



MySQL Enterprise Monitor

Monitoring & Performance Tools for DBAs



Safe Harbor Statement

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Agenda: MySQL Enterprise Monitor

- **MySQL Customers**
- **Overview & Architecture**
- **Installation & Configuration**
- **Features & Benefits**
- **Questions**
- **Appendix**
- **Additional Info**



Industry Leaders Rely on MySQL



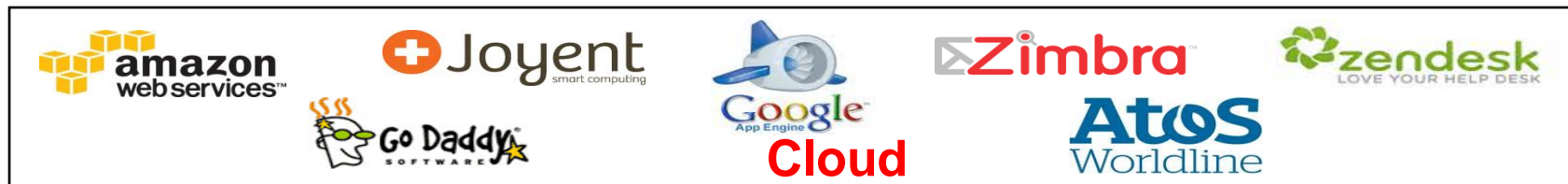
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Big Fish



Application

Big Fish Games is a global leader in the online games industry and distributes more games worldwide than any other online site.

Key Business Benefit

MySQL Query Analyzer provides a consolidated view of query activities and execution details, and has enabled Big Fish Games to quickly identify poorly running queries and tackle the root causes directly in the SQL code.

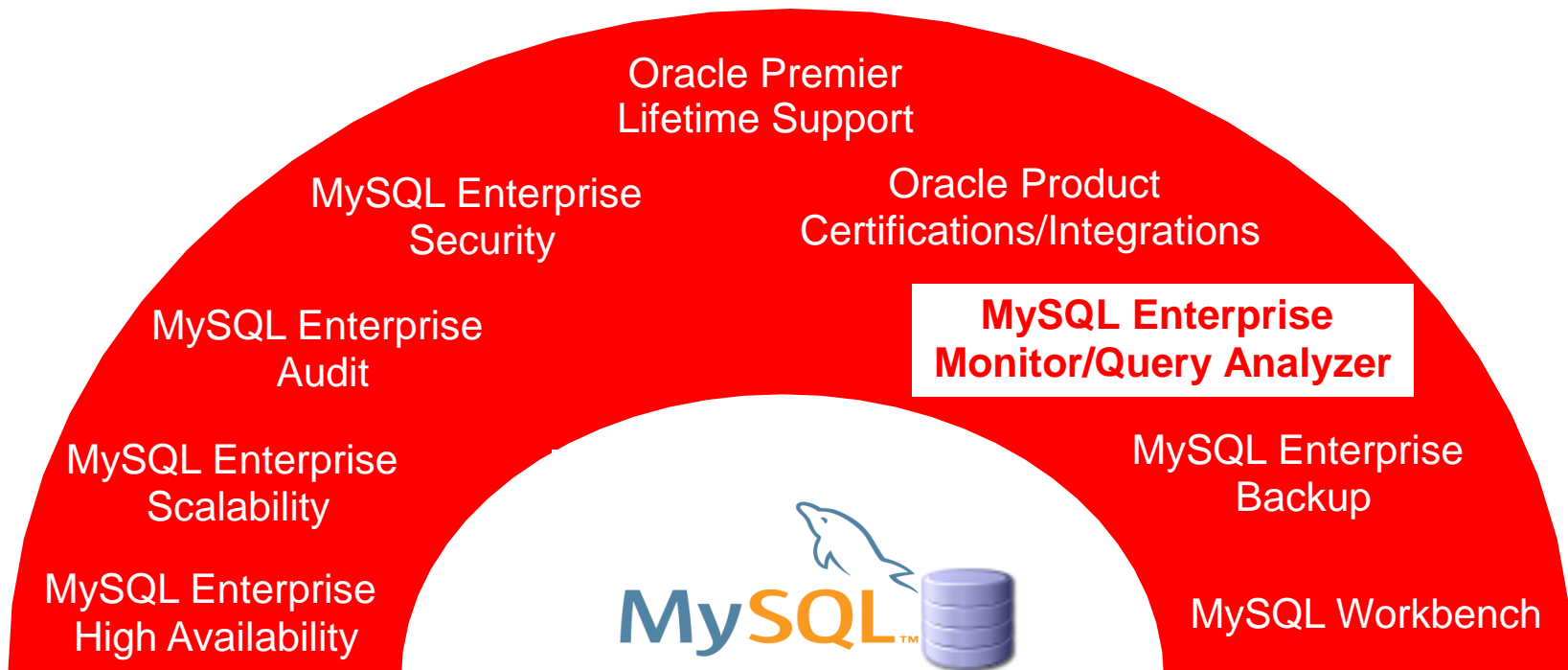
Why MySQL?

“With the MySQL Query Analyzer, we were able to identify and analyze problematic SQL code, and triple our database performance. More importantly, we were able to accomplish this in three days, rather than taking weeks.”

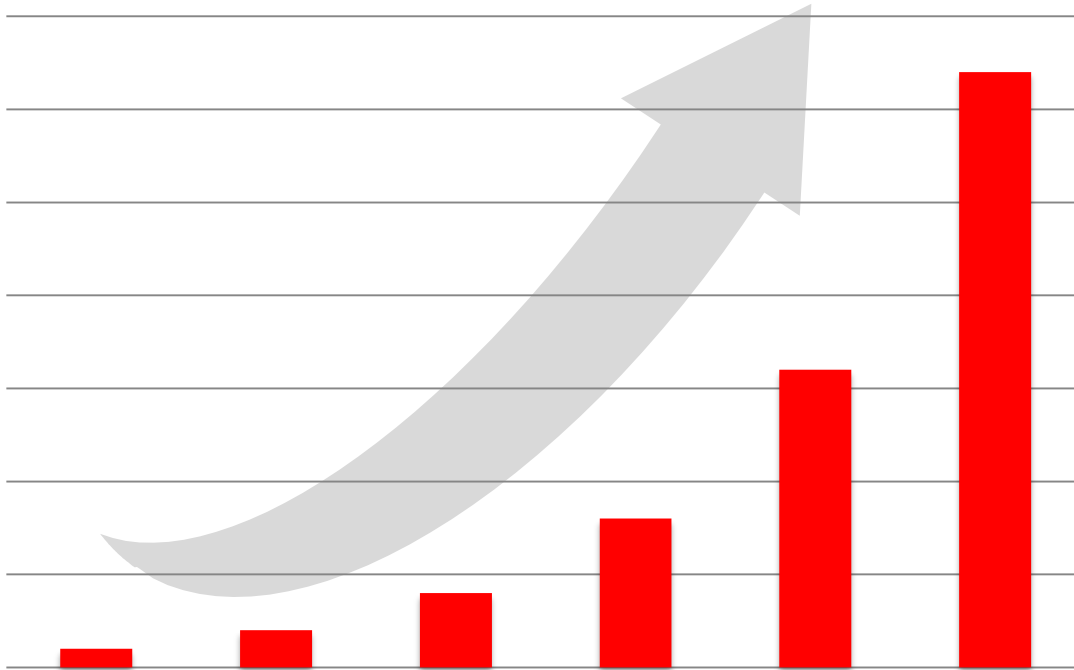
*Keith Souhrada
Software Development Engineer
Big Fish Games*

MySQL Enterprise Edition

Highest Levels of Security, Performance, and Availability



Database Application Growth



Situation

- 2.1 Billion Internet Users
- 40% Data Growth/Year
- \$1 Trillion eCommerce
- 600 New Videos/Minute
- 58 Million Tweets/Day

Requirements

- Performance
- Scale-out
- Automation

MySQL DBA Checklist

1. Ensure your production databases are available ✓
2. Monitor MySQL performance throughout the day ✓
3. Verify that MySQL replication is working properly ✓
4. Confirm that backups have completed successfully ✓
5. Monitor disk space to ensure MySQL won't run out of space ✓
6. Regularly monitor and identify blocking issues ✓
7. Verify there have been no changes to database schema ✓
8. Check OS metrics for unusual events ✓
9. Check for security vulnerabilities ✓
10. Monitor and analyze memory usage ✓

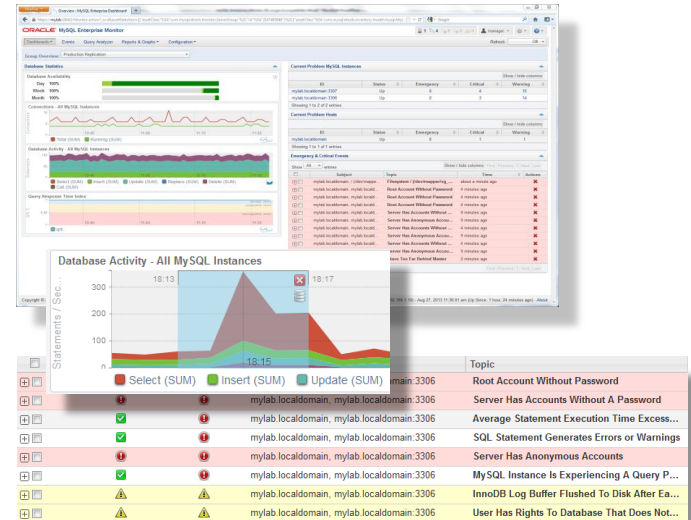
MySQL DBA Challenges

- **“The database is slow. What needs tuning?”**
- **“What are my most expensive queries?”**
- **“Are indexes optimized?”**
- **“Is replication lag a problem?”**
- **“Did my last backup succeed?”**
- **“When will my disk fill up?”**
- **“When will I need more hardware to scale-out?”**
- **“Has my database schema changed?”**
- **“Are there security vulnerabilities that I need to be concerned about?”**

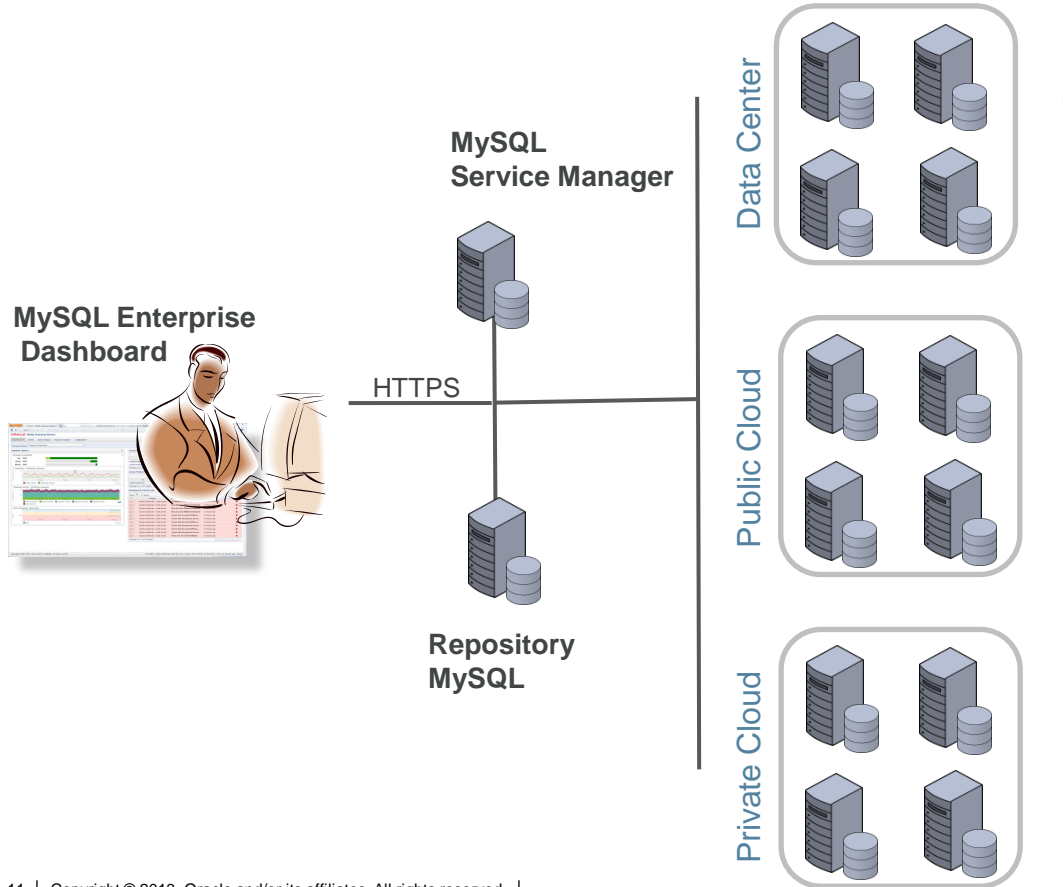


MySQL Enterprise Monitor

- Real-time MySQL performance and availability monitoring
- Visually find & fix problem queries
- Disk monitoring for capacity planning
- Cloud friendly architecture (no agents)
- Start monitoring MySQL in 10 minutes
- Remote agent option provides OS monitoring



Cloud-friendly Architecture



MySQL

- Provides MySQL related metrics
- MySQL Query Analyzer collects data using Performance Schema

Service Manager

- Collects all MySQL related metrics
- Collects all OS/Host related metrics

Repository

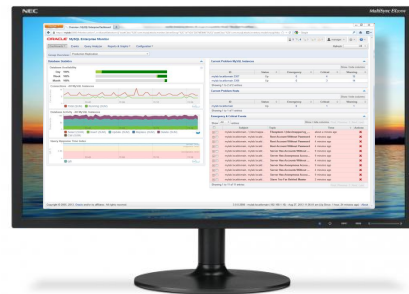
- Stores historical MySQL data

Agent (optional)

- Only for OS/Host metrics
- Not required for DB metrics

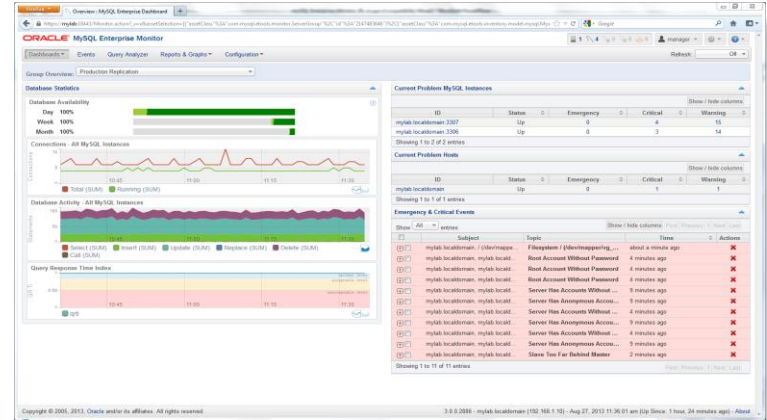
Installation & Configuration

- **Install the Service Manager**
 - `shell> ./mysqlmonitor-3.0.X.XXXX-...-installer.bin`
- **Up and Running in 10 minutes**
 - Auto-discovery of MySQL servers
 - Advisors are pre-configured
 - Advisors are pre-scheduled
- **Customization**
 - Centralized configuration dashboard
 - Advisors
 - Event Handling
 - Preferences, global settings, users, and logs



MySQL Enterprise Dashboard

- SLA monitoring
- Real-time performance monitoring
- Alerts & notifications
- MySQL best practice advisors

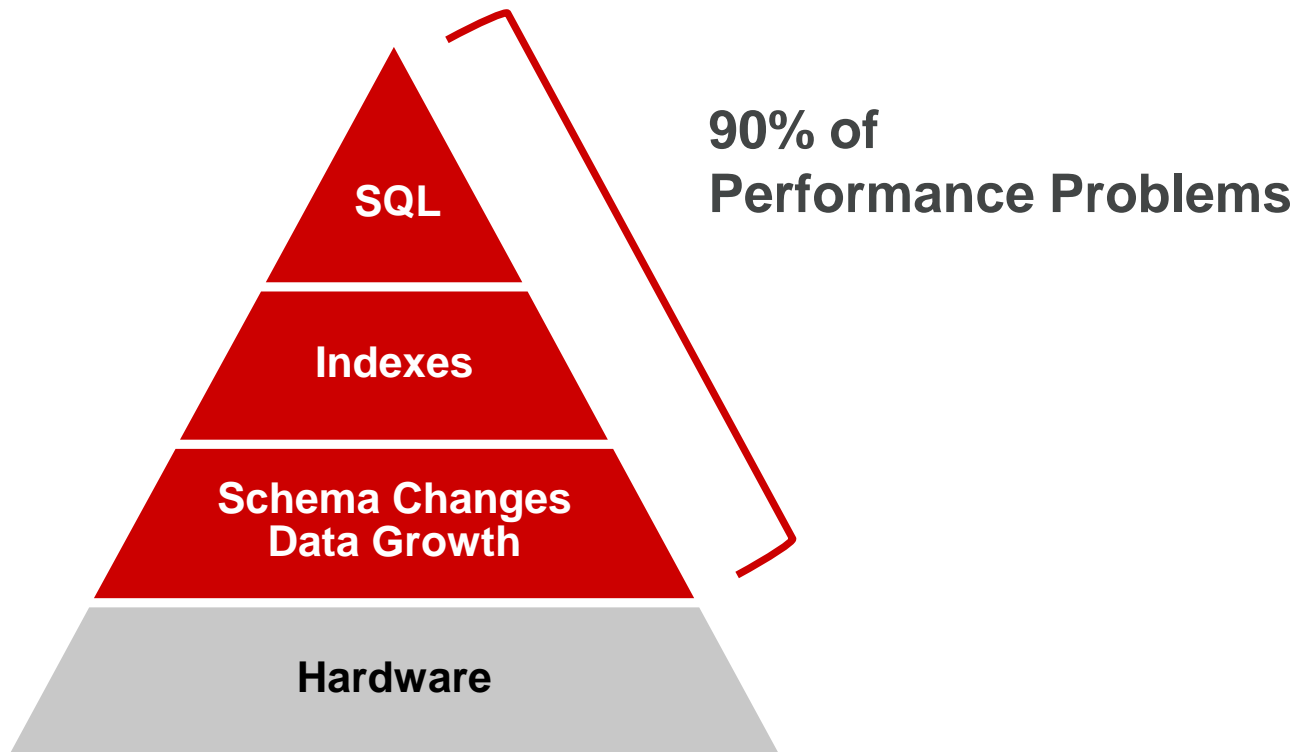


"The MySQL Enterprise Monitor is an absolute must for any DBA who takes his work seriously."

- Adrian Baumann, System Specialist
Federal Office of Information Technology &
Telecommunications



Source of Database Performance Problems



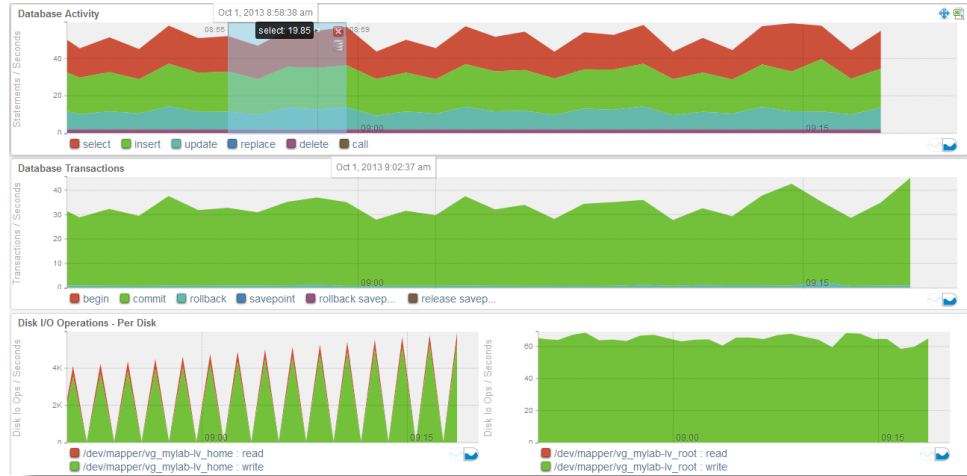
MySQL Performance Schema

- Identify performance bottlenecks
- Identify problematic queries
- Get real time insight into locks
- See exactly what is happening within MySQL
- Get real time insight into MySQL internals
- Get real time insight into query executions

```
mysql> select * from ps_top_io_by_file limit 10;
+-----+
+-----+
| file                                     | count_read | total_read | avg_read | count_write | total_written | avg_written | total |
+-----+-----+-----+-----+-----+-----+-----+-----+
| @@datadir/ibdata1                       |          7974 | 126.56 MiB | 16.25 KiB |          54979 | 12.72 GiB | 242.58 KiB | 12.84 GiB |
| @@datadir/ib_logfile0                   |             6 | 68.00 KiB | 11.33 KiB |          9348 | 1.25 GiB | 140.41 KiB | 1.25 GiB |
| @@datadir/ib_logfile1                   |             0 | 0 bytes | 0 bytes |          5447 | 1.21 GiB | 233.23 KiB | 1.21 GiB |
| @@datadir/mylab-bin.000001              |             2 | 120 bytes | 60 bytes |        104242 | 1.01 GiB | 10.15 KiB | 1.01 GiB |
| @@datadir/mylab-bin.000002              |             0 | 0 bytes | 0 bytes |          98905 | 1.00 GiB | 10.61 KiB | 1.00 GiB |
| @@datadir/mylab-bin.000003              |             0 | 0 bytes | 0 bytes |          75053 | 775.10 MiB | 10.58 KiB | 775.10 MiB |
| @@datadir/employees/salaries.ibd        |             0 | 0 bytes | 0 bytes |          8556 | 270.83 MiB | 32.41 KiB | 270.83 MiB |
| @@datadir/employees/titles.ibd          |             0 | 0 bytes | 0 bytes |          1950 | 69.08 MiB | 36.27 KiB | 69.08 MiB |
| @@datadir/employees/dept_emp.ibd        |             0 | 0 bytes | 0 bytes |          1376 | 49.17 MiB | 36.59 KiB | 49.17 MiB |
| @@datadir/employees/employees.ibd      |           607 | 9.48 MiB | 16.00 KiB |           944 | 35.92 MiB | 38.97 KiB | 45.41 MiB |
+-----+-----+-----+-----+-----+-----+-----+-----+
10 rows in set (0.00 sec)
```

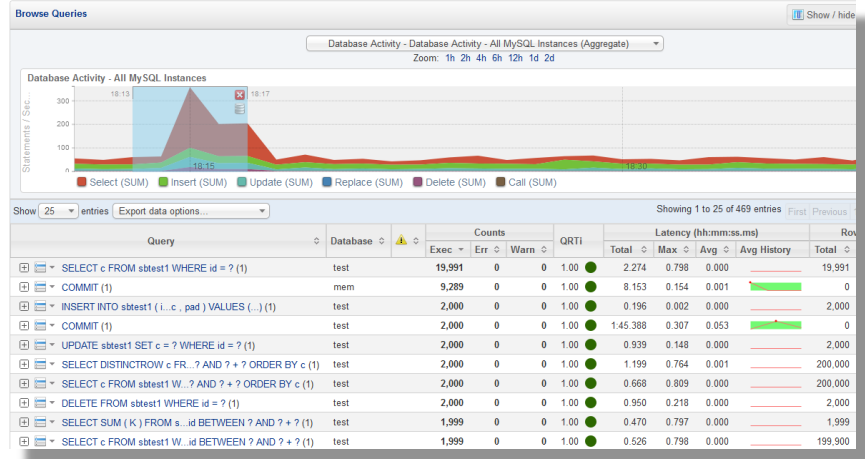
Performance Monitoring

- Monitor MySQL performance
- Monitor OS performance
- Monitor query performance
- Advice on index usage
- Alerts on performance problems



MySQL Query Analyzer

- Real-time query performance
- Visual correlation graphs
- Find & fix expensive queries
- Detailed query statistics
- Query Response Time index (QRTi)



“With the MySQL Query Analyzer, we were able to identify and analyze problematic SQL code, and triple our database performance. More importantly, we were able to accomplish this in three days, rather than taking weeks.”

Keith Souhrada
Software Development Engineer
Big Fish Games

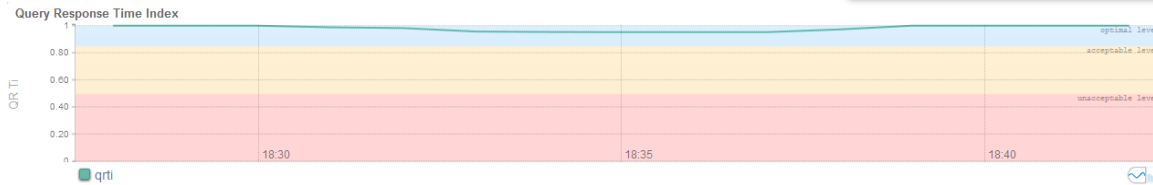


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Query Response Time Index (QRTi)

- “Quality of Service” (QoS) measurement for each query
- QoS measurement for a server, group, or every instance
- Single metric for query performance

Query	Database	Counts			QRTi
		Exec	Err	Warn	
INSERT INTO sbtest1 (i...c , pad) VALUES (...)	test	161,133	0	0	1.00
INSERT INTO sbtest1 (k...LUES (...)'* , ... ?)	test	20	0	0	0.50
SELECT SUM (K) FROM s...id BETWEEN ? AND ? + ?	test	161,156	0	0	1.00
SELECT DISTINCTROW c FR...? AND ? + ? ORDER BY c	test	161,160	0	0	1.00
CREATE INDEX k_1 ON sbtest1 (k)	test	1	0	0	0.00
SELECT c FROM sbtest1 W...? AND ? + ? ORDER BY c	test	161,157	0	0	1.00
BEGIN	test	161,139	0	0	1.00
CREATE TABLE sbtest1 (... = innodb MAX_ROWS = ?	test	1	0	0	0.50
COMMIT	test	161,091	0	0	0.69
DROP TABLE sbtest1	test	1	0	0	0.50



Solving Query Performance Problems

- 1
 - Visually Identify Slow Queries
 - Correlation Graphs
 - Query Response Time index (QRTi)
 - Execution Statistics

1

2

3

4

- 3
 - Tune Queries
 - Add Indexes
 - Tune Schemas
 - Improve Caching

- 2
 - MySQL Explain Plan
 - Sample Query
 - Query Graphs

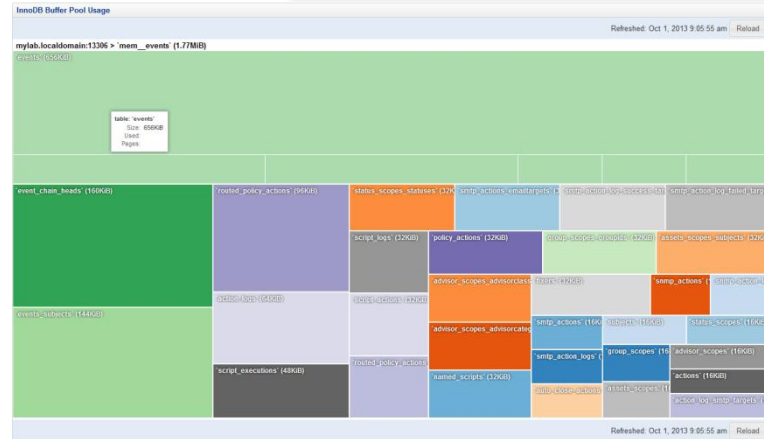
Better Performance

Advantages of Query Analyzer over Slow Query Log

- See query execution statistics
- Trace the query origination back to the application source code
- View the overall query performance over time
- See when the query was first introduced
- See the explain plan
- Focus on queries specific to a particular host and time period
- View query executions correlated with other performance graphs

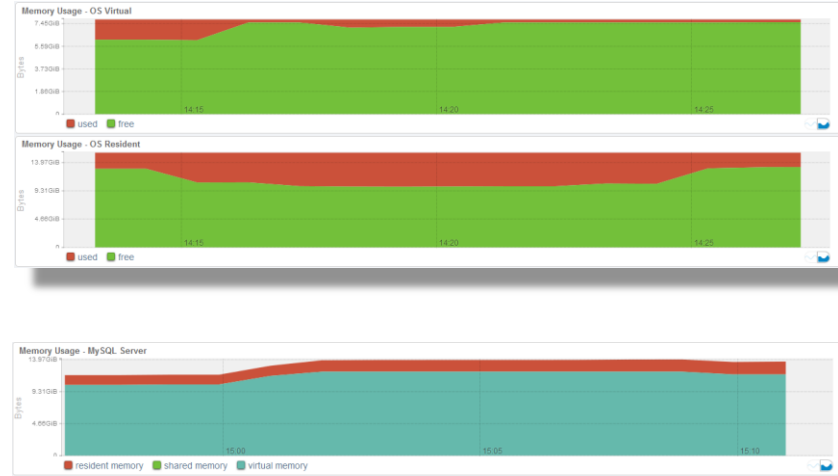
InnoDB Monitoring

- Monitor key performance metrics
- Stay on top of locking issues
- Get configuration advice
- Examine buffer pool usage



Memory Usage Monitoring

- Monitor OS memory usage
- Monitor MySQL memory usage
- Advice on configuration
- Alerts on memory usage



Replication Monitoring

- Auto-discovers replication topology
- Master/Slave performance monitoring
- Replication advisor
- Best practice replication advice

"I use the MySQL Enterprise Monitor every day to monitor and keep tabs on our MySQL databases. Quick one stop shopping for keeping tabs on them."

-Wes Homer,
Sr System and Network Administrator



Replication Monitoring										
Servers	Type	Threads		Time Behind	Binary Logs		Master Position		Log Space	
		IO	SQL		Current File	Position	Binary Log	Position	Binary Logs	Relay Logs
Replication 1 (4)	MIXED	✓	✓							
mylab.localdomain:3306	master/slave	✓	✓	00:00:00	mylab-bin.000001	791	mylab-bin.000001	791	791 B	1.1 KB
mylab.localdomain:3307	master/slave	✓	✓	00:00:00	mylab-bin.000001	791	mylab-bin.000001	791	791 B	1.1 KB
mylab.localdomain:3308	master/slave	✓	✓	00:00:00	mylab-bin.000001	986	mylab-bin.000001	791	0.96 KB	1.1 KB
MLORD-PC:3306	slave	✓	✓	00:00:00			mylab-bin.000001	986		1.29 KB

Best Practice Advisors

- Enforce MySQL best practices
- 14 Advisor categories
- 250+ Advisors
- Threshold-based alerts
 - Exponential moving averages
 - Rate change detection
- Expert problem resolution advice



Advisor Category	Configuration Status
Administration	Configured: 26 of 26
Agent	Configured: 3 of 3
Availability	Configured: 6 of 6
Backup	Configured: 5 of 5
Cluster	Configured: 10 of 10
Graphing	Configured: 87 of 87
Memory Usage	Configured: 6 of 6
Monitoring and Support Services	Configured: 5 of 5
Operating System	Configured: 5 of 5
Performance	Configured: 23 of 23
Query Analysis	Configured: 4 of 4
Replication	Configured: 13 of 13
Schema	Configured: 17 of 17
Security	Configured: 26 of 26

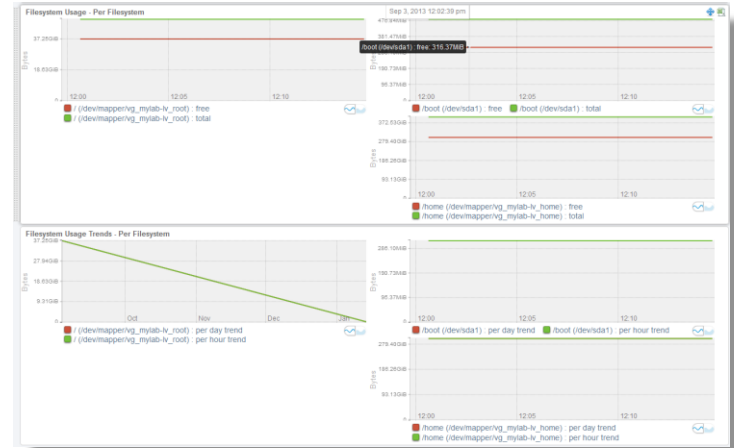
"I definitely recommend the MySQL Enterprise Monitor to DBAs who don't have a ton of MySQL experience. It makes monitoring MySQL security, performance and availability very easy to understand and to act on."

Sandi Barr
Sr. Software Engineer
Schneider Electric



Disk Monitoring

- Capacity Planning
- Forecast capacity requirements
- Projections
- Trend analysis
- Timeseries data



"With the monitoring dashboard and advisory rules, we can accurately predict our capacity requirements and optimize MySQL performance."

Keith Souhrada
Software Development Engineer
Big Fish Games



MySQL Enterprise Backup Monitoring

- Monitor backup results
- Monitor backup performance
- Ensure backups are up to date

ORACLE MySQL Enterprise Monitor

Dashboards ▾ Events Query Analyzer Reports & Graphs ▾ Configuration ▾

Advisors

✓ Edit Selected Advisors ✗ Disable Selected Advisors 📄 Create Advisor 📄 Import/Export

Administration Configured: 26 of 26

Agent Configured: 3 of 3

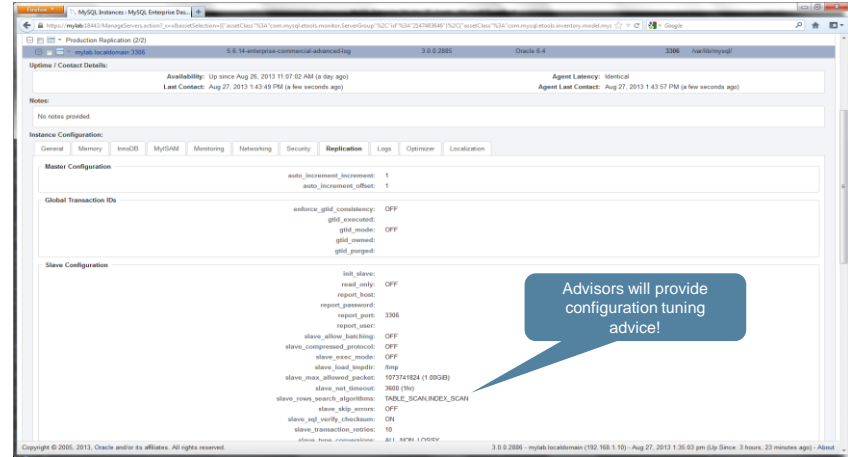
Availability Configured: 6 of 6

Backup Configured: 5 of 5

Item	Info	Coverage	Schedule	Event Handling	
MySQL Enterprise Backup Failed	?	100% (1/1)	5m	0 0 0	🚫 "FAILURE"
MySQL Enterprise Backup Succeeded	?	100% (1/1)	5m	1 0 0	✅ "SUCCESS"
Last Full MySQL Enterprise Backup Too Old	?	100% (1/1)	6h	1 0 0	⚠️ 7
Incremental MySQL Enterprise Backups Not Enabled	?	100% (1/1)	6h	1 0 0	🔔 0
MySQL Enterprise Backup Lock Time Excessive	?	100% (1/1)	5m	0 0 0	🔔 10 🚫 60

MySQL Configuration Management

- Centralized management
- Organized by topic
- Options grouped by feature
- See host details
- See network details



Security Administration

- Account management
- Know when privileges change
- Get advice on best practices
- Monitor access problems

	Current	Worst	Subject	Topic
🔍	🚫	🚫	mylab.localdomain, mylab.localdomain:3306	Root Account Without Password
🔍	🚫	🚫	mylab.localdomain, mylab.localdomain:3306	Server Has Accounts Without A Password
🔍	✅	🚫	mylab.localdomain, mylab.localdomain:3306	Average Statement Execution Time Excess...
🔍	✅	🚫	mylab.localdomain, mylab.localdomain:3306	SQL Statement Generates Errors or Warnings
🔍	🚫	🚫	mylab.localdomain, mylab.localdomain:3306	Server Has Anonymous Accounts

mylab.localdomain, mylab.localdomain:3306 Server Has Accounts Without A Password 6 minutes ago

Topic: Server Has Accounts Without A Password

Categories: Security

Current Status: Open

Auto-Closes by Default: Yes

Notes:

No notes provided.

Details:

Problem Description
Accounts without passwords are particularly dangerous because an attacker needs to guess only a username. Assigning passwords to all accounts helps prevent unauthorized users from accessing the system.

Advice
Assign a strong password to the following accounts on server mylab.localdomain:3306

- '@localhost'
- '@mylab.localdomain'
- 'root@127.0.0.1'
- 'root@:'
- 'root@mylab.localdomain'

A strong password should be at least 8 characters long, contain lowercase and uppercase characters, numbers and symbols, and not contain words found in a dictionary.

Recommended Action
SET PASSWORD FOR 'user_name'@'host_name' = PASSWORD('new_pass');

Links and Further Reading
Securing Your MySQL Installation
Securing a MySQL Server on Windows

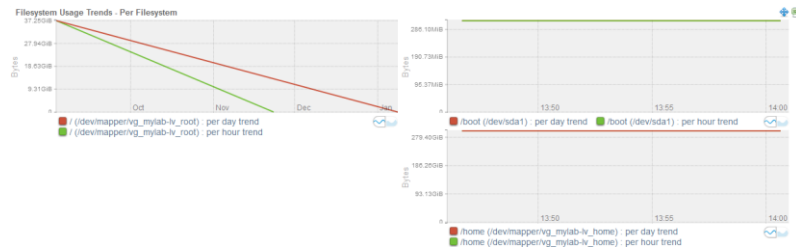
Expression
%user% != THRESHOLD

Evaluated Expression

- '@localhost'
- '@mylab.localdomain'
- 'root@127.0.0.1'
- 'root@:'
- 'root@mylab.localdomain' !=

Trends & Predictive Problem Detection

- Visual trend analysis
- Identify outliers
- Head off problems
- Handle imminent capacity issues



Topic: Filesystem / (dev/mapper/vg_mytab-lv_root) Running Out Of Space in about 13 days

Category: Operating System	Adviser: Filesystem Free Space
Current State: Open	Current Status: Critical
Auto-Closes by Default: Yes	Last Checked: Sep 3, 2013 2:10:39 PM
	Worst Status: Critical
	Worst Alarm Time: Sep 3, 2013 2:08:06 PM

Notes:
No notes provided.

Details:

Problem Description
Databases use disks and filesystems to store data, indexes, logs, and other artifacts. When space gets low, it can adversely affect the performance of your system, and in extreme cases may cause your application to halt or crash.

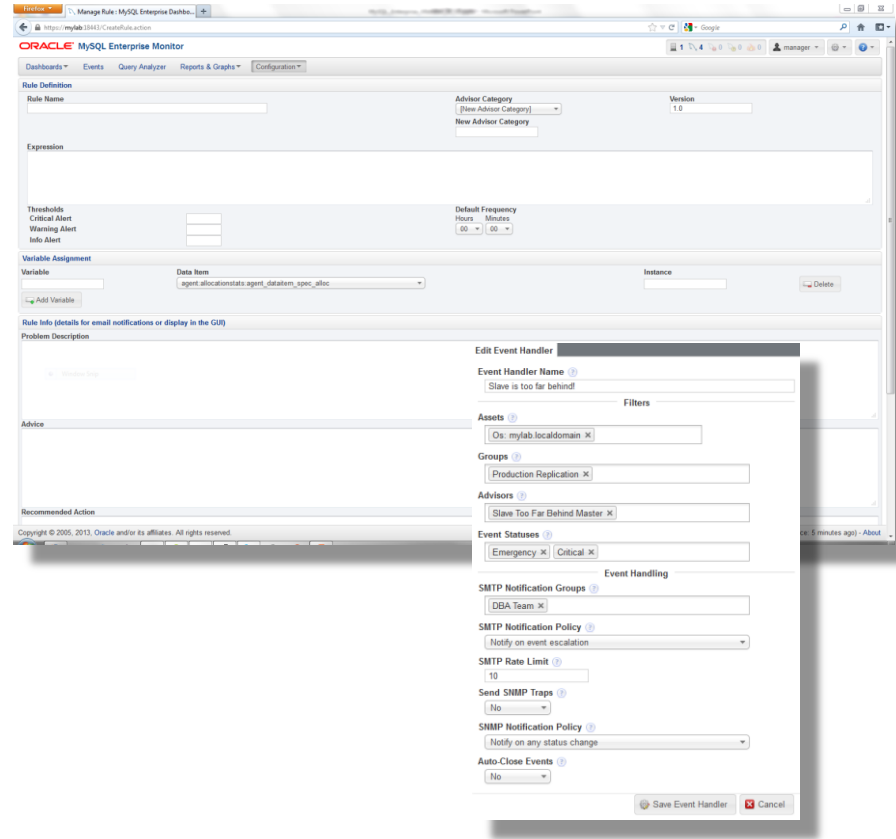
Advice
Investigate why filesystem / (dev/mapper/vg_mytab-lv_root) has a 24-hour average growth rate of 2.8 GiB. At that rate, the 28 GiB remaining (out of 49 GiB) will run out in about 13 days, around September 16, 2013. Consider archiving and deleting large files that are no longer needed, as well as temporary files (e.g. files in /tmp on Linux and %TEMP% on Windows). Look for files that are growing rapidly and consider alternatives (e.g. rotating logs, moving those files to another filesystem, etc.)

Links and Further Reading

- MySQL Manual: Managing Disk I/O and File Space for InnoDB Tables
- Article: Managing Disk Space in Linux
- Oracle Solaris Administration: Displaying Information About Files and Disk Space

Customizable & Extensible

- Create custom
 - Groups
 - Advisors
 - Graphs
 - Filters
 - Event Handlers



Solving Common Performance Issues

Causes of Performance Issues	MySQL Enterprise Monitor Helps
Queries doing table scans	See these queries immediately
Excessive temporary tables on disk	See the queries generating these
CPU spikes	Find out what caused it
Disk I/O saturation	Find out what caused it
Internal locking	Get alerts when locking issues occur
Hardware problems	Get alerts for disk and network problems
Database and schema changes	Get alerts when changes are made
New queries introduced	See what queries are added and when
Poor MySQL configuration	Get advice on configuration tuning

Top 10 Performance Issues Solved

- ✓ Identify the most expensive queries
- ✓ Full table scans (no indexes)
- ✓ Excessive temporary tables
- ✓ Large and/or frequent filesorts
- ✓ CPU usage overload
- ✓ Disk I/O saturation
- ✓ Hardware problems
- ✓ Database and schema changes
- ✓ New queries introduced
- ✓ Poor MySQL configuration
- ✓ Internal locking issues

MySQL Enterprise Monitor 3.0 Demo Videos

MySQL Enterprise Edition: Demos



Installing MySQL Enterprise Monitor

See how you can begin monitoring your MySQL servers in under 10 minutes, using MySQL Enterprise Monitor.



Real-time MySQL Performance & Availability Monitoring

Learn how MySQL Enterprise Monitor enables you to manage the overall performance and health of your MySQL servers.



Performance Tuning with MySQL Query Analyzer

Learn how MySQL Enterprise Monitor's Query Analyzer allows you to quickly and easily identify the root cause of query-based performance issues on any MySQL server.



Remotely Monitor MySQL in the Cloud

Using a Cloud and VM friendly design, MySQL Enterprise Monitor allows you to remotely monitor MySQL Servers in the cloud without the need for any remote agents.

MySQL Enterprise Edition

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- ▶ MySQL Enterprise Monitor
- ▶ MySQL Enterprise HA
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<http://www.mysql.com/products/enterprise/demo.html>





MySQL Enterprise Monitor

Monitoring & Performance Tools for DBAs



Appendix – Proxy and Aggregator

<http://dev.mysql.com/doc/mysql-monitor/3.0/en/mem-qanal-using-proxy.html>

<http://dev.mysql.com/doc/mysql-monitor/3.0/en/mem-qanal-using-aggregator.html>

Appendix – Connector Plugins

<http://dev.mysql.com/doc/mysql-monitor/3.0/en/mem-qanal-using-cj.html>

<http://dev.mysql.com/doc/mysql-monitor/3.0/en/mem-qanal-using-cnet.html>

<http://dev.mysql.com/doc/mysql-monitor/3.0/en/mem-qanal-using-cphp.html>