MySQL Technical Update:
SCaLE 2012

Dave Stokes  MySQL Community Manager
The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions.

The development, release, and timing of any features or functionality described for Oracle’s products remains at the sole discretion of Oracle.
Agenda

• Oracle’s Strategy and Investment in MySQL
• What’s New in MySQL
• PHP centric stuff
• Other goodies
• Q&A
UNMATCHED INVESTMENT

HUNDREDS OF EXPERTS

LARGEST MySQL ENGINEERING & SUPPORT ORGANIZATION

PERFORMANCE IMPROVEMENTS

REPLICATION

EMBEDDED

CLOUD

WINDOWS

HUNDREDS OF EXPERTS

ORACLE DRIVES MySQL INNOVATION

WORLD-CLASS SUPPORT

MySQL CLUSTER

WEB

STRATEGIC

MySQL ENTERPRISE EDITION

NoSQL

LINUX

LARGEST MySQL ENGINEERING & SUPPORT ORGANIZATION
Oracle’s Investment in MySQL

Rapid Innovation

Make MySQL a Better MySQL
• #1 Open Source Database for Web Applications
• “M” in most complete LAMP stack
• Embedded

Develop, Promote and Support MySQL
• Improved engineering, consulting and support
• Leverage 24x7, World-Class Oracle Support

MySQL Community Edition
• Source and binary releases
• GPL license
More Product Releases Than Ever Before
Oracle Drives MySQL Innovation

Q2 CY2010
- MySQL Workbench 5.2
- MySQL Enterprise Monitor 2.2
- MySQL Cluster 7.1
- MySQL Cluster Manager 1.0
All GA!

Q3 CY2010
- MySQL Database 5.5
- MySQL Enterprise Backup 3.5
- MySQL Enterprise Monitor 2.3
- MySQL Cluster Manager 1.1
All GA!

Q4 CY2010
- MySQL Workbench 5.2
- MySQL Enterprise Monitor 2.2
- MySQL Cluster 7.1
- MySQL Cluster Manager 1.0
All GA!

Q1 CY2011
- MySQL Enterprise Backup 3.6
- Oracle VM Template for MySQL
- MySQL Database 5.6
- MySQL Cluster 7.2
- MySQL Enterprise Backup 3.6
- Oracle VM Template for MySQL
- MySQL Database 5.6
- MySQL Cluster 7.2
- DMR*
- and MySQL Labs!
- (“early and often”)

Q2-3 CY2011

A Better MySQL

*Development Milestone Release
MySQL: Open Source (GPL)

Available to download and use under the GPL:

- MySQL Database (Community Server)
- MySQL Cluster
- MySQL Workbench Community Edition
- MySQL Utilities (in Python)
- MySQL Connectors
- MySQL Proxy
- Documentation (free to use, not covered under GPL)
- Forums

Set your ambitions high!
Industry Leading Customers

Web:
- Google
- eBay
- Facebook
- YouTube
- Zillow.com
- Wikipedia
- Mixi
- Yahoo!
- Travelocity

OEM / ISV’s:
- Sage
- Ingenico
- Check Point
- Tripwire
- Symantec
- SafeNet
- Adobe

SaaS, Cloud:
- SurfControl
- Go Daddy
- Zimbra
- RightNow
- F-Secure

Telecommunications:
- SFR
- Deutsche Telekom
- Cisco
- Comcast
- Ericsson
- Alcatel-Lucent
- Telenor

Enterprise 2.0:
- Lafarge
- Toys "R" Us
- Associated Press
- Leader Price
- Shinsei Bank

Rely on MySQL
Tough Questions

...performance issues? ...servers down?

...expensive, slow queries? ...security policies, change?

Where/When/How to Tune?

...will systems scale? ...Developers productive?

...Replication synch issues? ...version of MySQL to run?

...managing Oracle and MySQL databases? ...can I recover?
MySQL Enterprise Edition

Most secure, scalable MySQL Database, Online Backup, Development/Monitoring Tools, backed by Oracle Premier Lifetime Support
MySQL Database
Performance, Reliability, Ease of Use

Support for common development languages/platforms

Efficient multi-threaded session handling

Full DML, DDL parsing, cost based optimizer, caching of queries and result sets

Flexible Storage Engine options for application specific storage needs

Flexible logging and physical storage options

Connectors
Native C API, JDBC, ODBC, .NET, PHP, Python, Perl, Ruby, VB

MySQL Server
Connection Pool
Authentication - Thread Reuse - Connection Limits - Check Memory - Caches

SQL Interface
DML, DDL, Stored Procedures, Views, Triggers, etc.

Parser
Query Translation, Object Privilege

Optimizer
Access Paths, Statistics

Caches & Buffers
Global and Engine Specific Caches & Buffers

Pluggable Storage Engines
Memory, Index & Storage Management

InnoDB MyISAM Cluster Archive Merge Memory Partner Community Custom

File System
NTFS - NFS
SAN - NAS

Files & Logs
Redo, Undo, Data, Index, Binary, Error, Query, and Slow
MySQL Database

InnoDB - Transactional by Default

- Default Storage Engine for MySQL 5.5 and above
- ACID-compliant transactions, MVCC
- Row-level locking
- Two phase commit
- Efficient indexing
- Fast DDL operations
- Table compression
- Automatic crash recovery
- Referential integrity
- Online backup
- More
MySQL Database
SysBench Benchmarks - Linux

MySQL 5.5 vs. 5.1 - Read Write

370% performance gain for MySQL 5.5 over 5.1.50; at scale

MySQL 5.5.6
( Default InnoDB )

MySQL 5.1.50
(InnoDB Plug-in)

MySQL 5.1.50
(InnoDB built-in)

Intel Xeon X7460 x86_64
4 CPU x 6 Cores/CPU
2.66 GHz, 32GB RAM
Fedora 10
MySQL Database
SysBench Benchmarks - Linux

MySQL 5.5 vs. 5.1 - Read Only

200% performance gain for MySQL 5.5 over 5.1.50; at scale

Intel Xeon X7460 x86_64
4 CPU x 6 Cores/CPU
2.66 GHz, 32GB RAM
Fedora 10
MySQL Database

SysBench Benchmarks - Windows

MySQL 5.5 vs. 5.1 - Read Only

540% performance gain for MySQL 5.5 over 5.1.50; at scale

MySQL 5.5.6
(Default InnoDB)

MySQL 5.1.50
(InnoDB Plug-in)

MySQL 5.1.50
(InnoDB built-in)

Intel x86_64
4 CPU x 2 Cores/CPU
3.166 GHz, 8GB RAM
Windows Server 2008
MySQL Database
SysBench Benchmarks - Windows

MySQL 5.5 vs. 5.1 - Read Write

1560% performance gain for MySQL 5.5 over 5.1.50; at scale

MySQL 5.5.6
(Default InnoDB)

MySQL 5.1.50
(InnoDB Plug-in)

MySQL 5.1.50
(InnoDB built-in)

Intel x86_64
4 CPU x 2 Cores/CPU
3.166 GHz, 8GB RAM
Windows Server 2008
MySQL Database
High Availability with MySQL Replication
MySQL Database
Replication Internals

MySQL Master

MySql

updates
selects

updates

index & binlogs

data

MySQL Slave

MySql

I/O Thread

relay binlog

SQL Thread

binlog

data
MySQL Database
Replication Enables Scalability

- Write to one master
- Read from many slaves, easily add more as needed
- Perfect for read/write intensive apps
MySQL 5.6: A Better MySQL

- MySQL 5.6 builds on MySQL 5.5 by improving:
  - **Optimizer** for better Performance, Scalability
  - **Performance Schema** for better instrumentation
  - **InnoDB** for better transactional throughput
  - **Replication** for higher availability, data integrity
  - “**NotOnlySQL**” **options** for better flexibility

Web Cloud Embedded On-Premise

Try it now:
dev.mysql.com/downloads/mysql
MySQL Enterprise Security

MySQL External Authentication

• PAM (Pluggable Authentication Modules)
  • Access external authentication methods
  • Standard interface (Unix, LDAP, others)
  • proxied and non-proxied users
• Windows
  • Access native Windows services
  • Authenticate users already logged into Windows (Windows Active Directory)
• Pluggable Authentication API

Integrates MySQL with existing security infrastructures and SOPs.
Windows Authentication Example

1. MyDomain/joe logs into environment with Windows login, password

2. MyDomain\joe is authenticated on Windows OS

3. MyDomain/joe logs into application, application connects to MySQL with user win_joe.

4. Tokens are checked, win_joe user is authenticated using Windows login, password with MySQL specific privs

CREATE USER win_joe
  IDENTIFIED WITH authentication_windows
  AS 'joe';

Win OS users, groups, etc
1. Joe logs in using application user name/password.

2. Connector sends the user name/password to the MySQL server.

3. User name/password sent to the PAM library, yes/no answer from PAM library returned to client.

4. PAM library verifies credentials (using e.g. LDAP or Kerberos etc) and returns yes/no answer for delivery to client.

CREATE USER joe
IDENTIFIED WITH 'authentication_pam'
AS 'mysql';

PAM Authentication Example
MySQL Enterprise Scalability

MySQL Thread Pool

- MySQL default thread-handling – excellent performance, can limit scalability as connections grow
- MySQL Thread Pool improves sustained performance/scale as user connections grow
- Thread Pool API
Default Connection Pool

- Connections assigned to 1 thread for the life of the connection
- Same thread used for all connection statement executions (single threaded)
With Thread Pool Enabled

- Pool contains configurable number of thread groups (default = 16), each manages up to 4096 re-usable threads
- Each connection assigned to thread group via round robin

Ensures better, sustained performance as user loads continue to grow.
MySQL Enterprise Edition

MySQL 5.5 Sysbench OLTP Read/Write

With Thread Pool

MySQL Enterprise Edition

Without Thread Pool

MySQL Community Server

20x Better Scalability with Thread Pool

MySQL 5.5.16
Oracle Linux 6.1, Unbreakable Kernel 2.6.32
2 sockets, 24 cores, 2 X 12-core
Intel(R) Xeon(R) X5670 2.93GHz CPUs
72GB DDR3 RAM
2 X LSI SCSI Disk (MR9261-8i) (597GB)
MySQL Enterprise Edition

MySQL 5.5 Sysbench OLTP Read Only

Transactions Per Second

Simultaneous Database Connections

MySQL Enterprise Edition
With Thread Pool

MySQL Community Server
Without Thread Pool

3x Better Scalability with Thread Pool

MySQL 5.5.16
Oracle Linux 6.1, Unbreakable Kernel 2.6.32
2 sockets, 24 cores, 2 x 12-core
Intel(R) Xeon(R) X5670  2.93GHz CPUs
72GB DDR3 RAM
2 X LSI SCSI Disk (MR9261-8i) (597GB)
MySQL Enterprise High Availability
OVM Template for MySQL

- Oracle Linux with the Unbreakable Enterprise Kernel
- Oracle VM
- Oracle VM Manager
- Oracle Cluster File System 2 (OCFS2)
- MySQL Database (Enterprise Edition)

- Pre-Installed & Pre-Configured
- Full Integration & QA Testing
- Single Point of Support**

** Technical support for Oracle Linux and Oracle Virtual Machine requires Unbreakable Linux Network subscription.
MySQL Enterprise High Availability
Protecting Against Planned/Unplanned Downtime

Planned Events
- Maintenance or upgrades
- Secure Live Migration
- Zero interruption

Failures
- Server, VM or database failure
- HA Auto-restart in pool
- Automatic failure detection & recovery

Pool Masters assure Secure Migration or HA restarts complete in the event of a Manager outage
MySQL Enterprise High Availability

Windows Server Failover Clustering

- Windows Server 2008 R2, MySQL 5.5**
- Quorum (3rd vote), data (InnoDB + schema) & binaries (optional) stored in shared storage (testing iSCSI & FCAL)

Failover:
- Planned maintenance
- MySQL service failure
- Connectivity, Host failures
- Loss of service = couple of seconds + InnoDB recovery time
  - App sees temporary loss of connection and reconnects on same IP address
  - Replication slave recovers automatically
- Cluster managed through MS Failover Cluster Management snap-in GUI
- No new software/scripts required

** Technical support for Windows Server Failover Clustering must be sourced from Microsoft.
MySQL Enterprise Backup

- Online Backup for InnoDB
- Full, Incremental, Partial Backups (scriptable interface)
- Compression
- Point in Time, Full, Partial Recovery options
- Metadata on status, progress, history
- Unlimited Database Size
- Cross-Platform
  - Windows, Linux, Unix
- Certified with Oracle Secure Backup

**Ensures quick, online backup and recovery of your MySQL apps.**
MySQL Enterprise Monitor

- Global view of MySQL environment
- Automated, rules-based monitoring and alerts (SMTP, SNMP enabled)
- Query capture, monitoring, analysis and tuning, correlated with Monitor graphs
- Visual monitoring of “hot” applications and servers
- Real-time Replication Monitor with auto-discovery of master-slave topologies
- Integrated with MySQL Support

A Virtual MySQL Tuning Assistant!
MySQL Expert Advisors

MySQL Cluster
• Monitors and Advises on status/ performance of MySQL Cluster Data Nodes.

Custom
• Built by DBA to Enforce Organization specific best practices.

Upgrade
• Monitors and Advises on Bugs/Upgrades that affect current installation

Administration
• Monitors and Advises on Optimal Configuration

Performance
• Monitors and Advises on Optimal Performance Variable Settings

Replication
• Monitors and Advises on Master/Slave Latency.

Security
• Monitors and Advises on Unplanned Security Changes/Loopholes

Schema
• Monitors and Advises on Unplanned Schema Change

Memory Usage
• Monitors and advises on optimal memory/cache settings

140+ Rules, 40+ MySQL, OS specific Graphs

Save you time writing, deploying, versioning, maintaining custom scripts. Find problems and tuning opportunities you cannot find yourself.
MySQL Query Analyzer

- Centralized monitoring of queries without Slow Query Log, SHOW PROCESSLIST;
- Enabled via MySQL Connectors
- Aggregated view of query execution counts, time, and rows
- Visual “grab and go” correlation with Monitor graphs
- Traces query executions back to source code

**Saves you time** parsing atomic executions from logs. Finds problems you cannot find yourself.

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<table>
<thead>
<tr>
<th>Query</th>
<th>Database</th>
<th>Counts</th>
<th>Total</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>commit</td>
<td>mem</td>
<td>11,398</td>
<td>3.668</td>
<td>0.172</td>
</tr>
<tr>
<td>UPDATE inventory_instancestance_attribute_id = ?</td>
<td>mem</td>
<td>3,903</td>
<td>1.719</td>
<td>0.016</td>
</tr>
<tr>
<td>INSERT IGNORE INTO dc_n... ) VALUES (?, ?, ?)</td>
<td>mem</td>
<td>2,966</td>
<td>1.906</td>
<td>0.141</td>
</tr>
<tr>
<td>UPDATE inventory_instancestance_attribute_id = ?</td>
<td>mem</td>
<td>2,679</td>
<td>0.953</td>
<td>0.031</td>
</tr>
<tr>
<td>INSERT IGNORE INTO dc_n... ) VALUES (?, ?, ?)</td>
<td>mem</td>
<td>1,469</td>
<td>0.594</td>
<td>0.078</td>
</tr>
<tr>
<td>SELECT hibinstance0_. i...stance_attribute_id = ?</td>
<td>mem</td>
<td>1,463</td>
<td>0.734</td>
<td>0.016</td>
</tr>
<tr>
<td>INSERT IGNORE INTO dc_n, ?, ?, ? ) / , ..., /</td>
<td>mem</td>
<td>673</td>
<td>0.828</td>
<td>0.031</td>
</tr>
<tr>
<td>SELECT ngsavedstr0_. i...ance_attribute_id = ?</td>
<td>mem</td>
<td>474</td>
<td>0.359</td>
<td>0.016</td>
</tr>
<tr>
<td>INSERT IGNORE INTO dc_n, ?, ?, ? ) / , ..., /</td>
<td>mem</td>
<td>446</td>
<td>0.438</td>
<td>0.063</td>
</tr>
<tr>
<td>SELECT emailtarget0_. r.... rule_schedule_id = ?</td>
<td>mem</td>
<td>372</td>
<td>0.141</td>
<td>0.016</td>
</tr>
<tr>
<td>rollback</td>
<td>mem</td>
<td>298</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>SELECT ruleexpr0_. v...res0_. variable_id = ?</td>
<td>mem</td>
<td>290</td>
<td>0.109</td>
<td>0.016</td>
</tr>
</tbody>
</table>
Query Execution Drill Downs

Example query exec with variable substitution

Trace query exec back to source code

Full exec EXPLAIN
Automated Replication Monitor

- Auto-detects, groups/maintains Master/Slave topologies
- Consolidated, real time status/synch check
- Notifications on Synch Issues
- Proactive vs reactive

Saves you time monitoring and collecting replication status/synch data from MySQL command line.
MySQL Enterprise Monitor
Integrated with My Oracle Support

• Collect MySQL diagnostics and upload to MySQL Support
• Track MOS SRs from Enterprise Dashboard
MySQL Workbench SE

Database Design
• Visual Design, modeling
• Forward/Reverse Engineer
• Schema validation, Schema doc

SQL Development
• SQL Editor - Color Syntax Highlighting
• Objects - Import/Export, Browse/Edit
• Connections - Wizard, SSH Tunnel

Database Administration
• Status, Configuration, Start/Stop
• Users, Security, Sessions
• Import/Export Dump Files

Scripting & Plug-in Support
UI Designed to match VS 2010

**Saves you time** developing and managing your MySQL apps.
MySQL Enterprise Edition

Enables you to manage your Oracle and MySQL databases with Oracle tools/solutions you are already using.
MySQL Enterprise Oracle Certifications

- WebLogic Server
- Database Adapter for Oracle SOA Suite **
- Oracle Business Process Management **
- Oracle Virtual Directory
- Oracle Data Integrator
- Oracle Enterprise Performance Management
- Oracle Identity Analytics
- Open SSO STS, Open SSO Fedlet
- All ship with MySQL 5.x JDBC driver
- ** MySQL as a Metadata Repository option (in progress)
MySQL Enterprise Oracle Certifications

- Oracle Linux
- Oracle VM
- Oracle VM Template for MySQL EE
- Oracle GoldenGate
- Oracle Secure Backup
- My Oracle Online Support

Enables you to manage your Oracle and MySQL databases with Oracle tools/solutions you are already using.
Oracle Premier Support for MySQL

• 24 X 7 Problem Resolution Services
• Unlimited Support Incidents
• Knowledge Base
• Maintenance Releases, Bug fixes, Patches, Updates
• MySQL Consultative Support
• Staffed by experienced, seasoned MySQL Engineers
Tough Questions, Real Solutions

...performance issues?
• MySQL Enterprise Scalability
• MySQL Enterprise Monitor, Advisors, Query Analyzer
• MySQL Consultative Support

...servers down?
• Oracle Premier 7x24 Support
• MySQL Enterprise Monitor, Advisors
• MySQL Enterprise High Availability

...expensive, slow queries?
• MySQL Enterprise Monitor, Query Analyzer

...security policies, change?
• MySQL External Authentication
• MySQL Enterprise Monitor, Security Advisor

Where/When/How to Tune?
• MySQL Enterprise Monitor, Advisors, Query Analyzer
• MySQL Consultative Support

...Replication synch issues?
• MySQL Enterprise Monitor, Replication Monitor
• Oracle Premier 7x24 Support

...Developers productive?
• MySQL Workbench SE
• MySQL Enterprise Monitor, Query Analyzer

...version of MySQL to run?
• Oracle Premier 7x24 Support

...will systems scale?
• MySQL Enterprise Scalability
• MySQL Enterprise Monitor, Advisors, Query Analyzer
• MySQL Consultative Support

...can I recover?
• MySQL Enterprise Backup

...managing Oracle and MySQL databases?
• Oracle Product Certifications
And Now for the esoteric stuff
Mysqli - MySQL native driver for PHP

• Non-blocking, asynchronous queries
• 150+ performance statistics
• Since 5.3 used for Windows, default as of 5.4

Free PECL drop-in solutions for all PHP MySQL extensions:
• mysqliNd_ms - replication and load balancing support *new*
• mysqliNd_qc - client-side query cache (TTL) mysqliNd_uh - swiss-army-knife to hack mysqliNd with PHP

Better licensing, easier to build and distribute
Other goodies

• Unique to mysqlnd...
  • 150+ core performance statistics
  • 30+ query cache performance statistics
  • read-only variable concept for memory savings
  • debug and trace log

• ... find documentation: php.net/
• ... read development blogs: planet.mysql.com
• ... read more development blogs: planet-php.org
• ... follow on Twitter: @phperror, @Ulf_Wendel
MySQL 5.6  – Milestone releases

Binlog API, Binlog Group Commit, Global Transactions Ids, InnoDB Features, InnoDB FTS, InnoDB/Memachced, Performance Schema

These binaries were created by MySQL testing servers. They are provided solely for testing purposes, to try the latest bug fixes and generally to keep up with the development.

Please, DO NOT USE THESE BINARIES IN PRODUCTION.

Instead, install them on a spare server.

If you are looking for production ready binaries, please visit MySQL Downloads.

MySQL Software is provided under the GPL License

Cluster 7.2 with Memcached
Optimizer Tracing – Beyond EXPLAIN

SET optimizer_trace="enabled=on";
SELECT Name FROM City WHERE ID=999;
SELECT trace into dumpfile '/tmp/foo' FROM INFORMATION_SCHEMA.OPTIMIZER_TRACE;

Provides details of optimizer steps in a JSON format. You can then tune
Additional Resources
mysql.com
• MySQL Products and Editions
• TCO calculator
• White Papers
• Customer use cases and success stories

dev.mysql.com
• Downloads
• Documentation

Forums.MySQL.Com
Planet.MySQL.com
eDelivery.com
• Download and evaluate all MySQL products
Think You Know MySQL? Get the Facts.
MySQL is even better than you think. According to the experts, it’s easier to use and it’s more capable than most ISVs / OEMs realize, and by taking a few tried-and-tested steps before shipping your MySQL-embedded products, you can lower your product’s costs and increase its performance.

Join our expert-created and delivered MySQL Embedded Online Forum to learn:
• Why MySQL is a great embedded database for startups as well as the largest software, hardware, and appliance vendors in the world, and how its features ensure costs remain low throughout an application’s life cycle.
• MySQL installation options that require minimal or zero end user effort and how to easily build them into your application
• How to secure MySQL embedded in applications, appliances, and devices
• Tips to simplify your integration with MySQL using the most popular MySQL Connectors and guidance on selecting the settings that will maximize your application’s performance
• Why MySQL delivers excellent performance and how to go beyond the default settings to optimize MySQL’s queries, reporting, and search capabilities

Agenda:
It Just Works! The Beauty of MySQL as an Embedded Database
Building MySQL Embedded for Simple Installation and Security
Craig Sylvester, Principal MySQL Sales Engineer, Oracle

Getting the Most Out of MySQL Connectors for Better Performance and Streamlined Integration
Matt Lord, Senior Principal MySQL Support Engineer, Oracle

Better than Great: MySQL Embedded Performance and Reporting
Alexander Rubin, MySQL Technical Consulting Manager, Oracle
MySQL Tech Tour Event

Santa Clara, CA
Thursday, February 9, 2012
http://www.oracle.com/go/?&Src=7314534&Act=247&pcode=WWMK11042736MPP125

El Segundo, CA
Wednesday, February 8, 2012
http://www.oracle.com/go/?&Src=7314534&Act=249&pcode=WWMK11042736MPP127

Raleigh, NC
Thursday, February 2, 2012
http://www.oracle.com/go/?&Src=7314534&Act=248&pcode=WWMK11042736MPP126
Thanks for attending!

David.Stokes@Oracle.com