A SQL-based Approach for Mapping Relational Data to RDF

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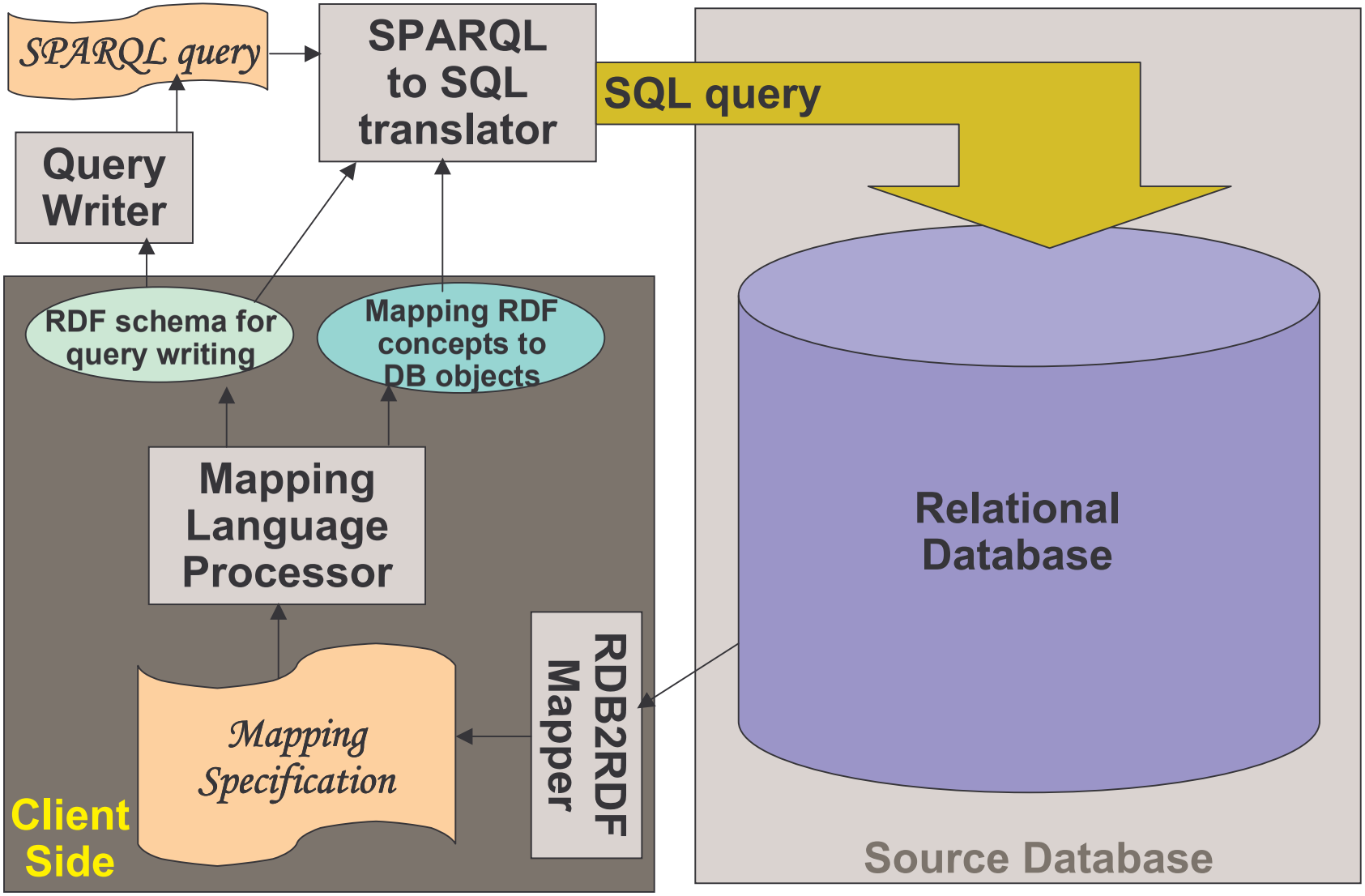
Architecture Diagram for RDB2RDF processing



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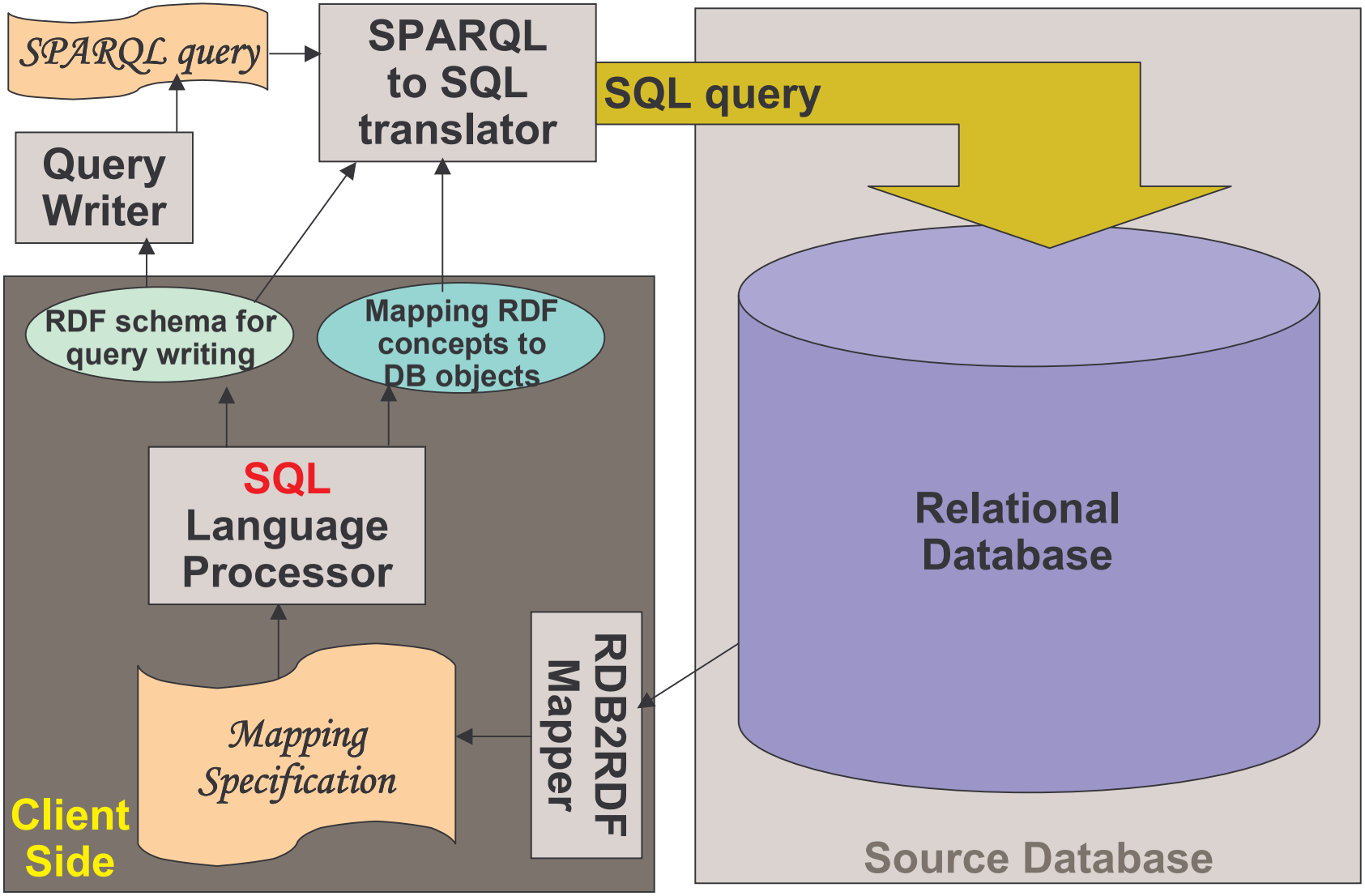

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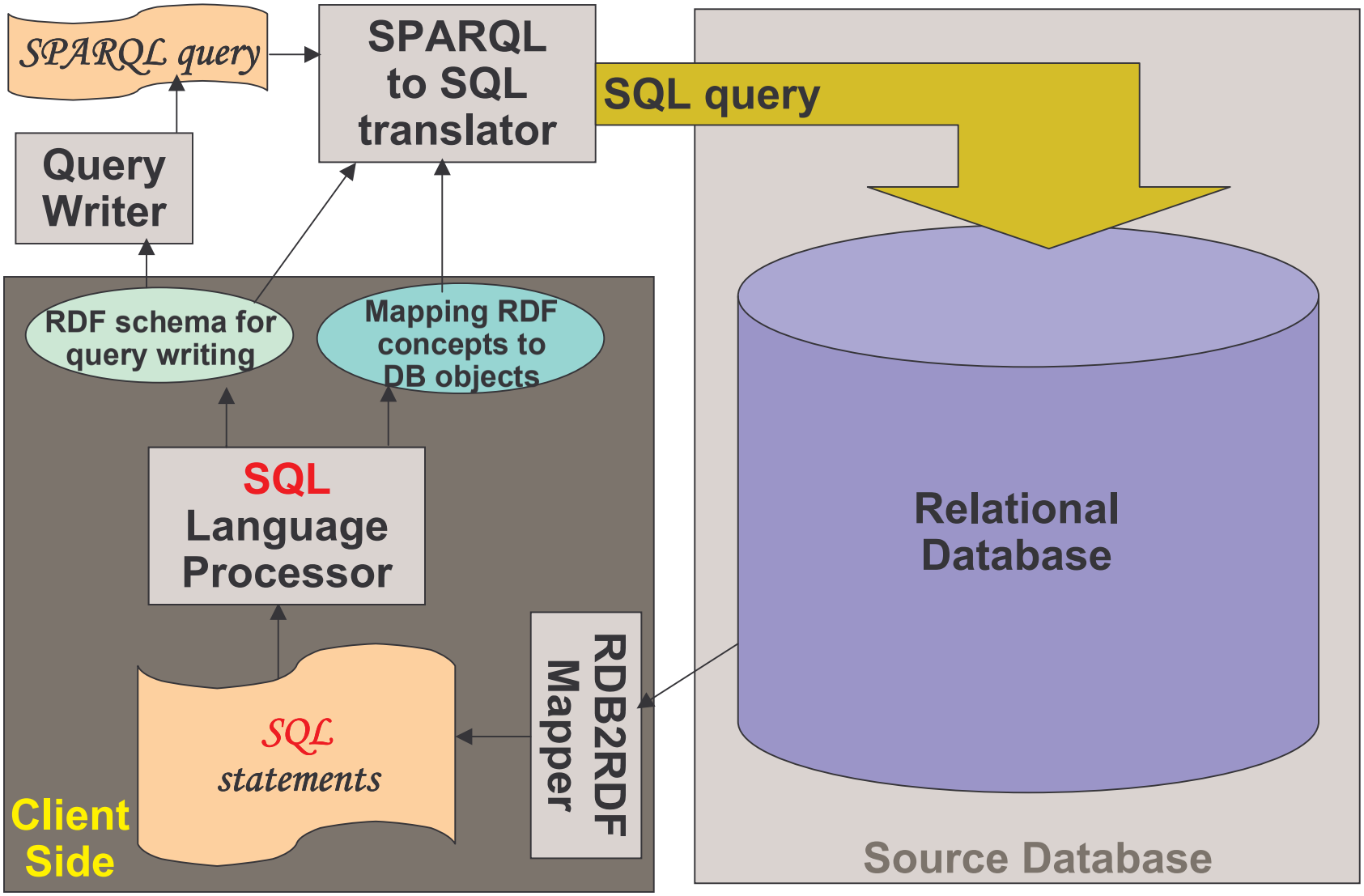
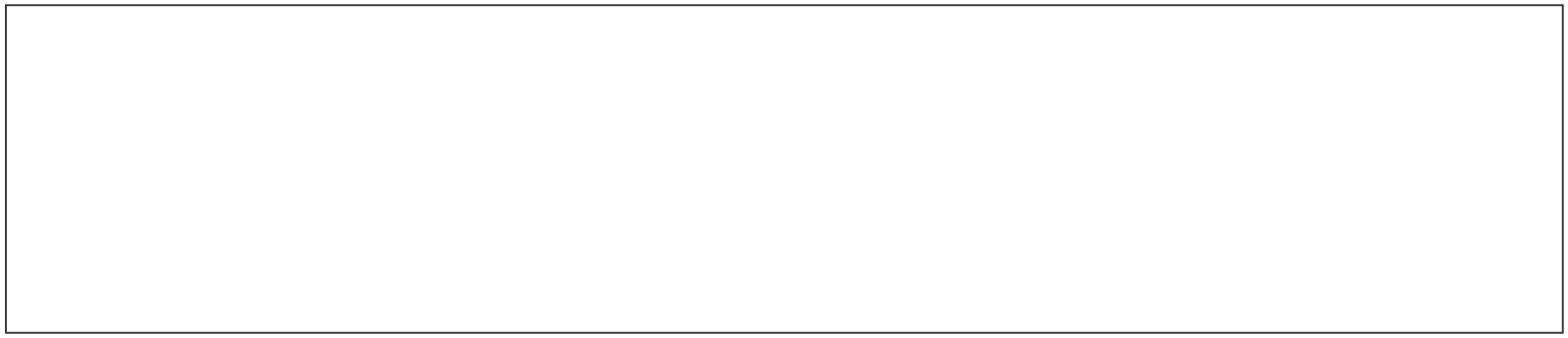


Overview



Overview

- Basis for defining an RDFS/OWL class and its properties based on relational data stored in a source database:
  - A SQL query specification against the source DB
    - No restriction on query complexity
  - Related foreign and unique key constraint definitions.

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  - No-DB: Only connects to database using JDBC or ODBC.

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  - Strong-DB: An RDBMS with support for Views and Constraints on Views. (Example: Oracle database server)
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- Proposed mapping language
  (Note: SQL is *not* a part of the mapping language)
  - Strong-DB ➔ No new language. Employ some *conventions* with SQL (e.g., when naming Views, View cols, and constraints).
  - No-DB ➔ Simple language to specify mapping between RDF classes, properties and SQL queries, query projections, constraints.

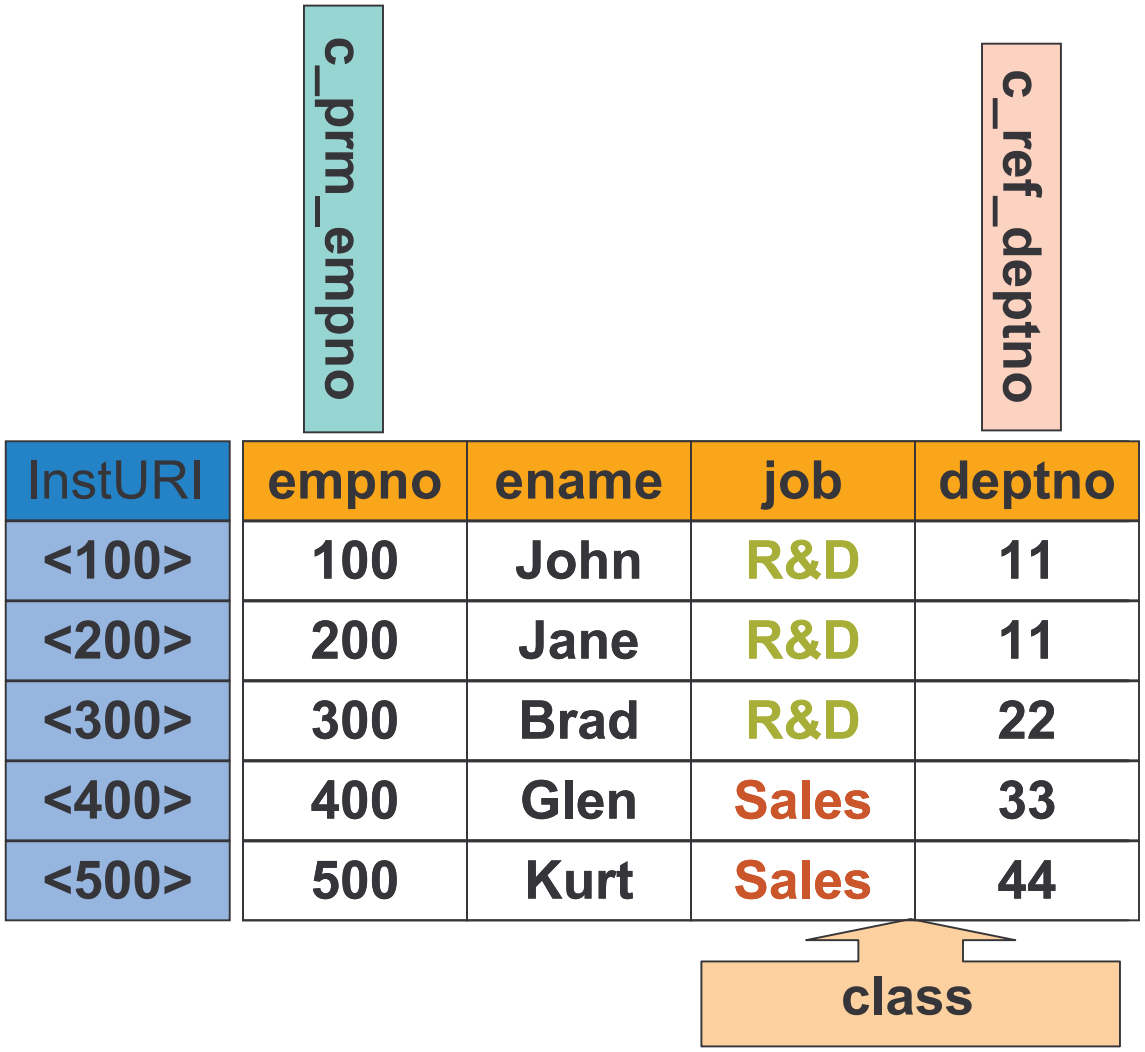
DB View ➔ RDF Class and Properties

c_prm_empno

c_ref_deptno

empno	ename	job	deptno
100	John	R&D	11
200	Jane	R&D	11
300	Brad	R&D	22
400	Glen	Sales	33
500	Kurt	Sales	44

DB View ➔ RDF Class and Properties



DB View ➔ RDF Class and Properties

c_prm_empno

c_ref_deptno

job- based classes

status- based classes

InstURI	empno	ename	job	deptno	rdf:type	status	rdf:type
<100>	100	John	R&D	11		part	<part>
<200>	200	Jane	R&D	11		full	<full>
<300>	300	Brad	R&D	22		intrn	<intrn>
<400>	400	Glen	Sales	33		full	<full>
<500>	500	Kurt	Sales	44		full	<full>

class

Example: DEPT view defines Class and Properties

```
CREATE VIEW "<xyz.com/dept>" AS
  SELECT   '<xyz.com/dept/' || deptno || '>'
         , deptno
         , dname
         , loc
    FROM   dept
```

Example: DEPT view defines Class and Properties

CREATE VIEW "<xyz.com/dept>" AS

SELECT	'<xyz.com/dept/' || deptno || '>'	InstURI
	, deptno	"<xyz.com/dept/deptno>"
	, dname	"<xyz.com/dept/Name>"
	, loc	"<xyz.com/dept/Location>"
FROM	dept	

Example: DEPT view defines Class and Properties

CREATE VIEW "<xyz.com/dept>" AS

SELECT

'<xyz.com/dept/' || deptno || '>'	InstURI
, deptno	"<xyz.com/dept/deptno>"
, dname	"<xyz.com/dept/Name>"
, loc	"<xyz.com/dept/Location>"

FROM dept

```
ALTER VIEW "<xyz.com/dept>"
add constraint "<xyz.com/dept/c_unq_deptno>"
unique ("<xyz.com/dept/deptno>")
disable novalidate;
```

Example: EMP view defines Class and Properties

```
CREATE VIEW "<xyz.com/emp>" AS
SELECT   '<xyz.com/emp/' || empno || '>'
       , empno
       , ename
       , '<xyz.com/emp/job/' || job || '>'
       , job
       , deptno
FROM     emp
```

Example: EMP view defines Class and Properties

CREATE VIEW "<xyz.com/emp>" AS

SELECT

'<xyz.com/emp/' || empno || '>'	InstURI
, empno	"<xyz.com/emp/empno>"
, ename	"<xyz.com/emp/Name>"
, '<xyz.com/emp/job/' || job || '>'	"rdf:type"
, job	"<xyz.com/emp/job>"
, deptno	"<xyz.com/emp/deptNum>"

FROM emp

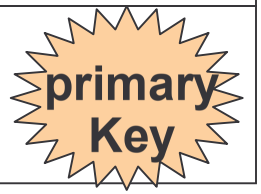
Example: EMP view defines Class and Properties

CREATE VIEW "<xyz.com/emp>" AS
SELECT

'<xyz.com/emp/' || empno || '>'	InstURI
, empno	"<xyz.com/emp/empno>"
, ename	"<xyz.com/emp/Name>"
, '<xyz.com/emp/job/' || job || '>'	"rdf:type"
, job	"<xyz.com/emp/job>"
, deptno	"<xyz.com/emp/deptNum>"

FROM emp

ALTER VIEW "<xyz.com/emp>"
add constraint "<xyz.com/emp/c_prm_empno>"
primary key ("<xyz.com/emp/empno>") disable novalidate;



Example: EMP view defines Class and Properties

CREATE VIEW "<xyz.com/emp>" AS
SELECT

'<xyz.com/emp/' || empno || '>'	InstURI
, empno	"<xyz.com/emp/empno>"
, ename	"<xyz.com/emp/Name>"
, '<xyz.com/emp/job/' || job || '>'	"rdf:type"
, job	"<xyz.com/emp/job>"
, deptno	"<xyz.com/emp/deptNum>"

FROM emp

ALTER VIEW "<xyz.com/emp>"
add constraint "<xyz.com/emp/c_prm_empno>"
primary key ("<xyz.com/emp/empno>") disable novalidate;

primary Key

ALTER VIEW "<xyz.com/emp>"
add constraint "<xyz.com/emp/c_ref_deptno>"
foreign key ("<xyz.com/emp/deptNum>")
references "<xyz.com/dept>" ("<xyz.com/dept/deptno>")
disable novalidate;

foreign Key

Example: EMP view with multiple rdf:type columns

CREATE VIEW "<xyz.com/emp>" AS

SELECT

'<xyz.com/emp/' || empno || '>'	InstURI
, empno	"<xyz.com/emp/empno>"
, ename	"<xyz.com/emp/Name>"
, '<xyz.com/emp/job/' || job || '>'	"<xyz.com/emp/job/rdf:type>"
, job	"<xyz.com/emp/job>"
, deptno	"<xyz.com/emp/deptNum>"
, '<xyz.com/emp/etype/' || etype || '>'	"<xyz.com/emp/etype/rdf:type>"
, etype	"<xyz.com/emp/etype>"

FROM emp

Example: EMP view with multiple rdf:type columns

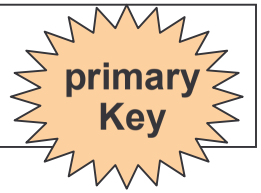
CREATE VIEW "<xyz.com/emp>" AS

SELECT

'<xyz.com/emp/' || empno || '>'	InstURI
, empno	"<xyz.com/emp/empno>"
, ename	"<xyz.com/emp/Name>"
, '<xyz.com/emp/job/' || job || '>'	"<xyz.com/emp/job/rdf:type>"
, job	"<xyz.com/emp/job>"
, deptno	"<xyz.com/emp/deptNum>"
, '<xyz.com/emp/etype/' || etype || '>'	"<xyz.com/emp/etype/rdf:type>"
, etype	"<xyz.com/emp/etype>"

FROM emp

ALTER VIEW "<xyz.com/emp>"
add constraint "<xyz.com/emp/c_prm_empno>"
primary key ("<xyz.com/emp/empno>") disable novalidate;



Example: EMP view with multiple rdf:type columns

CREATE VIEW "<xyz.com/emp>" AS
SELECT

'<xyz.com/emp/' || empno || '>'	InstURI
, empno	"<xyz.com/emp/empno>"
, ename	"<xyz.com/emp/Name>"
, '<xyz.com/emp/job/' || job || '>'	"<xyz.com/emp/job/rdf:type>"
, job	"<xyz.com/emp/job>"
, deptno	"<xyz.com/emp/deptNum>"
, '<xyz.com/emp/etype/' || etype || '>'	"<xyz.com/emp/etype/rdf:type>"
, etype	"<xyz.com/emp/etype>"

FROM emp

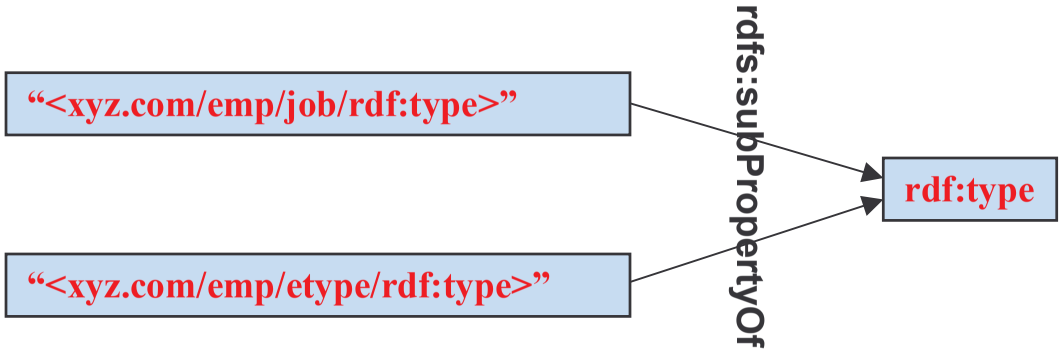
```
ALTER VIEW "<xyz.com/emp>"
add constraint "<xyz.com/emp/c_prm_empno>"
primary key ("<xyz.com/emp/empno>") disable novalidate;
```

primary Key

```
ALTER VIEW "<xyz.com/emp>"
add constraint "<xyz.com/emp/c_ref_deptno>"
foreign key ("<xyz.com/emp/deptNum>")
references "<xyz.com/dept>" ("<xyz.com/dept/deptno>")
disable novalidate;
```

foreign Key

Subproperties of rdf:type



Prefix-based DB identifiers (stay within length-limits)

RDF_PREFIX_MAP$

View	Prefix	Expansion	
“xyz:emp”	xyz:	<xyz.com/>	Prefix for class name
“xyz:emp”	emp:	<xyz.com/emp/>	Prefix for cols/cons
“xyz:dept”	xyz:	<xyz.com/>	Prefix for class name
“xyz:dept”	dept:	<xyz.com/dept/>	Prefix for cols/cons

- **ADD Unique constraint (View, Prefix)**
- **ADD Unique constraint (View, Expansion)**

No DB: <ViewName, SQLdefString> info

ViewName	SQLdefString
“xyz:dept”	SELECT ‘<xyz.com/dept/’ || deptno || ‘>’ , deptno , dname , loc FROM dept
“xyz:emp”	SELECT ‘<xyz.com/emp/’ || empno || ‘>’ , empno , ename , ‘<xyz.com/emp/job/’ || job || ‘>’ , job , deptno FROM emp

No DB: <ViewName, SQLdefString> info

ViewName	SQLdefString		
"xyz:dept"	SELECT	'<xyz.com/dept/' || deptno || '>'	InstURI
		, deptno	"dept:deptno"
		, dname	"dept:Name"
		, loc	"dept:Location"
	FROM	dept	
"xyz:emp"	SELECT	'<xyz.com/emp/' || empno || '>'	
		, empno	
		, ename	
		, '<xyz.com/emp/job/' || job || '>'	
		, job	
		, deptno	
	FROM	emp	

No DB: <ViewName, SQLdefString> info

ViewName	SQLdefString		
"xyz:dept"	SELECT	'<xyz.com/dept/' || deptno || '>'	InstURI
		, deptno	"dept:deptno"
		, dname	"dept:Name"
		, loc	"dept:Location"
	FROM	dept	
"xyz:emp"	SELECT	'<xyz.com/emp/' || empno || '>'	InstURI
		, empno	"emp:empno"
		, ename	"emp:Name"
		, '<xyz.com/emp/job/' || job || '>'	"rdf:type"
		, job	"emp:job"
		, deptno	"emp:deptNum"
	FROM	emp	

No DB: View Constraint info

ConsName	ConsType	ViewName	RefConsName
“dept:c_unq_deptno”	Unique	“xyz:dept”	
“emp:c_prm_empno”	Primary	“xyz:emp”	
“emp:c_ref_deptno”	Reference	“xyz:emp”	“dept:c_unq_deptno”

ConsName	ViewName	ColName	ColPosInKey
“dept:c_unq_deptno”	“xyz:dept”	“dept:deptno”	1
“emp:c_prm_empno”	“xyz:emp”	“emp:empno”	1
“emp:c_ref_deptno”	“xyz:emp”	“emp:deptNum”	1

No DB: <ViewName, ColPos, Property> info

ViewName	ColPos	Property
“xyz:dept”	1	InstURI
“xyz:dept”	2	dept:deptno
“xyz:dept”	3	dept:Name
“xyz:dept”	4	dept:Location
“xyz:emp”	1	InstURI
“xyz:emp”	2	emp:empno
“xyz:emp”	3	emp:Name
“xyz:emp”	4	rdf:type
“xyz:emp”	5	emp:job
“xyz:emp”	6	emp:deptNum
“xyz:emp”	0	emp:c_ref_deptno

No DB: A simple syntax for Classes

```
Class (ViewName, SQLdefString)
Class (“xyz:dept”, <sql-def-for-dept>)
Class (“xyz:emp”, <sql-def-for-emp>)
```

No DB: A simple syntax for Properties[1]

Property (PropertyName, ViewName, ColPos, Range)
Property (“dept:InstURI”, "xyz:dept”, 1, "xyz:dept”)
Property (“dept:deptno”, "xyz:dept”, 2, “xsd:positiveInteger”)
Property (“dept:Name”, “xyz:dept”, 3, “xsd:string”)
Property (“dept:location”, “xyz:dept”, 4, “xsd:string”)
Property (“emp:InstURI”, “xyz:emp”, 1, “xyz:emp”)
Property ("emp:empno”, “xyz:emp”, 2, “xsd:positiveInteger”)
Property (“emp:Name”, “xyz:emp”, 3, “xsd:string”)
Property (“emp:rdf:type”, “xyz:emp”, 4, “rdfs:Class”)
Property (“emp:job”, “xyz:emp”, 5, “xsd:string”)
Property (“emp:deptNum”, “xyz:emp”, 6, “xsd:positiveInteger”)
Property (“emp:c_ref_deptno”, “xyz:emp”, 0, “xyz:dept”)

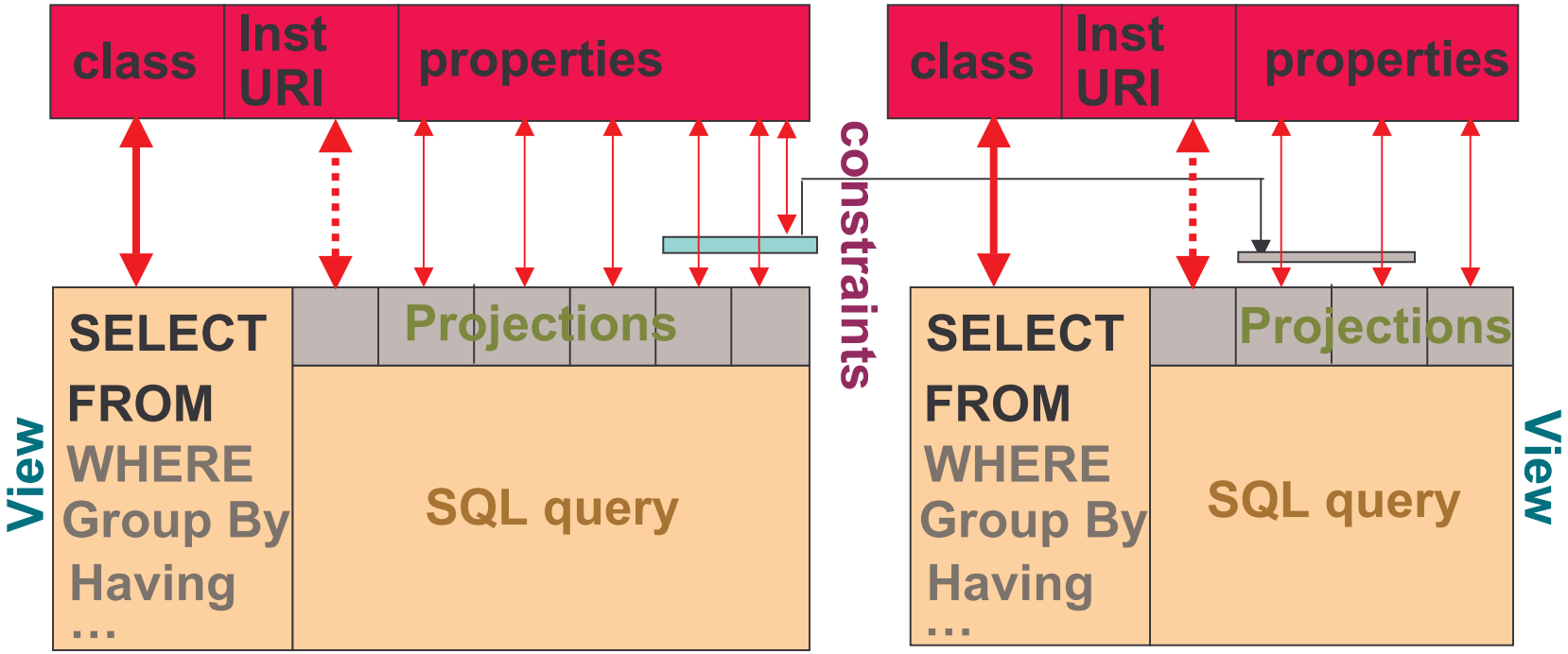
[1] **Inverse function specification for properties not shown, but can be added easily.**

No DB: A simple syntax for Constraints

Constraint (ConsName, ConsType, ViewName, RefConsName)
Constraint (“dept:c_unq_deptno”, Unique, “xyz:dept”, NULL)
Constraint (“emp:c_prm_empno”, Primary, “xyz:emp”, NULL)
Constraint (“emp:c_ref_deptno”, Reference, “xyz:emp”, “dept:c_unq_deptno”)

ConstraintColumn (ConsName, ViewName, ColName, ColPosInKey)
ConstraintColumn (“dept:c_unq_deptno”, “xyz:dept”, “dept:deptno”, 1)
ConstraintColumn (“emp:c_prm_empno”, “xyz:emp”, “emp:empno”, 1)
ConstraintColumn (“emp:c_ref_deptno”, “xyz:emp”, emp:deptNum”, 1)

Summary



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