



# Oracle8i™ Enterprise Edition

---

## Technical Data Sheet

November 1999

*Just as the Internet is changing the way that we use and access information, Oracle8i™ is changing the way that information is managed. Oracle8i Enterprise Edition is designed specifically to support the demanding requirements of Internet and traditional mission critical OLTP and data warehouse applications. From development to deployment, Oracle8i Enterprise Edition offers unparalleled and revolutionary functionality to manage all data necessary to web-enable your business.*

## PRODUCT SUMMARY

Oracle8i Enterprise Edition, the database for Internet computing, changes the way information is managed and accessed to meet the demands of the Internet age, while providing significant new features for traditional OLTP and data warehouse applications. With solutions developed and deployed with Oracle8i, any organization is able to exploit the unlimited opportunities the Internet provides. Oracle8i not only provides the advanced tools to manage all types of data that is found in today's most popular web sites, but it also provides the performance and scalability needed to support these large sites and other mission-critical applications.

Oracle8i Enterprise Edition provides efficient, reliable, secure data management for high-end applications such as high volume on-line transaction processing (OLTP) and query-intensive data warehouse applications. Oracle8i Enterprise Edition provides the tools and functionality to meet the demanding availability and scalability requirements required by today's mission-critical applications.

In today's fast-paced business climate, application developers have been pushed to produce advanced

applications not only quickly, but also with inherent flexibility to meet ever-changing needs. Oracle8i introduces additional support for Java™ – today's most popular and productive programming language by including a robust, integrated, and scalable Java VM within the server. This expands Oracle's support for Java into all tiers of applications, allowing Java programs to be deployed where they perform best, either in the client, server, or middle tier without recompiling or modifying the Java code. Oracle8i also includes Oracle® WebDB, a browser-based application development, deployment, and management toolset that makes web-enabling a business easy and inexpensive.

Oracle8i is much more than just a simple relational data store. Oracle, having invented the relational database, continues to lead and revolutionize the database industry by introducing Oracle® iFS (Internet File System) and Oracle® interMedia with Oracle8i. Oracle® iFS, the Internet file system, provides the easy-to-use functionality of a file system combined with the advantages of all data, such as text and web pages, in a single server – data integration with the cost savings of a single server. Oracle8i also introduces Oracle® interMedia, which allows businesses to manage

and access multi-media data, including image, text, audio/video, and spatial data.

Not only does Oracle8i introduce significant breakthrough technology, such as a Java VM and Oracle iFS, it also has significant new features and functionality for traditional OLTP and data warehouse applications. Oracle8i Enterprise Edition provides the scalability, availability, and performance needed by mission-critical applications. For data warehouses, Oracle8i now provides sophisticated summary management features to store aggregates that are commonly queried, reducing query processing significantly. For OLTP applications, Oracle8i introduces many features that improve the availability of the database during routine operations, such as index rebuilds, and in disaster situations, by providing automated standby database support.

The deployment of applications is just as critical as the functionality of the application, with performance and manageability the key to the success of the implementation. Oracle8i provides many alternatives to the client/server implementation architecture. Oracle is reducing the complexity of application management by providing an architecture that allows for thin-clients that are easy to support and maintain, and by consolidating data and logic in a single or replicated server environment. Data can be replicated to servers that are closer to users and have only the data those users need, providing better performance.

Finally, Oracle8i includes Oracle® Enterprise Manager, which is the comprehensive management framework for managing the Oracle database and application environment. Oracle Enterprise Manager includes an easy-to-use centralized console, a rich set of management tools, and the extensibility to detect and solve any problems that may arise. It also includes several administrative applications for performing day-to-day tasks for databases and applications, such as scheduling backup routines.

Based on the world's leading database technology,

Oracle8i is designed for efficient application development, superior content management, and successful application deployment on the Internet.

## APPLICATION DEVELOPMENT

### JAVA IN ORACLE8i

Java has quickly become today's most popular programming language because it appeals to everyone, from developers who find the language robust and object-oriented, to CIOs and managers who see Java as reducing costs and simplifying application development and support. Oracle8i extends Oracle's Java strategy by integrating a scalable Java Virtual Machine (Java VM) with the database server. Oracle8i also supports SQLJ, a syntax for embedding SQL in Java code. Java in the database allows developers to create high performing, scalable applications based on open, industry standards.

Oracle® JServer, Oracle's Java2 compliant Java VM, enables developers to write, store, and execute Java code within the database. This means developers can create stored procedures, functions, or triggers in Java. A Java VM within the database server also dramatically reduces the skill set required for database programming. As opposed to C, Oracle® Call Interface, PL/SQL™, and other languages, developers can now create applications using only Java.

SQLJ provides a powerful and easy to use interface between relational databases and Java. It is an open standard being developed by Oracle, IBM, and Sun. Using SQLJ, SQL can easily be embedded in client or server Java code for communication with a relational database. Client-side Java code with SQLJ statements are run through a Java precompiler to create executable Java programs based on JDBC. Server-side Java code directly accesses the database, via native interfaces.

Oracle8i also provides support for Enterprise JavaBeans™ and communication via the CORBA

communication standard, IIOP. Distributed Java objects can connect directly to Java objects in an Oracle Data Server via native CORBA protocols.

JDeveloper™ is Oracle's next generation component-based Java development tool. JDeveloper allows developers to build complete Oracle and 100 percent Java business solutions. JDeveloper supports any kind of development from a simple JavaBeans component to an enterprise-wide application development environment.

Oracle8i also integrates closely with Oracle® Application Server, which provides an open, standards-based architecture for developing and deploying real-world business and commerce applications. Its scalable, distributed architecture and superior database integration are the foundation for supporting business-critical, transaction-based applications.

## **XML SUPPORT**

XML has emerged as the de facto standard for describing business data for business to business (B2B) commerce on the Internet. Just as HTML is the universal language for formatting data and content on the Internet, XML is the language for describing business data. Similar to HTML, XML provides the facility to embed business descriptors along with raw business data in a message, simplifying data integration and exchange. Oracle provides several XML parsers that convert XML data into a form that can be easily understood by the Oracle8i database.

Oracle's XML products include the XML Parser for Java - version 1 and version 2 (which includes an XSLT processor), the XML Class Generator, and the XML Parsers for C, C++, and PL/SQL. Since the Oracle XML Parser for Java is implemented in Java, it runs efficiently in the Oracle8i Java VM, Oracle JServer. Oracle8i includes the Oracle XML Parser for Java, where the Java XML parser classes (DOM/SAX APIs) are pre-loaded into Oracle JServer.

## **ORACLE WEBDB FOR DEVELOPING WEB-BASED APPLICATIONS**

Oracle WebDB is the solution for building, deploying, and proactively monitoring web database applications, and content-driven Web sites. By combining an intuitive, HTML interface with a complete set of robust, browser-based HTML tools, Oracle WebDB enables users to easily and quickly develop Web database applications. Oracle WebDB is the fastest and easiest way to web-enable Oracle databases.

Oracle WebDB comes with all the tools necessary to build dynamic Web applications and content-driven Web sites. Applications and Web sites developed using Oracle WebDB are completely contained within the Oracle database. The only client software needed to develop and deploy Oracle WebDB applications is a Web browser. There is no need to install software on every machine being used, no need to use FTP to remotely manage files, and no need to have a complex deployment plan every time a developer fixes a bug and needs to upgrade the system. Oracle WebDB truly meets the demanding challenges the Internet poses to the traditional IT shop — fast application development and simplified deployment.

## **PRODUCTIVE DEVELOPMENT**

Oracle8i includes the powerful, flexible, scalable application development features necessary to construct a new generation of sophisticated applications at low cost. Declarative functionality such as constraints ensure scalable, reliable enforcement of data integrity, while minimizing development, maintenance, and administration costs. PL/SQL, an advanced procedural 4GL language that is tightly integrated with the Oracle8i Server, provides the power to easily express complex business rules as stored, procedural code in the form of stored procedures or triggers. Java is also available as an open

alternative to PL/SQL. Wherever PL/SQL can be programmed, so can Java. The Oracle8i programmatic interfaces enable 3GL programs to access and manipulate Oracle8i data and schemas.

Oracle8i supports PL/SQL Server Pages, which are server-side Web pages written in HTML and/or XML with embedded PL/SQL scripts designated with special tags. After being developed, the PL/SQL Server Page is loaded into the database and invoked via a URL. When executed, the PL/SQL Server Page dynamically creates standard HTML on the server-side that is then interpreted by a client-side browser or Internet-aware program.

Oracle National Language Support (NLS) ensures that error messages, sort order, date format, and other conventions automatically adapt to the native language. Parameter settings at the Oracle8i and operating system levels determine the behavior of individual conventions.

Oracle8i's productive development features improve application performance, scalability, and security, to support hundreds of applications and thousands of users.

## **CONTENT MANAGEMENT FOR THE INTERNET**

The Web and the Internet bring many new challenges to organizations. Today's Web sites are usually a series of Web pages that take too much time and too many human resources to develop, deploy, and manage. In addition, their infrastructure is usually not stable or robust enough to support mission-critical applications. Everything you need to transform data into a powerful application and content-driven Web site development environment is included with Oracle8i. It essentially eliminates the differences between the way in which database stores data and the way web sites store files.

### **ORACLE iFS (INTERNET FILE SYSTEM)**

Oracle iFS combines the power of Oracle8i with the ease of use of a file system. Completely

integrated with Oracle8i, Oracle iFS is a Java application that runs on the Oracle8i Java VM.

From the end user's standpoint, Oracle iFS appears as if it were just another volume on the network. Whether the user accesses the contents of Oracle iFS through Windows Explorer, a Web browser, an FTP client, or an e-mail client, the files appear the same. Relational data can appear as files; so too can hybrid documents that combine relational and non-relational data. It also supports intelligent text searches and queries of files and data stored in Oracle iFS.

From a developer's standpoint, Oracle iFS is the single data store containing the data for many different applications. And for the system administrator, Oracle iFS provides a single system for file storage and messaging, rather than several separate systems to maintain and administer. In short, Oracle iFS is a simpler way of storing different types of files in the database.

As part of Oracle8i, Oracle iFS provides universal access to any data in the database. While the Oracle iFS runs within Oracle8i, it appears as if it were simply another file system volume on the network. Any data or files in Oracle iFS can be accessed using any of these different protocols:

- SMB for Windows 95, 98 or NT clients. Users can drag files into and out of Oracle iFS, or edit them directly within Oracle iFS.
- HTTP or FTP for Web browsers and network computers. The contents of Oracle iFS are displayed as normal web pages or standard FTP directories.
- SMTP, IMAP4, POP3 for using Oracle iFS like an e-mail system through clients like Netscape Communicator, Eudora, Microsoft Outlook, and others.

## Oracle *inter*MEDIA

Web applications require advanced data management services that support the rich data types used in Web repository, e-commerce, and other Internet applications. Oracle *inter*Media adds support that enables Oracle8i to manage multimedia content, both for Internet, and traditional applications that need access to image, audio, video, text, and location information.

Oracle *inter*Media includes the following:

- Oracle's award-winning ConText<sup>®</sup> text services, to deliver the powerful text retrieval capabilities fundamental to Web applications. This lets users query and analyze documents stored in document archives, online news feeds, customer call reports, and other online text information sources. Users can query for data in the most common formats, including HTML, Word, Excel, and Acrobat/PDF formats.
- Audio, video, and image services support integrated management of audio, video, and image information within an Oracle8i database. These services enable access to audio, video, and image data in dozens of Internet formats from a variety of sources, both within Oracle8i and from external locations such as Web URL sites or specialized servers. Oracle *inter*Media supports delivery of video through any streaming server such as the Oracle<sup>®</sup> Video Server, or RealNetworks<sup>™</sup> RealAudio<sup>™</sup> and RealVideo<sup>™</sup> Servers. Oracle *inter*Media also supports drag and drop of audio, video, and image data through the Oracle *inter*Media clipboard into web applications and web authoring tools such as Oracle WebDB, Symantec<sup>®</sup> Visual Page, and Microsoft<sup>®</sup> FrontPage.
- Geometric locator services to support the development of Internet applications that help users locate information, such as stores, distribution points, and events, based on their location or distance from a given address. Oracle *inter*Media locator enables Oracle8i to perform location queries, and supports the Internet's leading online geocoding services, including

Centrus<sup>™</sup> from QMSOft<sup>®</sup> and MapXtreme<sup>™</sup> from MapInfo<sup>®</sup>.

## THE INTERNET CONVERGES WITH THE ENTERPRISE

Today's Internet applications require the same mission critical capabilities that traditional OLTP and data warehouse applications require, such as scalability, availability, and reliability. Oracle8i introduces many new features that support these traditional applications and provides the power and functionality to support Web-enabling these same applications.

## HIGH-END DATA WAREHOUSING

Data warehouse applications require different processing techniques than OLTP applications due to the complex, ad hoc queries running against large amounts of data. To address these special requirements, Oracle8i offers a rich variety of query processing techniques, sophisticated query optimization to choose the most efficient data access path and a scalable architecture that takes full advantage of all parallel hardware configurations. Oracle8i also addresses applications that have mixed workloads and where administrators want to control what users, or groups of users, have priority when executing transactions or queries.

## RICH QUERY PROCESSING TECHNIQUES

Successful data warehouse applications rely on superior performance, when accessing the enormous amounts of stored data. Oracle8i provides a rich variety of integrated indexing schemes, join methods, and summary management features, to deliver answers quickly to data warehouse users.

## SUMMARY MANAGEMENT

In a data warehouse application, users often issue queries that summarize detail data by common dimensions, such as month, product, or region. Oracle8i provides a mechanism for storing

multiple dimensions and summary calculations of a table. So, when a query requests a summary of detail records, the query is transparently re-written to access the stored aggregates, rather than summing the detail records every time the query is issued. This results in dramatic improvements in query performance. These summaries are automatically maintained from data in the base table. Oracle8i also provides summary advisory functions that assist database administrators in choosing where summary tables will be the most effective, depending on actual workload and schema statistics. Oracle Enterprise Manager supports the creation and management of materialized views and related dimensions and hierarchies via a graphical interface, greatly simplifying the management of materialized views.

## **ANALYTIC FUNCTIONS**

Oracle8i includes a powerful family of SQL functions for business intelligence and data-warehousing applications. These functions are collectively called “analytic functions”, and they provide significantly improved performance and simplified coding for many business analysis queries. Some examples of the new capabilities are:

- Ranking (“Find the top 10 sales reps in each region.”)
- Moving aggregates (“What is the 200-day moving average of our company’s stock price?”)
- Other functions include: Cumulative aggregates, lag/lead expressions, period-over-period comparisons, and ratio-to-report

Oracle8i also includes the CUBE and ROLLUP operators for OLAP analysis, via SQL. These analytic and OLAP functions significantly extend the capabilities of Oracle8i for analytic applications.

## **BITMAPPED INDEXES**

Bitmapped indexes deliver dramatic performance benefits to data warehouse applications. They coexist with, and complement other available indexing schemes, including standard B-tree indexes, clustered tables, and hash clusters. While B-tree indexes may be the most efficient index to retrieve data using a unique identifier, bitmapped indexes are most efficient when retrieving data based on much wider criteria, such as “How many red cars were sold last month?” In data warehouse applications, end-users often query data based on these wider criteria.

Bitmapped indexes are fully integrated into the Oracle8i Server. Oracle8i enables efficient storage of bitmap indexes through the use of advanced data compression technology. Parallel index creation and support for automatic index maintenance with update operations facilitate easy maintenance.

## **ADVANCED JOIN METHODS**

Oracle8i offers partition-wise joins which dramatically increase the performance of joins involving tables that have been partitioned on the join keys. Joining records in matching partitions increases performance, by avoiding partitions that could not possibly have matching key records. Less memory is also used since less in-memory sorting is required.

Hash joins deliver higher performance over other join methods in many complex queries, especially for those queries where existing indexes cannot be leveraged in join processing, a common occurrence in ad hoc query environments. Oracle8i’s hash joins eliminate the need to perform sorts, by using an in-memory hash table constructed at run-time. They are also ideally suited for scalable parallel execution.

## **SOPHISTICATED SQL OPTIMIZER**

Oracle8i’s numerous powerful query processing techniques are completely transparent to the end user. The Oracle8i cost-based optimizer

dynamically determines the most efficient access paths and join methods for every query. It incorporates powerful query transformation technology that automatically rewrites queries generated by end-user tools, for efficient query execution.

To choose the most efficient query execution strategy, the Oracle8i cost-based optimizer takes into account statistics, such as the size of each table, and the selectivity of each query condition. Histograms provide the cost-based optimizer with more detailed statistics for skewed, non-uniform data distribution.

The cost-based optimizer optimizes execution of queries involved in a star-schema, which is common in data warehouse applications. By using a sophisticated star-query optimization algorithm and bit-mapped indexes, Oracle8i can dramatically reduce the query response time compared to similar query executions done in a traditional join fashion.

Oracle8i query processing not only includes a comprehensive set of specialized techniques in all areas (optimization, access and join methods, and query execution), they are also all seamlessly integrated, and work together to deliver the full power of the query processing engine.

## **RESOURCE MANAGEMENT**

Managing CPU and disk resources in a multi-user data warehouse, or OLTP application is challenging. As more users require access, contention for resources becomes greater. Oracle8i has resource management functionality that provides greater control of system resources assigned to users. Important online users, such as order entry clerks, can be given a high priority, while other users — those running batch reports — receive lower priorities. Users are assigned to resource classes, such as “order entry” or “batch,” and each resource class is then assigned an appropriate percentage of machine resources. In this way, high priority users are given more system resources than lower priority users.

## **ADDITIONAL DATA WAREHOUSE FEATURES**

Oracle8i also includes many features that improve the management and performance of data warehouse applications. Index rebuilds can be done online without interrupting inserts, updates, or deletes that may be occurring on the base table. Function-based indexes can be used to index expressions, such as arithmetic expressions, or functions that modify column values.

The sample scan functionality allows queries to run and only access a specified percentage of the rows or blocks of a table. This is useful for getting meaningful aggregate amounts, such as an average, without accessing every row of a table.

## **VERY LARGE DATABASE SUPPORT**

Oracle8i addresses the largest and most demanding OLTP and data warehousing applications that have databases into the terabytes and beyond.

## **PARTITIONED TABLES AND INDEXES**

Partitioning stores large tables and indexes in pieces instead of as one large monolithic object. Partitions are a “divide and conquer” technique that provides scalable performance with a large amount of data. Each partition can be managed individually, and can operate independently of the other partitions, increasing availability and making administrative tasks easier. Oracle8i supports range, hash, and composite partitioning, which provides better manageability, availability, and performance.

Range partitioning provides the ability to subset data into individual partitions, based on a range defined by the data administrator. For example, an order table could be range-partitioned by sales date, putting each order record into one of four partitions, one for each quarter of the year. This method of partitioning data is useful when there is a logical range to divide the data into such as by quarter of the year. However, in this case, partition size could vary dramatically, which could affect performance of maintenance operations if

the data is skewed into one particular partition.

Hash partitioning provides an easy-to-use mechanism for evenly striping data across devices, retaining the benefit of performance. This method provides a very simple way to break data up into evenly sized containers that can be spread across multiple I/O devices or even multiple machines in a shared-nothing cluster. Query performance is improved by spreading I/O across multiple devices.

Manageability is simple if the number of partitions doesn't change, which makes this approach inappropriate for rolling change windows of historical data.

Composite partitioning combines the best of both approaches, range and hash. Data is first partitioned by a range of values then each partition is sub-partitioned into several hash partitions. Composite partitioning combines the superior manageability and availability benefits of range partitioning with the data distribution advantages of hash partitioning. Administrators can specify ranges of values for the primary partitions of the table or index then specify a number of hash sub-partitions. Data skew is unlikely because sub-partitions can always be added or dropped within a partition to maintain even distribution of each container. Administrators can also easily maintain rolling change windows of historical data by adding/dropping primary partitions without affecting sub-partitions in other primary partitions.

All partitioning techniques are transparent to applications and standard DML statements run against partitioned tables. The optimizer is partition-aware and partitions that do not contain any data for a query are eliminated from the search, often resulting in a substantial performance increase.

## **SCALABLE PARALLEL SQL ARCHITECTURE**

Large data warehouse and transactional servers must also provide scalable performance, for processing large amounts of data. Oracle8i's superior, integrated, parallel SQL architecture

provides excellent scalability on Symmetric Multiprocessor (SMP), massively parallel processors (MPP), and hybrid hardware platforms.

Oracle8i's parallel SQL architecture increases the performance of database queries and updates, by dynamically subdividing these operations into distinct tasks, and distributing the workload across all multiple processors. Oracle8i parallelizes more operations than any other database product. A partial list includes queries, inserts/updates/deletes, data loading, index creation, recovery, table creation using a SELECT, and data aggregations.

Oracle8i combines intelligent use of data partitioning in the form of partition elimination and parallelism across partitions with Oracle's unique, dynamic, intra-partition parallel query execution. This architecture transparently delivers scalable query performance, by using, but not constrained by, data partitioning. Since Oracle8i parallel execution is not completely based on data partitioning, administrators are not forced to choose between parallel execution performance and manageability. All available processing resources are utilized even in the presence of real-world data skew.

On an SMP platform, Oracle8i symmetrically parallelizes a database operation across all available processors. On an MPP or cluster platform, Oracle8i transparently exploits data locality. Each processor is assigned to work on its local data partitions. Moreover, Oracle8i always utilizes all available processors, independent of how the data is partitioned.

Oracle8i's adaptive parallel architecture combines the best elements of "shared disk" and "shared nothing" approaches, and provides excellent load balancing and dynamic load distribution. Oracle8i is a proven solution that enables customers to realize the maximum potential of parallel performance.

## TRANSPORTABLE TABLESPACES

Moving data from a data warehouse to a data mart, or from an OLTP system to a staging area for a data warehouse, can be cumbersome and time consuming. Oracle8i provides a mechanism, transportable tablespaces, for copying tablespaces (datafiles) between identical systems, and allowing the same data to be accessed by both systems. Now data movement can be as fast as transferring the file between machines. This greatly improves the performance and operational simplicity of transferring data.

## MAINFRAME-CALIBER OLTP

Oracle8i's reliable architecture delivers unmatched scalability, availability, and performance needed for mission-critical OLTP systems. Integrated, dynamic facilities ensure that Oracle8i and the Oracle® Parallel Server make efficient use of all system resources on hardware ranging from uni-processors to SMPs, from clusters to MPPs.

## SUPERIOR SCALABILITY FOR TRANSACTION PROCESSING

The Oracle8i architecture provides OLTP applications with scalability to support large numbers of users and high-volume transaction workloads. Oracle8i provides exceptional scalability on SMP, clustered, and MPP machines. OLTP applications take advantage of Oracle8i's parallel architecture by distributing tasks across multiple processors or machines, such as in a clustered environment, which improves individual transaction response times and overall system throughput. An automatic, dynamic self-tuning capability balances processing workload evenly across allocated hardware and operating system resources.

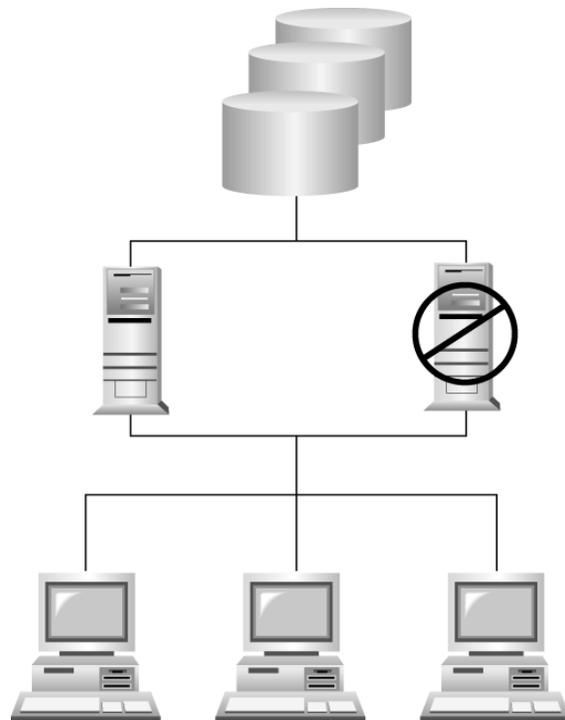
Additional processors and/or nodes can be added to expand your configuration incrementally as both your organization and data volumes grow, with minimal disruption to your existing environment. The result is dramatic performance

improvements and breakthrough price/performance.

## HIGH AVAILABILITY FOR TRANSACTION PROCESSING

Mission-critical, OLTP systems require high availability so your business can continue to operate if a hardware failure occurs. The Oracle Parallel Server uniquely extends the reliability of open systems applications by transparently harnessing the power of clustered computers into a single, logical processing "complex." The complex can tolerate individual machine and/or node failures while maintaining data availability.

The Oracle Parallel Server also supports hybrid configurations, combining elements of clustered and MPP architectures.



**Oracle8i with Oracle Parallel Server provides superior scalability to meet increasing transaction processing requirements while assuring high availability in case of hardware failure or site disaster**

## **HIGH PERFORMANCE FOR TRANSACTION PROCESSING**

For high-performance transaction processing, the Oracle8i multithreaded, multi-server architecture coordinates thousands of simultaneous user requests. Individual requests are queued and serviced by a minimum of server processes. Sophisticated caching of database blocks, SQL execution plans, and executable stored procedures takes maximum advantage of available server memory.

## **ADVANCED QUEUING WITH PUBLISH AND SUBSCRIBE MODEL**

Advanced queuing adds direct support in the database for high performance queuing or messaging operations. This capability adds asynchrony, and eliminates the dependency on external systems for applications requiring high scalability. The enqueue and dequeue operations may also be used to shift processing from within a transaction to a background process, improving the transaction response time.

In Oracle8i, advanced queuing supports a robust, rule-based publish/subscribe model for automatic forwarding of messages to registered clients. Applications can subscribe to a queue, using a rule to determine what queue messages they are “interested” in. With a business event framework, integrated applications that subscribe to messages for seamless communication can be created. New event triggers now allow a database event, such as a database startup or user login, to fire a trigger that executes an operation.

## **LARGE USER POPULATION SUPPORT**

Oracle8i and Net8™ efficiently utilize operating system and networking resources, allowing tens of thousands of concurrent users to connect over multiple network protocols. Connection pooling temporarily drops the physical connection for idle users, and transparently re-establishes the connection when needed. This increases the number of users that can be supported. The

Connection Manager multiplexes several user sessions over one network connection, which reduces resource requirements, especially for multi-tier application architectures.

## **TRANSACTIONAL DATA ACCESS**

Oracle8i offers a number of different access paths for locating transactional data quickly and efficiently including fast, full-table scans; b-tree single column and concatenated-index scans; clustered (pre-joined) tables; hash clusters (utilizing a single column, or an application specific SQL hash function); unique row identifiers; and indexes based on functions or expressions.

The Oracle8i cost-based optimizer dynamically selects the fastest available access path, and satisfies query requests directly from indexes, whenever possible.

## **RELIABLE QUERY RESULTS**

Oracle8i effectively supports mixed workload environments characterized by simultaneous query and update activity. Many databases force users to choose between good performance and guaranteed data consistency, one coming at the expense of the other. Oracle8i's non-blocking, multi-version read consistency always provides users with consistent query results while never imposing a performance penalty on concurrent update activity.

## **TP MONITOR SUPPORT**

Dynamic XA support provides high performance to multi-tier applications through industry-standard XA-compliant Transaction Processing (TP) monitors.

## **HIGH-AVAILABILITY OPERATIONS**

Oracle8i's online backup facility allows administrators to perform backup activities while the database is running, and without interrupting transaction processing — even during periods of heavy OLTP usage. Should a device containing

user data fail, lost data files can be recovered on another device, while Oracle8i continues processing requests directed at the remainder of the database. Oracle8i can use multiple processes to recover the database in parallel, speeding the on-line recovery.

Oracle8i also supports read-only tablespaces, saving time by eliminating backup and recovery of static data. Oracle8i includes a number of features that promote high availability in the presence of media failures or errors. Mirrored, multi-segment logs ensure that critical log data remains available if a log device fails. Optional check-sum computation, verification for database blocks, and redo log block facilitate early detection and improve diagnosis of media errors.

## **HIGH-AVAILABILITY APPLICATIONS**

In addition to providing scalable performance for OLTP and data warehouse applications, the Oracle8i server ensures high availability of your applications, by providing a variety of implementation options for disaster recovery. This allows you to choose the most appropriate recovery method for your application. The Oracle Parallel Server, the Oracle8i standby database feature, and Oracle Advanced Replication are methods of providing high availability for applications. Each is an integrated, supported function of the Oracle8i Server.

The Oracle Parallel Server ensures that your data is accessible in the event of a node failure, when operating in a clustered computer environment. If any node in the system should fail, affected users can simply log in to another operating node and resume processing. Transactions committed on the failed node, but not written back to the database files, are automatically recovered by one of the remaining nodes while transactions that were not committed are automatically rolled back.

The Oracle8i standby database feature provides a reliable and automated mechanism for implementing a standby database system to facilitate rapid disaster recovery. The scheme uses

a secondary system on duplicate hardware that is maintained in a constant state of media recovery through automatic application of log files archived at the primary site. In the event of a primary system failure, the standby database can be activated with minimal recovery, providing immediate system availability. The standby database can be operated as a read-only database, providing a platform for query only access and batch reporting.

Advanced replication can also be used to provide high data availability. Data from a primary system can be replicated to one or more alternate sites. Each alternate site is fully accessible, and can be used for query access, and, in some cases, for updates as well. In the event of a system failure, your application can failover to any of the alternate sites, providing continuous data availability.

## **EXTENDED BACKUP/RECOVERY SUBSYSTEM**

Oracle8i server-managed backup and recovery provides a high level of backup and recovery functionality from within the Oracle Server. Oracle8i maintains detailed information on when backups are performed, exactly which parts of the database are backed up, and where the files are stored. Should a recovery be necessary, Oracle8i analyzes the state of the database, and determines the operations necessary to repair the database. Then, Oracle8i automatically performs those operations, greatly simplifying the recovery for the administrator, and reducing the possibility of human error. A simple graphical user interface (GUI) within the Oracle Enterprise Manager controls backup and recovery. An application programming interface (API) is also available for third parties who want to provide an alternate interface. A media management layer interfaces with popular third party tape management products.

Multi-level incremental backups greatly reduce the size of the backups since only the changed blocks are backed up. This also reduces the time required to backup a datafile.

Oracle8i includes the LogMiner™ feature, which allows DBAs to view the contents of the transaction log files. This allows them to view what SQL DML and DDL operations were executed, by whom, and at what time. It also creates the SQL necessary to “backout” any DML operation that a user inadvertently executed. For example, LogMiner returns the necessary inserts statements to re-create records that were accidentally deleted from a table.

## **OBJECT-RELATIONAL DATABASE**

The Oracle8i object-relational paradigm enables developers to directly define their business objects, such as purchase orders, inventory items, and data warehouse information, within Oracle8i. Using this paradigm, developers of mainstream commercial applications can better manage their business objects.

## **EXTENSIBILITY AND USER-DEFINED DATATYPES**

Oracle8i allows users to define custom object types. An object type is typically defined to correspond to some business object such as a purchase order. The object type may contain multiple fields, or attributes, and the object type may be nested within other object types. More complex objects that include a variable number of items are supported through variable length arrays and nested tables. This allows, for example, a purchase order object type that can accommodate a variable number of line items.

Methods perform typical operations on the object type, for example, calculating the total of a purchase order. An Oracle8i method consists of program code associated with an object type. Methods may be created in PL/SQL or Java, and stored within the database or written in an external 3GL procedure, and called through a safe external

callout mechanism.

User 3GL code is safely and dynamically linked and loaded, which means a user cannot disrupt others using the same database. User-defined mapping and ordering methods provide database extensibility, and allow users to define how comparisons and ordering should be performed on object types.

Oracle8i includes a comprehensive set of APIs for specialized datatype developers. This allows partner-developed data cartridges to have the same internal access mechanisms as data cartridges developed at Oracle. New data cartridges have low-level access to memory, the optimizer, indexing, and other database internals. Partners can develop highly customized data cartridges that meet performance goals of demanding multimedia applications.

## **EVOLUTIONARY, OPEN, SECURE**

Oracle8i eases the evolution from relational to object-oriented database designs. The Oracle8i object-relational capabilities are built on the same solid foundation as the relational functionality.

Like relational views, Oracle8i object views provide the appearance of a complex object, including support for object methods, but the data is stored in underlying object (or relational) structures. An object view allows, for example, a purchase order object view to be defined on existing relational purchase order data. This design allows the existing relational applications, which still read and write rows and columns, to coexist with new object-oriented applications, which read and write purchase order objects.

## **APPLICATION DEPLOYMENT**

For applications to be successfully deployed, they must be secure, manageable, integrated with existing systems. Oracle8i provides flexible, integrated, manageable, distributed database facilities that make the integration of enterprise data practical. Data can be replicated for direct and highly available local access. Data can be

accessed remotely, using both SQL and procedure calls in a fully transparent manner, as if the data were local. Also, data can be in both Oracle and non-Oracle servers and can be accessed transparently. When deploying an application, Oracle Enterprise Manager is the key to managing the Oracle database and application environment.

## **ENTERPRISE SYSTEMS MANAGEMENT**

Oracle Enterprise Manager is a comprehensive family of systems management products that contain open interfaces for third party and customer applications, including integration with all the major network management platforms. The product family consists of next-generation systems management tools, designed to efficiently manage the complete Oracle environment, including systems, databases, networks, and applications. This reduces the number of hours administrators need for managing complex production environments.

The Oracle Enterprise Manager base product includes a centralized, light-weight console, a powerful Management Server that provides all framework services, and distributed, non-intrusive agents that execute tasks and monitor conditions on each managed system. The base product also includes an additional set of administration applications for performing day-to-day tasks for databases and other services.

## **ORACLE ENTERPRISE MANAGER ARCHITECTURE**

Oracle Enterprise Manager's lightweight, three-tier architecture offers flexible deployment options and unparalleled scalability. Built on a network computing model, Enterprise Manager clients, consoles, and other management applications, communicate with the middle-tier Management Servers primarily over IIOP using standard CORBA. Depending on the number of targets managed (Intelligent Agents) and notifications processed, users can increase scalability by

seamlessly adding additional Management Servers to the environment.

The Management Servers offer transparent workload balancing and failover, guaranteeing the assurance of constant and consistent availability.

## **ORACLE ENTERPRISE MANAGER CONSOLE**

The Oracle Enterprise Manager Console is the primary interface for performing all management tasks. The console's graphical display includes menus, toolbars, and four customizable panes which are extensible throughout the framework. These panes include: the Navigator, Groups, Event System, and Job System. All Oracle management applications can be launched from within the Console.

## **ORACLE MANAGEMENT SERVER**

The Management Server processes all system management tasks, administers the distribution of these tasks across the enterprise, and provides scalability across the system. The Management Server uses the Enterprise Manager Repository as its persistent back-end store. This Repository maintains system data, application data, and the state of managed entities distributed throughout the environment.

## **OPEN, STANDARDS COMPLIANT**

The Intelligent Agent is a process that runs independently on managed nodes. The Agent is responsible for service discovery, event monitoring, and job execution. The Intelligent Agent also supports the Simple Network Management Protocol (SNMP), enabling third party applications to communicate with the Agent. SNMP traps can be sent to SNMP consoles, such as HP OpenView. The Agent also provides direct access to Oracle's database Management Information Base variables.

## PERFORMANCE MANAGEMENT AND TUNING

In addition to Oracle Enterprise Manager, Oracle provides an advanced package of tools for performance tuning, diagnostics, and change management, known as:

- Oracle Diagnostics Pack
- Oracle Tuning Pack
- Oracle Change Management Pack

These tools, all integrated with the console of Oracle Enterprise Manager, consist of modules that help the administrator with performance management, tuning, diagnostics, and object change management. Oracle® TRACE and Oracle Expert™ enable application performance tracing and expert database tuning.

The Oracle Diagnostics Pack ensures high availability of business systems by simplifying the complex tasks of diagnosing and correcting performance problems. The pack allows you to monitor the health of databases (both Oracle and third-party), operating systems, and applications. It also allows you to both diagnose and correct problems now, and plan for future resource requirements to avoid problems in the future.

Oracle Tuning Pack is a set of applications that provide advanced tools for tuning the Oracle environment. The Oracle Tuning Pack tunes every dimension of your Oracle environment including application SQL, access methods, environment parameters and storage optimization. In addition, it is the only product that takes into account the inter-dependencies of these areas, providing a holistic approach to tuning.

The Oracle Change Management Pack is a set of advanced tools that enable administrators to manage change more effectively in the Oracle environment. The components of the pack allow administrators to safely make complex changes to schema objects, track changes to schemas and databases over time, make copies of schemas or objects, and compare and synchronize schemas

and databases.

## DATA DISTRIBUTION

The benefits of open, relational technology cannot be achieved without transparent integration of new and existing systems. Oracle8i provides flexible, integrated, manageable distributed database facilities that make the integration of enterprise data practical. Data can be replicated for direct and highly available local access. Data can be accessed remotely using both SQL and procedure calls in a fully transparent manner as if the data were local. Also, data can be in both Oracle and non-Oracle servers.

## DATA REPLICATION

Oracle8i Enterprise Edition delivers the industry's most comprehensive replication capabilities. From mass deployment applications such as sales force automation to applications requiring data synchronization between servers supporting, for example, multiple websites or call centers, Oracle Advanced Replication supports them all in one integrated environment.

For mass deployment applications, Oracle Advanced Replication provides support for potentially very large numbers of small remote sites, centralized management, disconnected operations, and sophisticated subsetting. With Oracle Advanced Replication users can exploit the scalability of the Oracle server at their central consolidation site, and the small footprint, self-management capabilities of Oracle® Lite for mass deployment to remote, often mobile sites. Replication environments are defined centrally using the Oracle8i template facility and deployed automatically to remote Oracle Lite or Oracle server sites. Performance is optimized to allow remote sites that normally operate in a disconnected manner to connect to the centralized server and synchronize data quickly. Sophisticated subsetting capabilities enable each remote site to maintain its own, unique subset of data easily without requiring the maintenance headaches and rigidity of data denormalization.

For server-to-server configurations supporting multiple web sites, call centers and other applications, Oracle Advanced Replication enables data, such as user account information or customer service records, to be moved quickly and in large volume between sites. To support very high transaction rates, Advanced Replication leads the industry by enabling replicated transactions to be propagated between sites in parallel while maintaining full transactional consistency. Replicated transactions can be propagated quickly in a near real-time manner so that should any one site fail users can connect to other sites to access their most current data.

Oracle Advanced Replication enables both mass deployment and server-to-server configurations to be integrated into one coherent environment so that, for example, salesforce automation applications and customer service call centers can share data. All advanced replication mechanisms were designed from the beginning to be bi-directional. All sites, e.g., servers or mass deployment sites, are potentially updatable. Updates are captured, propagated, and applied to all sites maintaining replicas of that data. Robust, comprehensive update conflict detection and resolution mechanisms protect your whole environment. A single tool - Oracle® Replication Manager, which runs as an applet within Oracle's Enterprise Manager facility - manages your whole environment. Replication change capture and apply functions run directly within the Oracle Server executable itself (in C code) for maximum performance and minimal resource utilization.

## **TRANSPARENT DISTRIBUTED SQL**

With Oracle8i, a single SQL statement can query or update data from multiple databases and even perform complex joins of data physically stored in different servers. Distributed optimization techniques select efficient execution plans and minimize data transmission over slow networks. Location transparency allows applications to be developed without knowledge of the location of data, and ensures that applications never need re-

coding if data moves from one node to another. Network transparency leverages existing networks and protocols to efficiently transmit data between servers and return results to clients. Distributed SQL functionality is tightly integrated into the core Oracle8i architecture, allowing sites to operate autonomously and preserve compatibility with all server functionality.

## **TRANSPARENT DISTRIBUTED TRANSACTIONS**

Oracle8i employs a robust, transparent two-phase commit mechanism to ensure the integrity of distributed update transactions. Updates may be performed by remote or distributed SQL statements, or through remote procedure calls (RPCs) to distributed Oracle8i Servers. Commit transparency ensures that all sites automatically commit or roll-back in response to the single standard SQL COMMIT statement—no complex procedural or 3GL coding is required. Oracle8i automatically detects failure conditions, and if necessary, automatically resolves them without manual intervention.

## **INTEGRATING NON-ORACLE SYSTEMS**

Oracle8i enables all your data to be accessed transparently, not just Oracle data. Oracle8i integrates all your data into one uniform view as if all the data resided on your Oracle server with full transparent SQL and distributed transaction capabilities. Access to non-Oracle data stores is integrated directly into the Oracle8i Server itself through a facility called heterogeneous services. Heterogeneous services extends the Oracle SQL engine to recognize the SQL and procedural capabilities of the remote store and the mappings required to obtain necessary data dictionary information. Using this information, the Oracle SQL engine chooses the optimal execution strategy for accessing heterogeneous data just as it does for data stored within Oracle servers.

The actual interface, capability settings and data dictionary mappings for each non-Oracle store are provided by Oracle Transparent Gateway®. Oracle Transparent Gateway are available to integrate

data from virtually any data store into your Oracle environment. Oracle Procedural Gateway<sup>®</sup> provide transparent procedural (RPC) access to non-Oracle systems. Oracle8i also provides an XA-compliant interface that allows external transaction managers, such as TP monitors, to coordinate distributed transactions that span Oracle and non-Oracle systems.

## ENTERPRISE DATA SECURITY

Oracle8i, together with Net8, provides comprehensive, flexible, and reliable facilities that:

- Ensure proper user authentication;
- Guarantee the privacy and integrity of data;
- Manage the assignment of database privileges
- Monitor database operations across the enterprise, including today's vulnerable intranet and Internet environments.

## SECURITY

Oracle8i functions as a Virtual Private Database by providing fine-grained access control that uses a parameter-driven, extensible application context, to allow applications to control users' access based on user attributes such as their customer number. For example, for a Web application, an administrator may wish to give access to external customers, but allow them to access only their own orders. Using fine-grained access control, this can be easily accomplished without the administrative overhead of views by using the context area to store the customer number and a security policy to determine what rows can be accessed.

For applications with special requirements to secure sensitive data from view, even from DBAs, Oracle8i provides a PL/SQL package to encrypt and decrypt data, including string inputs and raw inputs, using the industry-standard Data

Encryption Standard (DES), in exportable key lengths. This functionality allows data to be natively encrypted in the server to protect especially sensitive data, such as credit card numbers, "application user" passwords, or session cookies.

## USER AUTHENTICATION AND SECURITY

Oracle8i normally performs user authentication internally by verifying the password provided at login time. Optionally, authentication may be performed:

- Externally by the operating system
- By a security package
- With Oracle Advanced Security, by an external authentication service, such as a network operating system, network security service (i.e., Kerberos, SESAME, DCE), or by an authentication device (e.g., smart cards)

This functionality allows businesses to centrally manage Oracle security for the entire database or network, reducing administration costs considerably, by specifying security policies once and enforcing them network-wide. Oracle8i also provides data signature services callable from Oracle Call Interface, PL/SQL, and Java.

Oracle8i also offers security to multi-tier architectures. In some systems, the middle tier is often "super-privileged," to perform any action on behalf of any user, and the identity of the "real" client is not preserved through the middle tier. Middle-tiers, especially Web servers or application servers, may often sit on or outside a firewall, so limiting their access and auditing their actions is important. Oracle8i provides the ability to preserve the "real" client identity through the middle tier and limit the users on whose behalf a middle tier can connect. The server can also audit actions taken by a middle tier on behalf of a particular user.

Oracle8i's integrated security and directory services address two common problems that lead to security failures -- too many passwords and too many user accounts.

Oracle8i offers enhanced PKI-based single sign-on through Internet standard X.509 (version 3) certificates and Secure Sockets Layer (SSL). In addition to strong user authentication, SSL also provides network data confidentiality and data integrity for multiple types of connections: LDAP, IIOP (Internet Intra-ORB Protocol), and Net8. Oracle8i's integrated security and directory services offer reduced total cost of ownership through single station administration of users and privileges in Oracle Internet Directory, an LDAP-compliant directory, built on the Oracle8i database. Oracle8i's support for SSL and X.509 ensures that Oracle8i's security mechanisms are interoperable with the widest range of Internet products and services.

Finally, Oracle8i can enforce your password security policy. The security policy is encoded in a stored procedure. Checks may be performed, for example, for minimum length and complexity, or against a history of previously used passwords. Passwords may be authorized for a set time period after which they would have to be changed.

## **DATABASE PRIVILEGES**

Database privileges authorize users to perform certain SQL operations such as insert, update, or delete on selected database objects. Oracle8i's fine-grain privileges allow you to precisely enforce database security policies, ensuring users have only the privileges they require. Roles are used for grouping together privileges on tables and other database objects, and granting them to individual users or groups of users as a whole. In this way, security administrators can authorize users to run entire applications with a single GRANT statement, thus significantly reducing the burden and cost of security management.

## **AUDITING**

Oracle8i provides integrated, flexible, and reliable auditing capabilities that ensure all database operations of interest are recorded at the appropriate level of granularity. The AUDIT command declaratively enables the auditing of successful and/or unsuccessful user actions, during a session and during user attempts to access database objects. Audit trail data are securely recorded in the Oracle8i data dictionary and/or operating system files. Procedural auditing, via stored Java or PL/SQL procedures and database triggers, can be used to perform application-specific or context-sensitive auditing.

## **NETWORKING**

Net8 is the foundation for Oracle's family of networking features, providing the industry's most comprehensive, enterprise-wide data access solution for heterogeneous, distributed computing environments. It enables both client/server and server/server communications across any network, allowing applications and databases to reside on different computers and communicate as peer applications. Net8 eases the complexity of network configuration and management, maximizes performance, and improves diagnostic capabilities while introducing distributed access for Java-based applications.

Net8 provides a host of supporting services, including:

- Centralized administration through LDAP-compliant directory services and Oracle Names<sup>®</sup>;
- Integration with various naming environments through external naming;
- Efficient client connection management with Oracle Connection Manager and multiplexing;
- Support for Internet technologies such as IIOP and Java;
- Data encryption and security integration with Oracle Advanced Security.

Net8 is the enterprise networking and security solution that also provides unmatched user scalability.

## **SUMMARY**

Oracle8*i* is the latest generation of the world's leading database and the first database designed specifically to be an Internet development and deployment platform. It enhances Oracle8<sup>™</sup>, the industry-leading technology, with innovative features that make it easier for businesses, application developers, and system integrators to create corporate intranet and web applications.

Oracle8*i* is the perfect combination: a robust, proven database product with the functionality that enables businesses to harness the potential of a dynamic new medium: the Internet.

## KEY FEATURES

### APPLICATION DEVELOPMENT

- Oracle JServer: Java VM in the database
- Java stored procedures, functions, and triggers
- Seamless interaction between Java, SQL, and PL/SQL
- SQLJ: embedded SQL in Java code
- Enhanced JDBC driver
- WebDB to build, deploy, and monitor Web applications
- 100 percent ANSI/ISO SQL 92 Entry Level compliant — NIST tested
- ANSI/ISO standard precompiler applications interface
- SQL3 inline views (query in the FROM clause of another query)
- Updatable join views
- 100 percent ANSI/ISO standard declarative entity and referential integrity constraints
- Check, default, and not null constraints
- Primary, foreign, and not null constraints
- Optional delete cascade
- Constraint checking at end of statement or end of transaction
- Procedures, functions, and packages supported
- User-defined PL/SQL functions in SQL
- External procedure callouts
- Packages supplied to access/execute job queues, alerts, HTML, and file I/O

- Database triggers available on insert, update, and delete statement fired before or after operation
- Database triggers available on events such as database startup/shutdown, user logon/logoff
- Oracle® Precompilers
- Oracle Call Interface
- SQL\*Module®
- JDBC and SQLJ for Java applications
- Multithreaded client application support

### NATIONAL LANGUAGE SUPPORT (NLS)

- Full 8-bit and 16-bit NLS support for European and Asian languages
- Unicode UTF-2 variable width encoding
- Per-session control of language preference with system defaults
- National calendar support
- Dual database character sets
- Euro symbol support

### CONTENT MANAGEMENT

- Oracle *interMedia*
- Oracle *iFS*

### DATA WAREHOUSING

- Summary management
- Analytic functions
- Bit-mapped indexes
- Partition-wise joins
- Optimized star queries

- Resource management
- Online index rebuilds
- Function-based indexes
- Sample scan

### **VERY LARGE DATABASE SUPPORT**

- Unlimited database size
- Partitioned tables and indexes
- Range, hash, and composite partitioning
- Scalable, parallel architecture
- Transportable tablespaces
- Progress monitor for long-running operations

### **PARALLEL SQL**

- Parallel execution of SELECT, INSERT, UPDATE, DELETE, with full application transparency
- Parallel execution of queries based on full table scans, index scans, and partition scans
- Both intra-partition and inter-partition parallelism
- Parallel sorts, joins, and aggregates
- Parallelization of PL/SQL functions

### **PARALLEL DATA MANAGEMENT**

- Parallel create index and creation of table with SELECT clause
- Parallel, direct-path load
- Parallel constraint enabling, statistic collection, and summary creation
- Parallel direct database reads and direct database writes

### **TRANSACTION PROCESSING**

- Multi-threaded server architecture
- Scalable SMP performance
- Shared database buffer cache
- Share SQL cache
- Logging and archiving
- Deferred writes
- Serializable transactions
- Queuing with publish and subscribe model
- Database event triggers
- Connection Manager and Connection Pooling
- Object type columns in partitioned tables
- LOBs in partitioned tables
- Partitioned index-organized tables
- Optimizer plan stability
- Dynamic XA support

### **ORACLE PARALLEL SERVER**

- Clustered and MPP support
- Multiple node access to a single Oracle8i database
- Easy incremental expansion of computing nodes
- Linear scalability when nodes added
- Solution for high availability requirements
- Cache Fusion™ technology for scaling non-partitioned applications
- Single console to manage multiple instances

- Automatic connection load balancing
- Job execution forced on specific node

### **HIGH AVAILABILITY**

- Online backup by file, tablespace, or database
- Online recovery
- Read-only tablespaces
- Database mirror re-silvering
- Automated, queryable standby database
- Oracle Parallel Server for high availability

### **EXTENDED BACKUP AND RECOVERY**

- Server managed backup and recovery
- GUI console for Recovery Manager
- Parallel recovery
- Parallel backup and restore utility
- Point-in-time database, tablespace recovery
- Incremental multi-level backups
- Import/Export utility
- Mirrored multi-segment log files
- Fast-start fault recovery

### **OBJECT RELATIONAL DATABASE**

- Complex object types
- VARRAYs and nested tables
- Object references
- User-defined methods
- Syntax follows SQL3
- Object views
- Instead Of triggers to update views
- Client-side cache
- Object support for Pro\*C™, Oracle Call Interface
- Object Type Translator utility to generate C header files
- C and Pro\*C external procedures
- Binary, character LOBs with random, piece-wise access
- LOB storage inside or outside the database
- User-defined object identifiers and nested table identifiers
- Extensible indexing
- Extensible optimizer
- Specialized datatype services

## **SYSTEMS MANAGEMENT AND EASE OF USE**

- Java-based console and repository to manage the entire Oracle environment
- Multiple administrator framework
- Secure, remote database administration
- Three-tier architecture for scalability and failover
- Job scheduling
- Event management and resolution

## **DATA REPLICATION**

- Multiple, read-only snapshots (basic primary site replication)
- Full transactional consistency and data integrity
- Full and subset table replication
- Incremental refresh of snapshot copied
- Event and demand based refresh
- Primary key snapshots

## **ADVANCED REPLICATION**

- Snapshot templates for easy mass deployment
- Off-line instantiation
- Updatable snapshots (both master and snapshot tables updatable)
- Multiple master configurations (full table replication between master sites)
- Hybrid configurations (combine snapshot and multiple master configurations)
- Failover configuration support
- Automatic conflict detection and resolution
- Distributed schema

- Synchronous and asynchronous replication support
- Subquery snapshots

## **DISTRIBUTED QUERIES AND TRANSACTIONS**

- Transparent remote and distributed query
- Distributed, optimized joins
- Location transparency, network transparency
- Transparent, multi-site distributed transactions
- Distributed SQL updates and remote procedure calls (RPCs)
- Commit transparency

## **OPEN GATEWAYS**

- Data source transparency
- Transparent SQL gateways
- Transparent procedural gateways
- Distributed queries and update transactions
- Compliant with XA standard for TP-monitor coordinated two-phase commit

## **DATA SECURITY**

- Choice of internal or external user authentication
- External choices include: operating system, OS security package, network operating system, security service, authentication device
- PL/SQL package to encrypt /decrypt data
- Password policy enforcement
- Global users and roles
- Full datastream encryption through DES and RSA RC4 encryption algorithms

- Complete protocol support and application transparency
- Fine-grain database privileges
- Virtual Private Database
- Extensible and parameter-driven application context specification
- Hierarchical role-based security for group-level access control
- Roles are basis for ANSI/ISO SQL3 security standard
- Site-customized DBA roles
- Submitted for evaluation at US TCSEC C2, European ITSEC E3
- Automatic auditing on per-session or per-object basis
- Application-specific or context-sensitive auditing via PL/SQL stored procedures and database triggers
- N-tier authentication/authorization
- SSL and X.509v3 support
- RADIUS authentication

## **ORACLE8i ENTERPRISE EDITION OPTIONS**

- Some functionality and features described in this document may require licensing a separate option at an additional cost. For details on the availability of features and options, see the “Oracle8i: A Family of Database Products” paper at [www.oracle.com/database/availability](http://www.oracle.com/database/availability).



Oracle Corporation  
World Headquarters  
500 Oracle Parkway  
Redwood Shores, CA 94065  
U.S.A.

Worldwide Inquiries:  
+1.650.506.7000  
Fax +1.650.506.7200  
<http://www.oracle.com/>

Copyright © Oracle Corporation 1999  
All Rights Reserved

This document is provided for informational purposes only, and the information herein is subject to change without notice. Please report any errors herein to Oracle Corporation. Oracle Corporation does not provide any warranties covering and specifically disclaims any liability in connection with this document.

Oracle, ConText, Oracle Transparent Gateway, Oracle Procedural Gateway, Oracle Names, and SQL\*Module are registered trademarks, and Oracle8i Enterprise Edition, Oracle8i PL/SQL, JDeveloper, Net8, LogMiner, Oracle Expert, Oracle8, Cache Fusion, and Pro\*C are trademarks of Oracle Corporation.

All other company and product names mentioned are used for identification purposes only and may be trademarks of their respective owners..

---