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

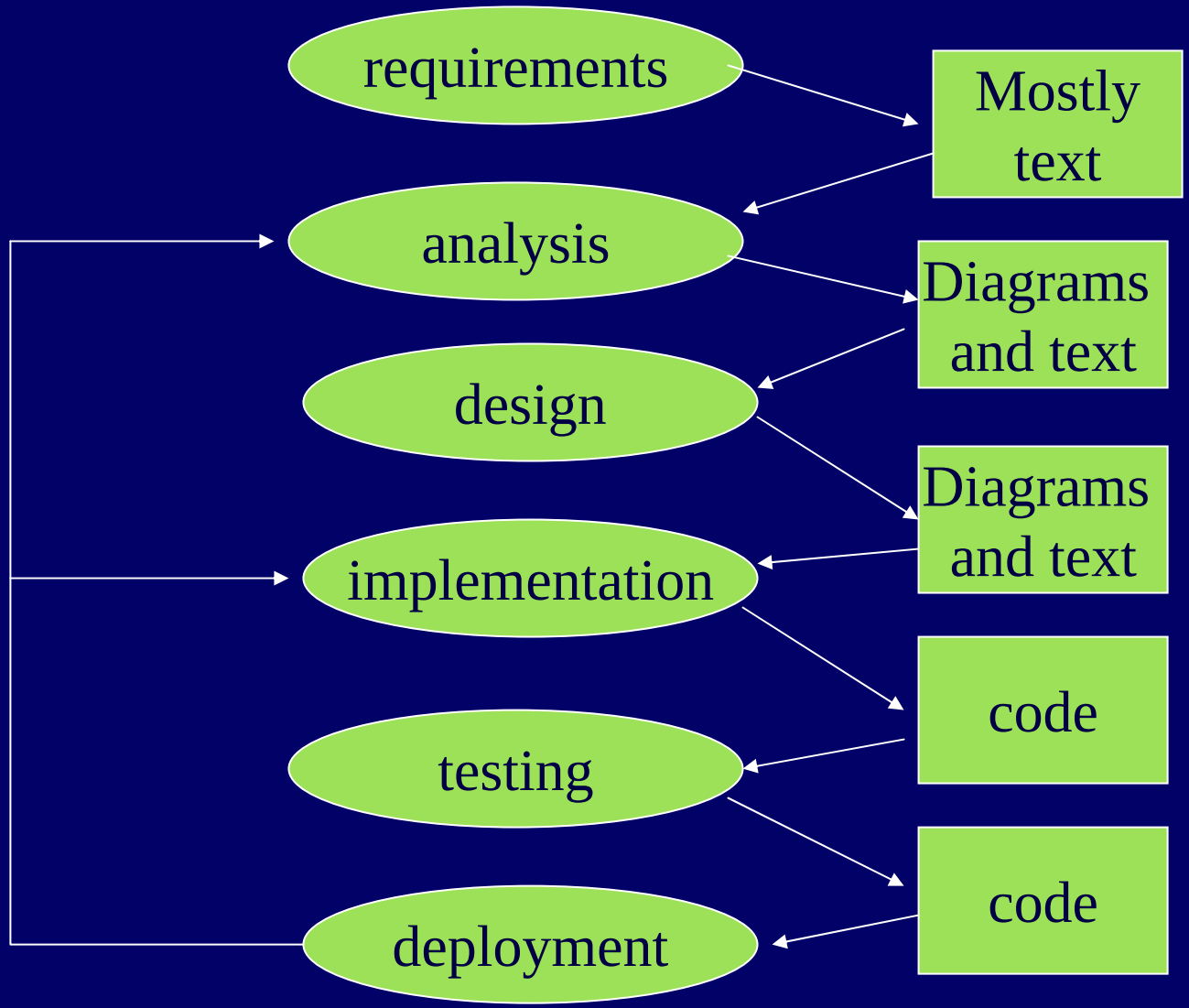
Introduction

- 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

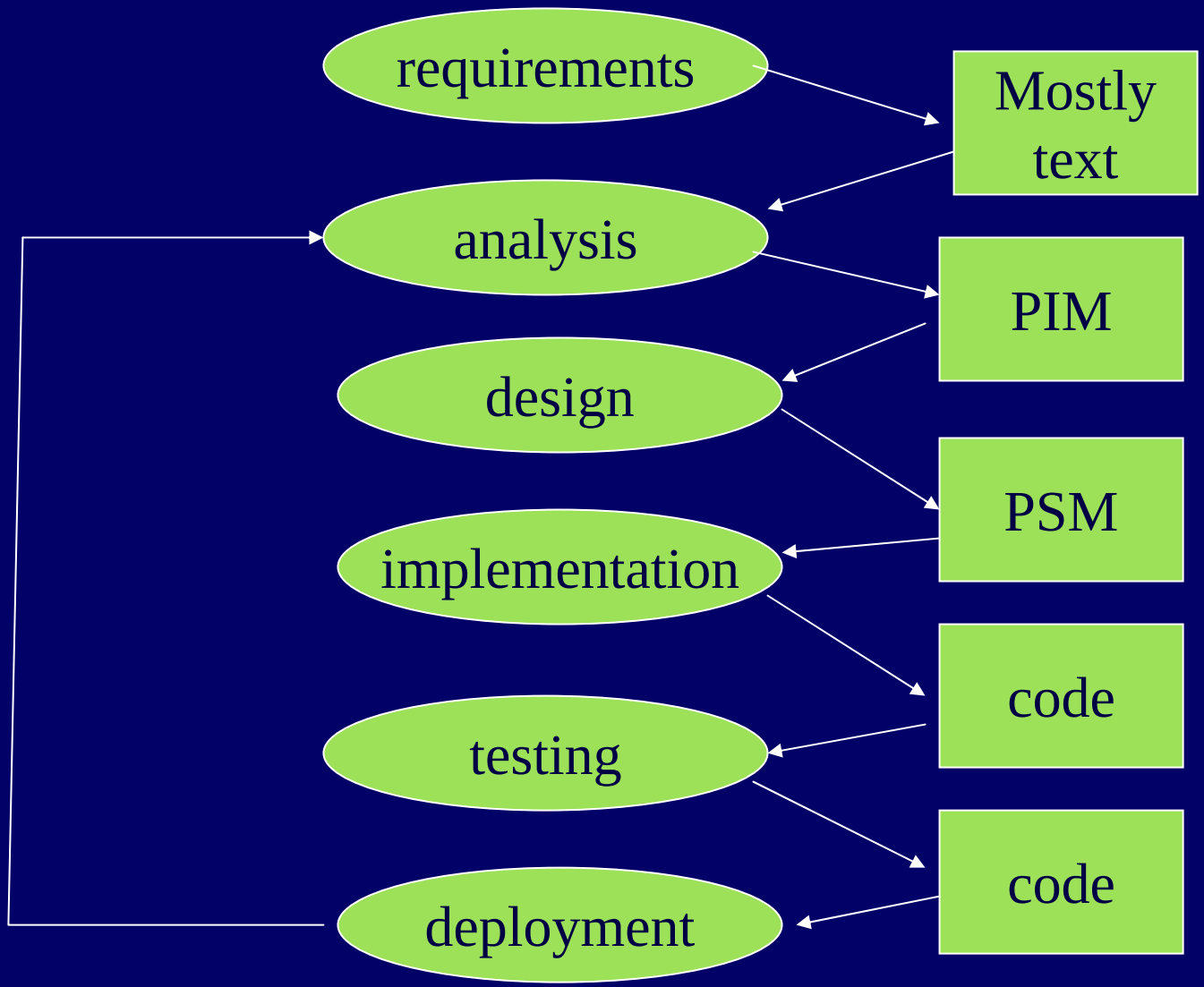
MDA Development Process

- Traditional software development life cycle



MDA Development Process

- MDA software development life cycle



MDA Development Process

Step1. Build PIM

Step2. Use transformation tool to
generate one or more PSM from PIM

Step3. Use transformation tool to
generate codes

MDA Development Process

- MDA Benefits:

1. Productivity:

   developers focus on business logic rather than on technical details

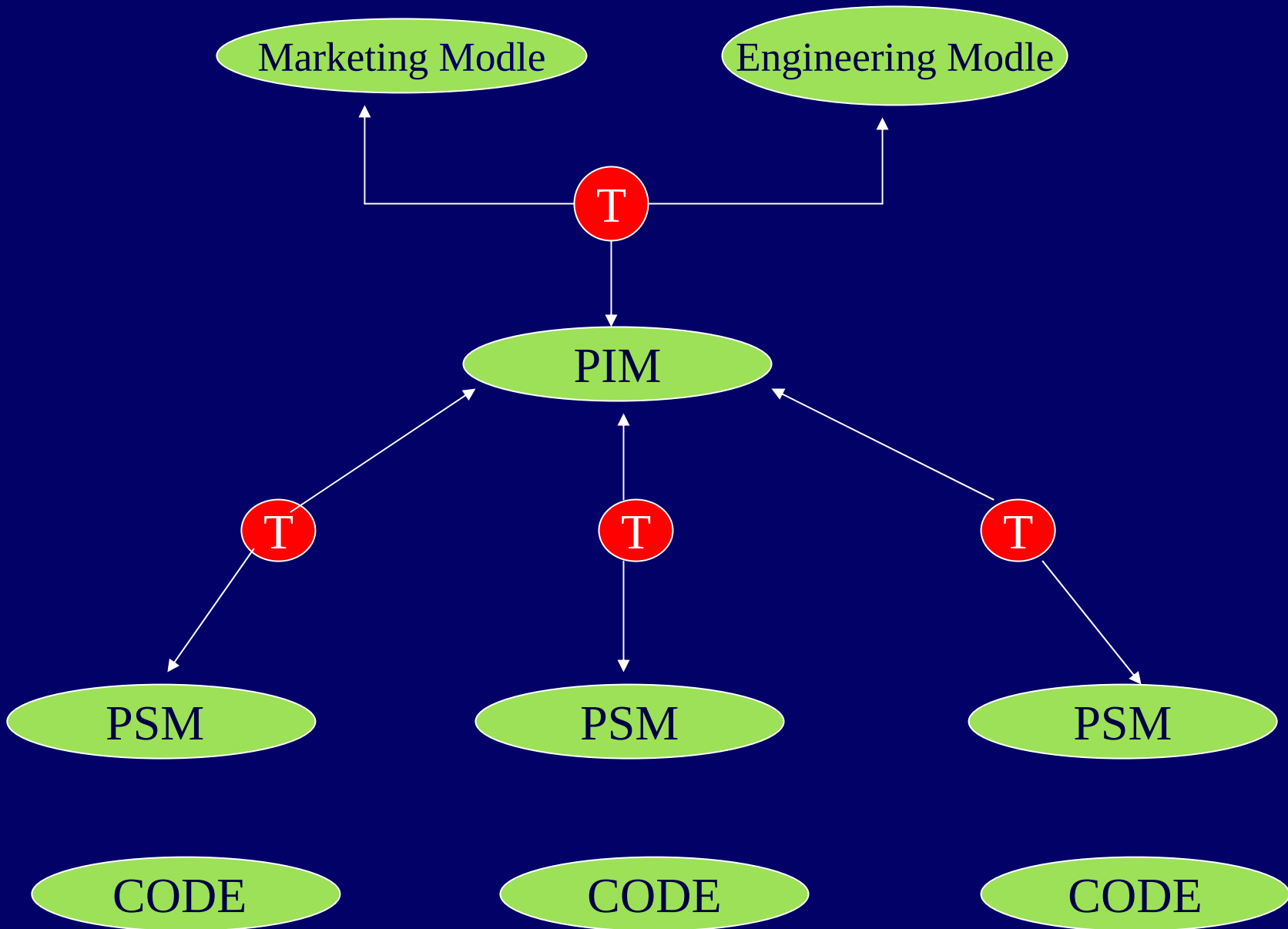
2. Portability:

   automated transformation tools available

3. Maintenance and Documentation:

MDA Framework

MDA Framework



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:

  develpe 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)

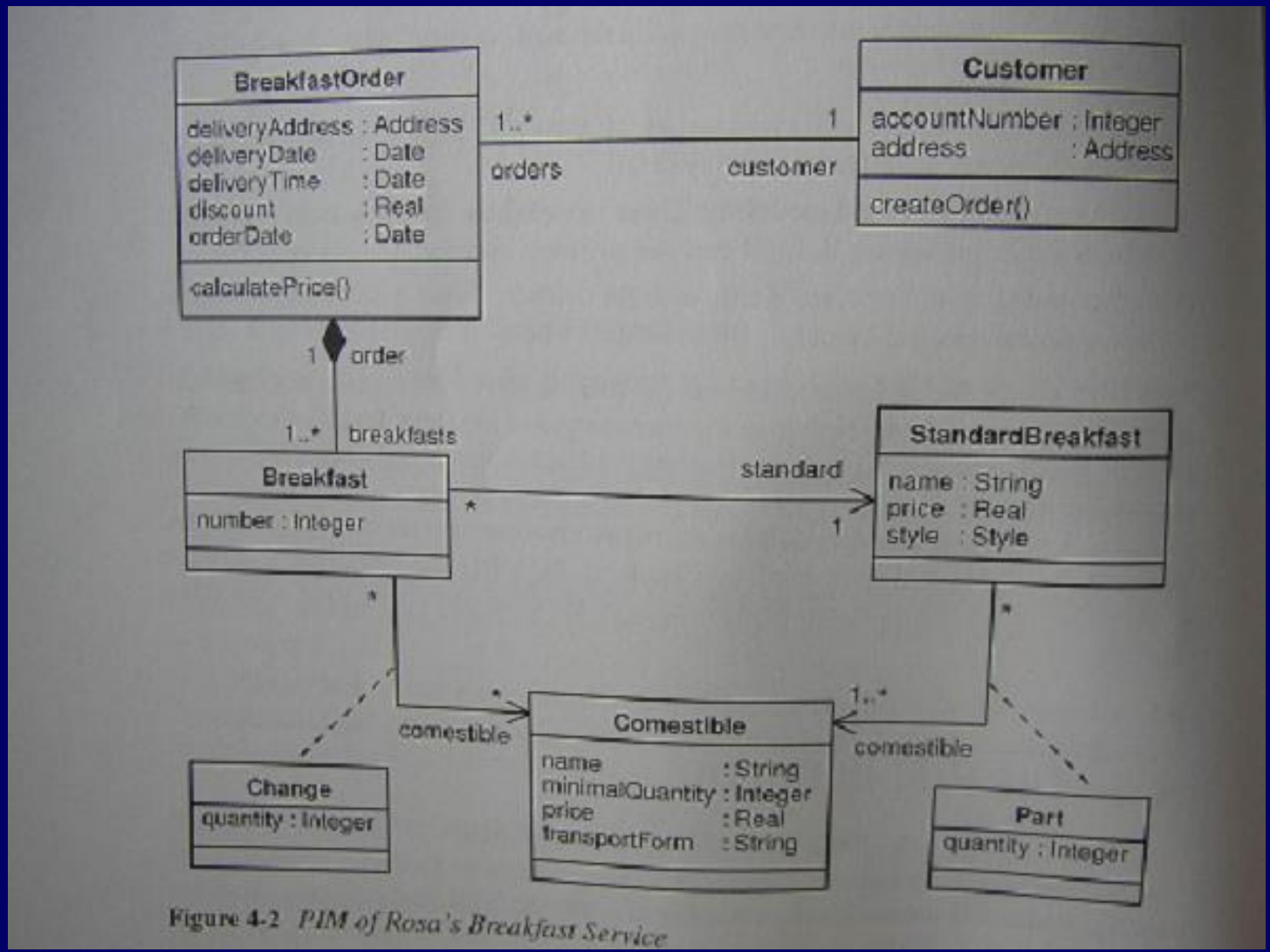


Figure 4-2 *PIM of Rosa's Breakfast Service*

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

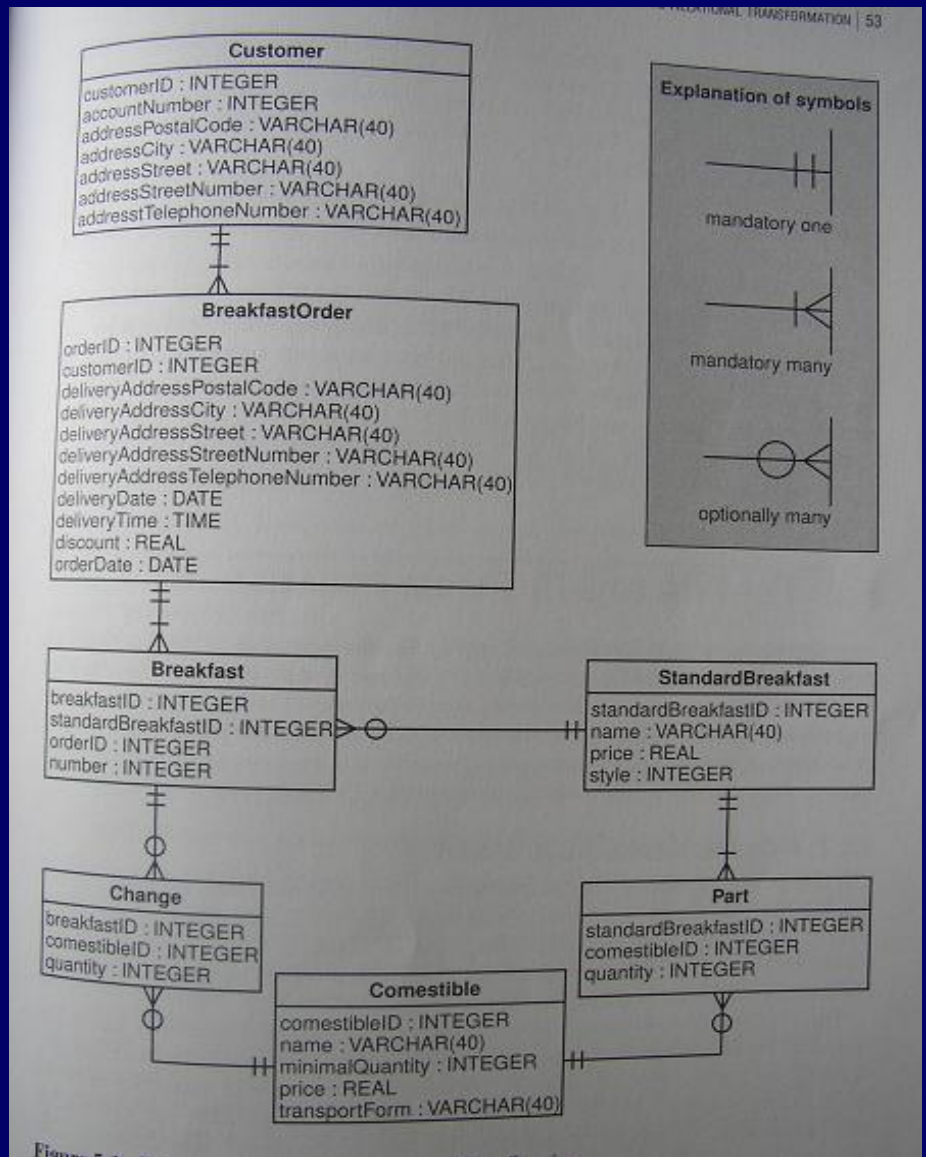
  4> multiplicities

  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

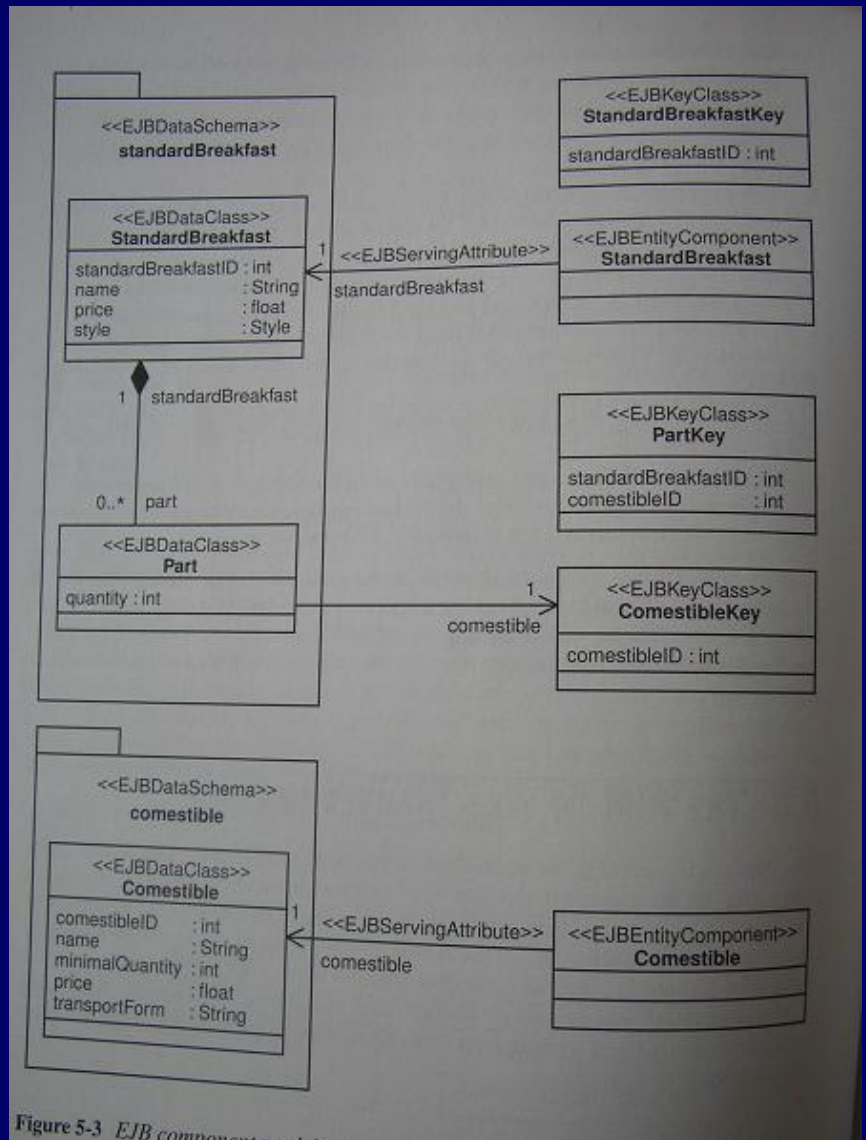


Figure 5-3 *EJB component*

A example of MDA

- PIM to JSP PSM

  what the transformation tool should do?

A example of MDA

- JSP PSM

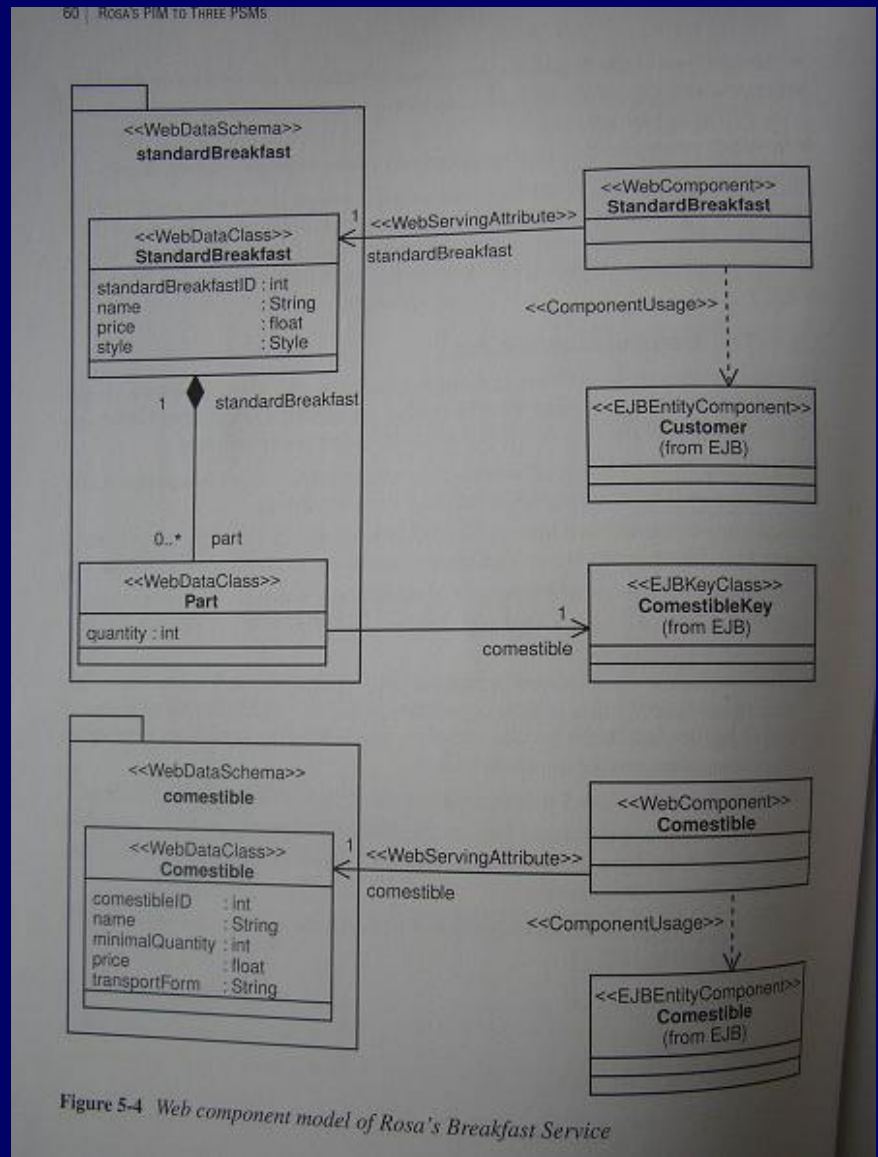


Figure 5-4 *Web component model of Rosa's Breakfast Service*

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 colume, 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”

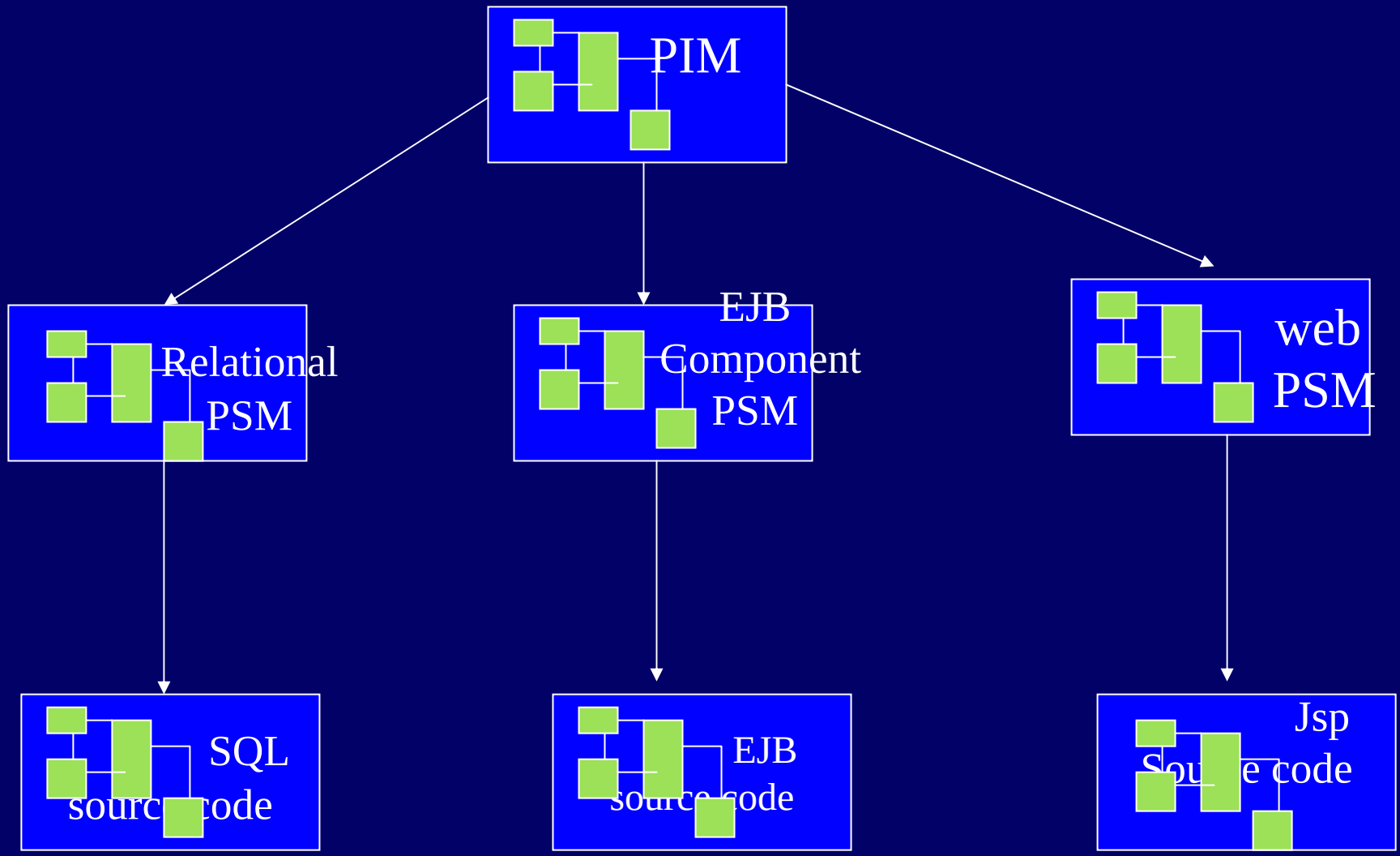
3>Generate a “PRIMARY KEY” names of the columns of the primary key, and end with “)”

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?

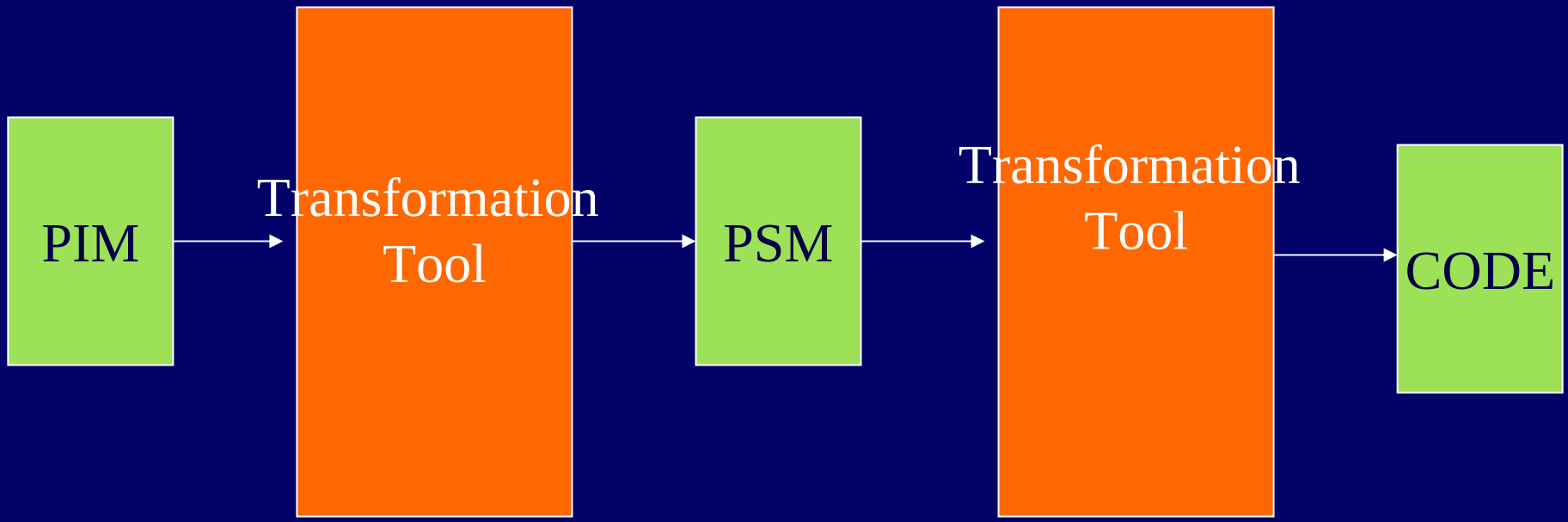
   A set of transformation rules that together describe how a model in the source language can be transformed into a model in the target language.

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

- Transformations in MDA



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

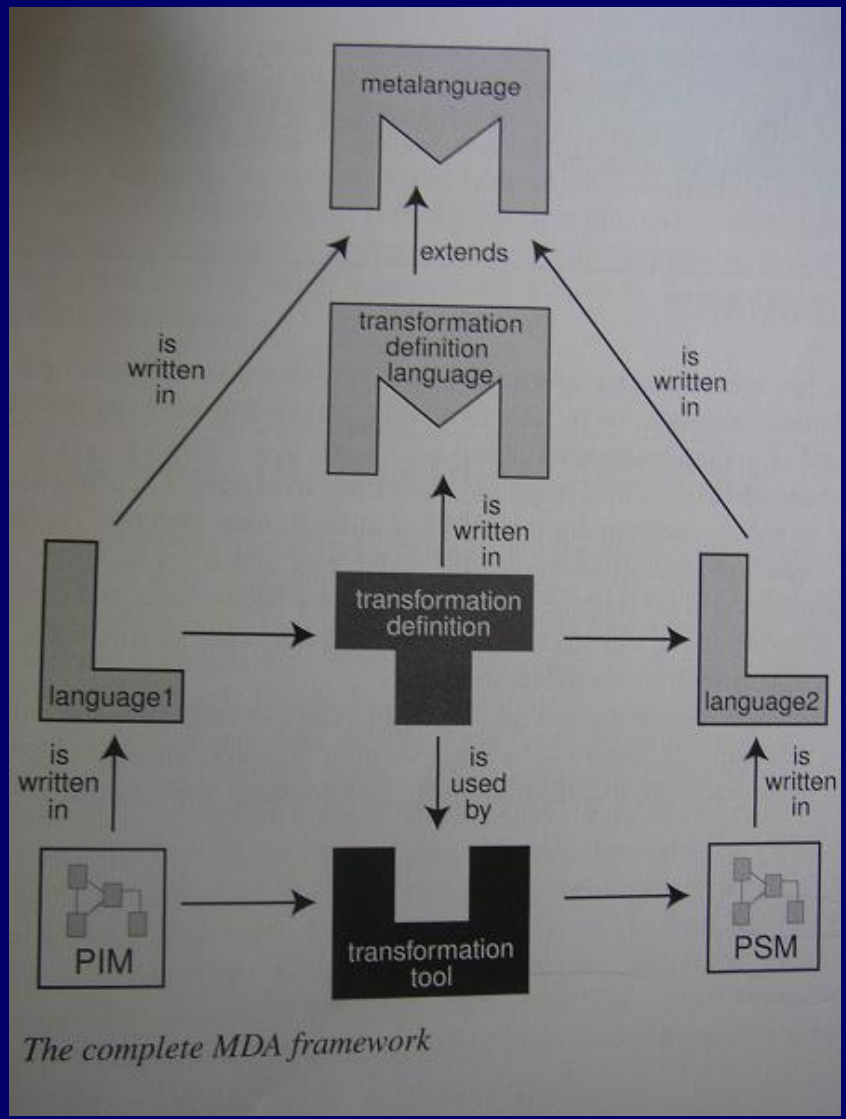
- Metamodeling and Transformation

1. Define the source and target model

2. Define the transformation rules

Transformations in MDA

- Metamodeling and Transformation



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 → Models

Influences

- The development participants

1. PIM analyst

   requirement : awareness of the functionalities of the system

2. PSM creator

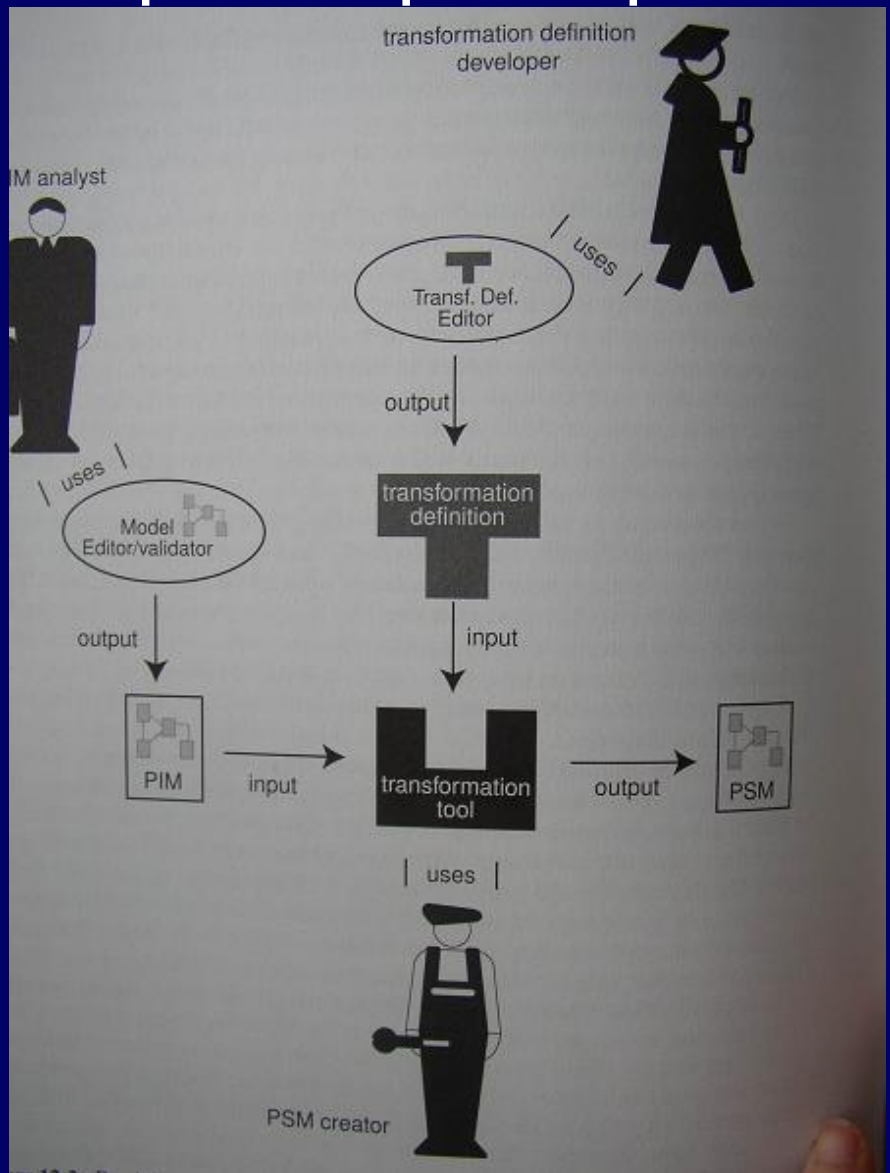
   requirement : knowledge of different platforms, system architectures and of transformation definitions

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