Oracle Database 10*g* and Oracle9*i* Database Manageability Comparison

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Executive Summary

Ease-of-use or manageability is a key focus area for Oracle. The latest release of the Oracle Database, Oracle Database 10*g*, introduced a number of new manageability enhancements designed to make the Oracle Database highly self-managing. This study was undertaken to quantitatively measure the resulting improvement in manageability of Oracle Database 10*g* over its predecessor, Oracle9*i* Database Release 2.

In this study we performed a total of 21 basic and common DBA tasks on the two products and measured the time taken and the steps required to complete each task, to assess their relative manageability. The time taken to complete the tasks was then weighted according to their frequency of use in a typical DBA workday to arrive at an overall time savings percentage. The tasks performed in this study covered the following four categories:

- Installation and Simple "Out-of-Box" Setup,
- Day-to-Day Database Administration,
- Backup & Recovery, and
- Performance Diagnostics & Tuning.

The study showed that Oracle 10*g* made tremendous gains in manageability. The main findings of the study are summarized below:

- Oracle 10*g* database administrators require 50% less time than Oracle9*i* to perform the basic management tasks included in this study.
- Oracle 10*g* needed 57% fewer administrative steps than Oracle9*i* to complete the same DBA workload.

As the results show, compared to Oracle9*i*, Oracle Database 10*g* reduces management complexity by half and therefore, makes the administrators twice as productive. This has huge cost savings implications for businesses, not only due to greater DBA productivity, but also due to the fact that increased automation in Oracle Database 10*g* reduces the chances of human errors leading to higher system availability and lower training and management costs.

Oracle 10*g* manageability features responsible for advances made over Oracle9*i* covered a wide range of areas, with the most remarkable improvements coming in the performance diagnostics and tuning category. With DBA's spending nearly a third of their time doing performance diagnostics and tuning related functions, the new automatic diagnostic and tuning engine of Oracle 10*g*, i.e., ADDM and SQL Tuning Advisor, completely transform the way these functions are performed and were the biggest factors responsible for making Oracle 10*g* easier to manage. Other areas of noteworthy improvements for Oracle 10*g* were software installation & configuration, space management, and human error recovery.

The study clearly demonstrates the huge leap taken by Oracle 10*g* over Oracle9*i* in the area of manageability. DBA's can significantly lower their workload and improve the availability and reliability of their system by simply adopting Oracle 10*g*. With Oracle 10*g*, businesses can expect to lower the cost of management and improve quality of service for their users.

Introduction

Information management systems today play an increasingly strategic role for businesses. Effective management of such systems, therefore, is vital to business success. With the cost of day-to-day operation and management of such systems easily outstripping their initial acquisition costs, it has become progressively more important for businesses to have systems that are easy to manage and maintain. Besides this cost of ownership factor, manageability also has serious ramifications for the availability, reliability, and maintainability of a system. With human error accounting for more than 50% of unscheduled downtime, any system that is simple and easy to use is less likely to encounter human errors and hence will be more immune from harm that such errors can cause. For all these reasons, it is no surprise that Oracle has taken significant steps to greatly enhance the manageability of its product by making it more self-managing, more proactive, and less complex.

Oracle Database 10*g* is the latest release of Oracle database software which contains a number of new features and functionalities designed to make businesses more productive. In this study, we will analyze the manageability improvement from Oracle9*i* to Oracle 10*g* and will attempt to establish a quantitative measure for the manageability differential between the two releases. This will give Oracle customers an objective basis for calculating management cost savings due to Oracle Database 10*g* and allow them to ascertain the business benefits of upgrading to this new release.

Methodology

As there exists no standard method of measuring or comparing ease-of-use or manageability, we have used the approach employed by a similar study conducted by Rauch Associates comparing Oracle9*i* Database with IBM DB2[1]. We performed a set of basic and common administrative tasks that reasonably represent a typical DBA's workload on both Oracle9*i* and Oracle10*g*, and measured them on a common set of metrics to gauge their relative manageability. The metrics used were:

- Time: Total time that a DBA spends in carrying out the task.
- Steps: Number of steps required to complete the task.

The time metric is used to ascertain the relative management **efficiency** of the two products. The quicker a DBA can complete a task, the more efficient and productive he/she will be. It should be noted that the time metric above represents DBA time and not necessarily task completion time, since the goal is to determine DBA time savings. For example, for certain tasks such as the backup database task, the time required to setup a regularly scheduled backup job by the DBA is measured and not the actual backup time, since actual backups normally happen unsupervised at off-peak hours when the DBA could be, and normally is, doing other things. Hence, the time savings in this task comes from simplification of backup management and this is what has been measured in the study.

The second metric, steps, is used to determine and quantify relative **complexity** of the two releases. This, in our opinion, is a reasonable way of quantifying complexity as it would be difficult to refute the contention that if one product requires its users to perform significantly greater number of discrete steps to complete an identical task than its counterpart, then the former is more difficult to use and hence, more complex than the latter.

Once measured, these metrics were used to perform a comparative manageability analysis of the two products. However, before interpreting these results, it was recognized that not all of the tasks in the workload are performed with equal frequency. For example, software installation is not done as often database backup. To realistically account for this, a weighted average was used to weigh each set of tasks according to their typical degree of use. A survey of database administrators was used to determine the appropriate weights for the tasks. This weighted time was then used to compare the overall relative manageability of Oracle9*i* and Oracle 10*g*.

A total of 21 tasks covering all the key DBA functions were performed. The tasks were grouped in the following four categories:
- Installation and Simple "Out-of-Box" Setup,
- Day-to-Day Database Administration,
- Backup & Recovery, and
- Performance Diagnostics & Tuning.

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[1] Comparison of Management Cost of Ownership: Oracle9*i* Database Release 2 and IBM DB2 v8.1.

The actual tasks that comprise each of the above categories are described in the *Test Workload* section later in the study.

The tasks were performed on two separate machines, one for each product, with identical parameters. The hardware and software details are as follows:

- *Hardware Platform*
  - o Dell single-CPU box with Intel Pentium processor, 1.7 GHz.
  - o Memory: 512 MB RAM
  - o Operating System: Windows 2000 (version 5.00.2195), Service Pack 4
- *Software*
  - o Oracle9*i*
    - Oracle9*i* Database Release 2 on Windows 2000.
    - Enterprise Manager and Packs (Oracle's bundled management tool including Diagnostics Pack and Tuning Pack)
  - o Oracle 10*g*
    - Oracle Database 10*g* on Windows 2000
    - Enterprise Manager and Packs (Oracle's bundled management tool including Diagnostics Pack and Tuning Pack)

Oracle Enterprise Manager (OEM) was the main tool used to perform the tasks for both Oracle9*i* and Oracle 10*g*. As this is the management tool that comes bundled with the Oracle database product, it was considered appropriate to use it for the purposes of this study.

Test Workload

The test workload in the study consisted of 21 DBA tasks, grouped in four categories. The tasks were specifically chosen to represent a realistic workload of a typical DBA. Each category and their respective tasks are listed below.

a) Installation and Simple "Out-of-Box" Setup:
   1. Install database, management software, and create new database
   2. Create additional instance
   3. Setup proactive monitoring

b) Day-to-Day Database Administration:
   4. Create user, assign roles and privileges
   5. Create tablespace
   6. Add space to tablespace
   7. Create table
   8. Create index
   9. Reclaim wasted space from tables with fragmented data
   10. Tune undo retention
   11. Export data
   12. Import data

c) Backup & Recovery:
   13. Configure and perform full online backup
   14. Perform full database point-in-time recovery
   15. Recover dropped table
   16. Recover datafile
   17. Recover from erroneous transaction

d) Performance Diagnostics and Tuning:
   18. Generate optimizer statistics
   19. Diagnose performance problem
   20. Fix performance problem: SQL Tuning
   21. Tune memory, SGA and PGA.

These tasks were performed on identical hardware and software configurations with the same application workload. For each task, elapsed time (efficiency) and number of steps (complexity) were measured.

Workload Weighting

The workload weightings used in the study are shown below.

Table 1: Workload Category Weights

Category	Weight
Installation and Simple "Out-of-Box" Setup	13%
Day-to-Day Database Administration	27%
Backup & Recovery	6%
Performance Diagnostics & Tuning	34%
Miscellaneous	20%
Total	**100%**

These weightings are based on a survey of database administrators. The "Miscellaneous" category represents time spent outside the four categories listed above and includes tasks such as training, time-off, planning, special assignments, etc. This category was included to acknowledge in the manageability comparison calculations that such tasks are necessary. However, in performing the calculations for this analysis, it was assumed that database administrators spend exactly the same amount of time in this category for both Orcale9*i* and Oracle 10*g,* so as not to favor one over the other.

Study Findings

The tables below summarize the main findings of the study[2]. As noted earlier, two metrics were measured in this study, time and steps needed to complete each task. The first metric, time to complete task, was measured to compare relative efficiency of the two products. Table 2 shows the time comparison between Oracle9*i* and Oracle 10*g*. The time taken to complete the tasks has been aggregated by task category in order to show the advantage one product has over the other for the different categories. The timings shown are the actual timings measured in the study and have not been weighted to reflect DBA workload savings.

Table 2: Task Time (minutes) Comparison by Category

	Installation & "Out-of-Box" Setup	Day-to-Day Database Administration	Backup & Recovery	Performance Diagnostics & Tuning	Total
Oracle9*i*	45	35	46	19	147
Oracle 10*g*	29	13	17	5	64
Oracle 10*g* Time Savings	36%	63%	63%	74%	56%
Remarks	Oracle 10*g* took 36% less time to complete install and simple "out-of-box" setup.	Oracle 10*g* took 63% less time to ongoing day-to-day administration tasks.	Oracle 10*g* took 63% less time to complete backup and recovery tasks.	Oracle 10*g* took 74% less time to complete performance diagnostics & tuning tasks.	Oracle 10*g* overall took 56% less time to complete all the tasks.

As the table shows, Oracle 10*g* has significant manageability advantage in each task category, providing time savings ranging from 36% to 74%, with an average savings of 54%. This means that a typical DBA can complete most administrative tasks in considerably less time using the manageability enhancements of Oracle 10*g*.

Table 3 below shows Oracle 10*g* weighted time savings for each category. The weighting factors described in the *Workload Weighting* section discussed earlier in the report, are applied to the time savings of Table 2 to arrive at the weighted savings. This is necessary because not all tasks are performed with the same frequency, and hence do not account for the same percentage of a DBA's time. For this reason each type of task has to be weighted based on the percentage of time a typical DBA spends on it. For example, in Oracle10*g* a DBA can complete typical Backup and Recovery functions in 63% less time than Oracle9*i*. However, since Backup & Recovery tasks only account for 6% of total DBA time, its impact on time savings on the entire DBA workload is only about 4% i.e., 63% * 6%. Similar calculations have been made for all other task categories and are shown in Table 3. These are the typical time savings that DBA's can expect to realize in their workload due to the manageability enhancements in Oracle 10*g*.

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[2] For more details on the exact task procedure results refer to the appendix at the end of the report.

Table 3: Oracle 10g DBA Workload Time Savings

	Installation & "Out-of-Box" Setup	Day-to-Day Database Administration	Backup & Recovery	Performance Diagnostics & Tuning	Total
Workload Weighting Factor	13%	27%	6%	34%	
Workload Time Savings	5%	17%	4%	25%	50%
Remarks	In the course of a DBA workday, DBA's need 5% less time in Oracle 10g to complete the tasks in this category than in Oracle9i.	In the course of a DBA workday, DBA's need 17% less time in Oracle 10g to complete the tasks in this category than in Oracle9i.	In the course of a DBA workday, DBA's need 4% less time in Oracle 10g to complete the tasks in this category than in Oracle9i.	In the course of a DBA workday, DBA's need 25% less time in Oracle 10g to complete the tasks in this category than in Oracle9i.	In the course of a DBA workday, DBA's need 50% less time in Oracle 10g to perform their function than in Oracle9i.

As Table 3 shows, a DBA can complete his task workload in Oracle 10g in half the time needed in Oracle9i. It yielded a savings of 5% for installation and configuration, 17% for ongoing day-to-day database administration, 4% for backup and recovery, and 25% for performance diagnostic and tuning, to produce an overall workload savings of 50%. These savings are based on the workload weighting factors used. Changing the weighting factor will impact the time saving estimates of this report. As mentioned before, the weights used are based on a broad survey of DBA's and are, therefore, adequate and reliable for the purposed of the study. However, it should be noted that because Oracle 10g clearly outperforms Oracle9i in very task category, even if the weights used are modified, the overall results would not be considerably different than the one presented here.

The second metric measured in this study to compare the complexity of the two products was the number of steps needed to complete each task. Table 4 below compares the complexity of the two products. Similar to Table 2, results have been aggregated by task category. As Table 4 shows, Oracle 10g considerably reduces complexity of many DBA tasks. Once again, Oracle10g showed improvements in all categories, with complexity reduction ranging from 40% to 69%. Overall, Oracle 10g needed less than half the number of steps required by Oracle9i to execute the test workload.

Table 4: Complexity Comparison by Category

	Installation & "Out-of-Box" Setup	Day-to-Day Database Administration	Backup & Recovery	Performance Diagnostics & Tuning	Total
Oracle9*i*	7	15	19	15	56
Oracle 10*g*	4	9	6	5	24
Oracle 10*g* Step Savings	43%	40%	68%	67%	57%
Remarks	Oracle 10*g* took 43% fewer steps to complete install and simple "out-of-box" setup.	Oracle 10*g* took 40% fewer steps to ongoing day-to-day administration tasks.	Oracle 10*g* took 68% fewer steps to complete backup and recovery tasks.	Oracle 10*g* took 67% fewer steps to complete performance diagnostics & tuning tasks.	Oracle 10*g* overall took 57% fewer steps to complete all the tasks.

Test Result Analysis

Oracle 10*g* has shown significant improvement over Oracle9*i* in the area of manageability. It is more efficient and less complex than Oracle9*i*. Whereas Oracle 10*g* showed improvements in all categories, the biggest manageability improvements was seen in the performance diagnostics and tuning category, followed by day-to-day administration category, then by backup and recovery and finally by installation and "out-of-box" configuration category.

Performance Diagnostics & Tuning

The introduction of Automatic Database Diagnostic Monitor (ADDM), which proactively analyzes and diagnosis any performance related issues, has made the task of problem diagnosis almost trivial in Oracle 10*g*. A DBA only needs to look at the ADDM report to determine the cause of problems in Oracle10*g*, as opposed to manually examining database vital signs and performance statistics to identify bottlenecks. Consequently, prior to Oracle10*g*, a good understanding of database architecture is required by the DBA to carry out the numerous diagnostics steps. In contrast, even a novice user can determine the cause of the problem by simply looking at the ADDM report in Oracle 10*g*. Even though the latter difference does not manifest itself in the study because we assumed that the tests were being performed by expert DBA's, in real world situations the qualitative difference in the inherent difficulty of the task will further boost the manageability difference between Oracle9*i* and Oracle 10*g*.

The other significant improvement in the performance diagnostics and tuning category in Oracle 10*g* was due to the new SQL Tuning Advisor feature. This feature automates all the steps required for tuning SQL statements and gives comprehensive tuning advice, along with the exact commands for implementing the advice. A user only needs to run the advisor and then accept its recommendations to comprehensively tune SQL statements in Oracle 10*g*. In addition, Oracle 10*g* provides infrastructure for tuning multiple SQL statements together in one step using SQL Tuning Sets. In our study we only tuned a single SQL statement, hence this functionality difference between Oracle9*i* and Oracle 10*g*, which is very useful for real

world environments, was not highlighted. The actual advantage of Oracle 10*g* in SQL tuning, therefore, is much more than what is revealed in the study results.

Another area where Oracle 10*g* has made performance tuning very easy compared to Oracle9*i* is in memory management. With Automatic Shared Memory Tuning DBA's no longer need to tune individual memory pools of the SGA. Just like with Automatic SQL Execution Memory Tuning feature introduced on Orace9*i*, users simply specify an SGA target size and the database automatically adjusts the sizes of the various memory pools as needed. This new Oracle 10*g* feature makes memory tuning a very simple exercise for DBA's, as they only need to be concerned with 2 memory parameters (as compared to 6 for Oracle9*i*) whose optimal value is proactively recommended by ADDM. Thus, all a DBA has to do in Oracle 10*g* is to make sure that the value of the 2 memory parameters are in line with ADDM recommendations.

The last area of improvement in this category is the automation of query optimizer statistics collection in Oracle 10*g*. As a result, DBA's no longer have to identify objects with stale or missing statistics by regularly monitoring objects to see if they had undergone sufficient DML activity to warrant regeneration of statistics, and then collect statistics on them as needed. This task has now been entirely automated in Oracle 10*g* and the database itself determines what objects need new statistics and then collects them on a regular basis without requiring any user input.

Day-to-Day Administration
The next category where Oracle 10*g* showed the greatest manageability improvement was for ongoing day-to-day administrative tasks. Two features deserve special mention here, Segment Advisor and Automatic Undo Retention Tuning. One of the problems in OLTP type applications is that over time DML activity can result in tables with unusable free space. This leads to tables becoming unnecessarily large due to inefficient use of space. Typically this problem was handled by performing online reorganization of the tables. Oracle9*i* provides GUI tools for such reorganization. The big improvement in Oracle 10*g* is in determining which tables are good candidates for such reorganization and which are not. The Segment Advisor identifies tables and indexes with enough unusable free space to make them good candidates for space reclamation. Also, in Oracle 10*g*, the space reclamation is done online and in-place. The segment is shrunk by moving rows around within the segment to fill up holes of free space. This new feature is called Online Segment Shrink and is integrated with the Segment Advisor. Thus, Oracle 10*g* has made a key space management function extremely easy and this improvement was the biggest contributor to its advantage over Oracle9*i* in this category.

The other feature responsible for Oracle 10*g*'s advantage was Automatic Undo Retention Tuning. With the introduction of Automatic Undo Management (AUM) in Oracle9*i*, manual rollback segment management was replaced with automatic management. However, this feature required a new parameter, UNDO_RETENTION, that had to be manually set and tuned. The Flashback Query feature of Oracle9*i* also relied on this initialization parameter. Appropriate setting of UNDO_RETENTION was, therefore, necessary to avoid ORA-1555 "snapshot too old" error message and to effectively use the Flashback Query feature. In Oracle 10*g* the value of this parameter is automatically determined by Oracle and dynamically modified as needed based on application workload changes without requiring any user

intervention. This feature eliminates an entire DBA task, thereby adding to Oracle 10*g*'s advantage over Oracle9*i*.

Installation and Simple "Out-of-Box" Setup
The biggest manageability improvement in this category was the fast and lightweight installation and configuration introduced in Oracle 10*g*. Software installation took about half the time needed in Oracle9*i* and the database setup and configuration did not require any separate manual steps. Once software installation was completed, the database and its management tool, Database Control, was fully configured and ready for use. With fast installation and auto-configuration, Oracle 10*g* saves DBA's both time and steps for a task that at some point must be performed by every single DBA. Moreover, the simplified install and configuration makes Oracle 10*g* much more accessible and easier to use that its predecessor for new users. This was the main factor behind Oracle 10*g*'s advantage over Oracle9*i* in this category.

Backup & Recovery
The key factors that contributed to Oracle 10*g*'s advantage in this category were the new flashback features. Human errors are the most common cause of system outage and Oracle 10*g* has built upon its flashback family of features to recover from a wider set of such errors. The ability to recover from an erroneous table drop, i.e., undrop a table, the ability to recover from an erroneous transaction, as well as the ability to recover from logical corruptions by quickly rewinding the entire database, Flashback Database, instead of the time-consuming full database point-in-time recovery, have been introduced in Oracle 10*g*. These human errors are fairly common and potentially fatal for business applications. The recourse in Oracle9*i* in such situations is the use of tablespace point-in-time recovery (TSPITR) capability to recover from an erroneous table drop, the use of LogMiner to recover from an erroneous transaction, and full database point-in-time recovery to recover from logical data corruption. In all these cases, the solution is relatively more complex and time-consuming. In contrast, Oracle 10*g* offers simple SQL commands and GUI interfaces for its Flashback family of features that are quick, easy to understand and use. These new flashback features were mainly responsible for Oracle 10*g* being more manageable than Oracle9*i* in this category.

These are main areas of improvement in Oracle 10*g* that are responsible for the considerable manageability difference between Oracle9*i* and Oracle 10*g*. The improvements are not confined to a single area but are comprehensive and cover all the major areas where DBA's spend most of their time. This across-the-board improvement in Oracle 10*g* is aptly reflected in the study by the huge margins by which Oracle 10*g* outperforms Oracle9*i*.

Conclusion

Oracle 10*g* represents a giant step forward from Oracle9*i* in making the database easier to use and manage. The key factors behind Oracle 10*g*'s superior manageability are its new intelligent self-managing infrastructure that provides proactive, self-monitoring and diagnostic capabilities, and the increased automation of many manual but vital DBA tasks such as SQL and memory tuning, space management, and performance diagnostics. Oracle 10*g* is the first truly self-managing database that is intelligent, automatic, adaptive, and proactive.

The study clearly demonstrates and quantifies the manageability advances made by Oracle Database 10*g*. Oracle Database 10*g* reduces the DBA management workload by more than half and the management complexity by the same factor relative to Oracle9*i*. This translates into more productive DBA's, more reliable systems, and significant cost savings for businesses.

Appendix: Detailed Test Results

Installation and Simple "Out-of-Box" Setup Tasks
Task 1: Install database and management software, and create starter database

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Install DB & Management Software, Create Seed Database/Instance, Configure Networking configuration	1. Start the Oracle Installer → Select Enterprise Edition →Typical install → enter SID for the database → Install	23 mins	1. Start the Oracle Installer → Select Enterprise Edition →Typical install → enter SID for the database → Install	20 mins	The installation was on a FAT file system.
Management framework setup	1. Configuration of the Management framework: launch Enterprise Manager Configuration Assistant → select all defaults to create a new repository and configure OMS 2. Create an OS user with the Logon as Batch privilege 3. Setup database and node credentials: select Preferences→ Preferred Credentials and enter username/password for Node (the user in step 2) and Database	12 mins	N/A		In Oracle 10*g*, configuration of the management framework is part of the software install step and is performed automatically.

Task 2: Create additional instance

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Create a new database instance	1. Launch DBCA from the Start Menu → select to create new database → general Purpose (default) → Enter Database SID→ Finish	8 mins	1. Launch DBCA from the Start Menu → select to create new database → general Purpose (default) → Enter Database SID→ Finish	8 mins	

Task 3: Event monitoring: Set up pro-active monitoring for memory, space, etc., utilization

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Create task to monitor for performance problems and space issues	1. In the Enterprise Manager Console right click on Events → Create Event. →Select database to monitor, add Performance tests: *Buffer Cache %, Instance Activity* Add space event test *Tablespace Full*	1 min	N/A		Oracle provides both performance and space alerts out-of-the-box in Oracle 10*g*.
Set thresholds for each event, save event, and start monitoring database	1. Click the 'Parameters' tab. Enter parameters for each event test: • Buffer Cache Hit %, use defaults • Tablespace Full, use defaults. Click the "Register and save to Library" button.	1 min	1. Go to the Manage Metrics" page (EM home page, click on the "Manage Metrics" link). 2. Click the "Edit Threshold" button. This takes you to the "Edit Thresholds" page. Set threshold for *Buffer Cache Hit (%)*.	1 min	Tablespace space alerts are pre-set with defaults in Oracle 10*g*.

Installation and Simple "Out-of-Box" Setup Tasks Summary

Metrics	Oracle9i	Oracle 10*g*
Time (minutes)	45	29
Steps	7	4

Day-to-Day Database Administration Tasks
Task 4: Create user, assign roles and privileges

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Create User and Assign Quotas	1. From EM select Security Management→ User →Right Click select "Create User" Property Sheet Enter user name Enter Password Grant it a DBA role →Create	1 min	1. Go to the *Administration* tab and click on *Users* link. Click the Create button and enter username, password, and role for the new user. Click *OK*.	1 min	

Task 5: Space Management: Create tablespace

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Create table-space	1. From EM → Storage → Tablespaces →Provide name → Create	1 min	1. Go to the *Administration* tab and click on *Tablespaces* link. Click the Create button and enter tablespace name, data file name, and size. Click *OK*.	1 min	

Task 6: Space Management: Add more space to the tablespace

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Add more space	1. From EM → Storage → Tablespaces→ Select to Edit/Alter tablespace EXAMPLE → Select one datafile→ Enter new file size →OK	1 min	1. Go to the *Administration* tab and click on *Tablespaces* link. Select EXAMPLE tablespace and choose the *Add Datafile* option and click *GO*. Enter new file name and size. Click *OK*.	1 min	

Task 7: Schema object management: Create table

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Create table	1. From EM → Schema → Table → Launch Create Table Wizard and enter name, column, data types, for 3 columns (number, varchar2, date) → Create	2 mins	1. Go to the *Administration* tab and click on *Tables* link. Click *Create* button. This launches wizard for table creation. Enter name, columns, data types for 3 columns (number, varchar2, date), and click *OK*.	2 mins	

Task 8: Schema object management: Create index

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Create Index	1. From EM → Schema → Index → enter table name and columns → Create.	1 min	1. Go to the *Administration* tab and click on *Indexes* link. Click *Create* button. This launches index creation page. Enter name, table name, and columns. Click *OK*.	1 min	

Task 9: Reclaim wasted space from tables with fragmented data

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Determine if any tables in the EXAMPLE tablespace have wasted space that should be reclaimed.	1. Create a script that looks at DBA_TABLES view to compare the total space allocated for each object (BLOCKS * DB_BLOCK_SIZE) in EXAMPLE tablespace to the estimated space used by the object (AVG_ROW_LEN * NUM_ROWS) 2. Review script output and identify target objects for reorganization	10 mins (est)	1. Run Segment Advisor on the EXAMPLE tablespace. 2. Accept recommendation.	3mins	In Oracle9i, since the process if identifying tables with wasted space is a manual process, a very conservative estimate was made for the time needed to perform this step.
Set up and schedule the reorganization	1. Identify scratch tablespace to store temporary data. 2. Select the table to reorganize in tablespace analysis window → Click the 'Reorganize Selected Segments' icon to launch Reorg Wizard.	2 min	N/A		In Oracle10*g*, reorganization is done in-place eliminating the need for a scratch tablespace. Also, segment advisor allows users to implement the recommendation by a single click (completed earlier) thereby removing the need for additional steps.

Task 10: Undo retention tuning

Task	Oracle9i			Oracle 10*g*		Remarks
	Step	*Time*		*Step*	*Time*	
Tune Undo Retention	1. Find out the length of the longest running query (select maxquerylen) from v$undostat) 2. Set Undo_Retention = longest running query 3. Find out the size of Undo tablespace needed to support undo_retention setting in steady state (select max(undoblks) * 8 * undo_retention/600 + overhead) 4. Allocate sufficient space to Undo tablespace (alter tablespace add datafile '…' size xxx ;)	5 mins		N/A	0	In Oracle 10*g*, undo retention tuning is automatic.

Task 11: Export a mid-size table

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
A 900M table with 20 million rows is exported	1. Exported table using the following command: exp cc/cc file=packageclis_direct.dmp rows=y tables=packageclis2 direct=y	2 mins	1. Export table using Data Pump with the following command: expdp cc/cc include=table:\"=\'PACKAGECLIS\'\" dumpfile=expdp.dmp directory=pumpCreate	2 mins	

Task 12: Import a mid-size table from an export file

Task	Oracle9i		Oracle 10g		Remarks
	Step	_Time_	_Step_	_Time_	
A 900 MB table with 20 million rows is imported	1. Import table using the following command: imp cc/cc@t2 file=packageclis.dmp rows=y tables=packageclis2	10 min	1. Import table using Data Pump impdp cc/cc dumpfile=expdp.dmp directory=pump	2 mins	

Day-to-Day Database Administration Task Summary

Metrics	Oracle9i	Oracle 10g
Time (minutes)	35	13
Steps	15	9

Backup & Recovery Tasks
Task 13: Configure and Perform Full Database Online Backup

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Configuring for online backup	1. Schedule regular online backups (EM → Tools → Database Wizards → Backup Management → launch Backup Wizard)	2 mins	N/A		Backup job is automatically configured in Oracle 10*g* at the time of database creation.
Perform backup	1. Submit job (EM → Job → Job Library → submit job)	1 min			

Task 14: Perform Full Database Point-in-Time Recovery

The recovery scenario in this task is that a critical application schema was dropped. This required that the entire database be recovered to a point in time just prior to the drop of the schema.

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Full db point-in-time recovery	1. From EM → Databases → Instance → Configuration, mount the database. 2. From EM → Tools → Database Wizards → Backup Management, launch the Recovery Wizard and perform full database point-in-time recovery. 3. From EM → Databases → Instance → Configuration, open the database	11 min	1. Recover the database using Flashback Database: Go to the EM *Maintenance* tab and click *Perform Recovery* link. This launches Recovery Wizard. Choose recovery type "Whole Database", supply preferred credentials, select Flashback Database option to perform point-in-time recovery.	2 min	

Task 15: Recover dropped table

The scenario in this task is to recover a 1.4 GB table, PACKAGECLIS, which was mistakenly dropped.

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Tablespace PITR recovery.	1. TSPITR will be performed here. Prepare an auxiliary instance by first creating an Oracle Password file. 2. Create parameter file for auxiliary instance. 3. Start auxiliary instance in NOMOUNT mode using SQL*Plus 4. Using RMAN interface perform TSPITR. 5. Using RMAN connect to target database and bring tablespace in question online. 6. Shutdown the auxiliary instance. 7. Delete auxiliary instance data files, control files, and redo log files.	14 min	1. Recover table using "FLASHBACK TABLE <table_name> TO BEFORE DROP" command.	1 min	

Task 16: Perform Datafile Recovery

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Datafile Recovery: application data file of size 1.2 Gigs is lost.	1. From EM → Tools → Database Wizards → Backup Management → Launch Recovery utility, specify data file to be recovered.	7 mins	1. Go to the EM *Maintenance* tab and click on *Perform Recovery* link. This launches the Recovery Wizard. Click through the wizard hit *Finish* button.	7 mins	

Task 17: Recover from Erroneous Transaction

The recovery scenario in this task deals with an erroneous transaction where an order was deleted by mistake from the ORDER ENTRY (OE) table.

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Transaction Recovery	1. Identify redolog/ archivelog that has trsansaction information. 2. Add the archivelog to LogMiner 3. Start LogMiner 4. Query LogMiner contents. 5. Identify transaction SQL and rewrite it to undo its effect. 6. Run the undo script.	11 min	1. Go to the tables page in EM (*Administration* → *Schema* → *Tables*), select the INVENTORIES table and select *Action* "Flashback by Rows Versions", and click *Go* button. This shows the operations performed on the INVENTORIES table. 2. Identify the operation performed (DELETE in this case) and click on the *Transaction ID* link to see what other tables were affected by the same transaction. This also gives the exact SQL needed to undo the entire transaction. 3. Execute the undo SQL identified in step 2.	7 min	

Backup & Recovery Task Summary

Metrics	Oracle9i	Oracle 10*g*
Time (minutes)	46	17
Steps	19	6

Performance Diagnostics & Tuning Tasks

Task 18: Generate Optimizer Statistics

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Look for objects with no optimizer statistics	1. From EM → Reports → Double click on "Schema Objects without Statistics" → Generate report for database.	1 min	N/A	0 min	Oracle 10*g* does not require manual management of optimizer statistics.
Collect optimizer statistics for tables	1. From EM → Database → Schema → Table→ Right Click on a table → Select Analyze to launch Analyze Wizard. 2. Select tables to be analyzed.	2 mins	N/A		Oracle10*g* automatically gathers optimizer statistics.
Schedule statistics collection	1. Specify schedule to collect statistics every Sunday night at 10PM.	1 min	N/A		

Task 19: Diagnose performance problem

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Diagnose performance problem.	1. Examine CPU utilization to identify if system CPU bound. 2. Analyze wait events and identify event most waited upon. 3. Identify SQL results in the wait identified above using EM drilldowns.	6 min	1. Go to the last ADDM report.	1 min	

Task 20: Fix Performance Problem: Tune Resource-Intensive SQL
In this task the performance problem identified in task 18 is remedied. The problem
identified in task 18 was that SQL statement was consuming most of the system resources
and hence, needed tuning.

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Tune high load SQL	1. From EM's SQL Analyze tool, select the most resource intensive SQL and then launch SQL Tuning Wizard. The wizard rewrites the query and tunes it. 2. Launch the Virtual Index Wizard to see if addition of indexes will help improve performance.	3 mins	1. Run SQL Tuning Advisor on the SQL identified in the previous task. 2. Accept recommendations.	2 mins	

Task 21: Memory Tuning

Task	Oracle9i		Oracle 10*g*		Remarks
	Step	*Time*	*Step*	*Time*	
Tuning SGA	1. Launch the Buffer Cache Advisor to find the right setting for Buffer Cache (EM → Databases → Instance → Configuration → Memory → click the Buffer Cache Advice button). 2. Change the buffer cache value to the new value by clicking the memory tab in database configuration section, and apply the change. 3. Launch the Shared Pool Advisor to find the right setting for Shared Pool (EM → Databases → Instance → Configuration → Memory → click the Shared Pool Advice button). 4. Change the Shared Pool value to the new value by clicking the memory tab in database configuration section, and apply the change.	4 mins	1. Check ADDM report. 2. Change SGA_TARGET and/or PGA Target based on ADDM advice.	2 min	

Tuning SQL Execution Memory	1. Launch the PGA Advisor to find the right setting for Aggregate PGA Target (EM → Databases → Instance → Configuration → Memory → click the Aggregate PGA Advice button). 2. Change the Aggregate PGA Target value to the new value by clicking the memory tab in database configuration section, and apply the change.	2 mins			

Performance Tuning Task Summary

Metrics	Oracle9i	Oracle 10*g*
Time (minutes)	19	7
Steps	16	6

Overall Task Summary

Table 5 below summarizes the results of the tests performed.

Table 5: Task Results Summary

Task	Description	Time		Steps	
		Oracle9i	*Oracle 10g*	*Oracle9i*	*Oracle 10g*
Installation and Simple "Out-of-Box" Setup					
1	Install db/software/out-of-box setup	35	20	4	1
2	Create database instance	8	8	1	1
3	Setup proactive monitoring	2	1	2	2
	Category Sub-Total	45	29	7	4
	% difference -- (9i - 10g)/9i	36%		43%	
Day-to-Day Database Administration					
4	Create user with roles, privileges	1	1	1	1
5	Create tablespace	1	1	1	1
6	Add space to tablespace	1	1	1	1
7	Create table	2	2	1	1
8	Create index	1	1	1	1
9	Reclaim wasted space from tables	12	3	4	2
10	Undo retention tuning	5	0	4	0
11	Export	2	2	1	1
12	Import	10	2	1	1
	Category Sub-Total	35	13	15	9
	% difference -- (9i - 10g)/9i	63%		40%	
Backup & Recovery Tasks					
13	Configure and perform full backup	3	0	2	0
14	Perform full db point-in-time recovery	11	2	3	1
15	Recover dropped table	14	1	7	1
16	Datafile recovery	7	7	1	1
17	Recover from erroneous transaction	11	7	6	3
	Category Sub-Total	46	17	19	6
	% difference -- (9i - 10g)/9i	63%		68%	
Performance Diagnostics & Tuning Tasks					
18	Generate optimizer stats	4	0	4	0
19	Diagnose performance problem	6	1	3	1
20	Fix performance problem: SQL Tune	3	2	2	2
21	Memory tuning (SGA/PGA)	6	2	6	2
	Category Sub-Total	19	5	15	5
	% difference -- (9i - 10g)/9i	74%		67%	
	Overall Total	**145**	**64**	**56**	**24**
	% difference -- (9i - 10g)/9i	56%		57%	