N-SCHEMA APPROACH -- A GENERALIZED MODEL FOR DATABASE ARCHITECTURE

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The existing three-schema and four-schema models for database architecture are oriented more toward the (semantic) needs of physical database design and less toward the knowledge representation of the enterprise and therefore cannot serve as an effective universe of discourse. The design of a system and its databases should follow the logic of a modeling (i.e., knowledge representation) continuum which goes from the real world, to the conceptual construct, the logical construct, and the implementational construct of problem processing, then to the physical databases. Different levels of abstraction along the continuum require different architectural configurations in database design. Thus, we propose a generalized N-schema model for database architecture.

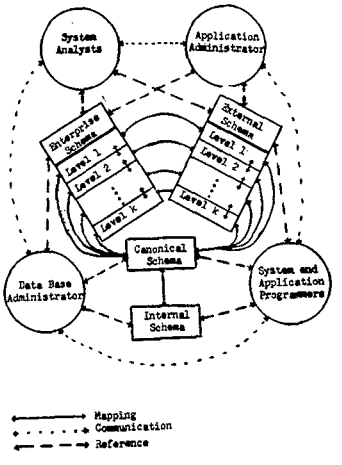
1. Introduction

A database is an abstract of reality. However, in designing the database, many levels of abstraction may be necessary before the physical database is actually developed. At least four distinct levels of abstraction can be identified: the real world level, the conceptual model level, and the data modeling level, and the physical storage level. This modeling continuum serves as the foundation for database architecture -- an issue of how to describe the database at various points of the continuum.

The modeling continuum implicitly suggests that a multi-schema approach should be employed for database architecture. In the literature, a three-schema approach [ANSI/X3/SPARC 5] and a four-schema approach [De 81] have been proposed. The ANSI/X3/SPARC three-schema framework consists of the external schema, the conceptual schema and the internal schema. The [De 81] four-schema approach splits up the conceptual model into two components -- the enterprise schema and the canonical schema. Both approaches have been evolved from the (semantic) needs in database design, rather than resulted from a left-to-right transformation along the above modeling continuum.

2. The Generalized N-Schema Model

In this paper, we propose a generalized N-schema model for database architecture. In this model, both the enterprise schema and the corresponding external schema are further split up into k levels, each represents different degrees of abstraction of the enterprise (i.e., the organization or the system) and different views of the respective subsystems. Between-level mappings convey the translation and transformation of upper level goals into lower level activities. Different levels of knowledge representation for the system (or subsystems) impose different requirements on data and relational abstraction and therefore call for different architectural configurations. Thus, a generalized N-schema approach better reflects the modeling continuum. It also has the flexibility of meeting the needs of various system design environments. The generalized N-schema model integrates the design of the database and the problem processing system.



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