How Toad® DBA Edition Complements Oracle Enterprise Manager 13c

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ABSTRACT

If you use Oracle technologies, you may be relying on Oracle Enterprise Manager (OEM) to manage your clouds, applications and databases. But if you're responsible for multiple environments with hundreds of databases as well as Oracle Real Application Clusters (RACs) and Oracle Exadata, then OEM alone will not enable you to do your job effectively.

Toad® for Oracle DBA Edition can help, complementing OEM by delivering critical functionality in three key areas: performance management, database maintenance and change management. By contrasting how DBAs can use Toad for Oracle DBA Edition and OEM for common tasks in each of these three areas, this technical brief illustrates how using Toad alone, or both solutions together, can simplify Oracle database management and improve DBA productivity.

ABOUT TOAD FOR ORACLE DBA EDITION

Toad was one of the first Oracle integrated development environments of its kind. Written in 1995 by a developer for use by developers, Toad for Oracle is now used by two million people worldwide, including not only developers, but also DBAs, analysts, managers, support engineers and many others. Toad's highly active community bears testimony to the enthusiasm of Toad's loyal user base and the value they find in the product.

Toad for Oracle DBA Edition simplifies and automates common database administration tasks so DBAs can become more proactive and solve database-related performance issues before users are impacted. It provides a complete solution for DBAs who are using Oracle Database Standard Edition or who work in smaller shops where OEM is not being used; it also functions as a complementary solution for DBAs using Oracle Database Enterprise Edition and OEM. DBAs can use Toad for Oracle to manage Oracle databases on-premises and in the cloud.

Toad's agentless architecture ensures a quick, lightweight installation and easy maintenance.

COMPONENTS

Toad for Oracle DBA Edition comprises the following components:

- **Toad for Oracle Xpert Edition** (includes SQL Optimizer for Oracle for automated SQL tuning)
- **Benchmark Factory® for Databases (Oracle Edition)** — Benchmark scalability testing and workload replay
- **Toad Data Modeler** — Cross-platform physical and logical data modeling
- **Spotlight® on Oracle** — Real-time performance diagnostics (including Spotlight on Windows and Unix/Linux)

RAC AND EXADATA

Toad supports monitoring of RAC and Exadata environments with Toad for Oracle DBA - RAC Edition and Toad for Oracle DBA – Exadata Edition. OEM supports RAC and Exadata environments with OEM 13c Cloud Control.

The Toad for Oracle DBA Edition addresses three key areas of database administration:

- **Performance management** — Offering real-time performance diagnostics and database and SQL optimizationor
- **Database maintenance** — Managing users, database health checks (including security as it relates to user Oracle accounts and permissions), and task automation and scheduling
- **Change management** — Managing configuration changes, schema changes and database workload replay testing

Key differentiators

- Toad for Oracle DBA Edition does not use Oracle Enterprise Edition Management Packs by default.
- Toad's agentless architecture ensures a quick, lightweight installation and easy maintenance. It is especially useful in environments with multiple databases spanning different geographic locations. OEM Cloud Control, on the other hand, has stringent networking requirements, so organizations with databases in different locations must have multiple local Cloud Control installations.
- Toad for Oracle DBA Edition is offered with a seat-based license, thereby providing diagnostics support for unlimited databases.

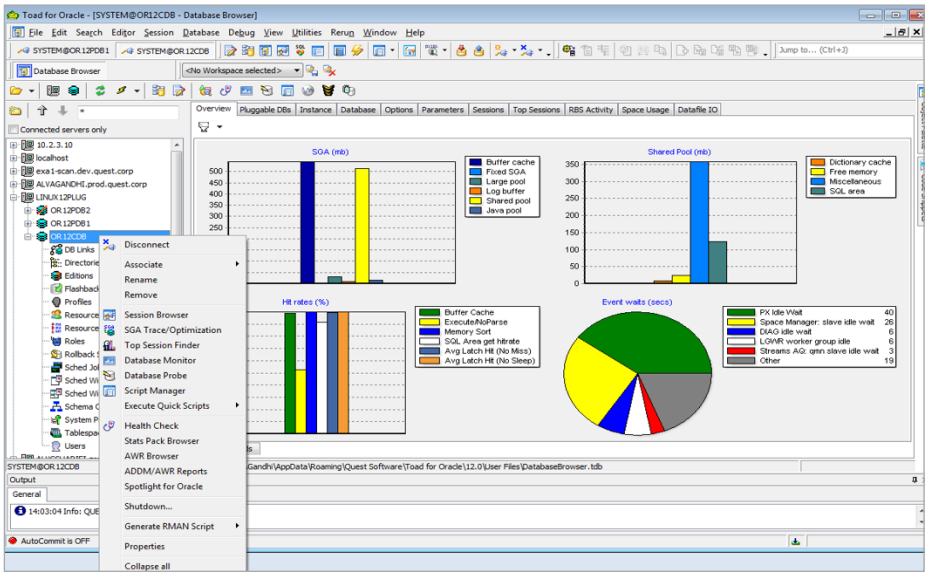

Figure 1. Toad for Oracle DBA Edition

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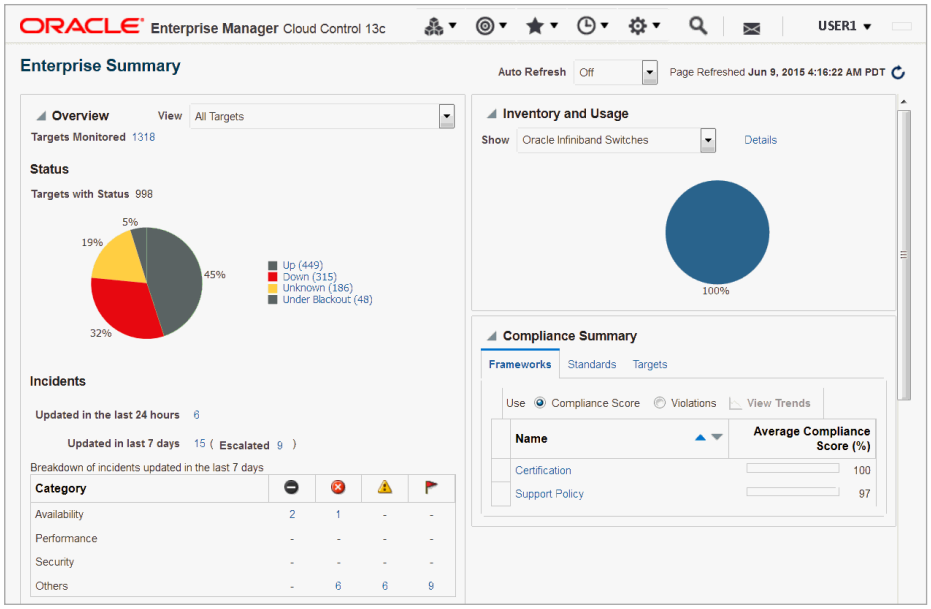

Figure 2. OEM Cloud Control 13c. (source: docs.oracle.com/cd/E63000_01/EMCON/overview.htm#CJAJFJIB)

ABOUT ORACLE OEM CLOUD CONTROL

The full Oracle OEM Cloud Control 13c combines all aspects of cloud-based and traditional infrastructure management into one integrated solution. This leads to several distinct menu structures, which can complicate navigation and hamper effective administration of database-related issues.

Now let's compare how to complete some common tasks using OEM and Toad for Oracle DBA Edition, focusing on three key areas: performance management, database maintenance and change management.

Toad is agentless and easy to install compared with OEM.

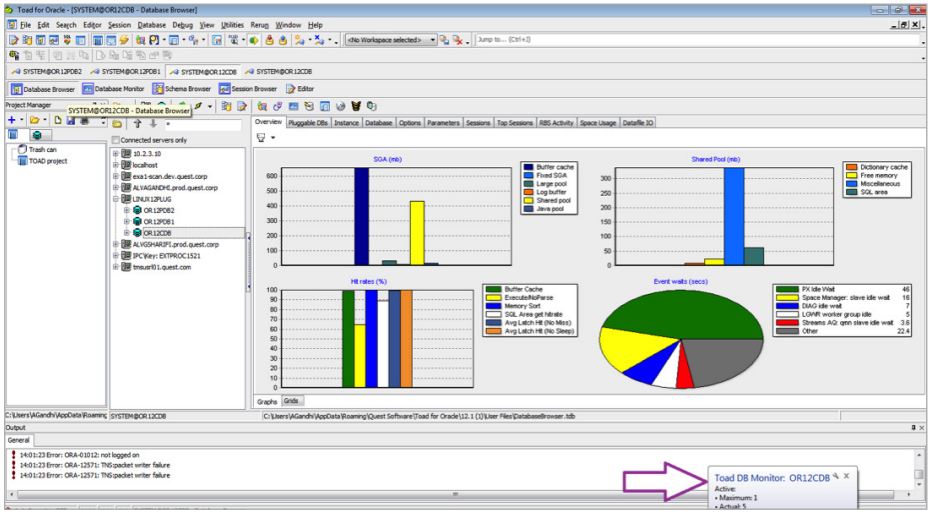

Figure 3. Toad's Database Monitor provides alerting which can initiate a launch of Spotlight

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PERFORMANCE MANAGEMENT

For a performance management comparison with Toad for Oracle DBA Edition, you will need, in addition to the OEM 13c console, two management packs that are available at extra cost:

- Diagnostics Pack — Offers automatic performance diagnostics and monitoring (required for any kind of performance monitoring)
- Tuning Pack — Offers automatic SQL tuning for applications

With Toad, you don't have to wait for users to complain. Instead, you can proactively set up alerts in Toad's Database Monitor for I/O, memory and wait events.

Example 1: Diagnosing a performance problem with a user application

Let's start with a simple example in which a user's application isn't responding. There could be any number of reasons for this problem; the DBA needs to quickly and effectively pinpoint the root cause and decide on the corrective action.

Using Toad for Oracle DBA Edition

With Toad, you don't have to wait for users to complain. Instead, you can proactively set up alerts in Toad's Database Monitor for I/O, memory and wait events. When you see an alert in the tray icon bar, you can launch Toad for Oracle DBA Edition's Spotlight on Oracle component for the deeper analysis of the issue.

Spotlight makes pinpointing the root cause of the problem simple. For instance, in the overview screen, you may see that "changes per second" is orange or red, as shown in Figure 4.

Once Toad has alerted you to the problem, take the following steps:

1. Click on the **changes per second** flow. A Lock Wait alarm pop-up opens (see Figure 4).
2. Click the **"Blocking Locks" drilldown link**. The detail screen provides additional information, including which session is holding the lock and which one is requesting it.
3. Click on one of the sessions to see the actual DML statement the session wants to execute, including the explain plan if possible. If desired, you can terminate the session causing the block from the current screen.

Using OEM

OEM offers no visual indicator when there is locking in any of your database environments. Instead, you must:

1. Wait for a user to report the problem.
2. Navigate to the Database home page.
3. From the Menu, choose **Performance —> Blocking Sessions.**
4. For extremely slow or unresponsive databases, click the menu option **Performance —> Real-Time ADDM**. Initiate the findings session and stop it. Then analyze the "Findings" and "Hang Data" tabs.

Figure 4. Spotlight on Oracle identifying a lock wait

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5. You might find it more interesting to go to the Performance tab. It shows you that there is a problem with "active sessions." Drill down and voila, there is the "session detail"; but nothing about the blocking session. You can drill down to find the actual SQL statement, including an explain plan.

6. Only if you explicitly go to the menu "Hang Analysis" will you see that there are two sessions with a blocking waiting lock. Again, drilling down gives some more details.

But how long does it take to come to the right conclusion?

Summary

With Spotlight's visual dashboard, efficient navigation and the persistence of context through to problem resolution, you can quickly find the root cause of application performance problems. Spotlight enables you to see what is happening in your Oracle databases in real time; drill down in context to obtain more information about the problem; and cross reference what you find with other views, such as user sessions. Spotlight even provides targeted expert advice, if necessary.

It is simply not possible to achieve the same real-time, smooth navigation and root cause analysis as efficiently by using OEM. With Spotlight, DBAs can be more effective and more proactive, so they can deliver a better user experience.

Example 2: Tuning SQL

Now let's assume that you suspect that a performance problem is SQL statement-related, but you are not sure which statement in the application is causing the issue.

Using Toad for Oracle DBA Edition

Again, with the Spotlight on Oracle component in Toad for Oracle DBA Edition, you can drill down into the root cause from the home page. There's no need to copy and paste the SQL statement you identify as a likely culprit into an editor so you can begin figuring out what to do, Instead, Spotlight provides a launch point to another component of the Toad for Oracle DBA Edition: SQL Optimizer for Oracle.

Spotlight's Top Sessions screen identifies the SQL statement causing the performance bottleneck, and a button on the screen enables you to launch SQL Optimizer to resolve the problem (see Figure 5).

SQL Optimizer's unique artificial intelligence optimization engine automatically transforms the original SQL statement into multiple semantically equivalent rewrites, and then rewrites those until there are no possibilities left (within user-configurable limits) and all the rewrites have unique execution plans.

SQL Optimizer's unique artificial intelligence optimization engine automatically transforms the original SQL statement into multiple semantically equivalent re-writes.

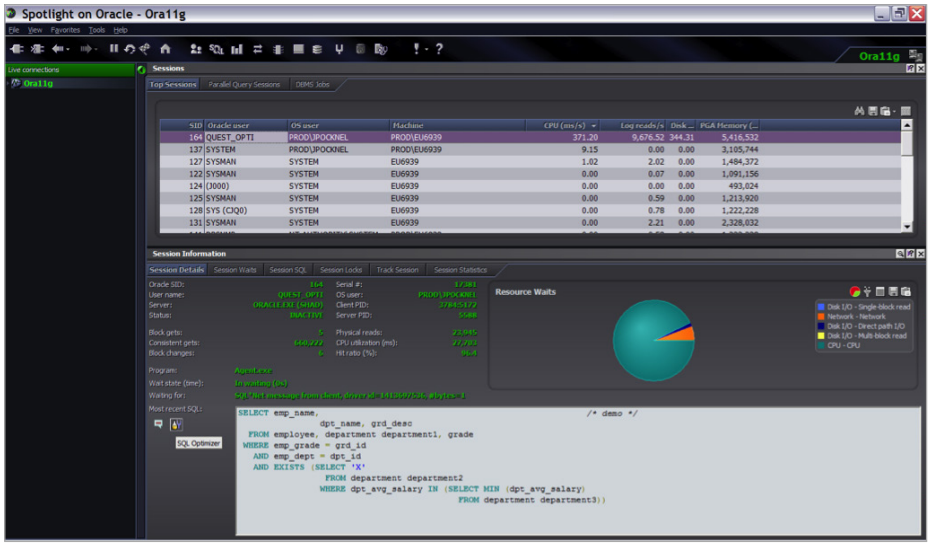

Figure 5. Spotlight on Oracle's Top Sessions screen shows the most CPU-intensive SQL and enables you to easily launch SQL Optimizer for Oracle.

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Multiple SQL statements and code can be fed into the Batch Optimizer for downstream optimization.

Information such as plan cost enables the DBA to make an informed decision as to which SQL statements to execute in order to get a measure of actual performance improvement compared to the original statement, as you can see in Figure 6.

This workflow here is also extremely productive, especially in a dynamic landscape where SQL statements are being continuously executed and you need a quick and decisive way to identify, diagnose and resolve performance problems while still maintaining control over how the best probable solution is implemented.

If you are using a packaged application or dynamic SQL, a rewrite may not be possible. Therefore, SQL Optimizer also offers the Plan Control method: SQL Optimizer looks for an alternate execution plan that is likely to improve execution time, and then enables you to deploy the plan into the Manage Plans module. This method is available only with Oracle 11g and higher because it uses Oracle's SQL Plan Management feature (available in Oracle EE). If you are using an earlier version of Oracle, you can use Stored Outlines instead.

SQL Optimizer also offers an even more efficient way to perform SQL optimization: the Batch Optimizer. The backend process is the same as described above, but multiple SQL statements and code can be fed into the Batch Optimizer (rather like a conveyor belt) for downstream optimization. This process frees DBAs from becoming involved with the optimization of each statement; they simply look at the results and decide which optimized statement to use in each case.

Using OEM

OEM together with the SQL Tuning Advisor takes an entirely different approach.

The most significant difference, especially on a production database, is that with OEM, the problematic SQL statement has to have actually been executed before it can be tuned. Here are some other key differences:

- SQL Tuning Advisor does not rewrite your code; it only offers suggestions for code changes, which the DBA must implement manually.
- SQL Tuning Advisor does not find all the rewrites, test the SQL or figure out which alternative is best.

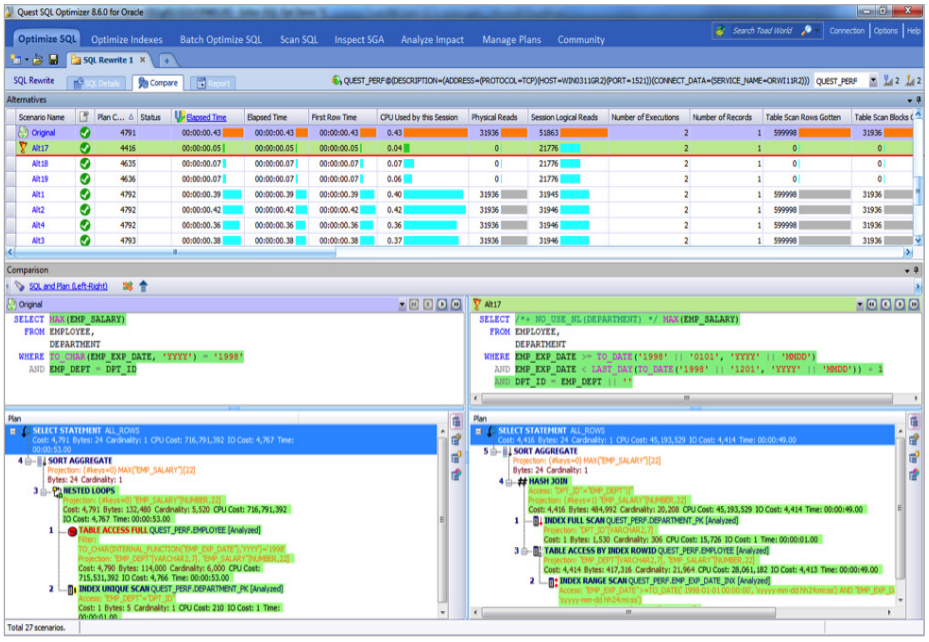

Figure 6. SQL Optimizer compares the original SQL against the best alternative.

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- SQL Tuning Advisor offers a more advanced plan analysis mode that can generate a better execution plan than the normal optimization mode. This advanced mode provides additional tasks like checking for advanced predicate selectivity, correlation between columns, join skews, and complex predicates such as functions, which help profile the SQL statement. Once a statement is profiled and stored, it can be used at will.
- With OEM, you can monitor long-running SQL statements using **Performance** —> **SQL Monitoring** in Database home page. You can drill down into the SQL and PL/SQL based on the execution plans and the waits.
- OEM also has a feature called SQL Repair Advisor, which a DBA can run in the rare event that a SQL statement fails with a critical error. The advisor analyzes the statement and in many cases recommends a patch to repair the statement. If the DBA decides to implement the recommendation, the applied SQL patch circumvents the failure by causing the query optimizer to choose an alternate execution plan for future executions.

Example 3: Index analysis

Sometimes DBAs need to look to options other than a SQL rewrite. In particular, sometimes an index offers a better alternative, especially if the DBA needs to collectively improve the execution performance of more than one SQL statement.

Using Toad for Oracle DBA Edition

The SQL Opitmizer component of Toad for Oracle DBA Edition makes this task easy, without unnecessarily stressing the database, through the use of single SQL indexing or workload-based indexing.

In the case of workload-based indexing, you can instruct SQL Optimizer to gather SQL from an application workload during a specified time period. SQL Optimizer evaluates your SQL workload and recommends a set of indexes to optimize database performance for that workload. After this evaluation process is complete, you can review the results and then select the new indexes you want to save and test.

SQL Optimizer evaluates your SQL workload and recommends a set of indexes to optimize database performance for that workload.

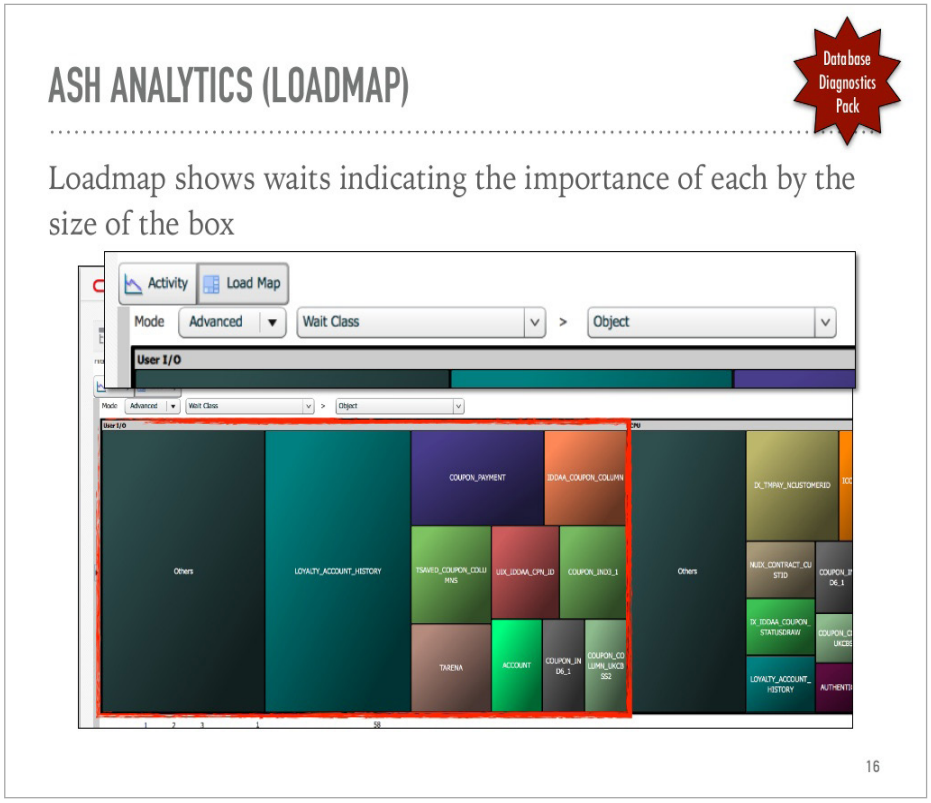

Figure 7. OEM's ASH Analytics Load Map screen showing a heatmap of all monitored databases (source: slideshare.net/gokhanatil/oracle-enterprise-manager-cloud-control-13c-for-dbas)

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With SQL Optimizer, you can perform an execution plan comparison without actually building the proposed index.

You can instruct SQL Optimizer to gather a SQL workload from any of the following sources:

- Oracle Automatic Workload Repository (AWR)
- Foglight for Databases repository
- Oracle System Global Area (SGA)
- Scan source code for SQL statements

After setting the appropriate options in terms of workload reduction goals, the evaluation process is initiated after which you can review the results to determine the performance improvements.

With SQL Optimizer, you can perform an execution plan comparison without actually building the proposed index. If full execution statistics are required before the DBA makes a decision, an index creation script is generated, run (to collect the stats) then the index is dropped afterwards. The script is saved for possible future use.

Using OEM

OEM provides a feature called the SQL Access Advisor, which also uses the concept of a workload, which would typically include a group of SQL statements. A critical difference, however, is that all the SQL statements must have already been executed in the database.

The workload source can be selected from one of the following:

- Current and recent SQL activity (stored in cache)
- Existing SQL tuning set (from SQL Tuning Advisor)
- A user-defined workload
- A hypothetical workload based on selected tables and schemas

Recommendations can be based on indexes, materialized views or partitioning. Once the submitted job is complete, graphs show workload I/O cost improvements and query execution time improvement. Where indexes are recommended, the DDL script is generated and can be scheduled or run.

It is worth repeating that SQL Access Advisor's recommendations can be made only after execution on the database. There is no opportunity to do a "what-if" analysis.

Performance management summary

For performance management tasks, Toad for Oracle DBA Edition enhances the DBA's productivity by starting with the big picture across all managed databases. From there, the DBA can use Toad's components to drill down, layer by layer, to find the root cause of a performance slowdown and implement a

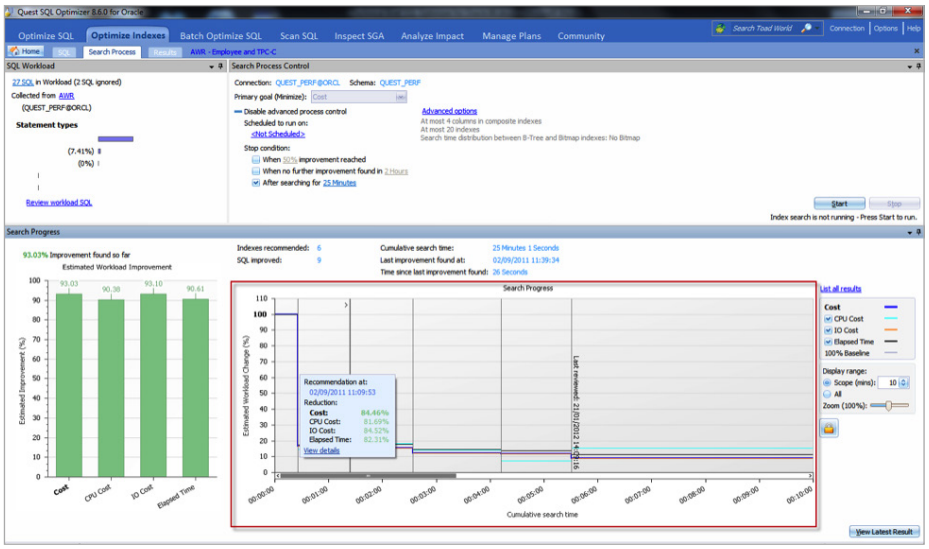

Figure 8. A paused index optimization showing (in the graph) workload reduction over time and where index recommendations were made. You can pause/stop the search process at any time.

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solution. In addition to the Spotlight functionality already described, Toad for Oracle DBA Edition includes additional features to help pinpoint performance-related problems, including Trace File Browser, Top Sessions and Session Browser and Database Health Check.

OEM's big picture, on the other hand, is limited to only one database at a time. In addition, OEM requires the DBA to have more experience in order to understand and correctly interpret what's presented in order to determine the exact cause of a problem. Implementing the most appropriate solution also requires experience. There are, however, certain tasks that OEM provides that Toad for Oracle DBA Edition was not designed to give, such as database configuration advisories and longer historical collection.

Toad for Oracle DBA Edition, therefore, is a worthy complement to OEM. It provides the DBA with faster and more effective methods of problem identification and resolution while minimizing the impact to production systems, especially when time and accuracy matter or when the DBA just requires a second opinion when it comes to SQL tuning.

DATABASE MAINTENANCE

Database maintenance includes tasks DBAs routinely perform, such as running scripts, generating reports, assessing security threats, and comparing schemas and databases. It also includes reactive tasks like managing Oracle user accounts, changing schema object permissions, and generating schema or object DDL scripts.

Naturally, organizations want to reduce the time DBAs must spend on database maintenance. Let's look at how to accomplish some typical tasks in Toad for Oracle DBA Edition and Oracle OEM.

Example 1: Creating a table similar to an existing table

First let's assume that a DBA wants to create a table similar to an existing one.

Using Toad for Oracle DBA Edition

With Toad for Oracle DBA Edition, creating a table similar to an existing one is simple:

1. Open the Schema Browser.
2. Click the Table tab.
3. Right-click the table.
4. Select **Create Like.**

OEM SQL Access Advisor's recommendations can be made only after execution on the database. There is no opportunity to do a "what-if" analysis.

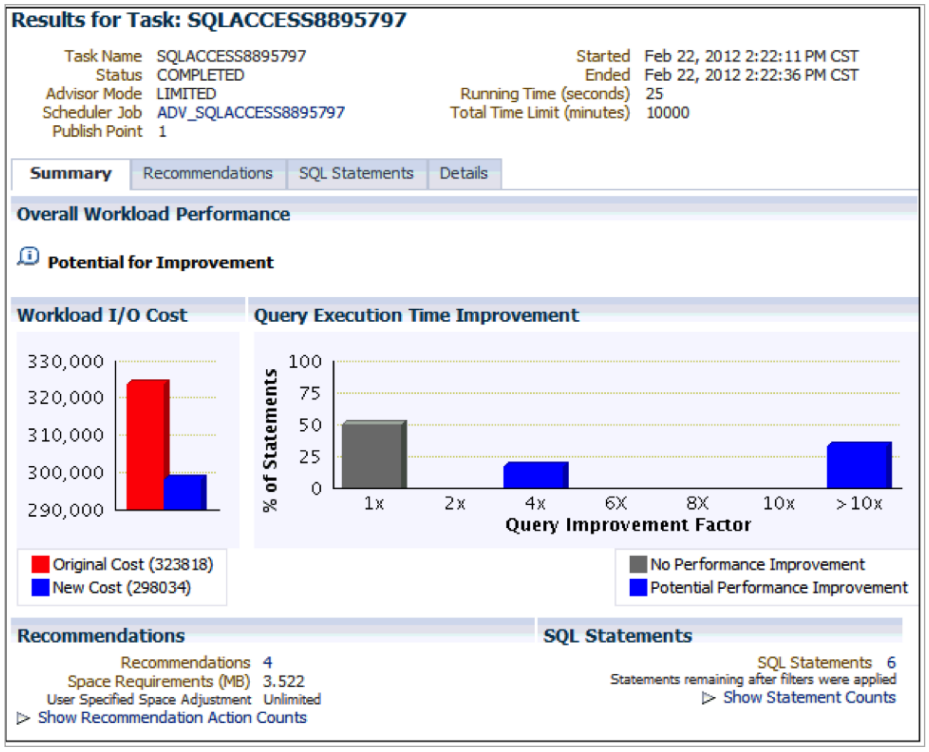

Figure 9. SQL Access Advisor results in OEM Cloud Control

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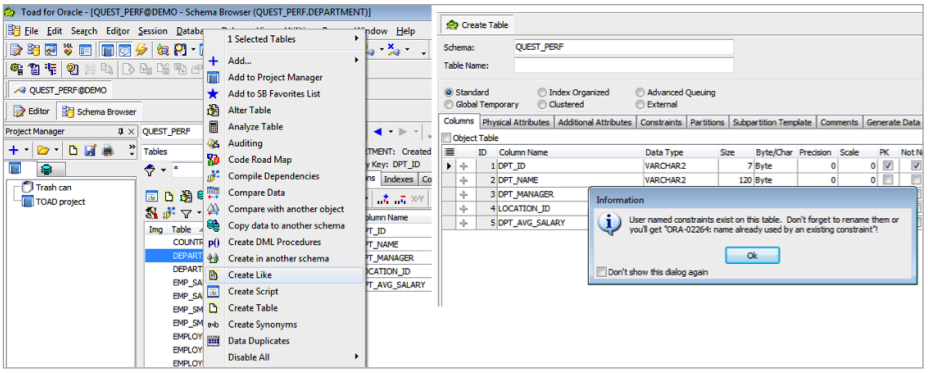

Figure 10. Toad makes it easy to create a new table that is similar to an existing table.

With Toad for Oracle DBA Edition, creating a table similar to an existing one is simple.

5. Notice the warning regarding the use of user-named constraints.

Using OEM

OEM is built to manage cloud-based and traditional databases over a web interface, so each function is a hypertext link that launches a new web page:

1. Targets (new page)
2. Databases (new page)
3. Instance (new page)
4. Administration (new page)
5. Schema Tables (new page)
6. Search (popup page)
7. Select Schema
8. Select the original table, use "Actions create like," and click GO.

After specifying the table name, you might want to create a duplicate table. But that's not possible because you are using the same names for the constraints (no warning is given). Clicking the execution (OK) button results in the error message "ORA-02264 name already used by an existing constraint."

Example 2: Getting an overview of all your databases

Now suppose you want to look at overviews of your managed databases. It is very common to have more than one database running on the same host, so you will likely want to have an overview of information such as the data files, memory layout or top sessions.

Using Toad for Oracle DBA Edition

With Toad for Oracle DBA Edition, information about all of your managed databases is combined in a single place, the Database Browser (see Figure 11).

1. Open the Database Browser from the main toolbar.
2. Click on your host and view all the details for all the databases using the tabs on the right-hand side.

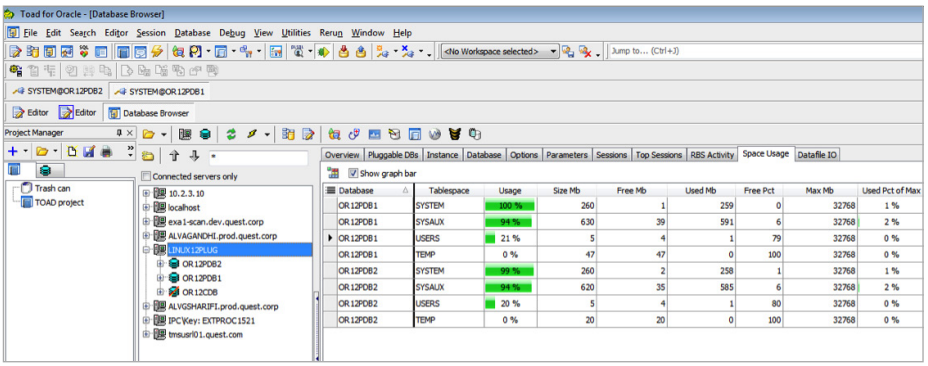

Figure 11. Toad's Database Browser provides a clear overview of multiple databases running on the same host.

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Access to both database objects and schema objects is provided in the navigator on the left-hand side, so you no longer need to open a separate Schema Browser window.

Using OEM

1. In OEM, you first have to navigate to the Database Home Page.
2. Clicking CPU gives you some information about the top sessions but not about the layout.
3. The memory layout can be found at Databases —> Administration —> Memory.
4. The tablespace layout is under Databases —> Administration —> Tablespaces.

Yes, everything is available, but keep in mind that you are working with a web browser, so navigation always launches new screens. Therefore, while OEM provides a lot of the same information as Toad, the navigation is very complex, costing you lot of time to find the root cause of a problem.

Feature comparison

OEM database maintenance features not available in Toad

- Recovery Manager (RMAN) repository (catalog) management
- Administration of Data Guard (standby database) (note that Spotlight on Oracle provides Data Guard alarms on the primary connection)
- Database cloning (Toad can clone Oracle 12c PDBs and push them to an Oracle database in the Oracle Cloud.)
- Streams and advanced replication management
- Conversion to cluster databases
- Administration of flashback recovery area and archiving
- Summary Advisor (management of materialized views)

Toad database maintenance functions not available in OEM

- Many features related to data, including browse, generate, subset, export/import, and report
- Management of user accounts without scripts (available in OEM Database Express – Security – Users (Menus)
- Editor (OEM has an interface to iSQL*Plus, but that product is no longer supported.)
- Compare and synchronize schemas (available in OEM but only with the add-on Lifecycle Management Pack)
- Comparison of objects (users, tables, PL/SQL, tablespaces and so on), including objects on other ODBC-compatible database platforms
- DBMS flashback, which performs a flashback to a version of the database at a specified wall-clock time or a specified system change number (SCN) (uses the DBMS_FLASHBACK package)
- Flashback data archive
- Desktop task scheduling — OEM enables the DBA to schedule tasks on the server, but Toad allows you to schedule many tasks using the Windows Task Scheduler, including schema compare, database health check, script execution and reporting
- Task automation — Toad's Automation Designer lets you sequence a group of tasks (such as those listed for desktop task scheduling) and run them against multiple managed databases, rather than having to run them separately for each database — a huge time savings
- Database Health Check, including database security vulnerabilities
- Database and schema reporting
- Script management
- Log Switch Frequency Map

Database maintenance summary

Toad dramatically increases the DBA's productivity by providing a single, collective view of all managed databases, instead of one database at a time, with the ability to drill down and perform database maintenance tasks in a consistent, efficient way. Task automation and scheduling allow many tasks that would otherwise be repetitive to be executed without the DBA's direct involvement, thus freeing the DBA up to work on other important projects.

OEM lets the DBA perform some of these tasks, but productivity is significantly slower due to navigational inefficiencies. Plus, OEM offers no opportunity to perform multiple tasks against multiple databases.

Toad's Automation Designer lets you sequence a group of tasks and run them against multiple managed databases, rather than having to run them separately for each database — a huge time savings.

Toad's Compare Schemas is a built-in task that enables you to select source and multiple target schemas all in the same window.

CHANGE MANAGEMENT

For change management in Oracle, you will need the following in addition to OEM:

- **Diagnostics Pack** — Offers automatic performance diagnostics and monitoring.
- **Tuning Pack** — Offers automatic SQL tuning for applications.
- **Database Lifecycle Management Pack** (formerly known as Change Management Pack) — Enables you to compare schema changes before and after an application upgrade.
- **Real Application Testing (RAT)** — Offers workload capture and replay together with SQL performance analysis.

Toad for Oracle DBA Edition includes a number of features specifically targeted towards change management, including configuration changes, schema changes and database workload replay testing.

Example 1: Comparing a development schema with a test schema

Let's start with a simple example where you need to compare a development schema with a test schema to see if they are synchronized. Synchronizing schemas is essential when performing testing or when a new iteration of changes needs to be carried out by development to ensure nothing gets lost and code continues to work as it was intended.

Using Toad for Oracle DBA Edition

Note that Toad for Oracle DBA Edition does not require the OEM Database Lifecycle Management Pack.

Toad's Compare Schemas is a built-in task that enables you to select source and multiple target schemas all in the same window. To access Compare Schemas, click **Select Database | Compare | Schemas** from the Toad menu.

You can run the schema compare using the Oracle Data Dictionary or using Toad offline snapshots (.def). Snapshot files are encrypted and can be used as baselines since they contain all the object definitions in the schema. They will prevent unauthorized access to the underlying objects and dramatically reduce the time taken to run future comparisons. Snapshot files can also be used as restore points to roll back to a point in time if something goes wrong. Plus, storing snapshot files in version control provides an audit trail of schema changes over time.

The Schema Compare window (see Figure 12) contains multiple tabs (Schema, Options, Object Set, Results and Sync Script) so you can do everything from this one window.

Compare Schemas will even report on two tables that are structurally the same but have a different number or rows of data.

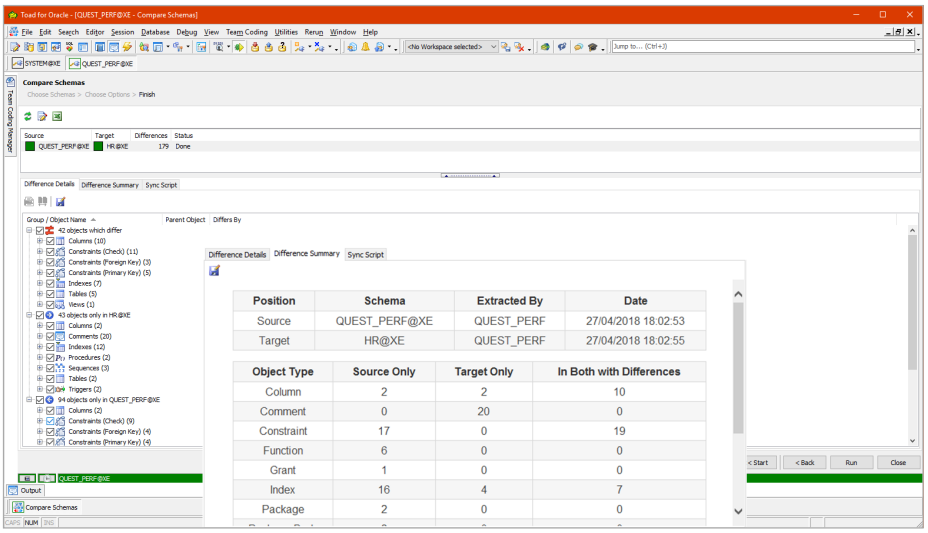

Figure 12. Compare Schemas showing a sync script for a selected object

Toad for Oracle v13.0 includes a Compare Multiple Schemas feature for situations where the DBA needs to compare the same schemas between, say, a production database and a test database.

Toad for Oracle DBA Edition includes a data modeling component called Toad Data Modeler, which can perform both logical and physical data modeling for most database platforms. One of its principal features is to compare two versions of the same physical data model — one with pending changes and the other a snapshot of production (after reverse engineering) — and create an Alter script. The DBA can review this script and apply the changes to production

Using OEM

OEM's Database Lifecycle Management Pack is a comprehensive solution that helps database, system and application administrators automate the processes required to manage the Oracle database lifecycle. It eliminates manual, time-consuming tasks related to discovery, initial provisioning, patching, configuration management, ongoing change management and disaster protection automation.

Schema compare is one function this pack offers, but performing a schema compare, especially if the schemas are on the same database, involves many steps.

You first need to have created a schema baseline that represents the state of the schema currently in use, say in production. You can then either compare this baseline with another baseline representing the planned changes or compare directly against the database.

Either process uses a wizard and involves a number of steps which need to be repeated each time you want to perform a schema compare.

The Database Lifecycle Management Pack lets you compare and synchronize a single object or the whole schema, or compare databases. Change plans can be used to deploy changes from a single source to multiple targets. Table data can also be compared.

An alternative to using OEM to perform this task would be to use SQL Developer. SQL Developer version 3.1 and higher includes a Database Diff feature that is independent of the OEM Database Lifecycle Management Pack, and the steps are fewer and easier to follow, especially for a simple schema compare operation.

Example 2: Database workload replay testing

For this example, we will look at something which is becoming of more interest to DBAs: database workload replay testing.

Databases are constantly changing, due to increased activity or workload, application changes, patch releases, database upgrades, hardware upgrades, and so forth. The DBA has to be sure that the database can accommodate these

The Toad Data Modeler component can perform both logical and physical data modeling for most database platforms.

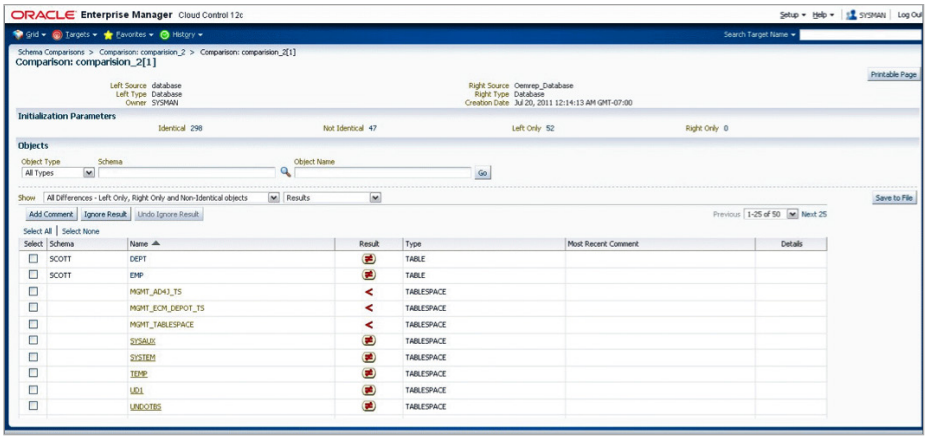

Figure 13. OEM Schema Comparison screen showing the detailed differences between two schemas (source; http://docs.oracle.com/cd/E24628_01/em.121/e27046/change_management.htm#DAFBFCHI)

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Benchmark Factory can be used for database workload replay, database server benchmarking and application scalability testing.

planned changes in order to maintain application response times and service levels

Using Toad for Oracle DBA Edition

Toad for Oracle DBA Edition includes a component called Benchmark Factory for Databases, a database load testing and scalability tool which supports Oracle versions 10g R2 through 12c. Benchmark Factory can be used in three ways:

- **Database Workload Replay** — Captures and plays back workloads on a test database to replicate the execution of production transactions.
- **Database server benchmarking** — Compares database platforms so you can better plan for patches, database upgrades, hardware upgrades, and so on; based on industry standards such as TPC-C, TPC-H and TPC-E.
- **Application scalability testing** — Helps development predict likely performance in a production environment of PL/SQL code, SQL statements, scripts, and so on.

Let's look at database workload replay in more detail.

Benchmark Factory enables you to capture a recording of your data and activity, and then steps you through replaying it on the same or another instance. This can be done using Oracle Trace Files or by choosing the Fine Grained Access Control (FGAC) option which provides improved accuracy. You can additionally filter out the activity by user, module, program, etc. Benchmark Factory supports Oracle versions 10g R2 through 12c and requires no Oracle OEM Management Packs. The software will even work on Oracle Database Standard Edition.

A wizard steps you through the process of collecting your data and transactions. Once completed, it allows you run that activity against that data on any instance of Oracle.

You have the option of using Statspack or Automatic Workload Repository (AWR) to generate performance reports. Statspack is free; AWR will require licensing.

Using OEM

Oracle's database workload replay solution (available from Database 11g) is called Real Application Testing (RAT) and is available as an option only with Oracle Enterprise Edition. RAT can be used to capture, analyze and replay database transactions. During replay, RAT can maintain the original transaction concurrency, timing and dependencies. RAT is quite complex, so for the purposes of simplicity, I will just give you an overview of how it works.

RAT consists of two main components:

- **Database Replay** — Captures production workload and replays it on a different system, such as a test system.
- **SQL Performance Analyzer** — Identifies SQL execution plan changes and performance regression (see Example 3).

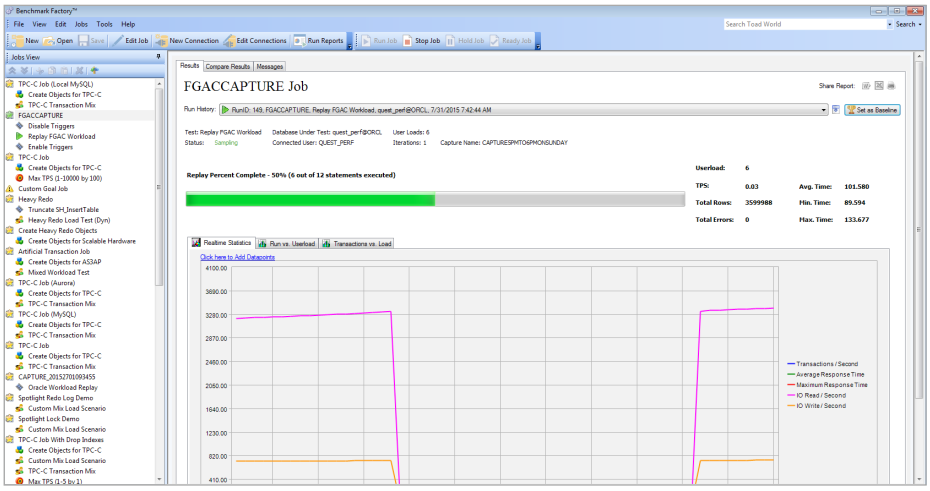

Figure 14. Toad for Oracle DBA Edition's Database Workload Replay

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There are four main steps in RAT:

1. Workload capture (from the production system):
   - Capture is available from Oracle version 9i and up (according to Oracle's website)
   - There are a variety of workload filters, including user, program, module, session ID and time period
2. Workload preprocessing:
   - Transforms the captured data into a replayable format
3. Workload replay, which maintains the following:
   - Any timing and concurrency characteristics
   - The transaction commit order
   - The same number of user connections
4. Analysis and reporting:
   - Analysis can be performed via AWR, Active Session History (ASH) and Automatic Database Diagnostic Monitor (ADDM)
   - AWR diff report can compare original performance to replayed performance

Example 3: Performance regression

In Example 2, we used production transactions and replayed them in test environment to simulate what might happen when making a planned change.

In this final example, let's look at how to assess the impact of a planned change on the database and also determine whether performance regression has taken place after the change has been made. Performance regression may well result after planned changes such as a different indexing strategy, database parameter changes, an Oracle patch or a database upgrade.

Impact analysis and performance regression testing through comparison of "before" and "after" is vital to understanding these effects before a change is implemented in production.

Using Toad for Oracle DBA Edition

Toad has two approaches to enabling DBAs to assess what happens when a change is planned:

- Static — Toad's SQL Optimizer component can compare the execution plans for a group of SQL statements within a selected workload before and after the planed change on the database — without actually executing them.
- Dynamic — Toad's Benchmark Factory for Oracle can play SQL transactions (workload) in a test environment in order to assess whether performance regresses.

Benchmark Factory enables you to take a snapshot of your data and activity, and then steps you through replaying it on the same or another instance.

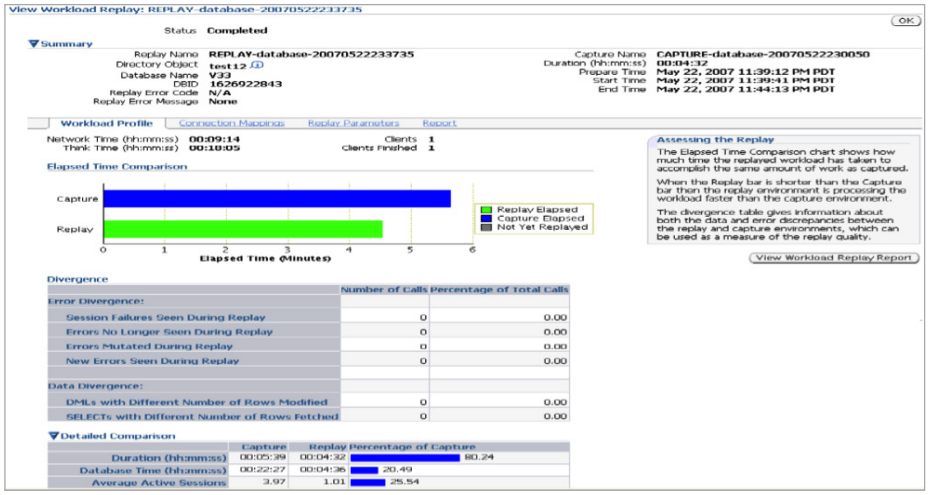

Figure 15. Oracle RAT Workload Replay results screen

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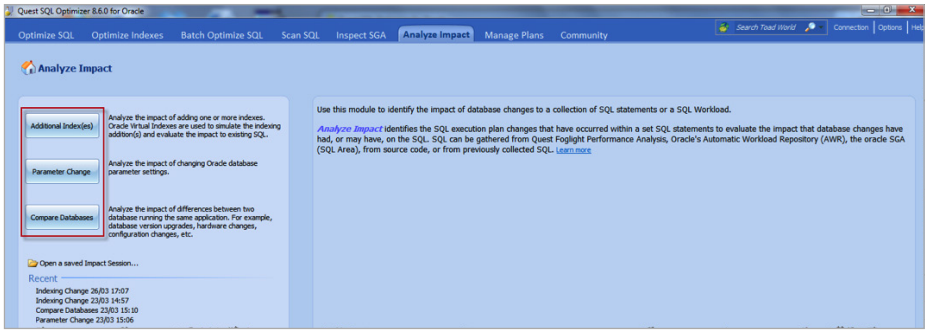

Figure 16. SQL Optimizer's Analyze Impact

Toad's SQL Optimizer component can compare the execution plans for a group of SQL statements within a selected workload before and after the planned change on the database — without actually executing them.

Let's take a look at each approach.

Toad's static approach

The SQL Optimizer component in Toad for Oracle DBA Edition, offers and Analyze Impact feature that lets you compare the execution plan changes to identify potential performance variations for a selected workload in scenarios such as:

- Index changes
- Database parameter change
- Comparison of two database instances as a result of a migration, upgrade or deployment

Previously saved impact analysis sessions can be reopened.

In order to provide a more representative assessment of the environment in which you want to review the impact of your planned changes, SQL Optimizer allows you to gather actual SQL workload from one of several sources:

- Oracle Automatic Workload Repository (AWR) (requires Oracle licensing)
- Foglight Performance Analysis repository
- Oracle System Global Area (SGA)
- A scan of the source code for SQL statements

In any case, you can easily specify criteria for the SQL workload you want to collect in order to filter out any unwanted SQL.

After gathering the SQL statements from your selected source, SQL Optimizer allows you to easily review and modify your SQL workload before running the analysis. You can review all your SQL statement statistics and execution plans from one screen.

Once the impact analysis is complete, SQL Optimizer displays a report that shows whether your planned change is likely to have a positive or negative impact on database performance based on your selected workload.

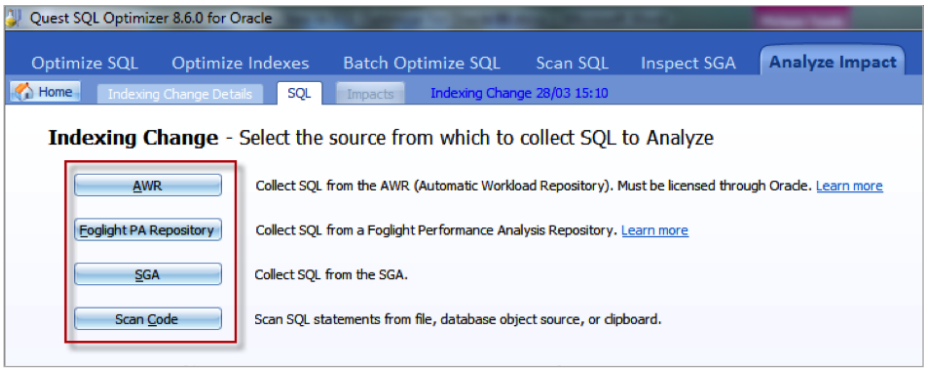

Figure 17. Selecting the workload source containing the SQL

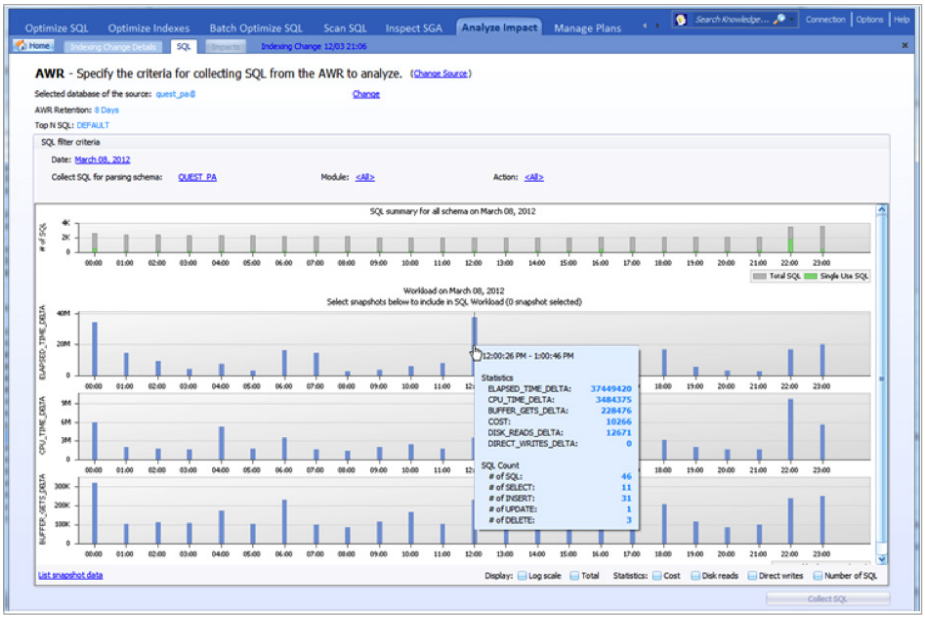

Figure 18. Specifying the SQL collection criteria from an Oracle AWR snapshot

Toad's dynamic approach

For regression testing, Toad for Oracle DBA Edition's Benchmark Factory for Oracle component can generate reports showing transaction performance versus user load to show whether performance regressed compared to that before the planned change was made.

In addition, the Spotlight on Oracle component can be used to determine, in real time, where performance bottlenecks may be occurring as a result of performance regression.

Using OEM

Oracle's approach is slightly different since it cannot perform a static impact analysis. SQL statements have to be executed first in order to have something which can be compared.

RAT contains a component called SQL Performance Analyzer, which uses a approach similar to Toad for Oracle DBA Edition and enables you to perform impact analysis of changes such as schema, database configuration, patches, and so on. The major difference is that, for index analysis, you have to perform the actual impact analysis on a test server since Oracle must build the recommended indexes first.

You can easily specify criteria for the SQL workload you want to collect in order to filter out any unwanted SQL.

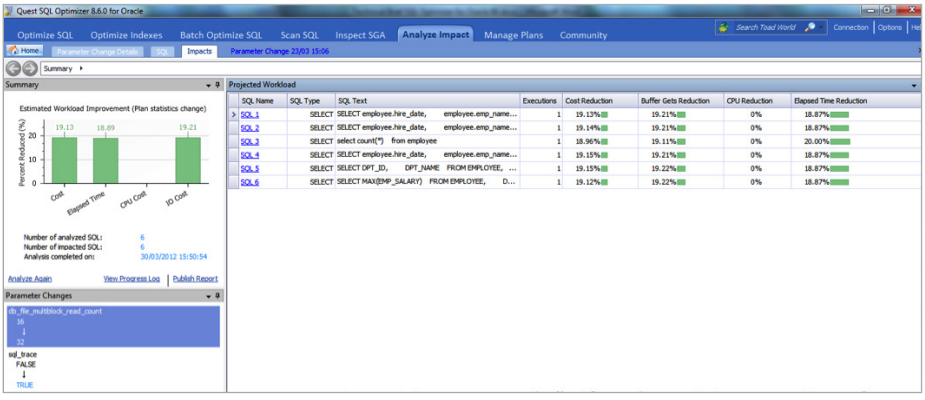

Figure 19. SQL Optimizer's Impact analysis on-screen report based on a planned database configuration change

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Benchmark Factory can play SQL transactions in a test environment in order to assess whether performance regresses.

SQL Performance Analyzer uses its RAT Replay technology and captures SQL execution performance stats in what are called SQL Tuning Sets (STSs). To be completely effective, you must use SQL Performance Analyzer in conjunction with OEM and the Management Packs listed earlier.

The basic idea is that you capture a workload (with all the transactions) via STS from production while the application is running and is being accessed by users. You then post the STS to your test database and execute everything in order to establish a baseline. You then manually implement all the planned changes you are intending to apply to production (patches, hardware, upgrades and so on) and re-execute all the SQL. Finally, you compare and analyze the performance against the baseline and a report shows which SQL statements regressed as a result of the changes.

SQL Performance Analyzer also lets you compare execution plans and execute SQL statements and time them.

SQL Tuning Advisor is used to help implement any alternative SQL statements. This cycle can be repeated over the life of the application as further changes are made.

Change management summary

For change management tasks, Toad for Oracle DBA Edition provides greater depth in some areas (such as impact analysis) than is available in Oracle OEM, across a wider range of platforms. Moreover, Toad is simple to use, thereby minimizing the amount of interpretation the DBA has to do. And you get all of this at a significantly lower cost.

Schema change management is much simpler in Toad than OEM owing to its tried-and-tested Schema Compare and Sync technology, which does not rely on OEM's Database Lifecycle Management Pack. If you require a full database compare, the Database Lifecycle Management Pack includes non-schema database objects. In Toad, Database Compare and Schema Compare are two separate operations, with Database Compare providing comparison for non-schema database objects but also other items not included in OEM (such as Initialization Parameters and Directories). However, Toad for Oracle DBA Edition offers the DBA two possible ways to generate a schema sync script depending whether their company uses data modeling technology.

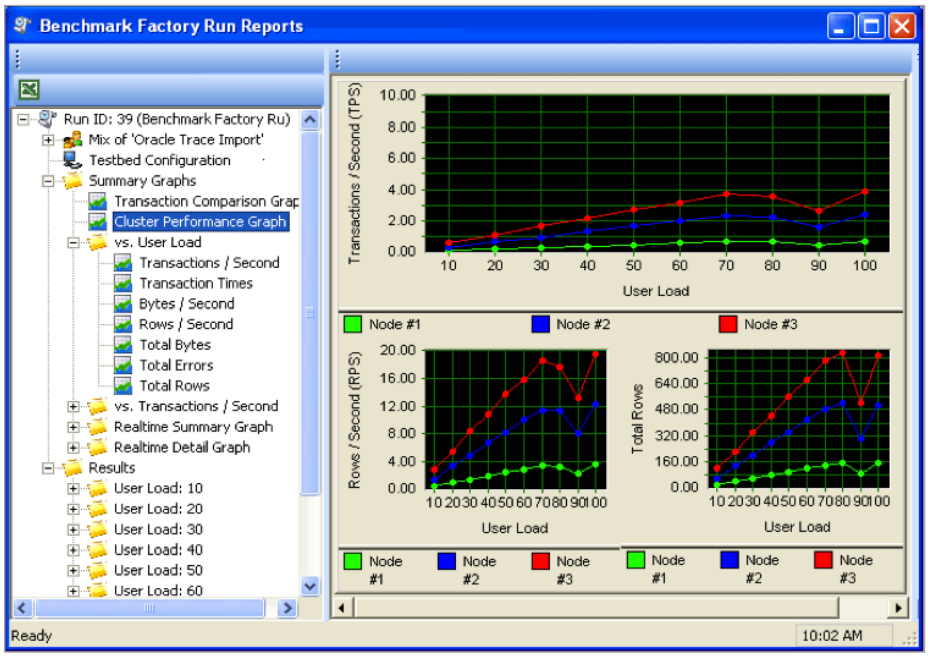

Figure 20. Benchmark Factory's Results screen showing Transaction Time vs User Load after a planned Oracle RAC configuration change

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The Toad Data Modeler component in Toad for Oracle DBA Edition is a full data modeling solution which can generate a deployment script simply by comparing the development data model with a reverse-engineered model of the production schema.

The SQL Optimizer technology in Toad for Oracle DBA Edition is far more advanced in terms of its SQL rewriting and index advice technology as well as its ability to perform what-if analysis compared to OEM's more "black-box" approach to SQL tuning.

The Benchmark Factory workload replay technology in Toad for Oracle DBA Edition is simpler to use, being based on established Oracle trace file technology as well as the newer Fine Grained Access Control and is integrated with Toad, but may involve additional work if extensive use of bind variables are used.

Oracle's RAT technology essentially recreates the whole production environment and so is a better representation, but there is no opportunity to make adjustments to user load or perform any other form of what-if analysis.

CONCLUSION

Toad for Oracle DBA Edition augments the capabilities of Oracle OEM 13c by providing a lightweight, easy-to-use and comprehensive tool for administration, performance diagnostics and tuning, and change management.

Filling the gaps of OEM

- Toad for Oracle DBA Edition offers a single view of all the servers and databases the DBA is managing and serves as the launch point to task execution.
- Toad offers easy-to-use features like Schema Compare and Sync and Database Workload Replay. To get similar functionality in OEM, you have to purchase the Lifecycle Management Pack and Real Application Testing at additional cost.

Simplifying what is difficult in OEM

- Browsing data is difficult in OEM. Toad offers many ways to easily access and report on data.
- Use of OEM in small to medium businesses is challenging. Just setting up OEM, for example, requires specialized resources to handle the complexities. Toad for Oracle DBA Edition, by contrast, can be easily implemented in just hours for many key tasks, making it an excellent investment.
- Toad for Oracle DBA Edition features root-cause diagnostics and SQL optimization to help DBAs quickly determine the correct course of action in each situation.

Extending what OEM offers

- There are many valuable features in Toad that are simply not available in OEM.
- Toad can automate many of the manual, repetitive tasks DBAs have to perform on a routine basis.
- Toad for Oracle DBA Edition can enable less experienced DBAs to quickly become proficient, enabling them to add more value to the team.

Toad for Oracle DBA Edition provides an excellent complement to Oracle OEM 13c with Database Enterprise Edition, and provides a comprehensive database management solution for organizations using Oracle Database Standard Edition.

ABOUT THE AUTHOR

John Pocknell is a senior product manager at Quest Software. Based at the European headquarters in the U.K., John is responsible for the strategy and roadmap for the Toad portfolio of products worldwide. He has been with Quest Software since 2000, working in the database design, development and deployment product areas, and has run many Toad training courses for customers. John has spent over 17 years successfully evangelizing Toad to customers at various events around the world and he writes many blogs and papers on the Toad user community, Toad World as well as technical papers about Toad on the Quest Software website.

John has worked in IT for more than 30 years, most of that time in Oracle application design and development. He is a qualified aeronautical engineer with more than 10 years of experience in provisioning IT consultancy services and implementing quality assurance systems to ISO 9001.

Toad's Spotlight on Oracle component can be used to determine, in real time, where performance bottlenecks may be occurring as a result of performance regression.

ABOUT QUEST

At Quest, our purpose is to solve complex problems with simple solutions. We accomplish this with a philosophy focused on great products, great service and an overall goal of being simple to do business with. Our vision is to deliver technology that eliminates the need to choose between efficiency and effectiveness, which means you and your organization can spend less time on IT administration and more time on business innovation.

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