A Pattern-based Framework for Representation
of Uncertainty in Ontologies

Miroslav Vacura, Vojtěch Svátek,
University of Economics, Prague.
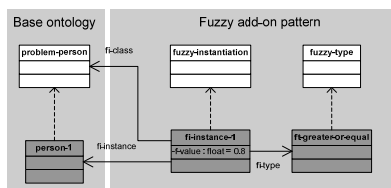
Pavel Smrž,
Brno University of Technology.

Nick Simou,
National Technical University of Athens

Problem

- While OWL datatypes provide means for including numeric uncertainty measures and necessary structural foundations ad hoc, there is no standardized way of representing uncertainty.

- Some known solutions: extending syntax, "Best Practices" W3C document, etc.

- Our aim:
  - use only standard OWL.
  - no need to reingeneer existing ontologies, when adding uncertainty.
  - possibility to use existing reasoners.

Solution
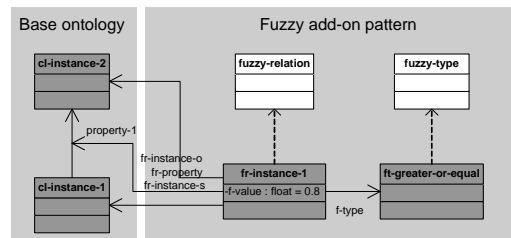

Instantiation Fuzzy –OWL axiom.

- Describing certainty, that given person, belongs to class problem-person.
- Add-on ontology pattern.

Crisp OWL DL ontology

```
<rdf:Description rdf:about="#person-1">
<rdf:type rdf:resource="#problem-person"/>
</rdf:Description>
<rdf:Description rdf:about="#problem-person">
<rdf:type rdf:resource="http://www.w3.org/2002/
07/owl#Class"/>
</rdf:Description>
```

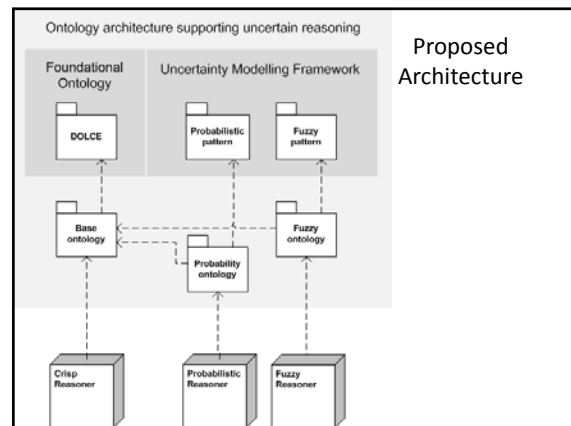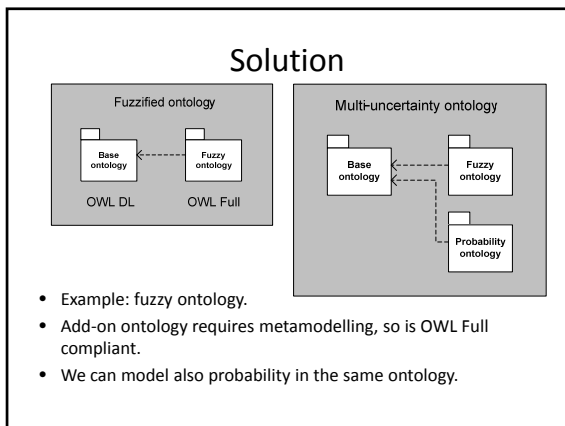# Fuzzy add-on ontology

```
<rdf:Description rdf:about="#fi-instance-1">
<f-value rdf:datatype="http://www.w3.org/2001/
XMLSchema#float">0.8</f-value>
<fi-class rdf:resource="#problem-person"/>
<fi-type rdf:resource="#ft-greater-or-equal"/>
<rdf:type rdf:resource="#fuzzy-instantiation"/>
<fi-instance rdf:resource="#person-1"/>
</rdf:Description>
```

Fuzzy-OWL role axiom

Solution

Fuzzified ontology

Base ontology → Fuzzy ontology

OWL DL — OWL Full

Multi-uncertainty ontology

Base ontology → Fuzzy ontology → Probability ontology

- Example: fuzzy ontology.
- Add-on ontology requires metamodelling, so is OWL Full compliant.
- We can model also probability in the same ontology.

Ontology architecture supporting uncertain reasoning

Proposed Architecture

Foundational Ontology — Uncertainty Modelling Framework

DOLCE — Probabilistic pattern — Fuzzy pattern

Base ontology — Probability ontology — Fuzzy ontology

Crisp Reasoner — Probabilistic Reasoner — Fuzzy Reasoner

THANK YOU FOR LISTENING.