MySQL Perhaps?
A comparison of MySQL 4.0
to the industry leading Oracle 9i.

By

Brad Touesnard

SmartForce

Fredericton, New Brunswick

7 April 2001

UNIVERSITY OF NEW BRUNSWICK

FACULTY OF COMPUTER SCIENCE

Executive Summary

MySQL is a relatively new relational database management system (RDBMS) that is constantly gaining strength, attempting to catch up with the industry leading Oracle Corporation. Lacking decades of Oracle's experience, it is expected that MySQL will take time to gain the full stature of its competitor. To effectively choose a RDBMS many domains must be explored including requirements, architecture, security and integrity, performance, and support.

In general, MySQL's requirements are equally as demanding as Oracle. However, Oracle's years of upgraded functionality makes for an impressive list of features, many of which are not yet included in MySQL. Additionally, Oracle's firm commitment to securing data and transactions is a difficult feat to match. In contrast, MySQL's open source initiative offers a support service like nothing that can ever be provided by Oracle, enabling administrators to debug the code directly.

All-in-all MySQL provides a great database solution for the majority of database applications.

More information on MySQL can be found at MySQL AB's home page (http://www.mysql.com). Equally, the best source of information on Oracle can be found at Oracle's home page (http://www.oracle.com).

Table of Contents

Table of Figures

1.0 Introduction

In the early 1970s, "IBM's E. F. Codd [published] the industry's first paper on relational database technology. He later [received] the ACM Turing Award for the invention of the relational model." (6) The relational database model supercedes the flat-file database model where a database is stored as a single table in a binary file and needs to be parsed to extract data. The relational model enables the use of a structured query language (SQL), also invented by the IBM Corporation, to retrieve data from related tables in an effortless, efficient manner.

IBM's invention of the relational database model spawned the invention of the first relation database management system (RDBMS) by the Oracle Corporation. Since then, Oracle has dominated the software industry in data management grossing almost three billion dollars in 1995. There is however, a number of RDBMS's that have been challenging Oracle in performance, functionality and most significantly price. Among those RDBMS's there is one gaining popularity, daring to contest the reputable Oracle in its time-honored market.

The MySQL AB Company was founded in 1995 to provide open source development control, service, support, and licensing of its product, MySQL. Today, "More than three million users make MySQL the most popular open source database with major corporate users including Yahoo!, MP3.com, Motorola, NASA, Silicon Graphics, HP, Xerox, Cisco and Texas Instruments." (3)

With MySQL in its early stages of development, there are significant features that are lacking in comparison to Oracle. In the following report, the major differences between Oracle and MySQL will be explored within requirements, architecture, security and integrity, and support.

2.0 Requirements

Database requirements are very important when considering a RDBMS. Whether or not the system requires components not yet purchased is a key issue when shopping for an RDBMS on a budget.

MySQL and Oracle offer support for a wide variety of system configurations and present very similar installation requirements (Fig. 1).

	MySQL 4.0	**Oracle 9i**
Operating System Platform	Linux, FreeBSD, Solaris, MacOS X, HP-UX, AIX, SCO, SGI Irix, Dec OSF, BsDi, Windows 9x/ME/NT/2000/XP	Linux, AIX, Alpha OpenVMS, Compaq Tru64 Unix, HP-UX, IBM OS/390, Solaris, Windows 9x/ME/NT/2000/XP
ODBC Driver	MyODBC 2.50	Oracle ODBC
JDBC Driver	Not Available	Oracle JDBC
Hard Disk Space	60 MB	70 MB
Memory	64 MB	96 MB
CPU	200 MHz	200 MHz
Video	256 Colors	256 Colors

Figure 1: Installation Requirements

Although, the installation requirements are minimal, this is not a fair estimate of the required hardware power needed to support an active RDBMS. Database hardware requirements depend on the function of a database system. The function of a database determines the amount of stress and storage the database system will be required to handle. The storage is derived from the capacity that is, the expected amount of data that will be managed by the database system. The stress is derived from the projected frequency and demand of database queries. Hence, if the projected frequency and demand is high, the stress is high, and consequently the system requirements are greater. Therefore the hardware requirements vary by application. It is easiest to understand this concept by studying an example application of an RDBMS.

Case Study 1: A small business owner would like to offer his line of ten thousand products online through a shopping cart system. His website currently receives fifteen hundred unique visitors per day and an average of eight users accessing the site concurrently.

	MySQL 4.0	Oracle 9i
Hard Disk Space	20 GB	20 MB
Memory	512 MB	640 MB
CPU	800 MHz	800 MHz

Figure 2: Minimum Requirements for Case Study 1

The hardware requirements for such a database server (Fig. 2) are greatly increased when compared to the installation requirements.

As shown in Figure 1, MySQL and Oracle offer support for the Unix operating system (OS), however MySQL installs much painlessly than Oracle. For Oracle to function properly on a Unix OS it must be carefully tuned by a professional. It is also noteworthy to mention that Oracle currently has no support for the MacOS platform.

3.0 Architecture

Database architecture is the fundamental element of a relational database management system. It encompasses the overall design and structure of a RDBMS.

3.1 SQL Dynamics

Structure Query Language (SQL) is the standard language which allows database administrators to perform procedures and operations on a database. Most RDBMS fully support the American National Standard Institute (ANSI) SQL99 standard, unfortunately MySQL is not one of those languages.

Oracle has fully conformed to the ANSI SQL standard while MySQL is still incorporating several features into its engine. MySQL's flexibility and robustness is improving with every release however, at this time it presents some inferiorities to Oracle in the domain of SQL dynamics.

In release 4.0 of MySQL, the long awaited support of the standard "UNION" SQL statement was achieved. Multi-table "DELETE" statements were also added to the engine. Many of the statements that were predicted for the 4.0 release were postponed; nested sub-queries are promised for version 4.1.

Although MySQL is obviously lacking some key features already supported by Oracle, it is growing at an incredible speed. Following the release of version 4.1, "critics of MySQL [will] have to be more imaginative than ever in pointing out deficiencies in the MySQL Database Management System." (4)

3.2 Stored Procedures and Views

Oracle presents two features which allow simpler insertion, update, and retrieval of frequently accessed data: stored procedures and views.

Stored procedures allow commonly run queries to be grouped together and run by a single call. A view is simply a single "SELECT" query which retrieves columns of data from tables in a database. Views act like an independent table such that a query can be run against it to retrieve data. At this time however, views can not be queried to insert, update or delete data.

MySQL does not currently offer stored procedures or views however, MySQL AB has stated that they plan to offer stored procedures in the near future with the release of version 4.1.

3.3 Triggers and Constraints

Foreign key constraints and triggers play an important role in Oracle's RDBMS.

Foreign key constraints are rules created by the database administrator to ensure that rows are not added to or deleted from one table that has dependencies in other tables. This lowers the risk of data integrity degradation. MySQL currently has plans to implement foreign key constraints in version 4.1.

When data is inserted into a data table, related data often needs to be added to other tables as well. Solving this dilemma is triggers which are stored procedures that are executed when a given event occurs. MySQL AB has stated that they are currently "looking at triggers." (7)

4.0 Security and Integrity

Databases often harbor sensitive and mission critical data; hence security is extremely important to database administrators. Any breach in security could result in grave trouble for the database proprietor. Paying careful attention to this issue, MySQL made some significant upgrades to security in version 4.0.

In previous versions of MySQL an entire table would be locked when a write operation was to be performed on that table. Although this method is secure, it is not practical for performance. Users requesting to write to a table have to wait until the previous write is complete before theirs begins. In version 4.0 however, row-level locking has been implemented which allows individual rows within a table to be locked rather than locking the entire table. Consequently several users can write to a table concurrently as long as they are not attempting to write to the same row. Oracle has supported this feature for some time but for MySQL it is a big improvement in security and performance.

Secure Sockets Layer (SSL) is a protocol developed by Netscape which enables the encryption of data transfers between the client and server. Release 4.0 of MySQL supports SSL transactions between the database server and the client. This allows secure transfers for clients outside the firewall whereas previously it was only assumed that the transfers would occur inside the firewall. Although MySQL security has a long way to go to meet Oracle, this is a step in the right direction. Oracle has long ago made a major commitment to security. "In 1990 Oracle formed a 'hack team' to begin a proactive approach to finding and fixing product vulnerabilities." (2)

MySQL does not currently match Oracle's built-in recovery systems but it does offer small features like rollbacks on queries.

"Oracle provides several features to ensure data integrity whether in the case of system failure, human error, or malicious attacks. These features include redo log files, rollback segments, and LogMiner." (2)

5.0 Performance

Performance is one of most important issues when deciding on a database management system. Performance comparisons can ensure that the consumer is purchasing the most reliable RDBMS. Benchmarking provides ideal comparisons, however it is often difficult to find such performance data.

Ziff Davis Media's eWEEK recently published an article comparing the performance of leading databases. They found that, "Drivers, memory tuning and database design issues were the three factors that had the most impact on performance." (1) In the benchmarking comparisons, Oracle 9i and MySQL 4.0 offered the best response times (Fig. 3) and the best throughput (Fig. 4).
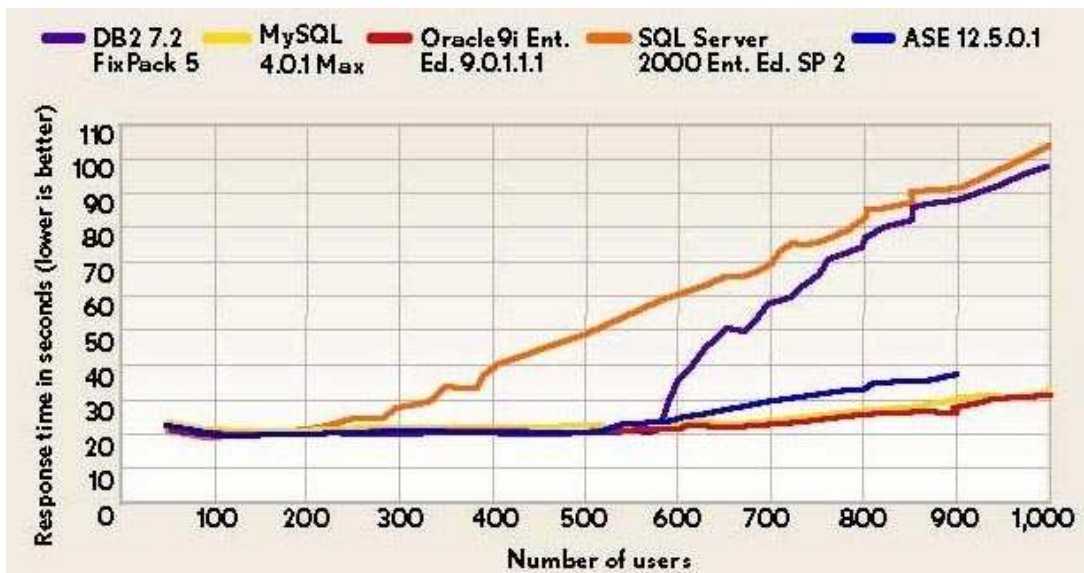

Figure 3: Database Response Times
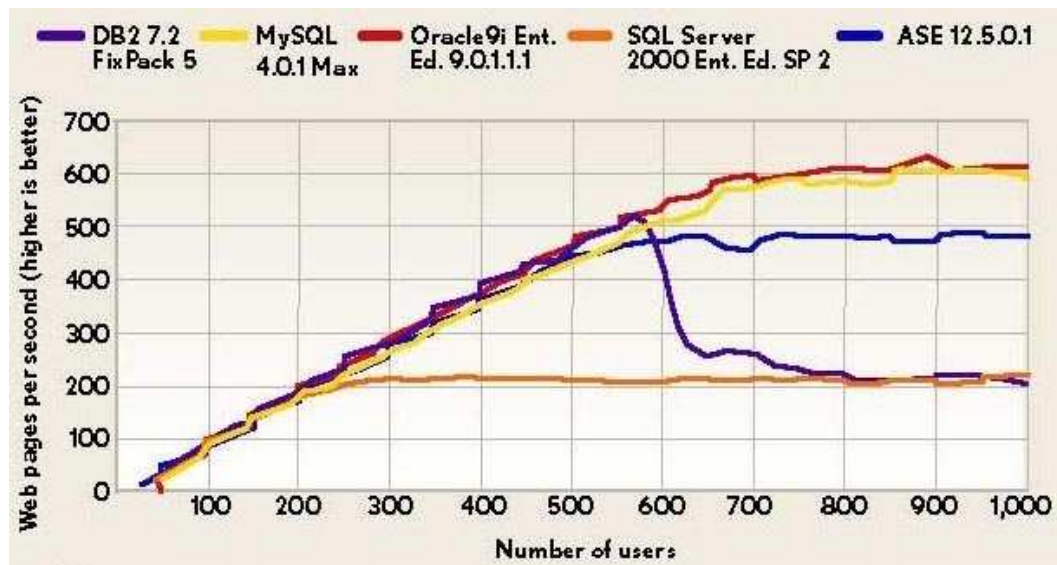
Chart obtained from eWeek.com (1)

Figure 4: Database Throughput

Chart obtained from eWeek.com (1)

It has been found that in general, when RDBMS are manually tuned, performance doubles from the default settings. MySQL's query results cache (new in version 4.0) increases overall performance by two thirds. Although not as quantifiable as drivers and memory tuning, modifying database design allots for a notable performance increase. Altering database design such as indexes and table row order proves to be quite advantageous.

6.0 Support

There are many things that can go wrong when dealing with databases and since data is often mission critical, it is extremely important to have technical support available at all times.

MySQL.com freely offers online searchable documentation and updates about product upgrades. Also, for an annual fee, MySQL AB offers support twenty four hours per day, seven days per week, all year round (24x7). They offer several support packages which range from minimal support coverage to the most complete coverage. All support services are provided by developers of the MySQL software, employees of MySQL AB. Additionally, since MySQL is accessible as open source software programmers well versed in the C and C++ can attempt to debug the application independently. Oracle also offers 24x7 support and access to technical resource section on their web site for an annual fee. MySQL AB and Oracle also provide training and consulting services on a pay per session bases.

> "Oracle Product Support provides skilled technical assistance related to installing and operating Oracle software products, in order to keep your information systems available and reliable, maximize the value of your investment in Oracle technology, and help you achieve your business objectives." (5)

Oracle and MySQL equally have books and user web sites containing an abundance of information supporting installation, reference, performance tweaking, etc.

7.0 Conclusions

For a free, open source database MySQL provides an attractive front for consumers looking for a dependable database management system. Its simple installation and low system requirements make it a fierce competitor for tight budgeted consumers.

Oracle is still much further ahead of MySQL in most domains of database architecture. MySQL's failure to be ANSI SQL99 compliant is a major issue for some consumers, even though MySQL has confirmed goals to attain ANSI compliance. Although not as influential, MySQL's lack of stored procedures, views, triggers, and constraints also hinder its popularity.

Security and data integrity is very important when considering a RDBMS. MySQL's recent upgrade of security features shows its dedication to security and certainly improves its chances of becoming a reputable mission critical RDBMS.

MySQL and Oracle seem to produce the same level performance in most database applications. This is notably the highest level of performance of any other RDBMS. Definitely a positive quality when considering a database solution.

MySQL's open source initiative enables direct support by any C or C++ programmer. This level of support can never be realized by any corporate RDBMS. Like Oracle, the MySQL AB Company also provides around-the-clock support directly from experienced professionals which is critical for emergencies which must be attended immediately.

Although not as robust as Oracle, MySQL still offers enough impresive elements for most database applications. Its growing number of corporate clients is concrete evidence of its achievements as a reliable RDBMS. MySQL AB is confident that the release of MySQL 4.1 will "will then match the requirement checklist of very demanding buyers." (3)

8.0 Recommendations

We recommend that…

- …regular database backups are conducted to ensure no massive data loss
- …at least the minimum MySQL AB support package is purchased to ensure immediate emergency support
- …Oracle support is purchased if there is no certified Oracle professional accessible for emergency support
- …MySQL 4.0 is installed on a Unix server (preferably Linux) for optimal performance.
- …Oracle 9i is installed on a Windows 2000 Server for optimal performance.
- …stored procedures, constraints, and triggers are used effectively to enhance performance.
- …MySQL is further investigated at the following web sites:
  - *MySQL.com* – http://www.mysql.com
  - *Developer Shed* – http://www.devshed.com/server_side/mysql
- …Oracle is further investigated at the following web sites:
  - *Oracle.com* – http://www.oracle.com
  - *Oracle Technology Network* – http://technet.oracle.com

Bibliography

1. Dyck, Timothy. <u>Server Databases Clash.</u> eWEEK. [On-Line]. Available: http://www.eweek.com/article/0,3658,s=708&a=23115,00.asp [Accessed on 2002-03-31]

2. Hazel, Lorraina. <u>An Overview of Oracle Database Security Features.</u> Sans Institute [On-Line]. Available: http://rr.sans.org/appsec/oracle.php [Accessed on 2002-04-07]

3. Huske, Kyle. <u>Sweden's MySQL Gets $1.8 Mln in Seed Funding.</u> IPO.com - Venture. [On-Line]. Available: http://www.ipo.com/venture/news.asp?p=IPO&pg=32297 [Accessed on 2002-03-27]

4. unknown. <u>MySQL 4.0 In A Nutshell.</u> MySQL.com [On-Line]. Available: http://www.mysql.com/products/mysql-4.0/index.html [Accessed on 2002-04-06]

5. unknown. <u>Product Support.</u> Oracle.com [On-Line]. Available: http://www.oracle.com/support/product/index.html [Accessed on 2002-04-06]

6. unknown. <u>The Evolution of Relational Database Technology.</u> IBM.com. [On-Line]. Available: http://www-3.ibm.com/software/data/db2/innovation/ [Accessed on 2002-03-27]

7. unknown. <u>Stored Procedures and Triggers.</u> MySQL.com [On-Line]. Available: http://www.mysql.com/doc/A/N/ANSI_diff_Triggers.html [Accessed on 2002-04-07]