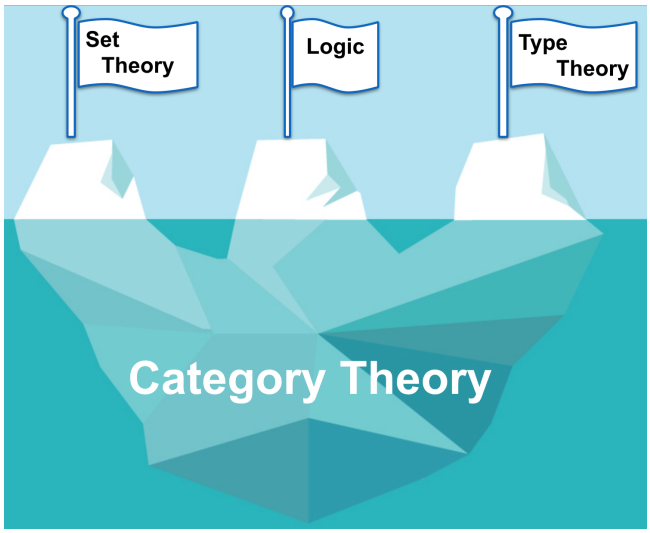
Karlsruhe Institute of Technology

Institute of Information Security and Dependability (KASTEL)
Application-oriented Formal Verification
Prof. Dr. Bernhard Beckert

Bachelor Thesis, Praxis der Forschung, Master Thesis

Model Consistency, Categorically



Model-driven development (MDD) helps manage the growing complexity of systems by providing purpose-oriented abstractions in the form of models. Each model typically focuses on a specific aspect of a system, leading to a modularized approach where the complete system is represented by interconnected models. The set of models needs to be kept consistent to ensure that they describe the same system. In its most generic form, consistency can be seen as a relation: models are either consistent or not.

Both models and consistency can be abstracted categorically. While Models are often described using languages like UML or SysML, disregarding the concrete syntax, they can be formalized as (attributed typed) graphs that have received a categorical treatment in the context of graph transformations. In categorical logic, the standard generalization of a relation is given by subobjects of Cartesian products. These two abstractions enable formal reasoning about consistency and studying how model transformations (like rewriting rules) preserve consistency at an abstract level, i.e., for generic classes of consistency and transformations.

From these ideas, several questions can be studied:

1. **Model Conditions in Multilevel Modeling:** Formalize conditions in deep modeling, using approaches like nested conditions or generalized sketches, aiming to provide a formal basis for deep OCL (or a fragment thereof).
2. **Categorical Formalization of Vitruvius** Provide a categorical formalization of the Vitruvius framework to study termination and the confluence of propagated changes when a model is edited.
3. **Localize inconsistencied** Use subobject classifiers to build a notion of local inconsistency to identify inconsistent parts of models and their influence.

Your Profile. You should have some knowledge of model-driven engineering and some appetance for abstract reasoning.

Contact

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