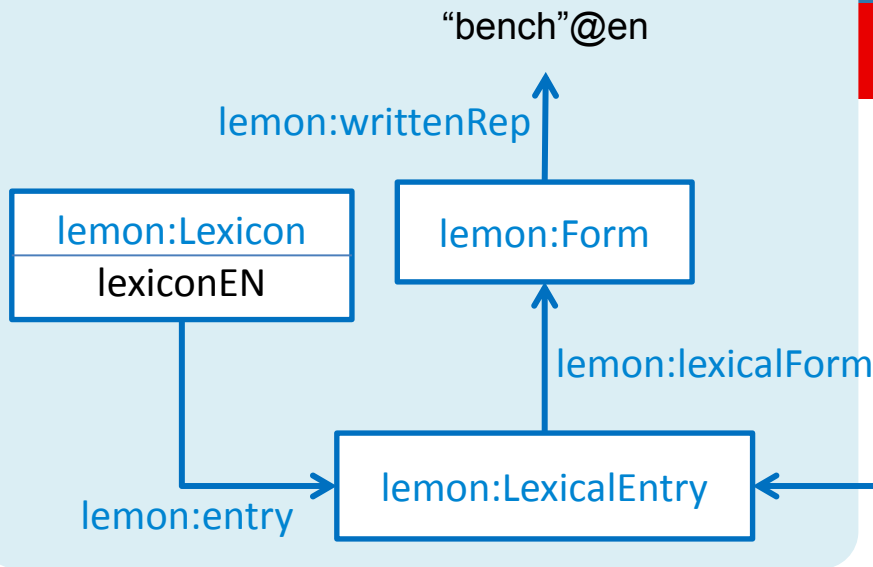
<http://purl.org/net/translation.owl>



Modeling lexicons with Lemon



Translation example



Specification

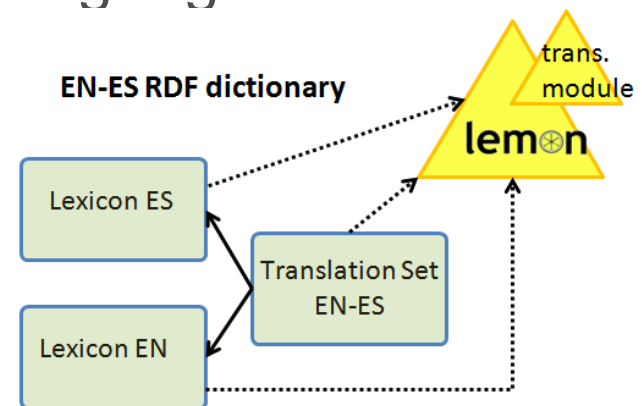
Modelling

RDF
Generation

RDF generation using Open Refine

For each bilingual dictionary:

1. Lexicon of the source language
2. Lexicon of the target
3. Translations



```
apertium:lexiconEN a lemon:Lexicon ;
dc:source <http://hdl.handle.net/10230/17110> .
...
apertium:lexiconEN lemon:entry apertium:lexiconEN/bench-n-en .

apertium:lexiconEN/bench-n-en a lemon:LexicalEntry ;
lemon:lexicalForm apertium:lexiconEN/bench-n-en-form ;
lexinfo:partOfSpeech lexinfo:noun .

apertium:lexiconEN/bench-n-en-form a lemon:Form ;
lemon:writtenRep "bench"@en .
```



Apertium RDF: 22 generated datasets

Specification

Modelling

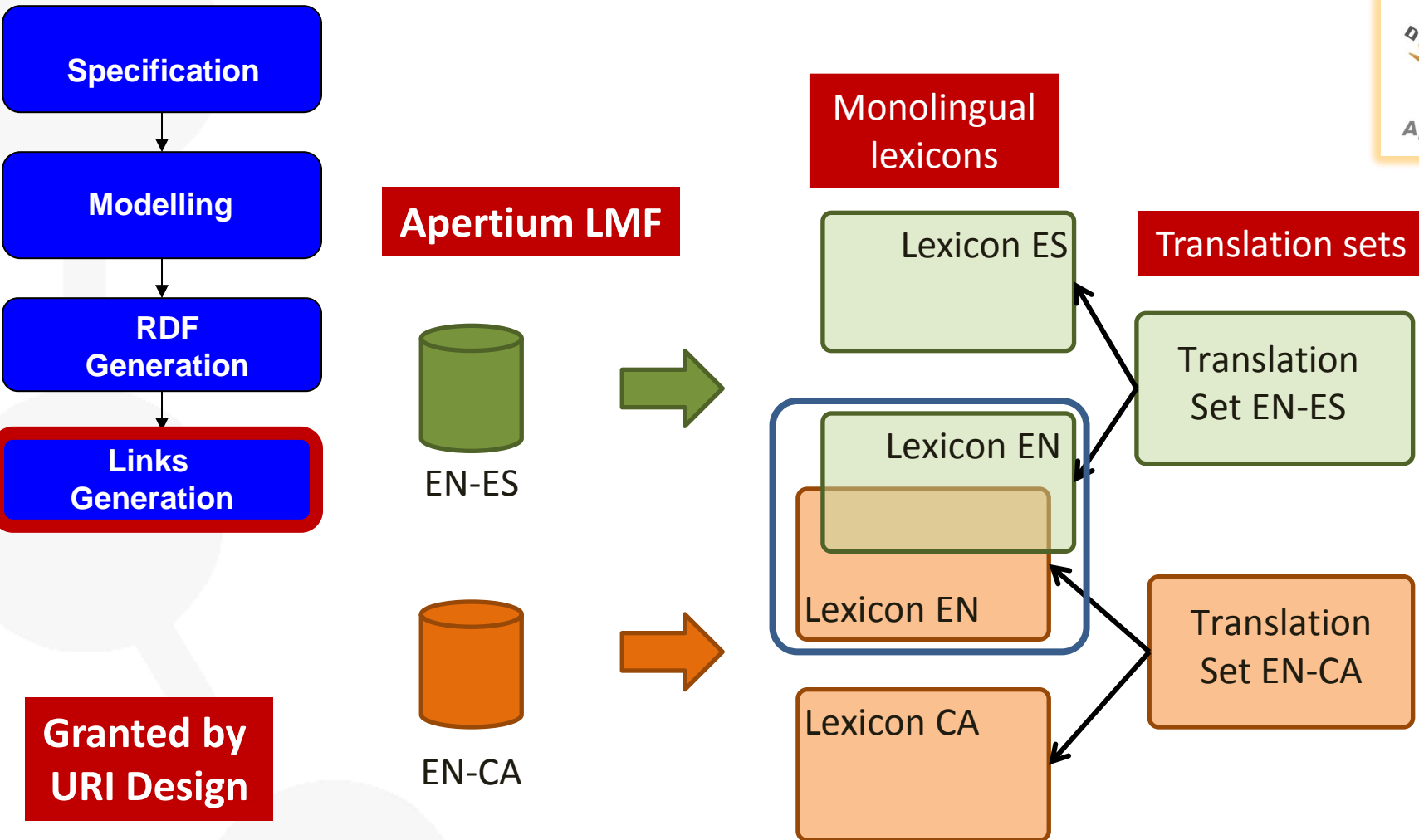
RDF
Generation

Lang. pair	# triples	# trans.
CA-IT	180,851	7,869
EN-CA	759,601	33,029
EN-ES	576,316	25,830
EN-GL	425,117	20,034
EO-CA	426,301	19,964
EO-EN	617,772	31,474
EO-ES	380,198	17,212
EO-FR	726,281	35,791
ES-AN	71,997	3,110
ES-AST	825,54	36,096
ES-CA	730,501	31,291

Lang. pair	# triples	# trans.
ES-GL	206,284	8,985
ES-PT	279,245	12,054
ES-RO	400,366	17,318
EU-ES	262,336	11,838
EU-EN	265,466	13,089
FR-CA	152,002	6,550
FR-ES	495,614	21,475
OC-CA	346,346	15,983
OC-ES	317,162	14,561
PT-CA	163,149	7,111
PT-GL	234,065	10,144



Linking with other Apertium RDF



Apertium English lexicon:
<http://linguistic.linkeddata.es/id/apertium/lexiconEN>

LexiconES

“ribera”@es

ribera

orilla

“orilla”@es

banco

“banco”@es

TranslationSetEN-ES

bank-ribera

bank-orilla

bank-banco

bench-banco

TranslationSetES-PT

banco-banco

orilla-orla

LexiconEN

bank

“bank”@en

bench

“bench”@en

“banco”@pt

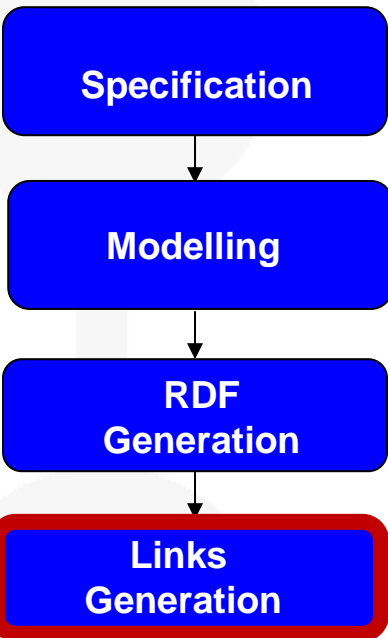
banco

orla

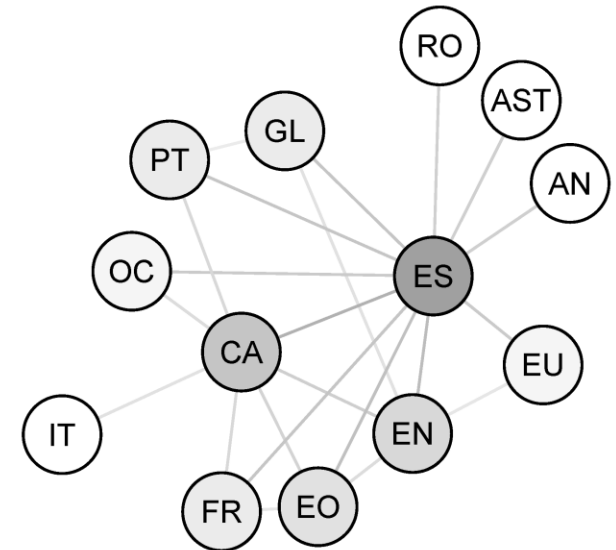
“orla”@pt

LexiconPT

Added value of linking Apertium



- Apertium RDF Graph



- **Dijkstra** algorithm to choose shortest path
- Indirect translations for “bank” EN-> ES -> PT

Pivot translation written repres.	Indirect translation written repres.
"banco"@es	"banco"@pt
"orilla"@es	"orla"@pt

- Apertium data on the Web following **SW** standards
- Common **entry point** for all the Apertium dictionaries
- Unique graph that contains direct and indirect **translations**
- **Linked with BabelNet**



Language Resources
The need of connecting licensed Language Resources
Linked Data foundations
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Outcomes of the LIDER project
The apertium RDF case and their links

LINGUISTIC LINKED LICENSED DATA IN USE

Multilingual search: retrieve an author

- Servantes Saavedra, Migel
- Therbantes, Minkel nte
- **Cervantes di Saavedra, Michele**
- سرفنتس ساقدرا، میجیل دی
- Zerbantes eta Saabedra, Mikel
- Θερβάντες, Μιγκέλ ντε
- Cervantes
- Sirfantis Saafedrā, Mīgīl dī
- Сервантес Сааведра, Мигель де
- Sewantisi Saweidela, Migai'er de
- 塞万提斯·萨维德拉, 米盖尔 德
- Cervantes, Miguel de



Buscar una persona, grupo, entidad, título de una obra o un evento. El nombre de una obra, obra, grupo o evento.

Cervantes Saavedra, Miguel de (1547-1616)

Miguel de Cervantes Saavedra fue un soldado, novelista, poeta y dramaturgo español. Supóñese que nació el 29 de septiembre de 1547 en Alcalá de Henares y murió el 22 de abril de 1616 en Madrid, pero fue enterrado el 23 de abril y popularmente se cree en forma errónea que murió en la de su mismo. Es considerado la máxima figura de la literatura española. Te universales son conocidos, sobre todo por haber escrito El ingenioso hidalgo don Quijote de la Mancha, que muchos atribuyen dentro de la primera novela moderna y una de las mejores obras de la literatura universal. Se le ha dado el sobrenombre de Príncipe de los Ingenios.

Información más de Wikipedia



En la BNE

Autor de
149
Obras

Tema en
116
Obras

Participa en
158
Obras

Sus obras

<p>Don Quijote de la Mancha (1605-1615)</p> <p>1 obra</p>	<p>Historia de España (1600-1614)</p> <p>1 obra</p>	<p>Don Quijote de la Mancha (1605-1615)</p> <p>1 obra</p>
<p>El coloquio de los perros (1625)</p> <p>1 obra</p>	<p>Los trabajos de Persiles y Sigismunda (1605-1617)</p> <p>1 obra</p>	<p>El ingenio (1600-1614)</p> <p>1 obra</p>
<p>Los cuernos de Casandra (1600-1614)</p> <p>1 obra</p>	<p>La gaceta (1600-1614)</p> <p>1 obra</p>	<p>El conde de Bobadilla (1600-1614)</p> <p>1 obra</p>
<p>La española inglesa (1600-1614)</p> <p>1 obra</p>	<p>La Beldad trágica (1600-1614)</p> <p>1 obra</p>	<p>La Numancia (1600-1614)</p> <p>1 obra</p>

... Anterior 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000

Obras sobre la persona

<p>Historia de España (1600-1614)</p> <p>1 obra</p>	<p>Historia de España (1600-1614)</p> <p>1 obra</p>	<p>Historia de España (1600-1614)</p> <p>1 obra</p>
<p>Historia de España (1600-1614)</p> <p>1 obra</p>	<p>Historia de España (1600-1614)</p> <p>1 obra</p>	<p>Historia de España (1600-1614)</p> <p>1 obra</p>

DATOS·BNE·ES ^{*beta}

Inicio

Inicio Obras Temas Ayuda

塞万提斯·萨维德拉, 米盖尔·德

Cervantes di Saavedra, Michele

Filtrar por tipo (2 resultados)

1 Obras 1 Personas

L 3 Ediciones

2 de 2

Cervantes Saavedra, Miguel de (1547-1616)

Miguel de Cervantes Saavedra fue un soldado, novelista, poeta y dramaturgo español. Supóñese que nació el 29 de septiembre de 1547 en Alcalá de Henares y murió el 22 de abril de 1616 en ...



Obras destacadas

Don Quijote de la Mancha

سافران، میچیل دی

Il comune di Napoli e il Comitato promotore delle onoranze a Cervantes si pregiano invitare la E.V. alle cerimonie che avranno luogo il 2 maggio 1959 in occasione dello scoprimento della lapide ...

2 maggio 1959

Obra

- Search a book in Spanish about the “Athénée de Madrid”



The screenshot shows the Wikipedia page for "Athénée de Madrid" in Spanish. The page title is "Athénée de Madrid" and it is noted as being redirected from "Ateneo de Madrid". A notice indicates that the article is a draft concerning the city of Madrid. The main text describes the "Athénée de Madrid" (in Spanish: "Ateneo de Madrid") as a private cultural institution created in 1835. It mentions the historical context, including the invasion of Spain by France and the subsequent exile of intellectuals. A photograph of the building's facade is included on the right side of the page.

Linguistic Linked Data allows Multilingual data integration



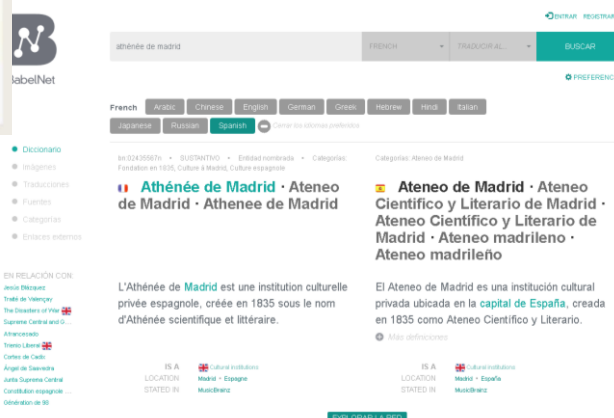
data.bnf.fr

Multilingual complementary information

(BnF) Bibliothèque nationale de France data.bnf.fr search data.bnf.fr

search results for "Athénée de Madrid"

There were no results matching the query. You can also search Athénée de Madrid in :
Le Catalogue général de la BnF
La base BnF Archives et Manuscrits
La bibliothèque numérique Gallica



- Search translation in other languages



BabelNet

ENTRAR REGISTRAR

athénée de madrid FRENCH TRADUCIR AL... BUSCAR

PREFERENCIAS

- French Arabic Chinese English German Greek Hebrew Hindi Italian Japanese Russian Spanish Cerrar los idiomas preferidos

- Diccionario
- Imágenes
- Traducciones
- Fuentes
- Categorías
- Enlaces externos

bn:02435567n • SUSTANTIVO • Entidad nombrada • Categorías: Fondation en 1835, Culture à Madrid, Culture espagnole

Athénée de Madrid · Ateneo de Madrid · Athenee de Madrid

L'Athénée de Madrid est une institution culturelle privée espagnole, créée en 1835 sous le nom d'Athénée scientifique et littéraire.

- IS A Cultural institutions
- LOCATION Madrid · Espagne
- STATED IN MusicBrainz

Ateneo de Madrid

The Ateneo de Madrid is a private cultural institution located in the capital of Spain, originally founded in 1835.

A través de la traducción automática אתנאו דה מדריד

No definition available

IS A Cultural institutions

Ateneo de Madrid · Ateneo Científico y Literario de Madrid · Ateneo Científico y Literario de Madrid · Ateneo madrileño · Ateneo madrileño

El Ateneo de Madrid es una institución cultural privada ubicada en la capital

EN RELACIÓN CON:

- Jesús Blázquez
- Traité de Valençay
- The Disasters of War
- Supreme Central and G...

Expand the information based on language

DATOS·BNE·ES ^{beta}

Inicio Personas Entidades Obras **Temas** Ayuda



Buscar una persona, grupo, entidad, el título de una obra o un tema. Ej.: Leonardo da Vinci, ONU, Grapes of Wrath, Az...

Ciudades antiguas

Término aceptado	Ciudades antiguas
Usado por	Ciudades--Historia SV
Término relacionado	Ciudades y pueblos desaparecidos Geografía antigua
Término equivalente en otros vocabularios	http://id.loc.gov/authorities/subjects/85026143
Información encontrada	(Villes antiques) (Ciudades antiguas) (Cities and towns, Ancient)
Fuente consultada	CSIC RAMEAU LCSH

Obras

Castillos en el aire Azara, Pedro (1 versión) Obras	Ciudades antiguas en la historia Ferreria Comesaña, Amalia (1 versión) Obras	Die Stadt im Altertum Kalt, Franz (1 versión) Obras
Introduction à l'urbanisme Paëu, Marcel (1 versión) Obras	La Cité antique Fustel de Coulanges (1 versión) Obras	La città antica Levi, Maria Ausilia (1 versión) Obras

"La cité antique" @fr

(BnF) Bibliothèque nationale de France data.bnf.fr

rechercher dans data.bnf.fr

La cité antique

Numa Denis Fustel de Coulanges (1830-1889)



Lange : **français**
Date : **1864**
Note : Ouvrage d'histoire antique, en 5 livres
Domaines : Archéologie. Préhistoire. Histoire ancienne

Éditions de l'œuvre (21 documents)

Documents à propos de cette Œuvre

Pages dans data.bnf.fr (2 pages)

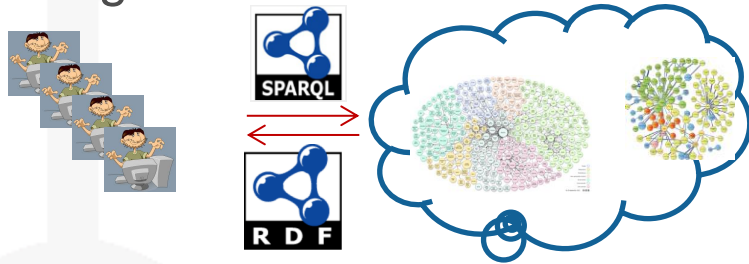
Sources et références

Digital resource available

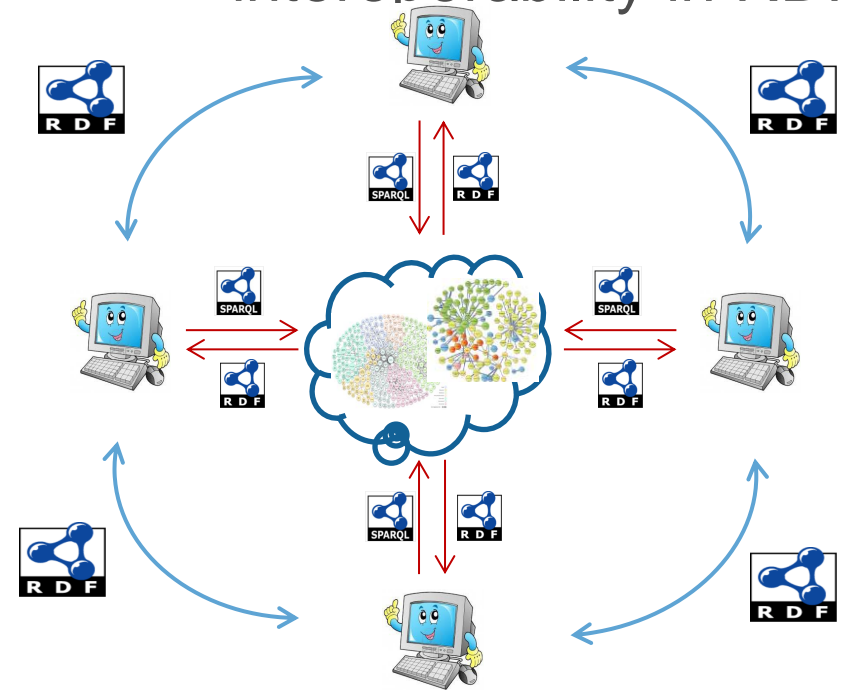


Uses and Users of Linked Data

1. **Programmers** built applications making queries in SPARQL and get RDF

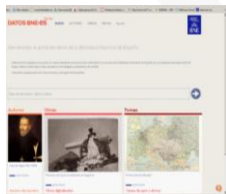


3. **Machine – Machine** data exchange and semantic interoperability in RDF

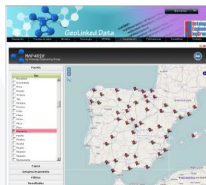


2. **Citizens/Users** access LD through a user interface (they do not see RDF)

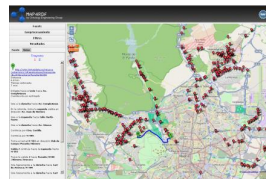
Culture



Geographical

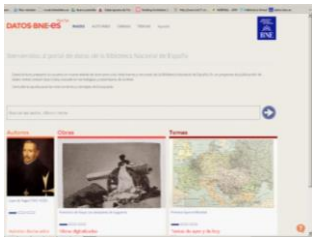


Smart Cities



The new Linked Data Ecosystem

Culture (@BNE)



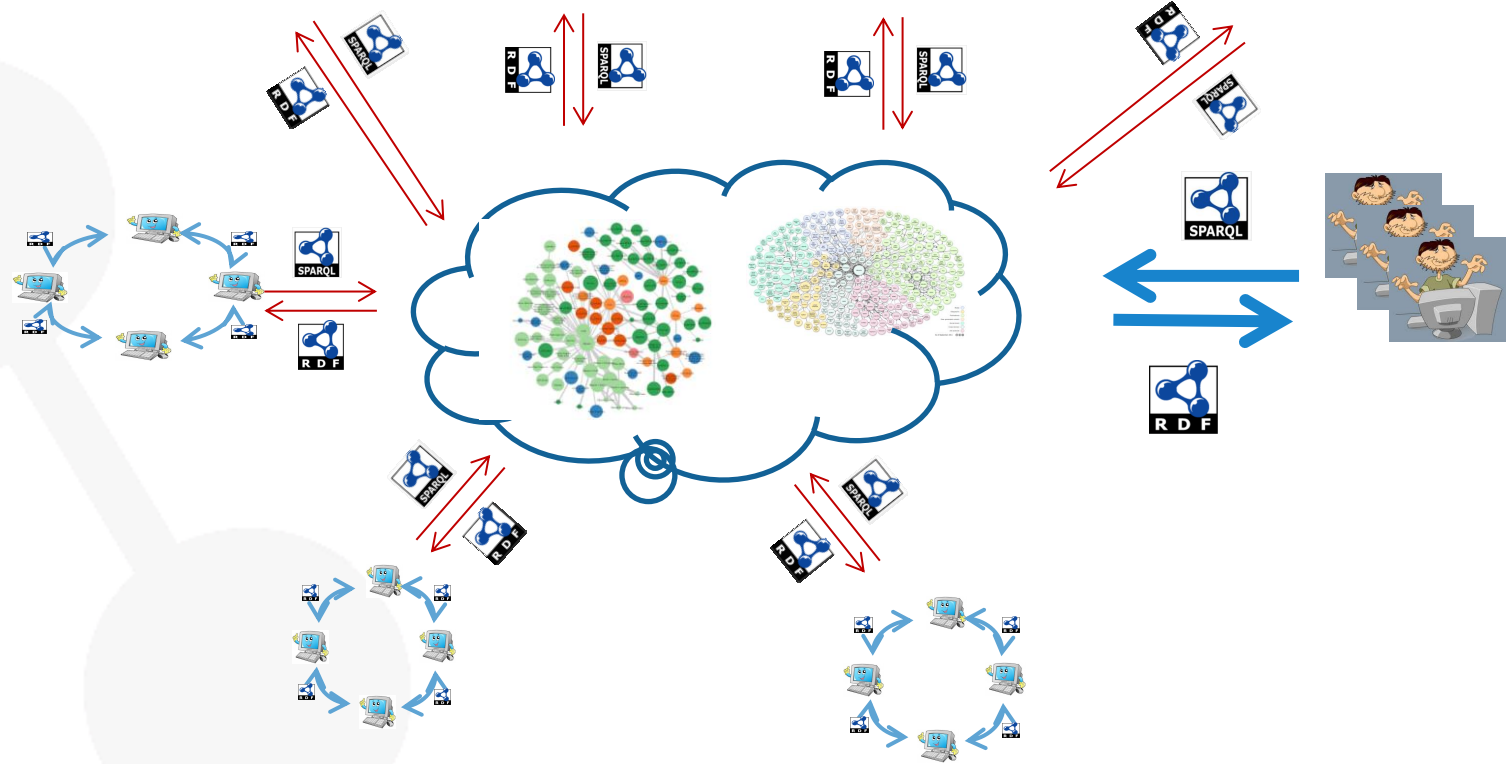
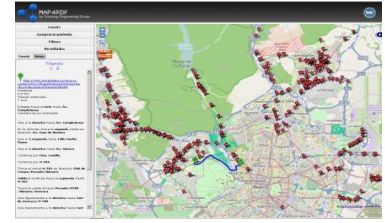
Geographical (@IGN)

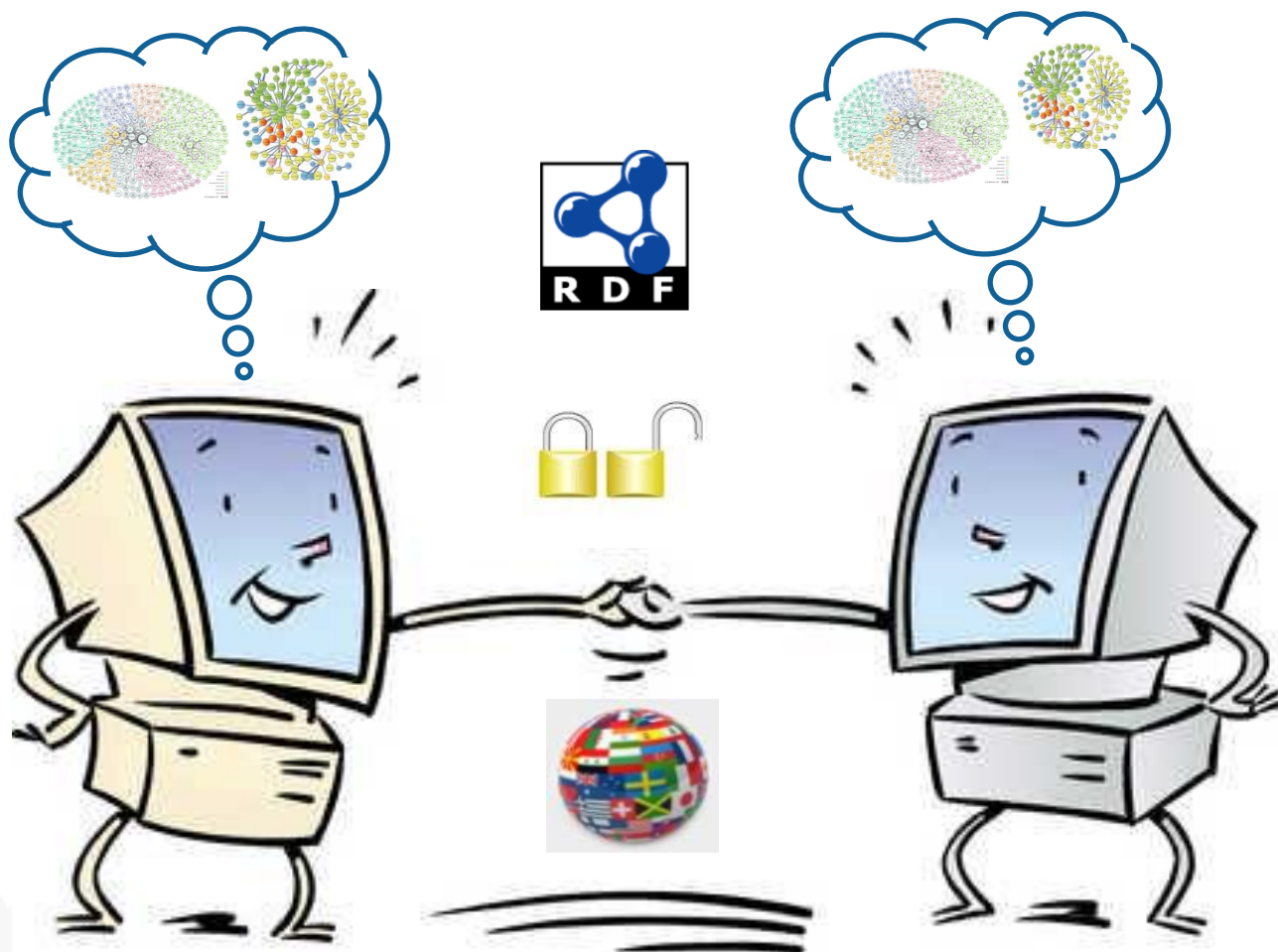


Meteorological (@AEMET)



Smart Cities







Thanks for your attention !