Performance Tuning using the SQLAccess Advisor

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Executive Overview ................................................................. 3
Introduction .................................................................................. 3
How to Use the SQLAccess Advisor ........................................... 3
  Templates .................................................................................. 4
Selecting the Workload ............................................................. 5
  Using the SQL Cache ............................................................... 6
  SQL Tuning Set ....................................................................... 6
  Hypothetical Workload ........................................................... 6
  User-Defined Workload .......................................................... 6
Filtering the Workload ............................................................... 6
What is to be Recommended ..................................................... 7
Generating the Recommendations ............................................. 8
Conclusion .................................................................................... 10
EXECUTIVE OVERVIEW

Probably every DBA or person responsible for managing a computer system, would like to improve query response times and the throughput of their system. However, as anyone who has ever tried to do this will tell you, it is not easy. This white paper introduces the SQLAccess Advisor in Oracle Database 10g, which helps you tune your database by recommending indexes and materialized views.

INTRODUCTION

There are many techniques that can be used to tune a computer system, some involve changing the hardware and many involve software changes; at the operating system, application and database level.

The problem when tuning a database is that when it is performed manually, it can be quite a time-consuming operation, typically taking days and if it proves to be a challenge, weeks or even months to achieve optimum performance. A major concern is that as you are tuning, are you using a representative example of how the database is actually being used. If not, then you may be creating objects that will not improve system response time.

If you have explored all of the traditional tuning options, and performance could still be improved, then consider using the SQLAccess Advisor in Oracle Database 10g, which will recommend indexes and materialized views to create, retain or drop based on the supplied workload. Alternatively, if you are just starting out building a new system and you are not sure which indexes or materialized views you may need, then the SQLAccess Advisor can help here also.

HOW TO USE THE SQLACCESS ADVISOR

The SQLAccess Advisor is run from Advisor Central in Enterprise Manager, as shown in Figure 1. There are a number of advisors that can be launched and monitored from here, as their tasks are executing. The screen at Advisor Central does not refresh automatically, there regularly click on the refresh button near the top right of the screen so that you know you are seeing the latest status.
There are only a few steps that have to be completed in order to generate recommendations. All the information about this tuning process, such as what is to be tuned, the recommendations and actions are held inside a task and in Enterprise Manager, the task is simply a storage mechanism that only requires a name to get started.

Since there is no limit to the number of tasks that you can create, it is possible to create tasks to model a number of different scenarios. For example, you could configure one task to represent your daily environment, another task for your overnight batch work and then compare the recommendations from each task to see if they have anything in common. Tasks do not have to be deleted; therefore you can build up a view of your system over a period of time and can compare a task that represents your typical daily activity now, to one that you created say six months ago and see if anything has changed.

**Templates**

The SQLAccess Advisor is supplied with several default templates, where the template defines all the rules as to how the recommendations are to be generated such as which mode to use, whether only indexes are to be created, how the new objects should be named etc. There is a extensive list of task parameters that are described in the Data Warehousing Guide.

When you define a task then it can be saved as a template, to be used in the future for another task, which can be very useful when you may want to modify the tuning parameters for a task slightly differently, to see if that has any effect on the recommendations. Templates are only accessible and can be selected if you are using the command line interface for the SQLAccess Advisor.
Selecting the Workload

Obtaining a good set of recommendations from the SQLAccess Advisor is very dependent on having a representative workload for your system. Database tuners will tell you that this is one of the most challenging aspects of database tuning, as gathering this data is not easy.

The SQLAccess Advisor allows the following workload sources:

- Current contents of the SQL cache
- User-defined via a table containing SQL statements
- SQL Tuning Set from the Workload Repository
- Hypothetical workload, by referencing schemas(s) in the database
- Oracle 9i Summary Advisor workload (command line only)
- Manually add SQL statements to a workload (command line only)

With all these workload sources, the database tuner now has plenty of opportunity to gather a representative workload for the tuning process.

In Figure 2 we see the first screen in the SQLAccess Advisor where the workload source is specified.
Using the SQL Cache

When the SQL cache is selected the entire contents are extracted, minus any SQL statements that refer to Oracle owned objects, such as those in SYS or SYSTEM. Additionally, if your database contains schemas for multiple applications, then you may need to filter the workload by clicking on the Show Advanced Options link.

SQL Tuning Set

Within Server Manageability there is a repository of workloads, which are known as SQL Tuning sets. The SQLAccess Advisor can select any one of these and since they can be created from problems identified by the other Advisors and Top SQL, they can be an excellent workload source to use for tuning.

Hypothetical Workload

If your system is being initially designed, then you may not have any workloads available. In this case, you can use the hypothetical workload, where you specify one or more schemas, and from their structure, the SQLAccess Advisor will generate what it thinks a workload may represent.

User-Defined Workload

There are times when you may already know the SQL statements that will comprise your workload and you can specify them manually. Perhaps you extracted the SQL generated from your tool or even wrote it by hand. If you place these SQL statements in a table, it can then be used to create a workload.

There is a specific format for the user-defined tables, which is described in the Data Warehousing Guide. This table contains many columns, but it is not necessary to specify a value for every column.

Filtering the Workload

Depending on the source of the workload, it is very easy to create one that contains far more data than you require, especially if it comes from say the current contents of the SQL cache. In this scenario, if you have many applications running, then you would extract SQL statements for all of those applications, but you may be only interested in tuning some of them. Therefore all workloads can be filtered by any of the following:

- Application or module name
- Number of SQL statements
- Only queries during a specified time window
- User who executes the statements
- Tables that either must or must-not be referenced in a query
What is to be Recommended

Once the workload exists, a set of recommendations can then be generated and in Figure 3 we see how this is done from within Oracle Enterprise Manager. Here we have the ability to say what type of recommendations types are required, only indexes, only materialized views, or both.

Next there is also the ability to say in which mode the advisor should run, limited or comprehensive. Depending on the complexity of the workload, the number of possible solutions with respect to the indexes and materialized views that could be created can be quite significant. There are times, when you may not be interested in looking at all of these solutions and only considering the most important ones. This can be achieved by using the limited mode. Results will be shown quicker and then the SQLAccess Advisor can be run again in comprehensive mode to see if any additional recommendations are possible.

Figure 3 SQLAccess Advisor Recommendation Options

Clicking on the Advanced Options shown in Figure 3 will also allow you to specify any number of other criteria during the recommendation process which includes:

- space restrictions that the recommendations must work within
- default tablespace and schema into which the indexes and materialized views will be placed
- specify the priority to be used for tuning the SQL statements such as average elapsed time or average disk reads
- whether to include drop recommendations that drop objects
Generating the Recommendations

Once all of the information has been supplied the recommendations can be generated. In Enterprise Manager, a job will be submitted and its progress can be monitored from Advisor Central which is shown in Figure 1.

Once the recommendations have been generated, they will remain until the task is deleted, which by default is 30 days. Thus giving the database tuner plenty of time to review the suggestions from the SQLAccess Advisor. This means that the recommendation process can be repeated many times, trying different workloads and options to see what effect this has on the suggested recommendations.

When the SQLAccess Advisor is used from within Enterprise Manager, the recommendations can be viewed by:

- Recommendations by workload cost benefit
- SQL Statements by workload cost benefit

This gives the database tuner the ability to see which recommendations will give the best improvement to the workload or individual SQL statements can be viewed to see how they can be specifically tuned, and the impact that will have on system performance.

Below in Figure 4 we see the Recommendations by Workload Cost Benefit. In this example we can see that there are 6 recommendations, where the improvement to the workload will be between 3% and 19%.

**Figure 4** Recommendation by Workload Cost
Instead, you may prefer to view the recommendations with respect to the SQL statements in the workload.

**Figure 5 Recommendation by SQL statement**

This view is shown in Figure 5, and we can see how each of these SQL statements can be improved. Although this example shows a one-to-one mapping between SQL statements in the workload and recommendation, the SQLAccess Advisor recommendations can be used by multiple SQL statements.

Any of these links can be selected, to view more detailed information. For example, selecting recommendation 3, we can see in Figure 6, what the SQLAccess Advisor is proposing, which is both a materialized view and an index to improve the performance for this query. Clicking on `CREATE MATERIALIZED VIEW` will then display the actual statement.
The SQLAccess Advisor first makes its recommendations, and then it lets you decide whether to implement all of its recommendations, or only some of them, or none. This is achieved by simply selecting the recommendations you require using either of the screens shown in Figure 4 or Figure 5.

At this stage, you have a choice on how to implement the recommendations. If you prefer to do it yourself, then the SQLAccess Advisor will generate a SQL script for you to use. You can then edit this if required, to match your company standards for data naming etc and then implement it at your leisure.

Alternatively, you can schedule a job in Enterprise Manager and it will execute the script to implement these recommendations.

CONCLUSION

The SQLAccess Advisor provides a very easy to use interface to help tune your systems. There are only a few steps to follow and since it requires very little system knowledge you can obtain recommendations without spending a lot of time gathering information or learning how to use the advisor. Since all data can be retained, it enables you to build up a library or workloads and recommendations, so you can see over a period of time, whether the patterns of usage of your systems are changing. Anyone who has to tune a database should consider using the SQLAccess Advisor because its so simple and quick to use. You may even find that it discovers a part of your system needed tuning that you never even thought was a problem.