SeMFIS: A Tool for Managing Semantic Conceptual Models

Hans-Georg Fill

Co-sponsored by the Austrian Science Fund: Grant Number: J3028-N23
Agenda

• Motivation
• Foundations
• Requirements for Handling Semantic Aspects
• The SeMFIS Approach
• Use Cases
• Conclusion and Outlook
Motivation

• Conceptual models today widely used in industry and academia
• Many different types of conceptual modeling languages: see projects on www.openmodels.at
• Some parts of semantics of conceptual models typically not made explicit, given in natural language
• Algorithmic processing of conceptual models interesting for analyses, simulations, configuration of information systems etc.
• Solution: Map conceptual models to semantic schemata / ontologies

Challenges:
❖ How to do this for arbitrary modeling languages?
❖ How to provide an open accessible solution?
Components of Modeling Methods

Meta Model =
Model of the Abstract Syntax of a Modeling Language

(Karagiannis and Kühn, 2002)
Semantic Aspects in Conceptual Models

- Basic assumption: Conceptual Models primarily intended for human understanding and communication
- Semantics of labels typically only given in natural language
- Meta models as a semi-formal specification: Only syntax and type semantics are formalized
- Machine processing of models requires some kind of formal semantics
- Ontologies as shared semantic schemata to enable processing
Example for a Meta Model and a Model

Meta Model

Model

Class

Activity

Decision

Relationclass

Notification

Meta semantics

Customer reached

Customer not reached

Contact Customer

Write E-Mail

Notify Customer
Spectrum of “Ontologies”

- **Taxonomy**: Relational Model
- **Thesaurus**: ER, Schema
- **Conceptual Model**: RDF/S, XTM, Extended ER
- **Logical Theory**: Description Logic, DAML+OIL, OWL, UML, First Order Logic, Modal Logic

(Obrst, 2003)
Requirements for Handling Semantic Aspects

- Approach should be applicable to arbitrary modeling languages and different types of ontology languages
- Ontologies should be exchangeable (re-use aspects)
- Exchange should be based on standards, e.g. OWL, XML
- Approach should be easy to use, despite the necessary formal definitions
- Support for distributed modeling and semantic annotation of models in a web-environment
- Open for further development by the scientific community

http://www.dke.univie.ac.at

Hans-Georg Fill 2012
The SeMFIS Approach

Goals:
• Provide an open platform for handling semantic aspects in conceptual models
• Applicable to arbitrary modeling languages
• Establish a community dealing with these aspects

Includes:
– Semantic conceptual model types
– Algorithms and support tools
– Open accessible web services
– Support tools and services

http://www.openmodels.at/web/semfis/
SeMFIS Algorithms, Web Services and Support Tools

Currently available algorithms:
• Exchanging models in XML format
• Exporting frames ontology models in Protégé frames format
• Transferring concepts from conceptual models into ontology models via annotation specifications
• Obfuscating model information using OWL inheritance

Currently available web services:
• Access the contents of models via web interfaces (XML / Rest)
• Generation of various graphical formats of models

Support tools:
• Protégé OWL Export plugin for SeMFIS incl. upload to an openmodels.at repository

http://www.dke.univie.ac.at
Implementation of SeMFIS on ADOxx

- ADOxx meta modeling approach developed since 1995, originally for business process management
- Part of the commercial ADOxx meta modeling Platform provided by the University spin-off BOC AG
- >1000 customers worldwide
- Available for free for projects within the Open Models Initiative on www.openmodels.at:
  - Open use and access of the platform
  - Online (RDP) and offline model editors
  - Currently > 25 academic projects based on ADOxx on Open Models
  - Variety of free services for developers and users, e.g. wikis, forums, developer tools, etc.
FDMM Formalism for Describing ADOxx Meta Models and Models

Set theory, first order logic statements

$$\mu_{mt}$$  $$\mu_O$$  $$\mu_D$$  $$\mathcal{T}$$  $$\beta$$

$$MT_{PO} = \langle O^T_{PO}, D^T_{PO}, A_{PO} \rangle$$

- $$O^T_{PO} = \{\text{Business-transaction, relates-business-transaction} \}$$
- $$D^T_{PO} = \{\text{String, Float, Enum_view} \}$$
- $$A_{PO} = \{\text{ID, W, RE, RI, WE, p, relates-from, relates-to, Process, View} \}$$

<table>
<thead>
<tr>
<th>Domain(W)</th>
<th>Range(W)</th>
<th>Card(Business-transaction, W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>{Business-transaction}</td>
<td>{Float}</td>
<td>{0, 1}</td>
</tr>
</tbody>
</table>

$$\mu_{MT}(MT_{PO}) = \{mt_{po1}\}$$

- $$\mu_O(\text{Business-transaction, MT}_{PO}) = \{BT_P, BT_Q\}$$
- $$\mu_D(\text{Float}) = \{25.00, 55.00, 60.00\}$$
- $$\langle BT_P \ W \ 25.00 \rangle \in \beta(mt_{po1})$$

Implementation

(Fill, Redmond, Karagiannis., 2012 presented at ICEIS 2012)

http://www.dke.univie.ac.at
SeMFIS Architecture

User interface

Application components

Repository

ADOxx Platform

User interaction (Windows)

SeMFIS Algorithmic Extensions

Modeling

Analysis

Simulation

Evaluation

HTML Generation

Import / Export

Web Service Component

Modeling subsystem (CORE)

Database

Web Environment

User interaction (Web)

SeMFIS Rest Services

Protégé Platform

Protégé Desktop Application

SeMFIS Protégé Plugin

http://www.dke.univie.ac.at

Hans-Georg Fill 2012
SeMFIS Use Case: Risk-adjusted BP Simulation

SeMFIS on ADOxx

New ontology concepts

Jess Tab link

Jess Rule Engine

Simulation Results

ADOscript

XML/pprj

Protégé Toolkit

(Fill, 2012 – presented at ECIS 2012)

http://www.dke.univie.ac.at

Hans-Georg Fill 2012
SeMFIS Use Case: Semantic based Abstraction / Obfuscation of Model Information

Enter new address in customer database
Assign address for account notifications
Retrieve cross-selling offers?
Client counseling on cross-selling offers
Semantic Annotation
Prob.: 30%
ET: 10 Min.

ET: 2 Min.
ET: 1 Min.

Customer interaction
IT interaction?
Prob.: 70%
ET: 1 Min.
ET: 10 Min.

Manual customer interaction; Customer data
Assign address for account notifications

ET: 2 Min.

Manual customer interaction; Customer data
Assign address for account notifications

ET: 2 Min.

Original BP Model

Abstracted BP Model

Customer interaction
Counseling activities
Product counseling
Investment counseling
Selling activities
Product selling
Cross-selling
IT interaction
Customer Management
Customer Database
Cross-selling application
Data
Customer Data
Name
…

Semantic Annotation
1
2
3
owl:subClassOf
owl:Class
Sequence Flow
Activity
Decision
Attribute

(Fill, 2011 – presented at BIR 2011)

http://www.dke.univie.ac.at

Hans-Georg Fill 2012
Conclusion and Outlook

• SeMFIS as a concept and a tool to handle semantic aspects of conceptual models
• Realization by using semantic conceptual models together with algorithms, web services and support tools

Future work:
• Further development of the web functionalities
• Provision of evolution and change handling facilities
• Additional practical evaluation in research and industrial projects

http://www.dke.univie.ac.at
Thank you for your attention!
References