Enterprise Information Integration using Semantic Web Technologies: RDF as the Lingua Franca

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Latest version of these slides:
http://dbooth.org/2008/stc/slides.ppt

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Outline

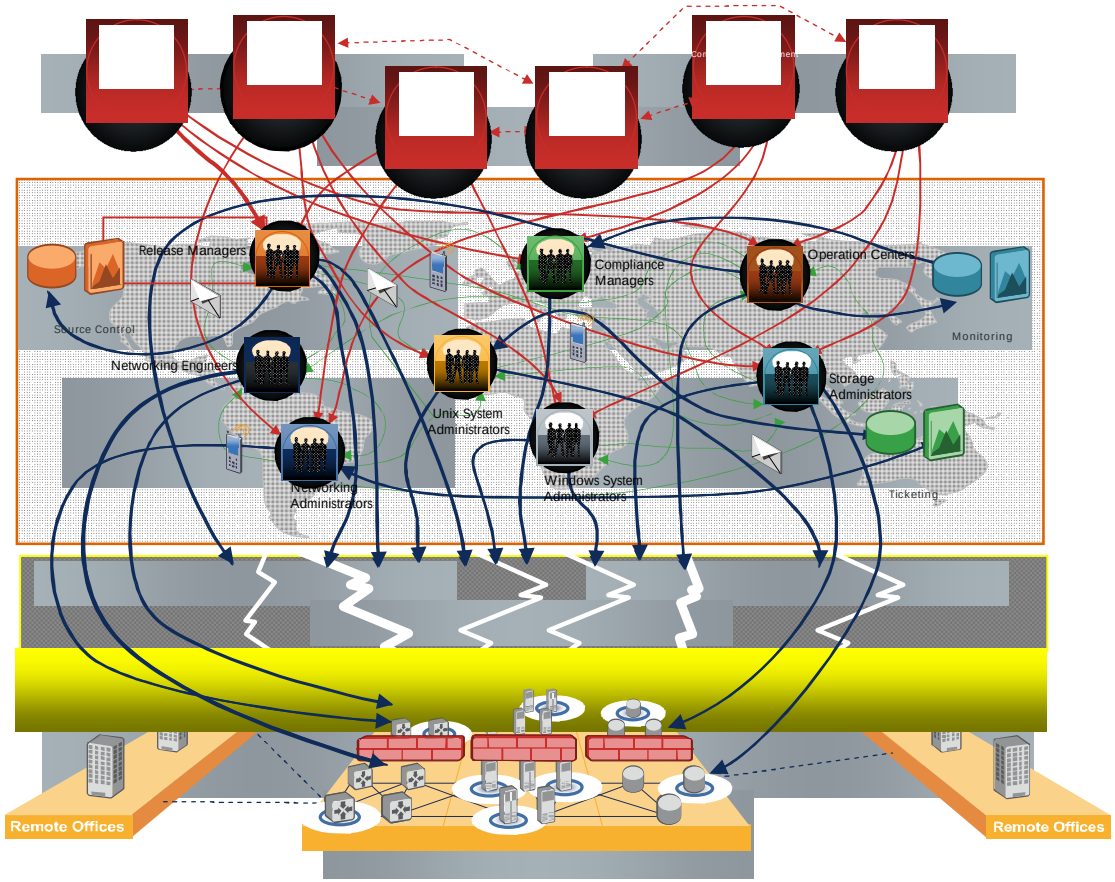
- PART 0: The problem
- PART 1: RDF: The lingua franca for information exchange
  - Why
    1. Focus on semantics
    2. Easier data integration
    3. Easier to bridge other formats/models
    4. Looser coupling
  - How
    1. RDF message semantics
    2. REST-based SPARQL endpoints
    3. XML with GRDDL transformations
    4. Aggregators
- PART 2: POC: A SPARQL adaptor for UCMDB
  - What is UCMDB
  - SPARQL adaptor

PART 0

The problem

Problem 1: Integration complexity

- Multiple producers / consumers need to share data
- Tight coupling hampers independent versioning



invent

Problem 2: Babelization

- Proliferation of data models (XML schemas, etc.)
- Parsing issues influence data models
- No consistent semantics
- Data chaos

Tower of Babel, Abel Grimmer (1570-1619)

PART 1

RDF: The lingua franca for information exchange

Why?

Four reasons . . .

Why?
1. Focus on semantics

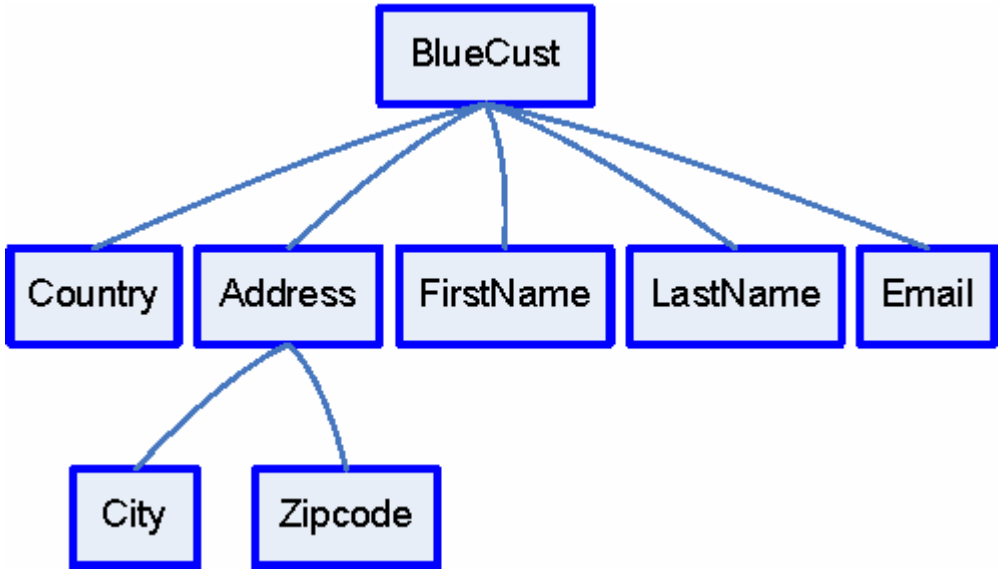
- XML:
  - Schema is focused on how to serialize
    - Constrains more than the model
  - Parent/child and sibling relationships are not named
    - Are their semantics documented? E.g., does sibling order matter?
- RDF:
  - One URI per concept
  - Syntax independent

- Who cares about syntax?

Why?
2. Easier data integration

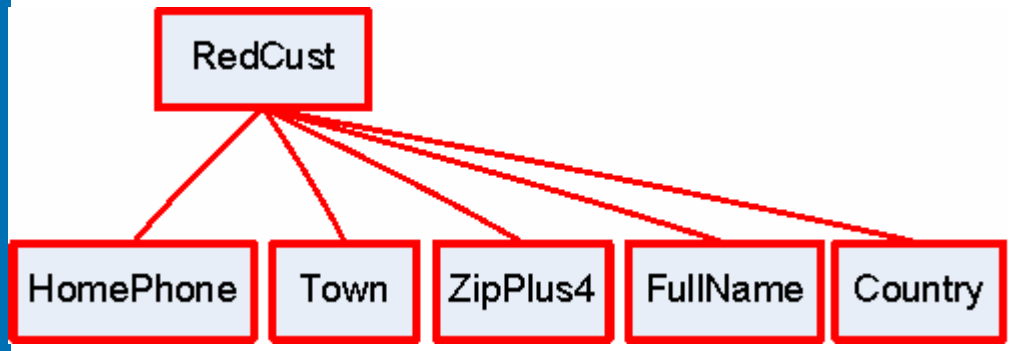
Why?
2. Easier data integration

- Blue App has model



Why?
2. Easier data integration

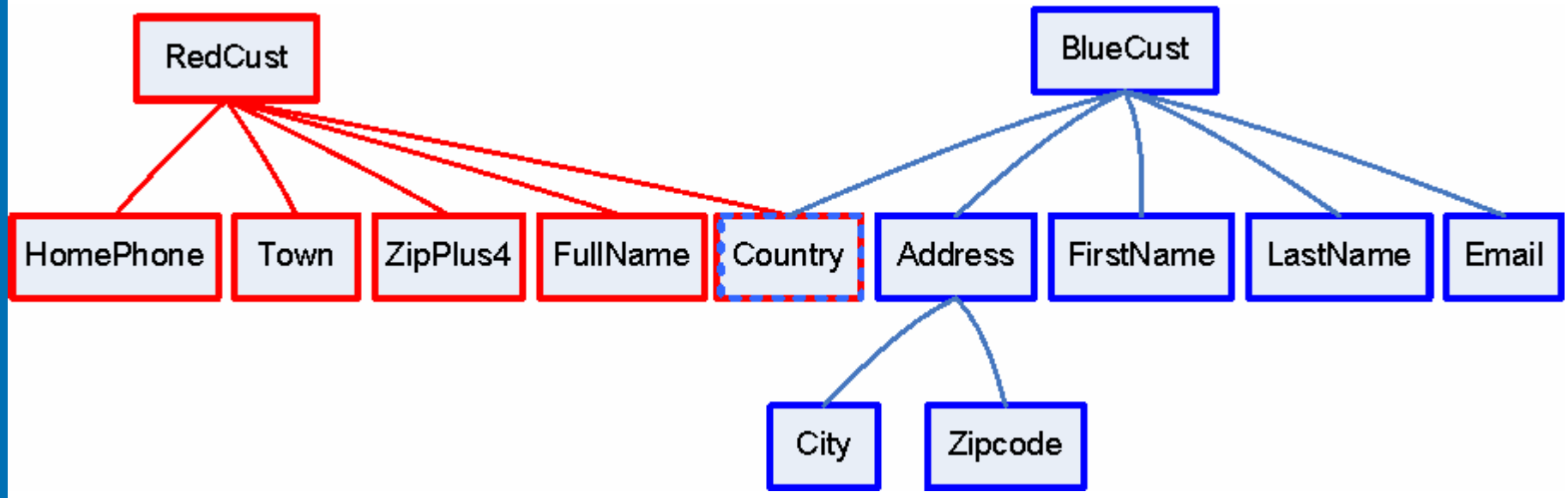
- Red App has model



- Need to integrate Red & Blue models

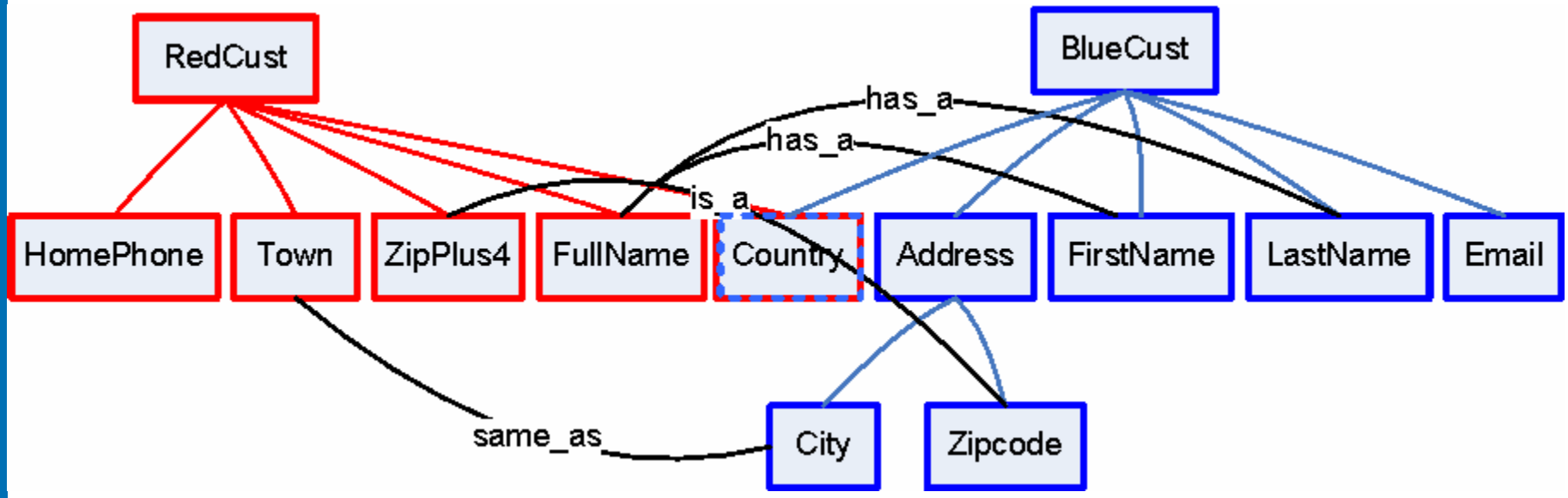
Why?
2. Easier data integration

- Step 1: Merge RDF
- Same nodes (URIs) join automatically



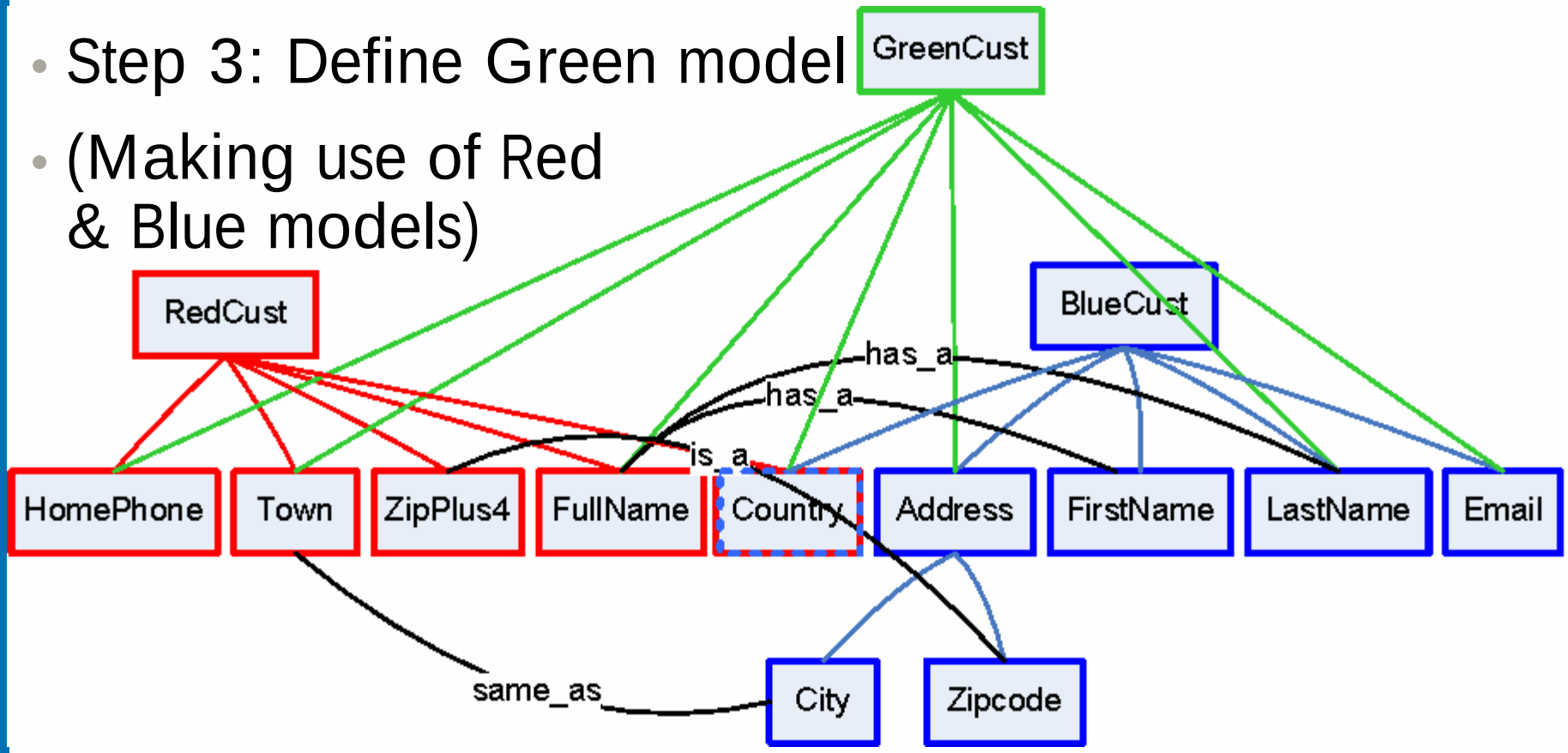
Why?
2. Easier data integration

- Step 2: Add relationships and rules
- (Relationships are also RDF)



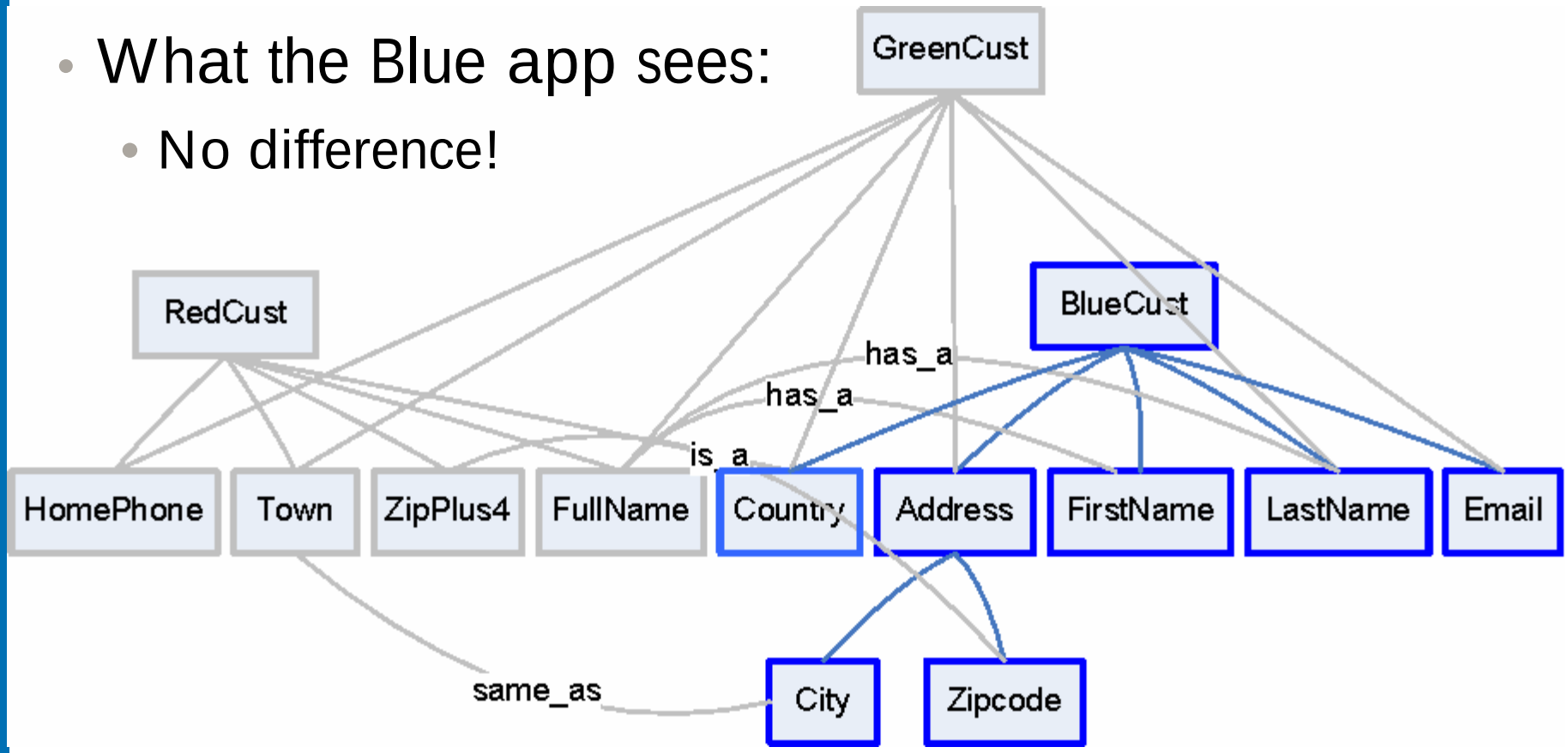
Why?
2. Easier data integration

- Step 3: Define Green model
- (Making use of Red & Blue models)



Why?
2. Easier data integration

- What the Blue app sees:
  - No difference!



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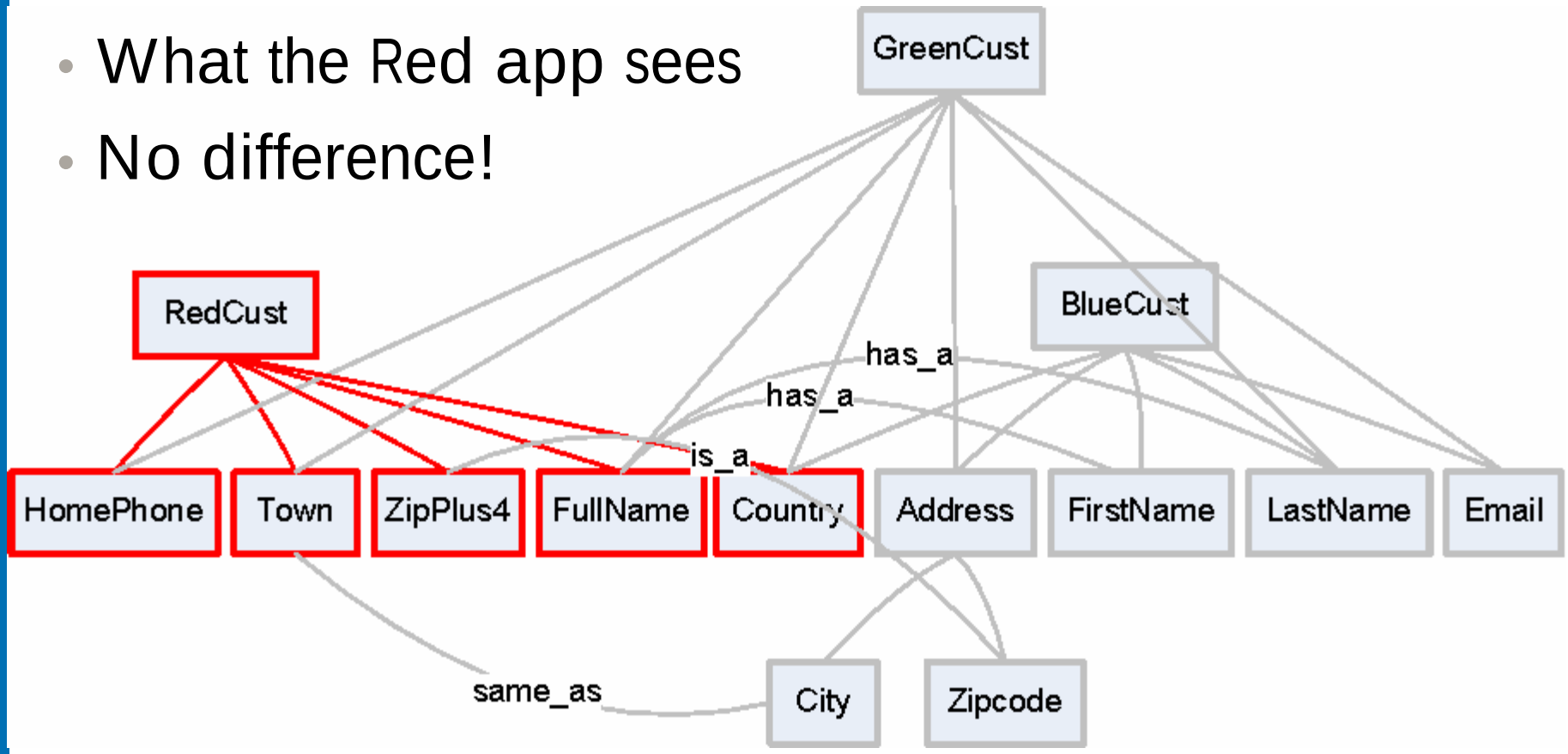
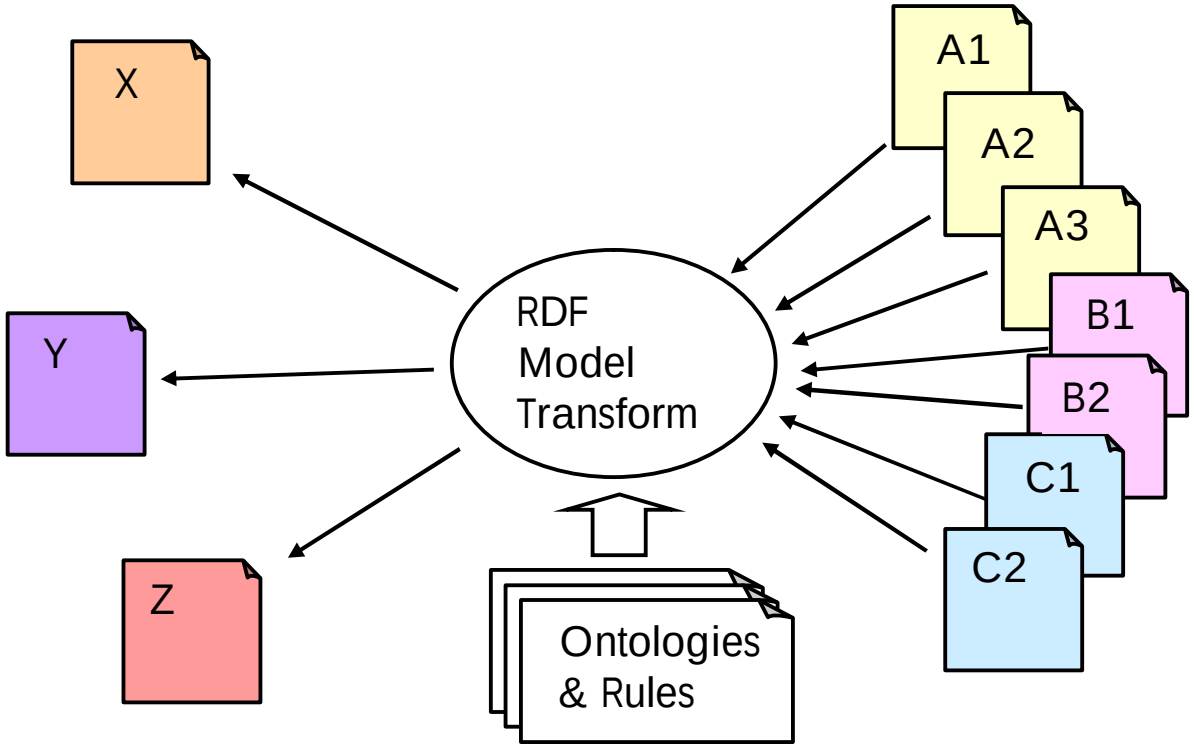


Why?
3. RDF helps bridge other formats / models

- Producers and consumers may use different formats / models
- Rules can specify transformations
- Inference engine finds path to desired result model

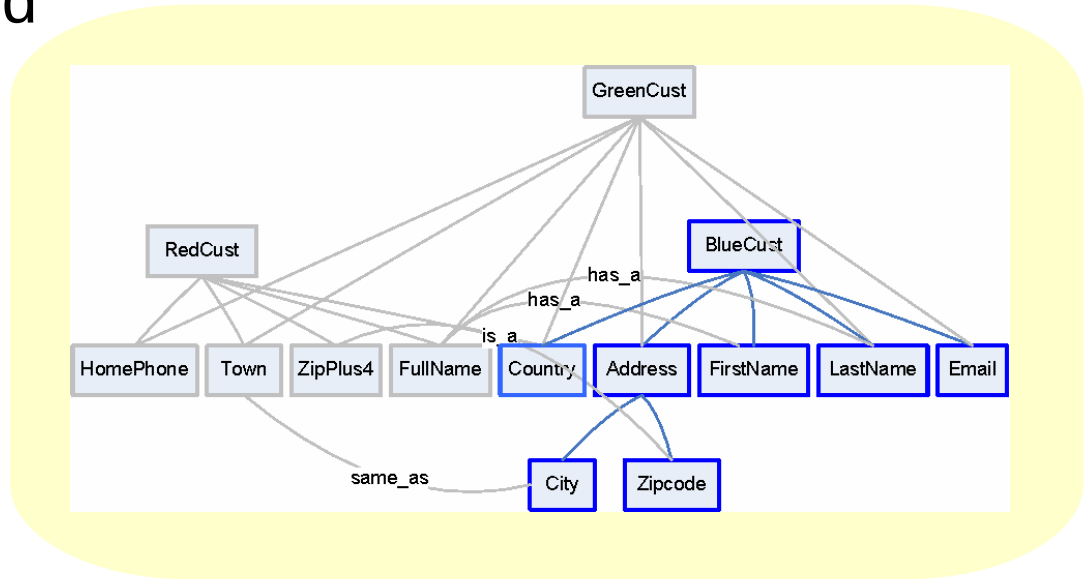


Why?
4. Looser coupling

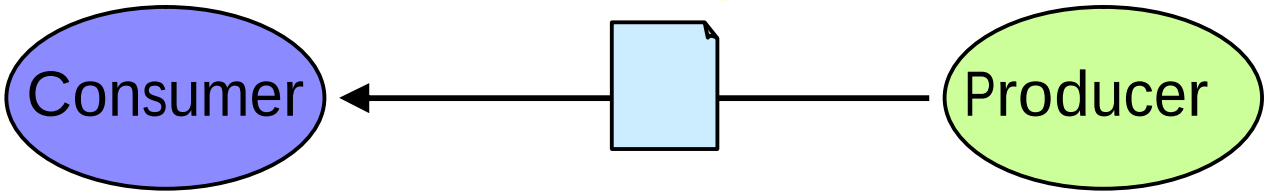
- Without breaking consumers:
  - Ontologies can be mixed and extended
  - Triples can be added
- Producer & consumer can be versioned more independently

Example of looser coupling

- RedCust and GreenCust ontologies added
- Blue app is not affected



(Blue app)



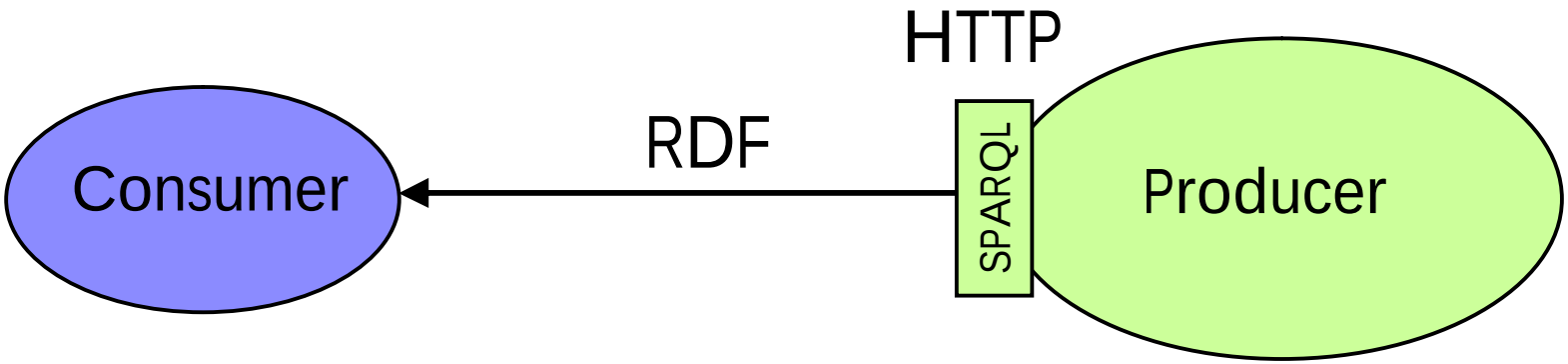
How?

Four ways . . .

How?
1. RDF message semantics

- Interface contract specifies RDF, regardless of serialization
- RDF pins the semantics

How?
2. REST-based SPARQL endpoints



REST-based SPARQL endpoints

- Why REST:
  - HTTP is ubiquitous
  - Simpler than SOAP-based Web services (WS*)
  - Looser process coupling

REST-based SPARQL endpoints

- Why SPARQL:
  - One endpoint supports multiple data needs
    - Each consumer gets what it wants
  - Insulates consumers from internal model changes
    - Inferencing transforms data to consumer's desired model
    - Looser data coupling

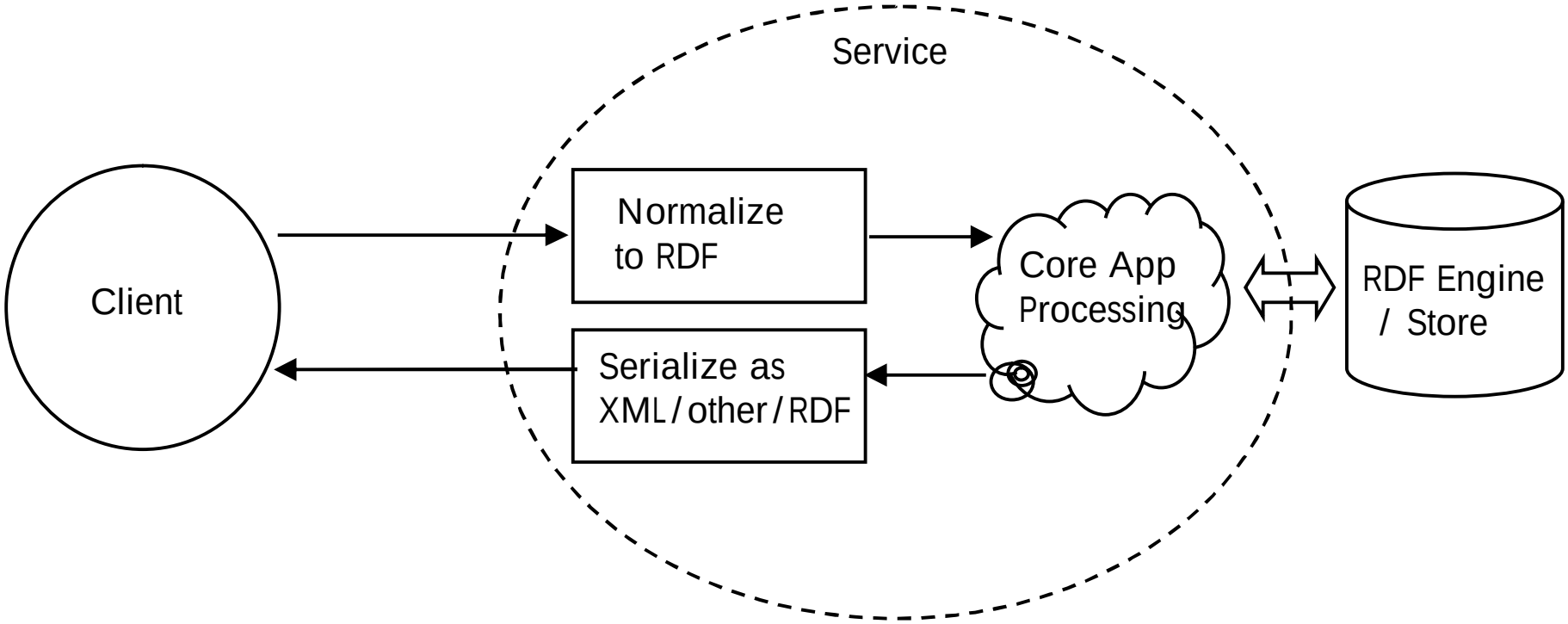
How?
3. XML with GRDDL transformations

- GRDDL is a W3C standard
- GRDDL permits RDF to be "gleaned" from XML
  - XML document or schema specifies desired GRDDL transformation
  - GRDDL transformation produces RDF from XML document
  - Mostly intended for getting microformat and other data/metadata from HTML pages

Using GRDDL for XML document semantics

- Each XML format can be viewed as a custom serialization of RDF!
  - GRDDL transformation produces semantics of the XML document
- Helps bridge XML and RDF worlds
- Same XML document can be consumed by:
  - Legacy XML app
  - RDF app
- App interface contract can specify RDF
  - Serializations can vary
  - Semantics are pinned by RDF

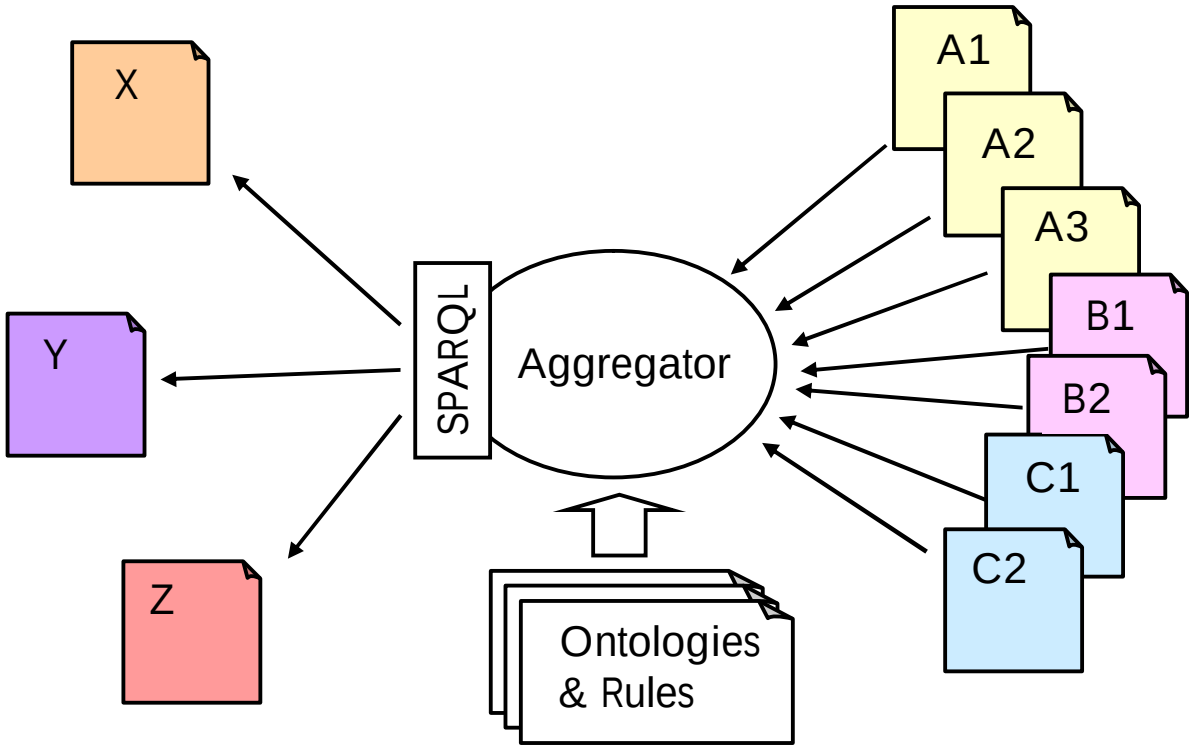
Using GRDDL for XML document semantics



See: http://dbooth.org/2007/rdf-and-soa/rdf-and-soa-paper.htm

How?
4. Aggregators

- Gets data from multiple sources
- Provides data to consumers



Aggregator

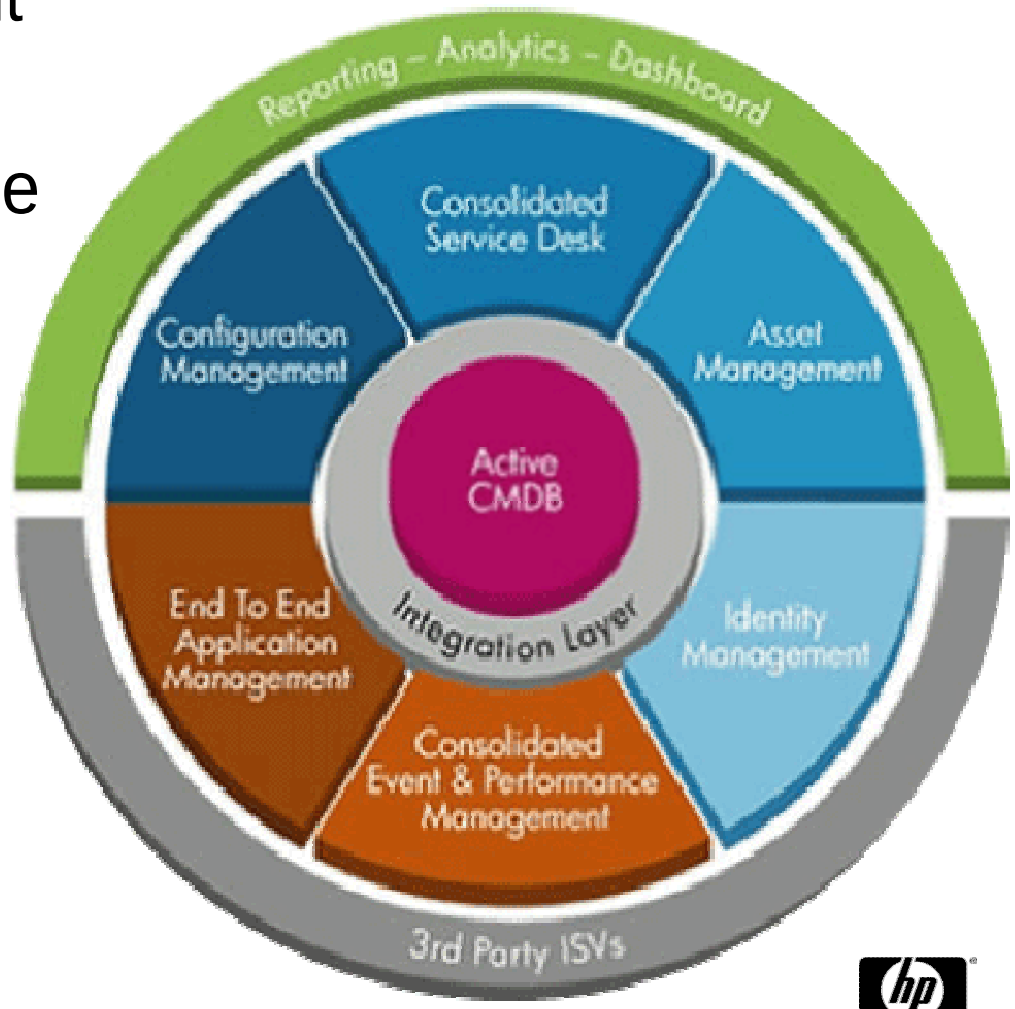
- Conceptual component
  - Not necessarily a separate physical service
- Handles mechanics of getting data
  - Different adaptors for different sources
    - REST, WS*, Relational, XML, etc.
    - Diverse data models
  - Might do caching and query distribution (federation)
- Provides model transformation
  - Plug in ontologies and inference rules as needed

PART 2

Proof-of-Concept: A SPARQL adaptor for UCMDB

IT Service Management (ITSM)

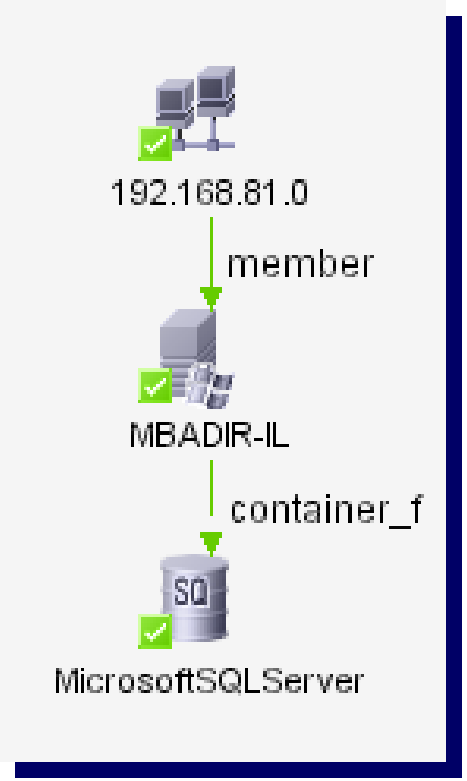
- Manage IT environment
- Configuration Management Data Base (CMDB) is central



The HP Universal CMDB (UCMDB)

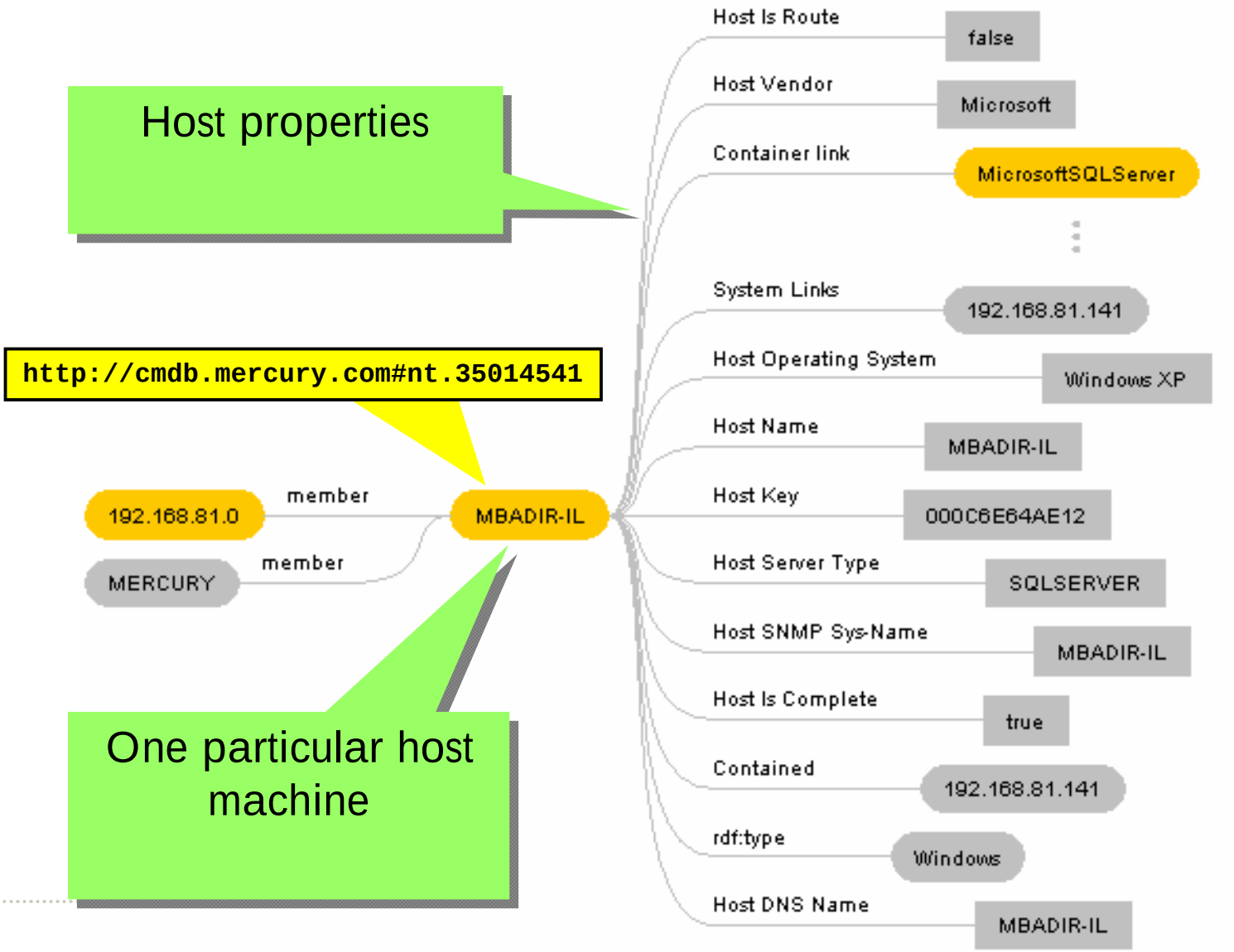
Goal:

- Maintain a comprehensive and current record of all configuration items (CIs) and their relationships



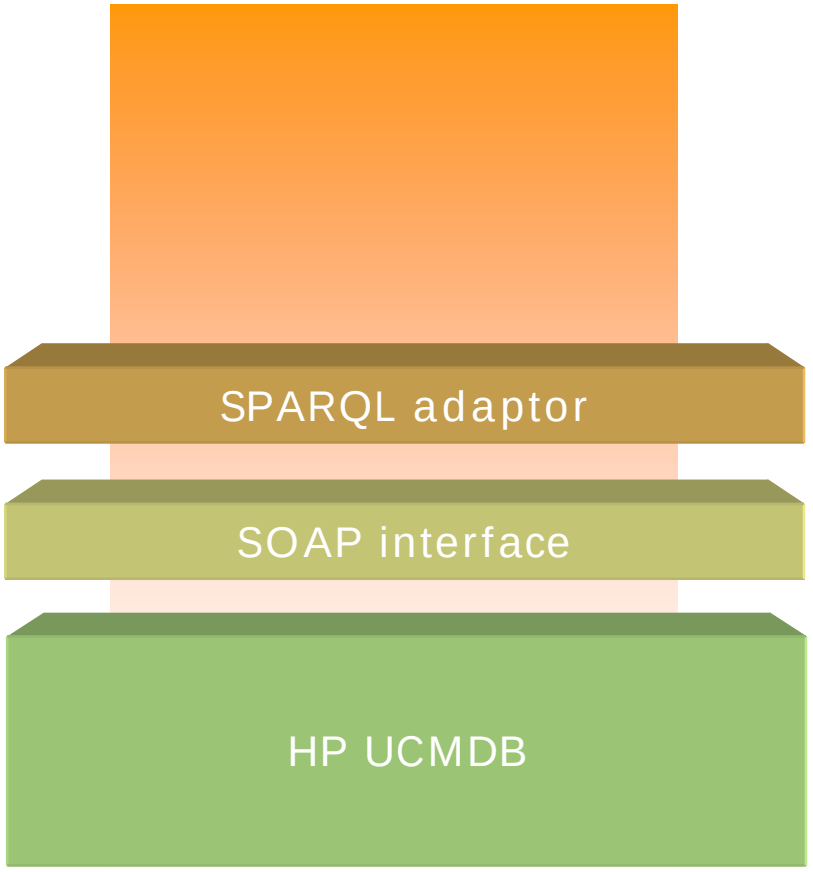
CMDB : Configuration Management DB

Example: host information

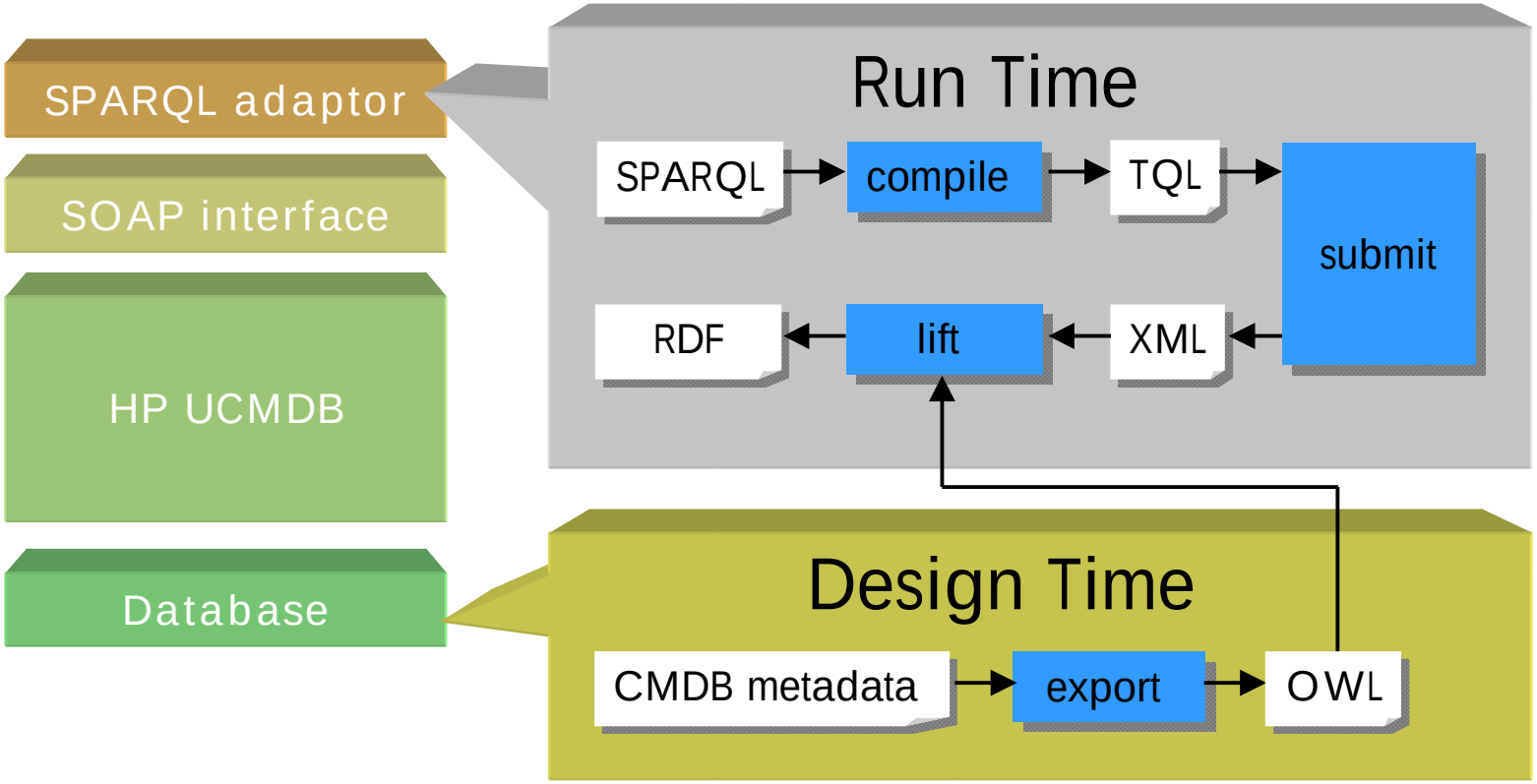


SPARQL adaptor

- Uses existing SOAP interface to UCMDB
- Enables SPARQL queries
- Results can be RDF
- No model transformation (yet)

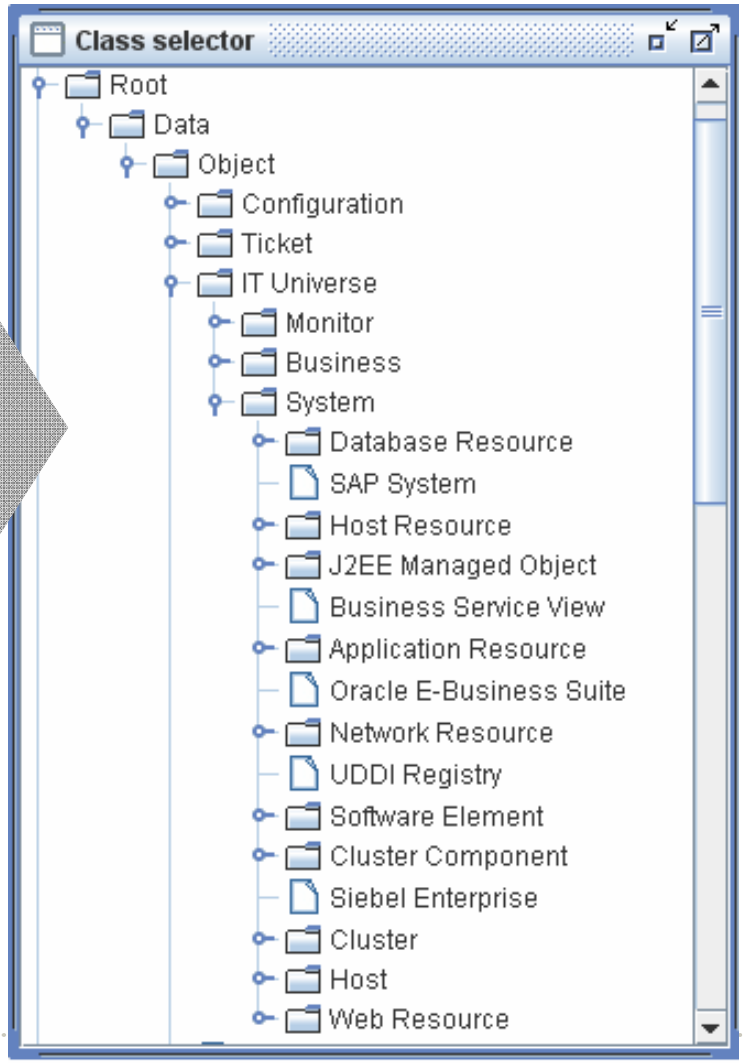


Architecture of SPARQL adaptor



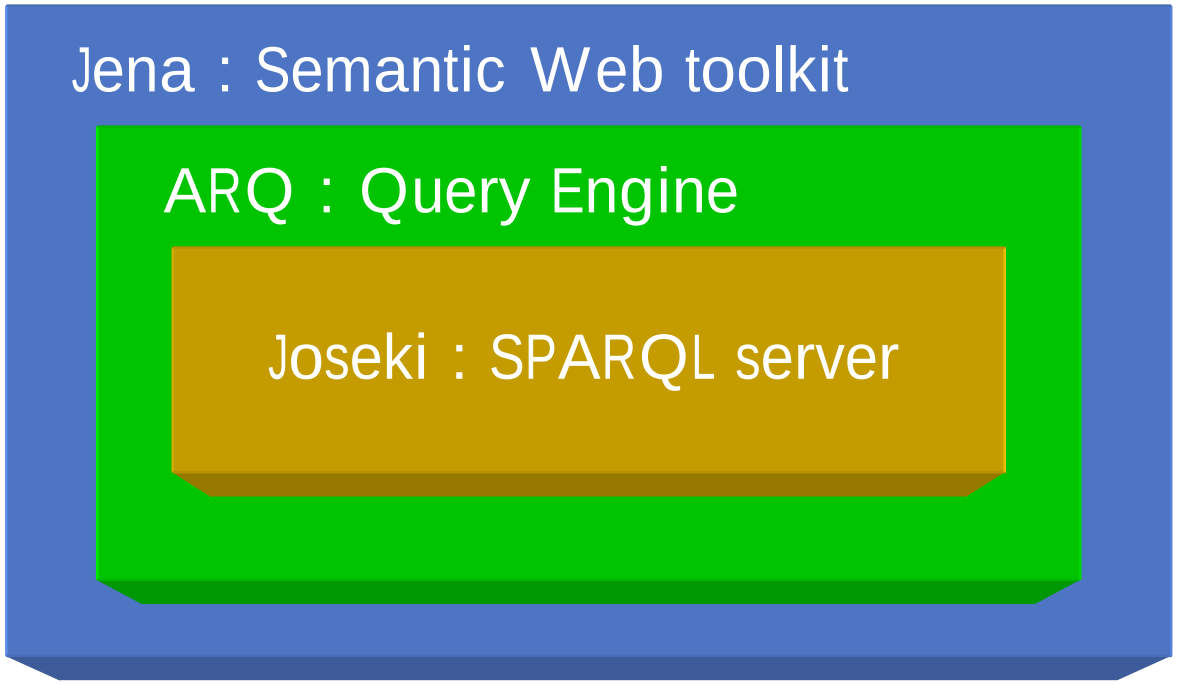
UCMDB ontology

- The HP UCMDB ontology defines CI types and relationship hierarchies.
- Derived automatically from HP UCMDB metadata.



Jena based implementation

- Jena, ARQ, Joseki developed at HP Labs*.



* http://www.hpl.hp.com/semweb/

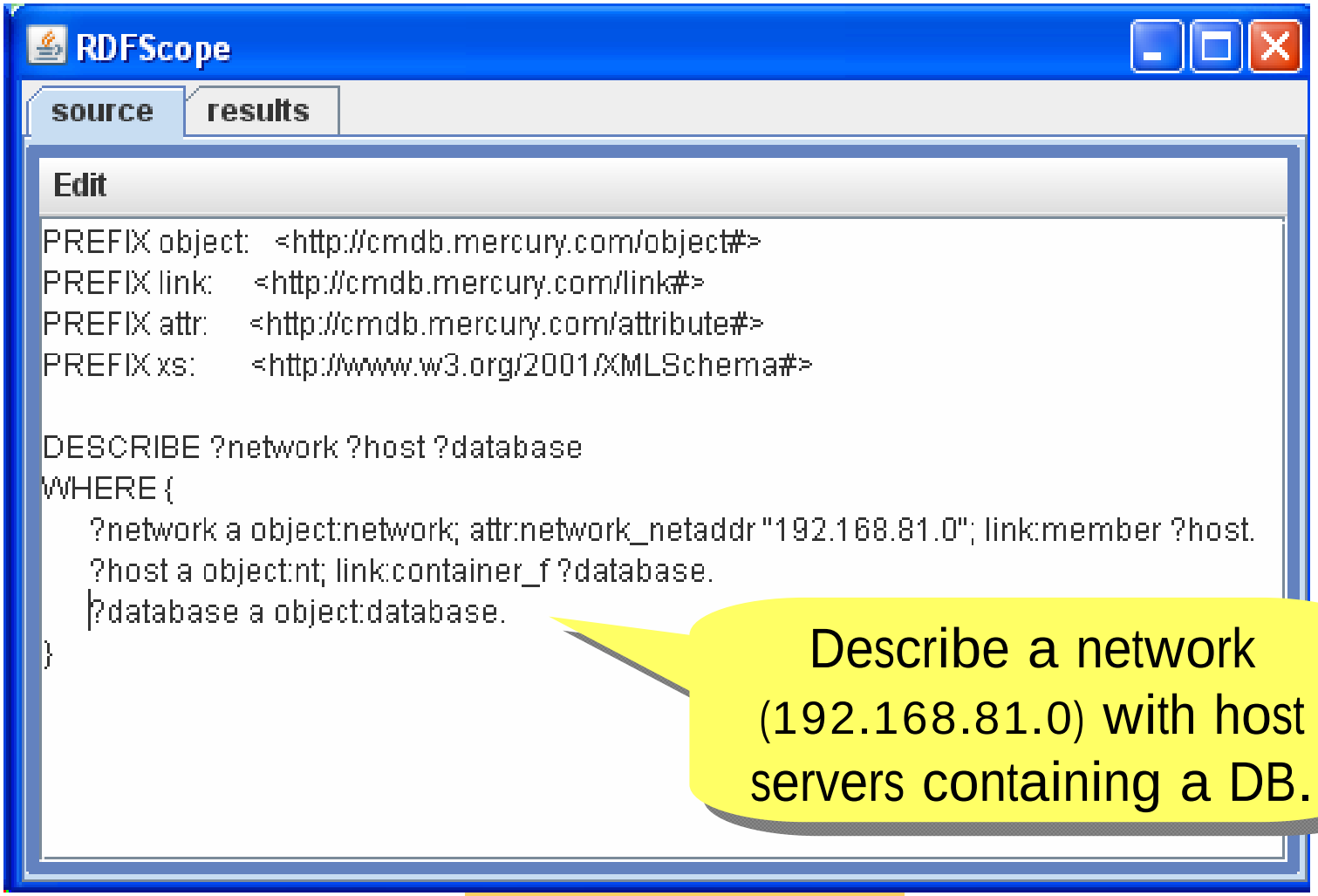
Query returning a table

Select the names of host servers
on the network with addresses from 192.168.81.0

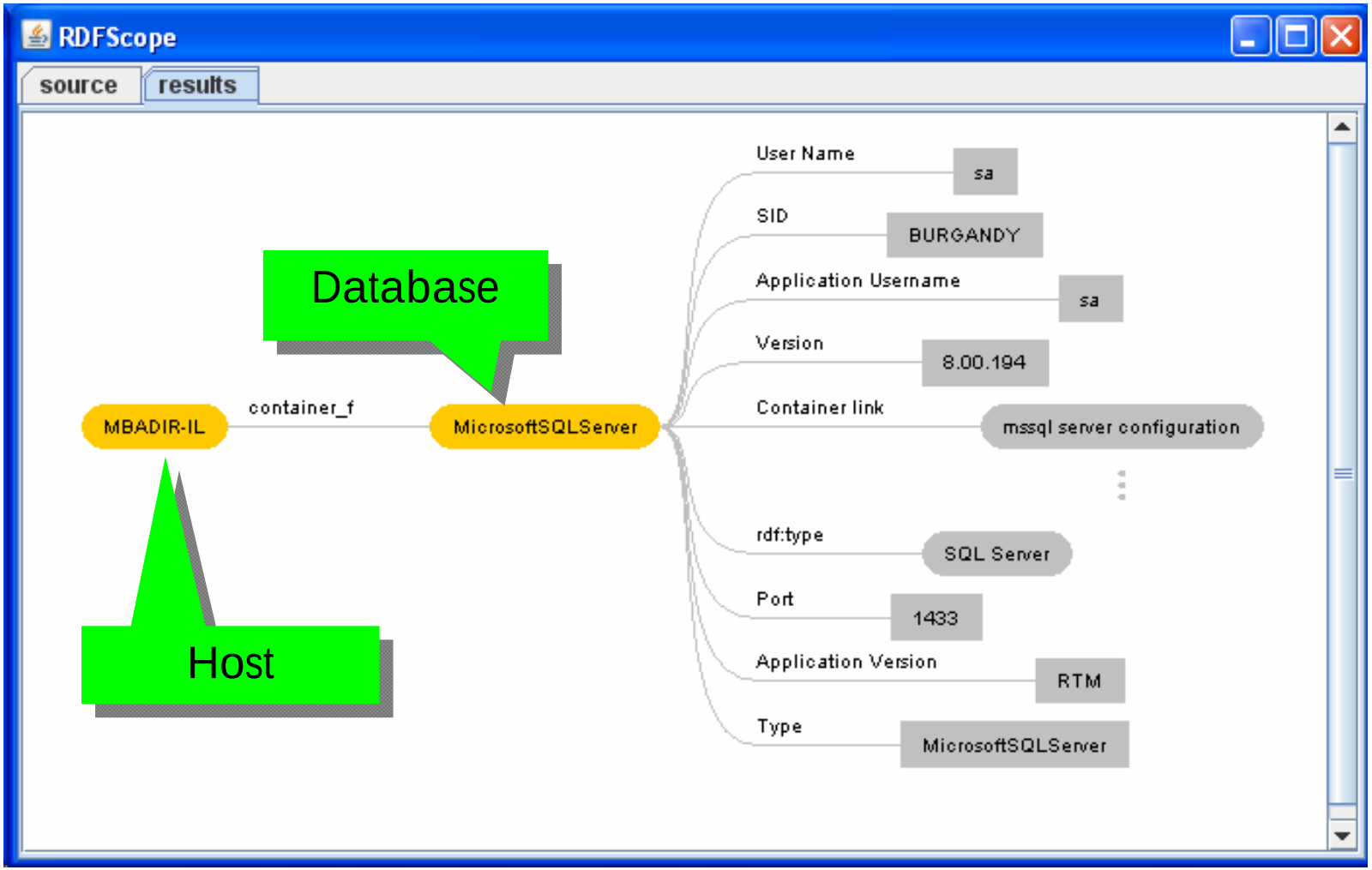
```
SELECT ?host_name
WHERE {
  [ a object:network ] attr:network_netaddr "192.168.81.0" ;
  link:member [ a object:host ;
    attr:host_dnsname ?host_name
] }
```

host_name
"ILDTRD129" ^^<http://www.w3.org/2001/XMLSchema#string>
"JONI" ^^<http://www.w3.org/2001/XMLSchema#string>
"MBADIR-IL" ^^<http://www.w3.org/2001/XMLSchema#string>

Query returning an RDF subgraph



Example RDF result set



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Questions?