MySQL Enterprise Edition
Product Guide

A MySQL® White Paper
September, 2011

Table of Contents

1 Introduction 3
2 MySQL Enterprise Edition 3
3 MySQL Database 4
4 MySQL Enterprise Security 5
5 MySQL Enterprise Scalability 6
6 MySQL Enterprise High Availability 8
7 MySQL Enterprise Backup 11
8 MySQL Enterprise Monitor and Advisors 11
9 MySQL Workbench 16
10 Oracle Premier Support 18
11 Conclusion 19
12 Additional Resources 19
Appendix A: MySQL Customers 20
Appendix B: Zappos Case Study 21
Appendix C: Booking.com Case Study 22
Appendix D: Adobe Case Study 23
Appendix E: Zimbra Case Study 24

1 Introduction

Whether you are building high volume websites, enterprise and departmental applications, or advanced communications networks, your organization needs the tools to build and manage these business-critical database applications. This paper explores how you can confidently deploy MySQL as part of a cost-effective cross-platform solution for delivering high-performing, highly available, reliable and scalable applications. It examines some of the challenges associated with building and supporting scalable, data-driven applications using open source technologies and provides a detailed overview of how MySQL Enterprise Edition can address these challenges. MySQL Enterprise Edition, combines the most secure, scalable, "always on" version of the MySQL database with online backup, monitoring, management and visual database design and SQL development tools, all backed by Oracle Premier Support, 24x7 global enterprise-class support services. Further, MySQL Enterprise Edition supports your use of MySQL in conjunction with many of the Oracle products and tools you may already be familiar with or are currently using. MySQL Enterprise Edition is specifically designed to help you bring high performing and scalable MySQL applications to market faster, mitigate risk, and ensure you meet customer and end-user Service Level Agreements (SLAs).

2 MySQL Enterprise Edition

MySQL is the world's most popular open source database. Whether you are a fast growing web property, software vendor,, or large enterprise, MySQL can cost-effectively help you deliver high performance, scalable database applications. If you are currently using MySQL, you probably started with the MySQL Community Edition. In fact, in many instances MySQL enters an organization via an application development project and makes its way into the data center when the application is promoted for production use. It often makes its way into shipping products in a similar fashion. Challenges arise when these applications become vital to business revenues or key business functions. The most common challenges around running MySQL and other open source technologies are revealed by a simple line of questioning:

- How will you ensure you are using the most reliable, secure, scalable, up-to-date version?
- How will you know:
  - If a server or applications is down?
  - If there is a replication master/slave synchronization or latency issue?
  - If something else is affecting the performance of a server?
- Will you know:
  - If MySQL is configured to scale-out as your application data and customer base grows?
  - How to configure MySQL variables to ensure your applications run at their peak performance?
- How will you:
  - Identify security loopholes in MySQL servers?
  - Know when there have been security alterations on a MySQL server?
- How will you:
  - Optimize your database designs and queries before they are migrated into your production environments or included in your products?
  - Ensure replicated servers are configured correctly for performance and scalability?
  - Monitor and tune poorly performing user/application SQL code?
- How will you integrate MySQL with your existing security standards and infrastructure?
- If you or your customers also use the Oracle Database, how can you:
  - Manage MySQL high availability using existing Oracle solutions?

To help you answer these questions with confidence MySQL provides the MySQL Enterprise Edition. MySQL Enterprise Edition is a commercial offering comprised of the MySQL database with security and scalability extensions, online backup, monitoring, management, and visual database design and SQL

development tools. MySQL Enterprise Edition is backed by Oracle Premier support for organizations delivering highly available, business critical applications and services. MySQL Enterprise includes the following components:

3 MySQL Database

The MySQL Database is a fully integrated transaction-safe, ACID compliant database with full commit, rollback, crash-recovery and row level locking capabilities. The MySQL Database is a cost-effective solution for:

- High-performance, scalable Web and E-commerce applications
- Corporate Departmental OLTP and Data Mart applications
- Low administration, high performance, reliable embedded database applications
- And more

The MySQL Database provides the following features:

- Replication to improve scalability and performance of high-volume applications
- Partitioning to improve performance and simplify management of very large database environments
- Stored procedures to increase developer productivity
- Triggers to enforce complex business rules at the database level
- Views to reduce the complexity of data while increasing security
- Information Schema to provide easy access to metadata
- Performance Schema for monitoring MySQL server run-time performance
- Pluggable storage engine architecture for maximum flexibility

MySQL Replication and High Availability

MySQL Replication has been widely deployed by MySQL users to deliver both scalability and high availability. It is simple for users to rapidly create multiple replicas of their database to scale-out beyond the capacity constraints of a single instance, enabling them to serve rapidly growing database workloads.

MySQL Replication works by simply having one server act as a master, while one or more servers act as slaves. The master server will log the changes to the database. Once these changes have been logged, they are then sent and applied to the slave(s).

Replication is often employed in a scale-out implementation so that requests that simply “read” data can be directed to slave servers. This allows transactions involving writes to be exclusively executed on the master server and leads to not only a performance boost but a more efficient use of resources.

Replication is also the most common approach to delivering High Availability (HA) for MySQL databases. Updates are replicated from a master to slave server with the goal being to fail-over to the slave server in the event the master goes offline either due to an error, crash or for maintenance purposes. Failover can be implemented at the application or database level using a variety of mechanisms.

MySQL Enterprise Edition builds on the above feature set by providing a set of commercial extensions that meet the advanced security, performance, scale and availability requirements of the most demanding applications, web and online environments. These extended features are exclusive to MySQL Enterprise Edition and are described below.

4 MySQL Enterprise Security

MySQL Database 5.5 and higher supports a pluggable authentication interface that enables users to develop plug-ins to authenticate MySQL client connections against external resource such as LDAP, Active Directory, PAM, Windows, etc. This enables MySQL to easily integrate with existing security standards and infrastructure.

MySQL External Authentication

MySQL Enterprise Edition provides ready to use external authentication modules for users who authenticate users via Pluggable Authentication Modules ("PAM") or native Windows OS services. Each is described below:

- MySQL External Authentication for PAM - Enables you to configure MySQL to use PAM to authenticate users on LDAP, Unix/Linux, and other systems.

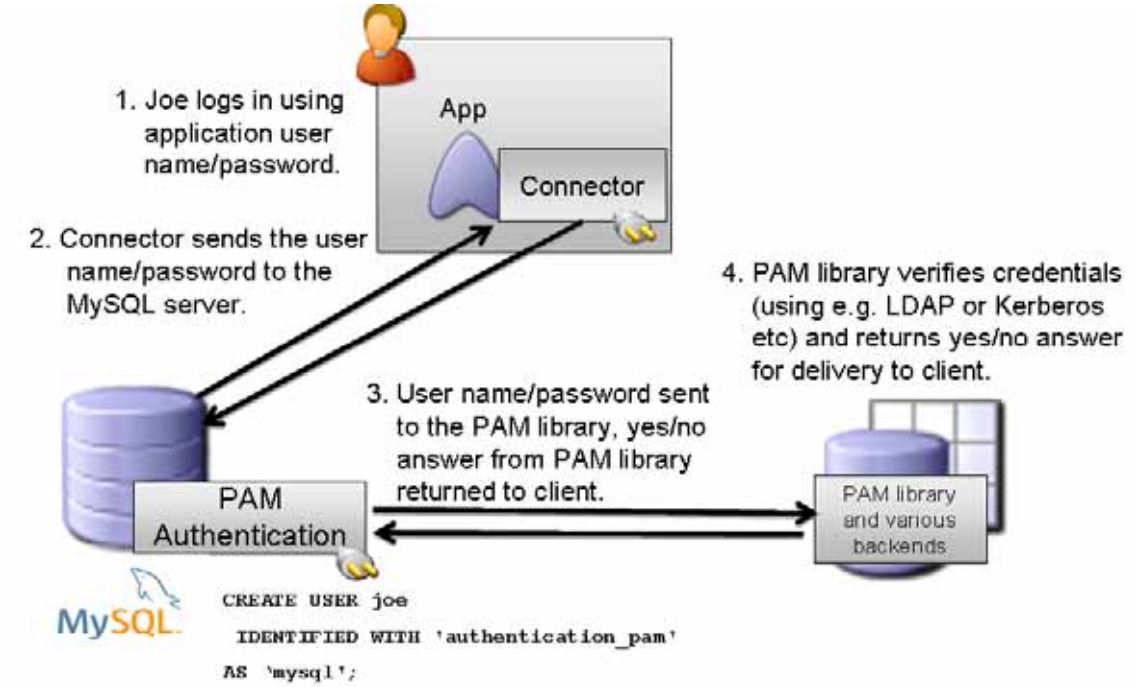

Figure 1: MySQL External Authentication for PAM

- MySQL External Authentication for Windows – Enables you to configure MySQL to use native Windows services to authenticate client connections. Users who have logged in to Windows can connect from MySQL client programs to the server based on the token information in their environment without specifying an additional password.

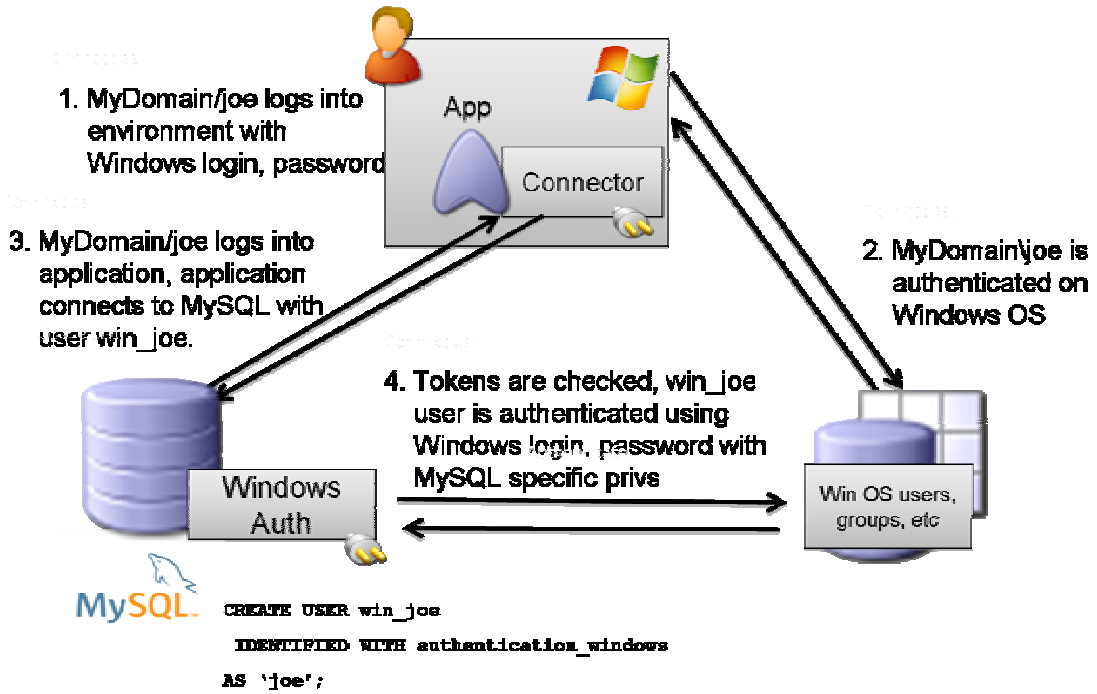

Figure 2: MySQL External Authentication for Windows

5 MySQL Enterprise Scalability

The default thread-handling model in the MySQL Database provides excellent throughput and performance. However, because it executes statements using one thread per client connection it can limit scalability.

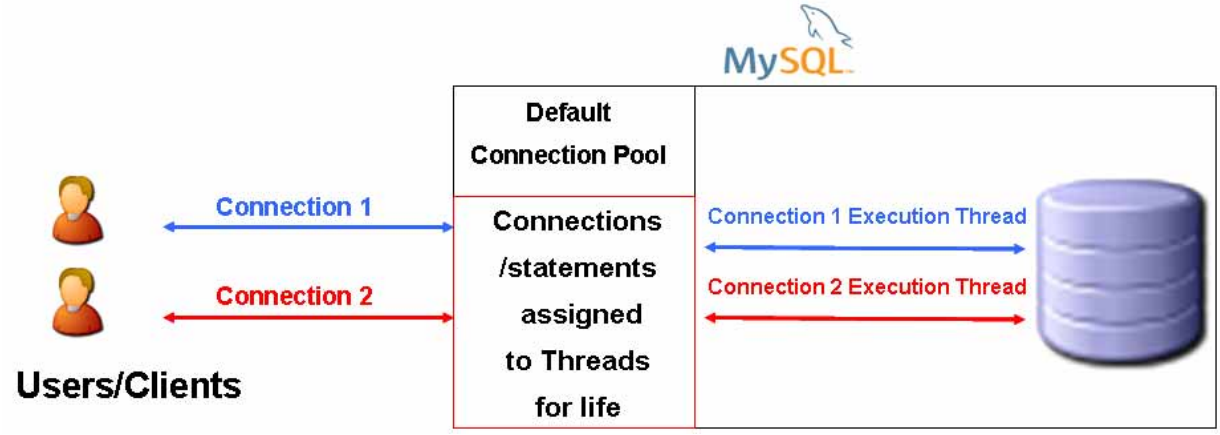

Figure 3: Default Connection Pool

As a result user response times have traditionally been impacted as user connections and query execution loads continue to grow.

The MySQL Thread Pool

To meet the sustained performance and scalability of ever increasing user, query and data loads MySQL Enterprise Edition provides the MySQL Thread Pool. The Thread Pool is a user configurable option that provides an efficient, alternate thread-handling model designed to fully exploit the processing power of today's multi-core systems.

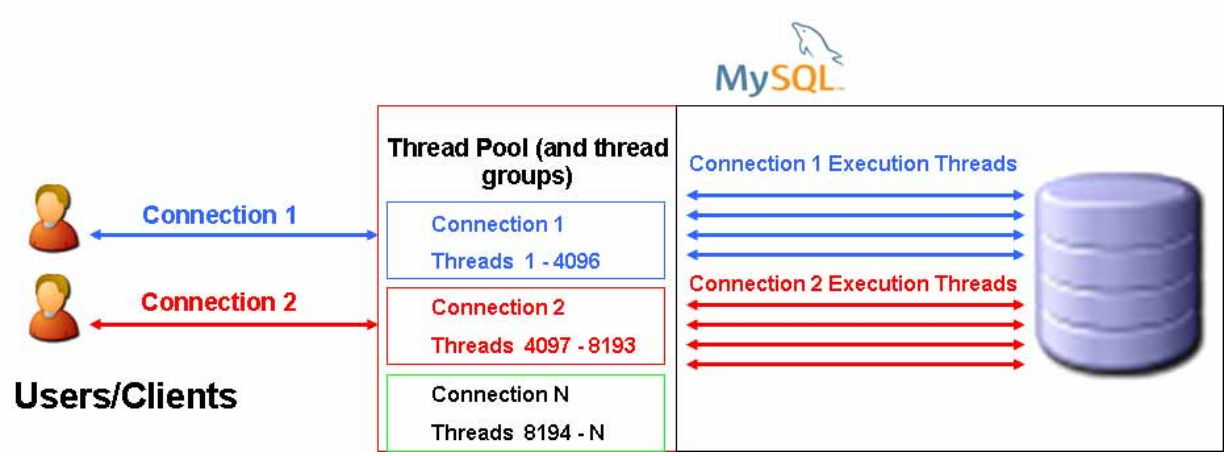

Figure 4: MySQL Thread Pool

The result is reduced overhead in the management of client connections and statement execution threads and improved scalability and sustained performance for high-traffic online applications that service ever-growing numbers of client connections.

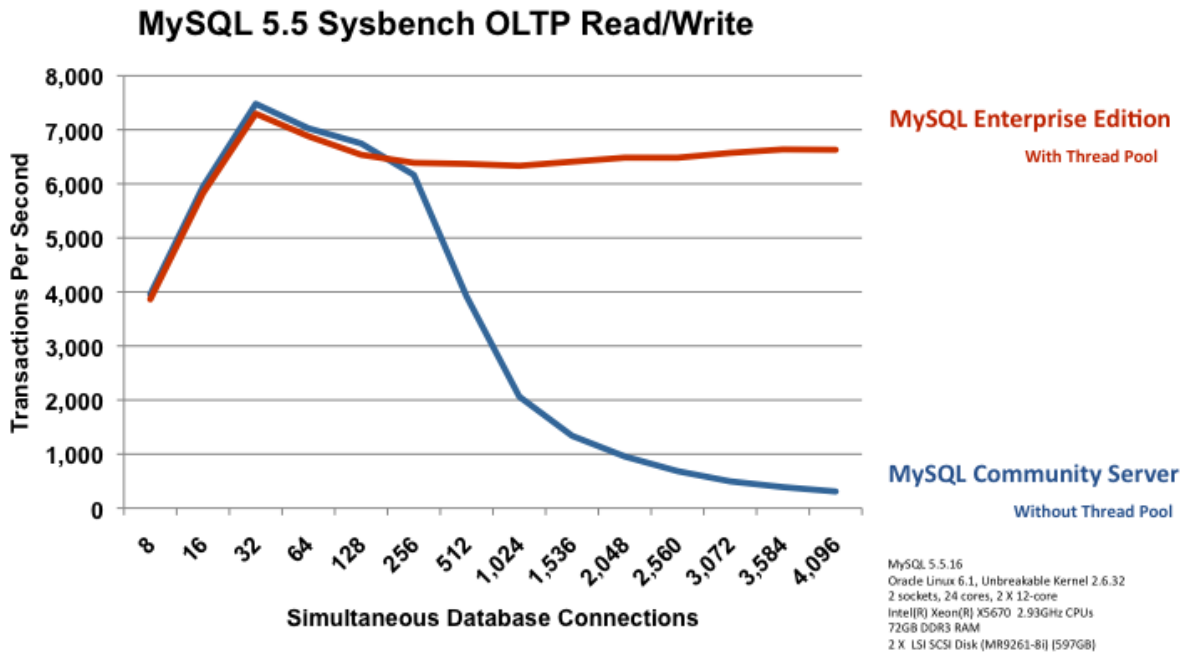

Figure 5: MySQL Enterprise Edition provides 20x better scalability for OLTP Read/Write activity with Thread Pool

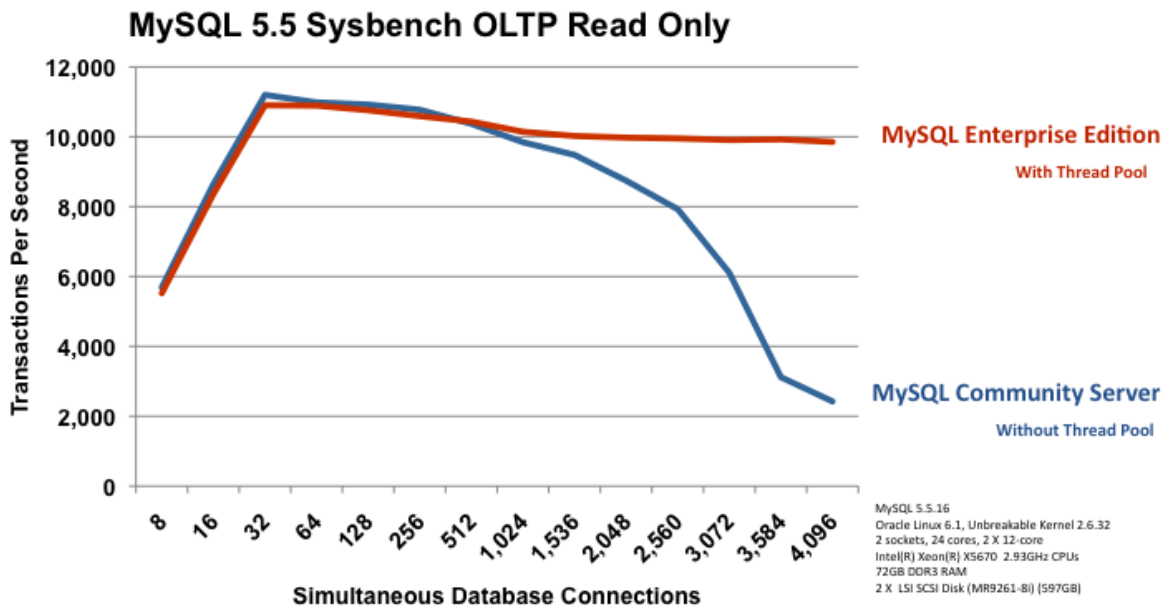

Figure 6: MySQL Enterprise Edition provides 3x better scalability for OLTP Read activity with Thread Pool

SysBench OLTP benchmarks show that the MySQL Thread Pool provides a significant improvement in sustained performance and scalability for applications that service a high number of concurrent connections. The graphs above show read/write activity improves by a factor of 20 while read only activity improves by a factor of 3, both at 4.096 concurrent connections, with the Thread Pool enabled.

6 MySQL Enterprise High Availability

Databases are the center of today's applications – whether SMB, enterprise, or web, as they store and protect an organization's most valuable assets, and run business-critical applications. Just minutes of downtime can often result in significant amounts of lost revenue and unsatisfied customers. Making database applications highly available is therefore a top priority for all organizations.

As demonstrated below, MySQL Enterprise offers a range of solutions to automatically detect and recover from failures – whether these occur at the network, host, OS or database layer – as well as eliminate downtime resulting from scheduled maintenance activities.

Oracle VM Template for MySQL Enterprise Edition

Integrating MySQL Enterprise Edition with Oracle VM and Oracle Linux, the Oracle VM Template for MySQL[1] is the fastest, easiest and most reliable way to provision virtualized and highly available MySQL databases.

The Oracle VM Template for MySQL Enterprise Edition ensures rapid deployment and helps eliminate configuration efforts and risks by providing a pre-installed and pre-configured virtualized software image, taking advantage of Oracle VM's mechanisms to deliver high availability.

[1] http://www.mysql.com/why-mysql/virtualization/index.html

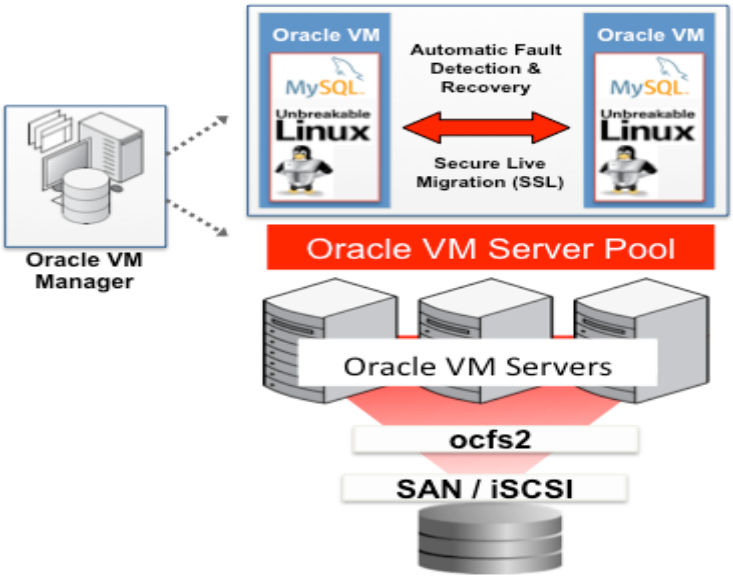

Figure 7: Oracle VM Template for MySQL 5.5 Enterprise Edition enable rapid provisioning and integrated High Availability

Organizations can meet stringent SLA (Service Level Agreement) demands by using the High Availability features of the Oracle VM Template for MySQL Enterprise Edition:

- **Automatic recovery from failures**, Oracle VM automatically restarts failed MySQL instances on available servers in the server pool after outages of the physical server, VM or MySQL database.
- **Live Migration,** enables operations staff to move running instances of MySQL to alternative hosts within a server pool when they need to perform maintenance operations.

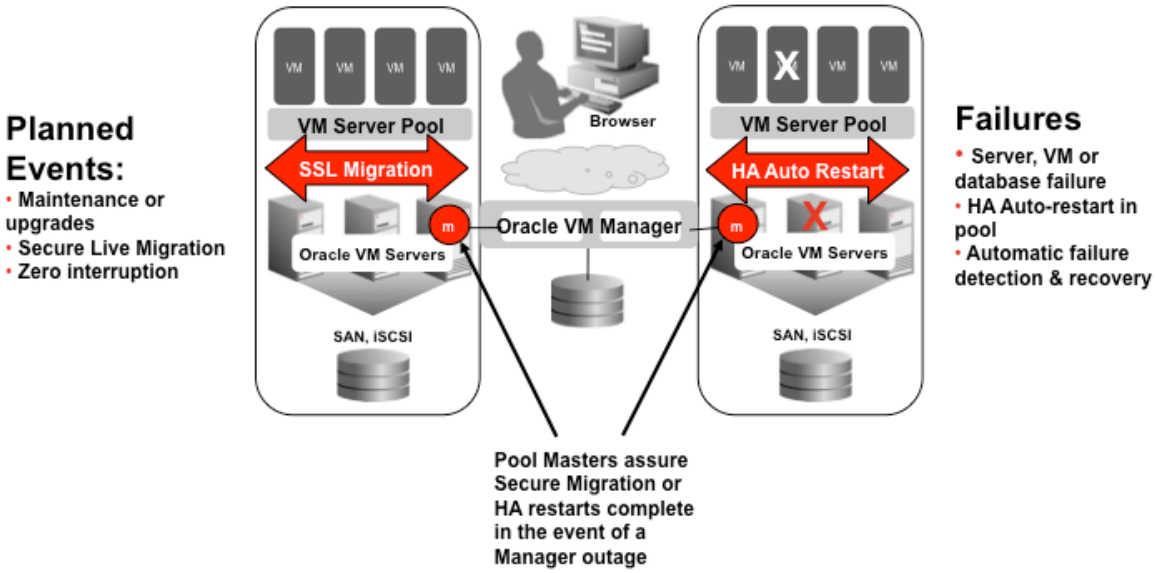

Figure 8: Oracle VM Template protects MySQL against planned and unplanned downtime

Together with Oracle's 24/7 world-class technical support across the entire stack[2], the Oracle VM template for MySQL Enterprise Edition enables users to quickly and safely deploy new web and cloud-based applications and services.

To learn more, download the whitepaper:
http://www.mysql.com/why-mysql/white-papers/mysql_wp_oracle-vm-template-for-mee.php.

Windows Server Failover Clustering

Microsoft Windows is consistently ranked as the top development platform for MySQL, and outranks any individual Linux distribution as the leading platform for MySQL deployments, according to surveys of MySQL Enterprise, ISV / OEM and Community users.

With the certification and support of MySQL with Windows Server Failover Clustering (WSFC), organizations can safely deploy business-critical applications demanding high levels of availability, powered by MySQL Enterprise.

Windows Server Failover Clustering (WSFC) is a feature of the Enterprise and Datacenter editions of Windows Server 2008 R2. The figure below illustrates the integration of MySQL with Windows Server Failover Clustering to provide a highly available service. Failures of either MySQL or the underlying server are automatically detected and the MySQL instance is restarted on the Standby node. Applications accessing the database, as well as any MySQL replication slaves, can automatically reconnect to the new host running MySQL using the same Virtual IP address.

Administrators can also initiate a failover themselves when they need to take a server offline for maintenance.

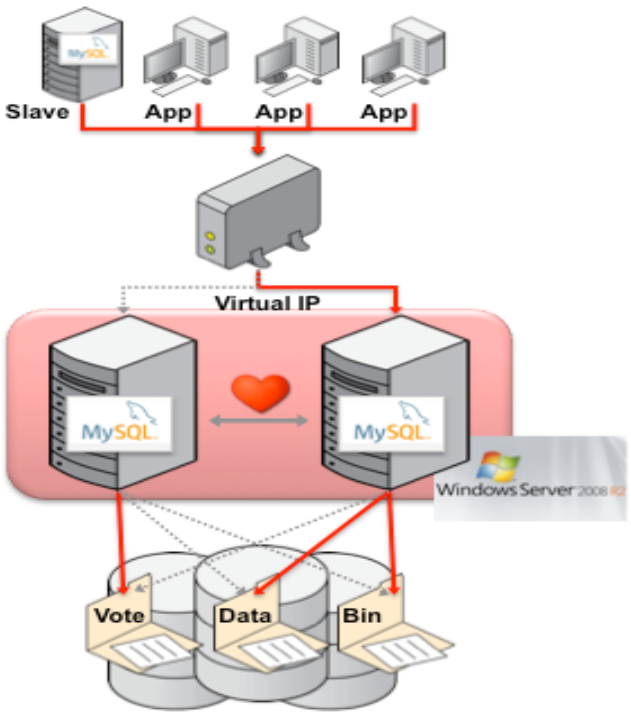

Figure 9: MySQL and Windows Server Failover Cluster Providing HA to Business Critical Applications running on the Windows Platform

[2] Users need to subscribe to the Unbreakable Linux Network to receive support for Oracle Linux and Oracle VM

MySQL Enterprise Edition is fully supported when deployed on Windows Server Failover Clustering[3], and best practices are provided to guide users through the provisioning and deployment.

To learn more download the whitepaper:
http://www.mysql.com/why-mysql/white-papers/mysql_wp_windows_failover_clustering.php.

7 MySQL Enterprise Backup

Backup

MySQL Enterprise Backup performs online "Hot", non-blocking backups of MySQL databases. Full backups can be performed on all InnoDB data while MySQL is online, without interrupting queries or updates. In addition, incremental backups are supported so that only data that has changed from a previous backup are backed up. Also partial backups are supported when only certain tables or tablespaces need to be backed up.

Restore

MySQL Enterprise Backup restores data from a full backup with full backward compatibility. Consistent Point-in-Time Recovery (PITR) enables restoration to a specific point in time. Using MySQL backups and binlog, you can also perform fine-grained roll forward recovery to a specific transaction. A partial restore allows recovery of targeted tables or tablespaces. In addition, you can restore backups to a separate location, or create clones for fast replication setup or administration.

Compression

MySQL Enterprise Backup supports creating compressed backup files, typically reducing backup size from 70% to over 90% when compared to the size of actual database files, reducing storage and other costs.

To learn more, download the whitepaper:
http://mysql.com/why-mysql/white-papers/mysql_wp_enterprise_backup.php.

8 MySQL Enterprise Monitor and Advisors

The MySQL Enterprise Monitor is a distributed web application that is deployed within the safety of a corporate firewall or can be used to monitor servers remotely. It continually monitors MySQL servers and proactively sends SNMP/SMTP alerts on potential problems and tuning opportunities before they become costly outages. It also provides MySQL Advisors and 140+ Advisor Rules that deliver MySQL best practices advice relating to administration, security, performance, replication setup and more so you know where to spend your time in optimizing MySQL systems. The MySQL Enterprise Monitor will also proactively alert you to potential problems such as security vulnerabilities and replication latency issues before they impact your systems.

Enterprise Dashboard for Monitoring all MySQL Servers

Using the Enterprise Dashboard, you can monitor MySQL and OS specific metrics for single or groups of servers, and can stay on top of all their replication topologies. The Enterprise Dashboard is designed so

[3] Oracle does not provide technical support for Windows Server Failover Clustering itself. This must be sourced from Microsoft.

you can easily understand the complete security, availability, and performance picture of all MySQL servers in one place, all from a thin, browser-based console.

Availability and Performance Diagnosis

The Enterprise Dashboard includes a color-coded Heat Chart that provides an at-a-glance view into the availability and performance of all of the MySQL servers across the enterprise. From the Heat Chart the you can instantly tell:

- The Up/Down status of all MySQL servers
- Key OS metrics that may be affecting MySQL
- Which MySQL servers need attention
- Where and how they need to spend their limited time

Figure 10: MySQL Enterprise Dashboard

Monitoring of Replication/Scale-Out Topologies

The Enterprise Dashboard makes it easier to scale out using MySQL Replication by providing industry-leading auto detection, grouping, documenting and monitoring of all MySQL Replication master/slave hierarchical relationships. Changes and additions to existing replication topologies are also auto detected and maintained providing you instant visibility into newly implemented updates. This helps reduce the learning curve for for anyone new to MySQL Replication or to specific scale-out environments.

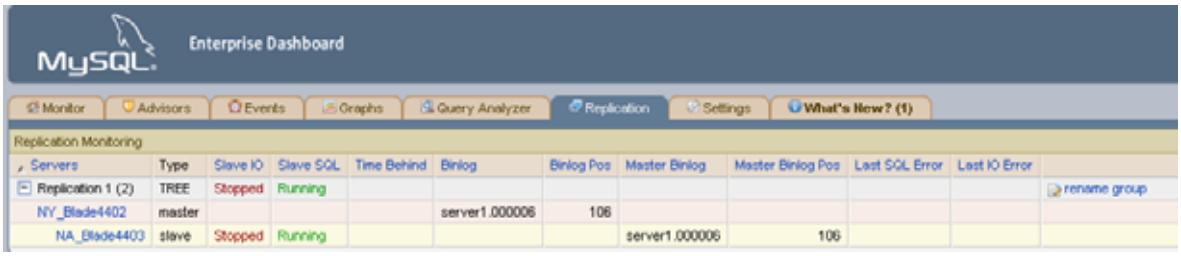

Figure 11: MySQL Enterprise Replication Monitor

MySQL Advisors

The MySQL Enterprise Monitor differs from traditional third-party database monitors in that it supplies a complete set of MySQL Advisors that are designed to automatically examine a MySQL server's configuration, security, and performance levels; identify problems and tuning opportunities; and provide the you with specific corrective actions.

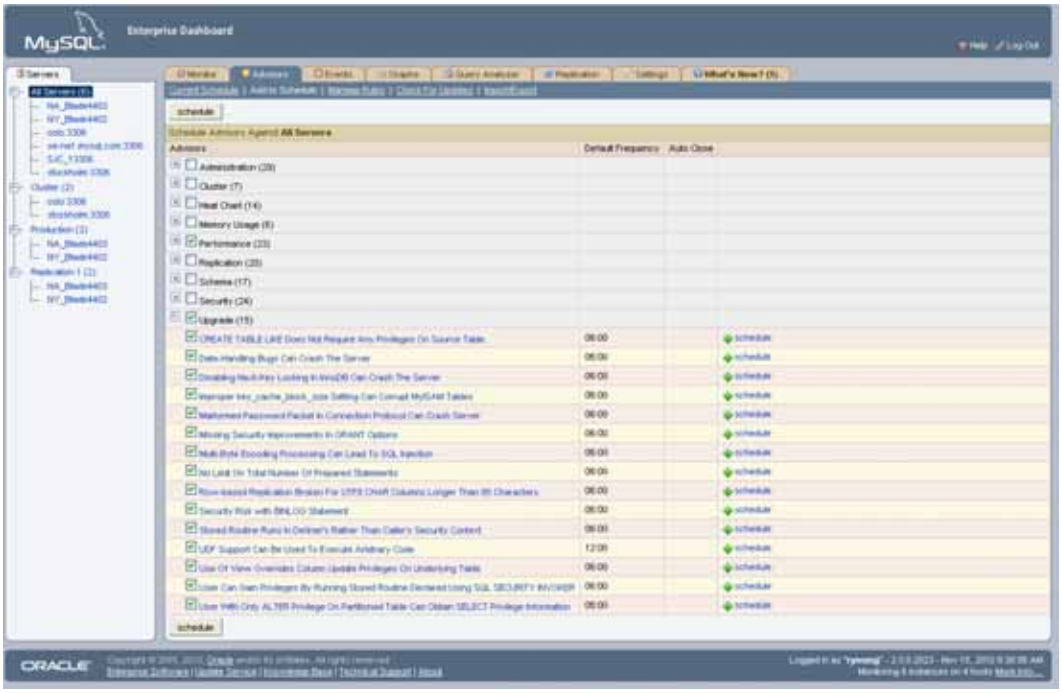

Figure 12: MySQL Enterprise Advisors

The MySQL Enterprise Monitor ships with the following set of best practice Advisors:

- **Upgrade** - Monitors and advises you on using the most secure and up to date version of MySQL you should deploy.
- **Administration** – Monitors and advises on problems relating to general database administration, recoverability and performance configuration settings
- **Security** – Monitors for security vulnerabilitis in the MySQL database and advises on how to protect against potential security breaches
- **Replication** – Monitors and advises on problems relating to Replication setup, security and Master/Slave latency
- **Memory Usage** - Monitors dynamic memory related server metrics (cache usage, hit ratios, etc.) and advises on configuration changes to improve performance

- **Performance** – Monitors dynamic performance related server metrics and advises on configuration and variable settings to improve performance
- **Schema** – Monitors for and advises on unplanned changes to a database schema
- **Cluster** – Monitors MySQL Cluster data nodes memory, undo/redo buffer space, undo/redo log space, and node up/down status and advises on how to optimize them.
- **Custom** - Create your own Best Practice Advisors and Rules to fit your specific use of MySQL

MySQL Advisor Rules

The MySQL Advisor Rules are a set of MySQL supplied best practices that enable you to implement new MySQL servers with confidence and to proactively manage the dynamic nature of MySQL servers over time. The MySQL Advisor Rules do this by monitoring all MySQL servers for adherence to MySQL recommended configuration and server settings and notifying the you with specific instructions on how to proactively address found exceptions to align with MySQL best practices. To do this, the MySQL Enterprise Monitor employs 140+ MySQL Advisor Rules that monitor over 600 MySQL and OS specific variables and metrics that track and report on the overall health, security, availability and performance of each MySQL server.

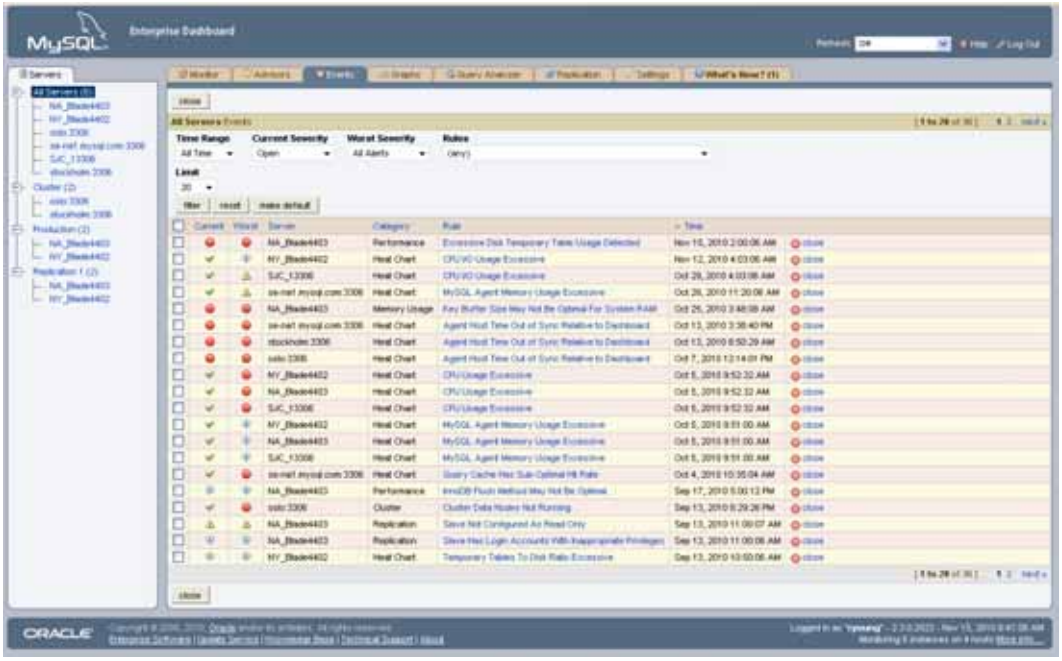

Figure 13: MySQL Enterprise Advisor Rules and Alerts

To learn more, download the whitepaper:
http://mysql.com/why-mysql/white-papers/mysql-wp-enterprise-monitor-virtualdba.php.

MySQL Query Analyzer

The MySQL Query Analyzer helps developers and DBAs improve application performance by monitoring queries and accurately pinpointing SQL code that is causing a slow down. With the new MySQL Connector Plug-ins, the performance of Java and Microsoft .NET applications can be optimized more efficiently by communicating directly with the MySQL Query Analyzer.

Queries are presented in an aggregated view across all MySQL servers so DBAs and developers can filter for specific query problems and identify the code that consumes the most resources. With the MySQL Query Analyzer, DBAs can improve the SQL code during active development and continuously monitor and tune the queries in production.

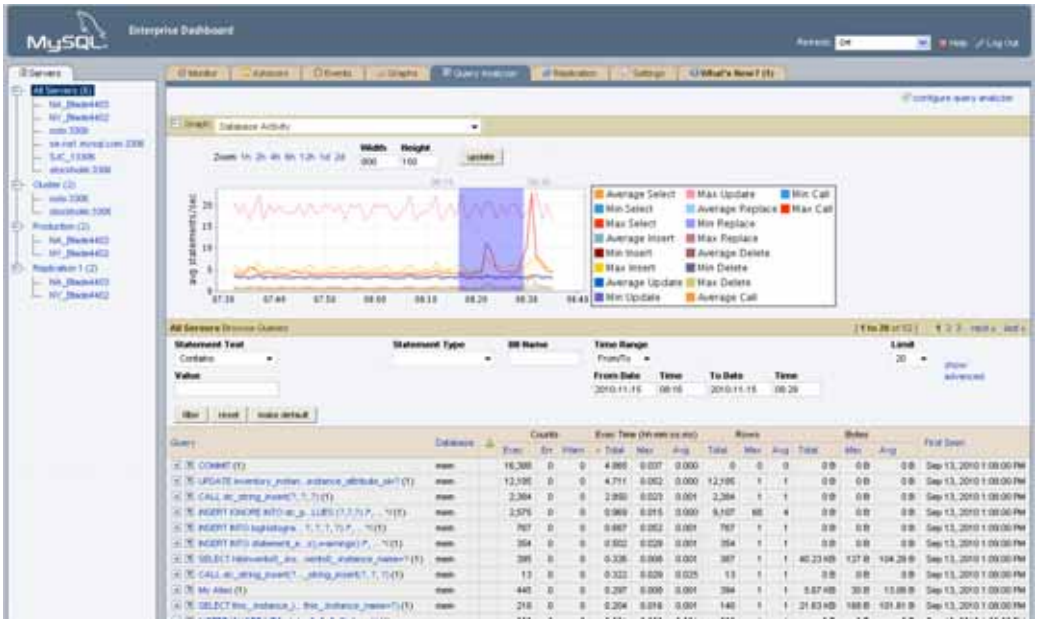

Figure 14: MySQL Query Analyzer

The MySQL Query Analyzer saves you time and effort in monitoring MySQL servers for problem queries by providing:

- An integrated monitoring solution for all supported versions of MySQL (4.1 and higher).
- Aggregated query content and performance stats in real time with no reliance on MySQL logs or SHOW PROCESSLIST.
- Visual correlation of query activity with Monitor graphs.
- A consolidated view into query activity across all MySQL servers, no user parsing required.
- Historical browsing/analysis of queries across all MySQL servers.
- Aggregated, searchable roll ups of all queries in canonical form (no variables) with total number of executions, total execution time, total data size and date/time of when query was "first seen":
    - **Total Executions** helps you see when queries are running too often or in error. Even properly tuned queries cause performance problems when they run excessively.
    - **SQL Warning and Error counts** help you see queries that did not finish or that returned incorrect result sets. These executions may never be found using other query monitoring options.
    - **Total Execution Time** helps you see the most "expensive" queries across all of the servers. This value helps you see where systems are spending the most time and resources and where you should focus your tuning efforts.
    - **Total Data Size (Rows and Bytes)** helps you analyze if queries are returning more data than your application is using. Sorting on this value, examining the underlying queries and comparing the returned rows and columns with your application requirements will help you tune your applications and schema for better performance.
    - **"First Seen"** allows you to easily monitor when queries attributed to new application deployments are affecting the performance of your production systems.
- Drill downs into query details, number of executions, execution stats, visual EXPLAIN plan, and query specific execution graphs.
- Drill downs that allow developers to trace query execution back to the originating source code.

To learn more, download the whitepaper:
http://mysql.com/why-mysql/white-papers/mysql_wp_queryanalyzer.php.

9 MySQL Workbench

MySQL Workbench is a unified visual tool that enables developers, DBAs, and data architects to design, develop, and administer database applications. MySQL Workbench includes advanced data modeling capabilities, a visual SQL editor and comprehensive administration tools for database design, query development, server configuration and user administration.

Design

MySQL Workbench enables a DBA, developer, or data architect to visually design, model, generate, and manage databases. It includes everything a data modeler needs for creating complex ER models, forward and reverse engineering, and also delivers key features for performing difficult change management and documentation tasks that normally require much time and effort.

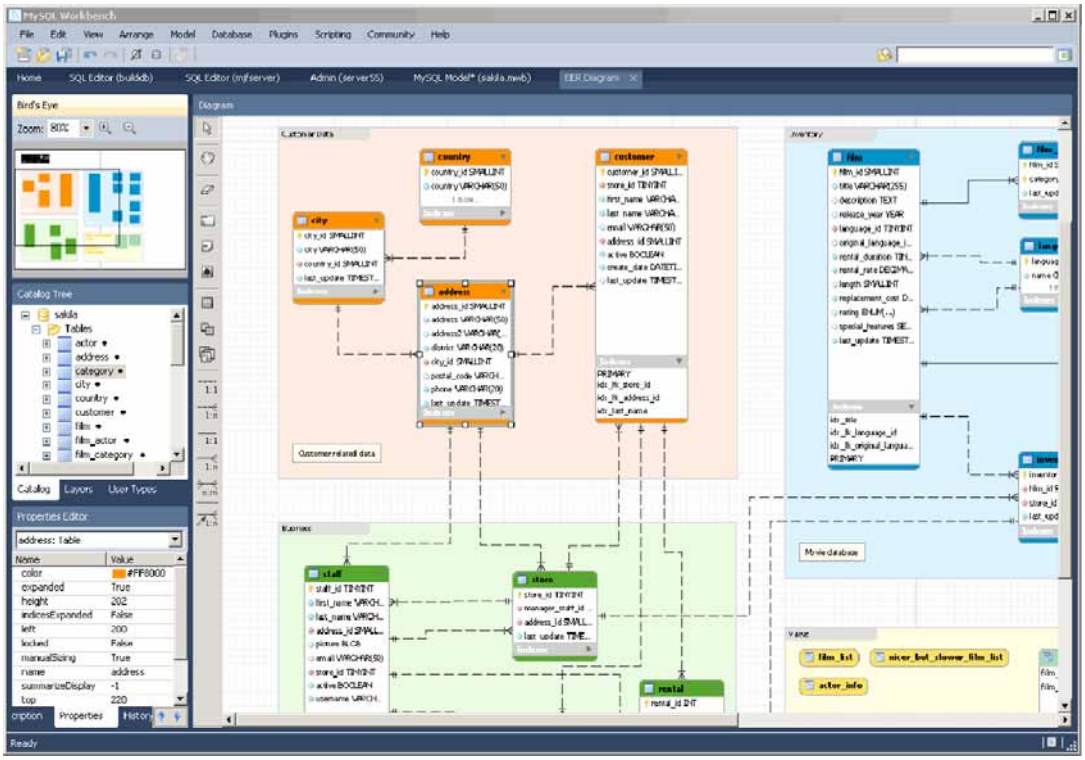

Figure 15: MySQL Workbench – Visual Database Design

Develop

MySQL Workbench delivers visual tools for creating, executing, and optimizing SQL queries. The SQL Editor provides color syntax highlighting, reuse of SQL snippets, and execution history of SQL. The Database Connections Panel enables developers to easily manage database connections. The Object Browser provides instant access to database schema and objects.

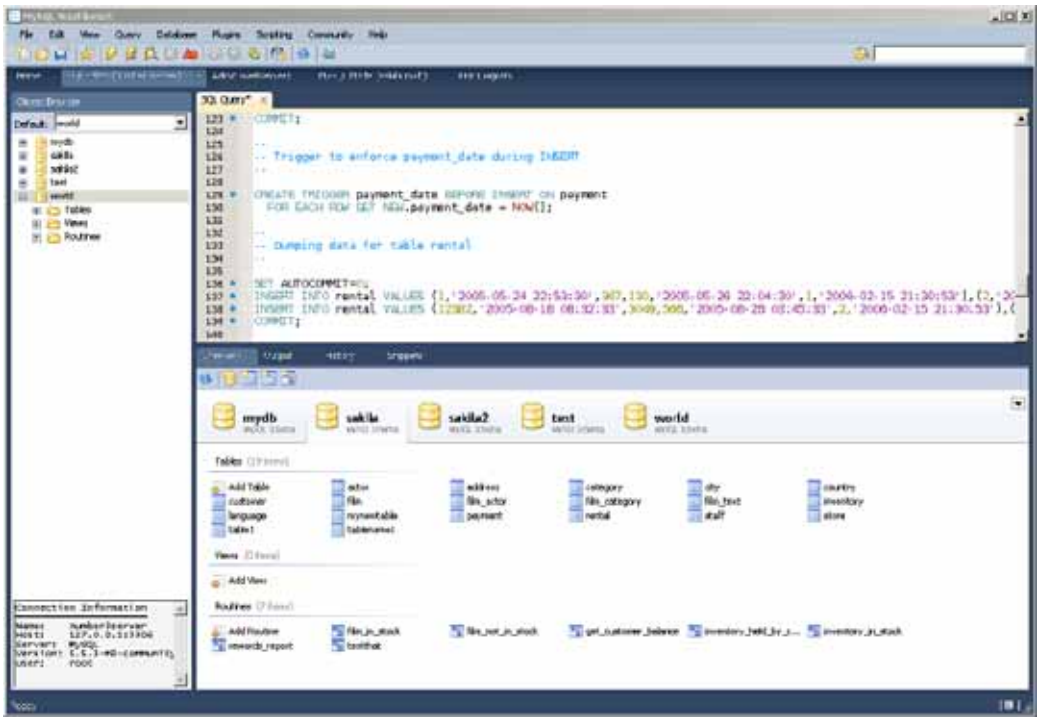

Figure 16: MySQL Workbench – SQL Development, Execution, Tuning

Administer

MySQL Workbench provides a visual console to easily administer MySQL environments and gain better visibility into databases. Developers and DBAs can use the visual tools for configuring servers, administering users, and viewing database health.

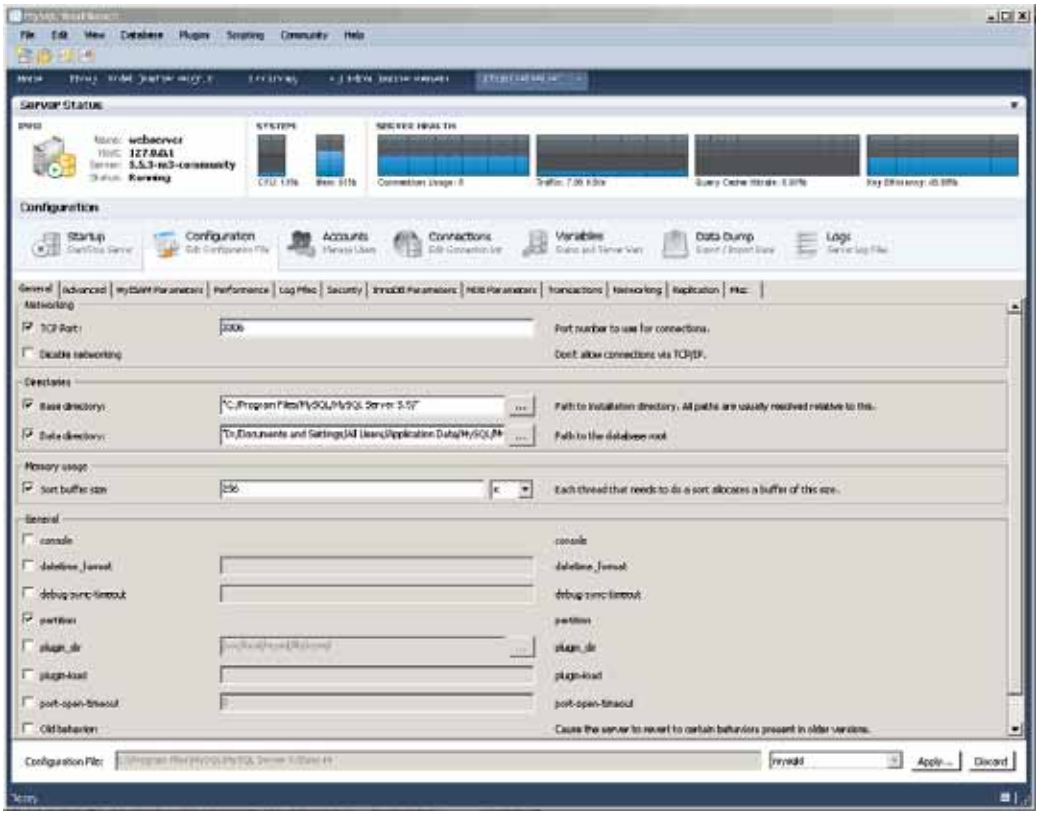

Figure 17: MySQL Workbench – Server Administration, Monitoring

To learn more, download the whitepaper:
http://mysql.com/why-mysql/white-papers/mysql-wp-workbench.php.

10 Oracle Premier Support

Oracle offers 24x7, global support for MySQL. The MySQL Support team is composed of seasoned MySQL developers, who are database experts and understand the issues and challenges you face. With Oracle Premier Support, you can lower the total cost and risk of owning your MySQL databases, improve the return from your IT investment, and optimize the business value of your IT solutions. MySQL support is included in the subscription for end users, and available separately from commercial licenses for ISVs and OEMs. Oracle Premier Support for MySQL includes the following features:

- 24 X 7 production support
- Unlimited support incidents
- Knowledge Base
- Maintenance releases, bug fixes, patches and updates
- MySQL consultative support

Learn more about Oracle Premier Support:
http://mysql.com/support/

11 Conclusion

In this paper we explored the components that are included in MySQL Enterprise Edition. These components are designed to help you mitigate risk and meet Service Level Agreements (SLAs) as you implement applications built on the lower costs and licensing freedom that comes with standardizing on MySQL and other Web 2.0 technologies. MySQL Enterprise Edition extends the MySQL Database to include advanced Security, Performance/Scale and High Availability features. The MySQL Enterprise Backup performs online "Hot", non-blocking backups of your MySQL databases. The Enterprise Monitor, Advisors and Query Analyzer proactively notify you of problems and tuning opportunities before they turn into customer facing issues. MySQL Workbench enables developers, DBAs, and data architects to design, develop, and administer database applications. For managing Oracle and MySQL databases, there are supported integrations and certifications that allow you to manage MySQL using many Oracle products. Finally, the Oracle Premier Support provides you with quick answers and resolutions when you need help, so your systems provide uninterrupted availability to your customers.

12 Additional Resources

MySQL Customers and Case Studies
http://www.mysql.com/customers

MySQL Enterprise Edition
http://mysql.com/products/enterprise/

MySQL Enterprise Backup
http://www.mysql.com/products/enterprise/backup.html

MySQL Enterprise Monitor
http://www.mysql.com/products/enterprise/monitor.html

MySQL Query Analyzer
http://www.mysql.com/products/enterprise/query.html

MySQL High Availability
http://www.mysql.com/products/enterprise/high_availability.html

MySQL Professional Services and Consulting
http://mysql.com/consulting/

MySQL for ISVs and OEMs
http://mysql.com/why-mysql/isv-oem-corner/

Oracle Products
http://www.oracle.com/us/products/index.html

Appendix A: MySQL Customers

Global companies such as Bank of America, Lufthansa, and Alcatel-Lucent rely on MySQL for their day to day business operations. Global ISVs and OEMs such as Adobe, F5 and Sage Group entrust their products' success to MySQL as their embedded database. These organizations have put MySQL to the test and have chosen MySQL for its ease of use, performance, and reliability.

MySQL is also the database of choice for a new generation of modern database applications including Web, SaaS and Cloud applications. The world's most trafficked Web sites including Facebook, Google and YouTube rely on MySQL for their business critical applications. These Web sites are proof that MySQL can meet the most demanding performance and scalability requirements. For example, Facebook deploys thousands of MySQL servers and has scaled MySQL to manage 500 million users.

Some of the most advanced MySQL customers and markets segments include:

- **Web:** Facebook, Google, YouTube, eBay, Wikipedia, Yahoo
- **eCommerce:** craigslist, Zappos, Ticketmaster
- **SaaS/Cloud:** RightNow, Zimbra, Clickability
- **Embedded:** Adobe, CA, Cisco, Hewlett Packard, Symantec

Partial List of MySQL Customers		
Web/End Users Customers	**Embedded/ISV Customers**	**Telecom Customers**
• Amazon.com • Baidu • BBC News • Craigslist • Disney • Ebay • Facebook • Google • LinkedIn • Lufthansa • NASA • Priceline.com • Puma • Shopatron • Ticketmaster • Twitter • Walmart • Wells Fargo • Yahoo! • YouTube • Zappos • Zynga	• Adobe • Airbus • Business Objects • CA NetQoS • Citrix • Dell Kace • Eastman Kodak • EMC • F5 Networks • F-Secure • Hewlett Packard • Intel • Iron Mountain • McAfee • Motorola • Quest • Sage Group • Scholastic • SonicWall • Symantec • Texas Instruments • Trend Micro	• Alcatel-Lucent • Aastra Telecom Schweiz AG • AT&T Wireless • BT Plusnet • Cable & Wireless • Cell C • Cisco • Clarus Systems • Comcast • Ericsson • France Telecom • Italtel • Motorola • Nokia Siemens Networks • Oi Telecom • Pyro Group • SFR • Telenor • Teligent • T-Systems International • UTS Starcom • Zoho Networks WebNMS

Appendix B: Zappos Case Study

Zappos - A "Growing" Challenge

Zappos prefers to think of itself as a customer-service company that happens to sell shoes and handbags online. Since its founding in 1999, Zappos has grown to 1,000+ employees and its website now carries over 1,000 name brands, over 150,000 styles and nearly 3 million products in stock for ready for immediate shipment. The company built its innovative business model and e-commerce site from scratch and created a better way to shop for consumers tired of finding that their most-desired items were always out of stock at traditional retailers.

The Challenge

In the earliest start-up days of Zappos.com, the company needed to properly balance enterprise database requirements with the realities of a not-so-limitless IT budget. After evaluating several open source alternatives, they selected MySQL because it was the most robust, easy-to-use and affordable database software available. As Zappos' business quickly grew, their use of MySQL also became more advanced and business-critical.

The MySQL Solution

To service growing customer demand, Zappos implemented a modern Scale-Out architecture using MySQL Replication to power its mission-critical website, underlying systems infrastructure, and business-support tools. It features two master MySQL database servers and five replicated, load-balanced slaves to handle high traffic volume — assuring fast performance and high availability for their online customers.

MySQL products and services protect them from downtime and performance issues via proactive monitoring and alerts that are provided by the Enterprise Monitor and Advisors. They have confidence and peace of mind knowing that any problem they experience with MySQL will be quickly resolved with help from the MySQL Support team.

Appendix C: Booking.com Case Study

Booking.com – Over 1 Million Customers Served per Day

Booking.com is Europe's largest online hotel travel reservations agency — attracting over 20 million unique visitors each month. Part of **Priceline.com**, the successful European site processes tens of thousands of online bookings every day for over 30,000 hotels in 8,000 destinations worldwide in 15 different languages.

The Challenge

As one of the Web's most successful online travel sites, Booking.com experienced explosive growth; travel bookings grew 100% from 2005 to 2006. In 2007, the company's development team undertook a project to re-architect their legacy MySQL-based system and improve their site's performance, uptime, scalability and business reporting capabilities. To get things started they employed the MySQL Professional Services group to consult on implementing a new, modern scale-out architecture built on Replication and the MySQL Enterprise Server.

The MySQL Solution

The new architecture involved dividing one main MySQL database into three separate master servers and then replicating their distinct data on multiple low-cost machines. They also implemented DRBD and Linux Heartbeat for MySQL to ensure the integrity and failover of their replicated data. In doing so, Booking.com was able to significantly increase their site's speed, reduce booking data errors, lower their infrastructure cost and improve the uptime of their customer servicing applications.

MySQL provides Booking.com with the support and services they need to deliver a pleasant, consistent travel booking experience to the customers they service. They continue to leverage the MySQL Professional Services team to consult on their Scale-out needs as their applications must continue to scale to serve their growing business. Booking.com also uses the Enterprise Monitor and Advisors to help find problems and tuning opportunities before they turn into problems and potential lost customers.

Appendix D: Adobe Case Study

Adobe Embeds MySQL to Make Creative Professionals More Productive
Adobe Systems is one of the largest software companies and is the leading provider of creative tools for print, web, interactive, mobile, video and film. Adobe® Creative Suite CS3 tightly integrates the company's flagship products including Adobe Photoshop CS3, Adobe InDesign CS3, Adobe Illustrator CS3, Adobe Flash CS3, Adobe Dreamweaver CS3 and Adobe Acrobat CS3 into a single design and development toolkit.

The Challenge
Designers and developers face a number of challenges as they try to deliver project after project under tight deadlines. Some of the reasons that make it difficult for workgroups of artists, designers and project managers to deliver projects on time and on budget include:

- Artists can't open an image file because it is being used by someone else
- Designers waste hours opening up files to find the most recent version
- Departments spend days re-creating work because files get overwritten by another designer
- Project managers waste precious time consolidating feedback from emails, faxes and hard copy edits

The MySQL Solution
Adobe embeds MySQL into several Adobe Creative Suite 3 components, including Adobe Acrobat CS3, Adobe Bridge CS3, and Adobe Version Cue CS3 so that workgroups can work more efficiently on complex projects. For example, MySQL enables Adobe Creative Suite users to:

- **Browse files and preview thumbnails** locally including PDFs, Illustrator, Photoshop and Flash without having to search the network
- **Locate files faster** by searching on keywords, authors, comments, file creation dates, edit dates or any other metadata
- **Share projects and work** on the same file without usage or edit conflicts
- **Easily manage PDF based reviews** by setting up access privileges, tracking comments and incorporating changes
- **View vital workflow information** such as who is currently editing the file and revisions that have been made on the file

Adobe chose MySQL for the following reasons:

- **Easy of use** making MySQL quick and easy to embed
- **Reliability** which contributes to the overall quality of Adobe Creative Suite
- **Low Administration** so Adobe Creative Suite customers don't need a DBA
- **High Performance** making searches & workgroup functions extremely fast

Appendix E: Zimbra Case Study

Zimbra Deploys Millions of Email Accounts as a SaaS Solution
Zimbra is the leader in open source, next-generation messaging and collaboration software, supporting over 8 million paid mailboxes across tens of thousands of organizations. Their customers include well-known service providers, Fortune 1000 enterprises and leading education institutions. Recently, Zimbra Collaboration Suite (ZCS) was deployed to over 10,000 H&R Block offices worldwide. In addition, Comcast, the nation's largest cable operator, will provide its Triple Play customers with an integrated communications solution using ZCS later this year.

The Challenge
Existing proprietary messaging and collaboration solutions such as Microsoft Exchange are difficult and expensive to operate, requiring organizations to hire dedicated, high cost administrators. Zimbra saw an opportunity to change the game by building a truly modern and innovative messaging and collaboration application cost-effectively delivered on premise or on demand, as Software as a Service (SaaS). To be successful, Zimbra built a system that would scale to meet the needs of businesses with hundreds-of-thousands of users — and service providers with millions, and even tens-of-millions of users.

The MySQL Solution
The Zimbra Collaboration Suite solution unifies email, contacts, shared calendar, VoIP, and online document authoring in a rich browser-based interface and integrates with a full messaging and collaboration server. To ensure high levels of scalability, reliability, security and high-performance, Zimbra chose to build their solution on top of proven, high-quality open source components including Linux, Apache, MySQL and Ajax. Furthermore, Zimbra employs a modular architecture that enables horizontal scale-out of the server and databases, which is crucial for high-growth enterprise-scale deployments. Zimbra chose MySQL in particular because of its robustness, efficiency, and ease to embed in the ZCS solution.