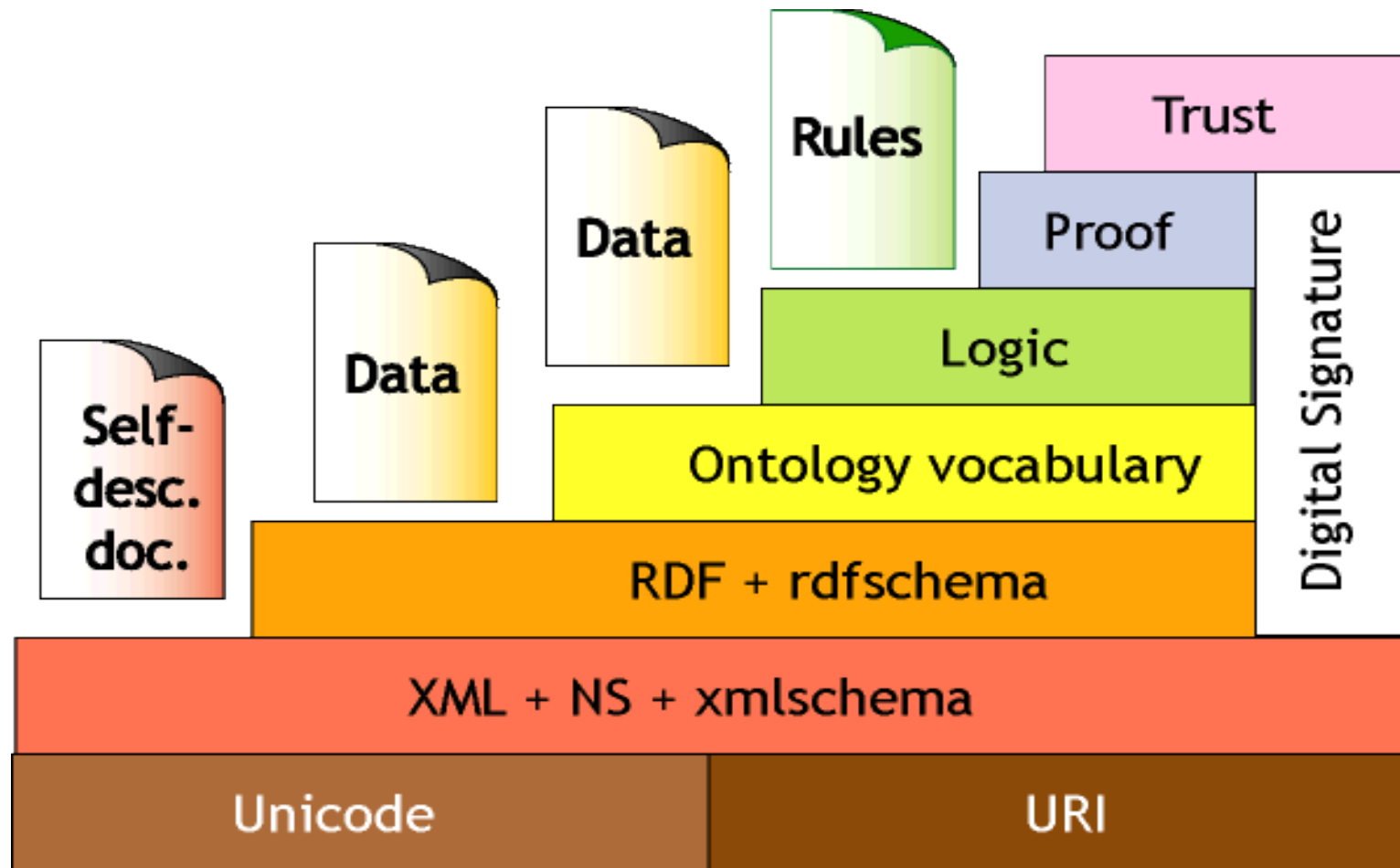


Povpraševalni jezik SPARQL

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Povpraševanje RDF: SPARQL

Rekurzivni akronim:

SPARQL protokol in RDF povpraševalni jezik

SPARQL Protocol and **RDF** Query Language

W3C standardizacija podobna XQuery za XML +

Dostop do oddaljenih postaj (remote access protocol)

Primer: SPARQL

PREFIX

```
abc: <http://mynamespace.com/exampleOntology#>
```

```
SELECT ?capital ?country
```

```
WHERE { ?x abc:cityname ?capital.  
        ?y abc:countryname ?country.  
        ?x abc:isCapitalOf ?y.  
        ?y abc:isInContinent abc:africa. }
```

SPARQL

PREFIX

```
abc: <http://mynamespace.com/exampleOntology#>
```

```
SELECT ?capital ?country
```

```
WHERE { ?x abc:cityname ?capital.  
        ?y abc:countryname ?country.  
        ?x abc:isCapitalOf ?y.  
        ?y abc:isInContinent abc:africa. }
```

- Spremenljivke so določene s predpono "?" (ali "\$").
- Vprašanje vrne ?capital in ?country.
- SPARQL procesor vrne vse zapise, ki se ujemajo z množico vzorcev RDF-trojic.
- Vprašanja so osnovana na lastnostih.
- Iskanje razredov je osnovano samo na osnovi atributov (lastnosti) razredov.

SPARQL

- Grafovski vzorec
- Poizvedba = RDF graf s **spremenljivkami in oznakami**
- SPARQL je definiran na tej osnovi
- Dodatne operacije: **AND, FILTER, UNION, OPTIONAL**

Primer 1

Podatki:

```
<http://example.org/book/book1>  
  <http://purl.org/dc/elements/1.1/title>  
    "SPARQL Tutorial" .
```

Vprašanje:

```
SELECT ?title  
WHERE  
{  
  <http://example.org/book/book1>  
    <http://purl.org/dc/elements/1.1/title>  
    ?title .  
}
```

Rezultat

```
Title  
"SPARQL Tutorial"
```

Primer 2

Podatki:

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .  
  
_:a foaf:name "Johnny Lee Outlaw" .  
_:a foaf:mbox <mailto:jlow@example.com> .  
_:b foaf:name "Peter Goodguy" .  
_:b foaf:mbox <mailto:peter@example.org> .  
_:c foaf:mbox <mailto:carol@example.org> .
```

Vprašanje:

```
PREFIX foaf: <http://xmlns.com/foaf/0.1/>  
SELECT ?name ?mbox  
WHERE  
{ ?x foaf:name ?name .  
  ?x foaf:mbox ?mbox }
```

Rezultat

name	mbox
"Johnny Lee Outlaw"	<mailto:jlow@example.com>
"Peter Goodguy"	<mailto:peter@example.org>

Primer 3

Podatki:

```
@prefix dt: <http://example.org/datatype#> .
@prefix ns: <http://example.org/ns#> .
@prefix : <http://example.org/ns#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#>

:x ns:p "cat"@en .
:y ns:p "42"^^xsd:integer .
:z ns:p "abc"^^dt:specialDatatype .
```

Vprašanje:

```
SELECT ?v WHERE { ?v ?p "cat"@en }
```

Ujemanje nizov z
jezikovnimi oznakami

Rezultat

```
v
<http://example.org/ns#x>
```

Primer 4

Podatki:

```
@prefix dt: <http://example.org/datatype#> .
@prefix ns: <http://example.org/ns#> .
@prefix : <http://example.org/ns#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#>

:x ns:p "cat"@en .
:y ns:p "42"^^xsd:integer .
:z ns:p "abc"^^dt:specialDatatype .
```

Vprašanje:

```
SELECT ?v WHERE { ?v ?p 42 }
```

Ujemanje vrednosti
numeričnega tipa

Rezultat

```
v
<http://example.org/ns#y>
```

Primer 5

Podatki:

```
@prefix dt:    <http://example.org/datatype#> .
@prefix ns:    <http://example.org/ns#> .
@prefix :      <http://example.org/ns#> .
@prefix xsd:   <http://www.w3.org/2001/XMLSchema#>

:x    ns:p    "cat"@en .
:y    ns:p    "42"^^xsd:integer .
:z    ns:p    "abc"^^dt:specialDatatype .
```

Vprašanje:

Ujemanje vrednosti
poljubnega tipa

```
SELECT ?v
WHERE { ?v ?p "abc"^^<http://example.org/datatype#specialDatatype> }
```

Rezultat

```
v
<http://example.org/ns#z>
```

Primer 6

Podatki:

```
@prefix org:      <http://example.com/ns#> .
```

```
_:a  org:employeeName  "Alice" .
```

```
_:a  org:employeeId    12345 .
```

```
_:b  org:employeeName  "Bob" .
```

```
_:b  org:employeeId    67890 .
```

Vprašanje:

```
PREFIX foaf:      <http://xmlns.com/foaf/0.1/>
```

```
PREFIX org:       <http://example.com/ns#>
```

```
CONSTRUCT { ?x foaf:name ?name }
```

```
WHERE { ?x org:employeeName ?name }
```

Kreiranje novih
trojic

Rezultat

```
@prefix org:      <http://example.com/ns#> .
```

```
_:x foaf:name "Alice" .
```

```
_:y foaf:name "Bob" .
```

Primer 7

Podatki:

```
@prefix dc:    <http://purl.org/dc/elements/1.1/> .
@prefix :     <http://example.org/book/> .
@prefix ns:   <http://example.org/ns#> .

:book1 dc:title "SPARQL Tutorial" .
:book1 ns:price 42 .
:book2 dc:title "The Semantic Web" .
:book2 ns:price 23 .
```

Vprašanje:

```
PREFIX dc: <http://purl.org/dc/elements/1.1/>
SELECT ?title
WHERE { ?x dc:title ?title
        FILTER regex(?title, "^SPARQL")
      }
```

Omejitev vrednosti
niza

Rezultat

```
title
"SPARQL Tutorial"
```

Primer 8

Podatki:

```
@prefix dc:    <http://purl.org/dc/elements/1.1/> .
@prefix :     <http://example.org/book/> .
@prefix ns:   <http://example.org/ns#> .

:book1  dc:title  "SPARQL Tutorial" .
:book1  ns:price  42 .
:book2  dc:title  "The Semantic Web" .
:book2  ns:price  23 .
```

Vprašanje:

```
PREFIX dc:    <http://purl.org/dc/elements/1.1/>
PREFIX ns:   <http://example.org/ns#>
SELECT ?title ?price
WHERE { ?x ns:price ?price .
       FILTER (?price < 30.5)
       ?x dc:title ?title . }
```

Omejitev vrednosti
niza

Rezultat

title	price
"The Semantic Web"	23

Primer 9

Podatki:

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

_:a  rdf:type          foaf:Person .
_:a  foaf:name         "Alice" .
_:a  foaf:mbox        <mailto:alice@example.com> .
_:a  foaf:mbox        <mailto:alice@work.example> .

_:b  rdf:type          foaf:Person .
_:b  foaf:name         "Bob" .
```

Vprašanje:

```
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT ?name ?mbox
WHERE { ?x foaf:name ?name .
        OPTIONAL { ?x foaf:mbox ?mbox }
}
```

Opcijski vzorci
v vprašanju

Rezultat

name	mbox
"Alice"	<mailto:alice@example.com>
"Alice"	<mailto:alice@work.example>
"Bob"	

Primer 10

Podatki:

```
@prefix dc:    <http://purl.org/dc/elements/1.1/>
@prefix :     <http://example.org/book/> .
@prefix ns:   <http://example.org/ns#> .

:book1  dc:title  "SPARQL Tutorial" .
:book1  ns:price  42 .
:book2  dc:title  "The Semantic Web" .
:book2  ns:price  23 .
```

Vprašanje:

```
PREFIX dc:    <http://purl.org/dc/elements/1.1/>
PREFIX ns:   <http://example.org/ns#>
SELECT ?title ?price
WHERE { ?x dc:title ?title .
       OPTIONAL { ?x ns:price ?price . FILTER (?price < 30) }
}
```

Opcijski vzorci
v vprašanju in
omejitve vrednosti

Rezultat

title	price
"SPARQL Tutorial"	
"The Semantic Web"	23

Primer 11

Podatki:

```
@prefix foaf:      <http://xmlns.com/foaf/0.1/> .

_:a foaf:name      "Alice" .
_:a foaf:homepage  <http://work.example.org/alice/> .

_:b foaf:name      "Bob" .
_:b foaf:mbox      <mailto:bob@work.example> .
```

Vprašanje:

```
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT ?name ?mbox ?hpage
WHERE { ?x foaf:name ?name .
        OPTIONAL { ?x foaf:mbox ?mbox } .
        OPTIONAL { ?x foaf:homepage ?hpage }
}
```

Več opsijskih vzorcev
v vprašanju

Rezultat

name	mbox	hpage
"Alice"		<http://work.example.org/alice/>
"Bob"	<mailto:bob@work.example>	

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Primer 12

Podatki:

```
@prefix dc10: <http://purl.org/dc/elements/1.0/> .
@prefix dc11: <http://purl.org/dc/elements/1.1/> .

_:a dc10:title      "SPARQL Query Language Tutorial" .
_:a dc10:creator    "Alice" .

_:b dc11:title      "SPARQL Protocol Tutorial" .
_:b dc11:creator    "Bob" .

_:c dc10:title      "SPARQL" .
_:c dc11:title      "SPARQL (updated)" .
```

Vprašanje:

```
PREFIX dc10: <http://purl.org/dc/elements/1.0/>
PREFIX dc11: <http://purl.org/dc/elements/1.1/>
```

Alternative v
vprašanju

```
SELECT ?title
WHERE { { ?book dc10:title ?title } UNION { ?book dc11:title ?title } }
```

Rezultat

```
title
"SPARQL Protocol Tutorial"
"SPARQL"
"SPARQL (updated)"
"SPARQL Query Language Tutorial"
```

Primer 13

Podatki:

```
@prefix dc10: <http://purl.org/dc/elements/1.0/> .
@prefix dc11: <http://purl.org/dc/elements/1.1/> .

_:a dc10:title      "SPARQL Query Language Tutorial" .
_:a dc10:creator    "Alice" .

_:b dc11:title      "SPARQL Protocol Tutorial" .
_:b dc11:creator    "Bob" .

_:c dc10:title      "SPARQL" .
_:c dc11:title      "SPARQL (updated)" .
```

Vprašanje:

```
PREFIX dc10: <http://purl.org/dc/elements/1.0/>
PREFIX dc11: <http://purl.org/dc/elements/1.1/>
```

```
SELECT ?title ?author
WHERE { { ?book dc10:title ?title . ?book dc10:creator ?author }
        UNION
        { ?book dc11:title ?title . ?book dc11:creator ?author }
}
```

Alternative v
vprašanju;
več trojic

Rezultat

author	title
"Alice"	"SPARQL Protocol Tutorial"
"Bob"	"SPARQL Query Language Tutorial"

Primer 14

Podatki:

```
# Default graph (stored at http://example.org/foaf/aliceFoaf)
@prefix foaf: <http://xmlns.com/foaf/0.1/> .

_:a foaf:name "Alice" .
_:a foaf:mbox <mailto:alice@work.example> .
```

Vprašanje:

```
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT ?name
FROM <http://example.org/foaf/aliceFoaf>
WHERE { ?x foaf:name ?name }
```

Vprašanje nad
imenovanim grafom

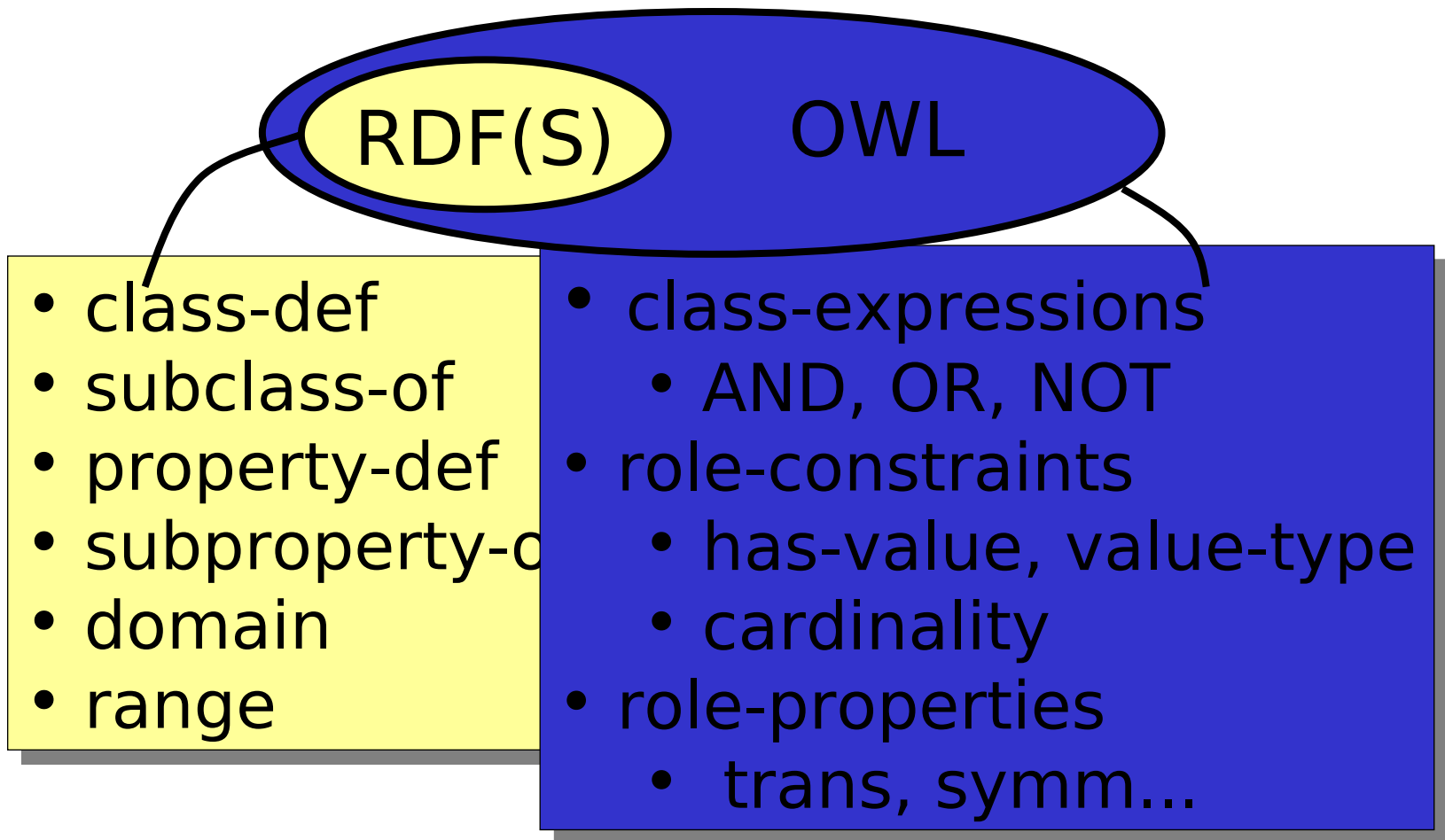
Rezultat

```
name
"Alice"
```

RDF v realnem svetu

- RDF in SPARQL sta W3C standarda
- Predstavitev metapodatkov
 - Apple (MCF), Adobe (XMP), Mozilla/Firefox
- Množica orodij za RDF
 - Oracle, HP, IBM,
 - Virtuoso, Bigdata, 3store, 4store, ...
- Mase začele shranjevati RDF
 - Medicina, naravoslovje, kemija, biologija, ...
 - Predstavitev **LinkData** v enem od naslednjih predavanj

V nadaljevanju: RDFS vs. OWL



Viri

- <http://www.w3.org/TR/rdf-primer/>
- <http://www.w3.org/TR/rdf-mt/>
- <http://www.w3.org/TR/rdf-sparql-query/>