SENG 42273
Semantic web and Ontological Engineering

Lecture 8

Recap

- From Traditional Web to Semantic Web
- Semantic web fundamentals
- The Building Block of the Semantic Web: RDF
- RDFS
- Ontology
- Web Ontology Language: OWL

Querying the Semantic Web

Basically, semantic web is a graph data structure.

SPARQL queries

- "Matching patterns" in the graph
- Works on **triple store** special kind of software or a data base for RDF (graph store)

Querying the Semantic Web

SPARQL endpoints

- Triple stores has a "place" called *endpoint* to submit SPARQL queries
  - dbpedia.org/sparql provides a query endpoint to query over an RDF representation of Wikipedia
  - Find a complete list of SPARQL endpoints at CKAN.org
- Clients send queries to an endpoint using the HTTP protocol

SPARQL : Matching Patterns

RDF Data:

```
<?xml version="1.0"?>
<rdf:RDF
   xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
   xmlns:swp="http://www.semanticwebprimer.org/ontology/apartments.ttl#"
   xmlns:dbpedia="http://dbpedia.org/resource/"
   xmlns:dbpedia-owl="http://dbpedia.org/ontology/">

   <rdf:Description
rdf:about="http://www.semanticwebprimer.org/ontology/apartments.ttl#BaronWayApartment">
      <swp:hasNumberOfBedrooms
rdf:datatype="http://www.w3.org/2001/XMLSchema#integer">3</swp:hasNumberOfBedrooms>
      <swp:isPartOf
rdf:resource="http://www.semanticwebprimer.org/ontology/apartments.ttl#BaronWayBuilding"/>
   </rdf:Description>

   <rdf:Description
rdf:about="http://www.semanticwebprimer.org/ontology/apartments.ttl#BaronWayBuilding">
      <dbpedia-owl:location rdf:resource="http://dbpedia.org/resource/Amsterdam"/>
      <dbpedia-owl:location rdf:resource="http://dbpedia.org/resource/Netherlands"/>
   </rdf:Description>

</rdf:RDF>
```

SPARQL : Matching Patterns

RDF Data:

```
@prefix swp: <http://www.semanticwebprimer.org/ontology/apartments.ttl#>.
@prefix dbpedia: <http://dbpedia.org/resource/>.
@prefix dbpedia-owl: <http://dbpedia.org/ontology/>.

swp:BaronWayApartment swp:hasNumberOfBedrooms 3;
                      swp:isPartOf swp:BaronWayBuilding.
swp:BaronWayBuilding dbpedia-owl:location dbpedia:Amsterdam,
                     dbpedia:Netherlands.
```

SPARQL:Matching Patterns

SPARQL Query

Match the triple:

`swp:BaronWayBuilding dbpedia-owl:location ?location` where `?location` is a variable

SPARQL Query

```
PREFIX swp:     <http://www.semanticwebprimer.org/ontology/apartments.ttl#>.
PREFIX dbpedia: <http://dbpedia.org/resource/>.
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>.
SELECT ?location
WHERE {
        swp:BaronWayBuilding dbpedia-owl:location ?location.
    }
```

SPARQL Query

Query Result

SPARQL is trying to find sets of triples that match a given graph pattern

?location
http://dbpedia.org/resource/Amsterdam.
http://dbpedia.org/resource/Netherlands.

SPARQL

How about this query?

```
 PREFIX swp:
<http://www.semanticwebprimer.org/ontology/apartments.ttl#>.
PREFIX dbpedia:  <http://dbpedia.org/resource/>.
PREFIX dbpedia-owl:  <http://dbpedia.org/ontology/>.
SELECT ?p ?o
WHERE {
swp:BaronWayApartment ?p ?o.
}
```

Set of Predicates and Objects of matching triples

?p	?o
swp:hasNumberOfBedrooms	3
swp:isPartOf	swp:BaronWayBuilding

SPARQL

Limiting number of query answers

```
PREFIX swp:     <http://www.semanticwebprimer.org/ontology/apartments.ttl#>.
PREFIX dbpedia: <http://dbpedia.org/resource/>.
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>.
SELECT ?p ?o
WHERE {
        swp:BaronWayApartment ?p ?o.
}
LIMIT 10
```

SPARQL

Matching chains of triple patterns

Find all the apartments which are part of a building located in Amsterdam

```
 PREFIX swp:
<http://www.semanticwebprimer.org/ontology/apartments.ttl#>.
PREFIX dbpedia:  <http://dbpedia.org/resource/>.
PREFIX dbpedia-owl:  <http://dbpedia.org/ontology/>.
SELECT ?apartment
WHERE {
?apartment swp:isPartOf ?building.
?building dbpedia-owl:location dbpedia:Amsterdam.
}
```

SPARQL

Filtering

```
PREFIX swp:    <http://www.semanticwebprimer.org/ontology/apartments.ttl#>.
PREFIX dbpedia: <http://dbpedia.org/resource/>.
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>.
SELECT ?apartment
WHERE {
        ?apartment  swp:hasNumberOfBedrooms ?bedrooms.
         FILTER (?bedrooms > 2).
}
```

```
PREFIX swp:    <http://www.semanticwebprimer.org/ontology/apartments.ttl#>.
PREFIX dbpedia: <http://dbpedia.org/resource/>.
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>.
SELECT ?apartment
WHERE {
        ?apartment  swp:address ?address.
       FILTER regex(?address, "^4 Baron Way").
}
```

SPARQL

Querying inconsistent resource descriptions

```
@prefix swp:     <http://www.semanticwebprimer.org/ontology/apartments.ttl#>.
@prefix dbpedia: <http://dbpedia.org/resource/>.
@prefix dbpedia-owl: <http://dbpedia.org/ontology/>.
@prefix xsd:     <http://www.w3.org/2001/XMLSchema#>.

swp:BaronWayApartment swp:hasNumberOfBedrooms 3.
swp:BaronWayApartment dbpedia-owl:location dbpedia:Amsterdam.
swp:BaronWayApartment refs:label "Baron Way Apartment for Rent".

swp:FloridaAveStudio swp:hasNumberOfBedrooms 1.
swp:FloridaAveStudio dbpedia-owl:locationCity dbpedia:Amsterdam.
```

SPARQL

```
PREFIX swp:     <http://www.semanticwebprimer.org/ontology/apartments.tt
PREFIX geo:     <http://www.geonames.org/ontology#>.
PREFIX dbpedia: <http://dbpedia.org/resource/>.
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>.

SELECT ?apartment ?label
WHERE {
        {?apartment  dbpedia-owl:location dbpedia:Amsterdam.}
        UNION
        {?apartment  dbpedia-owl:locationCity dbpedia:Amsterdam.}
        OPTIONAL
        {?apartment rdfs:label ?label.}
}
```

The results of this query are:

?apartment	?label
swp:BaronWayApartment	Baron Way Apartment for Rent
swp:FloridaAveStudio	

Further Reading

- Organizing results
  - Aggregate functions (COUNT,AVG,MIN,MAX,SUM)
  - Ordering and sorting ORDER BY DESC/ASCE
- ASK and CONSTRUCT keywords
- Querying Schemas

FOAF: Friend of a Friend ontology

An ontology about personal information

To make personal information standard and machine readable. FOAF is simply a vocabulary (or ontology) that includes the basic terms to describe personal information.

- Project homepage: http://www.foaf-project.org/
- Namespace: http://xmlns.com/foaf/0.1/
- Typical prefix: foaf:
- Documentation: http://xmlns.com/foaf/spec/

Some key terms used in FOAF

`Person`, `Name`, `Nick`, `Title`, `Homepage`, `Box`, `Mbox_shalsum`, `Img`, `Surname`, `Family_name`, `Givenname`, `Firstname`, `Knows`

FOAF: Friend of a Friend ontology

```
<rdf:RDF
      xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
      xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
      xmlns:foaf="http://xmlns.com/foaf/0.1/"
      xmlns:admin="http://webns.net/mvcb/">
<foaf:PersonalProfileDocument rdf:about="">
  <foaf:maker rdf:resource="#me"/>
  <foaf:primaryTopic rdf:resource="#me"/>
  <admin:generatorAgent rdf:resource="http://www.ldodds.com/foaf/foaf-a-matic"/>
  <admin:errorReportsTo rdf:resource="mailto:leigh@ldodds.com"/>
</foaf:PersonalProfileDocument>
<foaf:Person rdf:ID="me">
<foaf:name>Lankeshwara Munasinghe</foaf:name>
<foaf:title>Dr</foaf:title>
<foaf:givenname>Lankeshwara</foaf:givenname>
<foaf:family_name>Munasinghe</foaf:family_name>
<foaf:nick>Lankesh</foaf:nick>
<foaf:mbox_sha1sum>d117679fcc0651de49f2b237dab3be0072c84cfa</foaf:mbox_sha1sum>
<foaf:homepage rdf:resource="https://science.kln.ac.lk/tunits/setu/index.php /component/sppagebuilder/25-dr-
l-munasinghe"/>
<foaf:phone rdf:resource="tel:0112903286"/>
<foaf:knows>
<foaf:Person>
<foaf:name>Nalin</foaf:name>
<foaf:mbox_sha1sum>2247e39ff0300fb8f8b58b96cb5764912f9ca67b</foaf:mbox_sha1sum></foaf:Person></foaf:knows>
<foaf:knows>
<foaf:Person>
<foaf:name>Tiroshan</foaf:name>
<foaf:mbox_sha1sum>6870c6e1e03beff6dd9a6ec51f7059f5275eeb3f</foaf:mbox_sha1sum></foaf:Person></foaf:knows>
</foaf:Person>
</rdf:RDF>
```

FOAF: Friend of a Friend ontology

```
<?xml version="1.0"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
      xmlns:foaf="http://xmlns.com/foaf/0.1/">
 <foaf:Person>
  <foaf:name>Chandima  Maduwanthi</foaf:name>
  <foaf:gender>Female</foaf:gender>
  <foaf:title>Lecturer</foaf:title>
  <foaf:nick>Madu</foaf:nick>
  <foaf:firstName>Chandima</foaf:firstName>
  <foaf:mbox rdf:resource="mailto:maducm20@gmail.com"/>
  <foaf:knows>
    <foaf:Person>
       <foaf:name>Bimali</foaf:name>
       <foaf:gender>Female</foaf:gender>
       <foaf:title>Lecturer</foaf:title>
       <foaf:givenname>Bimali</foaf:givenname>
       <foaf:surname>Wickramasinghe</foaf:surname>
       <foaf:mbox rdf:resource="mailto:bcs@gmail.com"/>
    </foaf:Person>
  </foaf:knows>
</foaf:Person>
</rdf:RDF>
```

End