Bidirectional Transformation for Automatic Program & Software Construction

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Bidirectional Computation

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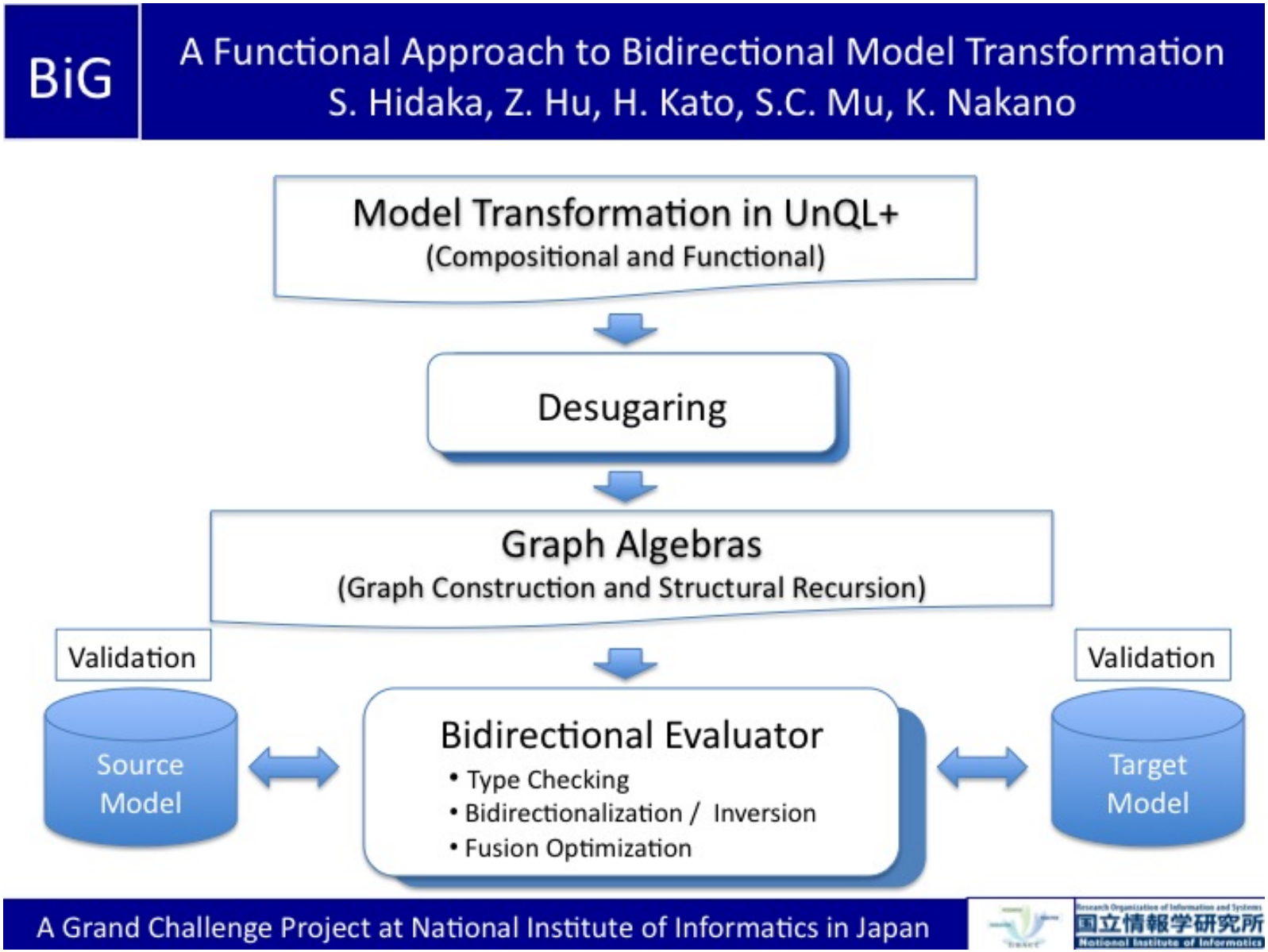
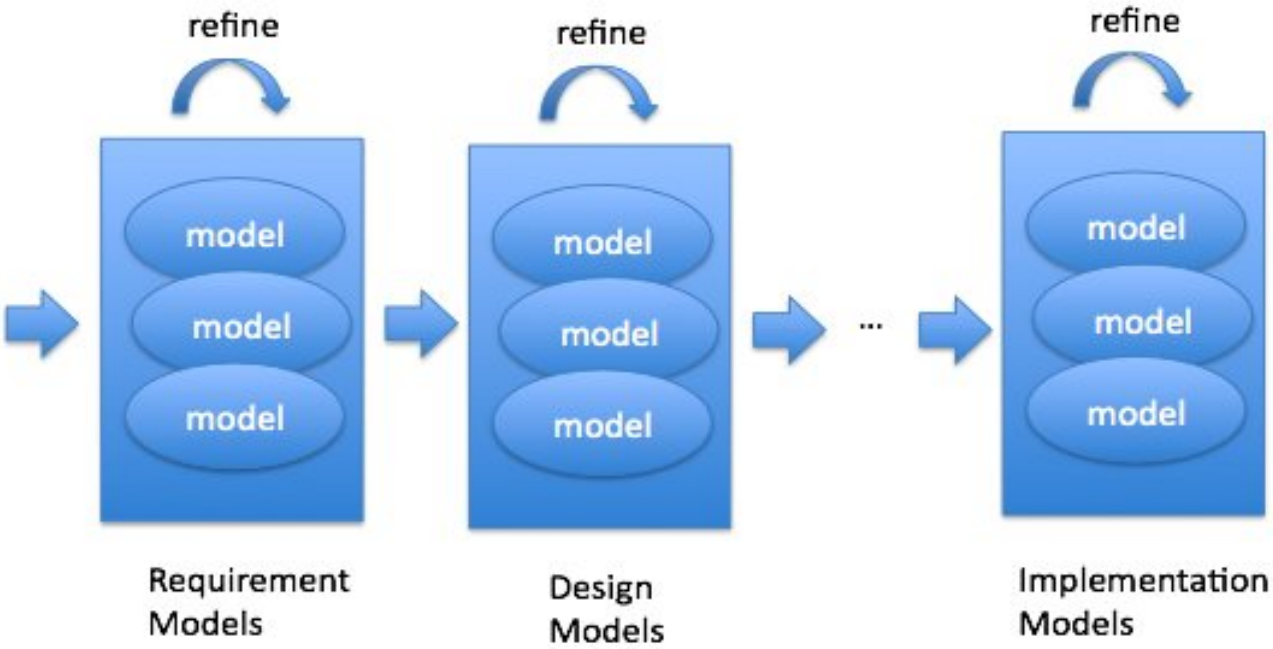
- ... ongoing work on bidirectional model transformation and its application

The BiG Project (from April 2008)



Model-Driven Software Development

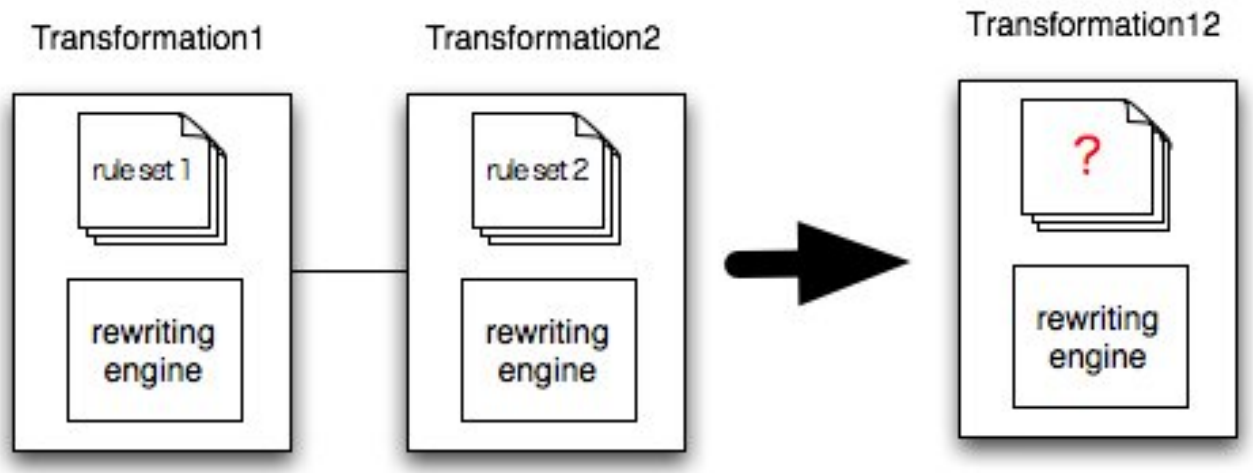
- Software Artifacts: Models
- Software Development: Model Transformations



Model Transformation Composition

The survey paper [Ehrig et al. 2005] says:

> *Open issues for all graph transformation approaches are elaborated concepts to compose transformations ...*



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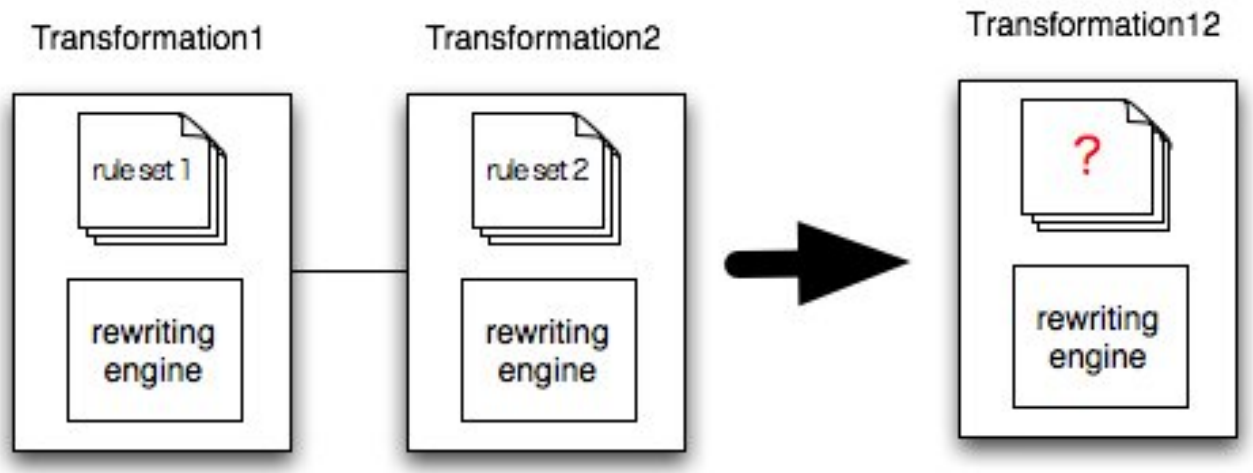

Composition is WANTED for systematic development of model transformation in the large [Klar et al: FSE07].

The BiG Project

Aiming at a compositional framework UnQL+ for model transformations:

- It is functional: not traditional "rule-based"
  $\Rightarrow$ a general functional framework
- It is algebraic (compositional): graph algebras and structural recursion
  $\Rightarrow$ a clear semantics for model equivalence and model transformation.
- It is bidirectional: combinator-based
  $\Rightarrow$ a clear semantics for bidirectional computation
- It can be practical: systematic development of model transformation in large
  $\Rightarrow$ a new system has been implemented in OCaml (about 8,500 loc) and test with some nontrivial examples.

Inversion in Parallelization

Let f° denote a right inverse of f.

$$\frac{\begin{array}{rcl} f\,(a:x) & = & a \oplus f\ x \\ f\,(x +\!\!+ [b]) & = & f\ x \otimes b \end{array}}{\begin{array}{l} f\,(x +\!\!+ y) = f\ x \odot f\ y \\ \quad \textbf{where}\ \ a \odot b = f\,(f^\circ\ a +\!\!+ f^\circ\ b) \end{array}}$$

My Talk Plan

- A Research Talk (about 30 minutes)
- Show an important use of inversion in parallel program construction:

  Automatic Inversion Generates Generic Divide-and-Conquer Parallel Programs