Enterprise COllaboration & INteroperability

COIN
SP5 – Enterprise Interoperability Services

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SP5 Outline

- Enterprise Interoperability and COIN
- WP 5.2 Information Interoperability Services
- WP 5.3 Knowledge Interoperability Services
- WP 5.4 Business Interoperability Services
Interoperability reference model
(FP6 EU Athena project)
Information/Data Interoperability
The data Interoperability problem

App\textsubscript{A}  

App\textsubscript{C}  

App\textsubscript{B}  

Different terminology
Different data organization
Different data structure
Set up phase
- Reference ontology
- Semantic annotation of the documents to be exchanged
- Transformation rules for each document type
  - Forward (Fwd)
  - Backward (Bwd)

Run-time phase
- Accepting the message (as issued by the sender)
- Transform the payload according to the Fwd Transf rules
- Produce the “neutral” ontology representation
- Transform the payload according to the Bwd Transf rules
- Deliver the message to the receiver, formatted according to the receiver specs
The Semantic Reconciliation approach

- **Mapping** = Semantic Annotation + Transf rules
- Mapping expressed in terms of a **RO**
- **Two sets of rules** for each SA (linear growth, $O(n)$)
- **Reconciliation** through composition of rules

**Transformation Rules**
- Forward (App$_X$2RO)
- Backward (RO2App$_X$)

[Diagram showing schema mapping between App$_A$, App$_B$, and App$_C$ through a Semantic Hub with a Reference Ontology.]
Sem Annot of Structured Documents
A classification of Mismatches

Lossless Mismatch

- **Naming**: different labels for the same entities
- **Abstraction**: Level of specialization/ refinement of the information. The same concepts are recognized, but they are defined at different levels of abstraction
- **Structuring**: The same set of concepts is modeled, but it differ the way these concepts are structured by means of relations
- **Subclasses-Attribute values**: an attribute with predefined value set is represented by a set of subclasses
- **Class-relation**: a concept is represented as a relation
- **Attribute Granularity**: The same information is decomposed into a different number of attributes (or sub-attributes)
- **Attribute Assignment**: Two conceptualization differ in the way they assign attributes to concepts
- **Complex Attribute**: A set of attributes is grouped and represented as a concept.
- **Encoding**: Different formats of data or units of measure.

Lossy Mismatch

- **Overlapping**: There is an intersection between the extensions of different concepts/attributes/roles.
- **Subsumption**: There is an inclusion between the extensions of different concepts/attributes/roles.
- **Categorization**: Two conceptualizations distinguish the same concept but divide it into different and incomparable sub-concepts.
- **Coverage**: Two conceptualizations do not model all the entities or information of a given domain.
Semantic Interop Runtime Engine

- Actual document reconciliation from A to B is performed applying the defined reconciliation rules
- Two transformations:
  - **Forward**, from the A format into the Ontology representation (FWD rules)
  - **Backward**, from the Ontology representation into the B format (BWD rules)
Knowledge Interoperability
Objectives

To achieve balanced and harmonised Collaborative Networks

- Modelling Enterprise Semantic Profile (ESP) focussing on Competencies and Skills (CS)
- Semantically enriching CS of each enterprise in the CN to:
  - Understand the overall CS of the CN
  - Identify CS gaps and complementarities
  - Define the “ideal” CS asset for the CN and identify the missing CS (e.g., to be acquired with new partners)

To this end, we need to develop:

- Semantic Supporting Services: SSS, necessary for KIS
- Knowledge Interop Services: KIS, to support the harmonisation of CS for better enterprise cooperation in the CN
To support ontology building with a collaborative approach

Characterised by

• **Automatic knowledge extraction**
  – Analysis of textual documents by using NLP techniques

• **Social participation**
  – Voting and discussing (forums) for validating and enriching extracted knowledge
• Step-wise approach
  – **Lexicon**: plain list of terms
  – **Glossary**: terms + natural language definition
  – **Taxonomy**: definition of ISA hierarchy
  – **Ontology enrichment**: additional relationships (e.g., predication, relatedness)
### Social participation functions: GUI

**Gloss Validation**

<table>
<thead>
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<th>3T Terms</th>
<th>Definitions</th>
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<th>Actions</th>
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**Participants validation**

**Ontology Master final validation**

**Validation Deadline**

**Forum discussion Deadline**

**Forum discussion**

**Participants**

**Moderator**
Enterprise Semantic Profiling service (ESP)

• To support the building of Semantic Profile of companies in the cluster
  – A semantic profile is represented as a set of concepts from the cluster ontology (OFV)

• ESP is characterized by
  – Analysis (terms extraction) of textual document describing the company
  – **Automatic matching** among extracted terms and the cluster’s ontology (to get the suggested profile)
Enterprise Semantic Matchmaking service (ESM)

- It provides a mechanism for computing the semantic similarity between enterprises profiles
- Semantic similarity is based on
  - Method for computing the similarity between 2 concepts (concept similarity, Consim)
  - Method for the Semantic Similarity between two Conceptual Vectors (Semsim)
Applicative KIS

• Competencies assessment:
  – **CS on target**: competencies currently owned by the cluster
  – **CS gaps**: missing competencies

• New partner evaluation
  – Computation of Semsim between
    • The new partner’s profile and the On target
    • The new partner’s profile and the Gaps
Process Interoperability
Objectives

• Transformation of private processes to public views
  – SBVR Vocabulary for Visibility Rules
  – SBVR annotations and Visibility Rules

• Detection of interoperability gaps
  – Categories and Classes of Interoperability Gaps
  – Deadlock detection patterns
CBP: from private to public view

Private 2 Public transformation

- New concept of **visibility rule**
  - Specify what is visible to who
  - Written SBVR: structured english
  - Separate file: decoupling and reusability

- Several public views out of single private process
  - According to SBVR rules

- BP interoperability addressed explicitly
  - Connected in specific CBP
Transformation of private processes to public views

The company has already defined a set of Rules which specify the access rights to different elements of the processes.

The rules are applied to the Private Process the company want to publish.

Given some parameters, the transformation is able to generate different public views.
SBVR annotations

Visibility Rules

- SBVR annotations:
  - link the process elements to the Visibility Rules
  - Only few elements need to be annotated

- Visibility Rules:
  - specify what is shown in the public view
Detection of Interoperability Gaps

• Categories of interoperability Gap
  – **Business Level** (vs. IT Level)
  – **Design Time** (vs. Run Time)

• Classes of interoperability gaps
  – **Deadlock**
    • A deadlock in a process model is given if a certain instance of the model (but not necessarily all) cannot continue working, while it has not yet reached its end [Awad, Puhlmann, 2008]
    • Deadlock patterns: Loop, Multiple Source, Improper Structure

  – **Interface mismatch**
    • An interface mismatch in a collaborative business process model is a serious impediment that prevents two separately-modeled business processes of successful interoperation due to different design assumptions

Conclusions

Interoperability services at level of:

- **Information**: semantic reconciliation of business documents
- **Knowledge**: semantics-based management of enterprise competencies
- **Process**: synchronization and optimization of Business Processes in collaborative environments