



# **SNS COLLEGE OF TECHNOLOGY**

**COIMBATORE-35**



## **DEPARTMENT OF INFORMATION TECHNOLOGY**

### **DATABASE MANAGEMENT SYSTEMS**

#### **Oracle: Database Design and Querying Tools; SQL Variations and Extensions**

#### **Database Design and Querying Tools**

Oracle provides a variety of tools for database design, querying, report generation and data analysis, including OLAP. These tools, along with various other application development tools, are part of a portfolio of software products called Oracle Fusion Middleware. Products include both traditional tools using Oracle's PL/SQL programming language and newer ones based on Java/J2EE technologies. The software supports open standards such as SOAP, XML, BPEL, and UML.

#### **Database and Application Design Tools**

The Oracle Application Development Framework (ADF) is an end-to-end J2EE based development framework for a Model-View-Control design pattern. Oracle framework, an application consists of multiple layers. The Model and Business Services layers handle the interaction with the data sources and contains the business logic. The View layer handles the user interface, and the Controller layer handles the flow of the application and the interaction between the other layers. The primary development tool for Oracle ADF is Oracle JDeveloper, which provides an integrated development environment with support for Java, XML, PHP, HTML, Javascript, BPEL, SQL, and PL/SQL development. It has built-in support for UML modeling. Oracle Designer is a database design tool, which translates business logic and data flows into schema definitions and procedural scripts for application logic. It supports such modeling techniques as E-R diagrams, information engineering, and object analysis and design. Oracle also has an application development tool for data warehousing, Oracle Warehouse Builder. Warehouse Builder is a tool for design and deployment of all aspects of a data warehouse, including schema design, data mapping and transformations, data load processing, and metadata management. Oracle Warehouse Builder supports both 3NF and star schemas and can also import designs from Oracle Designer. This tool, in conjunction with database features, such as external tables and table

functions, typically eliminates the need for third-party extraction, transformation, and loading (ETL) tools.

### Querying Tools

Oracle provides tools for ad hoc querying, report generation, and data analysis, including OLAP. Oracle Business Intelligence Suite (OBI) is a comprehensive suite of tools sharing a common service-oriented architecture. Components include a Business Intelligence server and tools for ad hoc querying, dashboard generation, reporting, and alerting. The components share infrastructure and services for data access and metadata management and have a common security model and administration tool. The component for ad hoc querying, Oracle BI Answers, is an interactive tool that presents the user with a logical view of the data hiding the details of the physical implementation. Objects available to the user are displayed graphically and the user can build a query with a point-and-click interface. This logical query is sent to the Oracle BI Server component, which then generates the physical query or queries. Multiple physical data sources are supported, and a query could combine data stored in relational databases, OLAP sources, and Excel spreadsheets. Results can be presented as charts, reports, pivot tables, or dashboards that are drillable and can be saved and later modified.

## SQL Variations and Extensions

Oracle supports all core SQL:2003 features fully or partially, with the exception of features-and-conformance views. In addition, Oracle supports a large number other language constructs, some of which conform with Optional Features of SQL Foundation:2003, while others are Oracle-specific in syntax or functionality.

### Object-Relational Features

- Oracle has extensive support for object-relational constructs, including:
- Object types. A single-inheritance model is supported for type hierarchies.
- Collection types. Oracle supports varrays, which are variable length arrays, and les. nested tab
- Object tables. These are used to store objects while providing a relational view of the attributes of the objects.
- Table functions. These are functions that produce sets of rows as output, and can be used in the from clause of a query. Table functions in Oracle can be nested. If a table function is used to express some form of data transformation, nesting

multiple functions allows multiple transformations to be expressed in a single statement.

- Object views. These provide a virtual object table view of data stored in a regular relational table. They allow data to be accessed or viewed in an object oriented style even if the data are really stored in a traditional relational format.
- Methods. These can be written in PL/SQL, Java, or C.
- User-defined aggregate functions. These can be used in SQL statements in the same way as built-in functions such as sum and count.

### **Oracle XML DB Oracle**

XML DB provides in-database storage for XML data and support for a broad set of XML functionality including XML Schema and XQuery. It is built on the XMLType abstract data type, which is treated as a native Oracle data type. XML DB provides several options for how data of this data type are stored in the database, including:

- Structured in object-relational format. This format is usually space efficient and allows the use of a variety of standard relational features, such as B-tree indices, but incurs some overhead when mapping XML documents to the storage format and back. It is mainly suitable for XML data that are highly structured and the mapping includes a manageable number of relational tables and joins.
- Unstructured as a text string. This representation does not require any mapping and provides high throughput when inserting or retrieving an entire XML document. However, it is usually not very space efficient and provides for less intelligent processing when operating on parts of an XML document. 1160 Chapter 28 Oracle
- Binary XML storage. This representation is a post-parse, XML Schema-aware, binary format. It is more space efficient than unstructured storage and can handle operations against parts of an XML document. It is also better than the structured format at handling data that are highly unstructured, but may not always be as space efficient. This format may make the processing of XQuery statements less efficient than when the structured format is used.

Both the binary and unstructured representation can be indexed with a special type of index called XMLIndex. This type of index allows document fragments to be indexed based on

their corresponding XPath expression. Storing XML data inside the database means that they get the benefit of Oracle's functionality in areas such as backup, recovery, security, and query processing. It allows for accessing relational data as part of doing XML processing as well as accessing XML data as part of doing SQL processing. Some very high-level features of XML DB include:

- Support for the XQuery language (W3C XQuery 1.0 Recommendation).
- An XSLT process that lets XSL transformations be performed inside the database.
- An XPath rewrite optimization that can speed up queries against data stored in object-relational representation. By translating an expression used in an XQuery into conditions directly on the object-relational columns, regular indexes on these columns can be used to speed up query processing.

### **Procedural Languages**

Oracle has two main procedural languages, PL/SQL and Java. PL/SQL was Oracle's original language for stored procedures and it has syntax similar to that used in the Ada language. Java is supported through a Java virtual machine inside the database engine. Oracle provides a package to encapsulate related procedures, functions, and variables into single units. Oracle supports SQLJ (SQL embedded in Java) and JDBC, and provides a tool to generate Java class definitions corresponding to user-defined database types.

### **Dimensions**

Dimensional modeling is a commonly used design technique for relational star schemas as well as multidimensional databases. Oracle supports the creation of dimensions as metadata objects in order to support query processing against databases designed based on this technique. The metadata objects can be used to store information about various kinds of attributes of a dimension, but perhaps more importantly, about hierarchical relationships.

### **OLAP**

Oracle provides support for analytical database processing in several different ways. In addition to support for a rich set of analytical SQL constructs (cube, rollup, grouping sets, window functions, etc.), Oracle provides native multidimensional storage inside the relational database server. The multidimensional data structures allow for array-based access to the data, and, in the right circumstances, this type of access can be vastly more efficient than traditional relational access methods. Using these data structures as an integrated part of a relational database provides a choice of storing data in a relational or multidimensional format while still taking advantage of Oracle features in areas such as backup and recovery, security, and administration tools. Oracle provides storage containers for multidimensional

data known as analytic workspaces. An analytic workspace contains both the dimensional data and measures (or facts) of an OLAP cube and is stored inside an Oracle table. From a traditional relational perspective, a cube stored inside a table would be an opaque object where the data could not normally be interpreted directly in terms of the table's rows and columns. However, Oracle's OLAP server inside the database has the knowledge to interpret and access the data and makes it possible to give SQL access to it as if it had been stored in a regular table format. Hence, it is possible to store data in either a multidimensional format or a traditional relational format, depending on what is optimal, and still be able to join data stored in both types of representations in a single SQLquery. A materialized view can use either representation. In addition to Oracle's OLAP support inside its relational database, Oracle's product suite includes Essbase. Essbase is a widely used multidimensional database that came to be part of Oracle with the acquisition of Hyperion.

### **Triggers**

Oracle provides several types of triggers and several options for when and how they are invoked. (See Section 5.3 for an introduction to triggers in SQL.) Triggers can be written in PL/SQL or Java or as C callouts. For triggers that execute on DML statements such as insert, update, and delete, Oracle supports row triggers and statement triggers. Row triggers execute once for every row that is affected (updated or deleted, for example) by the DML operation. A statement trigger is executed just once per statement. In each case, the trigger can be defined as either a before or after trigger, depending on whether it is to be invoked before or after the DML operation is carried out. Oracle allows the creation of instead of triggers for views that cannot be subject to DML operations. Depending on the view definition, it may not be possible for Oracle to translate a DML statement on a view to modifications of the underlying base tables unambiguously. Hence, DML operations on views are subject to numerous restrictions. A user can create an instead of trigger on a view to specify manually what operations on the base tables are to be carried out in response to a DML operation on the view. Oracle executes the trigger instead of the DML operation and therefore provides a mechanism to circumvent the restrictions on DML operations against views. Oracle also has triggers that execute on a variety of other events, such as database start-up or shutdown, server error messages, user logon or logoff, and DDL statements such as create, alter and drop statements