

# **Oracle9i New Features** for Administrators



he Oracle9i platform picks up where Oracle8i left off. The Oracle9i database was enhanced across all major functional areas: server availability, scalability, performance, security, and manageability.

Of course, as an Oracle Certified DBA candidate, you need to know about all aspects of the Oracle database, not just the new features; however, if you have a good background in previous Oracle versions, you can certainly benefit from an Oracle9i new-features overview.

Although the Oracle9i platform is also enhanced in the application server and development tools areas, this chapter focuses on the new features of Oracle9i that are database-related.

As with any new release of the Oracle Server, a lot of the new features replace or make obsolete features that exist in previous versions of the Oracle Server. The last section of this chapter discusses the deprecated and unsupported features in Oracle9i.

# High Availability

The Oracle9i database was enhanced in a number of areas to make sure that the database is available during maintenance operations, even if those maintenance operations are occurring on the user objects currently in use.

The Oracle DBA has more control over the recovery of the database in the case of instance failure, and the user has more options to re-create data even after changes or deletions have been committed.

More flexibility has been added to the import/export process, and LogMiner has been expanded to include DDL (Data Definition Language) statement support. RMAN (Recovery Manager) is more automated and more efficient; it is also easier to use with the new OEM (Oracle Enterprise Manager) interface.

You can perform additional operations on Index Organized Tables (IOTs), as well as redefinition operations on regular tables without any downtime for the users of those tables. The flexibility of the SPFILE initialization file option frees the DBA from having to edit a text-based initialization file and having to wait for a shutdown and restart for the new parameter values to take effect.

### **Disaster Recovery**

In previous versions of Oracle, the DBA had to contend with a number of different parameters to strike a balance between high performance, availability, and minimal recovery time. Oracle9i introduces the new parameter FAST\_START\_MTTR\_TARGET to allow the DBA to specify the maximum number of seconds that a crash recovery should take.

Database users can implement their own style of disaster recovery by using Oracle Flashback Query. A user can essentially move back to a particular point of time in the past and view the contents of a table or tables. Using this feature, users can "undo" changes made in the past by seeing which operations led to the change and then manually re-inserting or repairing the changes to the database. This feature can also be used as a historical query tool, for example, to give a bank customer an account balance as of a particular time in the past. This flashback capability is supported by the new system package DBMS\_FLASHBACK.

*Oracle Data Guard* makes standby databases easier to use, with more robust failover features and an easy to use GUI interface. It essentially combines the primary and standby databases into a single "high availability" resource. Oracle's native standby database functionality (which can be managed under the Data Guard umbrella) has been enhanced to allow the primary database to be used as the new standby, instead of being discarded as in previous versions of Oracle.

### Import/Export

Oracle9i contains a number of enhancements to make the Import and Export utilities more precise and efficient. Instead of having to manually recalculate table statistics after an import, the DBA can use statistics that were saved with the table during the export with the *STATISTICS* import parameter. This feature goes well beyond a simple "yes" or "no": the DBA can trust the Import engine to reject the saved statistics if they are questionable and to recalculate appropriately.

Another "fine-grained" enhancement to the Export utility is the ability to specify the tables to be exported by specifying the tablespace(s) that contain the tables to export. In addition to exporting all tables within a given tablespace, all indexes are exported with their corresponding tables regardless of where the index itself is stored.

The new Export and Import utilities support components of the Oracle Flashback Query feature, in which parts of an export can be extracted using new flashback parameters.

### LogMiner

*LogMiner*, already a robust tool in previous versions of Oracle, has been significantly enhanced in Oracle9i. Unlike previous versions, the new version can support DDL statements, chained or migrated rows, and direct path inserts. Additionally, you can extract the database's data dictionary to the redo logs and analyze the logs with LogMiner.

In previous versions of LogMiner, all DDL statements were indirectly represented in the log files as several transactions against the data dictionary, making it difficult for the DBA to determine what the actual DDL statement was. Now, LogMiner will log both the DDL statement that the DBA or user typed, plus the multiple DML (Data Manipulation Language) statements run against the data dictionary.

Being able to extract the dictionary to a flat file or redo logs has several advantages:

- There is no performance hit against the live data dictionary, reducing dictionary contention with other transactional users of the database.
- Because all the information needed is in the redo logs, the database need not be open to use LogMiner.
- In a quickly changing data dictionary, the table metadata in the redo logs may not match what is currently in the live data dictionary.

A couple of other features are worthy of mention. In previous versions of LogMiner, the analysis stopped when a corrupted redo log file was encountered. In the new version of LogMiner, the SKIP\_CORRUPTION option in the DBMS\_LOGMNR.START\_LOGMNR procedure notes and ignores the bad block(s). The other new option in this procedure is COMMITTED\_DATA\_ONLY. With this option enabled, any LogMiner operation will return results only from committed transactions.

#### **Backup and Recovery**

The enhancements to Recovery Manager (RMAN) are numerous. They fall into three basic categories:

- Persistent configuration parameters
- General enhancements to backup and restore
- A redesigned, easier-to-use graphical interface

RMAN now supports the *CONFIGURE* command, which allows the DBA to set the backup parameters persistently across backup sessions. Once all the appropriate parameters are set correctly, the DBA can do a full backup with one command, BACKUP DATABASE. The CONFIGURE command applies to many RMAN operations: backup retention policies, channel allocations, device type specifications, backup copies, and control file backups.

General enhancements to RMAN include *long-term backups*, *mirrored backups*, *restartable backups*, and *archive log backups*. Long-term backups are backups that you can explicitly archive for longer than the default retention policy. Mirrored backups are an enhanced version of the duplexing option originally released in Oracle8i, with the added capability to specify different formats (destinations) for backup copies. Time savings can be realized with the new restartable backup feature of RMAN. When you restart a backup with the NOT BACKED UP option, only missing or incomplete files are backed up, based on backup time. And finally, you can now include archive logs that have not been backed up in a datafile backup, instead of or in addition to using a BACKUP ARCHIVELOG command.

A significantly enhanced user interface to RMAN makes the DBA's job even easier. All the new options available in the command line interface are also available in the GUI version of the tool.

### **Online Operations**

Many of the new features in Oracle9i allow online operations to proceed without interruption; in other words, access to tables and other database objects is continuously available to users even though redefinition and reorganization operations may be going on in the background. Of particular note are high availability enhancements related to *Index-Organized Tables* (IOTs), online reorganization of tables, and server-side parameter files (SPFILEs).

In previous versions of the Oracle database, an IOT was unavailable for most reorganization and index operations. In Oracle9i, a number of operations on IOTs are allowed while the table is in use. For example, you can create and rebuild IOT secondary indexes; you can update stale logical ROWIDs; you can rebuild IOTs by using the ALTER TABLE ... MOVE option, which can not only rebuild the primary key index but also rebuild the overflow data segment.

Problematic for an enterprise DBA are large tables that are heavily used around the clock and occasionally need some kind of modification or reorganization. In Oracle9i, many of the common operations that would previously have made the table unavailable can now be done "on the fly" with minimal impact to the table's users. For example, you can convert nonpartitioned tables to partitioned tables, and vice versa. You can convert IOTs to heap-based tables. You can drop non-primary key columns, add new columns, and rename columns. In addition, you can modify storage parameters for a table. Tables without a primary key or tables with userdefined data types cannot be altered in this way, however.

SPFILEs enhance the online availability of databases by no longer requiring manual parameter file edits that may necessitate a restart of the database. An SPFILE is binary, not directly editable, and resides on the server. When you change SPFILE parameters with an ALTER SYSTEM command, they can be changed for the current instance only, the next restart of the instance (in other words, in the SPFILE), or both.

## Scalability

- he scalability of the Oracle9i Server is improved in three areas:
- Changes to the internal database structures to keep downtime to a minimum

- Expansion of the Oracle clustering technology (Real Application Clusters) to add additional resources without changes to application programs
- More flexibility in user session management to use session memory resources more efficiently

### Architecture

Numerous changes to the Oracle9i architecture make the Oracle database even more scalable as the enterprise grows, with little or no changes to applications or procedures. In many cases, these new features smooth the operation and maintenance of the database for the DBA. These features include global index architecture changes, metadata extraction capabilities, and tablespace block management changes along with various memory management enhancements.

*Global index* improvements allow users and DBAs to execute DDL commands without invalidating the entire global index. This keeps the availability of the index as high as possible while at the same time making the DBA's life easier by reducing the number of steps and commands required to keep the indexes valid.

Extracting the *metadata* from a database was a complicated task in previous versions of Oracle, involving multiple queries or doing special export/ import operations. Oracle9i adds a new package called DBMS\_METADATA to either browse all metadata or to extract metadata for specific database objects. The output can be in either SQL or XML format.

The use of *external tables* in Oracle9i extends the reach of SQL select statements to external files. Although there are a number of restrictions on how external tables can be accessed, external tables provide a useful way to stage intermediate tables for data warehouse ETL (extract, transform, load) operations without loading the intermediate data into the database itself.

Automatic segment space management within a tablespace makes the DBA's life easier by essentially eliminating a lot of the guesswork when attempting to specify the default segment parameters in the tablespace. The free and used space is managed with bitmaps instead of free lists; tablespaces whose segment space is automatically managed must also be locally managed (that is, not managed in the data dictionary).

In the area of memory management, major changes were made in Oracle9i to ease the maintenance and improve the utilization of memory in the SGA (System Global Area). In essence, SGA memory and its sub-components can

grow or shrink in response to changes in load or types of database operations being performed at the time. Memory in the SGA is now allocated in units called *granules*, whose size depends on the total estimated size of the SGA itself. In response to changing conditions, the DBA can dynamically change memory in each of the sub-components, such as the shared pool and buffer cache. To help the DBA in specifying an optimal buffer cache size, statistics collection can be enabled using the buffer cache advisory feature.

### **Real Application Clusters**

In a nutshell, *Real Application Clusters* (RACs) allows multiple instances to run against the same database. Special hardware is required to allow a group of shared disks to be accessed at a very high throughput rate by each node in the cluster. Each node in the cluster can have more than one CPU.

There are a couple of benefits to using RACs. It's easy to add an additional node when the workload increases, without having to change any application code or operational procedures. Additionally, as each node is added to the cluster, the total availability of the database increases, as an instance failure on any particular node automatically initiates transparent application failover on one of the other nodes.

*Cache Fusion*, one of the new features included with RACs, allows data blocks to be shared between instances without the use of the shared disk resources. Retrieving a block from another instance's cache is significantly faster than retrieving that same block from a disk subsystem.

### Session Management

*Oracle Shared Server*, formerly known as multithreaded server (MTS), contains many enhancements to further increase the performance and reduce the overhead of shared server connections. Changes to the connection establishment process reduce the total number of messages required to establish the connection between the client and the dispatcher. The new Common Event Model in the dispatcher handles both network and database events similarly, reducing overhead and the amount of polling required to capture the event notifications.

OCI (Oracle Call Interface) connection pooling allows middle-tier products to more efficiently manage a pool of connections for an application, rather than having the middleware explicitly manage the connections to the database.

### Performance

Performance gains in the Oracle9i Server are realized with new features that are highly visible to the user or application developer. Conformance to the latest SQL standards makes coding more efficient for the developer and makes the execution of this code potentially more efficient on the server side. The DBA has a new feature set to help monitor index usage, allowing the DBA to drop indexes that are used infrequently or not at all.

### SQL and PL/SQL Optimization

Oracle9i complies much closer with the SQL:1999 standards and syntax. Some of the standards now reflected in the Oracle SQL processor include enhancements to join operations, case statements, FK (foreign key) and PK (primary key) caching operations, and multi-table inserts. Significant enhancements to the PL/SQL processor allow for dramatic decreases in execution time for PL/SQL procedures, especially those that do not have SQL references.

You can now explicitly specify query join types in FROM clauses, rather than in the WHERE clause. The join types supported include *cross joins* (Cartesian products), *natural joins* (equijoins), and full, left, and right *outer joins*.

Oracle9i expands on the CASE expression that has been available since Oracle8i. A new type of CASE expression, a *searched CASE* expression, operates much like an IF...THEN...ELSE construct and allows for multiple predicates within the WHEN clauses. The *NULLIF* and *COALESCE* functions operate much like "abbreviated" CASE statements for returning and evaluating null values.

Unindexed foreign keys still require table-level share locks when an update or delete on the primary key takes place; however, the overhead is reduced and availability increased because the lock is immediately released after it is obtained. Foreign key creation is faster because Oracle9i caches the first 256 primary key values for DML statements that process at least two rows.

The new *multi-table insert* feature allows for easier coding and less SQL processing overhead, because all source and destination tables are specified in the same INSERT statement. You can also use this feature to easily refresh materialized views in a data warehouse environment.

PL/SQL execution is significantly more efficient in Oracle9i because the byte code generated in previous Oracle versions has been replaced by native C code. Additional performance gains are a result of the compiled code residing in the PGA (Program Global Area) rather than in the SGA, reducing contention in the SGA.

### I/O Performance

The presence of too many indexes can negatively impact performance when you are inserting or updating rows, especially in an OLTP (Online Transaction Processing) environment. In addition, significant amount of disk space may be wasted if these indexes are not needed. You can gather new statistics at query parse time to help identify which indexes are used during a particular query. You can alter indexes directly with the ALTER INDEX ... MONITORING USAGE clause; new data dictionary views such as V\$OBJECT\_USAGE indicate whether a particular index has been used in the specified time frame.

*Cursor sharing*, a feature introduced in Oracle8i, has been enhanced in Oracle9i. In Oracle8i, you could reuse SQL statements in the shared pool if only the literal values in the SQL statement were different. In many cases, this reuse improved memory utilization in the shared pool, but risked some performance degradation when the values in the keyed column were skewed in terms of the histogram statistics. As a result, using only one execution plan for these queries was a potentially inefficient operation. In Oracle9i, the execution plans are reused only if the optimizer has determined that the execution plan is independent of the literal value(s) used in the query. The parameter CURSOR\_SHARING can now have the value SIMILAR in addition to the already available FORCE and EXACT values.

To make Oracle's Cost Based Optimizer (CBO) more accurate, three new columns have been added to the PLAN\_TABLE: CPU\_COST, I0\_COST, and TEMP\_SPACE. In other words, the new Oracle9i cost model now takes into account the estimated CPU cost of the operation, the effect of caching, and the effect of using temporary segments for pre-fetching index blocks.

### Java Enhancements

The internal Java engine has better garbage collection and native compilation. The performance has been enhanced by the use of object sharing and session pinning. Middle-tier operations have also been enhanced by internal improvements to JDBC (Java Database Connectivity) and SQLJ (SQL embedded in Java applications).

## Security

Oracle9i adds a number of security related features to make random numbers more random, make rows of a table accessible only to those who need access, and allow the DBA to more easily audit table access based on an expanded set of conditions.

### **Data Encryption**

Oracle9i introduces a new function, GETKEY, in the package DBMS\_OBFUSCATION\_TOOLKIT. Provided that the encryption keys themselves are stored securely, GETKEY will generate a random number that is significantly more secure than a number generated from DBMS\_RANDOM.

### Label Security

Oracle9i provides *Label Security*, a more secure and "fine-grained" approach to controlling access to rows in a database by the use of a special label in each row of the database. This new access control method is based on Oracle's Virtual Private Database (VPD) features and is facilitated by the use of a new set of PL/SQL packages.

### **Fine-Grained Auditing**

Automatic auditing of the database has been enhanced in Oracle9i. In Oracle8i, auditing could be triggered only at a very high level: access of privileges or objects. In addition, the data returned in the audit table only contained a limited set of facts such as the username, date and time, and the object or privilege accessed. Using *Fine-Grained Auditing* (FGA), you can specify conditions on a given row of a table and record them in the audit table when those conditions are satisfied. In addition, user-defined procedures can be triggered when an audit condition is satisfied to perform additional processing, for example, to page the DBA when a particular row or set of rows is accessed in a table.

## Manageability

The new manageability features of Oracle9i simplify the life of the DBA by centralizing the locations where various database-related files are stored. The enhanced *undo tablespace* (rollback) features eliminate much of the guesswork when setting up the proper undo structures for various database scenarios. DBAs also have more control over how resources are used within a resource consumer group. All these enhancements are fully supported through a simplified and streamlined Oracle Enterprise Manager (OEM).

### **Oracle Managed Files (OMF)**

*Oracle Managed Files* (OMF) provides an easy way for the DBA to manage the locations of many types of database files by using two new initialization parameters. The DBA specifies only operating system locations for certain types of files, and the Oracle Server handles the unique naming of the operating system files themselves.

The two new parameters are DB\_CREATE\_FILE\_DEST and DB\_CREATE\_ ONLINE\_LOG\_DEST\_n. The parameter DB\_CREATE\_FILE\_DEST defines the default location for storing new datafiles associated with a given tablespace as well as for temporary files. The second parameter, DB\_CREATE\_ONLINE\_ LOG\_DEST\_n, provides similar functionality except that this location is specified for new control files and online redo log files. You manage archived redo log files as you did in previous Oracle versions.



Using OMF for one group of files does not prevent the DBA from continuing to use the older methods for naming files in the database; both methods can coexist nicely, and you can convert to a completely OMF-based database in stages.

### Undo Tablespace Management

Automatic Undo Management provides yet another way to ease the administrative burden for the DBA. In previous Oracle versions, managing space for undo (rollback) segments was complex and error prone. In Oracle9i, managing space is almost as simple as creating an undo tablespace big enough to handle the maximum number of undo entries at the busiest time of the day and letting the Oracle database handle the rest. Another "finegrained" enhancement to undo management is the ability for the DBA to specify how long to keep undo data before it is overwritten, potentially avoiding the classic, yet dreaded, "Snapshot too old" error.

You can create the undo tablespace when you create the database or later if migration from manual undo (rollback) management cannot be implemented immediately. Multiple undo tablespaces can exist in the database, although only one can be active at any given time.

### **Fine-Grained User Policy Management**

User security has been strengthened with more restrictive, and therefore more secure, default values. Most of the accounts created by the Database Configuration Assistant (DBCA) are initially locked with expired passwords. The initialization parameter 07\_DICTIONARY\_ACCESSIBILITY now defaults to FALSE, unlike previous versions of Oracle. As a result, only users with the SYSDBA privilege can see the contents of the data dictionary.

The Secure Application Role feature of Oracle9i extends the functionality of Application Context first introduced in Oracle8i. To enable an application role in Oracle8i required using a password as authentication for a role; this practice can be a big security problem if the password itself is breached, therefore allowing any application to access the restricted data via the role. Instead, in Oracle9i, the role is enabled by calling a stored procedure, which can validate the user based on a number of criteria, such as the IP address of the user or the time of day.

The Oracle *Enterprise Login Assistant* (ELA) improves enterprise user security and ease of use by allowing users to have only one username and password (stored in the Oracle Internet Directory). In addition, because SSL (Secure Sockets Layer) and wallets on the client side are not required, user administration is further simplified for the DBA. Even previous versions of the Oracle client can use ELA to utilize single sign-on functionality.

### Fine-Grained Resource Management

In Oracle9i, DBAs can further restrict or fine-tune resource usage by resource consumer group. The new *Active Session Pool* feature of the Database Resource Manager can now restrict how many active sessions can exist

from users within a particular resource consumer group. If this limit is reached, the new user must wait until another user's session has completed. The data dictionary views V\$SESSION and V\$RSRC\_CONSUMER\_GROUP have new columns that show how many consumer group sessions are waiting for resources and how long they have been waiting.

You can use the new Oracle9i feature *Automatic Consumer Group Switching* to switch a particular session's consumer group on the fly. You can temporarily switch long-running daytime queries to a resource group that is normally used for nightly batch jobs if the session is active for more than a particular length of time. As a result, the session will not be terminated, but switched to another consumer group that will have less impact on OLTP transactions during the day.

On a similar note, you can also restrict the amount of undo space used by a session for a given consumer group by using the new plan directive UNDO\_POOL. When this limit is exceeded, no further statements (other than SELECT) will be allowed for the session until other sessions within the same group release some undo segments or until the DBA manually increases the amount of undo quota allowed for the consumer group.

### Enterprise Manager

Oracle Enterprise Manager (OEM) has had a major facelift in terms of look and feel. Instead of the four-pane format of previous versions of OEM, the new Oracle9i OEM has a simpler, two-pane master/detail layout. Many of the functions that were available by launching a separate executable in previous versions are now tightly integrated into a single OEM console. For example, the database administration functions previously available in DBA Studio are now a component of OEM.

As with previous versions of OEM, you can launch the console in standalone or via an Oracle Management Server (OMS). Connecting standalone does not require the middle-tier services nor do the target databases need the Intelligent Agent installed; however, the DBA cannot use many of the advanced features of OEM. These features include functionality such as Web-enabled applications, paging, backup tools, and access to events, jobs, and groups, to name a few.

### **Globalization Support**

Previously known as National Language Support (NLS), *Globalization Support* is now the term that describes the features of Oracle9i that facilitate the use of the Oracle database with applications across all languages, continents, and time zones without having to customize the application for each locale in which the application is used.

New timestamp data types, such as TIMESTAMP and INTERVAL, are both more precise than the DATE data type in previous Oracle versions, but also allow the option to store a timestamp value as non-globalized, absolute within a specified time zone, or relative to the time zone of the user retrieving the data.

Along with the new TIMESTAMP and INTERVAL data types in Oracle9i are the operations and functions that support these types. "Common sense" operations between TIMESTAMP and INTERVAL are allowed, such as calculating an INTERVAL from two TIMESTAMP variables or adding an INTERVAL to a TIMESTAMP. A full complement of predefined functions are included to process these types, such as DBTIMEZONE to retrieve the value of the database time zone or TO\_TIMESTAMP to convert a string representation of a time-stamp to the internal representation.

Oracle9i supports Unicode version 3. New functions such as COMPOSE and DECOMPOSE handle characters with diacritical marks, and other new functions such as UNISTR convert a string to a Unicode string. And finally, expanded sorting options provide new sorts as well as a fourth level of sorting that can be user-defined using Oracle's Locale Builder.

# Unsupported and Deprecated Features

**M**any of the changes to the Oracle9i Server that enhance the performance or increase the ease of use for both administrators and users can unfortunately require changes to features or changes in how a task is accomplished in Oracle9i. *Unsupported* features are not available at all; *deprecated* features are still available for sites that need to spread out the conversion over a period of time and more than one release of the Oracle Server.

Some of the key changes in Oracle9i are in the areas of backup and recovery, security, initialization parameter changes, network enhancements, and Unicode datatype handling.

### **Backup and Recovery**

The Export/Import utilities still support the INCREMENTAL option, but this option may be removed in a future release. The INCREMENTAL option backed up an entire table even if only one row in the table was changed. You can still specify individual tables in an export operation, but administrators are encouraged to use RMAN (Recovery Manager) instead to back up and recover database tables and entire databases.

Using a clone database for tablespace point-in-time recovery (TSPITR) is deprecated in Oracle9i. Using the transportable tablespace (TTS) feature is recommended instead. For the same reason, the FOR RECOVER clause of ALTER TABLESPACE ... OFFLINE is supported only for backward compatibility.

### Security

The CONNECT INTERNAL and CONNECT INTERNAL/PASSWORD commands are not supported in Oracle9i. Instead, you use the syntax CONNECT / AS SYSDBA or CONNECT username/password AS SYSDBA.

Server Manager is no longer supported. Use SQL\*Plus for all DBA maintenance operations. Any automated scripts that were written for use with Server Manager should run in SQL\*Plus with only minor modifications.

#### Network

The following services previously supported under Oracle Net8 (now known as Oracle Net Services) are no longer supported in Oracle9i: NDS External Naming and Authentication, the SPX protocol, Net8 OPEN, the authentication methods Identix and SecurID, and the use of a protocol.ora file.

In addition, no new features have been added to Oracle Names, and in the future, Oracle Names will no longer be used as a centralized naming method for name resolution. Instead, administrators should use Oracle Internet Directory (OID) for name resolution. Oracle Internet Directory uses LDAP (Lightweight Directory Access Protocol) version 3 and provides a high level of scalability, security, and availability that Oracle Names cannot provide.

### **Initialization Parameters**

The initialization parameters in the following lists have been either deprecated or are not supported in Oracle9i. The replacements for these parameters are discussed in more detail in the other chapters of this book and the other books in the OCA/OCP series.

**Deprecated Initialization Parameters** 

ROLLBACK\_SEGMENTS

FAST\_START\_IO\_TARGET

TRANSACTIONS\_PER\_ROLLBACK\_SEGMENT

LOG\_CHECKPOINT\_INTERVAL

DB\_BLOCK\_BUFFERS

BUFFER\_POOL\_KEEP

BUFFER\_POOL\_RECYCLE

**Unsupported Initialization Parameters** 

ALWAYS\_ANTI\_JOIN

ALWAYS\_SEMI\_JOIN

JOB\_QUEUE\_INTERVAL

OPTIMIZER\_PERCENT\_PARALLEL

HASH\_MULTIBLOCK\_IO\_COUNT

DB\_BLOCK\_LRU\_LATCHES

DB\_BLOCK\_MAX\_DIRTY\_TARGET

SORT\_MULTIBLOCK\_READ\_COUNT

DB\_FILE\_DIRECT\_IO\_COUNT

GC\_DEFER\_TIME

GC\_RELEASABLE\_LOCKS GC\_ROLLBACK\_LOCKS LM\_LOCKS LM\_RESS USE\_INDIRECT\_DATA\_BUFFERS

### National Character Set

Various changes have been made to simplify and unify the use of Unicode characters in an Oracle database. The Unicode datatypes NCHAR, NVARCHAR2, and NCLOB can only be used as Unicode types in Oracle9i. The national character sets for these types can only be AL16UTF16 or UTF8; the AL24UTFFSS character set has been replaced by UTF8.

### Summary

The new features in Oracle9i focus on two high levels: improvements to the "user experience" and improvements to make the life of a DBA less stressful. From the user's point of view, the Oracle Server is available when the user needs it, and the performance improvements keep up with their query processing needs, both from an OLTP and a data warehousing point of view. From the DBA's point of view, the database is more secure, easier to manage, and easier to upgrade without noticeable changes to applications or operations.

The Oracle9i server is more available than ever. Failover support is more robust and automatic, and the DBA's job is more streamlined by enhancements to the GUI for these new availability features. Database users are able to be more self-sufficient with the new features of LogMiner and Oracle Flashback Query feature, maximizing database availability while reducing the dependency on the DBA for routine historical data requests. In addition, many of the operations that required the database to be shut down can now be done online with minimal impact to ongoing user activity. Many of the changes to the Oracle9i architecture facilitate both the performance and scalability of the Oracle server. Memory management is more flexible, allowing many of the SGA memory structures to grow and shrink as the demand on the system changes during the day. Access to external data is improved by treating some external data tables as if they were native Oracle tables.

The coding of SQL and PL/SQL statements is more streamlined for the application developer by higher conformance to the SQL:1999 standards. Additions to the supported join types, along with a more versatile CASE statement, and multi-table insert makes both the application developer and the Oracle server more efficient.

In terms of overall security, the Oracle9i Server provides more "finegrained" enhancements: a better random number generator, the ability to more tightly control access to rows in a table, and a more useful and flexible means of auditing access to the database.

The Oracle9i Server is much easier to manage from a DBA perspective with the new Oracle Managed Files (OMF) and the automated undo features. Security is further enhanced by the Secure Application Role feature, which replaces a relatively weak password authentication method with a more robust and secure stored procedure methodology for enabling roles. DBAs can also control resource usage more easily by using the Active Session Pool feature to limit resource consumption by consumer group.

Globalization Support (formerly known as National Language Support) has been expanded well beyond the role of supporting different character sets. It now includes additional data types and predefined functions to support applications that will be run simultaneously in different languages and different time zones, with no changes to the application programs.

Many of the new features in Oracle9i either replace or make obsolete features in previous Oracle releases.

# Key Terms

**B**efore you take the exam, be certain you are familiar with the following terms:

Active Session Pool	long-term backups
archive log backups	metadata
Automatic Consumer Group Switching	mirrored backups
Cache Fusion	multi-table insert
COALESCE	natural joins
CONFIGURE	NULLIF
cross joins	Oracle Data Guard
cursor sharing	Oracle Flashback
Enterprise Login Assistant	Oracle Managed Files
external tables	Oracle Shared Server
Fine-Grained Auditing	outer joins
global index	Real Application Clusters
Globalization Support	restartable backups
granules	searched CASE
Index-Organized Table	Secure Application Role
Label Security	STATISTICS
LogMiner	undo tablespace

### **Review Questions**

- 1. Which new feature of Oracle9i allows users to view the contents of a table at some point in the past?
  - A. LogMiner
  - **B.** Import
  - **C.** Metadata Viewer
  - D. Oracle Flashback
- **2.** Choose the statement below that is true regarding enhancements to shared SQL statements in the shared pool.
  - **A.** The cursor sharing feature can re-use a SQL statement even if the columns in the statement are in a different order or the GROUP BY clause is different.
  - **B.** The new columns CPU\_COST, IO\_COST, and TEMP\_SPACE in PLAN\_ TABLE help the rule-based optimizer (RBO) to be more accurate.
  - **C.** Even if the only difference in SQL statements is in the literal values, the SQL statement may not be re-used if the histogram statistics are skewed for a column in the WHERE clause.
  - **D.** The CURSOR\_SHARING parameter now supports the SIMILAR and DERIVED values.
- **3.** Given the table declaration below, identify invalid use of timestamp datatypes in an expression or function. (Choose two.)

CREATE TABLE TRANSACTIONS (TRANS\_ID NUMBER, AMOUNT NUMBER(10,2), TRANS\_START TIMESTAMP, TRANS\_END TIMESTAMP, SHIP\_DATE DATE, EXPIRE\_DATE INTERVAL DAY(0) TO SECOND(0));

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  - A. TRANS\_START TRANS\_END
  - B. TO\_TIMESTAMP(AMOUNT, 'YY-MM-DD HH:MI:SS')
  - C. TRANS\_START + INTERVAL '4' DAY
  - **D**. TRANS\_START + SHIP\_DATE
  - **4.** Which of the following operations cannot be performed online without any disruption to ongoing online transactions?
    - **A.** Dropping a user-defined column
    - B. Rebuilding secondary IOT indexes
    - **C**. Adding new columns to a heap-based table
    - **D**. Rebuilding a primary IOT index
  - **5.** Which of the following types of joins are now allowed in the FROM clause of a SQL statement? (Choose all that apply.)
    - A. cross joins
    - B. inner joins
    - C. full outer joins
    - **D**. left outer joins
  - **6.** How many panes exist in the new version of Oracle Enterprise Manager (OEM)?
    - A. One, with pop-up windows
    - **B**. Four, as in previous versions
    - C. Two, in a master/detail format
    - **D**. Two, with DBA tools in the right-hand pane
  - 7. The DBA is importing a table and an index from a dump file that was exported from another Oracle9i database. Which options does the DBA have when using the statistics from this dump file? (Choose all that apply.)

- A. Explicitly accept all statistics
- B. Explicitly reject all statistics
- **C**. Let IMPORT decide if the statistics are safe; otherwise recalculate
- D. Accept statistics only for non-partitioned tables
- **E.** Explicitly re-calculate statistics, regardless of whether the original statistics are good or bad
- **8.** The Secure Application Role feature in Oracle9i allows a user to authenticate role privileges by doing which of the following?
  - A. Calling a stored procedure
  - B. Using OS authentication
  - **C.** Using PWFILE authentication
  - **D**. Using an encrypted role password
- **9.** Chad normally runs queries against very small tables, but has informed the DBA that he will soon be running some queries against the data warehouse tables for the operations manager. What can the DBA do to make sure that these new queries won't slow down OLTP operations? (Choose the best answer.)
  - **A.** The DBA can use the Active Session Pool feature to put Chad's session on hold until another user in the same consumer group finishes their session.
  - **B.** The DBA can use the Automatic Consumer Group Switching feature to switch Chad's consumer group to the same group as the OLTP users.
  - **C.** The DBA can use the Active Session Pool feature to suspend the session if there are too many active OLTP sessions.
  - **D**. The DBA can use the Automatic Consumer Group Switching feature to switch Chad's consumer group to a secondary group that has a lower priority.

- **10.** Which of the following is not an advantage of having the data dictionary in the redo logs when using LogMiner for DML and DDL activity?
  - **A.** The LogMiner activity will not impact other users' activity against the data dictionary.
  - **B.** The LogMiner reports will be more accurate against a snapshot of the data dictionary rather than a constantly changing live data dictionary.
  - **C.** Bad blocks in one of the redo logs will not stop the LogMiner analysis with a static data dictionary.
  - **D**. The database does not need to be open to use LogMiner, since all needed information is in the redo logs.
- **11.** Which of the new RMAN options can the DBA use to save time when a backup does not complete successfully?
  - **A**. Restart the backup with the NOT BACKED UP option.
  - **B.** Use mirrored backups to send the backup to two different device types.
  - **C**. Include the archive logs in the backup.
  - **D.** There is no alternative to a failed backup other than to restart the backup.
- 12. Identify the true statement regarding binary SPFILEs.
  - **A.** All changes to an SPFILE are implemented only after the instance is restarted.
  - **B.** Changes made to an SPFILE with the ALTER SYSTEM command can be made simultaneously with the change to the memory copy of the parameter.
  - **C**. An SPFILE can exist on the client side.
  - **D**. SPFILEs can be used in conjunction with a text-format PFILE.

- **13.** Place the following block read options in order of access time, shortest to longest.
  - A. Block is read from remote cache without Cache Fusion
  - **B.** Block is read from a local cache
  - **C**. Block is read from a remote cache with Cache Fusion
  - **D.** Block is read from a shared disk
- **14.** PL/SQL execution is significantly more efficient at runtime for which of the following reasons? (Choose two.)
  - A. Native C code is generated for PL/SQL procedures.
  - **B**. The compiled code resides in the SGA.
  - **C.** Byte code is generated by the compiler and therefore can easily be re-used by different transactions.
  - **D.** The compiled code resides in the PGA.

### Answers to Review Questions

- **1.** D. The package DBMS\_FLASHBACK allows the user to view the contents of a table or tables at a specified time in the past.
- **2.** C. If the execution plan is independent of the literal values used in the query, it is likely that the query can be re-used.

The new columns in the PLAN\_TABLE assist the cost-based optimizer, not the rule-based optimizer, and the CURSOR\_SHARING parameter does not have DERIVED as a possible value.

- **3.** B, D. Any reasonable combination of date and time data types is allowed. However, date fields cannot be added together, and dollar amounts are not valid arguments to date conversion functions.
- **4.** A. Primary keys cannot be dropped nor can columns with userdefined data types be dropped without making a table unavailable.
- **5.** A, B, C, D. All the above joins are now specified in the WHERE clause. Previous versions of Oracle supported all these join types other than the full outer join in the WHERE clause.
- **6.** C. The new OEM not only uses a cleaner, easier-to-use two-pane layout, it integrates all the tools previously available through DBA Studio.
- **7.** A, B, C, E. IMPORT cannot reject statistics based on whether the table is partitioned.
- **8.** A. The stored procedure can restrict access to the role in a number of ways, such as by date and time or by the IP address of the user requesting access to the role.
- **9.** D. Switching to another consumer group with a lower priority will allow the query to finish while minimizing the impact on the ongoing OLTP transactions.

The Active Session Pool feature controls resource usage within the same consumer group and will not necessarily reduce the contention with OLTP transactions.

- **10.** C. Bad blocks can be ignored in LogMiner; however this feature is independent of where LogMiner retrieves the data dictionary information.
- **11.** A. Running RMAN with the NOT BACKED UP option backs up only the missing or incomplete files.
- **12.** B. The changes to an SPFILE may be made at the same time the change is made to the memory copy of the parameter. SPFILEs only exist on the server side and are created using a PFILE. Once the SPFILE is activated, the PFILE is no longer needed.
- **13.** B, C, D, A. Blocks read from a remote cache without Cache Fusion must be written to the shared disk by the remote instance before the blocks can be retrieved by the local instance.
- **14.** A, D. The compiled code is moved to the PGA to reduce contention on the SGA; interpreted byte code is inherently less efficient to execute than native compiled C code.