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Behind the Lines - Managing Semantically Rich Data in Architecture

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Introduction

Current CAD systems have inherent bottlenecks, which diminish possible achievements for architectural practices. Among these shortcomings there are two the paper will deal with. Firstly, traditional CAD relies on a pure geometric model. All non-geometric information about objects of architectural interest has to be attached to these geometric entities. This restricts the ability to describe semantically dependent relationships. Secondly, the integration of different design tools for building and construction is still at its very beginning. The data exchange remains restricted, since it is based on a fairly low semantic level of a document-based exchange of information, such as geometric representation in DXF or IGES, rather than on a high semantic level of a model-based exchange.

To overcome these bottlenecks, a new paradigm of CAD-development has been proposed during the last few years. This new paradigm, following the product modeling approach, is characterized by:

- extended conceptual data modeling on a high level of abstraction (this task remains to be the responsibility of architects and engineers, who are holders of all relevant knowledge),
- derivation of a neutral (i.e., exchangeable) data specification form, and
- generation of implementation forms, e.g., a common data management core or a database-definition, which integrates and controls the design data across multiple representations of design in different design tools. These ideas had been tested during the creation of a prototype environment called ID'EST (Integrated Design Environment using STep methodology) [Liebich and Kim 94]. The data management core is provided by an instantiation model, according to a product data model for building elements, spatial systems and suitable subsets of geometry and topology. This core is able to read, write, create and merge exchange files, following the STEP physical file convention. The prototype environment includes converters from and to current CAD systems in order to bridge the gap between the new object-oriented approach and the traditional CAD data structure. Therefore mapping tables have been defined, which link the layer, attribute and macro structure of a CAD system, using a naming convention, to the entity, attribute and relationship structure of the data management core.

The author suggests that this product modeling approach will provide semantically meaningful descriptions of buildings and will enable the integration of different design tools by keeping consistency among them. Thus it will provide a software platform which improves the design process and makes complex design tasks better manageable. This new paradigm will influence education as well, since it will shift the focus from pure geometric editing in traditional CAD to a deep semantic description of building in integrated design environments.