

15.–18.09.2008
in Nürnberg



Wissenstransfer
par excellence

Babylonische Zustände

Domain Specific Languages – Status quo

Arif Chughtai

IT-Consultant

mail@arifchughtai.org, www.arifchughtai.org

Agenda



- Motivation
- Concepts
- Characteristics
- Status Quo (DSLs, Products & Standards)
- Open Architecture Ware (oAW)
- Demo
- Resources

Motivation: DSL-Finding

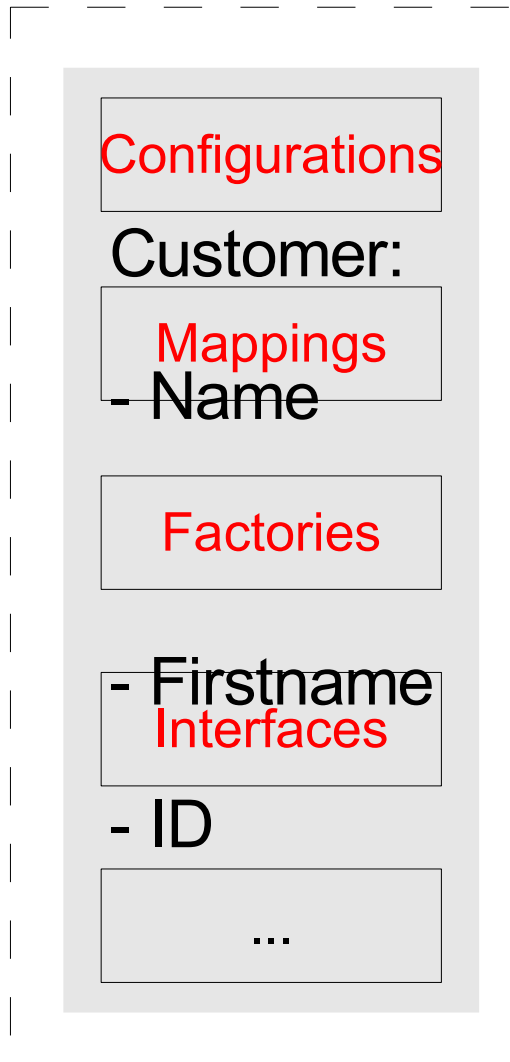


- *"Schusterjungen/Hurenkinder"*
- Which domain?
- http://de.wikipedia.org/wiki/Hurenkind_und_Schusterjunge

Motivation



Domain PLUS Infrastructure



Domain

Customer:
1. Name,
2. Firstname,
3. ID

Customer
- name
- firstName
- id

Customer
Name
Firstname
ID

Motivation



- Domain Driven Design (DDD) is upcoming
- Demands
 - Move software-development closer to domain/business
 - Separate domain aspects from technical ones
- Enhancement of technology enable utilization of well known concepts like DSLs

Motivation

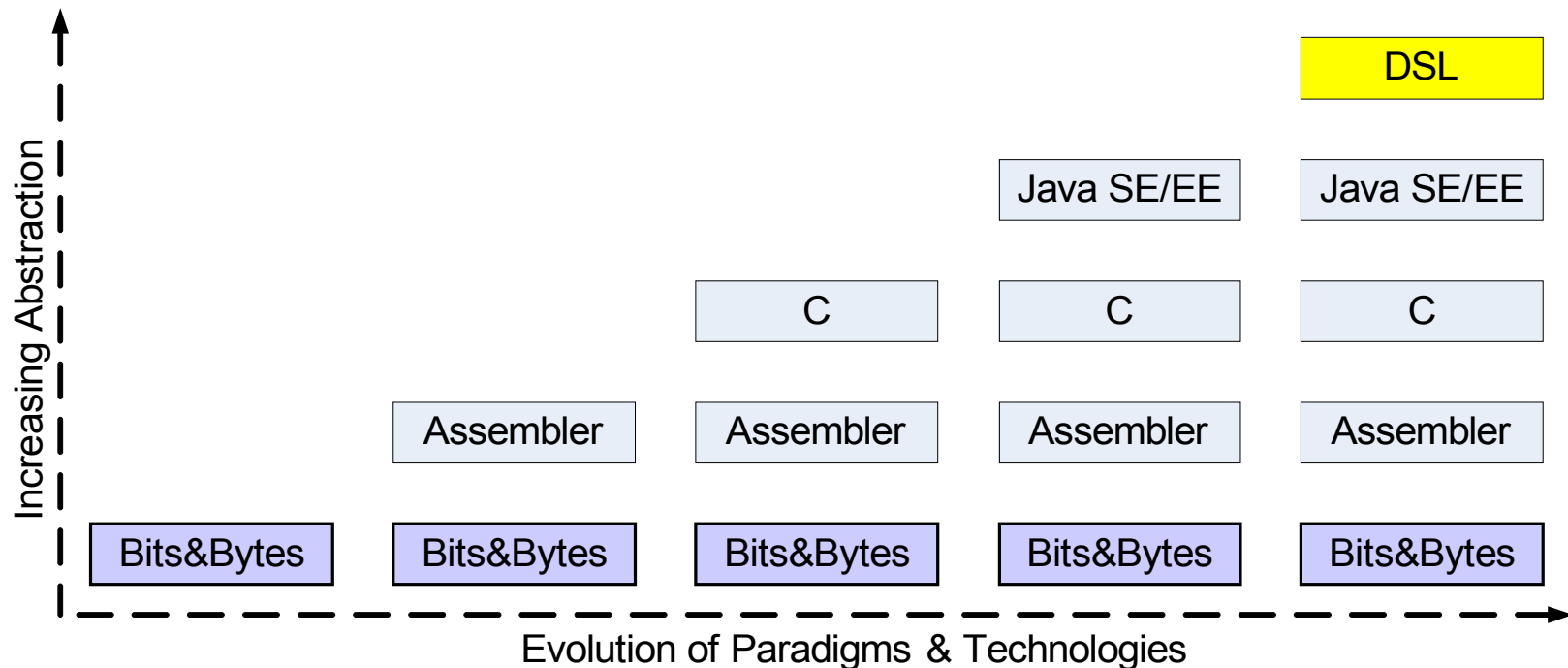


- Ongoing change/shift of
 - Technologies
 - Requirements
- Increasing complexity
- Architecture and models have to be regenerated
 - Lot of avoidable Efforts
 - Important thinks are neglected
- New generation infrastructure platforms doesn't help

Motivation



- More adequate paradigm is needed
- Model Driven Software Development (MDSD, MDD)
 - DSLs are integral part
- Further step of abstraction (well known :-)



Characteristics



- Domain
 - Insurance, health care, embedded systems, software architecture,...
 - Ex. Domain „Private Banking“: „Customer“, „Account“,...
- Domain models are expressed by DSLs
 - DSLs capture relevant properties of domains formally
 - Analysis of domain is required
- Ubiquitous Language
 - Glossary of domain
 - Contract
- Developed in iterations

Characteristics



- Limited in scope
- Limited in capability
- Small and simple
 - 'little languages'
 - 'mini-languages'
- Often turing incomplete

Characteristics



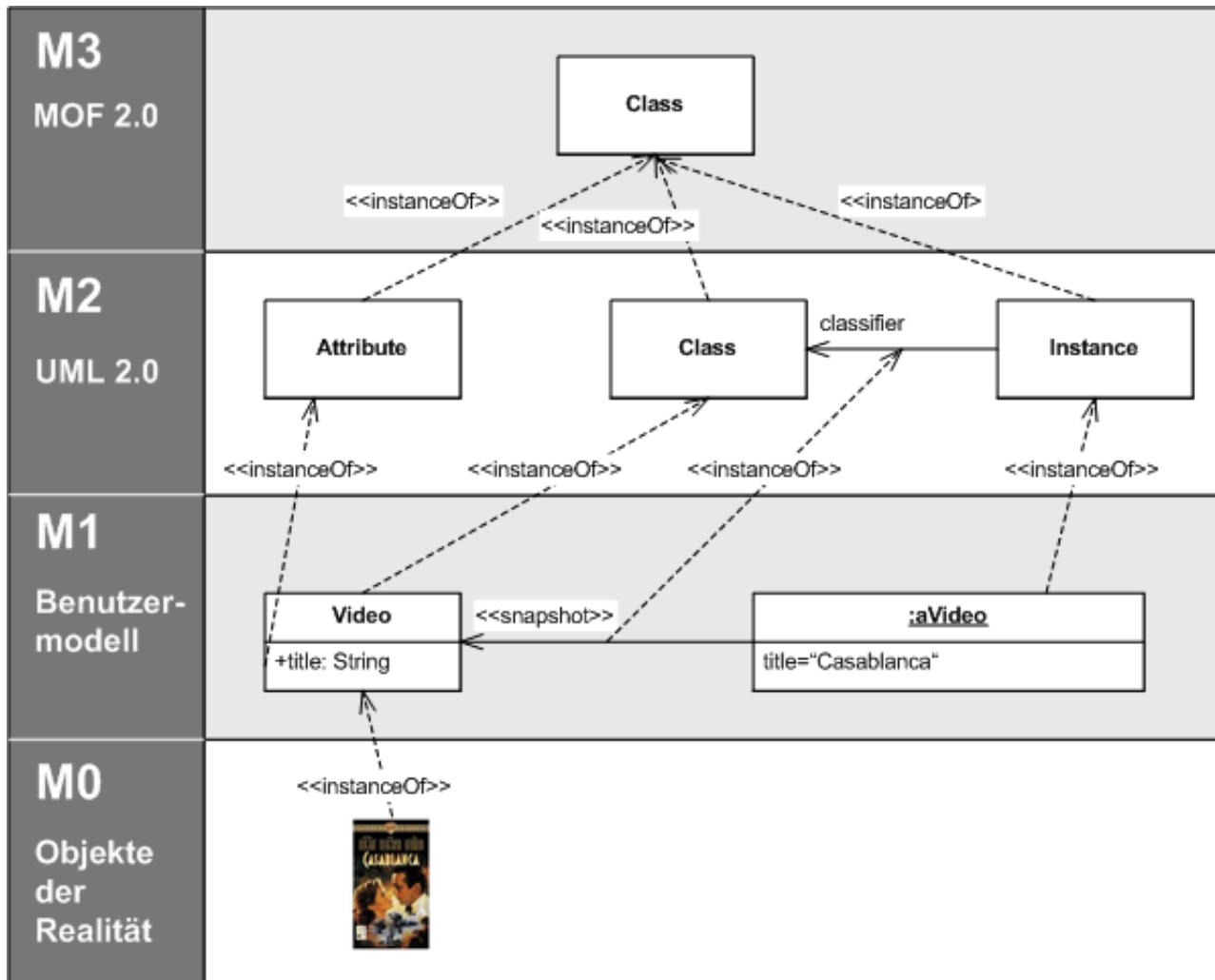
- General Purpose Languages (GPLs) vs. DSLs
 - Java,... vs. PHP,...
- External vs. internal DSLs
 - DSL defined via oAW,... vs. Ruby,...
- Vertical vs. horizontal DSLs
 - lex/yacc,... vs. SQL,...
- Technical vs. business related DSLs
 - DSL describing technical platform,... vs. DSL describing business

- Fluent interface

```
TimePoint fiveOClock, sixOClock;

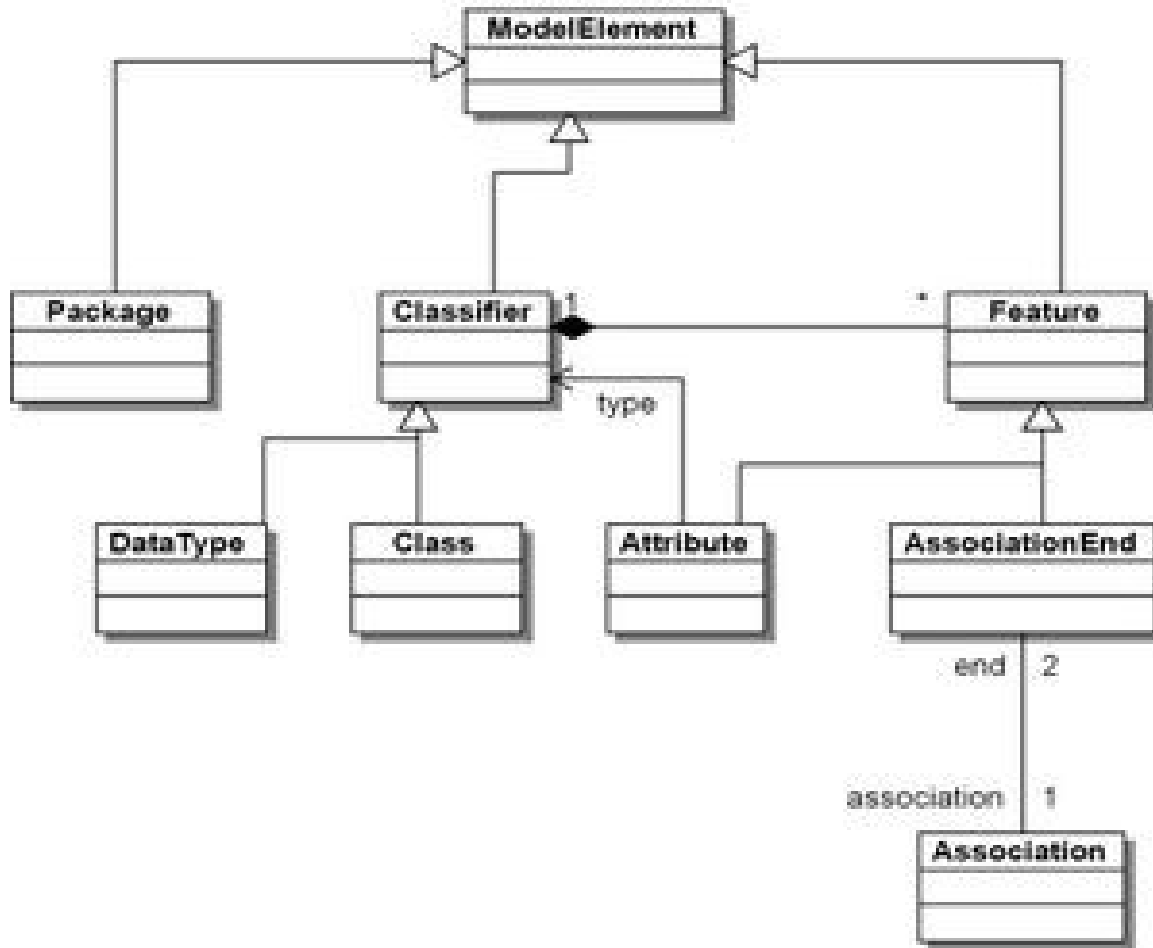
//Traditional
TimeInterval meetingTime = new
TimeInterval(fiveOClock, sixOClock);
...
//Fluent
TimeInterval meetingTime =
fiveOClock.until(sixOClock);
...
```

Concepts: Meta model



[Source: http://de.wikipedia.org/wiki/Meta-Object_Facility]

Concepts: Meta model



[Source: http://de.wikipedia.org/wiki/Meta-Object_Facility]

Concepts



- Abstract syntax (meta model)
 - Describes another model (structure and semantics)
 - Ex. description of oo-concept class
- Concrete syntax (notation/representation)
 - Implementation of abstract syntax
 - Ex. UML2 class diagramm
- DSLs comprise abstract and concrete syntax
 - Metamodel (level M2)

Concepts



- Static semantic
 - Constraints ensuring model is well-formed
- Semantic
 - Describes semantic of model
- Transformation
- Platform
- Application model
- Definition of new DSL requires at least
 - Abstract syntax
 - Editor
 - Generator

Concepts: MDSD/MDD Context

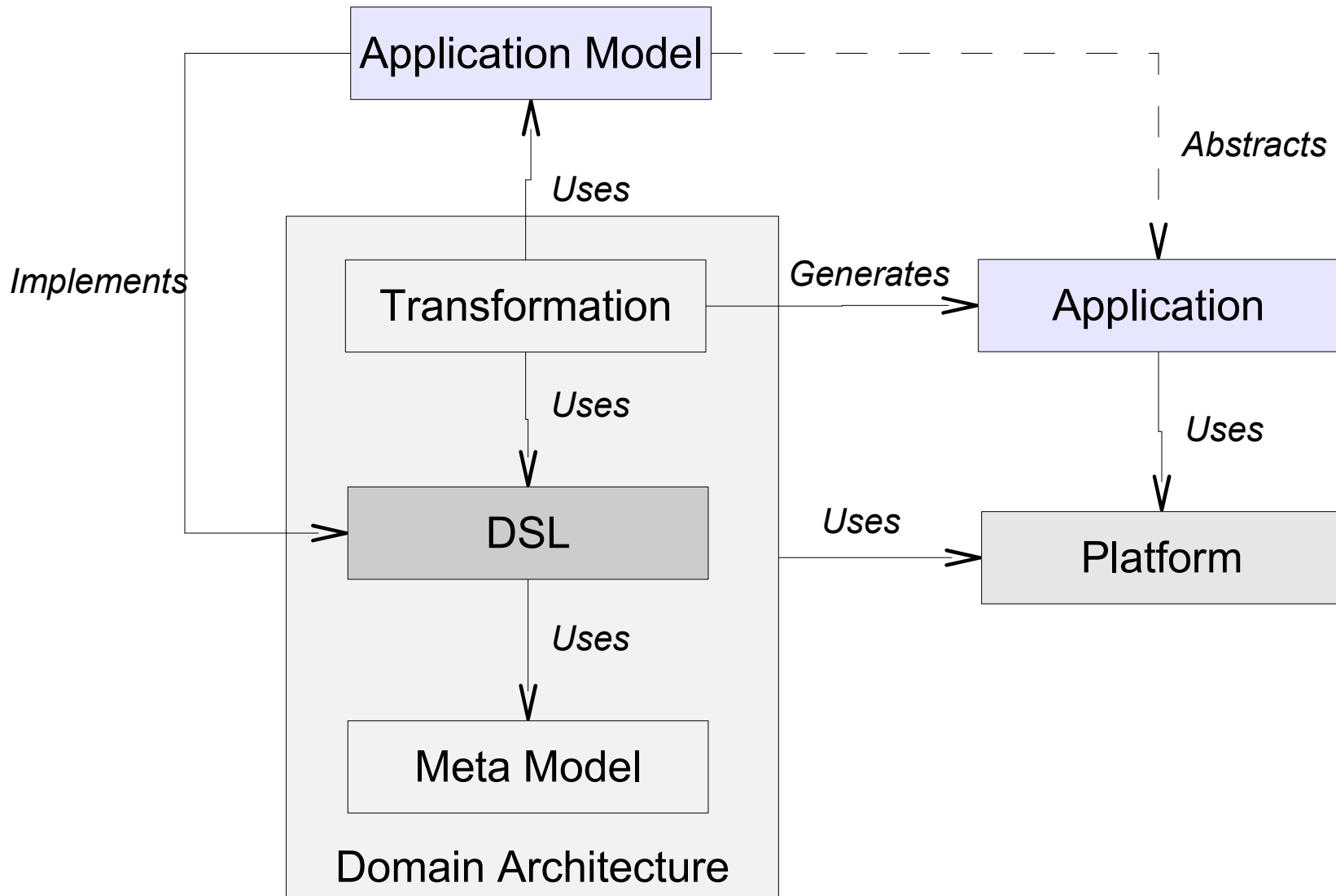


- DSLs are essential part of MDSD/MDD

- Different notations
 - Graphical
 - Textual
 - Tabular
 - ...

-

Concepts: MDSD Context



Status Quo



- Concepts and technologies are there
- It is not clear exactly what is or isn't a DSL?
 - DSL vs. fluent interface
 - DSL vs. UML
 - DSL vs. scripting languages
 - DSL vs. GPL
 - ...
- Many technical DSLs
- Struggle for standards

Status Quo: UML



- UML2 vs. DSLs
- Lot of vendors support UML2
- Some vendor(s) does not
 - Microsoft ;-)

Status Quo: Standards



- XML
- UML2
- XMI
- MOF
- OCL
- ATL/QVT
- ...

Status Quo: DSLs



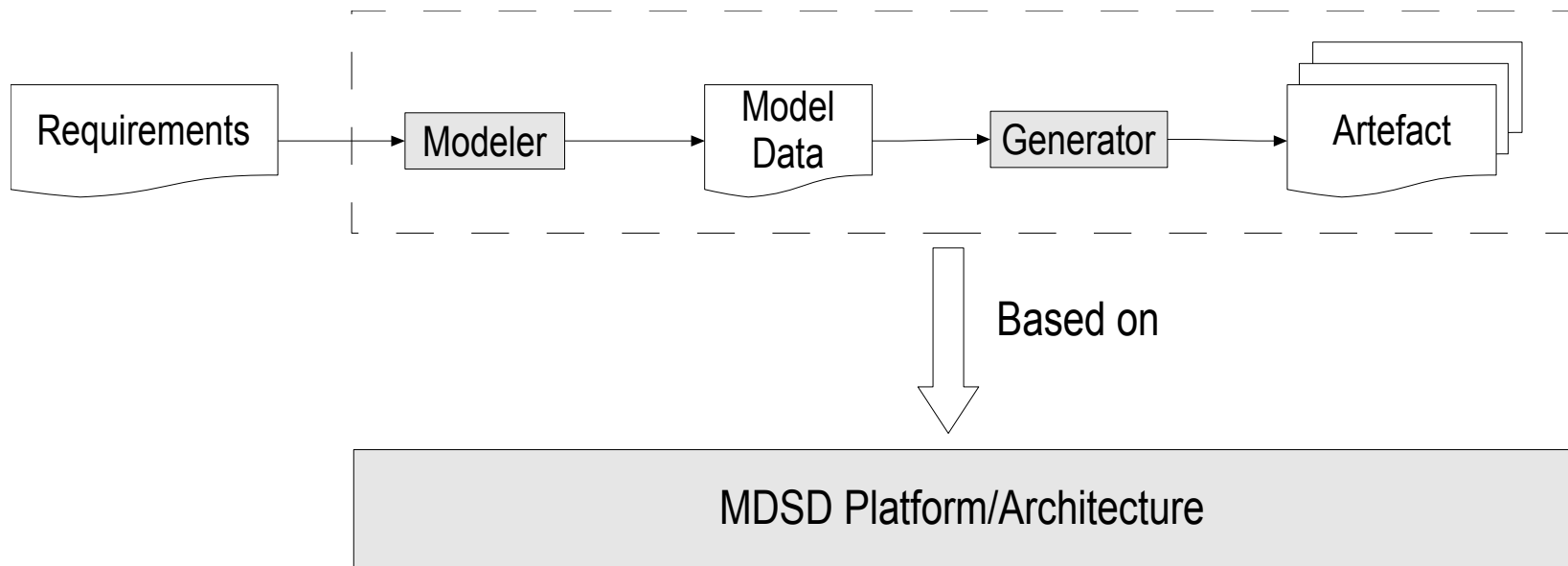
- UML2
 - Extendable GPL
 - Strong tool support
- Many textual DSLs
 - Scripting languages like Ruby, Groovy, Lisp,...
 - Regular Expressions
 - Pattern-Scanner Awk
 - Xtext
 - ...

Status Quo: Tools: Differentiation



- UML Modeler
- DSL Editors (textual and graphical)
- Generators
- MDSD-Frameworks

Status Quo: Tools



Status Quo: Tools: Selection Criteria



- Support of standards
 - MOF, XMI, UML2 incl. UML profiling
- Transformations as "First Class Citizens"
- Support of MDSD best practises
- (Protected regions!)
- Integration with other tools

Status Quo: Tools: UML



- Magic Draw
- Poseidon
- Omondo
- Visual Paradigm
- ...

Status Quo: Tools: MDSD



- Eclipse
 - Eclipse Modeling Framework (EMF)
 - Ecore equivalent of MOF
 - Open Architecture Ware (oAW)
- IBM
 - Rational Software Architekt (RSA)
- Microsoft
 - Domain-Specific Language Tools
 - Microsoft Visual Studio 2008/.NET Framework 3.5

Status Quo: Tools: MDSD



- ArcStyler (Interactive Objects)
- Optimal J (Compuware)
- AndroMDA
- Velocity
- ...

oAW



- Powerfull MDSD tool suite
- Open Source
- 100 % Java

- Since version 4.1 hosted inside Eclipse
 - Generative Modeling Technologies (GMT) project
- Download site
 - www.eclipse.org/gmt/oaw/download
- Large and stable community
- Industry proven

oAW: Feature List



- UML2 meta model and XMI
- Template/Expression languages
- Different kinds of models can be processed
- Arbitrary export formats (java, xml, php,...)

oAW: Feature List



- Comprehensive documentation (samples, tutorials,...)
- Support of major UML2 tools (RSA, Magic Draw, Eclipse UML2, Poseidon,...)
- Tool integration (Ant, Eclipse)
- Ready to use templates/cartridges for specific platforms/issues
- ...

oAW: Release 4.2 Features



- Compatible with...
 - Eclipse 3.3 Europa release and the corresponding EMF 2.3, UML2.1 and GMF 2.0!
- Debugger for Xpand and Xtend fully integrating Eclipse's debugging facility
- Supports Product Line Engineering (PLE) on generator level
- Xtext with many more options
- ...

oAW: Eclipse Plugin



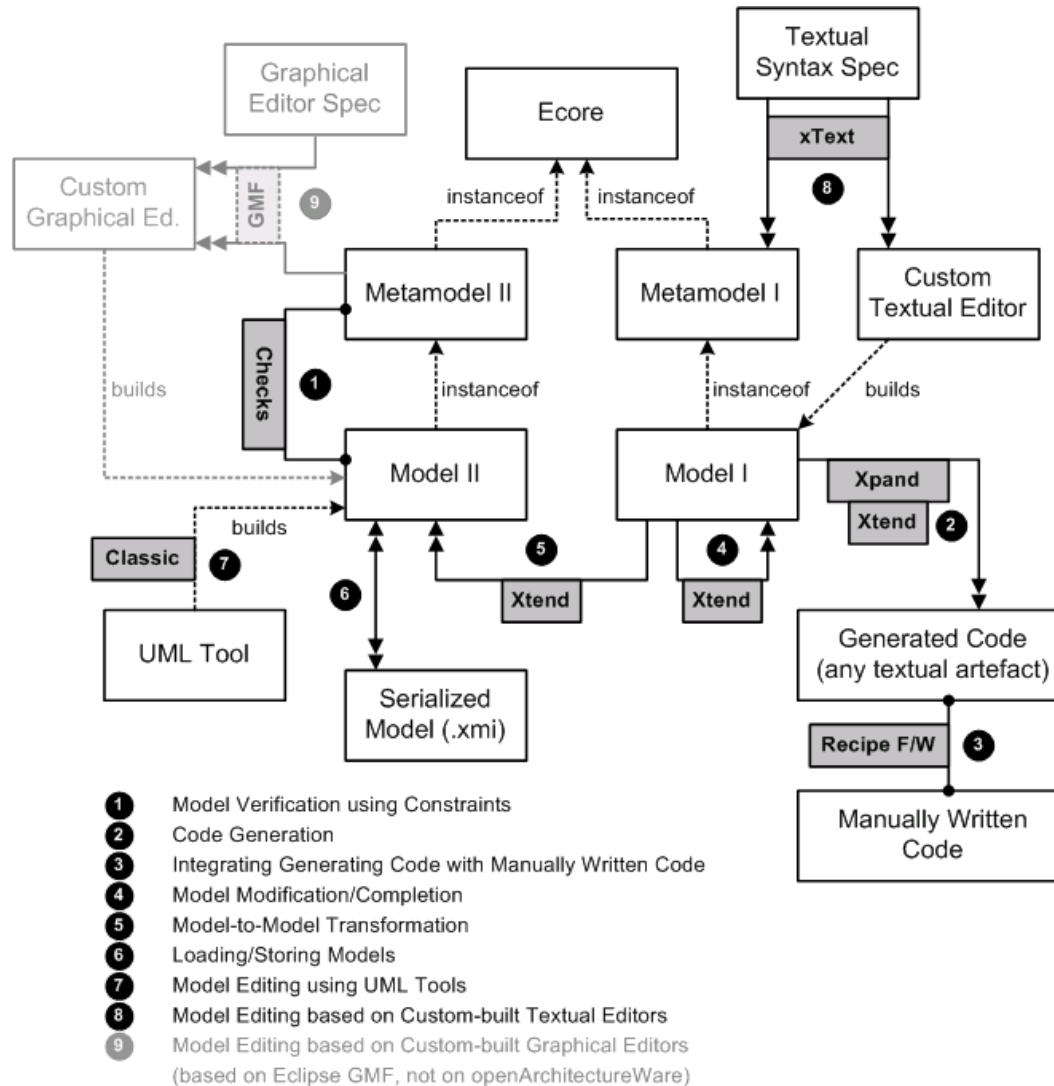
- Language specific editors
- Views
- Project Wizards
- Menu Items

oAW: Languages/Frameworks



- Xpand
 - Code generation
- check
 - Model validation
- Xtend
 - Extension of meta model elements
- Xtext
 - Creation of external textual DSLs
- Expression framework builds base

oAW: Big Picture

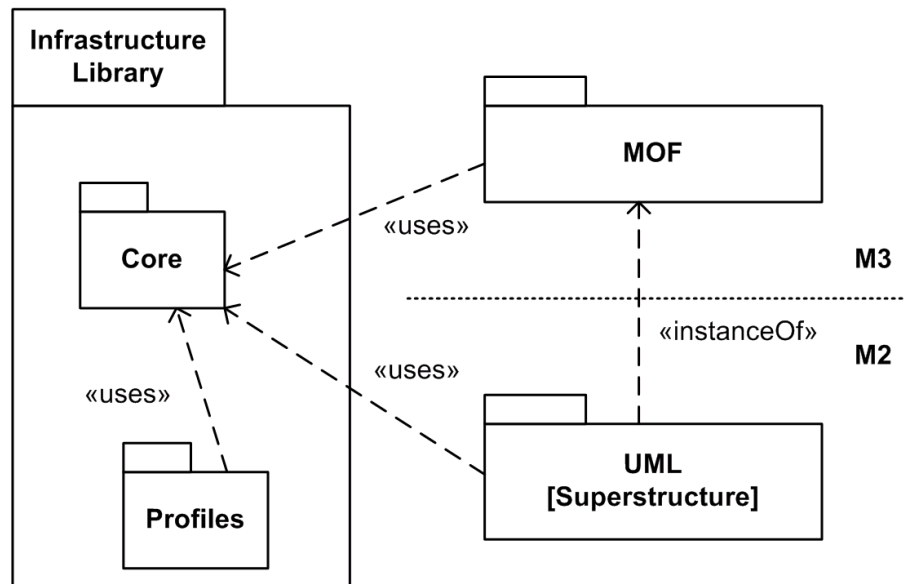


[Source: <http://www.eclipse.org/gmt/oaw/>]

Demo: UML



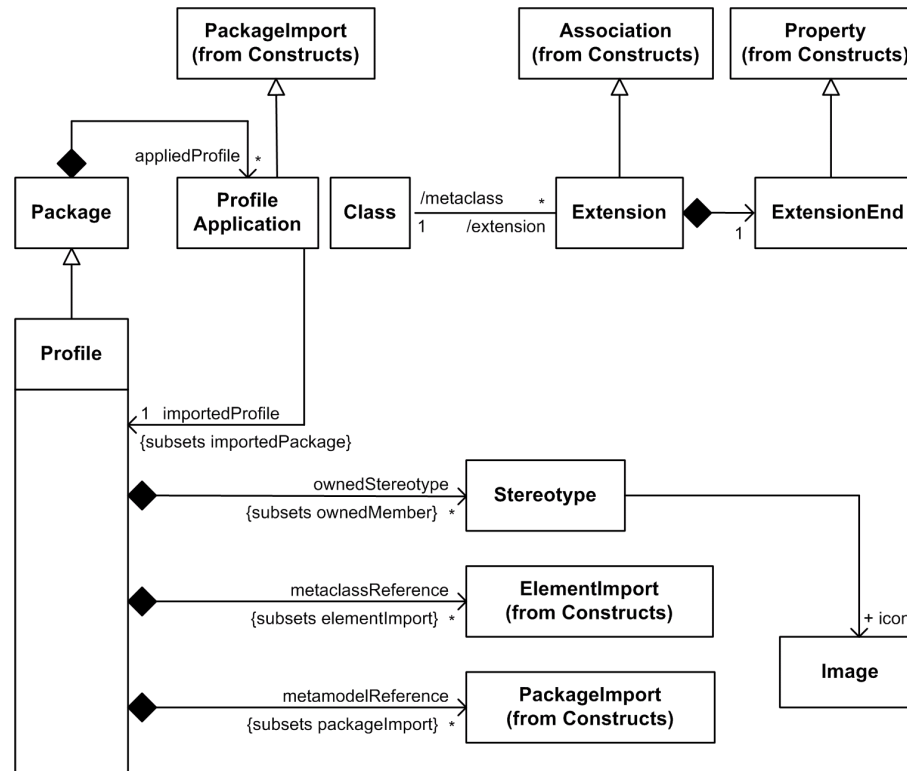
- To use UML2 as DSL it must be extended
- Heavy-weight extension
 - Extension of UML2 meta model
 - Completely new model concepts
 - Refinement of existing model concepts



Demo: UML



- Light-weight extension
 - UML2 profile mechanism (stereotypes)
 - No impact on UML2 meta model
 - Existing model concepts are complemented



Demo: oAW: Xpand



- Template language for iterating model structures
- Simple and intuitive
- 3 key elements
 - Identifier, meta model properties and constant text
- About 30 identifier
- Supports polymorphism
- Template file: `FileName.xpt`

Demo: oAW: Xpand: Key identifier



- **Template**
`<<DEFINE field FOR Class>> ... <<ENDDFINE>>`
- **Template execution**
`<<EXPAND field FOREACH Attribute>>`
- **Condition** `<<IF>> ... <<ENDIF>>`
- **Loop** `<<FOREACH>> ... <<ENDFOREACH>>`
- **File output** `<<File NameS+".java">>`

Demo: oAW: Xtext



- Expression language and framework for generating textual DSL and corresponding editors

- Rules are used to define DSL

- Rules follow EBNF grammar

```
RuleName:
```

```
    RuleExpression;
```

- Grammar definition file: `FileName.xtext`

- oAW generates parser, meta model (EMF) and editor

Resources: Books



- Stahl, Thomas and Völter, Markus (2006): Model-Driven Software Development - Technology, Engineering, Management; Wiley
- Vogel, Oliver et al. (2005): Software-Architektur - Grundlagen, Konzepte und Praxis; Spektrum
- Evans, Eric (2003): Domain-Driven Design; Addison Wesley

Resources: Web



- General MDSD
 - www.mdsd.info
 - www.modelbased.net
 - www.modelware-ist.org
- Code Generation Network
 - www.codegeneration.net
- Object Management Group
 - www.omg.org/mda
 - www.omg.org/technology/documents/formal/uml.htm

Resources: Web



- Book of Stahl, Thomas and Völter, Markus
 - www.mdsd-buch.de
- Book of Vogel, Oliver et al.
 - www.software-architektur-buch.de

Resources: Web



- Wikipedia
 - http://en.wikipedia.org/wiki/Domain_specific_language
- Martin Fowler
 - <http://martinfowler.com/articles/languageWorkbench.html>
- Markus Völter
 - www.voelter.de/services/mdsd.html
- Walter Kriha
 - www.kriha.de

Resources: Web



- openArchitectureWare
 - www.openarchitectureware.org
 - www.eclipse.org/gmt/oaw
 - www.architectureware.de
 - http://www.eclipse.org/gmt/oaw/doc/4.3/html/contents/xtext_reference.html
 - <http://oaw-forum.itemis.de>

Resources: Web



- Eclipse Modeling Project (EMP)
 - www.eclipse.org/modeling
- Eclipse Generative Modeling Tools (GMT) Project
 - www.eclipse.org/gmt

15.–18.09.2008
in Nürnberg



Herbstcampus

Wissenstransfer
par excellence

Vielen Dank!

Arif Chughtai

IT-Consultant

mail@arifchughtai.org, www.arifchughtai.org