ELFIE

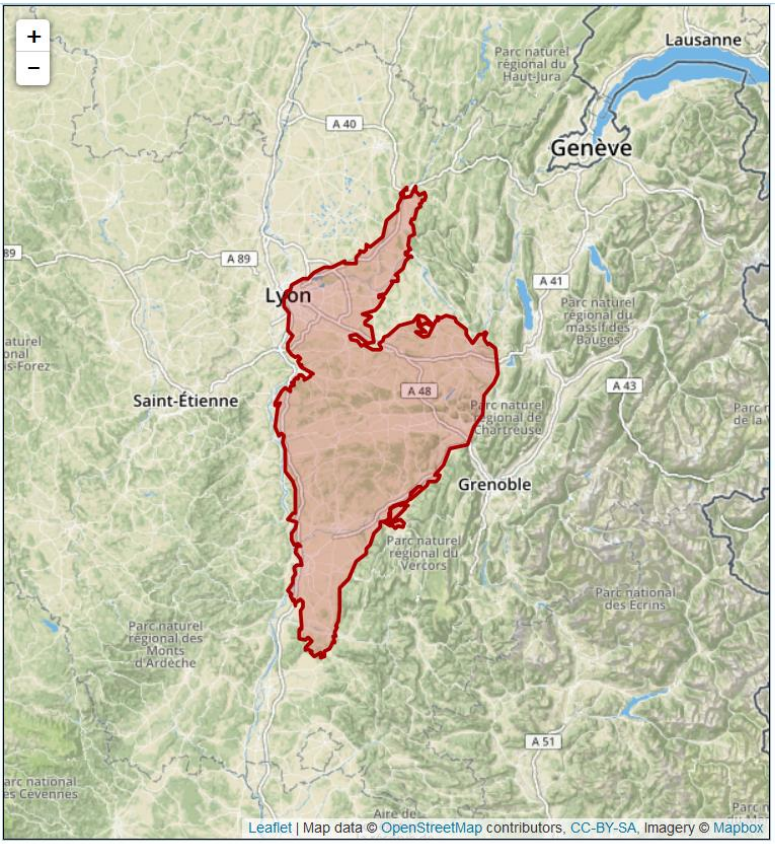
Environmental Linked Features Interoperability Experiment

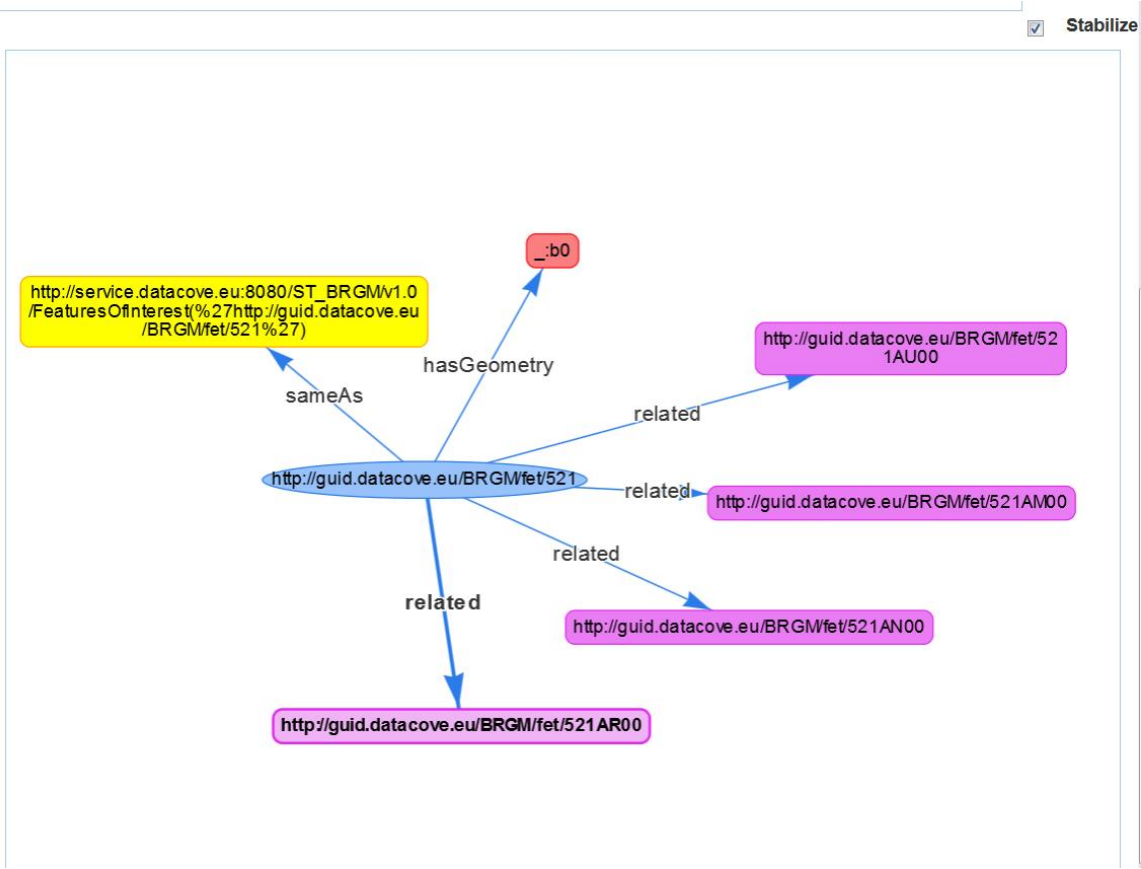
What if…

With one URI, serving as a unique identifier for one aquifer, you could discover a wealth of information pertaining to this resource?

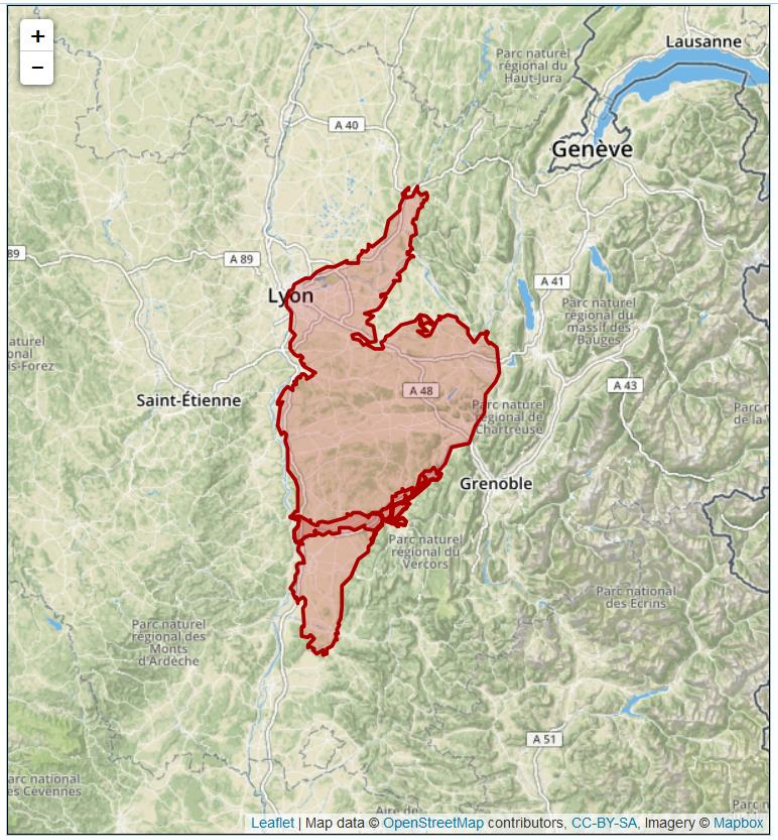
http://guid.datacove.eu/BRGM/fet/521

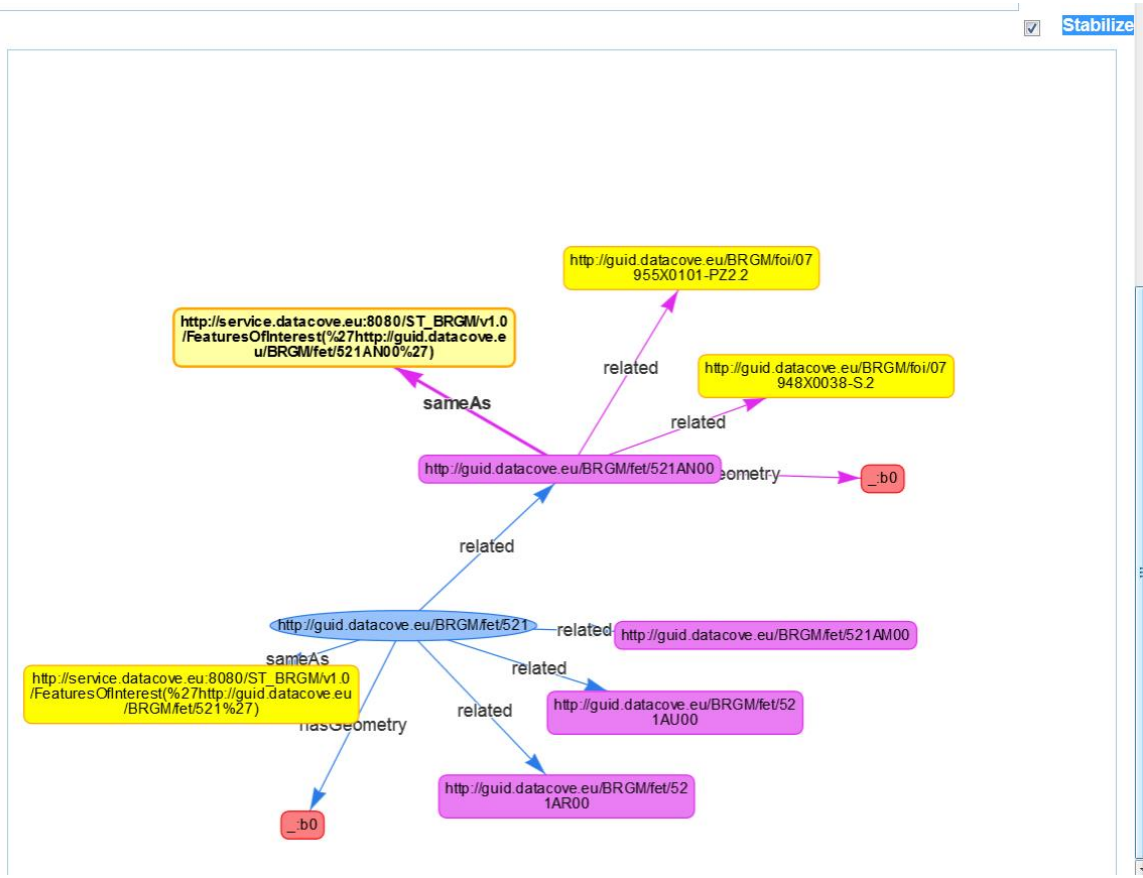
What if…


Lausanne
Genève
Lyon
Saint-Étienne
Grenoble
A 40
A 89
A 41
A 48
A 43
A 51
Parc naturel régional du Haut-Jura
Parc naturel régional du massif des Bauges
Parc naturel régional de Chartreuse
Parc naturel régional du Vercors
Parc national des Ecrins
Parc naturel régional des Monts d'Ardèche
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

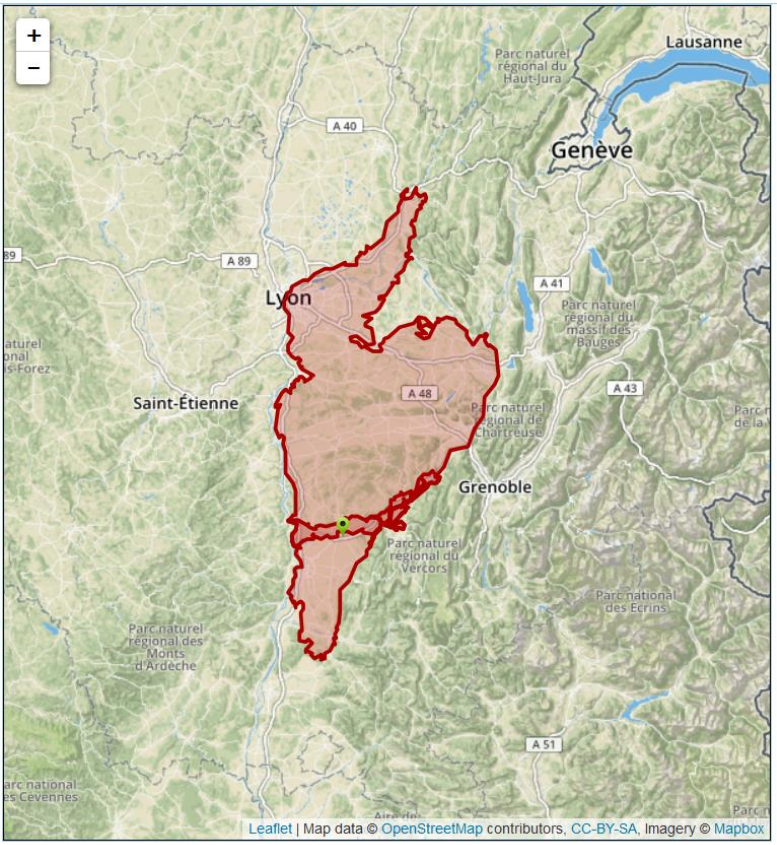

Stabilize
_:b0
http://service.datacove.eu:8080/ST_BRGM/v1.0/FeaturesOfInterest(%27http://guid.datacove.eu/BRGM/fet/521%27)
hasGeometry
sameAs
http://guid.datacove.eu/BRGM/fet/521AU00
related
http://guid.datacove.eu/BRGM/fet/521
related
http://guid.datacove.eu/BRGM/fet/521AM00
related
related
http://guid.datacove.eu/BRGM/fet/521AN00
http://guid.datacove.eu/BRGM/fet/521AR00

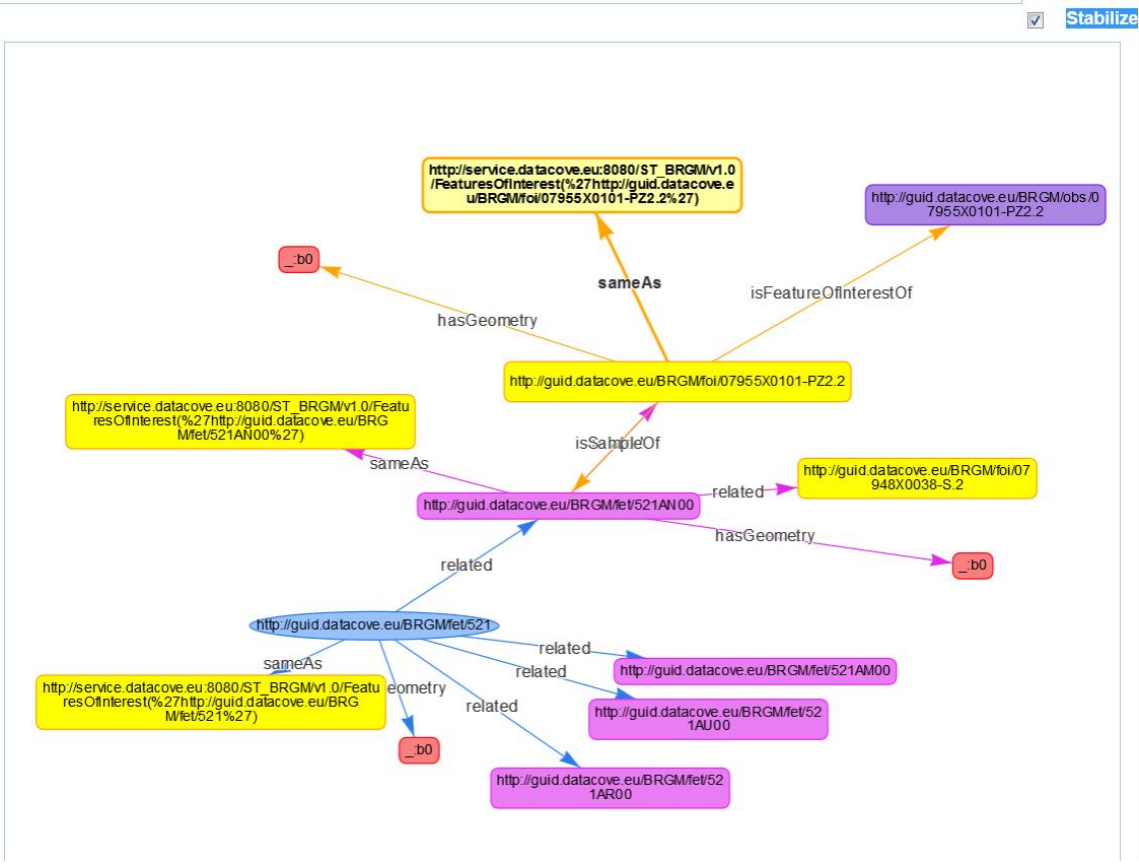
What if…


Lausanne
Genève
Lyon
Saint-Étienne
Grenoble
A 40
A 89
A 41
A 48
A 43
A 51
Parc naturel régional du Haut-Jura
Parc naturel régional du massif des Bauges
Parc naturel régional de Chartreuse
Parc naturel régional du Vercors
Parc national des Écrins
Parc naturel régional des Monts d'Ardèche
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

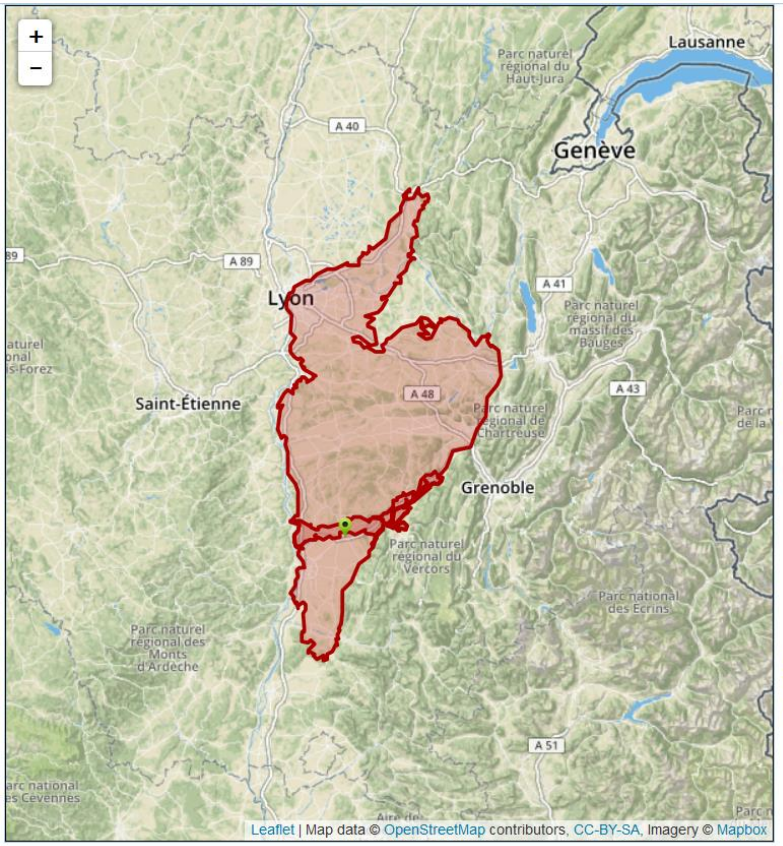

Stabilize
http://guid.datacove.eu/BRGM/foi/07955X0101-PZ2.2
http://service.datacove.eu:8080/ST_BRGM/v1.0/FeaturesOfInterest(%27http://guid.datacove.eu/BRGM/fet/521AN00%27)
http://guid.datacove.eu/BRGM/foi/07948X0038-S.2
related
sameAs
related
http://guid.datacove.eu/BRGM/fet/521AN00
_:b0
related
http://guid.datacove.eu/BRGM/fet/521
related
http://guid.datacove.eu/BRGM/fet/521AM00
sameAs
related
http://service.datacove.eu:8080/ST_BRGM/v1.0/FeaturesOfInterest(%27http://guid.datacove.eu/BRGM/fet/521%27)
related
http://guid.datacove.eu/BRGM/fet/521AU00
hasGeometry
http://guid.datacove.eu/BRGM/fet/521AR00
_:b0

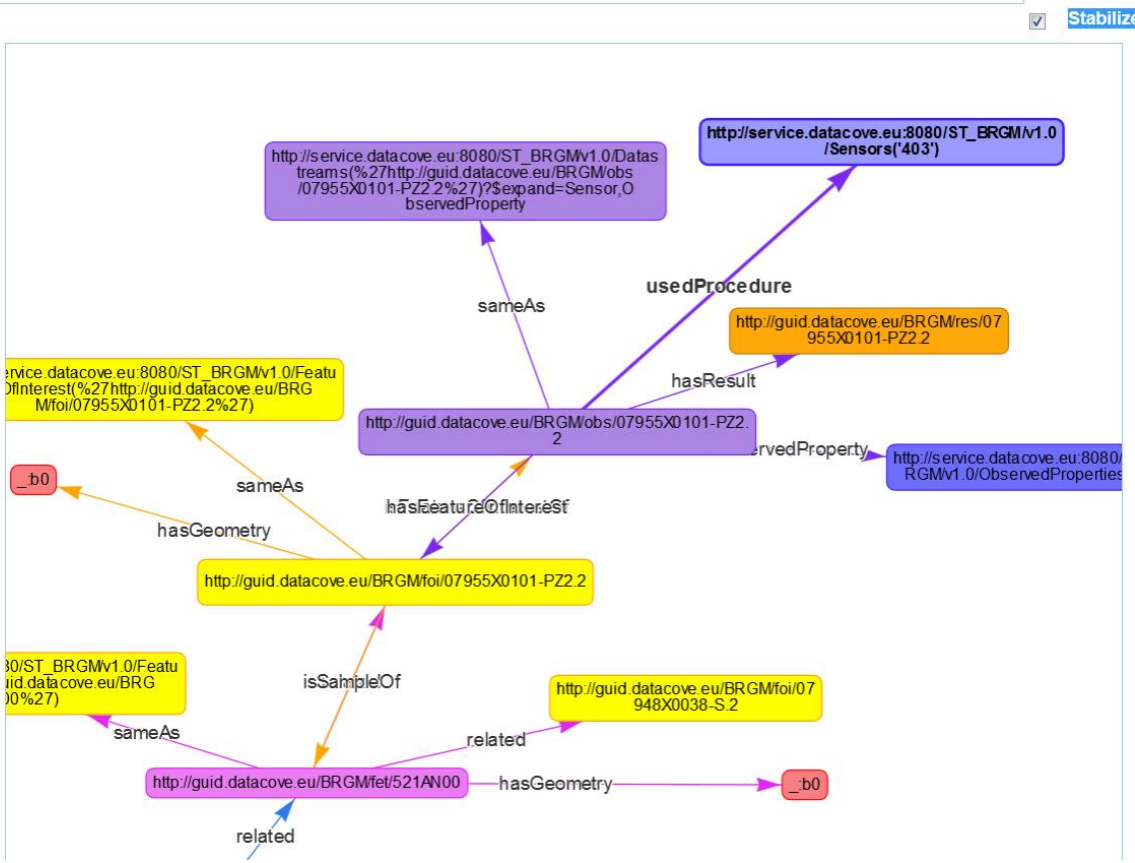
What if…


Lausanne
Genève
Lyon
Saint-Étienne
Grenoble
A 40
A 89
A 41
A 43
A 48
A 51
Parc naturel régional du Haut-Jura
Parc naturel régional du massif des Bauges
Parc naturel régional de Chartreuse
Parc naturel régional du Vercors
Parc national des Écrins
Parc naturel régional des Monts d'Ardèche
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox


Stabilize
http://service.datacove.eu:8080/ST_BRGM/v1.0/FeaturesOfInterest(%27http://guid.datacove.eu/BRGM/foi/07955X0101-PZ2.2%27)
http://guid.datacove.eu/BRGM/obs/07955X0101-PZ2.2
_:b0
sameAs
isFeatureOfInterestOf
hasGeometry
http://guid.datacove.eu/BRGM/foi/07955X0101-PZ2.2
http://service.datacove.eu:8080/ST_BRGM/v1.0/FeaturesOfInterest(%27http://guid.datacove.eu/BRGM/fet/521AN00%27)
isSampleOf
sameAs
http://guid.datacove.eu/BRGM/foi/07948X0038-S.2
related
http://guid.datacove.eu/BRGM/fet/521AN00
hasGeometry
_:b0
related
http://guid.datacove.eu/BRGM/fet/521
related
sameAs
http://guid.datacove.eu/BRGM/fet/521AM00
related
http://service.datacove.eu:8080/ST_BRGM/v1.0/FeaturesOfInterest(%27http://guid.datacove.eu/BRGM/fet/521%27)
eometry
related
http://guid.datacove.eu/BRGM/fet/521AU00
_:b0
http://guid.datacove.eu/BRGM/fet/521AR00

What if…


Lausanne
Genève
Lyon
Saint-Étienne
Grenoble
A 40
A 89
A 41
A 48
A 43
A 51
Parc naturel régional du Haut-Jura
Parc naturel régional du massif des Bauges
Parc naturel régional de Chartreuse
Parc naturel régional du Vercors
Parc national des Ecrins
Parc naturel régional des Monts d'Ardèche
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox


Stabilize
http://service.datacove.eu:8080/ST_BRGM/v1.0/Datastreams(%27http://guid.datacove.eu/BRGM/obs/07955X0101-PZ2.2%27)?$expand=Sensor,ObservedProperty
http://service.datacove.eu:8080/ST_BRGM/v1.0/Sensors('403')
sameAs
usedProcedure
http://guid.datacove.eu/BRGM/res/07955X0101-PZ2.2
hasResult
http://guid.datacove.eu/BRGM/obs/07955X0101-PZ2.2
_:b0
sameAs
hasGeometry
hasFeatureOfInterest
http://guid.datacove.eu/BRGM/foi/07955X0101-PZ2.2
isSampleOf
http://guid.datacove.eu/BRGM/foi/07948X0038-S.2
sameAs
related
http://guid.datacove.eu/BRGM/fet/521AN00
hasGeometry
_:b0
related

What if…


12519 observations for the observed Property
24.94
24.92
24.9
24.88
24.86
24.84
24.82
Oct 1
2017
Oct 8
Oct 15
Oct 22
Oct 29
Nov 5
Close
Types
Stabilize
Lyon
Saint-Étienne
isSampleOf

Survey Time!

Please go to: Menti.com
Enter the code: **71 29 22**

Background

- Environmentally relevant spatial features becoming ubiquitous
- Data from multiple sources often required for full picture
- Classic OGC Services not suited for provision of such links

→ Initiated an OGC Interoperability Experiment (IE)

https://opengeospatial.github.io/ELFIE/

OGC Interoperability Experiments

- Component of OGC Innovation Program
- Used to address new requirements identified by members
- Allows for experimentation on an identified technical objective

Goals

- Increase interoperability while decreasing data duplication and maintenance overhead
- Combine the power of web services with transparency of linked data
- Encode relationships between and among environmental features
- Encode highly general “preview” content for any feature
- Utilize commonly used and easily adopted approaches

More Background

- Environmental domain models limited to landscape interactions within the hydrologic cycle
- Leverage existing standards and best practices (notably SDW BP 2&3) and, as far as possible, integrate standard taxonomies and ontologies
- Evaluate potential of RESTful and Linked Data principles

Use Cases

1. **Water budget summary:** integrating water budget data with data on the hydrographic network, watershed boundary and outlet, this use case strives to give the user a summary overview of the water budget for a watershed.
2. **Flood risks and impacts:** linking hydrographic information on a watershed with meteorological and water level information as well as the relevant transport networks, real time information of benefit to decision-makers can be provided.
3. **Groundwater level monitoring:** integrating boreholes and other monitoring facilities with aquifers, thereby gaining a better understanding of groundwater levels.
4. **Surface-groundwater networks interaction:** provides a comprehensive overview of a water system by applying a linked data approach to all relevant domain features as well as measurements being taken on these features.
5. **Watershed data index:** by applying linked data principles to monitoring sites and watersheds, data stemming from water quality and quantity sensors is brought into context with the hydrographic network, allowing for a wide array of linked watershed information use cases.

Underlying Technical Issues

Current OGC services, while flexible and capable, do not directly allow exposure of features in a **REST-ful** way or provide traversable **hypermedia** describing available **methods**, data, or interfaces to **related** (linked) content.
Note: Status ~2017

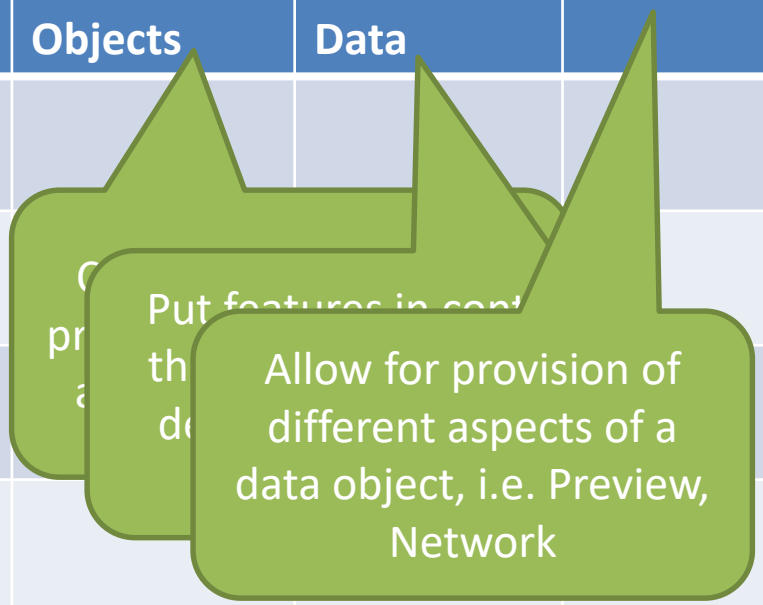
- **REST-ful:** GET + “accept: mime-type” gives you the mime-type if available
- **Hypertext:** traversable web of text. Hypermedia: traversable web of data
- **Methods, data, interfaces:** getCapabilities, describeFeaturetype, etc.
- **Related** (linked) content: things or data that are related from other services

Underlying Data Models

- Sensors, Observations, Samples and Actuators (SOSA)
- Timeseries Markup Language (TimeseriesML)
- Surface Hydrology Features (HY_Features)
- Groundwater Markup Language 2 (GWML2)
- Geoscience Markup Language 4 (GeoSciML)
- Soil Data Interoperability Experiment (SoilIEML)
- Floodcast (Experimental)

Breaking down Goals

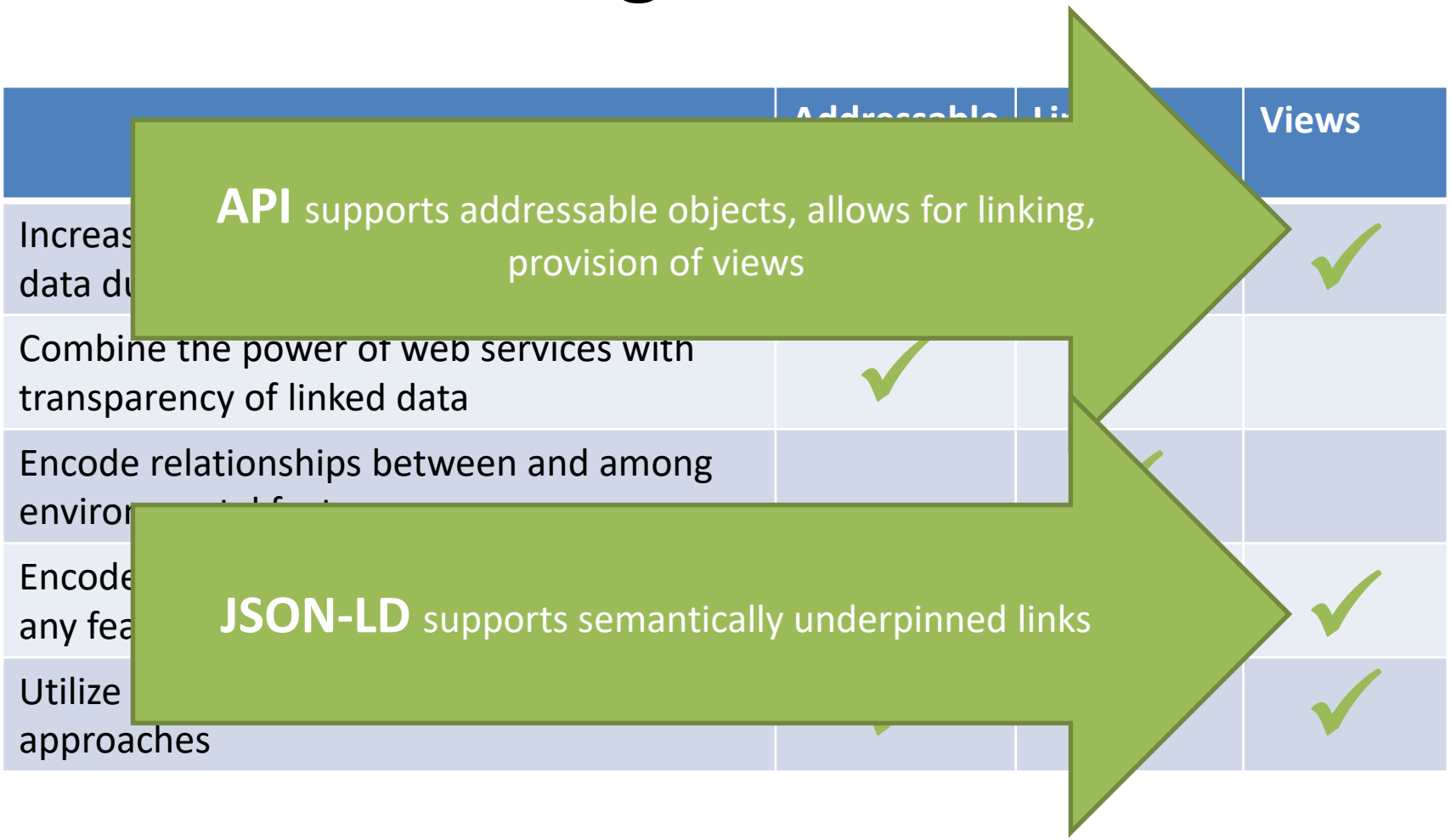
	Addressable Objects	Linked Data	Views
Increase interoperability while decreasing data duplication and maintenance overhead			
Combine the power of web services with transparency of linked data			
Encode relationships between and among environmental features			
Encode highly general “preview” content for any feature			
Utilize commonly used and easily adopted approaches			



Breaking down Goals

	Addressable Objects	Linked Data	Views
Increase interoperability while decreasing data duplication and maintenance overhead	✓	✓	✓
Combine the power of web services with transparency of linked data	✓	✓	
Encode relationships between and among environmental features		✓	
Encode highly general “preview” content for any feature			✓
Utilize commonly used and easily adopted approaches	✓	✓	✓

Breaking down Goals



JSON-LD Contexts

Overview of ELFIE Contexts available at:

- https://opengeospatial.github.io/ELFIE/json-ld/

Partially defined by „View“ concepts:

- Preview: https://opengeospatial.github.io/ELFIE/json-ld/elf.jsonld
- Network: https://opengeospatial.github.io/ELFIE/json-ld/elf-network.jsonld

JSON-LD Contexts

Partially dealing with observational concepts:

- Sensor, Observation, Sample, and Actuator (SOSA): https://opengeospatial.github.io/ELFIE/json-ld/sosa.jsonld
- TimeSeriesML: https://opengeospatial.github.io/ELFIE/json-ld/tsml.jsonld

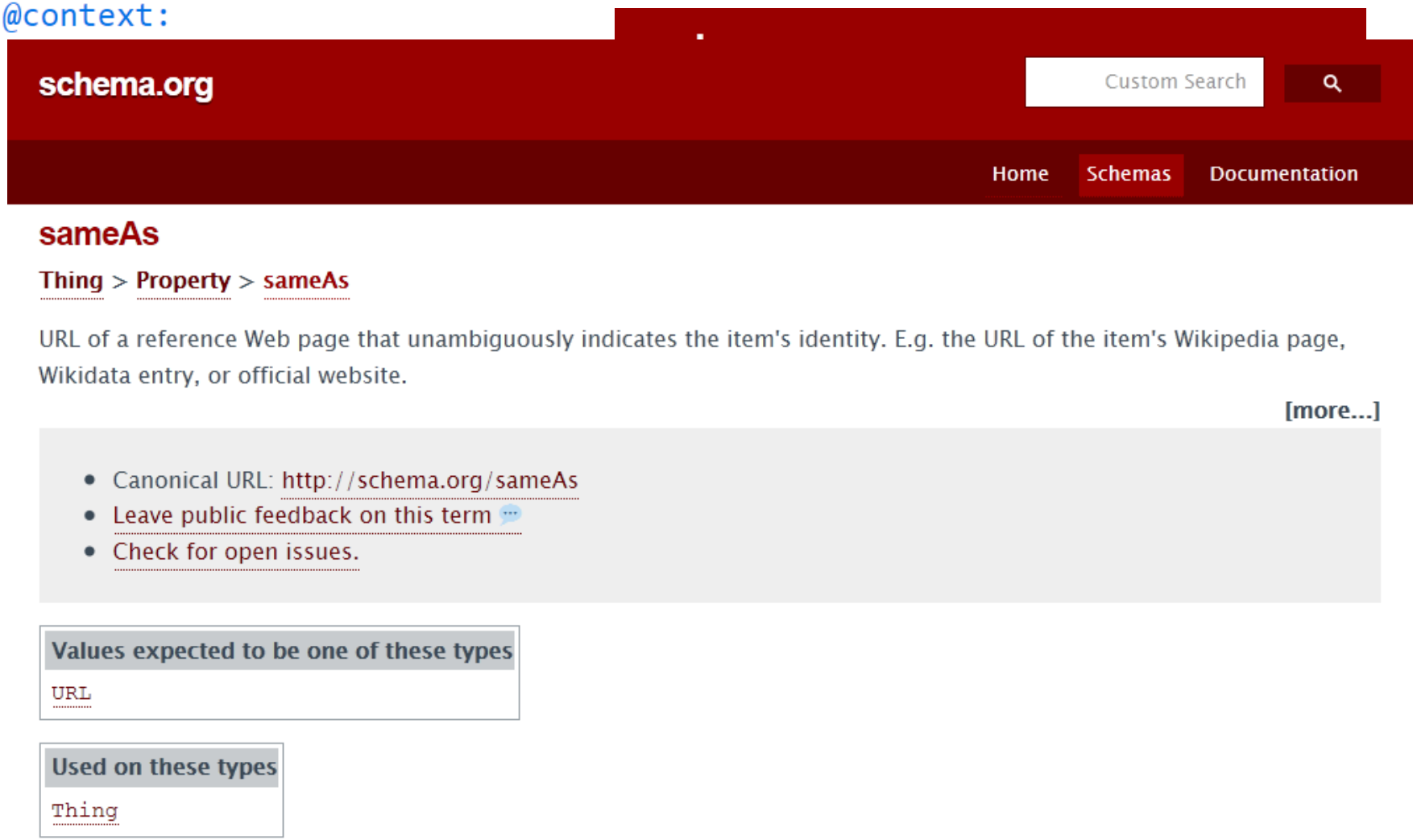
JSON-LD Contexts

Partially defined by domains:

- GroundWaterML 2.0: https://opengeospatial.github.io/ELFIE/json-ld/gw.jsonld
- Soil Data IE: https://opengeospatial.github.io/ELFIE/json-ld/soilie.jsonld

JSON-LD Contexts

▼ @context:



ELFIE Best Practices I

All files/responses shall:

- contain only one JSON object describing the requested resource
- begin with a @context property identifying the context(s) used
- have a JSON-LD @id (node identifier, equivalent to rdf:about, TTL's 'a') after the @context
- have a JSON-LD @type (equivalent to rdfs:type) after the @id

All properties that can be multi-valued (e.g. any relationship) should be presented as an array, regardless of the number of related resources.

ELFIE Best Practices II

Documents should provide link relations as object stubs, allowing the target resource to be typed and supporting decisions by a crawler

```
"relation": [ {
    "@id": "http://data.example.org/id/thing/1",
    "@type": "sosa:Sample“
  }, {
    "@id": "http://data.example.org/id/thing/2",
    "@type": "hyf:HY_River“
  }
]
```

ELFIE Issues

- **Resolvable Identifiers:** with existing OGC services, a specific feature can only be referenced via a complex and unstable request URI. Rewriting is a viable work-around; APIs allowing resolution of URI based identifiers would be ideal.
- **Domain Feature Model:** standard vocabularies utilized are well suited for referencing, but issues were encountered pertaining to the domain vocabularies only available in conceptual (UML) form or XML Schema. Ongoing work on the OGC Register should provide valuable insights.

ELFIE Issues

- **Spatial Representation:** utilization of GeoJSON structures not possible with JSON-LD (specifically the unordered arrays). Point data can be provided in a form valid for both standards, not possible for complex geometries.
  → ELFIE utilized GeoSPARQL
  However, being able to leverage the widespread use of GeoJSON would be valuable
- **Multiple Representations of an Object:** one real-world-object can have multiple data representations, often from different organizations or exposing different facets of the data. Mechanisms for maintaining alignment must be explored.

ELFIE → SELFIE

SELFIE: Second Environmental Linked Features Interoperability Experiment

- Designing Web-resource model & network behavior for cross-domain linked feature data complimenting & utilizing OGC API
- Answering the question: how do we use linked data in a way that's compatible with W3C best practices and leverages OGC standards?
- https://github.com/opengeospatial/SELFIE

Data Access

- API definition was deamed out-of-scope for ELFIE, static data examples made available via GitHub: https://opengeospatial.github.io/ELFIE/file_index
- Dynamic data transformed on-the-fly from SensorThings API and available via resolvable URIs an alternative

Data Access II

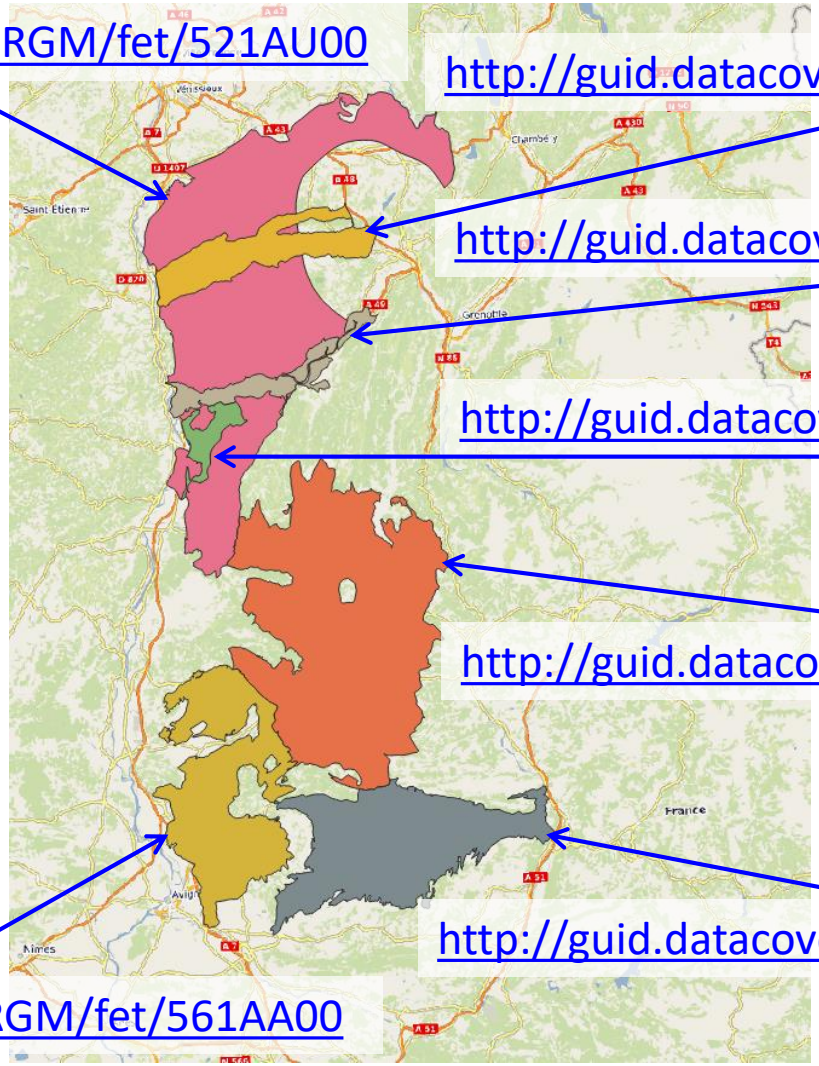
Dynamic access to Aquifer data:

- http://guid.datacove.eu/BRGM/fet/521
- http://guid.datacove.eu/BRGM/fet/521AM00
- http://guid.datacove.eu/BRGM/fet/521AU00
- http://guid.datacove.eu/BRGM/fet/521AN00
- http://guid.datacove.eu/BRGM/fet/521AR00
- http://guid.datacove.eu/BRGM/fet/531AE00
- http://guid.datacove.eu/BRGM/fet/561AA00
- http://guid.datacove.eu/BRGM/fet/565AF01

Data Access III

http://guid.datacove.eu/BRGM/fet/521AU00

http://guid.datacove.eu/BRGM/fet/521AM00



http://guid.datacove.eu/BRGM/fet/521AN00

http://guid.datacove.eu/BRGM/fet/521AR00

http://guid.datacove.eu/BRGM/fet/531AE00

http://guid.datacove.eu/BRGM/fet/565AF01

http://guid.datacove.eu/BRGM/fet/561AA00

ELFIE in Context - BLiv

- BLiv viewer implemented by BRGM
- Allows for three-fold display:
  - JSON-LD in Expanded form
  - Map view
  - Bubble Graph, both illustrating links and allowing for navigation between
- http://farfouille.brgm-rec.fr/Bliv/

ELFIE in Context - BLiv

http://guid.datacove.eu/BRGM/fet/521AU00

Accès directe SPARQL Endpoint

Specify the expected data format

JSON-LD Turtle RDF/XML

OR

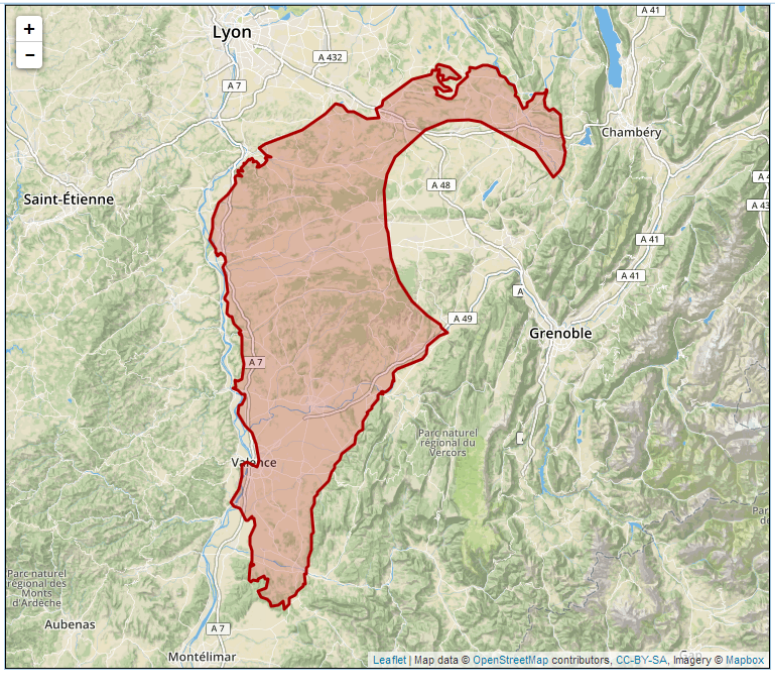

```
{
    "@id": "http://guid.datacove.eu/BRGM/fet/521AU00",
    "@type": "http://opengeospatial/def/ontology/hyfHY_WaterBody",
    "http://schema.org/name": "Aquifer 521AU00",
    "http://schema.org/sameAs": {
        "@id": "http://service.datacove.eu:8080/ST_BRGM/v1.0/FeaturesOfInterest(%27http://guid.datacove.eu/BRGM/fet/521AU00%27)",
        "@type": "http://www.w3.org/ns/sosa/Sample"
    },
    "http://www.opengeospatial.org/standards/geosparql/hasGeometry": {
        "@type": "http://www.opengeospatial.org/standards/geosparql/Geometry"
```

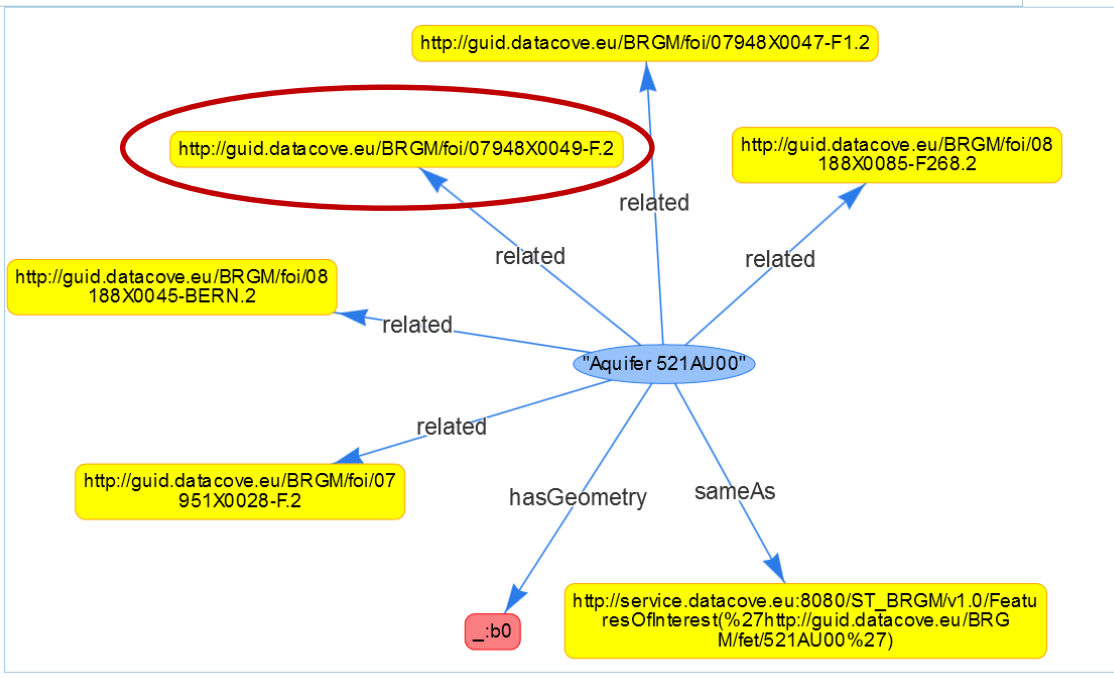

http://guid.datacove.eu/BRGM/fet/521AU00

Types

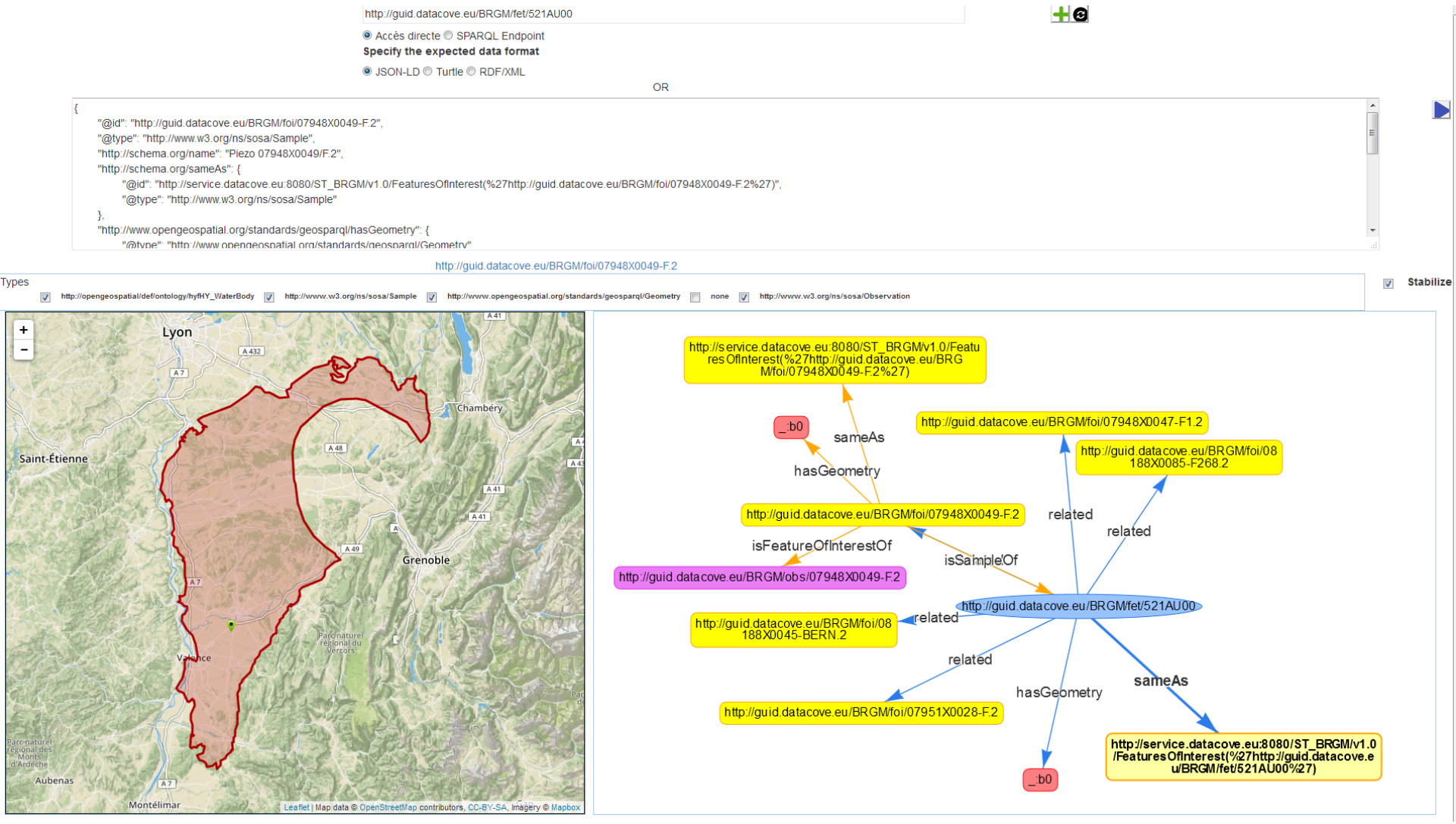
http://opengeospatial/def/ontology/hyfHY_WaterBody http://www.w3.org/ns/sosa/Sample http://www.opengeospatial.org/standards/geosparql/Geometry none

Stabilize





ELFIE in Context - BLiv



ELFIE in Context - BLiv

http://guid.datacove.eu/BRGM/fet/521AU00

Accès directe SPARQL Endpoint

Specify the expected data format

JSON-LD Turtle RDF/XML

OR

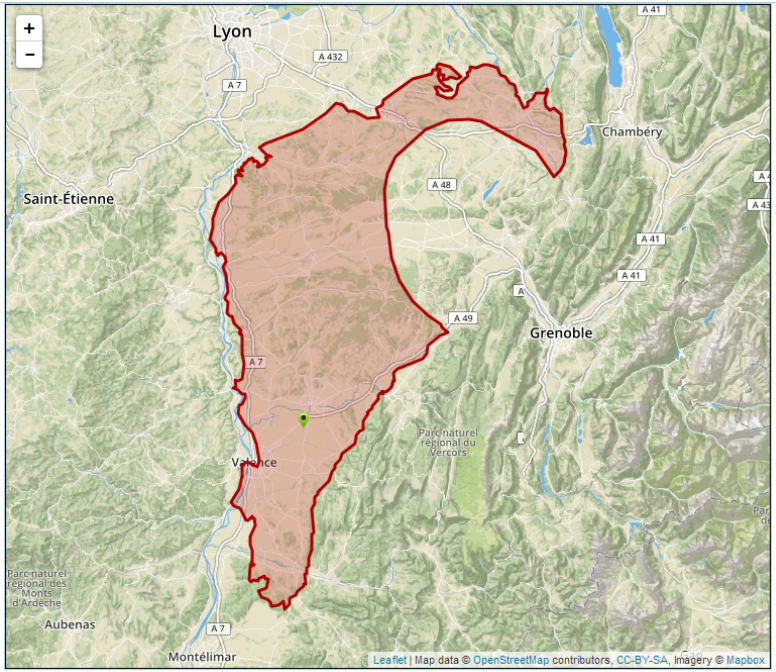
{}

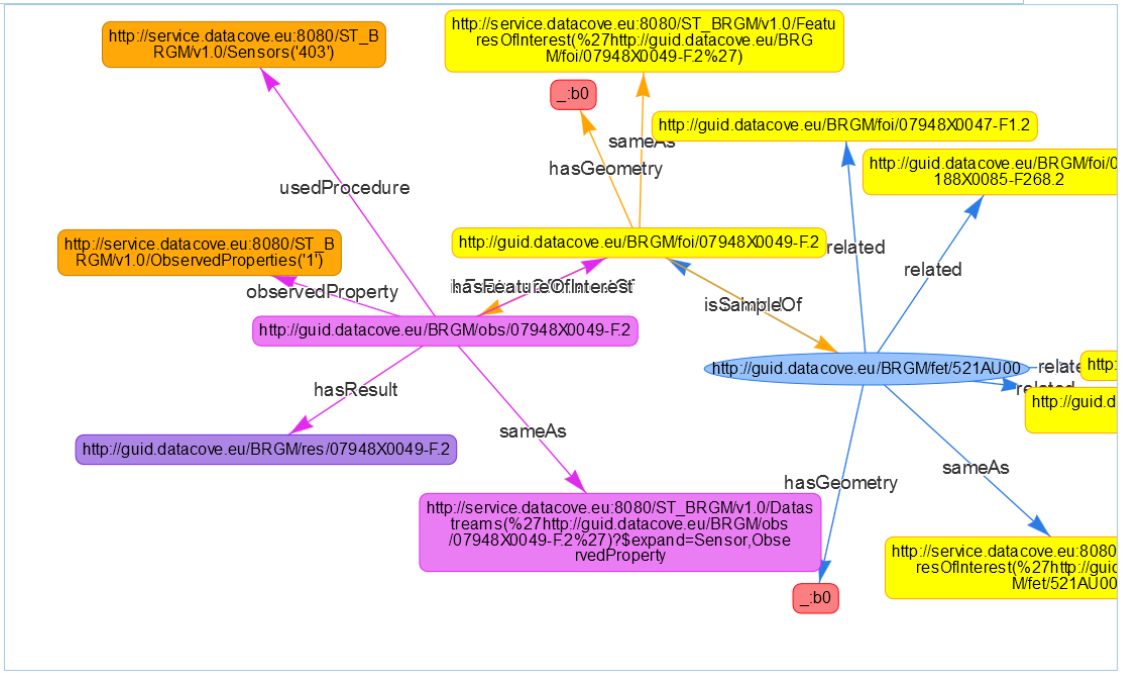
http://service.datacove.eu:8080/ST_BRGM/v1.0/ObservedPr...

Types

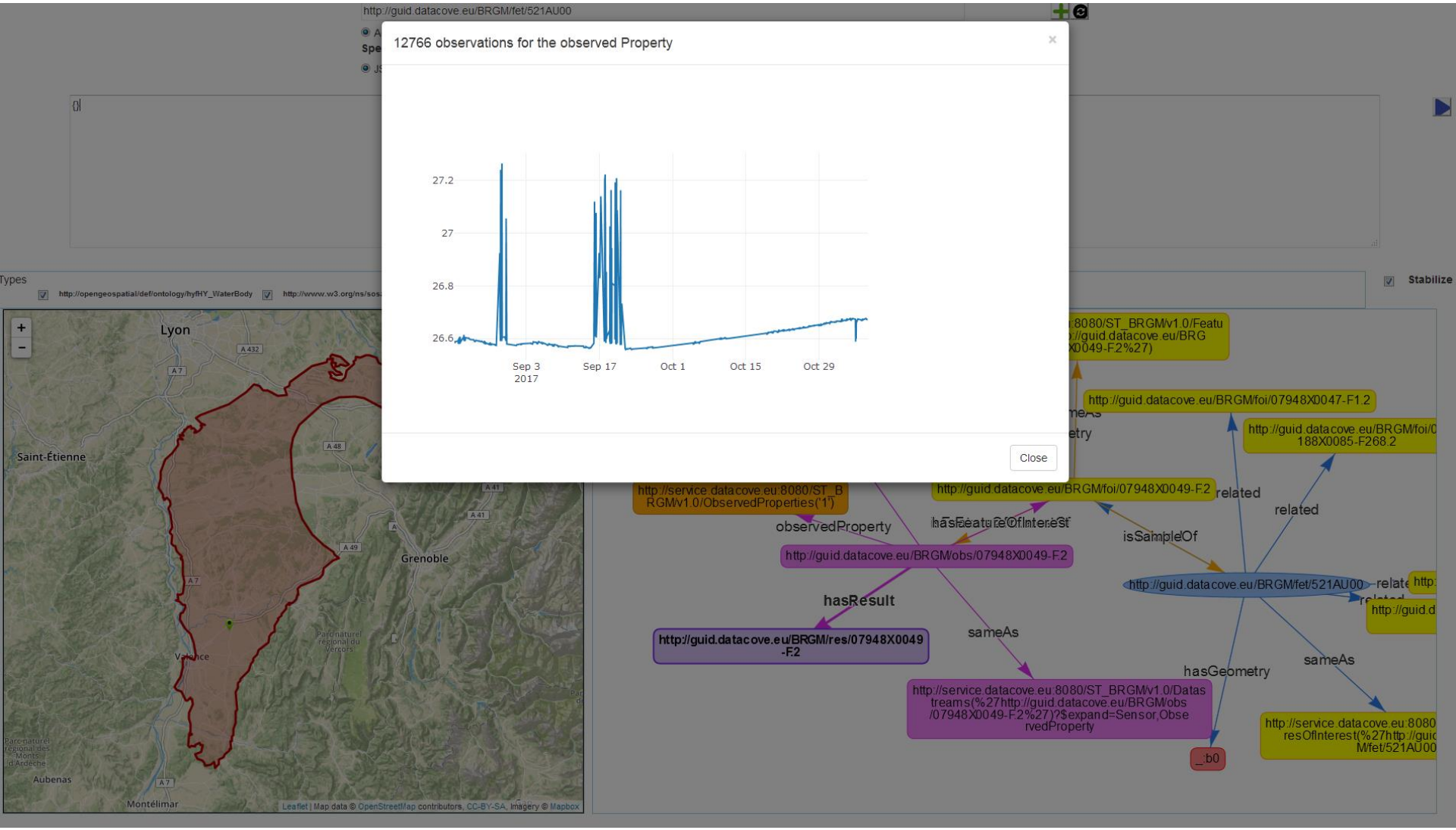
http://opengeospatial/def/ontology/hyfHY_WaterBody | http://www.w3.org/ns/sosa/Sample | http://www.opengeospatial.org/standards/geosparql/Geometry | none | http://www.w3.org/ns/sosa/Observation | wml2:MeasurementTimeseries

Stabilize





ELFIE in Context - BLiv



Outlook

- SELFIE currently work-in-progress
  - If you're interested, join us in this work at OGC
- Insights being examined for impact in current O&M revision
- Exploratory work towards integrating JSON-LD contexts within OGC API (BRGM)

Thanks for your attention!

Kathi Schleidt
Kathi@DataCove.eu

Nuno Oliveira
nuno.oliveira@geo-solutions.it

Sylvain Grellet S.Grellet@brgm.fr
Mickael Beaufils M.Beaufils@brgm.fr

Links

- https://opengeospatial.github.io/ELFIE/

BLiv Links

- http://farfouille.brgm-rec.fr/Bliv/

- http://guid.datacove.eu/foi/06932X0179-P11.2
- http://guid.datacove.eu/foi/06512X0037-STREMY.2

- https://sensorthings-wq.brgm-rec.fr/FROST-Server/v1.0/

Survey Questions

- Role: provision, use, both
- WS Motivation: free text
- Type of org: govt, research, industry, other
- What topics would you like to hear more about: word cloud
- Experience with: UML, OWS, APIs, XML, GeoJSON, JSON-LD