

MySQL Enterprise Server Monitoring

Once a MySQL **Enterprise Edition** version is installed and placed into use, the monitoring of a MySQL instance becomes extremely important. Monitoring will establish important vital statistics about your application, network, and database server, and will also allow system administration teams to resolve issues much more rapidly. Monitoring application and system metrics such as memory allocation, disk utilization, and CPU usage, will enhance a system administrator's ability to resolve bottlenecks and root causes of problems.

Available Tools

To monitor MySQL Enterprise Edition (commercial edition), we can use the Enterprise Monitor, which is available with this Edition. For all users of the free MySQL community-based version, MariaDB or Percona Server, MySQL Enterprise Edition is not available. The less robust ClusterControl product can provide access to the monitoring of MySQL in its free community version. The use of ClusterControl is not discussed in this article.

Most importantly, the MySQL Enterprise Monitor serves as an automated assistant for MySQL database administrators. This application/service is designed to help administrators with their day-to-day responsibilities by monitoring MySQL servers and identifying potential key problems. The monitor's features are designed to save the database administrator time and effort by providing the information he or she needs through a simplified interface.

Enterprise Monitor Features

MySQL Enterprise Monitor runs on a variety of Linux, Microsoft Windows, and Apple MacOS platforms. It is one of the oldest monitoring products for MySQL on the market and is available as part of a commercial enterprise subscription agreement from Oracle Corporation.

Enterprise Monitor offers a plethora of robust monitoring features including cloud-based remote monitoring, real-time health and availability monitoring, real-time performance monitoring, visual query analysis, MySQL cluster monitoring, InnoDB (storage engine) monitoring, replication monitoring, memory monitoring, disk monitoring, operating systems monitoring, security monitoring, security administration, and backup monitoring. Each of the aforementioned features is described below.

Enterprise Monitor General features:

Enterprise Monitor basically works “right out of the box” and does not require any configuration of client agents to be installed. Global policies can be specified, and then tweaked for custom groups. An artificial intelligence-like set of 14 Advisor Groups and 225+ Advisors provide automated expert guidance in a myriad of areas, such as poor indexing, blocking, concurrency, long-running processes, etc. User-defined custom advisors can also easily be created as well.

Additionally, trends for individual servers, groups, or entire topologies are historically recorded and can be accessed at any time, which lends itself as sources for problem resolution. Rules and alerts dynamically adapt to infrastructure changes, using both SMTP and SNMP with customizable thresholds. Finally, role-based Access Control allows one to fine-tune who has access to a particular set of monitoring assets available.

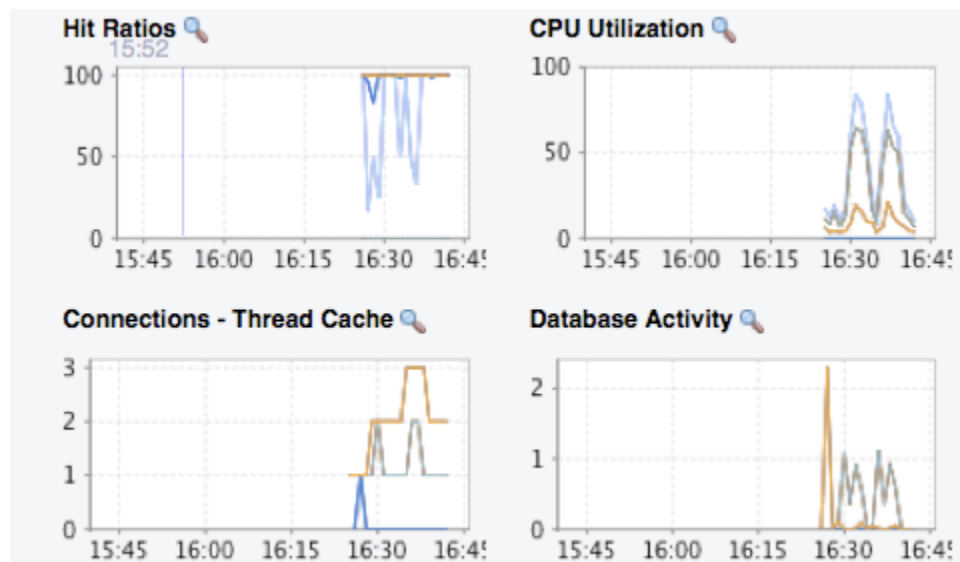
Once the monitored MySQL instances are configured, you can begin to look at the collected data. The Overview section gives you a short summary of some of the most important metrics in MySQL. Data is aggregated and it makes it easier to find any unexpected patterns, which can subsequently be drilled down, to determine specific problems or display metrics.

Cloud-based Remote Monitoring:

Enterprise Monitor can monitor any or all cloud-based, “mysqld” instances without the requirement for a remote agent.

Real-time Health and Availability Monitoring:

This feature of Enterprise Monitor determines the ability to meet time-based SLA's, and monitors the health of the database server with configurable alerts for important events, using both SMTP and SNMP with customizable thresholds. Here is a picture of one of the more standard monitoring screens:

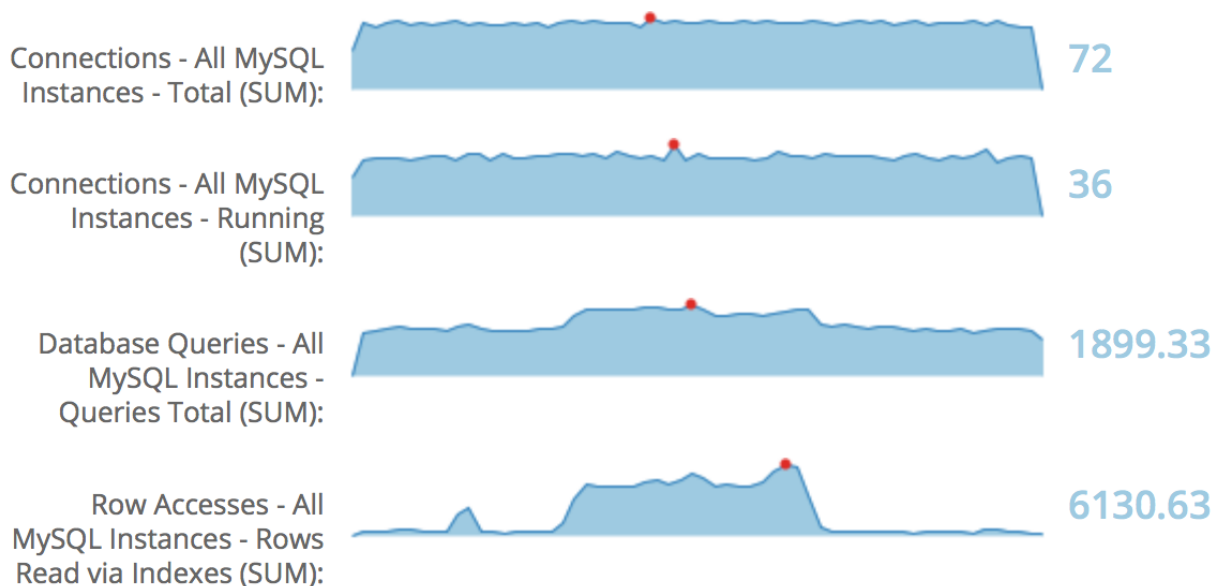


Real-time Performance Monitoring:

Real-time performance monitoring allows one to obtain database performance metrics, alerting of queries that do not meet certain thresholds, user resource utilization, maximum connection alerts, alerts of processes taking too long to complete, alerts of too many concurrent queries

executing on a given server, and alerts as to when queries block other queries. Here is one sample screen that describes connection and query information:

Global Overview



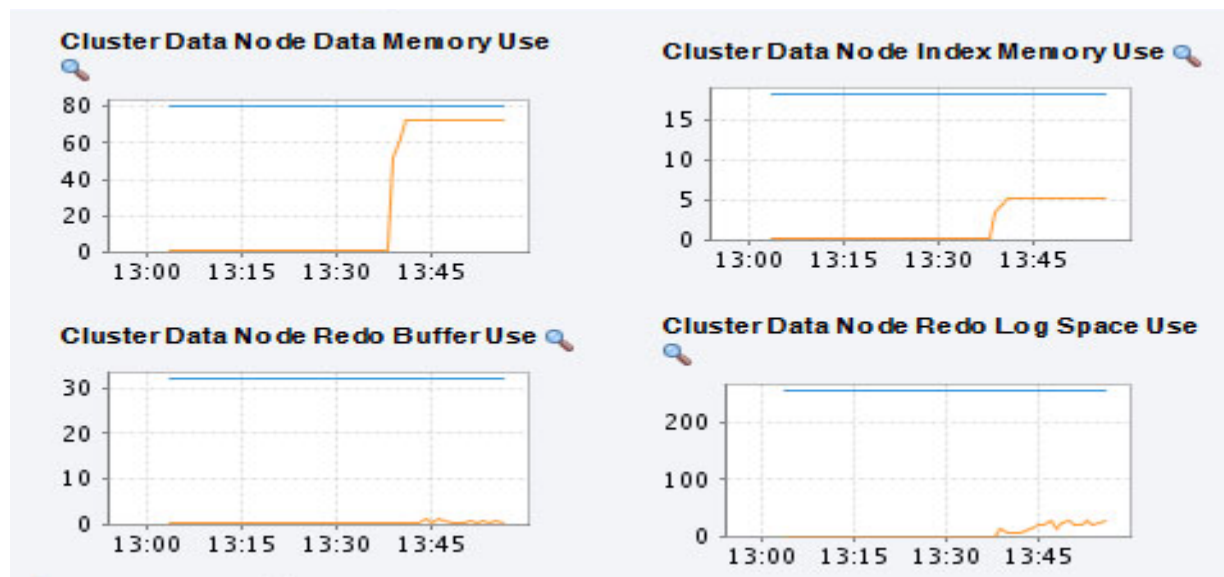
Visual Query Analysis:

The Query Analyzer portion of Enterprise Monitor enables one to monitor the statements being executed on a server and retrieve information about the query, the number of executions, and the execution times of each query. This will help identify problematic queries and bottlenecks. Query Analyzer works by intercepting the SQL statements that your MySQL client application sends to MySQL server. Queries are routed through the MySQL Enterprise Monitor Agent, the agent/proxy forwards the queries to the server and sends the replies back to the client application. In addition to forwarding the queries, the agent/proxy also normalizes the queries and then supplies the execution information about each query to the monitor. A sample high-level query screen is shown below, where each row can subsequently be drilled into:

Query	Database	Exec Count	Exec Time (hh:mm:ss.ms)			Rows			Bytes		
			Total	Max	Avg	Total	Max	Avg	Total	Max	Avg
+ SELECT COUNT(message_i... process_type , fmtdate (1)	intranet_mcslp	6	12.838	11.123	2.140	776	408	129	24.21 KB	12.8 KB	4.04 KB
+ SELECT inhost , path , ...GROUP BY fmtdate , path (1)	intranet_mcslp	2	0.906	0.686	0.453	4,038	2,526	2,019	230.89 KB	142.05 KB	115.44 KB
+ SELECT process_mode , p...ess_mode , process_type (1)	intranet_mcslp	6	1.674	0.333	0.279	36	7	6	808 B	165 B	134.67 B
+ SELECT media_photo . ph...RDER BY RAND() LIMIT ? (1)	intranet_mcslp	1	0.259	0.259	0.259	30	30	30	282 B	282 B	282 B
+ SELECT process_mode , p...ess_mode , process_type (1)	intranet_mcslp	1	0.241	0.241	0.241	8	8	8	189 B	189 B	189 B
+ SELECT data , COUNT(DI...P BY data ORDER BY data (1)	intranet_mcslp	1	0.217	0.217	0.217	195	195	195	3.06 KB	3.06 KB	3.06 KB
+ SELECT DISTINCT(media_... , photoid DESC LIMIT ? (1)	intranet_mcslp	25	1.781	0.209	0.071	250	10	10	2.44 KB	100 B	100 B
+ SELECT DISTINCT(album ...RDER BY RAND() LIMIT ? (1)	intranet_mcslp	1	0.193	0.193	0.193	10	10	10	594 B	594 B	594 B
+ INSERT INTO currencies ...ALUES (? , ? , ? , ?) (1)	intranet_mcslp	5	0.109	0.105	0.022	5	1	1	0 B	0 B	0 B
+ SELECT COUNT(DISTINCT(...oto_meta WHERE type = ? (1)	intranet_mcslp	1	0.095	0.095	0.095	1	1	1	8 B	8 B	8 B
+ SELECT COUNT(videoid ...?)) AND last_view > ? (1)	intranet_mcslp	5	0.100	0.091	0.020	5	1	1	35 B	7 B	7 B
+ INSERT INTO stocks (da...ALUES (? , ? , ? , ?) (1)	intranet_mcslp	2	0.078	0.071	0.039	2	1	1	0 B	0 B	0 B
+ SELECT * FROM statmon_m...e_disk WHERE statid = ? (1)	intranet_mcslp	92	3.202	0.066	0.035	345	9	4	15.25 KB	431 B	169.75 B
+ SELECT SUM(data) , CO... media_video . type = ? (1)	intranet_mcslp	2	0.082	0.064	0.041	2	1	1	33 B	17 B	16.5 B
+ SELECT media_photo . ph...RDER BY RAND() LIMIT ? (1)	intranet_mcslp	24	0.231	0.061	0.010	1,206	150	50	10.91 KB	1.37 KB	465.58 B
+ SELECT DISTINCT(machin...DATE() , logtime) < ? (1)	intranet_mcslp	23	0.786	0.055	0.034	92	4	4	575 B	25 B	25 B
+ INSERT INTO markets (d...ALUES (? , ? , ? , ?) (1)	intranet_mcslp	7	0.057	0.047	0.008	7	1	1	0 B	0 B	0 B
+ SELECT DISTINCT(media_...RDER BY RAND() LIMIT ? (1)	intranet_mcslp	1	0.042	0.042	0.042	60	60	60	2.29 KB	2.29 KB	2.29 KB
+ SELECT COUNT(DISTINCT(...st)) FROM media_audio (1)	intranet_mcslp	1	0.033	0.033	0.033	1	1	1	9 B	9 B	9 B
+ SELECT (COUNT(DISTINC... * ?) FROM media_audio (1)	intranet_mcslp	2	0.065	0.033	0.032	2	1	1	25 B	13 B	12.5 B

MySQL Cluster Monitoring:

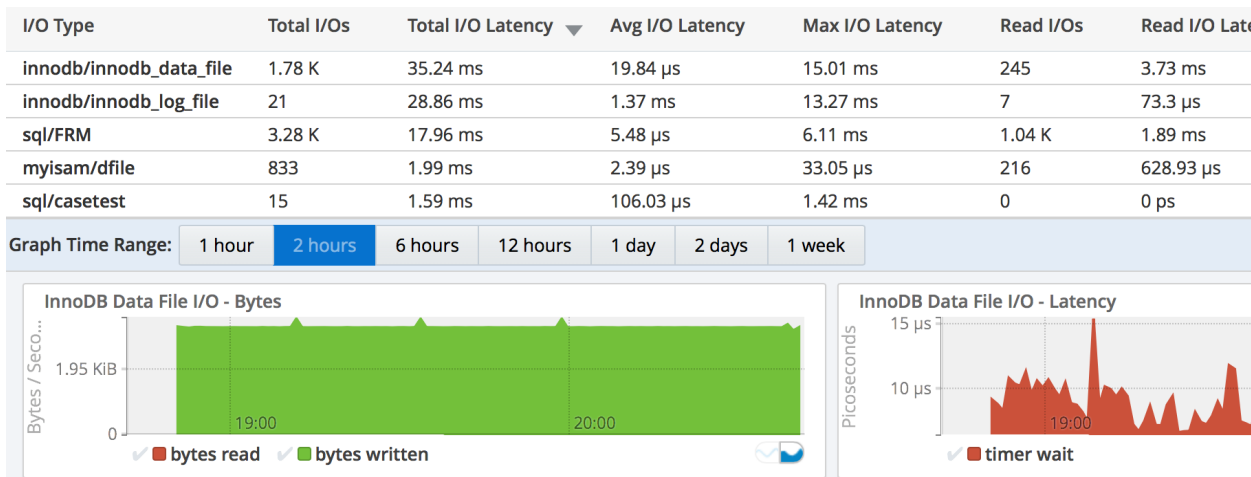
Enterprise Monitor Cluster Monitoring includes key metrics on cluster operations. It includes things such as cluster topology, cluster health, data and index memory utilization on a per cluster node basis, and usage of cluster files and buffers as they pertain to logs. Here is a sample screen view of overall cluster utilization:



innnoDB Monitoring:

Enterprise Monitor provides detailed innnoDB monitoring, which is the storage engine for MySQL. InnoDB monitoring includes things such as engine metric performance, suggestions on the configuration of innnoDB based on current and historical performance, identification of any

locking issues, buffer pool management, and alerts when index usage requires revamping. Here is a sample innodb monitoring screen:



Memory Monitoring is extremely valuable in identifying MySQL memory usage and also displaying memory utilization at the operating system level. It will issue alerts when memory utilization is overly high, and will also provide advice on reducing memory footprints based on current and historical data points. Here is a portion of a sample Memory Utilization screen:

Memory Type	Current Allocations	Currently Allocated	Current Avg Allocation
innodb/buf_buf_pool	2	262.13 MiB	131.06 MiB
innodb/log0log	9	32.01 MiB	3.56 MiB
innodb/lock0lock	9119	14.48 MiB	1.63 KiB
performance_schema/events_statements_history_long	1	13.66 MiB	13.66 MiB
performance_schema/events_statements_summary_by_digest.tokens	1	9.77 MiB	9.77 MiB
performance_schema/events_statements_history_long.tokens	1	9.77 MiB	9.77 MiB
performance_schema/events_statements_history_long.sqltext	1	9.77 MiB	9.77 MiB
performance_schema/table_handles	1	9.06 MiB	9.06 MiB
performance_schema/events_statements_summary_by_thread_by_event_name	1	8.67 MiB	8.67 MiB
innodb/hash0hash	41	8.59 MiB	214.55 KiB
sql/TABLE	6281	8.24 MiB	1.34 KiB
mysys/KEY_CACHE	3	8 MiB	2.67 MiB
innodb/os0event	59012	7.65 MiB	136 b
innodb/mem0mem	5492	6.56 MiB	1.22 KiB
performance_schema/memory_summary_by_thread_by_event_name	1	5.63 MiB	5.63 MiB
performance_schema/events_statements_summary_by_digest	1	4.88 MiB	4.88 MiB
performance_schema/events_statements_summary_by_account_by_event_name	1	4.33 MiB	4.33 MiB
performance_schema/events_statements_summary_by_host_by_event_name	1	4.33 MiB	4.33 MiB
performance_schema/events_statements_summary_by_user_by_event_name	1	4.33 MiB	4.33 MiB
innodb/ut0pool	2	4 MiB	2 MiB

Disk Monitoring:

Disk I/O Monitoring provides a window into the live Disk I/O being performed, and the longer term analysis based on usage. Additionally, it provides suggestions on possible configuration changes that can be made to reduce disk I/O and the amount of disk space consumed on the disk.

Operating System Monitoring:

Enterprise Monitor offers a significant window into overall operating system performance. This includes auto-discovery of any MySQL instances, the monitoring of key performance metrics (current and trend) for host machines, overall CPU utilization with alerts, memory swapping with alerts, network traffic associated with all ethernet devices, and memory threshold detection.

Security Monitoring:

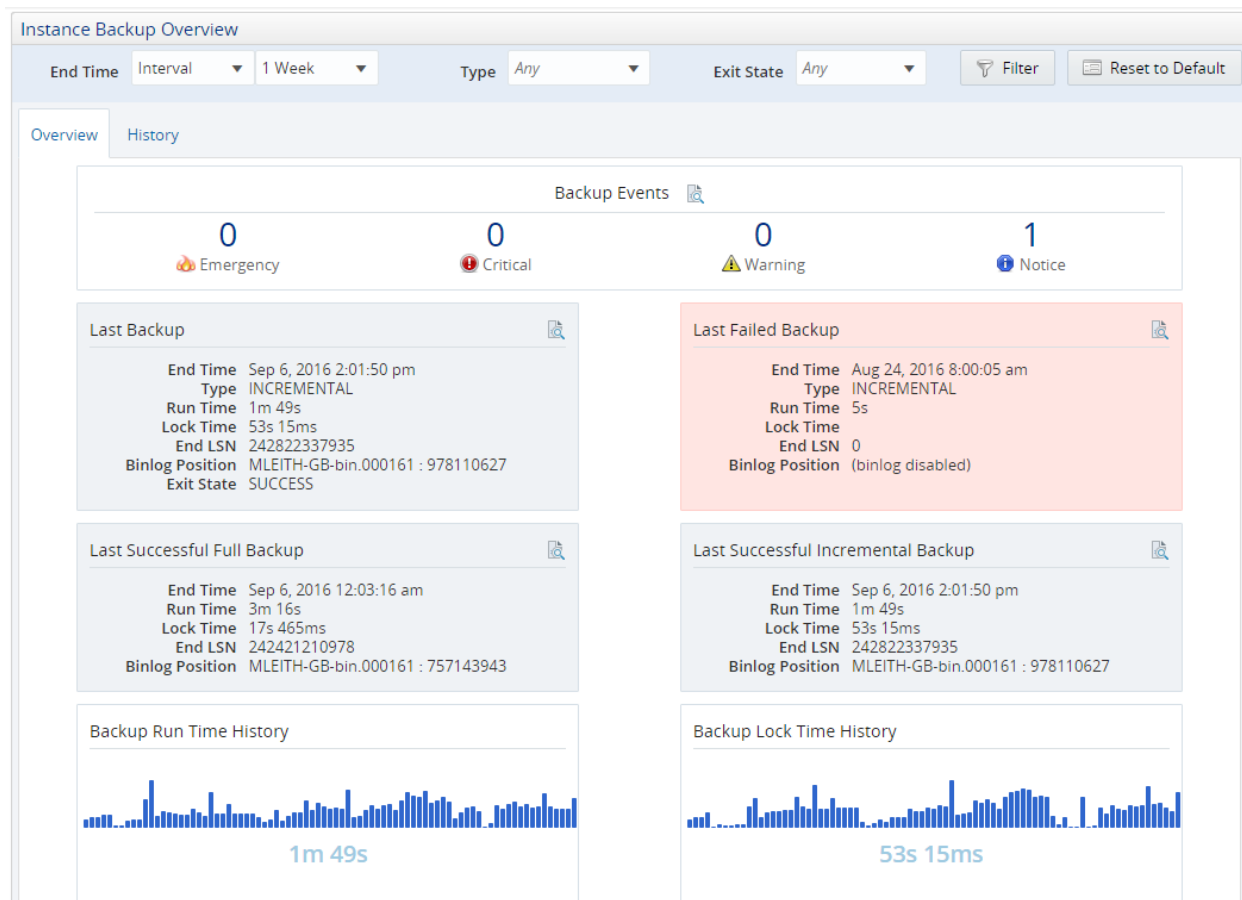
Enterprise Monitor offers security monitoring of firewall activities, by alerting potential security concerns to guard against any possible infiltration of data.

Security Administration:

Enterprise Monitor provides account management alerts for database accounts that have weak or no passwords, or for accounts that have overly wide-open attributes. Additionally, alerts are provided when network connectivity problems occur, or if there are any indications of a potential system intrusion.

Backup Monitoring:

Backup scheduling and monitoring are a necessary aspect to any database installation, to preserve data in the event of database corruption or required rollbacks. Enterprise Monitor offers a comprehensive backup solution, as it provides Monitor backup status, and history and archive details by group or instance. Additionally, it provides alerts if a backup fails or if the last database backup is arbitrarily (user-defined) too old. Moreover, alerts are generated if a backup attempt causes any locking or performance issues for MySQL. Finally, the ability to provide backup history including the backup type (full, partial, etc.), its completion status, and the completion timestamp are accessible. Here is a sample screen from the Database Backup dashboard:



Conclusion

Enterprise Monitor is a diverse and robust tool that enables any MySQL Enterprise Edition installation to be configured, monitored, and fine-tuned. Many high-level metrics can be observed and managed through the use of Enterprise Monitor, as well as the detailed aspects of database utilization down to the user or query level.