

Introduction

What?

Example Input
Example Output

How?

Transformation Structure
Transformation Behavior

Lessons Learnt

HOT: What is Special?
Transformation Views
Value of Case Study
Conclusions

Copy2GT: a higher order transformation case based on MoTMoT

Pieter Van Gorp

Universiteit Antwerpen

23rd January 2006



Introduction

What?

- Example Input
- Example Output

How?

- Transformation Structure
- Transformation Behavior

Lessons Learnt

- HOT: What is Special?
- Transformation Views
- Value of Case Study
- Conclusions

1. *What?*

1. Example Input
2. Example Output

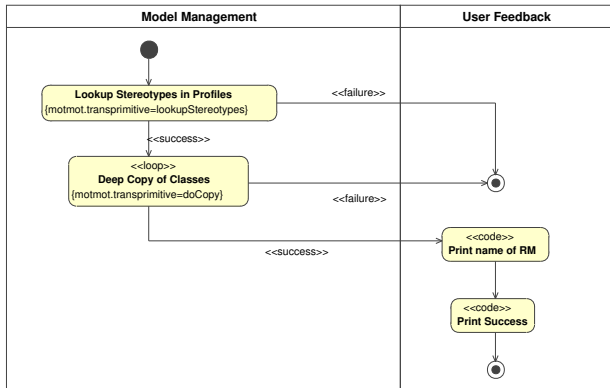
2. *How?*

1. Transformation Structure
2. Transformation Behavior

3. *Lessons Learnt*

1. HOT: What is Special?
2. Transformation Views
3. Value of Case Study
4. Conclusions

Don't focus too much on the semantics, but keep syntactical structure in mind



Input: GT rule for story "doCopy"

Introduction

What?

Example Input

Example Output

How?

Transformation Structure

Transformation Behavior

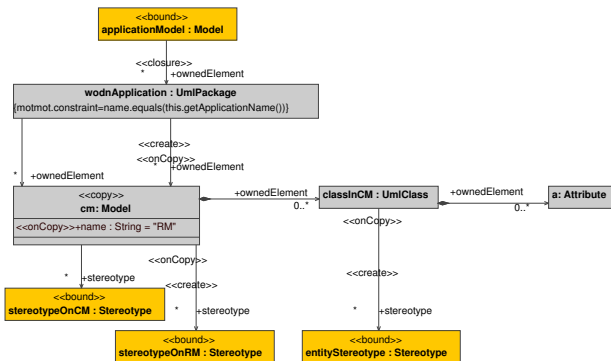
Lessons Learnt

HOT: What is Special?

Transformation Views

Value of Case Study

Conclusions



Output: Transformation Flow

Introduction

What?

Example Input

Example Output

How?

Transformation Structure

Transformation Behavior

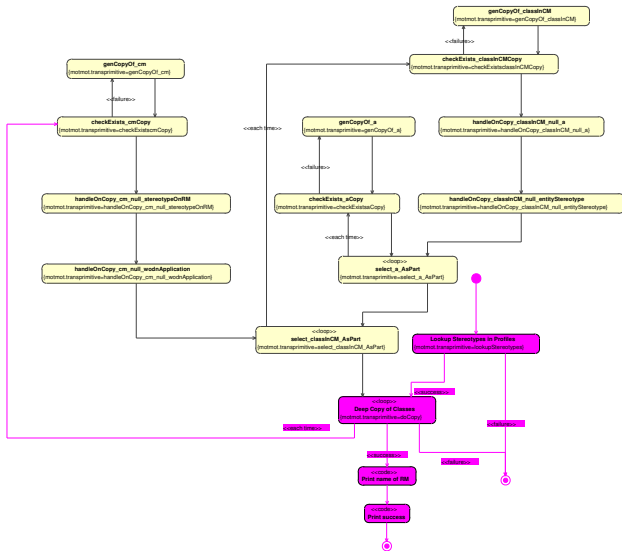
Lessons Learnt

HOT: What is Special?

Transformation Views

Value of Case Study

Conclusions



Generating GT rules modeling the behavior of the stories

Introduction

What?

Example Input

Example Output

How?

Transformation Structure

Transformation Behavior

Lessons Learnt

HOT: What is Special?

Transformation Views

Value of Case Study

Conclusions

- ▶ **GT Rules for copying Model nodes**
- ▶ GT Rules for copying Class nodes
- ▶ GT Rules for copying Attribute node

Output: GT rules for copying Model nodes (1)

Introduction

What?

Example Input

Example Output

How?

Transformation Structure

Transformation Behavior

Lessons Learnt

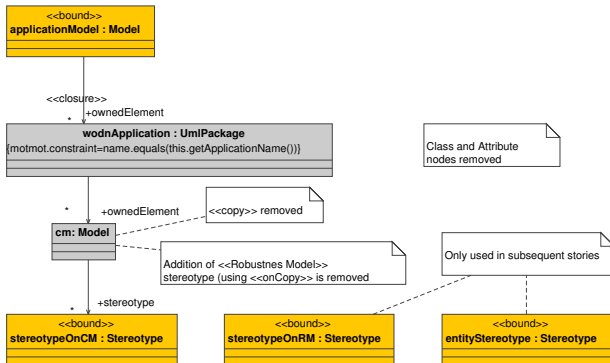
HOT: What is Special?

Transformation Views

Value of Case Study

Conclusions

Original “doCopy” Primitive has become:



Output: GT rules for copying Model nodes (2)

Introduction

What?

Example Input

Example Output

How?

Transformation Structure

Transformation Behavior

Lessons Learnt

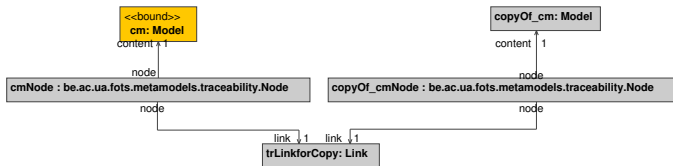
HOT: What is Special?

Transformation Views

Value of Case Study

Conclusions

Checking whether the conceptual model is already copied:



Output: GT rules for copying Model nodes

(3)

Introduction

What?

Example Input

Example Output

How?

Transformation Structure

Transformation Behavior

Lessons Learnt

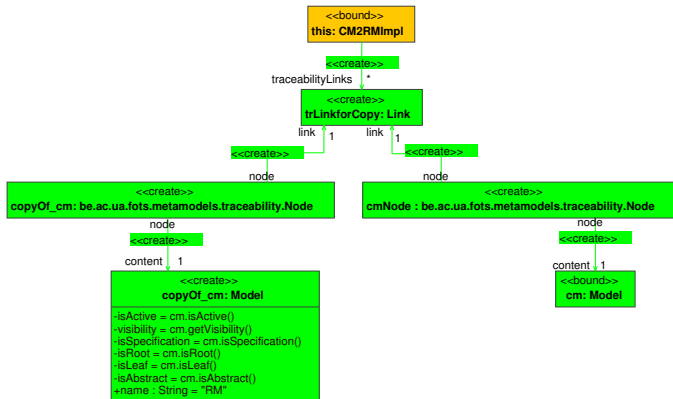
HOT: What is Special?

Transformation Views

Value of Case Study

Conclusions

Generating the copy of the node representing the conceptual model



Output: GT rules for copying Model nodes (4,5)

Introduction

What?

Example Input

Example Output

How?

Transformation Structure

Transformation Behavior

Lessons Learnt

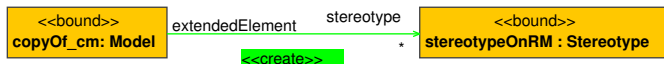
HOT: What is Special?

Transformation Views

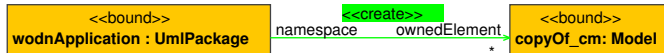
Value of Case Study

Conclusions

Decorating the copied model as a robustness model:



Adding the generated model to the application package:



Generating GT rules modeling the behavior of the stories

Introduction

What?

Example Input

Example Output

How?

Transformation Structure

Transformation Behavior

Lessons Learnt

HOT: What is Special?

Transformation Views

Value of Case Study

Conclusions

- ▶ GT Rules for copying Model nodes
- ▶ **GT Rules for copying Class nodes**
- ▶ GT Rules for copying Attribute node

Output: GT rules for copying Class nodes (1)

Introduction

What?

Example Input

Example Output

How?

Transformation Structure

Transformation Behavior

Lessons Learnt

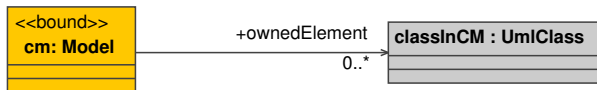
HOT: What is Special?

Transformation Views

Value of Case Study

Conclusions

Selecting the classes that need to be copied:



Output: GT rules for copying Class nodes (2)

Introduction

What?

Example Input

Example Output

How?

Transformation Structure

Transformation Behavior

Lessons Learnt

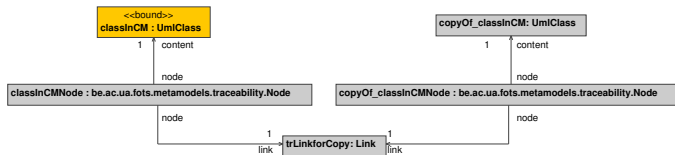
HOT: What is Special?

Transformation Views

Value of Case Study

Conclusions

Checking whether a class is already copied:



Output: GT rules for copying Class nodes (3)

Introduction

What?

Example Input

Example Output

How?

Transformation Structure

Transformation Behavior

Lessons Learnt

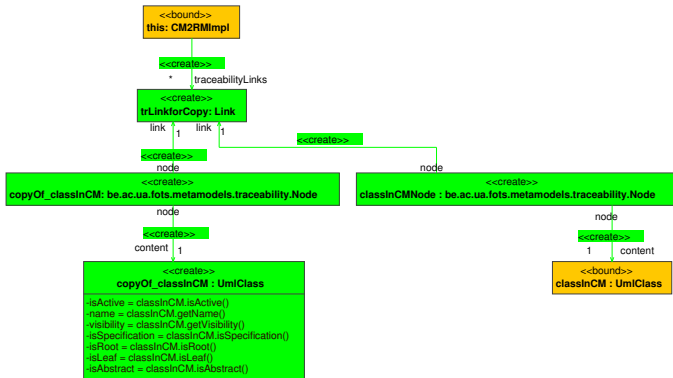
HOT: What is Special?

Transformation Views

Value of Case Study

Conclusions

Generating a Copy of a class:



Output: GT rules for copying Class nodes (4)

Introduction

What?

Example Input

Example Output

How?

Transformation Structure

Transformation Behavior

Lessons Learnt

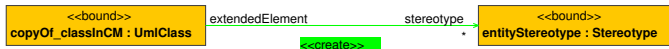
HOT: What is Special?

Transformation Views

Value of Case Study

Conclusions

Decorating class in robustness model as entity:



Generating GT rules modeling the behavior of the stories

Introduction

What?

Example Input

Example Output

How?

Transformation Structure

Transformation Behavior

Lessons Learnt

HOT: What is Special?

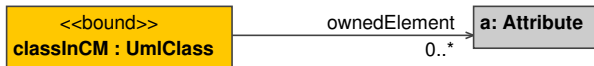
Transformation Views

Value of Case Study

Conclusions

- ▶ GT Rules for copying Model nodes
- ▶ GT Rules for copying Class nodes
- ▶ **GT Rules for copying Attribute node**

- ▶ Selecting the *attributes* that need to be copied:



- ▶ Checking whether an *attribute* is already copied,
- ▶ Generating a Copy of an *attribute*,
- ▶ Copying the *type* link of an attribute special case
>> *under development*

Transformation Structure

Introduction

What?

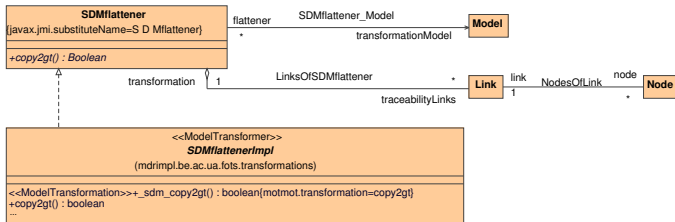
Example Input
Example Output

How?

Transformation Structure
Transformation Behavior

Lessons Learnt

HOT: What is Special?
Transformation Views
Value of Case Study
Conclusions



- ▶ *SDMflattener* represents interface of transformation:
 - ◆ *transformationModel*: the UML model conforming to the UML profile for SDM with Copy Support
- ▶ *SDMflattenerImpl* is generated by MoTMoT
 - ◆ *_sdm_copy2gt*: a higher order transformation method whose behavior is modeled as Story Diagrams

Flow for Copying "one level"

Introduction

What?

Example Input
Example Output

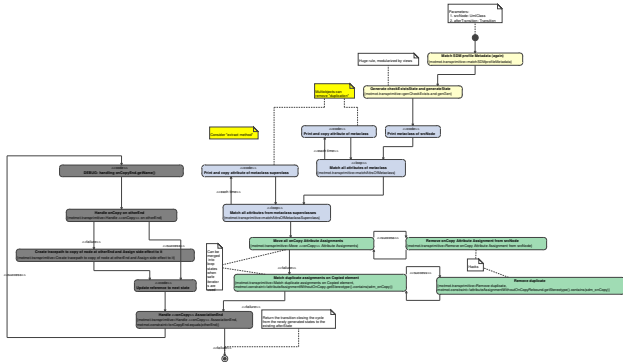
How?

Transformation Structure
Transformation Behavior

Lessons Learnt

HOT: What is Special?
Transformation Views
Value of Case Study
Conclusions

Generating GT rules for (1) copying a node and
(2) handling <<onCopy>> side-effects:



Flow for generating the delegation to the “next level”

Introduction

What?

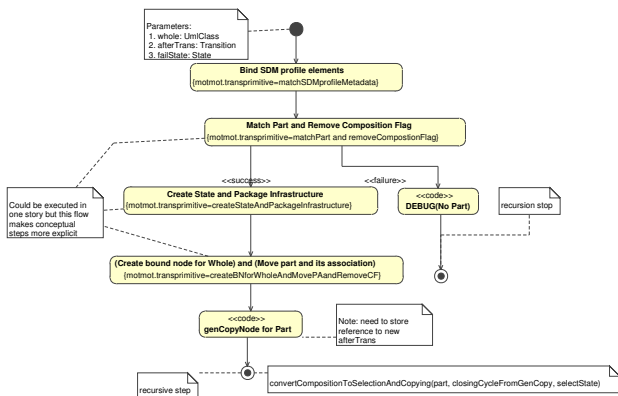
- Example Input
- Example Output

How?

- Transformation Structure
- Transformation Behavior

Lessons Learnt

- HOT: What is Special?
- Transformation Views
- Value of Case Study
- Conclusions



What makes Higher Order Transformations special?

- ▶ Transformations are models, so for MoTMoT it doesn't make a difference
 - ◆ WODN uses UML profile for CM, RM
 - ◆ Copy2GT uses UML profile for SDM
- ▶ Use of MoTMoT is different: requires two MoTMoT projects (Copy2GT and WODN)

How could we support it better?

- ▶ Simplify metamodel...
 - ◆ dedicated SDM metamodel,
 - ◆ trfo to/from plain profile
- ▶ Consider a framework for easier deployment

Introduction

What?

- Example Input
- Example Output

How?

- Transformation Structure
- Transformation Behavior

Lessons Learnt

- HOT: What is Special?
- Transformation Views
- Value of Case Study
- Conclusions

New Technique, “invented” while developing SDMflattener

- ▶ Added value:
 - ◆ no forced sequential flow
 - ◆ sharing of node variables
 - ◆ anticipates reverse engineering
- ▶ Advantage of using a mature visual language (UML): already supports views (as “diagrams”)

Introduction

What?

- Example Input
- Example Output

How?

- Transformation Structure
- Transformation Behavior

Lessons Learnt

- HOT: What is Special?
- Transformation Views
- Value of Case Study
- Conclusions

New SDM Operator

- ▶ MDE Project's "new abstractions"
- ▶ Ph. D's Credibility: WODN etc. easier to understand

M2M Implementation

- ▶ Ph. D's Platform Independence
 - ◆ Only Plain SDM Profile as interface to Fujaba and others
- ▶ Ph. D's Credibility
 - ◆ SDM M2M in favor of direct FTL M2C
- ▶ FOTS, GT Community's Precise Semantics
 - ◆ Explain new operator with mapping to Controlled GT
 - ◆ UML Tool support supports adoption

Introduction

What?

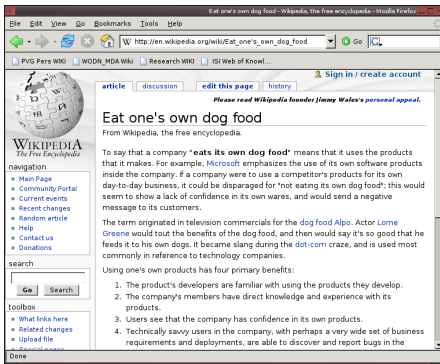
- Example Input
- Example Output

How?

- Transformation Structure
- Transformation Behavior

Lessons Learnt

- HOT: What is Special?
- Transformation Views
- Value of Case Study
- Conclusions



- ▶ We should eat more of our own dog food:
 - ◆ Detect new problems and solutions (copy operator, NACs, views)
 - ◆ Workshop Purpose: FOTS feeds, LORE eats (*I'm FOTS&LORE...*)
- ▶ MoTMoT needs 1 full-time FOTS member