Semantic Extensions and a Novel Approach to Conceptual Modelling

by

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Abstract

Conceptual modelling presented as a framework for database design is a discipline of great importance in many areas in computer science that seeks to represent real-world phenomenon using semantic primitives. To date, traditional (static) conceptual models have been successfully used and extended to deal with the semantics of relatively stable real world applications. However, the capturing of semantics is a seemingly endless task as it involves various dimensions and categories.

It is argued in this thesis that the incorporation of complex domain structures in conceptual modelling to represent the semantic domains of an attribute and the relationships within a concept in ontologies would provide more expressive and richer semantics. Additionally, it is argued that basic relationships in the entity-relationship model may need to be modified or extended to handle a broad spectrum of situations that arise from differing perspectives of the real world. Furthermore, it is argued that a conceptual model should allow rapid and simultaneous storage of data and data modelling as unexpected and sudden events require data to be modelled rapidly. This thesis begins with an extensive review of the field of conceptual modelling and an exploration of the concepts of mesodata, ontologies and semantic relationships in conceptual modelling as well as various aspects of extensions to the entity-relationship model.

Using these foundations, a classification of ER modelling extensions (CERME) framework is introduced that forms the basis of common aspects and comparative criteria which can be used to categorise and compare various proposals. In addition, the Mesodata Entity-Relationship (MDER) model, Mesodata Object Role Model (MDORM), Ontological Entity-Relationship (OntoER) model, Ontological Object Role Modelling (OntoORM) and Ontological Unified Modeling Language (OntoUML) class diagrams are presented that allow advanced semantics to be associated with the domains of an attribute. It is also demonstrated that these proposed models can be mapped into the commonly accepted standard relational model. Furthermore, for some of the modelling issues that are not easily accommodated into the ER model, this thesis introduces a new relationship construct, polymorphic relationships, to handle this situation. To this end, a novel approach to conceptual modelling, the LItER model, is presented that incorporates the previously proposed concepts of mesodata, ontologies and polymorphic relationships into the model which allows data to be modelled rapidly.

Certification

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed Dated

Somluck La-Ongsri

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