

CHAPTER 5



Advanced SQL

Database systems provide mechanism to access SQL from a general-purpose programming language, which is very important for building applications that use a database to manage data.

Database systems provide mechanism to allow procedural code that can be executed within the database either by extending the SQL language to support procedural actions or by allowing functions defined in procedural languages to be executed within the database.

Triggers can be used to specify actions that are to be carried out automatically on certain events such as insertion, deletion, or update of tuples in a specified relation.

Bibliographical Notes

The original SQL proposals for assertions and triggers are discussed in [Astrahan et al. (1976), Chamberlin et al. (1976)], and [Chamberlin et al. (1981)]. [Melton and Simon (2001)], [Melton (2002)], and [Eisenberg and Melton (1999)] provide textbook coverage of SQL:1999, the version of the SQL standard that first included triggers.

[Gray et al. (1995)] and [Gray et al. (1997)] describe the data-cube operator. Efficient algorithms for computing data cubes are described by [Agarwal et al. (1996), Harinarayan et al. (1996)], and [Ross and Srivastava (1997)]. Descriptions of extended aggregation support in SQL:1999 can be found in the product manuals of database systems such as Oracle and IBM DB2.

OLAP features in SQL, including rollup, and cubes were introduced in SQL:1999, and window functions with ranking and partitioning were added in SQL:2003. OLAP features, including window functions, are supported by most databases today. Although most follow the SQL standard syntax that we have presented, there are some differences; refer to the system manuals of the system that you are using for further details. Microsoft's Multidimensional Expressions (MDX) is an SQL-like query language designed for querying OLAP cubes.

Recursive query processing was first studied in detail in the context of a query language called Datalog, which was based on mathematical logic and followed the syn-

tax of the logic programming language Prolog. [Ramakrishnan and Ullman (1995)] provides a survey of results in this area, including techniques to optimize queries that select a subset of tuples from a recursively defined view.

There has been a substantial amount of research on the efficient processing of “top- k ” queries that return only the top- k -ranked results. A survey of that work appears in [Ilyas et al. (2008)].

Details about JDBC may be found at docs.oracle.com/javase/tutorial/jdbc. References to books on Java (including JDBC) are also available at this URL. The ODBC API is described in [Microsoft (1997)] and [Sanders (1998)]. [Melton and Eisenberg (2000)] provides a guide to SQLJ, JDBC, and related technologies. Information on ODBC, ADO, and ADO.NET can be found on msdn.microsoft.com/data.

In the context of functions and procedures in SQL, many database products support features beyond those specified in the standards, and do not support many of the features of the standard. More information on these features may be found in the SQL user manuals of the respective products.

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