The SPARQLing Unicorn

A Research Tool for Linked Open Data in QGIS and git-action-based ontology documentation

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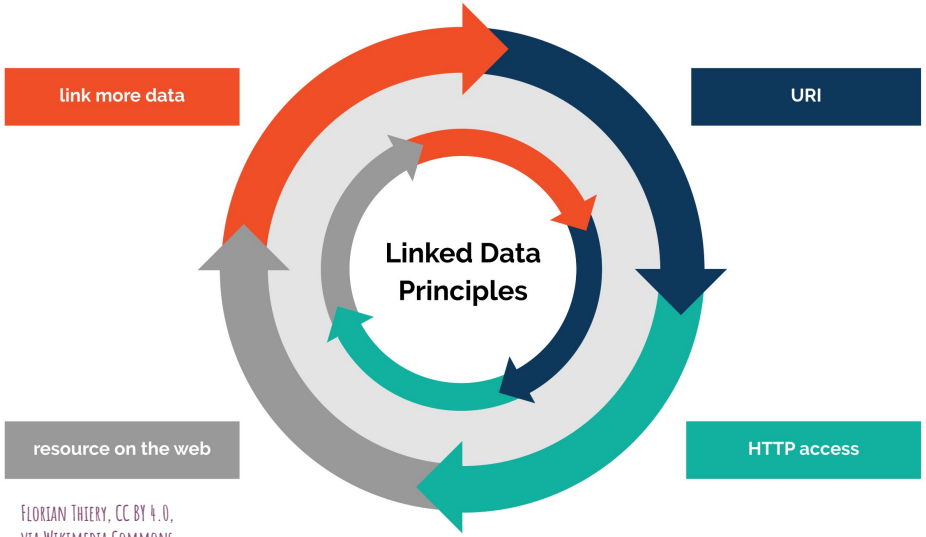
deRSE24 - Conference for RSEng in Germany
JMU Würzburg | 05. - 07. March 2024
Session: Metadata for Research Software

Introduction: Research Data

- At the end of many research projects stands the publication of research:
  - Research papers
  - **Data publications**
  - Software publications
- The publication of research data comes with many questions:
  - Which data formats?
  - Accessibility of data?
  - Long term storage and hosting?
  - Long term data provision using APIs?
  - Which metadata?
  - FAIR data?
  - Where to publish data?
  - How to generate views on data?
- How can we make research data long term usable with the least possible maintenance?



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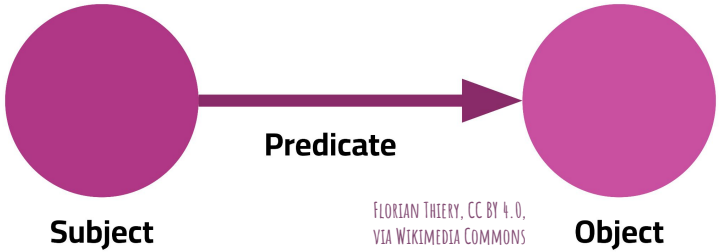

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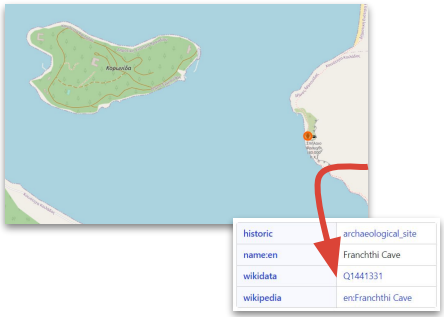
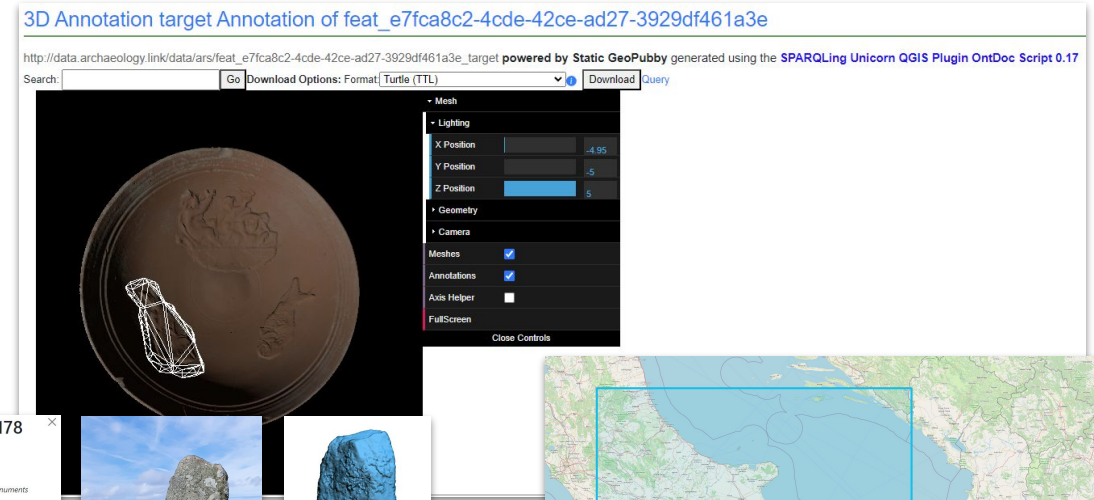
For the linking of data and FAIRification, the Linked Open Data (LOD) is the method of choice.

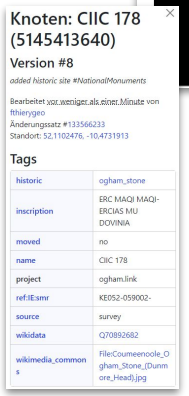
Publishing Research Data as LOD

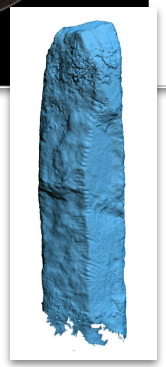
Introduction: Research Data as LOD

- Research projects typically yield a variety of different research data as their results
- Data come in different formats and fulfil different functions
- Research data points to further research data
- To capture these relations, people tend to publish research data as linked open data

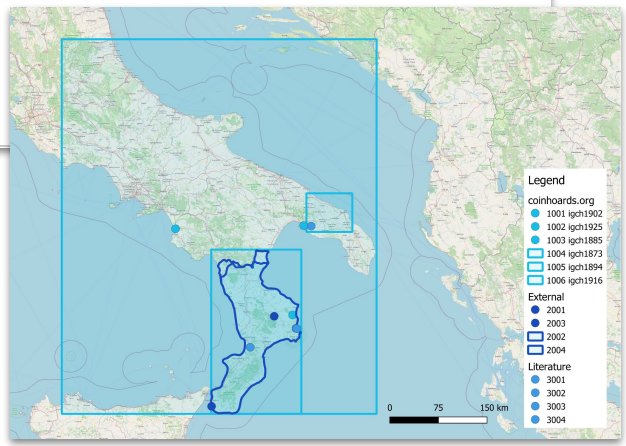


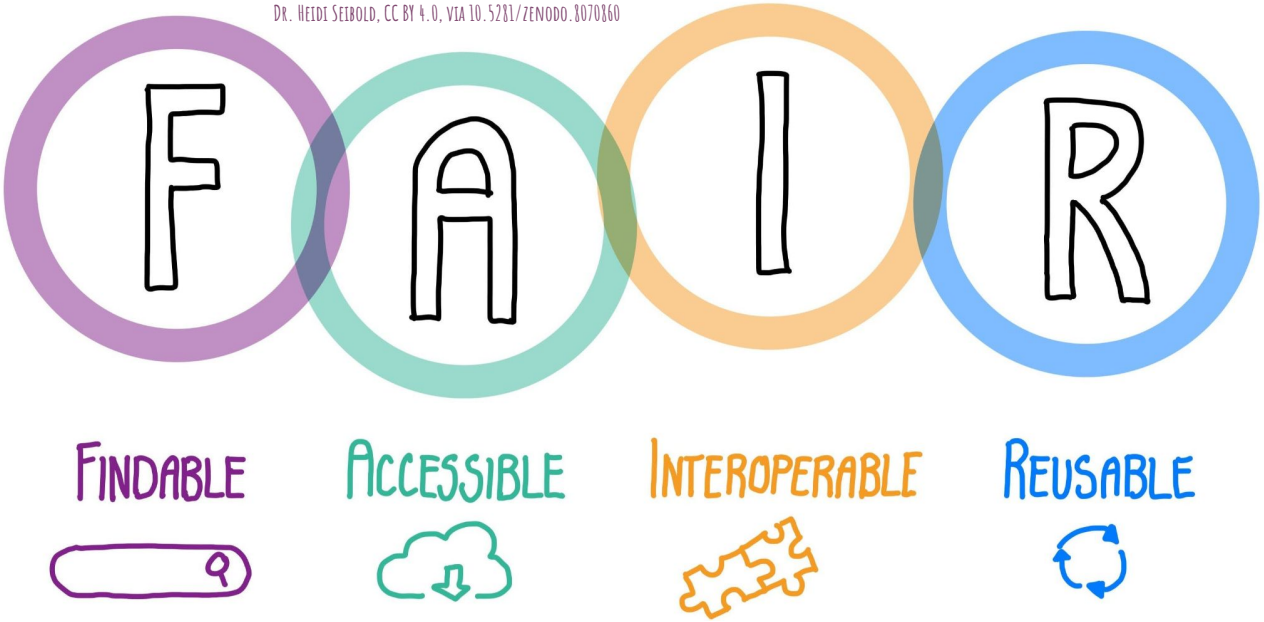






↑ Ogham in 3D Project, DIAS, CC BY-NC-SA 3.0 Ireland

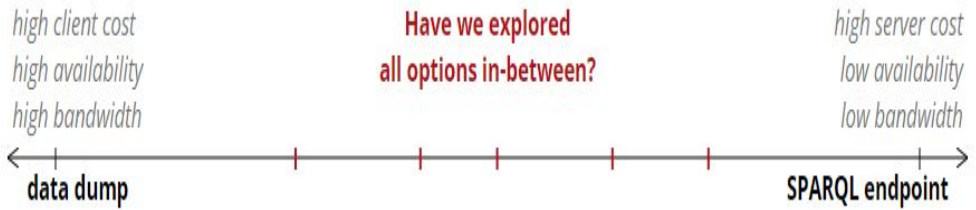




In order to create FAIR, reproducible and understandable data for re-use, LOD must be documented and Published.

Publishing Linked Open Data

- When publishing Linked Open Data, we have several expectations:
  - 5-star principles of Linked Open Data
  - FAIR publication
  - Open license
  - Reusing common vocabularies
  - Long term storage of the dataset, e.g. with a DOI
- Publish vocabularies independently of data
- Different ways to publish Linked Open Data:
  - Data Dumps
  - Linked Data Fragments
  - SPARQL Endpoint
- Assumptions for this talk:
  - No server resources exist after the research project is over
  - The research institute cannot provide long term hosting
  - The National Data Infrastructure is
    - Not in place
    - Not suitable for hosting the data
    - Not willing to accept the data



Linked Data Dumps

- Longterm hosting
- Sustainable
- Not easily discoverable by many research communities
- Experts knowledge is required to
- Linked Data Dumps are not necessarily Linked Open Usable Data
- How can we improve this situation?

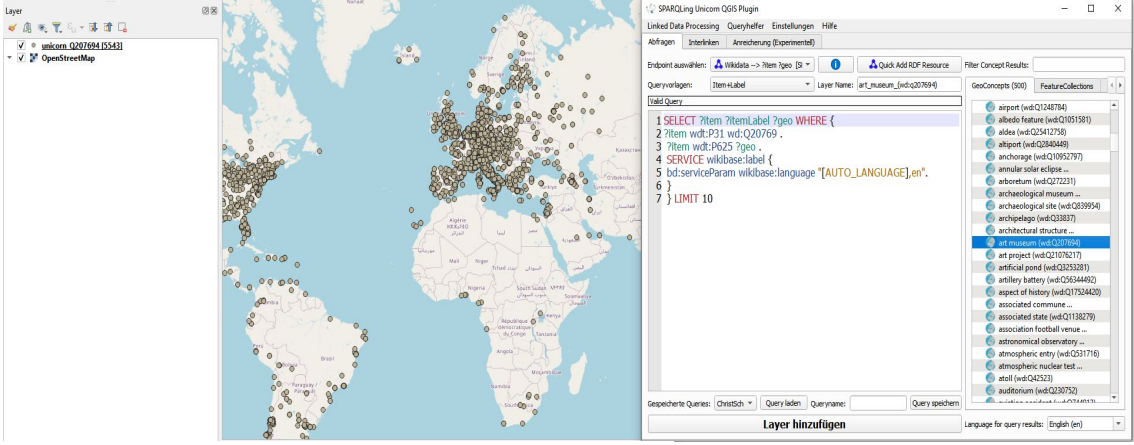
Motivation:

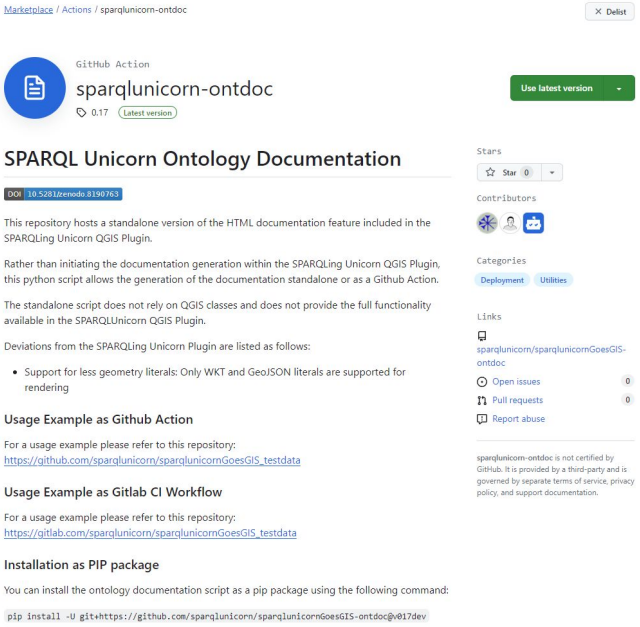
- Create Linked Open Usable Data (LOUD) Dumps
- What can we achieve in hosting data alone?
- How can we improve Linked Data Dump publications to be more user-friendly?

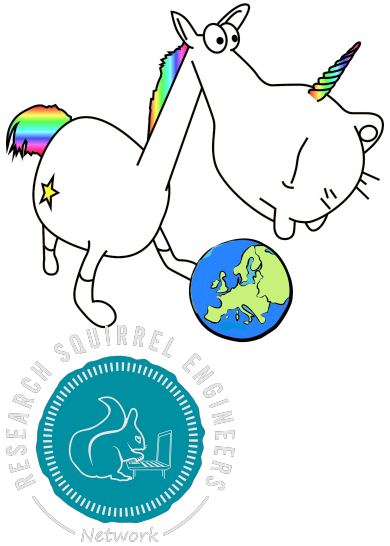
SPARQL Unicorn Ontology Documentation Tool

Documentation Tool

- An extension of the SPARQLing Unicorn QGIS Plugin
- Idea: Convert an RDF Dump to an enriched HTML Deployment
- The result should be ready to host on platforms such as Github and Gitlab Pages
- The Documentation Process should be usable as Continuous Integration components
- The Deployment should be in such a way that it is useful for a maximum of research communities

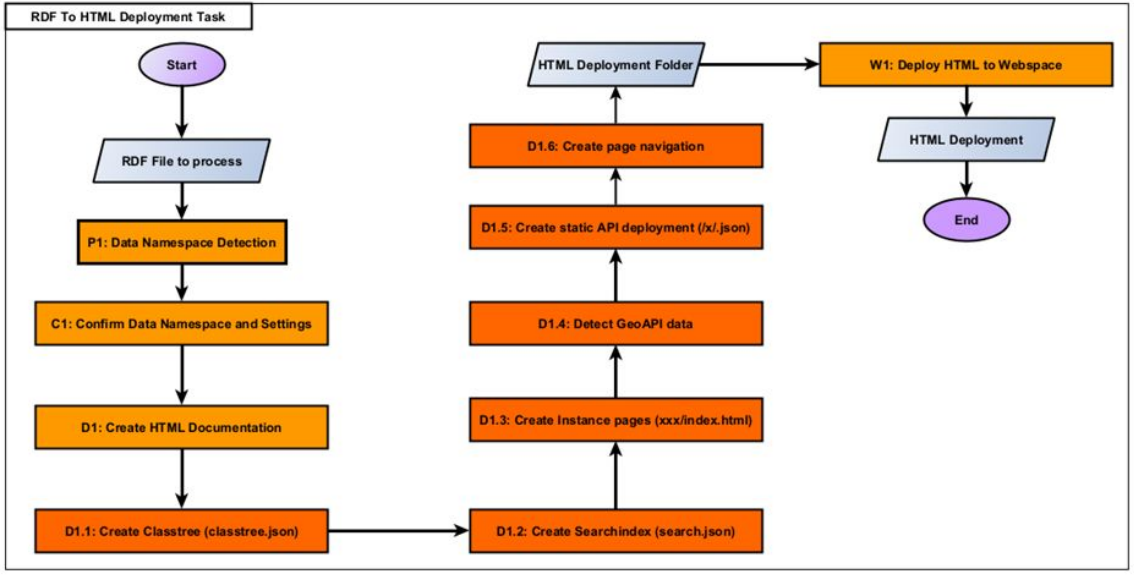


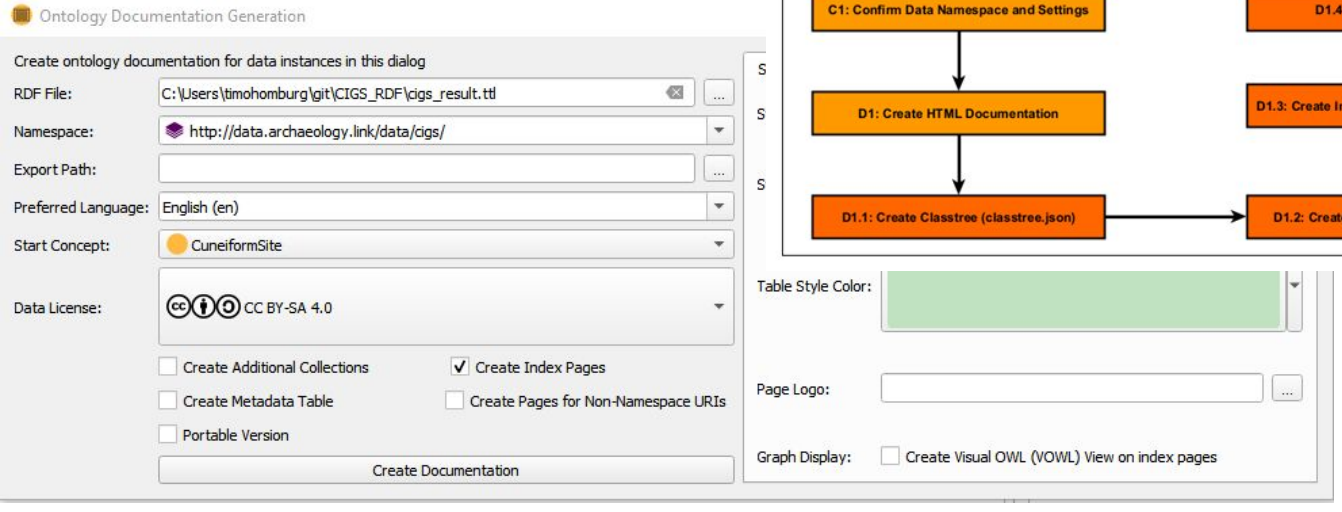




Documentation Tool: How to Use it

1. Load an RDF Data Dump File
2. Select one or more data namespaces which should be documented as HTML
3. Select a target folder and customize your export
4. Start HTML Generation to a local folder
5. Optional Deployment to a webspace

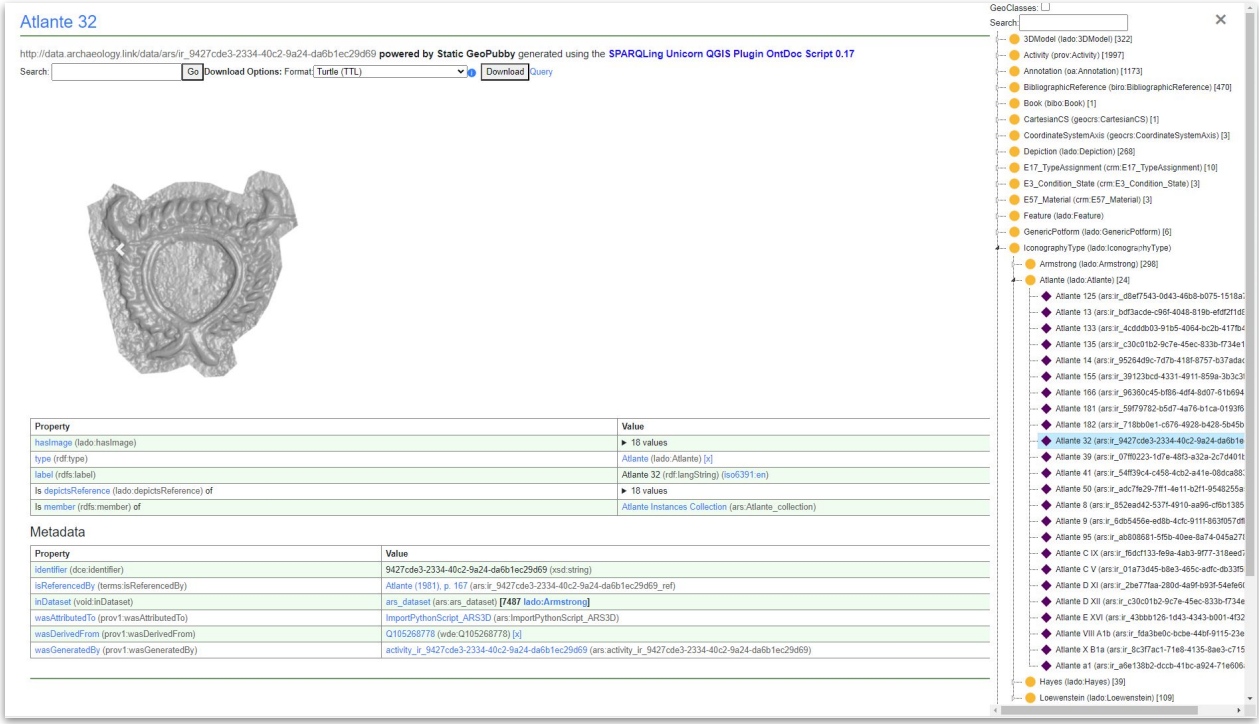




Documentation Tool: HTML+RDFa Rendering

- Idea: Create static web pages that mimic already established Linked Open Data Browsers
- Generate a Protegé-inspired class tree for navigation
- Create statistics of the dataset and publish them using VOID files
- Detect a variety of common vocabularies to create customized page widgets and pages:
  - 3D Model Viewer
  - Leaflet View for Geometries
  - Dictionary View for Ontolex-Lemon dictionaries

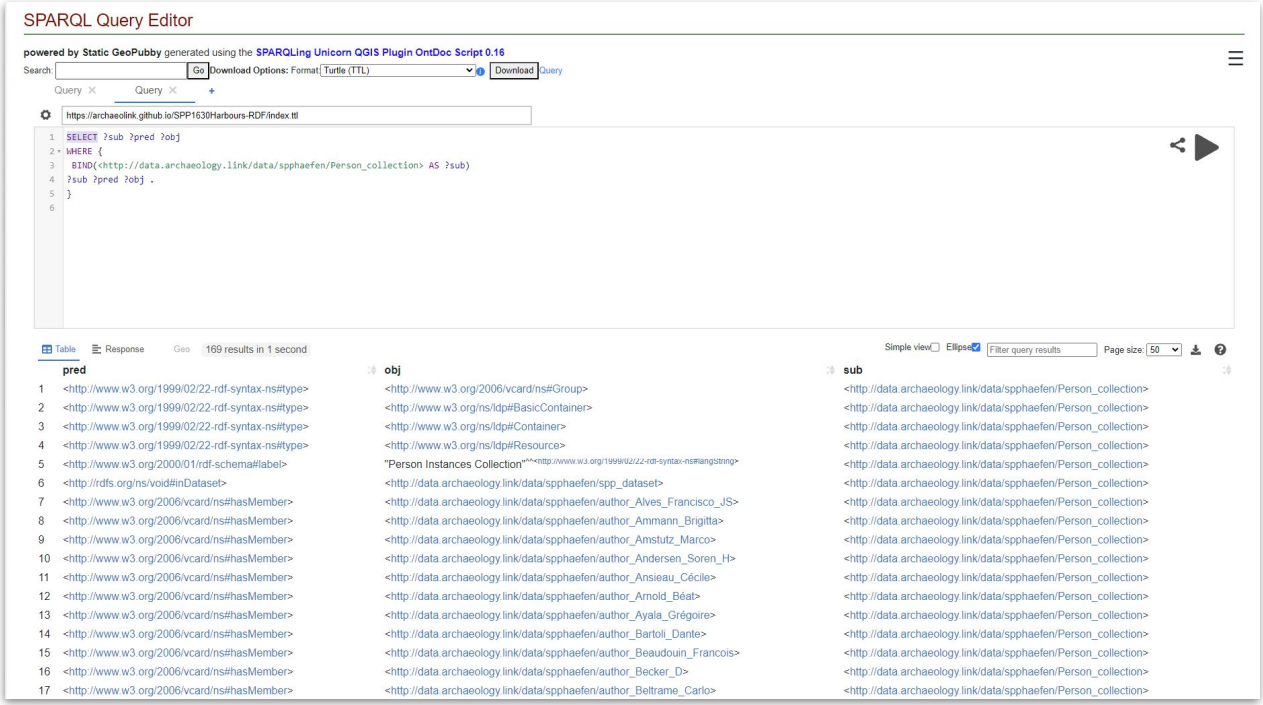
Example: ARS-LOD Data



Documentation Tool: SPARQLing Data Dumps in JS

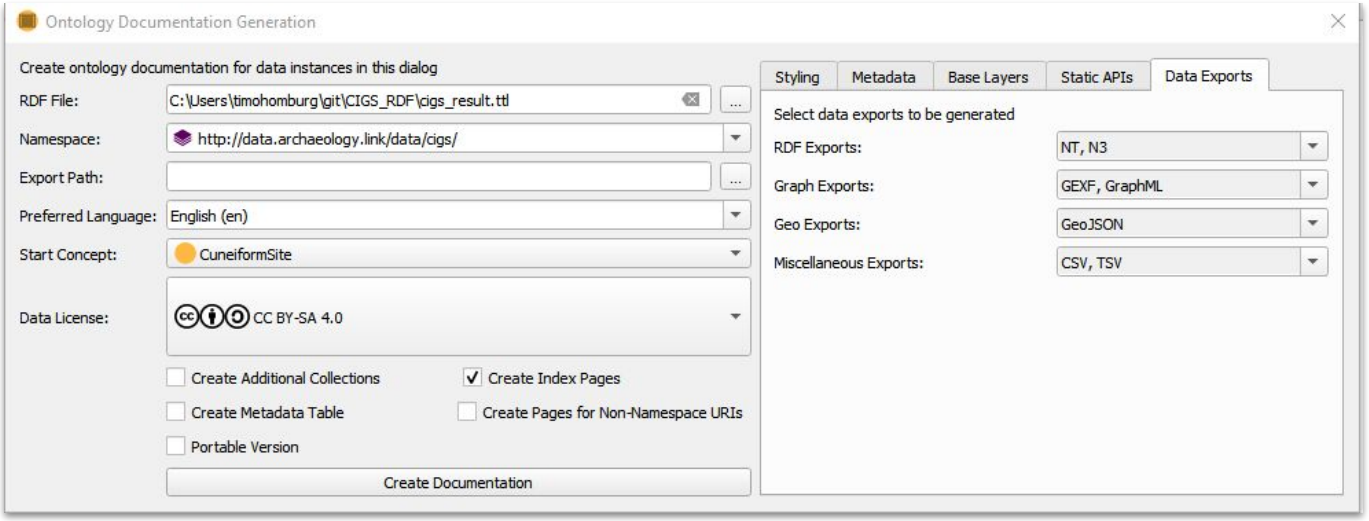
- Static Deployments cannot provide SPARQL endpoints
- Data Dumps can be queried in-browser using JavaScript
- Data Dumps can be queried by external tools loading the Linked Data Dump File

Example



Documentation Tool: Data Exports

- Different research communities are used to data being provided differently
- The SPARQL Unicorn Ontology Documentation Tool may create data exports for the following communities:
  - Different RDF serializations (.TTL, .JSON-LD, .N3)
  - Graph Analysis Data (.graphml, .gexf among others)
  - GeoExports (GeoJSON, KML, GML)
  - Relational Data Exports (.CSV, .TSV, .JSON)



Datadump Metadata - VOID(ext)

- Machine-readable discovery of the dataset
  - Automatically generated topics from vocabulary usage (e.g. GeoSPARQL: dbp:geodata)
  - Automatically derived topics from vocabulary statements
  - Statistics about the dataset (how many triples, subjects, predicates, objects etc.)
  - Which vocabularies are used?
  - Connections to other datastores

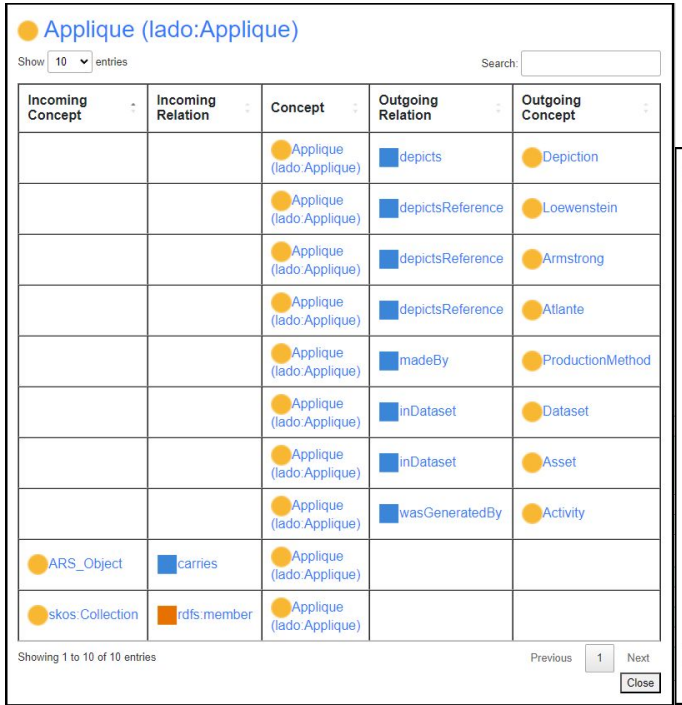
Example

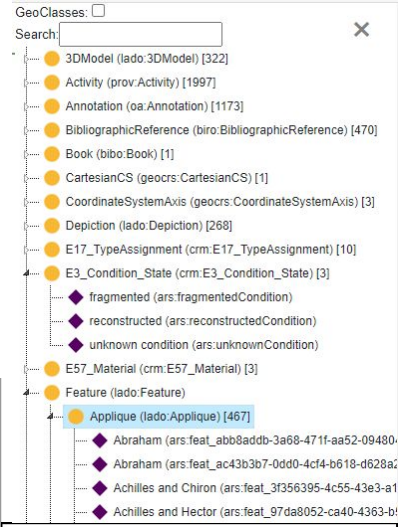
▼ Dataset Statistics [VOID]

Property	Value
classes	7 (xsd:integer)
entities	17159 (xsd:integer)
distinctObjects	53326 (xsd:integer)
distinctSubjects	18678 (xsd:integer)
properties	20 (xsd:integer)
triples	115216 (xsd:integer)
propertyClasses	0 (xsd:integer)
averagePropertyIRILength	38 (xsd:integer)
languages	1 (xsd:integer)
distinctBlankNodes	0 (xsd:integer)
datatypes	0 (xsd:integer)
distinctLiterals	35576 (xsd:integer)
averageSubjectIRILength	77 (xsd:integer)
averageObjectIRILength	62 (xsd:integer)
averageLiteralLength	17 (xsd:integer)
distinctIRIReferences	72024 (xsd:integer)
distinctRDFNodes	107600 (xsd:integer)

Datadump Metadata - ClassTree (Vocabulary)

- Human-readable Discovery
  - Classtree navigation
  - Additional generation of Collection instances for better navigation
  - Data Schema Views on Class Items
  - Views on the position of classified items in the graph
  - Classtree is captured as its own vocabulary (https://purl.org/vocab/classtree)





Static APIs

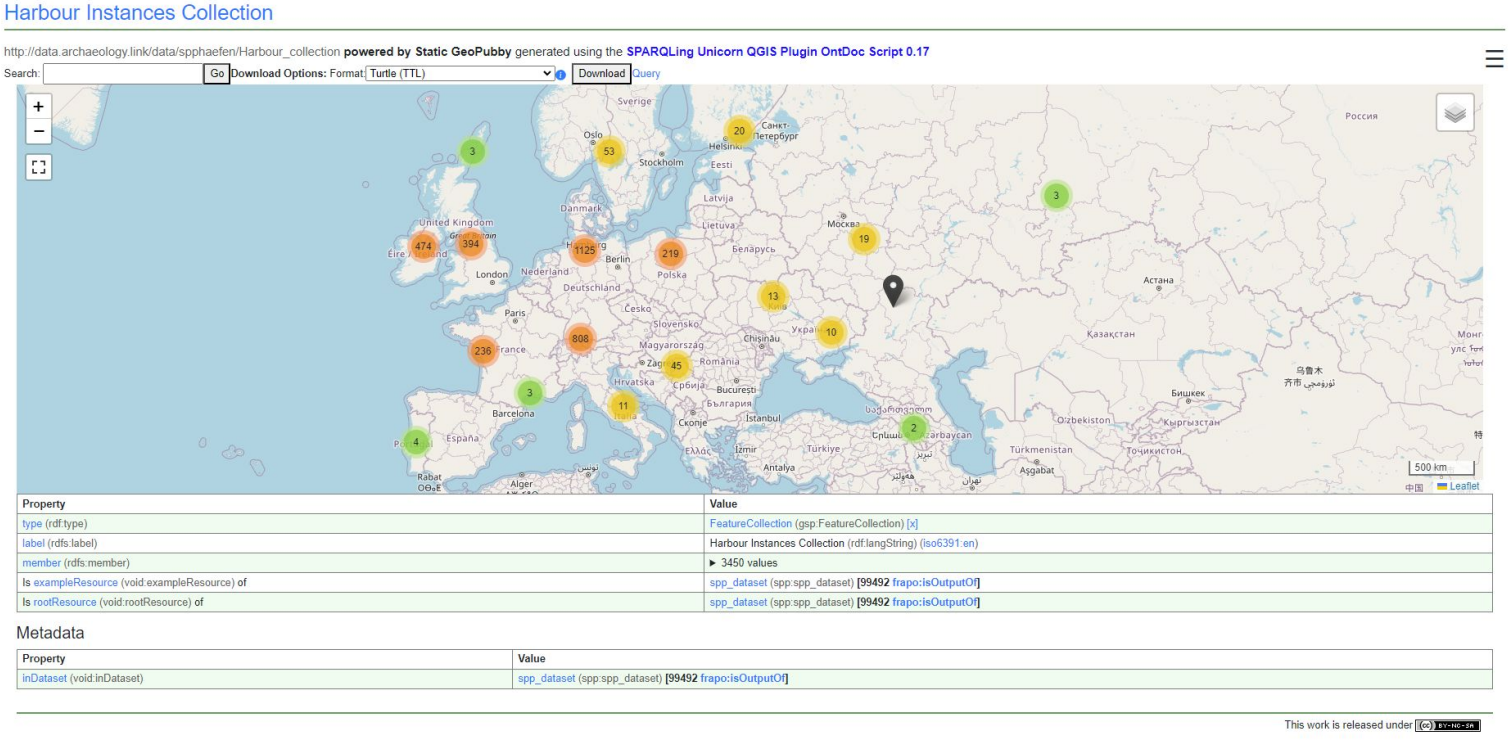
- *"A collection of flat (JSON?) files that live on a webspace"*
- Static APIs may be used to mimic existing APIs with a sacrifice of features that real APIs provide
- We can use static APIs to provide data in RDF Dumps to research communities in ways they are used to
- Do other (research-)communities provide static API definition that are useful?
    - Do they have to?
    - Can we adopt supposedly non-static APIs and publish them statically?

Which APIs, in their static form, provide enough functionality to be useful?

Static APIs: Example QGIS and OGC API Features

SPPHarbour Dataset:

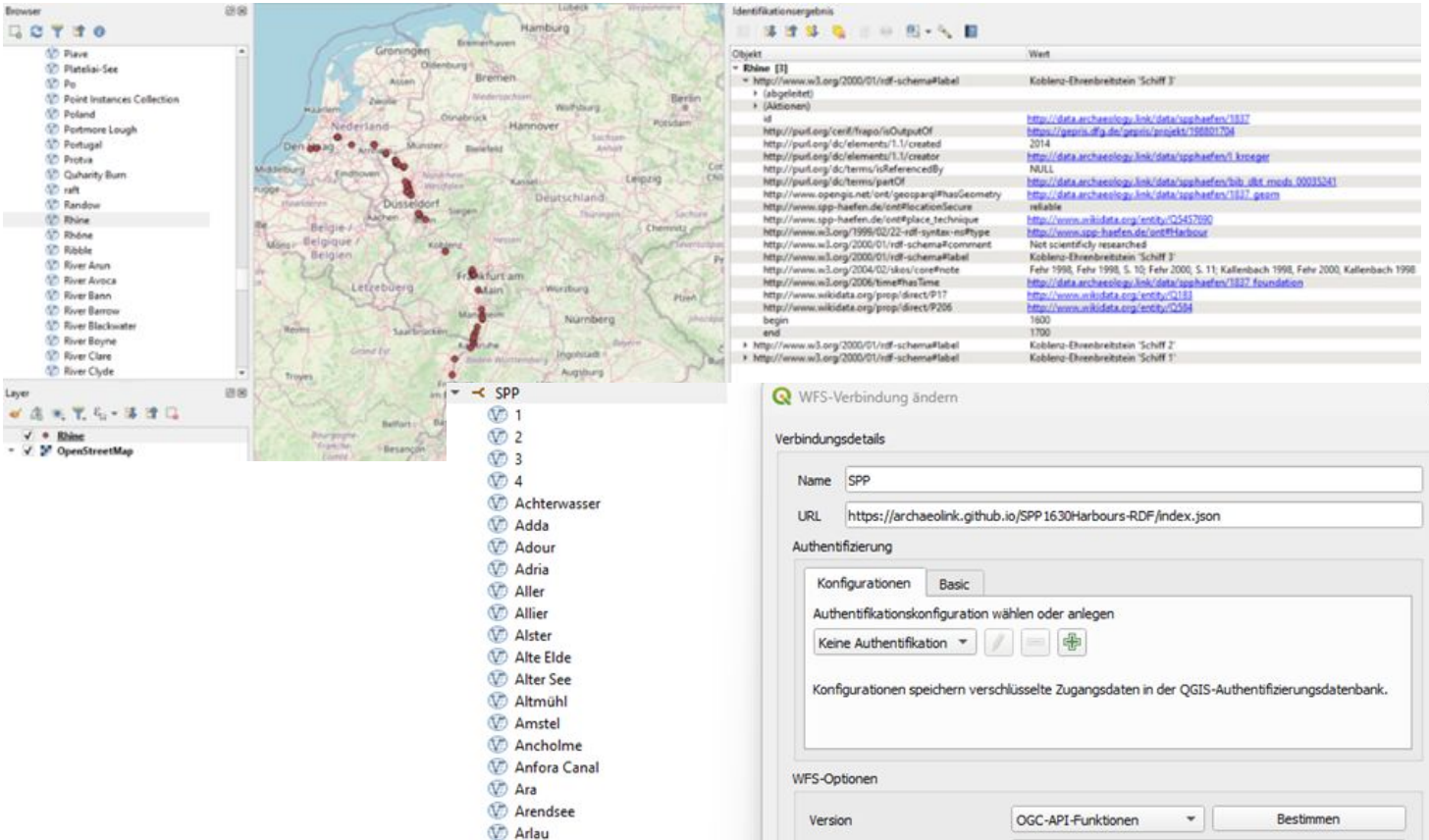
- A dataset of medieval Harbours in Europe
- GeoData modeled with the GeoSPARQL vocabulary
- Static Deployment as a Github Page



Static APIs: Example QGIS and OGC API Features

In **QGIS**:

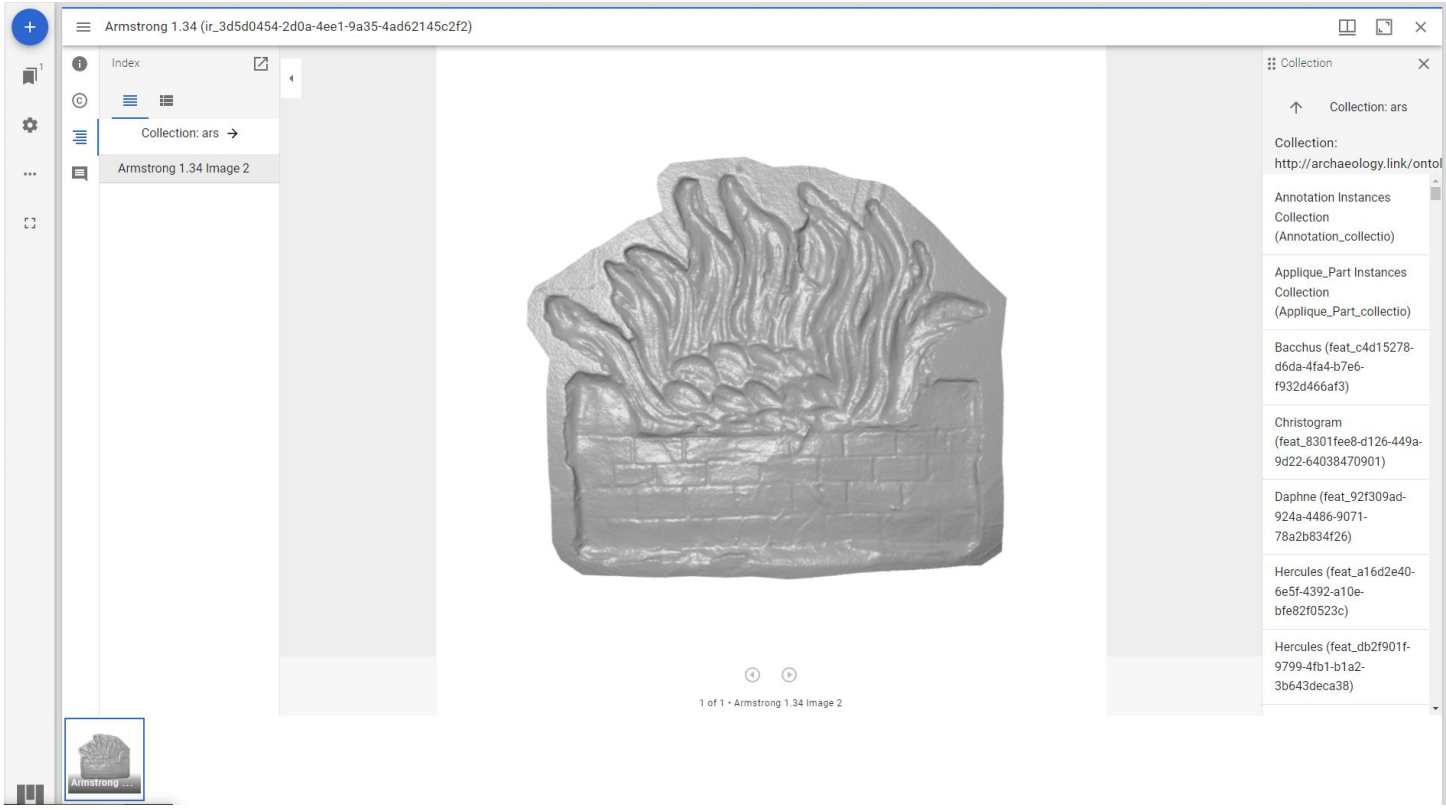
- Add static deployment as OGC API Features service
- Classes in RDF graph become FeatureCollection defintions in QGIS
- Only full FeatureCollections can be loaded
- No serverside filtering/searching



Static APIs: Example IIIF

- Expose Image data hosted on Zenodo using a static IIIF Deployment
- Use the JS Viewer Mirador (deployed with the HTML Dump) or any other IIIF View to access the data
- Only image loading is supported
- Image resizing, rotating etc. would require a server

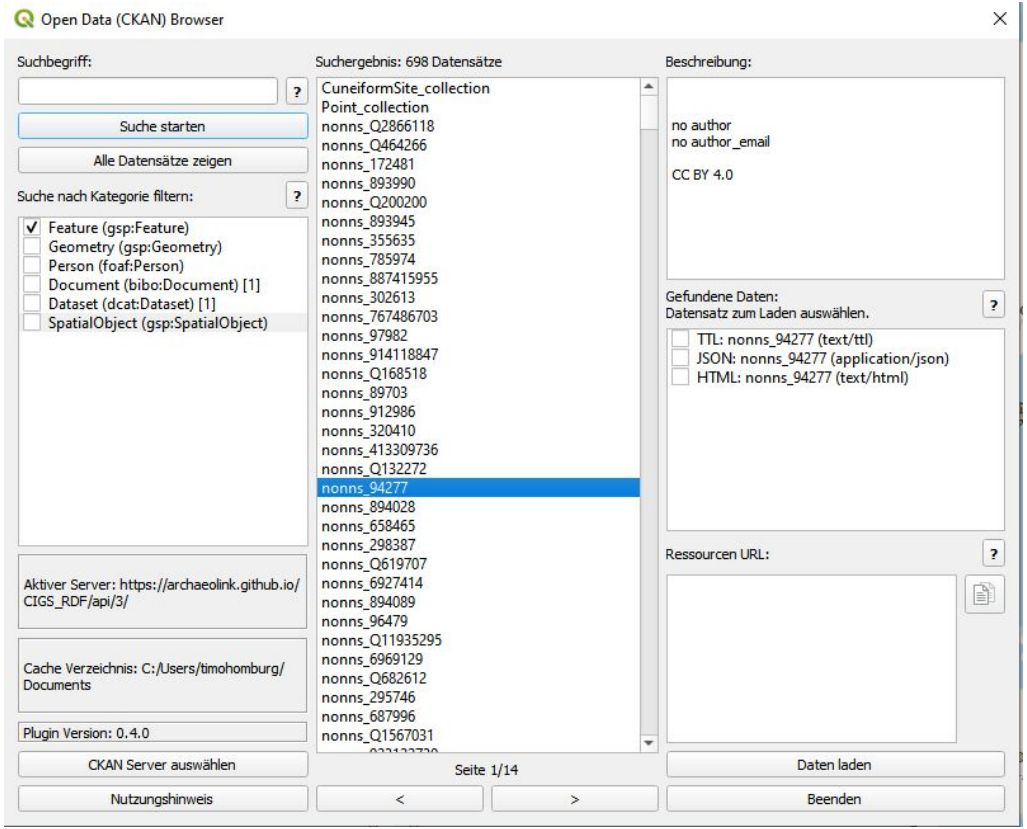
Example



Static APIs: Example CKAN

- Expose generated data export formats via the well-known CKAN API
- Datasets become accessible for a variety of CKAN clients without losing their linked open data context
- Searching via CKAN does not work
- Listing all CKAN datasets works

Example
https://archaeolink.github.io/CIGS_RDF/api/3/



SPARQL Unicorn Ontology Documentation in RDM

- SPARQL Unicorn Ontology Documentation **helps with**:
  - Publishing Research Data
  - Archiving Research Data
- SPARQL Unicorn Ontology Documentation **enables**:
  - Research Data Discovery
  - Research Data Reuse
- SPARQL Unicorn Ontology Documentation **simplifies**:
  - Research Data Analysis
  - Research Data Processing

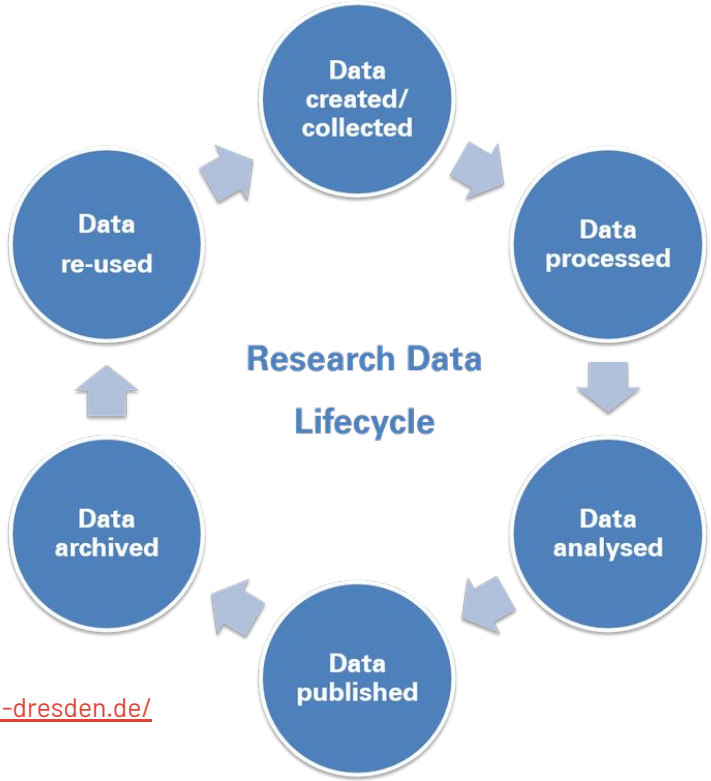


Image by https://tu-dresden.de/

Conclusions

- Research projects producing linked open data are often constrained to publishing LOD Dumps
- Discoverability of RDF Dumps by different communities can be enhanced by
  - Providing HTML Renderings
  - Additional data exports
  - Data access via static APIs
- We believe that easily generated access to LOUD Dumps can be a way to enhance the exposure and reuse of research data

Future Work

- Publishing RDF Dump Contents as Public Solid Pods
- Detection and visualization of further vocabulary contents
- Integration of further common (static) APIs
- HTML Templating

Finis!

Questions?