Guide to Database Applications in Financial Services

Adoption of LAMP Stack Improves Performance and Lowers TCO for Web and Data Warehouse Applications

A MySQL® Business White Paper
July 2005

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Executive Overview

The financial services industry has gone through a series of major evolutions over the past 10 years, including:

- Extensive consolidation through mergers & acquisitions
- Wide-reaching customer service and self-service applications available over the Internet
- A strong focus on maximizing ROI for IT investments

To help overcome the challenges created by these industry changes, financial services companies were among the first to widely adopt Linux for mission-critical uses, helping them more easily integrate disparate systems from mergers, provide web-based applications to better serve customers, and achieve dramatic cost savings.

Financial services companies now have taken the lead in adopting a more comprehensive open source middleware stack known as LAMP — Linux, Apache, MySQL, PHP/Perl/Python. Because the price of software increases as one moves up the stack from operating system to middleware to databases, the cost savings of adopting an open source software stack are even more dramatic than with just the operating system alone.

The paper will illustrate how MySQL can help lower financial services organizations' total cost of ownership (TCO) in deploying an open software stack while allowing them to expand existing businesses, develop new products, and comply with an ever-growing number of regulatory and statutory requirements. From scale-out web applications to multi-terabyte data warehouses, financial services customers are using MySQL to complement or replace more expensive proprietary databases.

In addition, this document will provide examples of how adoption of the LAMP stack has produced dramatic saving in retail banking operations as well as data warehousing for compliance, credit, and operational risk management.

The Industry's Challenges

Merger and Acquisition (M&A) activity among the world's largest financial firms (JP Morgan Chase, Deutsche Bank/Bankers Trust, Salomon Smith Barney, BNP Paribas, Bank of Tokyo Mitsubishi, and more) has resulted in a downsizing of both employees and IT systems. At the same time, the remaining employees and systems must handle an ever-growing number of customers and businesses.

To accelerate growth while continuing to retain customers, financial services companies have turned to online service. e-Commerce has become a significant source of revenue for the industry as financial transactions that once took place over the telephone or through the mail can now be executed in seconds from anywhere in the world via the Internet.

> "In today's market, we are constantly striving to keep cost down. Hardware and software costs contribute heavily to our IT budget. Leveraging open source and the MySQL database allow us to save money without sacrificing performance."
>
> **Kazushige Sato**
> **IT Manager, Online Services**
> **Aizawa Securities**

The financial services industry's consolidation and its move to online products and services have created some technical challenges:

- Integration of disparate systems from merged companies
- Developing fast and reliable applications for customer support and self-service over the Internet
- Providing the utmost security in financial transactions

In addition, there is an unparalleled need for performance and scalability of financial services applications. For example, credit risk management involves accessing large amounts of market and transaction data. Latency caused by underlying database performance can cause unacceptable delays in risk management processing. Database performance and scalability are critical to the success of financial services applications. In addition, retail and institutional financial services firms' e-Commerce customers can easily become frustrated if performance problems persist, resulting in transaction abandonment and customer defection.

As financial services companies increasingly rely on the Internet to reach growing numbers of customers and to process an ever-increasing number of transactions, database reliability and high availability are critical. The application must be "always on" to satisfy customer expectations. Additionally, for 24-hour trading desks, any database downtime can translate into huge losses.

In short, systems and databases must be fast, reliable, easy to use, and secure. Databases must have the ability to handle enormous amounts of data and, in many cases, scale out horizontally to take advantage of commodity hardware running Linux.

MySQL @ Work in the Financial Services Industry

To meet the challenges of conducting business online, many leading financial services companies have come to rely on MySQL. With MySQL Network these companies have access to a comprehensive set of proactive services that saves enterprise developers and DBAs time and effort. MySQL Network includes everything an enterprise needs to be successful using MySQL including:

- Certified Software that meets the highest level of quality testing for maximum uptime and fast performance
- MySQL Advisors that help eliminate problems before they occur
- Production Support directly from MySQL support engineers worldwide

MySQL Network specifically meets the needs of the financial services industry because of its:

- Reliability
- Scalability
- Ease of administration
- Low TCO

MySQL in Retail Banking

Retail banking has been heading toward complete automation as evidenced by the decreasing number of live tellers and increasing number of ATMs and electronic kiosks. Additionally, banks are now focusing on self-service web applications where retail customers can complete most of their banking transaction needs online from virtually anywhere in the world.

By capturing and analyzing off-site banking activity, banks can customize retail offerings by region, branch, season, customer age, gender, marital status, type of accounts the customer has, etc.

Banks must give their customers exemplary service while lowering the cost of each transaction. Mining, analyzing and reporting on information from a customer transaction database help banks predict which products and services each customer is most likely to purchase, allowing them to present a customized list of such products and services whenever the customer visits the bank's web site. Data mining and reporting also allows the bank to proactively offer customized products when the data indicates that the customer has experienced a life-changing event such as marriage, divorce, home purchase, and more. Using MySQL and some of its partners' tools, a bank can build needed functionality quickly and inexpensively.

There are several areas where MySQL is used in retail banking applications:

- The Source Database: MySQL is used extensively for web sites, transaction logging, and dynamic content delivery. With its high speed, MySQL is the perfect foundation for a high-performance business intelligence architecture.
- The Operational Data Store (ODS). This is where transactions are mirrored and stored for a finite period of time, and then discarded or moved into a data warehouse or datamart. The type of information usually found in the ODS includes real-time transactions such as stock trades as well as credit card and ATM transaction.

- The Data Warehouse. This provides summary data that focuses on a "single view of the customer" so that banks can easily spot trends in customer behavior and product preferences.

- The Datamart. This information is usually subject-specific, such as checking and savings transactions, stock portfolios, etc.

- The Extracting, Transforming, and Loading (ETL) Process: MySQL is excellent for high availability metadata as well as creating temporary table during the ETL Process.
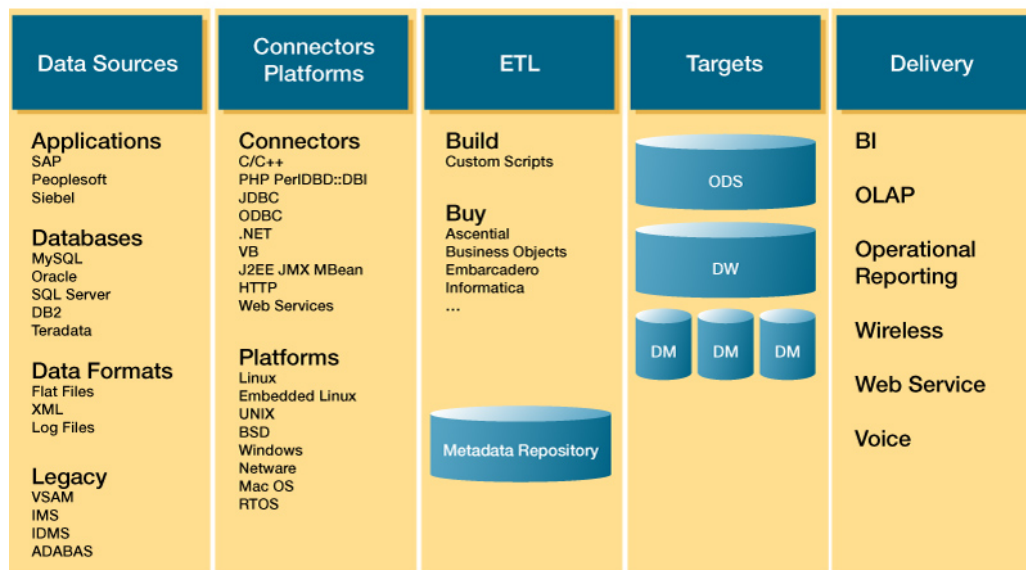

Financial Services Architecture
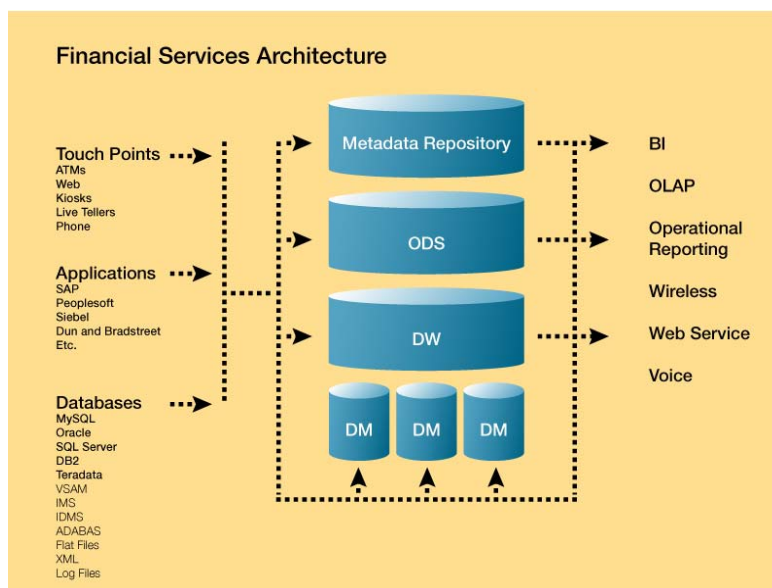
Data Warehousing for Compliance and Risk Management

Financial services companies are finding themselves scrambling to meet an ever-growing body of regulatory requirements: Basel I, Basel II, U.S. Treasury, SEC, NASD, USA Patriot Act, FASB 133, Sarbanes-Oxley, IASD, and more. For example, regulators are requiring financial services companies to improve their risk management capabilities, most notably in operational risk. Other regulators and certain statutes are requiring much more stringent controls for compliance issues such as anti-money laundering, fraud, identity theft, as well as a plethora of compliance issues relating to retail brokerage.

In an ideal world to meet all compliance issues, a bank must build a single repository for all of its customer, broker, transaction and processing data. This, in turn, requires that the database of each legacy system within the enterprise be integrated with this central repository on a real-time basis. While MySQL's scalability and reliability are of great importance for this kind of data warehouse, the critical issue is the difficulty of integrating the legacy databases with the central data warehouse as illustrated in the diagram below. This task alone can consume more than 50% of the enterprise risk management project budget; in large international banks it can cost many millions of dollars. Using MySQL and its ETL partners' tools, this task is made dramatically easier with significantly lower cost.

DWH Architecture (Traditional and Real-Time)

Data Sources	Connectors Platforms	ETL	Targets	Delivery
Applications SAP Peoplesoft Siebel **Databases** MySQL Oracle SQL Server DB2 Teradata **Data Formats** Flat Files XML Log Files **Legacy** VSAM IMS IDMS ADABAS	**Connectors** C/C++ PHP PerlDBD::DBI JDBC ODBC .NET VB J2EE JMX MBean HTTP Web Services **Platforms** Linux Embedded Linux UNIX BSD Windows Netware Mac OS RTOS	**Build** Custom Scripts **Buy** Ascential Business Objects Embarcadero Informatica … Metadata Repository	ODS DW DM DM DM	BI OLAP Operational Reporting Wireless Web Service Voice

For example, one large financial services customer's risk management group is building a 7 terabyte data warehouse using MySQL into which they are loading all monthly trade data to perform time series analysis. MySQL's demonstrated data warehouse scale-out capabilities, along with ease of integration, results in a large-scale yet economical solution for the IT department.

In addition to architecture issues, storing all the data required for compliance can result in huge storage requirements for data that is not readily needed by the organization for its day-to-day operations. For example, Sarbanes Oxley requires organizations to keep information available for seven years. However, in your environment, you may only need this

"MySQL is known as one of the fastest databases available, beating even commercial options according to widely accepted industry benchmarks. It has been shown to be capable of handling billions of rows."

Robert Frances Group

information readily available for two years. Using MySQL in an Information Lifecycle Management system allows you to move the older data to slower, less expensive storage.

This is possible through MySQL's MyISAM database structure. MyISAM breaks down all the database tables into files. Those files can reside on most any kind of storage, from high-speed SAN, to slower, read only CD-ROM. All of this is transparent to the MySQL server and any application accessing the server. Simply move the database files to the different storage location, update MySQL to point to that location, and your existing application runs unchanged.

Why Financial Services Companies Depend on MySQL

Across industries, MySQL customers have increasingly implemented large, low-cost database solutions based on MySQL Network. Some financial services firms running MySQL include Bloomberg, Aizawa-Securities Ltd., Credit Lyonnais, HypoVereinsbank, and Lloyds TSB Bank.

MySQL offers several advantages:

- **Ease of Development & Deployment**
  Since open source software focuses on only the most essential capabilities, as opposed to having hundreds of rarely used features, installation and deployment is easier than with proprietary software. MySQL comes with easy-to-use installation software, graphical management tools, and on-line help. Furthermore, MySQL partners provide database application development tools, ETL and integration tools, and data mining, analysis and reporting tools. These allow new web applications to be built, tested, and launched with greater efficiency and speed, bringing new revenue-generating businesses to market faster.

- **Performance and Reliability**
  For customer-facing web applications and their operational data stores, speed and reliability are mission critical. Downtime translates into lost transactions, lost profits, lost customers, and reduced market share. MySQL combined with MySQL Cluster can provide 99.999% reliability and is as fast as or faster than closed source databases

- **Scalability**
  The enormous amount of data that must be stored in a data warehouse to make data mining and analysis possible and effective requires a database server that is extremely scalable. Only MySQL scales out at reasonable cost. Scaling out (or Horizontal Scaling) means distributing the computing and data workload among multiple commodity servers by load balancing, with the ability to add or subtract servers to increase or decrease capacity. By distributing the workload, processing resources are spread among multiple low-cost servers, which improves both performance and the availability of the overall service at a dramatically lower cost.

> **Partial List of Financial Services Companies Using MySQL**
>
> Aizawa-Securities Ltd.
> APRIL GROUP
> Bloomberg
> Boursorama
> Credit Lyonnais
> HypoVereinsbank
> Lloyds TSB Bank
> Nuernberger Versicherungsgruppe
> Securities America

> *"One example is the move by many Wall Street IT sites to support options trading and portfolio analysis models on scale-out deployments of Linux servers, arranged into Linux clusters that leverage a globally accessible file system and MPI software."*
>
> **IDC**

- **Ease of Administration**
  The combination of low complexity, high reliability, and a wealth of support services make administering the MySQL database uncomplicated. Computerworld's research confirmed that "The MySQL database is easy to administer. For example, users say that data migration is a snap because administrators simply move their data directly into MySQL". Third party database administration tools such as Quest Software's Toad for MySQL and Embarcadero's DBArtisan allow DBAs to use their existing skills developed with other databases and immediately apply them to MySQL.

- **Low TCO**
  All of the above benefits contribute to MySQL's having the lowest TCO among all of the major database vendors. As bank IT departments are under pressure to lower costs, MySQL's dramatically lower TCO allows a company to invest more readily in web-based banking projects that would not otherwise be cost-effective. MySQL Network offers 90% of the functionality most used by customers at 10% the TCO of proprietary closed source databases

Conclusion

Financial services companies are under pressure to reduce their IT costs while managing applications and databases covering a growing number of businesses and customers. Adding open source software to the IT infrastructure has enabled CIO's to reduce the total cost of their systems - TCO savings of 90% with the dollar savings ranging from $250,000 up to several million dollars per year.

> *"The software works brilliantly. We will continue to use . . . other proprietary products, too, but MySQL allows us to create applications for the HVB group very rapidly."*
> **Frank Baumgart**
> **Manager, Credit Risk Department**
> **HypoVereinsbank**

Compared to its competitors, MySQL is the clear choice due to its performance, reliability, ease of administration, and very low licensing and support cost. In fact, a recent Computerworld article, 'MySQL Breaks into the Data Center', revealed how MySQL has become the world's most popular open source database and why companies intent on lowering their cost of operations are using it to further commoditize their IT infrastructure.

Other experts are highlighting what many believe is a new era of databases. Charles Garry from the Meta Group is confident that "the future of the database market will be the standardization on MySQL".

Finally, in addition to the examples cited in this paper, other areas in the financial services industry that can take advantage of MySQL's capabilities are electronic commerce networks, hedge funds, prime brokerage operations, and electronic derivatives market making. Please contact MySQL to learn more about how open source software can be used in your organization to improve efficiency and reduce costs.

About MySQL Network

For organizations deploying scale-out architectures, MySQL offers MySQL Network. MySQL enables these organizations to achieve the highest levels of reliability, security and uptime at an affordable price. MySQL Network is a simple, cost-effective way to maximize all the benefits available from MySQL to successfully deploy business-critical applications. It combines a comprehensive set of software and services including certified software, software updates, production support, customized alerts, and a technical Knowledge Base. Multiple tiers give you the flexibility to choose the appropriate level of service to match your requirements. For more information visit: http://www.mysql.com/network

Resources

A Guide to Lower Database TCO, MySQL AB, http://www.mysql.com/tco

A Computerworld article, "MySQL Breaks Into the Data Center" revealed how MySQL has become the world's most popular open source database and why corporations intent on lowering their cost of operations are using it to further commoditize their IT infrastructure. In this white paper we'll show you how. You'll also learn how organizations such as Cox Communications, NASA, Sabre Holdings and Yahoo! have improved database reliability, performance and TCO using MySQL.

Performance Benchmark White Paper, MySQL AB, http://www.mysql.com/it-resources/white-papers/performance.php

To meet the service levels demanded by your users, your database-based application needs to deliver high performance and scalability. In addition, it requires complete data availability, which includes fault tolerance, service uptime, and throughput. In short, performance and service uptime are the two most important criteria to ensure an application operates at expected levels.

Guide to Cost-effective Database Scale-Out Using MySQL, MySQL AB, http://www.mysql.com/it-resources/white-papers/mysql_wp_scaleout.php

Scaling out (or Horizontal Scaling) means distributing the computing and data workload among multiple commodity servers by load balancing, with the ability to add or subtract servers to increase or decrease capacity. By distributing the workload, processing resources are spread among multiple low-cost servers, which improves both performance and the availability of the overall service at a dramatically lower cost. This paper discusses the many advantages of the scale-out approach.

Analyst Reports

Your Open Source Strategy, Forrester: Schadler, September 2003, http://www.mysql.com/it-resources/analyst-reports/forrester-open-source-databases.php

Enterprises are intrigued by open source software --- but stymied by myths of cost, support, and risk. Smart firms will master these myths to get the open software stack they want.

So Much Database So Little Money, Hurwitz Associates, April 2005, http://www.mysql.com/it-resources/analyst-reports/hurwitz-vantage-point.php

Are there good reasons to pay hefty license fees for an enterprise database? Well, it depends on the circumstances, but in most situations the answers is "No".

Are there good reasons for using a completely free database within the Enterprise? Well, that depends upon the circumstances too. After all, many companies use a free browser (Firefox), a free web server (Apache) and a free operating system (Linux). However, with database the situation is likely to be more complex. Support can and should be a major consideration, and 24 x 7 support with a guaranteed response is never free.

The End of Database Licensing? Meta Group, April, 2005, http://www.mysql.com/it-resources/analyst-reports/meta-group-db-licensing.php

As the competition for open source heats up, it is the support (e.g., technical, implementation, ISV) that will decide how soon adoption takes place and show will win. MySQL Network is an innovative support offering that threatens traditional commercial software licensing models. MySQL Network is an offering that should increase the velocity of MySQL within the enterprise market and mark the "beginning of the end" for software licensing fees as a separately charged line item.