A Study of the InnoDB Storage Engine in the MySQL 5.6

Hong-Jin, Park
School of Computer, Information and Communications
Sangji University
83 Sangjidae-gil, Wonju, Gangwondo, Korea
hjpark1@sangji.ac.kr

***Abstract*—MySQL is the most widely used open source relational database management system. The logical structure of MySQL is largely divided into three layers and the storage engine belongs to the last layer. The purpose of this paper is to evaluate the performance of InnoDB engine, the engine that supports transaction of several storage engines used in MySQL 5.6. TPC-C (Transaction Processing performance Council – C), an international standard model of benchmarking, is used for performance evaluation and performance evaluation was carried out by installing HammerDB for this purpose. It was found that, if the number of user requests increases and the number of transaction processing requests increases, then the number of transactions processed in InnoDB also increases.**

Keywords- InnoDB, Storage Engine, TPC-C, MySQL 5.6

I. INTRODUCTION

A database management system (DBMS) is used when many users deal with a large amount of data in large computer systems. In particular, the relational database management system is a system for managing data to be stored in a two-dimensional data format composed of rows and columns. Generally, data on the server can be manipulated and modified according to commands written in SQL. Even now, several databases such as MySQL, PostgreSQL are used because the reliability is high and data classification, sorting and navigation speed are fast. Many relational database systems showing high evaluative performance are used and MySQL is the database system the most widely used universally as an open source among them.

The logical structure of MySQL database system consists of three layers. From these, the storage layer, which is the last layer, plays a role in storing and retrieving data into MySQL. MySQL 5.6 has 9 storage engines and the InnoDB engine is the one which is the most suitable for transaction processing among them. Compared to other engines, InnoDB engine provides a variety of functions such as excellent performance, automatic failure recovery function, concurrency support, various optimization supports as well as transaction processing. Currently, the InnoDB engine performs as MySQL's default engine.

This paper evaluates the performance of the InnoDB engine, which shows the best performance when processing transaction from several storage engines in MySQL 5.6. For performance analysis, we used TPC-C, one of benchmark models announced by Transaction Processing Performance Council (TPC). TPC-C is one of international standard models used as a performance benchmark for databases through Online Transaction Processing (OLTP) work. Ubuntu 14.04 LTS (Long Term Support) was used as an operating system and HammerDB was installed to evaluate performance with TPC-C.

II. MYSQL LOGICAL STRUCTURE : INNODB

MySQL is an open source relational database management system currently distributed by Oracle. The logical structure of MySQL is largely divided into three layers. There is a Handing layer in the highest layer and processes DB connection, authentication and security. Parsing of query, analysis, review, optimization and caching are performed in the middle layer of the logical structure in MySQL. There is a storage engine in the last layer and play a role of searching queried data in MySQL.

A. InnoDB Storage Engine

MySQL 5.6 provides a total of nine storage engines such as CSV, MRG_MYISAM, MyISAM, MEMORY, InnoDB etc. The available storage engines in MySQL can be checked with MySQL command SHOW ENGINES\G. MyISAM and InnoDB are the most widely used storage engines among them. The functions of MyISAM are simple and the speed for data search is faster than InnoDB. However, since the transaction to ensure safety for a series of operations performed at a time in the database is not supported, InnoDB engine is used if the data integrity should be ensured. InnoDB engine is adopted as a default engine from MySQL 5.5 and can process transactions. The InnoDB engine is also widely used in situations when the transaction does not necessarily need the best performance or an automatic failure recovery function among storage engines supporting transactions. InnoDB engine uses MVCC (MultiVersion Concurrency Control) to increase concurrency and performs a variety of optimization internally. Adaptive hash index is used to make the inquiry faster and functions to bring data predicted to be needed on the disk in advance; the Insert buffer is used to make the insertion faster.

III. PERFORMANCE EVALUATION

In this paper, after installing MySQL 5.6 on Ubuntu, we selected InnoDB as a storage engine for evaluation. In order to evaluate the InnoDB performance, HammerDB 2.19 was installed and the evaluation was carried out by using TPC-C. TPC defined a benchmark for database and transaction processing as benchmark test models. These models were announced by the transaction processing performance council and these are used to measure the performance of

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systems such as Disk I/O, etc. The TPC benchmark is meant to comprehensively evaluate the hardware performance including network and software performance, as well as operating system (OS) performance.

In this paper, we used HammerDB as the tool to evaluate the performance with TPC-C and the evaluation settings we used are as follows. After installing MySQL 5.6 on Ubuntu, we measured TPM (transactions per minute) values while gradually increasing virtual users from 2 people to 10 people and performing TPC-C. The performance evaluation is shown in Fig. 1 and Fig. 2.

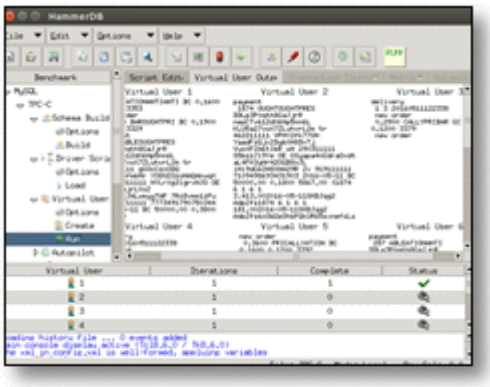

Figure 1. The View of Performance Evaluation – 1

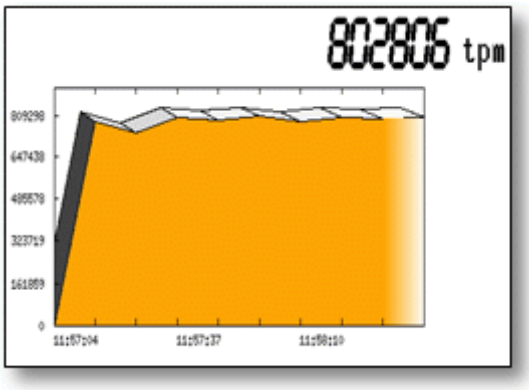

Figure 2. The View of Performance Evaluation – 2

Fig. 3 shows MySQL InnoDB Engine Performance evaluation. TPM is shown while gradually increasing the number of users from 2 people to 10 people. First, it can be seen that, if there are two users, 668,112 transactions are processed per minute and if users are 10 people, 802,806 transactions are processed per minute. If based on 2 users, transactions per minute were processed more quickly by 9% in the case of 4 people than in the case of 2 people and the processing speed was faster by approximately 12%, 18%, 20% in the case of 6 people, 8 people, 10 people, respectively. That is, the processing speed was faster by 20% when each of 10 users requests 10,000 transactions, than when each of 2 users requests 10,000 transactions and this shows that transaction processing is a lot within the same time.

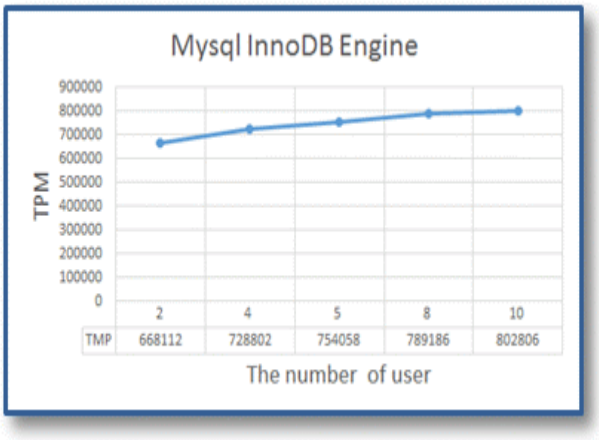

Figure 3. MySQL InnoDB Engine Performance

IV. CONCLUSION

In this paper, after installing MySQL 5.6 on Ubuntu, we selected InnoDB as a storage engine for evaluation. In order to evaluate the InnoDB performance, HammerDB 2.19 was installed and the evaluation was carried out by using TPC-C. It was found that, if the number of user requests increases and the number of transaction processing requests increases, then the number of transactions processed in InnoDB also increases.

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