Versatile Visualization, Authoring and Reuse of Ontological Schemas (Leveraging on Dataset Summaries)

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Main Topics

Ontology Engineering

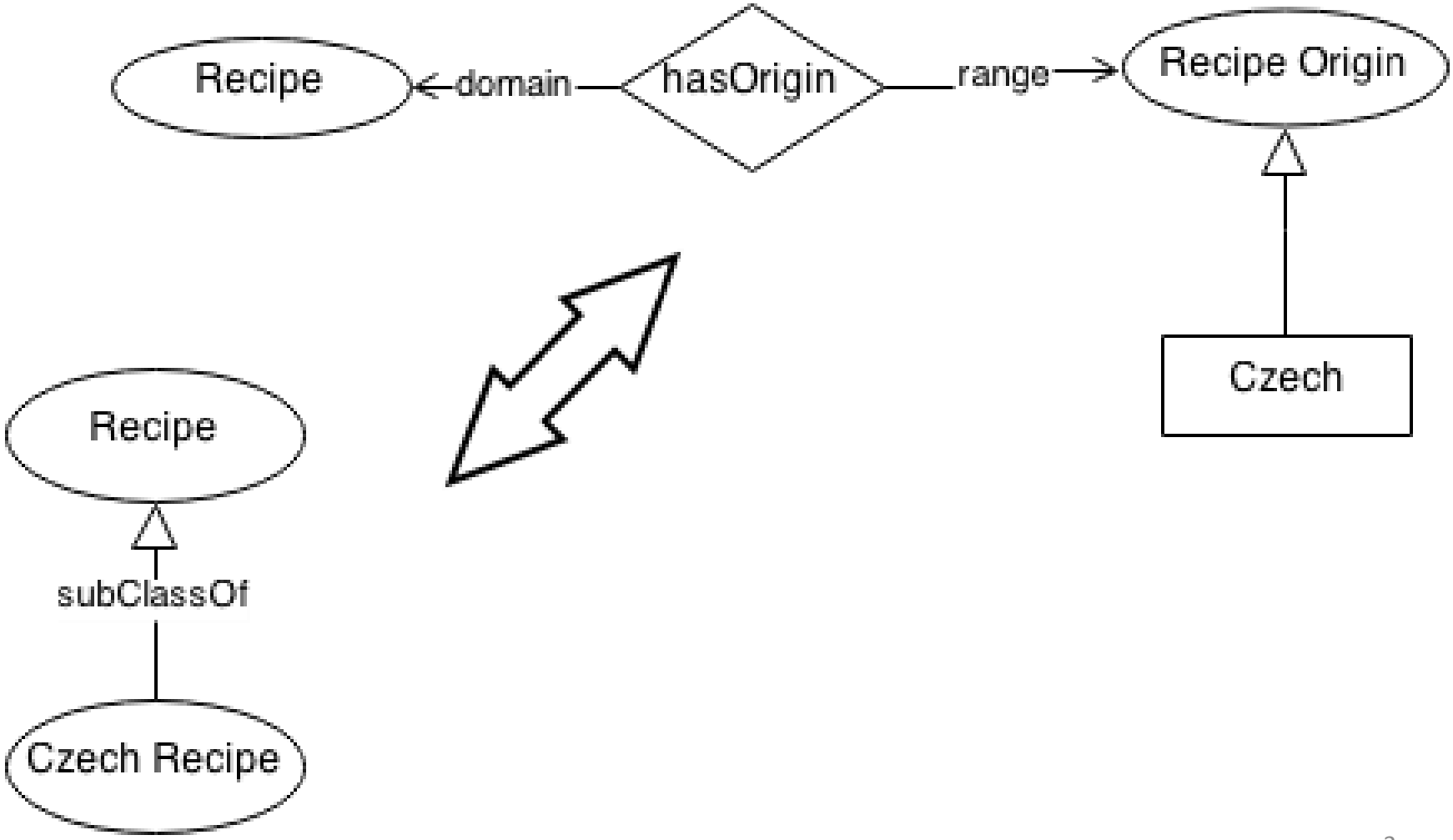
Semantic Web

- OWL modeling styles
  - Using different combinations of OWL constructs to represent the same situation
- Analyzing ontology coverage and usage
  - What particular situations **can** a particular ontology **describe**
  - How **is** a particular ontology **used** in a particular dataset (what types of instances are linked with which predicates)

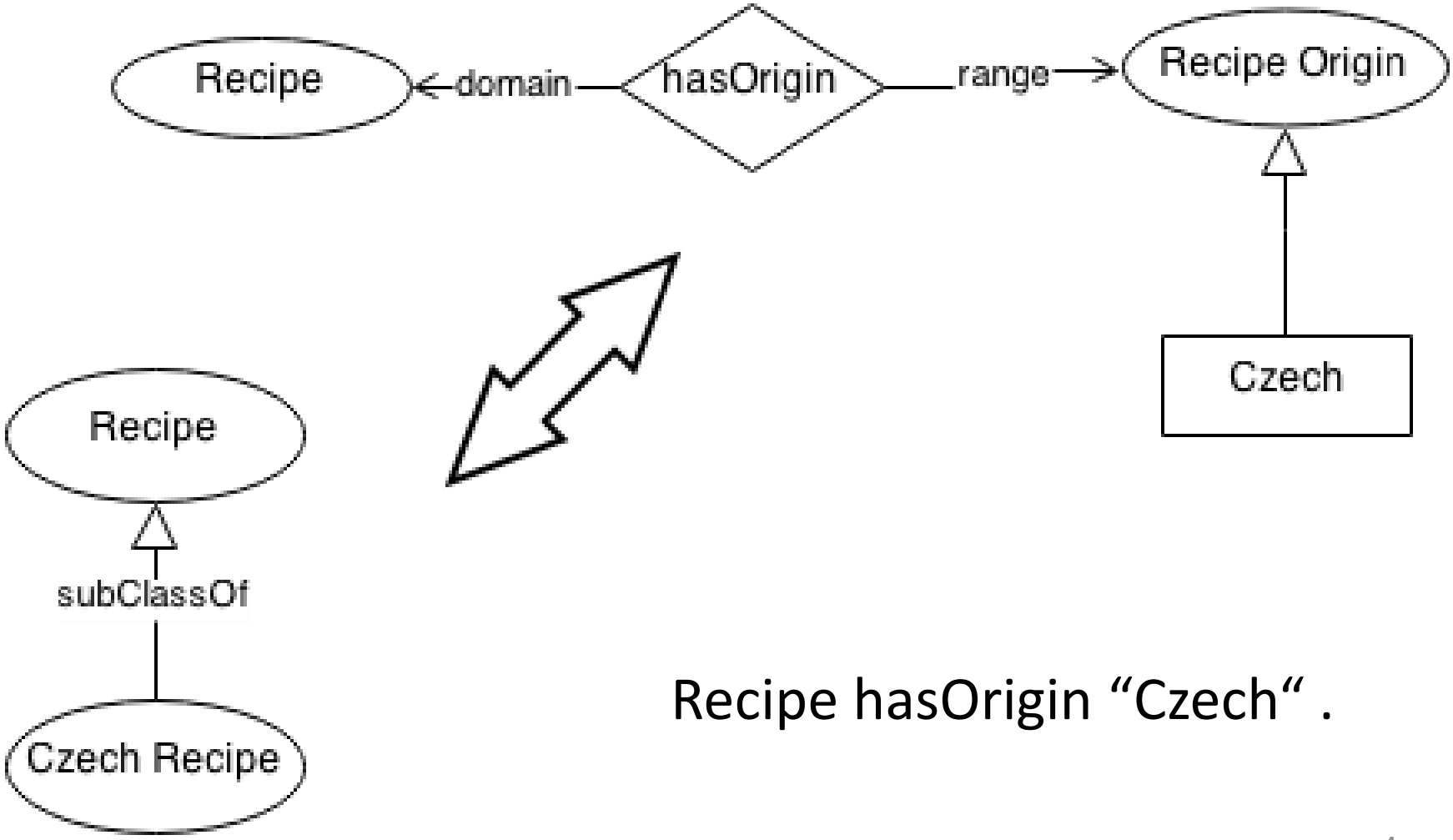
Ontology Visualization

Dataset Visualization

Different OWL Modeling Styles - Example



Different OWL Modeling Styles - Example

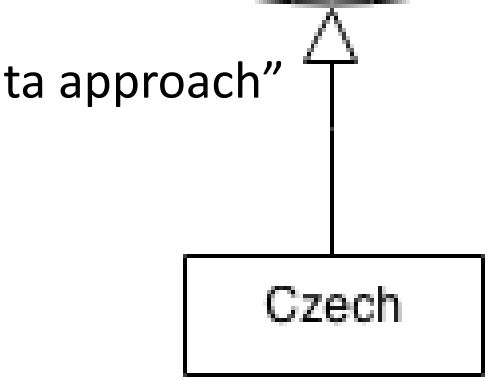


Recipe hasOrigin “Czech“ .

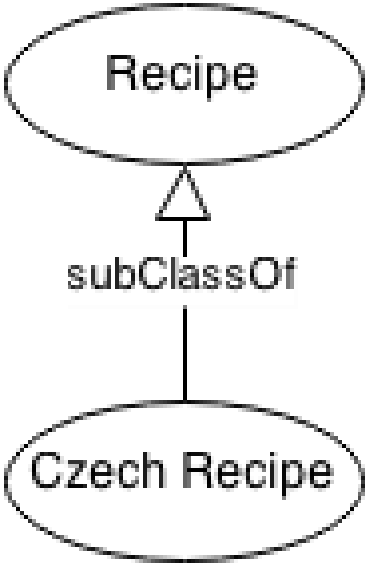
Different OWL Modeling Styles Fit Different Use Cases

Hypothesis

"Linked data approach"



"Reasoning approach"



"Simple vocabulary for RDFa annotation"

Recipe hasOrigin "Czech" .

Different OWL Modeling Styles Fit Different Use Cases

- Possible consequences:
  - Might lead to re-developing instead of re-using an ontology
  - Difficulties with following the “right modeling style” when developing an ontology
- Possible solution:
  - Use a meta-language allowing to unify the different styles into a single pattern
    - Transform an existing ontology into it or design the meta-model from scratch
  - and then generate OWL variants from it automatically

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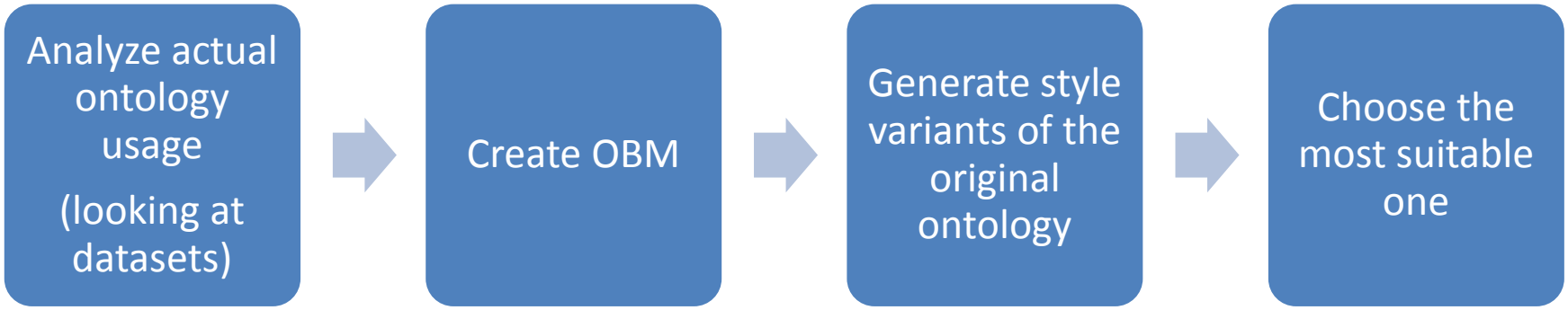
Proposal: use PURO Ontological Background Models (Svátek et al., OWLED 2013)

PURO Ontological Background Models (OBM)

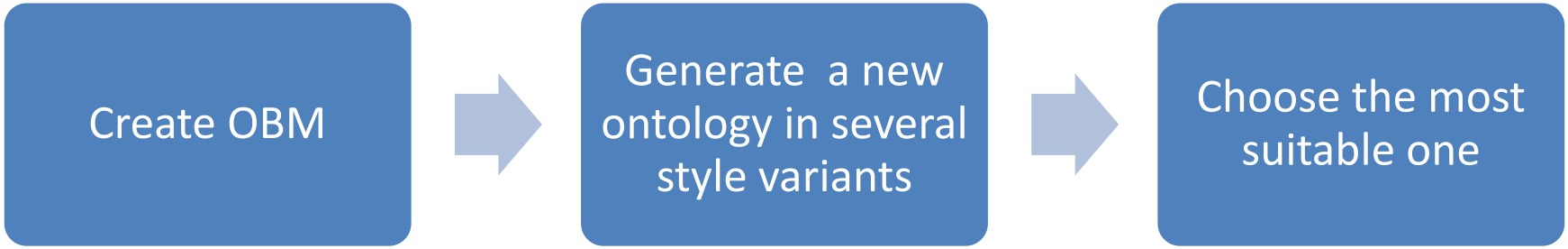
- Represents a specific part of reality (at the "instance level") "closer to the real world than OWL"
  - Not for direct usage for data representation
  - Designed as an aid for ontology engineering
- PURO: Particular-Universal Relationship-Object distinctions
- Language terms "to some extent" analogical to OWL language constructs, they can be mapped to corresponding OWL representation

Proposal of OBM Exploitation for Ontology Engineering

Transformation of an existing ontology into more suitable modeling style

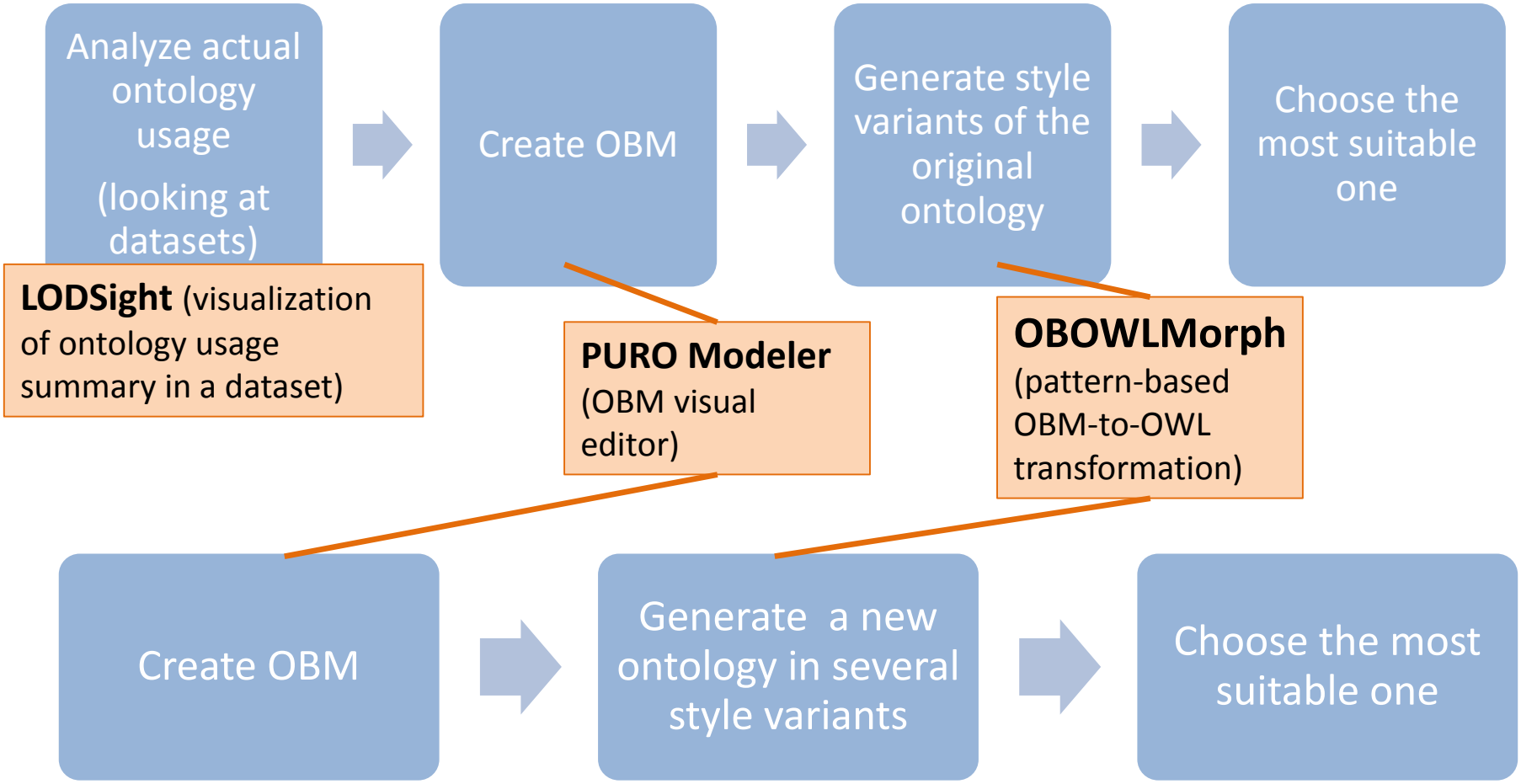


Building a new ontology in a desired modeling style



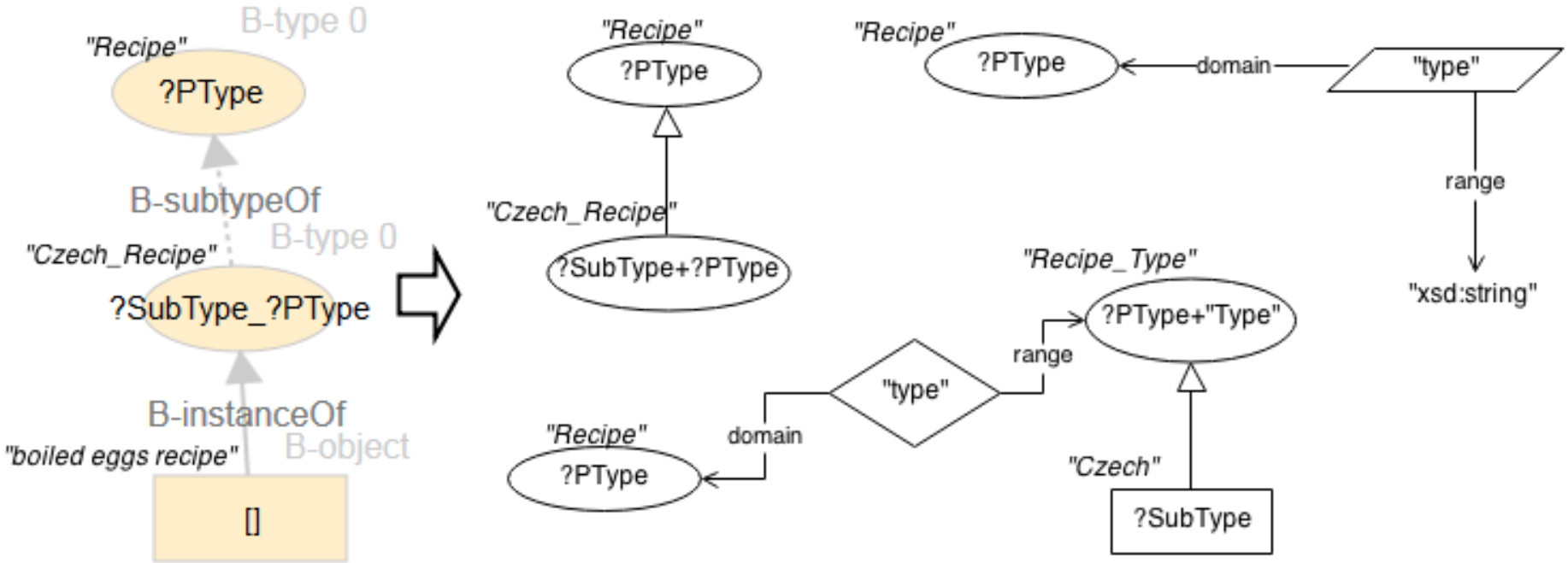
PhD Goals:

Development of visualization and transformation methods and their experimental implementation in an architecture consisting of three tools:



Transformation Based on OBM-to-OWL Patterns

- consisting of OBM fragment and corresponding OWL fragment variants



Related Problems

- Heterogeneity in OWL ontology design styles
  - Might lead to difficulties with
    - Ontology reuse and new ontology development (already discussed)
    - Comparing ontology local coverage (how well can the ontology describe a specific real world situation)
- Ontology in OWL does not define the usage of itself
  - Proper documentation defines it, but what if it is missing or incomplete?

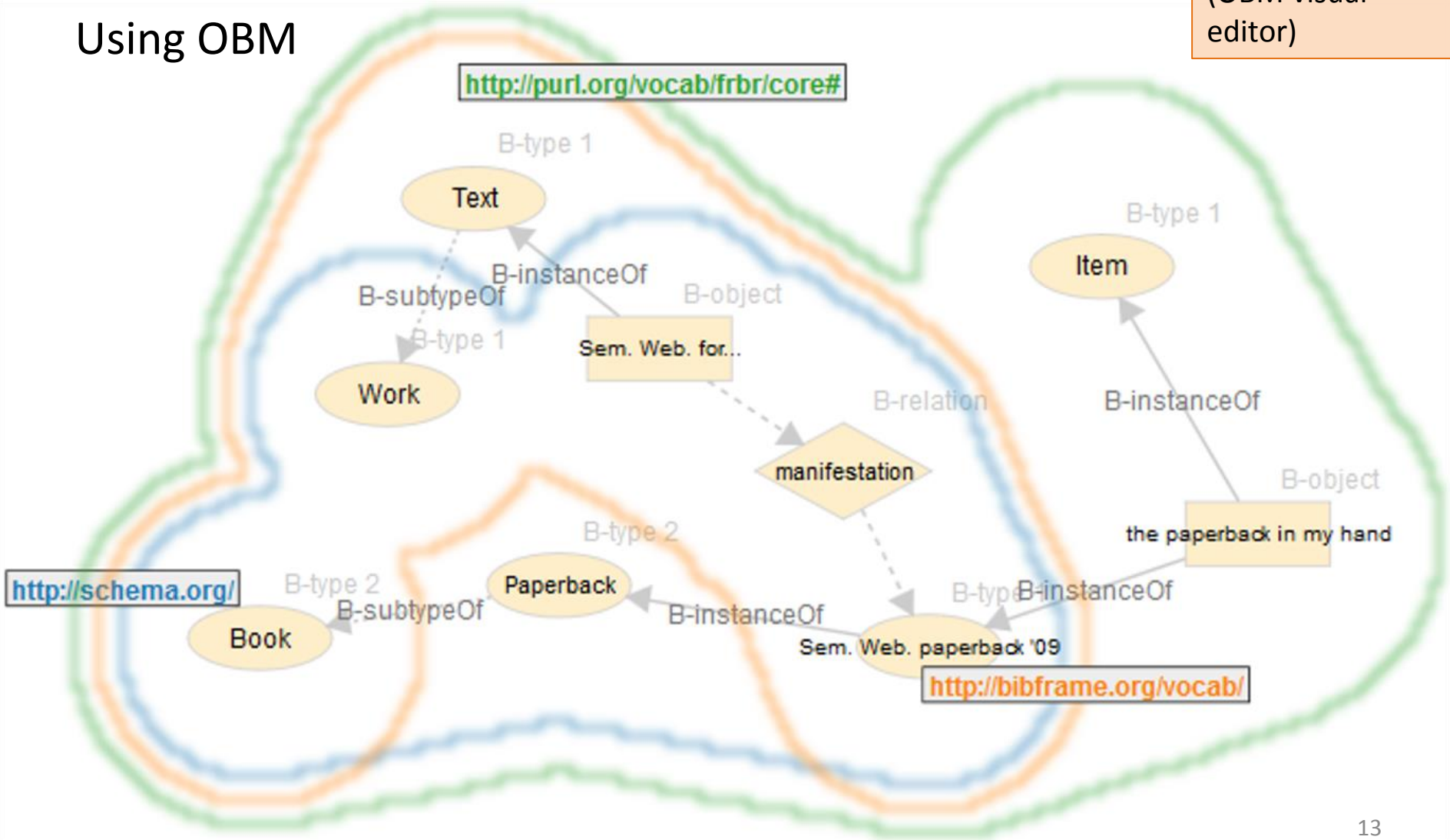
PURO Modeler (OBM visual editor)

LODSight (visualization of ontology usage summary in a dataset)

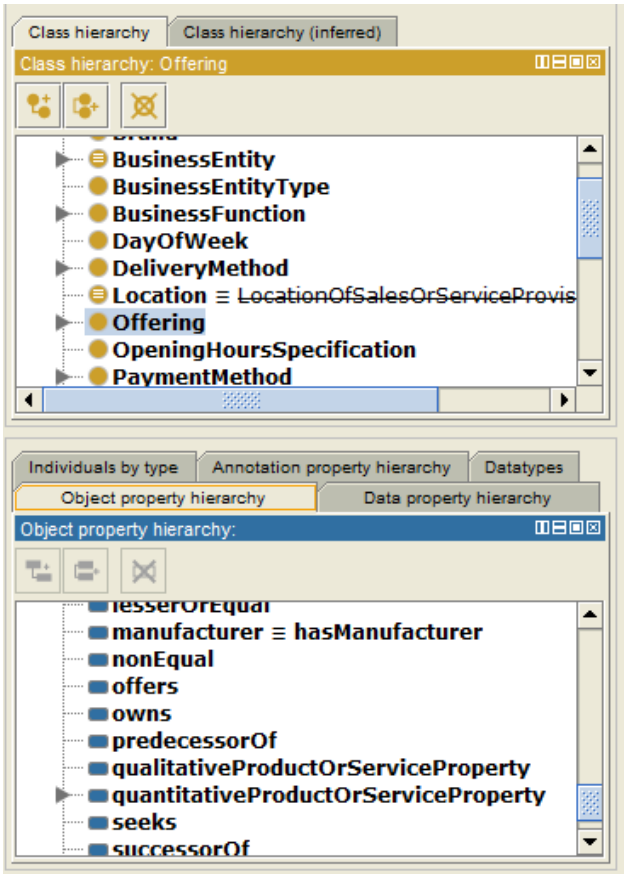
Comparing Ontology Local Coverage

PURO Modeler (OBM visual editor)

Using OBM



Ontology Does Not Explicitly Define Its Proper Usage



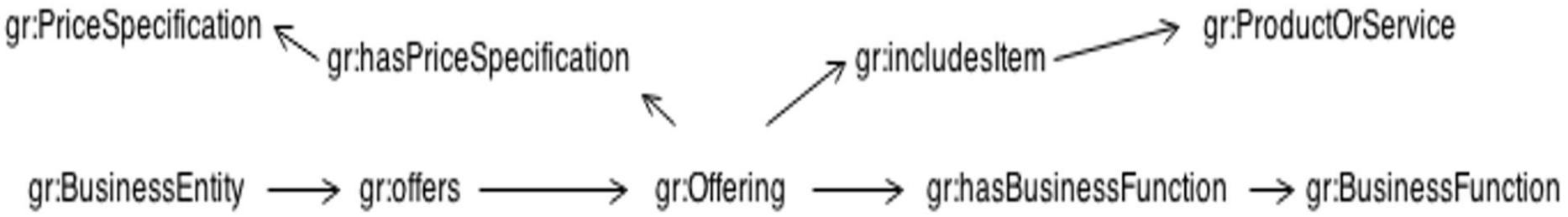
company1 rdf:type gr:BusinessEntity .
company1 gr:offers offer01 .
offer01 rdf:type gr:Offering .
offer01 gr:hasBusinessFunction gr:Sell .

Ontology Does Not Explicitly Define Its Proper Usage

- The usage can be learned-by-example from a dataset where the ontology is used
- Manual browsing of a dataset is too complicated and time consuming

Dataset Summary to Show Ontology Usage

- Based on visualizing frequent type-property paths
- With the possibility to show example instantiations



LODSight (visualization of ontology usage summary in a dataset)

Related Research

- Ontology mapping – also targets heterogeneity, but in a different way
- Meta-modeling – for abstraction from modeling style diferences
  - Ontological Background Models (OBM)
  - OntoUML (Albuquerque and Guizzardi, 2013) – not intended for ontology engineering
- Dataset summarization and visualization
  - Mainly *knowledge pattern extraction* (Presutti et al., 2011)

Preliminary Results

- Experiments with local coverage comparison in PURO Modeler (accepted paper for VISUAL workshop at EKAW)
- Preliminary experiments with LODSight – dataset summarization using SPARQL

Future Work

- Guidelines for OBM design
- OBM-to-OWL transformation patterns and algorithm
- Visualization techniques for large OBMs and groups of related OBMs
- Visualization of type-property dataset summarization along with example instantiations
- … (the PhD topic is a part of a larger project involving other researchers)

Thanks for your attention

- Questions?

- References:

  - Albuquerque, A., Guizzardi, G.: An ontological foundation for conceptual modeling datatypes based on semantic reference spaces. In Research Challenges in Information Science(RCIS), 2013 IEEE Seventh International Conference on (pp. 1-12).
  - Dudáš, M., Hanzal, T., Svátek, V.: What Can the Ontology Describe? Visualizing Local Coverage in PURO Modeler. In: VISUAL at EKAW'14, Linkoping, 2014.
  - Presutti, V., et al.: Extracting core knowledge from Linked Data. In: Proceedings of the Second Workshop on Consuming Linked Data, COLD 2011.
  - Svátek, V., et al.: Metamodeling-Based Coherence Checking of OWL Vocabulary Background Models. In: OWLED 2013.