Mapping a New Technology

A brief excursion into the evolution and future of geospatial data management. BY EDWIN F. KATIBAH

We've come a long way since the 1960s when we first had the notion to use computers to manage Earth-referenced (geospatial) data. Pioneering efforts—primitive by today's standards—included mapping applications that used line-printer characters to represent the Earth's features. In 1967, the U.S. Bureau of the Census introduced Geographic Base File/Dual Independent Map Encoding (GBF/DIME) for geocoding the 1970 census. As the potential for computer-based geospatial information grew, so did the number of commercial firms engaged in the business of geospatial technology. But it wasn't until 1981 that the groundbreaking Environmental Systems Research Institute (ESRI) introduced ARC/INFO, the first commercial geographic information product to efficiently integrate geospatial technology and a database in a single system.

Marriage Made on Earth The integration was possible thanks to a "dual database" system in which spatial data was stored in proprietary file structures and linked with nonspatial data in database management systems (DBMSs). The solution, while highly functional, had a number of shortcomings, including lack of support for multiple users and concurrency and transaction problems.

The introduction of commercial relational database management systems (RDBMSs) promised to solve these problems. ADT-INGRES and POSTGRES were among the early efforts to extend an RDBMS to include geospatial data. As new data-type support and other capabilities were added to database technology, the so-called third-generation, or object-relational, database management system (ORDBMS) was born.

The Illustra ORDBMS, for instance, first included geospatial database extensions—the 2D and 3D Spatial DataBlade module, and later, the Geodetic DataBlade module. These extensions were indexed by a built-in secondary access method called R-tree (Region tree), providing a complementary indexing strategy to the well-established B-tree method.

Informix is the only major database company to ship the R-tree built-in spatial access method as a standard spatial indexing strategy. The Informix Dynamic Server.2000 supports three major geospatial extensions: the Informix Geodetic DataBlade module, the ESRI Spatial DataBlade module (incorporated into the SDE, or spatial database engine, for the Informix product), and the MapInfo SpatialWare DataBlade module. Each uses the built-in R-tree spatial access method provided by Informix.

Major Shift The superiority of geospatial technology that is fully integrated in an ORDBMS is fundamentally changing the landscape of geospatial applications. As the industry evolves from file-based solutions through the current geospatially extended relational database phase, the result will be a fully integrated, object-relational system in which geospatial technology works seamlessly with documents, time series data, images, video, audio, and other standard and abstract data types. Problems once remedied by complicated and tedious relational database solutions can now be solved in a much more direct and accurate manner—as standard SQL.

Geospatial data management applications are aiding industry and government in ways never dreamed of in the 1960s. Sales managers can plot their reps' districts, retailers can determine how to stock their shelves, wildlife experts can manage habitat resources, transportation planners can monitor traffic, dispatchers route emergency vehicles, and governments manage property assessment and taxation—all with geographic information systems. Spatially enabled relational databases have made many mission-critical applications faster, larger, more secure, and easier to implement.

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