Chapter 6
Open Source Databases and Their Spatial Extensions

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Abstract This chapter discusses Open Source databases including two modes of spatial data management, two different key standards for spatial databases, the leading Open Source databases including MySQL, PostgreSQL, FireBird, Ingres and MaxDB, and summarises extending methods and the use of PostGIS and MySQL.

6.1 Introduction

This chapter is devoted to discussing several open source databases (OSDBs) and their extensions for spatial data handling. It starts with a general introduction of OSDBs focusing on MySQL, PostgreSQL, FireBird, Ingres and MaxDB. A function and source code comparison of them are given. Thereafter, two approaches to develop spatially enabled OSDBs are presented, namely a mid-ware spatial database engine (SDE) solution and a database management system (DBMS) with a spatial extension, or a spatial DBMS. In Sect. 6.4, three kinds of derived standards for OSDB spatial extension development are introduced, namely ISO SQL/MM, ISO/TC 211 (Geographic information/Geomatics) and OGC SFSQL. In Sect. 6.5, the extending method of PostgreSQL is illustrated together with the use of PostGIS and MySQL. Oracle Spatial, one of the most widely used commercial spatial databases, is compared with the OS alternatives is also given. Likely future developments of OSDBs are discussed in the last section of the chapter.

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6.2 A Review of Open Source Databases

OSDBs have received a great deal of attention for some time. MySQL, PostgreSQL, Ingres, Firebird and MaxDB are the most popular, and among these MySQL, which is dual licensed, is most extensive. MySQL is available on more than twenty different platforms, including major Linux distributions, Mac OS X, UNIX and Microsoft Windows. Its architecture, based on threads in Windows or processes in UNIX, makes it extremely fast and easy to customise. It has all of the major characteristics of commercial enterprise-level databases including full transaction-safe integration, atomicity, consistency, isolation, durability with ACID-compliance, with full commit, rollback, crash recovery and row level locking capabilities. Versions after V4.1 implement a subset of structured query language (SQL) with the geometry types environment proposed by the Open Geospatial Consortium (OGC). A geometry-valued SQL column is implemented to support the simple feature data (SFD) model.

PostgreSQL is a highly scalable, SQL-compliant, open source relational database system. It runs on all major operating systems, including Linux, UNIX and Windows. It has a proven architecture that has earned it a strong reputation for reliability, data integrity, and correctness. Like MySQL, it is also fully ACID-compliant, and has full support for foreign keys, joins, views, triggers, stored procedures, storage binary large objects, programming interface for C/C++, Java, .Net, Perl, Python, Ruby, Tcl, and ODBC. PostgreSQL also has numerous sophisticated features including multi-version concurrency control (MVCC), point in time recovery, tablespaces, asynchronous replication, nested transactions, online/hot backups, a sophisticated query planner/optimizer, and write ahead logging for fault tolerance. It allows geometric data types (i.e. point, line, lseg, box, path, polygon and circle) to represent internally two-dimensional spatial objects. However the internal spatial objects have had limited applications until recently because of its non-standardization. PostGIS, as a spatial extension of PostgreSQL, conforms with the OGC and ISO SQL/MM standards, which make it possible to use PostgreSQL for modern spatial application development.

Ingres is an enterprise-class OSDB, which is dual licensed. It is a reliable, high-performance relational database solution that offers scalability, integration, and flexibility (Ingres 2006). Ingres scales from a laptop to workstation clusters in a single version and has the lowest total cost of ownership in the commercial enterprise-level database industry. Its enterprise-class features such as cluster solution, parallel query, distributed transactions are available under an OS license, but the support for B1 security, Enterprise Access, EDBC products are not open. Designed for “set-and-forget” operations on a compact footprint, Ingres can function as an unattended database for both enterprise and embedded deployment. Ingres is the ancestor of PostgreSQL, and it has an extension similar to PostgreSQL, called spatial object library supporting two-dimensional spatial objects, which is proprietary.

Firebird is derived from Borland InterBase 6.0 source code. It is open with many ANSI SQL-standard features and has no dual license (Borrie 2006). It can also run on multiple platforms including Linux, UNIX and Windows. The software has two