Semantic Web Technologies in Model-driven Control Application Engineering

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Introduction and Background

- Model-driven engineering (MDE) and model-driven development (MDD) promote models as primary engineering artefacts
- In our previous work a model-driven development process ranging from process design to executable control applications has been developed.

Ontology Semantics in Control Application Models

- Ontologies can be used in software engineering to provide logic-based formalisms and semantics to concepts.
- In the approach OWL ontologies are used as a supplement to (UML Automation Profile based) models:
  - A semantic layer on top of the modeling language
  - Support development of control software applications in:
    - classification of concepts and structures
    - describing and linking other information
    - analysis of constructs
From UML AP Models to OWL Semantics

MDE/MDD Environment
- UML AP metamodel
  - conforms to
  - Model package

Metamodel mapping
- Implemented once, depends on the profile (metamodel) version being used.

Instance model generation
- Performed on-line for models being designed.

Reasoning and analysis
- UML AP ontology (rdf/owl)
  - conforms to

Domain ontology
- (concepts and knowledge of the particular domain)

Ontology individuals
- (model instances, data)

Model instances

Ontology individuals

Domain ontology

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Reasoning example:
Concept generalization
Utilization in an IDE

- Make the engineering environment more intelligent and aware of what is being developed
- Enable existing knowledge to be integrated to the engineering context to support work tasks
Ongoing Research (1/2)

• Describe design patterns using ontologies to be used in industrial control application development

• Provide sophisticated guidance for choosing design patterns that promote desirable features
Ongoing Research (2/2)

- Work support for control application engineers
  - Utilize semantic modeling context
  - Provide related engineering information that assists the development
  - Improve sharing of knowledge in engineering teams
Conclusion

• Ontology semantics have been successfully used as a supplement to control software modeling
• Classification and inference of models enables many opportunities to support engineering
  • Identify structures outside the scope of the metamodel
  • Include reusable design information for the given design context
  • Provide interoperability between concepts of different modeling methods
Thank You!

Questions?

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References