# Reducing Power Consumption in Database Management System

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## ABSTRACT

Query processing task consumed energy in Database management system. This power consumption must be pay attention because it affects environmental factors. In this paper we approach this issue. We present an approach that can be used to directly manage the power consumption. Our approach concentrates on power consumption for query processing in Database management system. We know that modern processors can execute at lower frequency and voltage also. DBMS and MySQL, can reduce the processor power consumption of the original consumption while increasing the response time. On MySQL, power consumption can reduce with a few response time increases. In this paper we also reveal some research issue in the area of efficient data processing.

## 1. INTRODUCTION

Lots of power consume in data servers to powering and cooling servers. A report [11] showed that when considering only the servers in data centers, in 2005 an estimated 1.2% of the total U.S. energy consumption is attributed to powering and cooling servers, at an estimated cost of $2.7B. Another report by the EPA [1] estimates that in 2006, and then it predicted that this energy consumption will double shortly. Other recent work [10] highlight that energy cost is the third largest cost in a data centers.

Power management is more important for modern data center management and planning [2, 10]. In other words, power consumption is also a criterion for computing environments that includes stand-alone servers and data centers. Database management system is running in server environments and not concentrates on that power consumption can be reduced or not, but in this approach we underline this. Both economical and environmental factors require that we start considering power consumption attribute in Database management system. This paper describes power efficient query processing. While four decades of research in the database and distributed data processing communities has produced a wealth of methods that optimize for response time and/or throughput, the addition of power consumption considerations opens a wide range of research issues. As a starting point, we consider power consumption in a DBMS when planning and processing queries. We note that power efficient methods for general data processing in distributed computing environments which includes servers, data centers, running DBMSs [5]. There are techniques that can be used to reduce power

consumption in query processing environments. "Global" techniques can be used to change some aspect of how the entire system is managed or used. An example is to change the job scheduling method for the entire system to reduce power consumption. Other techniques are "local" techniques which are used for query processing at individual machine. In a DBMS environment, we begin with a simple model for power and performance in a DBMS. Consider a system that can determine, on a per query or workload basis, power settings given response time and energy consumption goals.

There are number of alternative ways to evaluate a database Power Consumption and performance [18]. A system that does not have strict response time requirements could choose to run query processing using system setting to save Power.

Many hardware components are implementing hardware-based methods for reducing power consumption, but database management system and the hardware must co-operate to reduce power consumption. The essential thing is that hardware expose controls to allow the DBMS to provide directives related to power consumption. We must have to add some capability to automatic transitions and sensors for hardware. But few factors of service restrict it. A data center aim to fastest query processing first as per their requirement. But it is not possible for data center to operate at maximum utilization [7]. So it is beneficial to reduce power consumption and a bit compromise with response time of query processing. It is interesting point where approach to reduce power consumption perform dynamically to minimum variation in query response time. Our focus is on mechanisms that can be used to reduce power consumption.

The processor voltage and processor frequency can be controlled. The processor voltage and processor frequency parameters change in Database management system. Over the last few years Modern processors are designed to perform reduction of power consumption. It is new approach where software can give commands to processor to adjust their voltage/frequencies to operate at points other than their peak performance. It is automatic additional transitions that use processors at low voltage and low frequency. This mean when processor is idle or system settings require a lower performance level; it is move to lower performance state.

Secondly we consider it at the workload. It is about a DBMS in which there is some "admission control" for running queries. A query is examined and optimized, before it is process. Now consider a queue of queries that are ready to execute. After the examination if the queries have some common components like same sub query, then we can use multi-query optimization techniques to reduce power consumption. So finding common sub query consider delay in queries processing for power consumption and delays can be considered. Cause of delay queries to build up in the queue, which then allows multi-query optimization methods to evaluate the Power efficiently. Consequently the average per-query power consumption can be reduced. Our

approach shows that power consumption can be reduced while response time is also increased at a tolerable limit. This paper proposes approach to reduce power consumption while performing query processing.

## 2. POWER CONSUMPTION IN DBMS

Client server environment in database management system contains a wide range to reduce power consumption in query processing. For example, in a data center, the power supply and power distribution is very inefficient, and can often lead to losses as high as 44% [10]. Presently few Techniques are available to reduce power consumption in distributed system. Most of time Data centers are operating with minimum load most of the time [2, 10] and reducing voltage and frequency at lower load can reduce power consumption. Changing and managing the cooling technology can also lead to dramatic approach in power consumption [9, 10, 13]. To build more perfect system slower but more efficient hardware is good option is another way of reducing the power consumption of data centers [10]. These types of changes can improve the efficiency of query processing. An interesting point is that improved power efficiency for query processing in database management system. In traditional database management system improving query response times will still be valuable, as faster query processing often means lower power consumption. However, the move towards more power efficient query processing, coupled with the fact that most query processing are underutilized most of the time, reduction of power consumption including at query level, power consumption per server and for collection of servers. Most of the hardware components in server are not very power efficient. It has been noted that modern hardware consumes more than half the peak energy even when idle [2]. Because when hardware components are designed power consumption is not a prior design goal. In motherboard two sources of power consumption: processor and memory. Processors are more energy efficient. The processor manufacturers have done this by operating at lower voltages and also putting in smart mechanisms in the processor that automatically push the processor to lower performance states when it is idle or not in use. Memory has also slowly started getting more energy efficient. Furthermore, there are efforts to build hardware that will put memory banks into deep sleep (thereby saving energy) when not in use. Many manufacturers now consider the energy efficiency in their memory management product. So we hope that in Future the hardware components will also detect when they are idle or down. Responsibility of saving power lies with both system and user level software [15]. Even we know that higher-level software has information in better way about the job characteristics. So the mechanisms will more relevant to reduction of power consumption at database management system towards removing the extra consumption of power which can save.

## 3. IMPLEMENTATION WAY TO REDUCE CONSUMPTION

Currently manufacturer of hardware components dynamic voltage and frequency scaling (DVFS) to reduce processor voltage/ frequency, so it can move the processor to lower power/performance states (p-states) such as Intel's SpeedStep [18]. Many software packages allow programs explicit access to different p-states. System multiplier and system voltage settings are characterized by the combination of P-states. The CPU frequency is a product of the front side bus (FSB) speed and the CPU multiplier, where the CPU multiplier is dictated by the p-state. The CPU voltage is based on the CPU multiplier, and a lower multiplier allows the CPU to operate at a lower voltage.

Change in the speed of front side bus system can be speed up but it destabilized the system Over-clocking enthusiasts largely use this technique to make the system go faster. But, this technique can destabilize and this step is Over-clocking. Generally over-clocking can affect the durability of hardware components. Another way is Under-clocking.

There is a difference between system frequency modulation through p-state transitioning and under-clocking. System power management through p-state manipulation put a hard upper that a system can achieve. By under-clocking, we can reduce power consumption dynamically. In other word under-clocking may also reduce power consumption in main memory module because Under-clocking also slow down main memory operating frequency.

The processor voltage and processor frequency use the under-clocking to reduce power consumption and improve performance of system. For analysis, we use a query of DBMS. This query has a six table join and a group by clause on one attribute [17]. To explore the energy savings resulting from under-clocking the system, we first run in traditional way of query processing. Then, we used the software to under-clock the front side bus.

We are only measuring the system power consumption. It reveals that under-clocking can slightly reduce power consumption of system. In other words, the change in power consumption is matched by an equal change in the response time.

Power consumption is different for sequence access or random access. In sequential access system read the data of the file from the starting point but in Random accesses were generate point by random file point locations and go to that spot.

The sequential access throughput is constant regardless of the read size. For random access throughput rises as the read block size is increased, disk seeks can be reduce by increasing the read block size. Power consumption for the sequential access is flat. Sequential access is more power efficient than random access, speed and performance is close but does not exactly proportional. So it shows that the best way to save power in

disk is to maintain as much sequential access as possible.

In this paper, we consider a simple model of database which contains collection of tables and simple queries. These queries are seems same structure wise. The think time for query sequence is almost zero. And in simple model database system can run one query at a instance. Each query in a traditional DBMS is being evaluated. Evaluating each query can reduce response time. So queries are delayed and placed into a queue on arrival. Queries in queue are examined to aggregate or to find common attribute like sub-query and divide into groups. These queries in each group can be evaluated together. For example, query with SELECT clause can be merged to a single group with a disjunction of the predicates in each query. This query can run in the DBMS at lower power consumption than the individual queries.

## 6. CONCLUSIONS

In this paper, we have presented approach for considering reduction of power consumption in query processing in a database management system. Our approach towards to reduce power consumption on database stand alone server or data centers when processors are in ideal or near to idle situation.

In future, we need to design system to calculate power consumption of hardware components according to their state in database management system. Designing a DBMS in a manner that the response time and power consumption opens a wide range of research. It is also an important factor to categorise a database system into bad, good and very good database depends on their query processing, response time when it is warm or cool.

## 8. REFERENCES

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