The Semantics of Partial Model Transformations

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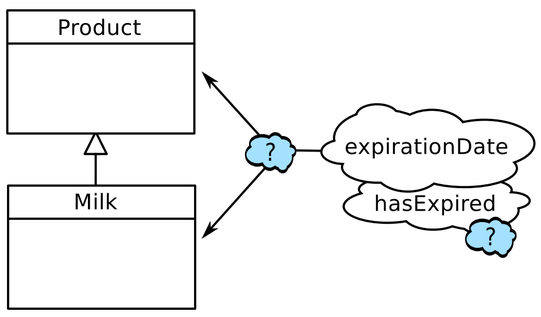
necsis

Problem Statement

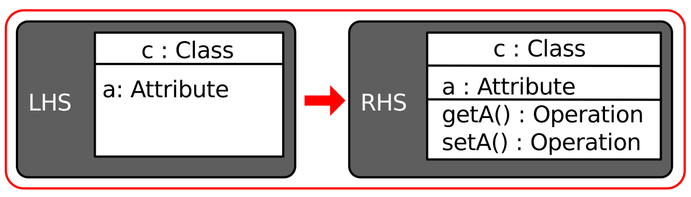
Models with uncertainty

– Represent choice among many possibilities
– Can be refined to many different classical models



Our Goal

Directly transform models containing uncertainty.

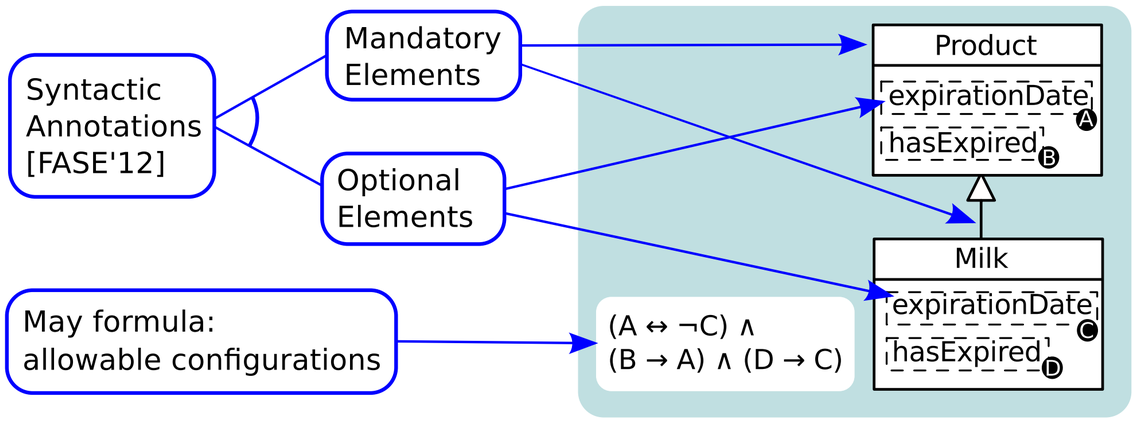


graph transformation rule

Existing model transformations

– Unambiguous model is assumed as input.
– When model contains uncertainty:
  • either first remove uncertainty ...
    – premature commitment
    – reduced quality
  • ... or transform all alternatives
    – hard to maintain

Explicating uncertainty with Partial Models

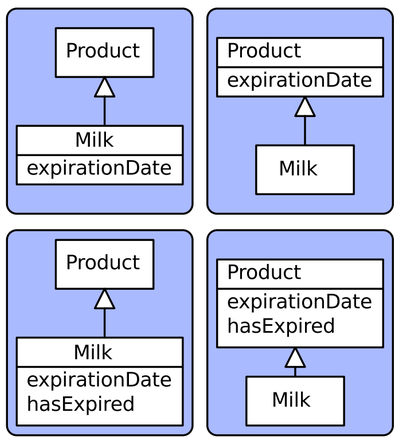


Semantics:
set of concretizations

refinement

encoding

Compact and **exact** representation of the set



Transforming Partial Models

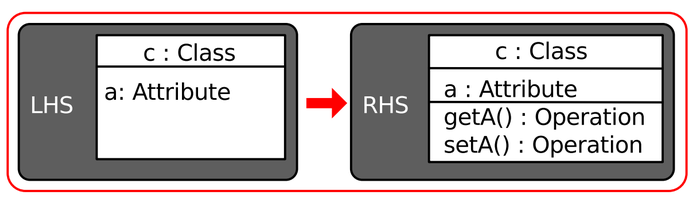
Transfer Predicates

Represent $M \overset{R^*}{\Rightarrow} N$ as:

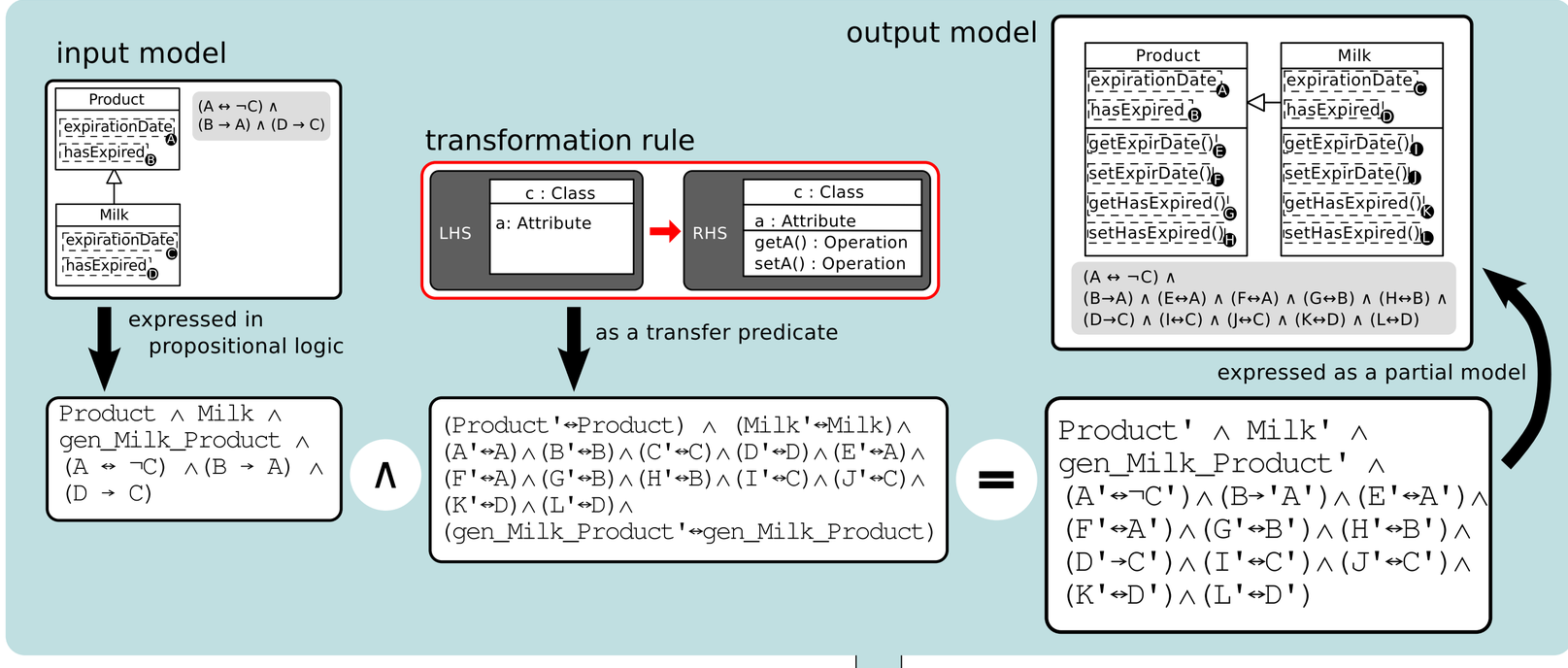
$$\Phi_M \wedge \mathcal{R}(R,M,N) = \Phi_N$$

At each application point, $\mathcal{R}$ is:

$$(\Phi_{LHS} \rightarrow \Phi_{RHS}) \wedge (\neg\Phi_{LHS} \rightarrow \Phi_{NE})$$



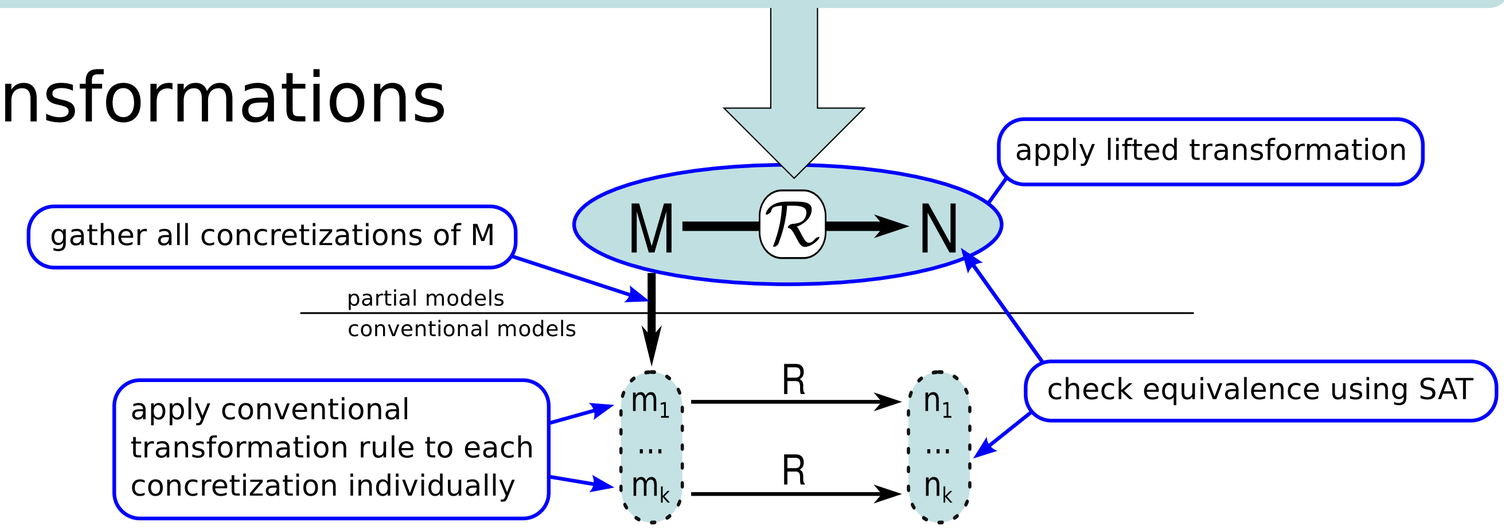
- $\Phi_{LHS} = c \wedge a \wedge \neg g \wedge \neg s$
- $\Phi_{RHS} = (c' \leftrightarrow c) \wedge (a' \leftrightarrow a) \wedge (g' \leftrightarrow a) \wedge (s' \leftrightarrow a)$
- $\Phi_{NE} = (x' \leftrightarrow x)$



Testing Correctness of Transformations

Correctness Criterion

Applying a transformation to a partial model should be the same as if we had created all its concretizations, applied the transformation to each separately, and encoded the result as a partial model.



Conclusion

Summary

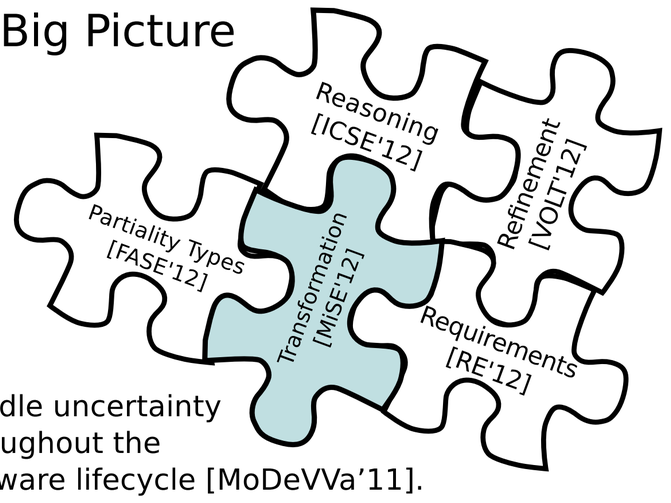
Transforming models that contain uncertainty.

- Represent uncertainty using Partial Models.
- Lift transformation rules from classical to Partial Models.
- Check Correctness Criterion for the lifted transformation .

Next Steps

- Compositionally test Correctness Criterion.
- Systematically create Transfer Predicates using FOL.
- Handle expanding/contracting model vocabularies.
- Partial Models as an Adhesive HLR Category?

The Big Picture



Handle uncertainty throughout the software lifecycle [MoDeVVa'11].

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