The Multi-dimensional World of Model-Driven Engineering: From MDE to CT and Back Again

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Abstract. Model-driven engineering (MDE) is a recent prominent trend in software development. In MDE, computer code is semi-automatically generated from a collection $\mathcal{U}$ of models capturing different views and functionalities of the system to be built. In terms of Tarski's model theory, a software *model $M \in \mathcal{U}$* is a theory and, simultaneously, a model of some theory called the *metamodel* of M. Thus, a software model is a three-layer structure embodying two syntax-semantics interplays.

Since different models capture different views of the systems, normally $\mathcal{U}$ is a diverse collections of inter-related models over different inter-related metamodels; to formalize the latter, we need a theory (=meta-metamodel) for metamodels too. In this way $\mathcal{U}$ acquires two sorts of morphisms: those relating syntax-semantics layers, and those inter-relating models in the same layer. The third major dimension (sort of morphisms) is refinement: a model N can refine another model M by adding details and "rephrasing" M's content in another language (metamodel). Finally, since models evolve and are always under construction, inter-relations between different versions M_i $(i = 1, 2, ...)$ of the same model M form yet another major dimension of $\mathcal{U}$. Some details can be found in [1].

The model universe $\mathcal{U}$ is an extremely complex structure. In the MDE framework, it must be precisely specified and kept consistent, and be amenable to processing by reasoning tools (like model checkers and proof assistants). It gives rise to the challenge of finding adequate, effective and manageable mathematical models of $\mathcal{U}$. The goal of the talk is to discuss this challenge, and speculate on the surprisingly direct applicability of abstract nonsense to software engineering practice.

References

[1] Z. Diskin. Model synchronization: mappings, tile algebra, and categories. In R. Lämmel, J. Fernandes, J. Saraiva, and J. Visser, editors, *Postproceedings GTTSE 2009*, volume 6491 of *LNCS*. Springer, 2011.

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