A Framework for Automated Database TuningUsing Dynamic SGA Parameters and Basic Operating System Utilities

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In present scenario the manual work (Done by Human) cost more to an organization than the automatic work (Done by Machine)and the ratio is increasing day by day as per the tremendous increment in Machine (Hardware + Software) Intelligence. We are moving towards the world where the Machines will be able to perform better than today by their own intelligence. They will adjust themselves as per the customer's performance need. But to make this dream true, lots of human efforts (Theoretical and Practical) are needed to increase the capability of Machines to take their own decision and make the future free from manual work and reduce the working cost. Our life is covered with the different types of systems working around. The information system is one of them. All businesses are having the base by this system. So there is the most preference job of the IT researcher to make the Information system self-Manageable. The Development of well-established frameworks are needed to made them Auto-tuned is the basic need of the current business.The DBMS vendors are also providing the Auto-Tune packages with their DBMS Application. But they charge for these Auto-Tune packages. This extra cost of packages can be eliminated by using some basic Operating system utilities (e.g. VB Script, Task Scheduler, Batch Files, and Graphical Utility etc.).

We have designed a working framework for Automatic Tuning of DBMS by using the Basic Utilities of Operating System (e.g. Windows) .These utilities will collect the statistics of SGA dynamic Parameters. The Framework will automatically analyze these SGA Parameter statistics and give suggestions fordiagnose the problem. In this paper we have presented that framework with practical Implementation.

Keywords*: SGA, SGA Dynamic Parameters, Database Tuning, DBA, Automated Tuning, TOC.*

1 Introduction

As we have seen, hardware costs fall rapidly while human costs remain relatively static. This leads to a condition there the human costs of manual tuning activities outpaces the costs of faster hardware .
(seeFigure 1).

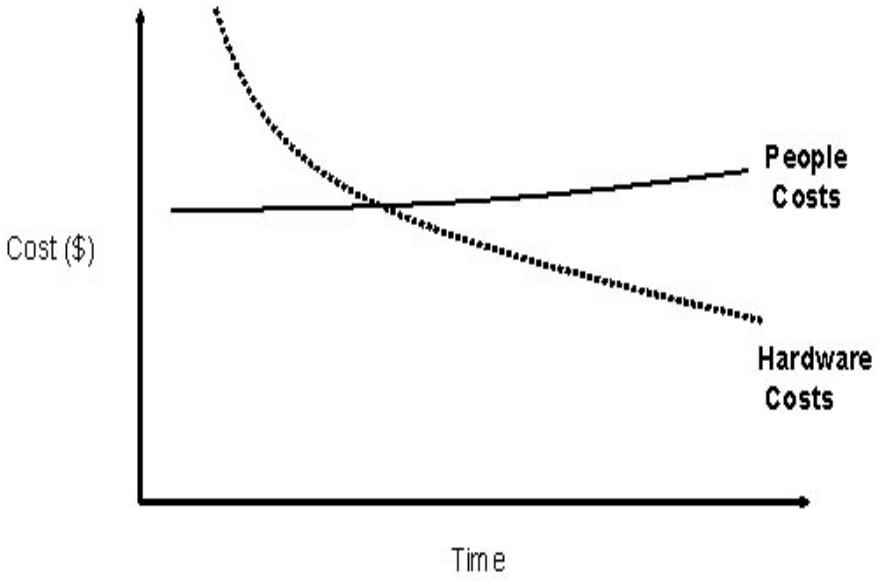

Fig 1: H/W cost vs Human Cost [Ref. 5]

Most large databases are managed by DBAs who are responsible for the good performance of the database but manual physical design is both time consuming and very tedious, as the database administrator (DBA) needs to find the benefits of different individual design features that can possible interact with one another. Motivated not only by the difficulty of tuning but also from the need to reduce the total cost of ownership in their products, several commercial DBMS vendors offer automated tools with several features but the cost for ownership of these tools is also high.With the dramatic drop of hardware and software prices, the expenses due to human administration and tuning staff dominate the cost of ownership for a database system [1].

2. Manual Tuning Framework

Database Administrator is responsible for enhancing the performance of database system. The detection of performance degradation is achieved by continuously monitoring system performance parameters. Several methods including the usage of materialized views and indexes, pruning table and column sets, usage of self healing [2] Techniques, usage of physical design tuning etc. have been proposed that proactively monitor the system performance indicators, analyze the symptoms and auto tune the DBMS to deliver enhanced performance. The performance degradation is due to increased workload on the system. This increased load has to be minimized to enhance the response rate of the system. In order to achieve this objective, either the administrator decreases some amount of load by closing some files or he may increase the RAM. The administrator has to check continuously or we can say, at regular intervals the Buffer Cache Hit Ratio(BCHR) [4]. Based on this hit ratio, the database administrator determines if more amount of

RAM has to be allocated. This task of load reduction by increasing RAM requires manual intervention and thus may take even years to complete [2].

(see figure 2)

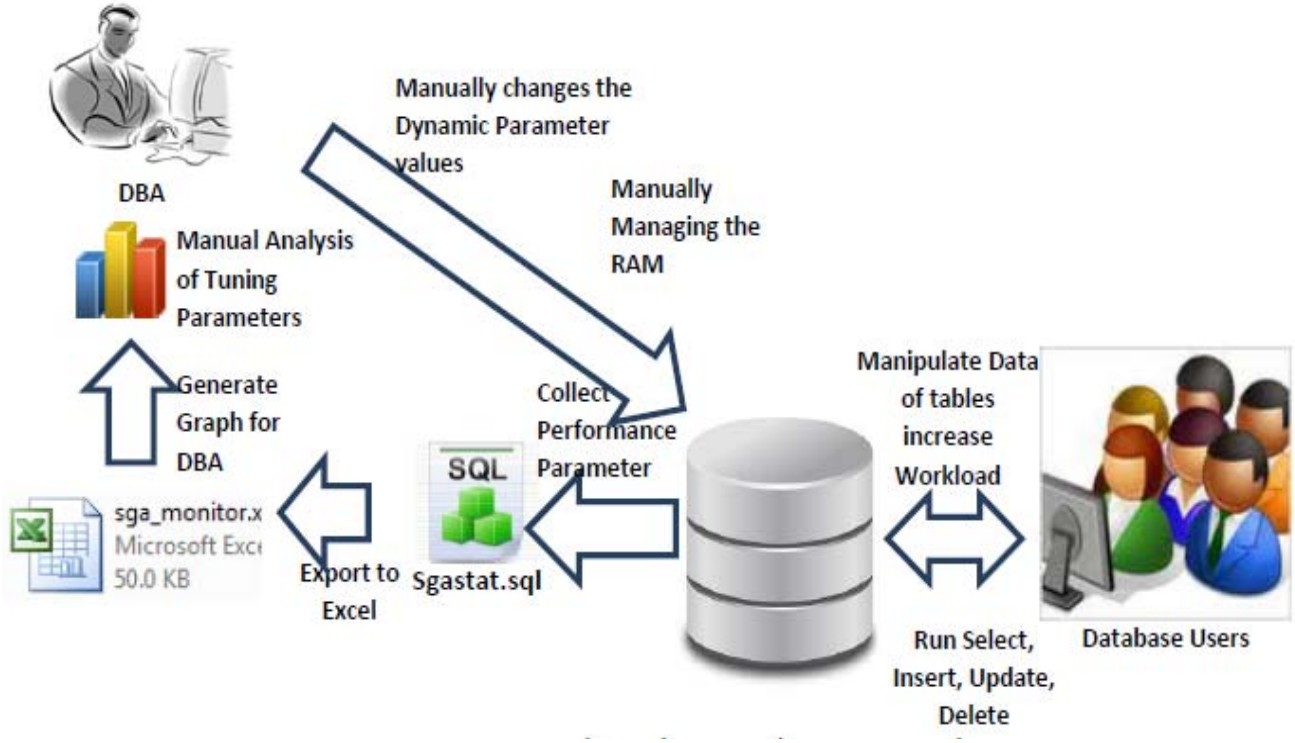

Fig 2: Manual Database Tuning Framework

However, Oracle manages RAM memory demands according to the demands of each task by using sophisticated algorithms to improve the speed of RAM intensive tasks. Oracle DBA can dynamically de-allocate RAM memory as well as re-allocate it. But since database administrator is a normal human being, he cannot calculate the actual amount of RAM memory required by an application. [5]

Due to this limitation of DBA, the allocation of RAM manually for optimizing performance of database system becomes a complicated as well as costly task.

3. Building Blocks of Automation Tuning Framework

Many business applications demand the use of complex database systems which should be administered and optimized for better performance. As suggested in [2], physical tuning should be avoided as it is expensive. As the physical design of database suffers from various limitations, an automated database tuning framework is proposed in order to achieve high grade of performance. The Framework is employed for identifying the symptoms and altering key system parameters.

The Framework has three basic building:(Complete Frameworkhas shown in figure6)

a. Automated Workload Generation Block
b. Working Database

c. Automated Database Tuning Block

This block will be used for generation of variable workload on working database by creating virtual users.

3.1. **Automation Workload Generation Block**

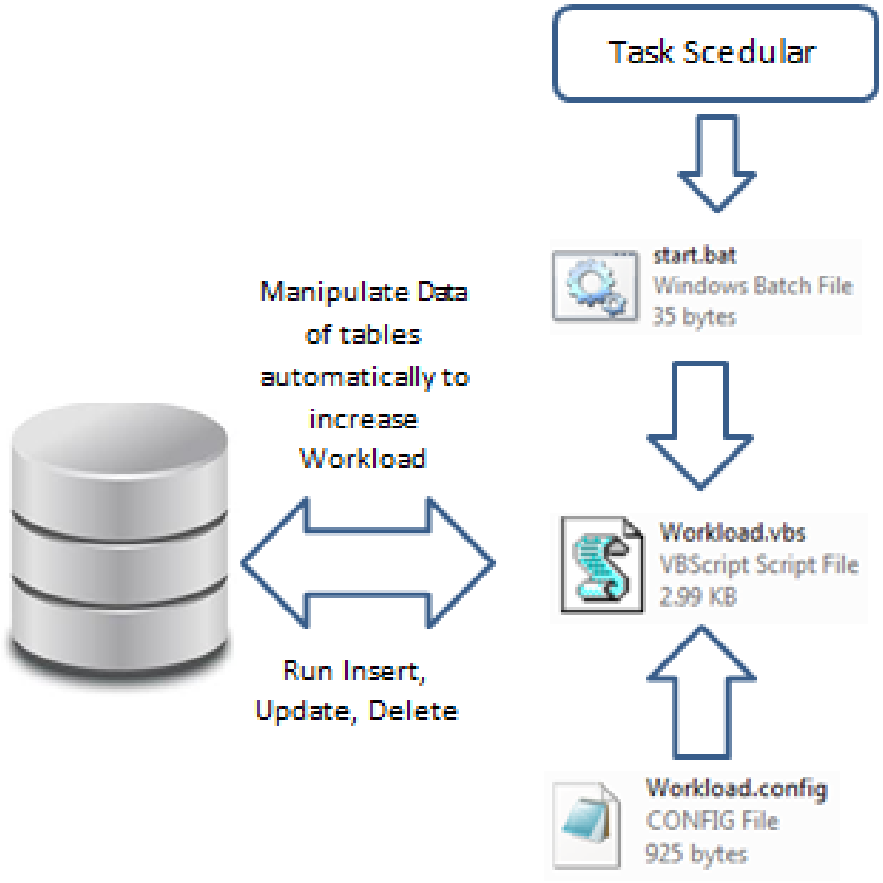

Fig 3: Automatic Workload Generation block

This block will use basic utilities of operating system (i.e. Vb Scripting, Config file etc.) to create virtual users and provide login accessibility to those virtual user for database.(See figure 3). The VB Script will increase the workload on working database as per the setting written in Workload.config file. By using these two files we can create virtual workload on working database and simultaneously achieve the automated generation of variable workload.

3.2. Working Database

This block is the working database on which other two blocks will perform their respective functions automatically (see figure 4):

Fig 4: Working Database

The working database is represented by the general symbol used for any Database.

3.3. Automation Database Tuning Block

This block is the soul of the complete framework. This block will collect the statistic of SGA Dynamic parameters automatically and insert to a monitoring table. On the basis of this table an automation application will correlate the parameters value to the performance of the Database.

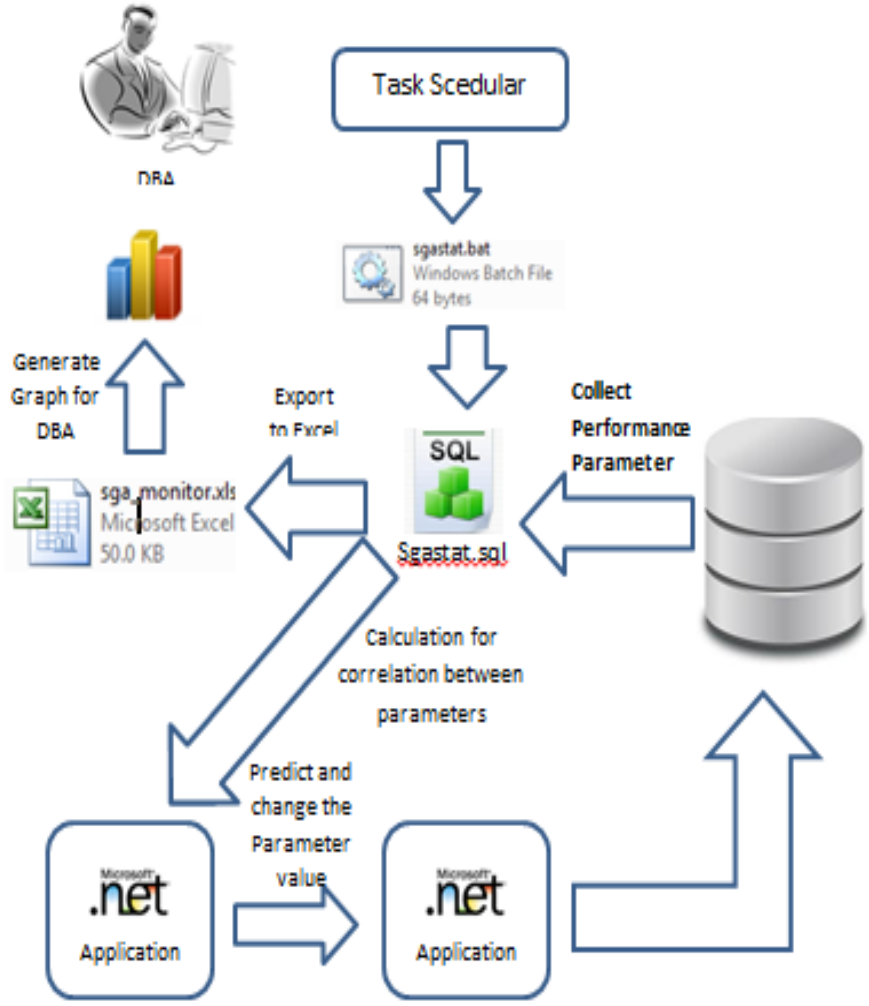

Fig 5: Automatic Tuning Block

VB script through the Schedular. The SQL script will fetch the SGA parameters statistics and insert in sga_monitor table.

After analysis of the parameters value the automation application will automatically decide to change the value of only those parameters whose changed value will increase the performance of the database. (See figure 5)
This table data will be used by a .Net application for analysis. After analyzing the values the same .net application will take self-decision to change the value of SGA parameters. One part of this block will also create the charts by using excel utility for DBA (Optional Block). This will help to DBA to find the automatic tuning is doing the job effectively or not.
These blocks will tune the database using various tuning rules as well as system parameters. However, several parameters can be altered simultaneously for better performance gain. The third block estimates the required value of dynamic SGA parameter based on the current DBMS input parameters and applies the necessary correction to change the size of these parameters based on the tuning rules.

4. Complete Framework of Automation Tuning

The Complete framework has shown in figure 6this framework is the combination of the above defined three blocks. After implementing this framework there will be no need for manual tuning. The combination of Basic Utilities of Operating System and database statistics an organization can achieve the automation in Database tuning.

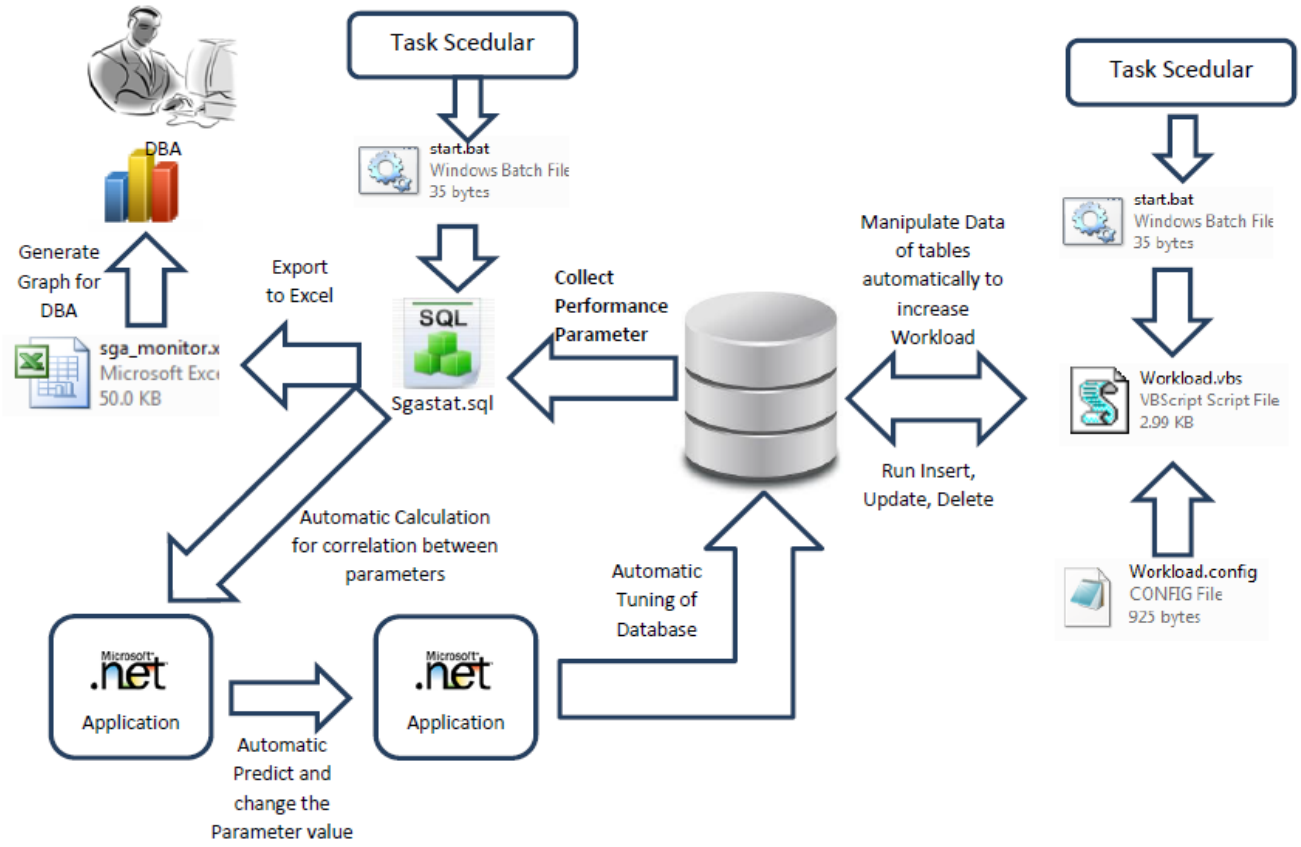

Fig 6: AutomatedDatabase Tuning Framework

The important thing about this framework is that it will be faster than other tuning utilities due to usage of Operating System basic utilities. These basic utilities are directly connected to the kernel of OS. So it will give faster result than other framework.

5. Conclusion and Future Work

Tuning the database can become quite complex, but modern databases offers the administrator an unparalleled ability to control the PGA and SGA. Until old databases evolves into a completely self-tuning architecture, the DBA was responsible for adjusting the dynamic configuration of the system RAM. Automated SGA adjustment scripts can be used to allow the DBA to grow and shrink the SGA regions. Manual tuning cost more for an organization but it is one of the major need for an organization to attract the customer. So we have proposed a solution to fulfill the need of an organization in the shape of this Automation Framework. This framework will not take any cost and it will give faster result compare to manual tuning.

The future work is to implement this framework and test in a working environment. The work is in progress and we will come with the result very soon in future.

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