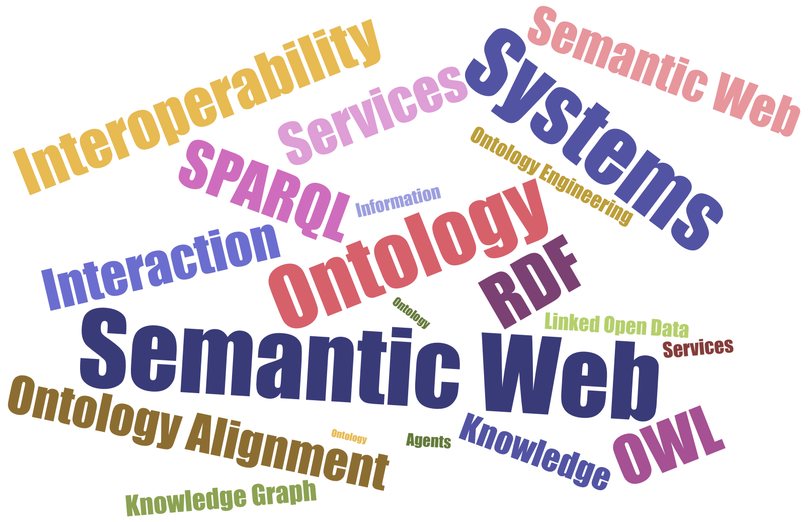
COMP318

Ontologies and Semantic Web



SPARQL - Part 3

Dr Valentina Tamma

V.Tamma@liverpool.ac.uk

Where were we

- SPARQL
  - RDF query language
  - SELECT Queries
    - SELECT … FROM … WHERE
    - Basic pattern

GRAPH PATTERNS

- Different types of graph patterns for the query pattern (WHERE clause):
  - Basic graph pattern (BGP)
  - `Group` graph pattern
  - `Optional` graph pattern
  - `Union` graph pattern
  - `Graph` graph pattern (Constraints)

Example RDF Dataset (Turtle)

```
@prefix : <http://example.org/data#> .
@prefix ont: <http://example.org/myOntology#> .
@prefix vcard: <http://www.w3.org/2001/vcard-rdf/3.0#> .

:john
      vcard:FN "John Smith" ;
      vcard:N [
            vcard:Given "John" ;
            vcard:Family "Smith" ] ;
      ont:hasAge 32 ;
      ont:marriedTo :mary .
:mary
      vcard:FN "Mary Smith" ;
      vcard:N [
            vcard:Given "Mary" ;
            vcard:Family "Smith" ] ;
      ont:hasAge 29 .
```

Constraints: Filters in Query Patterns

- Conditions on literal values with operators and functions
- Different forms
  - Value comparison, e.g., >, !=, >=
  - Numeric functions, e.g., +, *
  - SPARQL test, e.g., `BOUND(?x)`, `isLITERAL(?y)`
  - Negation, e.g., `!BOUND(?x)`
- Syntax: `FILTER` expression

```
SELECT ?v WHERE {
        ?v rdf:type umbel-sc:Volcano ;
           p:lastEruption ?le .
 FILTER ( ?le > 1900) }
```

SPARQL built-in filter functions

SPARQL		SPARQL 1.1	
Logical	`!, &&, ||`	Conditionals	`IF, COALESCE`
Math	`+, -, *, /`	Constructors	`URI, BNODE, STRDT, STRLANG`
Comparison	`>, <, !=, =, ...`	Strings	`STRLEN, SUBSTR, UCASE, LCASE, STRSTARTS, STRENDS, CONTAIS, CONCAT, ...`

SPARQL built-in filter functions

SPARQL		SPARQL 1.1	
SPARQL Tests	`isURI, isBlank, isLiteral, bound`	More math	`abs, round, ceil, floor, RAND`
SPARQL accessors	`str, lang, datatype`	Sate/Time	`now, year, month, day, hours, minutes, seconds, timezone`
Others	`sameTerm, langMatches, regex`	Hashing	`MD5, SHA1, SHA224, SHA256, SHA384, SHA512`

Solution Modifiers

- Modify the result set, but not single results
- Syntax: `ORDER BY`, `LIMIT`, `OFFSET`

SPARQL Queries: constraints

"Return all people over 30 in the KB"

```
PREFIX ont: <http://example.org/myOntology#>

SELECT ?x

WHERE {?x ont:hasAge ?age .
        FILTER(?age > 30)}
```

result

```
x

==================

<http://example.org/data#john>
```

```
:john
      vcard:FN "John Smith" ;
      vcard:N [
            vcard:Given "John" ;
            vcard:Family "Smith" ] ;
      ont:hasAge 32 ;
      ont:marriedTo :mary .
:mary
      vcard:FN "Mary Smith" ;
      vcard:N [
            vcard:Given "Mary" ;
            vcard:Family "Smith" ] ;
      ont:hasAge 29 .
```

GRAPH PATTERNS

- Different types of graph patterns for the query pattern (WHERE clause):
  - Basic graph pattern (BGP)
  - **`Group`** graph pattern
  - **`Optional`** graph pattern
  - **`Union`** graph pattern
  - **`Graph`** graph pattern (Constraints)

Example RDF Dataset (Turtle)

```
@prefix rdf: rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix umbel-sc: <http://umbel.org/umbel/sc/> .
@prefix dbpedia: <http://www.dbpedia.org/> .

dbpedia:Mount_Etna rdf:type umbel-sc:Volcano ;
                   rdfs:label "Etna" ;
                   p:location dbpedia:Italy .
dbpedia:Mount_Baker rdf:type umbel-sc:Volcano ;
                    p:location dbpedia:United_States .
dbpedia:Beerenberg rdf:type umbel-sc:Volcano ;
                   rdfs:label "Beerenberg"@en ;
                   rdfs:label "Бееренберг"@ru .
                   p:location dbpedia:Norway .
```

GROUP Graph patterns

```
SELECT ?v WHERE {?v rdf:type umbel-
   sc:Volcano .
  {?v p:location dbpedia:Italy}
  UNION
  {?v p:location dbpedia:Norway}
}
```

```
SELECT ?v WHERE { { ?v rdf:type umbel-
   sc:Volcano }
{ { ?v p:location dbpedia:Italy }
  UNION
  {?v p:location dbpedia:Norway } }
}
```

```
@prefix rdf: rdf: <http://www.w3.org/1999/02/22-rdf-
syntax-ns#> .
@prefix umbel-sc: <http://umbel.org/umbel/sc/> .
@prefix dbpedia: <http://www.dbpedia.org/> .

dbpedia:Mount_Etna rdf:type umbel-sc:Volcano ;
            rdfs:label "Etna" ;
            p:location dbpedia:Italy .
dbpedia:Mount_Baker rdf:type umbel-sc:Volcano ;
             p:location dbpedia:United_States .
dbpedia:Beerenberg rdf:type umbel-sc:Volcano ;
            rdfs:label "Beerenberg"@en ;
            rdfs:label "Бееренберг"@ru .
            p:location dbpedia:Norway .
```

OPTIONAL GRAPH PATTERNS

- Used to treat missing data
- Keyword **`OPTIONAL`** allows for optional patterns
- May yield unbound variables

SPARQL Queries: optional pattern

"Return the full name of all the people in the KB and their spouse"

```
PREFIX vCard: <http://www.w3.org/2001/vcard-rdf/3.0#>
PREFIX ont: <http://example.org/myOntology#>
SELECT ?y ?name
WHERE {?x vCard:FN ?name.
    OPTIONAL {?x ont:marriedTo ?y}}
```

results

```
 ?name                              ?y
=================================
"John Smith"   <http://example.org/data#mary>
"Mary Smith"
```

```
:john
      vcard:FN "John Smith" ;
      vcard:N [
            vcard:Given "John" ;
            vcard:Family "Smith" ] ;
      ont:hasAge 32 ;
      ont:marriedTo :mary .
:mary
      vcard:FN "Mary Smith" ;
      vcard:N [
            vcard:Given "Mary" ;
            vcard:Family "Smith" ] ;
      ont:hasAge 29 .
```

UNION Graph patterns

- Union graph patterns allow us to query for possible alternatives

"Which volcanoes are located in Italy or in Norway?"

```
SELECT ?v WHERE
{?v rdf:type umbel-sc:Volcano .
  {?v p:location dbpedia:Italy}
  UNION
  {?v p:location dbpedia:Norway}
}
```

results

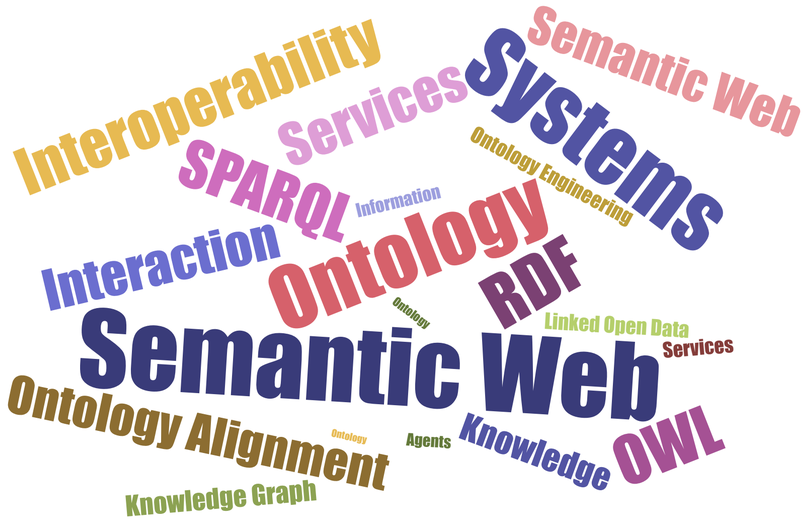
```
?v
=================
dbpedia:Mount_Etna
dbpedia:Beerenberg
```

```
@prefix rdf: rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix umbel-sc: <http://umbel.org/umbel/sc/> .
@prefix dbpedia: <http://www.dbpedia.org/> .

dbpedia:Mount_Etna rdf:type umbel-sc:Volcano ;
            rdfs:label "Etna" ;
            p:location dbpedia:Italy .
dbpedia:Mount_Baker rdf:type umbel-sc:Volcano ;
             p:location dbpedia:United_States .
dbpedia:Beerenberg rdf:type umbel-sc:Volcano ;
            rdfs:label "Beerenberg"@en ;
            rdfs:label "Бееренберг"@ru .
            p:location dbpedia:Norway .
```

COMP318

Ontologies and Semantic Web



End of SPARQL - Part 3

Dr Valentina Tamma

`V.Tamma@liverpool.ac.uk`