Poizvedovanje nad semantično opisanimi podatki - SPARQL

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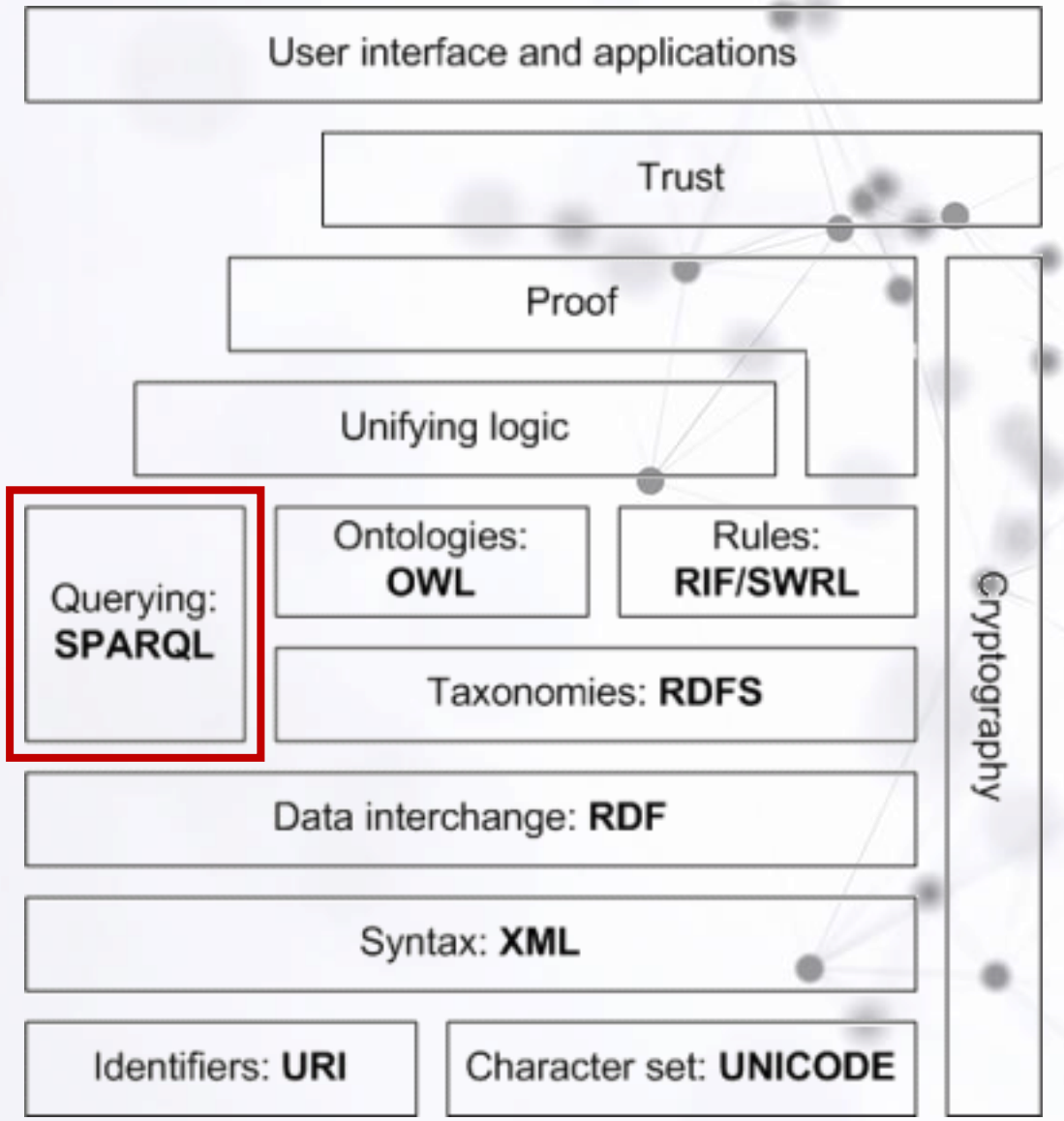
Delavnica MDP, 12.2.2026

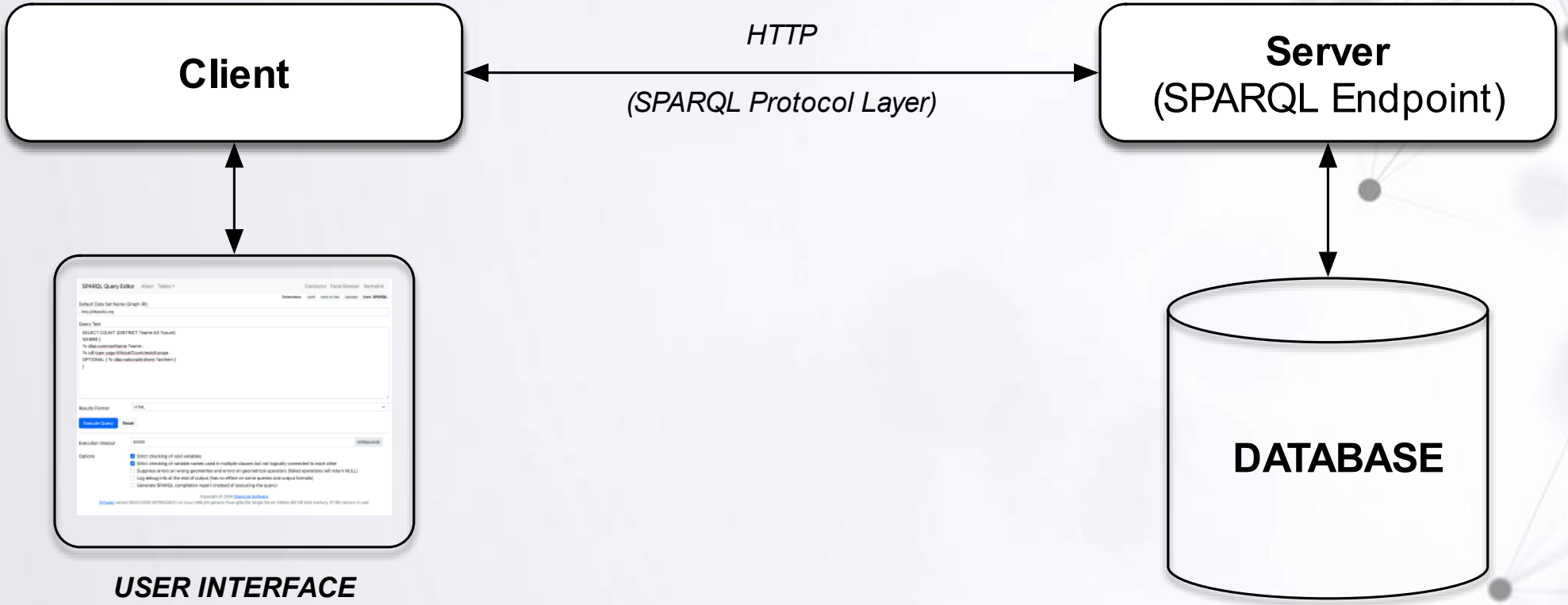
Semantic Web Stack

SPARQL 1.0 (2008)

SPARQL 1.1 (2013)



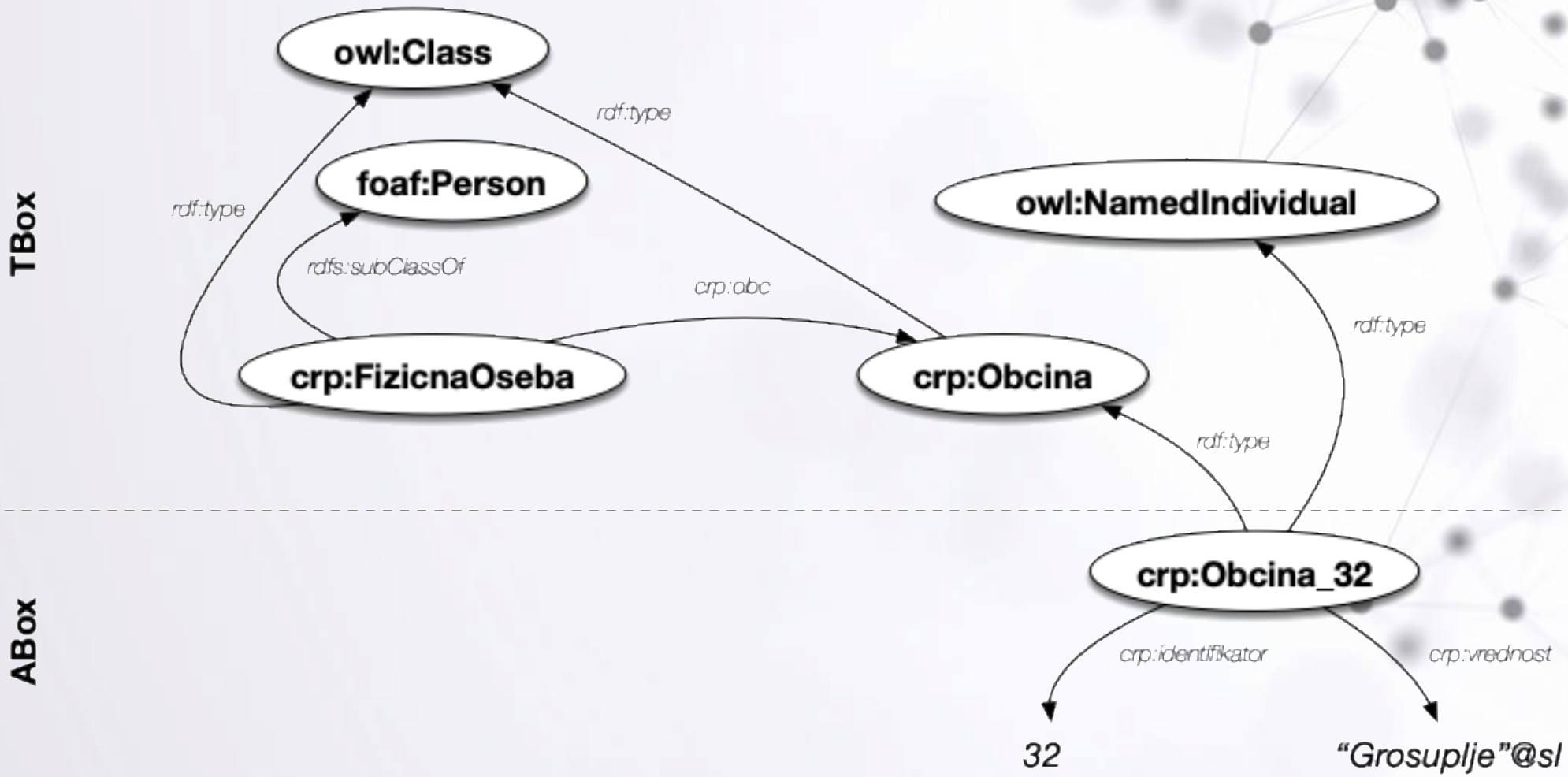
SPARQL


Client
HTTP
(SPARQL Protocol Layer)
Server
(SPARQL Endpoint)
DATABASE
USER INTERFACE

Predstavitev CRP kot graf

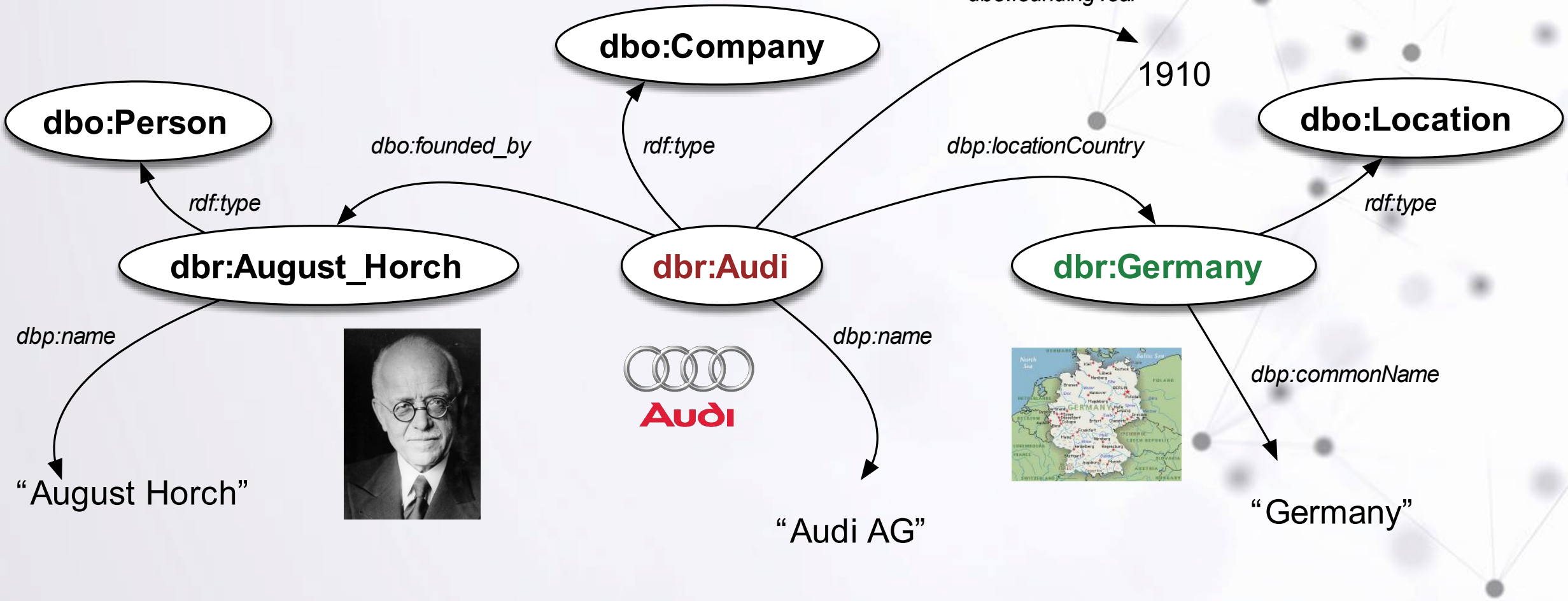
```
###  https://pzsi.sigov.si/datamodel/ns/crp#obc
:obc rdf:type owl:ObjectProperty ;
     rdfs:domain cnb:FizicnaOseba ;
     rdfs:range :Obcina .
```

Širša predstavitev CRP v okolici specifičnega objekta



Primer iz javnega grafa - DBPedia

Audi is an automaker that makes luxury cars and SUVs. **The company** was born in **Germany** and was established by **August Horch** in 1910.



SPARQL

SPARQL Query Editor About Tables Conductor Facet Browser Permalink

Extensions: cxml save to dav sponge User: SPARQL

Default Data Set Name (Graph IRI)

http://dbpedia.org

Query Text

```
SELECT COUNT (DISTINCT ?name AS ?count)
WHERE {
?c dbp:commonName ?name .
?c rdf:type yago:WikicatCountriesInEurope .
OPTIONAL { ?c dbp:nationalAnthem ?anthem }
}
```

Results Format HTML

Execute Query Reset

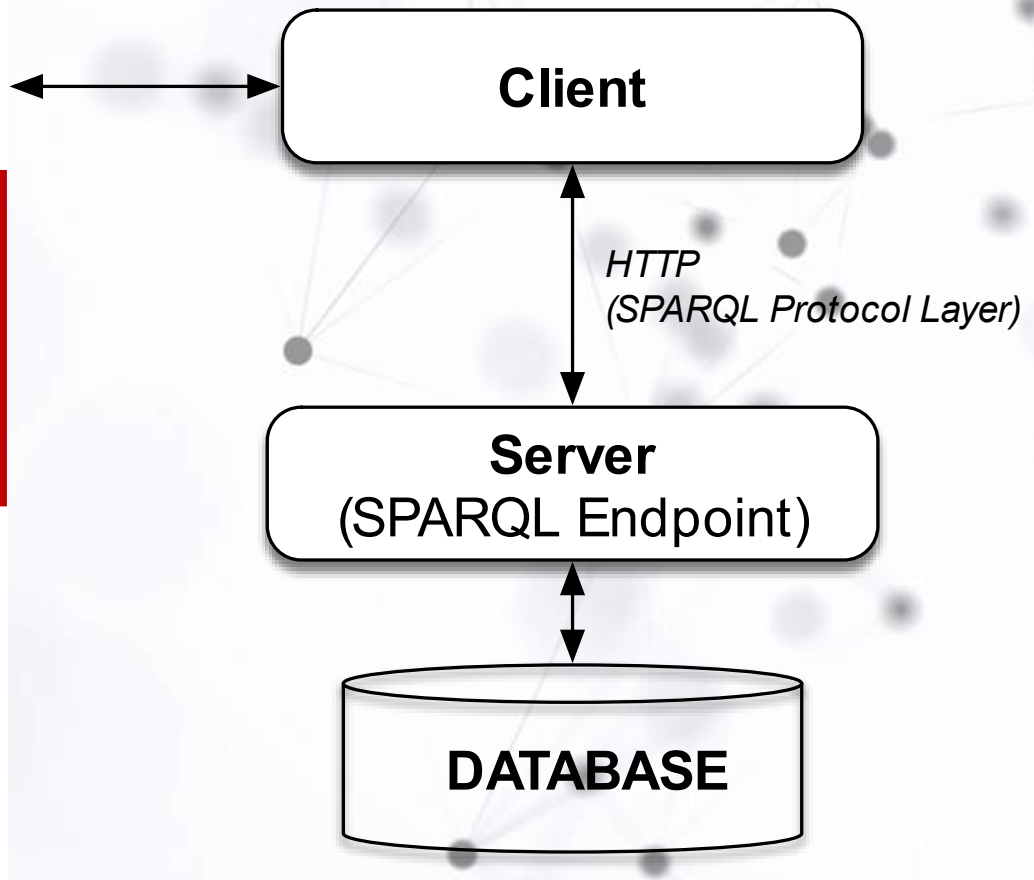
Execution timeout 30000 milliseconds

Options

- [x] Strict checking of void variables
- [x] Strict checking of variable names used in multiple clauses but not logically connected to each other
- [ ] Suppress errors on wrong geometries and errors on geometrical operators (failed operations will return NULL)
- [ ] Log debug info at the end of output (has no effect on some queries and output formats)
- [ ] Generate SPARQL compilation report (instead of executing the query)

Virtuoso version 08.03.3329 (42780c0b7c) on Linux (x86_64-generic-linux-glibc25) Single Server Edition (62 GB total memory, 41 GB memory in use)

USER INTERFACE



https://dbpedia.org/sparql

Ujemanje vzorcev

SPARQL
- Ujemanje trojčkov – format Turtle
- osnovno ujemanje (s spremenljivkami)

Primer

```
?subject dbp:name ?object .
```

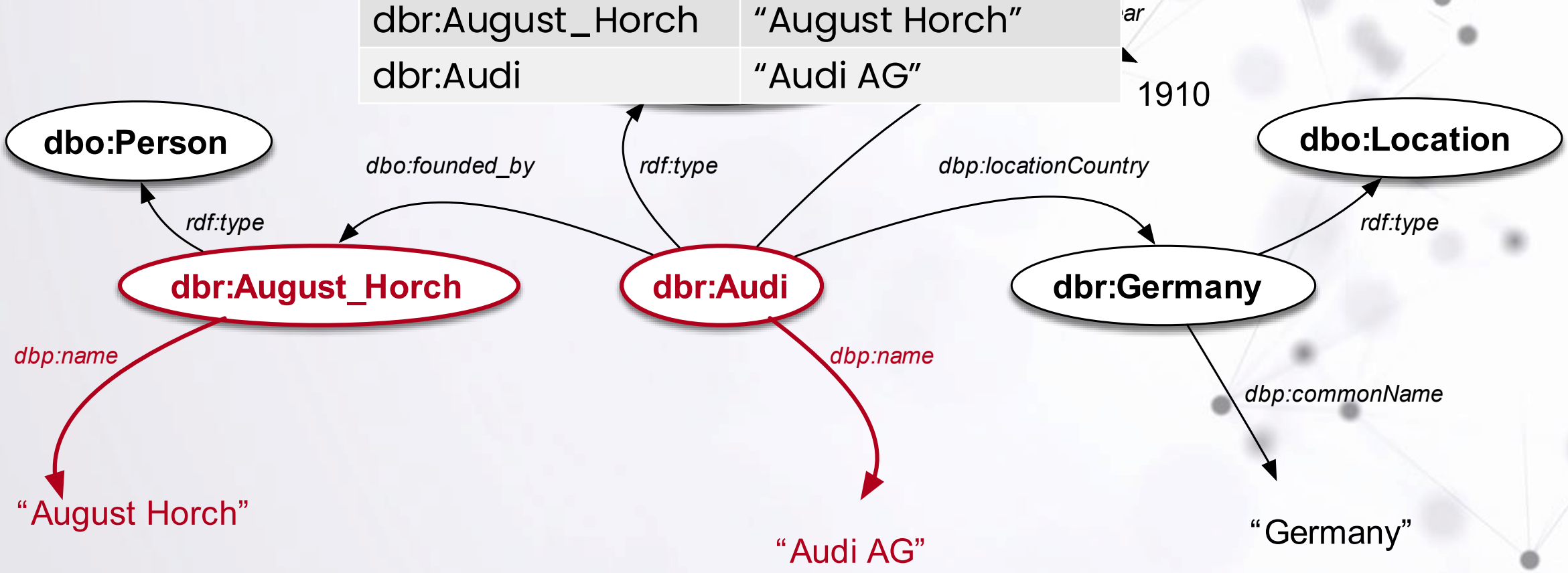
?subject	?object
dbr:August_Horch	“August Horch”
dbr:Audi	“Audi AG”

Ujemanje vzorcev

Primer

```
?subject dbp:name ?object .
```

?subject	?object
dbr:August_Horch	“August Horch”
dbr:Audi	“Audi AG”

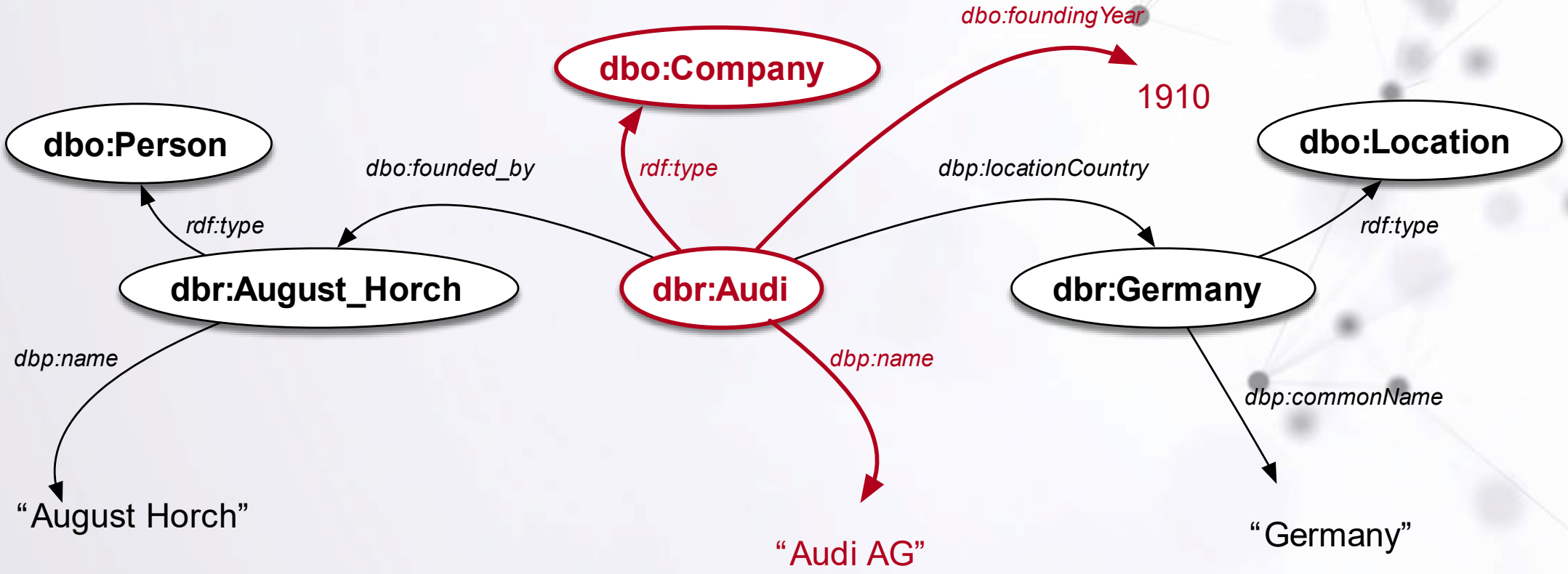


Konjunkcija posameznih vzorcev

?subject	?name	?foundingYear
dbr:Audi	“Audi AG”	1910

Primer

```
?subject dbp:name ?name .
?subject rdf:type dbo:Company .
?subject dbo:foundingYear ?foundingYear .
```



Poizvedba SPARQL

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?name ?foundingYear

FROM <http://dbpedia.org/>

WHERE {
      ?subject dbp:name ?name .
      ?subject rdf:type dbo:Company .
      ?subject dbo:foundingYear ?foundingYear .
}
```

Poizvedba SPARQL

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PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
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FROM <http://dbpedia.org/>

WHERE {
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      ?subject rdf:type dbo:Company .
      ?subject dbo:foundingYear ?foundingYear .
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PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?name ?foundingYear

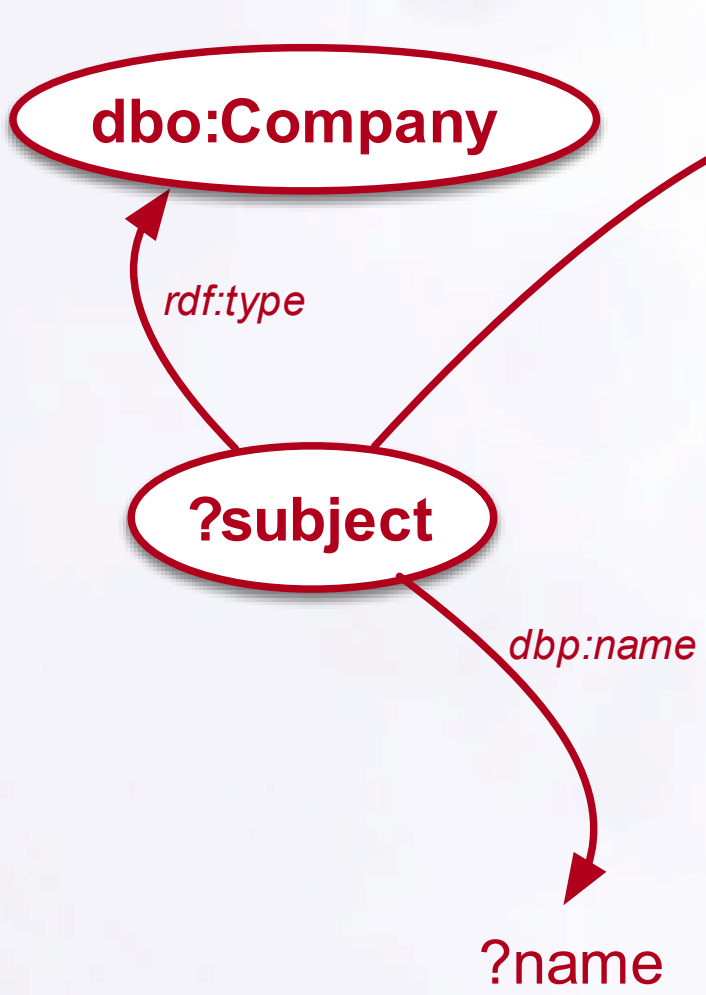
FROM <http://dbpedia.org/>

WHERE {
      ?subject dbp:name ?name .
      ?subject rdf:type dbo:Company .
      ?subject dbo:foundingYear ?foundingYear .
}
```

Poizvedba SPARQL (DBPedia)

DBPedia storitev SPARQL: https://dbpedia.org/sparql

DBPedia
- 900 million dejstev
- 400.000 organizacij



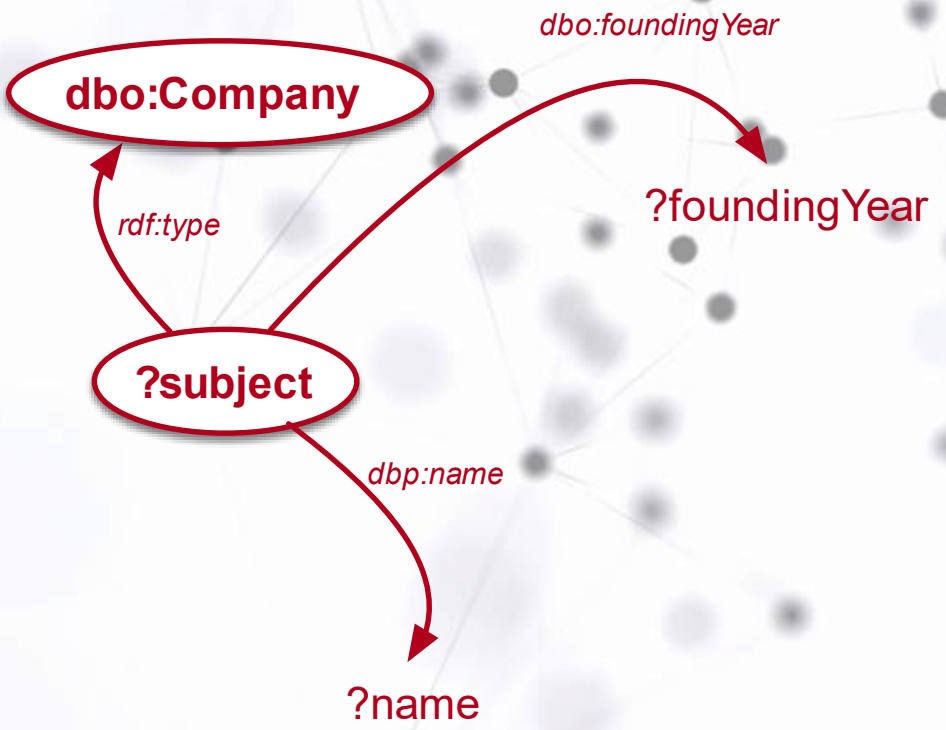
Poizvedba SPARQL – ORDER, LIMIT

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?name ?foundingYear

FROM <http://dbpedia.org/>

WHERE {
      ?subject dbp:name ?name .
      ?subject rdf:type dbo:Company .
      ?subject dbo:foundingYear ?foundingYear .
}
ORDER BY ASC (?name)
LIMIT 100
```



Poizvedba SPARQL – OFFSET

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?name ?foundingYear

FROM <http://dbpedia.org/>

WHERE {
      ?subject dbp:name ?name .
      ?subject rdf:type dbo:Company .
      ?subject dbo:foundingYear ?foundingYear .
}
ORDER BY ASC (?name)
LIMIT 100
OFFSET 14800
```

Poizvedba SPARQL – FILTER

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?name ?foundingYear

FROM <http://dbpedia.org/>

WHERE {
      ?subject dbp:name ?name .
      ?subject rdf:type dbo:Company .
      ?subject dbo:foundingYear ?foundingYear .
      FILTER (?subject IN (dbr:Audi))
}
LIMIT 100
```

Poizvedba SPARQL – FILTER REGEX

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?name ?foundingYear

FROM <http://dbpedia.org/>

WHERE {
      ?subject dbp:name ?name .
      ?subject rdf:type dbo:Company .
      ?subject dbo:foundingYear ?foundingYear .
      FILTER REGEX (?name, "^audi", "i")
}
LIMIT 100
```

Poizvedba SPARQL – OPTIONAL

https://dbpedia.org/ontology/Company

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?name ?foundingYear ?tradingName

FROM <http://dbpedia.org/>

WHERE {
      ?subject dbp:name ?name .
      ?subject rdf:type dbo:Company .
      ?subject dbo:foundingYear ?foundingYear .
      ?subject dbo:tradingName ?tradingName .
      FILTER REGEX (?name, "^audi", "i")
}
LIMIT 100
```

Poizvedba SPARQL – OPTIONAL

https://dbpedia.org/ontology/Company

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?name ?foundingYear ?tradingName

FROM <http://dbpedia.org/>

WHERE {
      ?subject dbp:name ?name .
      ?subject rdf:type dbo:Company .
      ?subject dbo:foundingYear ?foundingYear .
      OPTIONAL {?subject dbo:tradingName ?tradingName .}
      FILTER REGEX (?name, "^audi", "i")
}
LIMIT 100
```

Poizvedba SPARQL

https://dbpedia.org/page/Audi

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?carCompanyName

FROM <http://dbpedia.org/>

WHERE {
    ?carCompany rdfs:label ?carCompanyName .
    ?carCompany dbo:industry dbr:Automotive_industry .
    ?carCompany dbp:locationCountry dbr:Germany .
    FILTER (LANG(?carCompanyName)="en")
}
```

Poizvedba SPARQL

https://dbpedia.org/page/Audi

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?carCompanyName

FROM <http://dbpedia.org/>

WHERE {
    ?carCompany rdfs:label ?carCompanyName .
    ?carCompany dbo:industry dbr:Automotive_industry .
    ?carCompany dbp:locationCountry dbr:Germany .
    FILTER (LANG(?carCompanyName)="en")
}
```

Poizvedba SPARQL - UNION

https://dbpedia.org/page/Audi

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?carCompanyName

FROM <http://dbpedia.org/>

WHERE {
    ?carCompany rdfs:label ?carCompanyName .
    ?carCompany dbo:industry dbr:Automotive_industry .
    { ?carCompany dbp:locationCountry dbr:Germany . }
    UNION
    { ?carCompany dbp:locationCountry dbr:Slovenia . }
    FILTER (LANG(?carCompanyName)="en")
}
```

Poizvedba SPARQL

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?carCompanyName ?countryName

WHERE {
    ?carCompany rdfs:label ?carCompanyName .
    ?carCompany dbo:industry dbr:Automotive_industry .
    ?carCompany dbp:locationCountry ?country .
    ?country rdfs:label ?countryName .
    FILTER (LANG(?carCompanyName)="en" AND
            LANG(?countryName)="en")
}
```

Poizvedba SPARQL – Agregatne funkcije

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?carCompanyName ?countryName

WHERE {
    ?carCompany rdfs:label ?carCompanyName .
    ?carCompany dbo:industry dbr:Automotive_industry .
    ?carCompany dbp:locationCountry ?country .
    ?country rdfs:label ?countryName .
    FILTER (LANG(?carCompanyName)="en" AND
            LANG(?countryName)="en")
}
```

Poizvedba SPARQL – Agregatne funkcije

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT (COUNT(DISTINCT ?carCompanyName) AS ?carCompanyNameCount)

WHERE {
    ?carCompany rdfs:label ?carCompanyName .
    ?carCompany dbo:industry dbr:Automotive_industry .
    ?carCompany dbp:locationCountry ?country .
    ?country rdfs:label ?countryName .
    FILTER (LANG(?carCompanyName)="en" AND
            LANG(?countryName)="en")
}
```

Poizvedba SPARQL – GROUP BY

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?countryName (COUNT(DISTINCT ?carCompanyName) AS
?carCompanyNameCount)

WHERE {
    ?carCompany rdfs:label ?carCompanyName .
    ?carCompany dbo:industry dbr:Automotive_industry .
    ?carCompany dbp:locationCountry ?country .
    ?country rdfs:label ?countryName .
    FILTER (LANG(?carCompanyName)="en" AND
            LANG(?countryName)="en")
}
GROUP BY ?countryName
ORDER BY DESC (?carCompanyNameCount)
```

Poizvedba SPARQL – GROUP CONCAT

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?countryName (COUNT(DISTINCT ?carCompanyName) AS ?carCompanyNameCount)
(GROUP_CONCAT(?carCompanyName) as ?carCompanyNames)

WHERE {
    ?carCompany rdfs:label ?carCompanyName .
    ?carCompany dbo: industry dbr:Automotive_industry .
    ?carCompany dbp:locationCountry ?country .
    ?country rdfs:label ?countryName .
    FILTER (LANG(?carCompanyName)="en" AND
            LANG(?countryName)="en")
}
GROUP BY ?countryName
ORDER BY DESC (?carCompanyNameCount)
```

Poizvedba SPARQL – HAVING

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dbp: <http://dbpedia.org/property/>
PREFIX dbo: <http://dbpedia.org/ontology/>

SELECT ?countryName (COUNT(DISTINCT ?carCompanyName) AS ?carCompanyNameCount)
(GROUP_CONCAT(?carCompanyName) as ?carCompanyNames)

WHERE {
    ?carCompany rdfs:label ?carCompanyName .
    ?carCompany dbo:industry dbr:Automotive_industry .
    ?carCompany dbp:locationCountry ?country .
    ?country rdfs:label ?countryName .
    FILTER (LANG(?carCompanyName)="en" AND
            LANG(?countryName)="en")
}
GROUP BY ?countryName
HAVING (COUNT(?carCompanyName) > 5)
ORDER BY DESC (?carCompanyNameCount)
```

SPARQL – ostale funkcionalnosti

SPARQL 1.1

- SELECT, CONSTRUCT, INSERT DATA, ASK, DESCRIBE
- Zahtevnejši vzorci

SHACL

SPARQL in Python

Glej datoteko `./assets/SPARQL_in_Python.ipynb`

Uporaba lastne baze s SPARQL

GraphDB

```
docker run -p 127.0.0.1:7200:7200 --name graphdb-instance-name-11 -t ontotext/graphdb:11.2.1
```

Federirane poizvedbe

Sklepanje: prehod od podatkov k znanju

Uporaba več podatkovnih virov in materializacija - SURS in CRP