A introduction to MDA

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Agenda

- Brief Introduction
- MDA Development Process
- MDA Framework
- A Example of MDA Process
- Transformations in MDA
- MDA Today
- Influences
Introduction

- Proposed by OMG in 2000
- A new way of developing software systems
  1. A development process
  2. A framework
  3. A set of standards
- It aims to allow developers to create systems entirely with models
MDA Development Process
MDA Development Process

Traditional software development life cycle

- requirements
  - Mostly text
- analysis
  - Diagrams and text
- design
  - Diagrams and text
- implementation
  - Diagrams and text
- testing
  - code
- deployment
  - code
MDA Development Process

- requirements
- analysis
- design
- implementation
- testing
- deployment

MDA software development life cycle

- Mostly
- text
- PIM
- PSM
- code
- code
MDA Development Process

Step 1. Build PIM

Step 2. Use transformation tool to generate one or more PSM from PIM

Step 3. Use transformation tool to generate codes
MDA Development Process

MDA Benefits:

1. Productivity:
   developers focus on business logic rather than on technical details

2. Portability:
   automated transformation tools available

3. Maintenance and Documentation:
MDA Framework
MDA Framework

Building blocks in MDA

1. Models
   1) Platform Independent Model (PIM)
   2) Platform Specific Model (PSM)
   3) Source Code

2. Transformations
   1) PIM to PSM
   2) PSM to code
MDA Framework

Building blocks in MDA

3. MDA specifications

1) One or more standard, well-defined languages to write PIM
2) One or more standard, well-defined languages to write PSM
3) A language to write the definition of transformations between models

A well-defined language is a language with well-defined syntax and semantics, which is suitable for automated interpretation by a computer.
MDA Framework

Building blocks in MDA

4. Tools that implement the execution of the transformations
A example of MDA process
A example of MDA

Background:
develop an ordering system for a breakfast service shop

Implementation:
a standard web-based three-tier application
1. A database
2. A middle tier Enterprise Java Bean
3. User interface: JSP
A example of MDA

PIM (a class diagram)
A example of MDA

PIM to PSM transformations

PIM to Relational PSM

what the transformation tool should do?

1> how the data types are mapped
2> classes → tables
   attributes → field
   class attributes → foreign key
3> association class → foreign key
   create new tables
4> multiplicities
5> navigability
6> NULL value
A example of MDA

Relational PSM
A example of MDA

- PIM to EJB PSM
  what the transformation tool should do?
A example of MDA

EJB PSM
A example of MDA

PIM to JSP PSM

what the transformation tool should do?
A example of MDA

JSP PSM

Figure 5-4  Web component model of Rosa’s Breakfast Service
A example of MDA

PSM to code transformation

1. Relational PSM to SQL

what the transformation tool should do?

1> For each table, generate a “CREATE TABLE” text, followed by the name of the table, and a “{“, then execute rule 2, followed by rule 3, and end with “}”

2> For each column in the table, generate the name of the column, followed by the name of the type, and size of the column, then generate “Not” if the column may not have the NULL value and end with “NULL”

3> Generate a “PRIMARY KEY” names of the columns of the primary key, and end with “}”
A example of MDA

PSM to code transformation

1. EJB PSM to Java
2. JSP PSM to JSP

what the transformation tools should do?
A example of MDA
Transformations in MDA
Transformations in MDA

Definitions

1. What is a transformation?
   The automatic generation of a target model from a source model, according to a transformation definition.

2. What is a transformation definition?
   A set of transformation rules that together describe how a model in the source language can be transformed into a model in the target language.

3. What is a transformation rule?
   A description of how one or more constructs in the source language can be transformed into one or more constructs in the target language.
Transformations in MDA

PIM → Transformation Tool → PSM → Transformation Tool → CODE
Transformations in MDA

Desired features of transformations

1. Tunability

What if we want some control over the transformation process?

1) Manual control
2) Conditions on Transformation
3) Transformation Parameters
Transformations in MDA

Desired features of transformations

2. Traceability

What if we made some changes to the PSM afterwards?

1) Warn of the change
2) What part has been changed?
Transformations in MDA

- Desired features of transformations
  3. Incremental Consistency
  4. Bidirectionality
Transformations in MDA

What do we require of a transformation?

1. The control over the transformation process
2. A persistent source – target relationship
Transformations in MDA

A example of keeping persistent Source-Target relationship in Transformations
Transformations in MDA

Define a transformation

1. In most cases, it is already incorporated in the transformation tools
2. When there’s no tool available, we may have to define the transformations ourselves
3. A transformation definition language with strict syntax and concrete semantics
Transformations in MDA

Metamodelling and Transformation

1. Define the source and target model

2. Define the transformation rules
Transformations in MDA

Metamodeling and Transformation

The complete MDA framework
Transformations in MDA

Transformations definitions in MDA.

1. No standard yet

2. OMG is working on QVT (Query, View, Transformation), a standard language to write transformation definitions.
MDA today

- PIM language
- PSM language
- Transaction definitions
- Tools
- Other standards
Influences
Influences

A shift of focus in software development
Code $\rightarrow$ Models
Influences

The development participants

1. PIM analyst
   requirement: awareness of the functionalities of the system

2. PSM creator
   requirement: knowledge of different platforms, system architectures and of transformation definitions

3. Transformation definition developer
   requirement: knowledge of the PIM language, PSM languages, transformation language and the transformation rules.
Influences

The development participants
Influences

The development tools

1. Model Editor
2. Model Validator
3. Transformation Definition Editor
4. Transformation tool
Conclusion
Reference

- MDA Explained – Practice and Promise
- www.omg.org/MDA