

Updating Relational Data via SPARQL/Update

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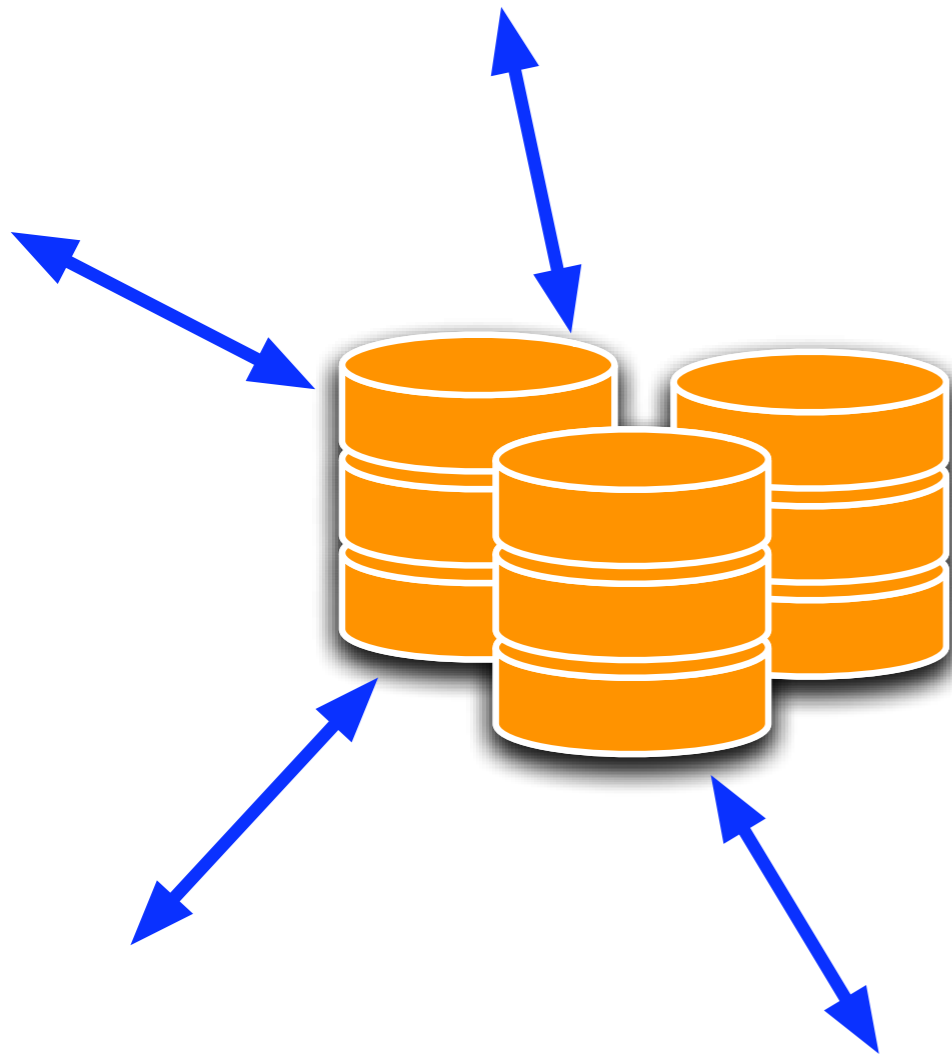
University of Zurich, Switzerland



University of Zurich
Department of Informatics



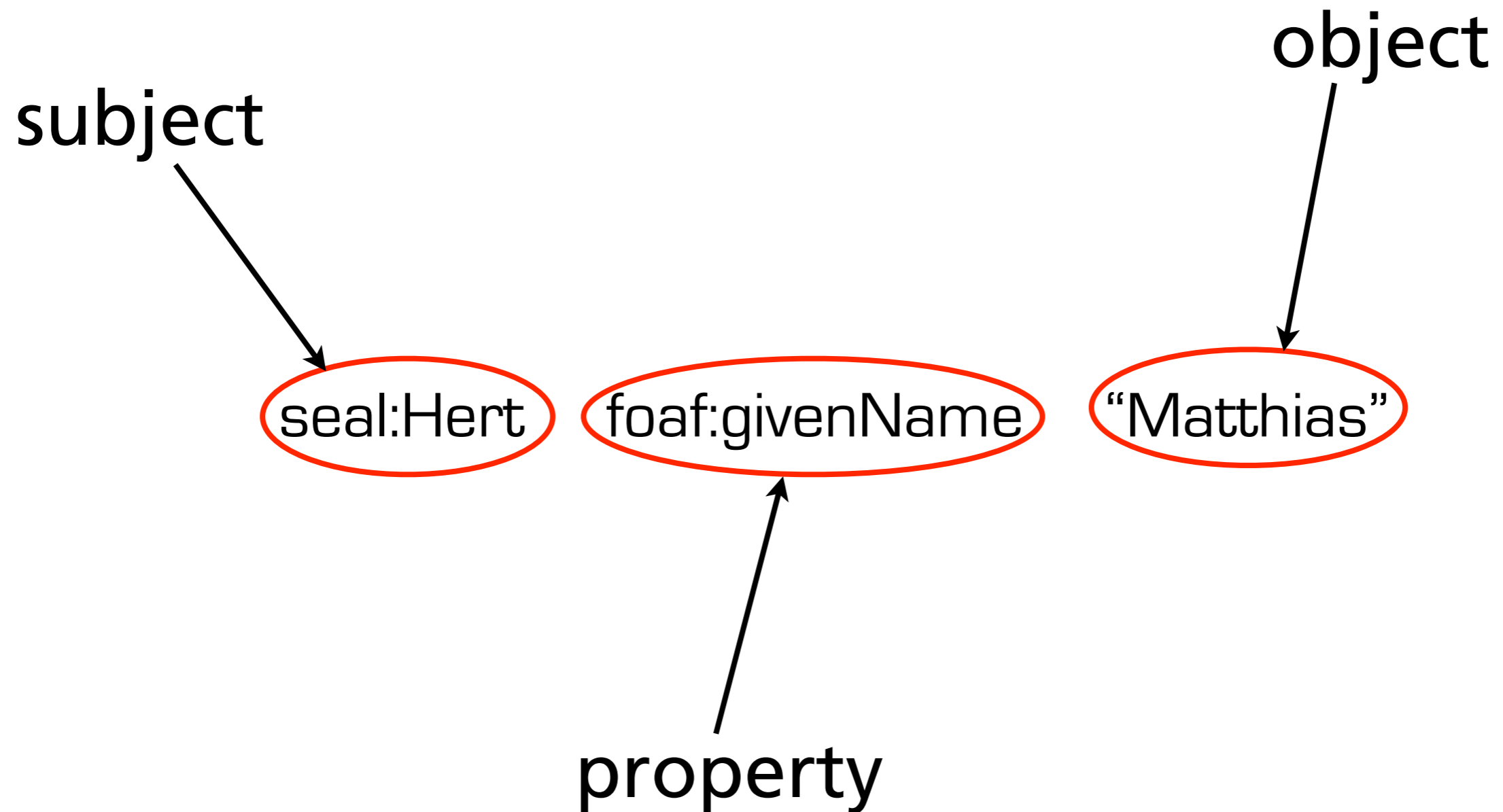
Motivation



- + large amounts of data
- semantics of the data
- relations are local



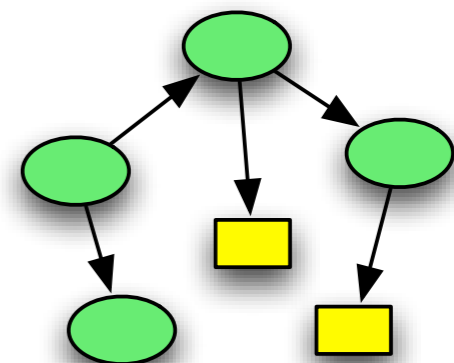
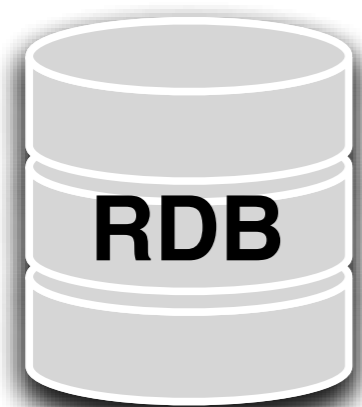
Semantic Web in a Nutshell



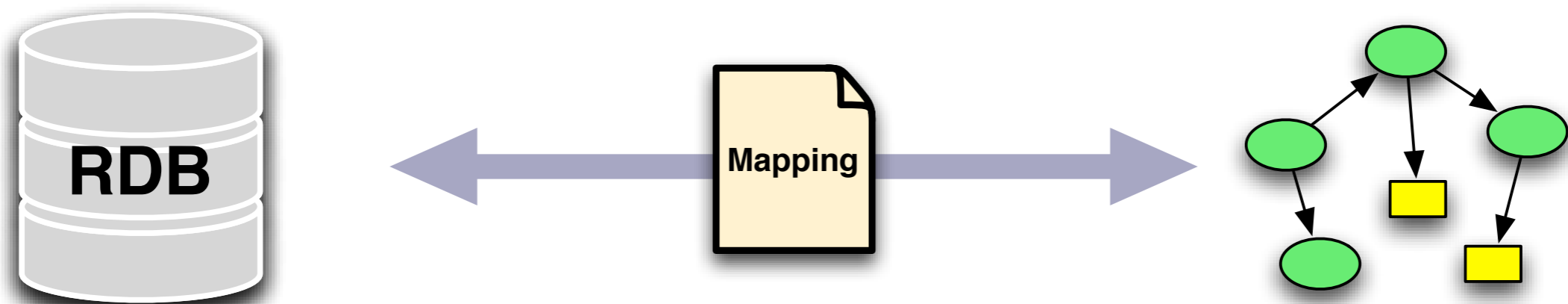
Semantic Web in a Nutshell

seal:Hert	rdf:type	foaf:Person
seal:Hert	foaf:givenName	“Matthias”
seal:Hert	foaf:familyName	“Hert”
seal:Hert	foaf:mbox	<u><mailto:hert@ifi.uzh.ch></u>
seal:Hert	uni:affiliation	uzh:IFI
uzh:IFI	rdf:type	uzh:Department
uzh:IFI	foaf:name	“Department of Informatics”

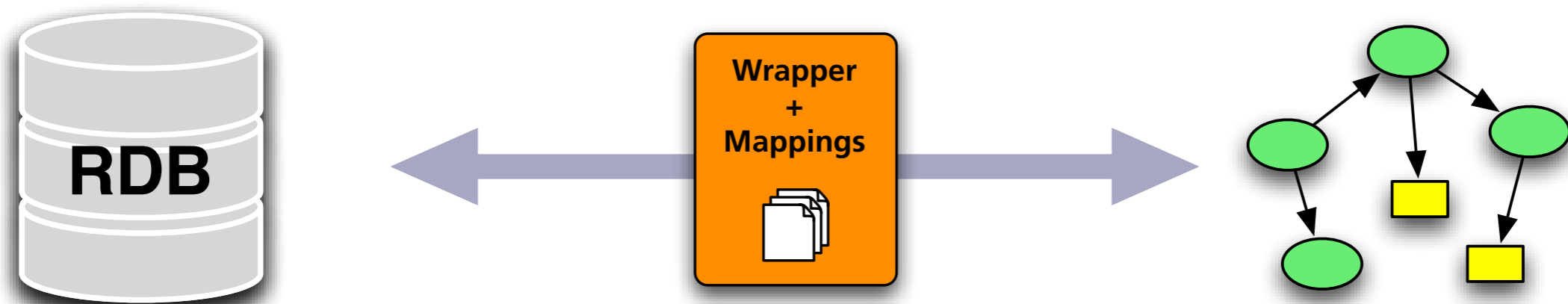
RDB-RDF Mapping



RDB-RDF Mapping



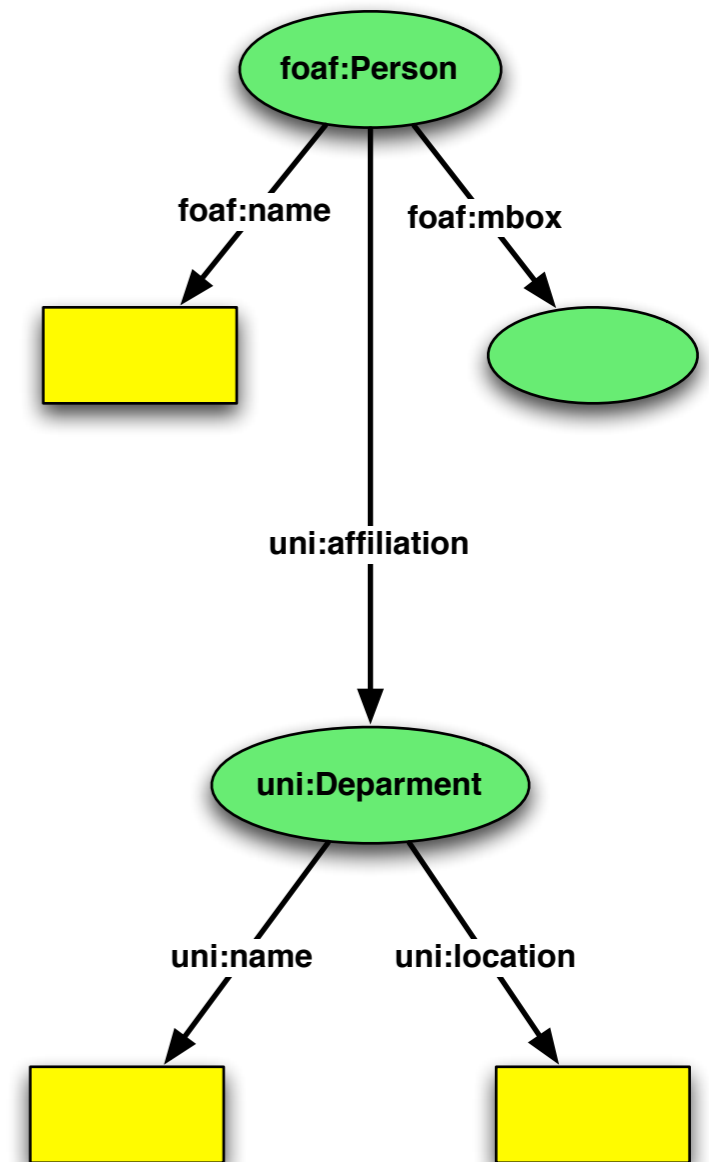
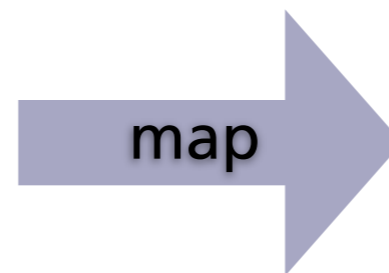
RDB-RDF Mapping



Example & Mapping

person			
<u>id</u>	name	email	dep

Department		
<u>id</u>	name	location



Example & Mapping

person			
<u>id</u>	name	email	dep
17	Matthias Hert	hert@ifi.uzh.ch	3

Department		
<u>id</u>	name	location
3	Department of ...	Zurich Nord

inst:Pers17 rdf:type foaf:Person

inst:Pers17 foaf:name "Matthias Hert"

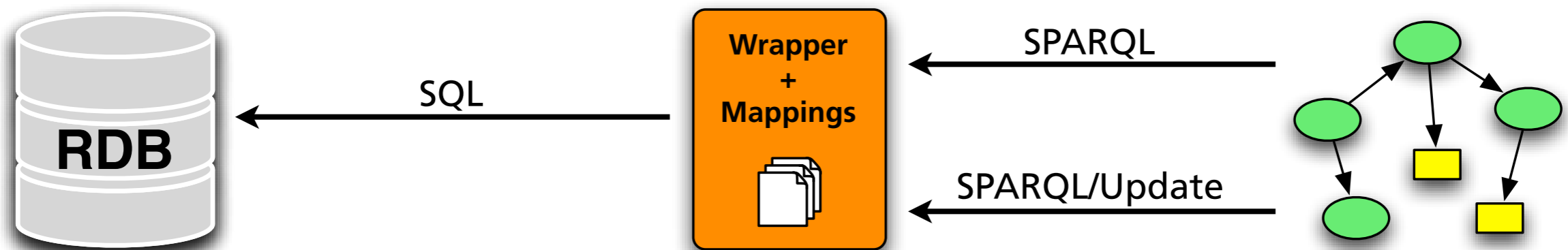
inst:Pers17 foaf:mbox <mailto:hert@ifi.uzh.ch>

inst:Pers17 uni:affiliation inst:Dep3

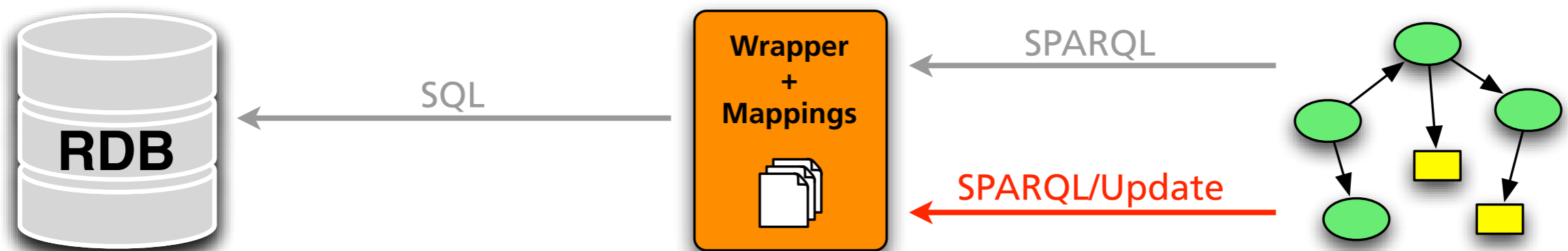
inst:Dep3 uni:name "Department of Informatics"

inst:Dep3 uni:location "Zurich Nord"

Request Translation



Request Translation



SPARQL/Update

INSERT DATA

DELETE DATA

MODIFY

W3C Working Draft



SPARQL 1.1 Update

W3C Working Draft 26 January 2010

This version:

<http://www.w3.org/TR/2010/WD-sparql11-update-20100126/>

Latest version:

<http://www.w3.org/TR/sparql11-update/>

Previous version:

<http://www.w3.org/TR/2009/WD-sparql11-update-20091022/>

Editors:

Simon Schenk <sschenk@uni-koblenz.de>

Paul Gearon <gearon@computer.org>

SPARQL/Update

```
INSERT DATA  
{  
  triples  
}
```

```
DELETE DATA
```

```
MODIFY
```

```
INSERT DATA
```

```
{
```

```
  inst:Pers29 rdf:type foaf:Person .
```

```
  inst:Pers29 foaf:name "Bob Smith" .
```

```
  inst:Pers29 foaf:mbox <mailto:smith@uzh.ch> .
```

```
  inst:Pers29 uni:affiliation inst:Dep3 .
```

```
}
```

SPARQL/Update

INSERT DATA

DELETE DATA

```
{  
  triples  
}
```

MODIFY

DELETE DATA

```
{  
  inst:Pers29 foaf:mbox <mailto:smith@uzh.ch> .  
}
```

SPARQL/Update

```
INSERT DATA
```

```
DELETE DATA
```

```
MODIFY
```

```
DELETE
```

```
{  
  template
```

```
}
```

```
INSERT
```

```
{  
  template
```

```
}
```

```
WHERE
```

```
{  
  pattern
```

```
}
```

```
MODIFY
```

```
DELETE {
```

```
  ?x uni:affiliation inst:Dep3 .
```

```
}
```

```
INSERT {
```

```
  ?x uni:affiliation inst:Dep4 .
```

```
}
```

```
WHERE {
```

```
  ?x rdf:type foaf:Person .
```

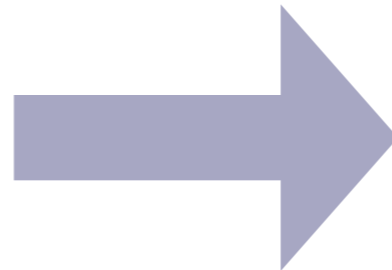
```
  ?x foaf:mbox <mailto:miller@uzh.ch> .
```

```
}
```

SPARQL/Update → SQL

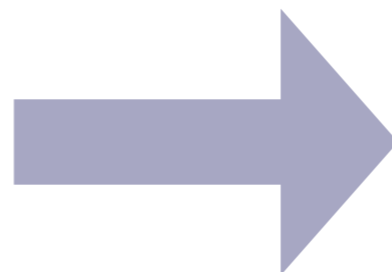
INSERT DATA

DELETE DATA



**Triples to
SQL**

MODIFY



**Modify to
SQL**

Triples to SQL

INSERT DATA

{

inst:Pers29 rdf:type foaf:Person .

inst:Pers29 foaf:name "Bob Smith" .

inst:Pers29 foaf:mbox <mailto:smith@uzh.ch> .

inst:Pers29 uni:affiliation inst:Dep3 .

}

Triples to SQL

INSERT DATA

{

inst:Pers29 rdf:type foaf:Person .

inst:Pers29 foaf:name "Bob Smith" .

inst:Pers29 foaf:mbox <mailto:smith@uzh.ch> .

inst:Pers29 uni:affiliation **inst:Dep6** .

inst:Dep6 uni:name "Department of Math" .

inst:Dep6 uni:location "Irchel" .

}

Triples to SQL

```
inst:Pers29 rdf:type foaf:Person .  
inst:Pers29 foaf:name "Bob Smith" .  
inst:Pers29 foaf:mbox <mailto:smith@uzh.ch> .  
inst:Pers29 uni:affiliation inst:Dep6 .  
inst:Dep6 uni:name "Department of Math" .  
inst:Dep6 uni:location "Irchel" .
```

Triples to SQL

A

```
inst:Pers29 rdf:type foaf:Person .  
inst:Pers29 foaf:name "Bob Smith" .  
inst:Pers29 foaf:mbox <mailto:smith@uzh.ch> .  
inst:Pers29 uni:affiliation inst:Dep6 .
```

B

```
inst:Dep6 uni:name "Department of Math" .  
inst:Dep6 uni:location "Irchel" .
```

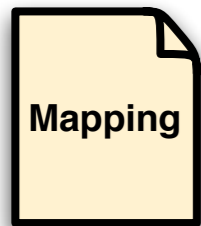
1. group triples

Triples to SQL

A

```
inst:Pers29 rdf:type foaf:Person .  
inst:Pers29 foaf:name "Bob Smith" .  
inst:Pers29 foaf:mbox <mailto:smith@uzh.ch> .  
inst:Pers29 uni:affiliation inst:Dep6 .
```

Triples to SQL



```
inst:Pers29 rdf:type foaf:Person .  
inst:Pers29 foaf:name "Bob Smith" .  
inst:Pers29 foaf:mbox <mailto:smith@uzh.ch> .  
inst:Pers29 uni:affiliation inst:Dep6 .
```

2. check data

Triples to SQL

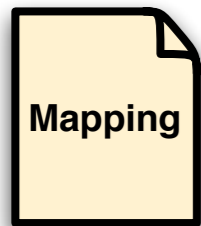


```
inst:Pers29 rdf:type foaf:Person .  
inst:Pers29 foaf:name "Bob Smith" .  
inst:Pers29 foaf:mbox <mailto:smith@uzh.ch> .  
inst:Pers29 uni:affiliation inst:Dep6 .
```

3. generate SQL

Triples to SQL

table = person
id = 29



inst:Pers29 rdf:type foaf:Person .
inst:Pers29 foaf:name "Bob Smith" .
inst:Pers29 foaf:mbox <mailto:smith@uzh.ch> .
inst:Pers29 uni:affiliation inst:Dep6 .

3. generate SQL

Triples to SQL

table = person
id = 29

attribute = name
value = 'Bob Smith'



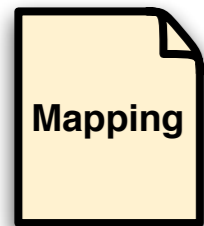
```
inst:Pers29 rdf:type foaf:Person .  
inst:Pers29 foaf:name "Bob Smith" .  
inst:Pers29 foaf:mbox <mailto:smith@uzh.ch> .  
inst:Pers29 uni:affiliation inst:Dep6 .
```

3. generate SQL

Triples to SQL

table = person
id = 29

attribute = name
value = 'Bob Smith'



```
inst:Pers29 rdf:type foaf:Person .  
inst:Pers29 foaf:name "Bob Smith" .  
inst:Pers29 foaf:mbox <mailto:smith@uzh.ch> .  
inst:Pers29 uni:affiliation inst:Dep6 .
```

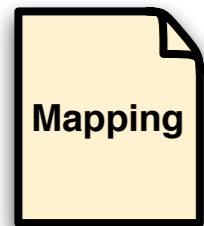
attribute = email
value = 'smith@uzh.ch'

3. generate SQL

Triples to SQL

table = person
id = 29

attribute = name
value = 'Bob Smith'



inst:Pers29 rdf:type foaf:Person .

inst:Pers29 foaf:name "Bob Smith" .

inst:Pers29 foaf:mbox <mailto:smith@uzh.ch> .

inst:Pers29 uni:affiliation inst:Dep6 .

attribute = dep
value = 6

attribute = email
value = 'smith@uzh.ch'

3. generate SQL

Triples to SQL

```
INSERT INTO person (id, name, email, dep)
VALUES (29, 'Bob Smith', 'smith@uzh.ch', 6)
```

3. generate SQL

Triples to SQL

A

```
INSERT INTO person (id, name, email, dep)
VALUES (29, 'Bob Smith', 'smith@uzh.ch', 6)
```

B

```
INSERT INTO department (id, name, location)
VALUES (6, 'Department of Math', 'Irchel')
```

3. generate SQL

Triples to SQL

```
INSERT INTO person (id, name, email, dep)  
VALUES (29, 'Bob Smith', 'smith@uzh.ch', 6)
```

```
INSERT INTO department (id, name, location)  
VALUES (6, 'Department of Math', 'Irchel')
```

FK



4. sort SQL

Triples to SQL

```
INSERT INTO department (id, name, location)  
VALUES (6, 'Department of Math', 'Irchel')
```

```
INSERT INTO person (id, name, email, dep)  
VALUES (29, 'Bob Smith', 'smith@uzh.ch', 6)
```

5. execute SQL

Modify to SQL

```
MODIFY
DELETE {
    ?x uni:affiliation inst:Dep3 .
}
INSERT {
    ?x uni:affiliation inst:Dep4 .
}
WHERE {
    ?x rdf:type foaf:Person .
    ?x foaf:mbox <mailto:miller@uzh.ch> .
}
```


Modify to SQL

Delete

MODIFY

```
DELETE {  
  ?x uni:affiliation inst:Dep3 .  
}
```

Insert

```
INSERT {  
  ?x uni:affiliation inst:Dep4 .  
}
```

Where

```
WHERE {  
  ?x rdf:type foaf:Person .  
  ?x foaf:mbox <mailto:miller@uzh.ch> .  
}
```

1. split Modify

Modify to SQL

```
SELECT ?x
WHERE {
    ?x rdf:type foaf:Person .
    ?x foaf:mbox <mailto:miller@uzh.ch> .
}
```

2. generate Select

Modify to SQL

```
SELECT id  
FROM person  
WHERE email = 'miller@uzh.ch'
```

3. translate Select

Modify to SQL

SQL results
<u>id</u>
34

4. *execute Select*

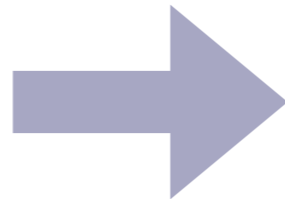
Modify to SQL

SPARQL results
<u>?x</u>
inst:Pers34

5. generate Delete & Insert

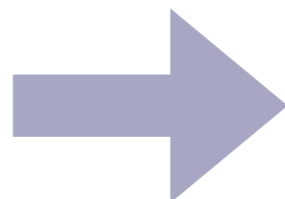
Modify to SQL

```
DELETE {  
  ?x uni:affiliation inst:Dep3 .  
}
```



```
DELETE {  
  inst:Pers34 uni:affiliation inst:Dep3 .  
}
```

```
INSERT {  
  ?x uni:affiliation inst:Dep4 .  
}
```



```
INSERT {  
  inst:Pers34 uni:affiliation inst:Dep4 .  
}
```

SPARQL results
<u>?x</u>
inst:Pers34

5. generate Delete & Insert

Modify to SQL

```
DELETE DATA {  
  inst:Pers34 uni:affiliation inst:Dep3 .  
}
```

```
INSERT DATA {  
  inst:Pers34 uni:affiliation inst:Dep4 .  
}
```

6. translate Delete & Insert

Modify to SQL

```
UPDATE person  
SET dep = NULL  
WHERE id = 34 AND dep = 3
```

```
UPDATE person  
SET dep = 4  
WHERE id = 34
```

6. translate Delete & Insert

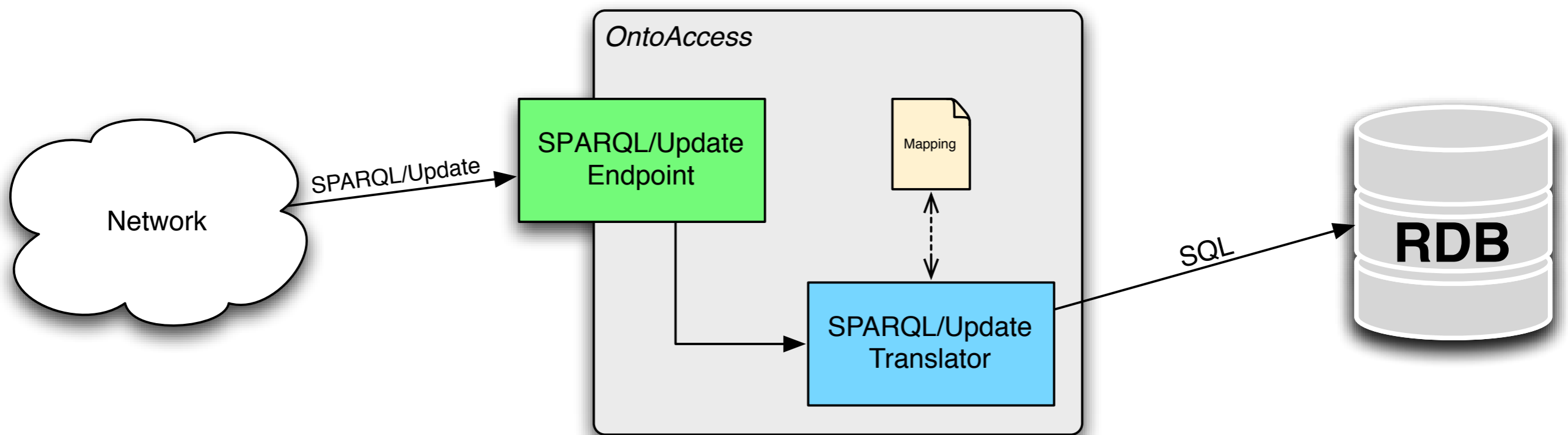
Modify to SQL

```
UPDATE person  
SET dep = NULL  
WHERE id = 34 AND dep = 3
```

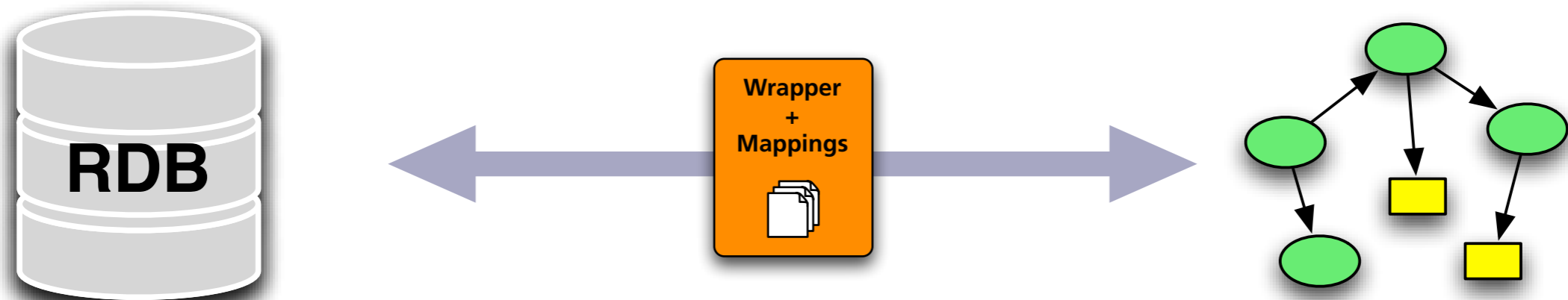
```
UPDATE person  
SET dep = 4  
WHERE id = 34
```

7. execute SQL

Prototype Implementation



Conclusion



- SPARQL/Update → SQL
- Bidirectional Data Flow

➔ <http://ontoaccess.org>

