



Chapter I

Survey on Spatial Data Modelling Approaches

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Abstract

The chapter identifies properties that a spatial data model, dedicated to support spatial data for cartography, topography, cadastral and relevant applications, should satisfy. The properties concern the data types, data structures and spatial operations of the model. A survey of various approaches investigates mainly the satisfaction of these properties. An evaluation of each approach against these properties also is included.

Introduction

A lot of research has been undertaken in recent years for the management of spatial data. Initial approaches in the area of GIS exhausted their efforts in the precise geometric representation of spatial data and in the implementation of operations between spatial objects. Subsequently, only primitive effort was made on the association of spatial data with conventional data. As a consequence, the management of geographic data had to be split into two distinct types of processing, one for the spatial data and another for the attributes of conventional data and their association with spatial data. Effort to define a formal and expressive language for the easy formulation of queries was almost missing and, therefore, too much programming was required. Finally, even the processing of spatial data lacked an underlying formalism. On the other hand, efficient processing of conventional data can only be achieved from within a Database Management System (DBMS). Besides, due to its complexity, the management of spatial data is not possible from within a conventional DBMS.

Because of this, a new research effort was undertaken in the area of *spatial databases*. Such effort covered various sectors, such as the design of efficient physical data structures and access methods, the investigation of query processing and optimization techniques, visual interfaces and so forth. All these approaches inevitably addressed spatial data modelling issues in an *indirect* way, in that spatial data modelling was not their primary objective. However, a *direct* way can also be identified, in that research has also been undertaken dedicated solely to the definition of data models.

This chapter surveys and evaluates spatial data modelling approaches in either of these types. Wherever applicable, the restriction of spatio-temporal models to the management of spatial data is also reviewed. In particular, properties concerning the data types considered, the data structures used and the operations supported by a data model for the management of cartography, topography, cadastral and relevant applications, are identified in the background section. A relevant review and evaluation of spatial data modelling approaches, *GIS-centric* and *DBMS-centric*, follow in the next two sections. Future trends are discussed in the fifth section, and conclusions are drawn in the last section.

Background

Traditional cartography, topography, cadastral and relevant applications require the processing of data that can geometrically be represented on a 2-d plane as

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