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Meta-Modelling as a Concept:

The Conceptualisation of Modelling Methods

Invited Tutorial

Tutorial Team
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AGENDA

PART I:

- Motivation
- Foundations & Technologies
- Conceptualization & Development
- Best Practices

PART II:

- Hands-On Session

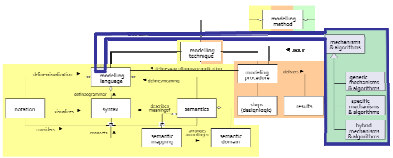
PART III:

- Conclusion
- Outlook

Tutorial Specific Scenarios

Selected Scenarios for Tutorial specific Hands-On:

1. Realising a **Modelling Language**
   - Case: Entity Relationship Model
2. Implementing an **Algorithm**
   - Case: Structural Similarities of Business Processes
3. **API / Web-Service** Invocations
   - Case: WIKI Interaction
   - Case: Google Map Interaction
4. Coupling Modelling Languages to support **Modelling Procedures**
   - Case: Coupling BPMN and UML-Use Case Diagram



Interact with MediaWIKI and Google Maps

3. SCENARIO: API / WEB-SERVICE INVOCATIONS

Scenario Description

Case: An implementation of a modelling method is extended/enhanced by functionality external to the meta-modelling platform through API calls on WebServices (WS).

GOAL:

-Demonstrate usage of APIs in ADOxx to call external services

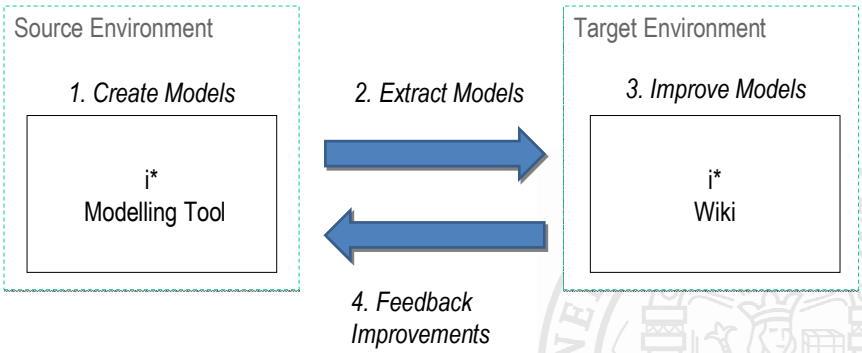
-Implement mechanisms for push and pull invocation to external services

Interaction Cases:

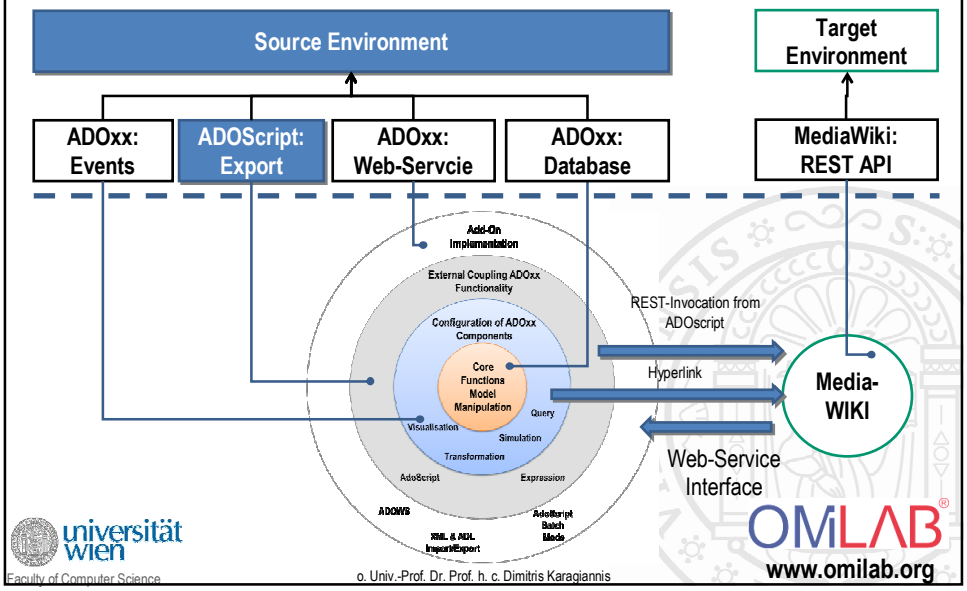
-*WIKI Interaction:* Models defined using the i* implementation in ADOxx are made available in a MediaWiki environment

-*Google Map Interaction:* Models defined for the design of supply chain distribution networks are enhanced with geolocation data using the Google Maps WS and OpenStreetMap WS

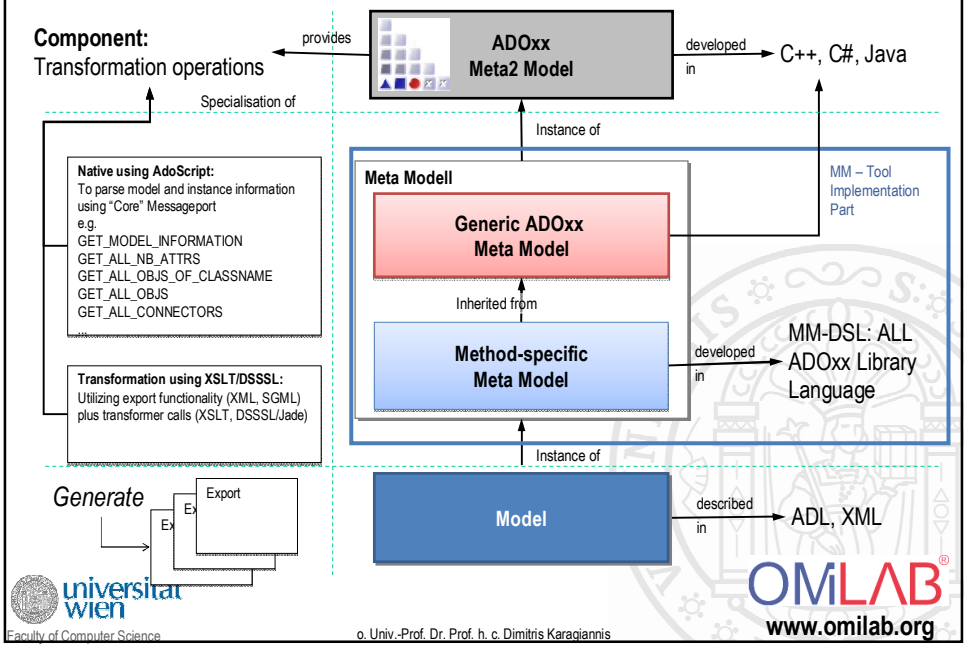
Description of MediaWiki Interaction



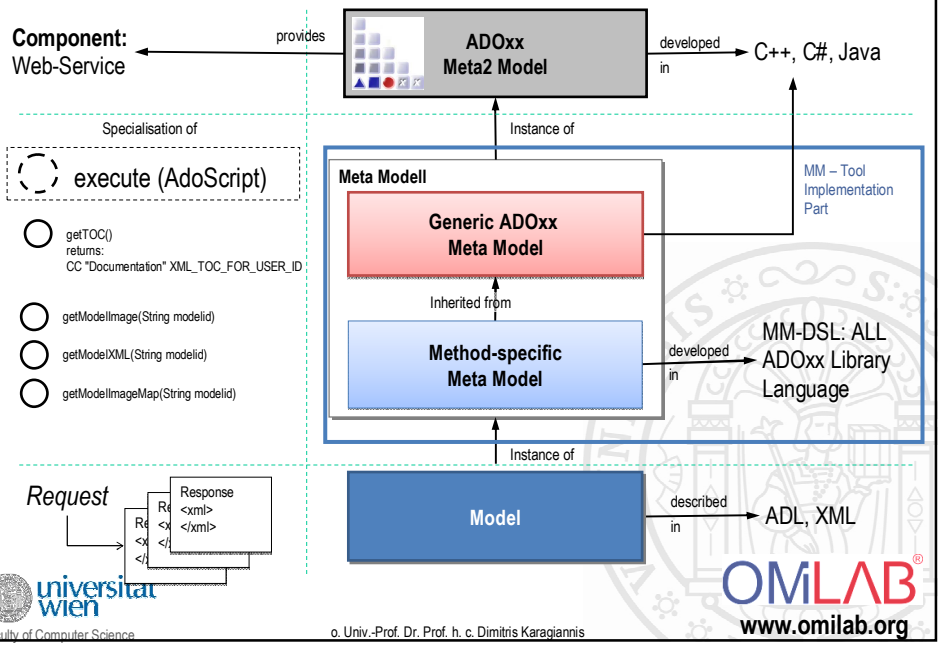
Mapping ADOxx Functionality



Meta Modelling Layer: Transformation Operations in ADOxx



Meta Modelling Layer: Web-Service Functionality in ADOxx



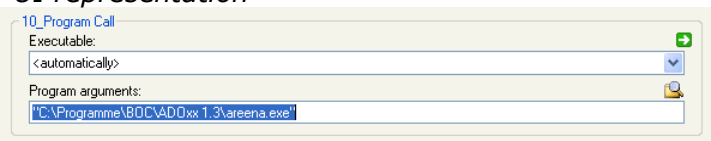
Applied ADOxx Functionality

- **ADOxx Constructs for Modelling Language Extensions**
  - Define a new ***attribute of type "PROGRAMCALL"*** to store/define the target URL of the wiki page
  - Update the ***interactive/dependent graphical representation*** to show the link
- **ADOxx Constructs for Mechanism and Algorithms Development**
  - Define ***event handler*** "SaveModel" to trigger the export from the Modelling environment to the wiki system
  - Use AdoScript ***Core Operations to parse model***
  - Use AdoScript ***External Call Operations to call and invoke*** the MediaWiki API for update of pages
  - Use AdoScript ***Core Opertions to enable feedback mechanisms via updating the model/instance***

Attribute Type: PROGRAMCALL

A PROGRAMCALL attribute is characterized by a fixed set of items. These items are related to AdoScripts which can be called via the user interface. A PROGRAMCALL attribute value consists of at most one of the defined items and an optional parameter.

UI representation



Operations

ProgramCallDomain :	{ *ItemDefinition* } .
ItemDefinition :	**ITEM** *itemText* [*ParameterDef* inition] { *FDlgFilter* } *AdoScript* .
ParameterDefinition :	**param :** *paramText* [**:** *defaultTextValue*] .
FDlgFilter :	**fdlg-filter**<*i*> **:** *filterText* **fdlg-type**<*i*> **:** *filterDescriptionText* .

itemText, *paramText*, *defaultTextValue*, *filterText* and *filterDescriptionText* are string values.

GRAPHREP WIKI Pointer for "Softgoal"

Implementation of

-*Attibute-dependent representation:* if a wiki link is available, the representation is changed

-*Interactive representation:* the wiki programcall is executed from the graphical view (hyperlink functionality) clickable on name representation

PSEUDOCODE

```
IF (attributeNotEmpty ('Wiki view')) {
  drawHyperlink (getCall('Wiki view'), name)
}
ELSE {
  drawName()
}
```

EVENT HANDLERS

In ADOxx event handlers are used to:

a)Listen to events that result from the interaction with of the modelling toolkit

b)Handle/Trigger operations based on the events

Event handlers are realized as an external coupling implementation in the platform, depending on the event, a certain set of parameters/variables are pre-set to be used during the implementation of the actual handler.

Event Category	Number of Events Available
Core	48
Application	3
Modelling	15
Simulation	2
Import/Export	2
Drawing	4

```
# Event implementation to prevent the deletion of instances of a
certain class
ON_EVENT "BeforeDeleteInstance" {
    CC "Core" GET_CLASS_NAME classid:(classid)
    IF (classname = "Information") {
        CC "Core" GET_ATTR_ID classid:(classid) attrname:"Allow
deletion"
        CC "Core" GET_ATTR_VAL objid:(instid) attrid:(attrid)
        IF (val = "no") {
            CC "AdoScript" ERRORBOX "Deletion not allowed!"
            EXIT -1
            # -1 means, that the deletion is aborted, but no error
            # message will appear. That's what we want here, as an
            # error box has already been shown by this event handler.
        }
    }
    # the following statement is redundant (no EXIT means EXIT 0)
    EXIT 0
}
```

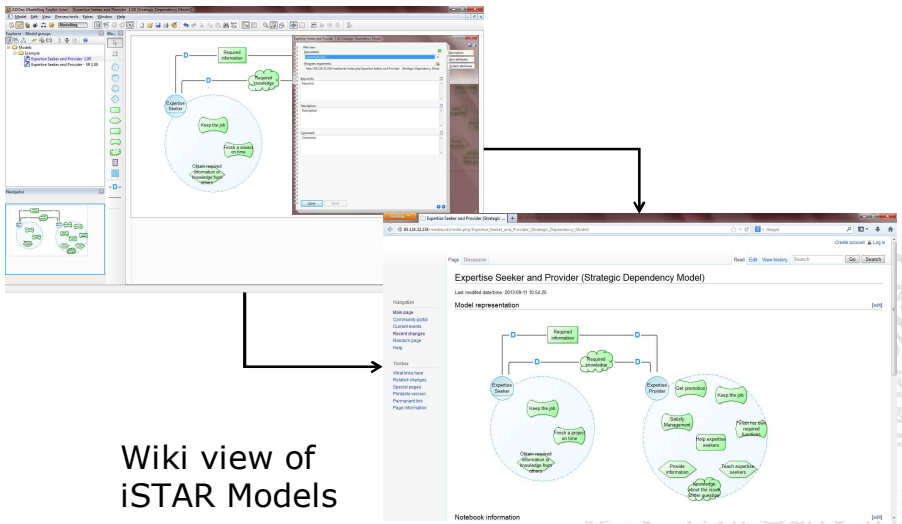

Pseudo Code: PUSH Invocation

```
TRIGGER SaveModel {
  #preset by trigger: modelid
  modelinformation = getModelInformation(modelid)
  wikiName = ConstructUniqueName(modelinformation)
  CallAPICreateWikiPage (wikiName)
  addAttributeValues(getNotebook(model))
  List instances = getAllInstances(modelid)
  CallAPICreateWikiSection('Instances')
  for instance in:(instances) {
    instanceinformation = getInstanceInformation(instance)
    instancewikiName = ConstructUniqueName(instanceinformation)
    CallAPICreateWikiPage (instancewikiName)
    addAttributeValues(getNotebook(instance))
    CallAPIaddTextToSection('Instances', instance)
    setTargetURL(instance)
  }
  setTargetURL(model)
}
FUNCTION addAttributeValues(notebook) {
  CallAPICreateWikiSection('Notebook')
  List attributes = getAllAttributes()
  for attribute in:(attributes) {
    CallAPIaddTextToSection('Notebook', attribute)
  }
}
```

...Core Operations

...Invocation Operations

Implementation Result



Wiki view of
iSTAR Models

Scenario Description

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GOAL:

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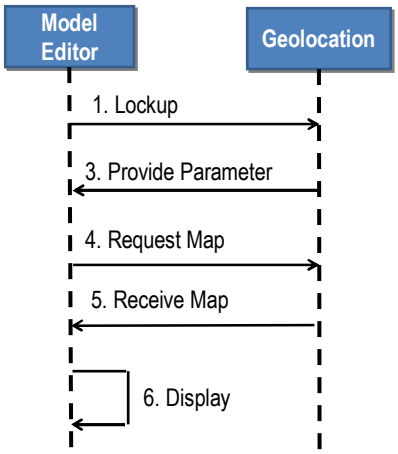
-Implement mechanisms for push and pull invocation to external services

Interaction Cases:

-*WIKI Interaction:* Models defined using the i* implementation in ADOxx are made available in a MediaWiki environment

-*Google Map Interaction:* Models defined for the design of supply chain distribution networks are enhanced with geolocation data using the Google Maps WS and OpenStreetMap WS

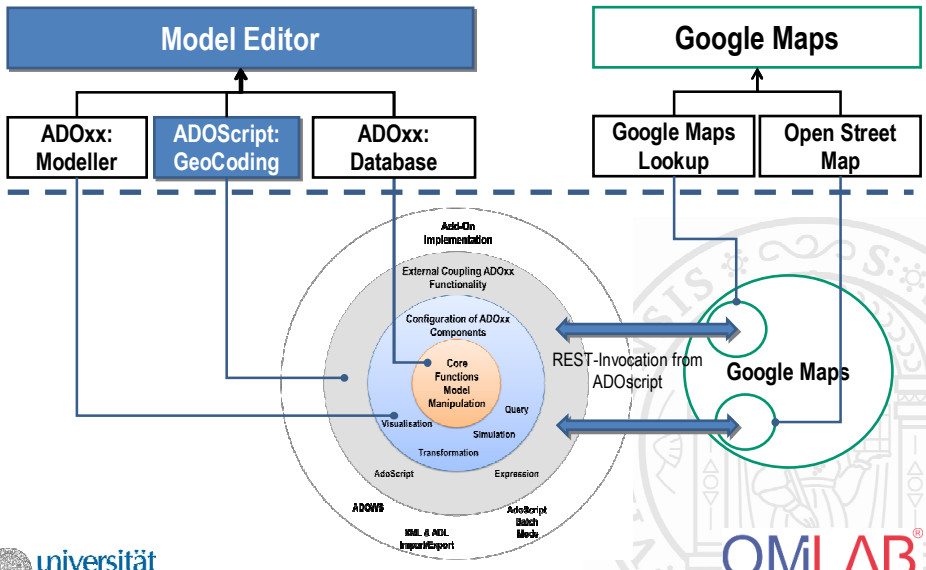
Description of GeoCoding Invocation



Additional Details:

1. Define map (location by name, zoom factor)
2. Request LONG/LAT options by location name through ReST call
3. Select center location from options
4. Request map image through ReST call

Mapping ADOxx Functionality



Applied ADOxx Functionality

- **ADOxx Constructs for Modelling Language Extensions**
  - Define a new ***attribute of type "PROGRAMCALL"*** to invoke the map service calls
  - Update the ***representation*** of the modeltype to represent the map as a background
- **ADOxx Constructs for Mechanism and Algorithms Development**
  - Use AdoScript ***External Call Operations to call and invoke*** the GoogleMaps/OpenStreetMap API for map information
  - Establish ***basic UI elements*** for selection of LONG/LAT options of model

Pseudo Code: PULL Invocation

```
ITEM Notebook Button "Update map" {
  #preset by button: modelid
  locationName = getModelAttribute('locationame')
  mapZoom = getModelAttribute('zoom')
  List locations = CallAPIGeoLookUpLocation (locationName )
  locationSelectionBox = buildListBox (parse(locations))
  locationSelectionBox.show(modal)
  If (endbutton = cancel) {
    EXIT
  }
  ELSE {
    File map = CallAPIGeoStaticMapService(selectedLonLat)
    setModelAttribute ('mapfile', map)
    triggerModelRepresentationUpdate(modelid)
  }

}
```

```
...Core Operations
...Invocation Operations
...Basic UI Operations
```

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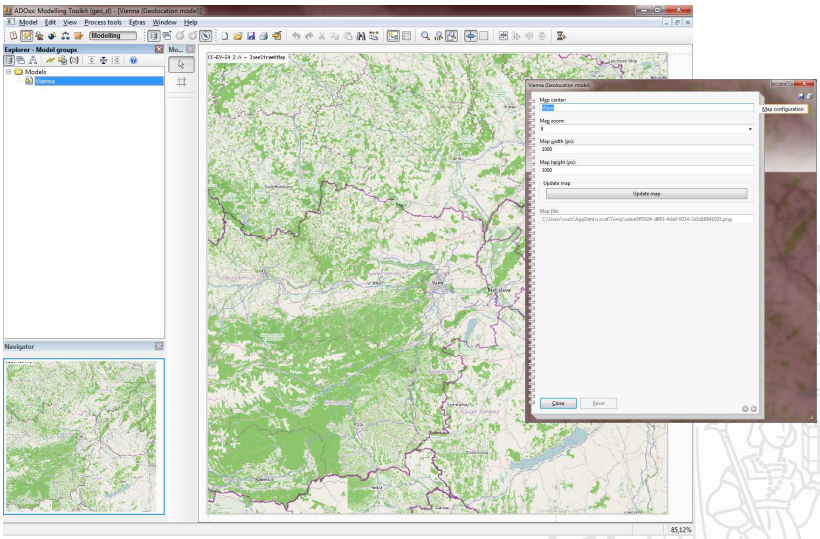
Implementation Result: Maps in Modelling Editor



Used ADOxx Functionality: API / Web-Service Invocation

- Introduction
- Setup of Implementation Environment
- Modelling Language Implementation
  - Classes
  - Relations
  - Class Attributes and Attributes
    - **GRAPHREP**
    - **ATTRREP**
    - CLASS Cardinality
    - CONVERSION
    - Model Pointer
  - Attribute Facets
  - Model Types
- Mechanisms & Algorithms Implementation
  - Core Functions for Model Manipulation
    - Database
    - Visualisation
    - Query
    - Transformation
  - Configuration of ADOxx Components
    - Visualisation
    - Query
  - External Coupling ADOxx Functionality
    - ADOscript Triggers
    - **ADOscript Language Constructs**
    - **Visualisation ADOscript**
    - Visualisation Expression
    - Query ADOscript
    - Transformation ADOscript
  - ADD-ON Implementation
    - **ADOxx Web-Service**
    - XML / ADL Import – Export
    - ADOscript Batch Mode

HANDS-ON

Interact with MediaWIKI and Google Maps

3. SCENARIO: MECHANISM IMPLEMENTATION FOR API / WEB-SERVICE INVOCATIONS

How to implement the Wiki integration

Pre-Condition:

MediaWiki is configured to answer ADOxx

Implementation Steps:

1.Add Attribute „Wiki view“ in _D-construct_

2.Change ATTREP of „Note, Actor, Agent, Role, Position, Goal, Task, Resource, Softgoal, Belief and Aggregation“

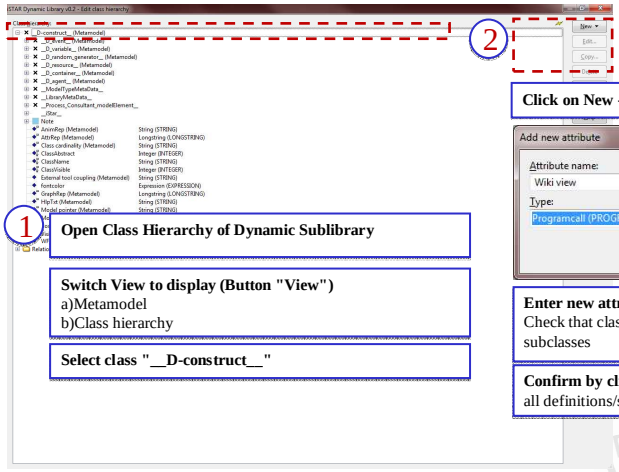
3.Change GRAPHREP of „Softgoal“

4.Add Save Event

5.CHANGE Modeltype ATTREP

6.Copy curl.exe, wget.exe and run_wiki_export.asc in directory. Set file directory accordingly.

NEW ATTRIBUTE
"Wiki view" for all classes



1

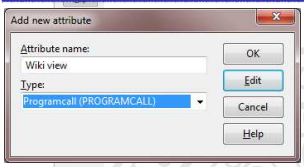
Open Class Hierarchy of Dynamic Sublibrary

Switch View to display (Button "View")
a)Metamodel
b)Class hierarchy

Select class "__D-construct__"

2

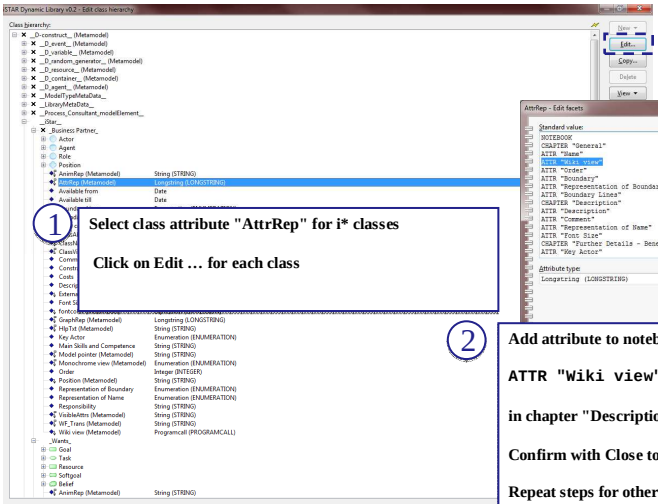
Click on New -> New attribute…



Enter new attribute name "Wiki view"
Check that class is defined for root class and inherited to all subclasses

Confirm by clicking on OK -> Attribute has been created, all definitions/setup have been inherited to subclasses.

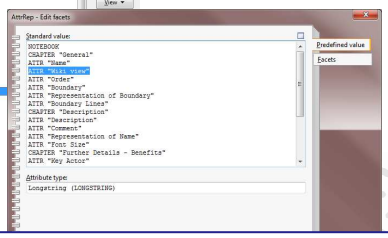
ADD NEW ATTRIBUTE TO NOTEBOOK OF CLASSES



1

Select class attribute "AttrRep" for i* classes

Click on Edit … for each class



2

Add attribute to notebook by adding the line

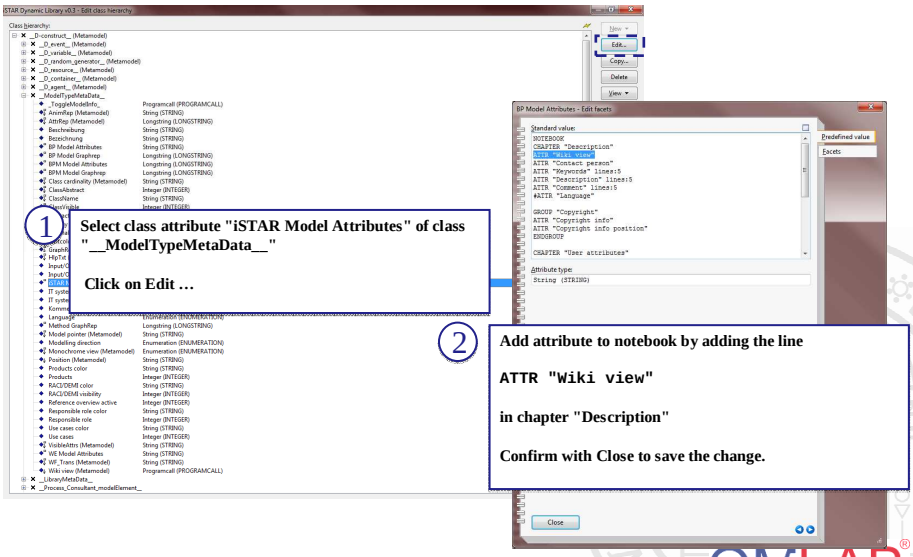
`ATTR "Wiki view"`

in chapter "Description"

Confirm with Close to save the change.

Repeat steps for other classes

ADD NEW ATTRIBUTE TO NOTEBOOK OF MODELTYPE



GRAPHREP WIKI Pointer for "Softgoal"

Implementation of

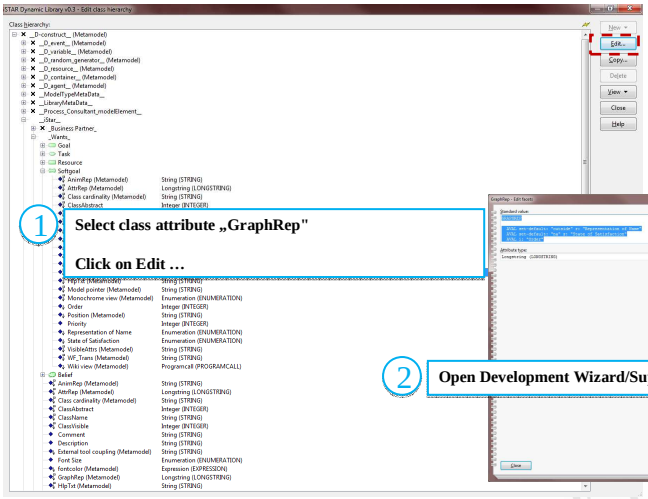
-*Attibute-dependent representation:* if a wiki link is available, the representation is changed

-*Interactive representation:* the wiki programcall is executed from the graphical view (hyperlink functionality) clickable on name representation

PSEUDOCODE

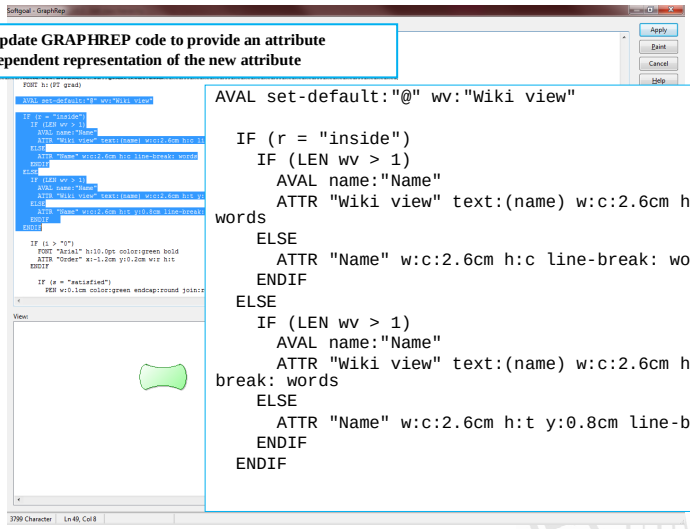
```
IF (attributeNotEmpty ('Wiki view')) {
  drawHyperlink (getCall('Wiki view'), name)
}
ELSE {
  drawName()
}
```

UPDATE OF GRAPHREP FOR "Softgoal"



UPDATE OF GRAPHREP FOR "Softgoal"

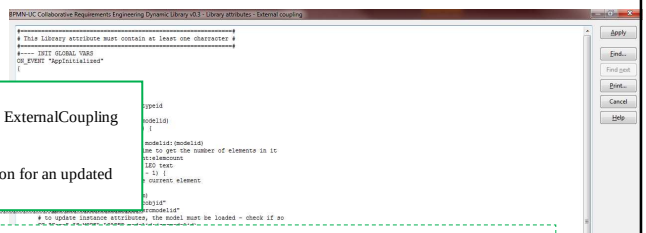
3 **Update GRAPHREP code to provide an attribute dependent representation of the new attribute**



```
AVAL set-default:"@" wv:"Wiki view"

  IF (r = "inside")
    IF (LEN wv > 1)
      AVAL name:"Name"
      ATTR "Wiki view" text:(name) w:c:2.6cm h:c line-break:
words
    ELSE
      ATTR "Name" w:c:2.6cm h:c line-break: words
    ENDIF
  ELSE
    IF (LEN wv > 1)
      AVAL name:"Name"
      ATTR "Wiki view" text:(name) w:c:2.6cm h:t y:0.8cm line-
break: words
    ELSE
      ATTR "Name" w:c:2.6cm h:t y:0.8cm line-break: words
    ENDIF
  ENDIF
```

EVENT HANDLER: "SaveModel"



1. **Event handler for save model**
   Define the event listener/handler in the ExternalCoupling Attribute

   „SaveModel" listens to the save opertion for an updated model

2.
```
ON_EVENT "SaveModel" {
#preset: modelid, origin ["new", "save", "saveas-new" or "saveas-save"]

  # Only for strategic dependency models that are saved by the modeller
  IF (origin = "save") {
    CC "Core" GET_MODEL_INFO modelid:(modelid)
    IF (modeltype = "Strategic Dependency Model") {
       SETG nProcessedModel:(modelid)
       # Update logic (implemented in an external file)
       EXECUTE file:("d:\\run_wiki_export.asc")
    }
  }
}
```


AdoScript Implementation run_wiki_export.asc

```
# Update mechanism for model/instance information into a collaborative environment,
such as wiki
# Preset: nProcessedModel
# 1. Parse model information
# Get information on the model, to construct a unique name for the wiki page:
# ModelName + ModelVersion + Modeltype
# location of the AdoScript and curl/wget extensions - needs to be a file location and
not db:\\
SETG sLocation:("d:\\")
CC "Core" GET_MODEL_INFO modelid:(nProcessedModel)
# RESULT: modelname:strValue ver:strValue version:strValue threadid:id
modeltype:strValue libid:id libtype:LibType libname:strValue access:Access
ecode:intValue
SETL sUniqueWikiPageName: (modelname + " " + version + " (" + modeltype + ")")
CC "AdoScript" MSGWIN ("Wiki view is generated for Model \"" + sUniqueWikiPageName +
"\"")
# get a temp file handler to store result
CC "AdoScript" GET_TEMP_FILENAME
# RESULT filename:strValue
# API calls are encoded in base64 to ensure special characters are treated correctly
SYSTEM (sLocation + "wget.exe -O "+filename+"
http://85.124.32.234/mediawiki_adoxx/createpage.php?pagename=" + base64encode
(sUniqueWikiPageName)) #with-console-window
...
```

Thank you for your attention!

For any questions please contact:

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