

Poizvedovanje nad semantično opisanimi podatki - SPARQL

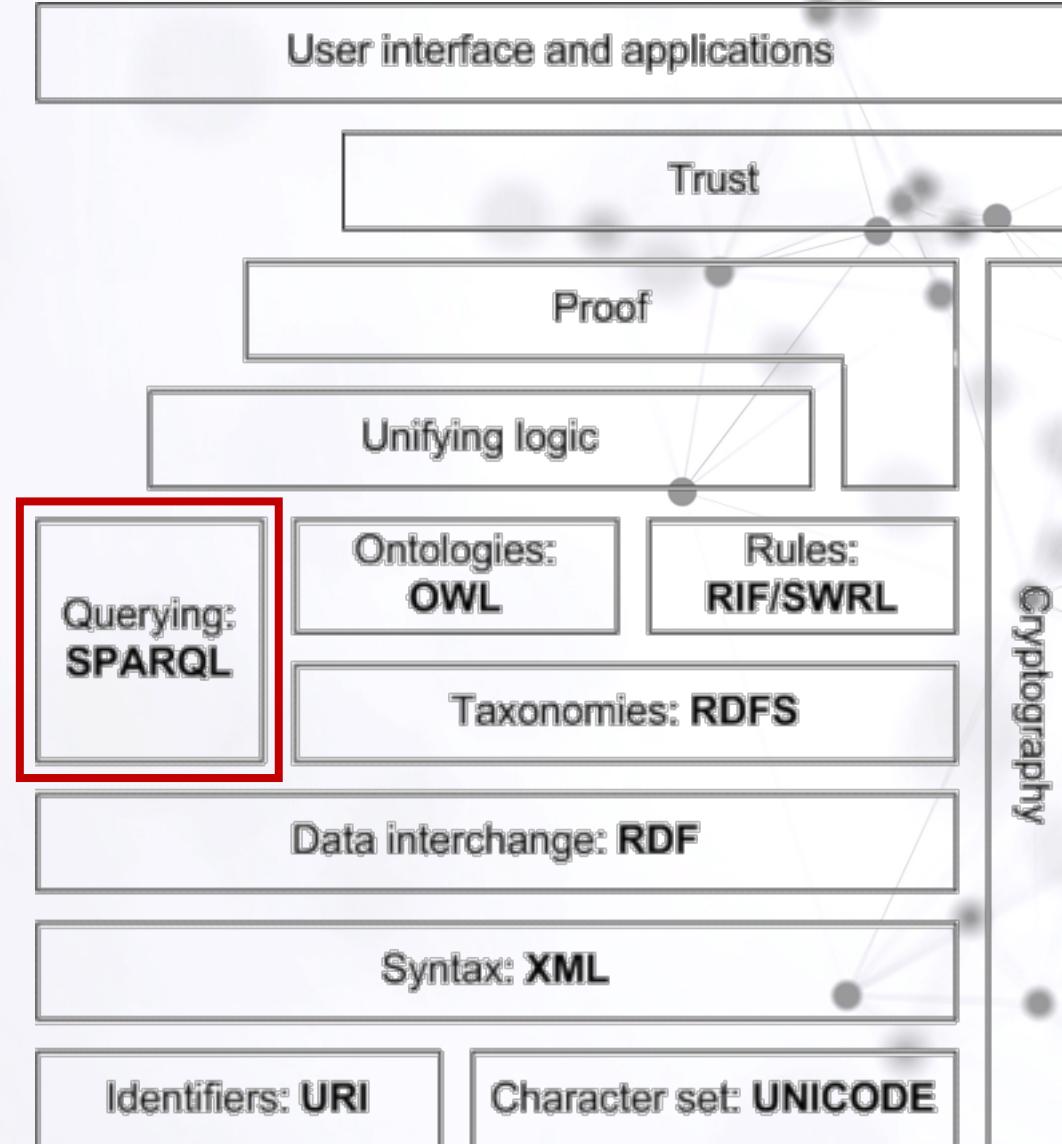
dr. Slavko Žitnik in dr. Dejan Lavbič

Delavnica MDP, 12.2.2026

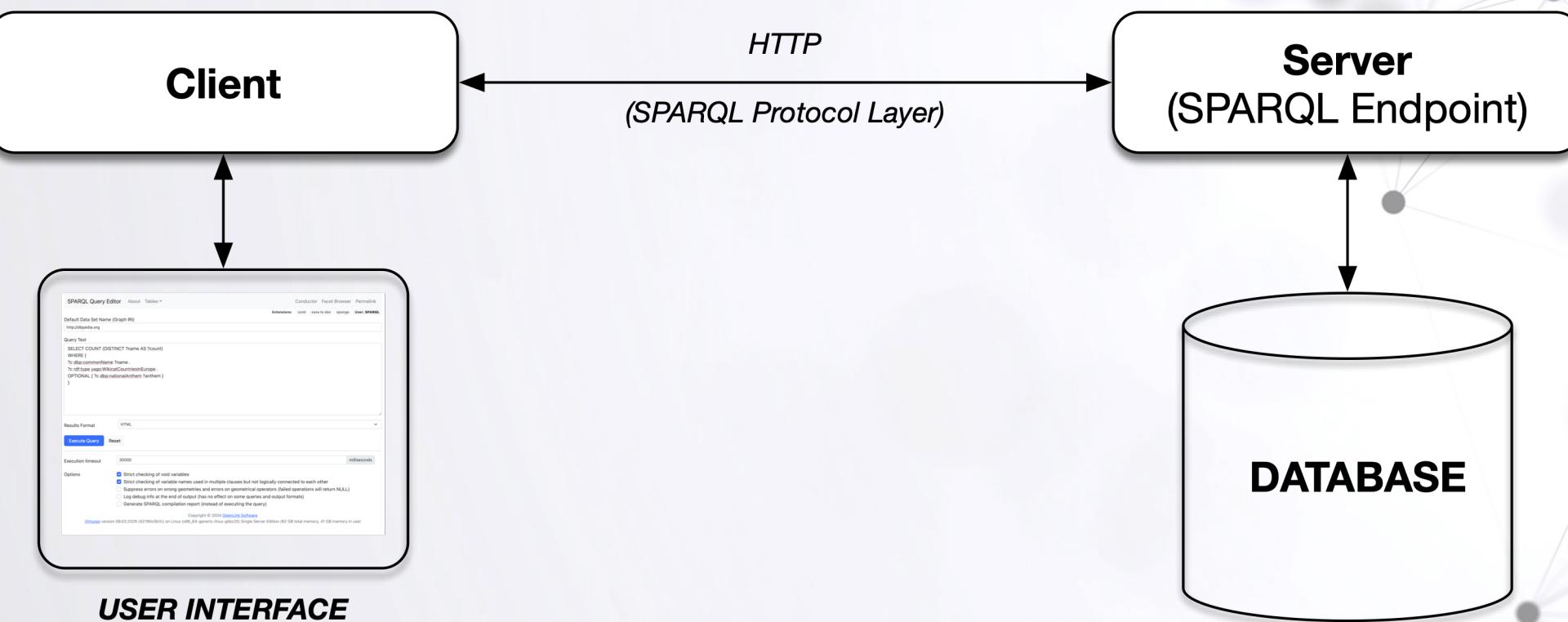
Semantic Web Stack

SPARQL 1.0 (2008)

SPARQL 1.1 (2013)

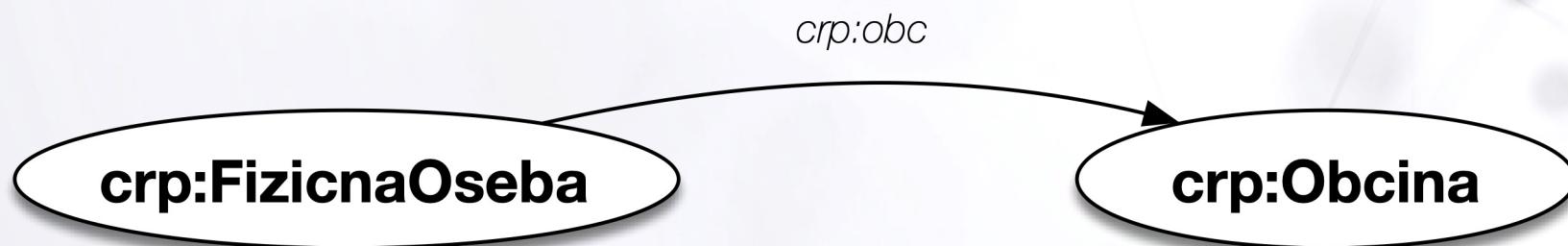


SPARQL



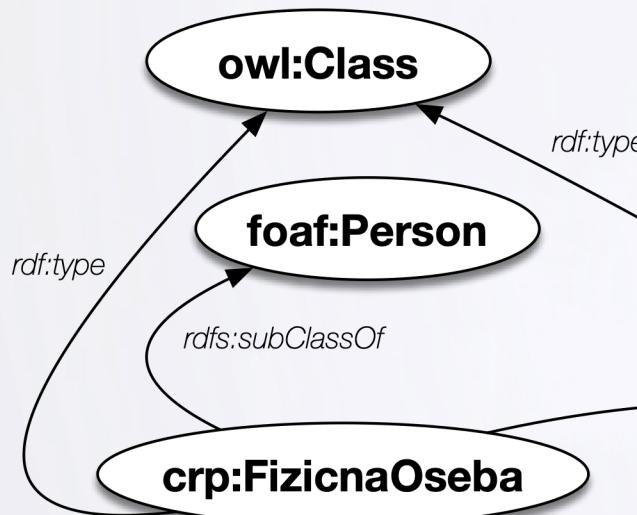
Predstavitev CRP kot graf

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



Širša predstavitev CRP v okolini specifičnega objekta

TBox



rdf:type

rdf:type

foaf:Person

crp:FizicnaOseba

owl:Class

crp:obc

owl:NamedIndividual

crp:Obcina

rdf:type

crp:Obcina_32

crp:identifikator

32

crp:vrednost

“Grosuplje”@sl

rdf:type

rdf:type

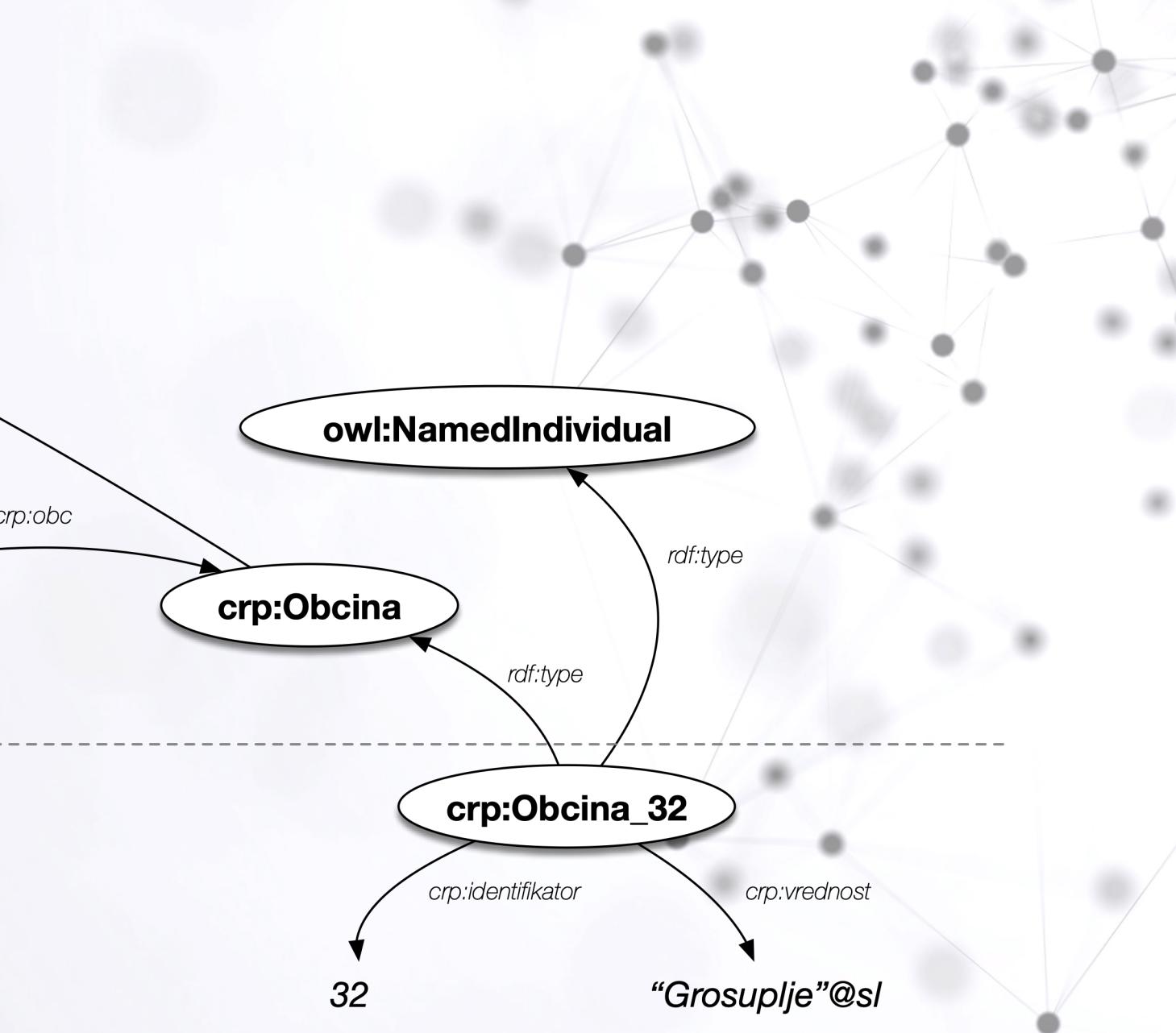
crp:Obcina

crp:identifikator

32

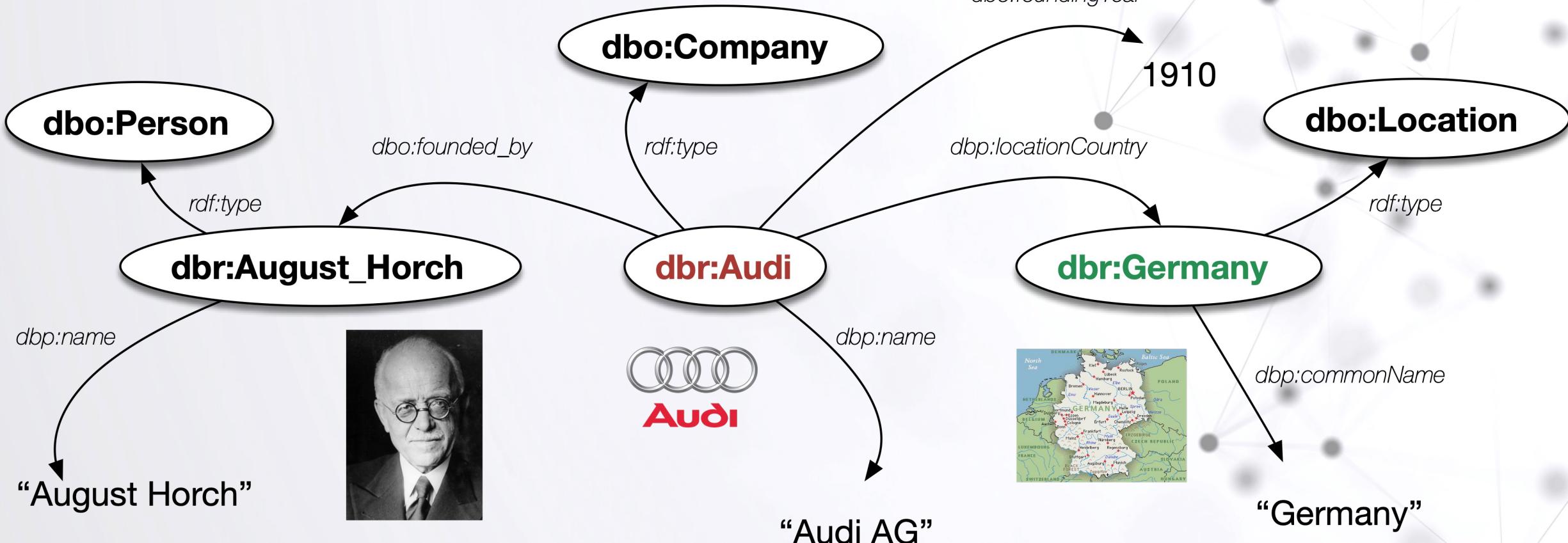
crp:vrednost

“Grosuplje”@sl



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

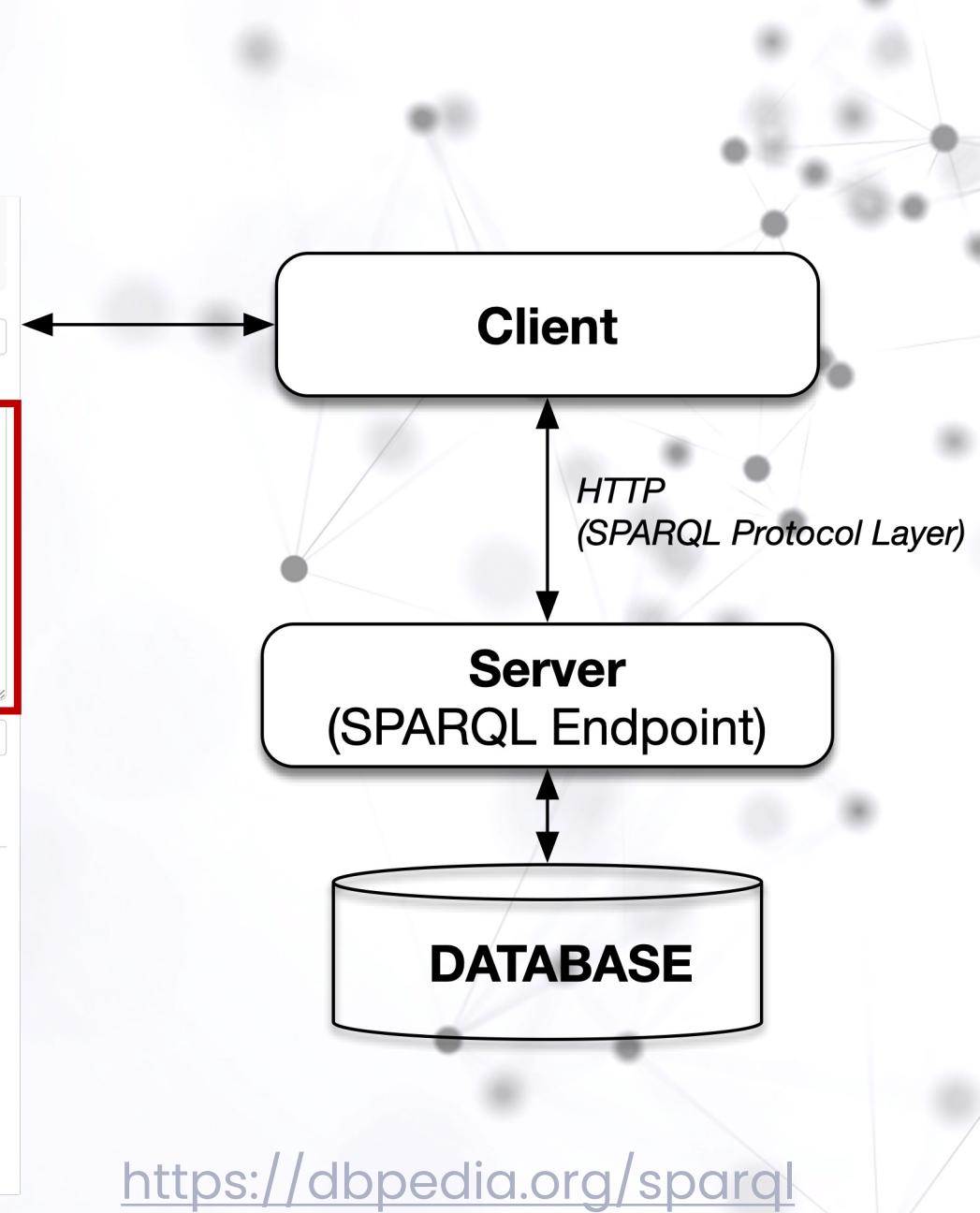
Execution timeout: 30000 milliseconds

Options

- Strict checking of void variables
- 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)

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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



Ujemanje vzorcev

SPARQL

Ujemanje trojčkov – format Turtle
osnovno ujemanje (s spremenljivkami)

Primer

?subject dbp:name ?object .

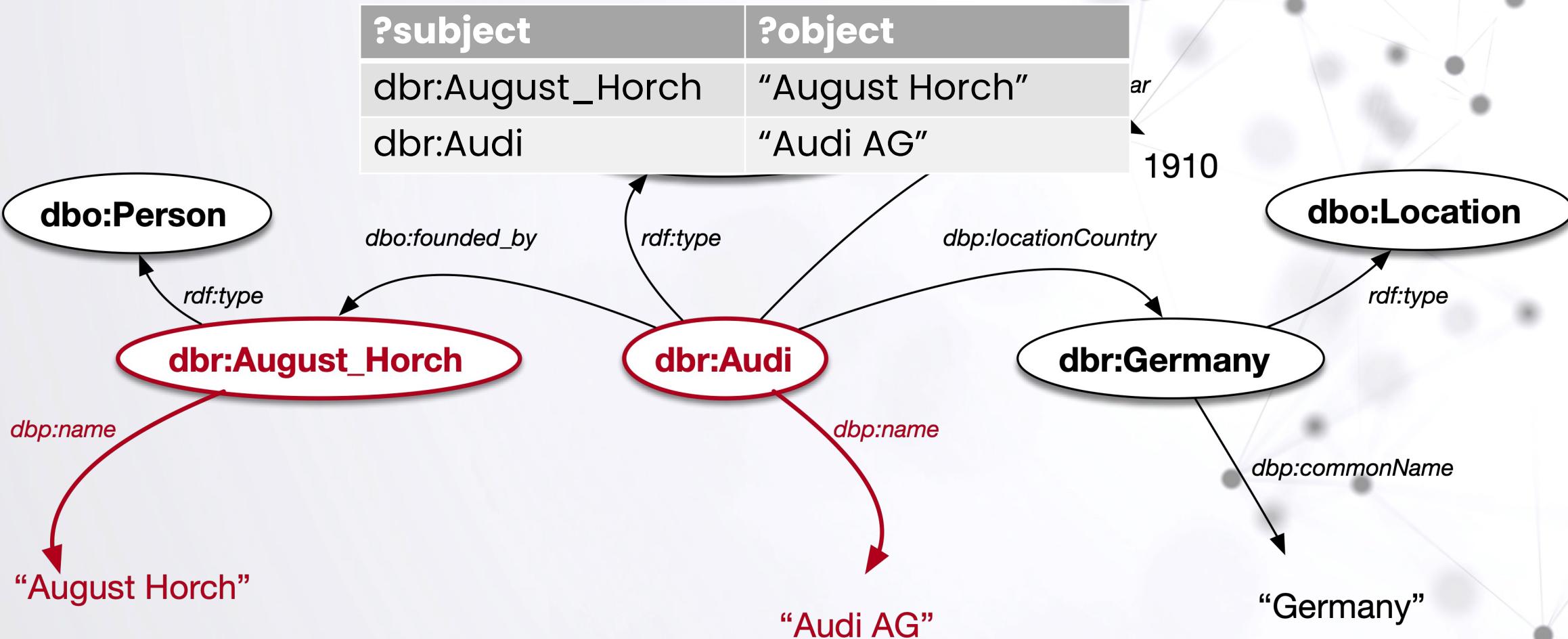
?subject	?object
dbr:August_Horch	"August Horch"
dbr:Audi	"Audi AG"



Ujemanje vzorcev

Primer

?subject dbp:name ?object .

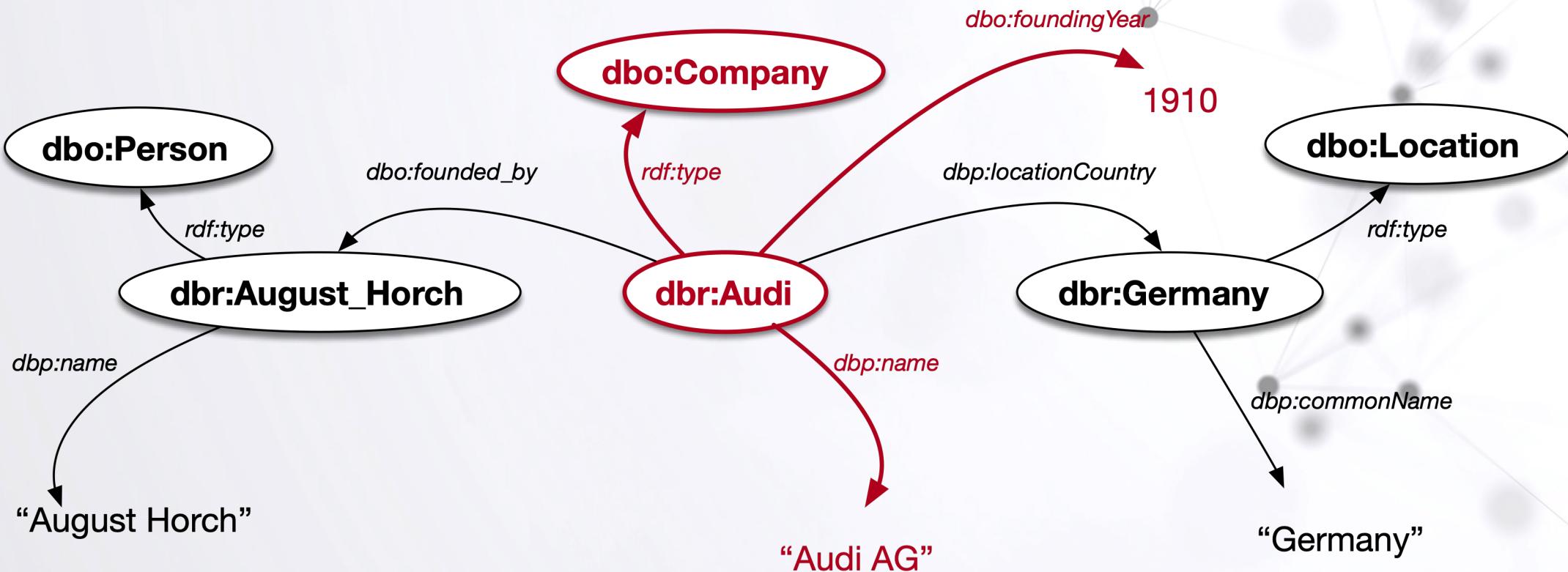


Konjunkcija posameznih vzorcev

Primer

?subject	?name	?foundingYear
dbr:Audi	"Audi AG"	1910

```
?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

```
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

```
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

```
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

```
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/>
```

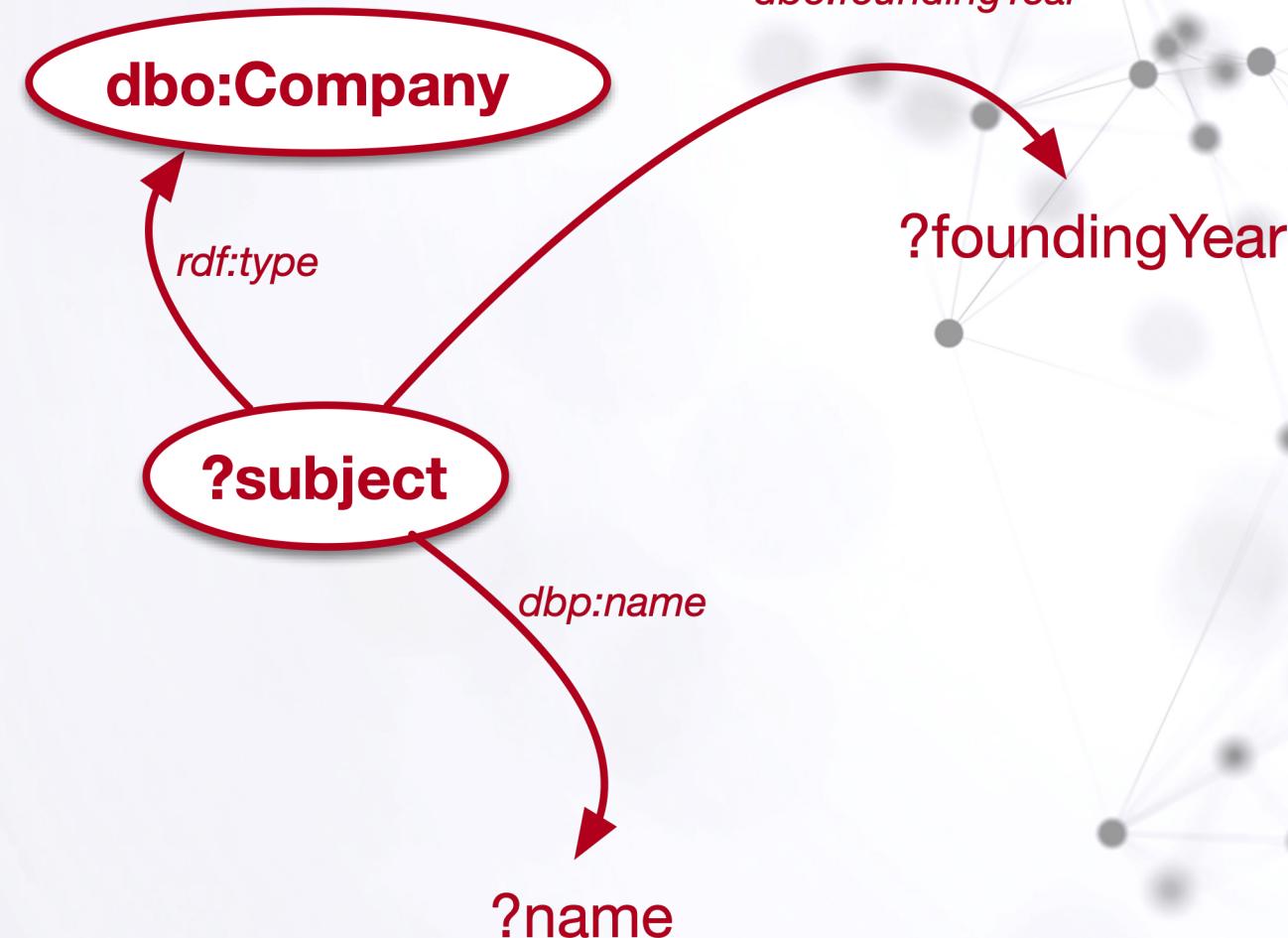
```
WHERE {  
    ?subject dbp:name ?name .  
    ?subject rdf:type dbo:Company .  
    ?subject dbo:foundingYear ?foundingYear .  
}
```

Poizvedba SPARQL (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 .
```

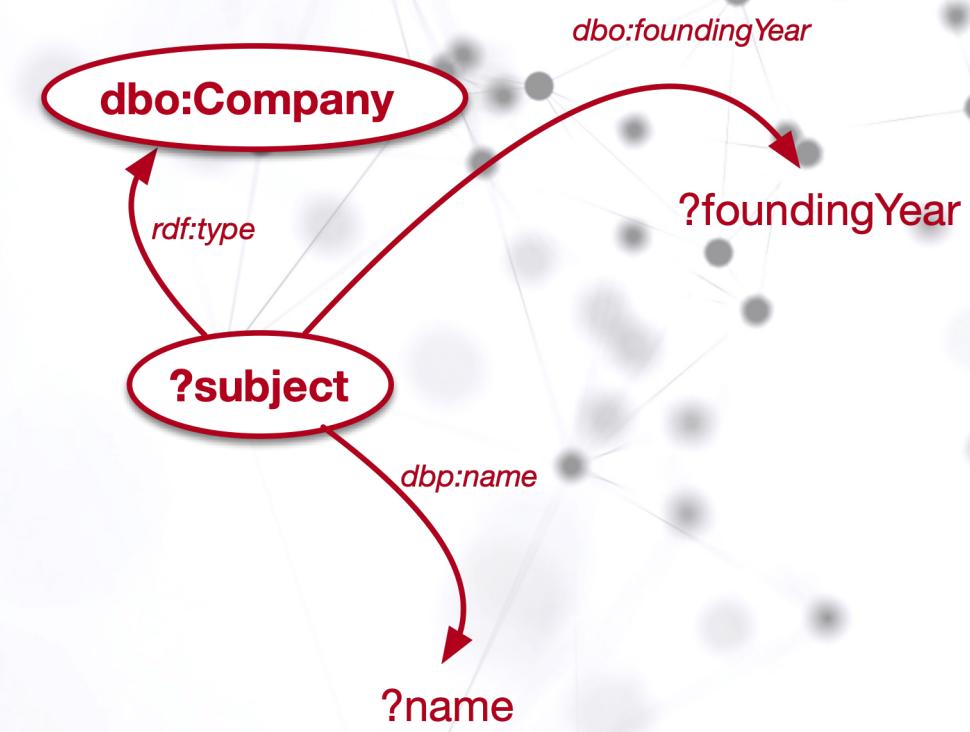
```
    ?subject rdf:type dbo:Company .
```

```
    ?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, "^\u0431audi", "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

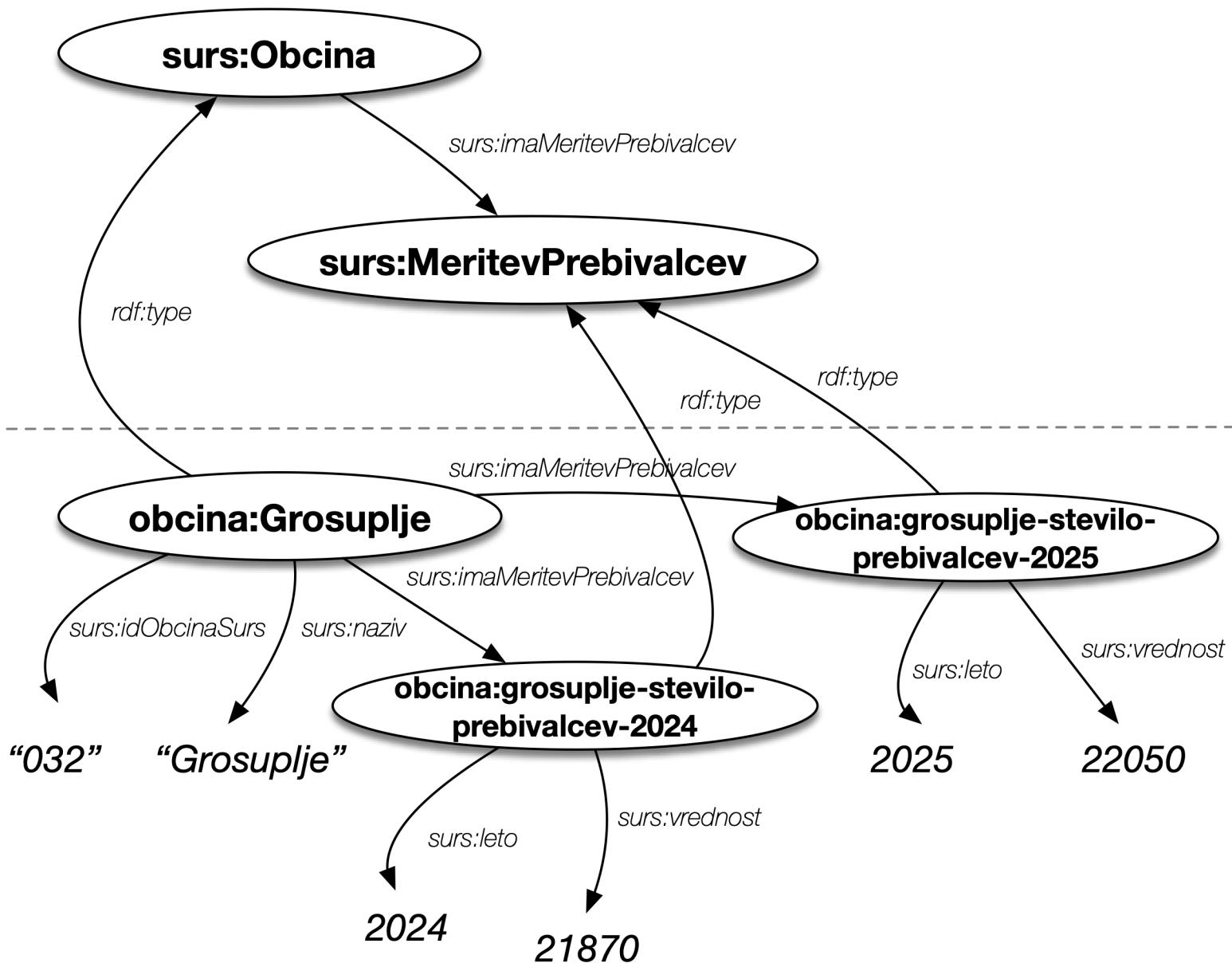
```
docker run -p 127.0.0.1:7200:7200 --name graphdb-instance-name-11 -t ontotext/graphdb:11.2.1
```

Federirane poizvedbe



Sklepanje: prehod od podatkov k znanju

Uporaba več podatkovnih virov in materializacija – SURS in CRP

TBox**SURS****CRP**