SPARQL Query Language

Basics

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Outline (Slides based on F. Freitas, Cin/UFPE, Brazil)

1. **Basic queries**
2. Constraints
3. Aggregation
4. Graphs
5. Query Forms
6. SPARQL in Fuseki

Readings

- Prud'hommeaux, E., and Seaborne, A., (2008), "SPARQL Query Language for RDF", http://www.w3.org/TR/rdf-sparql-query/
- Feigenbaum, L., (2009), "SPARQL by Example: A Tutorial", https://www.w3.org/2009/Talks/0615-qbe/
- SPARQL Validator: http://sparql.org/query-validator.html

SPARQL

- **SPARQL** is a **recursive** acronym standing for
  - **S**PARQL **P**rotocol **a**nd **R**DF **Q**uery **L**anguage
- It provides facilities to:
  - extract information in the form of IRIs, blank nodes, plain and typed literals.
  - extract RDF subgraphs.
  - construct new RDF graphs based on information in the queried graphs

Components of a Query

Query

```
@prefix foaf: <http://xmlns.com/foaf/0.1/>
@prefix rel:  <http://purl.org/vocab/relationship/>
@prefix uoft: <http://ontology.eil.utoronto.ca/MIE1501/foaf_example#>
```

```
SELECT ? x ?gname
FROM <http://endpoint.domainname:port>
WHERE   { ?x  foaf:givenName  ?gname }
ORDER BY ?gname
```

Prologue:

- Prefix definitions

Result form specification:

- SELECT, DESCRIBE, CONSTRUCT, or ASK
- SELECT: - Variable list or asterisk (“*”) character for all - DISTINCT for disjoint results

Dataset specification:

- Specify the dataset to be queried
- Use FROM and FROM NAMED clauses (each with a URI)

Query Pattern:

- WHERE clause specifies the graph pattern to be matched

Solution modifiers:

Modify the result set, but not the single results

- ORDER BY, LIMIT, or OFFSET

Basic Query: Select

```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix rel:  <http://purl.org/vocab/relationship/> .
@prefix uoft: <http://ontology.eil.utoronto.ca/MIE1501/
        foaf_example#> .

uoft:js rdfs:type foaf:Person .
uoft:js foaf:givenName "Joe" .
uoft:js foaf:familyName "Smith" .
uoft:js foaf:age 20 .
uoft:js rel:friendOf uoft:fj.

uoft:fj rdfs:type foaf:Person ;
      foaf:givenName "Fred" ;
      foaf:familyName "Jones" ;
      foaf:age 20 ;
      rel:worksWith uoft:js .

uoft:mj rdfs:type foaf:Person ;
      foaf:givenName "Mary" ;
      rel:spouseOf uoft:fj ;
      rel:friendOf [ rel:employedBy uoft:js ] .
```

Query

```
@prefix foaf: <http://xmlns.com/foaf/0.1/>
@prefix rel:  <http://purl.org/vocab/relationship/>
@prefix uoft: <http://ontology.eil.utoronto.ca/MIE1501/foaf_example#>
SELECT ? x ?gname
WHERE   { ?x  foaf:givenName  ?gname }
```

Basic Query: Select

	Subject	Property	Value
(1)	uoft:js	foaf:givenName	"Joe"
	uoft:js	foaf:familyName	"Smith"
	uoft:js	foaf:age	20
	uoft:js	rel:friendOf	uoft:fj
(2)	uoft:fj	foaf:givenName	"Fred"
	uoft:fj	foaf:familyName	"Jones"
	uoft:fj	foaf:age	22
	uoft:fj	rel:worksWith	uoft:js
(3)	uoft:mj	foaf:givenName	"Mary"
	uoft:mj	rel:spouseOf	uoft:fj
	uoft:mj	rel:freindOf	_:a
	_:a	rel:employedBy	uoft:js

Query

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

@prefix rel: <http://purl.org/vocab/relationship/>

@prefix uoft: <http://ontology.eil.utoronto.ca/MIE1501/foaf_example#>

SELECT ? x ?gname

WHERE { ?x foaf:givenName ?gname }

Result

x	gname
uoft:js	Joe
uoft:fj	Fred
uoft:mj	Mary

Compound Select

```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
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uoft:js rdfs:type foaf:Person .
uoft:js foaf:givenName "Joe" .
uoft:js foaf:familyName "Smith" .
uoft:js foaf:age 20 .
uoft:js rel:friendOf uoft:fj.

uoft:fj rdfs:type foaf:Person ;
      foaf:givenName "Fred" ;
      foaf:familyName "Jones" ;
      foaf:age 20 ;
      rel:worksWith uoft:js .

uoft:mj rdfs:type foaf:Person ;
      foaf:givenName "Mary" ;
      rel:spouseOf uoft:fj ;
      rel:friendOf [ rel:employedBy uoft:js ] .
```

Query

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@prefix uoft: <http://ontology.eil.utoronto.ca/MIE1501/foaf_example#>
SELECT  ?gname ?fname
WHERE   { ?x  foaf:givenName  ?gname ;
              foaf:familyName ?fname }
```

Compound Select

	Subject	Property	Value
(1)	uoft:js	foaf:givenName	"Joe"
(2)	uoft:js	foaf:familyName	"Smith"
	uoft:js	foaf:age	20
	uoft:js	rel:friendOf	uoft:fj
(3)	uoft:fj	foaf:givenName	"Fred"
(4)	uoft:fj	foaf:familyName	"Jones"
	uoft:fj	foaf:age	22
	uoft:fj	rel:worksWith	uoft:js
(5)	uoft:mj	foaf:givenName	"Mary"
	uoft:mj	rel:spouseOf	uoft:fj
	uoft:mj	rel:freindOf	_:a
	_:a	rel:employedBy	uoft:js

Query

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                                MIE1501/foaf_example#>
SELECT  ?gname ?fname
WHERE   { ?x  foaf:givenName  ?gname ;
              foaf:familyName ?fname }
```

Result

gname	fname
Joe	Smith
Fred	Jones

What happened to Mary?

Linked/Join Select

```
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix rel:  <http://purl.org/vocab/relationship/> .
@prefix uoft: <http://ontology.eil.utoronto.ca/MIE1501/
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uoft:fj rdfs:type foaf:Person ;
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uoft:mj rdfs:type foaf:Person ;
      foaf:givenName "Mary" ;
      rel:spouseOf uoft:fj ;
      rel:friendOf [ rel:employedBy uoft:js ] .
```

Query

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@prefix rel:  <http://purl.org/vocab/relationship/>
@prefix uoft: <http://ontology.eil.utoronto.ca/
                        MIE1501/foaf_example#>
SELECT  ?gname1 ?gname2
WHERE   { ?x rel:friendOf ?y ;
              foaf:givenName ?gname1 .
           ?y  foaf:givenName  ?gname2 }
```

Linked/Join Select

	Subject	Property	Value
(2)	uoft:js	foaf:givenName	"Joe"
	uoft:js	foaf:familyName	"Smith"
	uoft:js	foaf:age	20
(1)	uoft:js	rel:friendOf	uoft:fj
(3)	uoft:fj	foaf:givenName	"Fred"
	uoft:fj	foaf:familyName	"Jones"
	uoft:fj	foaf:age	22
	uoft:fj	rel:worksWith	uoft:js
	uoft:mj	foaf:givenName	"Mary"
	uoft:mj	rel:spouseOf	uoft:fj
	uoft:mj	rel:freindOf	_:a
	_:a	rel:employedBy	uoft:js

Query

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@prefix foaf: <http://xmlns.com/foaf/0.1/>
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@prefix uoft: <http://ontology.eil.utoronto.ca/
                                MIE1501/foaf_example#>
SELECT  ?gname1 ?gname2
WHERE   { ?x rel:friendOf ?y ;
                foaf:givenName ?gname1 .
          ?y  foaf:givenName  ?gname2 }
```
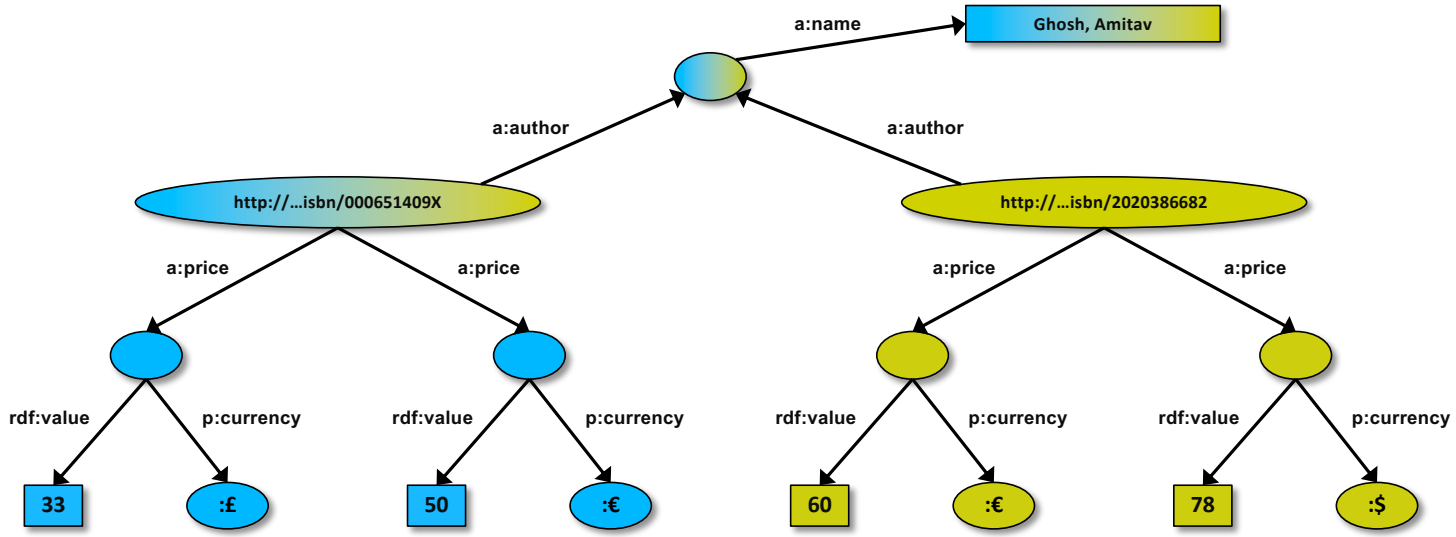

Result

gname1	gname2
Joe	Fred

Book Example: Graph Perspective

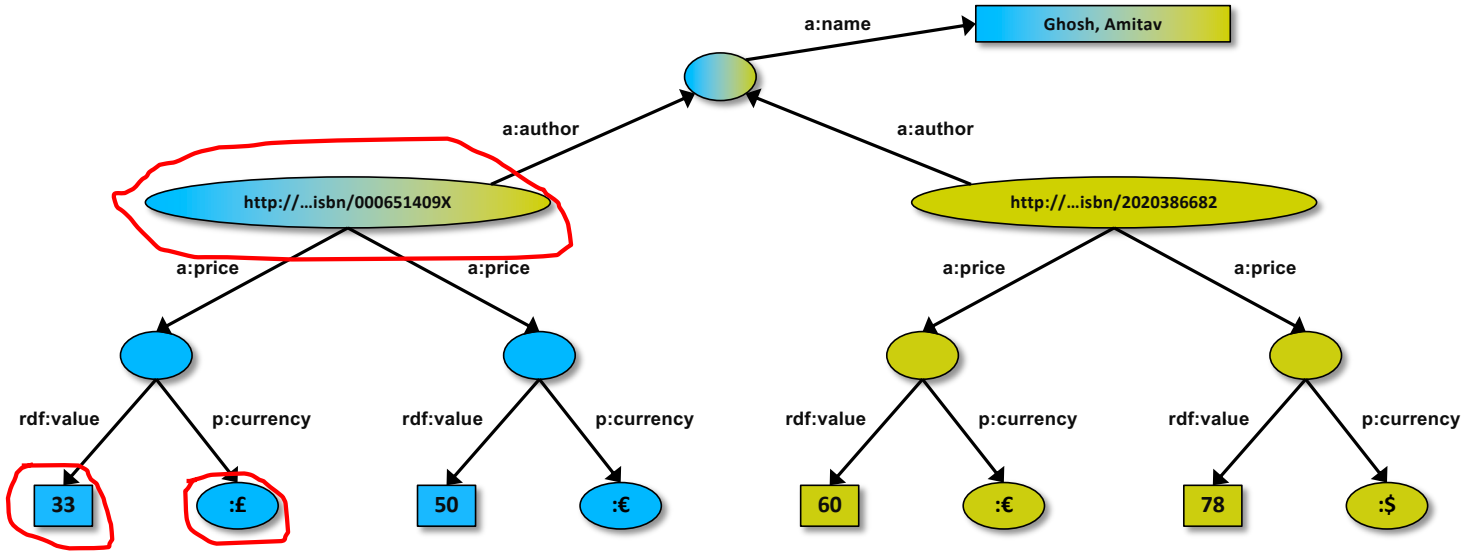
```
SELECT ?isbn ?price ?currency # note: not ?x!
WHERE {?isbn a:price ?x. ?x rdf:value ?price. ?x p:currency ?currency }
```



Graph Perspective

```
SELECT ?isbn ?price ?currency # note: not ?x!
WHERE {?isbn a:price ?x. ?x rdf:value ?price. ?x p:currency ?currency }
```

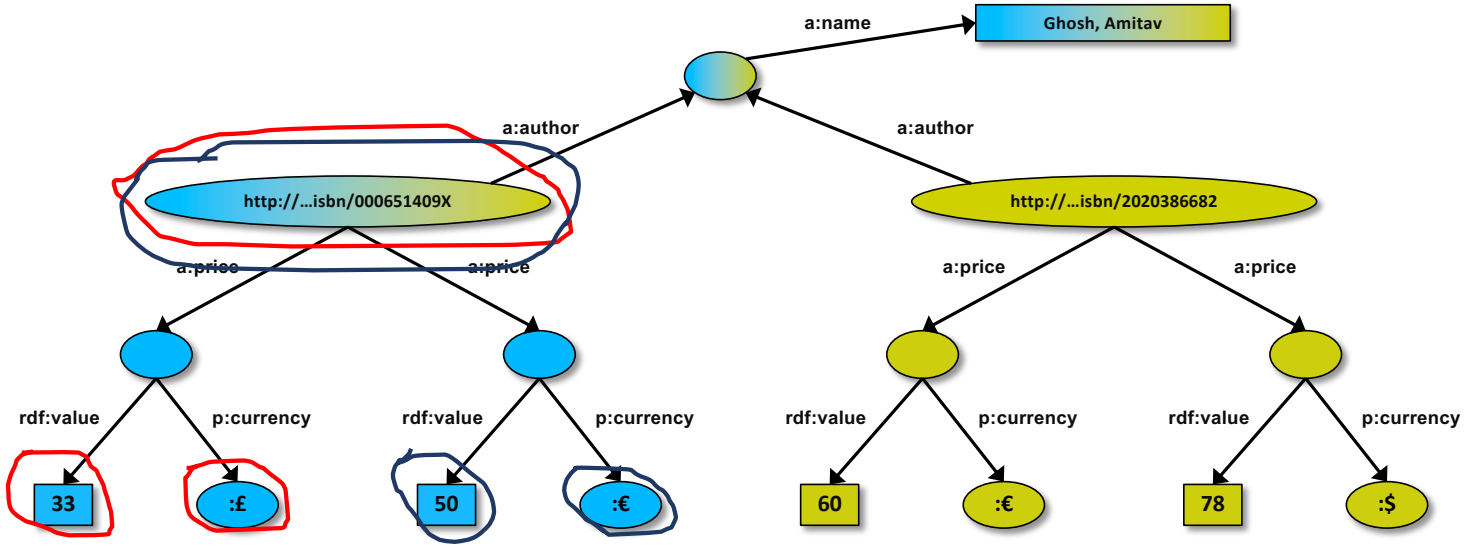
Returns: [<…409X>,33,:£]



Graph Perspective

```
SELECT ?isbn ?price ?currency # note: not ?x!
WHERE {?isbn a:price ?x. ?x rdf:value ?price. ?x p:currency ?currency }
```

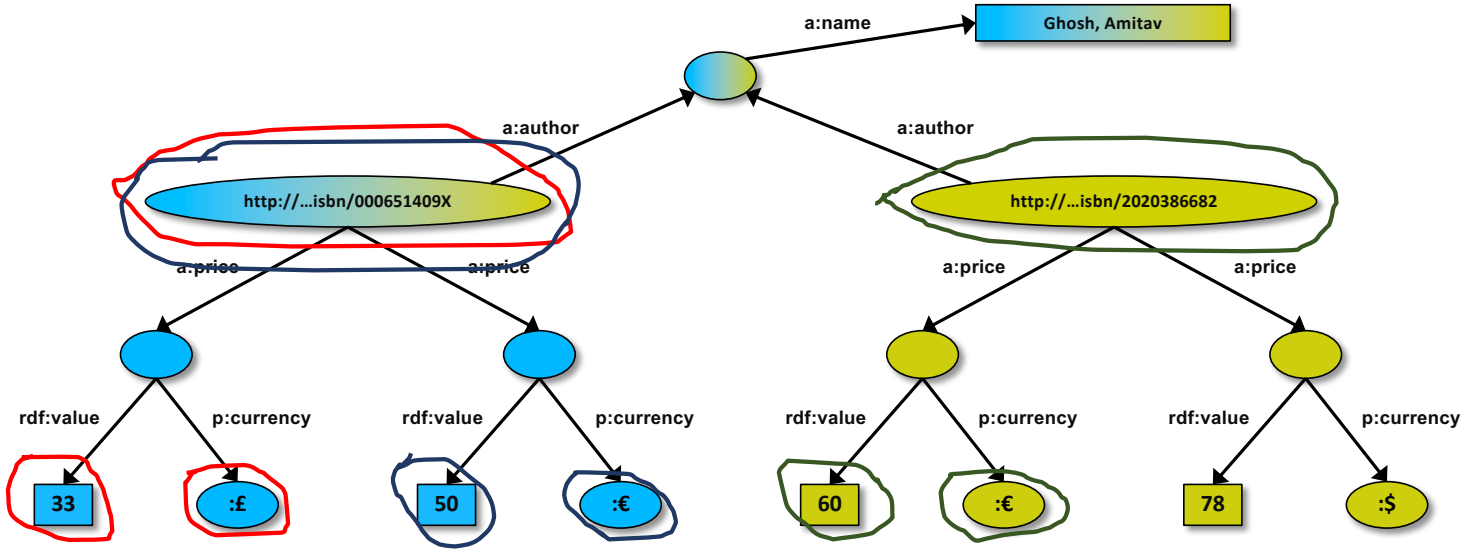
Returns: [<…409X>,33,:£], [<…409X>,50,:€]



Graph Perspective

```
SELECT ?isbn ?price ?currency # note: not ?x!
WHERE {?isbn a:price ?x. ?x rdf:value ?price. ?x p:currency ?currency }
```

Returns: [<…409X>,33,:£], [<…409X>,50,:€],
[<…6682>,60,:€]



Graph Perspective

```
SELECT ?isbn ?price ?currency # note: not ?x!
WHERE {?isbn a:price ?x. ?x rdf:value ?price. ?x p:currency ?currency }
```

Returns: [<…409X>,33,:£], [<…409X>,50,:€],
[<…6682>,60,:€], [<…6682>,78,:$]