



Chapter XVIII

From Information Model to Controllable Implementation

Hilary J Kahn and Nick P Filer
University of Manchester, UK

This chapter considers the use of specifications such as information models as the basis for implementations. Where the models are at a conceptual level, direct mapping to implementations such as databases is unlikely to produce optimum results. The chapter discusses the use of model transformations as a way of converting conceptual models to implementation models. It also introduces an informal categorisation scheme for transformations. Examples are used throughout. These are based on the EXPRESS information modeling language that has been defined as part of ISO 10303. Finally, a brief description of the STEPWISE model transformation environment is presented.

INTRODUCTION

Computer systems typically involve complex interactions between software elements and data resources. Current trends in software development favour an object-oriented approach and consequently are able to make use of concepts such as abstraction to improve efficiency in design, development and in software maintenance. Data resources in contrast may be implemented in a variety of ways, including serial files, webs, object-oriented databases and relational databases. The approach to the design of these data resources is equally varied but rarely makes use of abstraction as a key concept. In reality, database schemas focus on structure and implementation detail to ensure that data can be stored and accessed as efficiently as possible.

Many industries are highly dependent on large data repositories that are accessed by a range of software applications. In some of these industries, for example the chemical, oil, aerospace and automotive industries, the problems of data handling are compounded by the need for the data to be shared across company boundaries. One common reason for this is the need to work globally within multi-company consortia and to work with intricate contractor-supplier chains. In order to achieve the required degree of interoperability, there needs to be an in-depth understanding of the semantics and structure of the shared information.

One generic way to address this issue is to define the semantics of the information that is to be shared at an abstract level and allow implementations to store and access data in any way that guarantees the accuracy of the representation. Another, less flexible, solution is again to use an abstract specification of the semantics but to provide standardised ways of sharing the data. This is the solution adopted by STEP, the Standard for the Exchange of Product model data (STEP, 1994).

In STEP interoperability is, in theory, achieved using automatically generated data files and programming interface (PI) calls based on a specification (or information model) in EXPRESS (EXPR, 1994). The format of the automatically generated files is fixed using ISO 10303-21 (P21, 1994); a series of separate standards, such as the "Standard Data Access Interface specification" (SDAI), ISO 10303-22 (P22, 1994) specify language bindings for the PI. To some degree, this approach assists interoperability but the insistence on a fixed file format and a predefined programming interface style means that the implementors of tools built on the specification have no control over issues such as processing efficiency or levels of abstraction in software development. Furthermore, the STEP standard does not support mappings for other kinds of implementation, such as databases.

This paper addresses the use of EXPRESS information models as the basis for implementations where the user has control over the results. The methodology proposed is based on transforming an EXPRESS model that is intended to help people understand a given domain, into a model that can be mapped into an appropriate implementation. The transformation mechanism used retains the original domain semantics. The approach will support interoperability to the same extent that STEP does, but will do so in a much more flexible way.

The following sections set the scene by providing a brief introduction to STEP and to EXPRESS, and also by considering some industrial uses of EXPRESS specific to the oil industry. A classification of model types and some examples of model mapping follow this. Three scenarios are then presented to illustrate the effects of some specific model transformations. This is followed by a general categorisation of information model transformation. Finally, a brief description is given of the STEPWISE software environment that has been developed at the University of Manchester to support the general model transformation process.

20 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/information-model-controllable-implementation/22995

Related Content

Assessing Gender Differences in Software Developers Using the Human Capital Model

Ronald Dattero, Stuart D. Galupand Jing ("Jim") Quan (2005). *Information Resources Management Journal* (pp. 68-87).

www.irma-international.org/article/assessing-gender-differences-software-developers/1277

The Expert's Opinion

Mehdi Khosrow-Pour, D.B.A. (1989). *Information Resources Management Journal* (pp. 40-42).

www.irma-international.org/article/expert-opinion/50923

Challenges in Data Mining on Medical Databases

Fatemeh Hosseinkhah, Hassan Ashktorab, Ranjit Veenand M. Mehdi Owrang O. (2009). *Encyclopedia of Information Science and Technology, Second Edition* (pp. 502-511).

www.irma-international.org/chapter/challenges-data-mining-medical-databases/13621

ACEnet: Facilitating Economic Development Through Small Business Electronic Commerce

Craig Van Slyke, France Belangerand Marcy Kittner (2001). *Pitfalls and Triumphs of Information Technology Management* (pp. 1-20).

www.irma-international.org/chapter/acenet-facilitating-economic-development-through/54271

The Translator's Path: A Mixed-Methods UTAUT2 Investigation Into Crowdsourcing Translation Platform Adoption

Zhao Hui and Kaiyisah Hanis Mohd Azmi (2026). *Journal of Cases on Information Technology* (pp. 1-26).

www.irma-international.org/article/the-translators-path/409316