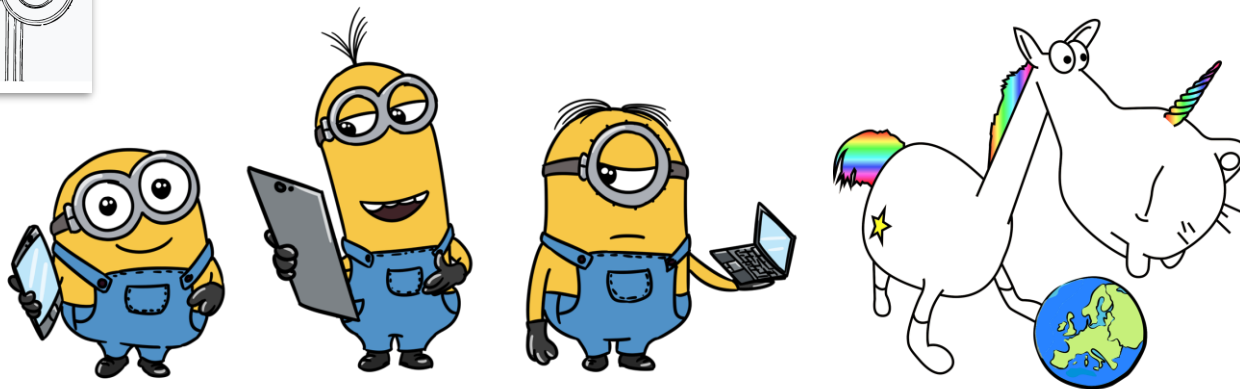




Timo Homburg & Florian Thiery



Little Minions and SPARQL Unicorns

as tools for archaeology





We are Research Squirrels
and interested in Open
Science and **Linked Data**



Timo & Florian
@situxxx & @fthierygeo



Sophie & Martina

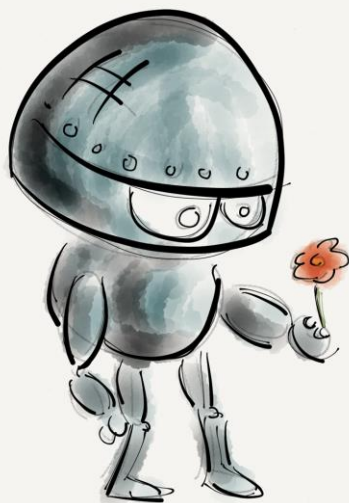


Research Squirrel Engineers

<http://squirrel.link>

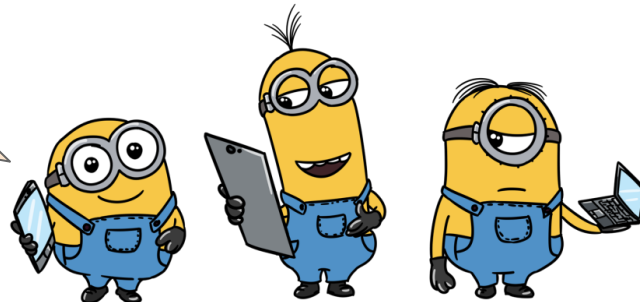


In our daily work, some small self-made scripts and home-grown small applications significantly help us to get work done. These little helpers – you can call them “little minions” – often reduce our workload or optimise our workflows.



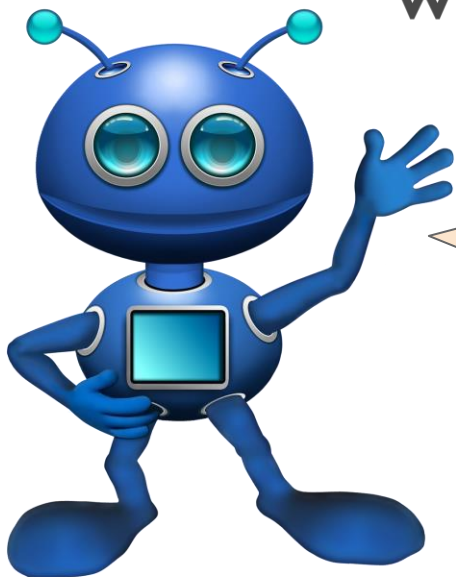


Therefore, the `Computer Applications and Quantitative Methods in Archaeology` (CAA) created a working group on `Little Minions` focusing on development and customization of FLOS Software for archaeology.

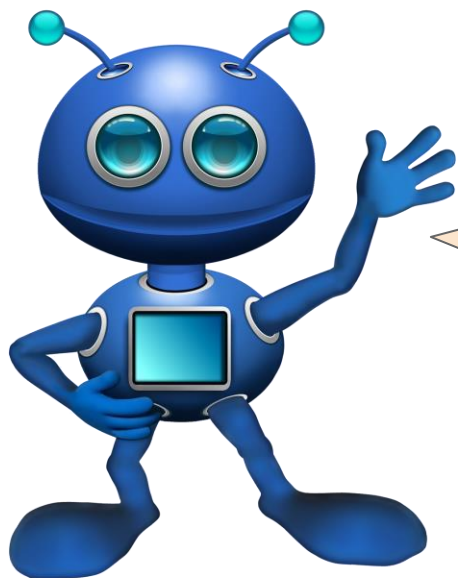




WIKIDATA



There are a variety of volunteered community driven data collecting initiatives like Wikidata. The Wikidata community created a lot of tools to interact with Wikimedia repositories.



There is a lack of user-friendly, easy to use and openly available archaeology-related tools for **Linked Open Data**.

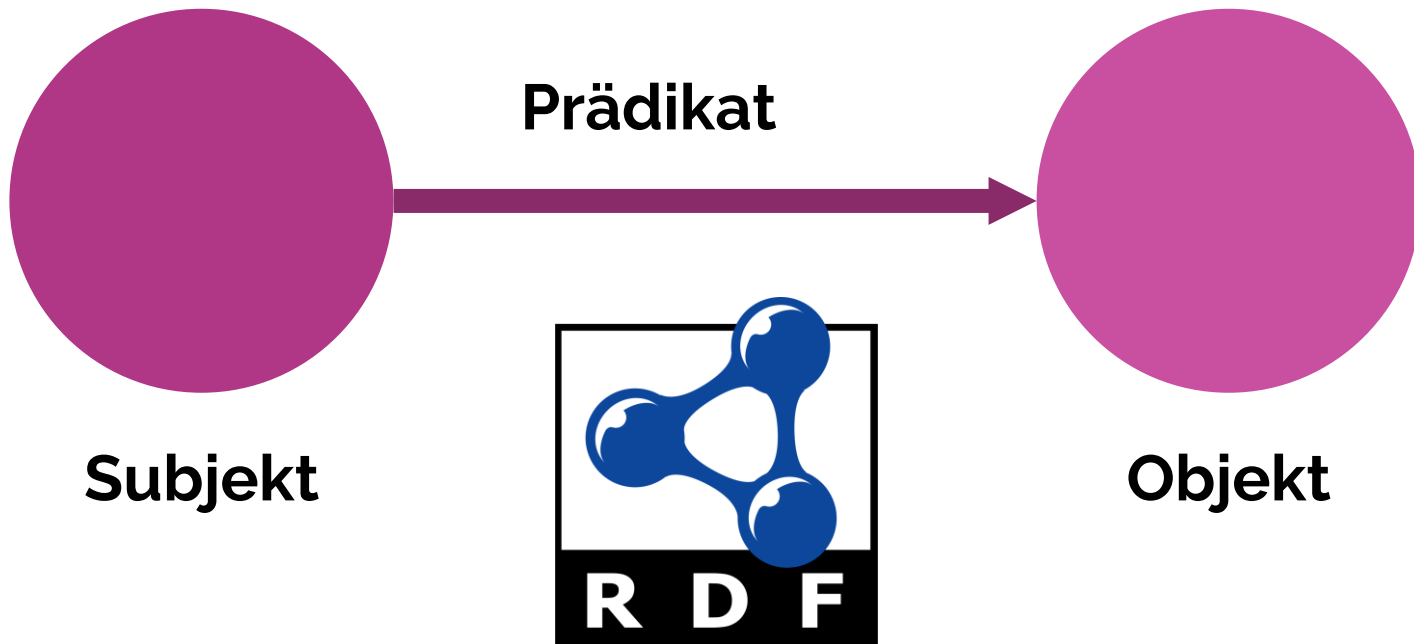




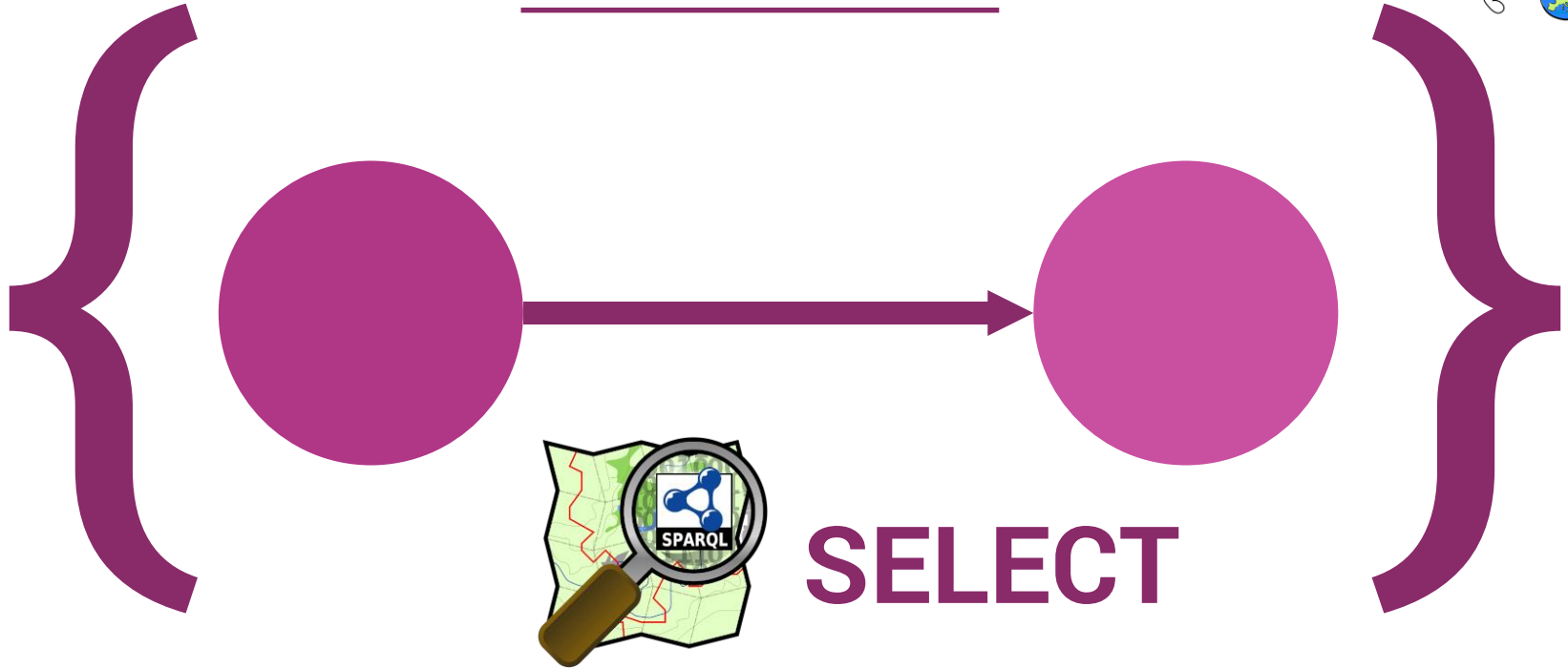
Linked Data

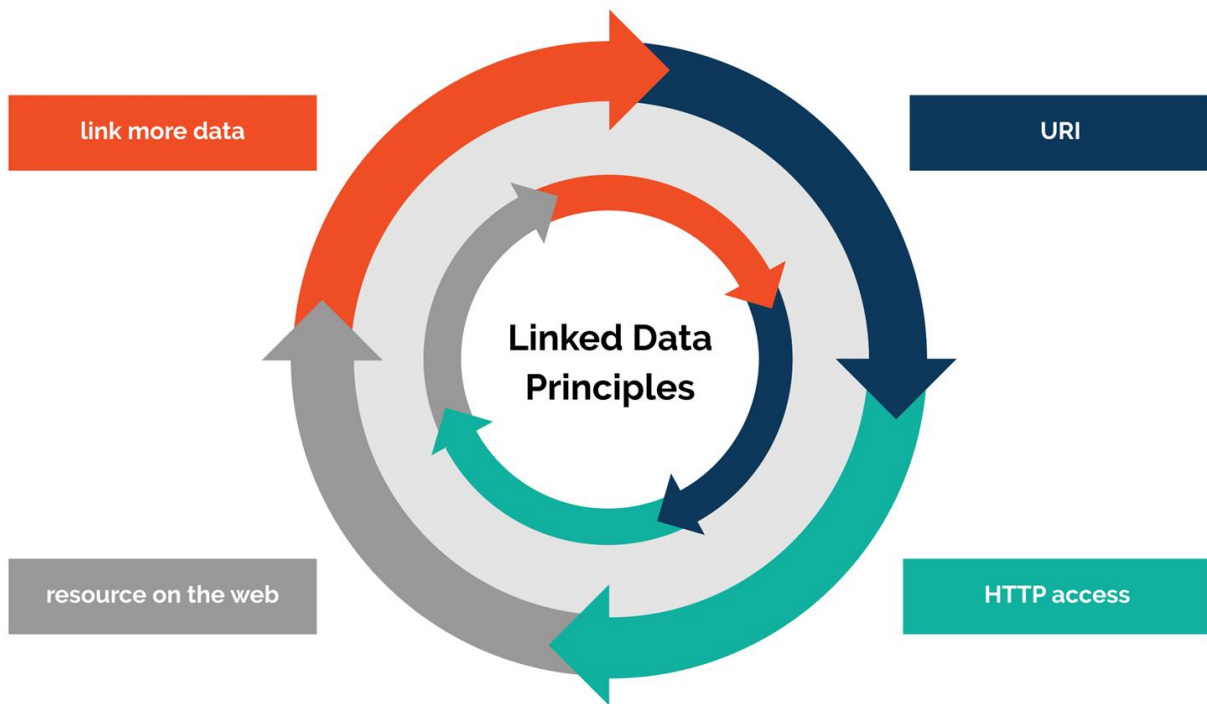


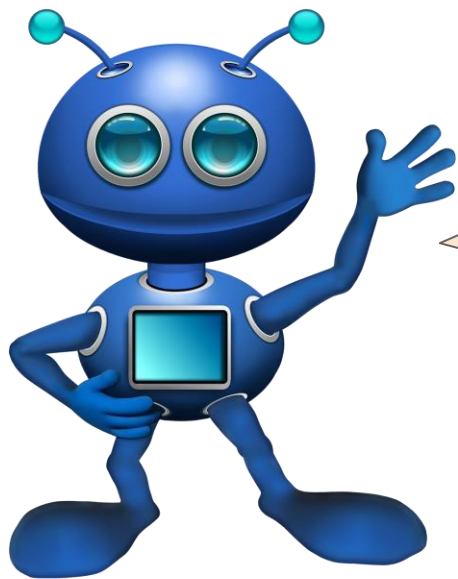
Linked Data?



SPARQL?!





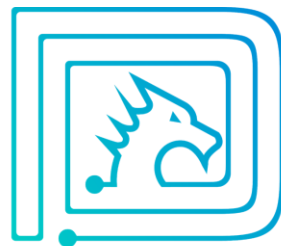


The WWW gives researchers the possibility of sharing their research data and enables the community to participate in the scientific discourse to create previously unknown knowledge. But much of these shared data are not findable or accessible, thus resulting in modern 'unknown data dragons'.



Data Dragon

**Here the CAA SIG on
Semantics and LOUD
in Archaeology
comes into play and
wants to promote
the LOD ideas.**



Data Dragon

Special Interest Group

*CAA SIG on “Semantics and LOUD
in Archaeology”*



*“We would like to further establish
Linked Data in **archeology**,
enable **beginners** to use and
produce Linked Data, invite other
scientists for discussion, and
embed LOD as an **important
topic** through an **SIG** at the **CAA**
conference and **community**.”*

Aims and Perspectives

- Create a friendly and open **platform** to discuss the role of LOUD and FAIR Data in archaeology.
- Enable the CAA community to get the **LOD basics** throughout workshops, teaching material, etc.
- Take on the challenge to develop LOUD **publishing workflows** in archaeology.
- Integrate the **semantic modeling & ontology community** (e.g. CIDOC CRM, SKOS, ...) and **infrastructure community** (Pelagios, Nomisma, Wikidata, ...) into LOD in archaeology.
- Forge closer **collaborations between researchers** already active in this field and allow for the education of researchers and other interested parties.



Data Dragon

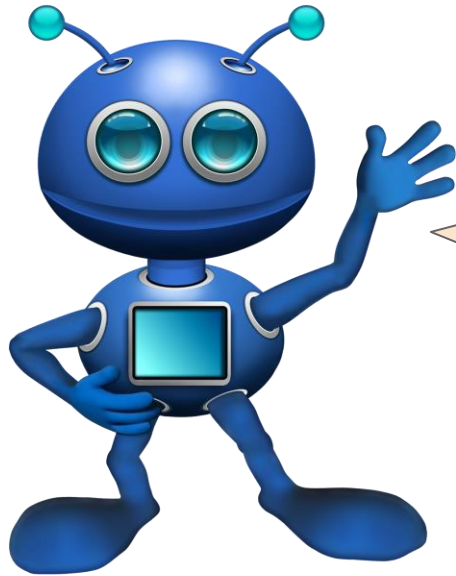
Special Interest Group

CAA SIG on "Semantics and LOUD in Archaeology"





Linked Data Tools



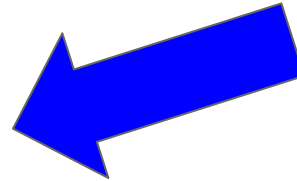
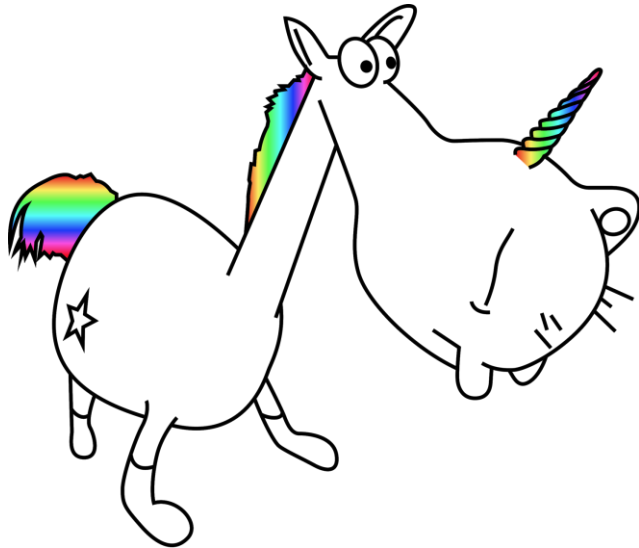
The DH community may use Recogito or Annotorious, to overcome the bottleneck of openly available and easy to use archaeology-related tools for Linked Open Data, but here, the **SPARQL Unicorn** idea and principles may help

ANNOTORIOUS

The *SPARQL* Unicorn was born at...



CHECK OBJECT INTEGRITY
CAA 2019
KRAKÓW 23-27 April



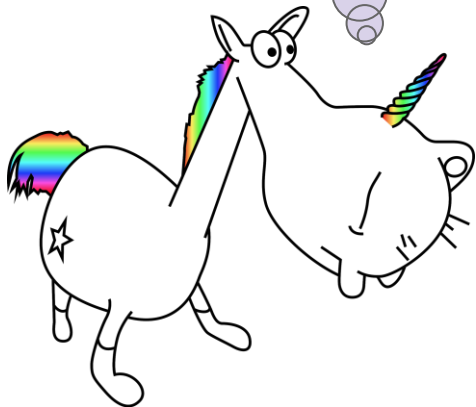
© Stary Port, Kraków



Community



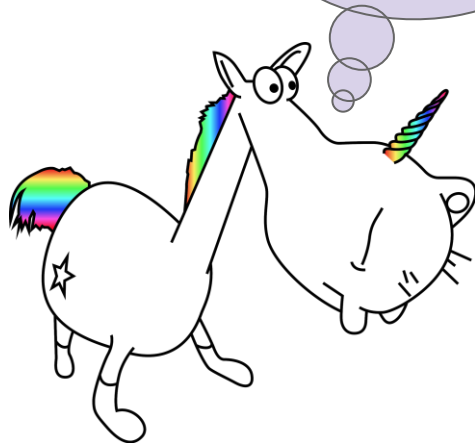
Most of the tools require knowledge of SPARQL. Queries can become very complex.

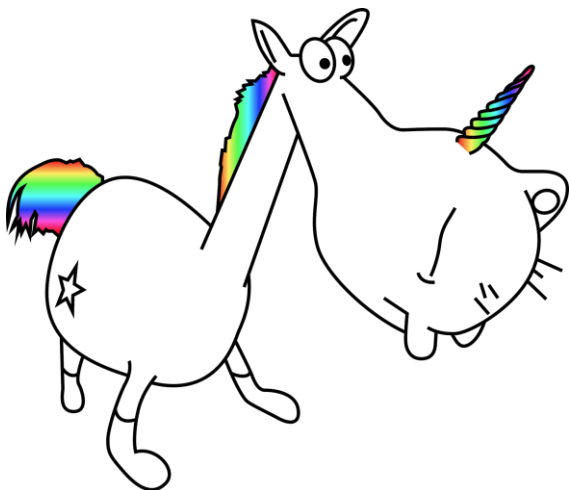


```
1 SELECT ?date ?work ?workLabel ?topics (GROUP_CONCAT(DISTINCT
separator=" // " ) AS ?places) (GROUP_CONCAT(?authorLabel; sepa
authorstrings) (GROUP_CONCAT(?editorLabel; separator=" - " )
2 WITH {
3 SELECT DISTINCT ?work WHERE {
4 ?work wdt:P921 / (wdt:P361+ | wdt:P1269+ | (wdt:P31* / wd
5 }
6 } AS %works
7 WITH {
8 SELECT (MIN(?dates) as ?datetime) ?work (GROUP_CONCAT(?topi
9 INCLUDE %works
10 ?work wdt:P921 ?topic .
11 FILTER NOT EXISTS {
12 ?topic wdt:P31 wd:Q839954} .
13 FILTER NOT EXISTS {
14 ?topic wdt:P31 wd:Q220659}
15 OPTIONAL { ?work wdt:P577 ?dates . }
16
17 ?topic rdfs:label ?topic_label . FILTER (lang(?topic_labe
18 }
19 GROUP BY ?work
20 } AS %result
21 WHERE {
22 INCLUDE %result
23
24 OPTIONAL { ?work wdt:P50 ?author .
25 ?author rdfs:label ?authorLabel . FILTER (lang(?
26 }
27 # no extra label assignment here, because we already have a
28 OPTIONAL { ?work wdt:P2093 ?authorstring . }
29 OPTIONAL { ?work wdt:P98 ?editor .
30 ?editor rdfs:label ?editorLabel . FILTER (lang(?
31 }
32 OPTIONAL { ?work wdt:P123 ?publisher . }
33
34 #collect related places (are in topic list; are instance of
35 OPTIONAL {?work wdt:P921 ?place
```



**How can I help researchers
without knowledge of SPARQL
in using community driven
data from the Semantic Web?**





(1) Describe your data in well documented semantic structured open formats, acc. to the 5 Star data principles.

(2) Model, generate and publish your data as 5 Star Linked Open Data

(3) Publish your data in Wikidata and interlink them to other resources in the Linked Open Data Cloud

(4) Use existing tools to query Wikidata dynamically and to do real time data analysis and support developers or develop new tools to give people without any deeper knowledge in Linked Open Data (SPARQL Unicorn tools) the possibility to also do dynamical real time analysis

(5) Use Wikidata and the SPARQL Unicorn tools in your own research and promote the SPARQL Unicorn principles that other interested researchers in the community may start with principle 1!

SPARQL Unicorn idea and principles



To summarize the three
aforementioned aspects,
there is a lack of FLOS GIS
Tools for LOD and
archaeology. The **SPARQLing
Unicorn QGIS plugin**
addresses the problem of the
lack of availability of tools for
Semantic Web geodata.



The SPARQLing Unicorn QGIS Plugin - a Linked Data Access Point for QGIS



The SPARQL Unicorn allows the execution of Linked Data queries in (Geo)SPARQL to selected triplestores and geo-enabled SPARQL endpoints and thus prepares the results of the queries in QGIS for the geocommunity.

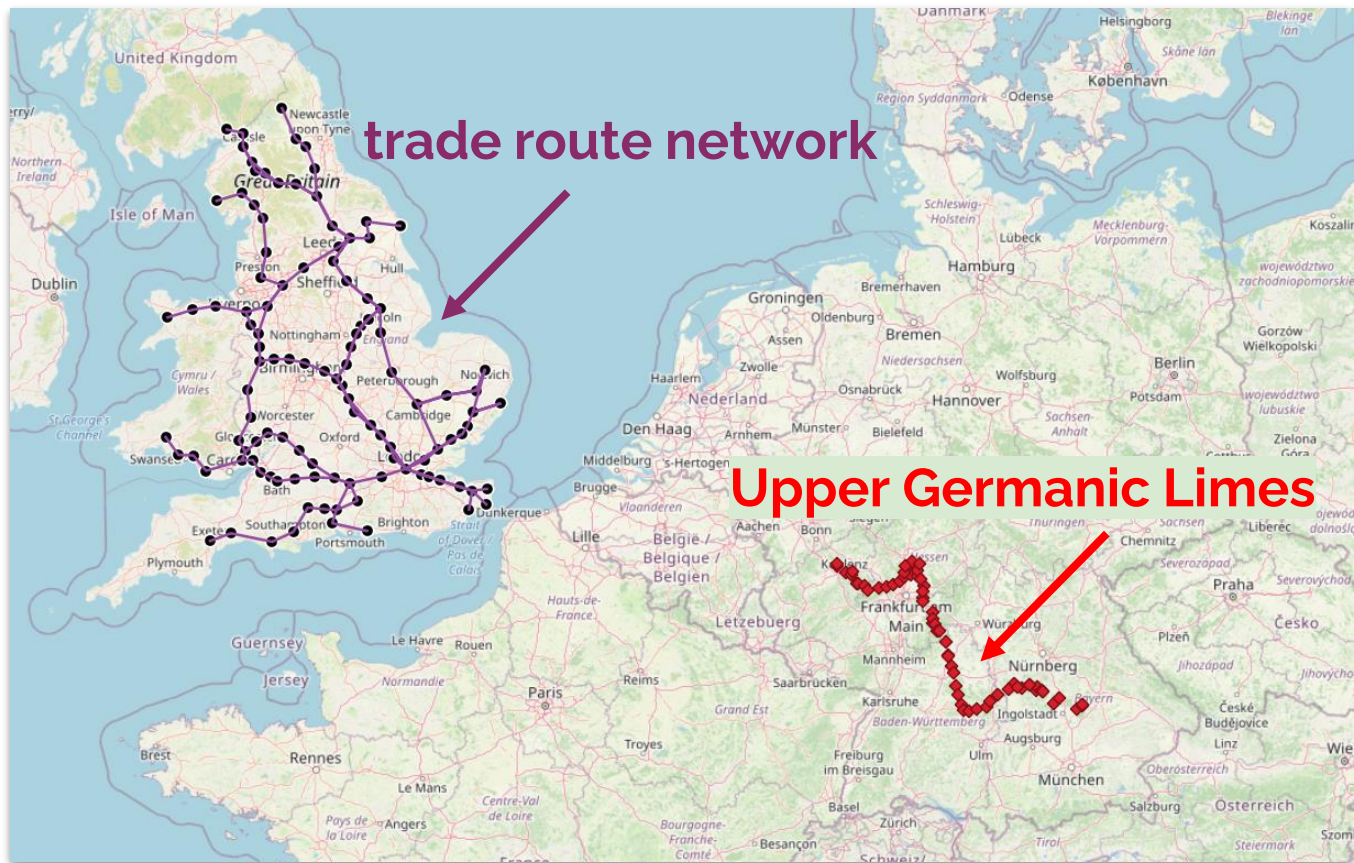


The plugin currently offers three functions: (a) simplified querying of Semantic Web data sources (b) enrichment of geodata and (c) transformation of QGIS vector layers to RDF data.



example data

<https://github.com/Research-Squirrel-Engineers/limes>





limestownpard	limestown	limesobject	ID	limescategory
Orlen	Tausenstein	Zugmantel	1	Kastell
Heftrich	Idstein	Alteburg-Heftrich	2	Kastell
Niederreifenberg	Schmitten	Feldberg	3	Kastell
	Bad Homburg	Saalburg	4	Kastell
Ober-Rosbach	Rosbach	Kapersburg	5	Kastell



Function A





Function A allows assisted querying of several archaeological related triplestores e.g. Wikidata, Nomisma, Kerameikos, Pleiades and Roman Open Data. For assisting the user, example queries, a concept search and templates are given.



SPARQLing Unicorn QGIS Plugin

Query Interlink Enrich (Experimental) ?

Select endpoint: Or: Or:

Layer concept: Query Templates:

Valid Query

```
SELECT ?item ?lat ?lon WHERE {
  ?item a <http://nomisma.org/ontology#Mint>.
  ?item geo:location ?loc .
  ?loc wgs84_pos:lat ?lat .
  ?loc wgs84_pos:long ?lon .
} LIMIT 100
```

vector tiles
XYZ Tiles
OpenStreetMap
WCS
WFS / OGC API - Features
OWS
ArcGIS-Map-Dienst
ArcGIS-Feature-Dienst
GeoNode

Layer

- unicorn_mint
- OpenStreetMap

Zu suchender Typ (Strg+H)

Koordinate 2552573,4023083 Maßstab 1:11293151 Vergrößerung 100% Drehung 0,0° Zeichnen EPSG:3857

example: Nomisma (mints)

The screenshot shows the QGIS interface with a SPARQL query window open. The query is as follows:

```

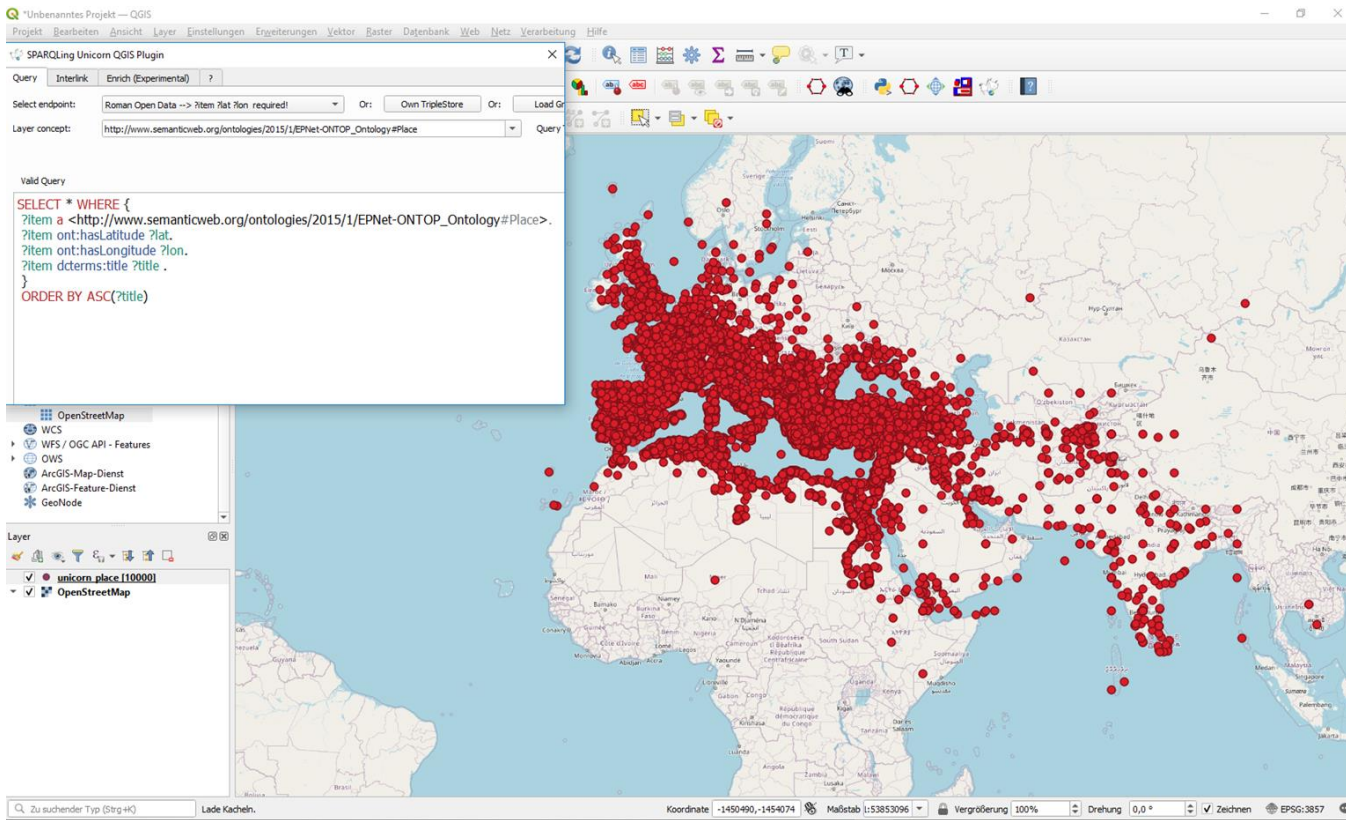
SELECT ?item ?geo WHERE {
  ?item rdf:type pleiades:Place .
  ?item pleiades:has_location ?loc .
  ?loc geosparql:asWKT ?geo .
  ?item pleiades:hasFeatureType placetype:port.
  ?loc pleiades:during timeperiod:roman.
}

```

The map displays the Mediterranean coast with several red dots representing ports. The interface includes a toolbar, a layer list with 'unicorn_place' and 'OpenStreetMap', and a status bar at the bottom showing coordinates (2077201, 2767336) and a scale of 1:19438749.



example: Pleiades (ports in the Roman period)



example: Roman Open Data (places)



For example: You could query the Wikidata triple store for prehistoric art sites or the Squirrel triple store for military camps of the limes. The results are saved as a QGIS vector layer.



Q *Unbenanntes Projekt -- QGIS

Projekt Bearbeiten Ansicht Layer Einstellungen Erweiterungen Vektor Raster Datenbank Web Netz Verarbeitung Hilfe

SPARQLing Unicorn QGIS Plugin

Query Interlink Enrich (Experimental) ?

Select endpoint: Wikidata -> ?item ?geo required! Or: Own TripleStore Or:

Layer concept: cave with prehistoric art(Q11269813)

Valid Query

```
SELECT ?item ?itemLabel ?geo WHERE {
?item wdt:P31 wd:Q11269813 .
?item wdt:P625 ?geo .
SERVICE wikibase:label {
bd:serviceParam wikibase:language "[AUTO_LANGUAGE],en".
}
}
```

WMS/WMTS
Vector Tiles
XYZ Tiles
OpenStreetMap
WCS
WFS / OGC API - Features
OWS
ArcGIS-Map-Dienst
ArcGIS-Feature-Dienst
GeoNode

Layer

- unicorn cave with prehistoric art(Q11269813|7491)
- OpenStreetMap

Koordinate: -96559,4284962 Maßstab 1:10064488 Vergrößerung 100% Drehung 0,0° Zeichnen EPSG:3857

example: Wikidata caves with prehistoric art



QGIS interface showing a SPARQL query window and a map of Germany with red dots representing military camps.

SPARQL Query:

```
SELECT ?item ?geo WHERE {
  ?item a <http://onto.squirrel.link/ontology#MilitaryCamp>.
  ?item geosparql:hasGeometry ?geom_obj .
  ?geom_obj geosparql:asWKT ?geo .
}
```

Map Layers:

- unicorns_militarycamp
- OpenStreetMap

Map Coordinates: 410803,6104370 | Maßstab: 1:2925286 | Vergrößerung: 100% | Drehung: 0,0° | EPSG:3857

example: Limes military camps



Function B





Function B allows the enrichment of a given geodataset using Semantic Web resources from the Linked Open Data Cloud, especially Wikidata (e.g. the elevation level of towns along the Roman Limes). Geospatial data is always seen in a context of usage which usually requires additional data from different knowledge domains. Semantically interpreted Linked Data may represent such a resource for data enrichment.



Enrichment query using the SPARQLing Unicorn

limestownpard	limestown	limesobject	ID	limescategory
Orlen	Taunusstein	Zugmantel	1	Kastell
Heftrich	Idstein	Alteburg-Heftrich	2	Kastell
Niederreifenberg	Schmitten	Feldberg	3	Kastell
	Bad Homburg	Saalburg	4	Kastell
Ober-Rosbach	Rosbach	Kapersburg	5	Kastell

Q Search Property or Class

Search Concept: Search Class Property

Triple Store:

Define Own URI: Use Own Class/Property

Search Results

municipality of Germany (Q262166) [the lowest official level of territorial division in Germany]

Apply

Q Enrichment Search

Search ID Concept: Search Concept

Triple Store: In Area: Search Area Concept

Search Properties

Search Results

- rdf-schema#label (5993.53%)
- description (1052.32%)
- core#altLabel (483.47%)
- located in time zone (209.88%)
- area (162.62%)
- located in the administrative territorial entity (137.39%)
- local dialing code (123.44%)
- coordinate location (123.39%)
- instance of (123.06%)
- elevation above sea level (116.47%)
- Who's on First ID (112.76%)

Apply



SPARQLing Unicorn QGIS Plugin

Query Interlink Enrich ?

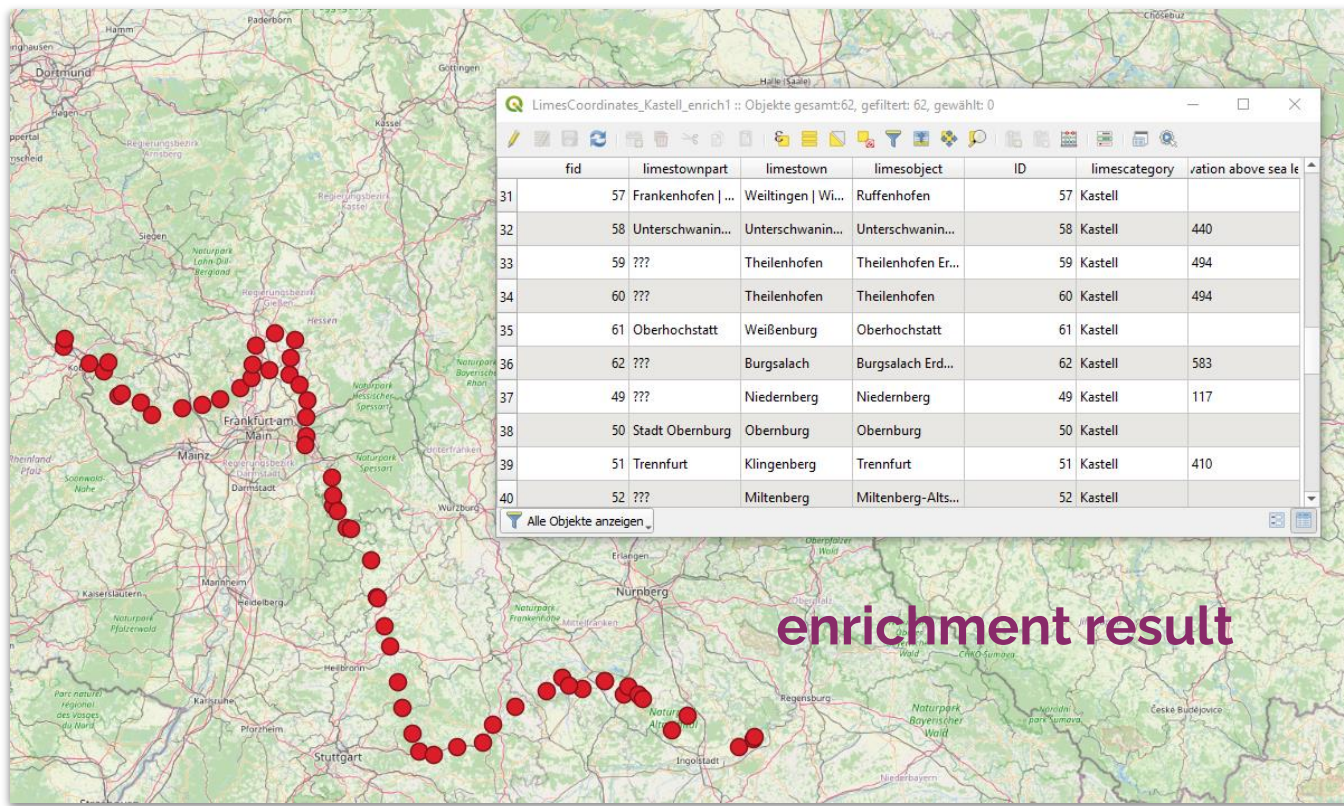
Refresh Layers LimesCoordinates_Kastell Load Layer

Add Row What to enrich?

Column	EnrichmentConcept	TripleStore	Strategy	content	ID Column	ID Property	ID Domain	La
1 fid			No Enrichment	Enrich Value	fid	http://www.w3...		
2 limestownpart			No Enrichment	Enrich Value	fid	http://www.w3...		
3 limestown			No Enrichment	Enrich Value	fid	http://www.w3...		
4 limesobject			No Enrichment	Enrich Value	fid	http://www.w3...		
5 ID			No Enrichment	Enrich Value	fid	http://www.w3...		
6 limescategory			No Enrichment	Enrich Value	fid	http://www.w3...		
7 elevation above sea level	elevation above sea level (116.47%)	https://query.w...	Get Remote	Enrich Value	limestown	http://www.w3...	http://www.wik...	de

enrichment dialogue
using the SPARQLing Unicorn

Start Enrichment Add enriched layer





Function C





Function C converts geospatial information e.g. from GeoJSON into RDF, so that this information might be represented for the purpose of publishing archaeological geodata as Linked Data.



SPARQLing Unicorn QGIS Plugin

Query Interlink Enrich ?

Refresh Layers LimesCoordinates_Kastell_enrich1 Load Layer

OWL Class: Search Class

Target Namespace:

Table Columns to Concepts: Export To Triple Store Import Mapping Export Mapping

	Export?	IDColumn?	GeoColumn?	Column	ColumnProperty	PropertyType	ColumnConcept	ValueConcepts
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	fid		Automatic		
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	limestownpart		Automatic		
3	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	limestown		DataProperty		
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	limesobject		DataProperty		
5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ID		DataProperty		
6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	limescategory		SubClass		
7	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	elevation above...		DataProperty		

Semantic Uplift using the SPARQLing Unicorn

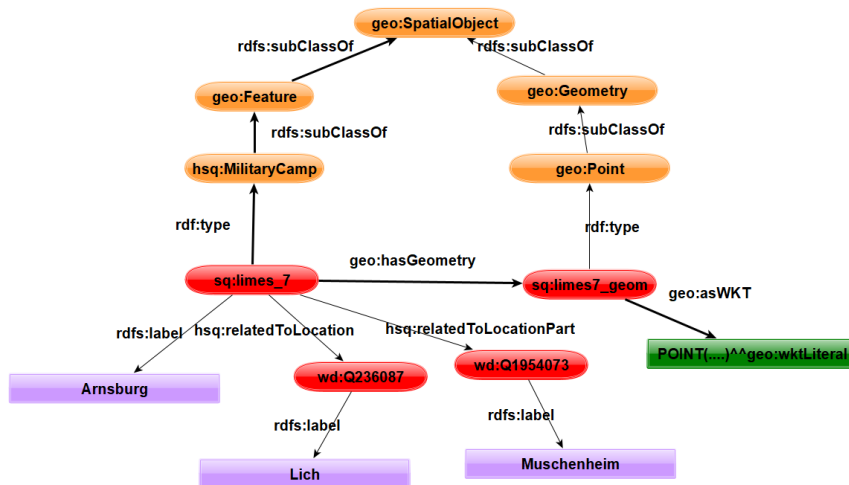
Export Result

```
<?xml version="1.0" ?>
<data>
<file class="http://www.wikidata.org/entity/Q146924" namespace="http://www.github.com/sparqlunicorn#" indid="ID" >
<column name="limestown" prop="data" >
</column>
<column name="limescategory" prop="subclass" >
</column>
<column name="elevation above sea level" prop="data" >
</column>
</file>
</data>
```



limestownpard	limestown	limesobject	ID	limescategory
	Friedberg	Friedberg	6	Kastell
Muschenheim	Lich	Arnsburg	7	Kastell
	Großkrotzenburg	Gross-Krotzenburg	8	Kastell

Semantic Uplift transformation process





Search



Property	Value
as WKT (geosparql:asWKT)	<ul style="list-style-type: none"> <http://www.opengis.net/def/crs/EPSG/0/4326> POINT (8.784294 50.487393) (geosparql:wktLiteral)
has geometry (geosparql:hasGeometry)	<ul style="list-style-type: none"> Arnsburg Geometry Arnsburg (xsd:string)
name (rdfs:label)	<ul style="list-style-type: none"> Lich (wd:Q236087) Muschenheim (wd:Q1954073) Arnsburg (wd:Q697359)
hsq:relatedToLocation	
hsq:relatedToLocationPart	
rdfs:seeAlso	
list ein(e) (rdf:type)	<ul style="list-style-type: none"> Kastell (hsq:MilitaryCamp) Feature (geosparql:Feature)

as Turtle | as RDF/XML | as JSON-LD | as TriG | as TriX | as (Geo)JSON | as GeoURI | as KML | as GML

Semantic Uplift result of a limes part



**the Unicorn needs help
from the archaeo-geo-community!**

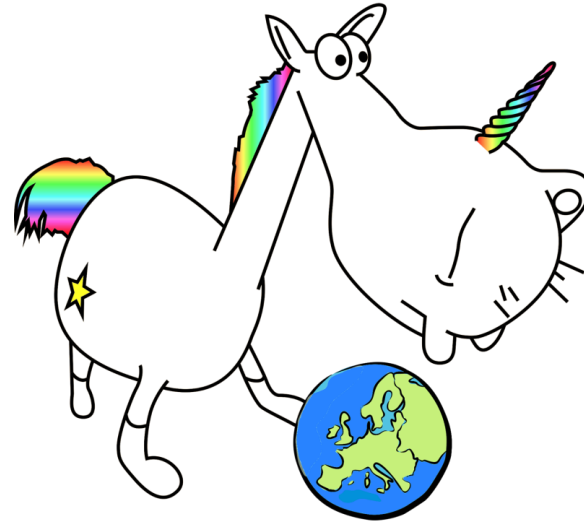
Thx!

Any questions?

timo.homburg@hs-mainz.de
rse@fthiery.de

<http://sparqlunicorn.link>

<https://plugins.qgis.org/plugins/sparqlunicorn/>



Research Squirrel Engineers



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