RSP-QL*: ENABLING STATEMENT-LEVEL ANNOTATIONS IN RDF STREAMS

Robin Keskisärkkä, Eva Blomqvist, Leili Lind, and Olaf Hartig
firstname.lastname@liu.se
E-CARE@HOME

- Distributed research environment
- Technology-supported independent living
- Patient safety, system reliability, and transparency
- Semantic interoperability

http://ecareathome.se/
USE-CASE SCENARIO
SEMANTIC WEB TECHNOLOGIES
RDF STREAM PROCESSING

width

slide

$\omega$

$\beta$

$S_1$ $S_3$ $S_5$

$S_2$ $S_4$ $S_5$

$S_6$ $S_8$

$S_7$ $S_9$

$S_{10}$ $S_{12}$

time
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX sosa: <http://www.w3.org/ns/sosa/>
REGISTER STREAM <alerts/ox> COMPUTED EVERY PT10S AS
SELECT ?ox
FROM NAMED WINDOW <win> ON <sensor/ox> [RANGE PT1M STEP PT10S]
WHERE {
    WINDOW <win> {  
        # Oxygen saturation
        GRAPH ?g {
            ?o a sosa:Observation .
            ?o sosa:hasSimpleResult ?ox .
        }  
    }
    FILTER(?ox < 0.95)
}
RDF REIFICATION

<obs/0> sosa:hasSimpleResult 0.97 .
PREFIX ex: <http://www.example.org/ontology#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX sosa: <http://www.w3.org/ns/sosa/>
REGISTER STREAM <alerts/ox> COMPUTED EVERY PT10S AS
SELECT ?ox
FROM NAMED WINDOW <win> ON <sensor/ox> [RANGE PT1M STEP PT10S]
WHERE {
  WINDOW <win> { # Oxygen saturation
    GRAPH ?g {
      ?o a sosa:Observation ;
      sosa:hasSimpleResult ?ox .
      _:b a rdf:Statement ;
      rdf:subject ?o ;
      rdf:predicate sosa:hasSimpleResult ;
      rdf:object ?ox .
      _:b ex:confidence ?c .
    
    FILTER(?c > 0.90)
  }
  }
  FILTER(?ox < 0.95)
}
RDF

<< :bob foaf:age 23 >> ex:certainty 0.9 .

Expressed using Turtle* format
SPARQL*

```
SELECT ?age ?certainty
WHERE {
}
```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX sosa: <http://www.w3.org/ns/sosa/>
REGISTER STREAM <alerts/ox> COMPUTED EVERY PT10S AS
SELECT ?ox
FROM NAMED WINDOW <win> ON <sensor/ox> [RANGE PT1M STEP PT10S]
WHERE {
  WINDOW <win> { # Oxygen saturation
    GRAPH ?g {
      ?o a sosa:Observation .
      FILTER(?c > 0.90)
    }
  }
  FILTER(?ox < 0.95)
}
EVALUATION
APPLICATION-BASED EVALUATION
SERIALIZATION

# Trig*
_:g0 {  
  << <observation/0> <value> <value/0> >> <confidence> "0.84"^^xsd:float .
}

# Trig reification
_:g0 {  
  <observation/0> <value> 0 .
  [] a rdf:Statement ;
    rdf:subject <observation/0> ;
    rdf:predicate <value> ;
    rdf:object 0 ;
    <confidence> "0.84"^^xsd:float .
}
SERIALIZATION OVERHEAD

![Graph showing serialization overhead]

- **X-axis**: Number of annotated triples
- **Y-axis**: Size (kilobytes)

- **Lines**:
  - Red line: RDF Reification
  - Grey line: RDF*

- **Legend**:
  - RDF Reification
  - RDF*

The graph illustrates the relationship between the number of annotated triples and the size of the serialized data, showing an increasing trend for both RDF Reification and RDF*.
QUERY EXECUTION PERFORMANCE

![Graph showing execution time (ms) vs number of annotated triples]

- RDF Reification optimized
- RDF Reification
- RDF*

[GitHub link: https://github.com/keski/RSPQLStarEngine]
CONTRIBUTIONS

• Conceptual extension of RSP-QL
• Formal definitions of the proposed approach
• Prototype implementation
• Evaluation
• Foundation for future research

https://github.com/keski/RSPQLStarEngine
RDF*

An RDF* triple is defined recursively as:

• any RDF triple is an RDF* triple, and;
• any RDF* triple with an RDF* triple in the subject or object position is an RDF* triple
A *triple* pattern is defined recursively as:

- any triple pattern is a triple* pattern, and;
- any triple* pattern with a triple* pattern in the subject or object position is a triple* pattern
(SINGLE-STATEMENT) NAMED GRAPHS

:g1 { :bob foaf:age 23 } .
:g1 ex:certainty 0.9 .
SINGLETON PROPERTIES

:bob foaf:age#1 23 .
foaf:age#1 rdf:singletonPropertyOf foaf:age .
foaf:age#1 ex:certainty 0.9 .