



Multi Layer Syntactical Model Transformation for Model Based Systems Engineering

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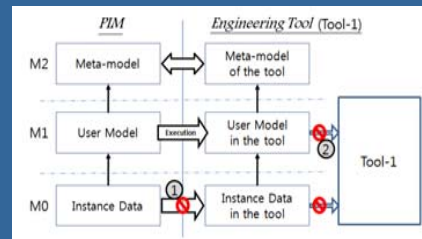
ABSTRACT

Model transformation plays essential roles in model driven engineering (MDE). However, model transformation has been investigated and implemented from the viewpoint of software engineering, the primary domain of MDE. The objective of this research is to explore the extension of model transformation technology to Model Based Systems Engineering problems in the IE domain, which introduces problems not encountered in software engineering.

Motivation

What is missing in contemporary model transformation in MDE:

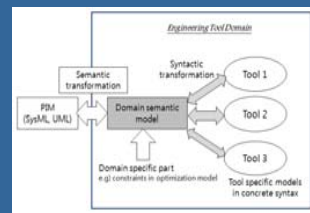
- 1. Instance data integration**
 - Purpose of engineering models: analysis
 - Need to use specific instance data
- 2. Syntactical inconsistency**
 - Engineering COTS tools have their own syntax
 - Convert XML to tool specific syntax model



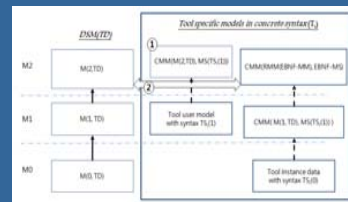
Our Solution:

Multi Layer Syntactical Model Transformation

Part I. Syntactical Model Transformation

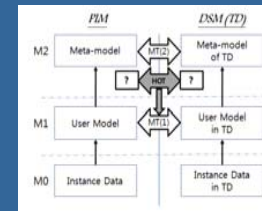


- Domain semantic model
- Separate syntactical transformation



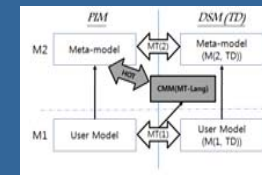
- Complete Meta-model
 - Semantic + Syntactic Meta-model
- Generate complete meta-model using HOT (Higher-order transformation)

Part II. Multi Layer Model Transformation

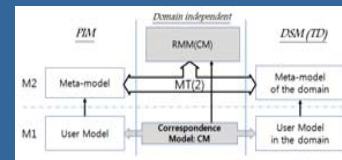


- Generate model transformation for instance data from HOT

Approach 1. Direct approach



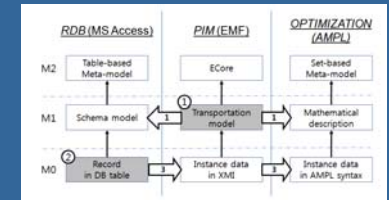
Approach 2. Correspondence model-based approach



Technical Tools

- 1. Meta-modeling Framework**
 - EMF (Eclipse modeling framework)
- 2. Syntactic Modeling Framework**
 - Xtext (ENBF-based Syntax Modeling)
- 3. Model Transformation**
 - ATL
- 4. Optimization Modeling Language**
 - AMPL

Demonstration in Optimization Domain



- **Step 1.** Develop PIM (transportation model) using Ecore
- **Step 2.** Transform PIM to RDB schema and mathematical description
- **Step 3.** Multi layer model transformation transfers instance data from RDB to AMPL instance data

Conclusion

- We theoretically and practically demonstrate that model transformation can deal with multiple layers.
- We propose and demonstrate a new way to handle a tool specific syntactical model.

Future Works

- Develop unified engineering modeling and analysis framework
- Configurable combination of descriptive models and analytic models based on our model transformation approach

TOWARD UNIFIED ENGINEERING DESIGN AND ANALYSIS FRAMEWORK