Chapter 3

DATABASE MODELS AND DATA MODELLING

1. INTRODUCTION

Development of database systems always starts with a modelling phase that seeks to capture the user’s requirements and turn them into technical specifications for implementation. Using a model to assist in the design process is a standard practice in architecture and engineering. Architects and engineers rely on models to validate design concepts, evaluate alternatives, estimate costs, analyse potential risks, develop and refine design specifications, and visualise the possible outcomes of implementing the design. In the design of database systems, the designer uses a model for exactly the same reasons before the actual system is built.

As database systems get larger and more complex, and user requirements become more sophisticated, data modelling as a design paradigm becomes correspondingly more important. Constructing a database system without a proper model is analogous to building a complex engineering structure without a blueprint. No database implementation project should be allowed to proceed without a model that is acceptable to the database sponsor, administrator and developer.

This chapter examines the principles and methods of modelling in database design within the context of the systems development life cycle (SDLC). The subject matter is approached first by defining key terms and concepts relating to database models and data modelling. The characteristics of several commonly used database models are then examined for conceptual, logical and physical database design. Finally, advances in the
principles and methods of documenting data models and data modelling are discussed.

2. DEFINITIONS AND CONCEPTS

The ability of a database system to satisfy its intended objectives depends on its design using various models developed at different stages of the database development process. The following sections explain the terminology relating to database models, how these models are developed and how they are used in the implementation of database systems.

2.1 Definition of a Database Model

In the context of database design, a model is considered to be a collection of concepts, language and graphics that are used to describe the data structure and data processing operations in a database. The focus of a model is the description of a database, rather than the methods used to build it. In other words, a database model is only a blueprint for the construction of a database. It describes what is to be included in a database but not how the database is constructed.

To use a common analogy, a database model in database design is like an architectural plan in construction design. An architectural plan describes the components of a building, the relationships among its structural parts, and the building codes and regulations that must be followed in its construction and intended use. An architectural plan does not typically specify the actual methods or procedures of constructing the building as these are left to the building contractor to decide. The function of an architectural plan is to serve as the means of communication between the developer (who stipulates the requirements and intended use of the building), the architect (who translates the developer’s requirements into an architectural design), the construction contractor (who constructs the building), and the individual(s) who will occupy the building.

A database model, similarly, describes the design of a database but not the ways of constructing it. Just like an architectural plan, a database model also serves as the means of communication between the database sponsor (who commissions the development of the database and is normally assumed to represent the user community at large), the database designer (also commonly known as the data modeller, who designs the database), the database developer (who implements the database by assembling the data, setting up the specified data structure, and loading the data into the database), and the intended end users.