

# **FROM MODEL EDITORS TO MODELLING TOOLS: OPERATIONALIZING MODELLING METHODS WITH ADOxx**

## OMiLAB: Approach

- A **research and experimental laboratory** for the conceptualization, development and deployment of modelling methods and the models designed with them.
- Project space for Engineering of modelling methods and **modelling tools**
- A space for a community of researchers and practitioners sharing a common understanding about **model value**

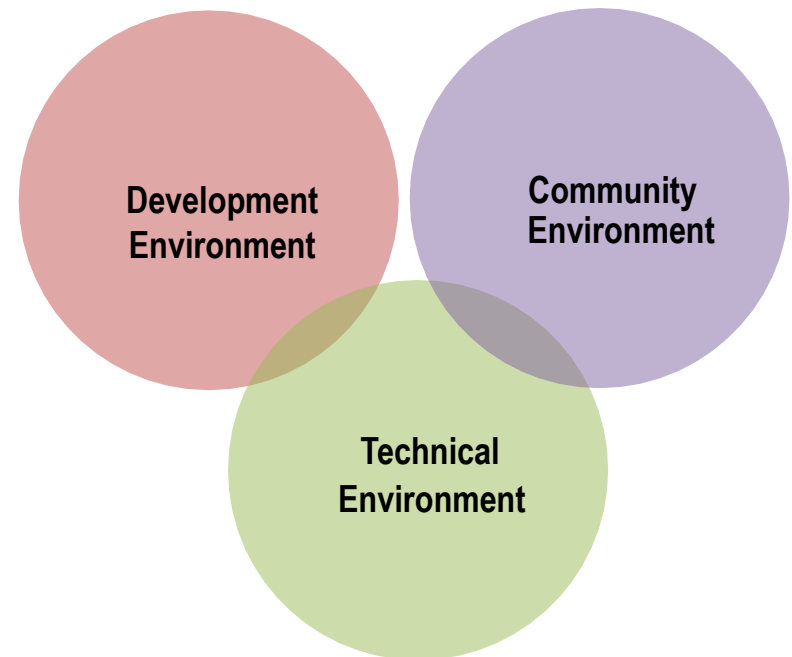
**Organisation:** University of Vienna,  
Faculty of Computer Science

**Research Group:** Knowledge Engineering



# OMiLAB: Environment

- **Development environment** consists of
  - Core (Open Use): ADOxx on OMiLAB
  - Add-Ons (Open Source): implemented community tools such as Model Annotator, GraphRep Generator, Model Publisher, Method Publisher, OM-Repository, Meta-Model Browser, MLEA – Modelling Language Engineering Assistant
- **Technical environment** supports
  - virtual and physical accessibility
  - packaging and deployment capabilities
- **Community environment** provides
  - Web-platform based on Liferay
  - Community events like conferences, workshops, summer schools
  - Publications like books, conference and journal papers
  - Project networking activities
  - Newsletters, media and OM-TV



# Agenda

- **Model Value**
- Definition of Model Structure on ADOxx
- Processing of Model Structure on ADOxx
  - Visualisation Functionality
  - Transformation Functionality
  - Analysis Functionality
- Conclusion

## Model Definitions

- **Model as mappings of reality**  
*...models as mappings of parts of reality for a particular purpose...*
- **Model as a construction**  
*...the result of a construction of a modeler who declares for model users a representation of an original as significant at a given time using a language...*

(Source: Schütte and Becker, 1998)

# Model with Different Values

## Representation Characteristic

*“Models as a representation of natural or artificial originals, that again can be models.” [1] (translated)*

## Abstraction Characteristic

*“Models in general do not capture all attributes of the represented original, but only those that seem relevant to the modeller or model user.” [1] (translated)*

## Pragmatic Characteristic

*Models meet their substitution function for specific subjects, within a pre-determined time interval and with limitations on defined intellectual and/or real operations. [1] (translated)*

(Source: Stachowiak 1973)

# Introduction of Terms

- **Modelling Language:**  
Modelling constructs (object types) and their relations (relation types) to each other to declare a model.
- **Metamodel:**  
The model of the syntax of the modelling language
- **Meta2 Model:**  
Model of abstract syntax of a language to describe meta models.
- **Modelling Technique:**  
A modelling language and proceeding instructions for creation of a model in this modelling language.
- **Mechanisms und Algorithms:**  
Provision of functionalities to process models such as manipulation, visualisation, query, transformation or simulation depending on the modelling language and modelling procedure.

Cf. (Karagiannis and Kühn, 2002; Karagiannis and Höfferer, 2006; Kühn 2004; Karagiannis and Visic, 2011)

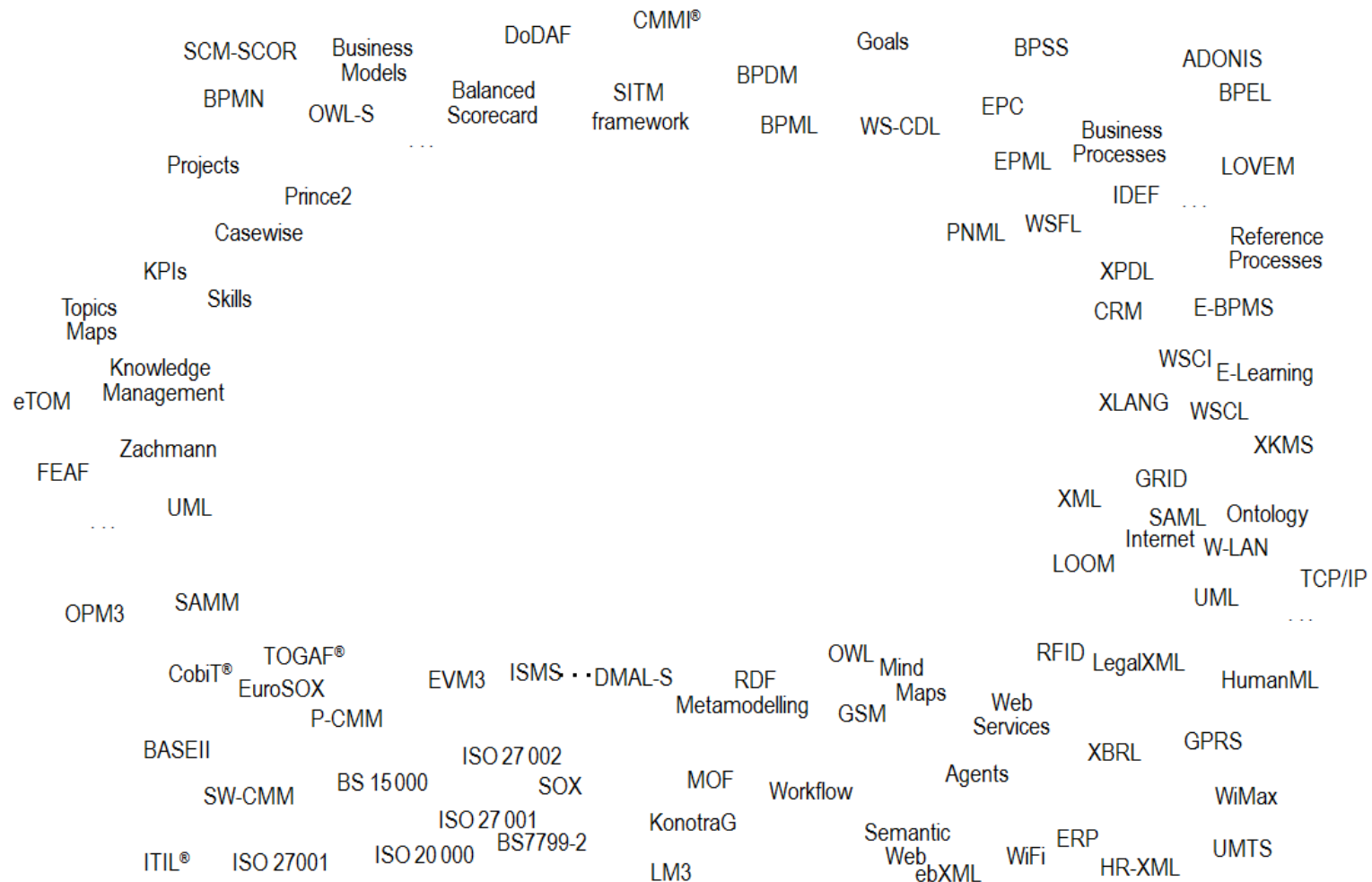
## Model Values: An Example

**THE RESULTS OF MODELLING  
CAN BE USED  
FOR GENERATING SOFTWARE,  
BUT ALSO ACT AS A BASIS OF  
ENTERPRISE KNOWLEDGE  
PLATFORMS**

**MACHINE PROCESSABLE**

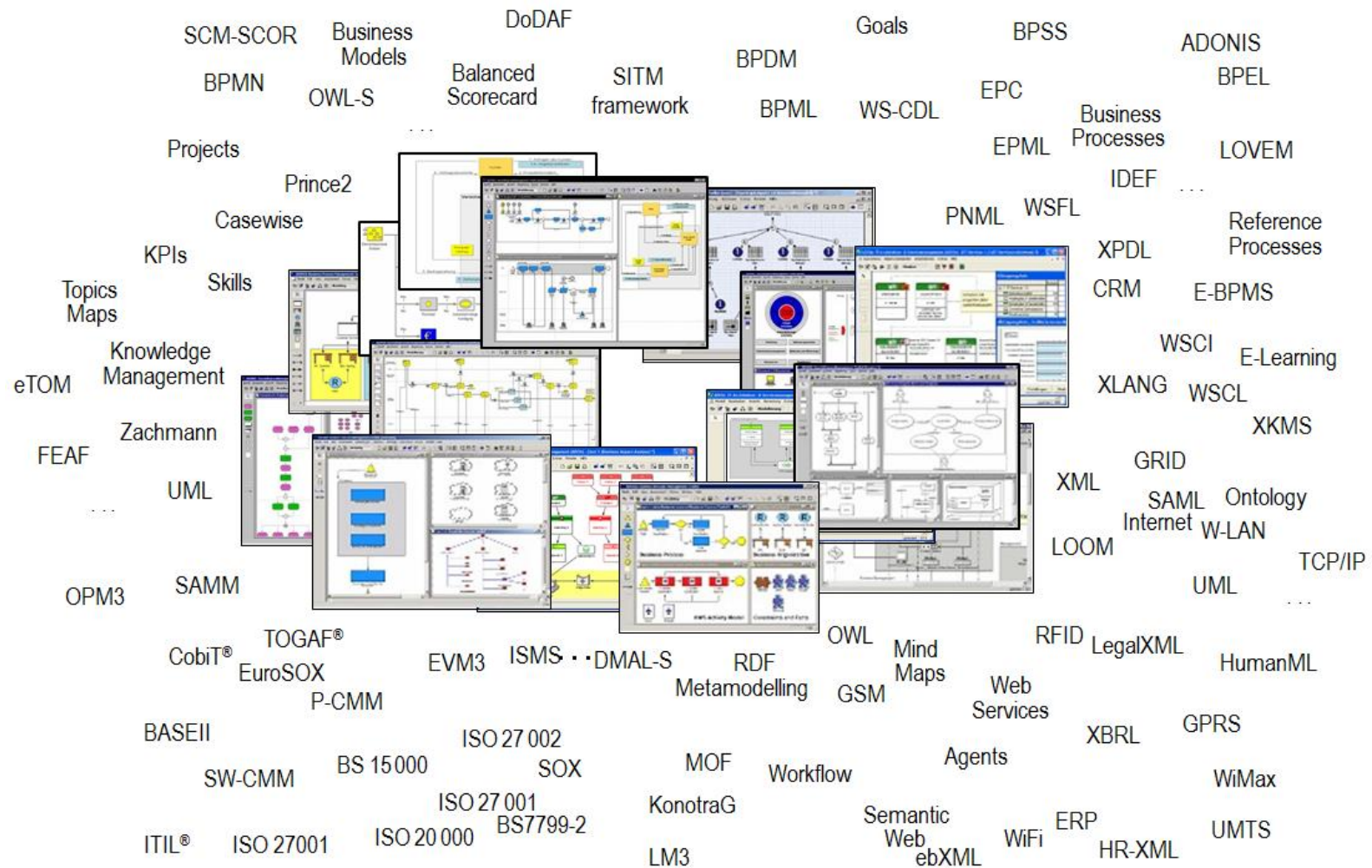


## Some machine-processable formats ...



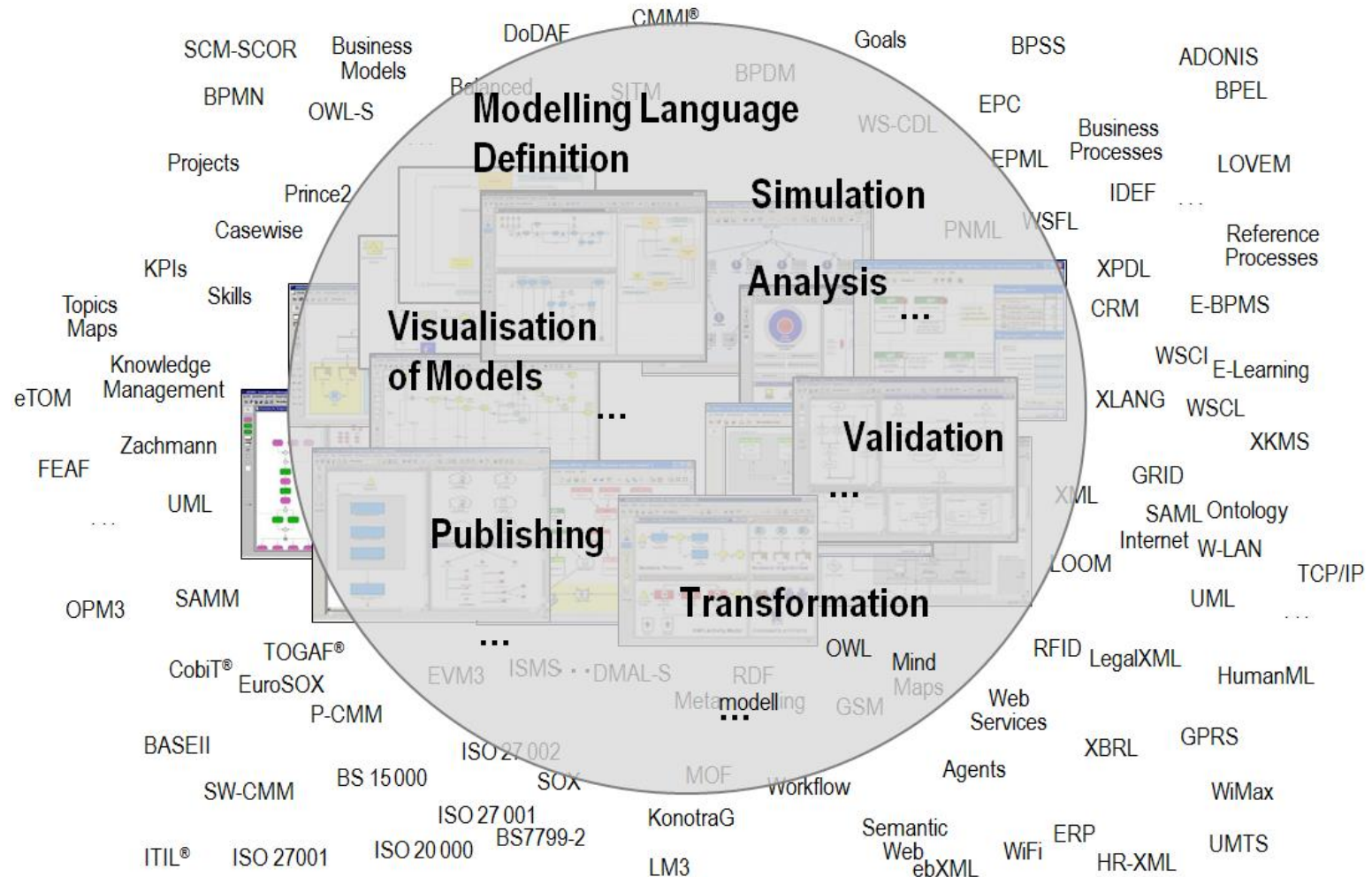
Cf. (Karagiannis and Kühn, 2002; Karagiannis and Höfferer, 2006)

## ... From an editor implementation, to ...



Cf. (Karagiannis and Kühn, 2002; Karagiannis and Höfferer, 2006)

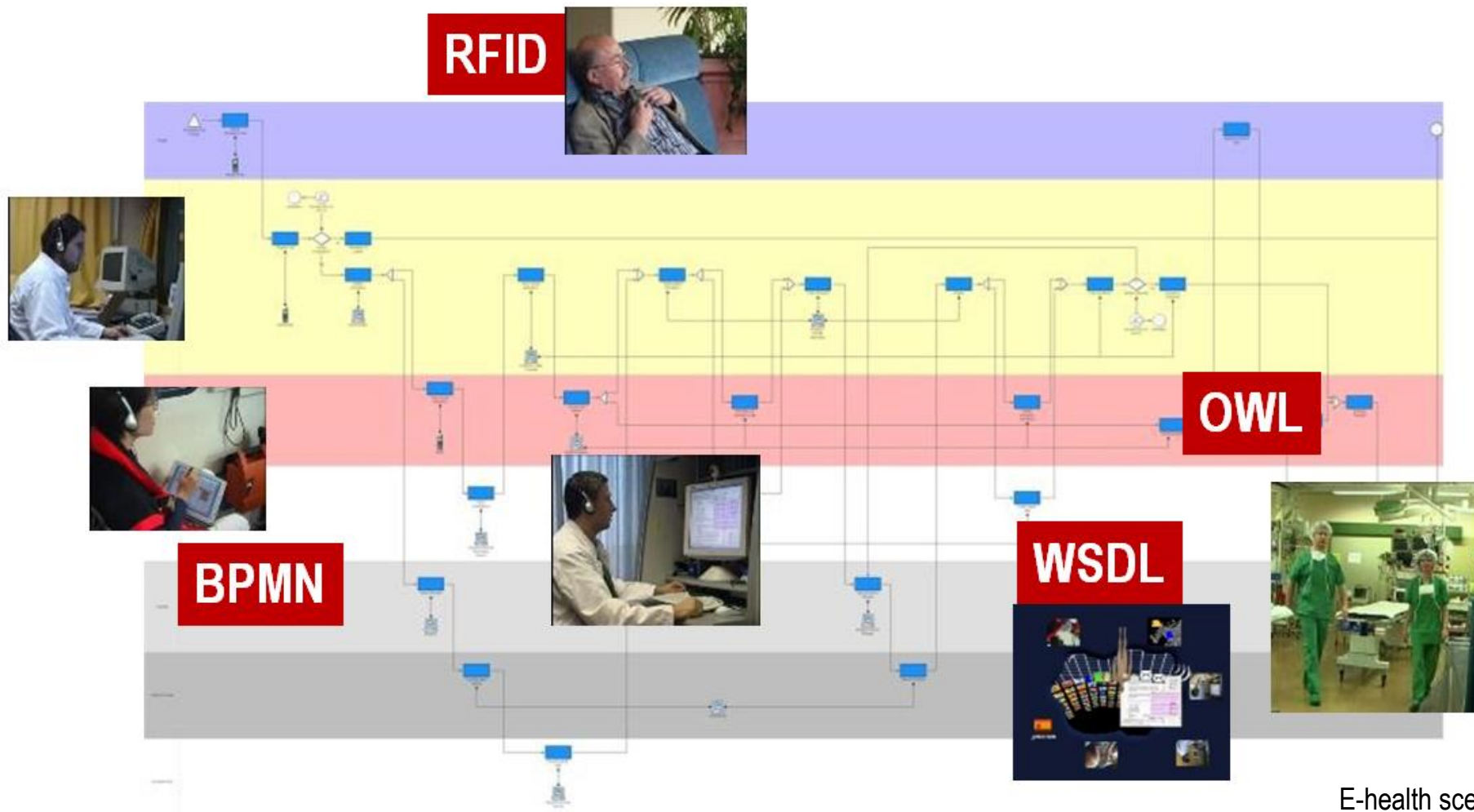
## ... to full-fledged modelling tool support ...



Cf. (Karagiannis and Kühn, 2002; Karagiannis and Höfferer, 2006)

# Scenario: Mobile eHealth Analysis and Simulation

AKOGRIMO Project

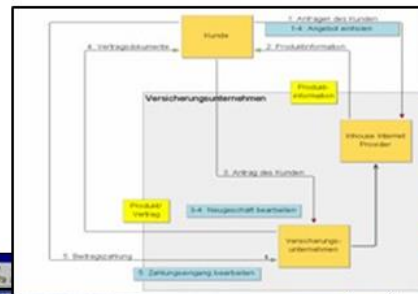


E-health scenario

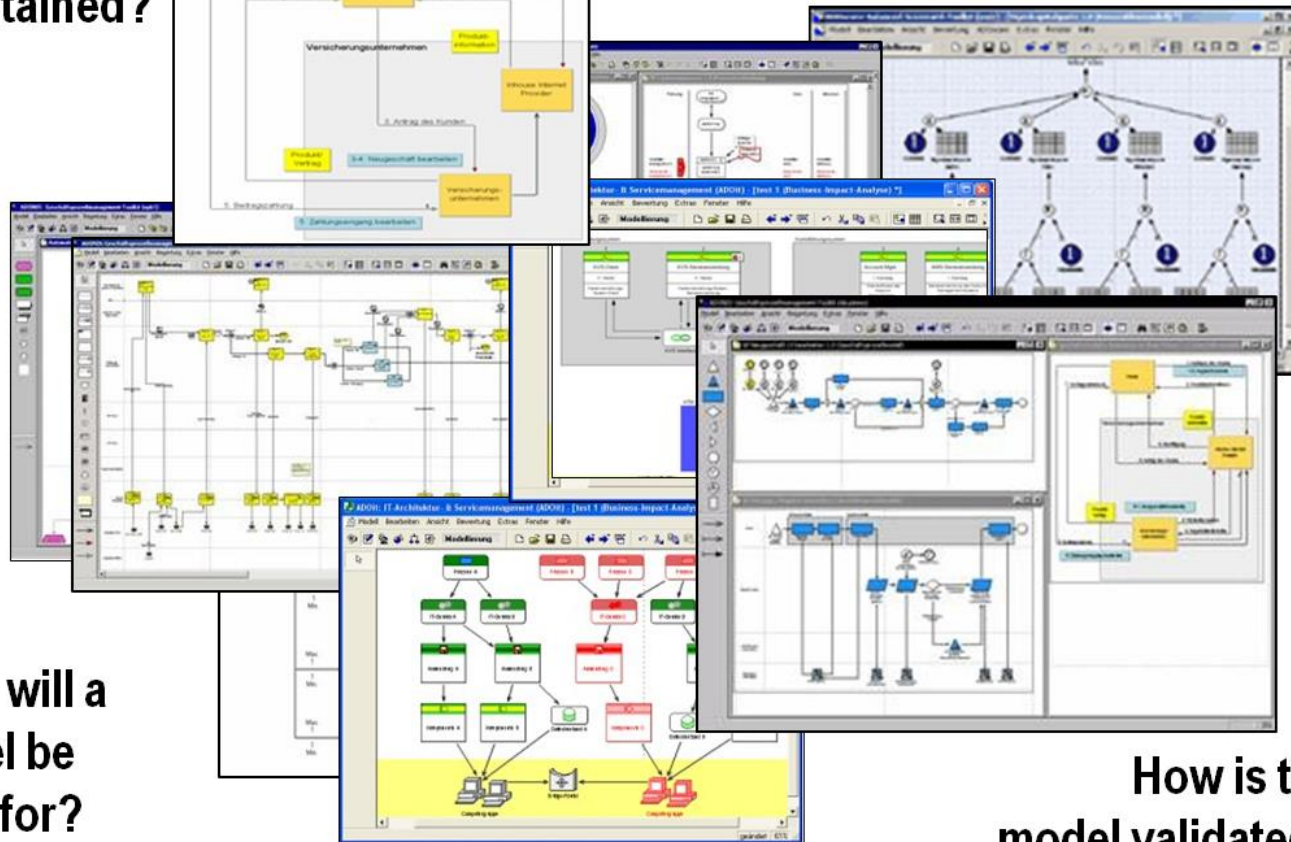


# The necessary information for model processing

**What data  
is contained?**



**Which algorithms  
should be applied?**



**What will a  
model be  
used for?**

**How is the  
model validated?**

## Some functionalities of modelling tools

Visualisation of models

User interaction like: drag and drop, zoom, grid snap, print, etc.

Simulation of models

Modelling language definition

Publishing in multiple formats

Transformation of models

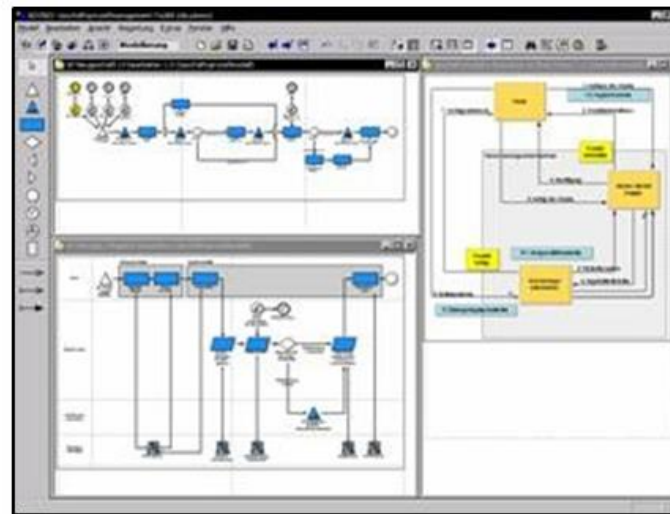
Exchange of models

Analyse models and evaluate the results

User access rights

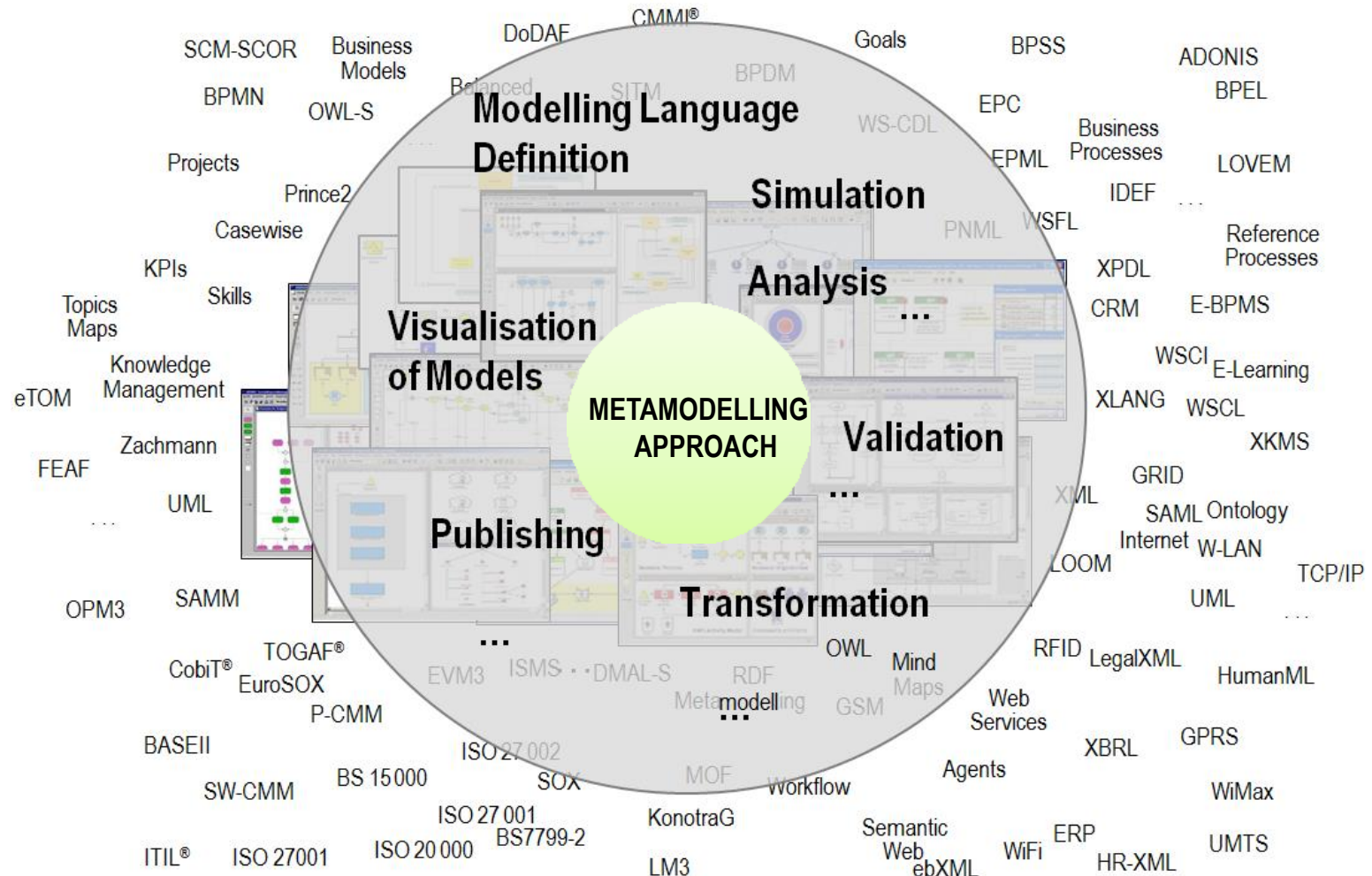
Storage and Manipulation of Models

Security and Safety



Cf. (Karagiannis and Kühn, 2002; Karagiannis and Höfferer, 2006; Fill, 2009)

# A Metamodel-based Realisation Approach



**...FOCUS OF TUTORIAL**

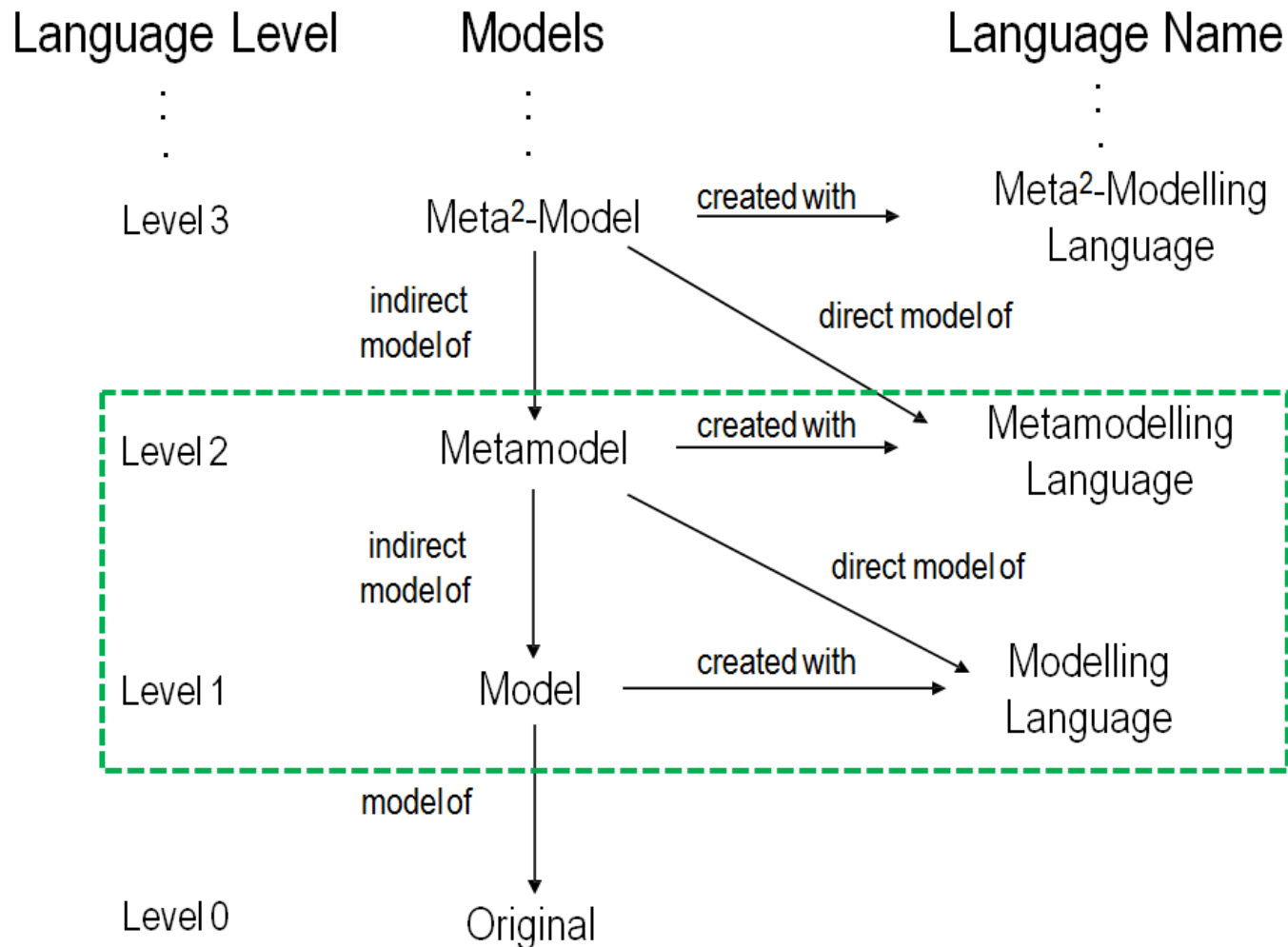
Cf. (Karagiannis and Kühn, 2002; Karagiannis and Höfferer, 2006)

# Agenda

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- **Definition of Model Structure on ADOxx**
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  - Visualisation Functionality
  - Transformation Functionality
  - Analysis Functionality
- Conclusion

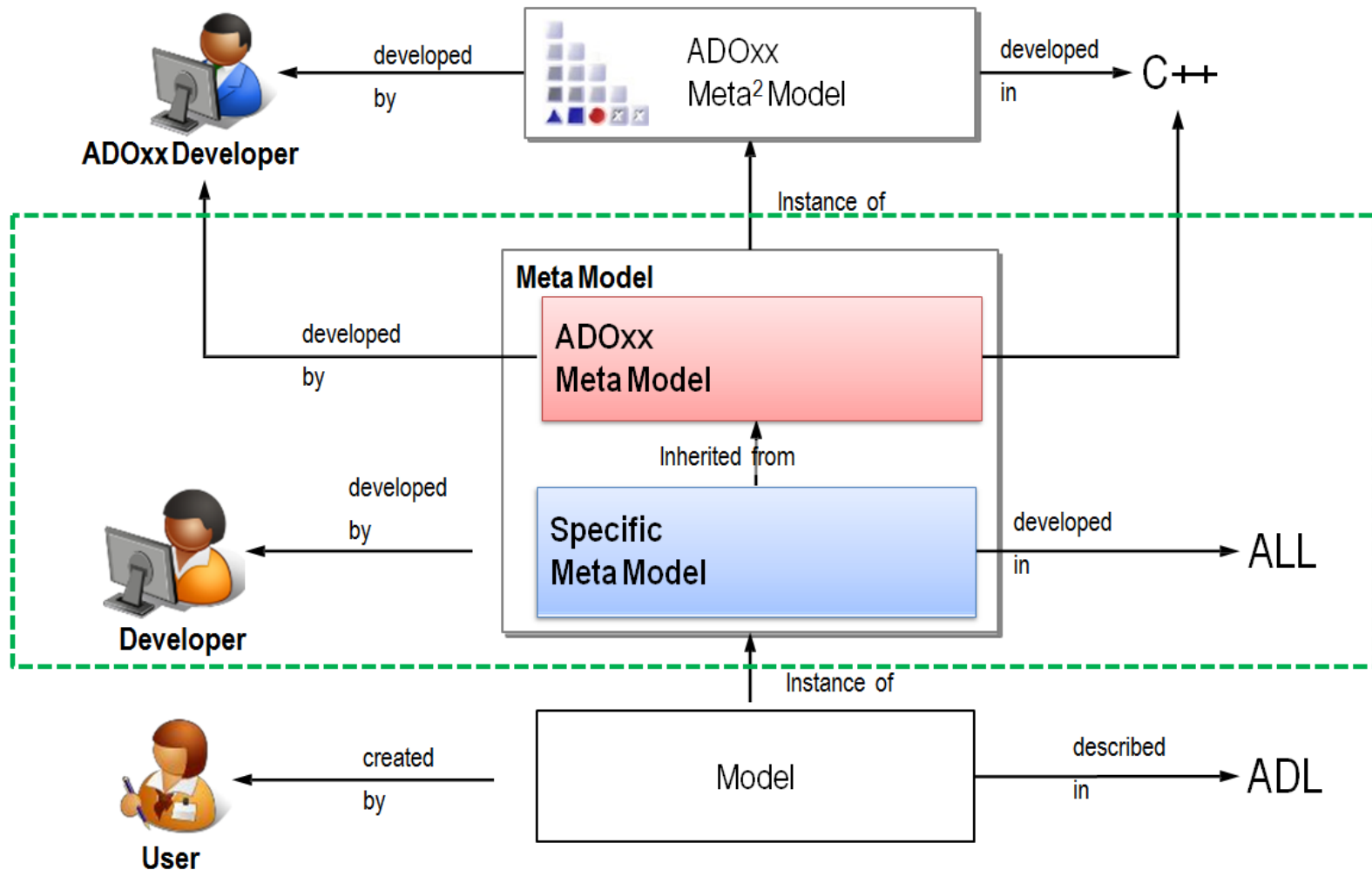


## Definition of Model Structure and Functionalities

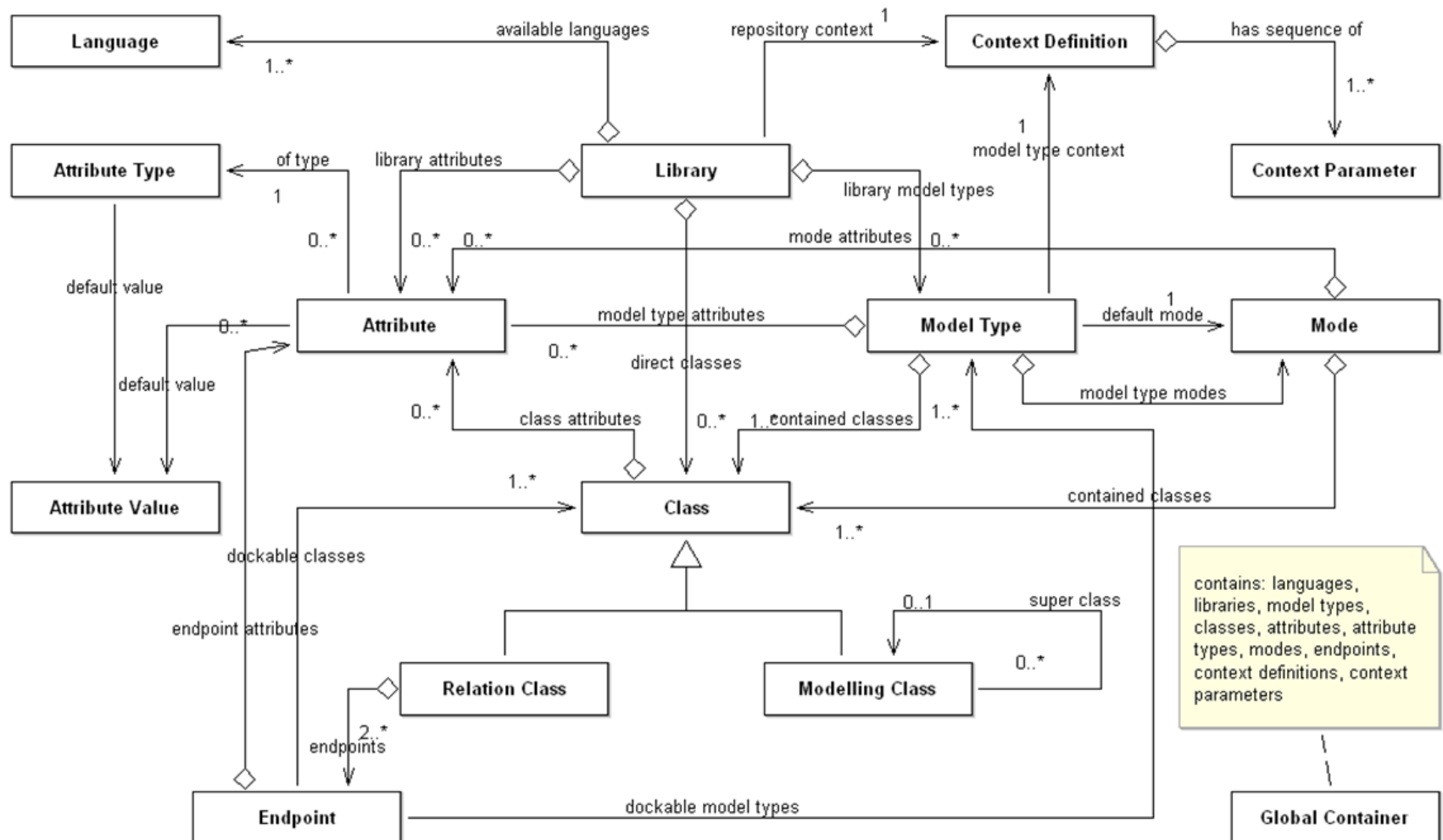


Functionalities

# ADOxx Platforms Hierarchy

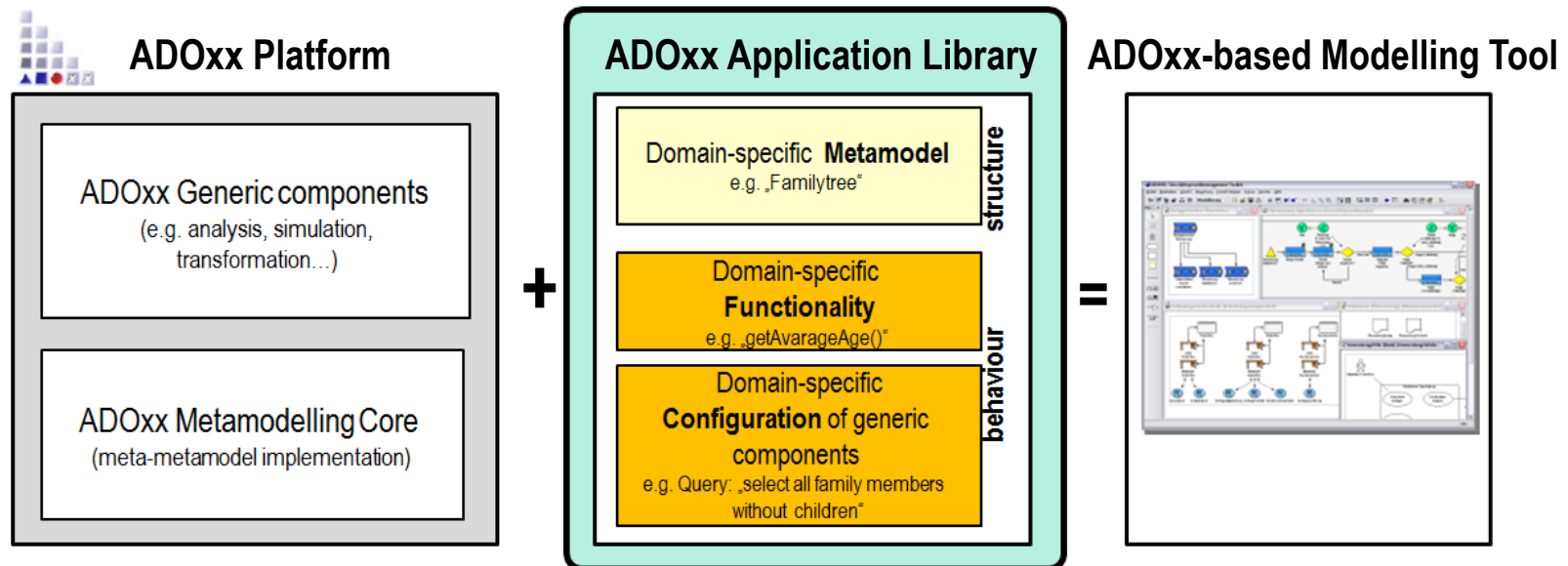


# ADOxx Meta<sup>2</sup>-Model

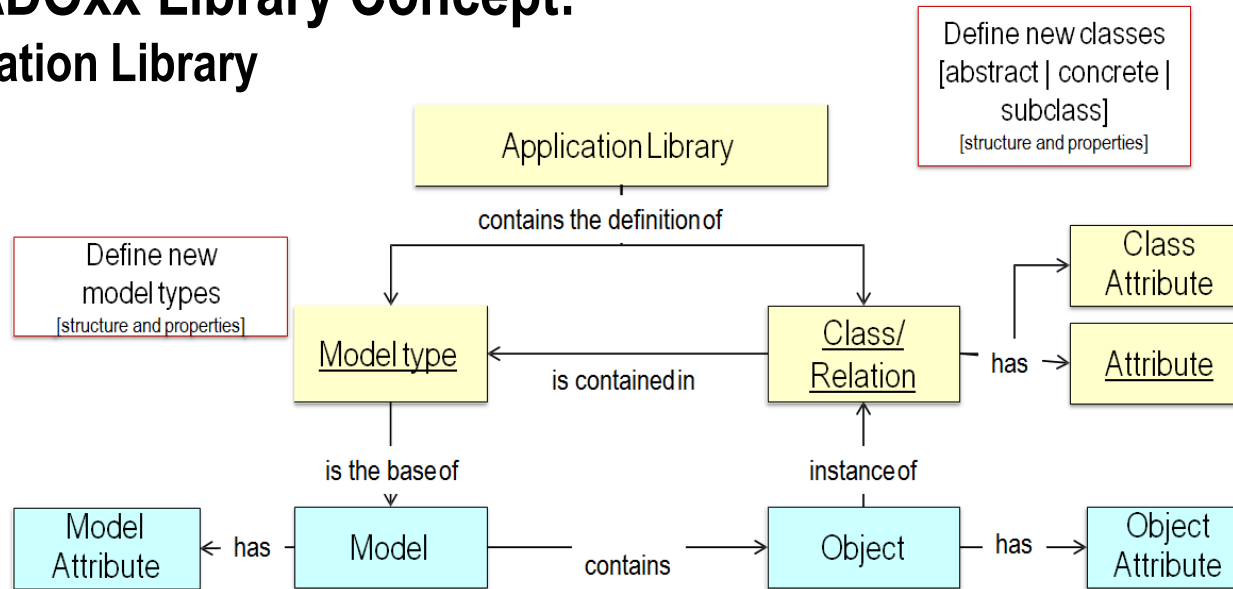


# The ADOxx Library Concept: More than a Metamodel

- The ADOxx Application Library is a concept which encapsulates both the structural and the behavioural aspects of metamodeling
- The ADOxx Application Library consists of:
  - Structural part: Metamodel definition
  - Behavioural part: Metamodel-specific functionality, Configuration of generic functionalities
- The ADOxx Application Library is a self-contained platform configuration package containing all necessary artefacts to configure a fully-fledged modelling tool



# The ADOxx Library Concept: Application Library



- **Model Types:**  
A model type is a well-defined sub collection of classes and relation classes of a meta model.
- **Classes:**  
A class is a construct that is used as a template to create objects of that class. The objects of a class are alternatively called "instances"
- **Attributes:**  
An attribute is a property of a modelling construct such as a model, object or relation. Each attribute has a type and a value.
- **Relations:**  
A relation class is a construct that is used as a template to create relations between objects. A relation class is defined between classes. A relation is always a directed connection between objects, i.e. each relation has a from-side and a to-side.

Cf. (Junginger et al., 2000; Kühn, 2004; Fill, Redmond, Karagiannis, 2012)

# Class Types in ADOxx

Define new classes  
[abstract | concrete |  
subclass]  
[structure and properties]

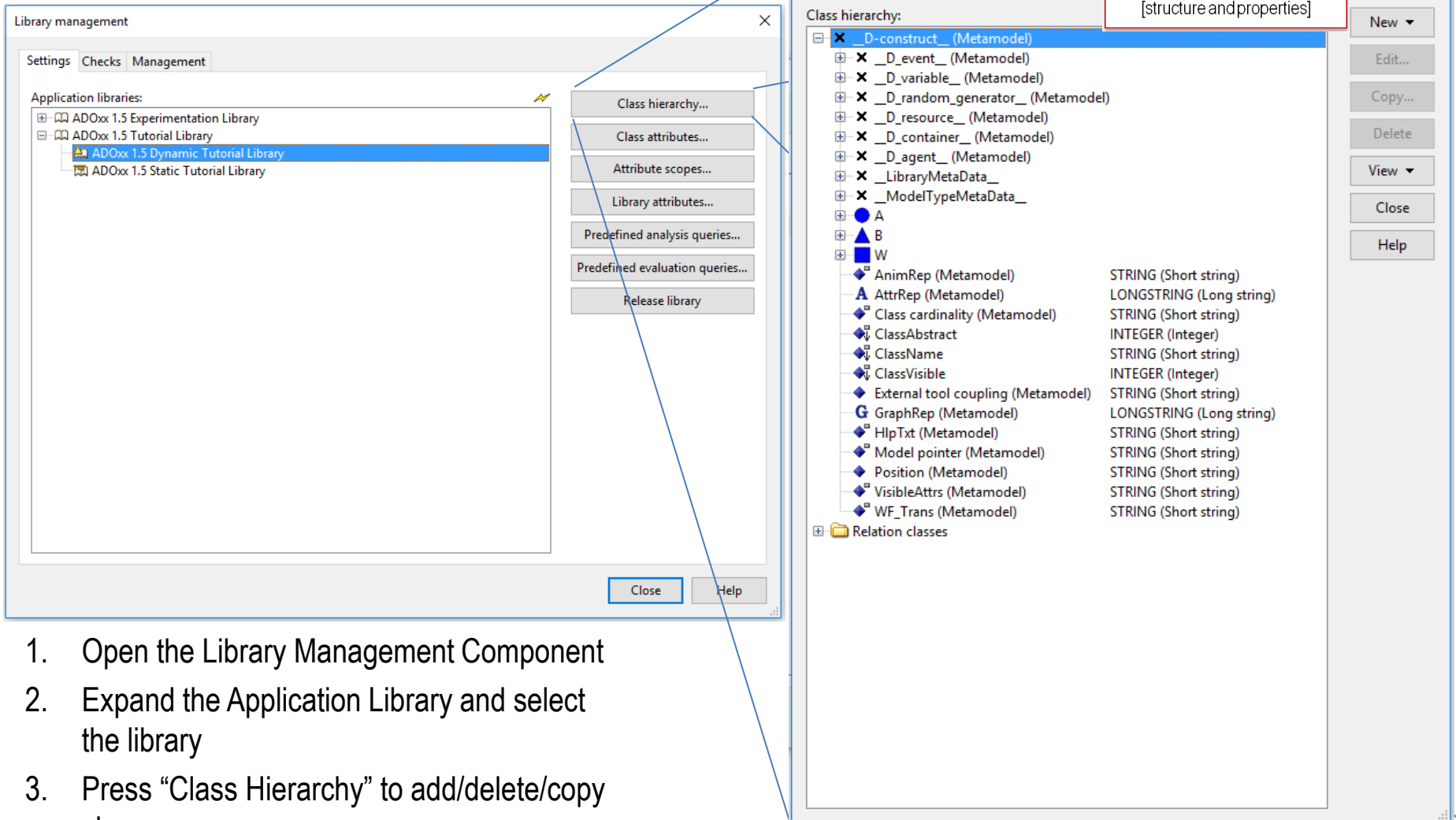
- **Abstract Classes**

- Abstract classes are self-defined classes enabling to structure the meta model and define syntax in form of attributes and semantic, which is inherited by sub-classes.
- Abstract classes either inherit from the root class of the meta model, or from any other class of the meta model. Hence, they inherit the behaviour from their super-class – which is often a pre-defined abstract class from the ADOxx meta model.
- Abstract classes enable an efficient meta model, hence they may not be in every ADOxx meta model.
- Nomenclature: `_ Class Name _`

- **(Concrete) Classes**

- Classes are self-defined classes defining a concrete modelling class that can be used, when applying the corresponding modelling language. Hence all model objects in every model created on ADOxx is an instance of a class.
- Classes inherit the semantic and the attributes from the Pre-defined abstract class and additionally - in case of inheriting - from the abstract class.
- Classes enable the realisation of a concrete meta model.
- Nomenclature: `Class Name`

# Demonstration: Class Definition 1



The screenshot displays the ADOxx 1.5 Dynamic Tutorial Library interface. On the left, the 'Library management' window shows a list of application libraries, with 'ADOxx 1.5 Dynamic Tutorial Library' selected. A blue arrow points from this library to the 'Class hierarchy...' button in the 'Management' tab. On the right, the 'Class hierarchy' dialog is open, showing a list of classes and their attributes. A red box highlights the text 'Define new classes [abstract | concrete | subclass] [structure and properties]'.

Library management

Settings Checks Management

Application libraries:

- ADOxx 1.5 Experimentation Library
- ADOxx 1.5 Tutorial Library
  - ADOxx 1.5 Dynamic Tutorial Library
  - ADOxx 1.5 Static Tutorial Library

Class hierarchy...

Class attributes...

Attribute scopes...

Library attributes...

Predefined analysis queries...

Predefined evaluation queries...

Release library

Close Help

ADOxx 1.5 Dynamic Tutorial Library - Edit class hierarchy

Class hierarchy:

- [-] X \_D-construct\_ (Metamodel)
- [-] X \_D\_event\_ (Metamodel)
- [-] X \_D\_variable\_ (Metamodel)
- [-] X \_D\_random\_generator\_ (Metamodel)
- [-] X \_D\_resource\_ (Metamodel)
- [-] X \_D\_container\_ (Metamodel)
- [-] X \_D\_agent\_ (Metamodel)
- [-] X \_LibraryMetaData\_
- [-] X \_ModelTypeMetaData\_
- [-] A
- [-] B
- [-] W
- [-] AnimRep (Metamodel) STRING (Short string)
- [-] AttrRep (Metamodel) LONGSTRING (Long string)
- [-] Class cardinality (Metamodel) STRING (Short string)
- [-] ClassAbstract INTEGER (Integer)
- [-] ClassName STRING (Short string)
- [-] ClassVisible INTEGER (Integer)
- [-] External tool coupling (Metamodel) STRING (Short string)
- [-] GraphRep (Metamodel) LONGSTRING (Long string)
- [-] HlpTxt (Metamodel) STRING (Short string)
- [-] Model pointer (Metamodel) STRING (Short string)
- [-] Position (Metamodel) STRING (Short string)
- [-] VisibleAttrs (Metamodel) STRING (Short string)
- [-] WF\_Trans (Metamodel) STRING (Short string)
- [-] Relation classes

Define new classes  
[abstract | concrete | subclass]  
[structure and properties]

New ▾

Edit...

Copy...

Delete

View ▾

Close

Help

1. Open the Library Management Component
2. Expand the Application Library and select the library
3. Press "Class Hierarchy" to add/delete/copy classes

## Demonstration: Class Definition 2

1. Add a new concrete class below the abstract element that is used to define a concrete class
2. Select the abstract class, click “New” -> “New class”
3. Name the new class

The new created class can be identified on instance level by the “Name” attribute. This attribute is automatically/implicit available for each class

Define new classes  
 [abstract | concrete | subclass]  
 [structure and properties]

ADOxx 1.5 Dynamic Tutorial Library - Edit class hierarchy

Class hierarchy:

- ✗ \_D-construct\_ (Metamodel)
- ✗ \_D\_event\_ (Metamodel)
- ✗ \_D\_variable\_ (Metamodel)
- ✗ \_D\_random\_generator\_ (Metamodel)
- ✗ \_D\_resource\_ (Metamodel)
- ✗ \_D\_container\_ (Metamodel)
- ✗ \_D\_agent\_ (Metamodel)
- ✗ \_LibraryMetaData\_
- ✗ \_ModelTypeMetaData\_
- A
- ▲ B
- W
- ✗ **\_G\_**
- ↳ AnimRep (Metamodel) STRING (Short string)
- ↳ AttrRep (Metamodel) LONGSTRING (Long string)
- ↳ Class cardinality (Metamodel) STRING (Short string)
- ↳ ClassAbstract INTEGER (Integer)
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- ↳ WF\_Trans (Metamodel) STRING (Short string)
- ↳ AnimRep (Metamodel) STRING (Short string)
- ↳ AttrRep (Metamodel) LONGSTRING (Long string)
- ↳ Class cardinality (Metamodel) STRING (Short string)

Derive a new class

Class name:

Superclass: \_G\_

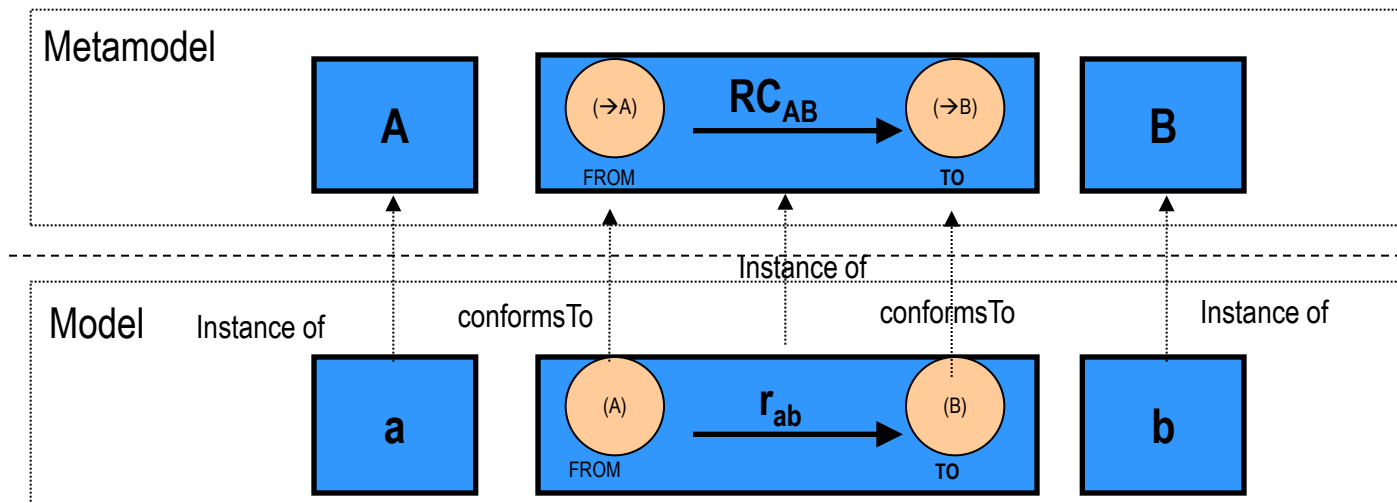
OK Cancel Help



# Relation Types

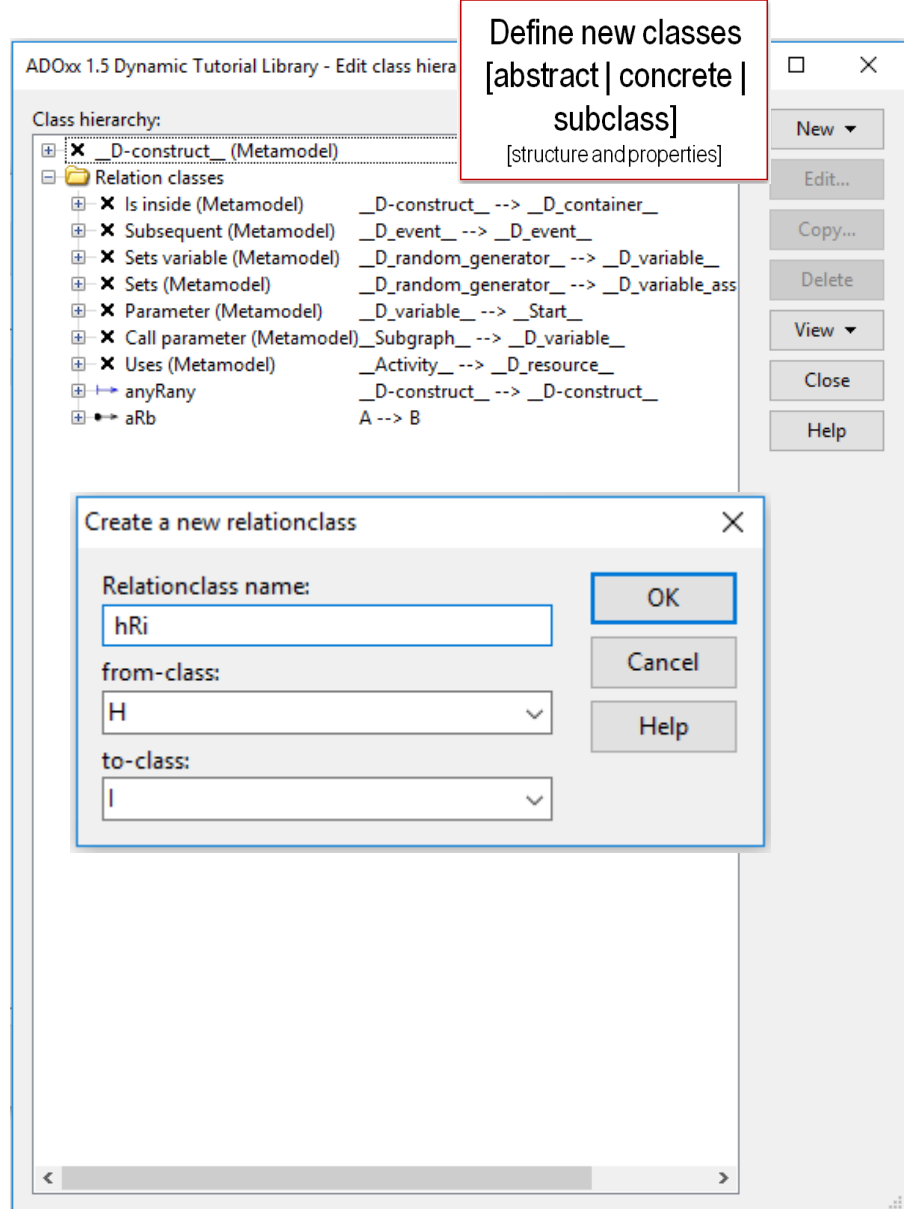
- Relations in ADOxx are expressed either as a class “Relation Class” or as a pointer in form of an attribute called “InterRef”.
- Relation as Class “RC”
  - describes relationship between two objects from two or more classes within one model.
  - has start and endpoints define which (abstract) classes a relation can connect
  - Cardinality and attribute defined the semantic of the relations class
- Relation as Attribute “InterRef”
  - Is a special configuration of a Relation Class and describes the relationship between two objects from two or more classes within or across models.
  - Is a pointer represented as an attributed in the class the relation starts from, with defined classes the relation can point to.
  - Cardinality defines the semantic of the InterRef

Define new classes  
[abstract | concrete |  
subclass]  
[structure and properties]



## Demonstration: Relation Class Definition

- Add two new relation classes to connect classes
  - Click “New” -> “New relation class”
  - Name new relation class
  - Define from-class
  - Define to-class



# Definition of Attributes

- Attributes for classes and relation classes have to be defined in the definition section of the class/relation class with 'TYPE'.
- The following attribute types are possible:

Define new classes  
[abstract | concrete |  
subclass]  
[structure and properties]

|                      |  |
|----------------------|--|
| • <b>INTEGER</b>     | <b>integer</b>   |
| • <b>DOUBLE</b>      | <b>floating number</b>                                   |
| • <b>STRING</b>      | <b>string – max. 3699 symbols</b>                        |
| • LONGSTRING         | string – max. 32000 symbols                              |
| • TIME               | time   |
| • DATE               | date   |
| • DATETIME           | date and time  |
| • ENUMERATION        | enumeration for selecting a characteristic               |
| • ENUMERATIONLIST    | enumeration for selecting one or several characteristics |
| • DISTRIBUTION       | statistical distribution                                 |
| • <b>PROGRAMCALL</b> | <b>enumeration for selecting a program</b>               |
| • RECORD             | a table of attributes                                    |
| • EXPRESSION         | a formula  |
| • <b>INTERREF</b>    | <b>reference on a model or an instance</b>               |
| • ATTRPROFREF        | a preset set of attribute values                         |

# Demonstration: Attribute Types and their Appearance

## Numerical Attributes: **Integer (INTEGER)**

Define new classes  
[abstract | concrete |  
subclass]  
[structure and properties]

1\_Integer:

0

- An attribute of the type "Integer" is defined as an integer from -1,999,999,999 to 1,999,999,999.
- An ADOxx integer is limited to 10 digits plus an optional sign ('+' or '-')
- The standard value of attributes of this type is "0" or a value defined

# Demonstration: Attribute Types and their Appearance

## Numerical Attributes: **Floating number (DOUBLE)**

Define new classes  
[abstract | concrete |  
subclass]  
[structure and properties]

2\_Double:

0.000000

- The amount of decimal places is defined by the attribute definition
- An attribute of the type "Double" is defined for a float within +/-999,999,999,999,999 for an integer (without decimal places) or +/-999,999,999.999999 for figures with 6 decimals.
- The corresponding attribute value is displayed to 6 decimal places. That means that a double value should not exceed a total of 15 significant digits with at last 6 decimal digits!
- The standard value of attributes of this type is "0.000000" or a value defined in the application library.

# Demonstration: Attribute Types and their Appearance

## String Attributes: **String (STRING)**

Define new classes  
[abstract | concrete |  
subclass]  
[structure and properties]

3\_String:

- An attribute of the type "String" is defined for texts up to 3700 characters of any type.
  - Hint: The maximum number of characters is 250 for name. That concerns classes, relation, instances, attributes, application models, libraries and application libraries.
  - Model names have a special rule!
- The standard value of attributes of this type is "" (no entry) or a value defined in the application library.

## Wrap up: Definition of Model Structure on ADOxx

- Introduction of ADOxx Library Concept
- Demonstration of implementation of model structure

## RESULT ACCOMPLISHED:

- Implemented model structure on ADOxx

```
//=====
CLASS <MyFirstClass> : <_LibraryMetaData_>
//=====

        CLASSATTRIBUTE <ClassAbstract>
        VALUE 0

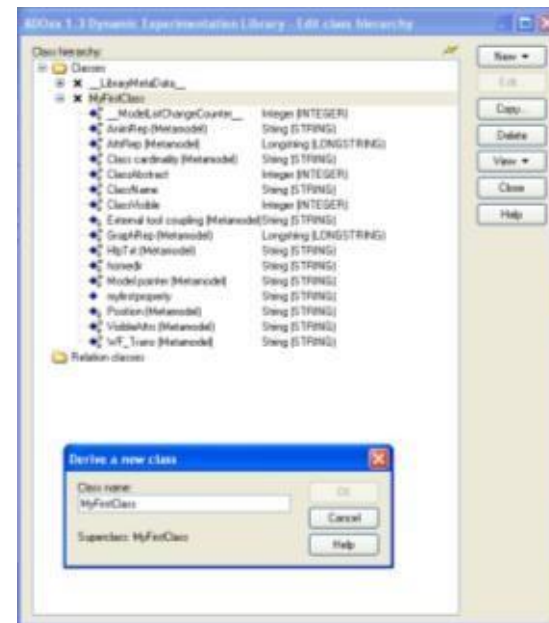
        CLASSATTRIBUTE <ClassVisible>
        VALUE 1

//--- Class <MyFirstClass> - Instance attributes-
        ATTRIBUTE <myfirstproperty>
        TYPE STRING
        VALUE ""

        FACET <MultiLineString>
        VALUE 0
        FACET <AttributeHelpText>
        VALUE ""
        FACET <AttributeRegularExpression>
        VALUE ""

//--- Class <MyFirstClass> - default values-
```

## Model Structure Definition using ADOxx Library Language (ALL)



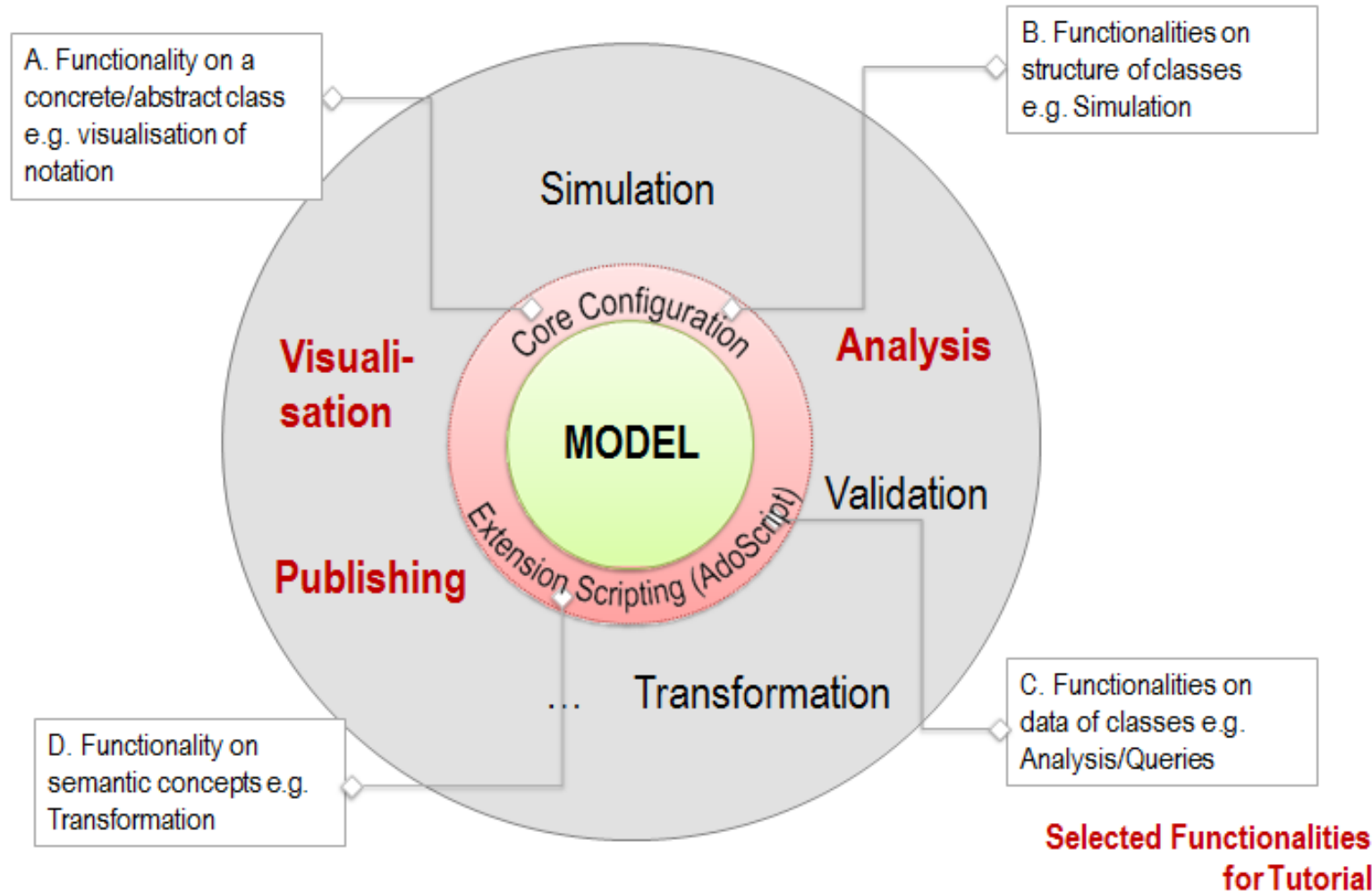
## Model Structure Definition using Development Environment

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- **Processing of Model Structure on ADOxx**
  - Visualisation Functionality
  - Transformation Functionality
  - Analysis Functionality
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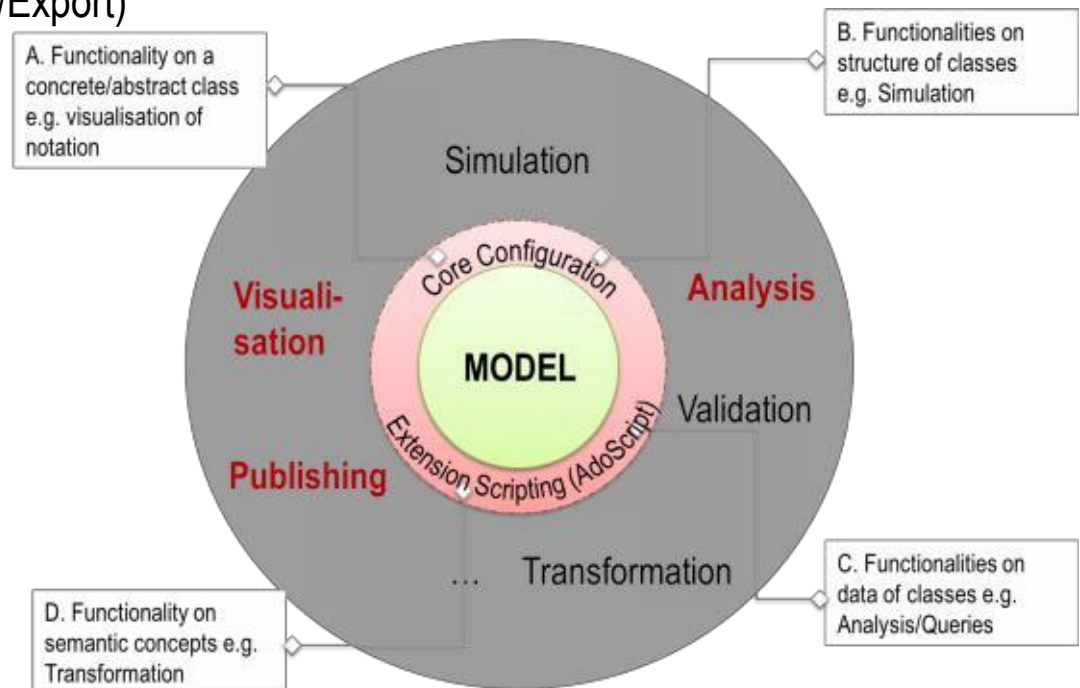


# Model Processing Classification



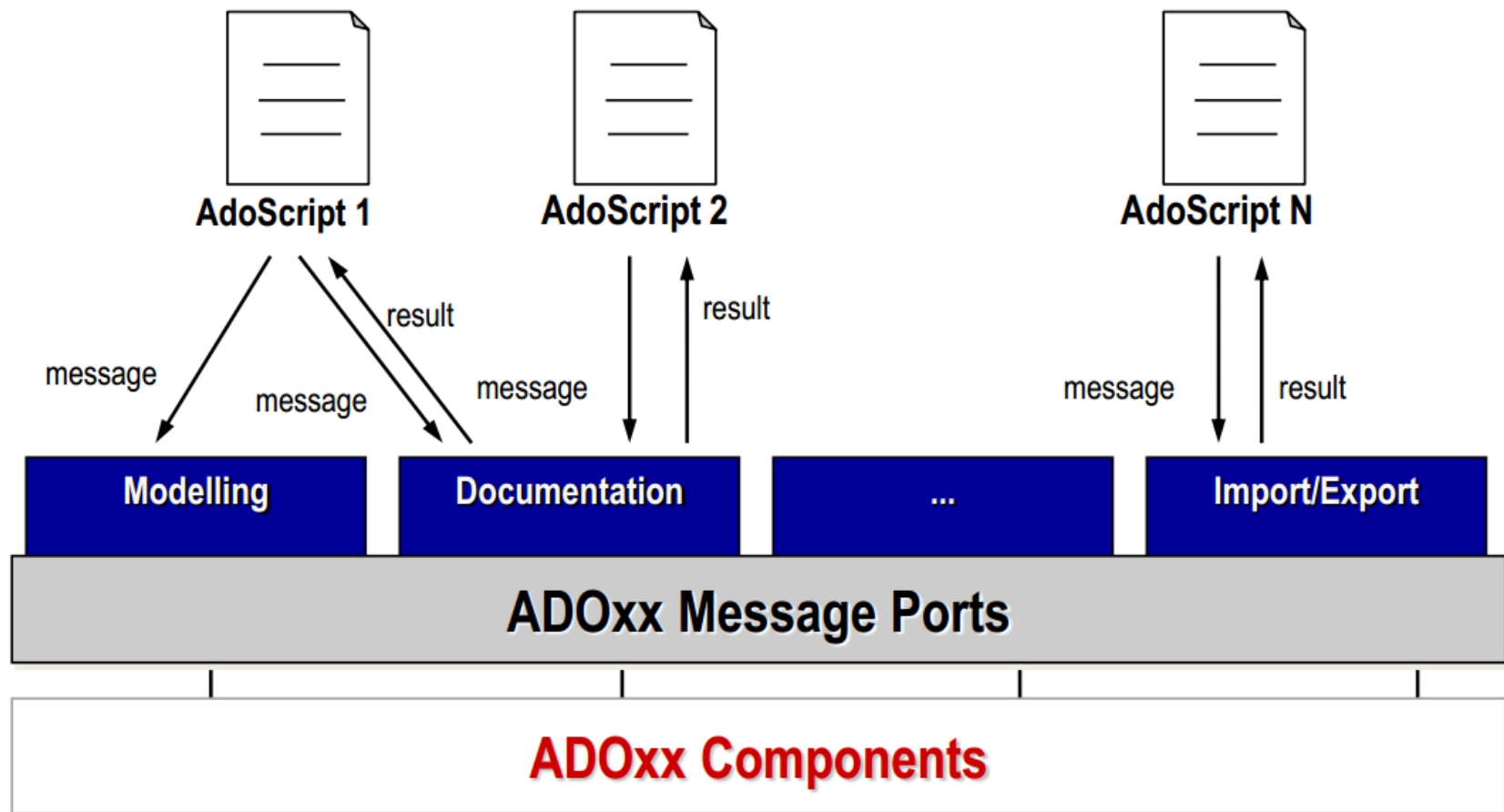
## Core Configuration

- User and Access Right Management
- File Management
- Library Persistence (DB and File Persistence)
- Model Persistence (DB and File Persistence)
- Serialization Functionality (Import/Export)
- ...



# Extension Scripting (AdoScript)

AdoScript: The ADOxx DSL



## Programmable through Scripting APIs

- Method-specific development of functionalities through scripting
- Function calls/APIs of the platform are possible through scripting.

### ***Component APIs***

Messageport **Acquisition**  
Messageport **Modeling**  
Messageport **Analysis**  
Messageport **Simulation**  
Messageport **Evaluation**  
Messageport **ImportExport**  
Messageport **Documentation**  
Messageport **AQL**

### ***UI APIs***

Messageport **AdoScript**  
Messageport **CoreUI**  
Messageport **Explorer**

### ***Manipulation APIs***

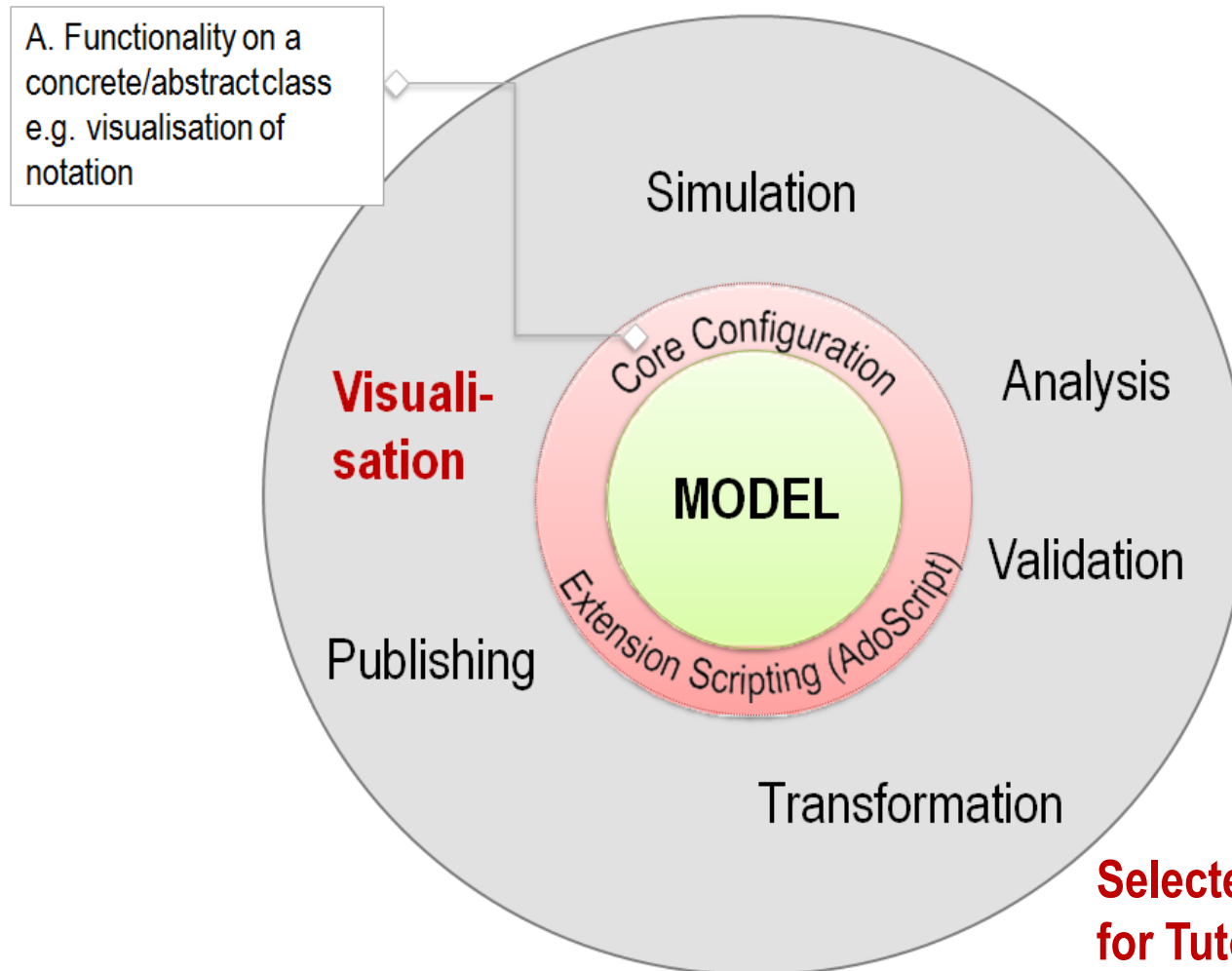
Messageport **Core**  
Messageport **DB**  
Messageport **UsrMgt**

### ***Application APIs***

Messageport **Drawing**  
Messageport **Application**

About 400 APIs are available.

# Model Processing Functionality: Visualisation



**Selected Functionalities  
for Tutorial**

# Object Visualisation

## Platform Functionality

- Object visualisation
- Model visualisation
  - Tabular view incl. view concept
  - Graphical view incl. view concept
  - Machine-generated models
    - Model analysis visualisation
    - Information visualisation
  - Human-generated models
    - Support functionality (automatic & user-defined)

## OMiLAB Development Tools

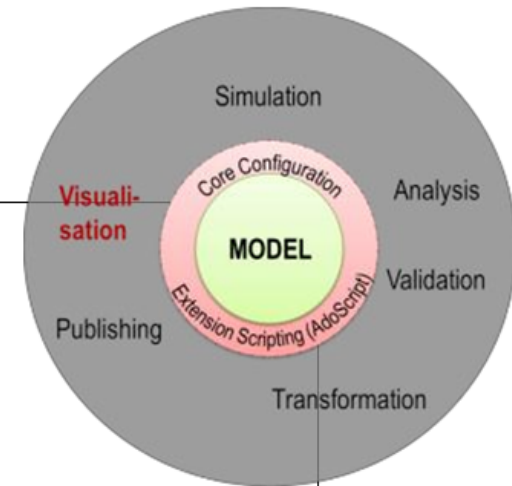
- OMiLAB GraphRepGenerator
- AdoScript Syntax Highlighter

**OPEN SOURCE**

## Platform Technologies

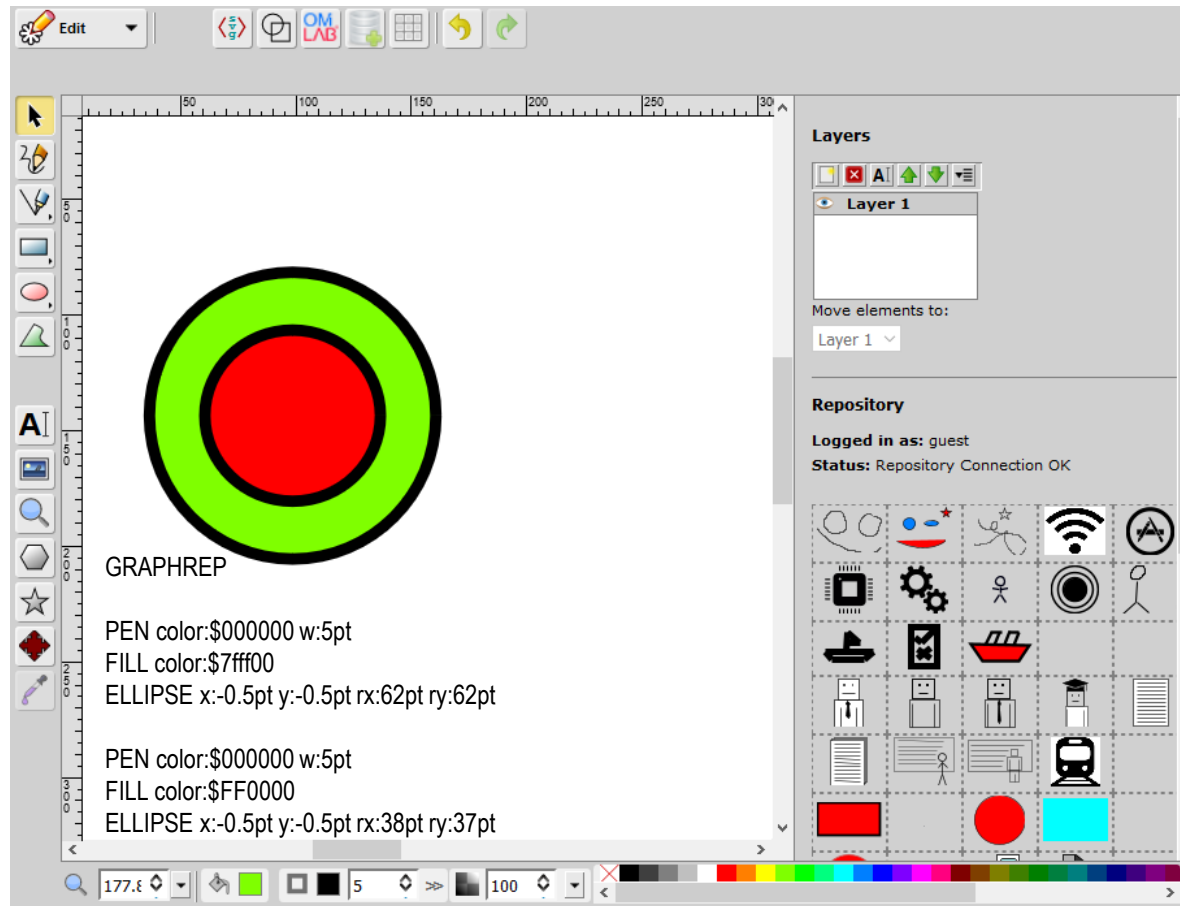
- GraphRep
- AdoScript

**OPEN USE**



# Demonstration: Implementation of Object Visualisation

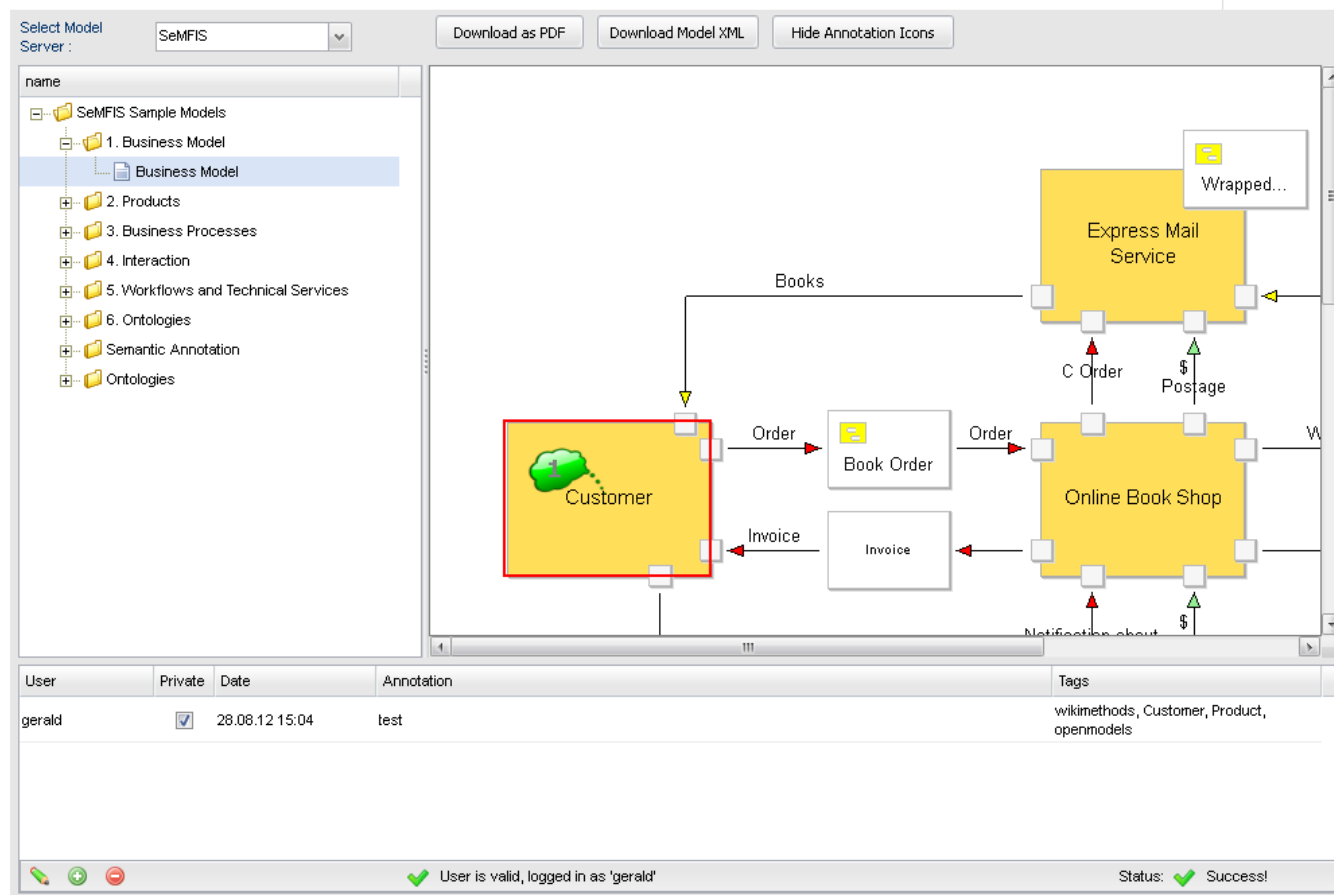
## USE OMILAB Development Tool



<http://austria.omilab.org/psm/content/Graphrep/iframe?view=Developer-Online>

# Demonstration: Implementation of Object Visualisation

## CONTRIBUTE to OMiLAB Developement

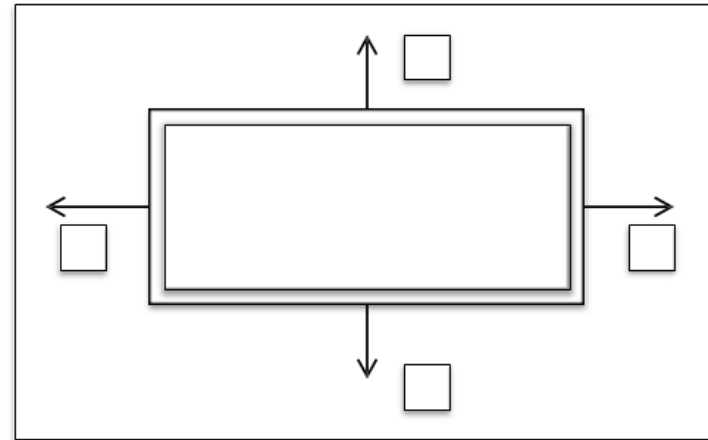
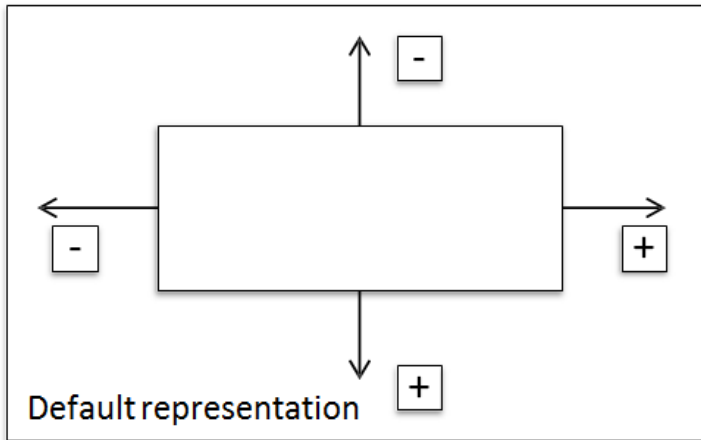


<http://austria.omilab.org/psm/development>



# Demonstration: Implementation of Object Visualisation

## DEVELOPMENT on ADOxx Platform



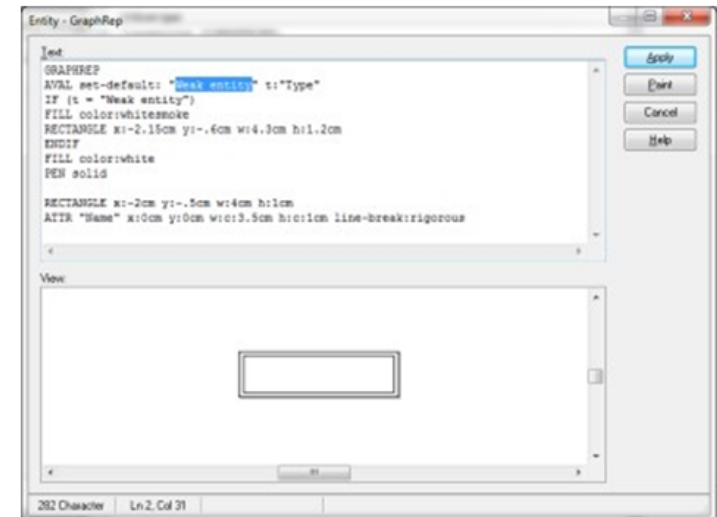
GRAPHREP

```

AVAL t:"Type"
IF (t = "Weak entity") (
  FILL color:whitesmoke
  RECTANGLE x:-2.15cm y:-.6cm w:4.3cm h:1.2cm
)
Conditional representation

FILL color:white
PEN solid
Default representation

RECTANGLE x:-2cm y:-.5cm w:4cm h:1cm
ATTR "Name" x:0cm y:0cm w:c:3.5cm h:c:1cm line-
break:rigorous
Name representation
  
```



# Model Analysis Visualisation

## Platform Functionality

- Object visualisation
- Model visualisation
  - Tabular view incl. view concept
  - Graphical view incl. view concept
  - Machine-generated models
    - Model analysis visualisation
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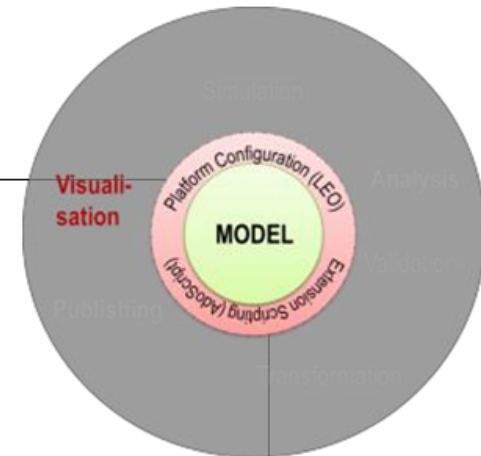
- OMiLAB GraphRepGenerator
- AdoScript Syntax Highlighter

**OPEN SOURCE**

## Platform Technologies

- GraphRep
- AdoScript

**OPEN USE**



# Demonstration: Model Analysis Visualisation

## DEVELOPMENT on ADOxx Platform

```

## Get active Model
CC "Modeling" GET_ACT_MODEL
SETL nStartmodelid: (modelid)

# make an info box for debugging reasons - convert
into a string
CC "AdoScript" INFOBOX ("Hello " + STR(nStartmodelid)
    title:"Start model id!")

## count how many objects are in the model
# get the id of the new model
CC "Core" debug SETL nModelid: (modelid)
SETL nClassID: (classid)

#-----
#-----
#-----
#-----
#-----
# get all objects in the model
CC "Core" debug SETL nClassID: (classid)

IF (LEN(objids) > 0)
    CC "AdoScript" EXIT
}

SETL debug nClassID: (classid)

CC "AdoScript" title:"Counting objects in the model"

## Creating a new model
CC "CoreUI" MODEL_CREATE
    title:"Zielmodell"
    Modellgruppe:"Modellgruppe"

## Create objects in the new model
# get the model id of the new model
CC "Modeling" GET_ACT_MODEL
SETL nResultmodelID: (modelid)

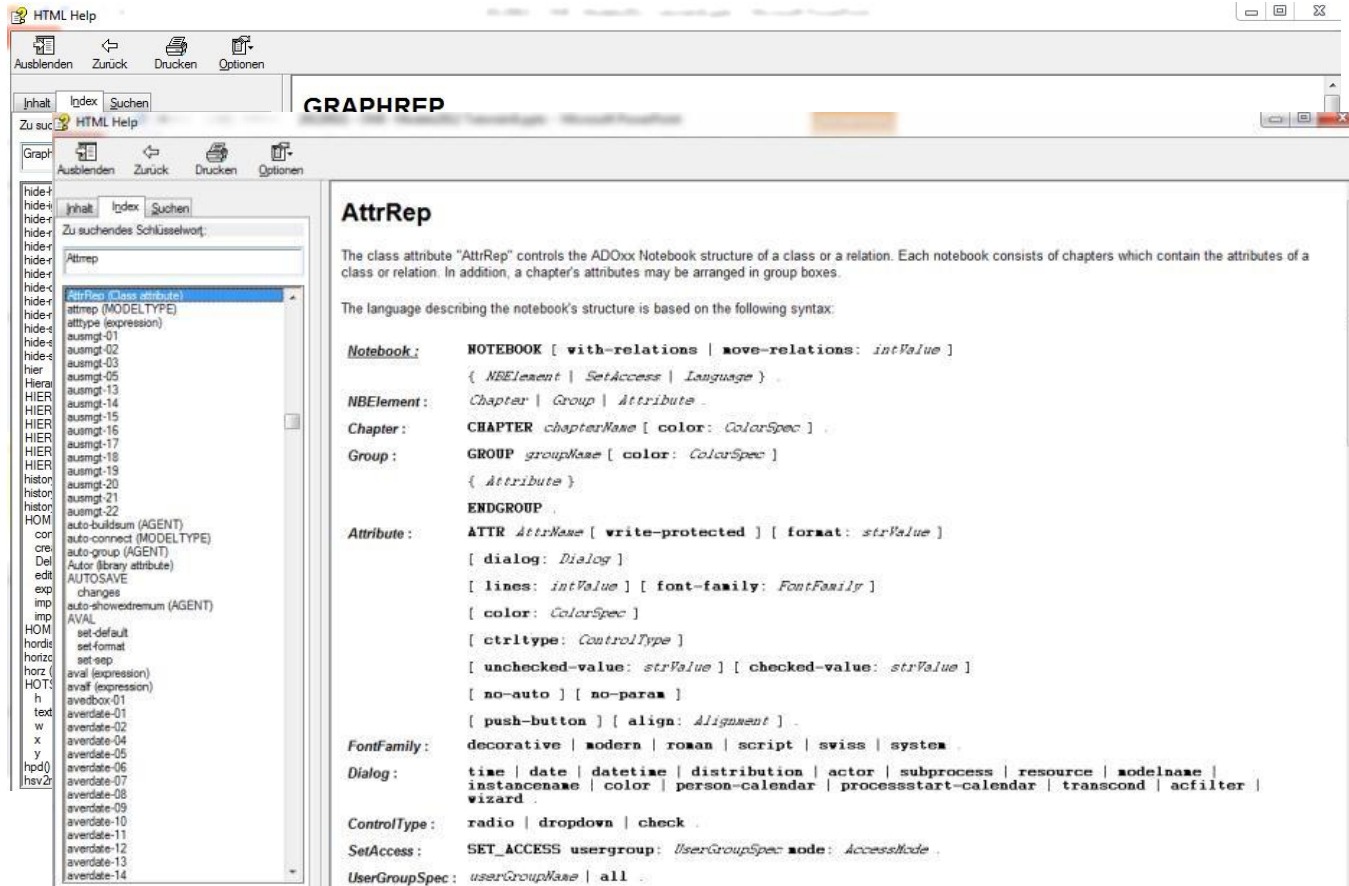
# make an info box for debugging reasons - convert
into a string
CC "AdoScript" INFOBOX ("Hello " + STR(nResultmodelID)
    title:"Result model id!")

CC "Core" CREATE_MODEL modeltype:"Result-Type 1"
    modelname:"My First own result" version:"1.0"
    mgroups:(mgroupids)

# open the new created model AND to make the new
IF (ecode = 0) {
    CC "Modeling" CREATE_WINDOW_FOR_LOADED_MODEL modelid: (nResultmodelID)
}

```

# Summary: GraphRep & AttrRep Syntax



The screenshot shows a web browser window displaying the HTML Help for GRAPHREP. The left sidebar contains a table of contents with various topics like 'hide', 'hier', 'HIER', 'histon', 'HOM', 'cor', 'cre', 'Del', 'edit', 'exp', 'imp', 'HOM', 'hordis', 'horz', 'HOT', 'h', 'text', 'w', 'x', 'y', 'hpd0', and 'hsv2'. The main content area is titled 'AttrRep' and contains the following text:

The class attribute "AttrRep" controls the ADOxx Notebook structure of a class or a relation. Each notebook consists of chapters which contain the attributes of a class or relation. In addition, a chapter's attributes may be arranged in group boxes.

The language describing the notebook's structure is based on the following syntax:

```

Notebook:      NOTEBOOK [ with-relations | move-relations: intValue ]
                  { NBElement | SetAccess | Language } .

NBElement:    Chapter | Group | Attribute .

Chapter:      CHAPTER chapterName [ color: ColorSpec ] .

Group:        GROUP groupName [ color: ColorSpec ]
                  { Attribute }
                  ENDEGROUP .

Attribute:    ATTR AttrName [ write-protected ] [ format: strValue ]
                  { dialog: Dialog }
                  [ lines: intValue ] [ font-family: FontFamily ]
                  [ color: ColorSpec ]
                  [ ctrltype: ControlType ]
                  [ unchecked-value: strValue ] [ checked-value: strValue ]
                  [ no-auto ] [ no-param ]
                  { push-button } [ align: Alignment ] .

FontFamily:   decorative | modern | roman | script | swiss | system .

Dialog:       time | date | datetime | distribution | actor | subprocess | resource | modelName |
                  instanceName | color | person-calendar | processstart-calendar | transcond | acfilter |
                  wizard .

ControlType:  radio | dropdown | check .

SetAccess:    SET_ACCESS usergroup: UserGroupSpec mode: AccessMode .

UserGroupSpec: userGroupName | all .
  
```

<https://www.adoxx.org/live/adoxx-notation-language-graphrep>

<https://www.adoxx.org/live/adoxx-attribute-notation-language-attrrep>

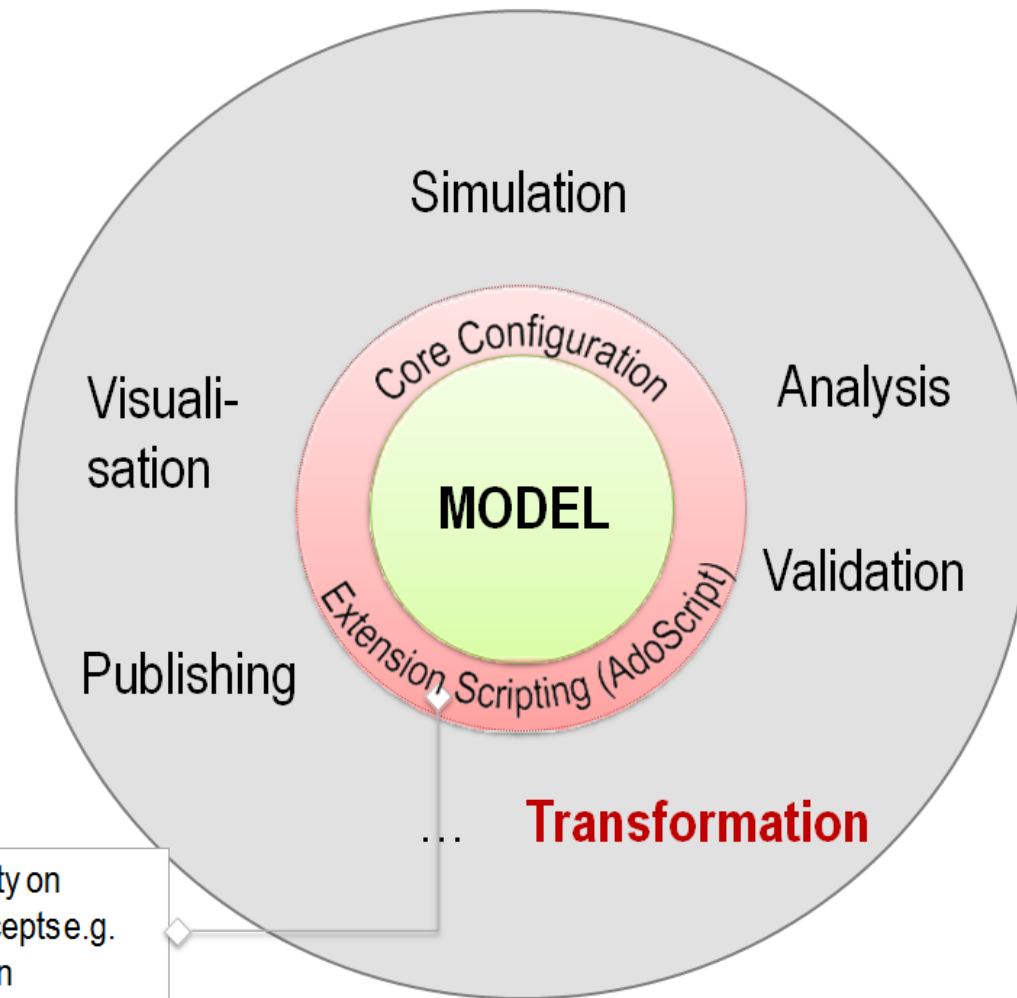
## Wrap up: Visualisation Functionality

- Introduction of visualisation platform functionality
- Definition of tools and services to support development
- Technology Overview to support visualisation functionality

## RESULT ACCOMPLISHED:

- Implemented Object Visualisation
- Implemented Script Functionality
- Modeltypes and View Definition
- Attribute Representation

# Model Processing Functionality: Transformation



D. Functionality on  
semantic concepts e.g.  
Transformation

# Model Transformation

## Platform Functionality

- Objecttransformation
- Modeltransformation
  - SAME PLATFORM
  - DIFFERENT PLATFORM
    - Inbound Interfaces
    - Outbound Interfaces

## OMiLAB Development Tools

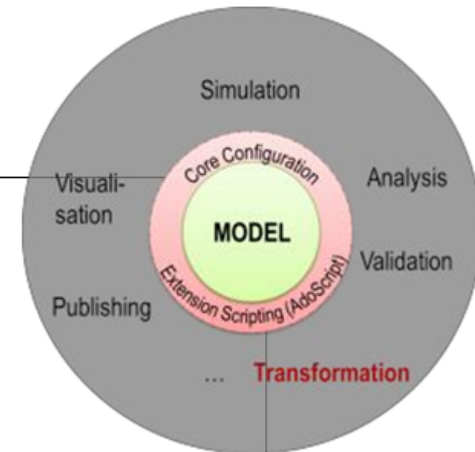
- Model Publishing Engine
- AdoScript Syntax Highlighter

**OPEN SOURCE**

## Platform Technologies

- Platform configuration
- AdoScript

**OPEN USE**



# Demonstration: Implementation of Model Transformation

## USE OMiLAB Development Tool

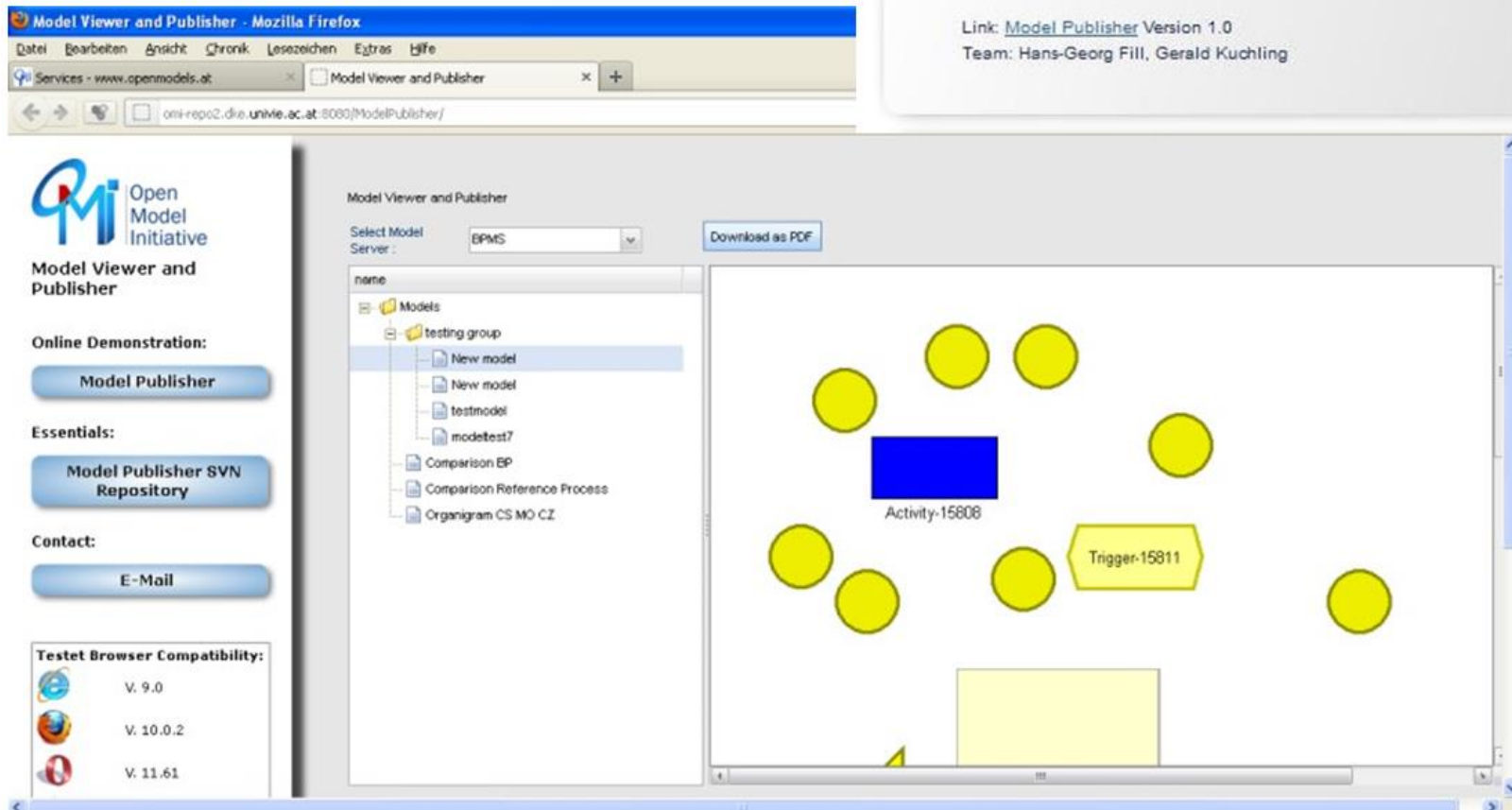


### Model Publisher

Model Publisher

Link: [Model Publisher Version 1.0](#)

Team: Hans-Georg Fill, Gerald Kuchling

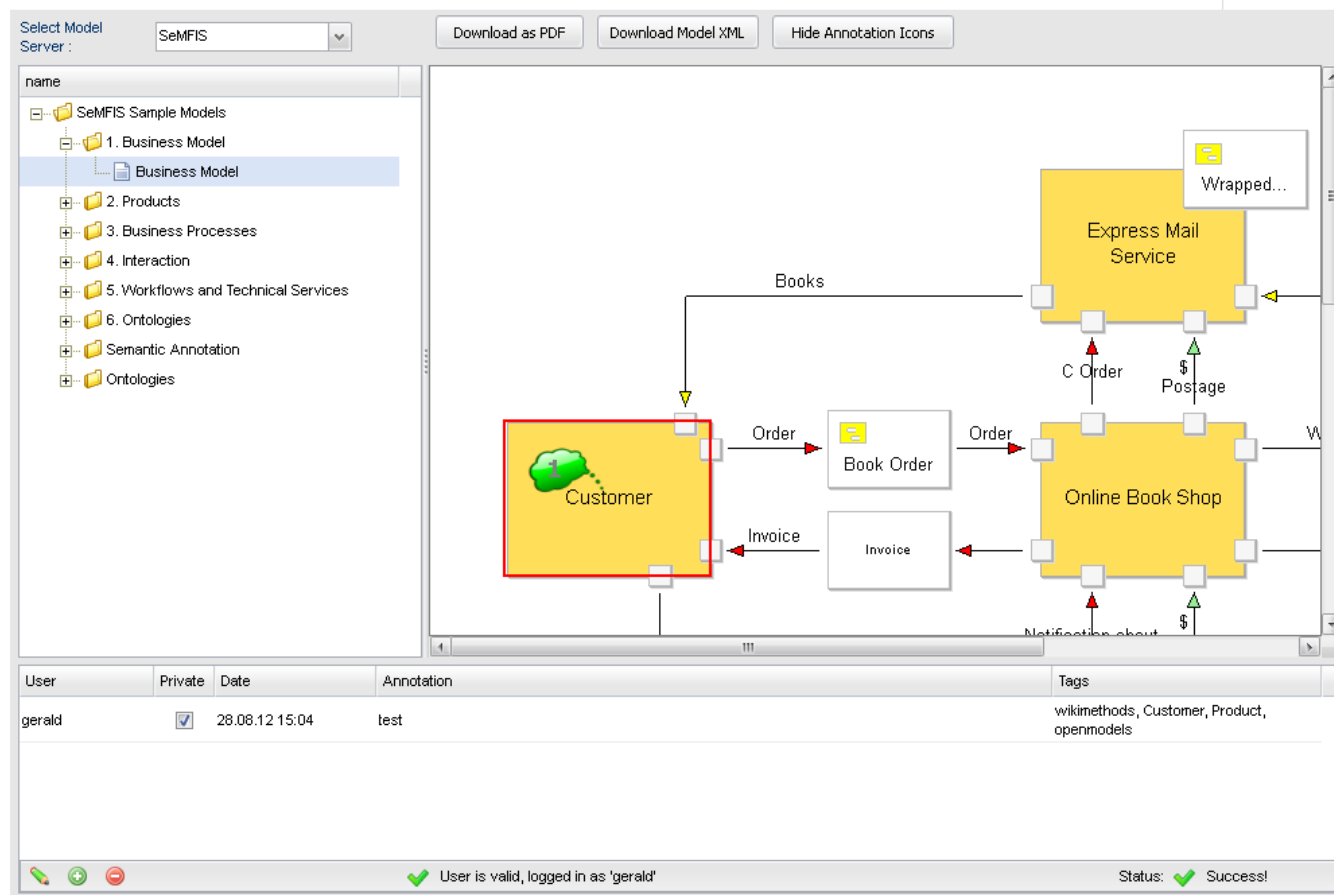


<http://austria.omilab.org/psm/development>



# Demonstration: Implementation of Model Transformation

## CONTRIBUTE to OMiLAB Developement



<http://austria.omilab.org/psm/development>

# Model Transformation (Different Platform)

## Platform Functionality

- Objecttransformation
- Modeltransformation
  - SAME PLATFORM
  - DIFFERENT PLATFORM
    - Inbound Interfaces
    - Outbound Interfaces

## OMiLAB Development Tools

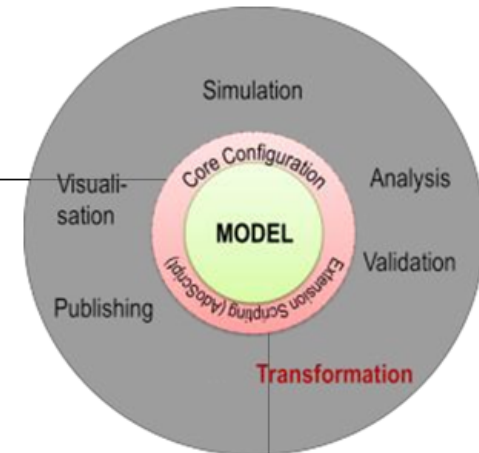
- Model Publishing Engine
- AdoScript Syntax Highlighter

**OPEN SOURCE**

## Platform Technologies

- Platform configuration
- AdoScript

**OPEN USE**



# Demonstration: Core Functionality for Serialisation as XML and ADL

## USE functionality on ADOxx Platform

### XML Export Sample

```
<?xml version="1.0" encoding="UTF-8" ?>
<!DOCTYPE ADOXML [View Source for full doctype...]>
<ADOXML version="3.1" date="28.06.2012" time="13:32" database="adoxx13" username="sample1" adoversion="Vers
" >
  <MODELS>
    <MODEL id="mod.13813" name="model-1" version="1.1" modeltype="Sample" libtype="bp" applib="ADOxx 1.3 Dv
    <MODELATtributes>
      <INSTANCE id="obj.13814" class="E" name="E1">
        <ATTRIBUTE name="Position" type="STRING">NODE x:4cm y:11cm w:2cm h:2cm index:1</ATTRIBUTE>
        <ATTRIBUTE name="External tool coupling" type="STRING" />
        <ATTRIBUTE name="a1" type="INTEGER">0</ATTRIBUTE>
        <RECORD name="a2" />
        <ATTRIBUTE name="a3" type="STRING" />
        <ATTRIBUTE name="b1" type="INTEGER">0</ATTRIBUTE>
        <RECORD name="b2" />
        <ATTRIBUTE name="b3" type="STRING" />
        <ATTRIBUTE name="e1" type="INTEGER">0</ATTRIBUTE>
        <RECORD name="e2" />
        <ATTRIBUTE name="e3" type="STRING">11</ATTRIBUTE>
        <ATTRIBUTE name="a4" type="INTEGER">0</ATTRIBUTE>
        <ATTRIBUTE name="b4" type="STRING" />
      </INSTANCE>
      <INSTANCE id="obj.13817" class="A" name="A1">
      <INSTANCE id="obj.13826" class="B" name="B1">
      <INSTANCE id="obj.13832" class="C" name="C-13010">
      <INSTANCE id="obj.13835" class="D" name="D-13013">
      <INSTANCE id="obj.16408" class="B" name="B-16408">
      <INSTANCE id="obj.16604" class="V" name="V1">
      <INSTANCE id="obj.17004" class="W" name="W1">
      <INSTANCE id="obj.17007" class="B" name="B-16408-17007">
      <INSTANCE id="obj.17291" class="E" name="E-17291">
      <INSTANCE id="obj.17294" class="E" name="E-17294">
      <INSTANCE id="obj.17297" class="E" name="E-17297">
      <INSTANCE id="obj.17328" class="E" name="D-13013-17321">
      <INSTANCE id="obj.17334" class="E" name="C-13010-17318">
      <CONNECTOR id="con.13841" class="aRb">
      <CONNECTOR id="con.13842" class="aRb">
      <CONNECTOR id="con.13843" class="aRb">
      <CONNECTOR id="con.13844" class="aRb">
      <CONNECTOR id="con.13845" class="aRb">
      <CONNECTOR id="con.16607" class="Is inside">
    </MODEL>
  </MODELS>
</ADOXML>
```

### ADL Export Sample

```
INSTANCE<E1> : <E>
  ATTRIBUTE<Position>
  VALUE "NODE x:4cm y:11cm w:2cm h:2cm index:1"
  ATTRIBUTE<External tool coupling>
  VALUE ""
  ATTRIBUTE<a1>
  VALUE 0
  ATTRIBUTE<a2>
  VALUE
  ATTRIBUTE<a3>
  VALUE ""
  ATTRIBUTE<b1>
  VALUE 0
  ATTRIBUTE<b2>
  VALUE
  ATTRIBUTE<b3>
  VALUE ""
  ATTRIBUTE<e1>
  VALUE 0
  ATTRIBUTE<e2>
  VALUE
```

# Model Transformation (Same Platform)

## Platform Functionality

- Objecttransformation
- Modeltransformation
  - SAME PLATFORM
  - DIFFERENT PLATFORM
    - Inbound Interfaces
    - Outbound Interfaces

## OMiLAB Development Tools

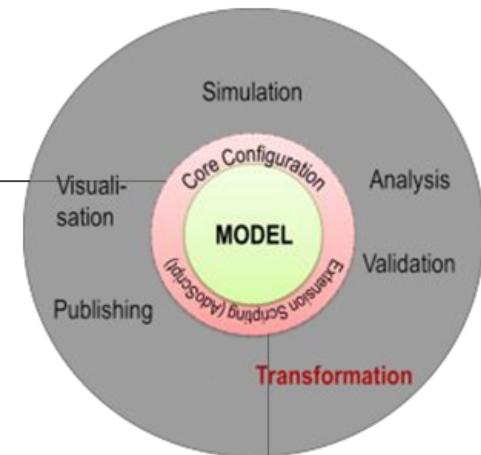
- Model Publishing Engine
- AdoScript Syntax Highlighter

## Platform Technologies

- Platform configuration
- AdoScript

**OPEN SOURCE**

**OPEN USE**



# Demonstration: Implementation of Model Transformation 1

## DEVELOP on ADOxx Platform

```
## Open Model
CC "Modeling" GET_ACT_MODEL
SETL nSourceModelID:(modelid)

SETL sClassnameSource:("A")
SETL sClassnameTarget:("E")

# BEGIN set new model
CC "CoreUI" MODEL_SELECT_BOX mgroup-sel without-models
    title:"Zielmodellgruppe"
    boxtext:"Selektieren Sie die Ziel-Modellgruppe in der Datenbank:"

CC "Core" CREATE_MODEL modeltype:"Sample"
    modelname:"My First sample"
    version:"1.0"
    mgroups:(mgroupids)
SETL nTargetModelID:(modelid)

# END set new model

CC "Core" GET_ALL_OBJS_OF_CLASSNAME modelid:(nSourceModelID)
classname:(sClassnameSource)
SETL sObjIDs:(objids)
```

# Demonstration: Implementation of Model Transformation 2

## DEVELOP on ADOxx Platform

```
# BEGIN set x, y pos
SETL nXpos:(5)
SETL nYpos:(5)
FOR i in:(sObjIDs) {
  # get class ID from class name
  CC "Core" GET_CLASS_ID classname:(sClassnameSource)

  # get the attribute "Name"
  CC "Core" GET_ATTR_ID classid:(classid) attrname:("Name")

  # and show it
  CC "Core" GET_ATTR_VAL objid:(VAL (i)) attrid:(attrid)
  CC "AdoScript" INFOBOX (val)
  SETL sAttrName:(val)

  #Make new model
  CC "Core" GET_CLASS_ID classname:(sClassnameTarget)
  SETL nClassTargetID:(classid)
  CC "Core" debug CREATE_OBJ modelid:(nTargetModelID) classid:(nClassTargetID)
    objname:(sAttrName)
  CC "Core" debug SET_ATTR_VAL objid:(objid) attrname:("Position") val:("x:"
    + STR (nXpos) +"cm y:" + STR (nYpos) + "cm")
  SETL nXpos:(nXpos + 2.5)
}
```

# Object Transformation

## Platform Functionality

- Objecttransformation
- Modeltransformation
  - SAME PLATFORM
  - DIFFERENT PLATFORM
    - Inbound Interfaces
    - Outbound Interfaces

## OMiLAB Development Tools

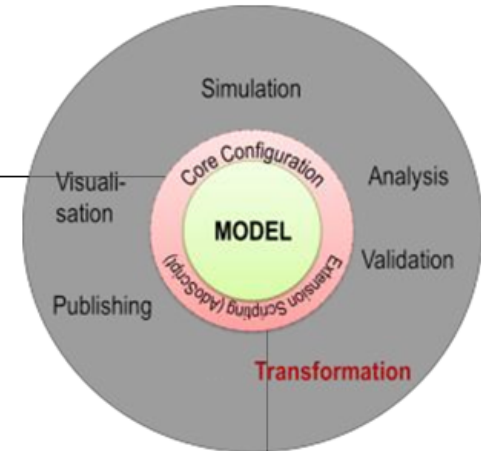
- Model Publishing Engine
- AdoScript Syntax Highlighter

**OPEN SOURCE**

## Platform Technologies

- Platform configuration
- AdoScript

**OPEN USE**



# Objecttransformation using CONVERSION

## DEVELOP on ADOxx Platform

- If you define `__Conversion__` for the class „A" with

```
CLASS „B"  
ATTR „ba1"  
ATTR „ba2" from: „aa3"
```

|                          |  |
|--------------------------|--|
| <i>Conversion</i> :      | <i>{ ClassConversion }</i> .                                   |
| <i>ClassConversion</i> : | <b>CLASS</b> <i>className</i> { <i>AttrConversion</i> } .      |
| <i>AttrConversion</i> :  | <b>ATTR</b> <i>attrName</i> [ <b>from:</b> <i>attrName</i> ] . |

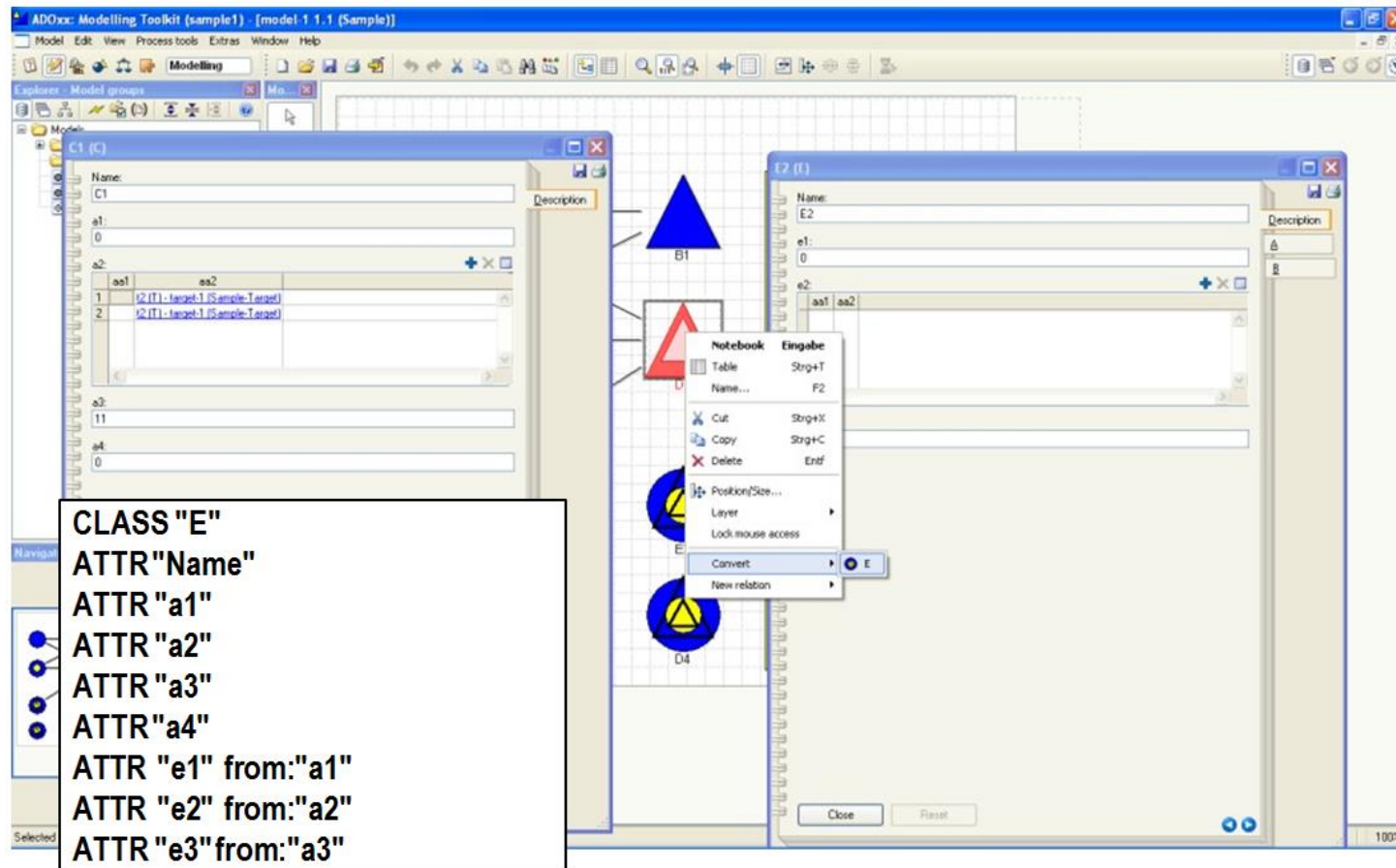
- this means that
  - objects of class „A" can be converted to objects of class „B",
  - the aa1 is assigned from A to ba1 in B as they have the same name,
  - the aa3 from A is assigned to Ba2 from B as they have different names,



# Demonstration: Objecttransformation

## DEVELOP on ADOxx Platform

Instances of C -> E



The screenshot shows the ADOxx Modelling Toolkit interface. On the left, a window titled 'C1 (C)' displays the structure of class C1, including attributes 'a1', 'a2', 'a3', and 'a4'. In the center, a diagram shows a blue triangle labeled 'B1' and a red triangle labeled 'D4'. A context menu is open over the diagram, with the 'Convert' option selected, which has a sub-menu showing 'E' as the target class. On the right, a window titled 'E2 (E)' displays the structure of class E2, including attributes 'e1' and 'e2'. A text box in the bottom left corner contains the following text:

```
CLASS "E"  
ATTR "Name"  
ATTR "a1"  
ATTR "a2"  
ATTR "a3"  
ATTR "a4"  
ATTR "e1" from:"a1"  
ATTR "e2" from:"a2"  
ATTR "e3" from:"a3"
```

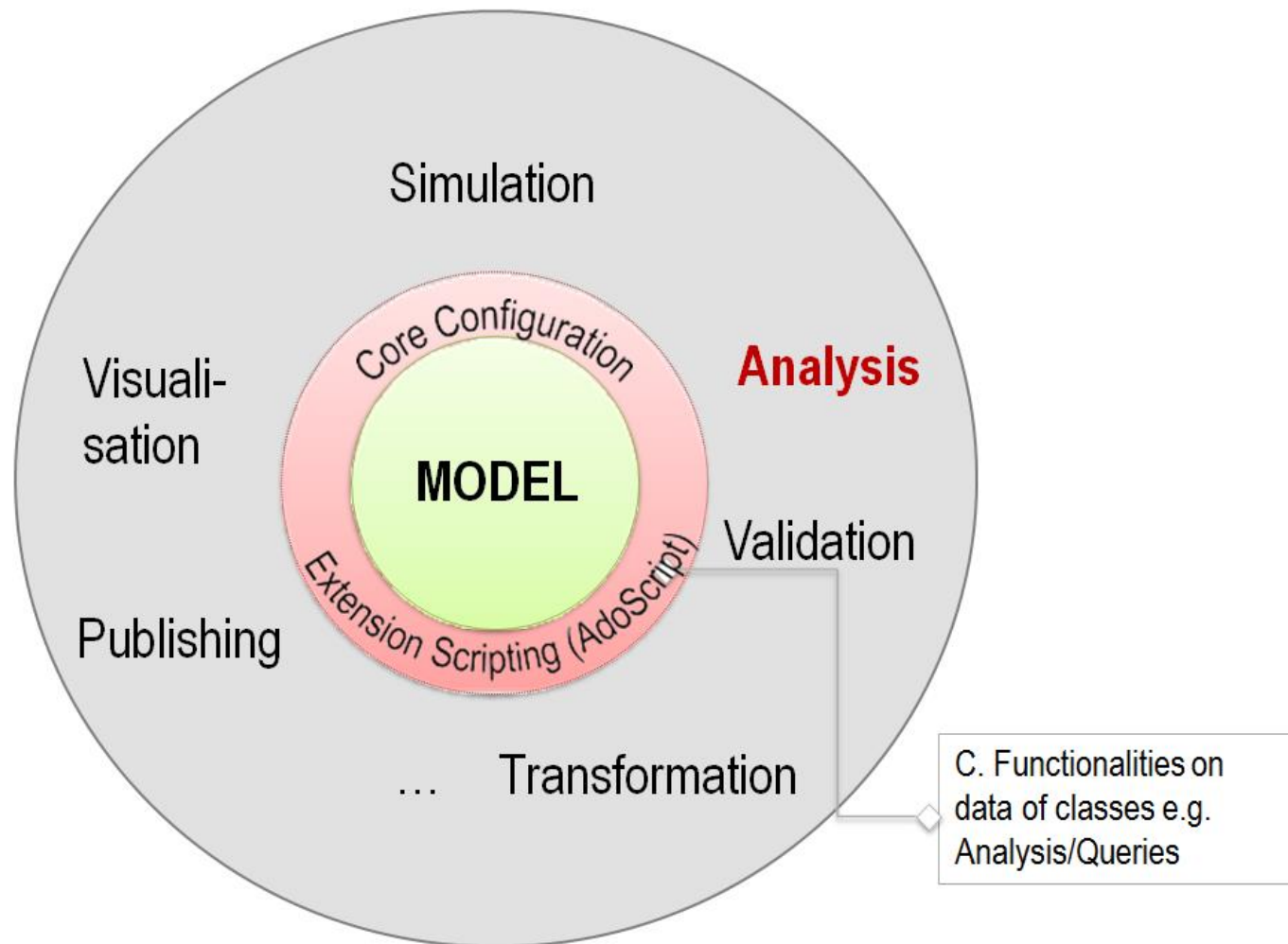
## Wrap up: Transformation Functionality

- Use the basic transformation mechanisms to use it for publishing
- Use scripting mechanisms for model transformation

## RESULT ACCOMPLISHED:

- Publishing example using the OMiLAB service
- Transformation of scripts

# Model Processing Functionality: Analysis



# Query of Model Content

## Platform Functionality

- Query of model content
- Quality validation
- Consistency checks
- Population through analysis

## OMiLAB Development Tools

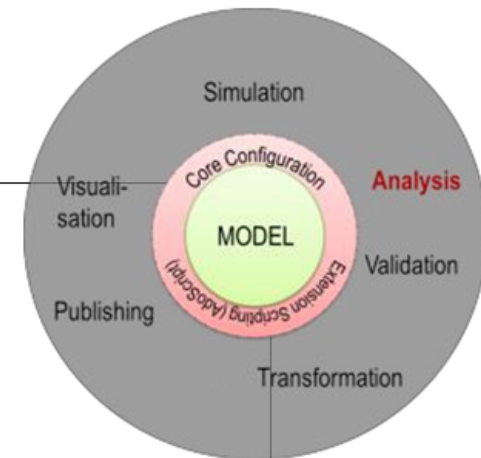
- ReSTAPI

**OPEN SOURCE**

## Platform Technologies

- AQL
- AdoScript

**OPEN USE**












# Demonstration: Analysis Functionality

## CONTRIBUTE to OMiLAB Development

Development

Add dev tool

|  |   |   |   |
|--|---|---|---|
| <br>GraphRep Generator    | Method Publisher<br> | MLEA<br>      | <br>model Annotator<br>Model Annotator |
| OMiRepo<br>               | OM-RestAPIs<br>      | OMiLAB TV<br> | Model Publisher<br>                    |
| <br>Web Model Navigator |   |   |   |

<http://austria.omilab.org/psm/development>

# Demonstration: Analysis Functionality

## DEVELOP on ADOxx Platform

### Example 1: Get all objects of class "A" in a certain model

```
CC "Modeling" GET_ACT_MODEL
#-->RESULT modelid:intValue
CC "AQL" EVAL_AQL_EXPRESSION expr:"<\"A\">" modelid:(modelid)
IF (ecode = 0) {
    CC "AdoScript" INFOBOX ("Found objects: " + objids)
}
ELSE {
    CC "AdoScript" INFOBOX "An error has occurred!"
}
```

### Example 2: Get all models of modeltype "Sample"

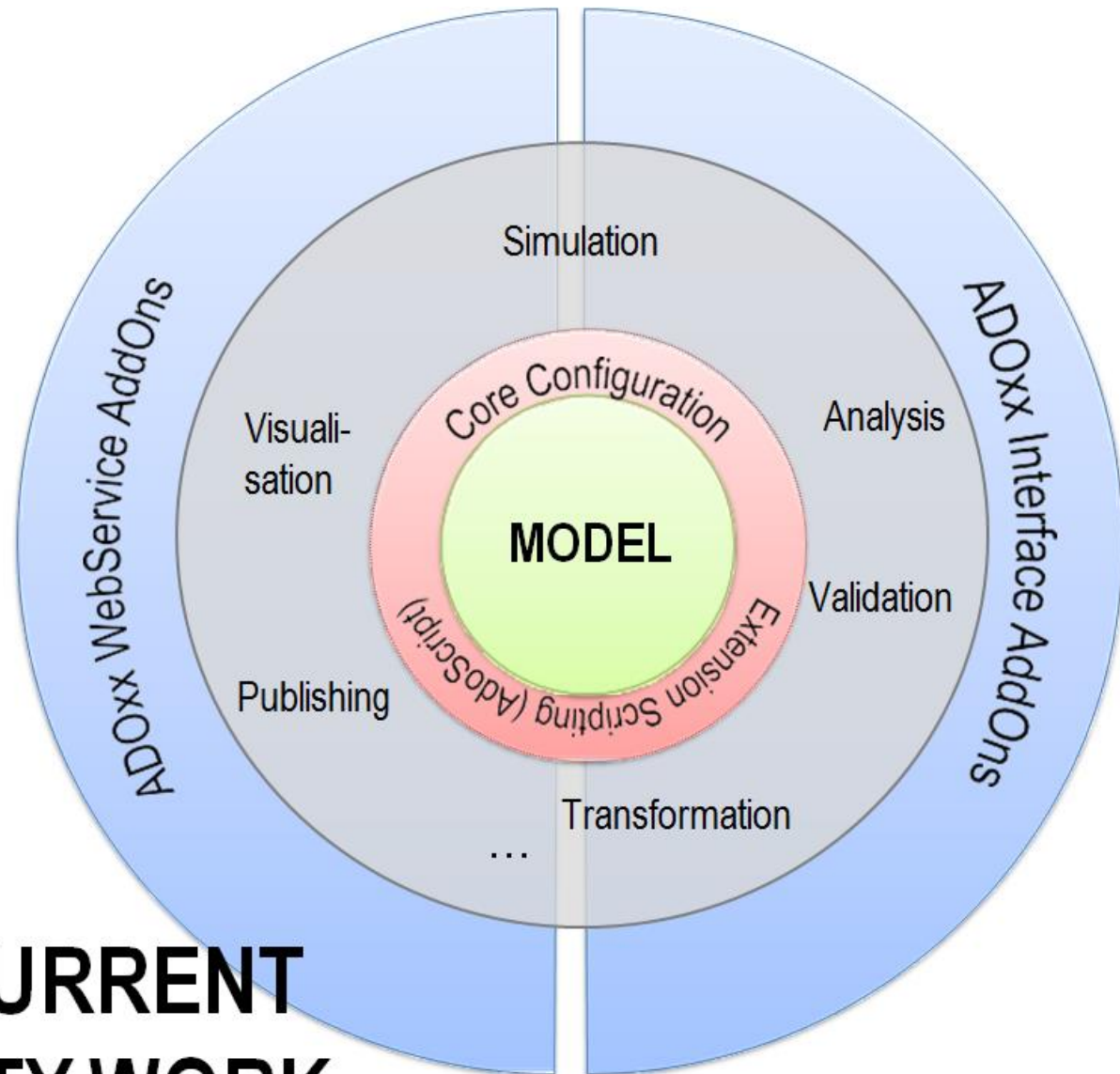
```
CC "AQL" EVAL_AQL_EXPRESSION expr:"<\"Sample\">" modelscope
IF (ecode = 0) {
    CC "AdoScript" INFOBOX ("Found models: " + objids)
}
ELSE {
    CC "AdoScript" INFOBOX "An error has occurred!"
}
```

## Wrap up: Analysis Functionality

- ReST API for model analysis
- Script <-> AQL combination to run analysis

## RESULT ACCOMPLISHED:

- Implemented API integration with demonstration environment
- AQL queries in script



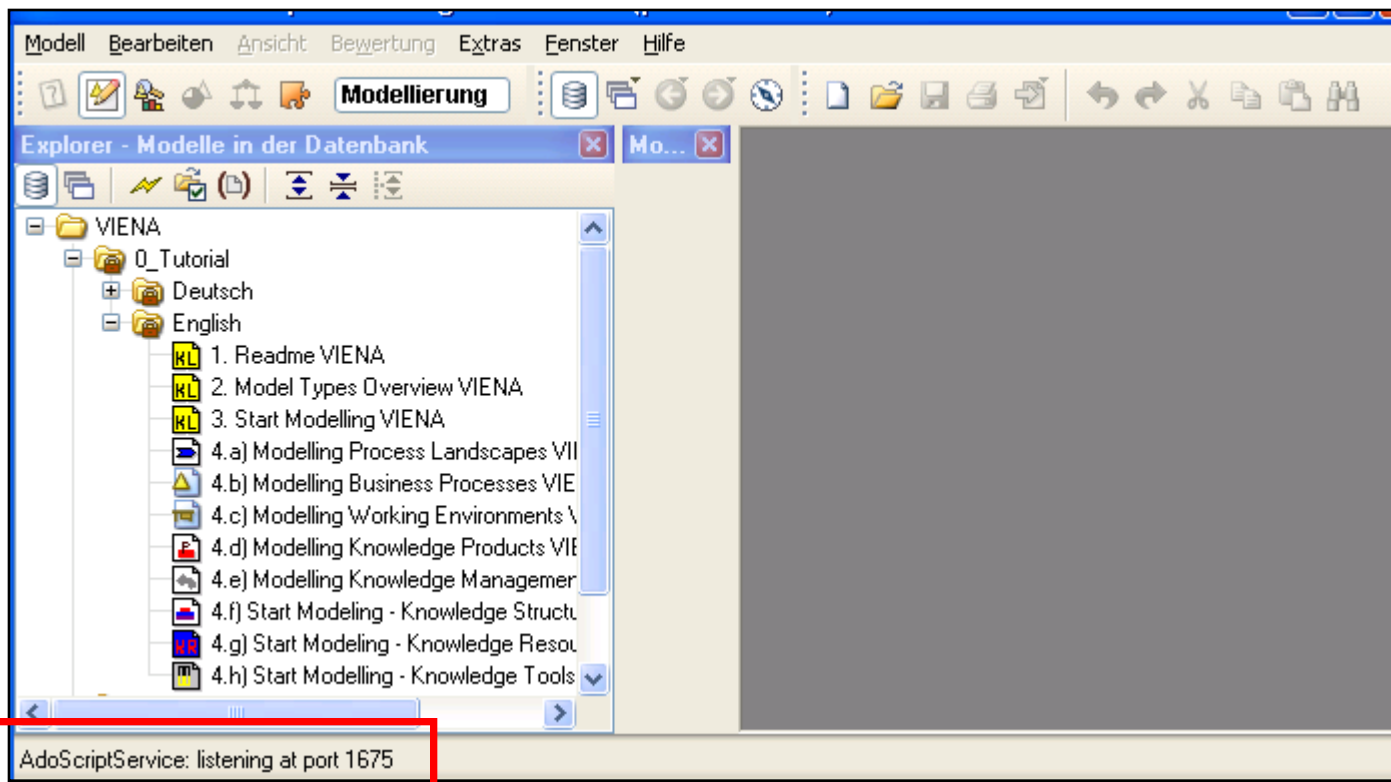
# ADOXX SELECT CURRENT COMMUNITY WORK



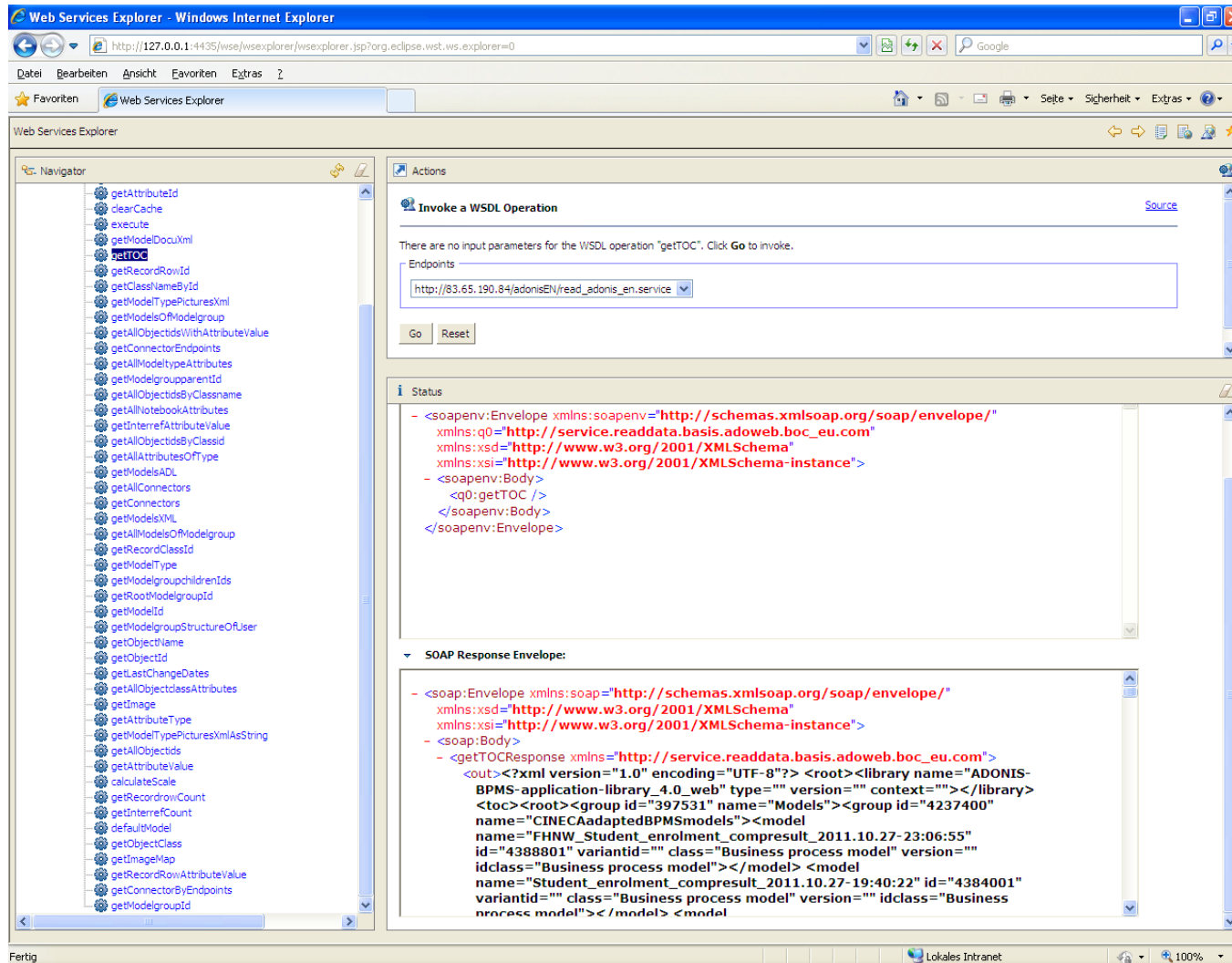
## ADOxx WebService Port

```
C:\WINDOWS\system32\cmd.exe

C:\ADOweb\STARTUP\prom37de>ECHO CC "AdoScript" SERVICE start port:1675 SETG serviceEnabled:1 ! ..\..\..\Programme\BOG\ADONIS39DE\areena -nodialogs -e -upromotevienna2 -ppassword -dprom37de -no_printer_warning
```



# ADOxx WebService Interaction



The screenshot shows the Web Services Explorer interface in a Windows Internet Explorer browser window. The address bar displays the URL: `http://127.0.0.1:4435/wse/wsexplorer/wsexplorer.jsp?org.eclipse.wst.ws.explorer=0`. The interface is divided into several panes:

- Navigator:** A list of available web service operations, including `getAttributeId`, `clearCache`, `execute`, `getModelDocuXml`, **`getTOC`**, `getRecordRowId`, `getClassNameById`, `getModelTypePicturesXml`, `getModelsOfModelgroup`, `getAllObjectsWithAttributeValue`, `getConnectorEndpoints`, `getModelTypeAttributes`, `getModelgroupparentId`, `getAllObjectidsByClassname`, `getAllNotebookAttributes`, `getInterrefAttributeValue`, `getAllObjectidsByClassid`, `getAttributesOfType`, `getModelsADL`, `getAllConnectors`, `getConnectors`, `getModelsXML`, `getAllModelsOfModelgroup`, `getRecordClassId`, `getModelType`, `getModelgroupchildrenIds`, `getRootModelgroupId`, `getModelId`, `getModelgroupStructureOfUser`, `getObjectValue`, `getObjectId`, `getLastChangeDates`, `getAllObjectclassAttributes`, `getImage`, `getAttributeType`, `getModelTypePicturesXmlAsString`, `getAllObjectids`, `getAttributeValue`, `calculateScale`, `getRecordrowCount`, `getInterrefCount`, `defaultModel`, `getObjectClass`, `getImageMap`, `getRecordRowAttributeValue`, `getConnectorByEndpoints`, and `getModelgroupId`.
- Actions:** A section titled "Invoke a WSDL Operation" with a message: "There are no input parameters for the WSDL operation 'getTOC'. Click Go to invoke." Below this, the "Endpoints" list contains the URL: `http://83.65.190.84/adonisEN/read_adonis_en.service`. "Go" and "Reset" buttons are present.
- Status:** Displays the SOAP request and response.
  - SOAP Request:**

```
<?xml version='1.0' encoding='UTF-8'?>
<soap:Envelope xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'
  xmlns:q0='http://service.readdata.basis.adoweb.boc_eu.com'
  xmlns:xsd='http://www.w3.org/2001/XMLSchema'
  xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'>
  <soap:Body>
    <q0:getTOC />
  </soap:Body>
</soap:Envelope>
```
  - SOAP Response:**

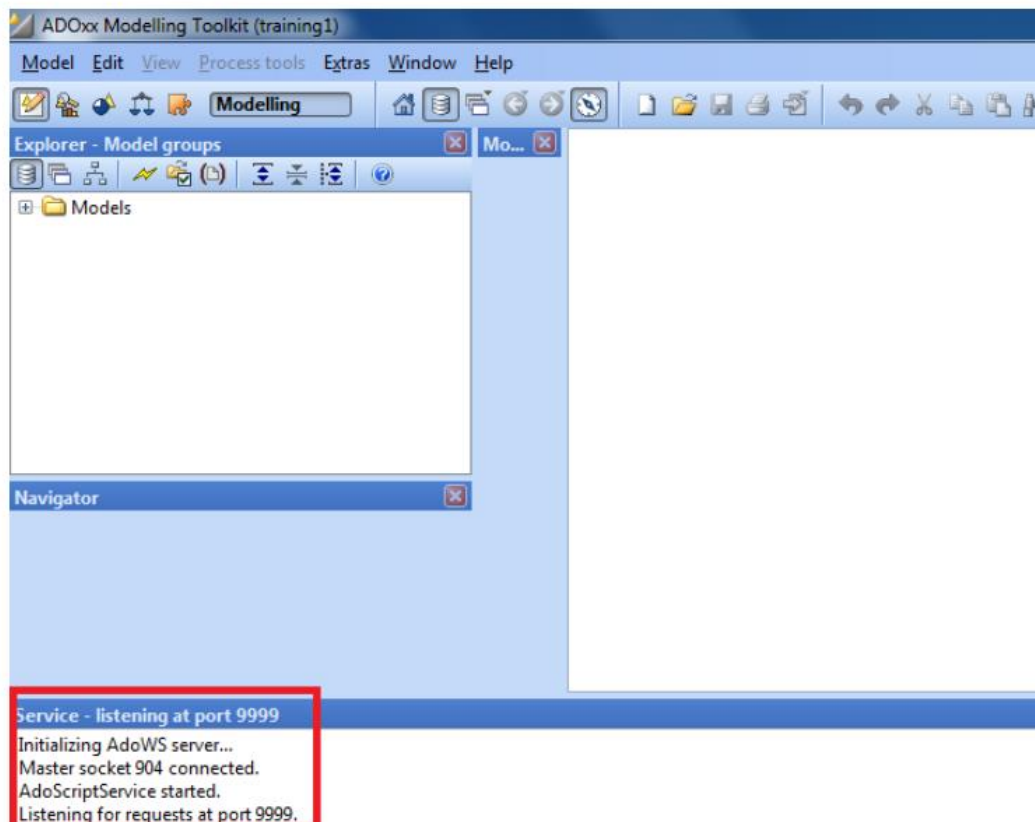
```
<?xml version='1.0' encoding='UTF-8'?>
<soap:Envelope xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'
  xmlns:xsd='http://www.w3.org/2001/XMLSchema'
  xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'>
  <soap:Body>
    <getTOCResponse xmlns='http://service.readdata.basis.adoweb.boc_eu.com'>
      <?xml version='1.0' encoding='UTF-8'?>
      <root>
        <library name='ADONIS-BPMS-application-library_4.0_web' type='' version='' context=''>
          </library>
        <toc>
          <root>
            <group id='397531' name='Models'>
              <group id='4237400' name='CINECAAdaptedBPMSmodels'>
                <model
                  name='FHNW_Student_enrolment_compresult_2011.10.27-23:06:55'
                  id='4388801' variantid='' class='Business process model' version=''
                  idclass='Business process model'>
                </model>
                <model
                  name='Student_enrolment_compresult_2011.10.27-19:40:22' id='4384001'
                  variantid='' class='Business process model' version='' idclass='Business process model'>
                </model>
              </group>
            </root>
          </toc>
        </root>
      </getTOCResponse>
    </soap:Body>
  </soap:Envelope>
```

The bottom status bar of the browser shows "Fertig" and "Lokales Intranet".

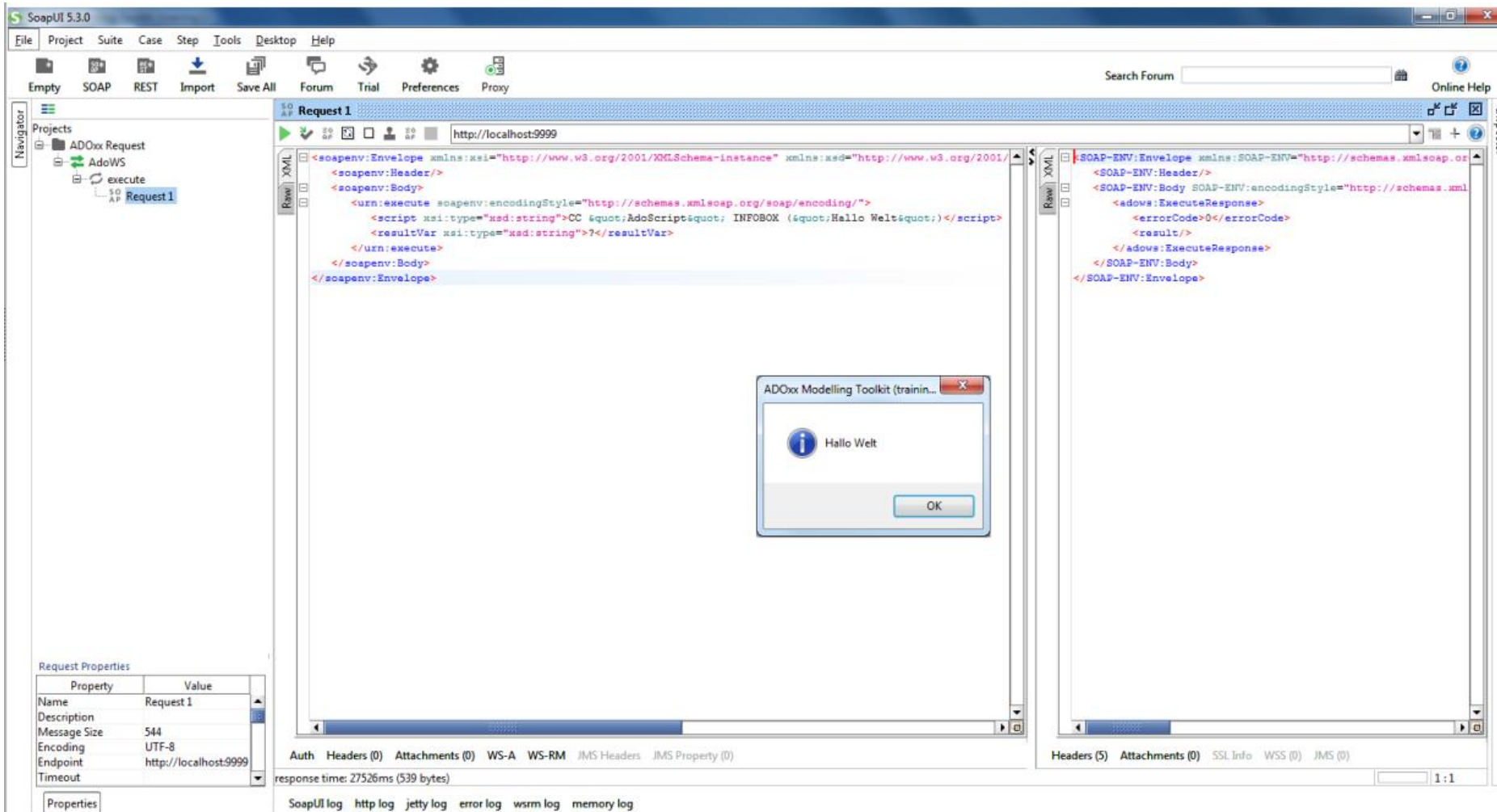
## ADOxx WebService: Example using SoapUI (1)

```
C:\windows\system32\cmd.exe

C:\Program Files (x86)\BOC\ADOxx15_EN_SA>echo CC "AdoScript" SERVICE start port:
<9999> output:textfield ! areena -utrainig1 -p1234 -dadoxxdb -ssqlserver -e
```



# ADOxx WebService: Example using SoapUI (2)



SoapUI 5.3.0

File Project Suite Case Step Tools Desktop Help

Empty SOAP REST Import Save All Forum Trial Preferences Proxy

Search Forum

Online Help

Navigator

Projects

- ADOxx Request
  - AdoWS
    - execute
      - Request 1

Request 1

http://localhost:9999

Raw XML

```
<?xml version='1.0' encoding='UTF-8'>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Header/>
  <soapenv:Body>
    <urn:execute soapenv:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
      <script xsi:type="xsd:string">CC &quot;AdoScripts&quot;; INFOBOX (&quot;Halo Welt&quot;)</script>
      <resultVar xsi:type="xsd:string">?</resultVar>
    </urn:execute>
  </soapenv:Body>
</soapenv:Envelope>
```

ADOxx Modelling Toolkit (trainin...)

Halo Welt

OK

Request Properties

| Property     | Value                 |
|--------------|-----------------------|
| Name         | Request 1             |
| Description  |                       |
| Message Size | 544                   |
| Encoding     | UTF-8                 |
| Endpoint     | http://localhost:9999 |
| Timeout      |                       |

Auth Headers (0) Attachments (0) WS-A WS-RM JMS Headers JMS Property (0)

response time: 27526ms (539 bytes)

SoapUI log http log jetty log error log wsrm log memory log

Headers (5) Attachments (0) SSL Info WSS (0) JMS (0)

1:1



# CONCLUSION

## The Method Conceptualisation Process ...

- Capturing of fundamental concepts, relationships in between and properties adhering to them, usually obtained through the analysis of a selected domain.
- Description of such conceptualisations varies depending on the addressed audience, with different expectations, like End User, Modeller, Developer, ....
- From a development perspective, a method conceptualization needs to be formal enough to enable developer continue along the life-cycle
- A model of the method (language)  
that facilitates a coherent view on the core concepts involved

## ...results in a Modelling Method Tool

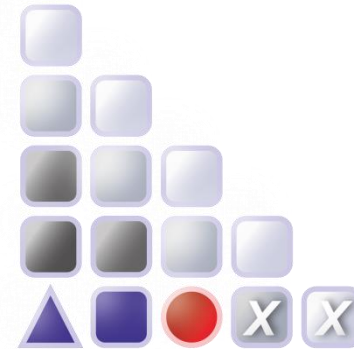
- When the realisation of a modelling method is expected to result in an application software/tool, a domain expert's (i.e., method developer) viewpoint needs to be "augmented" with the viewpoint of a software developer (i.e., method engineer).
- Typically, a method developer rarely considers design, implementation or deployment of relevant artefacts when "conceptualising" a modelling method.
- A method engineer on the other hand is usually not an expert in the domain that is addressed by a certain modelling method.



## Further Questions?



[www.omilab.org](http://www.omilab.org)



[www.adoxx.org](http://www.adoxx.org)

[tutorial@adoxx.org](mailto:tutorial@adoxx.org)





# REFERENCES

# OMiLAB References on the ADOxx Meta Modelling Approach

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