

Multi-level Modelling with the FMML^x and the XModeler^{ML}

Tutorial

Tony Clark¹, Ulrich Frank²

Abstract: Multilevel modelling is a new modelling paradigm that enables additional abstraction through an unlimited number of classification levels and thus contributes to reuse, integration and flexibility. The XModeler is a language engineering tool that allows for the common representation of (meta) models and code. The multi-level modelling and execution language FMML^x is implemented in the XModeler by extending its genuine meta model. This tutorial provides a comprehensive introduction into the foundations of multi-level modelling and its application. It will be shown how multi-level modelling enables relaxing fundamental conflicts of system design. During a practical exercise with the XModeler^{ML}, the participants will experience a new style of modelling that integrates language design with traditional ways of modelling.

Keywords: Conceptual Modelling; Model-Based Development and Maintenance; Self-Referential Enterprise Systems

1 Audience and Goals

The tutorial targets researchers and industrial practitioners who have an interest in how system modelling can better support the development life cycle from requirements through to implementation. The participants are expected to be familiar with object-oriented modelling and software construction. The tutorial is dedicated to three main goals. First, it is to raise the awareness of multi-level modelling in general and to foster a discussion with the participants about its prospects and related challenges. Second, it aims at an overview of the foundations of the language engineering and execution environment XModeler and the multi-level modelling language FMML^x. Third, the participants are to be enabled to develop and run multi-level models specified with the FMML^x.

2 Subject and Scope

Early ideas that relate to multi-level modelling go back to the programming language Smalltalk which includes a metaclass for every class. Later, Atkinson and Kühne coined

¹ Aston University, Birmingham tony.clark@aston.ac.uk

² Universität Duisburg-Essen ulrich.frank@uni-due.de

the term “multi-level modelling” and proposed it as an extension of the UML (which, unfortunately, did not happen to a satisfactory extent). In recent years an active community of researchers who work on various approaches to multi-level modelling has evolved. The annual workshop series “MULTI”, which is part of the Models conference, is the pivotal platform of this community. The XModeler is an integrated (meta-) modelling and (meta-) programming environment that features a common representation of models and code. Its recursive meta-model XCore enables the creation of classes on multiple levels. The FMML^x extends XCore to support the representation of specific classification levels and intrinsic features. Using the FMML^x requires to go beyond the familiar paradigm of conceptual modelling that is characterized by a clear distinction of modelling language and model, as well as of model and code. With the FMML^x, they are all developed simultaneously. This opens up new perspectives in modelling and software development. At the same time, it demands for new modelling methods. An introductory case study will demonstrate the peculiarities and prospects of using the FMML^x. Presentations of the XModeler and the FMML^x will enable participants to understand core foundational aspects of multi-level modelling and programming. The final part of the tutorial comprises of a further case study. After analysing the requirements, the participants will learn how to use the XModeler^{ML} (a new version of the original XModeler that features the FMML^x) to develop a multi-level model and a corresponding application system. This will not only enable them to use a multi-level language engineering and modelling facility. They will also get an idea of a new generation of application systems, which are integrated with the models they are based on at run-time. Users of these systems are empowered to navigate the conceptual foundation of the software they use, and if needed, adapt it to changing requirements.

The XModeler is provided on the web pages of the LE4MM project (<https://www.wi-inf.uni-duisburg-essen.de/LE4MM/>). The project pages also include various resources such as screencasts, an extensive bibliography and publications. Since the software is constantly being further developed, the participants are advised to check the web pages for the latest version shortly before the tutorial.

3 Lead Academics

Tony Clark is Professor for Software Engineering at Aston University in Birmingham. He is one of the developers of XMF and the Xmodeler. Tony was co-founder and Technical Director of Xactium Ltd, a software modelling tools company. Tony has been involved in a number of commercial and industrial projects including contributing to the UML 2.0 standard, and consultancies with companies including British Aerospace, BT and CitiGroup.

Ulrich Frank holds the chair of Information Systems and Enterprise Modelling at the Institute of Computer Science and Business Information Systems at the University of Duisburg-Essen. His main research topic is enterprise modelling, i.e. the development and evaluation of modelling languages, methods and corresponding tools. Further areas of research include method engineering, models at run time and methods for IT management.