
Operating Systems and Database Management System

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Abstract:

The performance of a Database Management System is based on many factors. One of the important factors is the Operating System it is working with. Resource allocation, file system, consistency control and other features of an operating system can greatly affect the performance of a Database Management System. In my research paper, I want to bring out how different operating systems influence different Database Management System by measuring the performance metrics of a Database Management System in those different operating systems and how different features of different operating systems are affecting the Database Management System performance.

The paper focuses on how an operating system deals with a Database Management System and how certain features of an operating system like resource allocation, memory size, locks, file system are affecting a particular Database Management System. The paper will also discuss the evolution of Database Management System in order to be compatible with the operating system and vice versa. It also discuss what are the present scenarios of the Database Management System and operating systems out in the world and also the future aspects of these entities. This paper contains the experimental values on different benchmarks using a DBMS on different Operating systems. These findings will help to promote future research into how DBMS must be developed according to the features of the operating systems so that their performance can be optimal.

1. Introduction:

Choosing a Database Management System (DBMS) for an application is significant because the performance of the application greatly depends upon how the data is being retrieved and stored. Along with the choice of the right DBMS, it is also very important to choose a right Operating System (OS) for that specific DBMS because the performance of the DBMS is impacted by the OS. In this paper, we will analysis to what extent the choice of OS impacts the performance of a DBMS.

In this paper, we will choose two Operating Systems running on the same hardware specifications and a Database Management System which is supported in both the operating systems. Some DBMS like MS-Access which are specific to Windows, is not fully supported by operating systems like Ubuntu. We will perform some basic database operations like insert, select, delete, update etc. with the help of the DBMS on different operating systems and compare their performance. On the basis of these results, we will draw out which OS is working better for a given DBMS and will also evaluate the factors of the operating system that are affecting the performance of the DBMS.

This paper will not give any new techniques that will change the performance of the DBMS. Instead, this paper provides with a detailed analysis of different operating system's features and their effect on different DBMS.

Section II of this paper reviews the present concepts and terms that are required for an understanding of issues this paper presents. Then in *Section III* explains the experimental process and the experiment's results. *Section IV* provides the conclusion of this paper.

2. Background:

In this section, the paper provides some information which is required for understanding of the paper

Operating System:

An operating system (OS) is a system software that manages computer hardware and software resources and provides common services for computer programs.

Difference in OS:

OS differ in features like file-system, basic memory management, handling optimizations, security etc. The operating systems used in this paper are Ubuntu 15.4 and Windows 10.

Ubuntu is the most popular Linux distro as per the statistics on the web. Ubuntu is based on Debian and uses dpkg as its package manager which gives a broader variety of packages. Ubuntu uses Ext2/Ext3/Ext4 file system.

Windows 10 is the most popular operating system being used in many personal computers and workstations. Windows uses NTFS file system.

Database Management System:

A DBMS is a collection of programs that allow users to specify the structure of a database, to create, query and modify the data in the database and to control access to it.

Functions of DBMS:

Some of the typical functions of a DBMS are -

Concurrency control: this allows shared access to the database, with multiple transactions being executed at the same time and scheduled in a safe manner.

Buffer management: this function allows transferring data to and from main memory and secondary storage.

Query processing and optimization: query processing converts queries into a low-level language, which are then optimized by the database.

Difference in DBMS:

DBMS differ from each other in terms of how they try to manage the memory and effectively they communicate with the operating system memory scheduler. They also differ in the techniques they use to store and retrieve the data from the database.

MySQL is one of the most popular database management systems in the world. It is a relational database that uses the SQL standard for their queries. MySQL is open source and its owned by oracle since 2010. Similarly, to other database management systems, MySQL has an I/O buffer where it stores data and indexing in memory. It utilizes this memory as much as it can to avoid paging as much as possible.

Interaction between OS and DBMS:

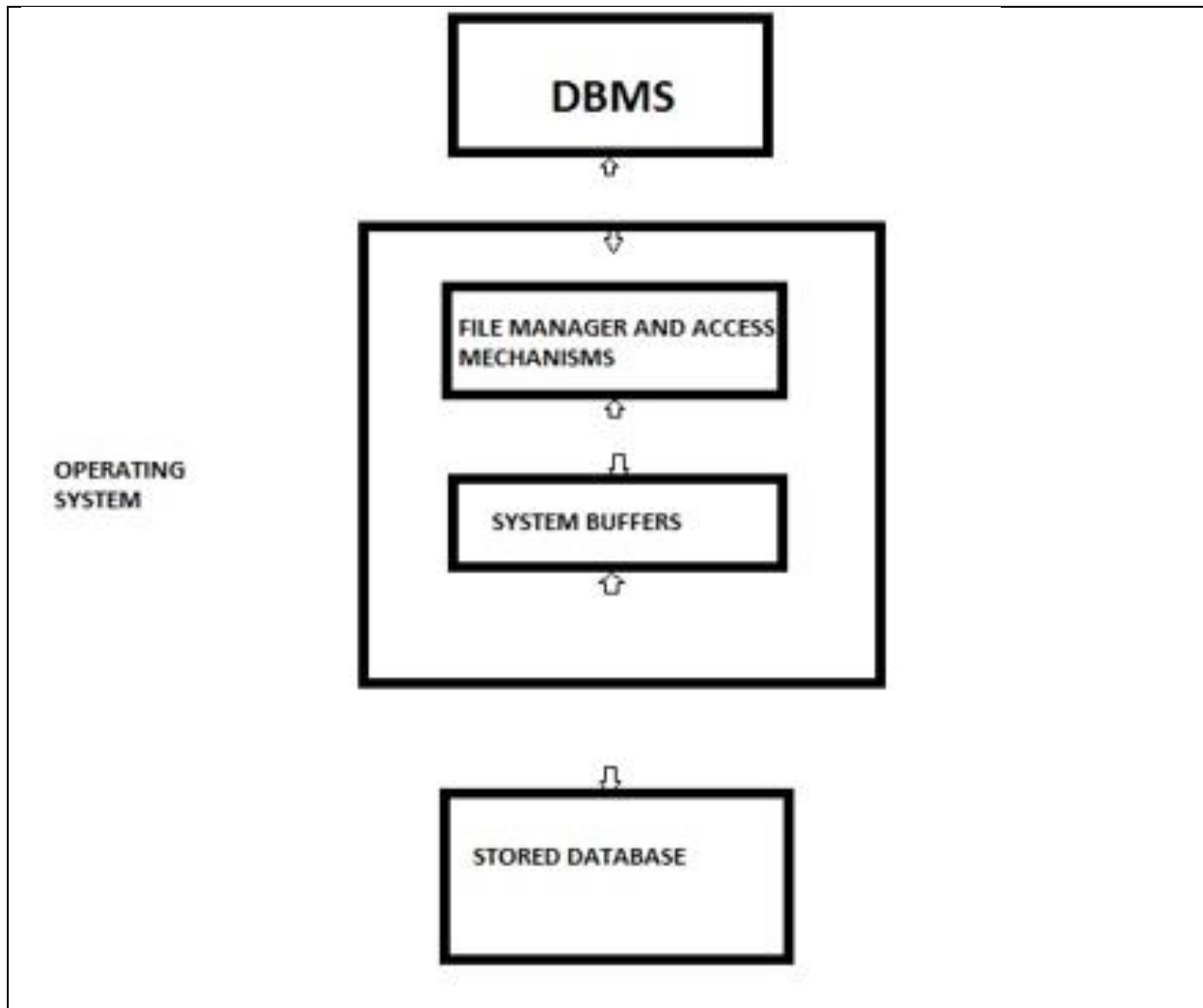


FIG: 2.1 INTERACTION BETWEEN OS AND DATABASE

The DBMS accepts requests for data from the user or program and initiates the operating system for the data to be transferred. For the data transfer to be appropriate, a file manager is used which keeps track of the underlying database files on disk. The database buffers or the system buffers are for manipulating data and storing the data.

3. Experiment

For this experiment, we chose Ubuntu 15.4 and Windows 10 running on the same hardware specifications as our operating systems. The reason I chose them because there is much difference in between these two OS as they belong to different families. Windows 10 belongs to Windows whereas Ubuntu belongs to Linux family. We chose MySQL Workbench (version 5.6) as our Database Management System which is supported in both the operating systems and it is freely available in the market.

3.1 Hardware Specifications: (used same for both the OS)

Processor	:	Intel i5
Hard disk	:	500 GB
RAM	:	8GB

Care was taken that operating environment remained consistent in both OS.

3.2 Performance Evaluation:

For analyzing the performance of the DBMS on different OS, I chose a table containing fifteen thousand records. On this table, I performed various database operations like insert, delete, update and select. The results of this experiment are graphically presented below:

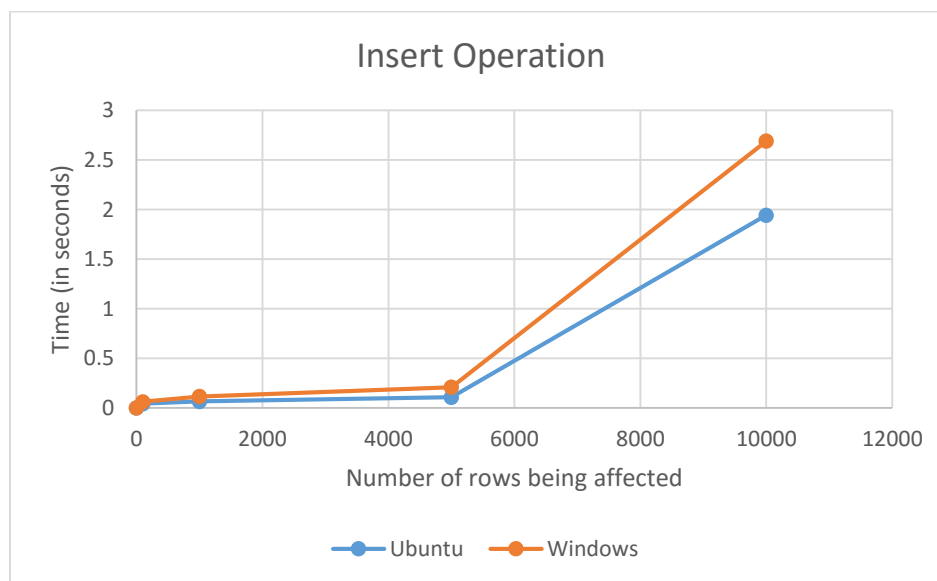


FIG: 3.2.1 PERFORMANCE EVALUATION FOR INSERT OPERATION

Even though MySQL showed similar performance for a small number of rows, the evidence was clear from the latter part of the graph.

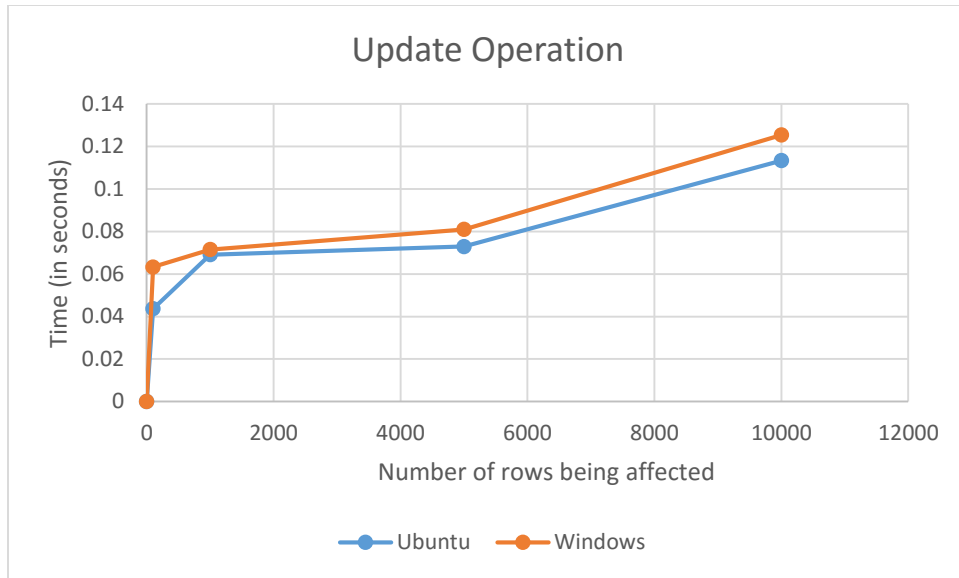


FIG: 3.2.2 PERFORMANCE EVALUATION FOR UPDATE OPERATION

For the update operation, the performance is much similar for both windows and Ubuntu. Although it looks much similar, Ubuntu has slightly better performance than windows in this case.

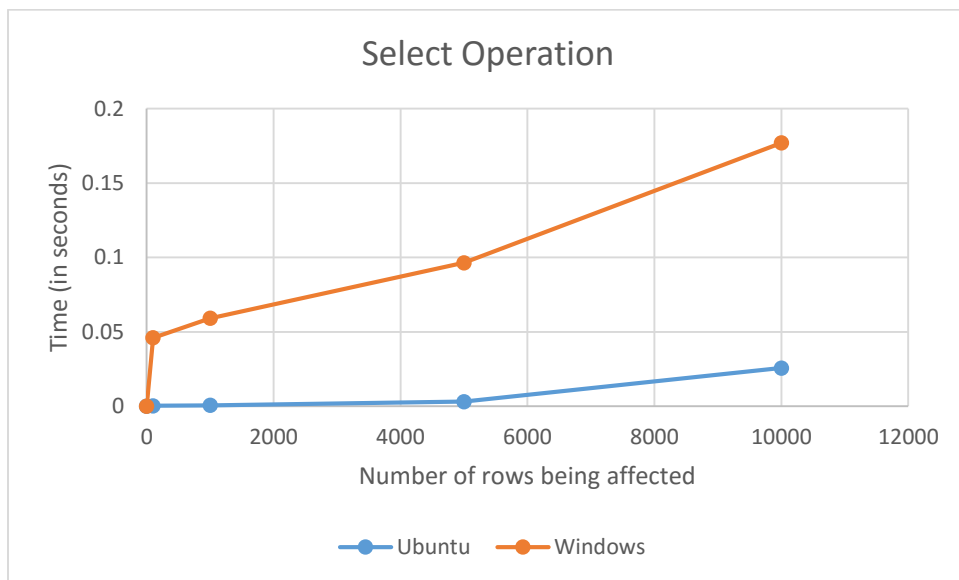


FIG: 3.2.3 PERFORMANCE EVALUATION FOR SELECT OPERATION

For the select operation, as the number of rows being affected gets increased, windows takes much significant time compared to Ubuntu. There is a considerable time gap between the windows and mac performance as the number of rows gets higher.

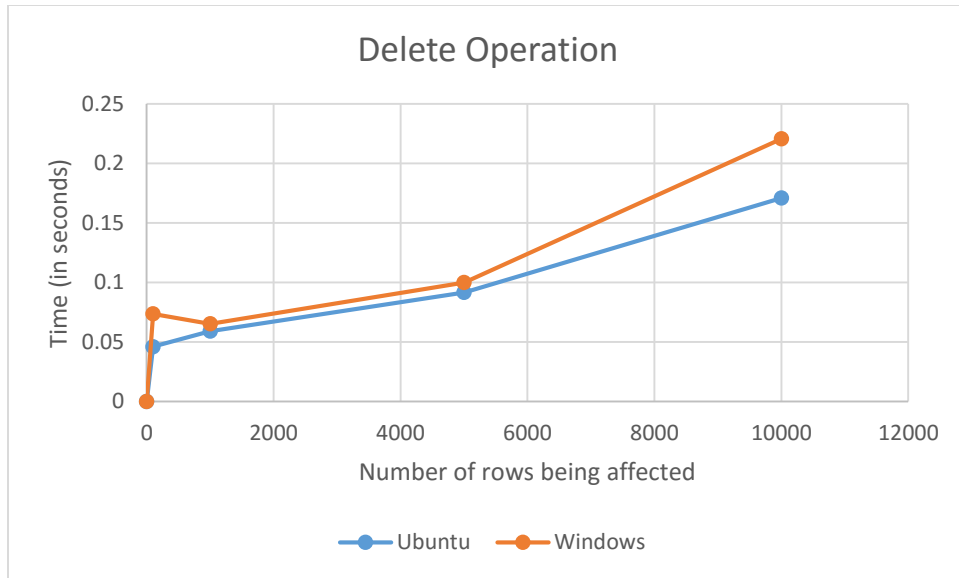


FIG: 3.2.4 PERFORMANCE EVALUATION FOR DELETE OPERATION

The above results show that Ubuntu outperforms Windows in terms of MySQL. Even though, MySQL took same initially for a small number of rows in both OS, the evidence was clear as the number of the rows kept increasing.

4. Conclusion:

In this paper, we have examined two different operating systems and their impact on MySQL. It was evident that the choice of operating system has a significant impact on the performance of the DBMS from the above results. This is because of the various features of the OS like a file system, process management, buffer pool management, scheduling and inter-process communication.

In our experiment, I have discovered that Ubuntu 15.4 gives better performance for MySQL when compared to Windows 10. This paper will provide on how different features of an OS can affect the performance of a DBMS. This paper will also help to choose a better OS when working with MySQL.

5. References:

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