INF3580 – Semantic Technologies – Spring 2011

Lecture 4: The SPARQL Query Language

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Today's Plan

1. Dagens tips
2. Repetition: RDF
3. Common Vocabularies
4. SPARQL By Example
5. SPARQL Systematically
6. Executing SPARQL Queries
7. More to come!

Outline

Kommandolinje-parser

Fra Redland-biblioteket:

```
rapper data.rdf
```

Dette vil parse og printe N-Triples av det den finner hvis det validerer.

```
rapper -i turtle data.ttl
```

vil gjøre det samme for Turtle.

Installere selv på Debian/Ubuntu:

```
apt-get install raptor-utils
```

Kan også anbefale

```
apt-get install redland-utils rasqal-utils
virtuoso-minimal
```

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Reminder: RDF triples

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- The subject maybe a resource or a blank node
- The predicate must be a resource
- The object can be a resource, a blank node, or a literal

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    geo:germany geo:name "Germany"@en .
    ```

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    ```
  - Typed, with a URI indicating the type:
    ```
    geo:berlin geo:population "3431700"^^xsd:integer .
    ```

Reminder: RDF Blank Nodes

Blank nodes are like resources without a URI

There is a city in Germany called Berlin

```
_:x a geo:City .
_:x geo:containedIn geo:germany .
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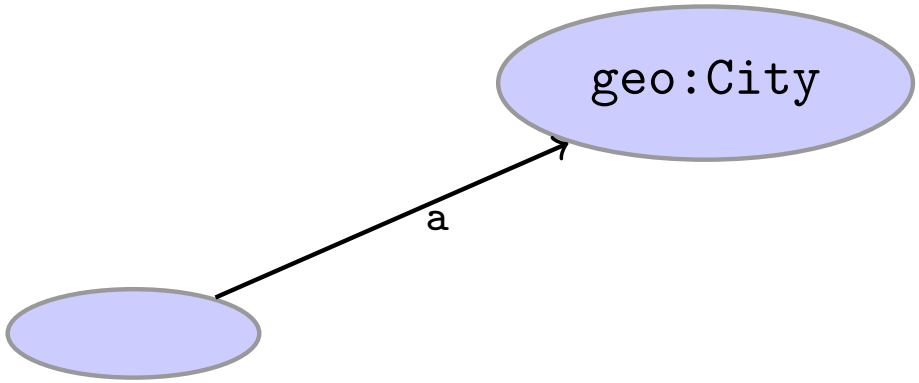

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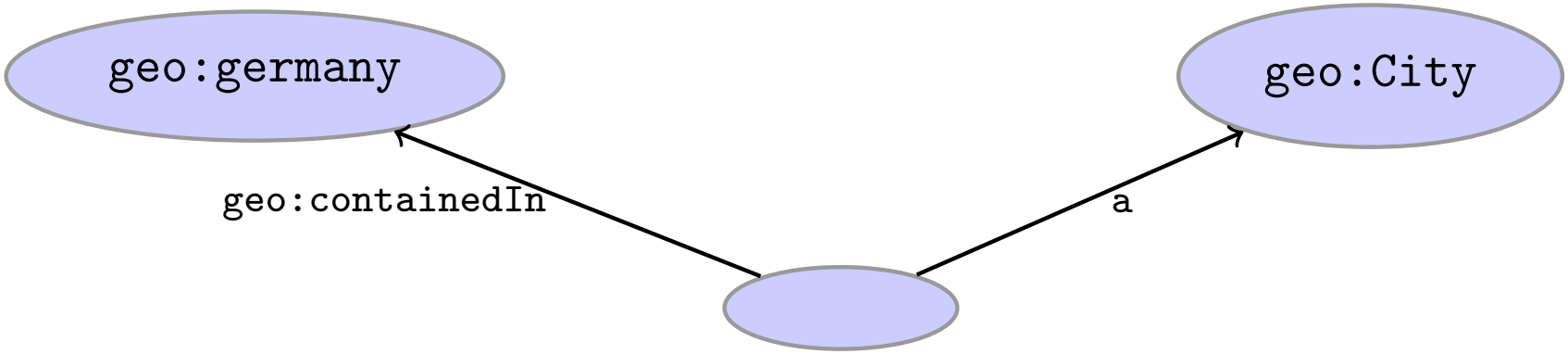

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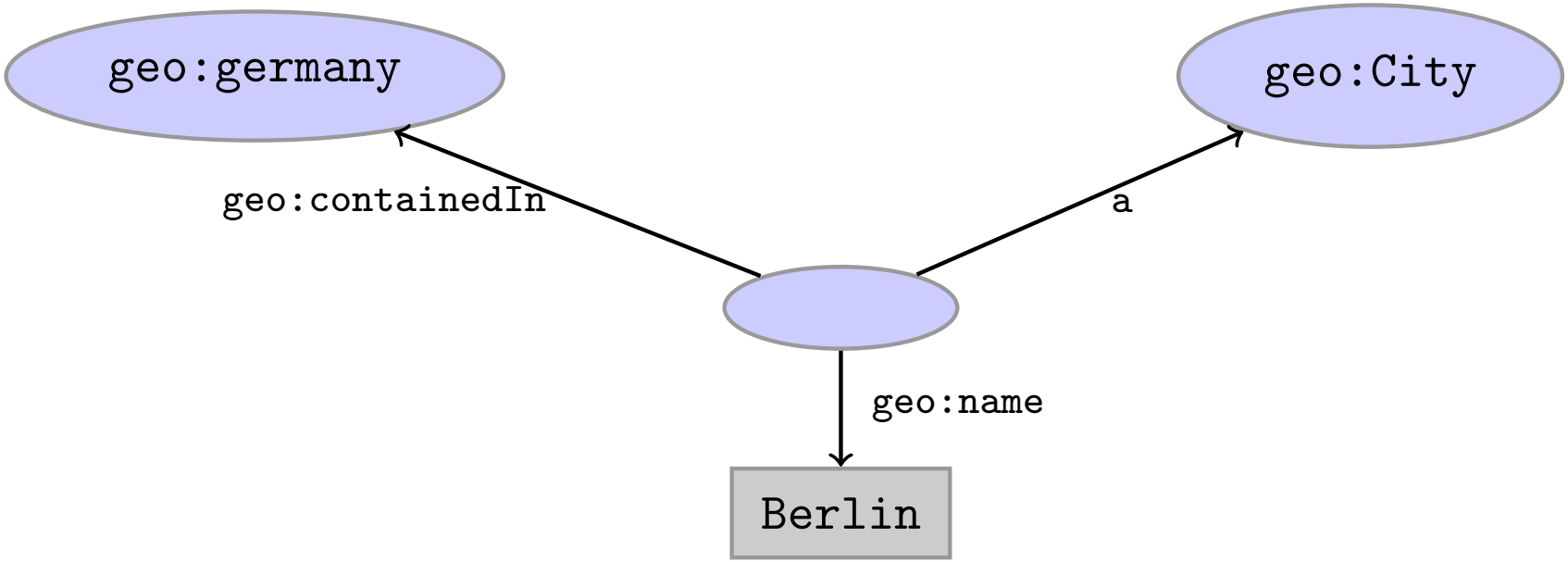

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- Simple pattern matching with `null` as wildcard possible

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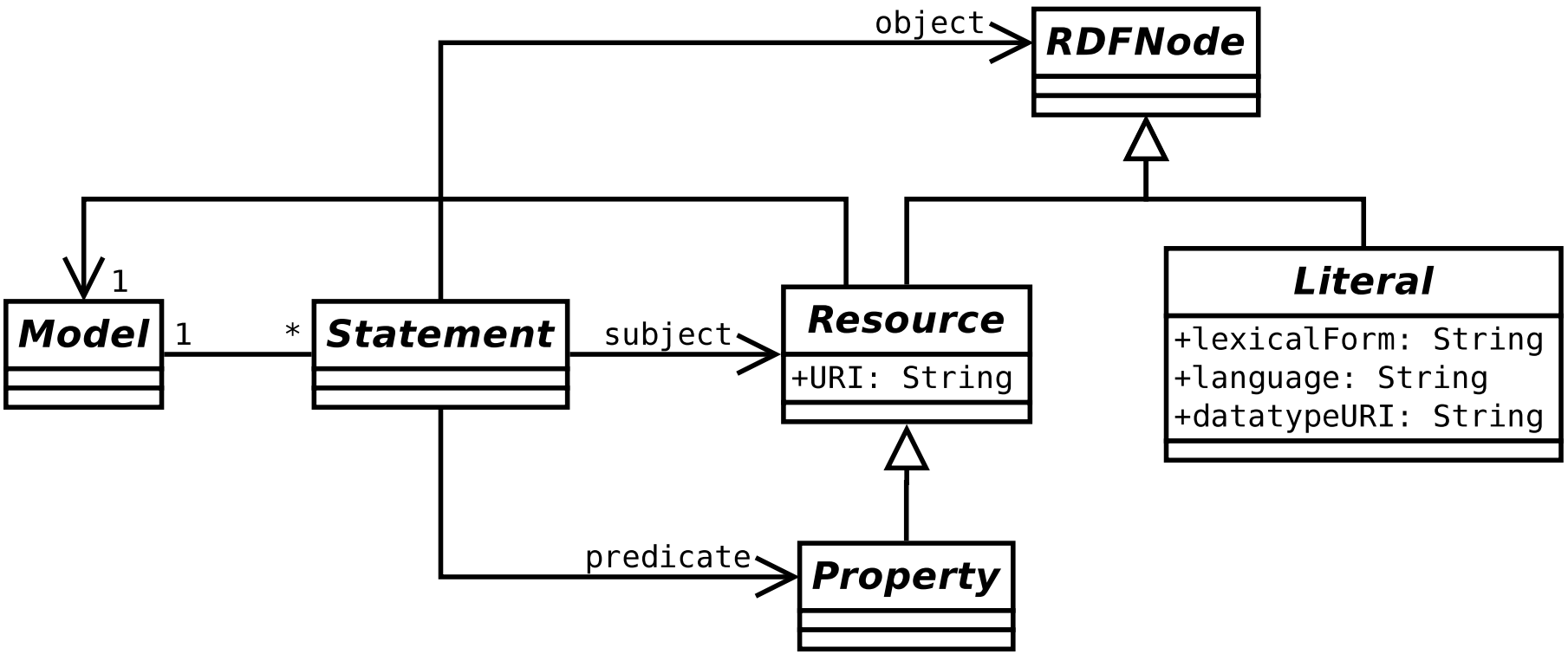

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- Examples:

```
geo:berlin rdf:type rdf:Resource .
geo:containedIn a rdf:Property .
rdf:type a rdf:Property .
```

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- Examples:

```
<http://heim.ifi.uio.no/martingi/foaf#me>
    a foaf:Person ;
    foaf:name "Martin Giese" ;
    foaf:mbox <mailto:martingi@ifi.uio.no> ;
    foaf:knows <http://.../martige/foaf#me> .
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- Examples:

```
<http://heim.ifi.uio.no/martingi/>
    dct:creator <http://.../foaf#me> ;
    dct:created "2007-08-01" ;
    dct:description "Martin Giese's homepage"@en ;
    dct:replaces <http://my.old.homepage/> .
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People called "Martin Giese"

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

?mg
<http://dblp.l3s.de/d2r/resource/authors/Martin_Giese>

Simple Examples (cont.)

Publications by people called "Martin Giese"

```
PREFIX foaf:  <http://xmlns.com/foaf/0.1/>
PREFIX dc:  <http://purl.org/dc/elements/1.1/>
SELECT ?pub WHERE {
    ?mg foaf:name "Martin Giese" .
    ?pub dc:creator ?mg .
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Simple Examples (cont.)

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Answer:

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<http://dblp.l3s.de/d2r/resource/publications/conf/cade/BeckertGHKRSS07>
<http://dblp.l3s.de/d2r/resource/publications/conf/fase/AhrendtBBGHHMMS02>
<http://dblp.l3s.de/d2r/resource/publications/conf/jelia/AhrendtBBGHHMS00>
<http://dblp.l3s.de/d2r/resource/publications/conf/lpar/Giese06>
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Simple Examples (cont.)

Titles of publications by people called "Martin Giese"

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SELECT ?title WHERE {
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    ?pub dc:title ?title .
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Answer:

?title
"Incremental Closure of Free Variable Tableaux."^^xsd:string
"The KeY system 1.0 (Deduction Component)."^^xsd:string
"The KeY System: Integrating Object-Oriented Design and Formal Methods."^^xsd:string
"The KeY Approach: Integrating Object Oriented Design and Formal Verification."^^xsd:string
"Saturation Up to Redundancy for Tableau and Sequent Calculi."^^xsd:string
...

Simple Examples (cont.)

Names of people who have published with "Martin Giese"

```
SELECT ?name WHERE {
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    ?pub dc:creator ?mg .
    ?pub dc:creator ?other .
    ?other foaf:name ?name.
}
```

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Answer:

?name
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"Martin Giese"
"Reiner Hähnle"
"Vladimir Klebanov"
...

Simple Examples (cont.)

Names of people who have published with "Martin Giese"

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SELECT DISTINCT ?name WHERE {
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    ?pub dc:creator ?mg .
    ?pub dc:creator ?other .
    ?other foaf:name ?name.
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Answer:

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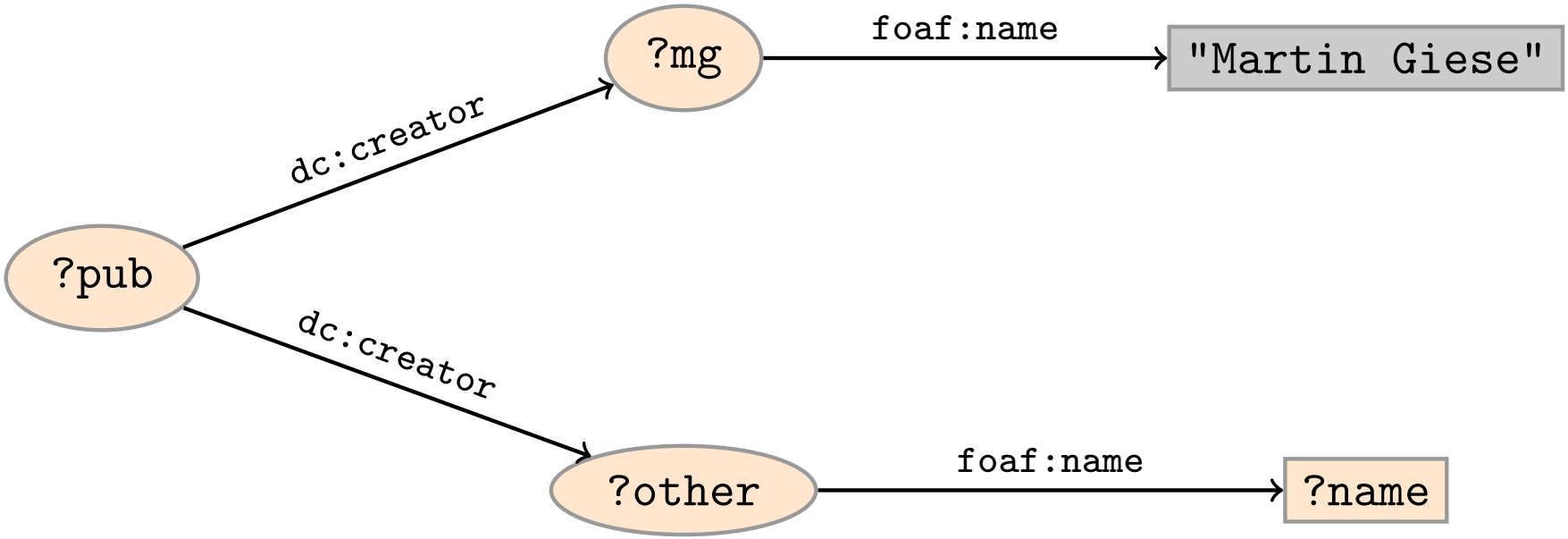
Graph Patterns

The previous SPARQL query as a graph:



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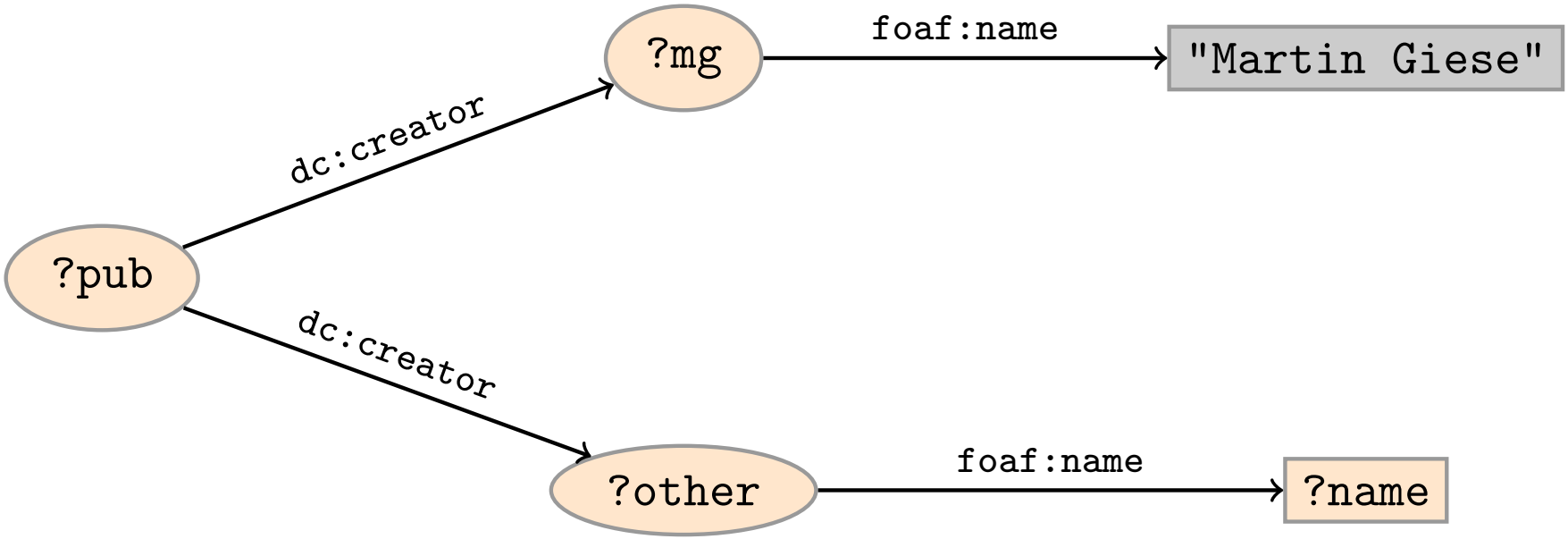

Assign values to variables to make this a sub-graph of the RDF graph!

Graph with blank nodes

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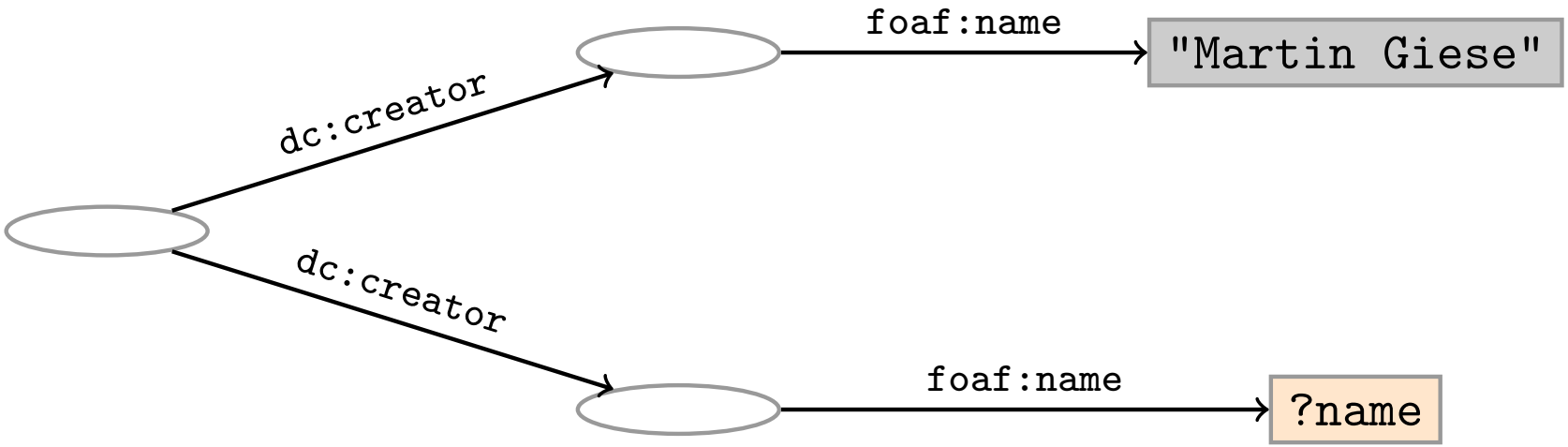
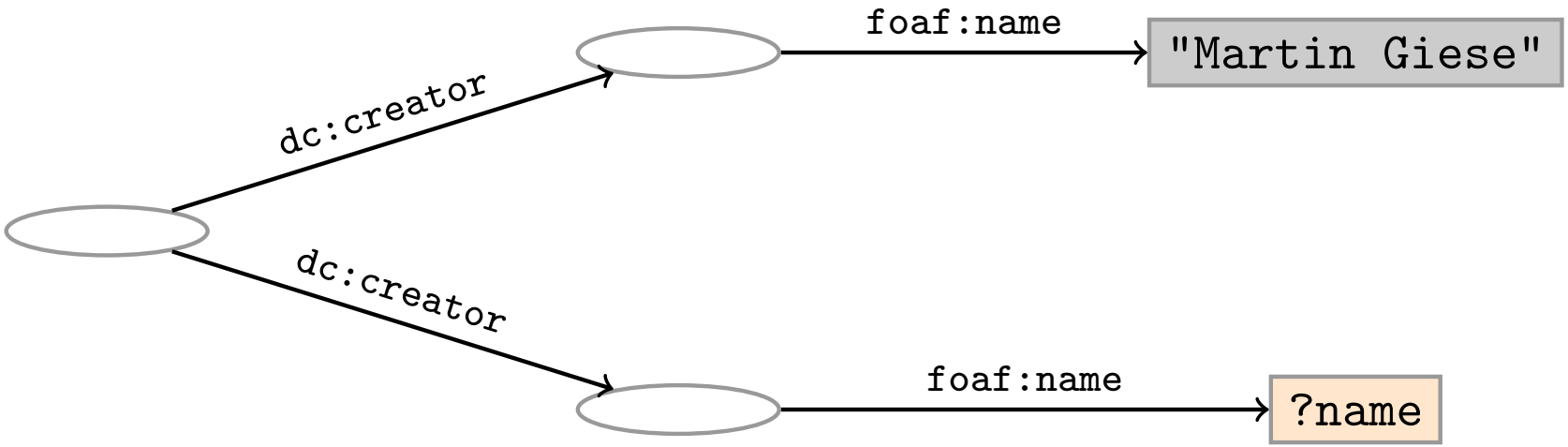


Graph with blank nodes

Variables not SELECTed can equivalently be blank:



Assign values to variables and blank nodes to make this a sub-graph of the RDF graph!

SPARQL Query with blank nodes

Names of people who have published with "Martin Giese"

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SELECT DISTINCT ?name WHERE {
    _:mg foaf:name "Martin Giese" .
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The same with blank node syntax

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SELECT DISTINCT ?name WHERE {
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Outline

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DESCRIBE Answer available information about matching resources

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- standard defines sorting conventions for literals, URIs, etc.

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  - `ResultSet` for results of a `SELECT`
- `CONSTRUCT` and `DESCRIBE` return `Models`, `ASK` a Java boolean.

Constructing a Query and a QueryExecution

- Query objects are usually constructed by parsing:

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String qStr =
      "PREFIX foaf:  <" + foafNS + ">"
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- To produce a QueryExecution for a given Query and Model:

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- Also has methods to get list of variables

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- `QueryExecution` contains methods to execute different kinds of queries (SELECT, CONSTRUCT, etc.)
- E.g. for a SELECT query:

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ResultSet res = qe.execSelect();
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- `ResultSet` is a sub-interface of `Iterator<QuerySolution>`
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- Important to call `close()` on query executions when no longer needed.

Example: SPARQL in Jena

```
String qStr = "SELECT ?a ?b ...";
Query q = QueryFactory.create(qStr);

QueryExecution qe =
   QueryExecutionFactory.create(q,model);

try {
   res = qe.execSelect();
   while( res.hasNext()) {
      QuerySolution soln = res.next();
      RDFNode a = soln.get("?a");
      RDFNode b = soln.get("?b");
      System.out.println(""+a+" knows "+b);
   }
} finally {
   qe.close();
}
```

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- Nothing you would want to do manually!

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- E.g.

```
String endpoint = "http://dblp.l3s.de/d2r/sparql";
String qStr = "SELECT ?a ?b ...";
Query q = QueryFactory.create(qStr);

QueryExecution qe =
   QueryExecutionFactory.sparqlService(endpoint,q);

try {
   res = qe.execSelect();
   ...
} finally {
   qe.close();
}
```

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- It is built about "graph patterns"
- Only queries compatible with "open world assumption"
- Comes with a protocol to communicate with "endpoints"
- Can be conveniently used with Jena and tens of other systems.

Outline

RDF Datasets

- SPARQL contains a mechanism for named RDF graphs
- Collections of named graphs are called "RDF datasets"
- Syntax for declaring named graphs in SPARQL
- Syntax for matching graph patterns in a given graph

SPARQL 1.1 in the works

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