

# Model Driven System Development and UML

MDSD meeting at Aarhus University,  
December 13'th, 2002

by

Finn Overgaard Hansen  
Engineering College of Aarhus  
foh@e.iha.dk

Version: 12-12-2002

© Engineering College of Aarhus

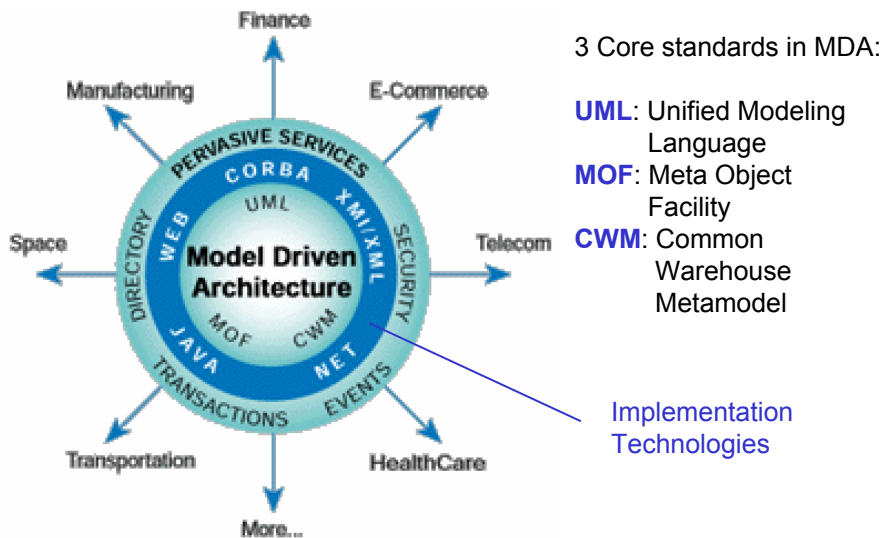


## Agenda

- OMG's Model Driven Architecture - MDA
- Commercial tools
  - BridgePoint
  - Rhapsody
  - Rational Rose Real-Time



## OMG's Model Driven Architecture (MDA)



Slide 3 of 25

© Engineering College of Aarhus



## MDA's PIM and PSM Models

- Models of different systems are structured explicitly into:
  - Platform Independent Models (**PIMs**)
    - A PIM is a formal specification of the structure and functions of a system that abstracts away technical details
  - Platform Specific Models (**PSMs**)
    - A PSM specifies the realization of the functionality in the PIM on a specific platform
- OMG standards are specified in terms of a PIM and, normally, one or more PSMs, all in UML

Slide 4 of 25

© Engineering College of Aarhus



## Example of PIM and PSM Models

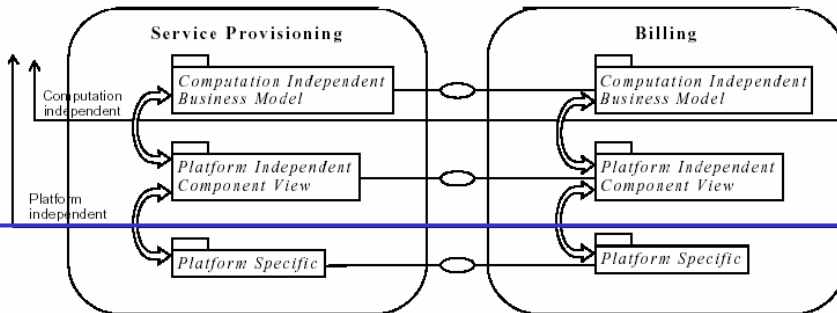


Figure 2. Consistent Model Separations and Relationships in MDA

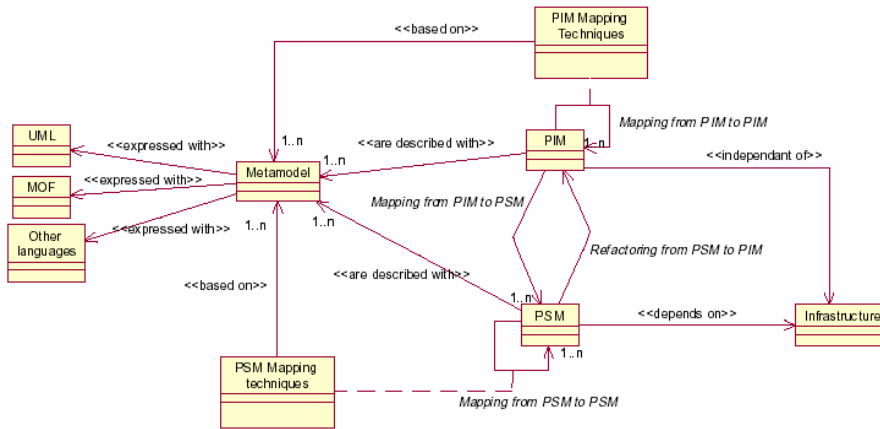


## Executable PIM Model

- The PIM can be complete and specific enough to enable **early execution and test** of the application
  - independent of design and implementation details
- Automation of an MDA approach provides the opportunity for:
  - a dramatic defect reduction
  - accelerated development
  - large scale reuse
  - easy platform migration of applications



# MDA Meta Model Description



Slide 7 of 25

© Engineering College of Aarhus



## Platform Specific Models in UML

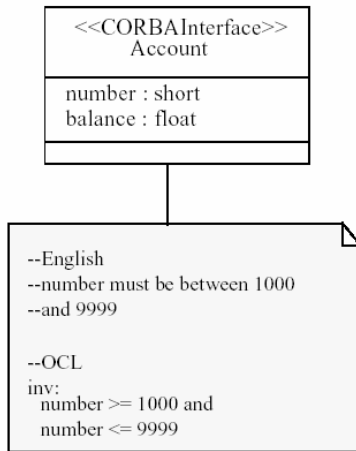
- Example: to transform a PIM into a CORBA PSM – certain decisions need to be made
- Such decisions can be defined by a UML profile:
  - a set of extensions to UML using the built-in extension facilities of UML (stereo types and tagged values)
  - UML Profile for CORBA – specifies how to use UML in a standard way to define CORBA IDL interfaces, structs, unions etc.

Slide 8 of 25

© Engineering College of Aarhus



## Example of a Semantically Enhanced CORBA Specification



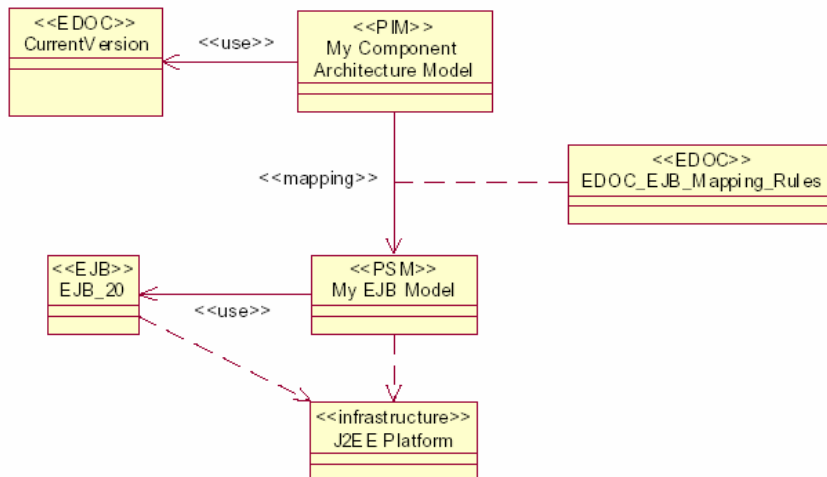
```

interface Account {
    attribute short number;
    attribute float balance;
};
  
```

Figure 7. IDL--By Nature Semantically Thin



## MDA Meta Model Example

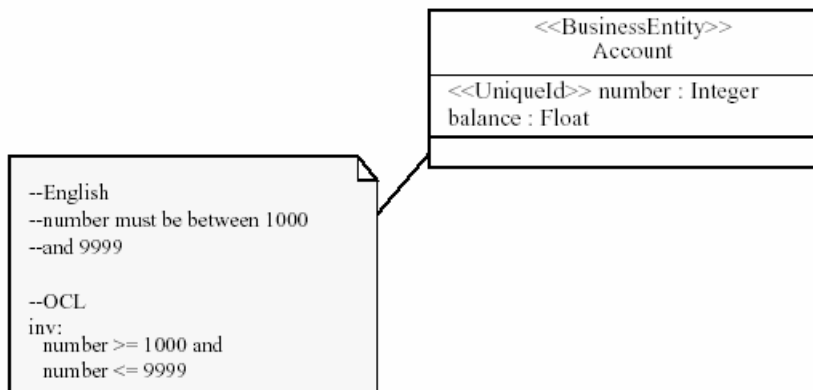


## Four ways to transform a PIM into a PSM

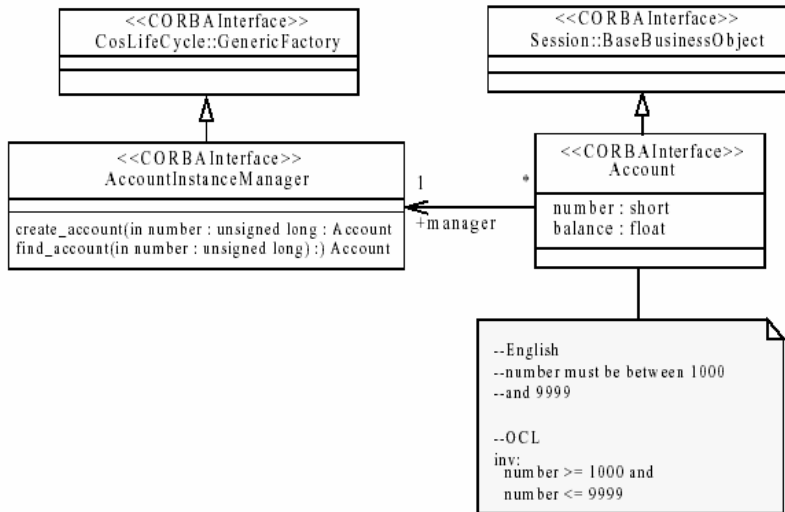
1. Manually construction of PSM based on the PIM
2. Manually construction of PSM with utilization of known refinement patterns
3. Semi automatically – an algorithm can create a PSM skeleton based on the PIM to be manually enhanced
4. Automatically – an algorithm can create a complete PSM



## Example: Platform Independent Model



## A CORBA-Specific UML Model (PSM)

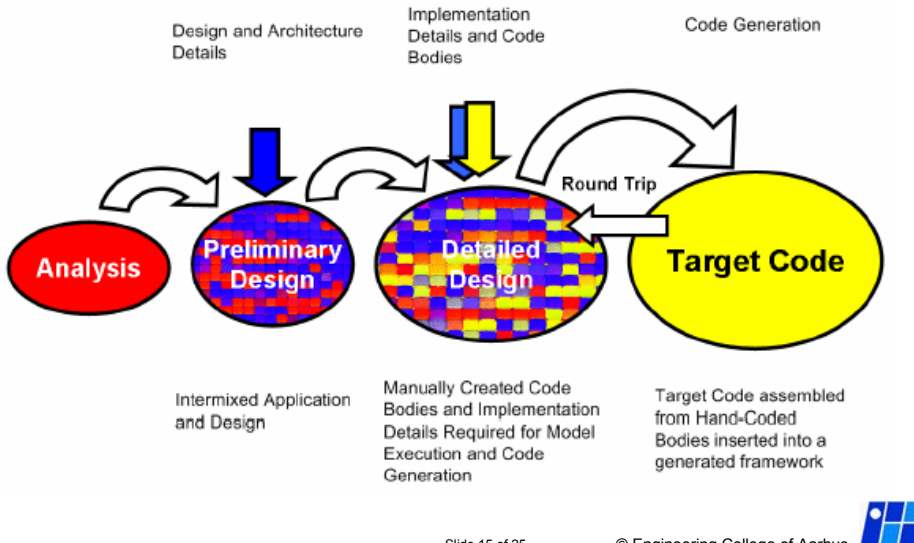


## Two Development approaches

- The Elaborative approach (the normal case)
- The Translational approach (e.g. the BridgePoint approach)



# Elaborative Development



Slide 15 of 25

© Engineering College of Aarhus

# BridgePoint Toolset

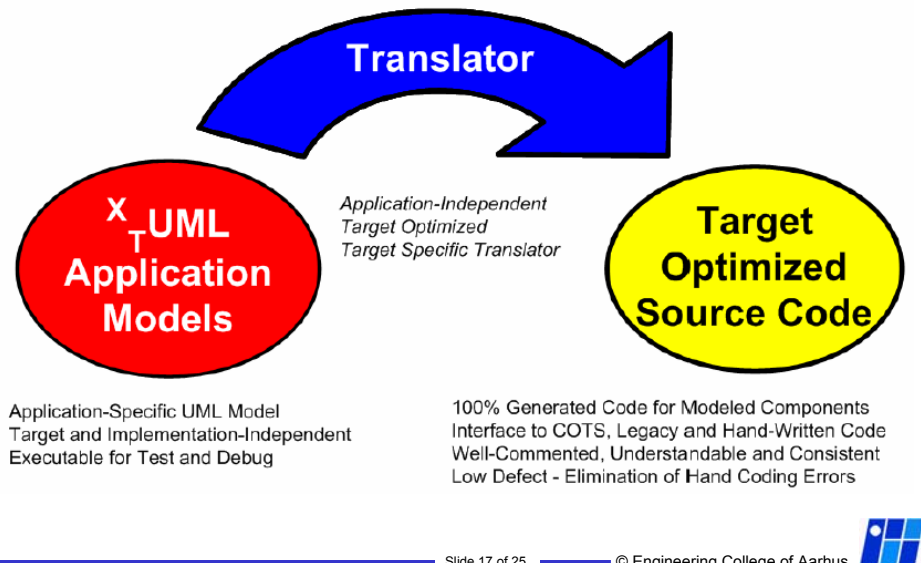
- Company: Project Technology provides the BridgePoint Toolset with the goal of:
  - “Accelerating Development of High-Performance Software with Model Driven Development Executable and Translatable UML (XT-UML)”
- Stephen Mellor (founder of Project Technology)
  - chairs the OMG Analysis and Design Task Force Working Group on MDA
  - a key group contributing to the detailed definitions of MDA elements
  - Stephen Mellor also chaired the consortium that defined OMG’s UML Action Semantic, which made the UML executable

Slide 16 of 25

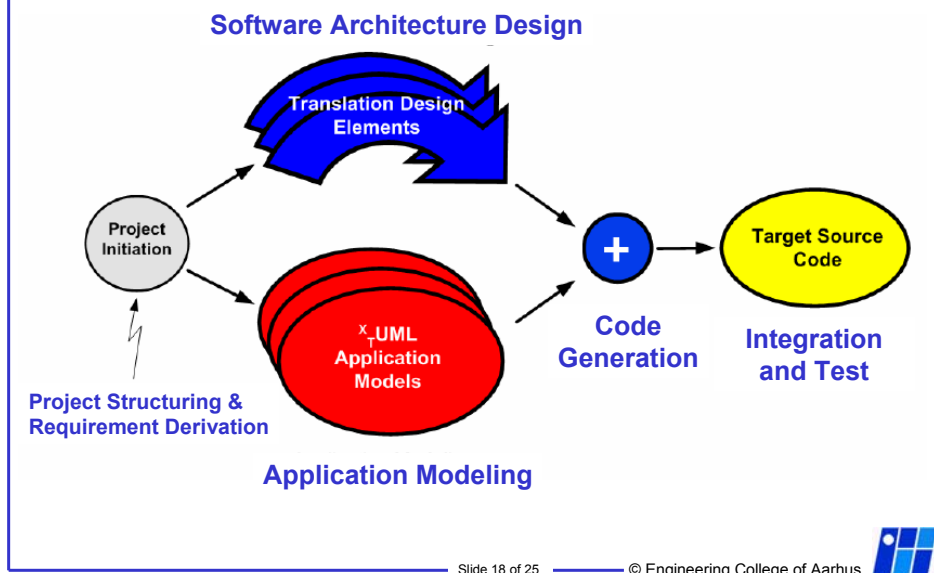
© Engineering College of Aarhus



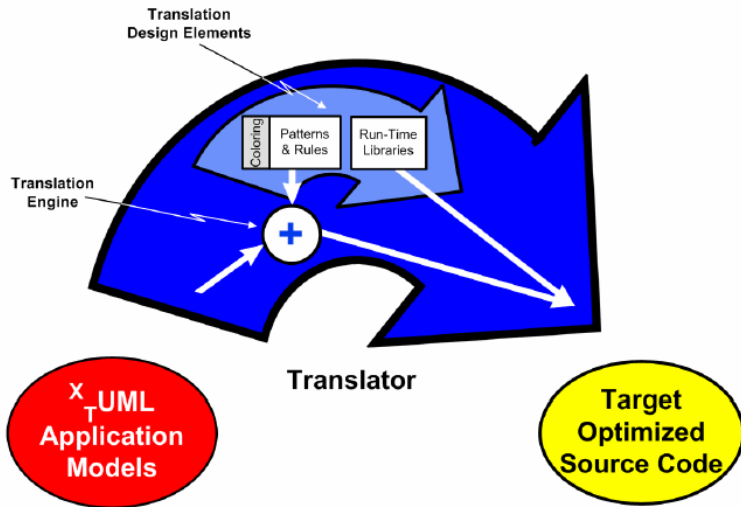
# Executable and Translatable UML



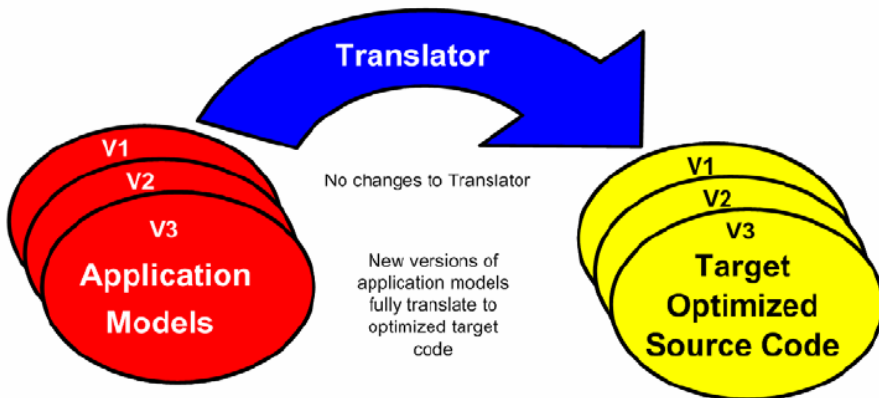
# The XT-UML Development Process



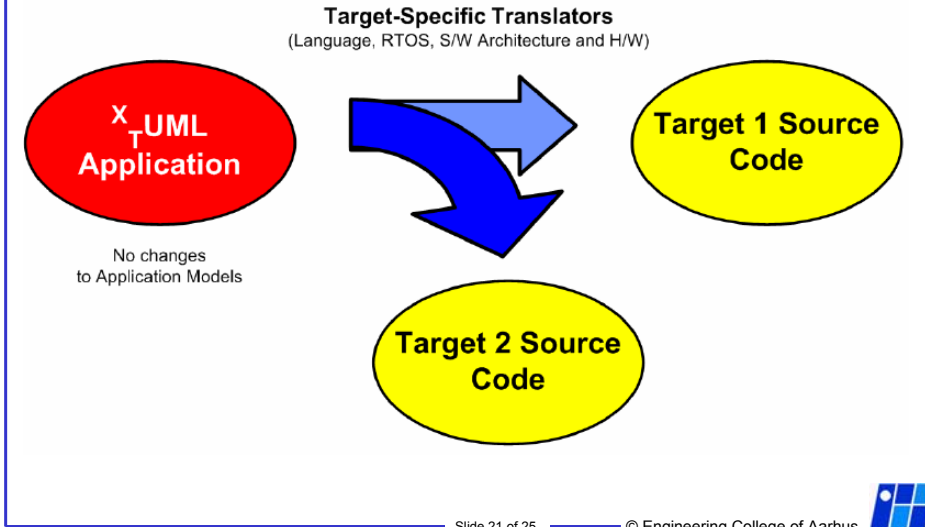
# XT-UML Translator



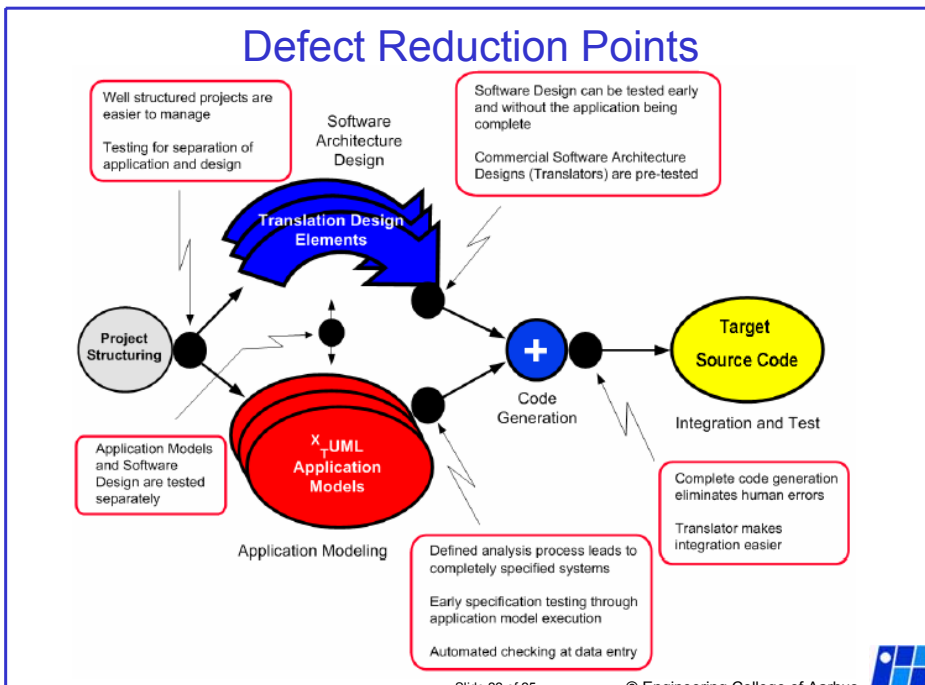
# XT-UML Iterative Application Development



# Target Migration



# Defect Reduction Points



## Rhapsody

- Company: Ilogix
  - David Harel (inventor of UML's State Chart)
  - Bruce Powel Douglass (author of several books)
- Rhapsody features:
  - Model based code generation i C, C++ and Java
  - Model based simulation
    - object browser with attribute information
    - state change in state machines
    - automatic generation of sequence diagrams when running the program
  - Integrated Real-Time OS framework
    - ported to many commercial OS
- Proprietary extensions to UML



## Rational-Rose Real Time

- Company: Rational Software Cooperation (now bought by IBM)
  - Booch, Rumbaugh, Ivar Jacobson
  - Bran Selic
- Rational-Rose Real Time is a specific product
  - a lot different from standard Rose
  - based on the ROOM Methodology – Bran Selic etc.
  - executable models based on a port-based abstraction



# References

- Object Management Group (OMG)
  - “Model Driven Architecture (MDA)”, an OMG standard (ormsc/2001-07-01)
  - [www.omg.org](http://www.omg.org)
- Project Technology – BridgePoint toolset
  - Paper: “Executable and translatable UML  $X_T$ UML”
  - [www.projtech.com/](http://www.projtech.com/)
- Rhapsody
  - [www.llogix.com](http://www.llogix.com)
- Rational Rose Real-time
  - [www.rational.com](http://www.rational.com)

