Systems interoperability through use of semantic technologies

Semantic Days' 2009

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Systems interoperability through use of semantic technologies

- The talk will give an overview of the major challenges related to system interoperability in general and the specific issues related to interoperability on the semantic level. Examples on solution approaches based on use of semantic technology from current European projects will be given.

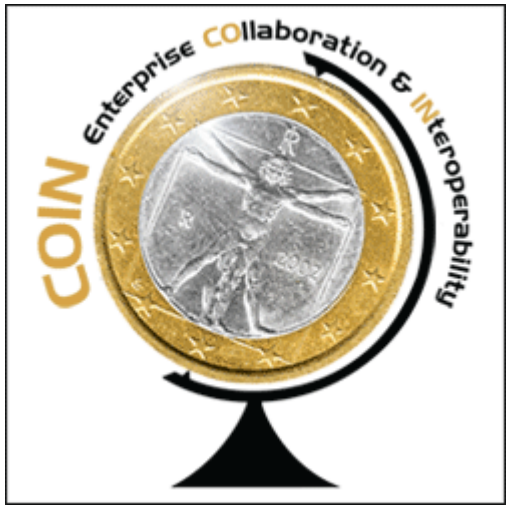
- Arne J. Berre, Chief Research Scientist, SINTEF,
- Svein Johnsen, Research Scientist, SINTEF

Summary

- Challenges related to system interoperability, Interoperability on the semantic level
- **COIN – Collaboration and Interoperability – Using SAWSDL architecture for semantic annotations, - experimenting with different technologies for realisation**

- Related projects presented at Semantic Days:
- *SWING/ENVISION:* *Tue: 1700-1730* ***Semantic annotation for web services and their relevance to environmental models (ENVISION, SWING)***
- *SHAPE:* *Wed 1030-1100* ***Supporting intelligent and automated integrated operations with agent technologies in a services architecture (using SoaML and Agents) (SHAPE)***
- *EMPOWER/MEMPOWER* *Wed: 1130-1200* ***IT architecture for supporting semantic interoperability through use of semantic annotations (and SAWSDL) (EMPOWER)***

The COIN Vision & Motto



COIN VISION: ***"By 2020 enterprise collaboration and interoperability services will become an invisible, pervasive and self-adaptive knowledge and business utility at disposal of the European networked enterprises from any industrial sector and domain in order to rapidly set-up, efficiently manage and effectively operate different forms of business collaborations, from the most traditional supply chains to the most advanced and dynamic business ecosystems."***

The COIN Consortium & Funnel Model

Industrial Partners

TXT e-solutions

SOLUTA.NET

IC FOCUS

Atos Origin

ESoNET

SIEMENS

Academic & Research Partners

universität innsbruck

VTT

BIBA

SINTEF

DFKI

LAAS CNRS Laboratory for Enterprise Knowledge and Systems

TU VIENNA

ESI European Software Institute tecnalia

Jožef Stefan Institute, Ljubljana, Slovenia

User Partners

IND

ISOIN

PÖYRY

UNCONVENTIONAL BUSINESS

Filas Finanziaria laziale di sviluppo

ACS Automotive Cluster of Slovenia

14 Meuro,
21 partners

FP7-1
IP project
Objective 1.3

4 years:
2008-2011

COIN Market: starting point

EC form / EI challenge	Knowledge i/op	Business i/op
Supply Chains	Aerospace DTA Lazio (ITA)	Automotive Slovenian Net (SLO)
Collaborative Networks	ICT Network (HUN)	Aeronautic Cluster of Andalusia (SPA)
Business Ecosystems	Pulp & Paper Poyry (FIN)	Healthcare VEN (UK)

COIN Side A: main innovations

- **The COIN Interoperability Space**

➢ To address **Information, Knowledge and Business** interoperability

➢ To support the **Federated** interoperability approach

➢ To integrate **Model- and Semantic- driven** interoperability methods

➢ To enable **Knowledge Profiles** semantic mediation

➢ To synchronize and optimize **collaboration Business Processes**

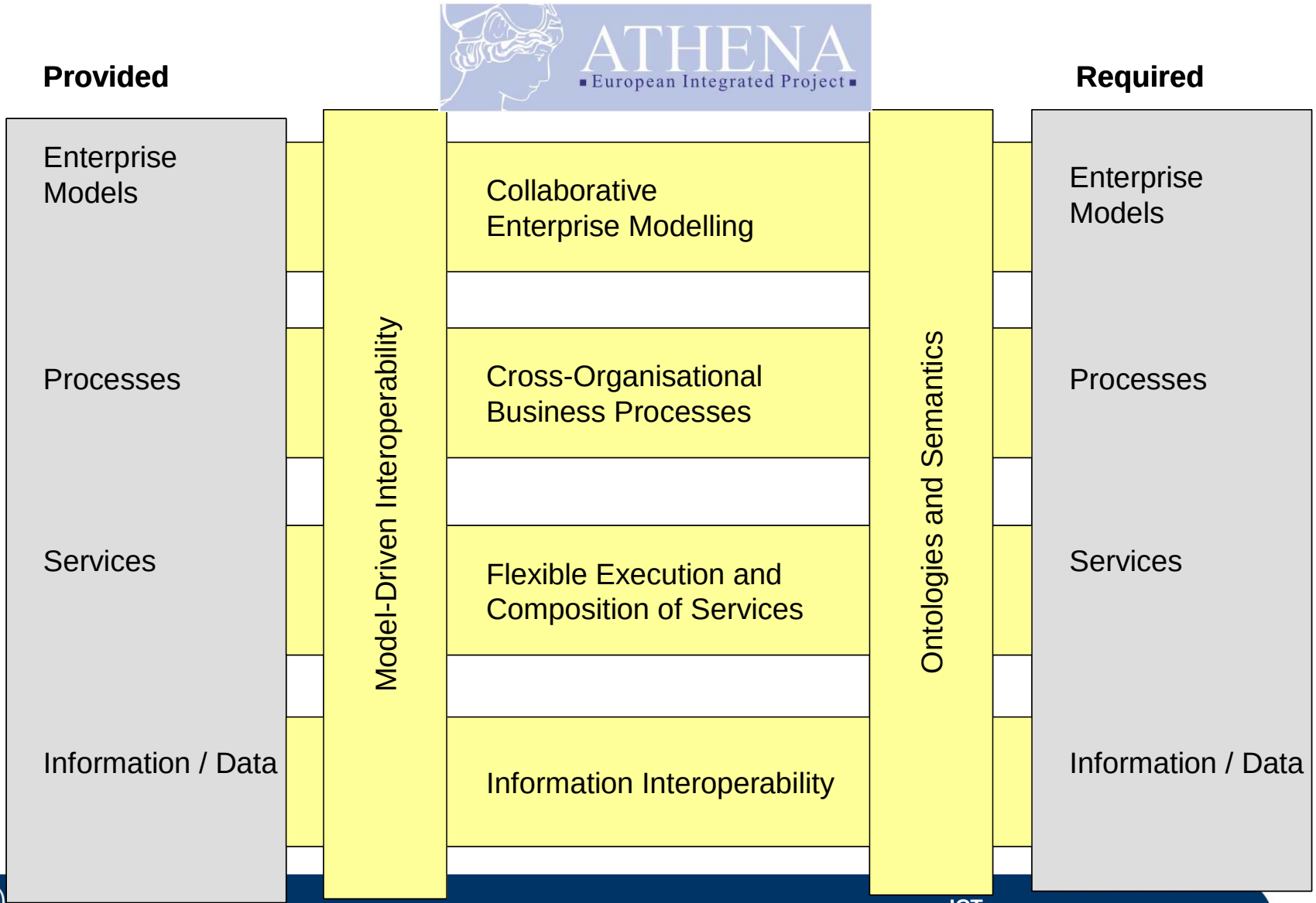
➢ To go beyond state-of-the-art 1:1 transactions:

✓ Supporting **1:1 negotiations** (e.g. supplier-customer)

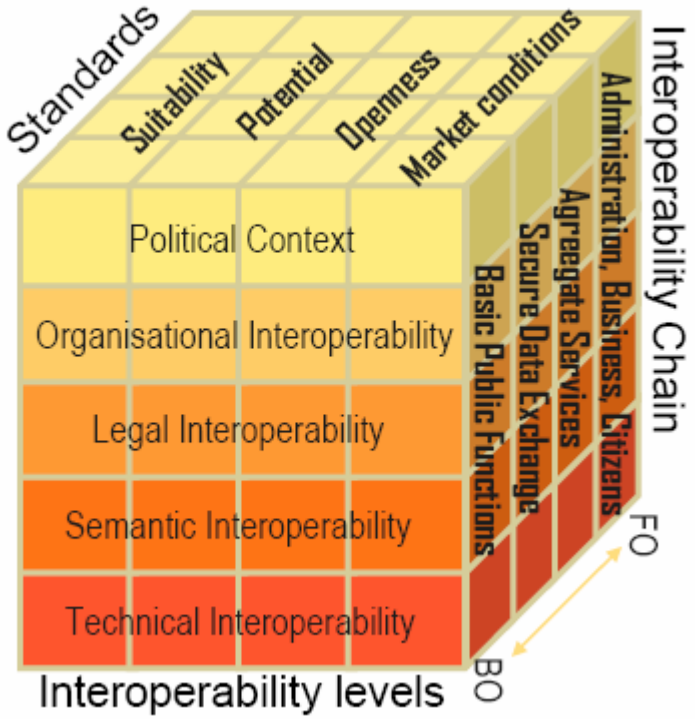
✓ Enabling **1:n relations** (e.g. tender-bidders)

✓ Allowing **n:m agreements** (e.g. sellers-buyers)

COIN Side A: state-of-the-art



EIF version 2.0 (2009)
European Interoperability Framework
EIF - Dimensions of Interoperability

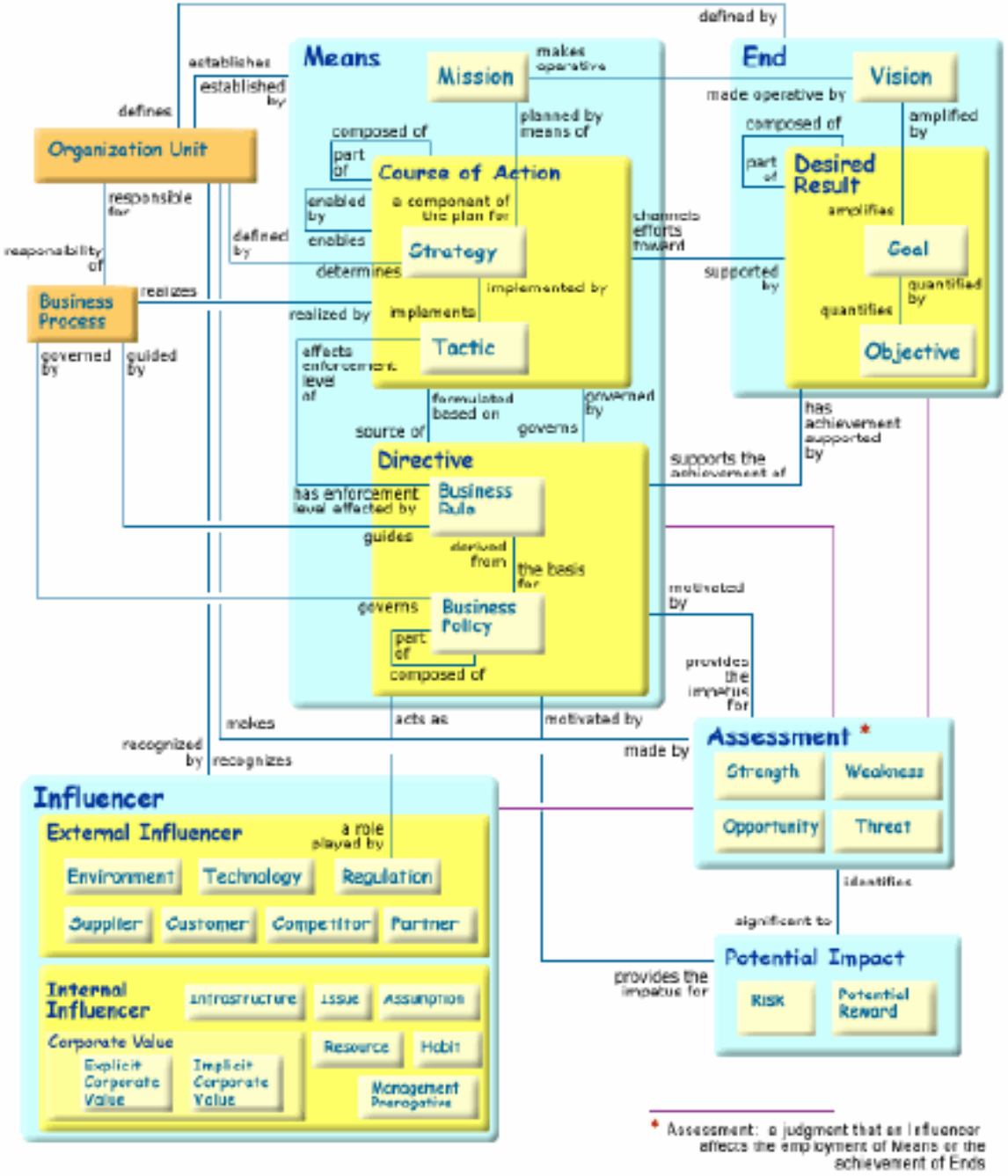


Definition: Interoperability (Revised in 2008 in EIF v2, to include common goals !)

"Interoperability is the ability of disparate and diverse organisations[1] to interact towards mutually beneficial and agreed common goals, involving the sharing of information and knowledge between the organizations via the business processes they support, by means of the exchange of data between their respective information and communication technology (ICT) systems."

In fact, interoperability is often confused with other, related concepts. It can be therefore a useful exercise to observe explicitly what interoperability is NOT:

- Interoperability is not ***Integration,*** which is a means of changing loosely coupled systems to make them into more tightly coupled systems.
- Interoperability is not ***Compatibility***, which is more about the interchangeability of tools in a particular context
- Interoperability is not ***Adaptability***, which is a means of changing a tool, adding additional capabilities as needed even on an ad-hoc basis, whereas interoperability refers to inherent capabilities



OMG BMM Business Motivation Model

Goal alignment with BMM and service collaboration with SoaML

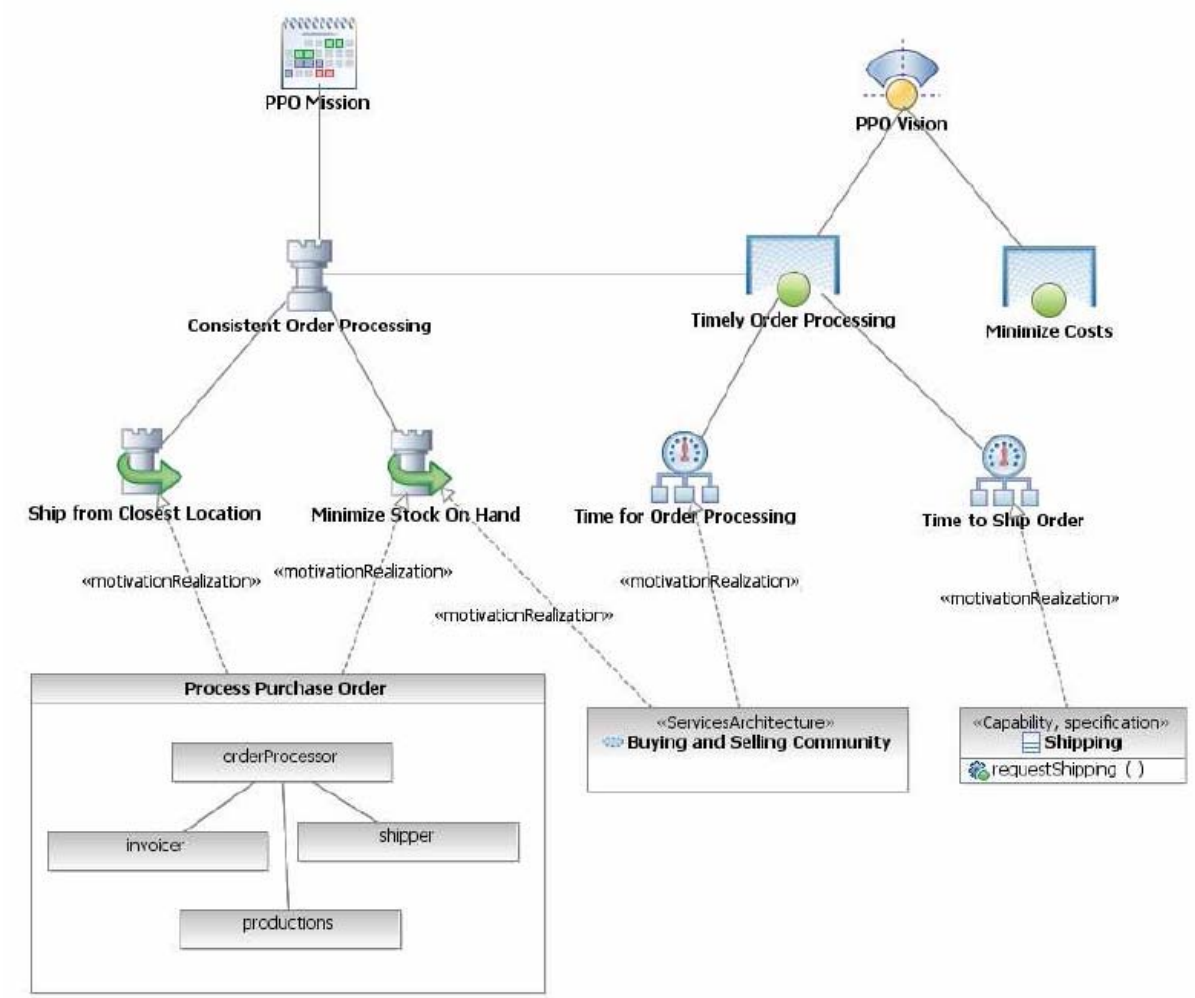


Figure on the left shows an example of a business motivation model that captures the following business requirements concerning the processing of purchase orders:

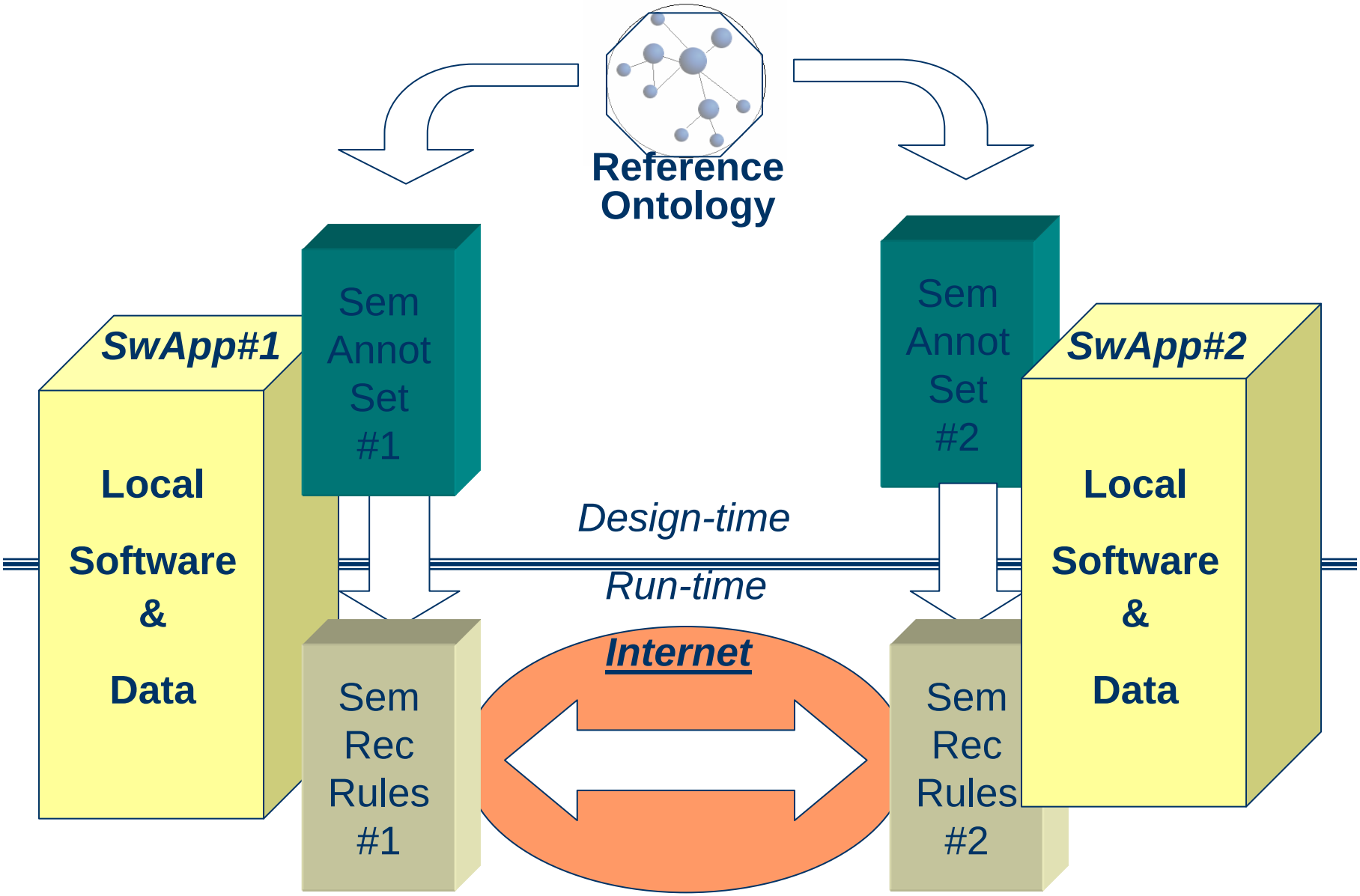
· Establish a common means of processing purchase orders.
· Ensure orders are processed in a timely manner, and deliver the required goods.
· Help minimize stock on hand.
· Minimize production and shipping costs

This example of a BMM model shows the business vision, the goals that amplify that vision, and the objectives that quantify the goals. It also shows the business mission, the strategies that are part of the mission plan, and the tactics that implement the strategies. Finally the strategies are tied to the goals they support. The example also shows a Process Purchase Order contract that formalizes the requirements into specific roles, responsibilities, and interactions. The Contract indicates what motivation elements it realizes through MeansRealizations.

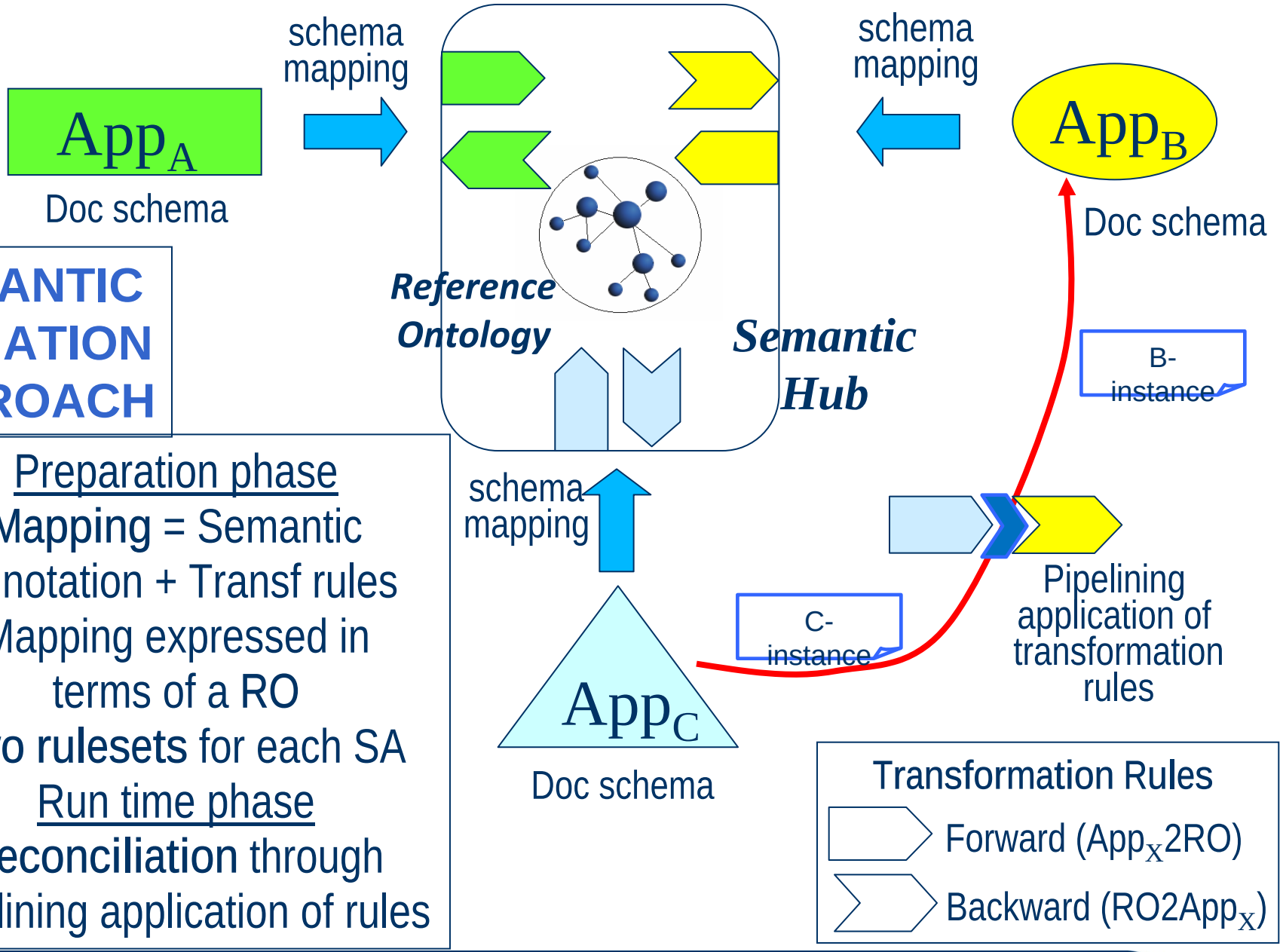
SAWSDL - Semantic Annotations for WSDL and XML Schema

- W3C Recommendation, August 2007
- This specification defines a set of extension attributes for the Web Services Description Language and XML Schema definition language that allows description of additional semantics of WSDL components. The specification defines how such semantic annotation is accomplished using references to semantic models, e.g. ontologies
- 3 constructs: modelReference, liftingSchemaMapping, loweringSchemaMapping

Architecture for semantic annotation and reconciliation



SEMANTIC MEDIATION APPROACH



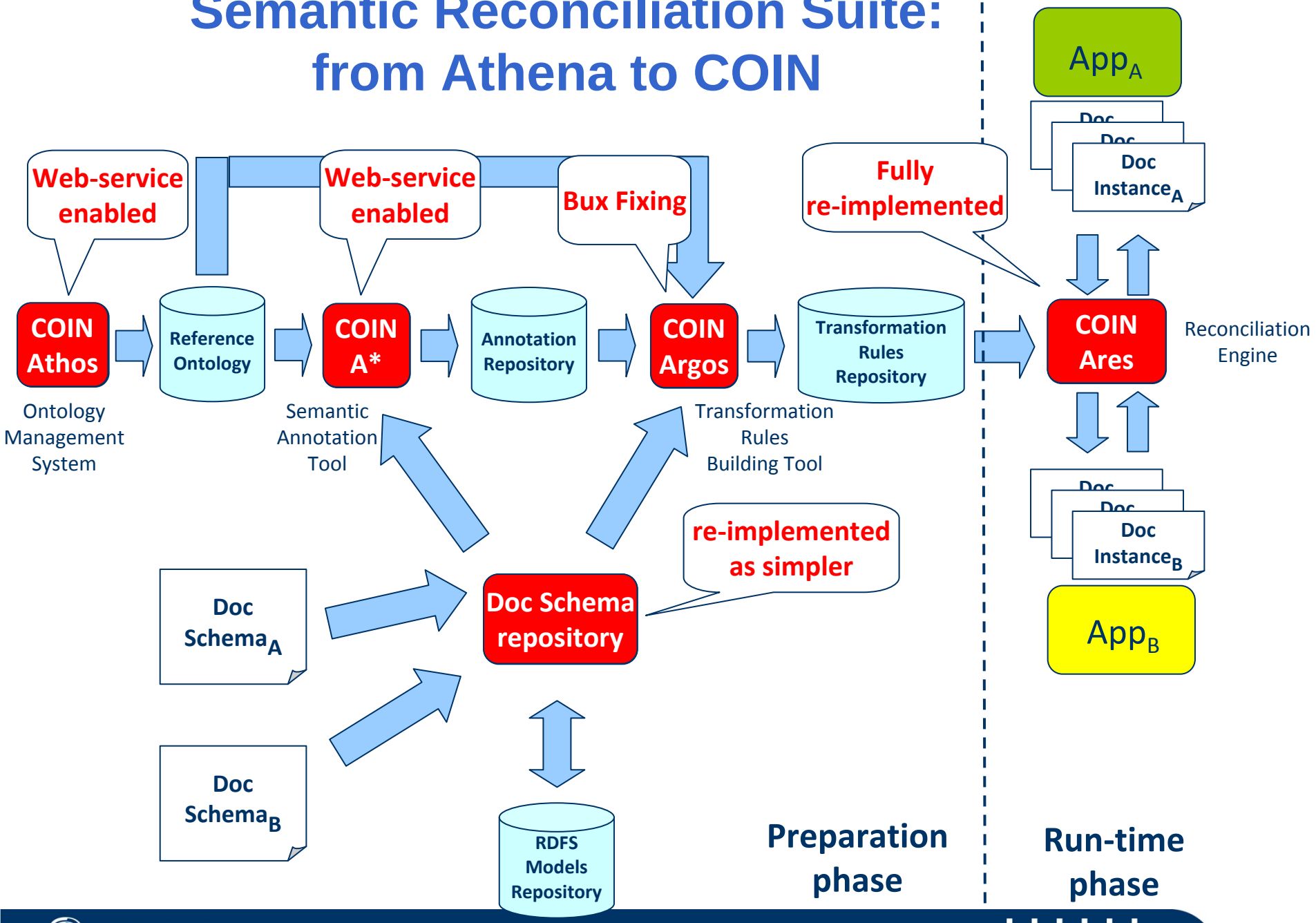
Preparation phase

- **Mapping** = Semantic Annotation + Transf rules
- Mapping expressed in terms of a RO
- **Two rulesets** for each SA

Run time phase

- **Reconciliation** through pipelining application of rules

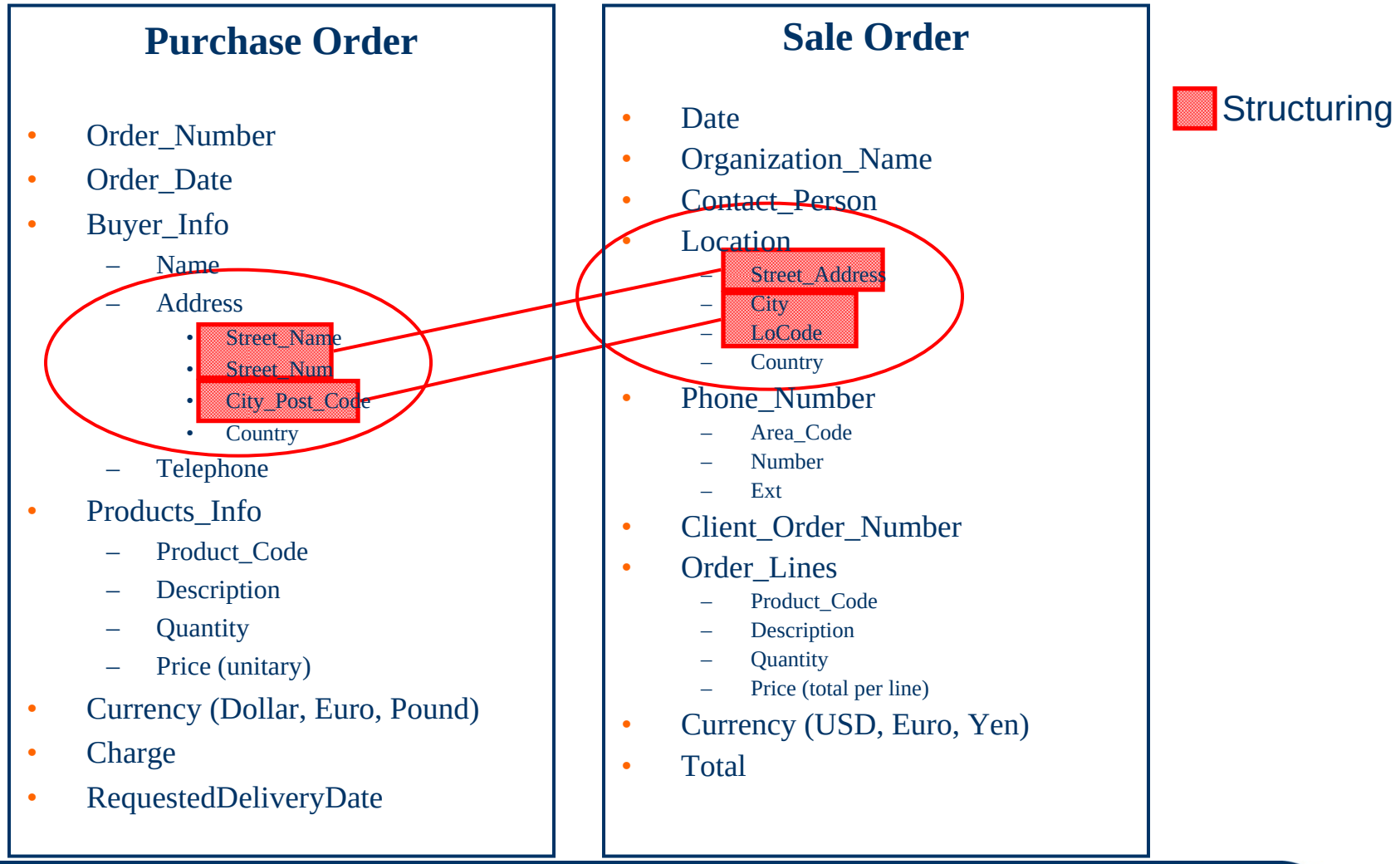
Semantic Reconciliation Suite: from Athena to COIN



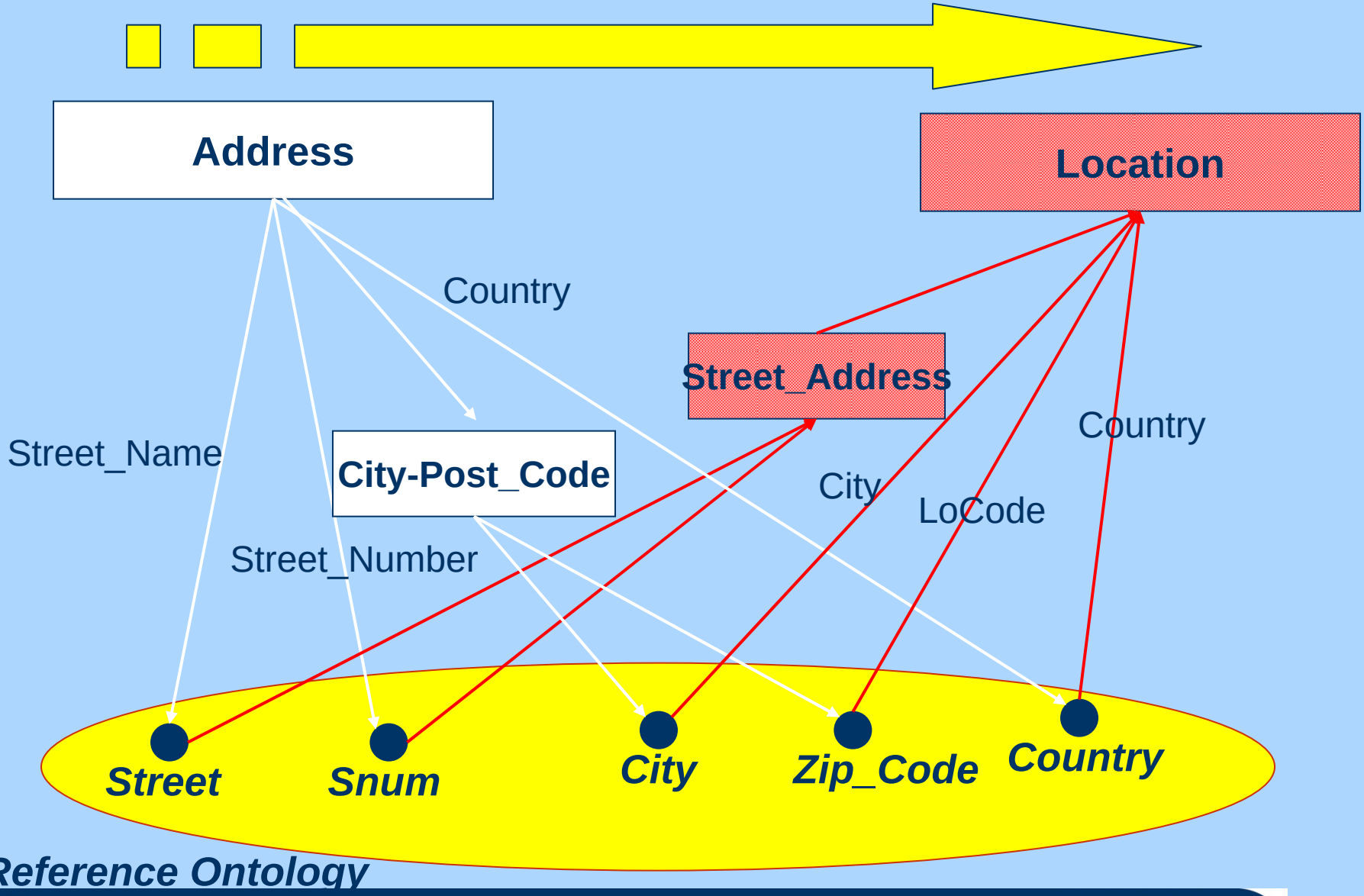
Example of Mismatch

EnterprA (Buyer)

EnterprB (Supplier)



Ontology-based Reconciliation Approach



Semantic annotations

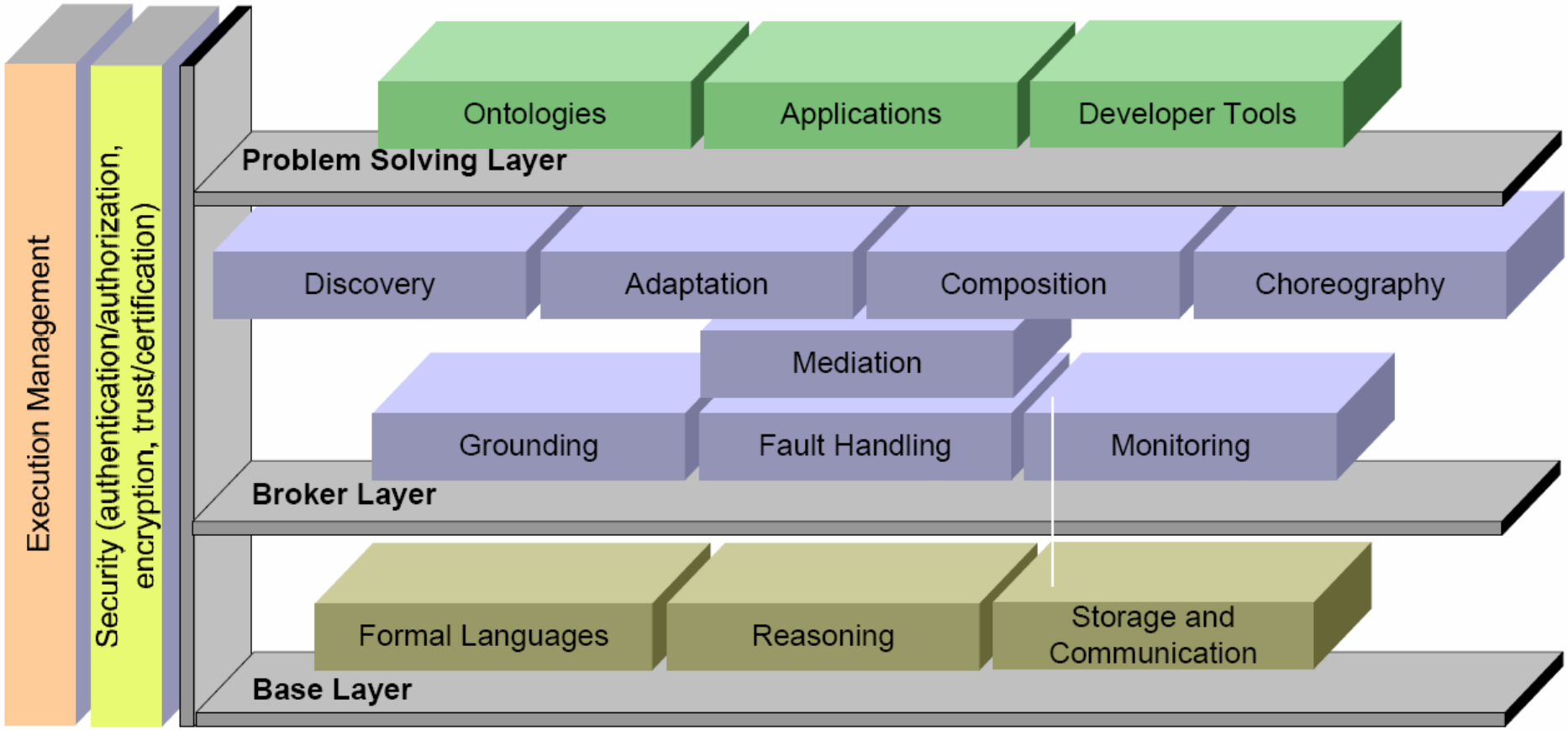
Local Schema (XML Schema)

```
…
<xsd:element name="Address">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Street_Name"
    type="xsd:string"/>
      <xsd:element
    name="Street_Number"
    type="xsd:positiveInteger"/>
      <xsd:element name="City-
    Post_Code" type="xsd:string"/>
      <xsd:element name="Country"
    type="xsd:string">
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
…
```

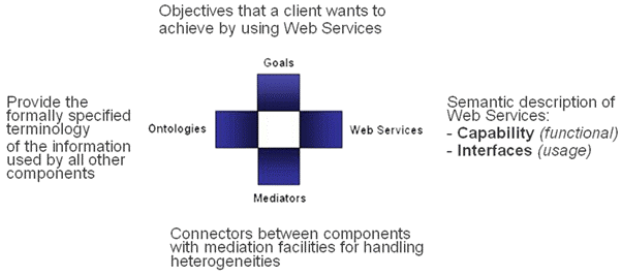
Reference Ontology (OWL)

```
…
<owl:Class rdf:ID="Address"/>
<owl: DatatypeProperty rdf:ID="Street">
  <rdfs:domain rdf:resource="Address"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</owl: DatatypeProperty>
<owl: DatatypeProperty rdf:ID="Snum">
  <rdfs:domain rdf:resource="Address"/>
  <rdfs:range rdf:resource="&xsd;positiveInteger"/>
</owl: DatatypeProperty>
<owl: DatatypeProperty rdf:ID="City">
  <rdfs:domain rdf:resource="Address"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</owl: DatatypeProperty>
<owl: DatatypeProperty rdf:ID="Zip_Code">
  <rdfs:domain rdf:resource="Address"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</owl: DatatypeProperty>
<owl: DatatypeProperty rdf:ID="Country">
  <rdfs:domain rdf:resource="Address"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</owl: DatatypeProperty>
…
```

COIN Metal: Baseline – Semantic SOA



WSMO/WSML



Service oriented architecture Modeling Language (SoaML) - Specification for the UML Profile and Metamodel for Services (UPMS)

Revised Submission
OMG document: ad/2008-08-04

Submitters

Adaptive
Capgemini
EDS
Fujitsu
Fundacion European Software Institute
Hewlett-Packard
International Business Machines
MEGA International
Model Driven Solutions
Rhysome
Softeam

Supporters

BAE Systems
STI/University of Innsbruck
DFKI
Everware-CBDI
France Telecom R&D
General Services Administration
Visumpoint
MID GmbH
NKUA – University of Athens
Oslo Software
SINTEF
THALES Group
University of Augsburg
Wilton Consulting Group

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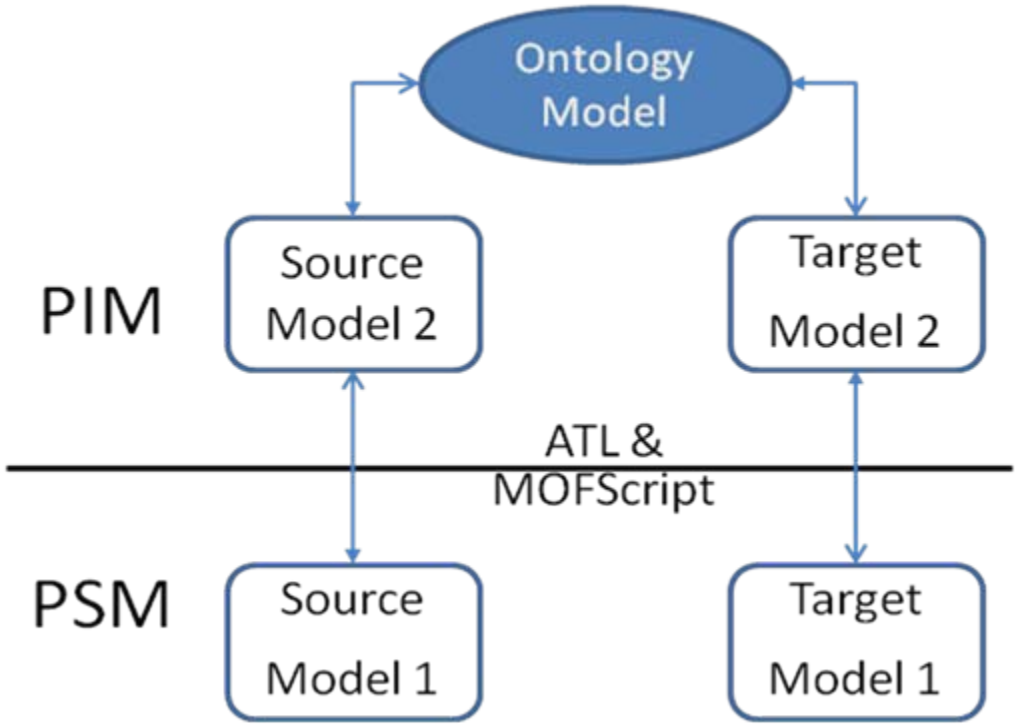
Find the document here:

http://www.omg.org/cgi-bin/doc?ad/08-11-01.pdf

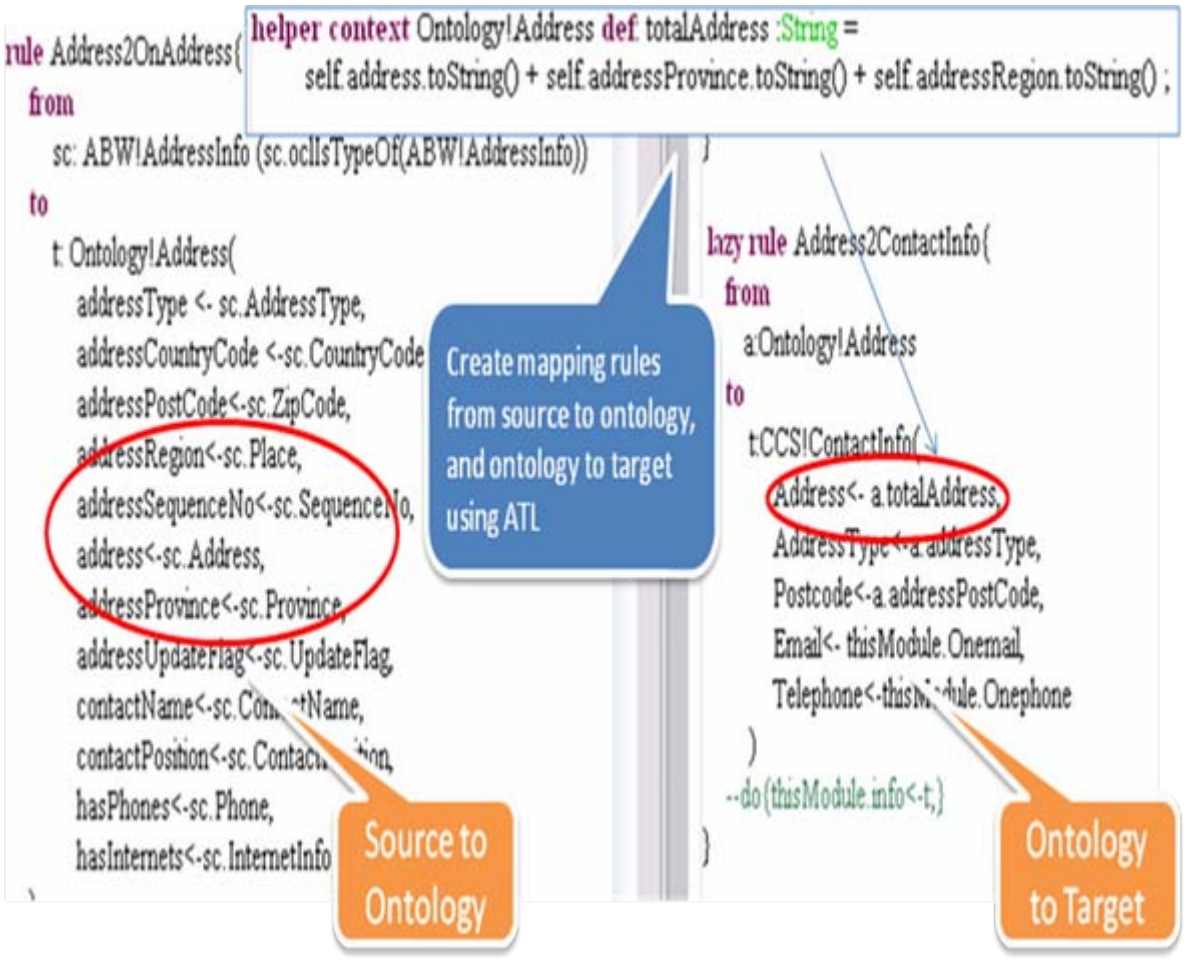
Revised submission per November 10th, 2008

See also: www.soaml.org

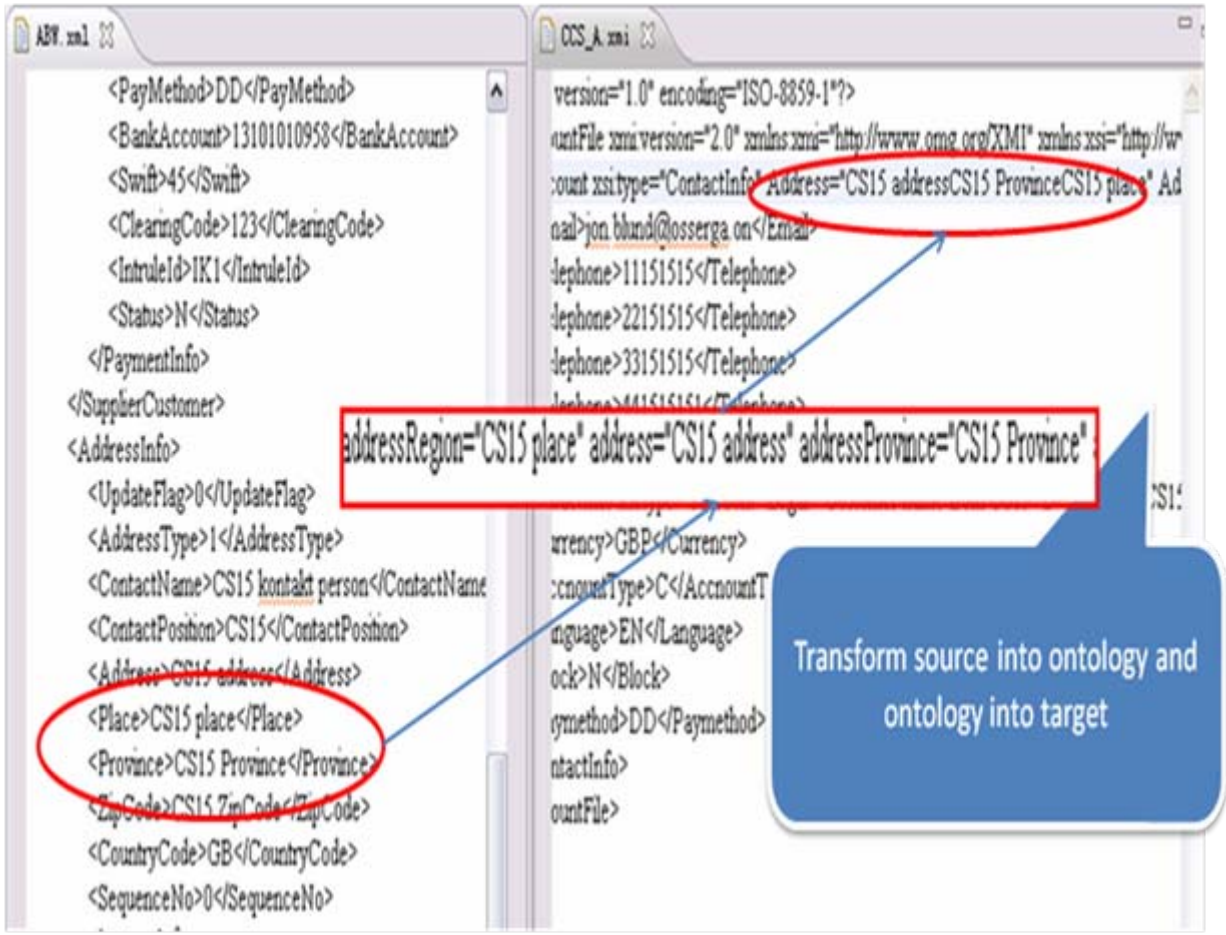
Platform independent annotations



“Address” in the source and target transformation rules



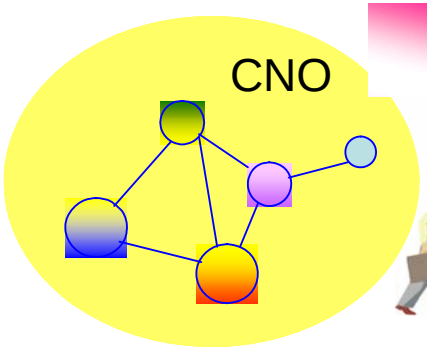
“Address” transformations from source.xml and target.xmi



COIN Side B: state-of-the-art

Short window of opportunity

Fast configuration of a temporary consortium well suited to the needs



Successful & Effective collaboration

Management / Governance

Preparedness

Breeding Environments — **VBE** / **PVC**

CNO creation

Metamorphosis

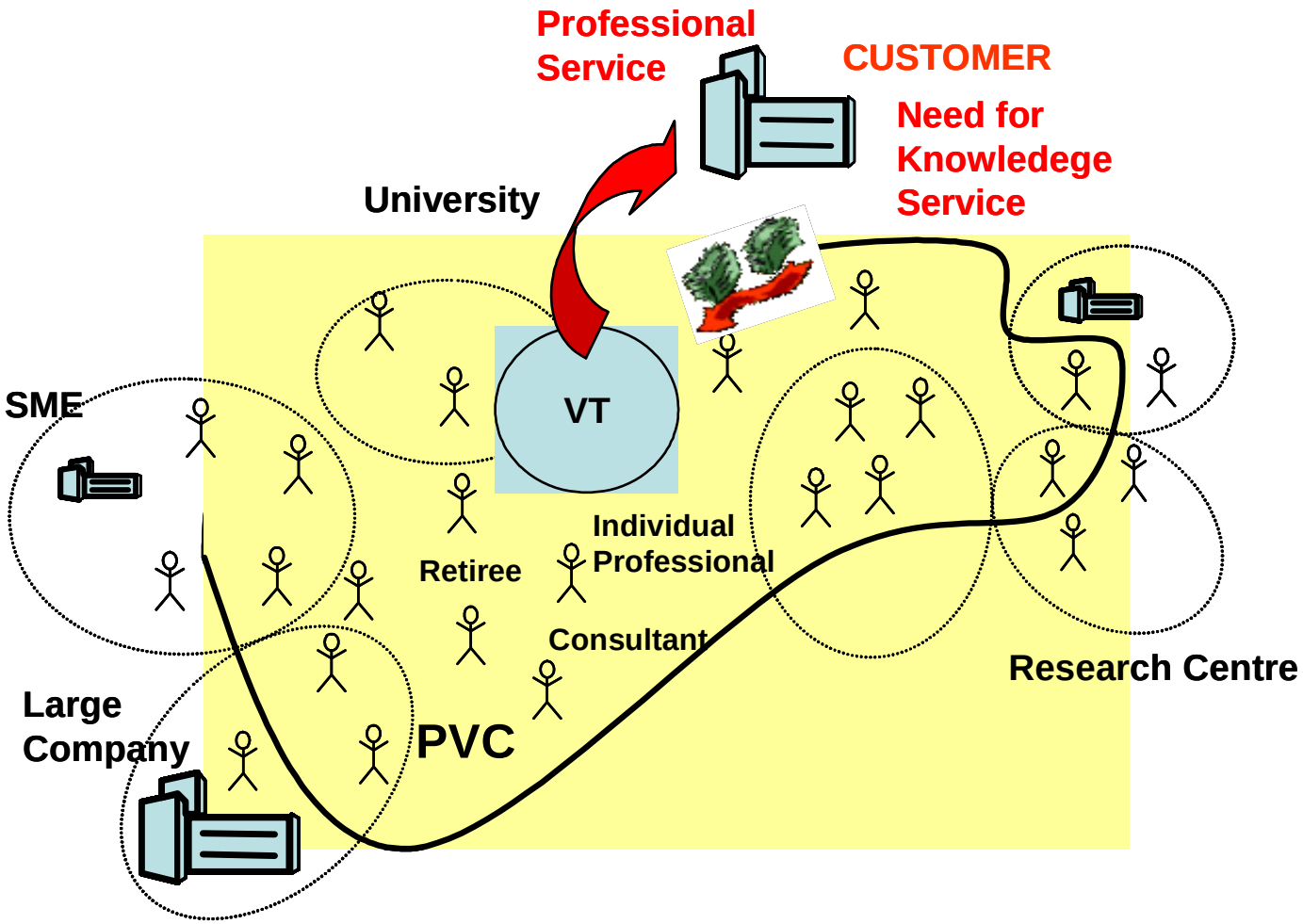
COIN Side B: main innovations

• The COIN Collaboration Space

- To allow **Endogenous** generation of Business Opportunities (LivingLabs & Open Innovation)
- To support **Product Design, Production Planning, Project Mgmt**
- To enable **Co-operativity** of Enterprise Applications (groups as users)
- To support **Web 2.0** and participative services (Enterprise 2.0)
- To involve also the Customers in the whole life-cycle of **Virtual Organizations** (VOs):
  - ✓ **VO preparation** (get the enterprises prepared to form VOs)
  - ✓ **VO creation** (select partners and competencies)
  - ✓ **VO operations & mgmt** (performance indicators definition-governance)
  - ✓ **VO dissolution** (inheritance and knowledge transfer)

COIN Side B: future outlook

- The Innovation Knowledge Ecosystem



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