

Semantic Web

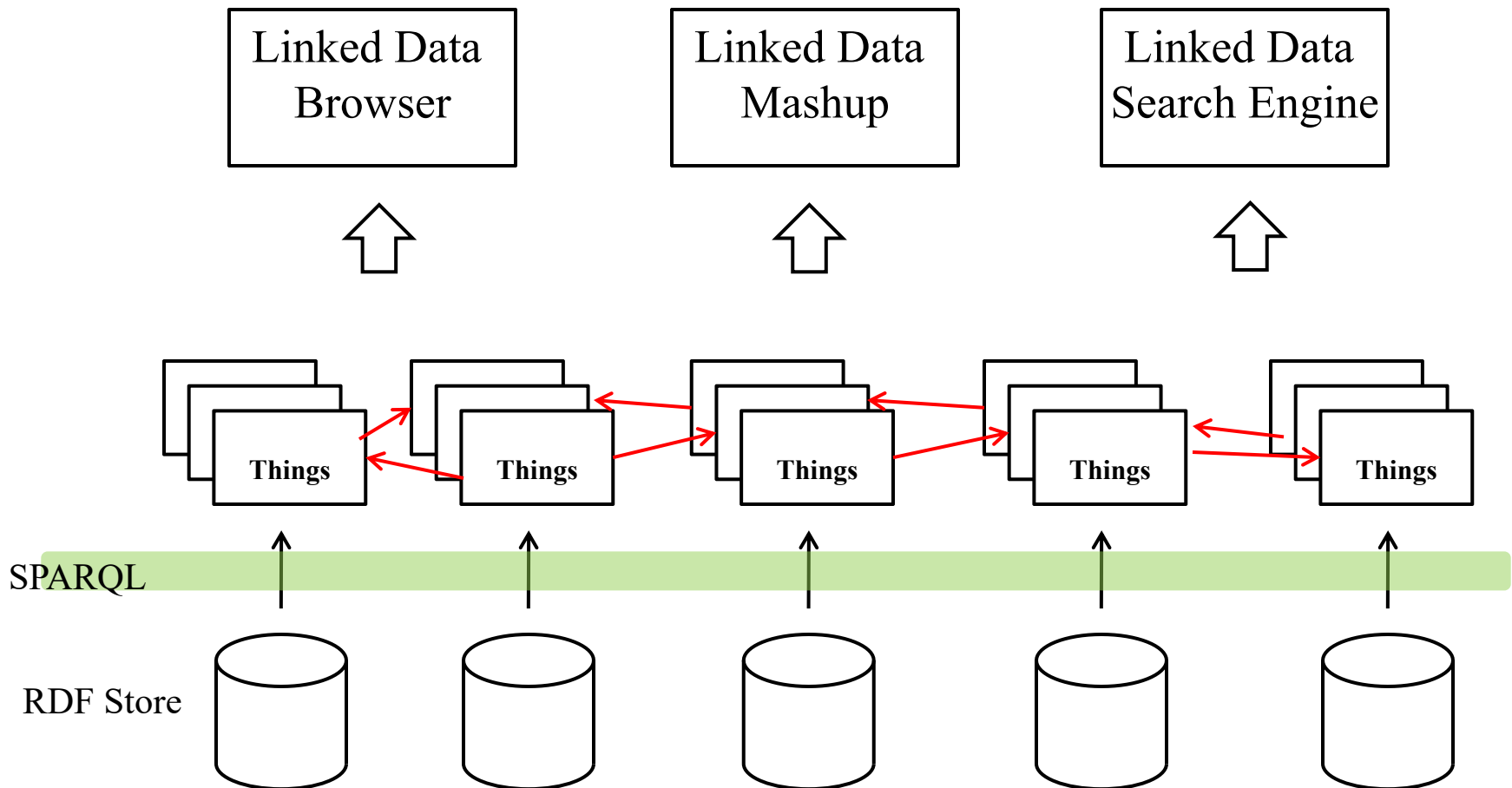
SPARQL

Hideaki Takeda

National Institute of Informatics

takeda@nii.ac.jp

How to use Linked Data



SPARQL

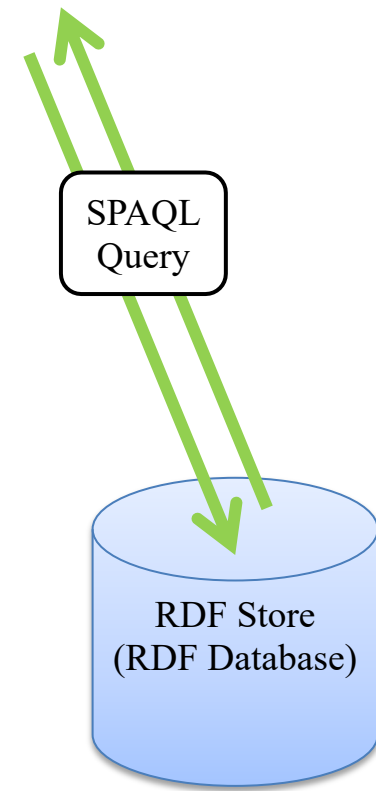
- Data query language for RDF
- Similar syntax with SQL

Query form

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

Variable for query

Query pattern (Turtle syntax)



Query form and results

Query form	Results
SELECT, ASK	XML, (JSON)
CONSTRUCT, DESCRIBE	RDF Graph

CONSTRUCT

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

```
CONSTRUCT {
```

```
  ?person foaf:name ?name .
```

```
}
```

```
FROM <http://fumi.me/foaf.rdf>
```

```
WHERE {
```

```
  ?person foaf:name ?name .
```

```
}
```

Multiple query patterns

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

```
SELECT * ← All variables
```

```
WHERE {
```

```
  ?person foaf:name ?name .
```

```
  ?person foaf:mbox ?email .
```

```
}
```

} Matching multiple patterns

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

```
SELECT *
```

```
WHERE {
```

```
  ?person foaf:name ?name;
```

```
    foaf:mbox ?email .
```

```
}
```

Connected graph

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

```
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
```

```
SELECT ?name ?uri
```

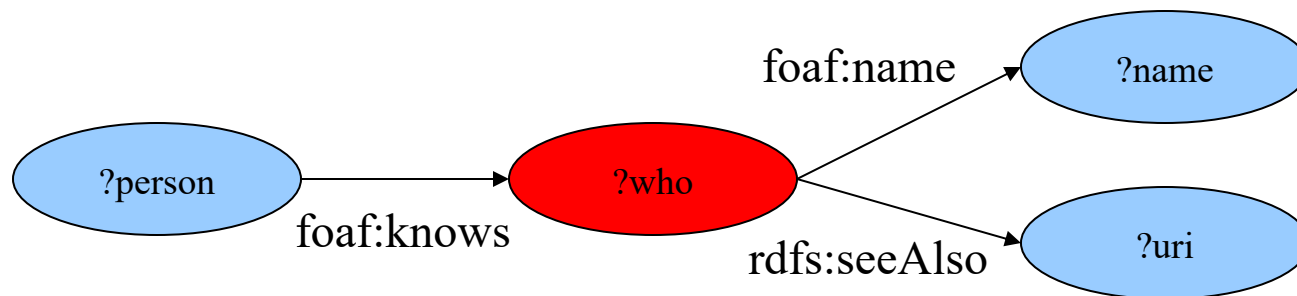
```
WHERE {
```

```
  ?person foaf:knows ?who .
```

```
  ?who foaf:name ?name;
```

```
    rdfs:seeAlso ?uri .
```

```
}
```



Optional values

- OK if it is not matched but return values if matched

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

```
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
```

```
SELECT ?name ?uri
```

```
WHERE {
```

```
  ?person foaf:knows ?who .
```

```
  ?who foaf:name ?name .
```

```
  OPTIONAL {
```

```
    ?who rdfs:seeAlso ?uri .
```

```
  }
```

```
}
```


Modifiers

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

```
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
```

```
SELECT ?name ?uri
```

```
WHERE {
```

```
  ?person foaf:knows ?who .
```

```
  ?who foaf:name ?name;
```

```
  OPTIONAL {
```

```
    rdfs:seeAlso ?uri .
```

```
  }
```

```
} ORDER BY ?name
```

Ascending Sort
(if descending ORDER BY DESC(?name))

```
LIMIT 10
```

Upper bound on the number of solutions

UNION

```
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
SELECT ?name ?mbox
WHERE {
  { ?person foaf:name ?name;
        foaf:mbox ?mbox .
  } UNION {
    ?person foaf:name ?name;
            foaf:mbox_sha1sum ?mbox .
  }
}
```

FROM

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

```
SELECT ?name
```

```
FROM <http://fumi.me/foaf.rdf>
```

```
WHERE {
```

```
  ?person foaf:name ?name .
```

```
}
```

Default dataset



Multiple Dataset

eliminate duplicates

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

```
SELECT DISTINCT ← ?name
```

```
FROM <http://www.w3.org/People/Berners-Lee/card>
```

```
FROM <http://fumi.me/foaf.rdf>
```

```
FROM <http://www.tom.sfc.keio.ac.jp/~hagino/foaf.rdf>
```

```
WHERE {
```

```
  ?person foaf:name ?name .
```

```
}
```

Merging dataset

Named Graph

- Distinguish data resources by URI/IRI
- Query for specifying Graphs

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

```
SELECT ?g ?name
```

```
FROM NAMED <http://www.w3.org/People/Berners-Lee/card>
```

```
FROM NAMED <http://fumi.me/foaf.rdf>
```

```
WHERE {
```

```
GRAPH ?g {
```

```
  ?person foaf:name ?name .
```

```
}
```

```
}
```

← Specifying graph resource

Default graph and Named graph

```
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX rss: <http://purl.org/rss/1.0/>
PREFIX dc: <http://purl.org/dc/elements/1.1/>
SELECT ?name ?title ?link ?date
FROM <http://planetrdf.com/index.rdf>
FROM NAMED <http://fumi.me/foaf.rdf>
WHERE {
  ?item dc:creator ?name .
  ?item rss:title ?title .
  ?item rss:link ?link .
  ?item dc:date ?date .

  GRAPH <http://fumi.me/foaf.rdf> {
    ?me foaf:name “武田英明”@ja .
    ?me foaf:knows ?who .
    ?who foaf:name ?name .
  } .
}
```

FILTER: regex

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

PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT DISTINCT ?name ?email

FROM <http://fumi.me/foaf.rdf>

WHERE {

 ?person foaf:name ?name;

 foaf:mbox ?email .

FILTER regex(str(?email), "w3.org", "i")

}

FILTER: xsd:Date

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

PREFIX rss: <http://purl.org/rss/1.0/>

PREFIX dc: <http://purl.org/dc/elements/1.1/>

SELECT ?name ?title ?link ?date

FROM <http://planetrdf.com/index.rdf>

WHERE {

 ?item dc:creator ?name .

 ?item rss:title ?title .

 ?item rss:link ?link .

 ?item dc:date ?date .

FILTER (xsd:dateTime(?date) > "2008-03-31T00:00:00Z"^^xsd:dateTime)

}

Or compare as string **FILTER (str(?date) > "2008-03-31")**

FILTER

- Logical connectives: !, &&, ||
- Arithmetic connectives: +, -, *, /
- Test: =, !=, >, <, ...
- Unary Test: isURI, isBlank, isLiteral, BOUND
- Data type: xsd:integer, xsd:decimal, xsd:float, xsd:double, xsd:string, xsd:boolean, xsd:dateTime
- Language Tag: @EN, @JP
- regex, str

Language tag

- Specifying language for literals
 - Turtle: “Tokyo”@en
 - RDF/XML: xml:lang=“en“
- FILTER
 - FILTER (lang(?name)=“en”)
- Note: literal with language tag is not equivalent to one without language tag
 - FILTER (?city = “Tokyo”)
 - ◆ No match with ”Tokyo”@en

Data type

- Types for literals
 - “1.3”^^xsd:decimal
 - “2008-05-01T09:12:58Z”^^xsd:dateTime
 - “true”^^xsd:boolean
 - “Japan”^^xsd:string
- Casting
 - Casting may be needed for applying operators.
 - ◆ FILTER regex(str(?title), “Semantic”)
 - ◆ FILTER xsd:int(?age) > 19
 - ◆ FILTER

Find doctoral students supervised by the Japanese scholar awarded by Nobel Prize of Physics

PREFIX dbp: <<http://dbpedia.org/resource/>>

PREFIX dbp-owl: <<http://dbpedia.org/ontology/>>

PREFIX rdfs: <<http://www.w3.org/2000/01/rdf-schema#>>

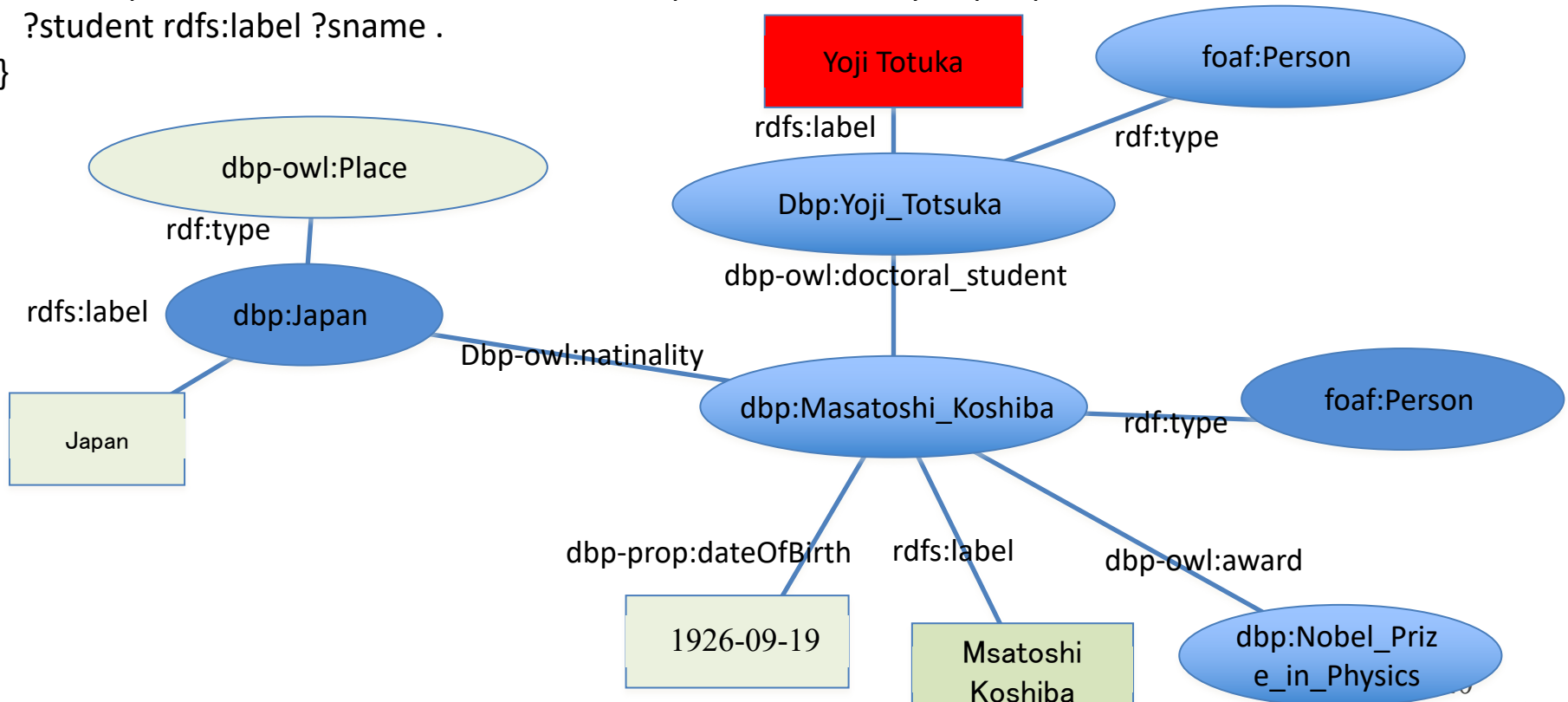
SELECT ?sname

WHERE {

```
?scholar a dbp-owl:Person ; dbp-owl:award dbp:Nobel_Prize_in_Physics;  
dbp-owl:doctoralStudent ?student; dbp-owl:nationality dbp:Japan .
```

```
?student rdfs:label ?sname .
```

}



Virtuoso SPARQL Query Editor

[About](#) | [Namespace Prefixes](#) | [Inference rules](#) | [iSPARQL](#)

Default Data Set Name (Graph IRI)

http://dbpedia.org

Query Text

```
PREFIX dbp: <http://ja.dbpedia.org/resource/>
PREFIX dbp-owl: <http://dbpedia.org/ontology/>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT *
WHERE {
  ?scholar a dbp-owl:Person ; dbp-owl:award dbp:Nobel_Prize_in_Physics;
  dbp-owl:doctoralStudent ?student; dbp-owl:nationality dbp:Japan .
  ?student rdfs:label ?sname .
}
```

(Security restrictions of this server do not allow you to retrieve remote RDF data, see [details](#).)

Results Format: (The CXML output is disabled, see [details](#))

Execution timeout: milliseconds (values less than 1000 are ignored)

Options: Strict checking of void variables

(The result can only be sent back to browser, not saved on the server, see [details](#))

sname
"Yōji Totsuka"@de
"戸塚洋二"@ja
"戸塚洋二"
"Yoji Totsuka"