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Mario Jeckle

XMI - Case-Tool unabhängiges Modellieren - Wunschtraum oder bald Realität

XCC Software Architecture Days
11. Juni 1999
Kloster Eberbach / Wiesbaden

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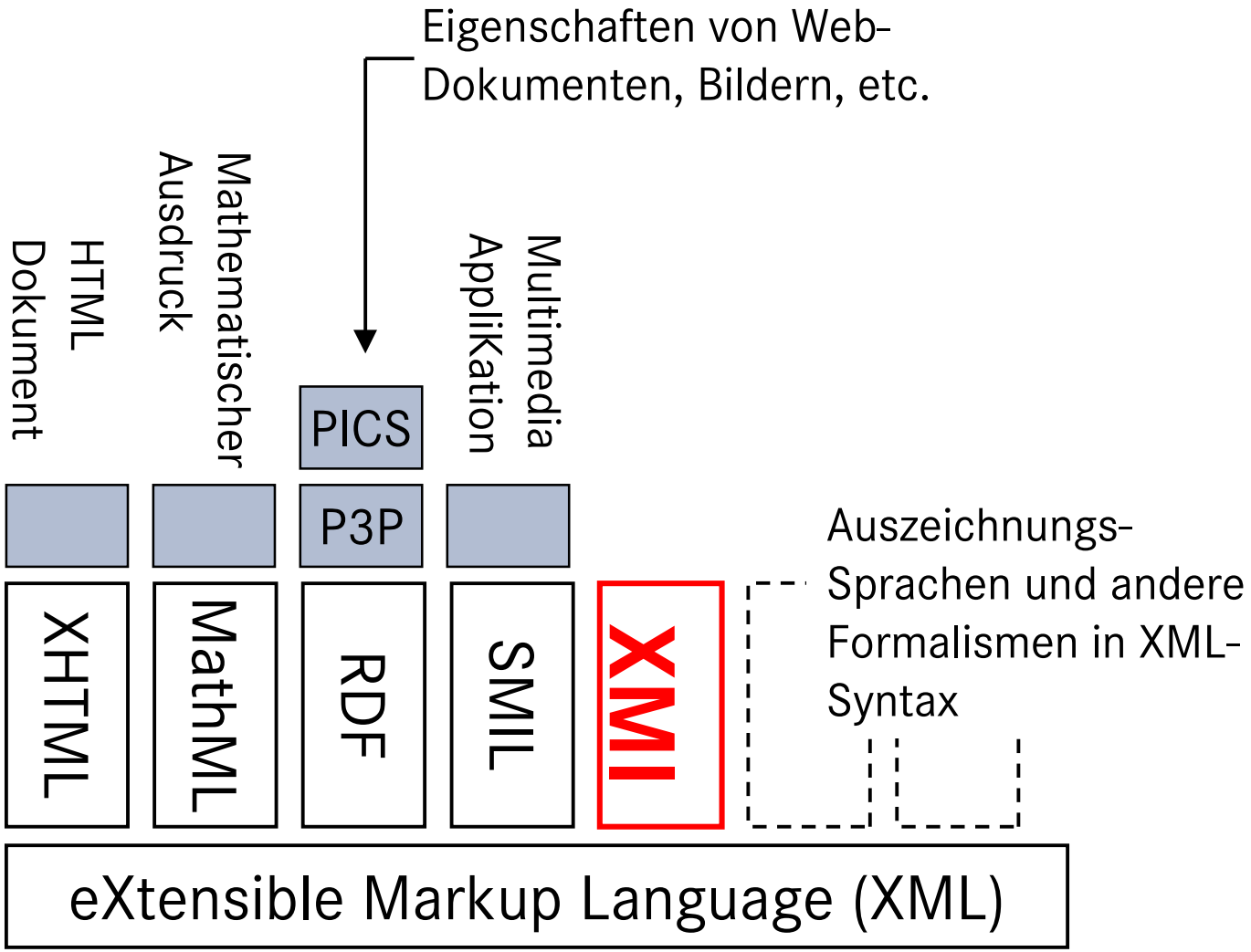
XMI within the family of XML languages



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TOC

Motivation

Heterogenität als Herausforderung

Lösungsansatz: Stream-based Model Interchange

Ziele von SMIF

Object Management Architecture

OMG's four layer Metamodel Architecture

Beispiele

CASE-Tool unabhängiges Modellieren?

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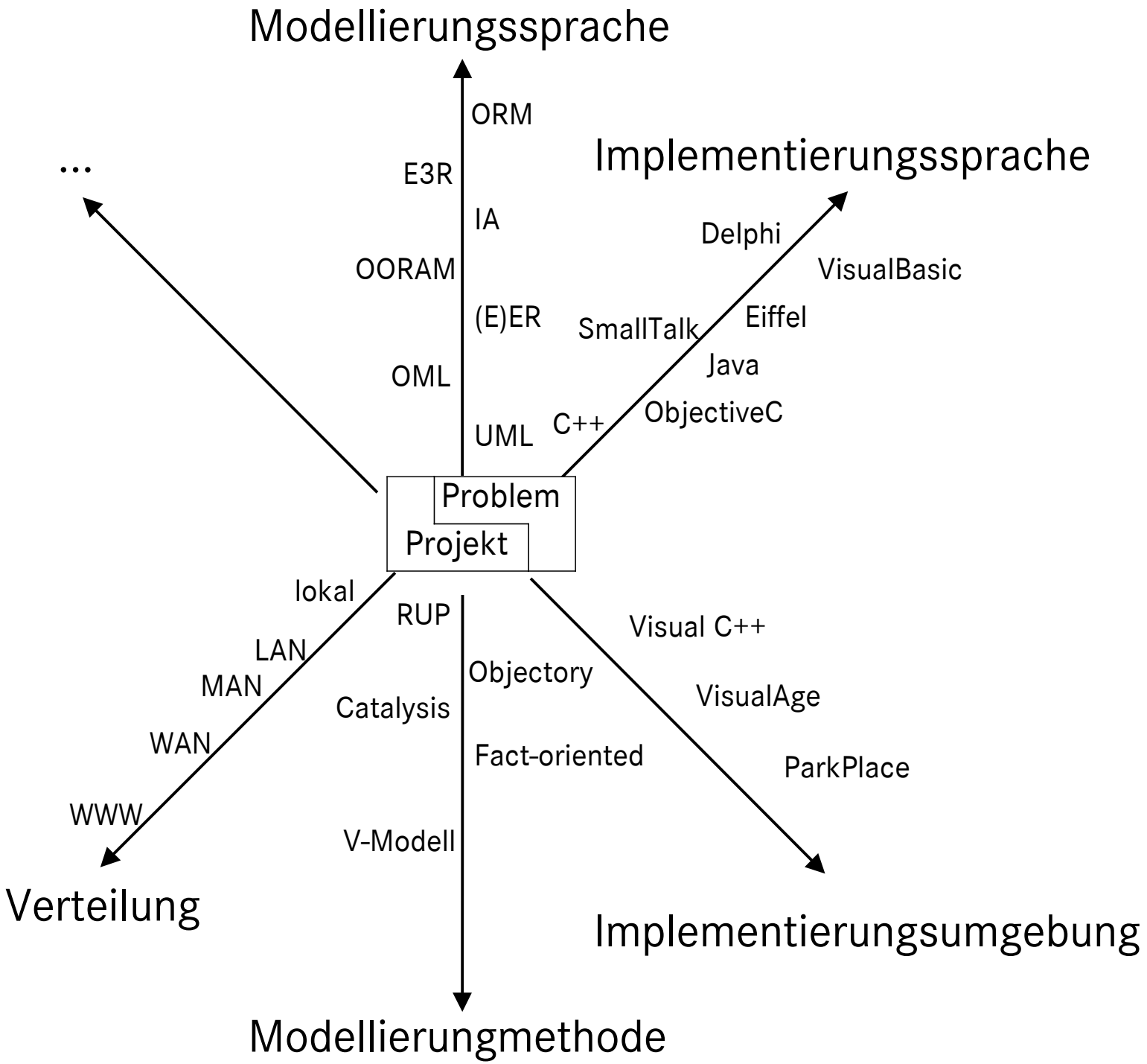
Challenged by Heterogeneity



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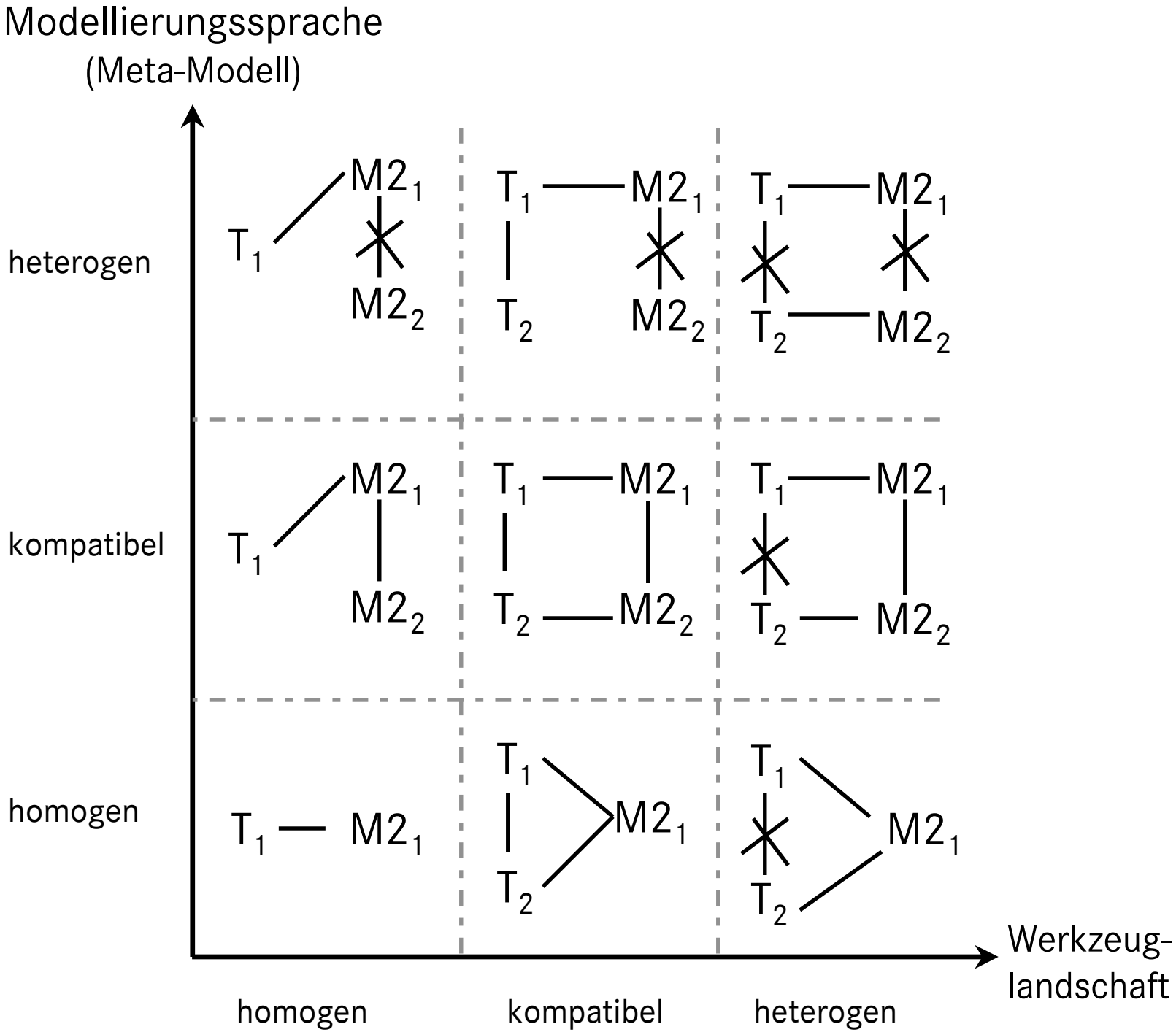
Conjunction of different modeling languages (meta models) and modeling tools



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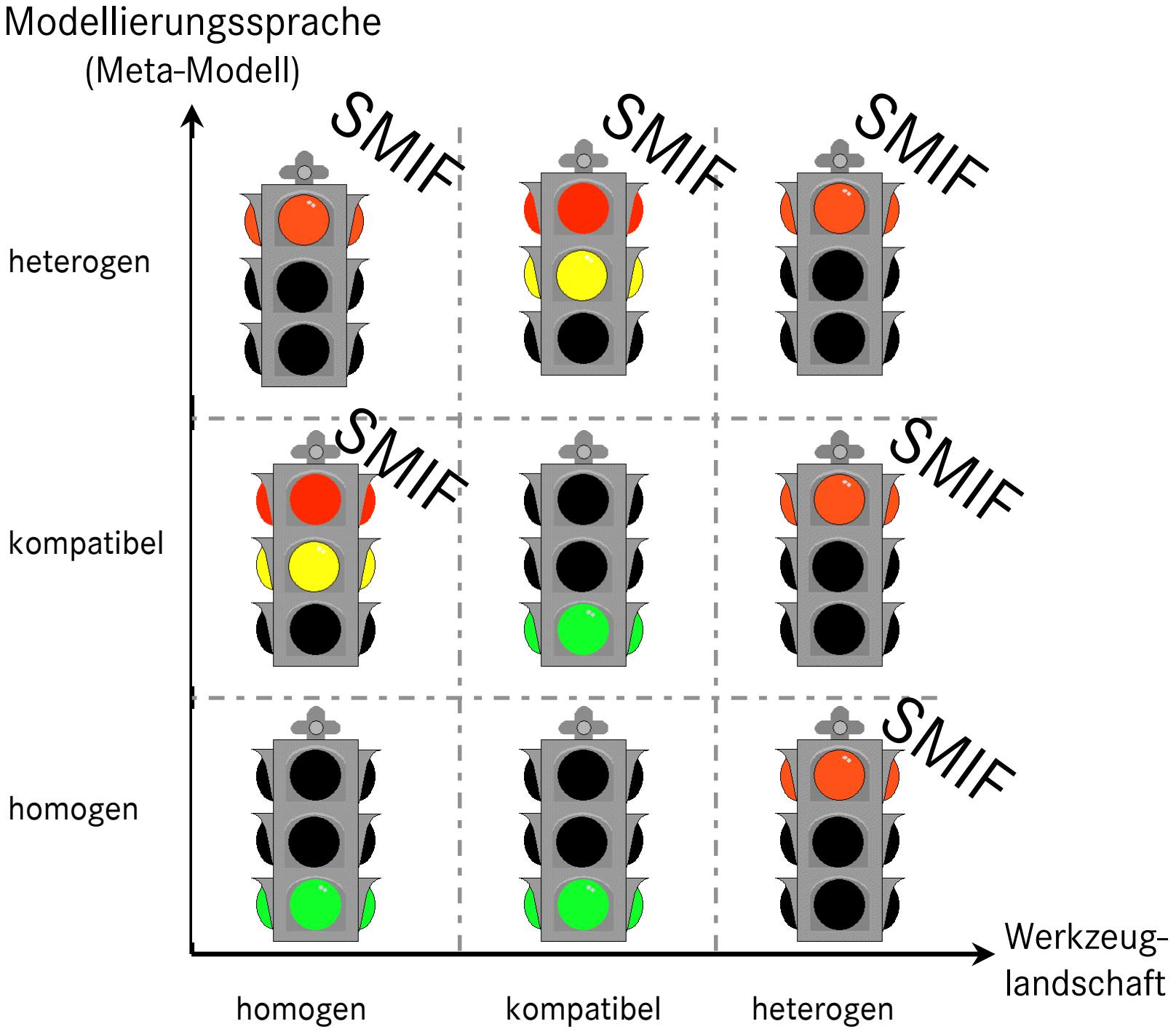
Assessing the interaction scenarios



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SMIF RFP

Addressed subject Areas

Ziele

- Herstellerunabhängiges Transferformat
- Instriestandard-Formatfestlegung
- generisches Format
- Modellaustausch
  - MOF-basierter Modelle
    - UML
    - Work-Flow Management Facility
    - Business Objects Facility

Lösung für

- Transferspezifikation
  - MOF basierter Modelle
  - CDIF codierter Modelle
  - STEP/EXPRESS Modelle
- Metamodell-Versionierung

Umsetzung:

- Web-Technologien (W3-Standards)
  - XML liefert Syntax und Encoding Standard
- MOF liefert Metadaten Definition

XMI ist eine Sprache der XML-Familie

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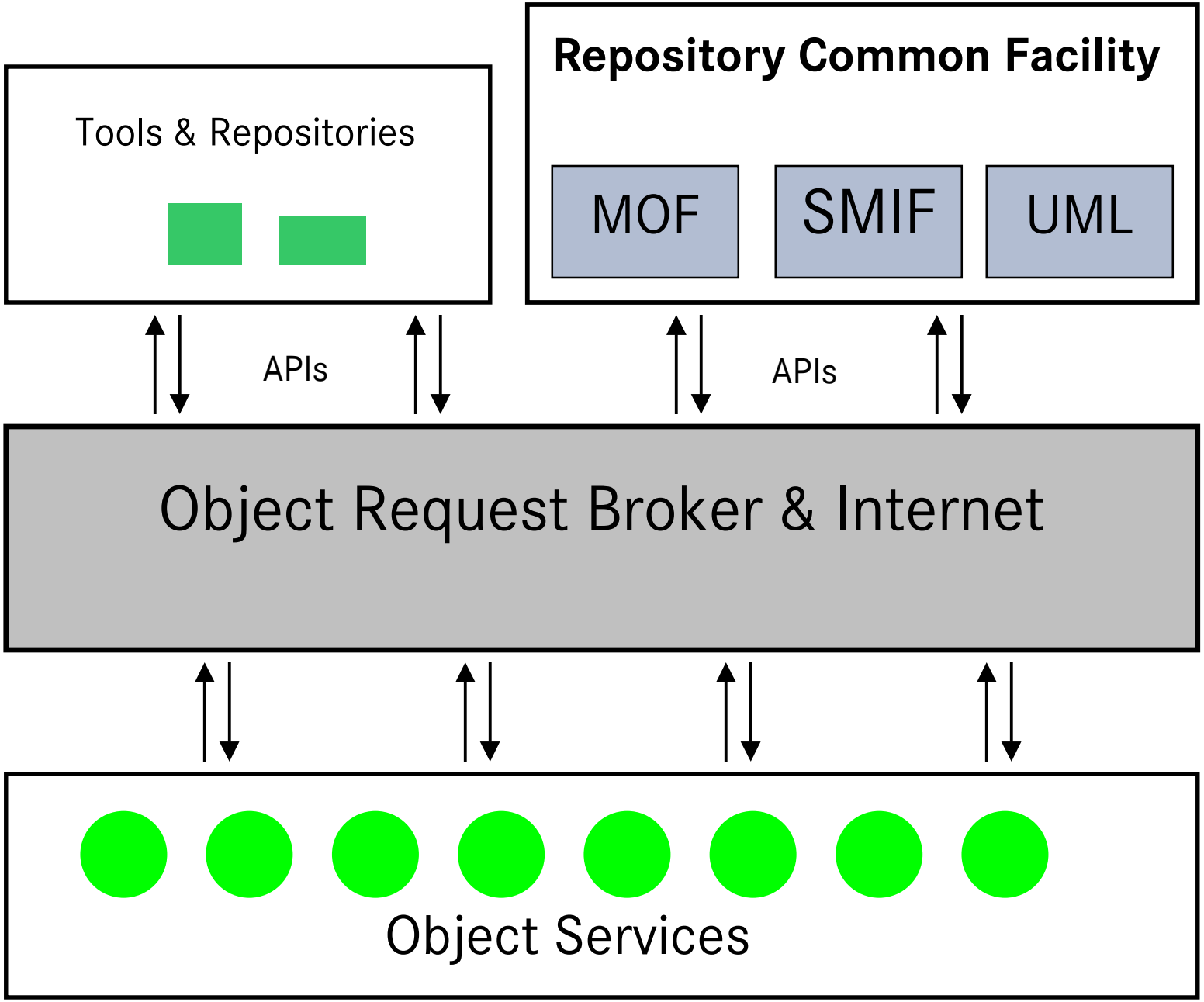
OMG's Stream-based Model Interchange (SMIF)

The Object Management Architecture (OMA)



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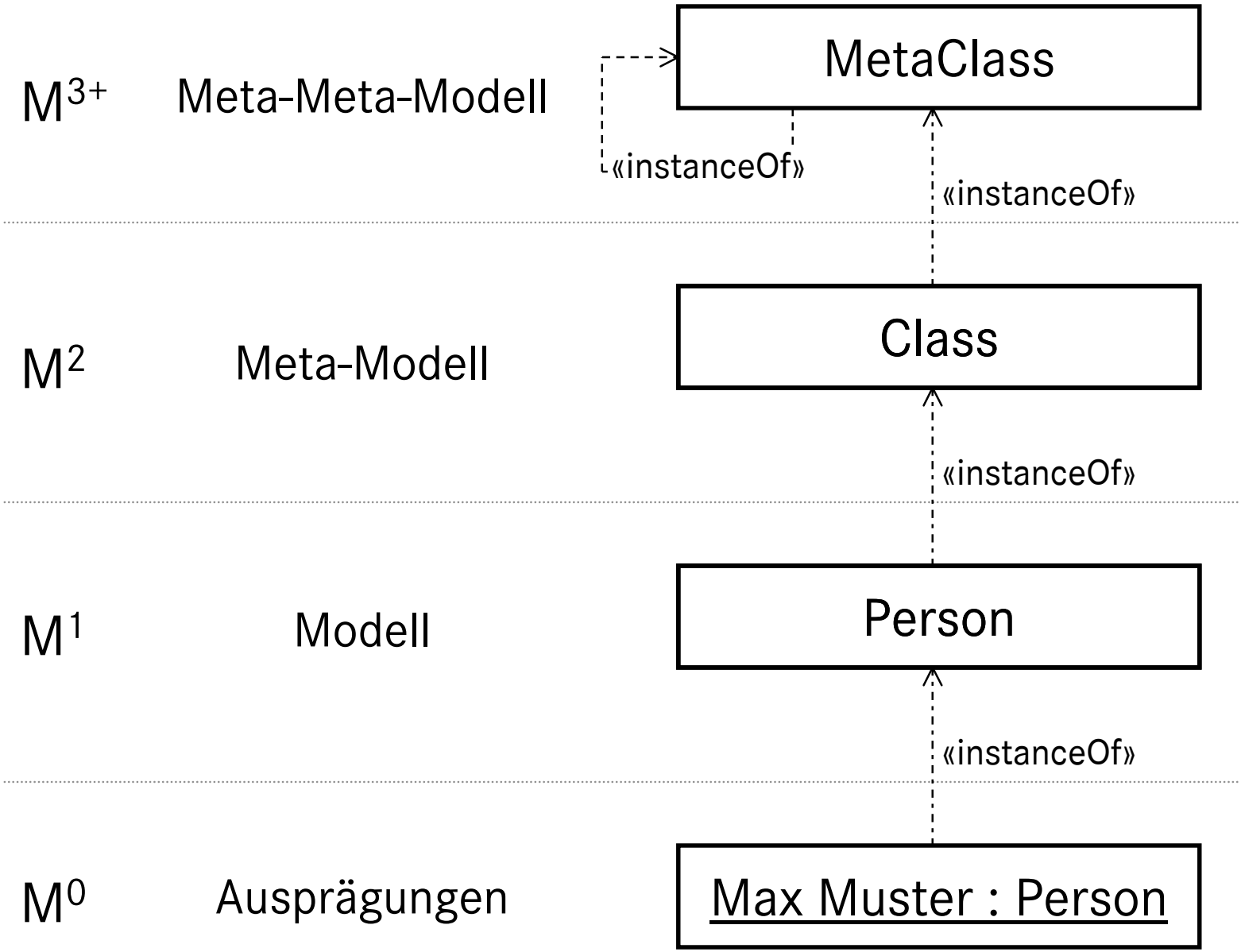
Four layer Metamodel Architecture



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XMI within the four layer Metamodel Architecture

M^{3+}	Meta Object Facilities Meta Meta Model	MOF as XML DTD	
M^{2}	UML & other Meta Models	UML & others as XML DTDs	MOF MetaModels as XML Documents
M^{1}	Model		UML & other Models as XML Documents
M^{0}	Instances		

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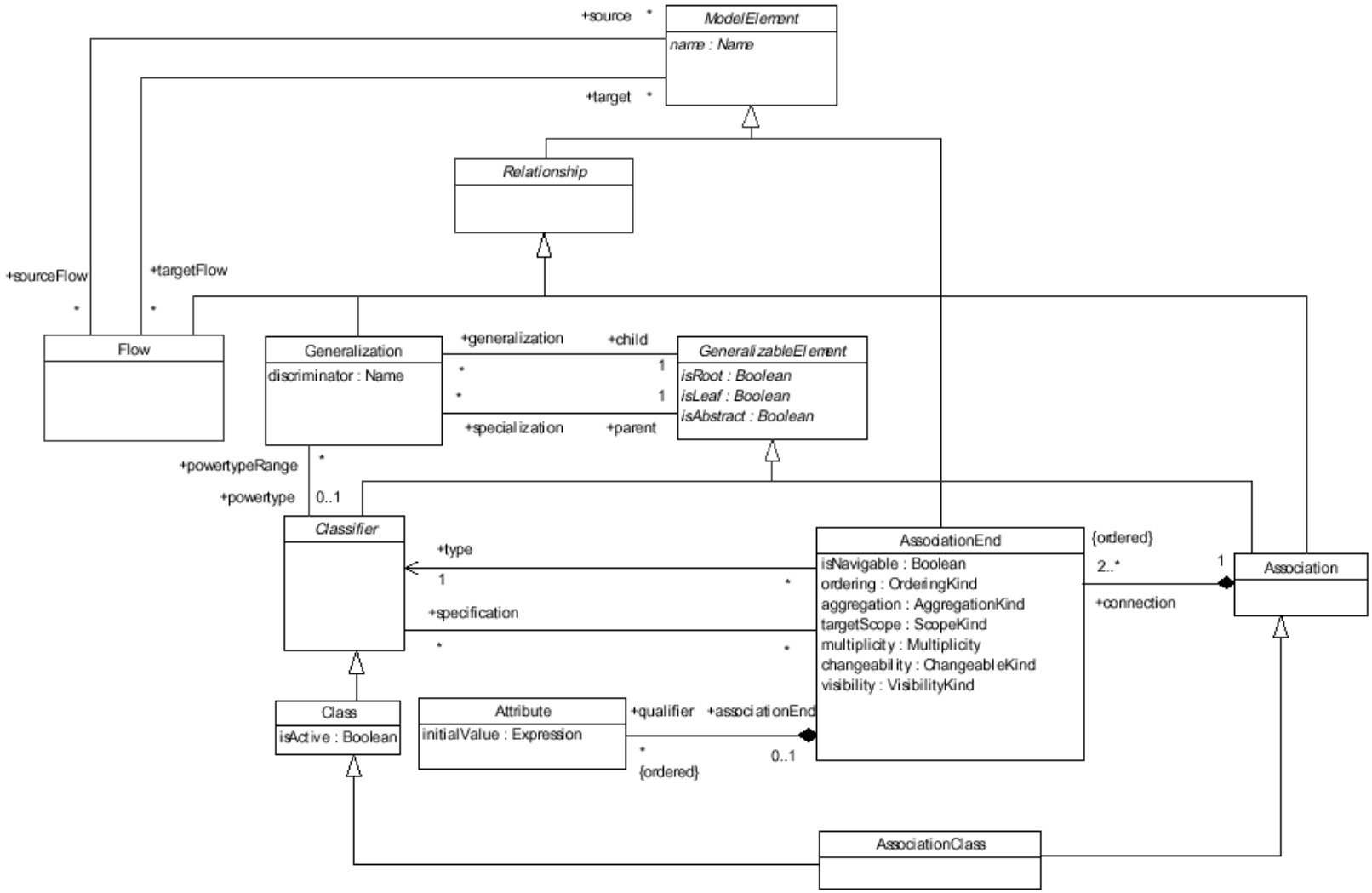
The UML Metamodel

(Core-Package Relationships)



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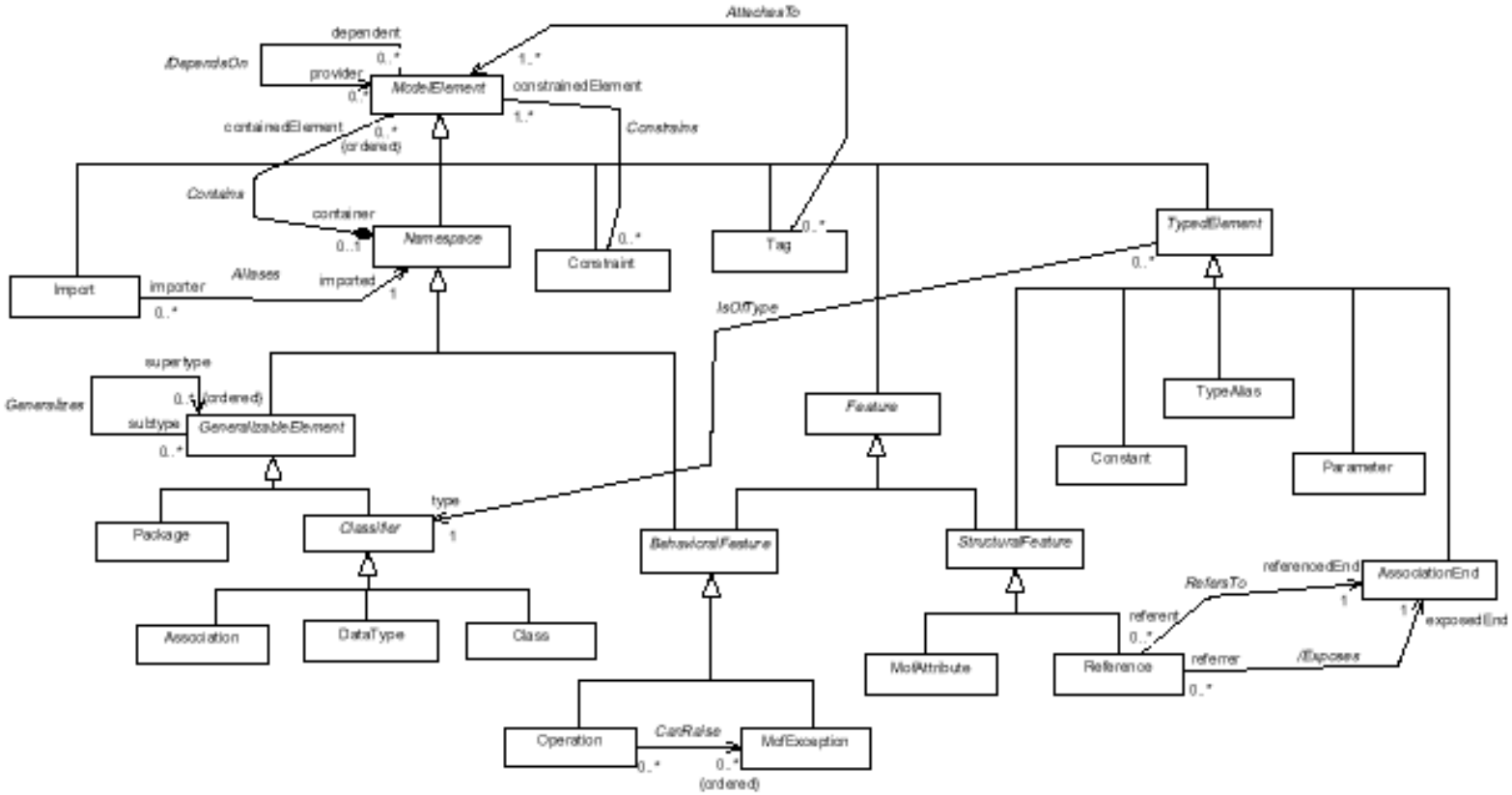
Meta Object Facilities

(Model Package)



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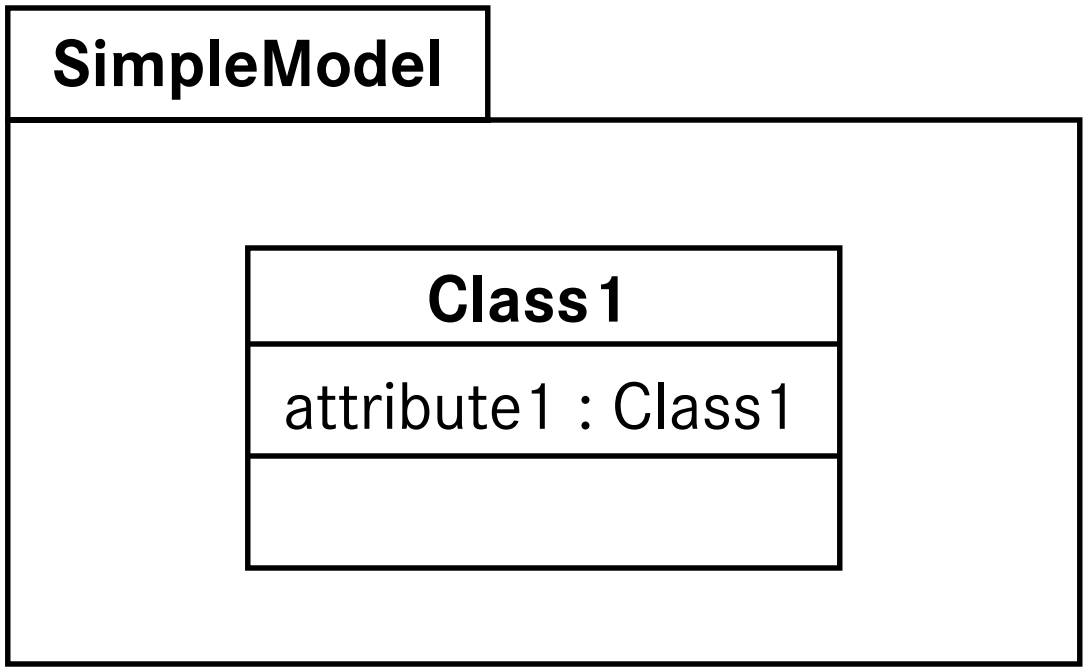
XML Metadata Interchange by Example

(UML Model)



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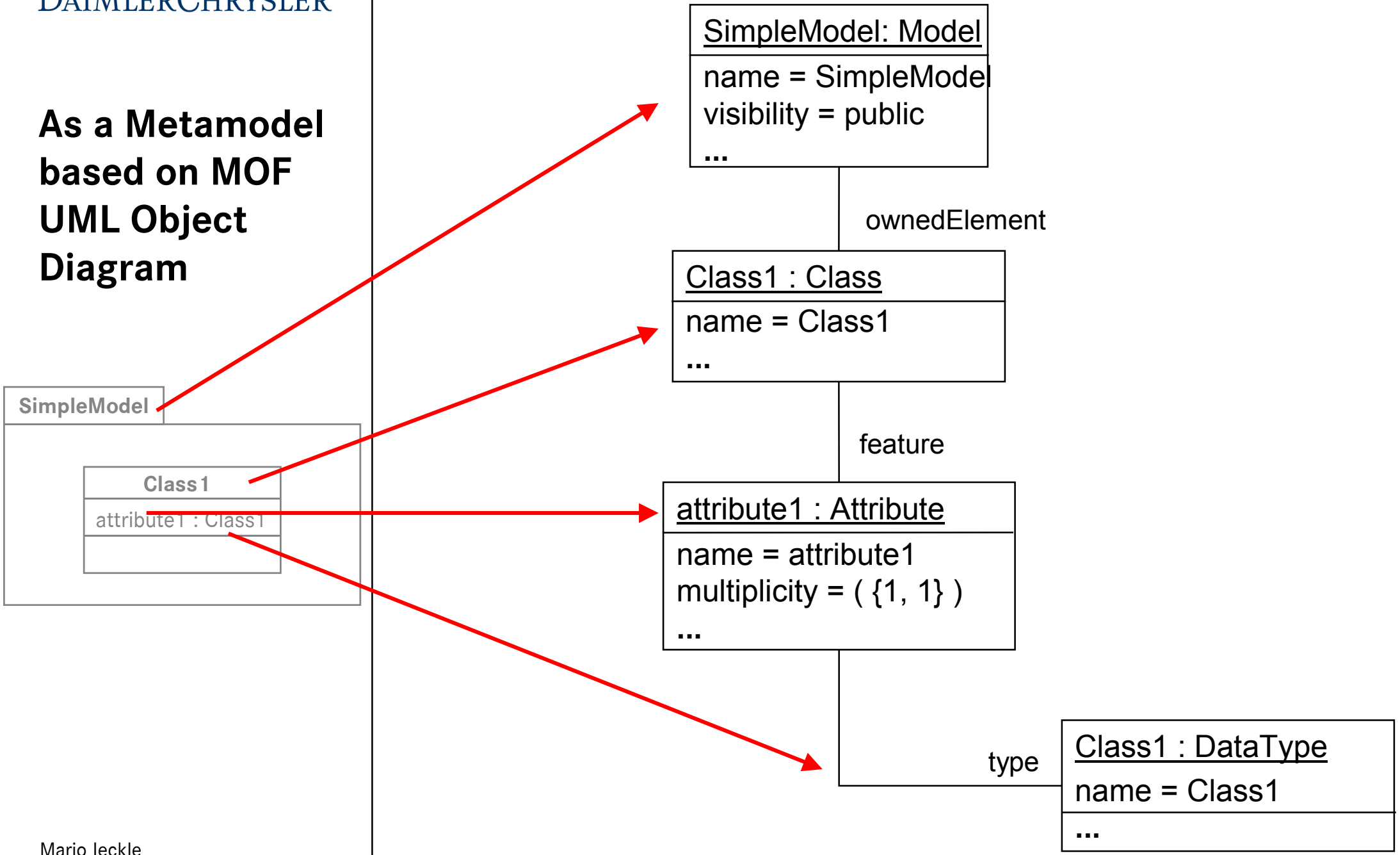
As a Metamodel based on MOF UML Object Diagram



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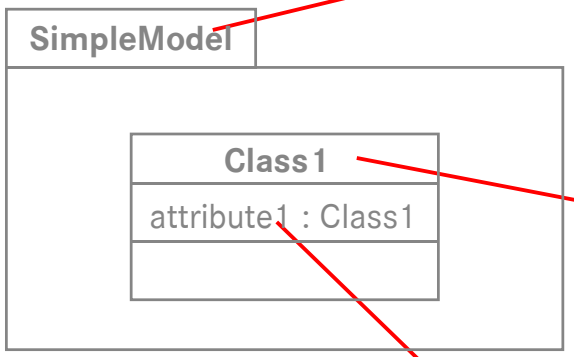
XML Metadata Interchange by Example

(XMI Code Part I)

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<?xml version = "1.0"?>
<!DOCTYPE XMI SYSTEM "uml.dtd">
<XMI xmi.version="1.0">
  <XMI.header>
    <XMI.metamodel xmi.name="uml" xmi.version="1.1"/>
  </XMI.header>
  <XMI.content>
    <Model_Management.Model xmi.id="i00000001">
      <Foundation.Core.ModelElement.name>
        SimpleModel
      </Foundation.Core.ModelElement.name>
      <Foundation.Core.ModelElement.visibility xmi.value="public"/>
      <Foundation.Core.GeneralizableElement.isRoot xmi.value="true"/>
      <Foundation.Core.GeneralizableElement.isLeaf xmi.value="true"/>
      <Foundation.Core.GeneralizableElement.isAbstract xmi.value="false"/>
      <Foundation.Core.Namespace.ownedElement>
        <Foundation.Core.Class xmi.id="i00000002">
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            class1
          </Foundation.Core.ModelElement.name>
          <Foundation.Core.ModelElement.visibility xmi.value="public"/>
          <Foundation.Core.GeneralizableElement.isRoot xmi.value="true"/>
          <Foundation.Core.GeneralizableElement.isLeaf xmi.value="true"/>
          <Foundation.Core.GeneralizableElement.isAbstract xmi.value="false"/>
          <Foundation.Core.Class.isActive xmi.value="true"/>
          <Foundation.Core.Classifier.feature>
            <Foundation.Core.Attribute xmi.id="i00000003">
              <Foundation.Core.ModelElement.name>
                attribute1
              </Foundation.Core.ModelElement.name>
```

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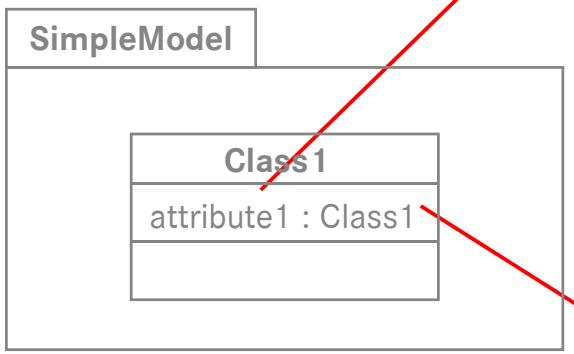
XML Metadata Interchange by Example

(XMI Code Part II)

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<Foundation.Core.ModelElement.visibility xmi.value="public"/>
<Foundation.Core.Feature.ownerScope xmi.value="instance"/>
<Foundation.Core.StructuralFeature.multiplicity>
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</Foundation.Core.StructuralFeature.multiplicity>
<Foundation.Core.StructuralFeature.changeable xmi.value="none"/>
<Foundation.Core.StructuralFeature.targetScope xmi.value="instance"/>
<Foundation.Core.Attribute.initialValue>
  <Foundation.Data_Types.Expression>
    <Foundation.Data_Types.Expression.language>
    </Foundation.Data_Types.Expression.language>
    <Foundation.Data_Types.Expression.body>
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    </Foundation.Data_Types.Expression.body>
  </Foundation.Data_Types.Expression>
</Foundation.Core.Attribute.initialValue>
<Foundation.Core.StructuralFeature.type>
  <Foundation.Core.DataType xmi.idref = "i00000004"/>
</Foundation.Core.StructuralFeature.type>
</Foundation.Core.Attribute>
</Foundation.Core.Classifier.feature>
</Foundation.Core.Class>
<Foundation.Core.DataType xmi.id="i00000004">
  <Foundation.Core.ModelElement.name>
    Class1
  </Foundation.Core.ModelElement.name>
  <Foundation.Core.ModelElement.visibility xmi.value="public"/>
  <Foundation.Core.GeneralizableElement.isRoot xmi.value="true"/>
  <Foundation.Core.GeneralizableElement.isLeaf xmi.value="true"/>
  <Foundation.Core.GeneralizableElement.isAbstract xmi.value="false"/>
</Foundation.Core.DataType>
</Foundation.Core.Namespace.ownedElement>
</Model_Management.Model>
</XMI.content>
</XMI>
```

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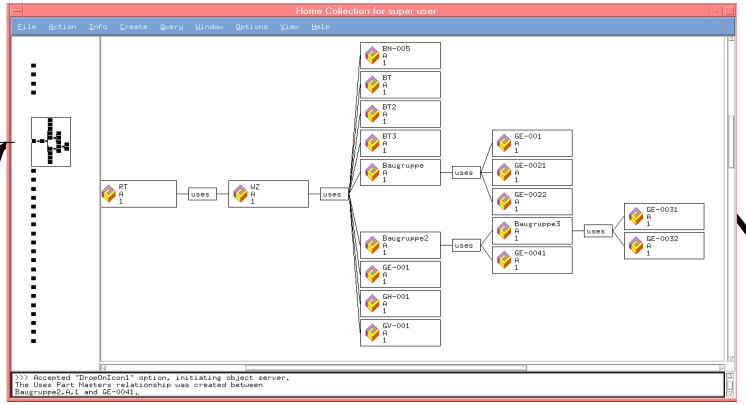
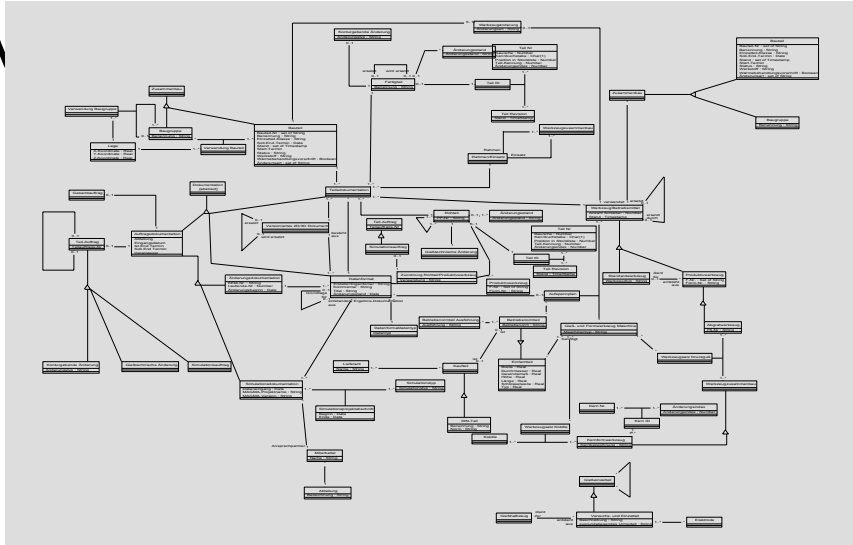
Example: An industry project applying the OMG standards UML and XMI



Visual Round-Trip Customizing



Problemstellung:

- Forward-Engineering:
  automatische Generierung von Customizingcode für Standardsystem
- Reverse-Engineering:
  Wiedergewinnung bestehender Customizinganteile

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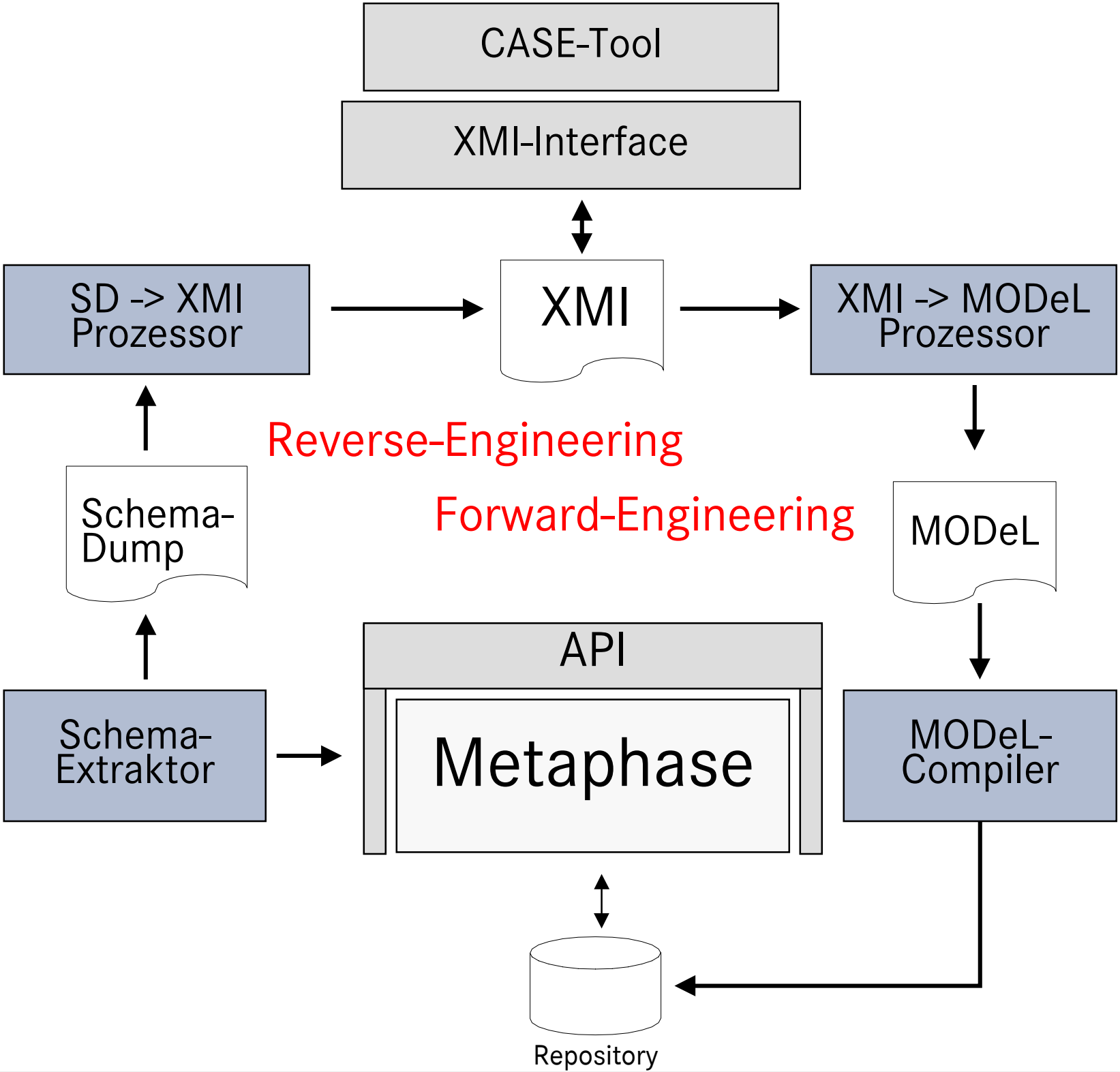
Architecture of the proposed solution



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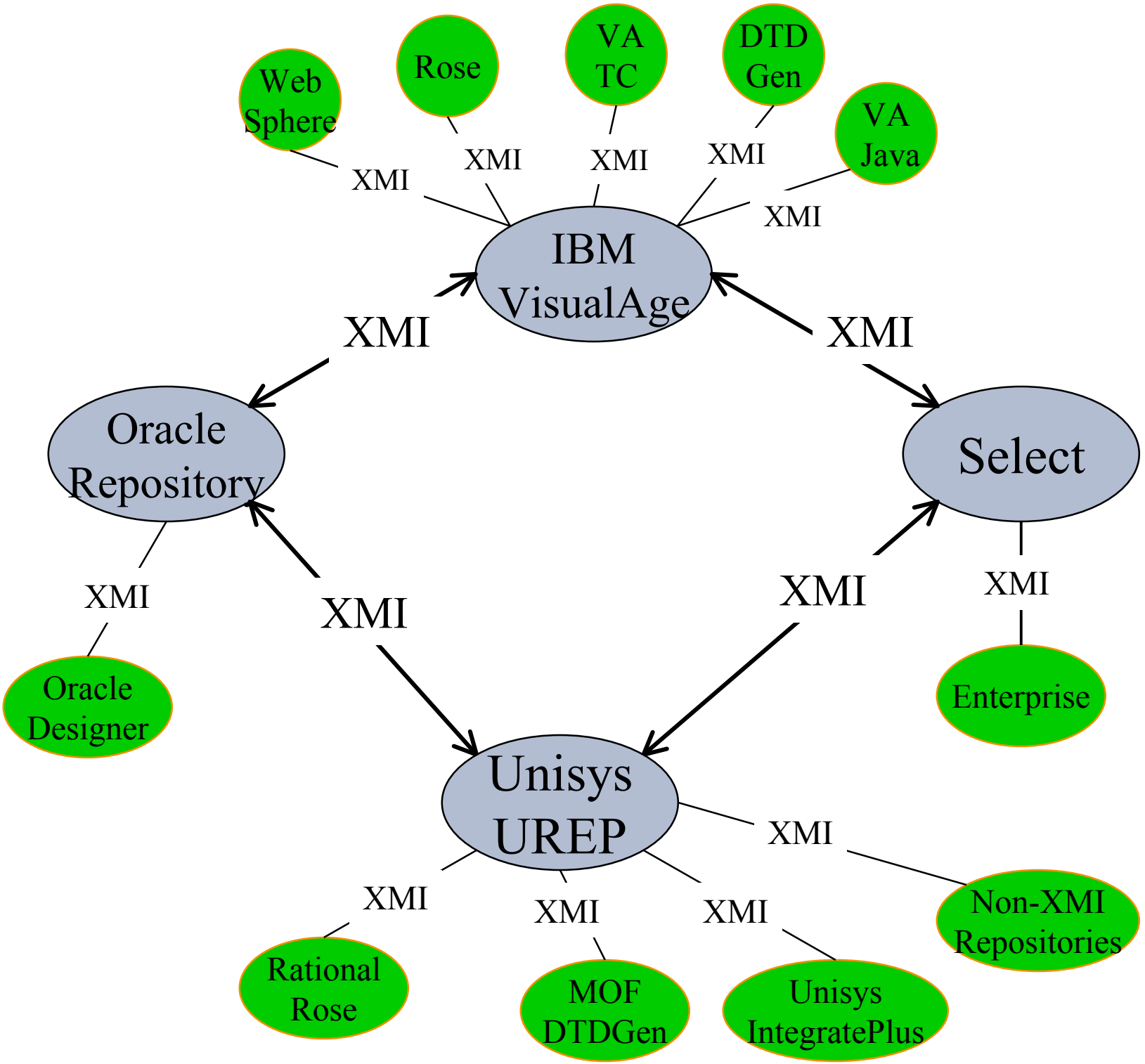
XMI demo and proof of concept

(in cooperation with XMI partners)



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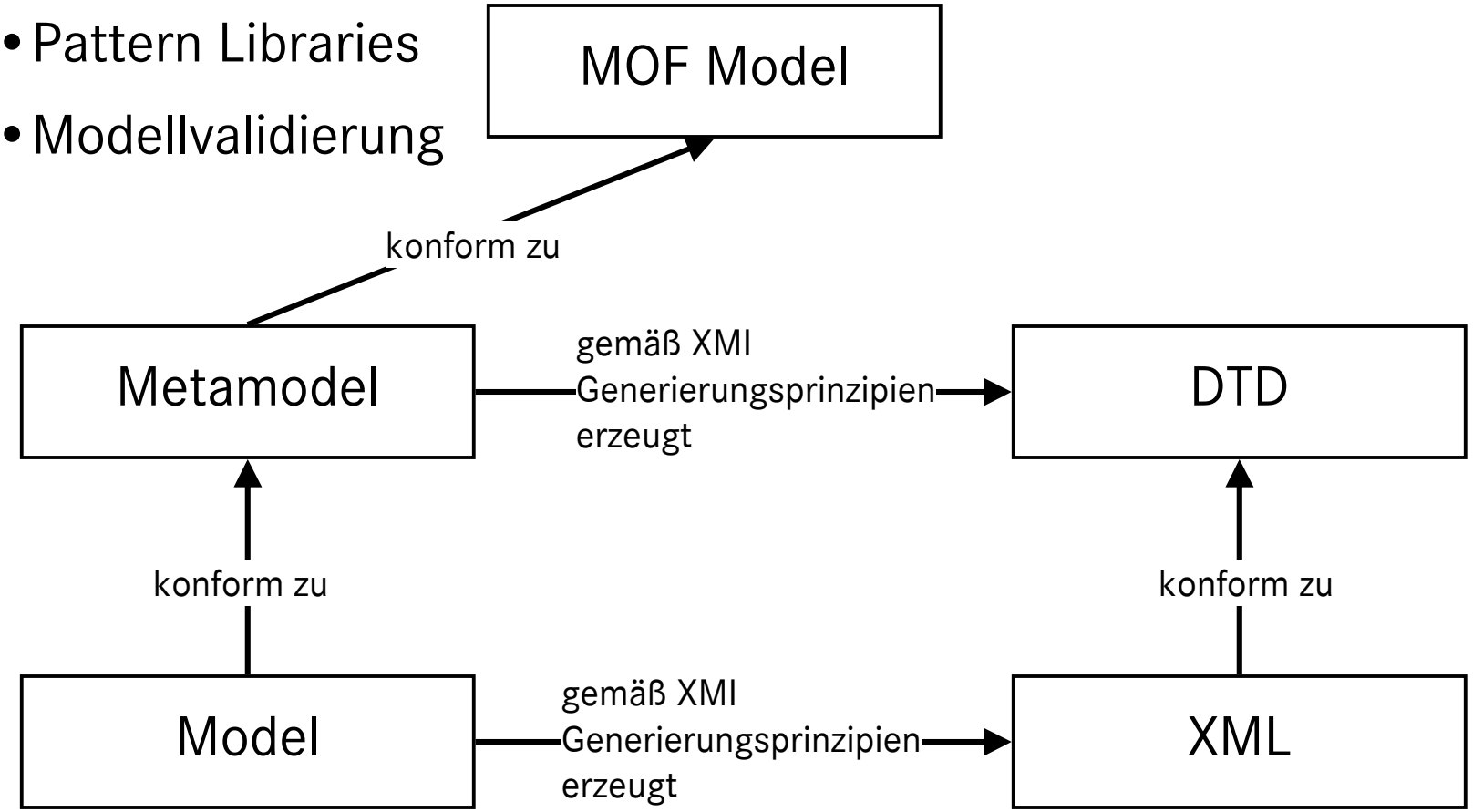
Usage Scenarios

XMI ist CASE-Tool unabhängiges Modellieren, aber auch...

- Einsatz als Modellaustauschformat
- Eindeutige textuelle Beschreibung von (Meta-)Modellen
- Toolunabhängige Code-Generierung
- Metriken
- Pattern Libraries
- Modellvalidierung



Results and Evaluation

+ Breite Industrieunterstützung

Unisys
IBM
DSTC
Oracle
Platinum Technology
Fujitsu
Softeam
Recerca Informatica
DaimlerChrysler

Cayenne Software
Genesis Development
Inline Software
Rational Software
Select Software
Sprint Communications
Sybase
Xerox
MCI Systemhouse
Boeing
Ardent
Aviatis
ICONIX
Integrated Systems
Verilog
Telefonica I+D
Universitat Politecnica de Catalunya
NCR
Nihon
NTT

Results and Evaluation

+ Breite Industrieunterstützung

+ Web-Technologie (W3-Standardfamilie)

+ Weiterführende Ansätze:
    Delta-Interchange
    Metamodellversionierung

Results and Evaluation

+ Breite Industrieunterstützung

+ Web-Technologie (W3-Standardfamilie)

+ Weiterführende Ansätze:

  Delta-Interchange

  Metamodellversionierung

+ Gute Skalierbarkeit

$$D_s + D_d + n * C_s + \sum_{i=1}^{n} (C_d + m_i * A_s + \sum_{j=1}^{m_i} A_d) \ldots$$

D_s	statischer Anteil Dokument
D_d	dynamischer Anteil Dokument
n	Anzahl Klassen
C_s	statischer Anteil Klasse
C_d	dynamischer Anteil Klasse
m	Anzahl Attribute pro Klasse
A_s	statischer Anteil Attribut
A_d	dynamischer Anteil Attribut

Results and Evaluation

+ Breite Industrieunterstützung

+ Web-Technologie (W3-Standardfamilie)

+ Weiterführende Ansätze:
  - Delta-Interchange
  - Metamodellversionierung

+ Gute Skalierbarkeit

- fehlende Human-readability (eigener RFP)

- Größe des XMI-Streams

References

Meta Object Facility (MOF): OMG Document ad/97-08-14

Bruce McLean: *Evaluation Report OMG OA&DTF RFP3 Stream-based Model Interchange Format (SMIF),* OMG A&D-TF

Revised Joint-Submission:

XMI Partners: *XML Metadata Interchange,* OMG-Dokument ad/98-10-05

WWW:

- http://www.software.ibm.com/ad/features/xmi.html
- http://www.omg.org
- http://www.krumbach.de/home/jeckle