

# How to “Make a Bridge to the New Town” using OntoAccess

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**University of  
Zurich**<sup>UZH</sup>



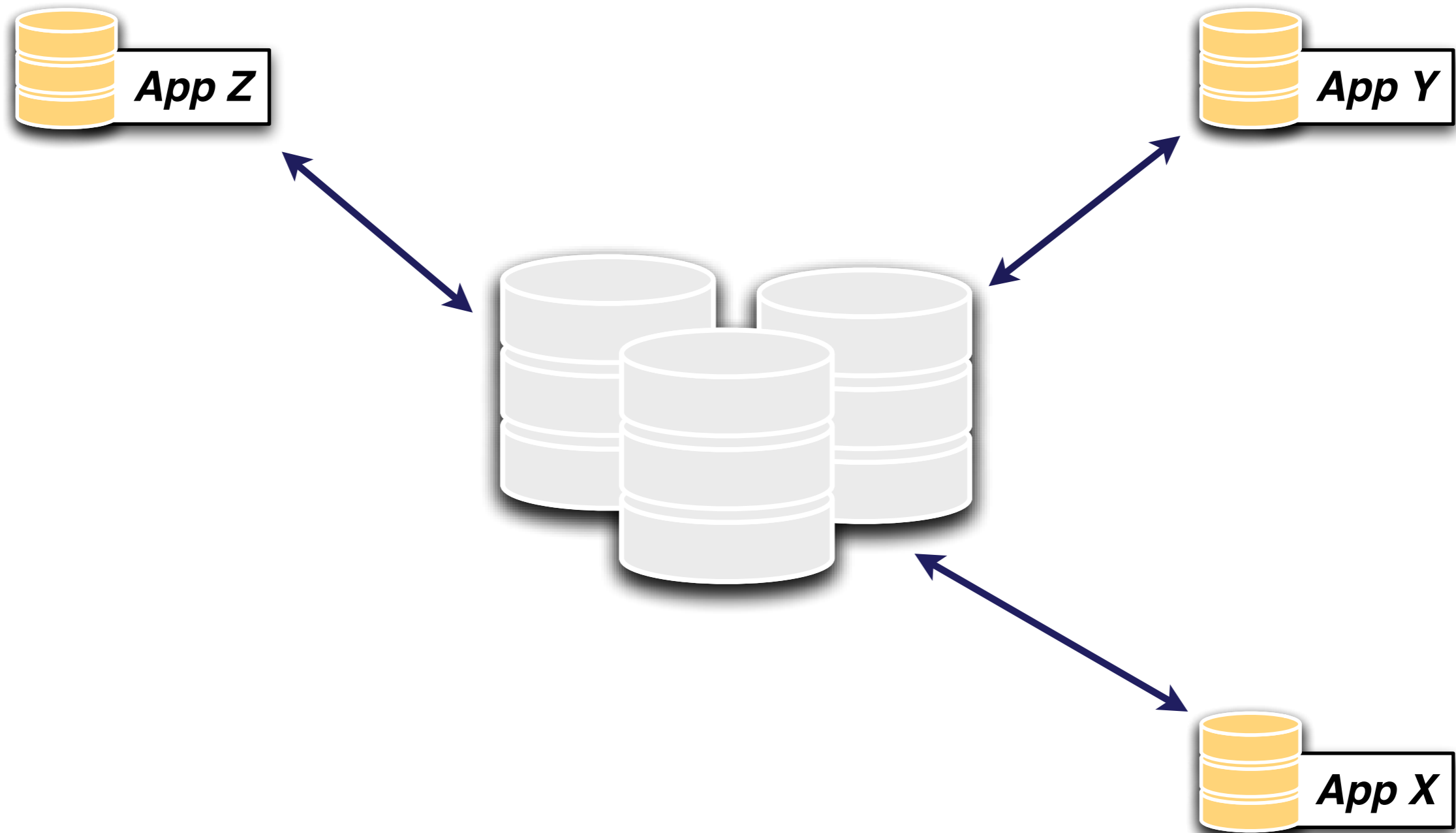
# Motivation



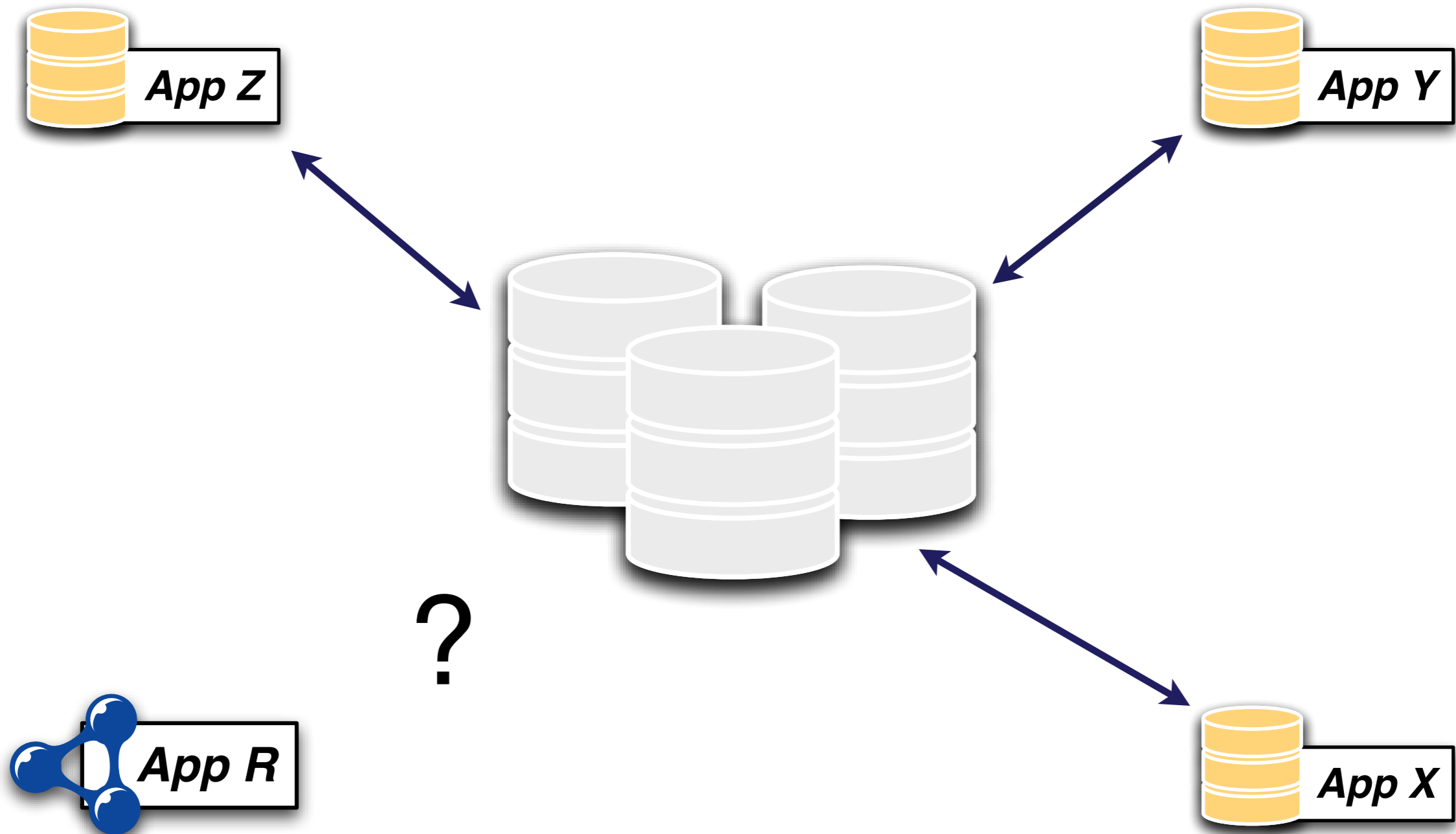
majority of structured data  
on the Web is in RDBs [1]

[1] K. C.-C. Chang, B. He, C. Li, M. Patel, Z. Zhang. *Structured Databases on the Web: Observations and Implications*. SIGMOD Record, 2004.

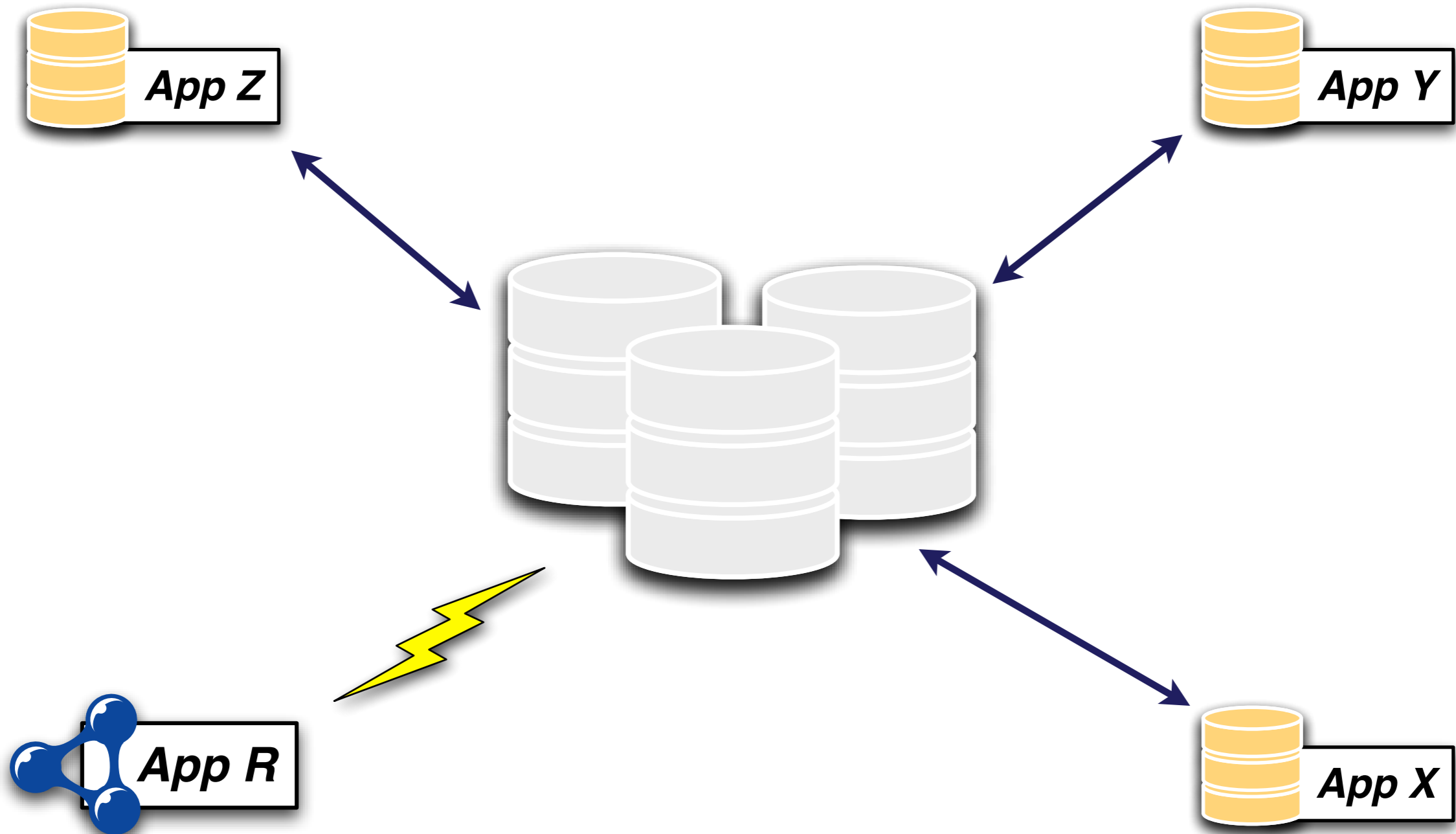
# Motivation



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# Motivation

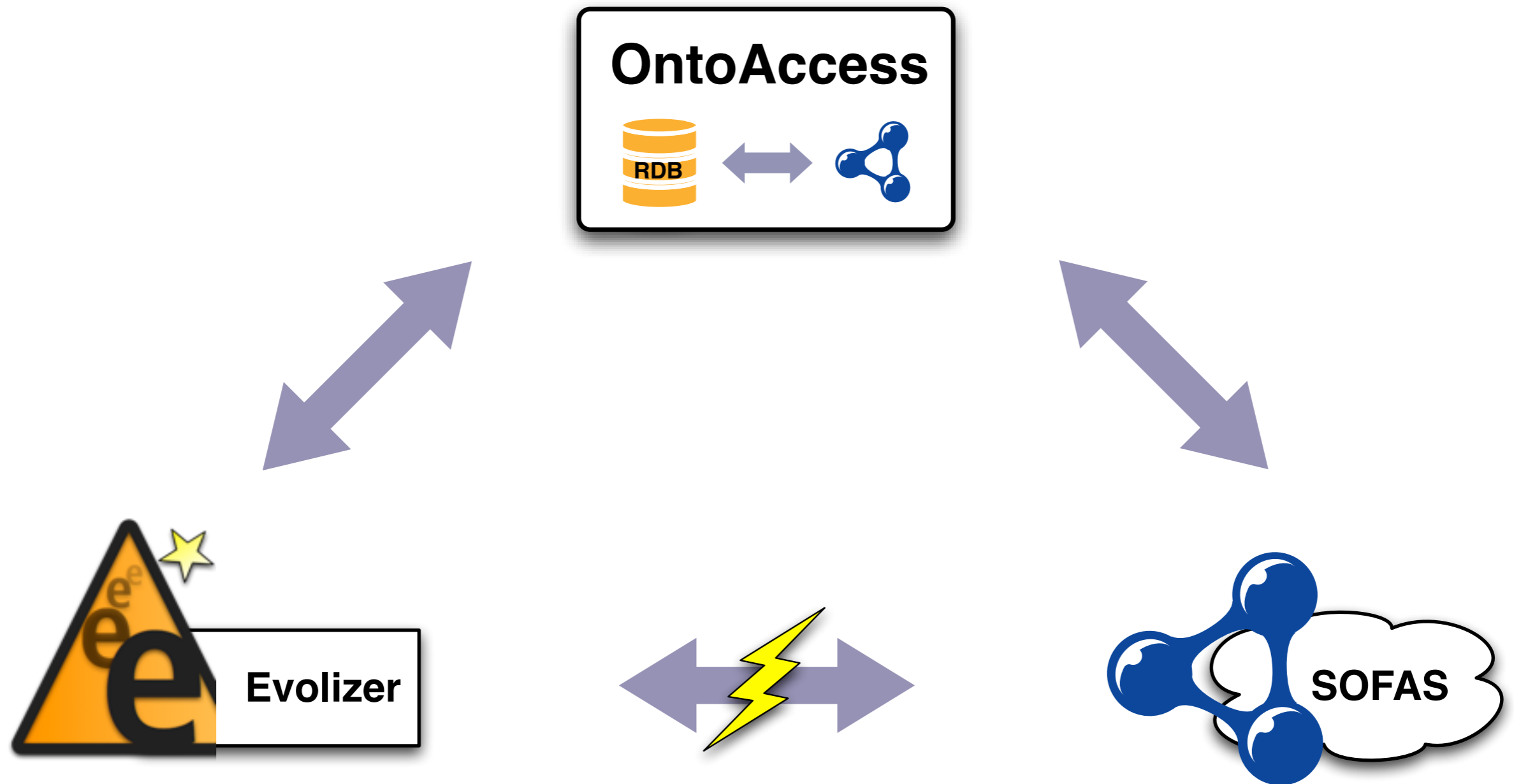


A photograph of the Golden Gate Bridge in San Francisco, California, viewed from a high angle. The bridge's iconic orange-red towers and suspension cables are prominent, stretching across the blue water of the bay. The city skyline is visible in the background under a clear sky.

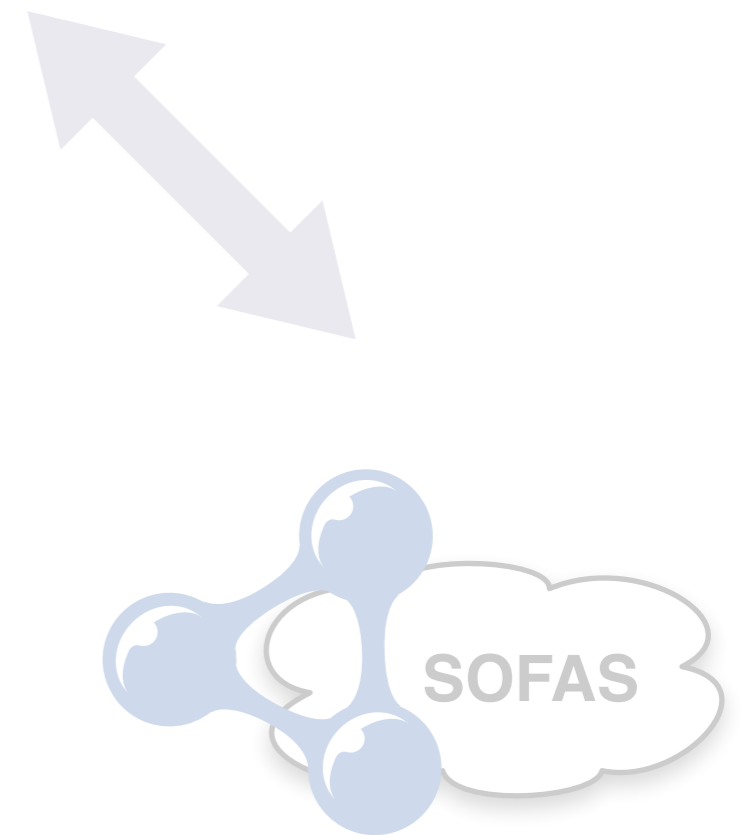
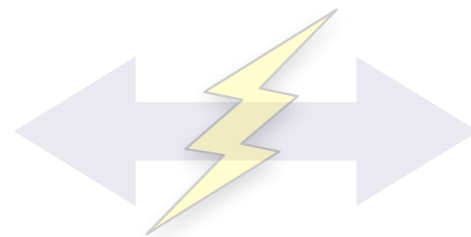
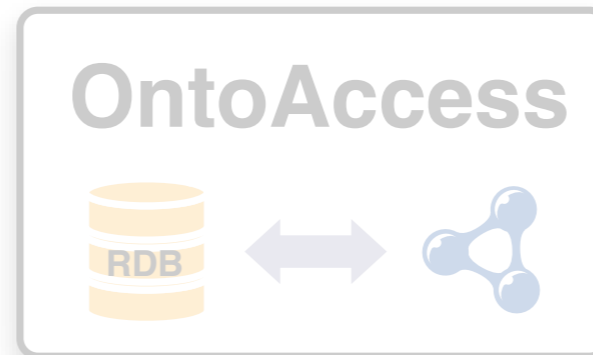
# “Make a Bridge to the New Town”

Object Oriented Reengineering Pattern  
by: Demeyer, Ducasse, Nierstrass

# Make a Bridge to the New Town



# Legacy System: Evolizer

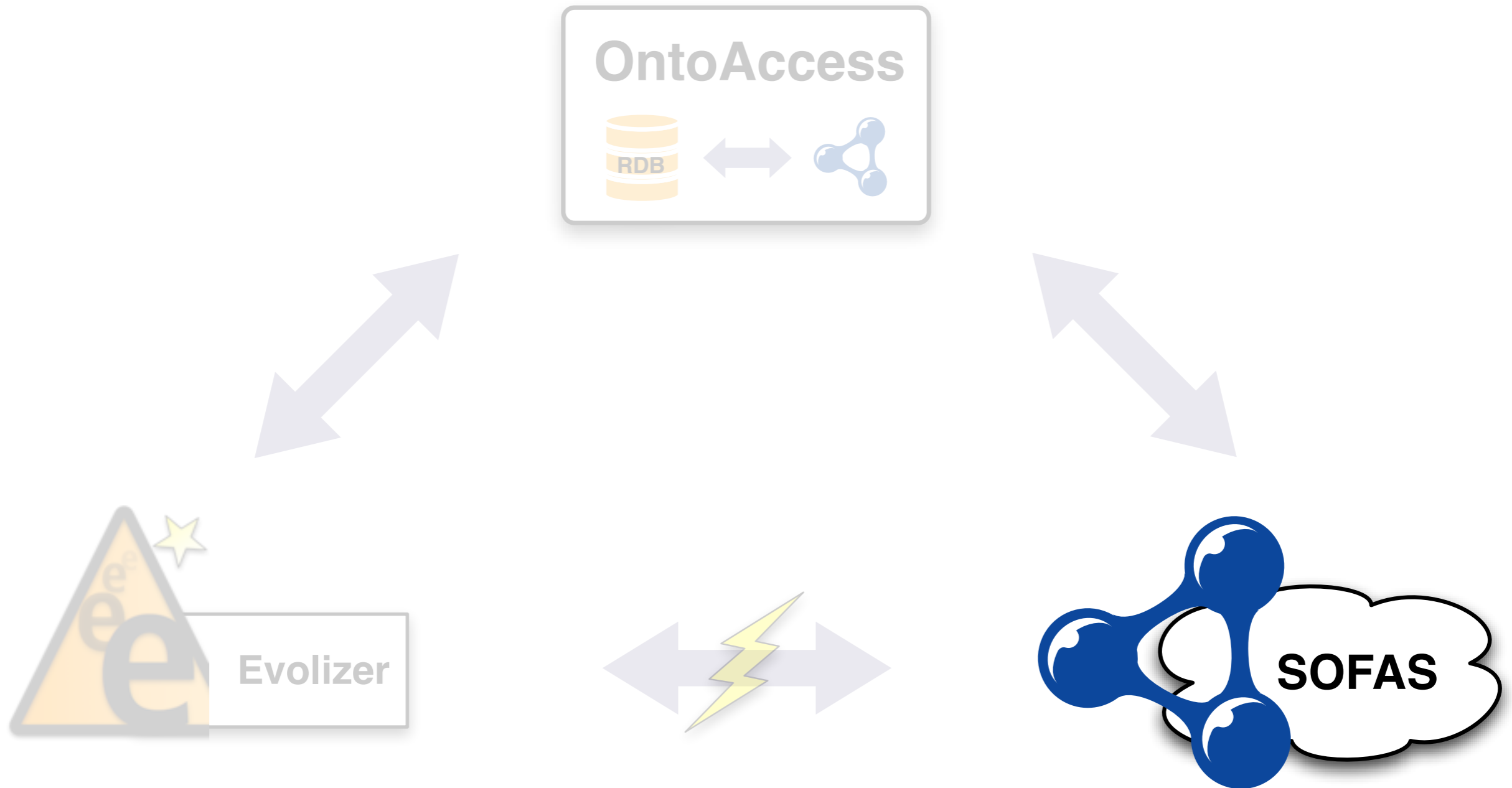




# Evolizer

- ▶ software analysis platform
- ▶ set of plug-ins for the Eclipse IDE
- ▶ integrates data from version control, issue tracking, mailing lists, etc. via importers
- ▶ data stored in a **relational database**

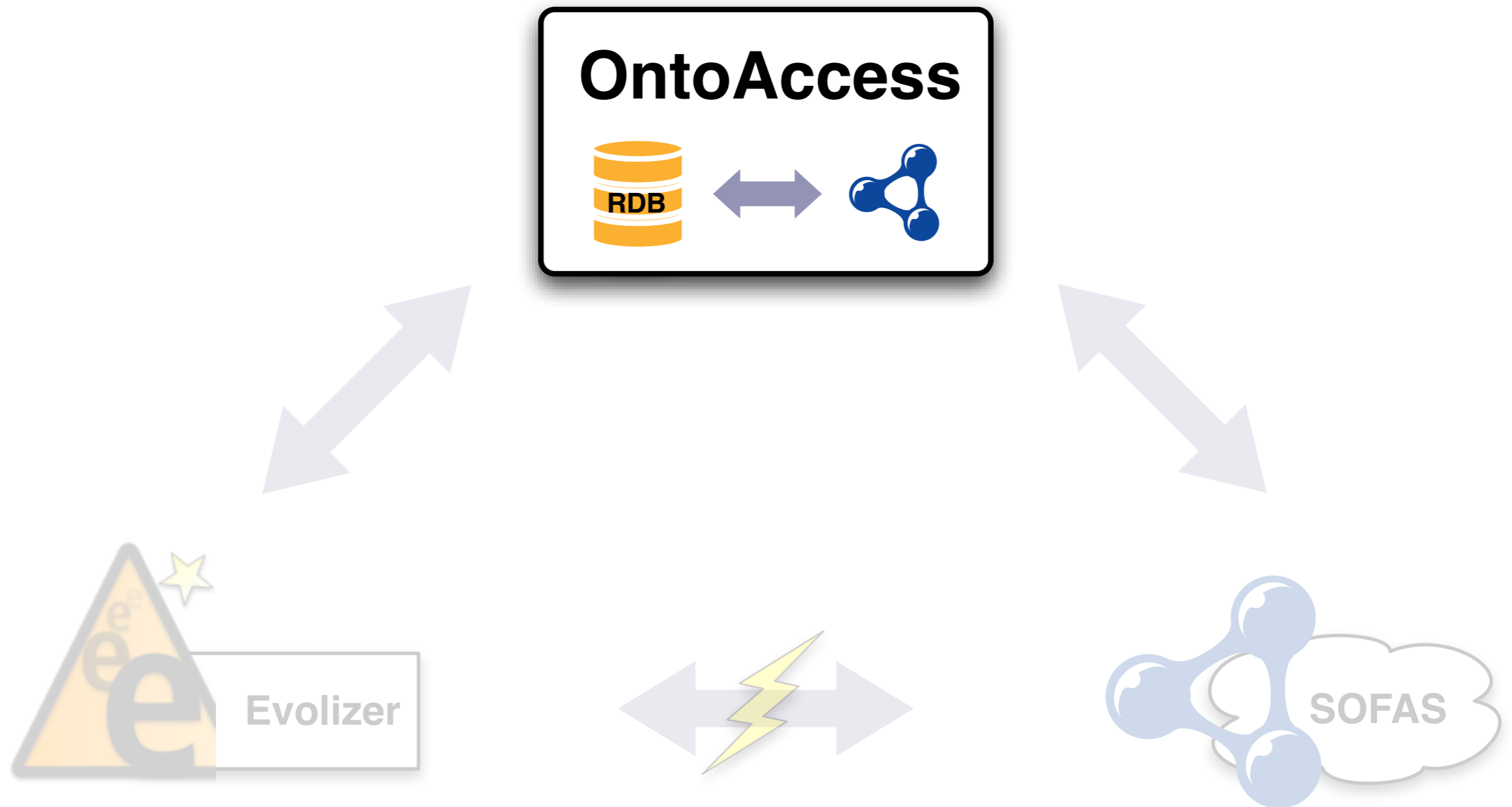
# New System: SOFAS



# SOFAS

- ▶ service-oriented (RESTful) platform
- ▶ software analysis services
- ▶ easily accessible & composable
- ▶ services described by **ontologies**
- ▶ data represented in **RDF**

# The Bridge: OntoAccess

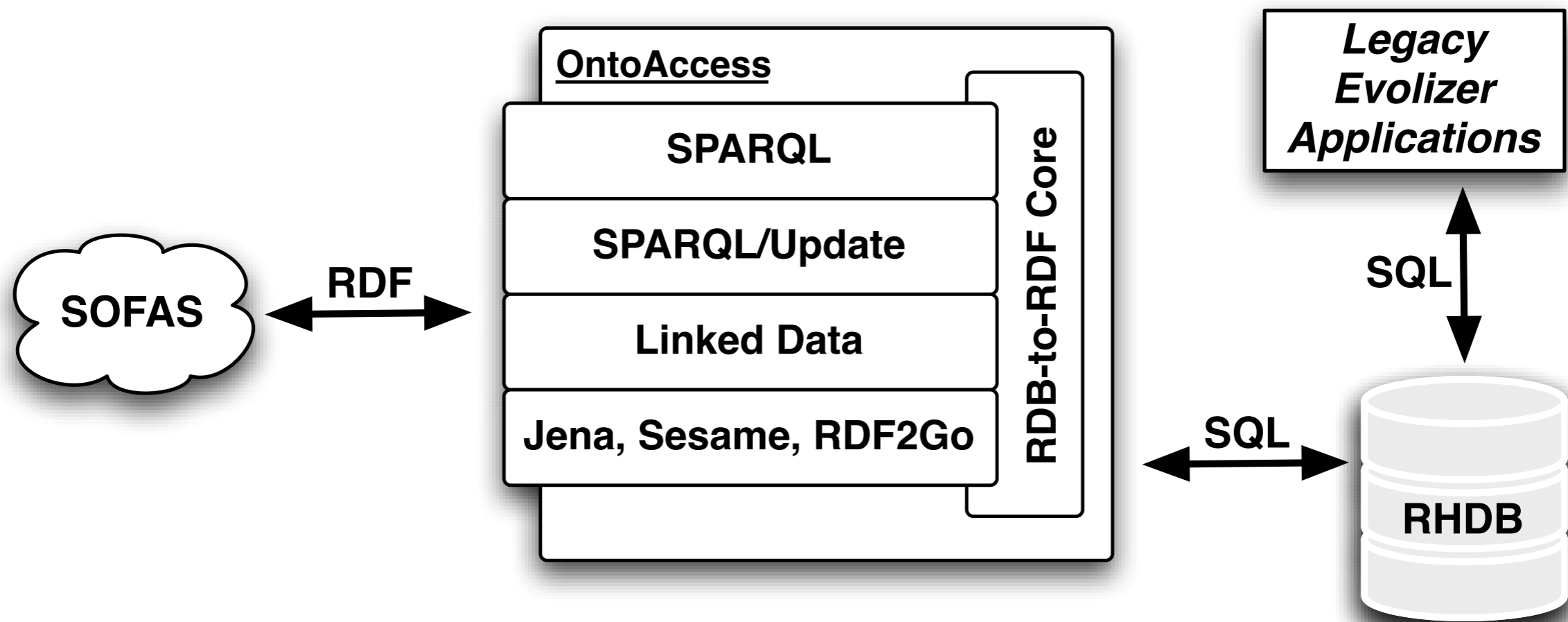


# OntoAccess

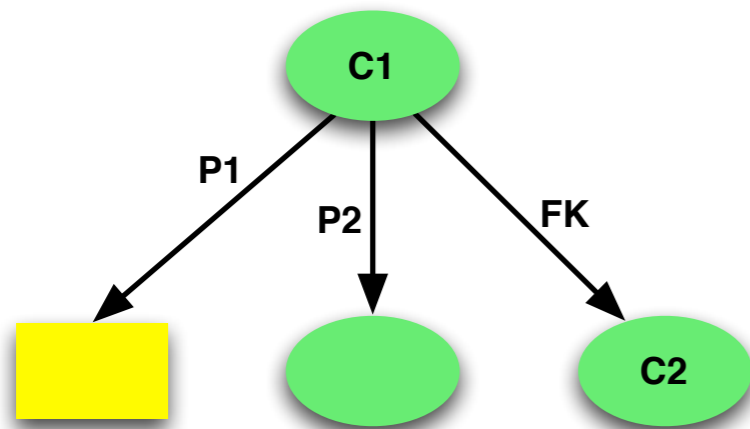


- ▶ RDB-to-RDF **mediation** platform
- ▶ RDF-based **read** access to RDB
- ▶ RDF-based **write** access to RDB
- ▶ on-demand request translation

# OntoAccess: Architecture

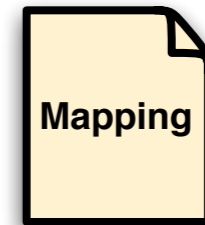
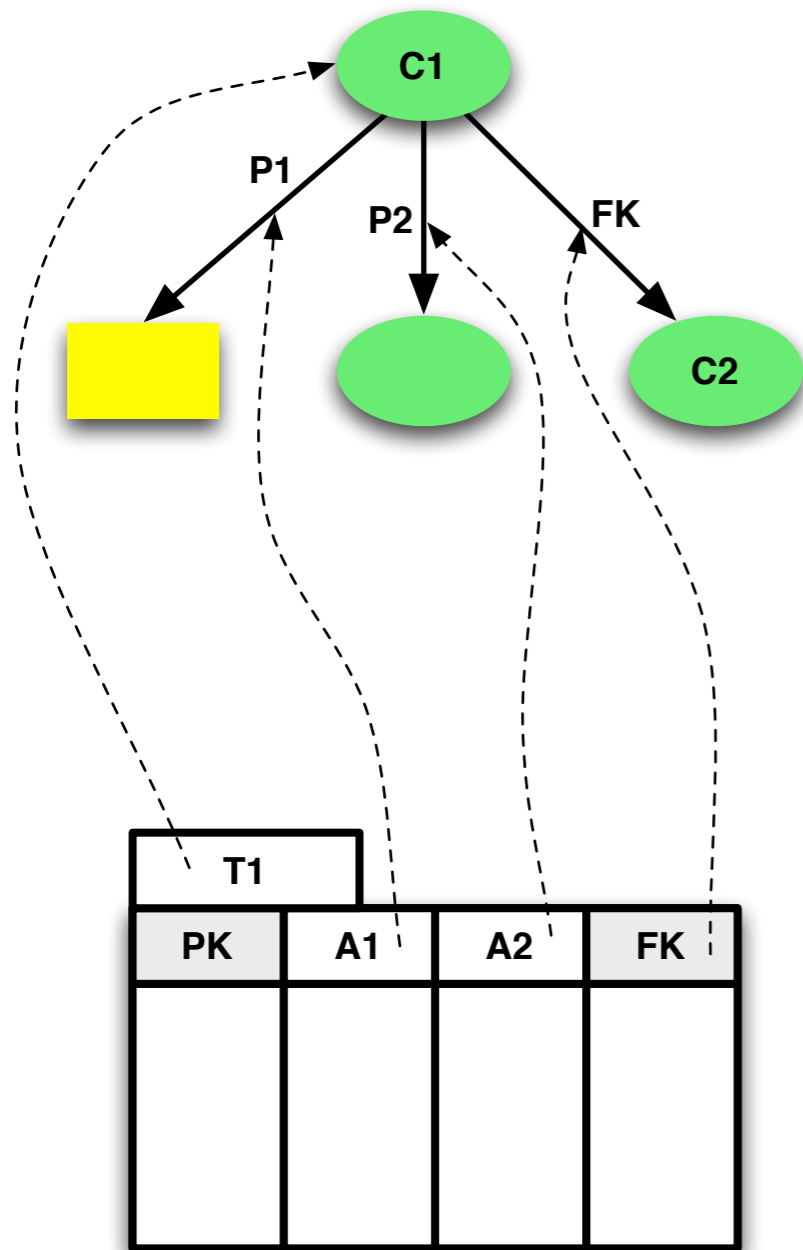


# OntoAccess: Mapping



T1			
PK	A1	A2	FK

# OntoAccess: Mapping

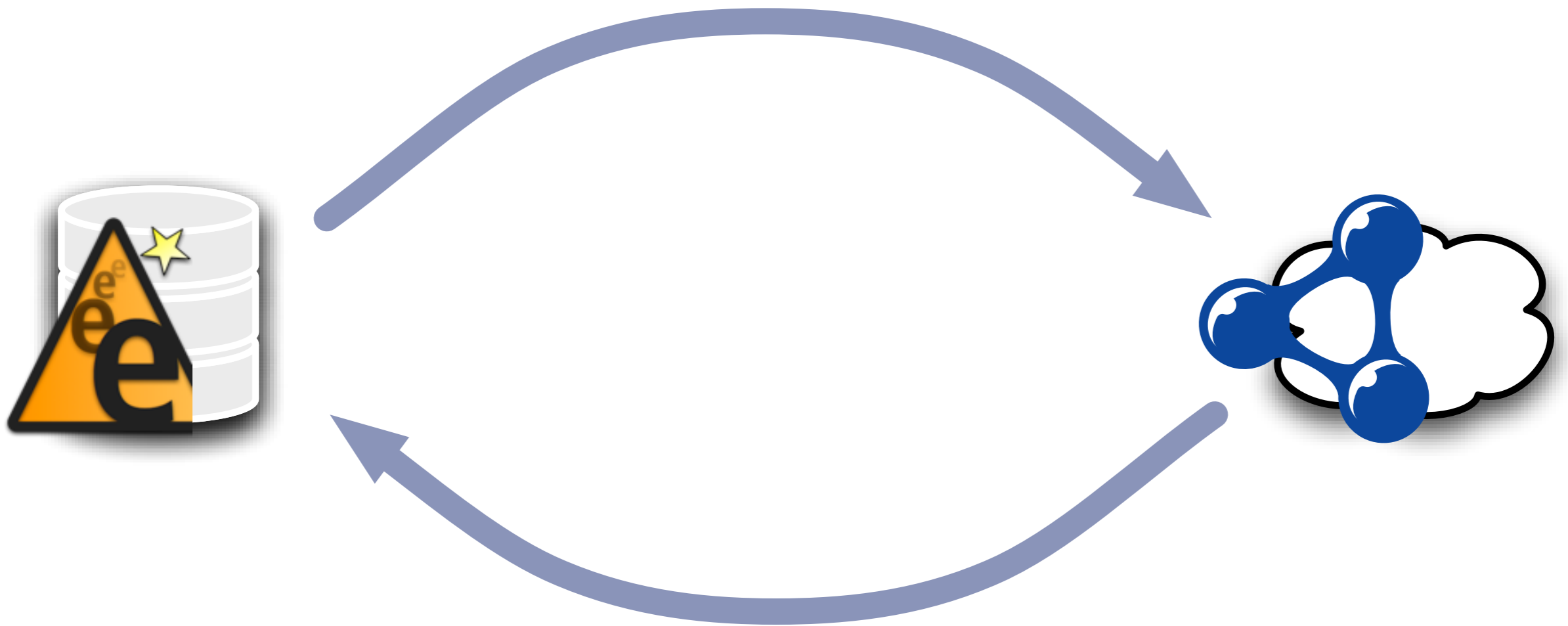


Why not use D2R,  
R2RML, ...?  
→ **read-only!**



# Case Study

UC1: Use Evolizer Data in SOFAS



UC2: Use SOFAS Data in Evolizer

# UC1: Evolizer → SOFAS

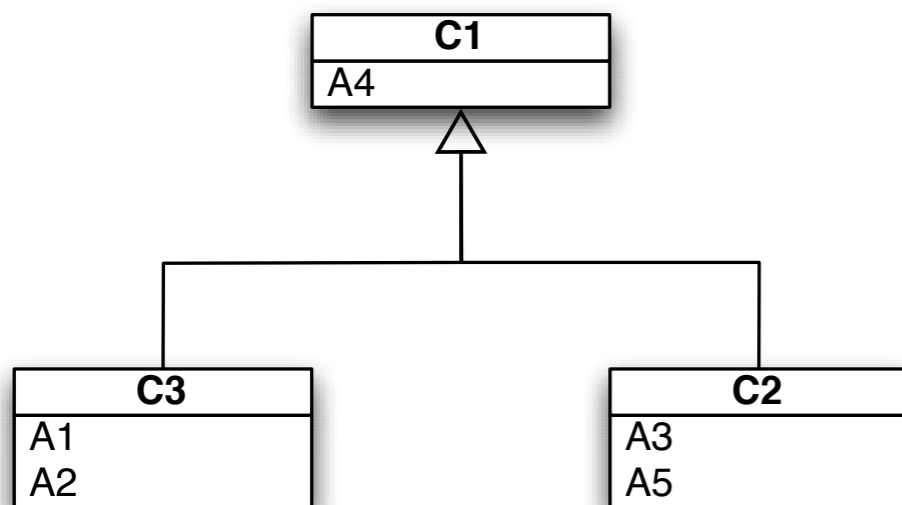
- ▶ data about hundreds of system in Evolizer
  - ▶ re-import in SOFAS would take months
  - ▶ some data not available online anymore
  - ▶ data still needed in Evolizer
- ➔ translate SPARQL queries and Jena API calls via OntoAccess to SQL

# UC2: SOFAS → Evolizer

- ▶ new data importers in SOFAS (e.g. Git)
  - ▶ new data computed in SOFAS (e.g. metrics)
  - ▶ data valuable to Evolizer & its tools
  - ▶ importers not available in Evolizer
- ➔ translate triples for bulk insert via  
OntoAccess to SQL DML

# Mapping Challenges

## a) Concept Inheritance

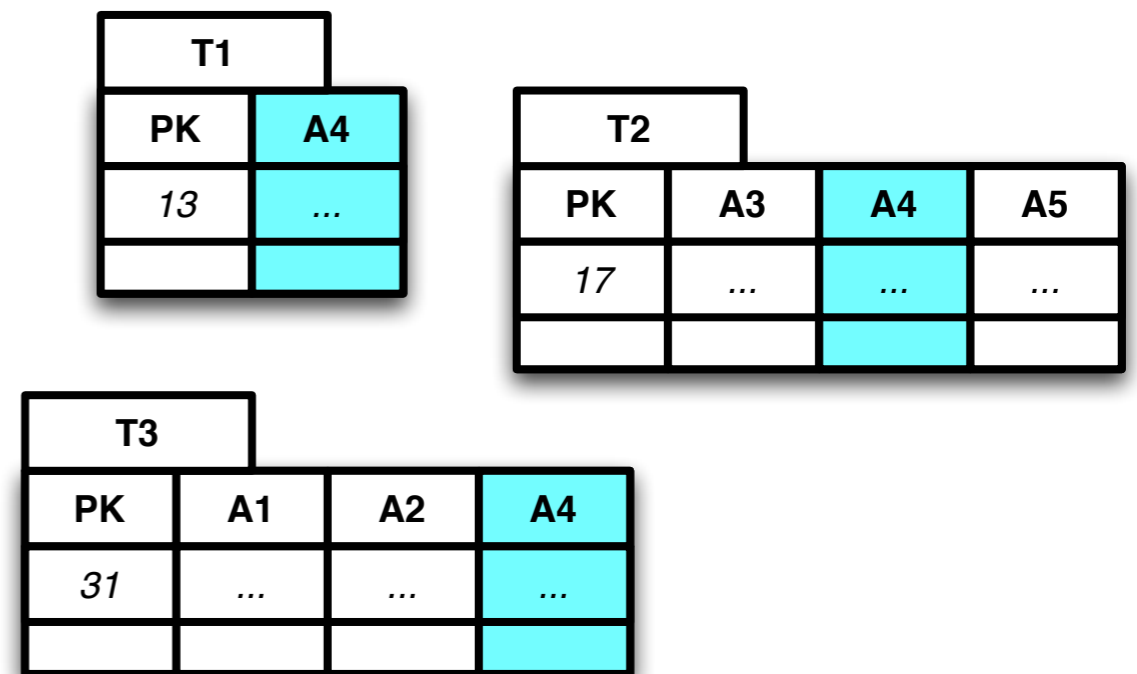
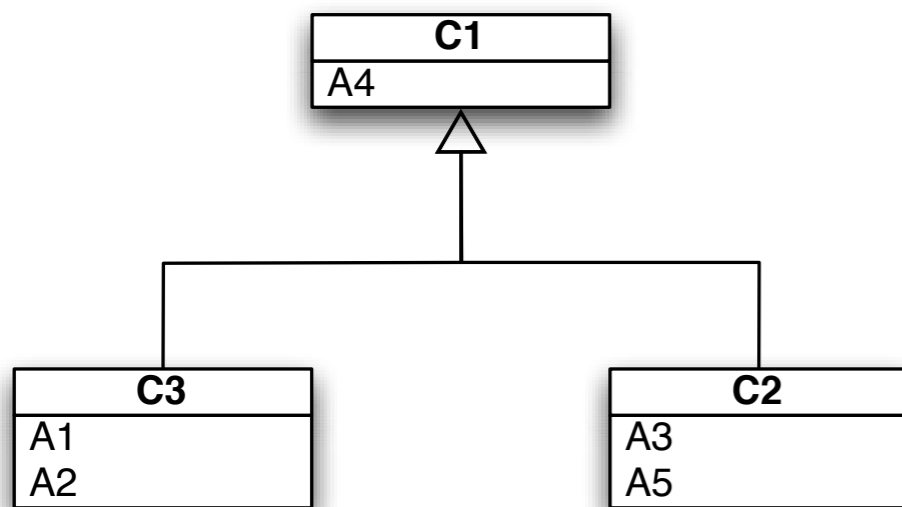


T1						
PK	A1	A2	A3	A4	A5	C
13	...	NULL	NULL	...	NULL	C1
17	NULL	NULL	...	...	...	C2
31	...	NULL	NULL	...	NULL	C3

*table-per-hierarchy*

# Mapping Challenges

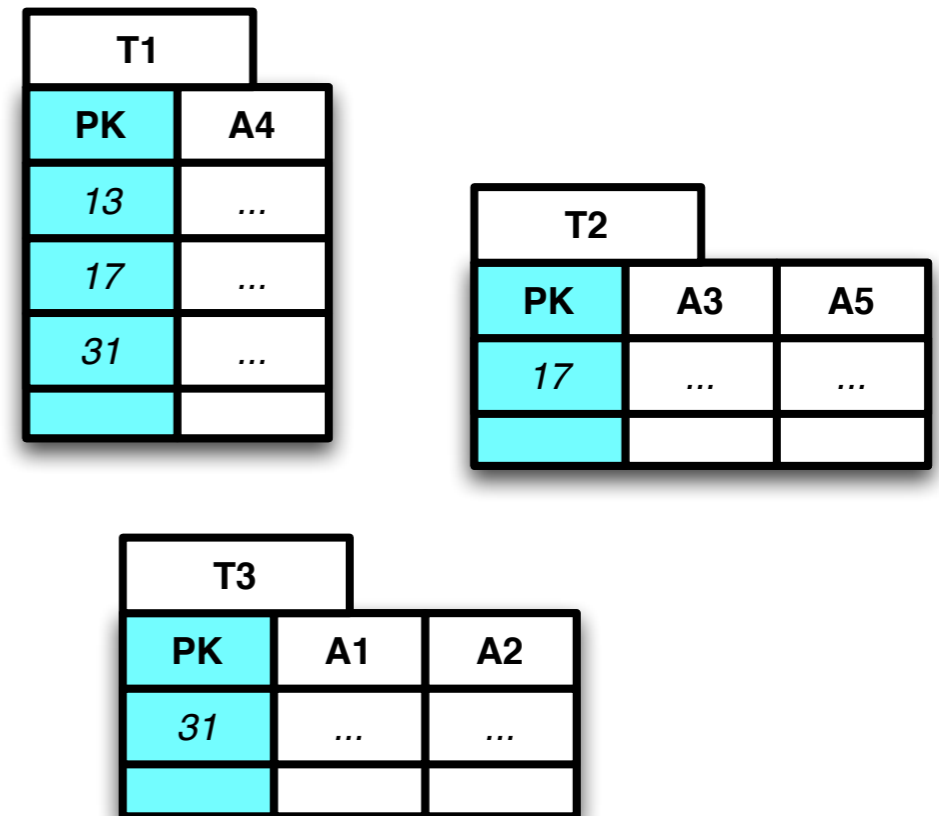
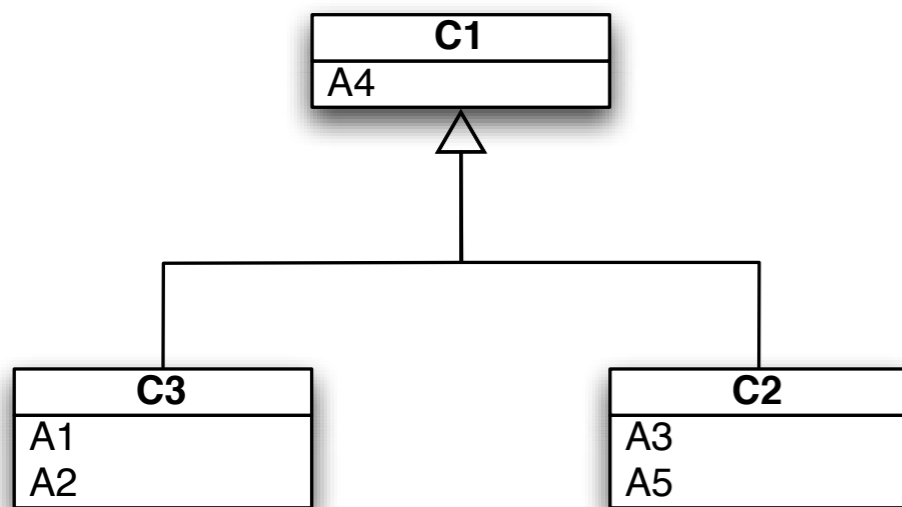
## a) Concept Inheritance



*table-per-concrete-class*

# Mapping Challenges

## a) Concept Inheritance



*table-per-subclass*

# Mapping Challenges

## b) Tool Support

```
@prefix dc: <http://purl.org/dc/terms/> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix dc: <http://purl.org/dc/terms/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix ma: <http://www.w3.org/2001/XMLSchema#> .
@prefix r3: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix ed: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

map:Profess
  <http://
  r3:
  r3:has
    "s
  r3:has
    [
  ] .

map:Studen
  <http://
  r3:
  r3:has
    m
  r3:has
    [
  ] .

map:Assista
  <http://
  r3:
  r3:has
    "s
  r3:has
    [
  ] .

map:Assista
  <http://
  r3:
  r3:has
    "fi
  r3:has

"stuffid" .
r3:has
  [
  ] .

map:Staff_st
  <http://
  r3:
  r3:has
    "s
  r3:has
    [
  ] .

map:Studen
  <http://
  r3:
  r3:has
    r3:has
    [
  ] .

map:Staff_e
  <http://
  r3:
  r3:has
    "e
  r3:has
    fo

map:Studen
  <http://
  r3:
  r3:has
    "e
  r3:has
    fo

map:Studen
  <http://
  r3:
  r3:has
    "fi
  r3:has

"firstName" :
r3:ma
  fo
  <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>

r3:h
  map:Profes
    <http://
    r3:
    r3:ma
    fo
    <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>

r3:h
  map:Assis
    <http://
    r3:
    r3:ma
    fo
    <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>

r3:h
  map:Studen
    <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
    r3m:TableMap ;
    r3m:hasAttribute map:Student_studentId , map:Student_firstName , r
    map:Student_email , map:Student_grade ;
    r3m:hasTableName "Student" ;
    r3m:mapsToClass edu:Student ;
    r3m:uriPattern "Student%%studentId%%" .

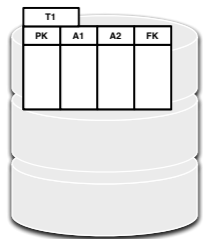
r3:h
  map:ResearchGroup_code
    <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
    r3m:AttributeMap ;
    r3m:hasAttributeName
      "code" ;
    r3m:mapsToDataProperty
      edu:code ;
    r3m:hasConstraint
      [ <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
        r3m:PrimaryKey
      ] .

r3:h
  map:Course_description
    <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
    r3m:AttributeMap ;
    r3m:hasAttributeName
      "description" ;
    r3m:mapsToDataProperty
      dc:description .

r3:h
  map:ResearchGroup
    <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
    r3m:TableMap ;
    r3m:hasAttribute map:ResearchGroup_code , map:ResearchGroup_r
    r3m:hasTableName "ResearchGroup" ;
    r3m:mapsToClass foaf:Group ;
    r3m:uriPattern "ResearchGroup%%code%%"
```

# Mapping Challenges

## b) Tool Support



```
CREATE TABLE Revision (  
  previousRevision INT,  
  ...  
  FOREIGN KEY (previousRevision)  
  REFERENCES Revision(id)  
);
```

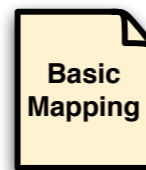
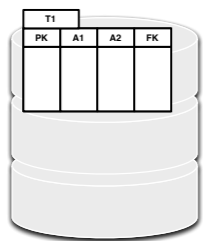
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@prefix dc: <http://purl.org/dc/terms/>  
@prefix foaf: <http://xmlns.com/foaf/0.1/>  
@prefix dc: <http://purl.org/dc/terms/>  
@prefix xsd: <http://www.w3.org/2001/XMLSchema#>  
@prefix ma: <http://www.w3.org/2001/XMLSchema#>  
@prefix r3: <http://www.w3.org/2001/XMLSchema#>  
@prefix ed: <http://www.w3.org/2001/XMLSchema#>  
  
map:Profess <http://...>  
map:Staff_st <http://...>  
map:Profes: <http://...>  
r3m:has <http://...>  
r3m:ma <http://...>  
r3m:h <http://...>  
map:Student <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
```

```
<http://...>  
r3m:has <http://...>  
r3m:u <http://...>  
r3m:u <http://...>  
r3m:hasTableName "ResearchGroup" ;  
r3m:mapsToClass foaf:Group ;  
r3m:uriPattern "ResearchGroup%%code%%"  
e, map:ResearchGroup_
```



# Mapping Challenges

## b) Tool Support



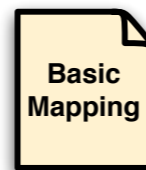
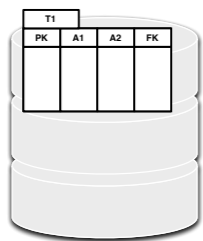
```
map:Revision_previousRevision a r3m:AttributeMap;  
  r3m:hasAttributeName "previousRevision";  
  r3m:mapsToObjectProperty map:previousRevision;  
  ....
```

```
@prefix dc: <http://purl.org/dc/terms/>  
@prefix foaf: <http://xmlns.com/foaf/0.1/>  
@prefix xsd: <http://www.w3.org/2001/XMLSchema#>  
@prefix r3m: <http://www.w3.org/2003/01/r2m-rdf-syntax-ns#>  
@prefix r3u: <http://www.w3.org/2003/01/r2m-uriref-syntax-ns#>  
@prefix ed: <http://www.w3.org/2003/01/r2m-edition-syntax-ns#>  
  
map:Profess <http://...>  
map:Staff_st <http://...>  
map:Profes <http://...>  
map:Student <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>  
  
"stuff.d" .  
r3m:has [ <...>  
  "firstName" :  
    r3m:ma fo <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>  
  ] .  
r3m:h map:Student <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
```

```
<http://...>  
r3m:has fo r3m:u r3m:hasTableName "ResearchGroup" ;  
r3m:mapsToClass foaf:Group ;  
r3m:uriPattern "ResearchGroup%%code%%"  
r3m:has r3m:ma map:Studen r3m:u
```

# Mapping Challenges

## b) Tool Support



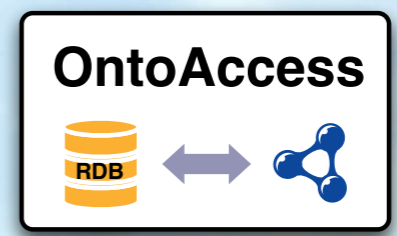
```
map:Revision_previousRevision a r3m:AttributeMap;  
  r3m:hasAttributeName "previousRevision";  
  r3m:mapsToObjectProperty ver:follows;  
  ....
```

```
@prefix dc: <http://purl.org/dc/terms/>  
@prefix foaf: <http://xmlns.foaf.org/>  
@prefix xsd: <http://www.w3.org/2001/XMLSchema#>  
@prefix r3m: <http://www.w3.org/2007/05/r3m/>  
@prefix map: <http://www.w3.org/2007/05/r3m-map/>  
@prefix ed: <http://www.w3.org/2007/05/r3m-ed/>  
  
map:Profess <http://...>  
map:Staff_st <http://...>  
map:Profes <http://...>  
map:Student <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>  
  
"stuff.d" .  
r3m:has [ <http://...>  
  "firstName" :  
    r3m:ma fo <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>  
  ] .  
r3m:h map:Student <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
```

```
<http://...>  
r3m:has fo r3m:u r3m:hasTableName "ResearchGroup" ;  
r3m:mapsToClass foaf:Group ;  
r3m:uriPattern "ResearchGroup%%code%%"  
r3m:has r3m:ma map:Studen r3m:u
```

# Lessons Learned

- ▶ OntoAccess well suited to “Make to Bridge to the New Town”
- ▶ existing RDB-to-RDF approaches unsuitable
- ▶ (extended) OntoAccess mapping provides required expressivity
- ▶ tool support indispensable



**“Make a Bridge to the New Town”**

*Thanks!*