Complex alignments for better covering ontology heterogeneities

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Outline

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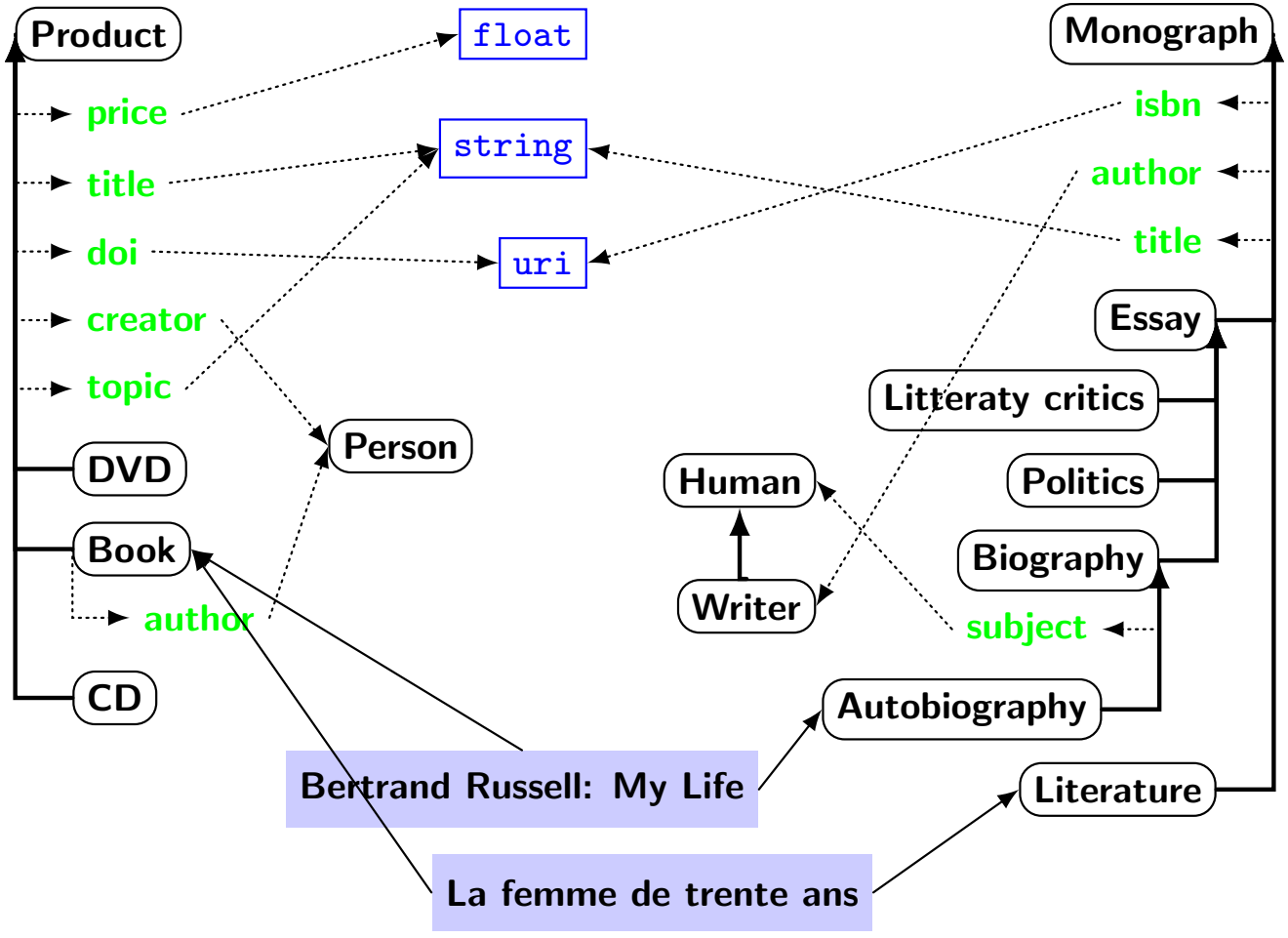
Ontology matching problem

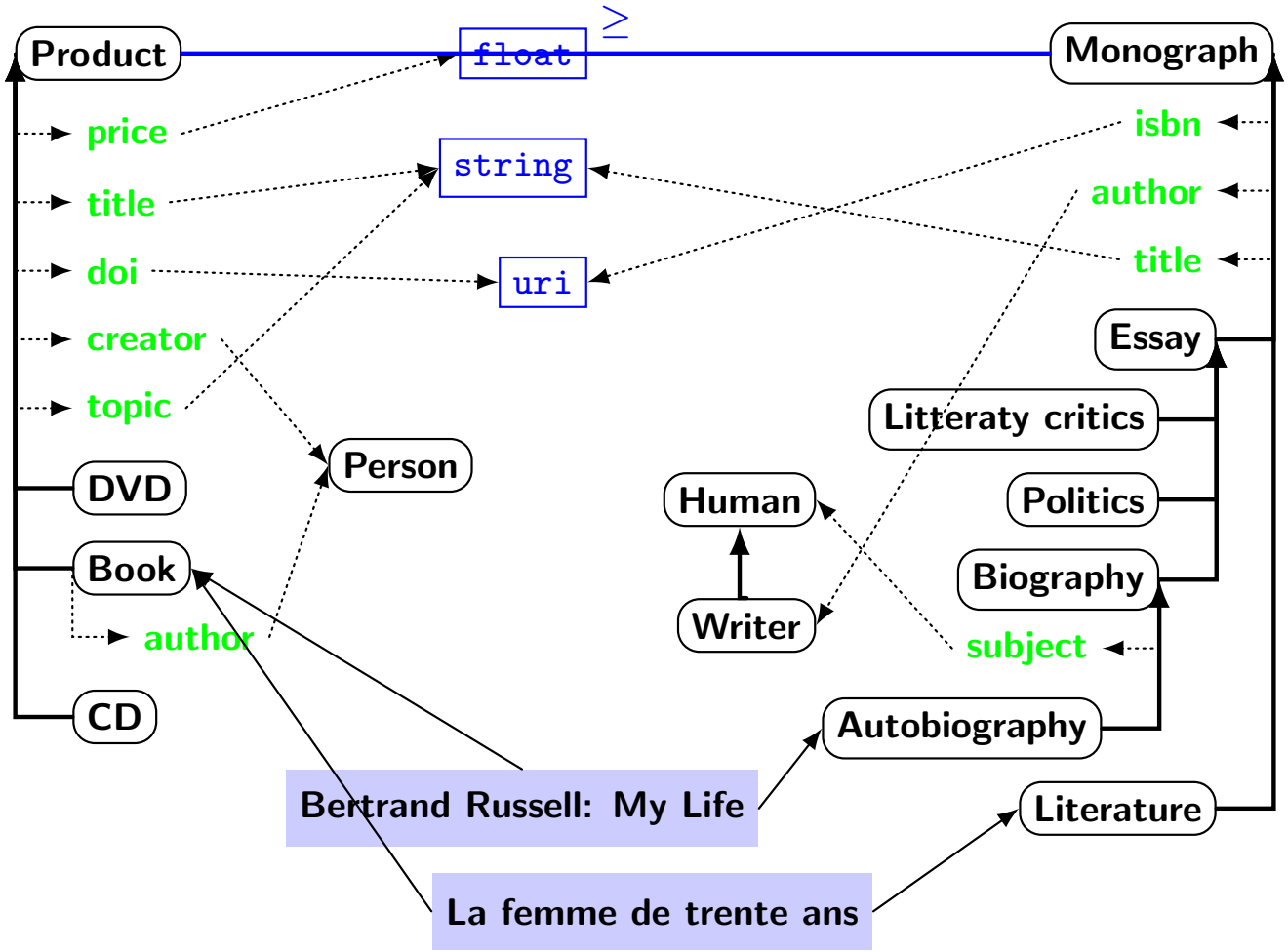
- Different ontology designers, different views on how to model the world
  - different vocabularies for annotating web sites
  - different ontologies for describing related knowledge bases
  - different ontologies describing agents' world
- For many tasks, ontologies have to be aligned

Ontology matching problem



Extracted from [Euzenat and Shvaiko, 2007]

Ontology matching problem



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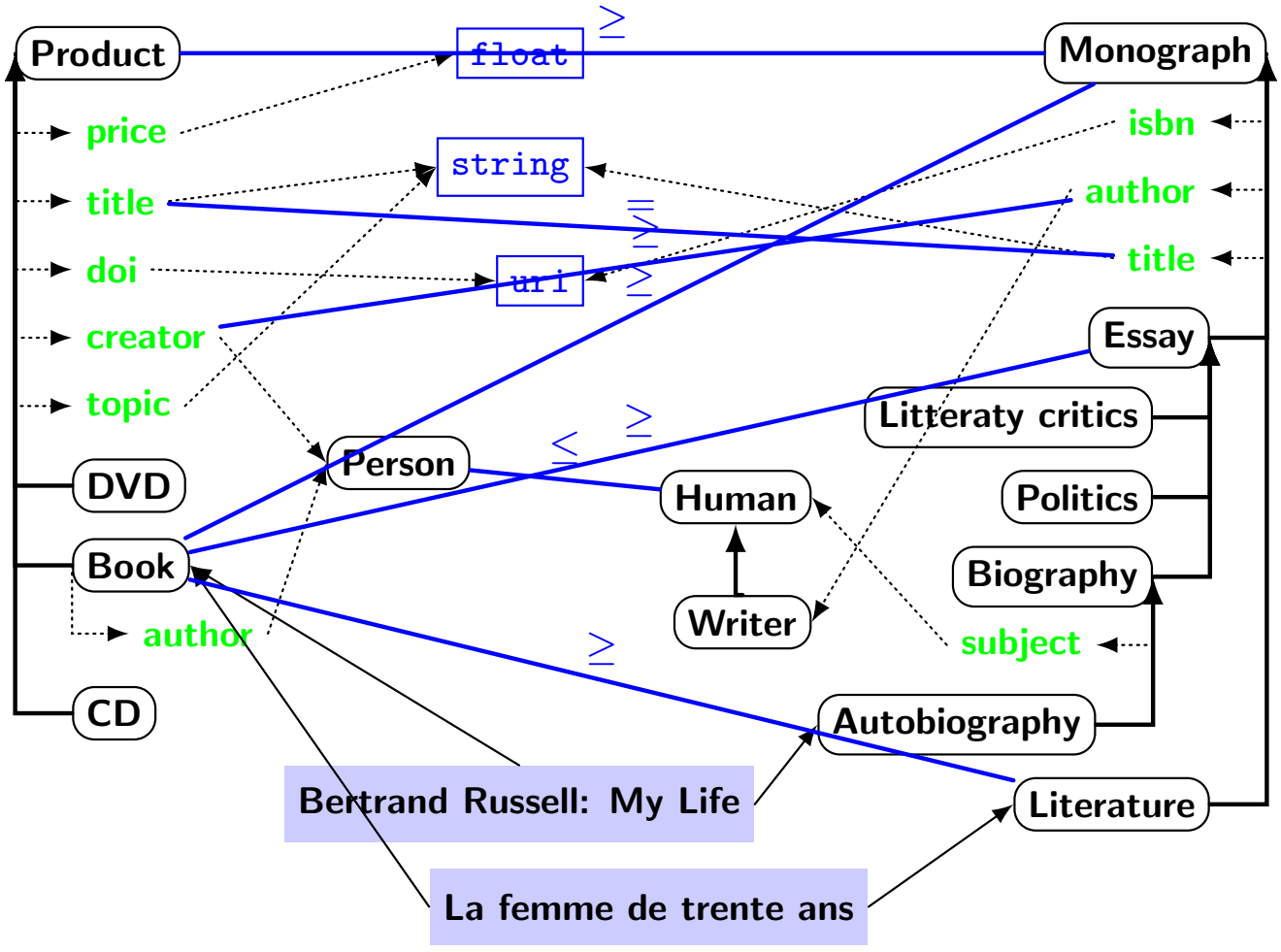
Ontology matching problem



Extracted from [Euzenat and Shvaiko, 2007]

Outline

Main research topics

- Uncertainty and incompleteness in alignments
- Ontology alignment evaluation [Algergawy et al., 2018]
- Domain and top-level ontology matching [Schmidt et al., 2018]
- Multiple alignments visualization [Severo et al., 2017]
- SPARQL query rewriting based on complex alignments [Thiéblin et al., 2018b]
- Complex ontology matching [Thiéblin et al., 2018a]

Outline

Simple vs. complex alignments

- Simple correspondences link single ontology entities
  - $\forall x\ o_s : Product(x) \Leftrightarrow o_t : Monography(x)$
- More expressiveness with complex correspondences
  - $\forall x\ o_s : Autobiography(x) \Leftrightarrow o_t : Book(x) \wedge o_t : author(x, y) \wedge o_t : topic(x, y)$

Complex matching approach (i)

- Discovers complex correspondences between populated ontologies
- Relies on the notion of Competency Questions for Alignment
  - represent the needs of a user with respect to an ontology alignment
  - define (and reduce) the scope of the alignment
  - have to be satisfied over two or more ontologies

Complex matching approach (ii)

1. Takes as input a set of CQAs as SPARQL queries over o_s
2. The answer to each CQA is a set of instances retrieved from a KB described by o_s
3. The instances are matched to those of the KB described by o_t
4. The generation of the correspondence is performed by matching the graph-pattern from the source query to the lexically similar surroundings of the target instances

Proposed approach

SPARQL CQA

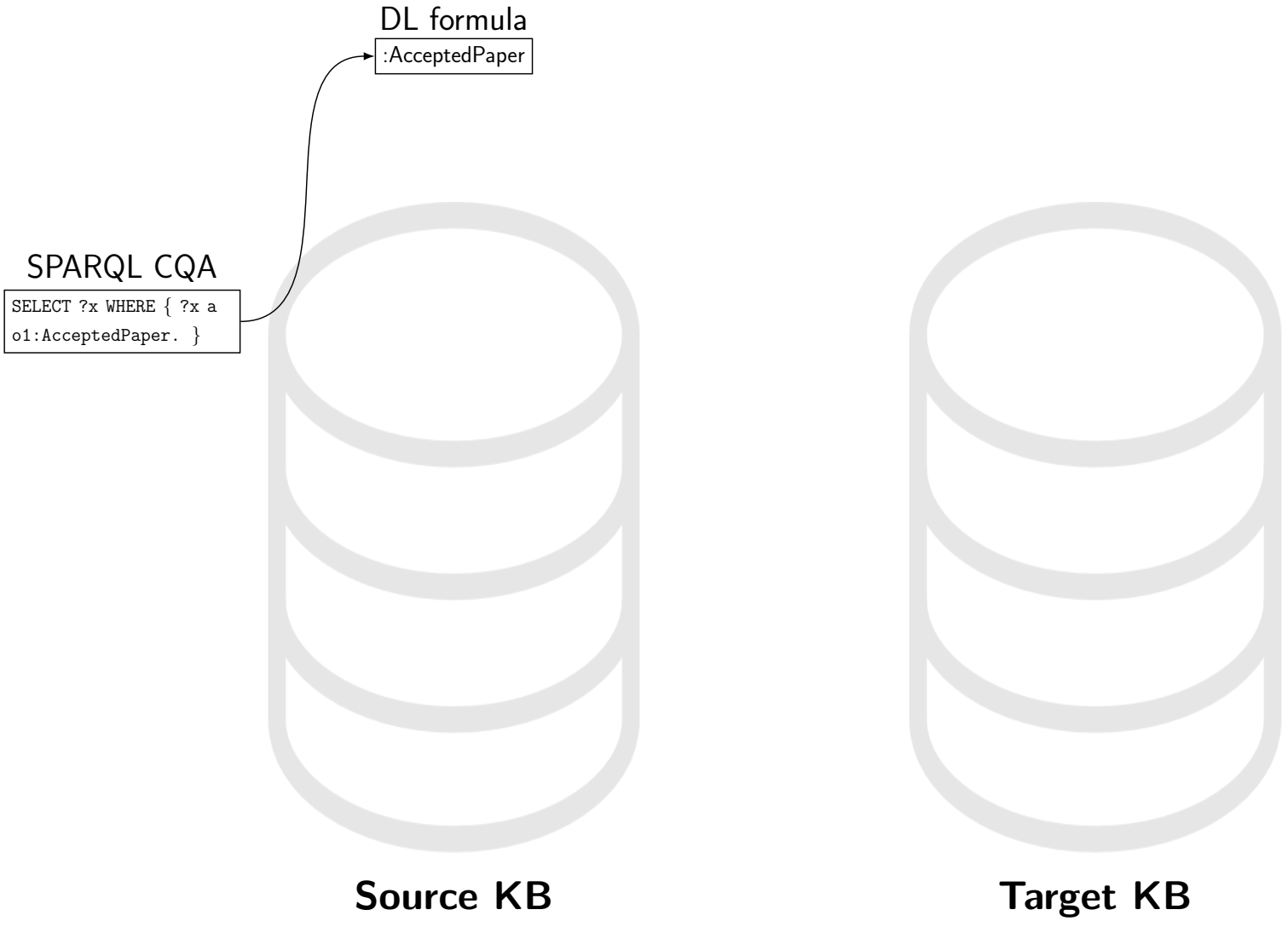
```
SELECT ?x WHERE { ?x a
o1:AcceptedPaper. }
```


Source KB

Target KB

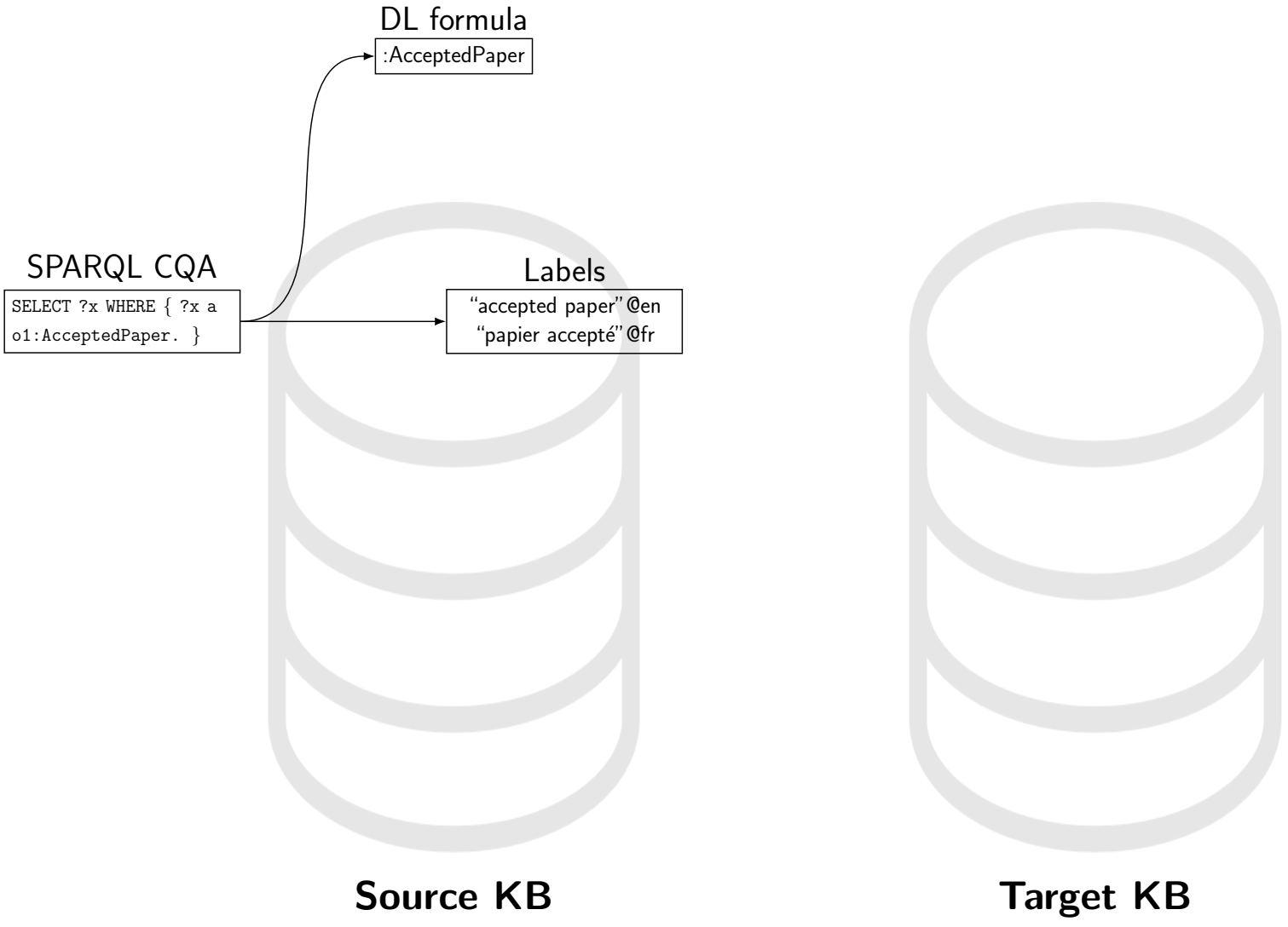
[Thiéblin et al., 2018a]

Proposed approach



[Thiéblin et al., 2018a]

Proposed approach



[Thiéblin et al., 2018a]

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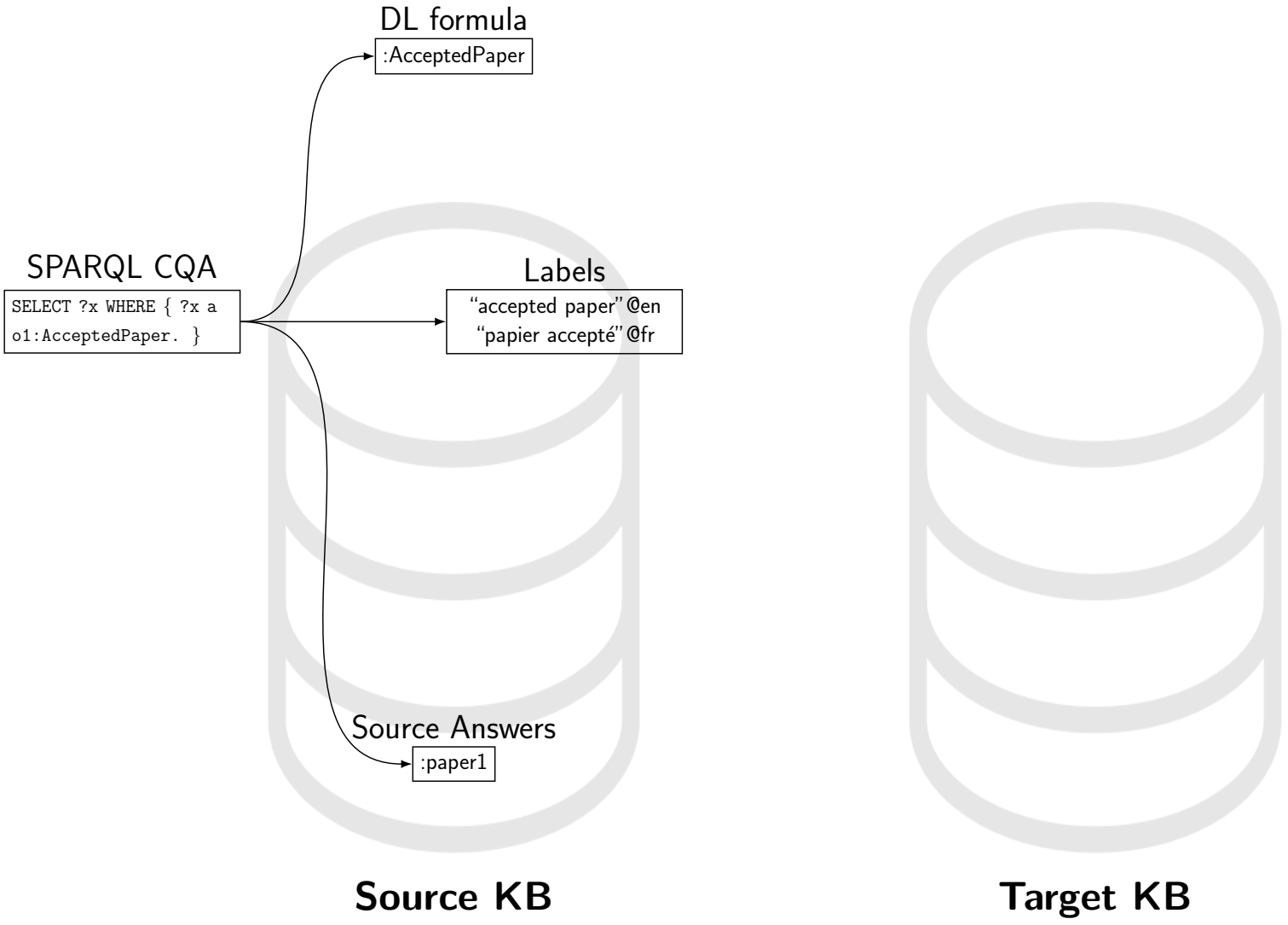

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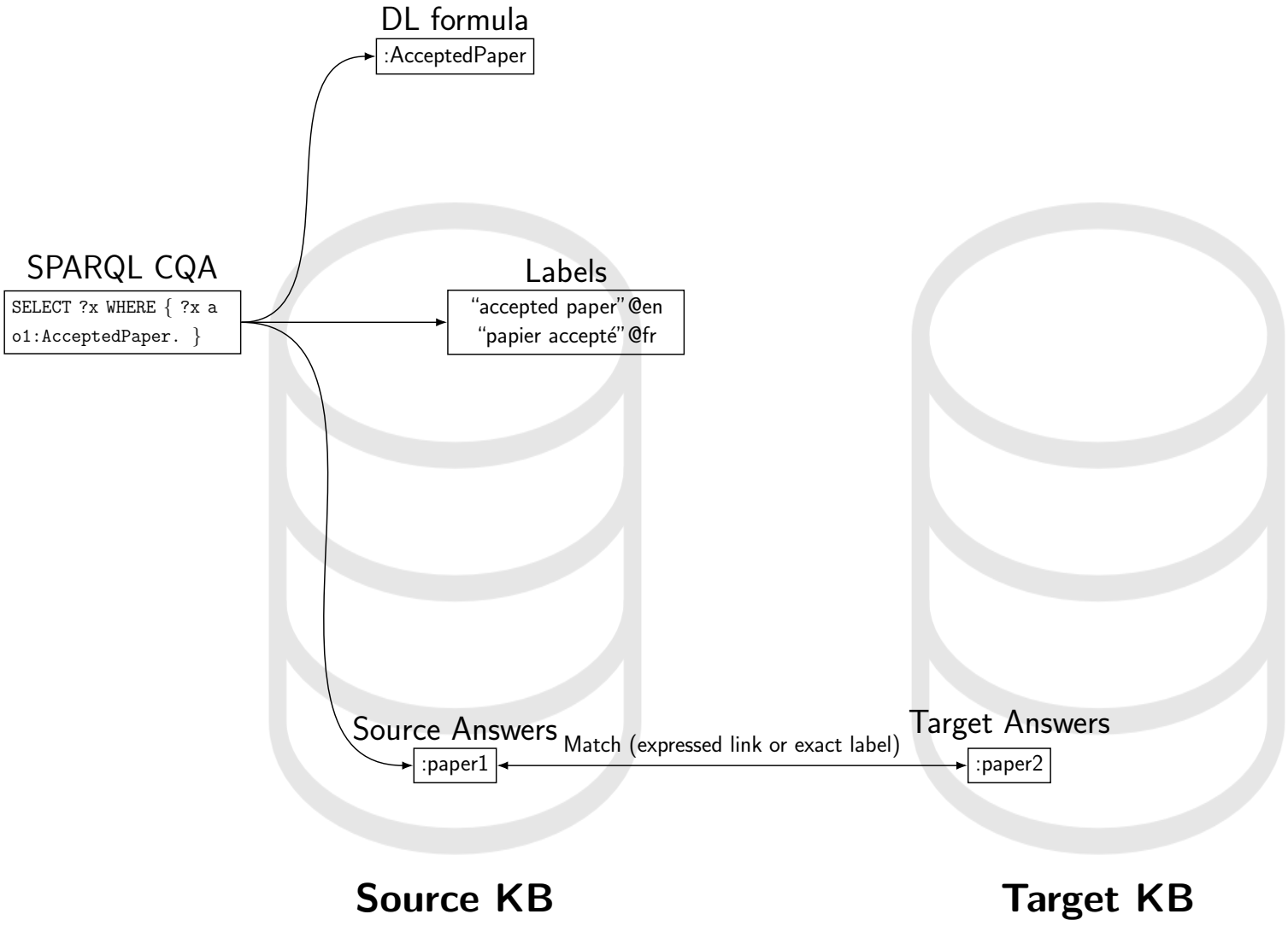
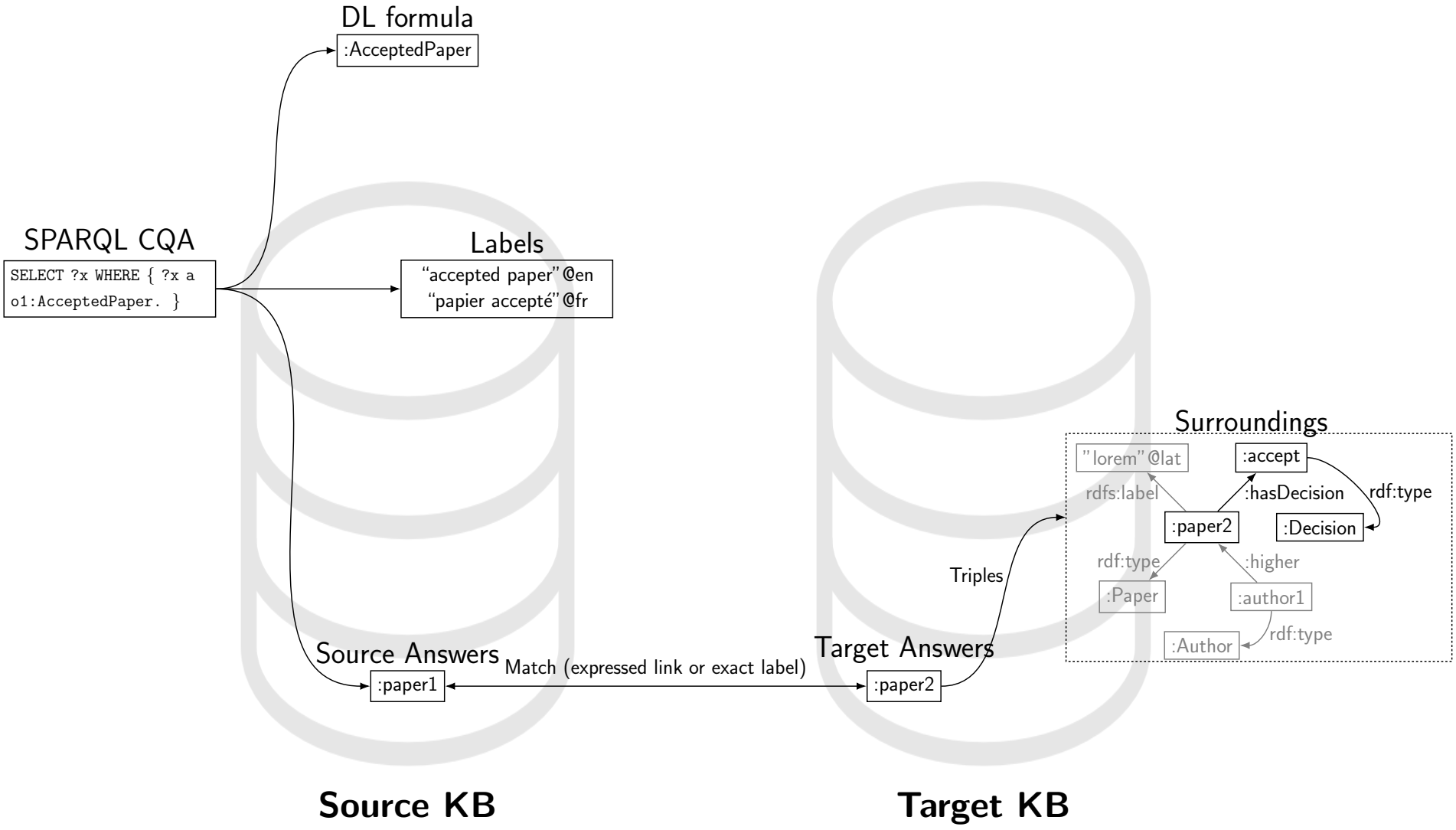
Proposed approach



[Thiéblin et al., 2018a]

Proposed approach



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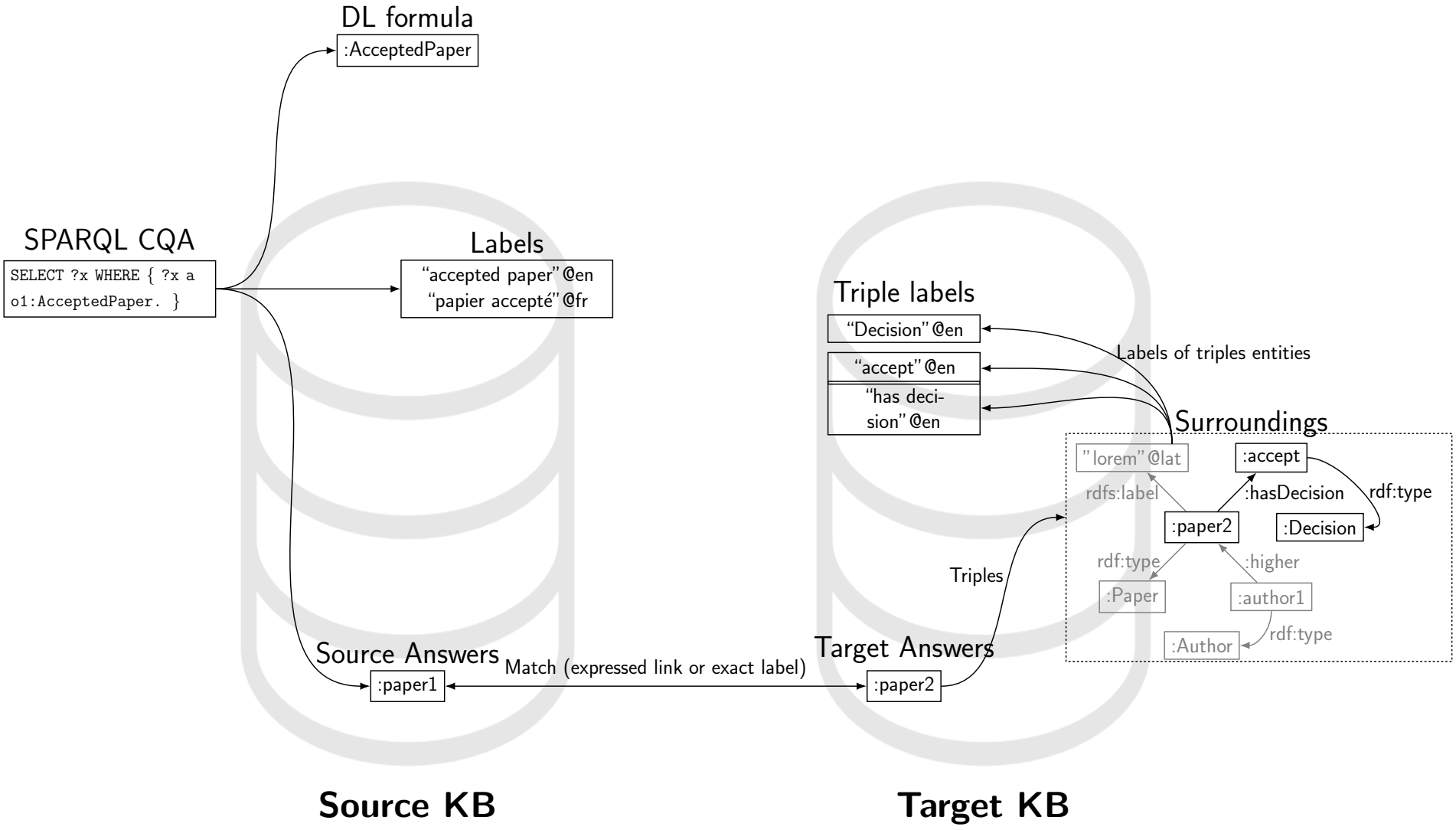

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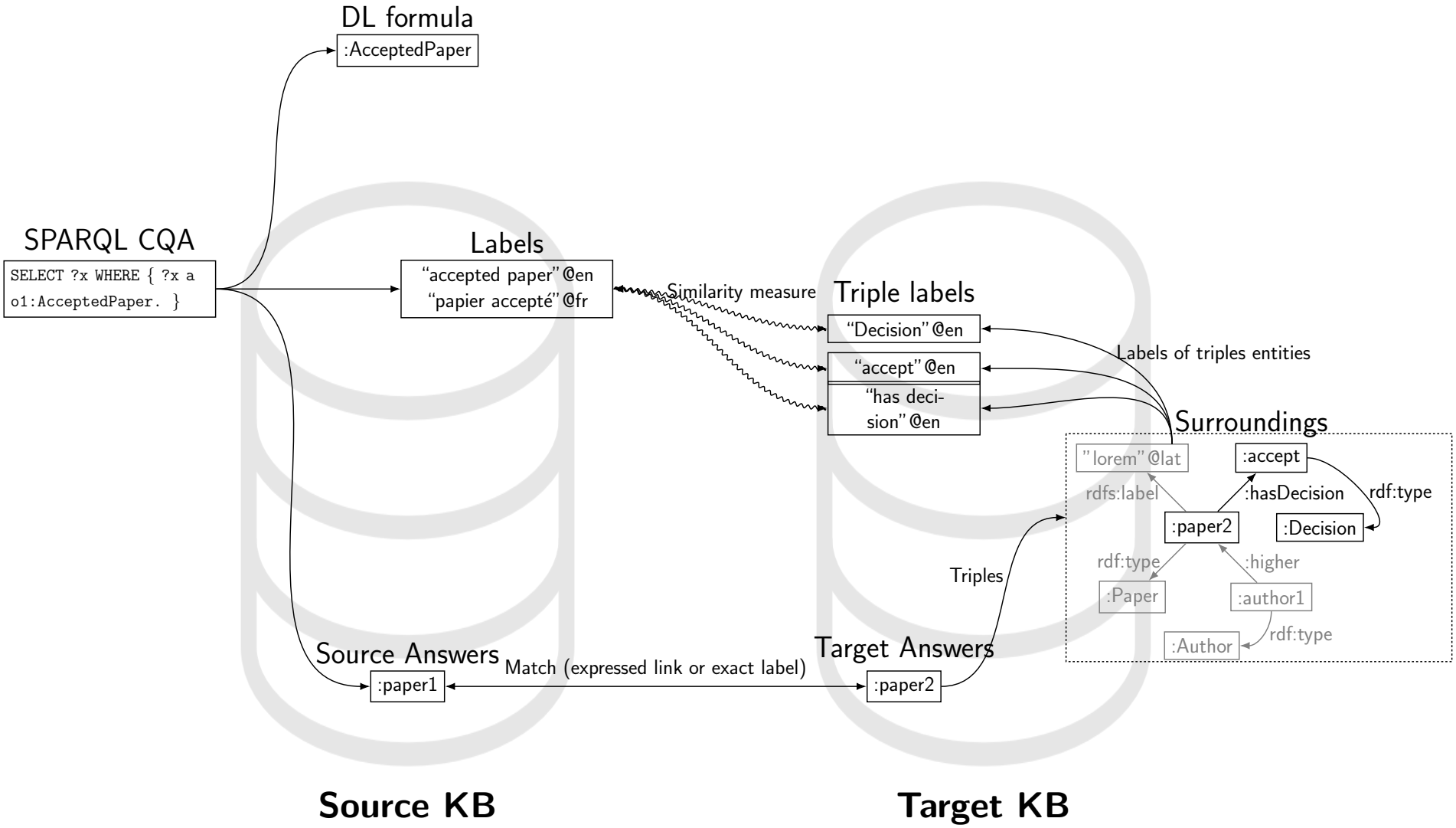

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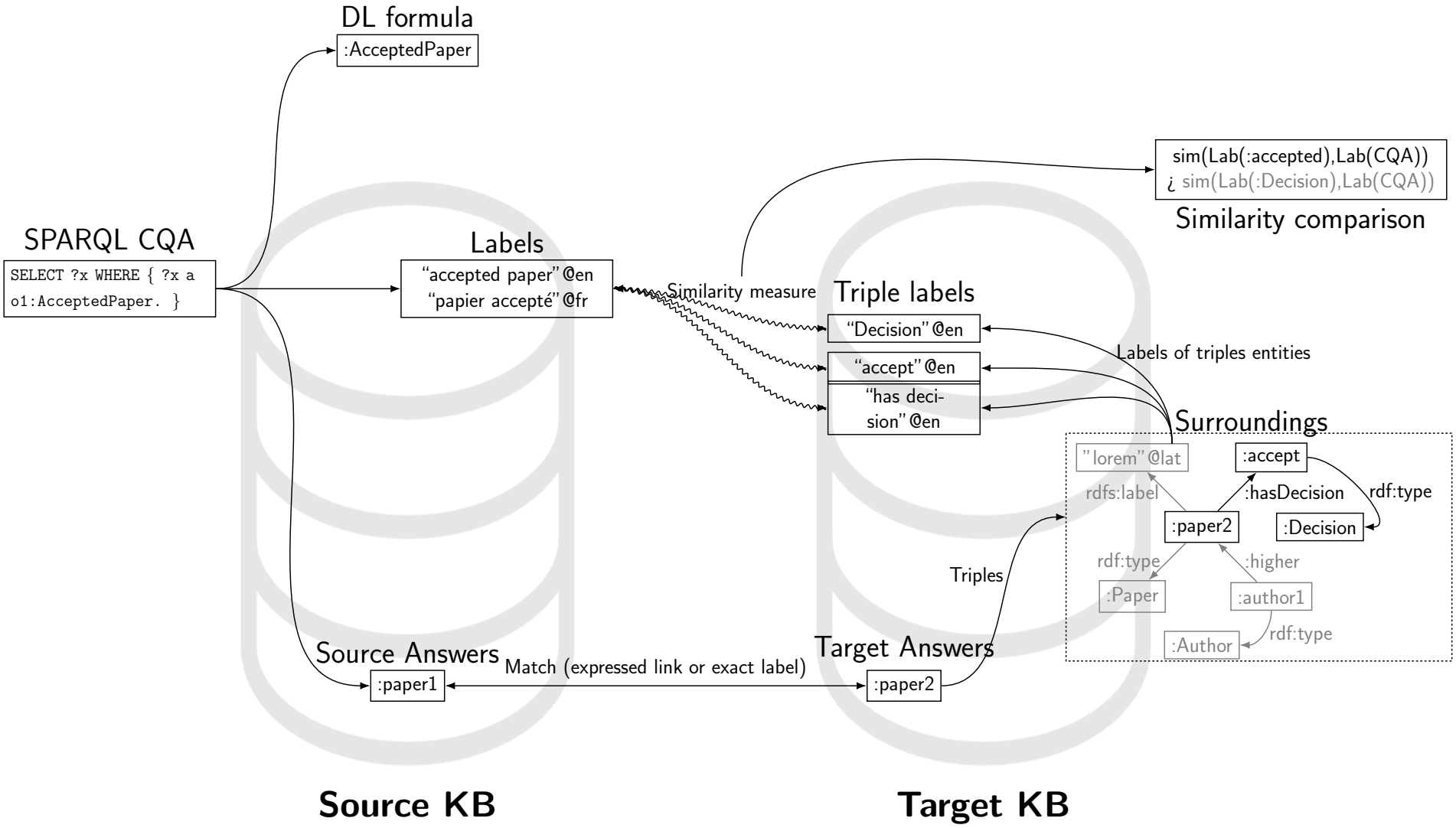

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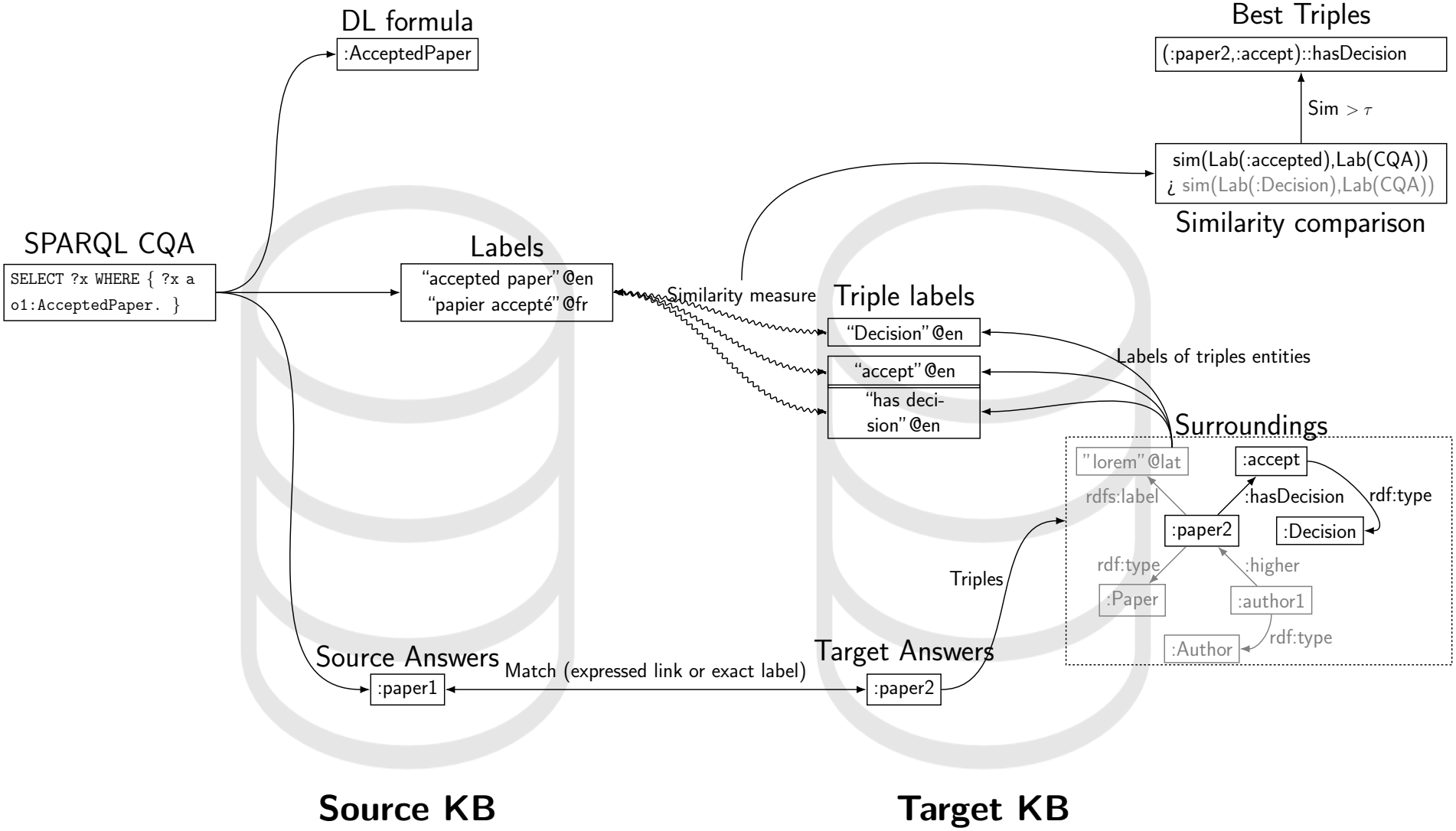

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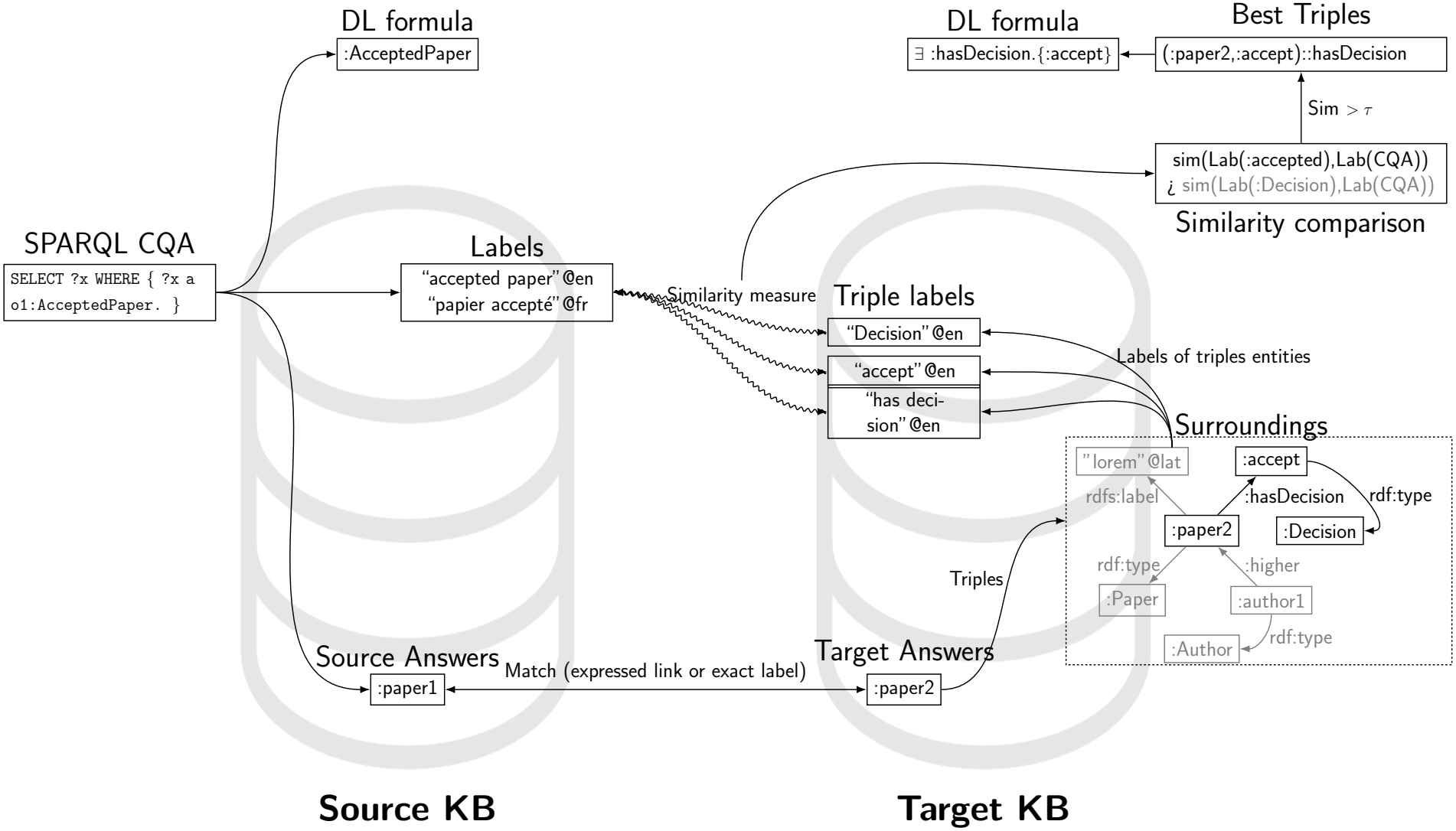

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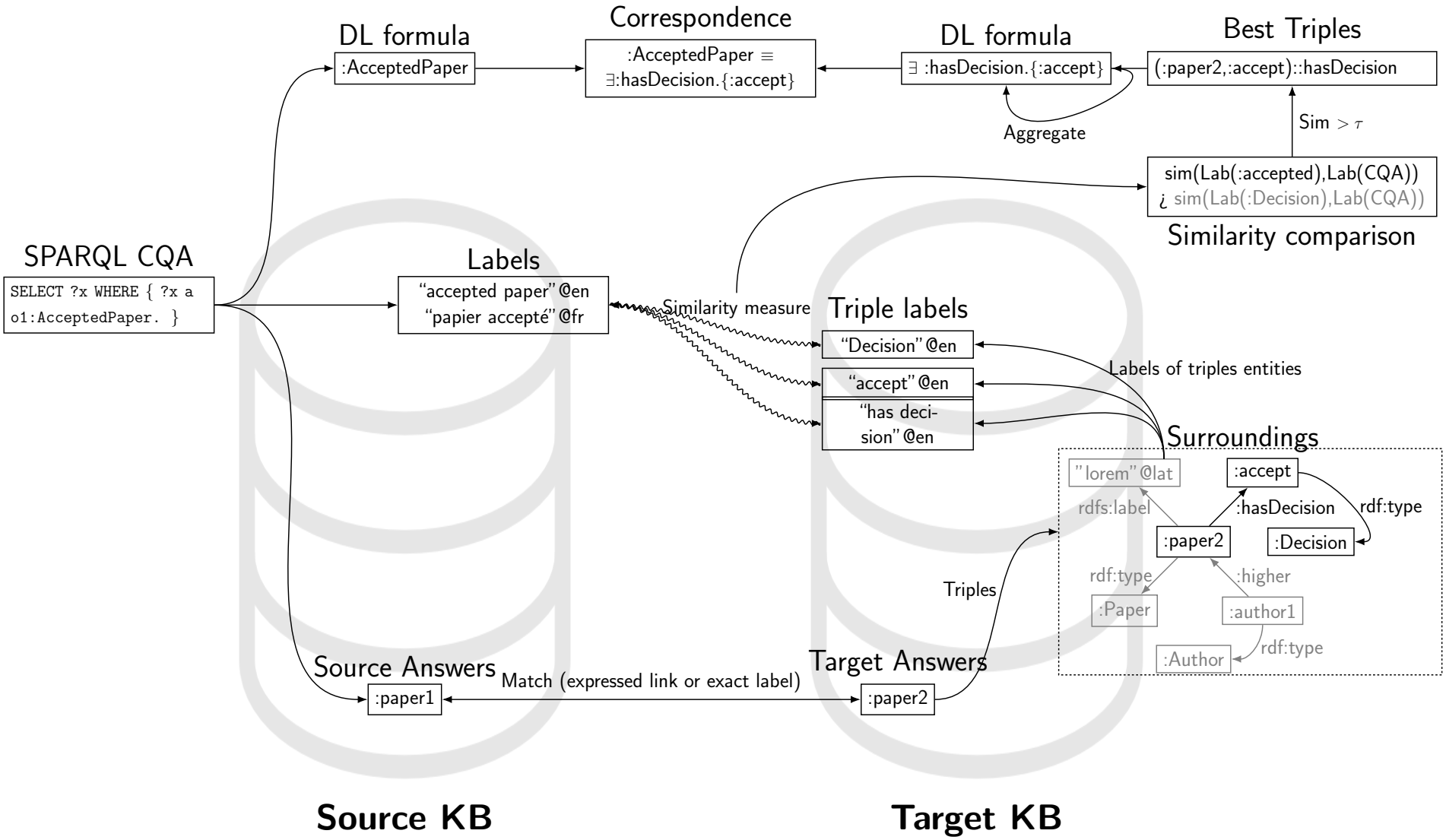


[Thiéblin et al., 2018a]

First results

OAEI 2018 Complex Taxon Track

Evaluation without CQAs (generated queries)

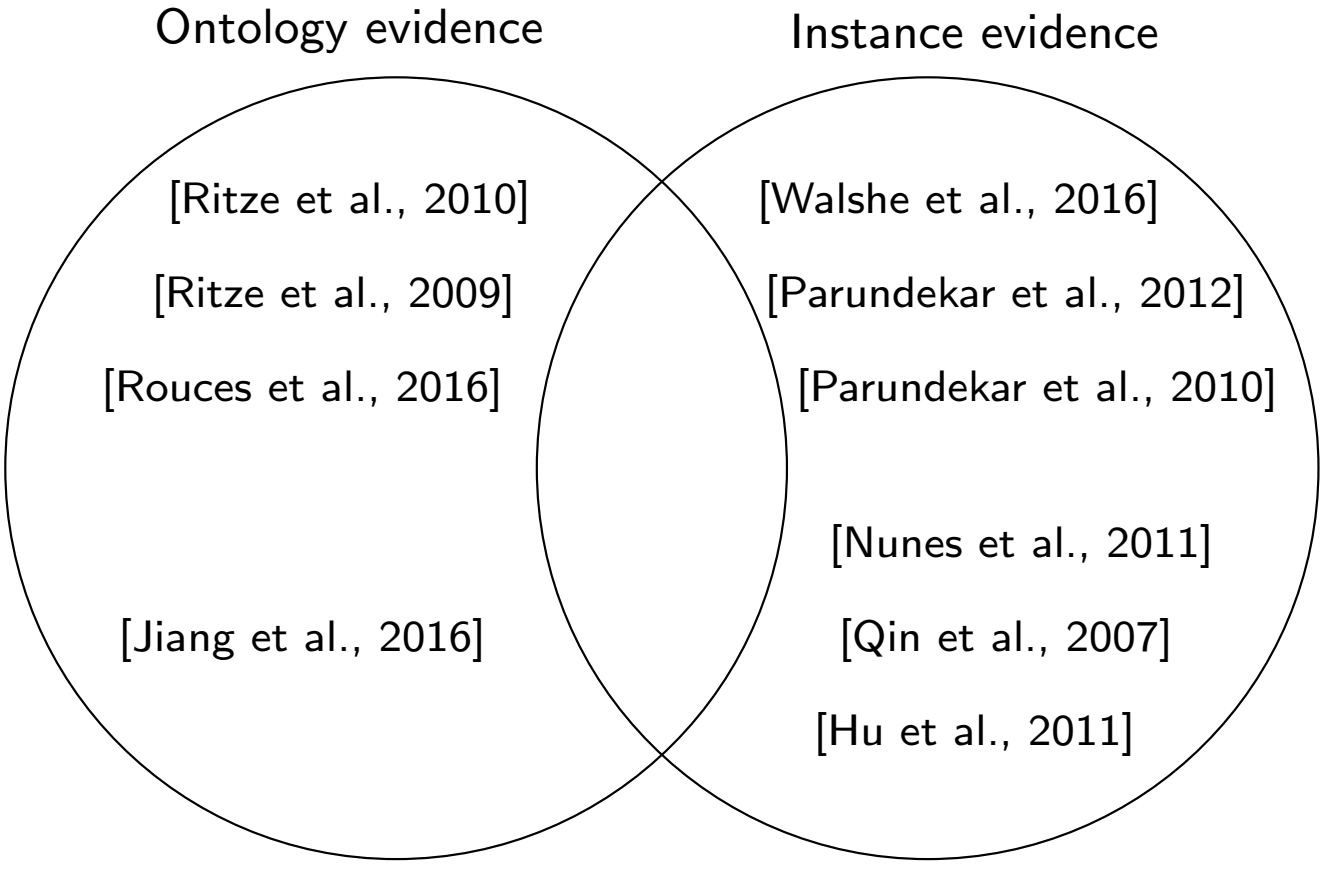
- Precision: 20%
- Queries well rewritten: 13% (best result)

Plant taxonomy evaluation

Evaluation with CQAs (only class expressions)

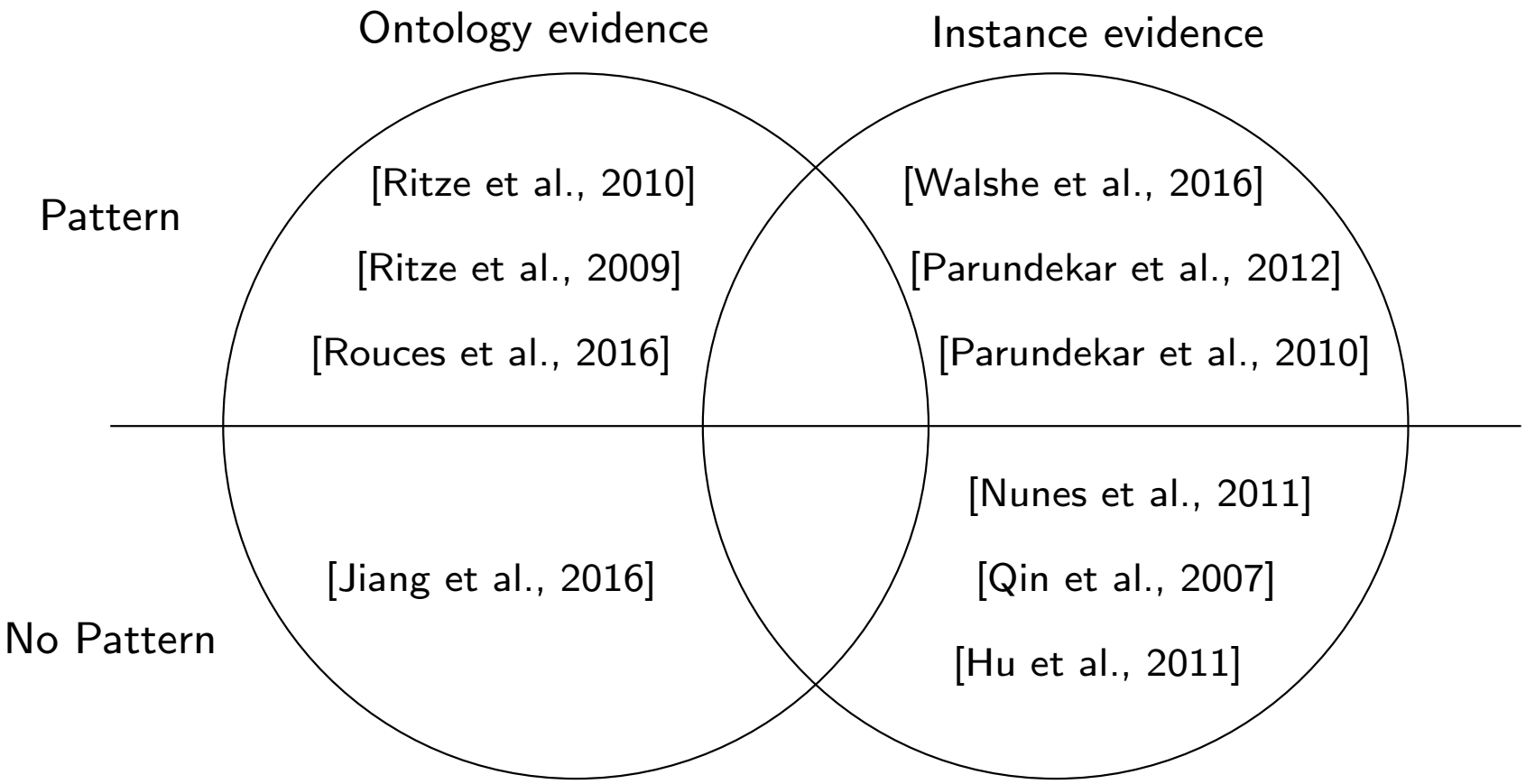
- Precision: 32.8%
- Queries well rewritten: 83.4%

Positioning



[Thiéblin et al., 2019]

Positioning



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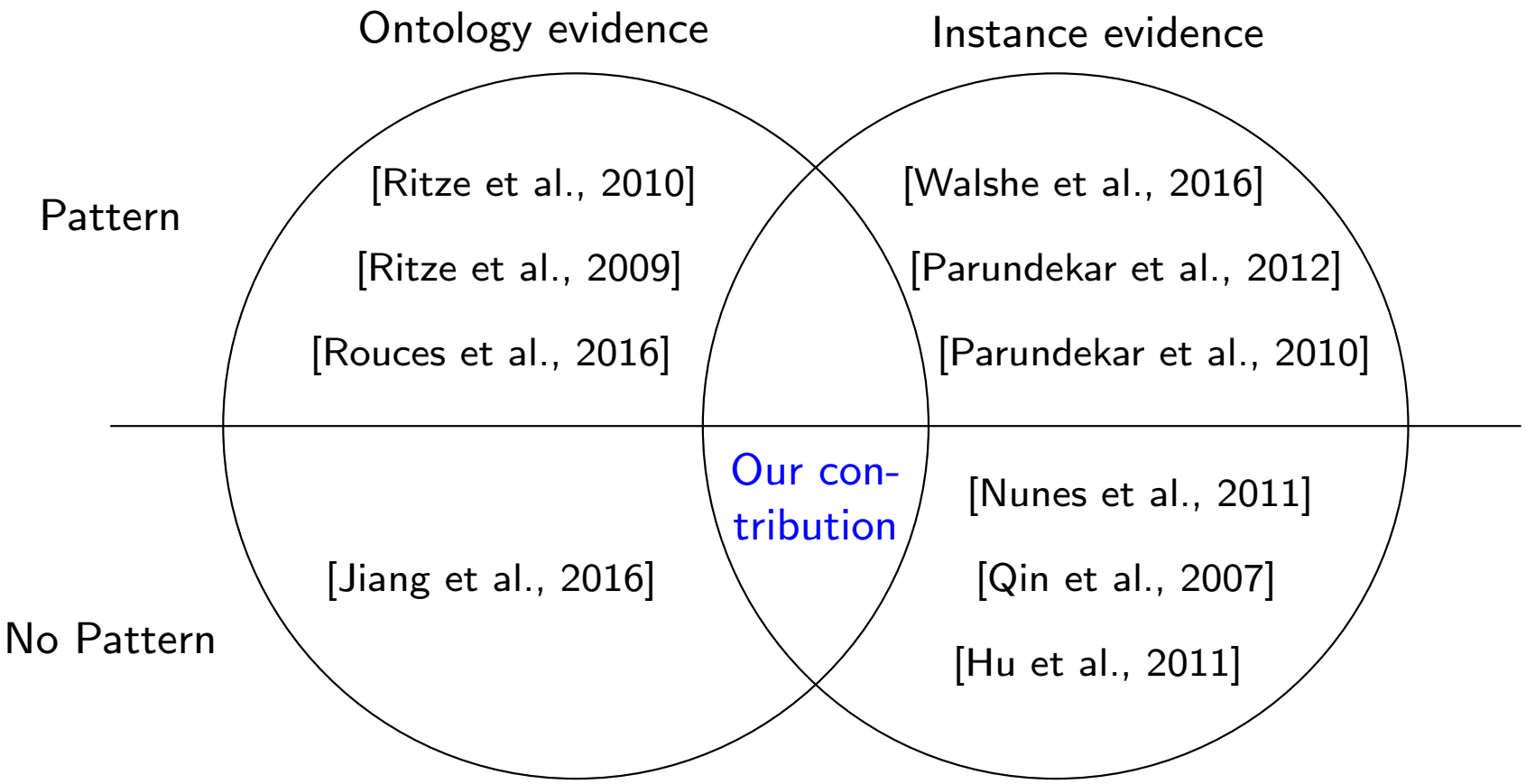

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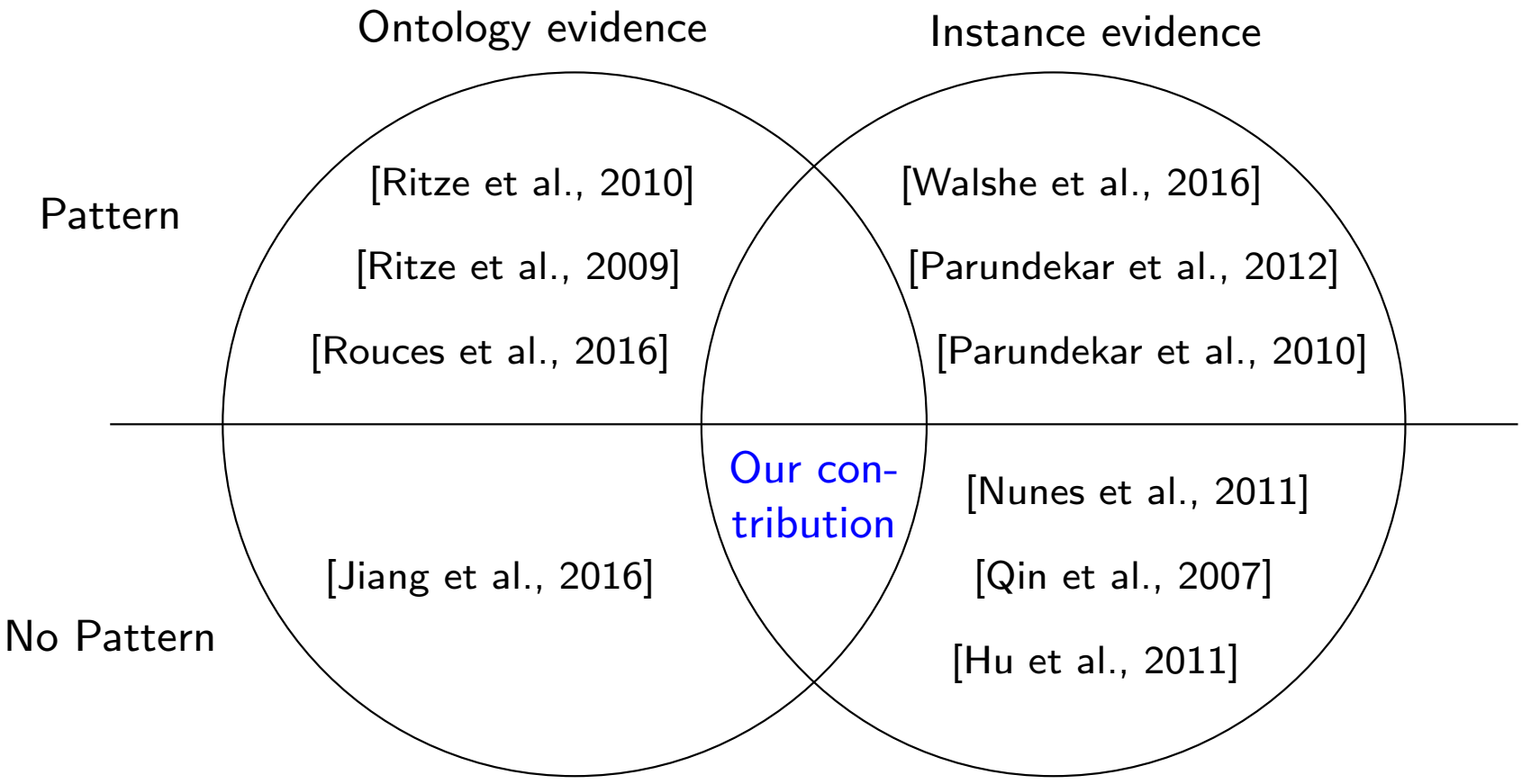
Positioning



In terms of user involvement, some propose a user validation *after* the matching process.
[Thiéblin et al., 2019]

Outline

Open questions

- How do compute the confidence of complex correspondences?
- How to involve the user in the loop? How to collaboratively establish complex alignments?
- How to automatically evaluate complex alignments?
- How to deal with complex alignments between multiple ontologies?
- How to reasoning on the uncertainty involving complex alignments and multiple ontologies?

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