



MySQL Enterprise for Managed Hosting and SaaS Providers

*Ensuring Service Level Agreements with
MySQL Enterprise*

A MySQL® White Paper

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1 Introduction

Software as a Service (SaaS) is rapidly becoming one of the fastest growing markets in the software industry. According to Gartner, “The market is poised for strong growth through 2011, when worldwide revenue will reach \$11.5 billion.”¹ The ascendancy of SaaS has been fueled by the ubiquity of fast and reliable Internet connectivity, open source software, scalable commodity hardware-based architectures and licensing price pressures. SaaS adoption is increasing not only in small and medium sized businesses, but also across modern enterprises. In the process, SaaS providers are disrupting the existing markets of traditional Independent Software Vendors (ISVs) who deliver “on-premise” solutions. In response, these ISVs are being forced to adopt new business models and technologies, in order to maintain and grow their market share.

Whether a SaaS provider chooses to host their applications in-house or remotely at either a collocation or a managed hosting facility, a subscription to MySQL Enterprise helps ensure that the databases comprising the core elements of their technology platform meet or exceed the expected Service Level Agreements (SLAs) concerning performance, scalability and uptime. These SLAs are another characteristic of SaaS offerings and are one of the means by which businesses evaluate SaaS versus on premise deployments. Some of the biggest names in SaaS, like RightNow Technologies and Zimbra, rely on MySQL Enterprise’s suite of software, services and support, to help deliver on their SLAs.

In this paper we explore the SaaS marketplace, its associated business and technical challenges, and offer some solutions in the process. We will also examine some strategies traditional ISVs should consider when deciding to enter the SaaS marketplace. Finally, we will present several case studies concerning how existing SaaS providers and transitioning ISVs, leverage MySQL Enterprise to deliver a new class of scalable, high performance online business applications.

2 SaaS Overview

SaaS differentiates itself from ISV solutions in several ways, including delivery model, technology platform, architecture and cost. One of the easiest ways to understand the fundamental differences between traditional ISVs and SaaS providers is to differentiate between how the corporate end-user “consumes” the vendor’s application. With ISVs, applications are traditionally delivered as a “product”. These applications, sometimes referred to as “on-premise” applications, are installed and maintained at the customer site by an internal IT organization. The application itself may also be heavily customized in order to satisfy specific business or integration requirements. These applications typically make use of a client-server architecture leveraging well established programming languages and infrastructure components. Ultimately, the application itself is presented in a local client connected over the corporate network.

In contrast, SaaS can be characterized most accurately as a “service”. In this delivery model, sometimes referred to as the “on-demand” model, corporate end-users access the application through their web browser over the Internet. A business making use of a SaaS application does not host or maintain the application or its associated infrastructure components. Instead, it is the SaaS provider who must ensure the availability, performance and scalability of the application, and guarantees these characteristics through a contractual SLA. Subsequently, there are often financial penalties for not meeting SLAs, which further motivates the SaaS provider to architect for scalability and high availability.

¹ August 9, 2007 - <http://www.gartner.com/it/page.jsp?id=511899>

Figure 1 illustrates a conventional “on-premise” architecture.

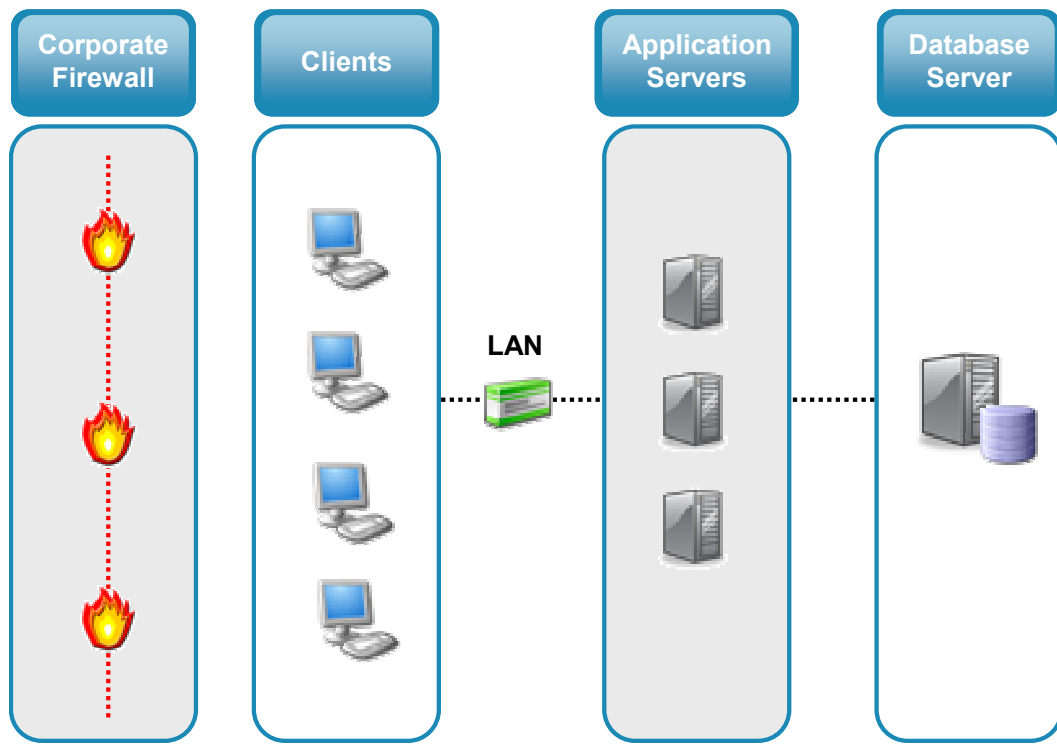


Figure 1: Traditional “On-Premise” Client/Server Architecture

The technology components leveraged by SaaS providers will likely be similar to those currently employed by many of the well-established web companies that have been delivering highly scalable online applications to end-users for many years. Arguably, the most popular technologies will be those found in the open source LAMP stack. LAMP is an acronym for Linux, Apache, MySQL and PHP, Perl & Python (with Ruby and AJAX programming frameworks becoming more popular every year.) Because LAMP powers some of the biggest names on the Internet, like Google, Yahoo!, Facebook and YouTube, it is no surprise that SaaS providers have embraced the open source LAMP stack. LAMP provides an open, robust and cost-effective platform for rapidly delivering disruptive and innovative online applications.

Figure 2 illustrates a modern SaaS architecture.

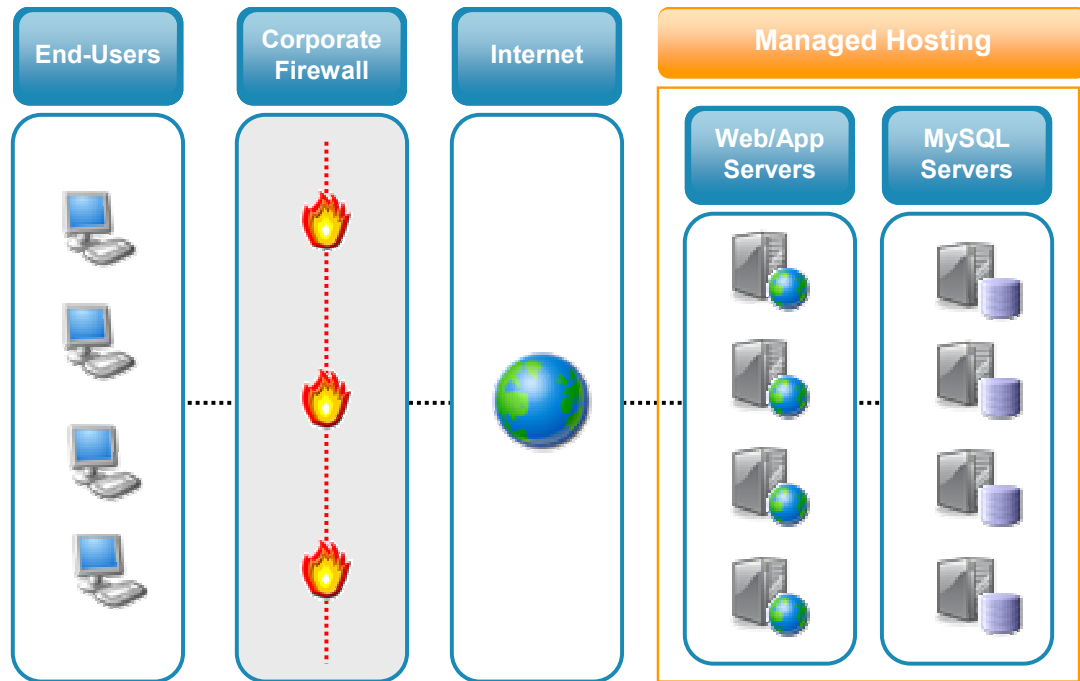


Figure 2: SaaS Architecture

Another area of stark differentiation between ISVs and SaaS providers, are the costs associated with implementing the solution. With ISVs there might be large upfront licensing costs and yearly maintenance fees, plus the required investments in hardware, implementation services and staffing. With a SaaS solution, there are comparatively minimal upfront costs and no additional hardware or staffing investments to make. Application licensing is often done using a subscription-based model, normally at a fixed fee per user, per month or per use. The Total Cost of Ownership (TCO) of a SaaS solution is typically less than half of a comparable non-hosted ISV application²

3 Contrasting SaaS and ASP

It is not only important to note the differences between SaaS and “on-premise” applications, but also the differences between SaaS and the older Application Service Provider (ASP) model. In general, ASPs host a third-party or customer application in their own data centers. This is counter to the typical SaaS provider’s delivery model, where the application hosting has been likely outsourced to a Managed Hosting Provider (MHP). In this way, SaaS providers shift the responsibility of availability, performance and availability to a third-party. To what degree, is largely dictated by what provisioning has been agreed to around hardware, bandwidth and network infrastructure, including monitoring across the entire hardware and software stack. On the other hand an ASP will move the customer’s data and application offsite, into their data centers and take full responsibility for the SLA.

Due to the sheer number and variety of unique applications that ASPs may find themselves hosting, it is difficult for the ASPs to provide expertise for all of these applications unless they have specialized in a specific vertical. Additionally, since most of these applications are not architected for a “shared” environment, each ASP customer implementation must have their own

² <http://www.crmlandmark.com/saasTCO.htm>

set of hardware, which forces the ASP to pass those costs along. Many businesses who have attempted to realize the cost-savings of outsourcing their application hosting to an ASP, find that they still have to retain costly application expertise in-house. Contrasted with a SaaS solution, all customers are standardized on a single, common application version and technology platform. It is also worth noting that during the Internet boom a few years ago, there were several high-profile bankruptcies of ASPs and issues concerning their ability to meet SLAs. These past events have in-turn, made SaaS a much more attractive model for the modern enterprise looking to out source their applications.

4 SaaS Characteristics

There are several core characteristics many SaaS providers share. These include, but are not limited to:

- The application is delivered over the Internet and accessed within a web browser
- The applications themselves are intended for a business audience, not a consumer audience
- Hosting of the application is handled by the SaaS provider, never at the customer site
- Application upgrades and maintenance are handled by the SaaS provider
- Upgrades are less disruptive and are rolled out simultaneously to all customers
- Uptime, on-demand scalability and performance are entrusted to the SaaS provider
- Acceptable levels of the above metrics are often stipulated in an SLA with the customer
- Rapid implementations vs. comparable “on-premise” software
- Minimal upfront costs and IT infrastructure investments for the customer
- Licensing is offered via a subscription model

5 SaaS Challenges

All SaaS providers encounter challenges in delivering on their SLAs. Often these are directly related to how they architect and deliver their applications. In the following sections we explore a few of these challenges.

High Availability

The most critical deliverable found in any SLA will be the SaaS provider’s assurance that the application will be online and available for specifically defined periods of time, which likely means 24x7 access. The majority of SaaS providers outsource the hosting of their applications to hosting providers. It therefore becomes paramount that there are clear escalation procedures, redundancy and monitoring in place to ensure that no one component failure can bring about a service interruption for the SaaS provider or their customers. The implication of a service interruption can often mean the SaaS provider must issue a credit to their customer. Because SaaS applications are data driven by design, a database that is unavailable or incapable of failing over to a redundant system, can immediately lead to unexpected downtime.

Performance

As mentioned, the availability of the application is arguably the most important stipulation in any SLA, however if the application is significantly crippled in its ability to respond to user input, it can just as severely impact a company’s capacity to conduct normal business and retain an acceptable level of productivity. Therefore, having tools that can measure and enhance the

performance characteristics of the application and database proactively, in real-time, and through the historical analysis of key metrics, greatly enhances the providers ability to deliver on an SLA.

On-Demand Scalability

SaaS providers face a unique challenge when delivering on the promise of on-demand scalability. For traditional ISVs, scalability revolves around meeting the demands of a single, on-premise implementation. These stand-alone applications are likely to be used by hundreds or thousands of end-users simultaneously. In this scenario, increasing the application's ability to support more users when the existing computing resources have reached their practical limits, typically means buying bigger hardware (more CPUs, memory, etc.) This technique for achieving scalability is referred to as "Scale-Up".

For SaaS providers, scalability is even more important. Because the nature of a SaaS application is to replace multiple stand-alone implementations with a single instance of the application, the number of users that must be supported increases relative to the number of companies who make use of the application. Therefore, a successful SaaS provider can easily find themselves actively supporting a user base of potentially millions.

SaaS providers can scale-up their applications to meet increased demand via costly hardware upgrades, or they can choose to leverage "Scale-Out". In a scale-out architecture, the application and underlying database run and/or are replicated on multiple servers. This is typically a more cost effective way to meet increased user demand incrementally using Commodity Off The Shelf (COTS) hardware. Leveraging scale-out is generally a better strategy for SaaS providers because the application can be scaled-out onto a large farm of servers. Each server in-turn runs one or more identical instances of the application and/or database.

In the forthcoming sections we explore some of disruptive technologies SaaS providers are leveraging to overcome the aforementioned challenges. These topics include the cost effective use of open source software, delivering on SLAs with MySQL Enterprise, scalability and high availability solutions, plus the benefits of choosing a MySQL Authorized Hosting Partner.

6 SaaS and Open Source

SaaS providers learned from the failures of the ASPs that preceded them to avoid expensive hardware and proprietary software licensing schemes. In doing so, it is no surprise that open source software, specifically the LAMP stack, running on COTS hardware, is the predominate technology platform employed by many emerging and established SaaS providers. Open source has allowed new SaaS providers entering the market to lower their initial startup costs and take advantage of the lowered barriers of entry. When open source is combined with multi-tenant architectures and virtualization, which in turn allows multiple customers to share computing resources, it puts SaaS providers at a particular advantage over their ISV competitors.

7 MySQL Enterprise for SaaS Providers

Whether your company is a pure play SaaS provider or in transition, MySQL Enterprise is the only comprehensive subscription of database and monitoring software, consultative services and production support, available at different service levels exclusively for MySQL. With over 18 million downloads in 2007, the MySQL Server is one of the most popular software applications on the Internet and the most popular open source database in the world. It is therefore no surprise that many of the most successful and fastest growing SaaS vendors are choosing MySQL as the

database of choice to power their applications and services. SaaS vendors like Zimbra, RightNow and Five9 and those with hybrid delivery models like Proofpoint, are choosing MySQL to take full advantage of its cost savings, performance and reliability characteristics.

MySQL Enterprise for SaaS Providers is a bundle specifically designed for organizations leveraging MySQL to deliver highly available applications and services over the Internet to end-users and customers. This bundle is comprised of:

- MySQL Enterprise Unlimited
- MySQL Professional Consulting
- MySQL Training and Certification

Organizations who can benefit from this bundle include:

- **SaaS providers who require maximum uptime and availability out of their MySQL databases.** Failing to deliver on SLA commitments has severe consequences including damage to their reputation, losing customers, and revenue. Organizations serious about SLAs rely on MySQL Enterprise for production support and services to help guarantee customer satisfaction.
- **ISVs looking to strategically manage their businesses transition from on-premise software to SaaS solutions.**
- **SaaS, ISV or OEM vendors who develop and deliver new services and applications with MySQL.** Having MySQL Enterprise production support and services during these phases of the application life cycle ensures getting the most out of MySQL's availability and performance characteristics. MySQL Enterprise is the only guaranteed means to get bug fixes and maintenance releases from MySQL.
- **SaaS providers who require tools to help them manage their MySQL scale-out architectures.** MySQL Enterprise offers a comprehensive set of replication monitoring tools and expert assistance via MySQL Enterprise Monitor to manage MySQL scale-out implementations.
- **SaaS providers who currently make use of Oracle, SQL Server, Sybase or DB2 with an Enterprise License Agreement (ELAs) who want to save money and time compared to deploying and managing more proprietary software.** Deploying new features on MySQL Enterprise, while maintaining an existing investment in proprietary databases, allows for a more rapid development and deployment of new features at a fraction of the cost.
- **SaaS Providers who have to plan for exponential and unpredictable growth over the coming years.** MySQL Enterprise Unlimited provides one fixed, predictable cost, no matter how big or how fast the business grows.

MySQL Enterprise Unlimited is a unique offering that enables SaaS providers to accelerate their initiatives and gain control of their software budgets by significantly reducing the cost of deploying and managing their database software. For the price of a single CPU of Oracle Enterprise Edition (\$40,000 per CPU), SaaS providers can deploy an unlimited number of MySQL Enterprise Servers, with full 24x7 production support. There is also unlimited 24x7 access to MySQL Enterprise Monitor.

For more information concerning MySQL Enterprise Unlimited and other MySQL services for SaaS providers, please visit:

<http://www.mysql.com/why-mysql/service-providers/enterprise-saas/>

8 MySQL Authorized Hosting Partners

Because the majority of SaaS providers choose not to host the applications they ultimately deliver to their customers, the importance of selecting a hosting provider with a proven track record of availability, performance and predictable fees, cannot be understated. MySQL Authorized Hosting Partners enable organizations like SaaS providers to eliminate the massive upfront costs required to bring a data center online and to maintain it. In addition to providing a more cost-effective alternative to maintaining their own IT infrastructure, many managed hosting providers offer organizations with guaranteed SLAs, often stipulating 100% uptime. This ensures that a SaaS provider's customers will be able to successfully execute on business requirements which require access and uptime 24x7.

Delivering on high SLA commitments for thousands of customers requires managed hosting providers to overcome a number of database challenges including high availability, scalability and the hiring of highly skilled support staff. Leading managed hosting providers are using the tools and services provided by MySQL Enterprise to improve application performance and availability, and deliver on the promise of guaranteed uptime.

Exclusive benefits to the hosting partner:

- Ability to run MySQL Enterprise on all of Partner's servers. MySQL Enterprise Server software is the most reliable, secure and up-to-date version of MySQL for cost-effectively delivering E-commerce, Online Transaction Processing (OLTP), and multi-terabyte Data Warehousing applications. It is a fully integrated transaction-safe, ACID compliant database with full commit, rollback, crash recovery and row level locking capabilities.
- Access to MySQL's Enterprise Monitor, which will continuously monitor your MySQL servers and alert you to potential problems before they impact a production system. It's like having a "Virtual DBA Assistant" at your side to recommend best practices in order to eliminate security vulnerabilities, improve replication, optimize performance and more. As a result, the productivity of your developers, DBAs and System Administrators can be improved significantly.
- Premium Technical Support from the developers of MySQL to help your team resolve the most complex MySQL issues, adding peace of mind.
- A strong brand ("Authorized MySQL Hosting Partner") that clearly identifies your company as a trusted provider of MySQL products and services -- among the crowded market of hosting providers.

For more information concerning the MySQL Authorized Hosting Partner Program, please visit:

<https://partner-portal.mysql.com/guide/hosting.html>

MySQL Authorized Hosting Partner: LogicWorks

Logicworks, is an Authorized Platinum Hosting Partner, provides their Managed Database Service for MySQL with a 100% Service Level Agreement, so that no database transactions are lost, and revenue-generating online initiatives are not impacted by poor database performance or non availability. Logicworks provisions and manages highly available hosting infrastructures, and includes services such as security, backup and recovery, OS and database patching, 24/7 technical support, and customized monitoring and health-check schemas. Logicworks specializes in deploying and managing clustered database architectures to achieve maximum information availability, to mitigate any possibility of database transaction loss. A long-time supporter of

MySQL in business-critical processes, Logicworks' 'Managed Database Service' extends a 100% SLA, helping customers plan and manage the challenges associated with growth and scalability.

For more information concerning this case study please visit:

http://www.mysql.com/why-mysql/case-studies/mysql_cs_logicworks.php

9 On-Demand Scalability

In general, SaaS applications should be architected to run in a stateless manner. In this way, user and session data can be stored either on the client side, or in a distributed data store that is accessible to any application instance in a scale-out environment. An application that is stateless allows transactions to be handled by any instance. A well-designed, stateless application should allow a user's transactions to interact transparently with many different instances during a single session.

Other design considerations to improve your applications scalability include:

- Pooling connection resources for reusability whenever possible. This includes network connections, and database connections.
- I/O operations should be done asynchronously. This permits the application to perform other tasks while waiting for I/O requests to complete.
- Operations performed on the database should maximize concurrency and minimize the use of exclusive locks.

Databases will inevitably be tasked with serving more concurrent user requests for reading, inserting, deleting and updating data as a SaaS provider increases their portfolio of customers and in-turn end users. The amount of time it will take to execute these requests will rise steadily without a scalability architecture and strategy, like scale-out, in place.

MySQL Replication and Scale-Out

MySQL natively supports one-way, asynchronous replication. MySQL Replication works by simply having one server act as a master, while one or more servers act as slaves. Asynchronous data replication means that data is copied from one machine to another, with a resultant delay. Often this delay is determined by networking bandwidth, resource availability or a predetermined time interval set by the administrator. However, with the correct components and tuning, replication itself can appear to be almost instantaneous to most applications. MySQL Replication can be contrasted with synchronous data replication, which implies that data is committed to one or more machines at the same time, usually via what is commonly known as a "two-phase commit".

In standard MySQL Replication, the master server writes updates to its binary log files and maintains an index of those files in order to keep track of the log rotation. The binary log files serve as a record of updates to be sent to slave servers. When a slave connects to its master, it determines the last position it has read in the logs on its last successful update. The slave then receives any updates which have taken place since that time. The slave subsequently blocks and waits for the master to notify it of new updates.

Figure 3 illustrates an architecture leveraging MySQL Replication.

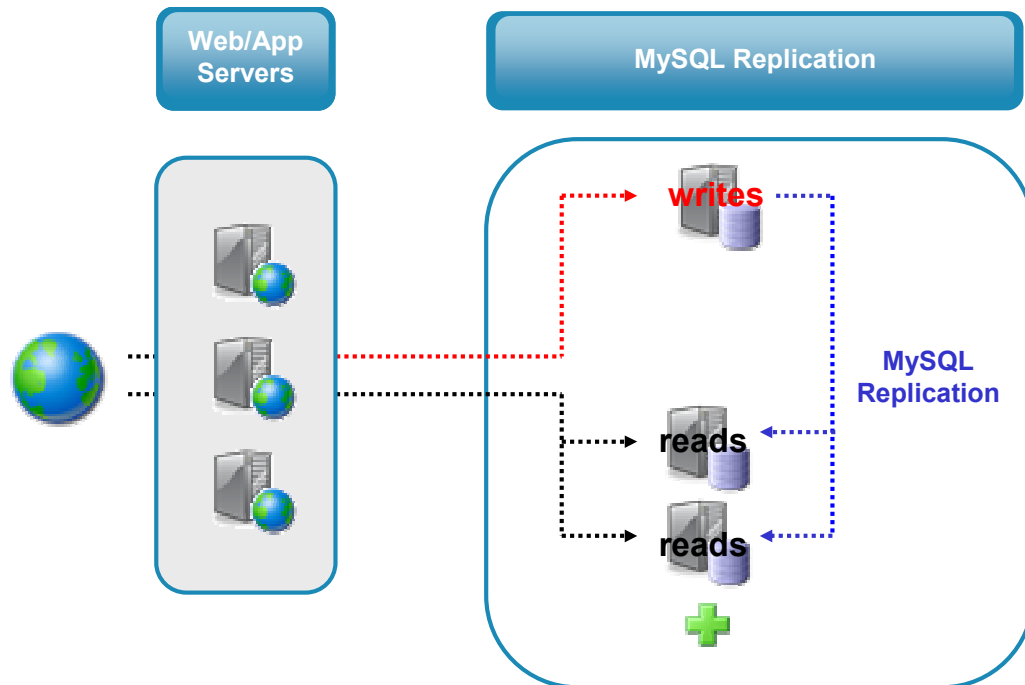


Figure 3: Scale-Out leveraging MySQL Replication

Replication offers the benefits of reliability, performance, and ease of use:

- In the event the master fails, the application can be designed to switch to the slave.
- Better response time for clients can be achieved by splitting the load for processing client queries between the master and slave servers. Queries which simply “read” data, such as SELECTs, may be sent to the slave in order to reduce the query processing load on the master. Statements that modify data should be sent to the master so that the data on the master and slave do not get out of synch. This load-balancing strategy is effective if non-updating queries dominate. (This is normally the case.)
- Database backups can be performed using a slave server without impacting the resources on the master. The master continues to process updates while the backup is being made.

Partitioning

Partitioning data either at the database or application layer is one method for increasing the efficiency of requests. By partitioning data at the database layer, sometimes referred to as user-defined partitioning, the data of individual tables are distributed across a file system according to rules defined by the user. For example, data can be partitioned by customer id, a date range or a hash. Besides the obvious benefits of minimizing I/O, partitioning can also yield benefits in how data storage and growth are managed.

Figure 4 illustrates MySQL Partitioning.

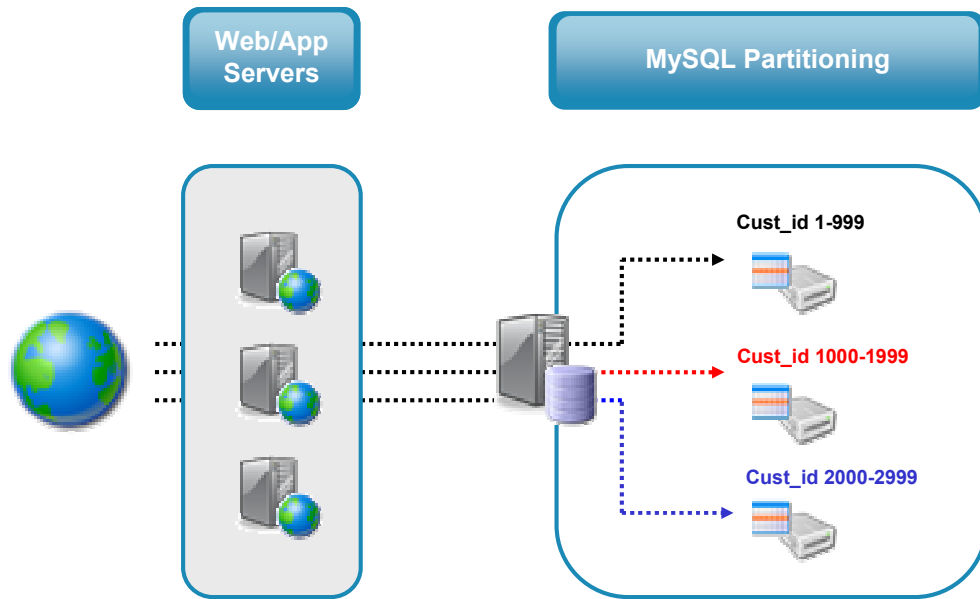


Figure 4: MySQL Database Partitioning

For more information concerning partitioning with MySQL, please visit:

<http://dev.mysql.com/doc/refman/5.1/en/partitioning.html>

Data can also be partitioned at the application layer in what is often referred to as “sharding”. In this partitioning scheme, instead of partitioning a table across a file system, individual tables may be distributed or isolated using similar partitioning algorithms onto individual systems. This manner of partitioning, when properly architected and managed can significantly improve the performance of data requests.

Figure 5 illustrates “sharding” or application-level partitioning.

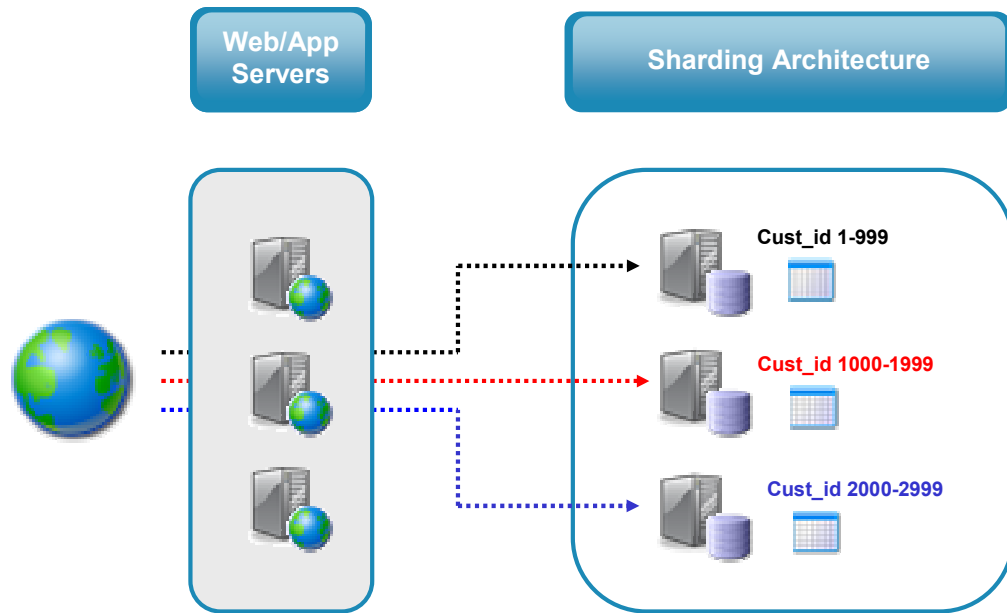


Figure 5: Sharding or Application Partitioning

10 High Availability

In this section we briefly describe several options for creating high availability MySQL architectures.

MySQL Replication for High Availability

SaaS providers can leverage MySQL Replication not only for scalability, but also as a transporting mechanism for enabling geographic redundancy in the event of a local disaster. Of course there are special requirements and considerations when implementing this type of architecture. The bandwidth speed of the replication, the security of the transporting protocol and the expected time for applications to fail over, are some of these key considerations.

Figure 6 illustrates MySQL Replication for high availability.

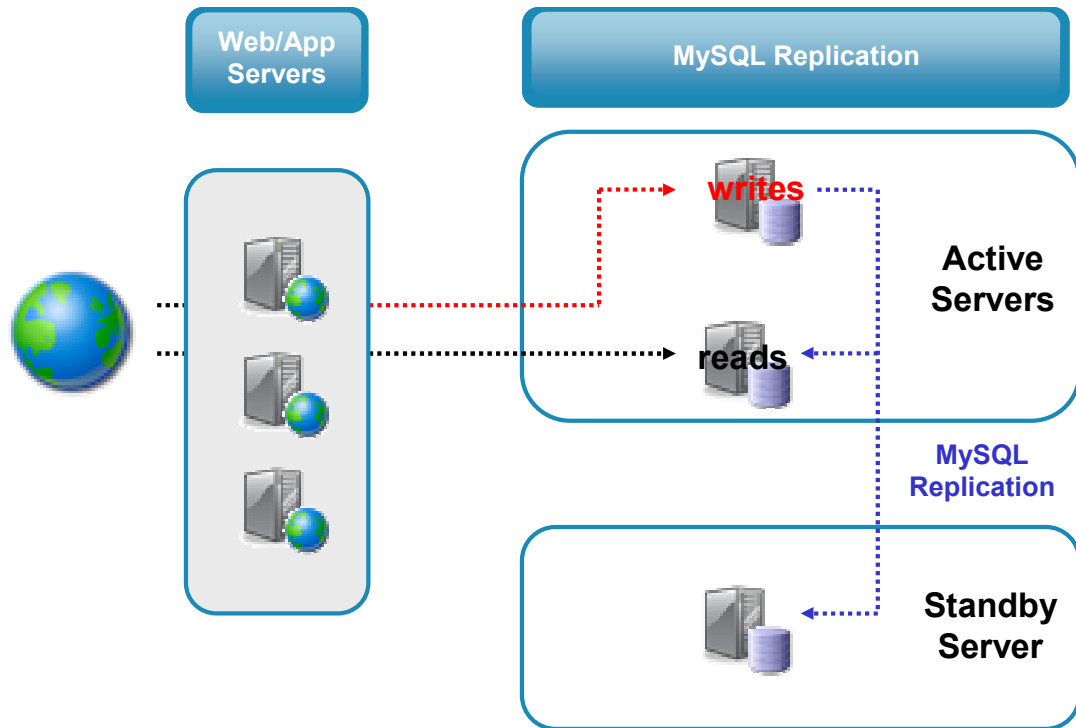


Figure 6: High Availability with MySQL Replication

DRBD for MySQL High Availability

Distributed Replicated Block Device or DRBD as it is more commonly known, is a Linux kernel module that synchronously replicates data between two systems. DRBD is typically leveraged in conjunction with some scripts that runs on top of standard IP networks without any special networking components required. DRBD creates a distributed storage system, which can be thought of as possessing similar attributes to that of a network RAID. At a high level, DRBD takes data, writes it to a local disk and then transports it to another node.

All the devices (or local partitions) which comprise the DRBD configuration have a “state”, which is either primary or secondary. DRBD creates, on all nodes, a link between a virtual device and a local partition. All the writing is done on the primary node, which then transfers the data to a lower-level block device (local partition) and propagates the data to the remaining nodes. These secondary nodes simply transfer data to the lower-level block device. All the reads are performed on the local partitions. It should be noted that DRBD can also be used in conjunction with shared storage devices.

Although DRBD has its own way of determining which node should be the primary, a cluster manager is frequently used to handle state transitions. Along with these state transitions, the cluster manager must also mount the file system it uses on top of the virtual device already created by DRBD. The most commonly implemented cluster manager in this architecture is Linux-HA.

In the configuration illustrated in Figure 7, we are using a combination of Linux Heartbeat for virtual IP management, DRBD for synchronous data management and standard MySQL.

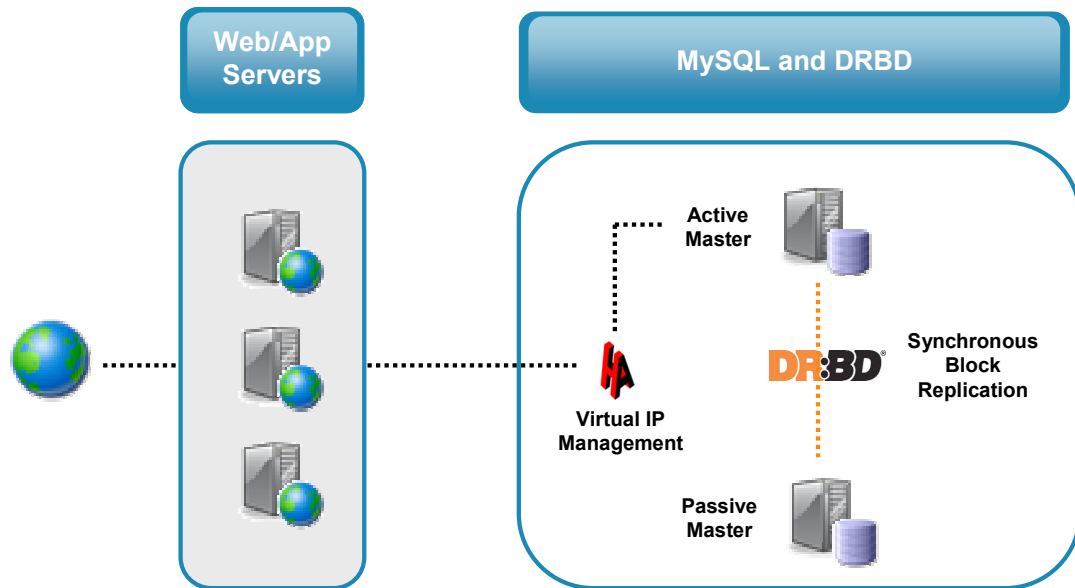


Figure 7: DRBD Architecture

This system can be characterized with the following attributes:

- No special networking components required
- Excellent performance - as blocks are being synchronously replicated, not rows of data
- DRBD manages any inconsistencies of data during a failure
- DRBD hides the complexity of many required recovery actions
- Linux Heartbeat manages fail over and virtual IPs

In the event the primary node fails, DRBD will promote one of the secondary nodes to a primary state. DRBD operates at the disk block-level and not the file system level. In turn, if the file system being used is not journaling-capable, a verification of the integrity of the file system should be performed after any secondary to primary fail over.

When the failed primary node returns to the configuration, the system may (or may not) promote it to the primary state after the data synchronization is performed. Only data which has changed will need to be resynchronized. In this way, DRBD provides a very efficient resynchronization process. It is often possible to have a total resynchronization time of under 5 minutes, regardless of device size (currently up to 4TB), even after the crash of an active node.

SaaS providers who wish to implement DRBD for MySQL can acquire professional consulting direct from MySQL. This is a fully supported MySQL high availability solution available through a MySQL Enterprise subscription. This support package includes:

- MySQL 24x7 Production Support for DRBD, available as an add-on to a MySQL Enterprise Subscription.
- Installation and Configuration Assistance. MySQL Professional Services possess extensive DRBD knowledge and experience to implement HA solutions for MySQL customers. MySQL consultants use proven methodologies and expertise in Database Design, Architecture, Performance Tuning, Replication, Fail-Over and Fault-Tolerance.

For more information concerning DRBD for MySQL High Availability, please visit:

11 Monitoring

As mentioned earlier, availability and performance are critical metrics often outlined in SLAs. The MySQL Enterprise Monitor, available through a MySQL Enterprise subscription, continuously monitors MySQL servers and alerts IT staff to potential problems before they impact the system. The Enterprise Monitor automatically recommends best practices to eliminate security vulnerabilities, improve replication, optimize performance and more. As a result, the productivity of developers, DBAs and System Administrators is improved significantly.

The MySQL Enterprise Monitor is a distributed web application that is deployed within the safety of corporate firewall. It is comprised of a centralized Service Manager and a lightweight Service Agent this is installed on each monitored MySQL server.

Figure 8 illustrates a screenshot from the MySQL Enterprise Monitor.

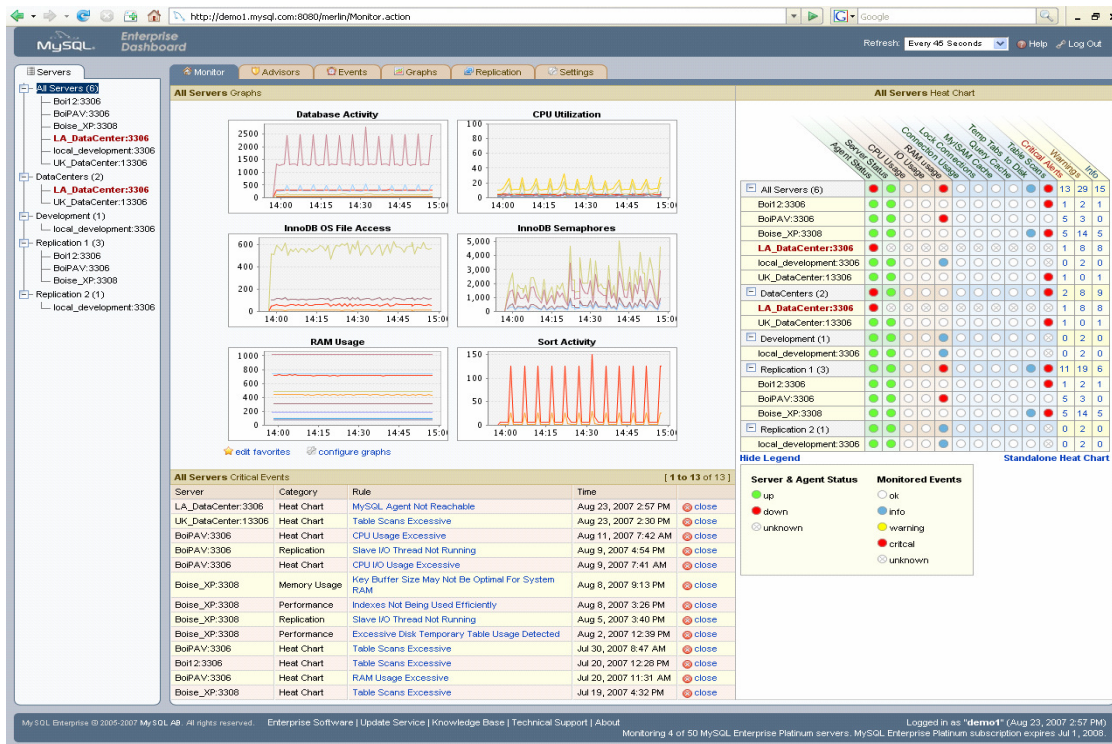


Figure 8: MySQL Enterprise Monitor

The MySQL Enterprise Monitor provides the following benefits:

- A consolidated view into the health of all MySQL servers
- Monitoring of over 600 MySQL and operating system variables within the Enterprise Dashboard
- Monitoring of MySQL sessions, connections, replication latency and more than over 20 configurable graphs
- Immediate visibility into replication topologies through auto detection and grouping

- The ability to view real time master/slave performance using the MySQL Replication Monitor
- Notifications on issues before they become costly outages using threshold driven alerts

12 SaaS Provider Case Studies

RightNow Technologies

RightNow Technologies provides customer relationship management (CRM) software solutions for large global enterprises. The company has more than 1,800 customers worldwide — including large, well known companies such as Black & Decker, Electronic Arts, Nikon and British Airways. RightNow helps these organizations manage all of their customer interactions, enabling them to provide outstanding customer experiences while controlling costs. The RightNow solutions have received numerous awards and industry recognition from publications and research firms such as CRM Magazine, Forrester and Gartner Group.

During the past five years, RightNow's client base has grown rapidly. To meet increasing demand for RightNow's solutions, which are available under a Software-as-a-Service (SaaS) delivery model, the company needed an IT infrastructure that was reliable, scalable and delivered peak performance, under heavy loads, in order to handle many high-volume client deployments. RightNow also needed to be able to continue to cost-effectively add capacity to its IT infrastructure so it could quickly add new customers, without having costs spiral out of control.

The RightNow solution includes service, marketing, and sales applications, which enables companies to interact with their customers consistently across all channels of communication. To ensure high levels of scalability, reliability, security and high-performance, RightNow chose to build its solution on high-quality, open source components including Red Hat Enterprise Linux, Apache, the MySQL database and PHP.

RightNow's MySQL implementation has evolved into a modern horizontal scale-out database architecture that utilizes master-slave replication, failover servers, backup servers, reporting servers and geographical redundancy. This scale-out architecture has enabled them to triple their Web traffic and manage:

- 30+TB of data - all stored in MySQL
- 17 billion queries and 500 million page turns per month
- Thousands of database schemas, all from different customers running dynamically-generated SQL, based on customer design

In addition, MySQL's low administration benefits allow RightNow to manage more than 200 servers with only four DBAs — a much better ratio than could be achieved using proprietary database technology.

Zimbra

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. The Zimbra Collaboration Suite (ZCS) has been 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 based on Zimbra's products.

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 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.

Supply Dynamics

Supply Dynamics is a leading supply chain solution provider that is focused on material consolidation solutions known as “Material Demand Aggregation”. Their hosted platform is helping Fortune 100 companies like General Electric, Honeywell and others to reduce production costs by as much as 15% and deliver products faster and at lower risk by linking their entire supply chain. MySQL is a key component of their reliable, high-performance multi-enterprise platform which enables original equipment manufactures (OEMs) to gain real-time visibility into aggregate demand and available supply as it relates to either forecasted or historical finished part demand. The Supply Dynamics platform is provided in a hosted, Software as a Service (SaaS) model, eliminating the need for supply chain partners to develop and maintain complex, expensive in-house supply chain applications.

OEMs typically have little or no visibility or control over the raw materials that go into their purchased parts and assemblies. That’s because their sub-tier suppliers are generally responsible for the sourcing of raw materials and (purchased complete) details on their own. This situation results in numerous inefficiencies, like inflated material cost and delayed product delivery which can severely impact a manufacturer’s bottom line.

To address this challenge, Supply Dynamics developed an innovative, SaaS solution that has the ability to seamlessly integrate with a OEM customer’s existing ERP/MRP systems such as SAP R/3. This allows the OEM to get an aggregate view into total raw material demand across its supply chain, encompassing a virtually unlimited number of sub-tier suppliers. As a result, the OEM and its sub-tier suppliers can collectively negotiate better raw material prices, reduce finished part production costs, improve delivery and accelerate manufacturing cycle times.

Supply Dynamics relies on MySQL to store tens of thousands of unique multi-level Bill of Material (BOMs) records, synchronizing those in real-time with actual finished part demand at the OEM. Supply Dynamics chose MySQL for its:

- **Reliability** – Supply Dynamics has never experienced database downtime since the MySQL database was adopted 5 years ago.
- **High-Performance** – Users get real-time visibility and control over the raw materials that go into their parts and the ability to analyze demand associated with hundreds of thousands of parts via customizable electronic dashboard designed by Supply Dynamics.

- **Low Administration** – The hosted Supply Dynamics solution does not require an army of Database Administrators (DBA), enabling engineers to focus on delivering valuable new functionality faster.

13 Conclusion

With on premise enterprise software sales continuing to slow over the coming years and on-demand SaaS business models and technical architectures becoming the new standard, it is imperative that SaaS providers have effective tools to deliver on the challenges facing them. In this paper we explored the SaaS marketplace, its associated business and technical challenges, and highlighted solutions available from MySQL. A MySQL Enterprise subscription is the only comprehensive solution including 24x7 support, monitoring tools and production database software. MySQL Enterprise enables SaaS providers to leverage the world's most popular open source database to deliver on the toughest availability, scalability and performance SLAs.

14 Additional Resources

White Papers

<http://www.mysql.com/why-mysql/white-papers/>

Case Studies

<http://www.mysql.com/why-mysql/case-studies/>

Press Releases, News and Events

<http://www.mysql.com/news-and-events/>

Live Webinars

<http://www.mysql.com/news-and-events/web-seminars/>

Webinars on Demand

<http://www.mysql.com/news-and-events/on-demand-webinars/>

15 About MySQL

MySQL AB develops and supports a family of high-performance, affordable database products. The company's flagship offering is 'MySQL Enterprise, a comprehensive set of production-tested software, proactive monitoring tools, and premium support services.

MySQL is the world's most popular open source database software. Many of the world's largest and fastest-growing organizations use MySQL to save time and money powering their high-volume Web sites, business-critical systems and packaged software -- including industry leaders such as Yahoo!, Alcatel-Lucent, Google, Nokia, YouTube and Booking.com.

With headquarters in the United States and Sweden -- and operations around the world -- MySQL AB supports both open source values and corporate customers' needs. For more information about MySQL, please visit www.mysql.com.