NEW IN ORACLE DATABASE 10G RELEASE 2

- Support for the forthcoming W3C XQuery standard. XQuery can be used to query XML and non-XML data stored in Oracle database 10g Release 2. XQuery re-write allows XQuery expressions to be executed as native relational operations.

- New XML specific DML operators simplify the task of making complex changes to the structure of existing XML documents. Supported operations include adding and removing nodes from existing documents. XPath re-write allows these operations to be performed directly on the underlying relational structures.

- Extended compliance with ANSI SQL/XML Standard provides more features to simplify the process of generating complex XML documents from relational data. This includes support for generating XML documents that include XML declarations, comments, processing instructions and CDATA sections.

- Support for the HTTPS protocol provides enhanced security when accessing contents stored in the Oracle XML DB repository and the Oracle HTTP Web Server.

- XPath Rewrite enhancements allow XPath re-write to occur in conjunction with XML Schemas that incorporate advanced features of the XML Schema standard. In particular XPath re-write is now supported in conjunction with substitution groups and inheritance via restriction and extension.

- XSLT Performance improvements. XSLT transformation in Oracle Database 10g Release 2 continues to build on the XML data type, first introduced as part of Oracle Database 9i Release 1. XMLElement makes the Oracle

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Oracle Database 10g Release 2 adds high-performance native storage and retrieval of XML content to the capabilities of Oracle Database 10g release 2. The Oracle XML DB Repository makes it possible to access XML and other kinds of content, stored in the Oracle Database, from popular desktop tools using standard internet protocols. This allows organizations to apply Oracle’s core capabilities of security, platform scalability and reliability to the growing volumes of XML and other forms of content that need to be managed in today’s complex business environment.

The Importance of XML

In the fast moving world of IT technology, the W3C’s XML standards rank second in terms of popularity behind ANSI/ISO’s SQL standard. In order to remain competitive developers and DBAs need a solid XML infrastructure that allows them to efficiently leverage the benefits and productivity improvements that can be obtained from adopting XML based standards.

Like SQL, XML has been widely adopted in just about every conceivable market. XML based standards can be found in Health-care, Manufacturing Financial Services, Government and Publishing sectors. XML and XML based standards such as Web Services and XBRL have become the de-facto mechanism for exchanging structured information between organizations as-well as between disjoint application systems within organizations. XML is also rapidly becoming the tool of choice for managing and controlling unstructured content.

Oracle has been actively involved in both the XML standards process, and in development core XML Technology since the earliest days of the XML effort. This development effort has culminated in the industry’s leading implementation of the W3C standards, The Oracle XML Developer’s Kit (XDK) and the first relational database to offer comprehensive and efficient native support for storing, querying and manipulating XML in its native form, Oracle Database 10g.

As the use of XML expands, organizations have to choose between publishing and consuming XML at the edges of their application systems or deciding to persist and process the XML in its native form. Oracle XML DB gives you the best of both worlds; it eliminates the need to write the ever more complex code to needed to translate between the XML and relational paradigms, while at the same time allowing you to bring all the power of the Oracle relational database to bear on your XML content.

Native XML Storage

Oracle Database 10g Release 2 continues to build on the XML data type, first introduced as part of Oracle Database 9i Release 1. XMLElement makes the Oracle...
Database 10g Release 2 makes use of a new XSLT Virtual machine (XLST VM) which can significantly improve the performance of XSLT operations.

- Support for Transportable Tablespaces allows high performance import and export of XML content between database instances.
- Support for schema-based metadata provides developers with more options for managing metadata associated with documents stored in the Oracle XML DB Repository.

Database XML aware, and allows XML documents to be stored in the Oracle database using an optimized native storage format. This storage format guarantees DOM Fidelity, which guarantees that none of the information contained in the XML document is lost when the document is stored in the Oracle Database. DOM Fidelity preserves not only the content of the nodes and attributes, but also node ordering, namespace, type and null declarations, Comments, Processing Instructions and Mixed Text.

The XMLType data type can be used just like any other SQL data type, including in table definitions, view definitions and as a PL/SQL variable, parameter or return type. The XMLType, and the associated XML abstraction layer, allows application developers to create applications that are independent of the underlying storage of the XML content.

**SQL Support for common XML operations**

Along with XMLType Oracle Database also provides a number of XML related SQL operators and PL/SQL methods. These operators provide application developers with the ability to use XML metaphors to perform operations on XML content. They improve programmer productivity by significantly reducing the amount of code and effort required to perform common XML related operations. The operators support XPath evaluation, fragment extraction and fragment update, XML Schema validation, and XSL Transformation. Developers are able to perform these operations without having to become familiar with the lower level Document Object Model APIs defined by W3C. Oracle XML DB also provides application developers with the flexibility to use the W3C DOM APIs on XMLType content when necessary.

**Support for the XPath and XQuery Languages**

Oracle Database 9i Release 1 included support for using XPath expressions as a method of querying XML documents. XPath is W3C standard for identifying nodes within an XML document. Oracle Database 9i release 2 added support for XPath re-write allowing significant optimization of XPath based queries over schema-based XML, as well adding support for XPath based updating of XML content. In Oracle Database 10g release 1 XPath re-write was extended even further leading to significant performance improvements for queries involving common, complex XPath expressions.

In Oracle Database 10g release 2 XPath re-write has been extended even further to handle complex XML Schema constructs such as substitution groups and inheritance by both extension and restriction.

Also new in Oracle 10g release 2 is support for the W3C XQuery standard. Query support provides XML programmers with the ability to use the XQuery language to query XML content and other forms of stored in Oracle Database 10g release 2. Since the XQuery standard is not yet a W3C recommendation it should be noted Oracle reserves the right to modify the XQuery implementation that ships with future releases of the Oracle Database in whatever means are necessary to be compliant with the final W3C XQuery recommendation.
Support for the XML Schema data model

Oracle XML DB can also use the information contained in an XML Schema to deliver optimized storage for documents that are compliant with the XML Schema. This optimized storage model enables a number of advanced Oracle XML DB features including XPath and XQuery re-write, and lazily loaded DOM. Oracle XML DB allows the XML Schema to be annotated with hints that provide application developers and DBAs with the ability to fine tune the storage model to meet the performance needs of their applications.

Oracle Database 10g Release 1 extended Oracle database’s support for the XML Schema standard adding support for XML Schema evolution. This allows DBAs and application developers to deal with the process of managing on-going changes to their XML Schemas.

Multiple choices for indexing XML content
Oracle XML DB allows many different types of index to be created on XML content. B-Tree and functional indexes can be created on the content of specific nodes within a collection of documents. Text indexing techniques allow the creation of XML aware and full-text indexes on XML documents. The available indexes are automatically taken into account when determining the optimal way of resolving an XML operation that that includes an XPath or XQuery expression. An Oracle specific XPath extension function allows Oracle full-text search to be performed on the content of a text node or attribute.

XML specific memory and performance optimizations
Oracle XML DB includes a number of run-time performance optimizations that significantly improve XML operations.

- XPath and XQuery re-write XPath and XQuery based operations to be transparently executed as relational operations.
- An XSLT VM, implemented in ‘C’ delivers high throughput XSLT Transformation capability.
- A lazily loaded virtual DOM ensures optimized memory usage for DOM based operation on schema-based XML content. It also totally eliminates the overhead associated with parsing XML content when performing DOM based operations.

High performance, standards based XML Publishing
Many organizations are new required to publish data in XML formats. Drivers for
this include the need to effective exchange information with supplies and consumers and the need to meet mandated reporting formats such as XBRL. The SQL: 2003 standard introduced a new set of SQL functions specifically designed to meet the needs of these organizations. These operators simplify the process of transforming the results of a SQL query into one or more XML documents. The great advantage of these operators is that they are remarkably easy to use and extremely flexible.

Oracle XML DB includes a highly optimized implementation of these operators. The operators can be used in conjunction with XML content, relational content and, via Oracle's gateway technology, external data sources. This enables the creation of XML documents which draw content from heterogeneous data.

The SQL/XML operators can also be used to define XMLType views which provide a persistent XML view of non-XML content. All of the XML operators and methods that work with XMLType columns or tables can be used with XML views. XPath and XQuery re-write XML operations on XMLType views to be re-written into equivalent relational operations that operate directly on the underlying data structures.

**Advanced SQL <-> XML Interoperability**

Another key feature of Oracle XML DB is the high degree of interoperability it provides. XML Operations on none XML content can be performed via XMLType views. Relational operations on XML content are enabled by using XPath and XQuery expressions to map nodes in an XML document to columns in a relational view. This allows application developers and tools that do not understand the XML abstraction to work directly with XML content stored in the database.

**XML DB Repository**

Many XML applications, particularly those that use XML to describe and manage content, typically need to organize XML documents using a folder hierarchy. A number of popular W3C Standards such as XLink, and XPointer, use a path-based metaphor to describe the relationships between XML documents.

The Oracle XML DB repository extends the basic XML related functionality of Oracle XML DB, by providing a folder hierarchy that can be used to organize XML content stored inside the database. The hierarchy is optimized for managing XML content but is fully capable of acting as a repository for other, related kinds of content such as Office productivity documents, images and other forms of multimedia content.

The Oracle XML DB Repository is fully accessible from SQL and PL/SQL. New views and operators allow SQL queries and updates to be executed on content and metadata managed by folder hierarchy. These operations can be restricted to a particular sub-tree within the repository. A comprehensive set of PL/SQL packages allow developers to perform functions like creating and deleting content, locking and unlocking content, versioning content, moving and linking content.

The Oracle XML DB repository allows a path or URL to be used to access content. A new index, the hierarchical index, ensures that the performance of using a path to
locate a document stored in the repository is comparable to using a primary key to locate a row in a table. It also ensures that the performance of folder restricted query (a query where the operation is limited to documents located in a particular folder tree) is similar that of a relational query based on an index scan.

**Versioning and Access Control**

The Oracle XML DB repository includes a simple versioning model based on the WebDAV standard. The current implementation provides linear versioning. The version management system is initiated and controlled via simple PL/SQL procedures.

The Repository also provides support for using the WebDAV Access Control List (ACL) model to specify access rights for each document it manages. Every document stored in the repository is associated with an Access Control List. An Access Control List grants or revokes permissions from one or more principles.

In Oracle XML DB an Access Control List is simply an XML document. The principles referenced by an ACL document are database users, database roles or Oracle Internet Directory (OID) Users or Groups. New ACLs can be created by simply inserting ACL documents into the Oracle XML DB repository.

**XML DB Protocol servers**

The Oracle XML DB protocol servers allow content stored in the Oracle XML DB Repository can be accessed directly using open internet protocols. Currently Oracle XML DB provides full support for the HTTPS, HTTP, WebDAV and FTP protocols. This allows Microsoft’s Windows™ and other operating systems that include support for the WebDAV standard to interact directly with content stored in the Oracle XML DB repository. This means that standard content creation tools such as Microsoft’s Office™ products, work seamlessly with the Oracle XML DB repository. Content creators and editors are not restricted as to which tools they can use when working with the Oracle XML DB repository.

The protocol servers are fully compliant with internationalization standards. This allows clients that use different native character sets to share content stored in the Oracle XML DB repository. The protocol servers perform automatic bi-directional translation between the client and the database character set when content is accessed.

**Flexible application development options**

All of the Oracle XML DB features are accessible via SQL. This means that any tool capable of sending SQL statements to the database, and calling PL/SQL packages can work with Oracle XML DB. The XMLType is fully supported from JDBC, ODBC, OCI and ADO.NET. Optimized support for W3C DOM APIs is provided in PL/SQL, JAVA and C and C++.
Further Information

More detailed information on all of the features of Oracle XML DB and Oracle XML DB repository, including detailed whitepapers, can be obtained at the Oracle XML DB page on the Oracle Technology Network: