



Cognitive Economy Intelligence
Plattform für die Resilienz
wirtschaftlicher Ökosysteme

Semantification of Geospatial Information for Enriched Knowledge Representation in Context of Crisis Informatics

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Gefördert durch:



aufgrund eines Beschlusses
des Deutschen Bundestages



- RDF is the Lingua Franca of Semantic Integration
- Extending GeoSPARQL allows new horizons in crisis and resiliency management
- Our tools are free software

RDF Processing Toolkit

Integrate a manifold of different data sources using SPARQL standards

Apache Jena

A free and open source Java framework for building Semantic Web and Linked Data applications

OGC GeoSPARQL

Representation and querying of geospatial linked data for the Semantic Web

① Live API consumption & federation

vs.

② Materialized RDF Geo Data

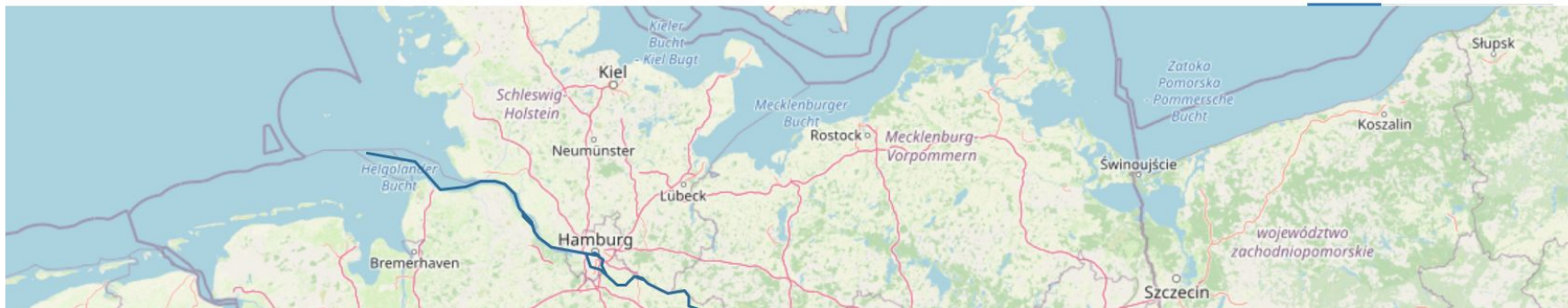
- **API**
 - + up-to-date
 - + quick to use
 - - request limits
 - - coarse granularity
 - - not every object is mapped
- **Materialized Data**
 - + Geo information linked with other (existing) concepts
 - - Needs to be kept in sync

① Live API consumption & federation

```
SELECT
?osm_id
?geom
WHERE {
  SERVICE <https://query.wikidata.org/sparql> {
    ?s rdfs:label "Elbe"@de .
    ?s wdt:P402 ?osm_id ;
       wdt:P31 wd:Q4022 .
  }
  BIND(iri(concat("https://nominatim.openstreetmap.org/lookup?osm_ids=R",
    ?osm_id, "&polygon_text=1&polygon_threshold=0.01&format=jsonv2")) AS ?site) .
  ?site url:text ?raw_result .
  BIND(strdt(?raw_result, xsd:json) AS ?json_result) .
  BIND(strdt(json:path(?json_result, "$[0].geotext"), geo:wktLiteral) AS ?geom) .
}
```

ble [☰ Response](#) [🖼️ Gallery](#) [📊 Chart](#) [📍 Geo](#) [🌐 Geo-3D](#) [📍 Geo events](#) [📄 Markup](#) [🌐 Network](#) [📄 Pivot](#) [☰ Timeline](#) 1 result in 0.999 seconds

[Normal](#) [Grouped](#) [Heatmap](#)

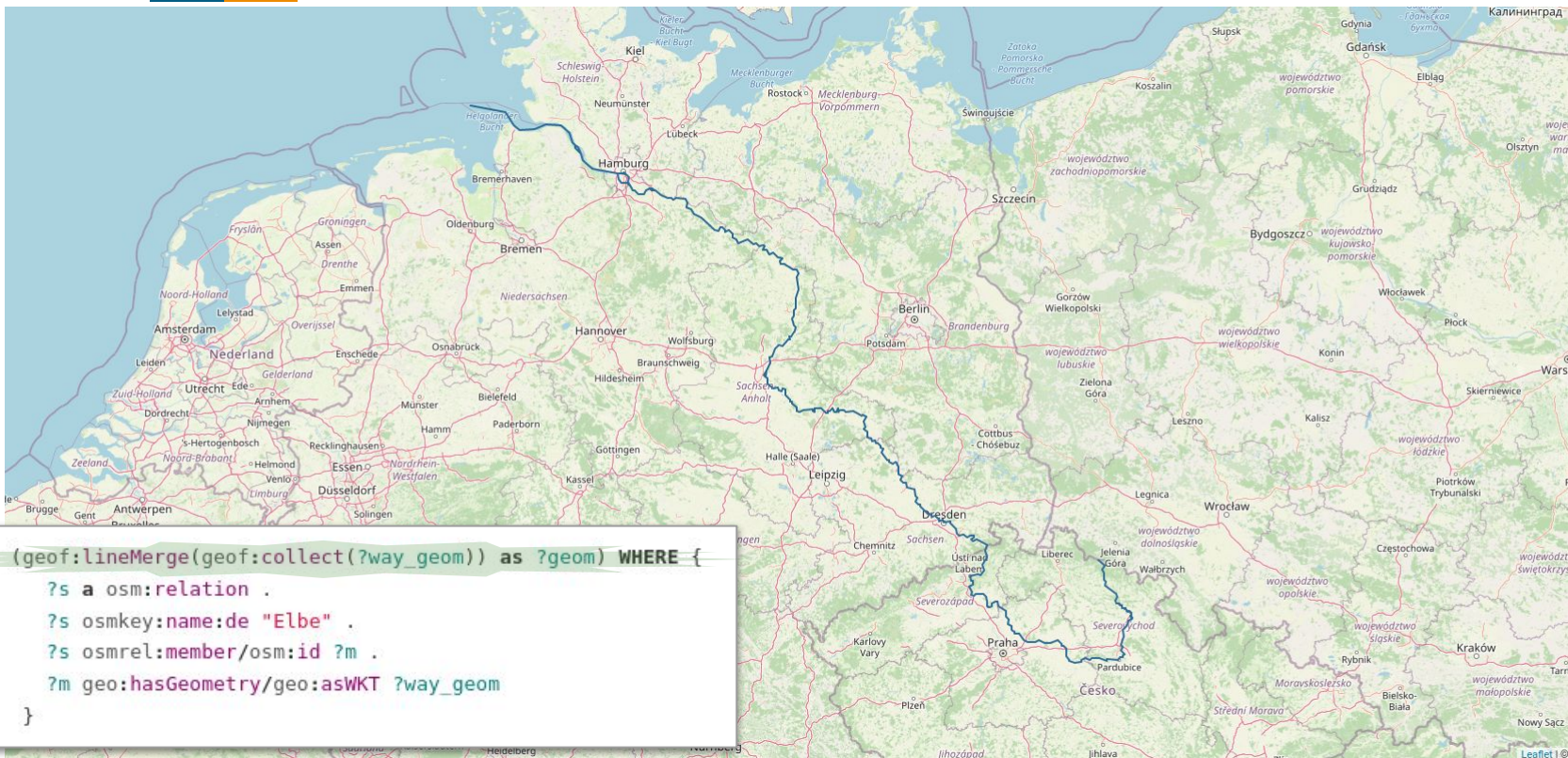




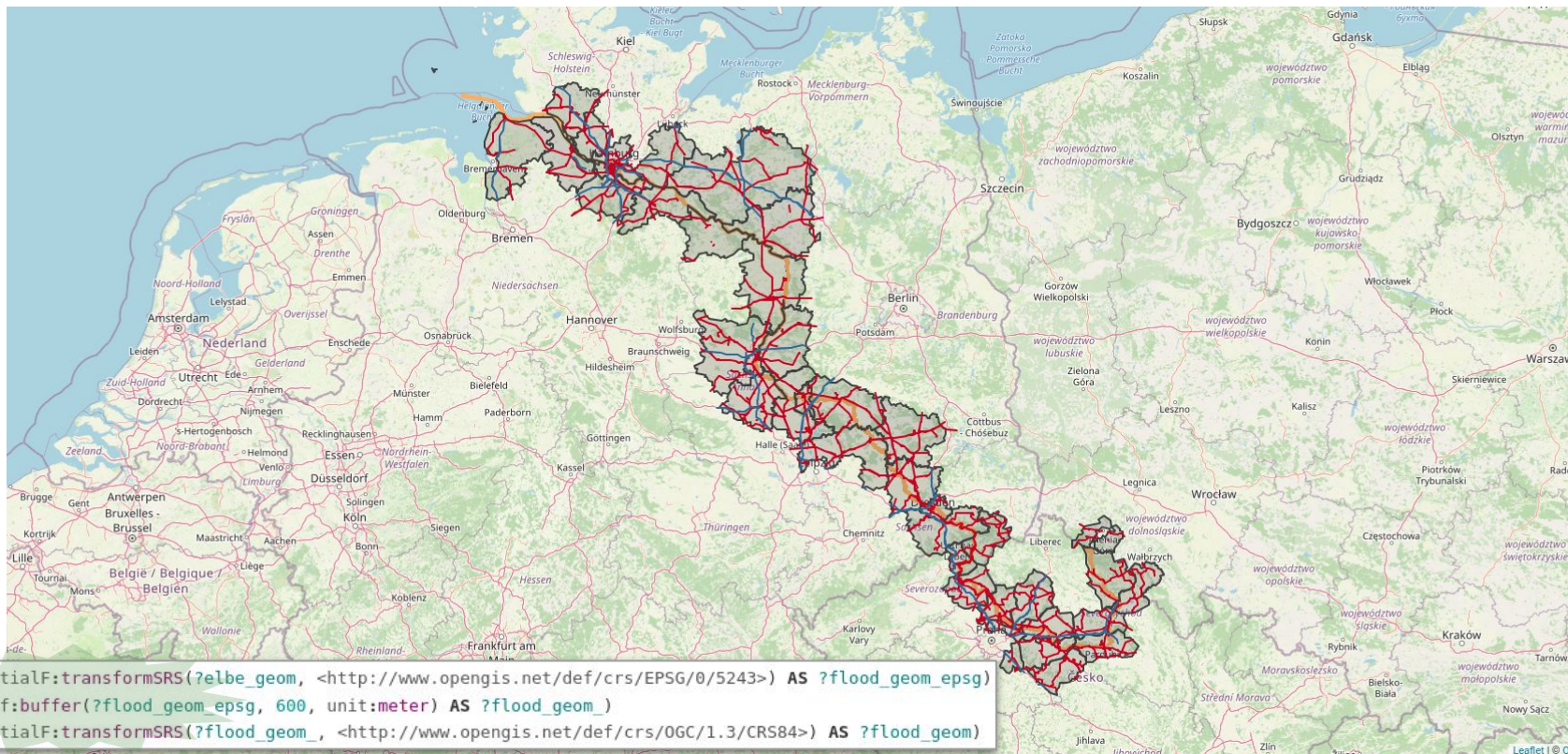
```
<node id="831225088" lat="48.002756" lon="7.848349"/>
<node id="831224996" lat="48.0026865" lon="7.848733"/>
<node id="1061500830" lat="48.0025018" lon="7.8482462"/>
[...]
<way id="69367089">
<nd ref="831225088"/>
<nd ref="831224996"/>
[...]
<nd ref="1061500830"/>
<nd ref="831225088"/>
<tag k="name" v="Mensa Institutsviertel"/>
<tag k="building" v="university"/>
```

```
osmway:69367089 geo:hasGeometry [a geo:Geometry ; geo:asWKT "MULTIPOLYGON(...)"^^geo:wktLiteral ] ;
osmkey:name "Mensa Institutsviertel" ;
osmkey:building "university" .
osmway:91332395 geo:hasGeometry [a geo:Geometry ; geo:asWKT "MULTIPOLYGON(...)"^^geo:wktLiteral ] ;
osmkey:name "Rechenzentrum" ;
osmkey:building "university" .
```

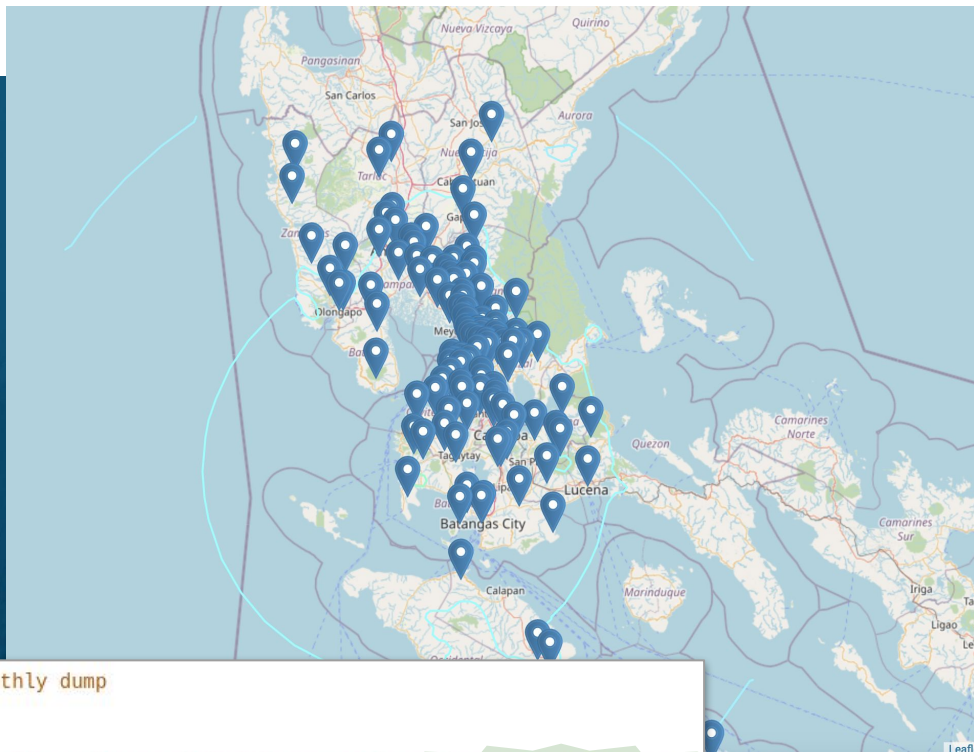
② Mapping OSM data to RDF (direct mapping)



② Assemble river from Openstreetmap relation



Elbe river with transport & adm regions



```
# get n significant earthquakes from latest monthly dump
{
  select ?event_json {
    <https://earthquake.usgs.gov/earthquakes/feed/v1.0/summary/significant_month.geojson> url:text ?txt .
    BIND(strdt(?txt, xsd:json) as ?json)
    BIND(json:path(?json, "$.features") as ?features)
    ?features json:unnest (?event_json) .
  } limit 20
}
```

Earthquake regions with nearby companies


```

CONSTRUCT {
  ?s
    a coy:Port ;
    coy:hasLocation ?country ;
    ports:hasLocode ?locode ;
    rdfs:label ?portname ;
    geo:hasGeometry ?geoNode ;
  .
  ?geoNode
    a geo:Geometry ;
    geo:asGML ?geoLitGml ;
}

```

```

WHERE
{
  BIND(xml:parse(<env://INPUT>) AS ?xml1) .
  ?xml1 xml:unnest ("/*[local-name()='FeatureCollection']/*[local-name()='member']/*" ?item) .
  BIND(xml:path(?item, "/*@gml:id") AS ?id) .
  BIND(afn:print(concat("Currently processing: ", str(?id))) as ?log_message_1) .
  BIND(iri(concat(str(ns:), ?id)) AS ?s) .
  BIND(xml:path(?item, "/*/geonode:portname/text()") AS ?portname) .
  BIND(xml:path(?item, "/*/geonode:code/text()") AS ?locode) .
  BIND(xml:path(?item, "/*/geonode:iso3/text()") AS ?iso3_) .
  BIND(iri(concat(str(country:), ?iso3_)) AS ?country) .
  BIND(xml:path(?item, "/*/*/*[namespace-uri()='http://www.opengis.net/gml/3.2']") AS ?geo_) .
  BIND(strdt(?geo_, geo:gmlLiteral) AS ?geoLitGml) .
  BIND(iri(concat(str(ns:), ?id, "/geometry")) AS ?geoNode) .
}

```

```

<?xml version="1.0" encoding="UTF-8"?>
<wfs:FeatureCollection xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:wfs="http://www.opengis.net/wfs" >
  <wfs:member>
    <geonode:wld_trs_ports_wfp gml:id="wld_trs_ports_wfp.14315">
      <geonode:portname>Charlotte (Ski degate)</geonode:portname>
      <geonode:code>CASKI</geonode:code>
      <geonode:iso3>CAN</geonode:iso3>
      <geonode:geonameid>6148858</geonode:geonameid>
      <geonode:shape>
        <gml:Point srsName="urn:ogc:def:crs:EPSG::4326" srsDimension="2" gml:id="wld_trs_ports_wfp.14315.1">
          <gml:pos>53.24742403 -132.00969253</gml:pos>
        </gml:Point>
      </geonode:shape>
    </geonode:wld_trs_ports_wfp>
  </wfs:member>
</wfs:FeatureCollection>

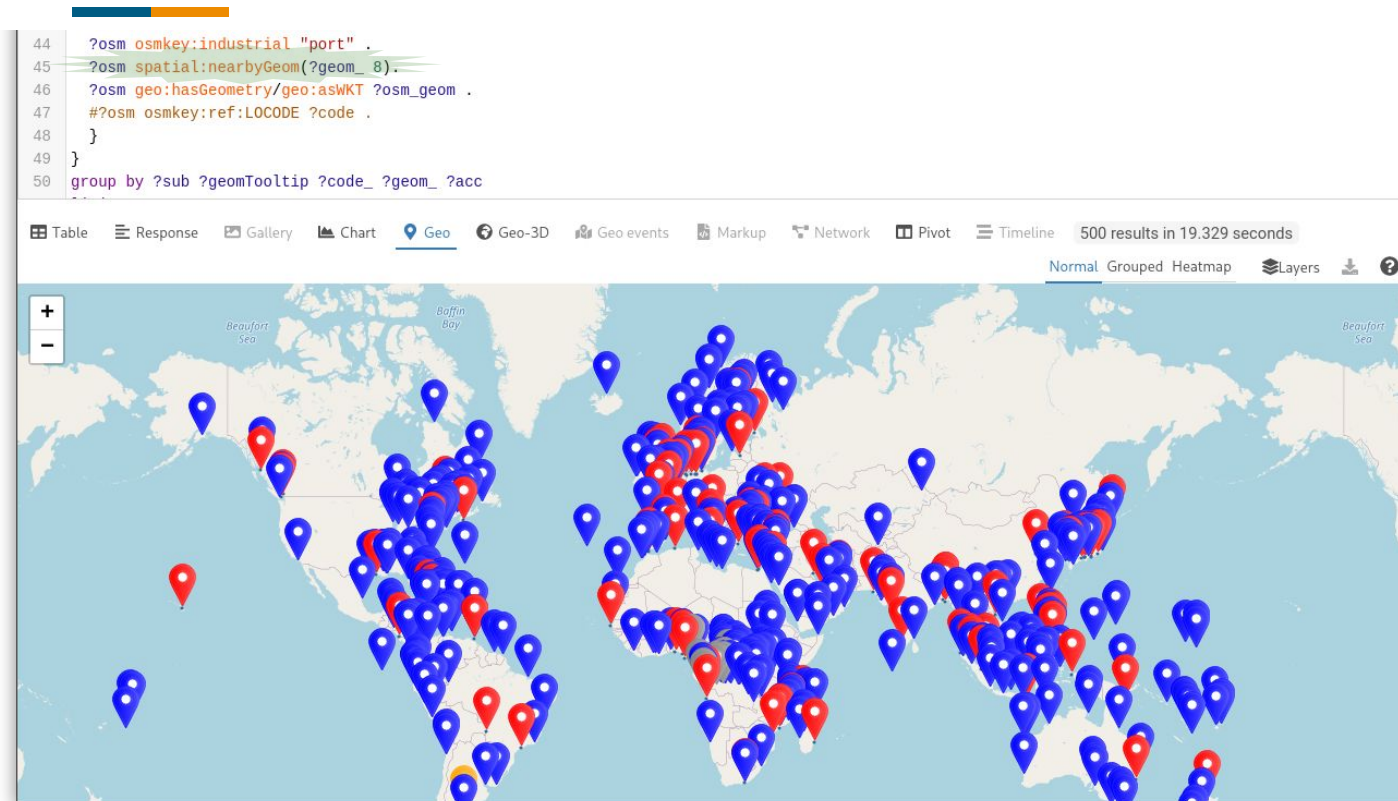
```

```

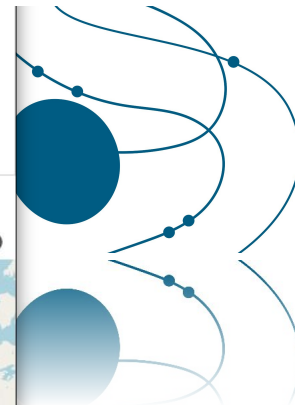
<https://data.coypu.org/wfp-ports/wld_trs_ports_wfp.14318>
  rdf:type      coy:Port ;
  rdfs:label    "Killingholme" ;
  geo:hasGeometry [
    a geo:Geometry ;
    geo:asWKT   "POINT(-0.21511851 53.64560882)"^^geo:wktLiteral ] ;
  owl:sameAs  <https://data.coypu.org/wfp-ports/locode/GBKGH> ;
  ports:hasGeonamesId <http://sws.geonames.org/2641323/> ;
  ports:hasLocationPrecision "accurate" ;
  ports:hasOperatingCountry <https://data.coypu.org/country/GBR> .

```

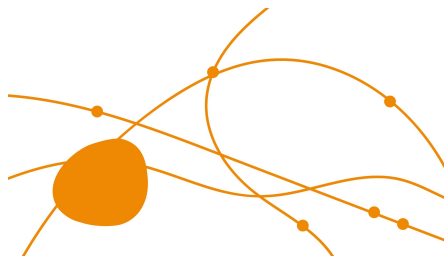
Mapping GML data to RDF



Comparing water ports in **OSM** & **WFP DB**



Pitfalls



Wrong namespace used in GML

```
<gml:Point
  srsName=\"http://www.opengis.net/def/crs/OGC/1.3/CRS84\"
-  xmlns:gml=\"http://www.opengis.net/ont/gml\">
+  xmlns:gml=\"http://www.opengis.net/gml/3.2\">
  <gml:pos>-83.38 33.95</gml:pos>
</gml:Point>
```

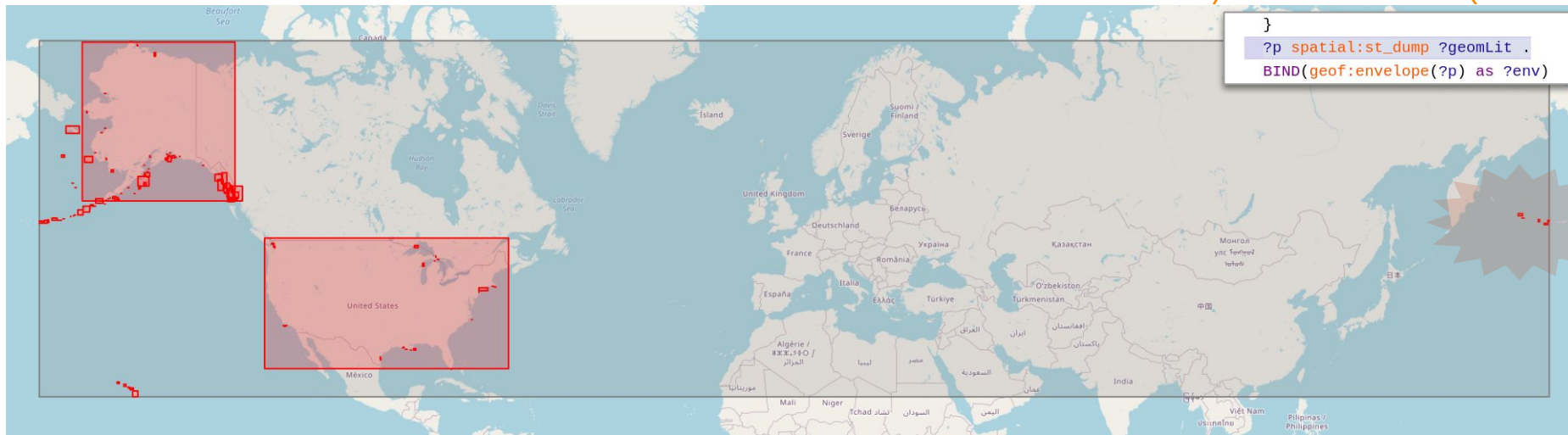
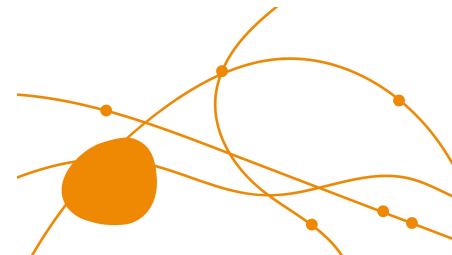
srsName silently unsupported

```
-(CURL) -o $@
'https://geonode.wfp.org/geoserver
/wfs?srsName=EPSG%3A4326&
typename=geonode%3Awld_trs_ports_wfp&
outputFormat=gml32&version=1.0.0&
service=WFS&request=GetFeature&hdx=hdx'
+(CURL) -o $@
'https://geonode.wfp.org/geoserver
/wfs?typename=geonode%3Awld_trs_ports_wfp
&outputFormat=gml32&version=1.1.0&
service=WFS&request=GetFeature&hdx=hdx'
```

XML data too huge



Performance issue finding all companies in the USA

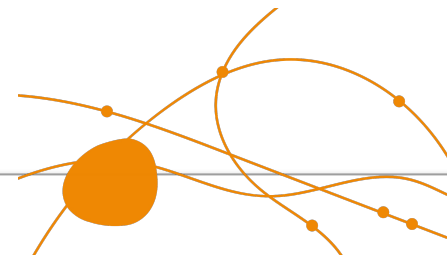


Pitfalls

Pitfalls

Too many power lines

```
SELECT * WHERE
{
  GRAPH <http://data.coypu.org/osm/infrastructure/power/lines> {
    ?line a osm:way ;
    geo:hasGeometry/geo:asWKT ?geom .
    ?line osmkey:voltage ?voltage .
    # get length here
    BIND(geof:length(spatialF:transformSRS(?infra_geom, <http://www.opengis.net/def/crs/EPSG/0/5243>))
         as ?length)
    FILTER(xsd:integer(?voltage) > 200000)
    FILTER(xsd:integer(?length) > 600)
  }
} LIMIT 10
```



Contributions

Jena

<https://jena.apache.org/>

- Batch Services
- GeoSPARQL speed up & fixes
- GeoJSON export
- Compressed loading fixes
- JSON streaming ...

JenaX

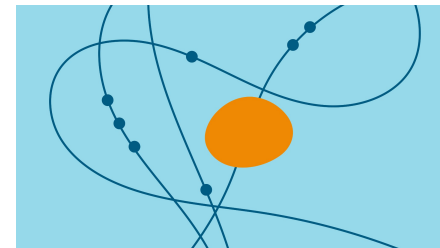
<https://github.com/Scaseco/jenax>

- Remote API queries
- Extended GeoSPARQL support: collect, union, lineMerge, GeoJSON reader, simplify, lat, lon, centroid, ...
- JSON, CSV, XML, Array parsing, ...

RDF Processing Toolkit

<https://github.com/SmartDataAnalytics/RdfProcessingToolkit>

- mapping execution
- In memory graph models
- Pipelines configurable with environment variables



- Bearer auth proxy
- Plotly + SPARQL + GeoJson



Weitere Informationen

<https://coypu.org/>

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