An Overview of the Lawrence Berkeley Laboratory Extended Entity-Relationship Database Tools

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Abstract

In this paper we briefly overview a suite of tools developed at Lawrence Berkeley Laboratory (LBL) for aiding users in defining, querying, and browsing databases developed with commercial relational database management systems (DBMS), using object-oriented constructs. These tools are based on a version of the Extended Entity-Relationship (EER) model and a query language developed by us. They allow users to deal with concise EER structures and queries rather than relational database definitions and queries which are usually large, hard to maintain, and involve terms that obscure the semantics of the application. Using the LBL/EER database tools users are insulated from the underlying DBMS, and thus can avoid learning DBMS specific concepts and query languages.

1 Introduction

Typical definitions and queries for database applications developed with commercial database management systems (DBMSs) are large, hard to maintain, and involve terms that obscure the semantics of the application-specific structures and operations. Consequently, the development of database applications involves two main levels: abstract and physical. Abstract constructs (i.e. objects and their associations) are usually close to the way users describe their applications. Physical constructs (e.g relations, indexes) are part of DBMSs and tend to involve a large number of technical details. Interacting directly with DBMSs requires users to have DBMS expertise, and entails a tedious, lengthy, and error-prone development process. Alternatively, it is preferable for users to interact with databases only at the abstract level, thus being insulated from the technical details of the physical level. This approach implies the existence of database tools that are able to accept requests expressed in abstract

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terms, and translate them into executable commands and procedures of the underlying DBMS. Such tools have been developed at Lawrence Berkeley Laboratory (LBL), based on a version of the Extended Entity-Relationship (EER) model and a query language developed by us, called the Concise Object Query Language (COQL) [10].

Although numerous database tools are commercially available (e.g., see [3]), they fail to provide one or more of the following capabilities: (i) support for certain constructs, such as generalization and aggregation, that are essential for specifying semantically rich database schemas, (ii) generation of complete DBMS database definition, including referential integrity and domain constraints; (iii) query capabilities at the same (high) level of abstraction as the database definition constructs. The LBL/EER tools support a rich set of abstract constructs, generate complete database definitions and procedures, and provide query capabilities at the same level of abstraction as the schema definition capabilities. Moreover, the LBL/EER tools are based on extensive research of various aspects of the database development process (see [4, 5, 6, 7, 10]).

We overview briefly in this paper the LBL/EER suite of tools for:

1. determining (reverse engineering) the EER schema of an existing relational database (called REL2EER); this tool can be used together with an editor that allows adding missing referential (foreign key) information to existing relational databases (ADD_REF);
2. graphically editing EER schemas (ERDRAW);
3. specifying EER value sets and associated (e.g., range) constraints (ERVALS);
4. translating EER schemas and domain constraints into DBMS database definitions and procedures (SDT);
5. specifying EER views for querying and browsing purposes (ERVIEW);
6. specifying EER queries over EER schemas or views and browsing their results (QBT);
7. translating EER queries into SQL queries and procedures (COQL and EER Update Translators).

The LBL/EER tools insulate database applications from the underlying DBMS, allowing users to use existing commercial relational DBMSs while ensuring a way for migrating to new DBMSs in the future. These tools can be used both for developing new database applications and on top of existing databases implemented with a relational DBMS.

For a new database application, a domain expert first designs an EER schema using the EER schema editor (ERDRAW) and the value set editor (ERVALS). The resulting EER schema, expressed in the SDT-EER language, is translated by the EER schema editor (SDT) into a relational database definition and integrity procedures. Different views of the EER schema can be customized for different groups of users using the EER view language, SDT-VIEW. Finally, users can use