Interoperability through semantic labeling with context

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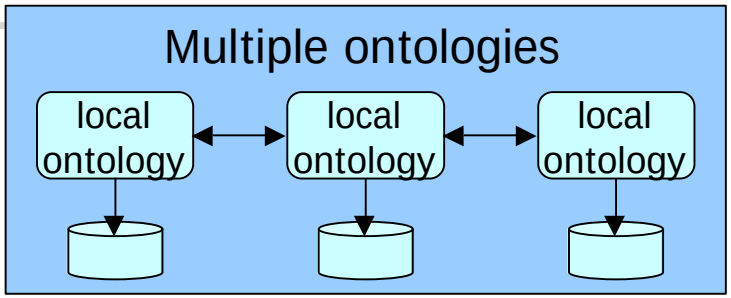
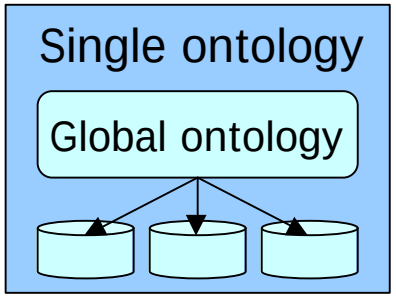
Semantics: the key to interoperability

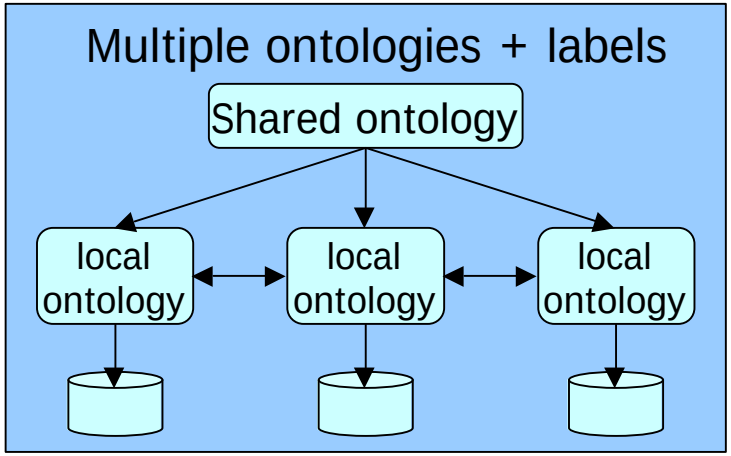
- Proper understanding of the meaning of business, service and protocol data is crucial
- Most e-commerce standards use incompatible semantics for their key concepts
- Business context affects the semantics
- Most e-commerce standards can be represented as ontologies (shared conceptualizations of given knowledge domains)
- There is an acute need for context-aware semantic translation (mapping) techniques

Semantic translation techniques

- Direct translation
  - Requires N*(N-1) translations "from scratch" – a popular Q'n'D approach ☺
- Unification and adoption
  - Requires a synthesis of N ontologies – non-trivial!
  - Requires replacement of N ontologies with 1 common – impossible!
- Labeling
  - Requires just N translations (plus N*(N-1) refinements... ☺)
  - Requires a comprehensive yet abstract shared ontology – non-trivial







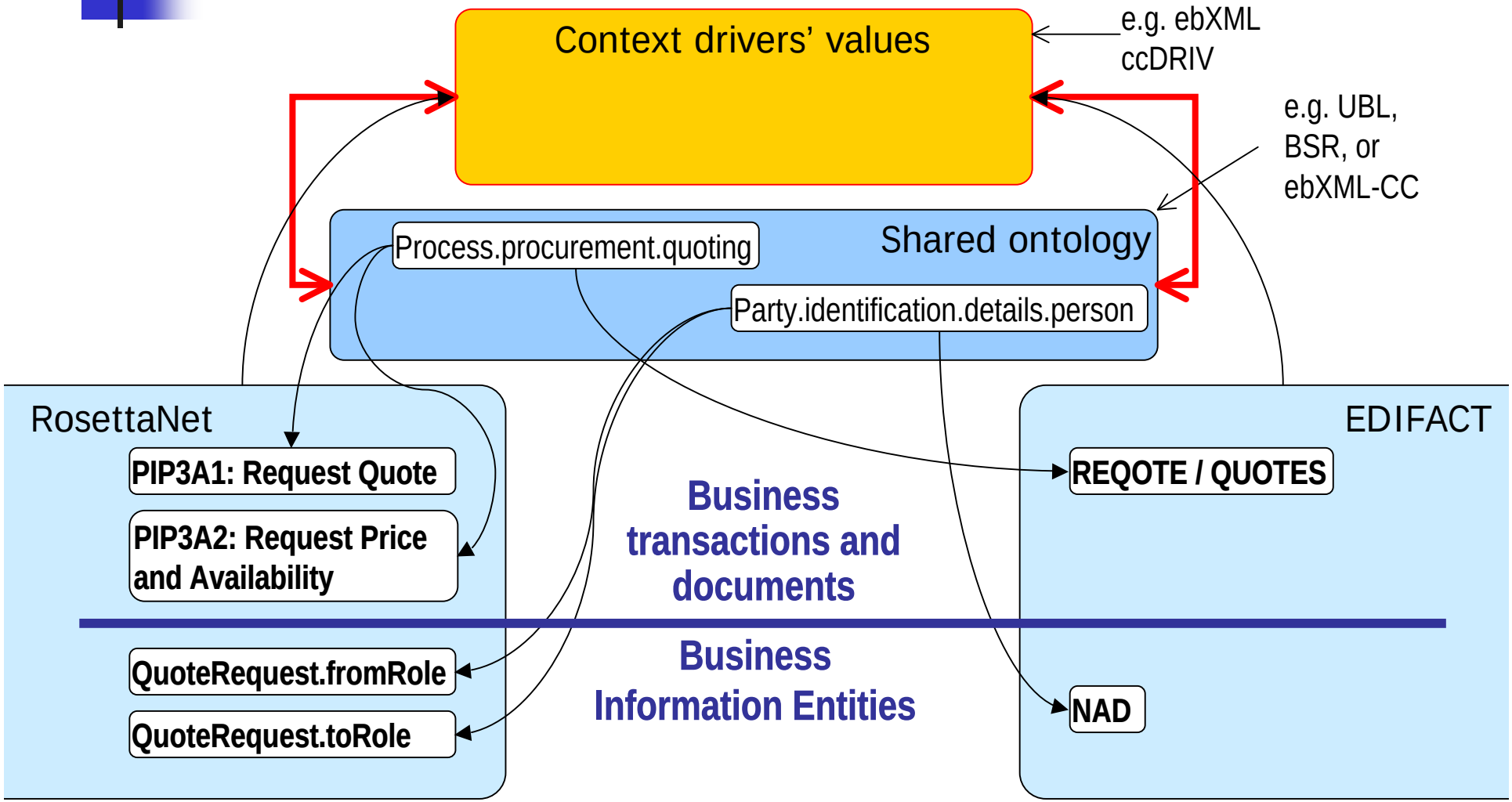
Role of context

- Local context
  - Relationships to other concepts in the same ontology
- External context
  - Relationships to concepts outside the ontology
  - Examples: different user communities
    - a “purchase” term is commonly understood by people in general
    - a “cargo unload at port of call” term is commonly understood by people involved in shipping of goods

Semantic labeling with context

- Identify concepts in your ontology by attaching labels (concepts) taken from shared ontology
- Find corresponding labels in the foreign ontology
- Apply more steps to refine the relationships:
  - Local context (Anchor-PROMPT)
  - Automated, formal reasoning and inference
    - Use context in shared ontology
    - Use DL expressions, or similar formulas
    - Consider properties and their value-spaces
  - External context – semantic enrichment
    - Use of directories, registries and catalogues
  - Heuristics (best practice and rule of thumb ☺)
- Define the translation rules in a formal way

Semantic labeling in action – importance of context



Interoperability gains

- Better understood business semantics of key concepts
  - This influences system integration implementations
- Significant reduction of mapping efforts
  - Instead of M*N*(N-1) mappings between N standards in M contexts, you can start with M*N mappings to a common universal ontology

Work to be done

- Further research into methods and techniques
- Conversion of existing standards into precise machine-readable models
  - EDIFACT – XML version of DIRDEF and MIGs needed!
  - Excel and Word documents are pain!
    - Non-portable, often poorly structured and difficult to process automatically
  - UML models are sometimes too much!
    - Incompatible XMI versions, the format itself is very complex, vague UML semantics
  - DTD, XSD or RDF models often seem to fit the bill
- Construction of upper-level shared ontology
  - MULECO draft – Annex to ECIMF deliverables
  - BSR, UBL, ebXML-CC ... ?
- Tools supporting the methodologies?

Application to ECIMF

- The ECIMF Semantic Translation Tool uses semantic labeling with context
- The tool is extensible and modular, so that experience can be gained with this approach and if it proves inappropriate, it can be changed
- Initial testing using a subset of ebXML-CC shows interesting (if mixed) results

More information

- ECIMF project
  - http://www.ecimf.org
- CEN/ISSS WS-EC
  - http://www.cenorm.be/isss
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