Chapter XIII

Cooperation with Geographic Databases

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ABSTRACT

The purpose of this chapter is to create cooperation between geographic databases (GDBs) and multidimensional databases (MDDBs), which are considered as the most promising and efficient information technologies for supporting decision making. We focus on the common key elements between geographic and multidimensional data which allow effective support in data cooperating. These elements are basically time and space, which are present implicitly or explicitly in MDDB and are modeled on the dimensions, Time and Location. Thus, because GDBs are primarily concerned with geographic data, we will focus on space as a bridge element for cooperating MDDBs and GDBs.

We propose an approach that extends the geographic data structure through special attributes, called binding attributes, in order to describe all phenomena represented by MDDBs. This extension will make it possible to answer more specific “OLAP-based” queries within GDBs without modifying the physical organization of data in both environments.
INTRODUCTION

In recent years, the enormous increase in data and its sources, due to the growing number of independent databases widely accessible through computer networks, has created a new challenge, which is to find a way of sharing data and programs across different databases. It has motivated cooperation between database systems, creating systems that are sometimes referred to as multi-database or federated database systems. They support collection of cooperating but independent database systems, without requiring data to be physically moved and without incurring significant complications in the functioning of the individual systems. The great advantage that a large community of users has when connecting many data sources nowadays is the tremendous increase in the amount of available data, and this allows enterprises to become more competitive. Unusual trends in particular applications can be identified through the analysis of a huge amount of data, creating opportunities for new business or for forecasting production needs. In this field, decision support systems that treat data in very large databases have recently attracted research attention. These databases may represent business information (such as transaction data), medical information (such as patient treatment and results), scientific data (such as large sets of experimental measurements), or spatial information (such as geographic data and its visualization as maps).

Currently, in the research community, multidimensional databases (MDDBs) and geographic information systems (GISs) are seen as the most promising and efficient information technologies for supporting decision making. Multidimensional databases, through On-Line-Analytical-Processing (OLAP) techniques, provide business dataset handling and summarization over multiple dimensions (OLAP Council, 1997).

Geographic information systems, which are geographic data base (GDB)-dependent, through graphic display functionalities and complex data structures, facilitate the storage and manipulation of either geographic data and its related attributes or data which refers to the phenomena of interest.

A feature notably lacking in most GDBs is the capability of accessing and manipulating data stored in MDDBs on which analyses of transaction-based business data (OLAP) are carried out. Therefore, a new challenge would be to create cooperation between or a federation of these sophisticated technologies in order to introduce a new feature into decision-making support.

In this chapter, we focus on the common key elements between geographic and multidimensional data which allow effective support in data cooperating. These elements are basically time and space, which are present implicitly or explicitly in MDDBs and are modeled on the dimensions, Time and Location. Cooperation between the above-mentioned environments based on each of these elements needs an appropriate approach and data modeling. Thus, because GDBs are primarily concerned with geographic data, we will focus on space as a bridge element for cooperating MDDBs and GDBs. In this way, the location dimension, which is defined
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