Abstract

This manual documents the MySQL Enterprise Monitor version 2.3.21.

For notes detailing the changes in each release, see the MySQL Enterprise Monitor 2.3 Release Notes.

For legal information, see the Legal Notice.

For help with using MySQL, please visit either the MySQL Forums or MySQL Mailing Lists, where you can discuss your issues with other MySQL users.

For additional documentation on MySQL products, including translations of the documentation into other languages, and downloadable versions in variety of formats, including HTML and PDF formats, see the MySQL Documentation Library.

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Preface and Legal Notices

This manual documents the MySQL Enterprise Monitor version 2.3.21. For license information, see the Legal Notices. This product may contain third-party code. For license information on third-party code, see Appendix A, Licenses for Third-Party Components.

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Chapter 1 MySQL Enterprise Monitor Introduction and Architecture

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MySQL Enterprise Monitor is a companion product for MySQL Server that monitors your MySQL
instances, notifies you of potential issues and problems, and advises you how to fix the issues. MySQL
Enterprise Monitor can monitor all kinds of configurations, from a single MySQL instance that is
important to your business, all the way up to a huge farm of database server machines powering a
busy web site.

This section describes the basic components that make up the MySQL Enterprise Monitor product.
These components can be installed in various configurations depending on your own database and
network topology, to give you the best combination of reliable and responsive monitoring data, with
minimal overhead on the database server machines. A typical MySQL Enterprise Monitor installation
consists of:

• One or more MySQL instances to monitor. MySQL Enterprise Monitor can monitor both Community
  and Enterprise MySQL server releases.

• A MySQL Enterprise Monitor Agent for each monitored MySQL instance.

• A single MySQL Enterprise Service Manager, which collates information from the agents and
  provides the user interface to the collected data through the Dashboard.

The structure of a typical MySQL Enterprise Monitor installation is shown in the following figure.

Figure 1.1 MySQL Enterprise Monitor Architecture

MySQL Enterprise Monitor can monitor one or more MySQL instances, on a single computer or spread
across multiple host machines. The agent, MySQL Enterprise Monitor Agent, collects variables, status,
and health information from a MySQL instance and sends this information to the MySQL Enterprise
Service Manager. You typically have multiple MySQL Enterprise Monitor Agent processes, one
monitoring each MySQL instance.
The monitoring data is sent to the MySQL Enterprise Service Manager, which collates information from all the agents. The MySQL Enterprise Service Manager checks whether the values of status values are within reasonable limits. When thresholds are reached, the server can trigger an event (including an alarm and notification) to highlight a potential issue, such as low memory, high CPU usage, or more complex conditions such as insufficient buffer sizes and status information. Each test and its associated threshold value form a rule.

Each rule, together with its associated alarms and notifications, is known as a MySQL Enterprise Monitor advisor. Advisors are a vital part of the MySQL Enterprise Service Manager, warning about potential problems and providing troubleshooting advice.

You interact with the MySQL Enterprise Service Manager through a web interface, powered by an included web server. This interface, the MySQL Enterprise Monitor User Interface, displays the information collected by the agents. You can view current status for individual MySQL servers or groups of servers. You control and configure all aspects of the service using the MySQL Enterprise Monitor User Interface.

The MySQL Enterprise Monitor User Interface can display statistical and query information as graphs. For example, you can produce graphs over time of aspects such as server load, query numbers, or index usage information. The graphs help to pinpoint the timeframes and trends related to potential issues.

The MySQL Enterprise Monitor Agent can also collect detailed information about database queries, including the row counts and performance times for executing each query. You can correlate the detailed query data with the graph information to identify which queries were executing when you experienced an issue. A system called Query Analyzer presents the query data in various ways.

1.1 MySQL Enterprise Service Manager

The MySQL Enterprise Service Manager is the hub of MySQL Enterprise Monitor: it collects information, stores the information for display, generates warnings and alerts, sends emails and other notifications, and supports the MySQL Enterprise Monitor User Interface as the interface to the system.

You can consider the MySQL Enterprise Service Manager as being composed of three parts:

- The data collected by the MySQL Enterprise Service Manager is stored within the MySQL Enterprise Monitor repository. The repository uses a MySQL database, so that MySQL Enterprise Monitor can take advantage of MySQL features such as the InnoDB storage engine and partitioning systems.

You can optimize the configuration of the MySQL server depending on the hardware capacity, for example extending the cache memory for the InnoDB storage engine or the thread processes. The default configuration places both the MySQL server and the Tomcat service on the same machine. To dedicate more resources to the MySQL and Tomcat components, you can separate the two across two different machines.

- The MySQL Enterprise Monitor User Interface is a series of JSP pages displayed through the Tomcat service. These web pages display and control all the components of the system, including...
MySQL Enterprise Monitor User Interface

the different views of data, notification system, graphing engine and the configuration of the MySQL Enterprise Service Manager.

1.2 MySQL Enterprise Monitor User Interface

The MySQL Enterprise Monitor User Interface is a web-based interface to the MySQL Enterprise Service Manager. MySQL Enterprise Monitor User Interface provides a quick overview of the current status of your server, and lets you drill down into the current status, events, and historical information submitted by each MySQL Enterprise Monitor Agent.

The main features of the MySQL Enterprise Monitor User Interface include:

- A single page, Monitor, that gives an overview of the current health and status of all your servers, an overview of any events that are triggered, a heat chart for critical status information, and a customizable set of graphs.

- The Heat Chart table shows the current status of all your servers, using icons to highlight important issues. A heat chart is included on the main Monitor tab, and you can also keep a standalone Heat Chart open on your desktop to monitor your server states.

- The Advisors tab lets you create, edit, control, install, and schedule advisors within the system.

- The Query Analyzer helps you identify problem queries.

- The Replication view monitors the structure and health of your replication environment.

- The Settings tab lets you set the parameters for the server, including setting notification lists, configuring SNMP, and setting the intervals for removing old data.

- The What's New? tab gives a live connection to the My Oracle Support site, with news about the latest releases, critical fixes and patches, and any current service requests.

For a more detailed overview of MySQL Enterprise Monitor User Interface, see Section 2.1, "MySQL Enterprise Dashboard".

1.3 MySQL Enterprise Advisors Collections

The MySQL Enterprise Advisors are organized into collections. These collections include advisors and definitions for graphs that you can view within the MySQL Enterprise Monitor User Interface.

Each MySQL Enterprise Advisors uses the information collected by the MySQL Enterprise Monitor Agent on each machine to test data values or configuration settings and send an event notification when a threshold is reached. Advisors can be a simple piece of advice, a warning, or a critical event. Within the MySQL Enterprise Service Manager these events are displayed through either the events tab, or for critical items, a heat chart summarizing the current status of your MySQL servers.

The events can be displayed within the MySQL Enterprise Monitor User Interface, or can trigger additional notifications, such as an email or an SMS text message. The information provided by the advisors, and the collected data, are also exported through SNMP (Simple Network Management Protocol), so you can use SNMP traps within your existing network monitoring infrastructure.

A schedule determines how frequently each advisor is executed.

1.4 Monitored MySQL Server

MySQL Enterprise Monitor can monitor any MySQL server running MySQL 4.1 or higher. The advisors and rules provide specific support for different versions. For example, there are unique rules and graphs for different MySQL versions, and some rules provide advice about MySQL upgrades.

In addition to monitoring the internal operation of the MySQL server, the MySQL Enterprise Monitor Agent and MySQL Enterprise Service Manager can determine the topology of MySQL servers in a replication configuration, and monitor the replication status.
MySQL Enterprise Monitor Agent

MySQL Enterprise Monitor uses a number of unique values known as UUIDs to identify the different components, including the MySQL instance being monitored. UUID values related to the MySQL instance and the host on which it runs are stored in a table `mysql.inventory` within the instance. MySQL Enterprise Monitor creates this table if it does not exist already.

- Each MySQL Server has a UUID, stored in the `mysql.inventory` table, that uniquely identifies the MySQL server to the rest of MEM. The server UUID is used to collate information about a single MySQL instance.

- Each host (the machine on which the agent is running) has a UUID to uniquely identify the host to the rest of MySQL Enterprise Monitor. This is used to collate the OS information (such as CPU, RAM and disk data). The host ID also determines whether the MySQL server is on the same host as it was before, to identify when data has been moved between machines, or when a machine has been upgraded. The host UUID is stored within the `hostid` row within the `mysql.inventory` table.

- Each agent has a UUID to identify the agent to MEM. The agent UUID is defined within the `agent-uuid` parameter within the agent configuration file.

These UUIDs are used in combination to register and collate information, and to determine the location and source of an issue.

Note

Because each host must be unique, be careful when restoring from a backup so you do not have hosts with duplicated SSH keys or UUIDs.

You can monitor any MySQL server, because the agent communicates with the MySQL server using the same protocol as any other client. For best results when using MySQL Enterprise Monitor Agent with your MySQL Server, follow these guidelines:

- Each instance must have a unique ID, as stored within the `mysql.inventory` table.

- Configure the MySQL server with a user that has the correct permissions and rights to be able to monitor the different parameters of the server. For instructions to create a suitable user, see Section 5.3.1, “Creating a MySQL User Account for the Monitor Agent”.

1.5 MySQL Enterprise Monitor Agent

The MySQL Enterprise Monitor Agent performs the following tasks:

- Connects to a MySQL server and collects core information about it. The core data is called the inventory. The inventory includes details such as the MySQL server version number, supported storage engines and replication configuration. The data in the inventory helps to determine what other kinds of data can be collected from the MySQL server.

- Collects a set of standard data items that constitute the bulk of the data sent to the MySQL Enterprise Service Manager. This includes all of the information about the configuration, database objects and other content.

- Collects information about the host operating system on which the agent is running, including CPU, RAM, and file system information and statistics.

- Collects query analyzer data by acting as a MySQL Proxy, collecting, and forwarding MySQL queries from clients and sending the collected query execution information to the MySQL Enterprise Service Manager. This is known as the MySQL Enterprise Agent Proxy Service.

- Collects query analyzer data by acting as an aggregator of the query execution statistics for applications and languages that do not connect directly with the MySQL Enterprise Service Manager, but instead supply raw query-by-query statistics to the agent for distribution up to the MySQL Enterprise Service Manager. This is known as the MySQL Enterprise Agent Aggregator.
• Collects any custom data items that you can optionally configure to provide unique monitoring and statistical information for your MySQL server.

Note
The MySQL Enterprise Monitor Agent consists of a number of different components, such as the Aggregator and the Proxy. The documentation sometimes refers to these components by name to describe the functionality, configuration, and deployment of specific parts of the Agent.

The agent is a general purpose service that provides the basis for all this functionality and is the key component of MySQL Enterprise Monitor as it provides the MySQL Enterprise Service Manager with the information about each individual MySQL server.

Each MySQL Enterprise Monitor Agent requires a UUID to uniquely identify the MySQL Enterprise Monitor Agent to the MySQL Enterprise Service Manager. This UUID is independent of the UUID assigned to each monitored server. Do not copy the UUID from one instance of the agent to another, as that would cause duplicate agent UUID exceptions.

When the agent first starts, it performs the following operations:

• Loads the configuration information.
• Checks that the Agent UUID exists.
• Generates what it thinks the current Host ID should be.
• Starts the network thread and collector threads.
• Compares whether the instance we are connected to has the same Host ID, to make sure we are not starting on a copied instance wrongly.
• Registers with the MySQL Enterprise Service Manager and then sends a heartbeat signal.
• Receives a "list known data items" call from the Service Manager.
• Loads the list of data items, including any custom data items, to be read from the server.
• Responds to the Service Manager with the known items.
• Receives a "list instances" call from the Service Manager for certain data items.
• Runs the inventory process to determine the core information about the MySQL server.
• Responds to the Service Manager with the inventory.
• Receives schedule information for each data item from the MySQL Enterprise Service Manager in "collect data" tasks.
• Starts collecting data and sending it to the MySQL Enterprise Service Manager according to the schedule set during configuration.

Once running, each MySQL Enterprise Monitor Agent periodically collects information from the monitored MySQL server and sends it to MySQL Enterprise Service Manager.

### 1.5.1 MySQL Enterprise Monitor Agent Basic Architecture

The MySQL Enterprise Monitor Agent core architecture provides the basic chassis on which the other components operate. The main purpose of the core architecture is to support the connectivity to the MySQL server being monitored, and the communication ability with the MySQL Enterprise Service Manager to collect and send collected information, and receive configuration and other information from MySQL Enterprise Service Manager.
In addition to providing the main chassis for the MySQL Enterprise Agent Proxy Service component, the agent also performs a number of key operations in collecting information from the MySQL server that is being monitored. In particular, the core agent:

- Provides the direct monitoring of the MySQL server, including checking the server accessibility, configuration, obtaining the server ID, and setting up the environment to start collecting more detailed information. In addition to the information accessible by accessing variable and configuration information within the server, other configuration parameters, such as the replication configuration, is also recovered from the server.

- Collects the operating system specific information, including RAM, disk storage and other data.

- Collects the data from the server, including obtaining the values and configuration of the MySQL server, status variables and other information.

- Communicates with the MySQL Enterprise Service Manager. Data is collected at scheduled intervals according to the schedule set by the server. This information is then sent to the MySQL Enterprise Service Manager at a regular schedule that is designed reduce the effect of multiple agents on multiple machines simultaneously sending large blocks of data up to the MySQL Enterprise Service Manager at the same time.

These responsibilities are handled in addition to the MySQL Enterprise Agent Proxy Service service that provide information about queries for the query analyzer.

Because the MySQL Enterprise Monitor Agent and the MySQL Enterprise Service Manager may lose communication with each other (for example, due to transient network errors), the MySQL Enterprise Monitor Agent can store the data that would normally be sent up to the MySQL Enterprise Service Manager. Once communication is re-established, the saved data is sent up to the server.

### 1.5.2 MySQL Enterprise Monitor Agent Proxy Service Architecture

When using MySQL Enterprise Monitor Agent as a proxy service, the queries from user applications are sent through the MySQL Enterprise Monitor Agent, which forwards them to a MySQL server, returning the query results while recording query statistical information. When operating in this mode, the agent acts as both the agent and proxy for the same monitored MySQL server, as shown in the following figure.

**Figure 1.3 The MySQL Enterprise Monitor Architecture when using proxy and agent services for the same MySQL Server**
The figure shows a single MySQL Enterprise Monitor Agent and two of the components, the core agent service and the MySQL Enterprise Agent Proxy Service. The MySQL Enterprise Monitor Agent is connected to the single monitored MySQL server. In turn, the MySQL Enterprise Monitor Agent is connected to the MySQL Enterprise Service Manager to provide monitoring and query analyzer data, and to the user application, which uses the proxy service to supply query analyzer data.

### 1.5.3 MySQL Enterprise Monitor Agent Aggregator Service Architecture

The MySQL Enterprise Agent Aggregator supports an alternative method to the MySQL Enterprise Agent Proxy Service for communicating query data to the MySQL Enterprise Service Manager for use within the query analyzer. It is applicable for plugin components such as MySQL Enterprise Plugin for Connector/PHP, where many short-lived connections are difficult to monitor directly without introducing a performance or scalability bottleneck. These plugins relay query information from the corresponding connectors to the MySQL Enterprise Agent Aggregator.

The MySQL Enterprise Agent Aggregator collects and summarizes the raw query statistics from the connectors. It sends the resulting blocks of data up to MySQL Enterprise Service Manager along with the rest of the monitoring data collected by the MySQL Enterprise Monitor Agent. The following figure represents this layout.

**Figure 1.4 The MySQL Enterprise Monitor Architecture when using aggregator and agent services for the same MySQL Server**

The MySQL Enterprise Agent Aggregator is used only when collecting queries from the Enterprise Connector plugins. For more information, see Section 3.1.4, “Using the MySQL Enterprise Agent Aggregator”.

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**MySQL Enterprise Agent Aggregator Service Architecture**

The figure shows a single MySQL Enterprise Monitor Agent and two of the components, the core agent service and the MySQL Enterprise Agent Proxy Service. The MySQL Enterprise Monitor Agent is connected to the single monitored MySQL server. In turn, the MySQL Enterprise Monitor Agent is connected to the MySQL Enterprise Service Manager to provide monitoring and query analyzer data, and to the user application, which uses the proxy service to supply query analyzer data.

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The MySQL Enterprise Agent Aggregator collects and summarizes the raw query statistics from the connectors. It sends the resulting blocks of data up to MySQL Enterprise Service Manager along with the rest of the monitoring data collected by the MySQL Enterprise Monitor Agent. The following figure represents this layout.

**Figure 1.4 The MySQL Enterprise Monitor Architecture when using aggregator and agent services for the same MySQL Server**

The MySQL Enterprise Agent Aggregator is used only when collecting queries from the Enterprise Connector plugins. For more information, see Section 3.1.4, “Using the MySQL Enterprise Agent Aggregator”.

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This chapter contains information about the main sections of MySQL Enterprise Monitor User Interface, how to use the interface, and how to set the different configuration and other settings.

You can open the Dashboard and connect to the MySQL Enterprise Monitor User Interface either using the standard HTTP protocol, or using an SSL connection (HTTPS). By default, you can connect to MySQL Enterprise Monitor User Interface using http://host:18080, where host is the hostname or IP address of the MySQL Enterprise Service Manager. The default SSL URL is https://host:18443. You can override these values during installation. To check the configured values, look at the configuration_report.txt file within your installation directory.

You can configure additional users to have access to your MySQL Enterprise Monitor User Interface. Each user can have a specific privilege level: read-only, restricted from using the Query Analyzer data, or prevented from using any administrator features. For more information, see Section 2.8.4, “Managing Users”.
Note
If you are connecting using SSL, the built-in certificate is self-signed and may be highlighted as 'unsafe' within the browser on initial connection. To prevent problems accessing the site, add an exception for the certificate to your browser for this server.

2.1 MySQL Enterprise Dashboard

The MySQL Enterprise Monitor User Interface provides you with information about your MySQL servers: a list of the latest MySQL Enterprise Advisors reports, server status information, alerts, and updated views of monitored MySQL servers. The Monitor screen gives a quick overview of the status of your MySQL servers.

You access the MySQL Enterprise Monitor User Interface through a standard web browser. For more details on the supported browsers, see Section B.2, “Supported Browsers”.

The MySQL Enterprise Monitor User Interface page is divided into four sections: the header, the footer, the main bar, and a context-sensitive Servers list. These areas perform the following functions:

• The Header

The top of the screen shows the refresh cycle and Help and Log Out links. Click the Help link to open the documentation in a separate browser window. Choose Log Out if you wish to leave the Dashboard or to log in as a different user.

The Refresh selection configures the MySQL Enterprise Monitor User Interface page to automatically refresh and reload at a specific interval, for pages that you leave open for a long time and consult at a glance. Do not make the interval too short, or the load on the MySQL Enterprise Service Manager might affect overall performance.

• The Footer

The footer has external links to Oracle software download and support web sites, and information about the current user. You can remain connected to the Dashboard and contact technical support.

The footer also contains a link to the Settings page. For more information about the Settings page, see Section 2.8.7, “Product Information”.

• The Server Tree

The tab on the left displays the Server tree, where you navigate to different groups or to specific servers. By default, the first group of servers is selected. This selection determines the information shown on the Monitor page.

If a server group is selected, the information presented on the Monitor page is aggregate information for this group; if only one server is selected, the information applies to that server only.

When you change your server selection, the information shown in the graphs and in the Heat Chart changes.

Note
For more information about server groups, see Section 2.8.3.2, “Grouping Servers”.

The individual server, or server group, selected in the Server Tree also determines what information appears when the Advisors tab or the Events tab is selected.

• The Main Section
The main section of the page shows the relevant information for the selected task or option. For example, when the **Query Analyzer** tab is selected, the main section of the page shows the Query Analyzer data and a list of the current queries.

You can navigate to a number of pages that provide more detailed information. These pages include:

- **Monitor**: The overview page that shows a quick summary of the servers, their status, events, availability and load. The remainder of this chapter details the contents of this page.
- **Advisors**: Shows the various advisors configured in your installation and lets you schedule their execution on different servers, apply and manage rules and manage the advisor installation itself. For more information, see Section 2.3, “The **Advisors** Tab”.
- **Events**: Provides an interface into the event system that highlights specific issues and problems on your monitored servers. For more information on using Events, see Section 2.4, “The **Events** Tab”.
- **Graphs**: Lets you view and configure graphs covering various statistics. For details on how to view and use these graphs, see Section 2.5, “The **Graphs** Tab”.
- **Query Analyzer**: Interfaces to the query monitoring system that monitors and tracks the individual queries that are being executed on a system. You can find problem queries that may need optimization or that may affect server load. For more information, see Section 2.6, “The **Query Analyzer** Tab”.
- **Replication**: Provides information on the status and structure of your servers that use replication. For more information, see Section 2.7, “The **Replication** Tab”.
- **Settings**: Controls the settings for the server, including email configuration, passwords, and server and user management. For more information, see Section 2.8, “The **Settings** Tab”.
- **What’s New?**: Provides the latest news and information about your installation directly from an Oracle Web site. For more information on the data provided, Section 2.9, “The **What’s New** Tab”.

### 2.2 The **Monitor** Tab

The **Monitoring** tab, which is shown first when you log in to MySQL Enterprise Monitor User Interface, provides a quick overview of your current monitoring information, and provides an instant health check for all of the MySQL servers across the enterprise.

From this page, you can:

- View monitoring data and all critical MySQL Advisor Rule violations for all or selected servers.
- Close and annotate MySQL Advisor Rule violations.
- Determine if there is a Monitor Agent that is not communicating with the Service Manager.
- Determine if there is a server that is in trouble or completely down.
- View indicator value graphs for key MySQL and operating system (OS) level metrics. Graph presentation defaults to a thumbnail view, but opens into a larger image upon being clicked.

Graphs are shown in the center of the page beneath the tabs. If applicable, you also see a list of critical events.

On the right is the color-coded **Heat Chart**, showing the advisors that are installed by default. The **Heat Chart** shows the most important advisors, allowing a quick overview of the state of your servers. You can open the **Heat Chart** in its own window by clicking the **Standalone Heat Chart** link. If applicable, you also see a list of critical events.
The Show/Hide Legend link toggles display of the explanations of the icons used in the Heat Chart.

Note
Find colorblind-accessible icons in the alternate directory. On Linux, this directory is immediately below the /monitor/apache-tomcat/webapps/ROOT/web/resources/images/ directory. These images are stored in the same directory on Windows. To use them, back up the originals and then copy and paste the alternate set into the images directory.

When a specific server is selected in the Server Tree, the Meta Info area beneath the legend shows details about this server. The information shown in this area is the host name, the MySQL version number, the number of scheduled rules, the operating system, and the CPU.

The Meta Info section also shows how long the agent has been running, when it last contacted the MySQL server it is monitoring, and the last time the agent contacted the dashboard. When you mouse over the date shown beside Up Since, a pop-up box displays the elapsed time since the server instance was last started. You can also mouse over the Last MySQL Contact and the Last Agent Contact dates.

Note
In the case of remote monitoring, the agent runs on a different machine than the MySQL server that it is monitoring. The Hostname, MySQL, and Rules information applies to the system being monitored. The OS and CPU information applies to the machine on which the agent is running. For more information about remote monitoring, see Section 5.3.6, “Configuring an Agent to Monitor a Remote MySQL Server”.

2.2.1 The Server Graphs and Critical Events

The center of the Monitor page gives a visual representation of the state of your servers.
The Server Graphs and Critical Events

Figure 2.1 MySQL Enterprise Monitor User Interface: The Graphs Screen

The graphs present information about the currently selected server or server group. The default graphs show the hit ratios, CPU utilization, connections, and database activity for a specific interval.

Graphs also let you drill down from overall usage information to the queries that were being executed on the server at the time. Click and drag on a graph to zoom in on the graph content and view the queries that were being executed during the specified period, to understand server performance and responsiveness. This information is only available when you configure query analysis, and enable query analysis for the servers you are monitoring. For more information, see Section 2.6, “The Query Analyzer Tab”.

To set the interval, click the configure graphs link immediately below the graphs. In the resulting dialog box, choose the default interval for the x-axis of the graphs. Defining a shorter or longer interval gives you a shorter or longer term view of server activity. You can also adjust the thumbnail and full-size graph dimensions from this dialog box. Save any changes, and the chosen values become the defaults whenever you log in.

You can also choose the default graphs shown on the Monitor page. Click the edit favorites link and choose the graphs you want from the drop-down list box. To choose contiguous graphs, hold down the Shift key and click the desired graphs. To select graphs that are not in a sequence, click
the desired graphs while holding down the Ctrl key. The Monitor page can display a maximum of six graphs. Save your changes, and these become be the default graphs whenever you log in.

Color coding helps distinguish different aspects of each graph. With Database Activity for example, you can readily distinguish SELECT statements from INSERT statements.

Clicking a graph opens a detailed view with Graph Display and Configure tabs. Choose the Configure tab to temporarily change the way that a graph displays. Changes made from this tab only apply to the standalone graph while it is open. Persistent changes are made as described above.

Dismiss the enlarged graph by clicking the hide button.

Alerts from the event system are displayed immediately below the charts. For more information on the events display, see Section 2.4, “The Events Tab”.

To export a graph, either a .png file of the graph image or a .csv file of the underlying data, use the two icons to the right of the graph label. See Section 2.5.4, “Exporting Graph Images and Data” for details about the export feature.

2.2.2 The Heat Chart

The Heat Chart is on the right side of the Monitor page and shows the status of critical rules. Monitored servers are organized by groups. To view the status of a specific server, click the + button next to the appropriate server group.

Whenever a new agent contacts the Service Manager for the first time, all the rules in the Heat Chart Advisor are automatically activated. These Advisors monitor the status of the server and agent, critical operating system indicators, and important events related to your MySQL servers. An example follows.
To interpret the Heat Chart, see the following legend.

**Figure 2.2 MySQL Enterprise Monitor User Interface: The Heat Chart**

![Heat Chart](image)

<table>
<thead>
<tr>
<th>Server &amp; Agent Status</th>
<th>Monitored Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>up</td>
<td>ok</td>
</tr>
<tr>
<td>down</td>
<td>info</td>
</tr>
<tr>
<td>unknown</td>
<td>warning</td>
</tr>
<tr>
<td></td>
<td>critical</td>
</tr>
<tr>
<td></td>
<td>unknown</td>
</tr>
</tbody>
</table>

The status unknown typically applies when an agent is down and can no longer report the status of the server that it is monitoring. The status unknown can also apply if the data that should be collected is not available on the server being monitored.

You can open the Heat Chart in its own browser window by clicking the Standalone Heat Chart link immediately below the Heat Chart on the left. You can set the refresh rate to a different rate than the setting on the Monitor page.
In addition to showing the most important advisors, the **Heat Chart** also has columns that display the number of critical, warning, and informational alarms. Clicking the hyperlink in any one of these columns takes you to the **Events** tab, which gives more detailed information. For more information about events, see Section 2.4, “The **Events** Tab”. Hovering over the heat chart also provides server counts within the tooltips pop-up.

When the Dashboard is first installed, no notification groups are associated with the Advisors shown in the Heat Chart. For more information on this topic, see Section 5.2.6.3, “Installing, Updating or Upgrading Advisors After Initial Login” and Section 2.8.5, “Manage Notification Groups”.

### 2.3 The **Advisors** Tab

**Note**

MySQL Enterprise subscription, MySQL Enterprise Monitor, MySQL Replication Monitor, and MySQL Query Analyzer are only available to commercial customers. To learn more, see: [http://www.mysql.com/products/](http://www.mysql.com/products/).

MySQL Enterprise Advisors are a series of scripts that gather information from your MySQL servers via the **Service Manager** and the Monitor **Agents**, analyze that information based on custom rules included as part of MySQL Enterprise Monitor, and then offer alerts and advice when necessary. As new rules are introduced, the MySQL Enterprise Advisors can be updated over the Web.

The MySQL Enterprise Advisors are classified under the following categories (advisor groups):

- **Administration**:
  - Better manage databases.
  - Suggest improvements for smoother operation.

- **Backup**:
  - Confirm whether backup jobs succeed or fail.
  - Check how long various stages of backup jobs take.
  - Works with MySQL Enterprise Backup 3.5.3 and up. Relies on the logging feature described in the MySQL Enterprise Backup documentation at Using the MySQL Enterprise Backup Logs.

- **Cluster**:
  - Shows the up/down status of MySQL Cluster data nodes.
  - Alert you when data node and index node memory runs low.
  - Alert you when Redo and Undo buffer and log space runs low.

- **Heat Chart**:
  - Drive the status indicators in the **Heat Chart**.
  - Identify up/down status and performance issues.

- **Memory Usage**:
  - Indicate how efficiently you are using various memory caches, such as the InnoDB buffer pool, MyISAM key cache, query cache, table cache, and thread cache.

- **Performance**:
  - Identify potential performance bottlenecks.
• Make suggestions for improved database speed.

• Replication:
  • Identify replication bottlenecks.
  • Improve replication design.

• Schema:
  • Identify schema changes.
  • Find security loopholes.

• Security:
  • Protect MySQL servers.
  • Find security loopholes.

• Upgrade:
  • Checks if your current MySQL version has critical issues and requires an update.

An advisor category provides a set of rules designed to enforce MySQL best practices for that specific category. Rules can be targeted to run at the individual server or group level and, upon rule violation, provide alerts and expert advice on how to address and correct a problem before it becomes a costly outage.

The file `items-mysql-monitor.xml` contains supplementary information used to construct rules. On Windows, this file is in the `C:\Program Files\mySQL\Enterprise\Agent\share\mysql-monitor-agent` directory and on Unix, in the `/opt/mysql/enterprise/agent/share/mysql-monitor-agent` directory. For example, the following rule detects a root account with no password.

```
<ITEM>
  <NAME>no_root_password</NAME>
  <FIELD>no_password</FIELD>
  <SCOPE>table</SCOPE>
  <CODE>
    <![CDATA[SELECT COUNT(*) AS no_password FROM mysql.user WHERE user='root' AND password='']]>
  </CODE>
  <NAMESPACE>mysql</NAMESPACE>
  <RETURNS>INTEGER</RETURNS>
  <SOURCE>table</SOURCE>
  <INSTANCE>mysql.user</INSTANCE>
</ITEM>
```

Any MySQL Enterprise Monitor customer can use any of the available rules.

When the Dashboard is first installed, the only rules that are scheduled are those that belong to the Heat Chart group.

Go to the Advisors screen by logging in to the Dashboard and choosing the Advisors tab.

### 2.3.1 Installing and Updating Advisors

Instructions for installing Advisors are given in Section 5.2.6.3, “Installing, Updating or Upgrading Advisors After Initial Login”, and following.

If your Service Manager can connect to the Internet, you can download the latest Advisors by navigating to the Advisors tab and finding the Check for Updates link. You can periodically update advisors in this way.
2.3.2 Scheduling Rules

Once the MySQL Enterprise Advisors have been installed, you can configure which advisors you would like to run on a scheduled basis.

You can schedule rules by individual server or by group. This is done by first selecting the desired server or server group from the Server tree found on the left side of the screen. Next select the Advisors tab.

Opening the Advisors tab takes you to the Current Schedule page. If you only recently installed MySQL Enterprise Monitor, you only see the Heat Chart group of advisors. Clicking the + button shows all the rules in the Heat Chart group.

Clicking the + button beside any specific rule shows the servers that this rule is running on, its frequency, and its status. Initially, all the Heat Chart rules are enabled.

For a more complete description of a rule, click the rule’s name. This opens a dialog box that gives detailed information about the rule.

To view the advisors other than the Heat Chart group, select the Add to Schedule link.

Rules are grouped by functionality and displayed in alphabetic order. To expand a group click the + button to the left of the advisor name.

To activate all the rules in a group, select the checkbox beside the group name. Then you can apply rules against a specific server or a group of servers. A message showing the selected server or server group is displayed below the schedule button. For example, if the All Servers group is selected in the server tree, then the message is “Schedule Advisors Against All Servers”.

To select a specific rule, expand the group tree by clicking the + button, then select the checkbox to the left of the rule. Click schedule to display the following dialog box:
The Schedule dialog box lets you configure the following fields:

- **Frequency**: Dictates how often the rule runs. The default value for different rules varies, but a rule can be set to run at any interval desired.

**Warning**

Set the frequency of each rule appropriately based on the tradeoff between resource usage and the chance and severity of the issue. Rule evaluation consumes system resources: CPU, memory, and disk space. While the amount consumed is small, frequently running all the rules against dozens of servers could put a significant load on the Service Manager. For example, unless you stop and restart your servers often, choose a low frequency for rules that check server configuration variables.

Another consideration is that certain status variables increase monotonically until a server is restarted. Examples of these are `Key_reads`, `Qcache_hits`, `Questions`, `Table_locks_waited`, and similar variables. The value returned by `SHOW STATUS` for these variables is the value since the server was started (or since the last `FLUSH STATUS` command), which is not very useful for performance tuning, especially if the server has been running for an extended period of time. For performance tuning, it is much better to know the change in state (for example, delta) of these values over...
the last 10 minutes, 1 hour, or whatever time frame is appropriate for your application. The frequency at which you schedule a rule is the time frame used to calculate the delta values of these variables, and it is the delta that is used in expression evaluation, not the absolute value. Consequently, select a frequency that is appropriate for the metrics being used in the expression.

- **Notifications**: A listbox of users, notification groups, or both who are emailed when an advisor reaches an alert level. Single or multiple selections are allowed. For instructions on setting up notification groups see, Section 2.8.5, “Manage Notification Groups”.

- **Use SNMP Traps**: Indicates that an SNMP trap should be raised for this rule. For details on the SNMP configuration within MySQL Enterprise Monitor, see SNMP Trap configuration.

- **Auto-Close**: Specifies whether the rule should use the auto-close system. Events triggered by rules can be automatically closed when the situation that triggered the rule is no longer in effect. Some rules are configured with auto-close enabled by default. To determine which advisors this applies to, see Section B.9, “Advisor/Graph Reference”. For more information on closing and auto-closing events, see Section 2.4.1, “Closing an Event”.

You can configure individual rules to either use the default auto-close settings for the advisor, to enable auto-close events, or to disable auto-close events. If auto-close of events is enabled, specify any text to add to the event closure in the Auto-Close Note textbox.

Once you have set the schedule parameters, click the schedule button to schedule the advisor.

You can schedule multiple rules by selecting the checkbox next to each rule and clicking the schedule button is an effective way to schedule multiple rules.

When scheduling more than one rule, you can select a checkbox to use the default frequency of each rule, or choose a frequency that applies to all selected rules. When customizing the frequency, choose a value that is appropriate to all the rules selected.

---

**Note**

If the agent does not have the SUPER privilege and InnoDB-related rules are scheduled, a warning appears in the DataCollection log. This also occurs if mysqld is started with the skip-innodb option. For more information about agent rights, see Section 5.3.1, “Creating a MySQL User Account for the Monitor Agent”.

### 2.3.2.1 Heat Chart Notifications

It is particularly important to set Notifications for the Heat Chart group of rules. From the Current Schedule page, click the + button beside a rule and then click a server. Doing this opens a window with three tabs: **Overview**, Settings, and Advanced.

The Overview tab shows which advisor group a rule belongs to, a description of its purpose, and a link to the history of this alert.

In the Settings tab you can adjust the frequency of this rule and also specify a notification group. To select more than one contiguous group press the Shift key and click the desired groups. (Some web browsers require that you drag your selection.) To make non-contiguous selections, hold down the Control key and click the desired groups.

If you have set up global SNMP traps, check the Use SNMP Traps checkbox for a specific rule to make your Network Management System (NMS) handle events related to that rule. For more information about Simple Network Management Protocol (SNMP) see Simple Network Management Protocol (SNMP) Traps.

The Advanced tab gives detailed information about how this rule is implemented.
2.3.3 Editing Built-in Rules

The frequency and thresholds defined for a rule are default recommendations. To edit these properties, choose the Create/Edit Rule link.

The following image shows the screen used to edit rules:

**Figure 2.5 MySQL Enterprise Monitor User Interface: Editing Rules**

Beside the rule name is the Advisor drop-down list box, used for setting the advisor group. This list box shows existing groupings and any you have added. The Expression textarea shows the advisor rule, Variable Assignment the data item associated with variable(s) used in the rule and Thresholds determines when to trigger each alert type.

The three levels of Thresholds are Info Alert, Warning Alert, and Critical Alert indicating increasing levels of severity. Levels can be triggered by the expression result being equal to a certain value, greater than a certain value, or less than a certain value.

The data items that variables are associated with are operating system (OS) properties such as available RAM or MySQL characteristics such as the InnoDB buffer pool. To see all available data items drop down the Data Item list box. For a listing of these data items see Appendix D, Data Collection Items.

In Figure 2.5, "MySQL Enterprise Monitor User Interface: Editing Rules", the drop-down Data Item list box within the Variable Assignment frame shows the various MySQL server status or operating system specific variables that you can use in expressions. The text boxes below Thresholds define the levels at which informational, warning, or critical alerts are issued.

To lower the threshold for an informational alert, simply increase the number given in the Info Alert text box.
When a data item can apply to multiple objects, specify through the **Instance** text box which instance to use for that item. In almost all cases, set this value to **local**. The exceptions are as follows:

- For CPU-related items set **Instance** to **cpu0**. Additional CPUs on a system are referred to as **cpu1**, **cpu2** and so on.

- There can be multiple disks mounted on a system. To refer to a specific drive, set **Instance** to the name of the mounted drive. On Windows this would be **C:** , **D:** , and so on. On Unix systems, use whatever is valid for the **df** command.

- For RAM-related items set **Instance** to **mem**.

- Where there are table-specific variables, specify the database name and table name in the **Instance** text box. This topic is discussed in detail in the following section.

[Note]

It is not possible to have a data item that is unrelated to an instance. This raises the error, *You must map "<variable>" to an instance,* and you cannot save the rule.

Since an agent can only collect data from one MySQL server, the **instance** entry for a variable in a rule does not need to specify which MySQL server to use; no matter how many servers are being monitored, there is always a one-to-one relationship between an agent and its monitored server.

However, on one server there could be multiple occurrences of a variable. For example, there are multiple possible occurrences of table-specific variables such as **Avg_row_length** because there can be multiple databases and tables defined in a MySQL server. In this case, the “instance” refers to the database and table that a data item should be associated with, specified in the form **databasename.tablename**. So, for example, if you want to reference the **Avg_row_length** of the mysql database **user** table in an expression, select the mysql:tablestatus:Avg_row_length from the **Data Item** list box and specify **mysql.user** in the **Instance** text box.

On the other hand, in the case of a global server variable, there is only one possible target. For example, there can only be one instance of **delay_key_write** because this variable is global and applies to the server as a whole. In this case specify **local** in the **Instance** text box.

To save your changes click the **save** button at the bottom of the page.

[Note]

You can change only the thresholds and the frequency of built-in rules. So that rules function properly when updated, other changes are prohibited.

Should you wish to make other changes to a built-in rule, copy it and modify it as desired.

You can edit a rule even if it is currently scheduled. Your changes are preserved when new rules are imported using the **Check for Updates** link.

### 2.4 The **Events** Tab

[Note]

MySQL Enterprise subscription, MySQL Enterprise Monitor, MySQL Replication Monitor, and MySQL Query Analyzer are only available to commercial customers. To learn more, see: [http://www.mysql.com/products/](http://www.mysql.com/products/).

Once an advisor is scheduled, it runs at set intervals. If it finds nothing of interest, it creates no alerts or emails.
Events are defined using a number of different levels according to the severity of the alert. The seven levels are:

- **Failure**: Indicates a failure for the given rule or event. Usually, this indicates that the rule on which the event is based has failed, probably due to a typo or other error. Occasionally, it can indicate a failure to retrieve the required information for a given rule.

- **Critical**: The event is critical and requires immediate attention. Critical events normally indicate that a serious problem has occurred or is about to occur. Examine the event, determine the cause, and fix the issue as soon as possible.

- **Warning**: The event is something to be aware of, but does not affect the operation of your server.

- **Info**: The event is for informational purposes. Info events call attention to issues that do not affect the operation of your server, such as a minor configuration issue.

- **Success**: The rule executed successfully with no issues. The result of the rule is OK. It also signals when an event that was previously in a Critical or Failure state returns to normal.

- **Unknown**: The current status of the event/rule cannot be determined.

- **Closed**: The issue has been corrected and marked closed.

For convenience, the event states are also represented by icons, as defined in the following table. The table also shows the relative level of the alert from the highest (Critical) to the lowest (Unknown). The order represented here is used when identifying when an event has transitioned between levels (for example, from Success to Critical), hence triggering a notification, and when sorting events based on their current state.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>An octagonal red icon indicates a critical alert.</td>
</tr>
<tr>
<td>!</td>
<td>A triangular yellow icon indicates a warning.</td>
</tr>
<tr>
<td>📣</td>
<td>A conversation bubble is an informational alert.</td>
</tr>
<tr>
<td>✅</td>
<td>A green tick beside an event indicates that the rule has run successfully and no alert created.</td>
</tr>
<tr>
<td>🤔</td>
<td>A question mark icon indicates that the status of the rule is unknown.</td>
</tr>
</tbody>
</table>

When alerts are triggered, they appear on the **Events** screen. Alerts also appear on the **Monitor** screen in order of severity. The notification group or groups associated with a specific rule receive email notification when an alert is triggered. For more information about creating notification groups, see Section 2.8.5, “Manage Notification Groups”.

To view open events, click the **Events** tab. The tree-view on the left determines which server or server group these events belong to. Open events are shown in tabular format.
The event table has the following columns:

- **Current**: An icon indicating the current severity of the alert.
- **Worst**: An icon indicating the worst severity recorded for this alert.
- **Severity**: An icon indicating the severity of the alert.
- **Server**: The name of the server the alert applies to.
- **Category**: The category of the advisor.
- **Rule**: A short description of the rule that is violated.
- **Time**: The approximate time the event occurred.
- **Status**: The status of the event.
- **Unnamed Column**: Provides a link to the Close dialog box.

By default, all events are shown but the list of events can be filtered using the form displayed above the event list. The options include filtering by:

- Severity.
- Date (using a range with From/To).
- Advisor group.
- Specific rule.
- Status.

Choose the options you are interested in and click the filter button to refresh the display. To limit the number of items that appear on a page, choose a different value from the Limit drop-down list box.

The drop-down list box showing severity has the options: **All, Alerts, Critical, Warning, Info, Success**, and **Unknown**. Selecting the option **All** shows all alerts and also those rules that have run successfully.

A successful rule is one that has not been violated and is indicated by a green tick icon.
The Alerts shows only those rules that have been violated.

Columns can be sorted by clicking the individual column headings. The alerts shown in Figure 2.6, “MySQL Enterprise Monitor User Interface: Events Screen”, are filtered for All. Typically, when filtering by severity you choose Alerts and, if you see a Critical, Warning, or Info alert, use the All filter to see when the rule last ran successfully. Narrowing down the time-frame can help determine the cause of the alert.

Besides filtering for severity, you can filter for a specific time period using the From and To text boxes. You can also filter by specific rules or categories of rules. The Status drop-down list box lets you choose All, Open, or Closed events. To avoid excessive scrolling, you can also limit the number of events shown on a specific page.

For more information about an alert, click the rule name. A pop-up window appears, showing a description of the alert and the exact time of occurrence. This pop-up window provides links to useful resources and advice for resolution. You can also view the exact expression that generated the event.

2.4.1 Closing an Event

The creation of an event by an advisor rule signifies that an issue might require closer attention. Investigate the issue that triggered the event; rectify the issue or problem (or choose to ignore it); then close the event, when you are satisfied it does not have a significant impact on your servers.

Some of the advisors identify transient or temporary issues, such as a replication slave being unavailable. For these advisors, you can schedule events to automatically be closed when the event moves from notification status back to the Ok state.

You can configure auto-close functionality on all advisors through the Advisors tab when you schedule the advisor against one or more servers. When auto-close is enabled, the event remains open while the condition that triggered the event is still in effect. When the condition is no longer broken, the event is automatically closed with the configured auto-close test. You can still manually close such events before resolving the issue. For more information on scheduling rules, see Section 2.3.2, “Scheduling Rules”.

To close an individual alert, click the close link in the Operations/Notes column. Document the resolution using the Resolution Notes text area and choose the close button. During the closing operation, you can also reconfigure the rule scheduling that triggered this event, and the auto-close settings. For more information on configuring rule scheduling and auto closing, see Section 2.3.2, “Scheduling Rules”.

To close a number of alerts simultaneously, select the checkbox beside each alert to close and click the close button.

When closing individual or multiple events, a notification window indicates what operations have been completed. The events remain in the displayed event list, but the close link is instead a link to the resolution notes. You can update the active list by clicking filter to re-filter the event display.

A historical list of all events, including closed events, is available by setting the Current Severity to Closed. The list shows all of the closed events for a given time range and the servers selected in the server tree. Historical data is limited by the purge data settings.

2.4.2 Notification of Events

Notification of an event takes place when a rule is executed and the severity level for a given rule changes from a lower status to a higher one. This occurs on the first change to each individual severity level until the event is closed.

For example, the table shows the severity levels raised during the lifecycle of a single event, showing when a notification is actually raised.
The **Graphs** Tab

<table>
<thead>
<tr>
<th>From Level</th>
<th>To Level</th>
<th>Notification Raised?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ok</td>
<td>Info</td>
<td>Yes</td>
</tr>
<tr>
<td>Info</td>
<td>Warning</td>
<td>Yes</td>
</tr>
<tr>
<td>Warning</td>
<td>Info</td>
<td>No</td>
</tr>
<tr>
<td>Warning</td>
<td>Critical</td>
<td>Yes</td>
</tr>
<tr>
<td>Critical</td>
<td>Warning</td>
<td>No</td>
</tr>
</tbody>
</table>

If auto-close is enabled for a given rule, this notification sequence is still valid, but the event is automatically closed when the event reaches the Ok state. This re-enables notification when the advisor creates a new event.

SNMP notifications are sent each time a given rule is executed, regardless of the current or returned state. Auto-closed events cause SNMP traps with the closed alarm level.

2.5 The **Graphs** Tab

**Note**

MySQL Enterprise subscription, MySQL Enterprise Monitor, MySQL Replication Monitor, and MySQL Query Analyzer are only available to commercial customers. To learn more, see: [http://www.mysql.com/products/](http://www.mysql.com/products/).

Navigate to the **Graphs** tab by choosing the **Graphs** tab.

By default, four graphs are displayed on the **Monitor** page. These graphs present information about the currently selected server or server group, showing the hit ratios, CPU utilization, connections, and database activity. Color coding helps distinguish different aspects of each graph.

From the **Monitor** tab, you can make permanent or temporary changes to the way a graph is displayed. For example, you can view the last hour’s activity, or a specific period of time.

The **Monitor** tab is the only place where you make persistent changes to the way the graphs display. You can set the size of the thumbnails and the full-sized graphs and you can also set their refresh interval. For more information, see Section 2.2.1, “The Server Graphs and Critical Events”.

As with the **Monitor** tab, the data shown in the graphs is determined by the server or group of servers selected in the server tree. Each graph is only displayed if there is appropriate data for the selected servers; for example, only slave servers have a **Replication Slave Delay** graph, and the **Cluster** graphs only apply to MySQL Cluster servers.

The **Graphs** tab shows all the available graphs in a single column, and provides the capability of adjusting the scale of the graphs, allowing a more or less detailed view as the situation requires. Click on the **Graph Gallery** to view multiple graphs per column.

To ensure that you have the latest versions of the graphs, click on the **Check For Updates** link on the top left of this page.

All graphs support the ability to drag and select a specific area of the graph. When you select an area of the graph, the display changes to the **Query Analyzer** tab and displays the queries that were being executed during the selected time period. You can also zoom into the graph by selecting specific time periods. For more information on using the graphs to monitor the execution of specific queries, see Section 3.2.2, “Using Graphs to Identify Queries”.

2.5.1 Displaying Graphs

The graphs on the **Monitor** tab are:

- Hit Ratios
• Database Activity
• Connections
• CPU Utilization

When the Graphs tab is first opened, no graphs are visible. To view a graph click the + button on the left or, to view all graphs, use the expand all button.

The larger size of graphs is the primary reason for viewing graphs on the Graphs tab rather than on the Monitor tab. Additionally, you can only show a maximum of six graphs on the Monitor tab; the remaining graphs can only be viewed from the default Graphs tab, or from within the Graph Gallery.

2.5.2 Setting an Interval

Change the interval for a graph by choosing values from the Hours and Minutes drop-down list boxes. If necessary adjust the width and height of the graph and then click the update button. The changes to the time span apply to all the graphs on the Graphs tab but have no effect on the graphs on the Monitor tab.

To change the graphs both here and on the Monitor tab, use the configure graphs link on the top right. This opens a dialog box for setting the default interval for the x-axis. Save your changes, and the values chosen become the defaults whenever you log in. You can also change the defaults from the Monitor tab as described in Section 2.2.1, “The Server Graphs and Critical Events”; defaults for other users are unchanged.

Use the reset button to restore the default value for the interval. Doing this will also reset the default size of the graphs.

2.5.3 Setting a Time Span

Setting a graph to display a time span gives you a historical perspective on server activity. For example, you can check what was happening at a specific point in time, or look at an extended period to determine patterns or trends.

In the Time Display drop-down list box select the From/To option. Choosing this option updates the display to include To and From text boxes.

Set the date you wish to start viewing from by manually entering the date in year, month, and day format (2007-03-14). However, it is much easier to click the calendar icon and choose a date from the drop-down calendar. Enter a terminating date in the same way. You can also choose the specific time of day by selecting the hour and minute.

If necessary, adjust the width and height of the graph and then click the update button. The changes to the time span apply to all the graphs on the Graphs page but have no effect on the graphs on the Monitor tab. You cannot change the time span of the graphs that appear on the Monitor tab. Changes apply only to the current user; defaults for other users are unchanged.

Use the reset button to cancel your changes.

2.5.4 Exporting Graph Images and Data

You can save graphs on the Dashboard pages in either .csv format (the raw data for the graph) or .png format (an image file showing the rendered graph). Where graphs are displayed on the Monitor, Graphs, and Query Analyzer pages, 2 icons to the right of the graph title let you export in these formats.

Hover over the icon to confirm which one corresponds to which format. Since .png files typically display in the browser rather than bringing up a Save dialog, either click the icon and save the image file on the resulting page, or bring up the context menu for the icon and choose Save linked file or the equivalent for your browser. (You might need to change the extension to .png in the Save dialog.)
For .csv files:

- The filename includes a timestamp showing the date and time that you export the graph data, in UTC format.
- If the graph covers any period when the MySQL server or Agent was down, no data is included in the CSV file for that period. (Rather than blank or zero values.)

### 2.6 The Query Analyzer Tab

The MySQL Query Analyzer lets you monitor the statements being executed on a monitored server and retrieve information about the query, number of executions and the execution times of each query. Queries are normalized, removing unique data such as literal values, so that the generic queries can be counted and identified more easily.

Query Analyzer works by collecting information about SQL statements that your MySQL client application sends to the MySQL server, either by using the MySQL Enterprise Monitor Agent proxy service, or by using the MySQL Enterprise Monitor Plugin for a given Connector that sends the information directly to MySQL Enterprise Service Manager.

For more information using the Query Analyzer, including how to provide queries to MySQL Enterprise Service Manager, how to use the user interface, and how to drill down to find the queries and information that you need, see Chapter 3, *Using the Query Analyzer*. For the meaning of each field on the Query Analyzer tab, see Section 3.2, “Query Analyzer User Interface”.

### Figure 2.7 MySQL Enterprise Monitor User Interface: Query Analyzer

![Query Analyzer Tab](image)

### 2.7 The Replication Tab

**Note**

MySQL Enterprise subscription, MySQL Enterprise Monitor, MySQL Replication Monitor, and MySQL Query Analyzer are only available to commercial customers. To learn more, see: [http://www.mysql.com/products/](http://www.mysql.com/products/).

Navigate to the Replication page by choosing the Replication tab. This page summarizes the state of your replication servers; you can drill down to see details about any master or slave. Using this page helps you avoid running the `SHOW SLAVE STATUS` command over and over on multiple servers; for consistency, the Replication page uses some of the same keywords as the output from that command.
Note

Set up agents to monitor each master and slave server. Only servers that are monitored appear on this page.

The Replication page groups all master servers with their slaves. Masters and their slaves are autodiscovered and a grouping is created, based on the way that the servers are interconnected (known as the replication topology). This grouping shows up on the replication page and also in the Heat Chart on the Monitor tab. Scans run on a five minute interval, so depending upon the order of discovery, it can take as long as 2 polling intervals to create a complete group.

Figure 2.8 MySQL Enterprise Monitor User Interface: Replication Groups

Discovery events are logged to the Replication log. To view this log, navigate to the Settings page and choose the Logs link. View all replication-related events by clicking the Replication link. This log can be a useful tool for debugging the replication topology discovery process.

Warning

For discovery to work properly, the agent must be installed on the same machine as the server you are monitoring. Do not use remote monitoring.

You can manage replication groups from the Manage Servers page in the same way as other groups. However, any slaves removed from a server group are automatically restored to that group. You can also add non-slaves to a replication grouping. For more information about server groupings see Section 2.8.3.2, “Grouping Servers”.

Replication Page Details

Choose a value from the Refresh drop-down list box to set the rate at which information is updated. This refresh rate applies only to the information presented on this page: It is independent of the rate set for the Monitor tab.

The following columns describe replication master and slave servers:

- **Servers**: Displays the group name and any servers that are part of the group. Levels of indentation in this column show the relationship between master servers and their slaves. The icon next to each server indicates if the server is enabled for semi-synchronous replication or not. A gray “disabled”-style icon indicates that semi-synchronous replication is not available.

- **Type**: Indicates the topology of a server group or in the case of individual servers, whether a server is a master, a combined master/slave, or a slave.
• **Threads**: Displays information about the two dedicated replication threads that run on the slave server. Both threads must be running for the slave to work properly. **IO** reports the status of the slave I/O thread. **SQL** reports the status of the slave SQL thread.

• **Time Behind**: The interval that the slave is behind the master, in **hh:mm:ss** format. This column is blank if a server is a master. Typically, you try to keep this value low.

• **Binary Logs**: Displays information about the **binary log** file. **Current File** shows the binary log file name. **Position** shows the current position in the binary log file.

• **Master Position**: Displays information about the binary log position from the master server. **Binary Log** shows the master binary log file name. **Position** shows the current position in the master binary log file.

• **Log Space**: Displays the sizes of log files related to replication. **Binary Logs** shows size information for the binary log files. **Relay Logs** shows size information for the relay log files.

• **Last SQL Error**: The most recent error encountered by the slave SQL thread.

• **Last IO Error**: The most recent error encountered by the slave I/O thread.

• **Unlabeled Column**: To edit a server group name, click on the applicable **rename group** link under this column.

Most column headings are active links; click the header to change the display order. Sorting works differently for different column groupings. Click the **Seconds Behind** header to order servers by the number of seconds they are behind their master. The server topology is respected regardless of sort order. For example, in a **TREE** topology, ordering occurs within branches only.

If the agent is down, servers show in bold red in the **Servers** column. The **Slave IO** and the **Slave SQL** columns display **stopped** in red text if these threads are not running. If an agent is down, the last know status of the IO or SQL threads is shown in italics.

Clicking a master server opens a dialog box that displays information about the server. The information shown includes:

• The number of slave servers.

• The binary log file name.

• The binary log position.

• Which databases are replicated and which not.

The dialog box also includes a link to hide or show the slave servers.

Clicking a slave server opens a dialog window showing extensive information about the slave.

**Usage Notes**

For information on the kinds of problems you might find while monitoring replication, and how to solve them, see Troubleshooting Replication and Improving Replication Performance.

**2.8 The Settings Tab**

**Note**

MySQL Enterprise subscription, MySQL Enterprise Monitor, MySQL Replication Monitor, and MySQL Query Analyzer are only available to commercial customers. To learn more, see: [http://www.mysql.com/products/](http://www.mysql.com/products/).

The initial installation lets you configure your **My Oracle Support** credentials and outgoing email settings. This section explores the configuration settings in more detail, and shows how to manage
Global Settings

servers, users, notification groups, Simple Network Management Protocol (SNMP) traps, log files, and the product information screen.

Knowledge of server management is a prerequisite for properly configuring advisors, which is explained in Section 2.3, “The Advisors Tab”.

To get to the Settings tab, open the Dashboard and choose the Settings tab.

2.8.1 Global Settings

The Global Settings control the main configuration parameters for the entire MySQL Enterprise Monitor system, including your email notifications, data purge, and My Oracle Support credentials.

The Global Settings tab is divided into these sections:

• **Outgoing Email Settings**

  Configures the settings for email notifications by MySQL Enterprise Service Manager. Configure the From Address SMTP Server settings. If your server requires authorization, complete the necessary server login details, and whether SSL is required.

  Because alert notification via email is a key component of the MySQL Enterprise Monitor Advisor solution, consider configuring an SMTP account for at least one recipient. Choose the Settings tab and go to the Global Settings screen by clicking the appropriate link. Here you configure the email settings that apply to the currently logged-in user.

  Find the Outgoing Email Settings on the left of this page.

  Figure 2.9 MySQL Enterprise Monitor User Interface Settings: Outgoing Email

![Figure 2.9 MySQL Enterprise Monitor User Interface Settings: Outgoing Email](image)

Ensure that the Enable Email Notifications checkbox is checked and enter information as appropriate.

The default value for the SMTP port is 25. If your mail server runs on a different port, specify the port, separated from the server name by a colon. For example, if your mail server runs on port 587, enter email.myserver.com:587 into the SMTP Server text box.

**Note**

An email server must be available for sending email alerts.

The SMTP client uses Transport Layer Security (TLS) if the SMTP server supports it.
If your SMTP server incorrectly indicates that it supports TLS, check the Disable JavaMail TLS/SSL check box.

To enter the SMTP server password, check the Update Password On Save box first. When you return to this dialog to update settings other than the SMTP password, leave this box unchecked to avoid blanking out the saved password. If the SMTP password does change later, check the box again and enter the new password.

To test your configuration immediately, add an email address to the On Save, Send Test Email Message to box.

For more information, see Outgoing Email Settings.

- **SNMP Traps**

  The SNMP Traps section of the Global Settings tab lets you enable Simple Network Management Protocol so that your Network Management System (NMS) can handle MySQL Enterprise Monitor events. SNMP notifications are off by default. To enable the checkboxes that associate specific rules with SNMP traps, click the Enable SNMP Notifications checkbox first.

  Figure 2.10 MySQL Enterprise Monitor User Interface Settings: SNMP Traps

MySQL Enterprise Service Manager includes support for both SNMPv1 and SNMPv2. You can select the SNMP version to use by clicking the corresponding Use SNMPv1 or Use SNMPv2 radio button.

In the Target 1 or Target 2 text box enter the IP address or hostnames of your NMS listeners. The port number defaults to the well-known SNMP port, 162. If you are not using this port, enter the port that your Network Management System is listening on.

Enter the appropriate community string in the Community String text box. The default value for this string is public.

For the trap address for Advisor traps, you can optionally elect to use the address of the agent that triggered the alert, rather than the address of the MySQL Enterprise Service Manager. To do this, click the Use the remote MySQL agent host IP address as the SNMP trap agent address for Advisor traps. For internally generated SNMP traps (that is, with MySQL Enterprise Service...
Manager) you can also specify an alternate address by putting the IP address in the **SNMP trap agent address for internally generated traps** box.

To ensure that the specified target is valid, check the **On Save, Send Test Trap** check box. The remaining check boxes configure how your NMS responds to MySQL Enterprise Monitor. Check the **Up/Down Application** check box to configure NMS for starting up or shutting down the MySQL Enterprise Monitor. For configuration of advisor events, choose a level of severity and check the **Advisor event with the severity of Critical** check box. Finally, choose the **Application Error** check box to configure NMS to support application error traps. Be sure to save your settings before exiting.

To enable **SNMP traps**, check the **Enable SNMP Notifications** checkbox, then check the **Use SNMP Traps** checkbox for each rule that should result in an SNMP trap. For instructions on doing this, see Section 2.3.2, “Scheduling Rules”.

The Management Information Base (MIB) file associated with SNMP trapping is called `MONITOR.MIB`. For the location this file see Section C.1.4, “The Management Information Base (MIB) File”.

**Note**

The MIB file supplied with MySQL Enterprise Service Manager is not directly compatible with OpenNMS. For a sample of the modifications to make, see the comments for Bug #41714.

- **Server Locale**

  The **Server Locale** setting determines the language of notification for the following items:
  
  - Email notifications.
  
  - SNMP traps.
  
  - The naming conventions for shared resources such as a replication group name prefix.

  **Figure 2.11 MySQL Enterprise Monitor User Interface Settings: Server Locale**

The initial value in this drop down list box is the locale for the OS on which the Dashboard is running.

- **Server Hostname**

  You can alter the hostname and port used to identify the MySQL Enterprise Service Manager when reporting notifications. This can be useful if the server hostname, and the hostname you want to use when connecting to your MySQL Enterprise Service Manager.
Figure 2.12 MySQL Enterprise Monitor User Interface Settings: Server Hostname

Note
Only change the **Port** setting if you have altered or redirected the original port used when installing MySQL Enterprise Service Manager. Entering the incorrect information does not affect the accessibility of your system, except when clicking links within the notification messages.

- **Data Purge Behavior**

  The **Data Purge Behavior** section of the **Global Settings** tab lets you remove old log files and also old data from the repository. The default purge interval is **28 days**. To purge data, change this setting by choosing from the drop-down list. Choosing **52 weeks**, for example, removes all data that is older than a year.

Figure 2.13 MySQL Enterprise Monitor User Interface Settings: Data Purge

Warning
Purging data permanently removes information from the repository. Since events are derived from data contained in the repository, they are purged along with the data.

Ensure that there is adequate disk space for the repository. If you are monitoring numerous servers and running many rules the size of the repository can increase rapidly. Choose purge behavior accordingly.

Note
The purge process is started approximately once every day, or when the MySQL Enterprise Monitor User Interface is restarted. If you change the purge duration from a larger timespan to a smaller one, the data may start to be purged immediately.
The system assumes that you will close events (or they will be auto-closed). The purge functionality only purges closed events and related data. Note that leaving events open for long time spans will use more data storage space.

You can configure the data purge behavior for a number of different systems individually:

- **Remove Historical Data Collection Older Than** configures the duration that the main data about your servers is retained. This includes all data collections, including CPU, memory and connections and activity statistics.

- **Remove Query Analyzer Data Older Than** configures the duration that the query analyzer statistics and information about individual queries is retained.

Notes for setting purge behavior:

- Purging can be carried out manually by enabling the `innodb_file_per_table` for the repository database and then using an `OPTIMIZE TABLE` operation to reclaim space from deleted rows in the table.

- If you set the purge value to a very low timespan value when the previous setting was quite high, then the space used for the data that was purged is not reclaimed from the InnoDB tablespaces. You can do this by running `OPTIMIZE TABLE` on the MySQL tables for MySQL Enterprise Service Manager to reclaim the space from the purged rows.

- **Remote Server Inventory Schedule**

  MySQL Enterprise Monitor keeps track of all the databases and tables in a server, as well as the amount of RAM, disk space, and other items. A re-inventory updates this information in case you have added or dropped databases and tables. Depending upon the configuration of your system, this operation can tax resources. If you are monitoring many remote servers this is an operation you may want to perform in off-peak hours only.

  **Figure 2.14 MySQL Enterprise Monitor User Interface Settings: Remote Server Inventory Schedule**

- **My Oracle Support Credentials**

  You can specify the credentials for logging into the My Oracle Support site. These should match the user name and password that you have registered with Oracle for access to the support site.
Figure 2.15 MySQL Enterprise Monitor User Interface Settings: My Oracle Support Credentials

Note
Only administrators can change the My Oracle Support Credentials section; for other users, this section does not show up in the interface. For more information about different users and their rights see Section 2.8.4, “Managing Users”. Specifying incorrect credentials results in the error message, “Your credentials do not appear to be valid.”

- **HTTP Proxy Settings**

You might want to update your HTTP Proxy Settings if your MySQL Enterprise Service Manager is not directly connected to the internet. The proxy settings are used when updating the information within the What's New tab. For more information, see Section 2.9, “The What's New Tab”.

Figure 2.16 MySQL Enterprise Monitor User Interface Settings: HTTP Proxy Settings

- **Advisor Bundle**

You can update your Advisor Bundle and the associated rules and graphs by importing a new Advisor Bundle. To update your Advisor Bundle using a bundle file that you have previously downloaded:

Figure 2.17 MySQL Enterprise Monitor User Interface Settings: Advisor Bundle

1. Click Choose File and locate your Advisor Bundle on your computer.
2. Click Save to upload the updated bundle and validate the contents.
To update the Advisor Bundle automatically over the web, click the **update advisors** button.

- **LDAP Authentication**

You can configure LDAP Authentication to be used for the users that are provided access to the MySQL Enterprise Monitor User Interface. To use LDAP authentication, it must have been enabled and configured within the settings.

**Figure 2.18 MySQL Enterprise Monitor User Interface Settings: LDAP Authentication**

The configurable elements for LDAP authentication are:

- **Use LDAP for Authentication**

  To enable LDAP authentication, click the **Use LDAP for Authentication** checkbox.

- **LDAP is Authoritative**

  If you want to make LDAP the authoritative (only) authentication mechanism, check the **LDAP is Authoritative** checkbox. Note that if you select this option and the LDAP service is misconfigured, you can lock yourself out of MySQL Enterprise Monitor User Interface entirely.

- **Primary Server Hostname**

  Hostname or IP address of the primary LDAP directory server.

- **Port Number**

  Port number of the primary LDAP server. You must change this option to the port used for SSL connections if you have enabled encryption.

- **Secondary Server Hostname (optional)**
Hostname or IP address of the secondary/failover LDAP directory server.

- **Port Number**

  Port number of the secondary/failover LDAP server. You must change this option to the port used for SSL connections if you have enabled encryption.

- **Encryption**

  Encryption type required for communication with the LDAP server(s). Supported options are None, StartTLS, and SSL.

- **Referrals**

  Authentication should follow any referrals provided by the server. The default is to use whatever the LDAP directory server is configured to do. If you are using Microsoft Windows Active Directory, you must set this option to Follow.

- **Authentication Mode**

  The authentication mode to use. Choices are Bind as User, which binds to the LDAP directory using the credentials given to login to MySQL Enterprise Service Manager. Comparison requires an LDAP login/password that can see the configured password attribute to make a comparison with the given credentials.

- **Update Password On Save** box and password fields

  To enter the LDAP server password, check the Update Password On Save box first. When you return to this dialog to update settings other than the LDAP password, leave this box unchecked to avoid blanking out the saved password. If the LDAP password does change later, check the box again and enter the new password.

- **User Search Pattern**

  Pattern specifying the LDAP search filter to use after substitution of the username, where `{0}` marks where the username should be substituted for the DN.

- **User Search Base (leave blank for top level)**

  The entry to use as the base of the subtree containing users. If not specified, the search base is the top-level context.

- **Search entire subtree**

  The search scope. Set to true to search the entire subtree rooted at the *User Search Base entry. The default value of false requests a single-level search including only the top level.

- **Map LDAP Roles to Application Roles**

  Specifies whether MySQL Enterprise Service Manager should use the roles defined in LDAP to map to MySQL Enterprise Monitor application roles. If enabled, and LDAP is not configured to be authoritative, if a user authenticates successfully via LDAP and has a valid mapped role, they are granted permissions to the application. Roles are mapped according to the entries in the Application Role/LDAP Role(s) fields, which take comma-separated lists of LDAP roles to map to the given MySQL Enterprise Monitor roles.

  If you select this option, you are provided with additional fields that let you configure how roles are looked up within the LDAP server.
For more information on LDAP authentication and integration with Tomcat, see Tomcat Documentation.

- **Customize MySQL server name**

Figure 2.19 MySQL Enterprise Monitor User Interface Settings: Customize MySQL server name

These settings change the way host names are displayed in the Dashboard, typically by shortening the names to avoid cluttering the display with repetitive information:

- The **Show MySQL server names as** field controls whether the Dashboard displays fully qualified domain names (the default); or only the host name, omitting the repetitive suffix such as `.company_name.com`; or host names transformed by a substitution expression, for example to turn a long multi-part host name into a short nickname.

  The syntax for the substitution expression is a name-value pair separated by an equals sign, with a regular expression on the left side and the replacement text on the right side. The regular expression follows the Java syntax from [http://download.oracle.com/javase/6/docs/api/java/util/regex/Pattern.html](http://download.oracle.com/javase/6/docs/api/java/util/regex/Pattern.html). To keep special characters (particularly dot) from being interpreted within the regular expression, escape them with `\` or make a single-item character class, `\[.\]` for example. If the right side contains whitespace, a comma, or is an empty string, surround it with single or double quotation marks. You can use backreferences such as `$1`, `$2`, and so on to substitute parts of the regular expression into the replacement text; you cannot use the $ character in the replacement text except as part of a backreference. You can include more than one replacement expression by separating them with commas. Some examples include:

  ```
  dx521\.[example\.]com=Staging
dx984\.[example\.]com=Production
database-server-(\S+)\.[example\.]com=$1
  ^database-server=\S+", \[example\.]com=$", dx521="Staging DB", dx984="Production DB"
  ```

  If you use incorrect syntax in the replacement expression, the original hostname is displayed with a suffix such as `(!)`; this suffix varies depending on your locale setting.
2.8.2 User Preferences

On this tab, users can change their password, user name, and locale information.

Figure 2.20 MySQL Enterprise Monitor User Interface: User Preferences

To change your password, enter a new value into the Password text box. To change your user name, enter a new value into the Username text box. Click the save user properties button to commit this change.

You can also adjust your time zone and locale information from this tab. The settings on this tab apply only to the user who is currently logged in.

The MySQL Enterprise Service Manager determines the default value for the locale by looking at your browser settings. Changing this value determines the language setting for any future logins to the Dashboard, overriding your browser settings.

Note
Be sure to set the correct time zone so that alerts are time stamped correctly.
This setting applies only to the specific user.

2.8.3 Manage Servers

Use the Manage Servers tab to get a list of the currently monitored servers connected to the MySQL Enterprise Service Manager, and view the current MySQL version and important configuration settings for each.

Figure 2.21 MySQL Enterprise Monitor User Interface: Manage Servers
The **Manage Servers** tab provides a list of servers, organized by groups, in a similar fashion to the main server navigation list. For each server, the following information is displayed:

- **Query Analyzer**

  Shows the Query Analyzer configuration for the server, showing whether Query Analyzer is enabled, whether the recovery of example queries is enabled, and whether explain plans for queries have been enabled.

  From this display, you can also control the Query Analyzer settings for each server by clicking the **Off** link for each server to change the settings. This brings up the **Configure Query Analyzer** pop-up window. For more information, see Section 3.2.3, “Query Analyzer Settings”.

- **MySQL**

  Shows the version number of the MySQL server being monitored.

- **Up Since**

  Shows the time when the MySQL server was started (the server up time).

- **Last MySQL**

  The last time communication with the MySQL server occurred.

- **Agent**

  Shows the version number of the MySQL Enterprise Monitor Agent server being monitored.

- **Last Agent**

  Shows the last time communication was received from the agent.

- **Port**

  The configured MySQL port number.

- **Data Dir**

  The data directory path for the MySQL server.

- **Reporting Delay**

  The time between when the data was obtained by the agent when it was received by MySQL Enterprise Service Manager.

You can search and filter the server list by using the fields and pop-ups at the top of the list. You can filter using one or more of following techniques:

- To filter by server name, select the match type (**Contains**, **Regex**, **Doesn't Contain**, or **Negative Regex**), and enter a string or regular expression into the **Value** field.

- To filter based on whether the Query Analyzer functionality has been enabled or disabled, use the **Query Analyzer** pop-up.

- To filter by MySQL server version, you can enter either an explicit version number into the **MySQL Version** field, or you can additional symbols to restrict the versions to different ranges. The field supports the following statements:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version Prefix</td>
<td>5.0</td>
<td>Shows all MySQL servers matching the specified version. For example, 5.0 matches any version of MySQL from 5.0.0 to 5.0.99</td>
</tr>
<tr>
<td>Statement</td>
<td>Example</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Explicit Version</td>
<td>5.0.84 = 5.0.84</td>
<td>Shows all MySQL servers matching the specific version number.</td>
</tr>
<tr>
<td>&gt; Version</td>
<td>&gt; 5.0.84</td>
<td>Shows all versions greater than the specified version.</td>
</tr>
<tr>
<td>&gt;= Version</td>
<td>&gt;= 5.0.84</td>
<td>Shows all versions greater than or equal to the specified version.</td>
</tr>
<tr>
<td>&lt; Version</td>
<td>&lt; 5.0.84</td>
<td>Shows all versions less than the specified version.</td>
</tr>
<tr>
<td>&lt;= Version</td>
<td>&lt;= 5.0.84</td>
<td>Shows all versions less than or equal to the specified version.</td>
</tr>
<tr>
<td>String</td>
<td>enterprise, log</td>
<td>Shows all servers with the specified string in their version.</td>
</tr>
<tr>
<td>! String or Version</td>
<td>! enterprise, ! 5.0.84</td>
<td>Shows all servers not having the specified string, or not matching the specified version.</td>
</tr>
</tbody>
</table>

You can combine multiple arguments to produce more complex formats. For example, to list all of the servers of 5.1 or higher that do not have enterprise in the version string, you could use >=5.1 ! enterprise.

**Agent Version**

Filters the list based on the MySQL Enterprise Monitor Agent version number. This can be useful if you want to know which means require an upgrade to a later version. The Agent Version field supports the same selection criteria as the MySQL Version field, allowing to select based on specific version numbers and strings.

**Agent Transport**

Filters the list based on the protocol the Agent uses to communicate with the MySQL Enterprise Service Manager. You can select either standard HTTP or HTTPS/SSL-based connections.

After you make you selection, use the filter button to filter the server list. To reset your selections to show everything, click reset.

Using the list of servers, you can create groups to more easily manage and monitor your servers according to the departments, applications or other groupings that you may want to use. For information on how to create and modify groups, see Section 2.8.3.2, “Grouping Servers”.

You can also perform simple administration on the server within the MySQL Enterprise Monitor framework, including configuring the Query Analyzer, renaming the server (as it appears within MySQL Enterprise Service Manager) or the group name, and updating the information about the server (re-inventory). All of these operations are handled by using hovering over the triangle next to the server name or group.
The pop-up provides a list of options, which are different depending on whether you select an individual server or a group. For a group of servers, you can rename the group, delete the group, or obtain a bundled version of the support diagnostics information. For individual servers, you can modify the Query Analyzer configuration, rename the server, refresh the server inventory, get the support diagnostics information, or turn the event blackout period on and off.

- To change the configuration of the Query Analyzer for the server, see Section 3.2.3, “Query Analyzer Settings”. This option is not available for a group.

- To rename a server, choose edit server details, or to rename a group, choose rename group. For information on renaming a server, see Section 2.8.3.1, “Renaming a Server”. To rename a group, change the name within the pop-up prompt provided.

- To re-inventory your MySQL server and update version and configuration information, click the triangle and choose refresh inventory. This triggers an update of the server information without affecting the schedule inventory process. You can use this when you have upgraded or made significant configuration changes to your server to update the inventory and ensure that the correct rules and advisors are being executed on your server.

- You can obtain the support diagnostics file for either individual servers, or entire server groups. To get a diagnostic report file, select support diagnostics from the pop-up menu. The information is provided as a Zip file that is downloaded to the machine. The information contained in the report includes detailed information about your server (or multiple servers if you selected a server group), including configuration, hardware, MySQL options/variables and historical graphs. To view the information extracted, unzip the downloaded file and double-click the index.html.

For generic information about your MySQL Enterprise Monitor installation, see Diagnostic Report.

Note
Renaming a server using the Manage Servers tab overrides all other settings, including changes made within the agent configuration.

- Use the [Enable | disable] event blackout control to turn blackout periods on and off. The server name is greyed out while the blackout period is in effect. Only event reporting is affected; query analysis continues during the blackout period.

2.8.3.1 Renaming a Server

You can rename an existing server without losing the current historical data or configuration information. Renaming the server also lets you make its name more descriptive according to the server's role within your organization. For example, you might rename a server from the default host name to include the department and application for the MySQL server.
To rename a server, click the rename link next to the server. Enter information about the server, including the host name and registered IP addresses for the agent. Fill in the alternative name that you want to be displayed in the text box at the bottom of the window. You can also enter notes about the server, which are displayed as a tooltip in the Server tree when you hover over the note icon.

Figure 2.23 MySQL Enterprise Monitor User Interface: Server Renaming

2.8.3.2 Grouping Servers

To help with server management, the Service Manager lets you group servers in any fashion you choose. For example, you can manage servers according to purpose. For example, you might group servers by whether the servers handle Internet or intranet data, by whether they power finance or HR applications, or by physical location.

All monitored servers are automatically included in the top level server grouping, All Servers. Other server groupings are replication groups or user-defined groups.

You can create a user-defined group by clicking the Manage Servers link. Add a group name and then click the create group button. The new group is displayed immediately.

Replication groups are automatically discovered by MySQL Enterprise Monitor and in this respect differ from user-defined groups. For more information about replication groups see Section 2.7, “The Replication Tab”. However, like user-defined groups you can edit the name of a replication group and add other servers to it.

To add to a group, select the add to group link. Choose the server or servers to add, then complete the operation by clicking the add to group button. You can add a server to a group even if the agent is down.

To remove a server from a group expand the server group tree and click the remove from group link. To delete a server altogether see Section 2.8.3.3, “Removing a Server From the Dashboard”.

Note

Slaves removed from a replication group are rediscovered and re-added to that group.

To delete an group, you can use the Delete Group link. This deletes the group and removes the servers from the deleted group.
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Warning
You cannot delete automatically created groups, such as those built during replication discovery, unless the group is empty. If the group is not empty, you get a error.

There are three ways to modify an existing group: by renaming it, adding to it, or removing it. Select the rename link to change the name of a group and add to group to add servers. Deleting a group simply requires clicking the remove all from group link. This removes the server group but has no effect on individual servers.

2.8.3.3 Removing a Server From the Dashboard

To stop monitoring a MySQL server, stop the corresponding agent, then remove it from the Dashboard. (The agent must be stopped first, so the server is considered inactive in the Dashboard.)

For instructions on stopping an agent, see:

- Windows: Section 5.3.4.1, “Starting/Stopping the Agent on Windows”
- Unix: Section 5.3.4.2, “Starting/Stopping the Agent on Unix”

Once the agent is stopped, delete the monitored server. Deleting a server simply means that it no longer shows up in the Dashboard.

You can remove one or multiple servers at the same time. To remove a server or servers, click the checkbox next to each applicable server, then click the delete servers button. You are asked to confirm the deletion of the servers: click delete to delete the servers, or cancel to cancel the delete operation.

Note
You can remove a server from any group at any time. Removing the last server from a group also removes that group.

2.8.4 Managing Users

The Manage Users panel lets you create, delete and manage individual users that have access to MySQL Enterprise Service Manager.

Figure 2.24 MySQL Enterprise Monitor User Interface: Manage Users

To log in to the Dashboard a user account is required. There are four types of users with varying privileges:

- **manager** role
  
  A user with the role of manager can perform all operations within MySQL Enterprise Service Manager, including changing the server configuration, adding and removing users, and viewing query analyzer and other data.

- **dba** role

  Users with the dba role should be database administrators who are using MySQL Enterprise Monitor to monitor servers and queries. They have a similar set of privileges to those with the manager, except that they cannot do the following:
Managing Users

- Cannot add/remove or change users.
- Cannot change the My Oracle Support credentials used to communicate with the My Oracle Support website.
- Cannot change the HTTP proxy settings.
- Cannot change the Query Analyzer settings.
- Cannot update the Advisor bundle.
- Cannot change the LDAP authentication preferences.

In addition to these limitations, you can control for each user with the dba role whether:

- **View Query Analyzer tab**: Limits whether the user can see the Query Analyzer tab and its contents.
- **View action (example) queries**: Limits whether the user can see the values within queries shown within the query analyzer.

The setting for these abilities is provided when you select the dba role for a user.

- **read-only**
  
  The read-only role is identical to the dba role, but is unable to make any changes to the configuration of MySQL Enterprise Monitor, although they can view the current settings.

- **agent**
  
  The agent role is reserved for all users that you want to have access and ability to send agent information. You can use this if you want to provide individual logins for each agent.

The Administrator defined during installation as having the root role is unique; this user cannot be deleted.

If you are logged in as an Administrator, you can add a new user by choosing the Manage Users link from the Settings tab. To create a user click the create user button, select a role for the user, and enter a user name and password.

When a new user first logs in, a dialog box opens requesting time zone and locale information. To change this information later, use the User Preferences tab. For more information, see Section 2.8.2, “User Preferences”.

If you installed the Advisors through the Dashboard, you have probably configured the settings for the root role user already. (See Section 2.8.1, “Global Settings” and following for more information about this topic.)

**Warning**

To receive support-related updates, configure the My Oracle Support credentials for at least one user. These settings were set up on the first login to the Dashboard. For information on changing these settings, see Section 2.8.1, “Global Settings”.

To edit an existing user's information, select the Manage Users link, then select the user to edit. Make your desired changes in the fields provided, then save the changes.

Users can be authenticated either using an internal authentication system, which stores the user, password and role information within MySQL Enterprise Monitor, or you can opt to use an external LDAP service. To use the LDAP service, you still create each user, and then select the Authenticate this user using LDAP checkbox within the Edit User window. The username entered is authenticated
against the configured LDAP server. For more information on configuring the LDAP server to be used, see [LDAP Authentication](#).

To delete an existing user, click the **delete** link next to the user to delete.

### 2.8.5 Manage Notification Groups

The **Manage Notification Groups** panels lets you create and manage the notification groups used when different notifications and warnings are distributed.

**Figure 2.25 MySQL Enterprise Monitor User Interface: Manage Notification Groups**

Notification groups are collections of users who should be notified when advisor alerts occur. These users may have login credentials for the Dashboard but this is not a requirement.

You can create a group by clicking the **create group** link. Specify a group name and add recipients. When adding a user an email address must be specified. If you are adding multiple users separate them with commas.

To modify an existing notification group, select the **edit** link next to the group name. Deleting a group simply requires clicking the **delete** link.

**Figure 2.26 MySQL Enterprise Monitor User Interface: Edit Notification Group**

If a rule triggers an alarm, an email is sent to the members of the notification group specified when the rule was scheduled. For more information about scheduling rules see Section 2.3.2, “Scheduling Rules”.

You can set the subject line of the email that is sent by editing the **Subject Line** field. You can insert the alarm level using the string `{0}`, the rule name that was triggered using `{1}`, and the server name that triggered it using `{2}`.

You can optionally set the emails that are generated when the notification occurs to be limited to the size of an SMS message. You can then use a notification group email address that forwards to an SMS service so that you can get notification on your phone with an SMS service. Selecting the checkbox next to **SMS** only changes the length and format of the message that is sent to be compatible with the SMS size limits.

You can also optionally select a notification group to be used when sending critical error messages (such as MySQL Enterprise Monitor Agent or MySQL Enterprise Service Manager failures) by selecting the checkbox next to **MEM Admin**.
Note

Ensure that there is a mail server available for sending out alerts, and that there is an account configured for receiving any alerts that are created. For SMS messages, you must configure an email address with a third-party service that forwards the notification emails to an SMS number. SMS sending functionality is not provided in MySQL Enterprise Service Manager.

2.8.6 Logs

Use the Logs link to inspect, reset, and filter the various log files associated with the MySQL Enterprise Service Manager. For information about these log files, see Section C.1.3, “Log Files for the MySQL Enterprise Service Manager”. If a log entry represents a serious issue and the message is not self-explanatory, consult the applicable troubleshooting documentation: Section 2.11, “Troubleshooting the MySQL Enterprise Monitor User Interface” or Section 5.3.9, “Troubleshooting the Agent”.

The following image is an example of this screen.

Figure 2.27 MySQL Enterprise Monitor User Interface: Logs

The various categories of logs are shown in alphabetic order. The most recent changes to each log are shown in the Last Modified column. The number of entries in any specific log is shown under the Entries column.

To view detailed information, click the Log Name. This opens a separate browser window showing the date, time, alert type, and accompanying message.

On this screen, you can filter log information by the message type and by time period.

To filter by message type, select from the options in the level drop-down box. These are, in order of decreasing severity:

- All.
- Error.
- Warning.
- Information.
• Trace.
• Debug.

You can also adjust the number of items that appear on each page.

Press the clear all logs link to remove all log entries. To remove entries of a specific kind, click the clear logs link associated with the specific log. A confirmation dialog box lets you back out of this operation and avoid accidentally removing log information.

To clear log files of a specific age, see the Data Purge Behavior section of the Global Preferences page. For more information on this topic see Data Purge Behavior.

Use the edit log level link to change the type of error logged. The value selected from the Edit Log Level dialog box determines what appears under the Threshold column (second from the left in Data Purge Behavior).

Selecting Error from the list box creates the least number of log entries and Debug the most. Choosing None turns off logging altogether.

You can also download a compressed version of all the log files, as explained in Section 2.8.7, “Product Information”.

2.8.7 Product Information

Use the Product Information link to view detailed information about the product status.

• Enterprise Dashboard Server Info

The Enterprise Dashboard Server Info section provides detailed information about the running of your MySQL Enterprise Service Manager, including information about the Java environment, hostname and version information.

The section also includes detailed information about the current status of your MySQL Enterprise Service Manager, showing information on the agents, rules, and outstanding status of the various components. The following information is provided in this section:

• Pending Heartbeats
• Processed Heartbeats
• Pending Jobs
• Number of Agents
• Monitored mysqld Instances
• Build Version
• Advisor Version
• Number of Rules
• Number of Graphs
• Last Successful Email
• Last Email Failure
• Last Failure Message

You can monitor the status of the email messages sent by MySQL Enterprise Service Manager by looking at the values of the Last Successful Email and Last Email Failure sections. Any failure
by MySQL Enterprise Service Manager to send an email is reported, with the failure date recorded in **Last Email Failure**. You can examine the **Last Failure Message** field to determine the precise reason for the failure.

- **Readme**

  The **Readme** section contains a copy of the text **Readme** file provided with each release, and provides release specific information about your MySQL Enterprise Service Manager installation.

- **Diagnostic Report**

  The **Diagnostic Report** section includes a hyperlink, **Download diagnostic report**. The Zip file contains a variety of information and log files which can be used by support to determine and diagnose some problems with your MySQL Enterprise Monitor installation. The file is named according to your license number and the current date/time, for example **support-1234-6578-20100331T1026.zip**. The file includes, but is not limited to, the following items:

  - **Replication 1.dot**: The calculated MySQL server replication structure.

  - **java-threads.dot**: A list of the current Java threads and the dependencies.

  - **java.props**: The current Java configuration properties.

  - **java.threads**: A list of the current Java threads and their backtrace.

  - **mysql-monitor.log**: The MySQL log file.

  - **preferences.properties**: The MySQL Enterprise Monitor preferences.

  - **query.instanceOverview.html**: An HTML list of the current query analyzer data.

  - **root.csv**: A copy of your main MySQL Enterprise Monitor log file.

  - **server.props**: A copy of your server properties.

This report is especially useful for debugging the MySQL Enterprise Service Manager and the MySQL Enterprise Monitor Agent.

When you select the report, a new page opens showing the report generation status. A message is provided once the generation has completed.

---

### 2.8.8 Import/Export

The **Import/Export** system lets you export or delete custom rules and graphs that have been imported into the system so that you can transfer them to another MySQL Enterprise Monitor User Interface instance. You can also use this screen to import new custom rules and graphs.

To export rules or graphs:

1. Select the rules or graphs that you want to export. You can select multiple items by selecting the checkbox against each rule or graph.

2. Click **export**.

The custom rules and graphs are saved using a filename of the form **custom-export-DATE-TIME.jar**, where **DATE** is the date of export in international format (YYYYMMDD) and **TIME** is the time (HHMM).

To delete rules or graphs:
1. Select the rules or graphs that you want to export. You can select multiple items by selecting the checkbox against each rule or graph.

2. Click delete.

3. A confirmation dialog asks you to confirm that the rule or graph should be deleted. Data collections and the corresponding rules are unscheduled from all servers on which the rules have been applied. You cannot undo the operation; to re-enable the rules and graphs at a later date, export them first, then delete them so that you can re-import the custom graphs.

4. To confirm deletion, click delete. To cancel deletion, click cancel.

You can import custom rules and graphs by using the import function. You can use an XML file, or a previously exported jar file.

To import custom rules or graphs:

1. Click Choose File. This presents you with a custom dialog so that you can choose a file on your client computer to be uploaded to the MySQL Enterprise Monitor User Interface. Locate the file, and click Choose.

2. Click import.

3. A notification window appears indicating the number of graphs and rules imported.

For more information on writing new rules, custom data items, and creating new graphs, see Chapter 4, Customizing MySQL Enterprise Monitor.

### 2.9 The What's New Tab

The What's New page provides a simplified interface for providing updates and news related to your My Oracle Support account. By default, the information is automatically updated every hour. To disable the updates or force an update, see Section 2.9.1, “Setting What's New Configuration”.

Figure 2.28 The What’s New Tab
The **What's New** tab is divided into three main sections:

- The area on the left-hand side of the page provides information about the major new features and functionality in MySQL Enterprise Monitor.

- **Open Support Issues** provides a quick interface to the list of currently open issues with MySQL Support as identified through the My Oracle Support web site. Issues that are currently marked in the system as “Customer Working” or “Solution Offered” are also added to the main MySQL Enterprise Dashboard above the Heat Chart.

To use the Open Support Issues functionality, set your My Oracle Support credentials within MySQL Enterprise Monitor User Interface, as explained in Section 2.8.1, “Global Settings”.

- **Important Product Release Announcements** provides a list of news items from a Web-based news feed. The news feed contains important information, including, but not limited to:
  - New releases of MySQL Products, including MySQL Server and MySQL Enterprise Monitor.
  - End-of-life and support changes.
  - Urgent errors and notifications.

New (unread) items are indicated with a star icon. Unread items on the **What's New** page are also signified with a number in the tab title within the main Dashboard. Items are automatically marked as read when you visit the **What's New** page.

The announcements information is made available in two ways: through a Web connection where the information is updated at a set interval, or through information included with the MySQL Enterprise Advisors bundles.

**Note**

To poll the My Oracle Support site directly, your MySQL Enterprise Service Manager must have access to the My Oracle Support website. If your MySQL Enterprise Service Manager is not directly connected to the Internet, you can set an HTTP proxy to help access the information. For more information on configuring an HTTP proxy, see Section 2.8.1, “Global Settings”.

**Note**

To turn off the display of open service requests and product notifications, use the **Configure What's New** link on the **What's New** tab, as explained in Section 2.9.1, “Setting What's New Configuration”.

### 2.9.1 Setting What's New Configuration

To configure the operation and forcibly update the information on the **What's New** page, click the **configure what's new** button at the top-right of the **What's New** page.
The configurable options are:

- **Automatically check for Product-Related Announcements?**

  To disable the New Announcements updates, deselect the checkbox. Updates are enabled by default.

  The last time an update of the New Announcements information was successfully executed is displayed below the title.

  You can force an update of the New Announcements information by selecting the yes radio button next to **Force check now?**. A check will be executed when you click the save button to close the configuration dialog.

- **Automatically check for updates to open My Oracle Support Issues?**

  To disable the Support Issues updates, deselect the checkbox. Updates are enabled by default.

  The last time an update of the Support Issues information was successfully executed is displayed below the title.

  You can force an update of the Support Issues information by selecting the yes radio button next to **Force check now?**. A check will be executed when you click the save button to close the configuration dialog.

- **Automatically check for Advisor Updates?**

  The MySQL Enterprise Service Manager can automatically look for changes to your MySQL Enterprise Advisors information by polling an Oracle software download Web site.
To disable the Advisor updates, deselect the checkbox. Updates are enabled by default.

You can force a check for updates to the Advisor information by selecting the yes radio button next to **Force check now?**. A check will be executed when you click the save button to close the configuration dialog.

Click save to save your settings. If you selected any system to force an update, the update will take place in the background. To cancel your changes, click cancel.

### 2.10 Performance Tuning MySQL Enterprise Monitor User Interface for Large Installations

By using MySQL database technology to store and process monitoring data, MySQL Enterprise Monitor has enough capacity to monitor large MySQL installations featuring many busy database servers. A MySQL Enterprise Monitor system can scale along with your monitoring requirements, using many of the same scale-out and scale-up techniques you use for your MySQL-powered web sites and applications.

When your MySQL Enterprise Monitor configuration becomes “large”, typically roughly 200 or more Agent instances, use the following guidelines to help plan the capacity of the machines you use to run MySQL Enterprise Monitor, and to tune MySQL Enterprise Monitor, its repository database, and other underlying components.

- Consider which rules to apply to which servers rather than enabling all rules or applying them to all servers. Certain issues are more likely to occur for particular MySQL servers based on their configuration and workload.

- Devote a machine with 16GB or more of memory, 12GB or more for the `innodb_buffer_pool_size` configuration option, and 1GB for the `innodb_log_file_size` configuration option. Consider adjusting other InnoDB-related configuration values higher also. For information about InnoDB-specific tuning, see Optimizing InnoDB Redo Logging, Optimizing InnoDB Disk I/O, and Optimizing InnoDB Configuration Variables.

- For a high-capacity MySQL Enterprise Monitor server, a fast RAID (0+1, 10) array with a number of spindles and fast disks (possibly SSDs) is ideal.

- When using MySQL 5.1 for the repository database (as is the case with the MySQL server bundled with MySQL Enterprise Monitor), enable the InnoDB Plugin for faster all-around InnoDB performance, if you are not using the InnoDB Plugin already. For setup instructions, see [http://dev.mysql.com/doc/refman/5.1/en/replacing-builtin-innodb.html](http://dev.mysql.com/doc/refman/5.1/en/replacing-builtin-innodb.html).

- Set `maxThreads` in the `<Connector>` element in `apache-tomcat/conf/server.xml` to at least the number of expected Agent instances, plus some extra slots for connections used by the Dashboard user interface. Adjust the `<Connector>` elements for plain HTTP, HTTPS/SSL, or both depending on the protocols you use with MySQL Enterprise Monitor User Interface.

- Consider adjusting the maximum size of the connection pool for the repository database instance. This setting is controlled by the parameter `dbpool.default.maxActive` in the `config.properties` file, whose location is listed in Section C.1.5, “The config.properties file”. The `dbpool.ui.maxActive` parameter controls the connection pool for the Dashboard user interface; by default, the Service Manager uses 15% of the connections specified by `dbpool.default.maxActive` to accommodate the Dashboard user interface.

- Especially if you make extensive use of the Query Analyzer, consider adjusting the `ehcache` parameters as described in Section 2.11.2, “Known MySQL Enterprise Monitor User Interface Problems and Workarounds”.

- Consider increasing the maximum heap size of the JVM for the Service Manager. For example, 300 or more Agents might require 2-4GB of heap, along with sufficient CPU capacity to perform garbage collection on such a large heap.
2.11 Troubleshooting the MySQL Enterprise Monitor User Interface

This section describes different kinds of issues that you might experience with the MySQL Enterprise Monitor User Interface, and how to solve or avoid them.

2.11.1 Diagnosing MySQL Enterprise Monitor User Interface Problems

To diagnose any issues with the MySQL Enterprise Monitor User Interface, start by looking at the Logs link under the Settings tab, as described in Section 2.8.6, “Logs”. This page consolidates troubleshooting information across all the MySQL Enterprise Monitor components.

2.11.2 Known MySQL Enterprise Monitor User Interface Problems and Workarounds

The message An item was expired by the cache while it was locked (increase your cache timeout) can be accompanied by a spike in CPU usage, gaps in data displayed by the Query Analyzer, or both. The workaround is to edit the apache-tomcat/webapps/ROOT/WEB-INF/classes/com/mysql/etools/monitor/pom/hib/ehcache-mysql.xml file and increase the value for maxElementsInMemory for the cache with the name "com.mysql.etools.monitor.pom.hib.HibInstanceAttribute" so that it is greater than the number of rows in the MySQL Enterprise Monitor inventory_instance_attributes table. This may also require configuring the service manager to have a larger maximum heap size, see Section C.1.1, “Configuring Tomcat Parameters”.

• Expect to install the Service Manager and the repository database instance on separate machines.
Chapter 3 Using the Query Analyzer

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The MySQL Query Analyzer lets you monitor SQL statements executed on a MySQL server and see
details about each query, as well as number of executions and execution times. Similar queries with
different literal values are combined (normalized) for reporting purposes.

Query Analyzer collects information about SQL statements that a MySQL client application sends to
the MySQL server. The client application must either route its database requests through the MySQL
Enterprise Monitor Agent proxy service, or use the MySQL Enterprise Monitor Plugin for a given
Connector that sends the information directly to MySQL Enterprise Service Manager. Once your
MySQL client application is configured to communicate via the MySQL Enterprise Monitor Agent,
queries are monitored and the normalized queries are sent to the MySQL Enterprise Monitor Agent.

For the different ways to enable Query Analysis, see Section 3.1, “Providing Query Analyzer Data” For
the user interface of the Query Analyzer, see Section 2.6, “The Query Analyzer Tab” and Section 3.2,
“Query Analyzer User Interface”.

Important

The MySQL Proxy component and Query Analyzer require that clients
connecting through MySQL Enterprise Monitor Agent use MySQL 5.0 or later.
Clients that use the libmysqlclient library provided with MySQL 4.1 or
earlier do not work with MySQL Enterprise Monitor Agent.

Once the data is collected, you view and monitor the queries, check the execution statistics, and filter
and drill down on the information. By comparing the queries to the server graphs, you can correlate
query execution with server status. For more information on viewing, filtering and reporting on the
Query Analyzer data, see Section 3.2, “Query Analyzer User Interface”.

Note

When MySQL Enterprise Monitor is not accessible from a Connector/J or
Connector/NET query analyzer plugin, then the application performance
will not be impacted. Over time, the plugin will determine that a backlog of
reportable data exists, and fall back to consolidating it over longer ranges of
time. But if more than 1,000 canonical queries are being used by the application
(an unlikely scenario), then data will begin to be dropped.
### 3.1 Providing Query Analyzer Data

The MySQL Query Analyzer can be fed information from a number of different sources, in each case with the provider supplying the statistical information about the queries, execution times, result counts and other data to be displayed and analyzed with the Query Analyzer tab within MySQL Enterprise Monitor User Interface.

There are a number of different methods available for supplying query information to MySQL Enterprise Service Manager:

- **Using the MySQL Proxy** functionality built into MySQL Enterprise Monitor Agent. This is the method offered and supported since MySQL Enterprise Monitor 2.0.

  When using the proxy, queries from the client application are directed through the proxy to the MySQL server, with all results from the MySQL server being returned from the proxy to the client application. While this transmission of information takes place, the proxy component keeps statistical information and supplies this information to MySQL Enterprise Service Manager for analysis.

  The following figure shows the structure of this process in relation to the MySQL server containing the client application data, the client application, and the MySQL Enterprise Monitor components:

  ![Figure 3.1 MySQL Enterprise Monitor Architecture using Query Analyzer with Proxy](image)

  For more information on using this method, see Section 3.1.5, “Using the Agent Proxy”.

- **Use a MySQL connector** with a corresponding MySQL Enterprise Monitor Plugin that provides tracing and statistical information directly to MySQL Enterprise Service Manager.

  Using this method requires a connector that is capable of collecting and sending the query statistical data directly to MySQL Enterprise Service Manager. The connectors handles all of the collection of the basic query statistics, such as the execution time for each query, and the row counts, and provides this information to MySQL Enterprise Service Manager for analysis. This solution negates
the need the proxy component, providing you with maximum speed between your application, connector and MySQL server containing your client application data.

The following figure shows the structure of this solution:

**Figure 3.2 MySQL Enterprise Monitor Architecture using Query Analyzer Directly from Connector**

For more information on using this method, see the following table for information on which connectors support this method of operation.

- Using a MySQL connector with a corresponding MySQL Enterprise Monitor Plugin that uses the aggregator functionality in MySQL Enterprise Monitor Agent to communicate information to MySQL Enterprise Service Manager.

Using the aggregator method, the MySQL Connector communicates raw statistical information about the queries and then sends this information to the MySQL Enterprise Monitor Agent, which aggregates the information into a format suitable for MySQL Enterprise Service Manager to perform the analysis and present the information.
Using the MySQL Enterprise Plugin for Connector/J

3.1.1 Using the MySQL Enterprise Plugin for Connector/J

The MySQL Enterprise Plugin for Connector/J lets you use the Query Analyzer to monitor MySQL queries from any application using the Connector/J JDBC driver. As described in Section 3.2, “Query Analyzer User Interface”, the Query Analyzer can help you locate queries that are inefficient or slow. Tuning such queries helps to shorten load times for web pages, and improves overall system responsiveness and scalability.

Information about the queries is sent directly to the MySQL Enterprise Service Manager. Once you install the MySQL Enterprise Plugin for Connector/J, query analysis becomes available for your applications without requiring any modification to the application code.

---

Figure 3.3 MySQL Enterprise Monitor Architecture using Query Analyzer with Aggregator

For more information on using this method, see the following table for information on which connectors support this method of operation.

Different connectors support either the direct and aggregator methods of supplying statistical information through a plugin that provides the necessary code to communicate either directly with MySQL Enterprise Service Manager, or indirectly through the MySQL Enterprise Monitor Agent aggregator. The following table provides information on which connectors support the different functionality types.

### Table 3.1 Query Analyzer Feeding Solution Comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>C/Java</th>
<th>C/.NET</th>
<th>C/PHP</th>
<th>Proxy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses Aggregator</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Uses Proxy</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Supports EXPLAIN</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

---
### Table 3.2 Query Analyzer Connector/J Summary

<table>
<thead>
<tr>
<th>Feature</th>
<th>C/Java</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses</td>
<td>No</td>
</tr>
<tr>
<td>Aggregator</td>
<td>No</td>
</tr>
<tr>
<td>Uses</td>
<td>No</td>
</tr>
<tr>
<td>Proxy</td>
<td>Yes</td>
</tr>
<tr>
<td>Supports</td>
<td>EXPLAIN</td>
</tr>
</tbody>
</table>

### Prerequisites

1. MySQL Connector/J version 5.1.12 or later.
2. JDK-1.5.0 or later.
3. MySQL Enterprise Service Manager version 2.2 or later.
4. The MySQL client application user must have **SELECT** privileges on the `mysql.inventory` table. This table contains the server **UUID**; it is required to report the Query Analyzer data to the MySQL Enterprise Service Manager. Use the **GRANT** statement. For example:

   ```sql
   mysql> GRANT SELECT on mysql.inventory to 'user'@'localhost' IDENTIFIED BY 'password';
   ```

5. Apache Commons logging in the **CLASSPATH** of the application being analyzed. If you are not already using Commons Logging, modify the application’s **CLASSPATH** as described in the following section to point to the JAR file bundled with the MySQL Enterprise Monitor product.

### Installation

Place the JAR file `lib/c-java-mysql-enterprise-plugin-version.jar` in the application’s **CLASSPATH** where it is visible to the version of MySQL Connector/J in use. Ideally, use the same location as MySQL Connector/J’s JAR file, or in a parent classloader to that JAR file’s location.

If the application being analyzed does not have Apache Commons Logging in the **CLASSPATH**, install the file `lib/required/commons-logging-1.1.1.jar` in the application’s **CLASSPATH** as well. If no other component in your application uses Apache Commons Logging, install it in the same place where the Query Analyzer plugin was installed.

There is static shutdown() method on `com.mysql.etools.jdbc.StatementPerformanceCounters`, which can be used to cleanly shutdown the query analysis plugin when the application is going to be shutdown.

If the application in question is deployed in a J(2)EE application server, there is an included `ContextListener` distributed with the plugin which will call this method when the application’s context is shutdown (or reloaded). Application Servers which support `@WebListener` (such as JEE6 and above) do not need to do any extra configuration, but users with older Application Servers need to add the following line to their application’s **web.xml** file:

```xml
    <listener>
      <listener-class>
        com.mysql.etools.jdbc.ContextListener
      </listener-class>
    </listener>
```

The Connector/J plugin prior to version 1.0.81 can use a workaround by placing the plugin in the shared library loader of their Application Server, rather than in the **WEB-INF/lib** directory.
Configuration

Once the required JAR files are deployed, modify the connection URL for JDBC to use and configure the Query Analyzer plugin. Add the following properties and their corresponding values to the URL that is used by the application you are monitoring.

For more information on Connector/J properties, see Connector/J (JDBC) Reference.

Table 3.3 MySQL Monitor Plugin for Connector/J Options

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Property Type</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>mysqlenterprise.disableSourceLocation</td>
<td>boolean</td>
<td>false</td>
</tr>
<tr>
<td>mysqlenterprise.serviceManagerConnectTimeout</td>
<td>numeric</td>
<td></td>
</tr>
<tr>
<td>mysqlenterprise.serviceManagerPassword</td>
<td>string</td>
<td></td>
</tr>
<tr>
<td>mysqlenterprise.serviceManagerResponseTimeout</td>
<td>numeric</td>
<td></td>
</tr>
<tr>
<td>mysqlenterprise.serviceManagerUrl</td>
<td>string</td>
<td></td>
</tr>
<tr>
<td>mysqlenterprise.serviceManagerUser</td>
<td>string</td>
<td></td>
</tr>
</tbody>
</table>

- statementInterceptors = com.mysql.etools.jdbc.StatementPerformanceCounters

  Enables the operation of the plugin. Without this configuration option, query information is not provided to MySQL Enterprise Service Manager.

- mysqlenterprise.disableSourceLocation

  Whether to send stack traces with example queries to the service manager.

- mysqlenterprise.serviceManagerUrl

  Permitted Values

<table>
<thead>
<tr>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>string</td>
</tr>
</tbody>
</table>

  Specifies the URL to the service manager. You can get this information from the configuration file created when MySQL Enterprise Service Manager was installed. You must include the full URL, including the port number. For example, http://monitor.example.com:18080.

- mysqlenterprise.serviceManagerUser

  Permitted Values

<table>
<thead>
<tr>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>string</td>
</tr>
</tbody>
</table>

  Specifies the agent username to be used when communicating information to MySQL Enterprise Service Manager.

- mysqlenterprise.serviceManagerPassword

  Permitted Values

<table>
<thead>
<tr>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>string</td>
</tr>
</tbody>
</table>

  Specifies the agent password to be used when communicating information to MySQL Enterprise Service Manager.

- Optional

  - mysqlenterprise.serviceManagerConnectTimeout
Using the MySQL Enterprise Plugin for Connector/J

### mysqlenterprise.serviceManagerResponseTimeout

<table>
<thead>
<tr>
<th>Introduced</th>
<th>2.3.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type</td>
</tr>
</tbody>
</table>

The number of milliseconds to wait for pending reads or writes to or from the Service Manager to complete before timing out. The default is no timeout. Introduced in Connector/J version 1.0.0.61.

To use SSL to communicate query information to the MySQL Enterprise Service Manager, configure the following properties. Out of the box, the plugin is configured to work with the self-signed certificates that ship with the MySQL Enterprise Monitor. Therefore, it provides confidentiality for the information that is sent by the plugin if the service manager URL starts with `https://`. However, as configured, the plugin does not prevent man-in-the-middle attacks, nor does it support client-side certificates for authentication. To enable these features, change the values of the following parameters:

#### Table 3.4 MySQL Monitor Plugin for Connector/J SSL Options

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Property Type</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>mysqlenterprise.clientCertificateKeystorePassword</td>
<td>string</td>
<td></td>
</tr>
<tr>
<td>mysqlenterprise.clientCertificateKeystoreType</td>
<td>string</td>
<td></td>
</tr>
<tr>
<td>mysqlenterprise.clientCertificateKeystoreUrl</td>
<td>string</td>
<td></td>
</tr>
<tr>
<td>mysqlenterprise.trustCertificateKeystorePassword</td>
<td>string</td>
<td></td>
</tr>
<tr>
<td>mysqlenterprise.trustCertificateKeystoreType</td>
<td>numeric</td>
<td></td>
</tr>
<tr>
<td>mysqlenterprise.trustCertificateKeystoreUrl</td>
<td>string</td>
<td></td>
</tr>
<tr>
<td>mysqlenterprise.verifySslCerts</td>
<td>boolean</td>
<td>false</td>
</tr>
<tr>
<td>mysqlenterprise.verifySslHostnames</td>
<td>boolean</td>
<td>false</td>
</tr>
</tbody>
</table>

- **mysqlenterprise.verifySslHostnames**
  
<table>
<thead>
<tr>
<th>Permitted Values</th>
<th>Type</th>
<th>boolean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>false</td>
<td></td>
</tr>
</tbody>
</table>

  If set to "true", host names presented in the SSL server certificate are verified following the same scheme as used by Firefox and Curl and specified by RFC 2818.

- **mysqlenterprise.verifySslCerts**

<table>
<thead>
<tr>
<th>Permitted Values</th>
<th>Type</th>
<th>boolean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>false</td>
<td></td>
</tr>
</tbody>
</table>

  Specifies whether the plugin verifies that the certificate presented by the server was signed by a CA in the **trustCertificateKeystore**.

- **mysqlenterprise.trustCertificateKeystoreUrl**

<table>
<thead>
<tr>
<th>Permitted Values</th>
<th>Type</th>
<th>string</th>
</tr>
</thead>
<tbody>
<tr>
<td>URL to the trusted root certificate KeyStore (if not specified, use Java defaults).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• **mysqlenterprise.trustCertificateKeystorePassword**

  **Permitted Values**  | **Type**  | **string**

  Password for the certificate store.

• **mysqlenterprise.trustCertificateKeystoreType=[type]**

  **Permitted Values**  | **Type**  | **numeric**

  KeyStore type for trusted root certificates (NULL or empty means use **JKS** default, standard keystore types supported by the JVM are **JKS** and **PKCS12**, your environment may have more available depending on what security products are installed and available to the JVM.

• **mysqlenterprise.clientCertificateKeystoreUrl**

  **Permitted Values**  | **Type**  | **string**

  URL to the client certificate KeyStore (if not specified, use Java defaults)

• **mysqlenterprise.clientCertificateKeystorePassword=[password]**

  **Permitted Values**  | **Type**  | **string**

  Password for the client certificate store.

• **mysqlenterprise.clientCertificateKeystoreType**

  **Permitted Values**  | **Type**  | **string**

  KeyStore type for client certificates (NULL or empty means use **JKS** default, standard keystore types supported by the JVM are **JKS** and **PKCS12**, your environment may have more available depending on what security products are installed and available to the JVM.

For example, to configure a Connector/J to communicate with the MySQL Enterprise Service Manager localhost, on port 18080, using the agent username agent, and password PASSWORD, you would add the following options to your connection string (but define the option on a single line):

```java
statementInterceptors=com.mysql.etools.jdbc.StatementPerformanceCounters
&serviceManagerUrl=http://localhost:18080/
&serviceManagerUser=agent
&serviceManagerPassword=PASSWORD
```

Remember that you must also add the application-specific options to the JDBC URL. For example, the following fragment connects to the MySQL database **test** on localhost, using the user and password of **mysqltest**, while also collecting query data and sending it to the MySQL Enterprise Service Manager on localhost:

```java
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.SQLException;

Connection conn = null;
...
try {
    conn =
        DriverManager.getConnection("jdbc:mysql://localhost/test?" +
        "user=mysqltest" +
        "password=mysqltest" +
        "&statementInterceptors=com.mysql.etools.jdbc.StatementPerformanceCounters" +
        "&serviceManagerUrl=http://localhost:18080/" +
```
Using the MySQL Enterprise Plugin for Connector/PHP

```java
"&serviceManagerUser=agent" +
"&serviceManagerPassword=PASSWORD"
);

// Do something with the Connection
...
} catch (SQLException ex) {
    // handle any errors
}
```

**Note**

If a DataSource is in use (typically when using Glassfish, Weblogic, or Websphere), these properties must be passed as part of the URL property, they cannot be added to the DataSource configuration itself.

If an alternate logging system has not been selected for Connector/J, it is recommended that Connector/J's log factory is configured to use something other than the standard logger by adding the following property to the URL or DataSource:

- `logger=Log4JLogger` (for applications using Log4J)
- `logger=CommonsLogger` (for applications using Apache Commons Logging)
- `logger=Jdk14Logger` (for applications using Java 1.4 or later logging)

Further configuration of the plugin is done via the Enterprise Service Manager's user interface, using the **Query Analyzer** tab. From here, the capture of query performance data for a given MySQL instance that the plugin is being with can be enabled or disabled. Further, the level of detail that is captured; summary, examples (with source code locations) and EXPLAIN plans can be configured as well.

The Query Analyzer plugin checks the configuration once each minute (while it is reporting data it has collected), thus configuration changes are not immediate.

**Usage**

After you set up MySQL Enterprise Plugin for Connector/J, you monitor the performance of your Java applications through the **Query Analyzer** tab, as described in Section 3.2, “Query Analyzer User Interface”.

**Troubleshooting**

Be aware of the following while using the MySQL Enterprise Plugin for Connector/J:

- When a Java application that is reporting queries terminates, you might lose the information about some queries because the queued query information has not been sent to MySQL Enterprise Service Manager. To work around this issue, add a sleep to your application to ensure the normal reporting schedule submits the outstanding queries. For example, you could add:

```java
Thread.sleep(60000);
```

to your application, to pause before the application terminates.

**3.1.2 Using the MySQL Enterprise Plugin for Connector/PHP**

The MySQL Enterprise Plugin for Connector/PHP lets you use the **Query Analyzer** to monitor MySQL queries from PHP applications, such as PHP-enabled web pages. As described in Section 3.2, “Query Analyzer User Interface”, the Query Analyzer can help you locate queries that are inefficient or slow. Tuning such queries helps to shorten load times for web pages, and improves overall system responsiveness and scalability.
The PHP query data is routed through the aggregator component of MySQL Enterprise Monitor Agent. Because PHP processes are typically short-lived, the Aggregator receives bursts of query information from the PHP plugin, aggregates and computes statistics, and periodically sends this data to the MySQL Enterprise Service Manager, where it is displayed on the Query Analyzer tab. You must have the MySQL Enterprise Agent Aggregator enabled and running to use Query Analyzer with PHP applications. See Section 3.1.4, “Using the MySQL Enterprise Agent Aggregator” for details about setting up the MySQL Enterprise Agent Aggregator.

Table 3.5 MySQL Enterprise Plugin for Connector/PHP Summary

<table>
<thead>
<tr>
<th>Feature</th>
<th>C/PHP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses Aggregator</td>
<td>Yes</td>
</tr>
<tr>
<td>Uses Proxy</td>
<td>No</td>
</tr>
<tr>
<td>Supports EXPLAIN</td>
<td>No</td>
</tr>
</tbody>
</table>

Prerequisites

The MySQL Enterprise Plugin for Connector/PHP requires PHP 5.3.2 or above, with the MySQL native driver, mysqlnd, installed. This is the recommended configuration. If your PHP installation was not configured with the mysqlnd enabled, you must rebuild and install PHP from source using at least one of the following options:

- --with-mysqli=mysqlnd
- --with-pdo-mysql=mysqlnd
- --with-mysql=mysqlnd

The preceding options are supplied to the configure command, depending on which extension you are using (mysqli, PDO_MYSQL). If you use more than one extension, provide multiple options. Specifying any of the options listed rebuilds PHP with mysqlnd support. You also must enable the PHP JSON module.

For further information on MySQL Native Driver (mysqlnd), see MySQL Native Driver.

The MySQL client application user, that makes PHP connections in your PHP code, must have SELECT privileges on the mysql.inventory table. This table contains the server UUID; it is required to report the Query Analyzer data to the MySQL Enterprise Service Manager. Use the GRANT statement. For example:

```
mysql> GRANT SELECT on mysql.inventory to 'user'@'localhost' IDENTIFIED BY 'password';
```

Installation

The plugin is provided as a regular PHP module (PHP extension), and installation follows those PHP standard procedures as described on http://php.net/install.pecl.

Download the MySQL Enterprise Plugin for Connector/PHP, then use the following step-by-step instructions to install and configure the MySQL Enterprise Plugin for Connector/PHP extension.

1. Locate your php.ini configuration file. If you do not know the location, you can view information about your PHP installation by creating a script containing:

```php
<?php phpinfo(); ?>
```
Place the script within a directory configured for providing PHP web pages. Now load the page in your web browser to see a list of configuration and other information about your PHP installation.

Check the output for **Loaded Configuration File**. If the value is *(none)*, refer to the **Configuration File (php.ini) Path** and create a file called `php.ini` in there. If a **Scan this dir for additional .ini files** option is listed you can also create a file using any name you like, ending `.ini`, in that directory to set configuration options.

2. Identify whether or not your PHP build was built “thread safe” by checking the **Thread Safety** value in the output from the `phpinfo()` test. If your PHP build is thread safe, you need `mysqlenterprise_ts.so` on Linux and Unix, or `php_mysqlenterprise_ts.dll` on Microsoft Windows. If not, use `mysqlenterprise.so` on Linux, Unix, or `php_mysqlenterprise.dll` on Microsoft Windows.

3. Add an entry for the MySQL Enterprise Plugin for Connector/PHP module. You can use the full path:

   ```
   extension=/path/to/mysqlenterprise.so
   ```

   Alternatively, put the file into the directory identified by your `extension_dir` configuration option, and specify just the filename:

   ```
   extension=mysqlenterprise.so
   ```

   **Note**

   If `mysqlnd` is loaded as a shared library (`mysqlnd.so`), then it must be loaded before `mysqlenterprise.so` as otherwise an error such as “PHP Warning: PHP Startup: Unable to load dynamic library ’mysqlenterprise.so’ - /mysqlenterprise.so: undefined symbol: mysqlnd_plugin_register in Unknown on line 0” will be emitted by PHP. Either:

   - If `php.ini` is used to load the PHP extensions, then list it first. For example:
     ```
     extension=mysqlnd.so
     extension=mysqlenterprise.so
     ```
   - If individual ini files are used to load the PHP extensions, then note that the ini files are loaded alphabetically, so adjust accordingly so that `mysqlnd.so` is loaded first. For example, `/etc/php.d/` might contain:
     ```
     mysqlnd.ini
     mysqlzz_enterprise.ini
     ```

4. Restart your Web server application to reload PHP and the configured extensions.

5. Now reload the `phpinfo()` page that you created earlier, and inspect the listing for the `mysqlenterprise` module.

   **Caution**

   If you are using PHP on Microsoft Windows with the Apache web server (httpd) built from apache.org, note the following.

   Historically, the Win32 Apache web server binary from apache.org is compiled with the legacy Microsoft Visual Studio 6 compiler (VC6). MySQL no longer supports VC6, and as a consequence the MySQL Enterprise Plugin for
Connector/PHP for Microsoft Windows is compiled with the newer VC9 compiler. You cannot use PHP as a loaded module with an Apache web server build that uses VC6. Alternative Apache builds exist that use VC9, so check your source and be sure that your binaries are both compiled using VC9. Or, instead of loading PHP as a module, you can run PHP in (Fast)CGI mode. See http://windows.fyicenter.com/view.php?ID=68&R=71 for configuration details.

Note that PHP binaries for Microsoft Windows from php.net have compiled in `mysqlnd` support by default, since PHP 5.3.0.

## Configuration

The configuration of the MySQL Enterprise Plugin for Connector/PHP is handled through the standard PHP configuration files, either globally using `php.ini`, or by using the per-directory options, as detailed in PHP Configuration. The following table shows the available configurable options.

### Table 3.6 MySQL Enterprise Plugin for Connector/PHP Options

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Property Type</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>aggregator_connect_timeout_sec</code></td>
<td>integer</td>
<td>1</td>
</tr>
<tr>
<td><code>aggregator_connect_timeout_usec</code></td>
<td>integer</td>
<td>0</td>
</tr>
<tr>
<td><code>aggregator_password</code></td>
<td>string</td>
<td></td>
</tr>
<tr>
<td><code>aggregator_url</code></td>
<td>string</td>
<td>tcp://127.0.0.1:14000</td>
</tr>
<tr>
<td><code>aggregator_user</code></td>
<td>string</td>
<td></td>
</tr>
<tr>
<td><code>debug_callback</code></td>
<td>string</td>
<td></td>
</tr>
<tr>
<td><code>disable_backtrace</code></td>
<td>boolean</td>
<td>1</td>
</tr>
<tr>
<td><code>log_file</code></td>
<td>string</td>
<td></td>
</tr>
<tr>
<td><code>quan_enabled</code></td>
<td>boolean</td>
<td>1</td>
</tr>
</tbody>
</table>

The following list describes these options in more detail:

- **mysqlenterprise.quan_enabled**
  
  Type: `boolean`
  
  Permitted Values: `true`, `false`
  
  Default: `true`

  A boolean value specifying whether query analysis should be enabled.

  PHP Category: `PHP_INI_PERDIR`

- **mysqlenterprise.aggregator_url**
  
  Permitted Values: `string`
  
  Default: `tcp://127.0.0.1:14000`

  A string specifying the hostname and port for the MySQL Enterprise Agent Aggregator.

  PHP Category: `PHP_INI_ALL`

- **mysqlenterprise.aggregator_user**
  
  Permitted Values: `string`
  
  Default: `null`
The user name for communicating with the MySQL Enterprise Agent Aggregator. This is defined in the MySQL Enterprise Monitor dashboard, and is assigned the **Agent** role.

**Note**
This will only have an effect if the password *(mysqlenterprise.aggregator_password)* is also set.

**PHP Category:** *PHP_INI_SYSTEM*

- *mysqlenterprise.aggregator_password*
  
  **Permitted Values**
  
  **Type** string

  The password for communicating with the MySQL Enterprise Agent Aggregator. This is defined in the MySQL Enterprise Monitor dashboard.

  **Note**
  This will only have an effect if the user *(mysqlenterprise.aggregator_user)* is also set.

  **PHP Category:** *PHP_INI_SYSTEM*

- *mysqlenterprise.aggregator_connect_timeout_sec*
  
  **Permitted Values**
  
  **Type** integer
  
  **Default** 1

  Timeout in seconds when communicating with the MySQL Enterprise Agent Aggregator.

  **Note**
  The settings for *mysqlenterprise.aggregator_connect_timeout_sec* and *mysqlenterprise.aggregator_connect_timeout_usec* are combined (added together) to determine the timeout.

  **PHP Category:** *PHP_INI_SYSTEM*

- *mysqlenterprise.aggregator_connect_timeout_usec*
  
  **Permitted Values**
  
  **Type** integer
  
  **Default** 0

  The microseconds part of the timeout when communicating with the MySQL Enterprise Agent Aggregator.

  **Note**
  The settings for *mysqlenterprise.aggregator_connect_timeout_sec* and *mysqlenterprise.aggregator_connect_timeout_usec* are combined (added together) to determine the timeout.

  **PHP Category:** *PHP_INI_SYSTEM*

- *mysqlenterprise.disable_backtrace*
  
  **Permitted Values**
  
  **Type** boolean
  
  **Default** 1
Whether a backtrace will be generated. A backtrace is helpful while locating the source of errors, but it will have a performance impact.

**PHP Category:** PHP\_INI\_ALL

- **mysqlenterprise.debug_callback**

  **Permitted Values**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>mysqlenterprise.debug_callback</td>
<td>string</td>
</tr>
</tbody>
</table>

  Name of the callback function to be invoked whenever data is sent to the agent. This callback is defined in the PHP application, and is a PHP function that requires one parameter. This parameter is an array of HTTP requests made to the aggregator.

  **Note**

  This should only be set while debugging MySQL Enterprise Monitor, and likely only used when support personal asks for it and defines how you should use this configuration option.

**PHP Category:** PHP\_INI\_ALL

- **mysqlenterprise.log_file**

  **Permitted Values**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>mysqlenterprise.log_file</td>
<td>string</td>
</tr>
</tbody>
</table>

  Opens a file to log all the Query Analyzer information sent to MySQL Enterprise Agent Aggregator while monitoring queries.

  **Note**

  This should only be enabled while debugging MySQL Enterprise Monitor because it will log every request, which may result in a large log file.

**PHP Category:** PHP\_INI\_SYSTEM

For example, you might configure your `php.ini` file with the following options:

```plaintext
extension = /usr/local/apache/php/lib/php/extensions/mysqlenterprise.so
mysqlenterprise.aggregator_url = tcp://aggregator:14000
mysqlenterprise.quan_enabled = 1
mysqlenterprise.debug_callback = cta_callback
mysqlenterprise.disable_backtrace = 1
mysqlenterprise.aggregator_user = username
mysqlenterprise.aggregator_password = "password"
```

The Aggregator-related options must be set, as MySQL Enterprise Plugin for Connector/PHP cannot function without a connection to the Aggregator.

  **Note**

  Restart your web server for the configuration options to take effect. Verify your desired settings are in effect by checking the output of the `phpinfo()` PHP function.

**Usage**

After you set up MySQL Enterprise Plugin for Connector/PHP, you monitor the performance of your PHP applications through the **Query Analyzer** tab, as described in Section 3.2, “Query Analyzer User Interface”.
Troubleshooting

When the MySQL Enterprise Plugin for Connector/PHP connects to a MySQL server, it must be able to retrieve the UUID of that server. If there is a problem, for example if the `mysql.inventory` table does not exist or the MySQL user does not have privileges to read it, the problem is reported using the standard PHP error reporting mechanism. PHP classifies such a problem as an `E_WARNING`. Depending on how you have configured PHP error reporting, the associated messages might be displayed as part of the application output, stored in a PHP error log file, or discarded. For instructions to set up an Agent UUID, see Section 5.3.8, “Generating a New UUID”. For specific details about PHP error reporting, see http://php.net/errorfunc.

Note

In PHP, the `error_log` PHP directive defines the location of the PHP error log, and its usage requires that the `log_errors` PHP directive is enabled.

3.1.3 Using the MySQL Enterprise Plugin for Connector/Net

The MySQL Enterprise Plugin for Connector/Net lets you use the Query Analyzer to monitor MySQL queries from any application using Connector/Net, including both standalone and web-based applications. As described in Section 3.2, “Query Analyzer User Interface”, the Query Analyzer can help you locate queries that are inefficient or slow. Tuning such queries helps to shorten load times for web pages, and improves overall system responsiveness and scalability.

Information about the queries is sent directly to the MySQL Enterprise Service Manager. Once you install the MySQL Enterprise Plugin for Connector/Net, query analysis becomes available for your applications without requiring any modification to the application code.

Table 3.7 Query Analyzer Connector/Net Summary

<table>
<thead>
<tr>
<th>Feature</th>
<th>C/NET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses Aggregator</td>
<td>No</td>
</tr>
<tr>
<td>Uses Proxy</td>
<td>No</td>
</tr>
<tr>
<td>Supports EXPLAIN</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Prerequisites

- You must be using Connector/Net version 6.2.3 or later.
- The MySQL client application user must have SELECT privileges on the `mysql.inventory` table. This table contains the server UUID; it is required to report the Query Analyzer data to the MySQL Enterprise Service Manager. Use the `GRANT` statement. For example:

  ```
  mysql> GRANT SELECT on mysql.inventory to 'user'@'localhost' IDENTIFIED BY 'password';
  ```

- Your application should already be using the `Mysql.data.dll` and have been built with the library requirement.
- If you are using the released builds of Connector/Net, you must include the `logging=true` option within your connection string.

Installation

Download the MySQL Enterprise Plugin for Connector/Net package. Extract the package using a suitable zip tool, and then place the plugin library, `MySql.MonitorPlugin.dll`, in the same directory as your compiled application.
Configuration

If the application to profile does not have an app.config application configuration file, then make one.

To enable Query Analyzer functionality, register the trace listeners in the System.Diagnostics section of the app.config file. The following example shows the format of a typical configuration file:

```xml
<system.diagnostics>
  <sources>
    <source name="mysql" switchName="SourceSwitch" switchType="System.Diagnostics.SourceSwitch">
      <listeners>
        <add name="EMTrace" type="MySql.EMTrace.EMTraceListener, MySql.MonitorPlugin"
          initializeData="" Host="SERVERHOST:SERVERPORT" PostInterval="POSTINTERVAL" UserId="AGENTUSERID" Password="AGENTPASSWORD"/>
      </listeners>
    </source>
  </sources>
  <switches>
    <add name="SourceSwitch" value="All"/>
  </switches>
</system.diagnostics>
<system.data>
<DbProviderFactories>
</DbProviderFactories>
</system.data>
```

Within the configuration, set the values of the following parameters:

- **Host**
  The hostname and port number, separated by a colon, of the MySQL Enterprise Service Manager that receives the Query Analyzer data.

- **PostInterval**
  Query analyzer information is collected and then transmitted ("posted") in a batch from your application to the MySQL Enterprise Service Manager. This value specifies the number of seconds between each transmission. Choose this value carefully. Too long and it might take some time for queries to appear in the Query Analyzer.

- **UserId**
The name of a user within MySQL Enterprise Service Manager that has rights to send agent information.

- **Password**

The password of a user within MySQL Enterprise Service Manager that has rights to send agent information.

To get extended information on queries and have that information available through the Dashboard, enable the Connector/Net usage advisor. The extended information identifies potential issues such as a query not using an index, or not accessing all columns from a result set.

To enable the usage advisor, add `usage_advisor=true` to the connection string within your application. Enabling this option also automatically enables logging within Connector/Net. For more information, see Connector/Net Connection String Options Reference.

During execution of the application during development within Visual Studio, a significant amount of output is displayed in the Output window. To view this same trace output when running the application outside Visual Studio, configure an additional listener by adding the following within the `system.diagnostics` section of your `app.config` file:

```xml
<trace autoflush="false" indentsize="4">
  <listeners>
    <add name="consoleListener" type="System.Diagnostics.ConsoleTraceListener" />
  </listeners>
</trace>
```

**Usage**

After you set up MySQL Enterprise Plugin for Connector/Net, you monitor the performance of your .NET applications through the Query Analyzer tab, as described in Section 3.2, "Query Analyzer User Interface".

### 3.1.4 Using the MySQL Enterprise Agent Aggregator

The optional MySQL Enterprise Agent Aggregator component of the MySQL Enterprise Monitor Agent collects query performance data from additional sources, such as an instrumented application server, user-written scripts, or possible future connectors. It combines and formats the query data for display within the Query Analyzer window, using multithreading to avoid performance bottlenecks. (The .NET and Java connectors bypass the aggregator; they do their own multithreaded processing internally.)

The following figure shows the data flow between your application, various MySQL Enterprise Monitor components, and the database server when you use the MySQL Enterprise Agent Aggregator.
Using the MySQL Enterprise Agent Aggregator

Figure 3.4 The MySQL Enterprise Monitor Architecture using aggregator and agent services for the same MySQL Server

From the illustration, query data is provided by each individual MySQL Enterprise Plugin for Connectors as queries are executed through the corresponding connector. Query data is distributed up to the aggregator, which reports the corresponding Query Analyzer data to the MySQL Enterprise Service Manager.

Note
When using the aggregator service, the MySQL Enterprise Monitor Agent requires a variable amount of memory overhead to collect and pass on the data from connectors to the MySQL Enterprise Service Manager. The amount depends on the number and text size of executed SQL statements.

You can configure support for the aggregator during the installation of the MySQL Enterprise Monitor Agent. This sets the correct configuration information within the agent configuration files. If you do not configure the MySQL Enterprise Agent Aggregator during installation, the corresponding lines for configuration are commented out.

To re-enable the aggregator service in your agent:

1. Shut down the MySQL Enterprise Monitor Agent.
2. Uncomment the MySQL Enterprise Agent Aggregator lines from the etc/mysql-monitor-agent.ini:

```
# Aggregator Parameters
aggr-address=:14000
aggr-lua-script=lib/mysql-aggregator/lua/aggr.lua
aggr-mem-baseurl=http://memserver:18080/v2/rest
```

3. Add the `aggr` keyword to the plugins parameter. For example:

```
plugins=aggr,agent
```

4. Start the MySQL Enterprise Monitor Agent.
The key configuration option is `aggr-address`, which sets the address and port on which to listen for incoming aggregator information. The following table shows the list of available options for the aggregator.

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
<th>Introduced</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--aggr-address</code></td>
<td>Listening address:port combination</td>
<td>2.3.0</td>
</tr>
<tr>
<td><code>--aggr-flush-interval</code></td>
<td>The interval in seconds between flushes of query data to the MySQL Enterprise Service Manager</td>
<td>2.3.0</td>
</tr>
<tr>
<td><code>--aggr-lua-script</code></td>
<td>Path to the Lua script</td>
<td>2.3.0</td>
</tr>
<tr>
<td><code>--aggr-max-request-body-size</code></td>
<td>Limits the maximum size of requests sent to the Aggregator, to avoid potential out-of-memory errors</td>
<td>2.3.8</td>
</tr>
<tr>
<td><code>--aggr-mem-baseurl</code></td>
<td>Base URL of the server</td>
<td>2.3.0</td>
</tr>
<tr>
<td><code>--aggr-ssl-address</code></td>
<td>Listening port:address combination for SSL connections</td>
<td>2.3.0</td>
</tr>
<tr>
<td><code>--aggr-ssl-ca-file</code></td>
<td>CA certificate file</td>
<td>2.3.0</td>
</tr>
<tr>
<td><code>--aggr-ssl-cert-file</code></td>
<td>Server certificate (PEM)</td>
<td>2.3.0</td>
</tr>
<tr>
<td><code>--aggr-ssl-ciphers</code></td>
<td>Supported ciphers for SSL</td>
<td>2.3.0</td>
</tr>
<tr>
<td><code>--aggr-test-mode</code></td>
<td>Start the aggregator in test mode</td>
<td>2.3.0</td>
</tr>
</tbody>
</table>

For more information on setting these options and others, see Section C.2, “MySQL Enterprise Monitor Agent Reference”.

### 3.1.5 Using the Agent Proxy

There are three different ways of feeding Query Analyzer using the proxy component of the MySQL Enterprise Monitor Agent:

- Change your MySQL client application to talk to the Proxy port you configured during installation. This requires changing your MySQL client application code, and may require that you stop and restart your MySQL client application, but does not require any changes to the MySQL server. For more information, see Section 3.1.5.1, “Enabling Query Analyzer by Changing the MySQL Client Application”.

- Change your MySQL server to listen on a different port, and configure the proxy to listen on the original MySQL server port. This does not require any changes to your MySQL client application, but requires shutting down and restarting the MySQL server, which might affect its cache and cause a temporary performance drop. For more information, see Section 3.1.5.2, “Enabling Query Analyzer by Changing MySQL Server”.

- Use IP tables to redirect the network packets to the proxy.

#### Example 3.1 Routing with Proxy and IP tables on Linux

This example assumes that default ports are used, it’s on localhost, the proxy is installed on to the database box itself, and that it will not work on an intermediary server.

**Enabling (with `--I`):**

```
sudo iptables -t nat -I PREROUTING -s ! 127.0.0.1 -p tcp --dport 3306 -j REDIRECT --to-ports 6446
```

**Disabling (with `--D`):**

```
sudo iptables -t nat -D PREROUTING -s ! 127.0.0.1 -p tcp --dport 3306 -j REDIRECT --to-ports 6446
```
Important

MySQL Query Analyzer gathers query performance information from a variety of sources. Query Analyzer uses a new agent plug-in to proxy your queries and collect performance data that is then transmitted to the Enterprise Monitor. This is a new role for the Agent: it is no longer just monitoring, it is now optionally between your MySQL client application and the MySQL server.

Depending upon your system load, it is possible to overload the proxy or have the proxy/agent consume system resources needed by mysql itself. In particular, the memory needed by the MySQL Agent for basic monitoring is fairly small and consistent and depends on the number of rules you have enabled. However, when the Query Analyzer is enabled, the Agent can use significantly more memory to monitor and analyze whatever queries you direct through it. In this case, the amount of memory used depends on the number of unique normalized queries, example queries and example EXPLAINs being processed plus the network bandwidth required to send this query performance data to the Service Manager. In general, the amount of memory used for the Query Analyzer is well-bounded, but under heavy load or, in some cases under older versions of linux, RAM usage by Query Analyzer could be too high for your environment and load.

Therefore, we advise you to use this release of Query Analyzer extensively in development, test and stage environments under load for an extended period of time before considering usage in a production environment. For all deployments:

1. Carefully monitor the Agent's resource consumption using the new graph Memory Usage - Agent graphs available on the Graph tab. You can also add an SMTP or SNMP notification to the new Heat Chart rule MySQL Agent Memory Usage Excessive.

2. If the amount of memory consumed is too high, consider sampling queries during nonpeak hours or monitoring only a subset of queries on this system.

Note: zone-specific memory usage is not available for 32-bit Solaris operating systems.

If you experience any problems with Query Analyzer, we are interested in working with you closely and quickly to resolve them. Please open a service request right away. We are working hard on optimizing Agent/proxy RAM usage.

Note that you must enable Query Analyzer within the proxy during agent installation. If you did not enable Query Analyzer during the installation of the agent, check the following elements within the main mysql-monitor-agent.ini configuration file:

- Add the proxy keyword to the plugins parameter. For example:

  plugins=proxy,agent

- Ensure that the quan.lua items file is enabled in the agent-item-files configuration property:

  agent-item-files = share/mysql-monitor-agent/items/quan.lua,share/mysql-monitor-agent/items/items-mysql-monitor.xml

- Check and set the proxy-address, proxy-backend-addresses, and proxy-lua-script settings are configured:

  proxy-address=:6446
Using the Agent Proxy

`proxy-backend-addresses = 127.0.0.1:3306`  
`proxy-lua-script = share/mysql-monitor-agent/quan.lua`

For more information on these configuration options, see Section C.2.1, “MySQL Enterprise Monitor Agent Configurable Options”.

You might also need to make some additional changes to the security configuration on your server to ensure that queries are correctly reported to MySQL Enterprise Service Manager:

- Check the authorization for each user ID used in the connect strings for MySQL client applications that connect through the proxy. Each such user ID must be allowed to connect to the MySQL server from the host on which the agent is running. When the application connects to the server with the proxy as an intermediary, the client host name is the host name of the system running the agent.

  **Warning**

  Because the proxy is providing the immediate connectivity to the MySQL server, authentication must use the proxy hostname, not the client hostname.

To update your user credentials, use the `GRANT` statement. For example:

```
mysql> GRANT SELECT,UPDATE,INSERT on database.* to 'user'@'localhost' IDENTIFIED BY 'password';
```

- The MySQL client application user must have `SELECT` privileges on the `mysql.inventory` table. This table contains the server `UUID`; it is required to report the Query Analyzer data to the MySQL Enterprise Service Manager. Use the `GRANT` statement. For example:

```
mysql> GRANT SELECT on mysql.inventory to 'user'@'localhost' IDENTIFIED BY 'password';
```

### 3.1.5.1 Enabling Query Analyzer by Changing the MySQL Client Application

Generally, changing your MySQL client application is the easiest and recommended method. For example, given a typical structure like the one in the following figure, you would modify the client application so that it communicated to the proxy rather than directly with the MySQL server,

**Figure 3.5 MySQL Enterprise Monitor User Interface: Standard Agent/Monitor Topology**

```
+-----------------+         +-----------------+         +-----------------+
|    Client      |         |     Monitored   |         |     MySQL       |
|Application     |         |    MySQL Server |         |      Server     |
|                |         |                 |         |                |
|                +--------+-----------------+         +-----------------+  
|                  |       |    MySQL        |         |       Enterprise |
|                  |       |  Enterprise     |         |     Monitor     |
|                  |       |    Monitor      |         |                |
|                  |       |Agent            |         |                |

```

The following figure shows an example of the structure when communicating through the proxy:
To enable Query Analyzer within your MySQL client application:

1. Make sure that the MySQL Enterprise Service Manager and your MySQL Enterprise Monitor Agent are configured and running.

2. Confirm the configuration of your agent by examining the contents of the `etc/mysql-monitor-agent.ini` file within your installed Agent directory.

   Queries are sent to the host specified in the `proxy-backend-addresses` parameter, and the agent listens for connections to be redirected to the server on the host name and port configured in the `proxy-address` parameter.

3. Now modify your MySQL client application to communicate with the address specified in the `proxy-address` parameter.

   Alternatively, if you do not want to modify your application directly, you can use iptables or firewall rules to redirect queries from the original host/port combination to the agent's port.

   Because connections to the MySQL server come from the proxy, not the original host, the user credentials must have a suitable `GRANT` statement for connections from `localhost`, or the host on which the agent and its proxy component run. The user name and password information are passed directly through the proxy from the client to the server.

4. Confirm that your MySQL client application still operates normally. There should be no difference between communicating directly with the MySQL server and communicating via the proxy.

---

**Note**

If you are using the `mysql` client to connect to the proxy and your backend servers, make sure that you are communicating with the proxy over the right port. By default, if you specify `localhost` as the host name, then `mysql` connects using the local Unix domain socket, rather than the TCP/IP socket.

You can enforce `mysql` to use the right port either by explicitly requesting the protocol type, or by using the IP address rather than `localhost`. For example, both of these command lines start the client using the right protocol:

```
shell> mysql --port=6446 --protocol=tcp
shell> mysql --port=6446 --host=127.0.0.1
```

**Note**

It is recommended that you use one agent and associated proxy per MySQL server instance. A single proxy is not able to forward queries to multiple MySQL server backends.
### 3.1.5.2 Enabling Query Analyzer by Changing MySQL Server

When enabling Query Analyzer by changing the MySQL Server, shut down your server, edit the MySQL configuration file, and then restart MySQL. Also, change your Agent configuration so that the proxy listens on the original MySQL TCP/IP port. To use this method, follow these steps:

1. Edit the `/etc/my.cnf` or other MySQL configuration file and change or add the `port` setting from its current value (default 3306), to another value. For example:

   ```
   port = 3307
   ```

2. Shut down your MySQL Server.

3. Start your MySQL Server and confirm that is running.

4. Edit your MySQL Enterprise Monitor Agent configuration so that the proxy listens for connections on the original MySQL port:

   ```
   proxy-address=:3306
   proxy-backend-addresses = 127.0.0.1:3307
   ```

5. Stop and restart MySQL Enterprise Monitor Agent.

You can now connect to your MySQL server through the MySQL Enterprise Agent Proxy Service by connecting on the original port:

   ```
   shell> mysql --host=127.0.0.1
   ```

### 3.2 Query Analyzer User Interface

To analyze the queries captured by the agent/proxy, change to the Query Analyzer tab. The following figure shows an example of the table on that page:

![Figure 3.7 MySQL Enterprise Monitor User Interface: Query Analyzer](image)

The main Query Analyzer table provides the summary information for all of the queries executed via the agent/proxy. The table tracks all the queries submitted to the server via the agent/proxy. The table shows a maximum of 20 rows, and you can page through the list of queries by using the page
numbers, or the **next, previous, first, and last** buttons. To filter the list of queries that are displayed, or to change the number of queries, see Section 3.2.4, “Filtering Query Analyzer Data”. To export the query information as a `.csv` file, see Section 3.2.5, “Exporting Query Information”.

Each row within the table provides the statistical information for one normalized query statement. If you have configured multiple agent/proxies to accept and forward queries to different servers, then you can expand the server view. The summary information displayed is different depending on whether you have selected a server group or an individual server.

If you have selected a server group, then the information displayed is aggregated from across the entire group. The same query executed on multiple servers shows average, total and minimum/maximum information for that query across all the servers. If you select an individual server, then only queries executed on that server are included within the table.

For each row, the following columns are populated according to the selected filtering options. For example, if the filter is configured to show queries within the last 30 minutes (**Interval**), then only queries executed during that time are displayed, and the corresponding statistics, such as execution times, rows returned and bytes returned, reflect that 30 minute timespan.

- **Query**: The normalized version of the query. Normalization removes the query-specific data so that different queries with different data parameters are identified as the same basic query.

  The information is shown as one query per row. Each query row is expandable, and can be expanded to show the execution times for individual servers for that query.

- **Database**: The default database in use at the time of the query. The database name might be blank, or might not match the database used within the query, if you used a qualified table name (for example, `select ... from db_name.table_name`) or if you issued a `USE` statement to switch databases after connecting.

- **Execution notices**: Highlights any specific issues experienced when running queries, including excessive table scans and bad index usage. These provide an immediate indication of a problem with a query that might require additional examination.

- **Counts**: The number of times that the query has been executed. The column is sub-divided into three further columns, showing the number of executions of the query (**Exec**), the number of times an error has been reported for the query (**Err**), and the number of times a warning has been produced (**Warn**).

  The **Exec Time** column is further subdivided into the following columns:

  - **Total**: The cumulative execution time for all the executions of this query.
  - **Max**: The maximum execution time for an execution of this query.
  - **Avg**: The average execution time for the execution of this query.

  When looking at the information provided in this query, compare the average and maximum execution times to see if there was a problem on a specific server or during a specific time period when the query took place, as this could indicate an issue that needs to be investigated.

  **Note**

  Due to limitations in the counters used for monitor queries on Microsoft Windows systems, the time reported for short queries might be reported 0.000. This will be fixed in a future release.
• **Rows**: The rows returned by the query. The column is sub-divided into the following columns:
  - **Total**: The sum total number of rows returned by all executions of the query.
  - **Max**: The maximum number of rows returned by a single execution of the query.
  - **Avg**: The average number of rows returned by all executions of the query.

• **Bytes**: The number of bytes returned by each query. The column is sub-divided into the following columns:
  - **Total**: The sum total bytes returned by all executions of the query.
  - **Max**: The maximum number of bytes returned by a single execution of the query.
  - **Avg**: The average number of bytes returned by all executions of the query.

• **First Seen**: The date and time the normalized version of this query was first seen, which might be earlier than the period specified by the filter.

You can sort the list of queries by clicking the column name. The direction of the sort (highest to lowest, or lowest to highest) is indicated by a triangle next to the currently selected column. The default is to sort the list of queries by the **Total Execution** time.

To help you and locate queries you can filter the list of queries using a variety of criteria. For more information on the filtering methods available, see Section 3.2.4, “Filtering Query Analyzer Data”.

To simplify the identification of a given query, you can create a query alias. The alias is used in place of the normalized query text within the Query Analyzer table. To create an alias for a query, hover over the triangle create alias link against the query. The maximum length for a query alias is 255 characters.

### 3.2.1 Getting Detailed Query Information

Click on an individual query to see more detailed information about the individual query in a pop-up window, as shown in Figure 3.8, “MySQL Enterprise Monitor User Interface: Canonical Query Tab for a Query”. The available tabs within this window depend on whether you have configured the more detailed query information. By default, you see the **Canonical Query** view.

You can also view **Example Query**, which provides more detailed data about a specific query, including the data and parameters submitted. You can also enable **Explain Query**, which lets you remotely execute an **EXPLAIN** statement with the specified query and view the resulting information. Finally, you can view any graph data produced during the execution of the query by using the **Graphs** tab.

• The **Canonical Query** tab:
The canonical view for a query provides three different views of the query, which can be changed using the links under the **Canonical Form** section. The **truncated** version is a shortened version of the query. The **full** version of the query is the entire query statement. Normalization removes the constants from the individual queries so that queries following the same logical structure are identified as the same basic query.

In addition to the summary information given in the table, the **Execution Time Statistics** section provides you with more detailed execution time statistics, including the minimum time, maximum time, average time, total time and the standard deviation. The standard deviation lets you determine whether a particular invocation of a query is outside the normal distribution of times for the given query.

The **Row Statistics** provide more detailed contents on the maximum, minimum, average, total, and standard deviation for the number of rows returned by the query, and the total size and maximum size of the data returned. The time period for the total and average figures is shown under the **Time Span** header.

The **Execution Summary** section provides the summary data available in the main table, covering the execution count, and counts of the number of errors, warnings, queries that triggered table scans, and those that indicated a bad index use.

The **First Seen** reports when the normalized version of this query was first seen, whether or not this was within the indicated **Time Span**.

To close the query detail window, click the **Hide** button.

- The **Example Query** tab:
The **Example Query** tab provides detailed information about the most expensive query executed, as determined by the execution time.

In addition to the full query, with data, that was executed, the tab shows the execution time, data, user, thread ID, client host and execution host for the given query.

For queries from any of the MySQL Enterprise Plugin for Connectors, the **Source Location** contains the information from the Connector where the query was generated.

- The **Explain Query** tab:

  The **Explain Query** tab lets you view the output from running the query with the `EXPLAIN` prefix. For more information, see **EXPLAIN Syntax**.

- The **Graphs** tab:
3.2.2 Using Graphs to Identify Queries

The MySQL Enterprise Monitor User Interface supports correlated graphs so that you can compare the graphed execution parameters, such as the server load, thread statistics, or RAM usage, against the queries that were being executed by the server or servers being monitored at that time.

You can use the correlated graphs in two different ways:

- Drag and select an area on a graph as displayed within the Monitor tab of the MySQL Enterprise Monitor User Interface. When using either of these two tabs, you can drag and select any region on a displayed graph, and the display changes to the Query Analyzer tab, displaying the corresponding zoomed graph, and the associated queries being executed during the selected period.

- Select a graph to be displayed within the Query Analyzer tab. Open the Graph section, and use the pop-up list to select the graph to be displayed. You can see an example of this in Figure 3.12, “MySQL Enterprise Monitor User Interface: Correlated Graphs”.

When using the correlated graphs, selecting an area within the graph sets the start and end time within the query filtering selection. You can combine with other filtering options, such as the Query Type, to zero in on the queries to examine.
To use the graphs in this manner, select a starting point and click, while holding down the button, drag a selection area to set the time-range for the query display. The time range that you select is displayed above the graph as you select the area.

Figure 3.12 MySQL Enterprise Monitor User Interface: Correlated Graphs

To zoom in or out of the displayed graph, use the links next to the Zoom label. You can select to show just an hour of the graph material, or larger ranges up to two days. At all times, the area on the graph highlighted in blue is the actual date/time range selected within the list of analyzed queries.

To export the graph, either a .png file of the graph image or a .csv file of the underlying data, use the two icons to the right of the graph label. See Section 2.5.4, “Exporting Graph Images and Data” for details about the export feature.

3.2.3 Query Analyzer Settings

There are a number of settings related to the Query Analyzer data. You can configure the Query Analyzer operation by using the configure query analyzer link within the Query Analyzer tab, or through the configure query analyzer button within the Manage Servers tab within the Settings tab. Both methods provide you with the same dialog:

Figure 3.13 MySQL Enterprise Monitor User Interface: Query Analyzer Configuration

Through either solution, the configuration options that you select are applied to the individual server or server group selected within the Servers navigation panel.

There are three configuration options available through either method:

- **Enable Query Analyzer** configures whether Query Analyzer is enabled for this server or server group. If selected, Query Analyzer will be enabled. To disable, select the check box.
Note
The Query Analyzer functionality might show as being enabled on a server, even if the modules within MySQL Enterprise Monitor Agent supplying Query analyzer data are not enabled.

If Query Analyzer is enabled, you can also configure the Example Query function by selecting the Enable Example Query checkbox. Enabling this option provides an additional tab when you open the Canonical Query window when clicking a query.

- **Enable Example Query** displays more information about individual queries. When enabled, queries and their data items (rather than the canonical form shown by default) are provided. Enabling this option could expose the full query statements and therefore could present a security issue.

With the Example Query option enabled, an additional tab is available within the query summary details. For more information, see Section 3.2.1, “Getting Detailed Query Information”.

If you enable Example Query, you can also enable Example Explain. To enable this tab, select the Enable Example Explain checkbox.

- **Enable Example Explain** provides another tab when viewing a query where you can view the output from EXPLAIN output from MySQL for the selected query. This shows the full query and how the query was executed within the servers.

Enabling this option might add overhead to the execution of your server, as the server runs an EXPLAIN statement each time it identifies a long running query. For more information, see Appendix F, MySQL Enterprise Monitor Frequently Asked Questions.

To enable or disable Query Analyzer for an individual server, go to the Settings tab and click the Manage Servers link. To configure all the properties, click the configure query analyzer link next to the server you want modify.

Alternatively, for each server, the Query Analyzer column shows the current setting, On or Off, and whether the Example and Explain functionality is enabled. To change any setting, click the current status to toggle between the On/Off position.

To disable or enable Query Analyzer for the selected servers, use the disable query analyzer or enable query analyzer buttons within the Settings tab. You must have selected one or more servers from the list of available servers before selecting these buttons.

You can use the options that you have just selected as the default for all new servers that register with MySQL Enterprise Service Manager by using select the Make this the default for all new servers checkbox. By default, when a new server registers with MySQL Monitor, the server is automatically configured to supply Query Analyzer data. This can have impact on the performance of your monitor and agent as it increases the amount of information supplied to the MySQL Monitor.

Configuration of Query Analyzer occurs through the configure defaults button from within the Query Analyzer tab.

### 3.2.4 Filtering Query Analyzer Data

You can filter the queries shown within the Query Analyzer table by using the form at the top of the table. The different fields of the form are used to specify the parameters for the filter process. Once you have specified a filter, all the queries and related statistics shown within the Query Analyzer table are displayed in relation to the filter settings. For example, by default, the filter settings show the queries for the last 30 minutes. All the statistics shown are relative to the last 30 minutes, including average, maximum and execution counts.

The filter fields are:
Filtering Query Analyzer Data

The filtering functionality is available in a simple format, supporting simple statement and timing based filtering, and an advanced option allowing you to filter by specific columns within the Query Analyzer table.

Figure 3.14 MySQL Enterprise Monitor User Interface: Query Analyzer Filter Options

The basic filter options are:

- **Statement Text** and **Value** support text searching of the normalized query. For the search type you can specify either a basic text match (Contains), or a regular expression match (Regex). In addition to the basic text match, you can also search for a query that does not contain a particular string. For regular expression searches, you can specify whether the regular expression should match, or not match (negative regexp) the queries. Regular expressions are parsed using the standard MySQL `REGEXP()` function. For more information, see [Regular Expressions](#).

  **Note**

  The search is performed against the canonical version of the query. You cannot search against specific text or values within the parameters of the query itself.

- **Statement Type**: Limits the search to statements of a particular type (SELECT, LITERAL, etc.).

- **DB Name**: Limits the queries to those executed within a specific database. The database match is performed using the LIKE match from the MySQL database, hence you can use the % and _ characters to multiple and single character matches. For more information, see [Pattern Matching](#).

- The **Time Range** menu selects whether the time selection for filtering should be based on the time interval (only queries recorded within the displayed time period are shown, using the Hours and Minutes pop-up), or whether the selection should be based on a time period (From/To), where you can select the time range to be displayed.

  Using the Interval mode shows queries within the given time period from the point the graph was updated. For example, if you select 30 minutes, then the queries shown were captured within the last 30 minutes. If you updated the display at 14:00, then the queries displayed would have been captured between 13:30 and 14:00. Using interval mode limits the timespan for the filter selection to a maximum of 23 hours and 59 minutes.

  Using the From/To time range lets you show queries between specific dates and times. Using this mode you can show only the queries received during a specific time span, and you can display the query history for a much longer time period, for as long as you have been recording query analysis information.

- **Limit** specifies the number of queries to be displayed within each page.

To use the advanced filtering techniques, click **show advanced**. This provides additional filters:

- **Notices**: Filters on the notices column, allowing you to filter the list to show only the queries that did not raise a notice, indicated a full table scan, or indicated that a bad index was used.

- Two column filters are provided, which allow you to filter the queries based on specific values within any of the columns shown in the Query Analyzer report list.

  To use the column filters, you must specify the **Column** that you want to filter on, the **Operator** to use when performing the comparison and the **Value** that you want to compare.
For example, to filter by showing all the queries that return more than 100 rows on average, set the Column to Average Rows, the Operator to >=, and the Value to 100.

- The View selection determines whether the information should be returned on a group basis, where an aggregate of the same query executed on all monitored servers is shown, or on a Server basis, where queries are summarized by individual server. If the latter option has been selected, the table includes an additional column showing the server.

All the filter settings that you specify are used collectively, that is, all the specified filter options are used to match against the list of queries.

When you have set your filter parameters, you can update the Query Analysis display by clicking the filter button. To reset the fields to the default settings click the reset button.

If you want to make the current filter options the default when viewing the Query Analyzer page, click the make default button. The settings are saved for the current user only.

### 3.2.5 Exporting Query Information

To get the text and details of the queries displayed on the Query Analyzer page, click one of the icons to the right of the Browse Queries label in the separator bar. The query information is exported as comma-separated data in a .csv file, with fields corresponding to the columns shown in the Dashboard, and the time of the export encoded in the filename in UTC format. The icon representing a single page exports the query information for the currently displayed page only. The icon representing a stack of pages exports the query information for all available pages of query information.

Within the Query Analyzer popup, you can also export information about each data group as a .csv text file or a .png image file, using icons next to the labels on the left side. The output file is named according to the pattern Statement_Report_Summary_%server/group_%creationtimestamp.csv or .png. The data exported by these icons includes:

- Execution Time: Count
- Executions: Exec Time, Max Exec Time, Min Exec Time, Average Exec Time
- Rows: Rows, Max Rows, Min Rows, Average Rows
- Kilobytes: Bytes, Max Bytes, Average Bytes

**Note**

Microsoft Excel users on Windows users can import the .csv file as a spreadsheet. If the file contains English text, typically you can double-click it to open in Excel. If the file contains localized Japanese text, you must use the File > Open menu choice within Excel to open the file.

In the Safari browser, exported files containing localized data might contain %NN character sequences in their names, due to browser issues with UTF-8 and Base64 encodings.

### 3.3 Troubleshooting Query Analyzer

This section describes different kinds of issues that you might experience with the MySQL Query Analyzer, and how to solve or avoid them.

**Limited or No Data**

If the Query Analyzer page shows no queries or a smaller range than you expect, confirm that your system is correctly configured for Query Analysis:
• The Query Analyzer must be enabled for each monitored host; it is not enabled by default. Click the configure query analyzer button on the Query Analyzer page to check. For more information, see Section 3.2.3, “Query Analyzer Settings”.

• Confirm that the agent is running by checking the Agent log and the status of the server within MySQL Enterprise Service Manager.

• Confirm the following in the agent configuration files:

  • The plugins parameter within the main configuration file, mysql-monitor-agent.ini, must contain the proxy plugin:

    ```
    plugins=proxy,agent
    ```

  • The agent-item-files parameter within the main configuration file, mysql-monitor-agent.ini, must specify the share/mysql-monitor-agent/items/quan.lua script:

    ```
    agent-item-files = share/mysql-monitor-agent/items/quan.lua, share/mysql-monitor-agent/items/items-mysql-monitor.xml
    ```

  • The proxy configuration parameters must point to the MySQL server where you want your queries to be sent. For example, if you are running your agent on the same host as your MySQL server then you might have the following lines in your mysql-monitor-agent.ini file:

    ```
    proxy-address=:6446
    proxy-backend-addresses = 127.0.0.1:3306
    proxy-lua-script = lib/mysql-monitor-agent/lua/quan.lua
    ```

    The above configuration means:

   • The agent/proxy listens on the current machine, using port 6446 (proxy-address).
   • The agent/proxy sends all queries it receives to the host 127.0.0.1 on port 3306 (the standard MySQL port), as per the proxy-backend-addresses parameter.

You can see a sample complete configuration file (mysql-monitor-agent.ini), using the 127.0.0.1 as the MySQL backend server, and reporting to a MySQL Enterprise Service Manager called monitor:

```
[mysql-proxy]
plugins=proxy,agent
agent-mgmt-hostname = http://agent:password@monitor:18080/heartbeat
mysqld-instance-dir = etc/instances
agent-item-files = share/mysql-monitor-agent/items/quan.lua, share/mysql-monitor-agent/items/items-mysql-monitor.xml
proxy-address=:6446
proxy-backend-addresses = 127.0.0.1:3306
proxy-lua-script = lib/mysql-monitor-agent/lua/quan.lua
agent-uuid = a3113263-4993-4890-8235-cadef9617c4b
log-file = mysql-monitor-agent.log
pid-file=/opt/mysql/enterprise/agent/mysql-monitor-agent.pid
```

• Confirm that you can connect through the agent proxy to your backend MySQL server. You can do this by checking with the MySQL client. You must specify the same options as you would if you were connecting to the original server, including specifying the same user and password information:

```
shell> mysql --host 127.0.0.1 --port 6446 --user=root -p
Enter password:
Welcome to the MySQL monitor. Commands end with ; or \
Your MySQL connection id is 299239
Server version: 5.0.60-log Gentoo Linux mysql-5.0.60-r1
```
• Check that your MySQL client application is configured to use the configured proxy port, instead of
the real MySQL port when sending queries.

• If your Query Analyzer graphs stop working or contain gaps showing no activity, look in the Service
Manager log for the message An item was expired by the cache while it was locked
(increase your cache timeout). For the action to take, see Section 2.11, “Troubleshooting
the MySQL Enterprise Monitor User Interface”.
Chapter 4 Customizing MySQL Enterprise Monitor

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You can customize your MySQL Enterprise Monitor rules, advisors, and graphs, based on your organization's business rules, best practices, and the types of issues you can anticipate.

4.1 Creating Advisors and Rules

For common scenarios, reuse or edit the advisors, rules, and graphs provided by MySQL Enterprise. To create new advisors, rules, and graphs for your own needs, go to the Advisors tab and choose the Create/Edit Rule link, or go to the Graphs tab and choose the Import/Export link to create a graph.

4.1.1 Creating Advisors

Similar existing rules are grouped together in advisor groups.

The built-in advisor groups are:

- Administration
- Cluster
- Heat Chart
- Memory Usage
- Performance
- Replication
- Schema
- Security
- Upgrade

You can also create your own advisor group to suit your circumstances. Click the create advisor button. Enter an appropriate name and click the add button. The newly created group appears in the Advisor column.

The newly created advisor is added to the list box of advisors shown in Figure 2.5, “MySQL Enterprise Monitor User Interface: Editing Rules”. You can now use this category of advisors when you create a new rule.
4.1.2 Overview of Graph Creation

Graphs are defined using XML, and then imported into MEM. The new custom graph will now be displayed with the built-in graphs, which are sorted by `name` within the graph tab.

For an example graph on how to create a graph, see Section 4.1.9, “Creating a New Graph: An Example”.

The XML elements for creating a graph are as follows:

- **version**
  The version number of the graph. Generally only important with the bundled graphs, and is only used internally.

- **uuid**
  The unique id of the graph. Each revision (version) requires a new uuid, which is only used internally.

- **name**
  The visible graph name, which is displayed within the graph listing. Note: graphs are sorted alphabetically.

- **frequency**
  Optionally define the frequency for the graph, which defaults to 1 minute. May use seconds, minutes, hours, and days.

- **rangeLabel**
  The Y-axis range label. For example, a graph about disk space usage may use MB.

- **series**
  Each series contains a label and an expression. The label is the visible name of the series, and the simple expression defines it.

- **variables**
  Each variables definition contains a name, instance, and dcItem element. The instance defines what the graph will act upon, and each dcItem element contains a nameSpace, className, and attribName:
    - **nameSpace**
      Namespace (type) of the data collection item.
    - **className**
      Class (namespace type) of the data collection item.
    - **attribName**
      Attribute name of the data collection item.

See the listing of data collection items for available nameSpace, className, and attribName items.

4.1.3 Overview of Rule Creation

You create rules using the same screen seen in Figure 2.5, “MySQL Enterprise Monitor User Interface: Editing Rules”. To create a new rule with all-new settings, click the create rule button. To create a rule
similar to an existing one, click the copy rule button. You can edit any rule element during the copying process, unlike editing an existing rule.

You can change the rule name, change the advisor group that a rule belongs to, and set your own version number. In Figure 2.5, “MySQL Enterprise Monitor User Interface: Editing Rules”, you have already seen how to alter the threshold and frequency of a rule.

Note
If you do not specify a version number for the new rule, the version 1.0 is automatically added.

Most importantly, you can alter a rule’s expression. Expressions are the core of a MySQL Enterprise Advisors and define the scenario being monitored. An expression can be as simple as a single server parameter or can be complex, combining multiple parameters with mathematical operations.

An expression has two main characteristics:
• An expression tests whether a best practice is being violated.
• The result of an expression must always be 1 or 0 (corresponding to true or false).

If an expression evaluates to true for a specific server, an alarm is raised, indicating that a best practice is not being followed. If an expression evaluates to false, the best practice is being followed and no alarm is raised.

For example, if you decide that enabling binary logging is a best practice for a production server (as Oracle recommends), then this best practice is violated if log_bin is OFF. Consequently, the expression for the “Binary Logging Not Enabled” rule is “%log_bin% == OFF”. If this evaluates to 1, an alarm is raised because the best practice is not being followed.

An expression is made up of one or more variables and zero or more mathematical operators. The MySQL Enterprise Monitor product uses the Java Expression Parser. The operators and functions consist of:
• The IN() operator.
• The MySQL functions LEAST(), LOCATE(), ABS(), MOD(), NOW() (returns time since UNIX epoch UTC in seconds), UNIX_TIMESTAMP (technically a no-op), and INTERVAL [n] SECOND, MINUTE, HOUR, WEEK, MONTH.
• The operators functions listed on this page: http://www.singularsys.com/jep/doc/html/operators.html.
• Comparisons with MySQL timestamps and datetimes collected by the agent in the standard MySQL format 'YYYY-MM-DD hh:mm:ss[.nanos]'.
• The IF function: IF (condition, true_expression, false_expression) returns either true_expression or false_expression, depending on whether condition is true or false. This function uses short-circuit evaluation, so only one of the return expressions is evaluated.
• The LEFT(string, length) and RIGHT(string, length) functions.
• The NUM(string) function.

Note
The CAST(expression as type) function is not implemented. Instead, use NUM(string) to use strings as numbers.

• Other functions and operators may be implemented as needed to assist with custom rule creation. Open a service request if you have such a requirement.
For a complete list of the built-in variables used to create rules, see Server Option and Variable Reference.

Creating an expression is dependent on variables defined in the Variable Assignment frame. This frame links variables used in the expression field with data gathered from the target MySQL server instance: server status variables, operating system status information, and table information. Variable names are associated with elements in the Data Item drop-down list. To define more than one variable, click the add row button. For a complete listing of the data collection items used in creating rules, see Appendix D, Data Collection Items.

The remaining fields determine the information that you receive in a notification email or the informational pop-up window associated with each advisor.

Note
When saving a new rule, choose a unique name not used by any existing rule.

4.1.4 Variables

When MySQL Enterprise Monitor evaluates an expression, it replaces variables with values. For example, part of the expression for the “MyISAM Key Cache Has Sub-Optimal Hit Rate” rule calculates the hit rate as follows:

\[100 - ((\%Key\_reads\% / \%Key\_read\_requests\%) \times 100)\]

If the current value of \%Key\_reads\% is 4522 and the current value of \%Key\_read\_requests\% is 125989, the hit ratio is 96.4%:

\[100 - ((4522 / 125989) \times 100)\]

By convention, the Advisors supplied by MySQL use ‘%’ as the delimiter, for example, \%Key\_reads\%. This makes variables more readily identifiable.

Variables can be used in the Description, Advice, Action, and Links attributes of a rule, as well as in expressions. This lets you report the current value of an expression. For instance, you can add the message, “The current value of Key\_reads is \%Key\_reads\%.” to the Advice text box. When this is displayed on the screen, the value of \%Key\_reads\% is substituted into the text. If \%Key\_reads\% has a value of 4522, the message becomes “The current value of Key\_reads is 4522.”

4.1.5 Thresholds

Each expression has a threshold value that triggers an alert. The THRESHOLD keyword associates that value with an alert level: either an Info, Warning, or Critical alert.

For example, the expression for the performance advisor, “Thread Cache Size May Not Be Optimal”, is:

\[100 - ((\%Threads\_created\% / \%Connections\%) \times 100) < \text{THRESHOLD}\]

The THRESHOLD is set at 95% for an Info level alert, 85% for a Warning alert, and 75% for a Critical alert, producing alerts of three different levels.

Expressions can be straightforward. The expression for “Binary Logging Not Enabled” (one of the Administration alerts) is:

\[%log\_bin\% == \text{THRESHOLD}\]

When the result is OFF, only one alert is triggered: a Warning level alert. You cannot just use the expression \%log\_bin\% == "OFF", because this would not test binary logging against a threshold and so would not result in an alert.
Specify precise conditions when each expression should be evaluated, to avoid false alarms. For example, the expression for the “MyISAM Key Cache Has Sub-Optimal Hit Rate” rule is:

\[ (%Uptime% > 10800) \&\& (%Key_read_requests% > 10000) \&\& (100 - ((%Key_reads% / %Key_read_requests%) \times 100) < THRESHOLD) \]

The first part of the expression, \((%Uptime% > 10800)\), delays evaluating this expression until the system has been running for 10800 seconds (3 hours). When a server starts up, it might take a while to reach a state that is representative of normal operations. For example, the InnoDB buffer pool, MyISAM key cache, and the SQL query cache might require some time to fill up with application data, after which the cached data boosts performance.

In addition, if some part of the system is not heavily used, an alert might be triggered based on limited data. For example, if your application does not use the MyISAM storage engine, the “MyISAM Key Cache Has Sub-Optimal Hit Rate” rule could be triggered based on very limited use of other MyISAM tables such as the `mysql.user` table. For this reason, this advisor has a second part: \((%Key_read_requests% > 10000)\). The rule is not evaluated unless there is plenty of activity associated with the key cache.

### 4.1.6 Using Strings

Enclose string values within double quotation marks in the Expression or the Thresholds text boxes. For example, the expression for the “Slave I/O Thread Not Running” rule is:

\[ (%Slave_running% == "ON") \&\& (%Slave_IO_Running% != THRESHOLD) \]

Similarly, the Critical Alerts threshold text box is set to a value of "Yes".

When the expression is evaluated, either "OFF" or "ON" is substituted for %Slave_running%, and "Yes" or "No" for %Slave_IO_Running%, depending on the state of your system. If the slave is running but the I/O thread is not, the expression becomes:

\[ ("ON" == "ON") \&\& ("No" != "Yes") \]

Without quotation marks, this expression would not evaluate to TRUE as it should.

**Note**

So that it is interpreted properly, the == operator is converted to = before being passed to the MySQL expression parser.

### 4.1.7 Wiki Format

When editing or defining a rule, you can enter text in Wiki format in the Problem Description, Advice, Recommended Action, and Links and Further Reading text boxes. You can format and highlight text and add hyperlinks, using the notation listed in the following table.

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>bold</strong></td>
<td>boldface text</td>
</tr>
<tr>
<td><del>italic</del></td>
<td>italicize text</td>
</tr>
<tr>
<td>\</td>
<td>create a line break</td>
</tr>
<tr>
<td>\</td>
<td>create a double line break</td>
</tr>
</tbody>
</table>
| \\
\ | create a backslash |
| *item 1* | create a bulleted list item |
| #item 1 | create a numbered list item |
Example | Description
--- | ---
\ | use the `\` to escape special characters
{moreInfo:name|url} | create a hyperlink

So the following Wiki text:

Replication is a __very nice feature__ of MySQL. Replication can be very useful for solving problems in the following areas:

* Data Distribution
* Load Balancing
* Backup and Recovery

You can check replication status and start a slave using the following commands: SHOW SLAVE STATUS \G;\START SLAVE;

Would be translated into the following HTML markup:

Replication is a <b>very nice feature</b> of MySQL. Replication can be very useful for solving problems in the following areas:

<ul>
  <li>Data distribution</li>
  <li>Load Balancing</li>
  <li>Backup and recovery</li>
</ul>

You can check replication status and start a slave with the following commands: SHOW SLAVE STATUS \G;\START SLAVE;

4.1.8 Creating a New Rule: An Example

This section documents the steps to create a rule. Before creating a rule, review the preceding sections of this chapter.

This example is based on the bundled **Excessive Disk Temporary Table Usage Detected** rule that checks the frequency MySQL stores temporary tables on disk instead of memory. We decide that 50% or less of the table hits to disk should trigger a critical alert, and lesser numbers should produce informational and warning level alerts.

Begin by navigating to the Advisors tab and clicking the manage rules link. Then choose the create rule button.

Create your custom rule by following these steps:

1. Using the Rule Name text box, give the rule an appropriate name, in this case something such as "My Excessive Temporary Table Disk Usage".

2. From the Advisor drop down list box, choose an advisor group for your rule. The Performance group of rules might be suitable but if you wish, create your own group of advisors. For instructions on doing this, see Section 4.1.1, "Creating Advisors".

3. Enter the following expression in the Expression text area:

\[
100 - (\{\%tmp\_disk\_tables\% / \%tmp\_tables\%\} * 100) < \text{THRESHOLD}
\]

4. Set the Thresholds.

   a. Set the Info Alert level to 50.
Creating a New Graph: An Example

b. Set the **Warning Alert** level to 75.

c. Set the **Critical Alert** level to 90.

5. Define your first variable in the **Variable Assignment** frame.

a. In the **Variable** text box, enter `%tmp_tables%`, the variable used in the **Expression** text box above. The variable name can be whatever you choose to use in your expression.

b. In the **Data Item** drop down list box, find and select the `mysql:status:Created_tmp_tables` entry. (For a description of all the data items available, see Appendix D, *Data Collection Items.*) This dynamic MySQL Enterprise Monitor value will be applied to the variable name you chose above, which is `%tmp_tables%` in our example.

c. In the **Instance** text box, enter `local`.

6. To add another variable, click **Add row** and define your second variable in the **Variable Assignment** frame as done above.

a. In the **Variable** text box, enter `%tmp_disk_tables%`, the variable used in the **Expression** text box above. The variable name can be whatever you choose to use in your expression.

b. In the **Data Item** drop down list box, find and select the `mysql:status:Created_tmp_disk_tables` entry. (For a description of all the data items available, see Appendix D, *Data Collection Items.*) This dynamic MySQL Enterprise Monitor value will be applied to the variable name you chose above, which is `%tmp_disk_tables%` in our example.

c. In the **Instance** text box, enter `local`.

7. Add appropriate entries for the **Problem Description**, the **Advice**, and the **Links** text areas. Optionally, use Wiki markup for these text areas. You can also reference the variables you defined above, such as `%tmp_tables%` and `%tmp_disk_tables%` in our example, in these text areas.

8. Save the rule.

After you create the rule, schedule it against the server that you want to monitor. For instructions on scheduling rules, see Section 2.3.2, “Scheduling Rules”.

### 4.1.9 Creating a New Graph: An Example

This section documents the steps to create a graph. Before creating a graph, review the preceding sections of this chapter as Graphs and Rules use similar components. And for an overview that's specific to graphs, see Section 4.1.2, “Overview of Graph Creation”

This example creates a graph that checks and compares disk usage, by displaying the usage and total available disk space over time.

Begin by navigating to the **Graphs** tab and clicking the **Import/Export** link. Then note the **Custom Rule/Graph Import** button. This is where the XML file that we create will be imported.

A definition to check disk space usage may look like the following:

```xml
<?xml version="1.0"?>
<com_mysql_merlin_server_graph_Design>
  <version>1.0</version>
  <uuid>a57c2bba-ea9b-102b-b396-94aca32bee29</uuid>
  <name>my_filename_usage_test</name>
  <rangeLabel>MB</rangeLabel>
</com_mysql_merlin_server_graph_Design>
Creating a Custom Data Collection Item

Upon successfully loading a graph, a popup notification may say "1 graph imported" and this graph will immediately show up within the Graphs dashboard (like every other graph) under the name defined within the definition, which is "my filename usage test" in the example above.

4.1.10 Creating a Custom Data Collection Item

Section 4.1.8, "Creating a New Rule: An Example" shows how to create a custom rule and Appendix D, Data Collection Items shows the data items you can use in rule creation. In some circumstances, you might want to create a rule that uses a custom data collection item.

To create additional custom data collection items, edit the share/mysql-monitor-agent/items/custom.xml custom rule file added during installation. The custom.xml is installed automatically, but is not modified during an upgrade installation. The rules file is listed last in the agent-item-files configuration parameter, so any rules and data collection items you add to this file supersede the standard data collection definitions.

After you make changes to the custom.xml, restart the agent to load the custom definitions.

4.1.10.1 Modifying the Custom Data Item XML File

As an example, this section shows how to create a data item for monitoring the amount of free InnoDB tablespace. You can have multiple items in your custom.xml file, just specify additional class entries. The custom.xml file in the installation includes a sample entry. You can replace that entry, or add the following definition to the file:

```xml
<query><![CDATA[SELECT MIN(substring_index(substring_index(table_comment," ",3)," ",-1)/1024/1024) as Free FROM INFORMATION_SCHEMA.TABLES WHERE engine = 'InnoDB']]]></query>
```

After saving the file, ensure that the agent-item-files parameter within the configuration includes the custom.xml file. For example:
Customizing Standard Advisors

4.2 Customizing Standard Advisors

You can override the standard rules and the data collection items that support them by adding entries to your custom-items.xml with different queries to collect information. To customize data collection for existing advisors, you can use the information in Section 4.1, “Creating Advisors and Rules”.

4.3 Disabling and Unscheduling Rules

You can change a rule so that it no longer applies to a specific server or group of servers, or suspend a rule for a period of time.

To disable or unschedule an advisor, choose the Current Schedule screen of the Advisors tab.

Note

Advisors, even those that are unscheduled or disabled, still run during discovery mode when MySQL Enterprise Monitor starts, and when the dashboard runs the “inventory” process.

You can disable or unschedule one or more rules using the buttons on the upper or lower left of the screen. You can also change one rule at a time by clicking the enabled or unschedule hyperlink to the right of a rule.

To no longer run a rule against a specific server, expand the advisor group and the specific rule by clicking the + button and then the unschedule button. In the dialog window that opens, click the unschedule button. To back out of the operation, choose cancel. To institute this rule again, use the Add to Schedule page.

To suspend a rule temporarily, use the disable button and follow the same process as for unscheduling. Once a rule is disabled, the link under the status column changes to red and reads disabled. When a rule is disabled, data is no longer collected for that rule. To re-enable a disabled rule, click the disabled link or the enable button.

To alter multiple rules for one or more servers, select the appropriate checkbox and clicking the unschedule, enable, or disable button.

Note

Rules associated with the heat chart cannot be disabled or unscheduled, as they are required by MySQL Enterprise Monitor.

4.4 Advisor Blackout Periods

During maintenance periods for database servers, you can stop Monitor Agents from reporting their findings. During such a blackout period, rules are not evaluated and notifications are put on hold, but
Monitor Agents continue to collect data. In this respect, blacked-out rules differ from disabled rules; data continues to be collected and stored in the repository.

To enable a blackout period, enter the following URL into the address bar of your browser, substituting the appropriate host name, port and server name:

```
http://localhost:18080/rest?command=blackout&server_name=SuSE:3306&blackout_state=true
```

Check the `configuration_report.txt` file for the host name and port to use. Specify the correct port for the Tomcat server. Specify the server to blackout using the name that appears in the Server Tree, including the colon and port number as shown in the preceding example.

When the HTTP authentication dialog box requesting your Dashboard user name and password opens, specify the credentials for the Manager user. Use the ID and password you specified when you initially logged in to the Dashboard.

You can also blackout a server group by entering the following URL into the address bar of your browser, substituting the appropriate host name, and server group name:

```
http://localhost:18080/rest?command=blackout&group_name=Finance&blackout_state=true
```

When the HTTP authentication dialog box opens, enter the administrator's credentials.

To confirm that a server is blacked out, check that its name is grayed out in the Dashboard.

To reactivate the blacked-out server or server group, use the appropriate URL and query string, changing the `blackout_state=true` name/value pair to `blackout_state=false`. Again, this must be done by a user with administrative privileges.

```
Note
```

Restarting MySQL Enterprise Monitor does **not** reactivate a blacked out server.

### 4.4.1 Scripting Blackouts

You can write a script to black out a server, rather than opening a web browser and typing entries into the address bar. This section documents a sample blackout script that can be run from the command line.

Create the following file and save it as `blackout.pl`.

```perl
#!/usr/bin/perl
use LWP 5.64;
# USAGE: blackout.pl servicemanager:18080 admin password servername:3306 true
# $ARGV[0] = management server hostname:port
# $ARGV[1] = management server username
# $ARGV[2] = management server password
# $ARGV[3] = mysqld managed instance server name and port
# $ARGV[4] = blackout state (true/false)

my $browser = LWP::UserAgent->new;
$browser->credentials( $ARGV[0], '', $ARGV[1], $ARGV[2] );
```
my $url = URI->new('http://'.$ARGV[0].'/rest');
$url->query_form( # And here the form data pairs:
    'command' => 'blackout',
    'server_name' => $ARGV[3],
    'blackout_state' => $ARGV[4]
);
my $response = $browser->post( $url );

if (!$response->is_success) {
    die $response->status_line . "\n";
}

if ($response->content =~ /UserUnauthorizedException/ ||
    $response->content =~ /ServerDoesNotExistException/) {
    die $response->content;
}

## Note
Windows users can omit the initial `#!` line.

On Unix systems, use the `chmod +x blackout.pl` command to make the file executable.

At the command line, enter `blackout.pl servicemanager:18080 admin password
ervername:3306 true`.

Check the `configuration_report.txt` file for the host name and port to use. Specify the correct port for the Tomcat server. Specify the server to black out using the name that appears in the Server Tree, including the colon and port number as shown in the preceding example. Specify the name of a user who is a Manager. A user with DBA rights cannot black out a server, and the script does not display any error in this case.

To confirm that a server is blacked out, check that its name is greyed out in the Dashboard. To end the blackout, run the same script, changing the final argument to `false`.

## Note
Restarting MySQL Enterprise Monitor does not reactivate a blacked out server.
Chapter 5 Installation Reference

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Note
MySQL Enterprise subscription, MySQL Enterprise Monitor, MySQL Replication Monitor, and MySQL Query Analyzer are only available to commercial customers. To learn more, see: http://www.mysql.com/products/.

This chapter describes the process of installing the MySQL Enterprise Monitor on all operating systems.

Installation Sequence

A working installation requires installing:

• One MySQL Enterprise Service Manager. It stores its data in a database repository. You can use an existing MySQL instance for the repository, or set up a separate instance as part of the MySQL Enterprise Service Manager installation. See Section 5.2, “Installing the Service Manager”.

• The MySQL Enterprise Advisors. These are installed as part of the MySQL Enterprise Service Manager install, on the same machine.
• One or more MySQL Enterprise Monitor Agents, one for each MySQL server to monitor. See Section 5.3, “Monitor Agent Installation”. Install the MySQL Enterprise Service Manager first, because the Agent installation asks for credentials and network settings that you choose as you install the MySQL Enterprise Service Manager.

To minimize network overhead, you usually install the Agent on the same machine that hosts the monitored MySQL server, but you can install it on any machine that has network access to both the monitored MySQL server and the MySQL Enterprise Monitor User Interface.

The Agent inspects a specific MySQL server, and transmits health and usage data back to the Service Manager. The Advisors interpret the results, which are displayed in the browser-based MySQL Enterprise Monitor User Interface.

After installing and starting the Service Manager and Agents, configure the settings in the MySQL Enterprise Monitor User Interface, as explained in Section 5.2.6, “MySQL Enterprise Service Manager Configuration Settings and Advisor Installation”.

Installer Files

Depending on your configuration and environment, download these files from the Oracle Software Delivery Cloud web site. These include:

• MySQL Enterprise Service Manager, MySQL Enterprise Monitor User Interface, and Advisors for the platform that you intend to execute the MySQL Enterprise Service Manager on. For a new installation, this installer is named `mysqlmonitor-version-platform-installer.bin`. For an upgrade installation, this installer is named `mysqlmonitor-version-platform-update-installer.bin`.

• One or more MySQL Enterprise Monitor Agent, one for each MySQL Server to monitor. In the typical scenario, where you install the Agent on the same machine as each monitored MySQL server, make a list of the platforms your MySQL servers run on, then download the Agent installer package for each of those platforms. For a new Agent installation, this installer is named `mysqlmonitoragent-version-platform-installer.extension` For an upgrade Agent installation, this installer is named `mysqlmonitoragent-version-platform-update-installer.extension`.

For information on the installation requirements for different platforms, see Section B.3, “Installation Requirements”.

5.1 Credentials Needed for Installation

Before installing the MySQL Enterprise Monitor components, gather credentials (root user IDs and passwords) for all the MySQL servers you plan to monitor. The Agent installation requires a dedicated user ID in each monitored MySQL server; the installation can create this user for you, or you can create it yourself in advance, but either way requires a root login to the MySQL instance.

Note

With MySQL 5.5.16 and higher, you can configure these user IDs to authenticate using the PAM Authentication plugin. Currently, MySQL Enterprise Monitor does not support authentication through the Windows Native Authentication plugin. See MySQL Enterprise Monitor 2.3 Release Notes for details of the MySQL Enterprise Monitor configurations that are and are not supported under the various authentication plugins.

Optionally, gather credentials for your My Oracle Support account, which you can specify in the MySQL Enterprise Monitor User Interface configuration step immediately after everything is installed and started.

The following sections outline the users associated with the MySQL Enterprise Monitor.

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5.1.1 Existing Users

The MySQL user: For Monitor Agents to report the status of a MySQL server, they connect to a MySQL user with privileges to ready any data on that server: `SHOW DATABASES, REPLICATION CLIENT, SUPER, CREATE, and SELECT`. If you already have such a user on a MySQL server, specify its credentials when installing the Agent for that server. For details about this account, see Section 5.3.1, “Creating a MySQL User Account for the Monitor Agent”.

The My Oracle Support user: These are the credentials you use to log in to the My Oracle Support web site. The What’s New page accesses this account to receive updates and examine relevant service issues.

5.1.2 Users Created During Installation

The Repository user: This user is the only user in the `user` table in the `mysql` database in the bundled MySQL server. To avoid confusion with monitored MySQL servers, this server is referred to throughout this document as the repository. The repository user can log in from `localhost` using the password specified during installation and has all privileges on all databases. These credentials are used to create the repository and its tables and to record data in them. During installation, the default value for the user name for this role is `service_manager`. No default password is specified. You can use these credentials to manage the repository from the command line or when using a program such as MySQL Administrator.

At the end of MySQL Enterprise Service Manager installation, the file `configuration_report.txt` is created, and along with other configuration details, contains the credentials of the repository manager. Look for this file in the following directories:

- Windows: `C:\Program Files\MySQL\Enterprise\Monitor`
- Unix: `/opt/mysql/enterprise/monitor`

5.1.3 Users Created on First Log-in

The Manager user: This user is the administrator of the MySQL Enterprise Monitor User Interface. The first time you log in to the dashboard, log in as this user. You choose the ID and password for this user.

The Agent user: The Monitor Agent needs to report the status of the MySQL server it is monitoring. For this reason it needs to log in to the dashboard. You choose the ID and password for this user.

Note

The Monitor Agent communicates both with the Dashboard, and with the MySQL server it is monitoring. For a description of the agent as a MySQL user, see Section 5.1.1, “Existing Users”.

5.2 Installing the Service Manager

The MySQL Enterprise Service Manager is the core element of the MySQL Enterprise Monitor. The installation process for this element also includes some supplemental components:

- Apache Tomcat (always)
- Java VM (always)
- MySQL Server, for repository (optional; you can use an existing MySQL instance instead)

Note

After installation, you can determine the version number of the various components by entering `http://server_name:18080/main?command=list_versions` into the web browser's address bar.
During installation, versions of MySQL and Tomcat are installed onto the machine, using default values for network ports that are different from standard installation for these applications. You can select different port numbers during installation, to avoid conflicts or to follow a company standard.

During installation, default values are shown for user names and ports, for your convenience. You can choose different values. The installer detects ports that are already in use and lets you select different ports.

**Warning**
The MySQL Enterprise Service Manager version 2.0 and higher requires agents using 2.0 or higher.

All the installations share the same basic configuration parameters that you confirm during installation. Before you start your installation, review the section on these common parameters, then the section specific to your installation platform:

- For details of the common parameters, see Section 5.2.1, “Service Manager Installation Common Parameters”.
- For Unix/Linux, see Section 5.2.2, “Installing the Service Manager on Unix and Linux”.
- For Windows, see Section 5.2.3, “Installing the Service Manager on Windows”.

### 5.2.1 Service Manager Installation Common Parameters

All installations of the Service Manager install the Tomcat and MySQL applications using the same basic set of parameters. Although the defaults provided by the installation process are designed not to interfere with existing installations of either product, check these parameters before installation to ensure that you do not experience any problems.

A value must be assigned to all settings that are defined in the configuration file. This is different than passing these settings into the command-line, which may default to `true` when not passing in a value.

Glib is used for option handling, and specifically `g_key_file_get_boolean()` to parse boolean values. This means that `false` and `0` represent boolean `false`, whereas `true` and `1` represent boolean `true`. For example:

Passing a value to `config.properties` may look like this:

```
log-use-syslog=1
```

Or to the command-line, like either of these:

```
$ ./mysqlmonitor-installer.bin --log-use-syslog
$ ./mysqlmonitor-installer.bin --log-use-syslog 1
```

The common parameters are divided into those applying to the location of the MySQL server, the Tomcat server, and the connection properties for the MySQL server (Repository Configuration):

- **Tomcat Server Options**
  - Tomcat Server port: The default port that the Tomcat server uses when listening for connections. If you change this option, make the same change to the equivalent port number specified during the Agent installation. The default value is 18080.

```
$ ./mysqlmonitor-installer.bin --log-use-syslog
$ ./mysqlmonitor-installer.bin --log-use-syslog 1
```

- **Note**
  - If you do not have a web server running on port 80, you can use this well-known port rather than 18080. Since port 80 is the default for a web server, you can then open the dashboard without specifying a port.
Tomcat Shutdown port: The port used by the management scripts that is used to shut the Tomcat server down when you need to stop the Service Manager. The default value is 18005.

Tomcat SSL Port: The standard port used to connect to the Service Manager when you want to use Secure Sockets Layer (SSL) encrypted communication. The default value is 18443.

MySQL Server selection

- Using the bundled MySQL Server is preferred, but you may also choose to use your own MySQL Server to store repository data for the MySQL Enterprise Service Manager. The MySQL Server can be located on the same machine as the MySQL Enterprise Service Manager, or on a different machine. If you use your own MySQL Server, it must already be running when you start the installer.

Note

Configuring the MySQL Enterprise Service Manager repository to use a database that you plan to monitor will be problematic, because the MySQL Enterprise Service Manager statistics will interfere with your setup. Using the same host will function normally, although some monitored statistics are host specific.

The requirements for the MySQL Server are:

- MySQL 5.1.43 or higher.
- Partitioning enabled.
- InnoDB Storage Engine enabled. MySQL Enterprise Monitor operation relies on the InnoDB-related configuration options being set high enough to handle the monitoring traffic. For example, the bundled MySQL server includes the settings:

```
innodb_buffer_pool_size = 512M
innodb_log_file_size = 256M
innodb_flush_log_at_trx_commit = 2
innodb_support_xa = 0
innodb_file_per_table
innodb_max_dirty_pages_pct = 20
innodb_locks_unsafe_for_binlog = 1
```

Using too-low settings for the repository data could result in errors such as Session is closed! in the Tomcat log file.

Configure the MySQL server with suitable credentials to allow MySQL Enterprise Service Manager to create the database, tables and other settings. The user should have ALL privileges on the MySQL Enterprise Monitor repository, which is stored within the database mem, or you can provide full access to all tables. Also, ensure you have the GRANT OPTION. For example, you might create a suitable user using the following GRANT statement:

```
mysql> GRANT ALL PRIVILEGES ON *.* TO 'service_manager'@'localhost'
    -> IDENTIFIED BY 'password' WITH GRANT OPTION
```

Repository Configuration (MySQL Server)

- Repository Username — if you are connecting to an existing MySQL database, specify the username and password that you configured with access to the MySQL Enterprise Monitor repository. If you install the bundled MySQL database, choose a username and password for the MySQL Enterprise Service Manager, and that user is created automatically during installation.
normal use, you do not need to access the repository database directly, but it might be required to resolve a service request. The default value is service_manager.

- Repository User password — the password to use to connect to the MySQL database. Set it to a secure password so that the repository data is secure.

- Use SSL when connecting to the database — adds a line mysql.use_ssl=true to the config.properties file. The repository database must be configured for SSL connections, as described in Building MySQL with SSL Support. You can add this line yourself to enable SSL connections after installation. You can also manually add any of the following items to config.properties to customize the SSL connections to the repository database:

  mysql.verify_server_cert (default is false)
  mysql.trust_cert_keystore_url (no default)
  mysql.trust_cert_keystore_type (no default)
  mysql.trust_cert_keystore_password (no default)
  mysql.client_cert_keystore_url (no default)
  mysql.client_cert_keystore_type (no default)
  mysql.client_cert_keystore_password (no default)

These items correspond to similarly-named JDBC connection properties that are described in Driver/Datasource Class Names, URL Syntax and Configuration Properties for Connector/J.

The information that you configure during installation is recorded within the configuration_report.txt file within the installation directory for the Service Manager, with any passwords obscured. (Thus, be sure to record all passwords that you specify during the installation process.)

5.2.2 Installing the Service Manager on Unix and Linux

To install the Service Manager find the file named mysqlmonitor-version-installer.bin (where version indicates the version number, the OS, and the architecture). Ensure that this file is executable by typing:

```bash
shell> chmod +x mysqlmonitor-version-installer.bin
```

To install to the default directory (/opt/mysql/enterprise/monitor), login as root. An unprivileged user installs to the /home/user_name/mysql/enterprise/monitor/ directory.

What follows describes installation from the command line. You can install the Service Manager graphically by running the installer from within a windows manager. In both cases, the steps are identical. You can also install the Service Manager in unattended mode. This is especially useful if you are doing multiple installations. For more information on this topic, see Section 5.4, “Unattended Installation”.

1. Begin installation by typing:

   ```bash
   shell> ./mysqlmonitor-version-installer.bin
   ```

2. First choose the language for the installation:

   ```
   Language Selection
   Please select the installation language
   [1] English
   Please choose an option [1] :
   ```

3. Throughout the installation process, you are asked the configuration questions for different options. Default values are shown between square brackets; to use the default press Enter. Otherwise, enter the new value and press Enter:
First, select the directory to install MySQL Enterprise Service Manager. The default is /opt/mysql/enterprise/monitor/. Make sure that the location you choose has enough space to hold the installation files and the database information that is created when MySQL Enterprise Service Manager is running.

Please specify the directory where the MySQL Enterprise Service Manager will be installed.

Installation directory [/opt/mysql/enterprise/monitor/]:

4. Now set the Tomcat Server options. For more details on these parameters, see Section 5.2.1, “Service Manager Installation Common Parameters”.

Tomcat Server Options

Please specify the following parameters for the bundled Tomcat Server

Tomcat Server Port [18080]:
Tomcat Shutdown Port [18005]:
Tomcat SSL Port [18443]:

You will also be asked if SSL support is required. SSL support lets your agents and the monitor communicate with each other using SSL. Using SSL means that the data exchanged by the agent and MySQL Enterprise Service Manager are secure and can be used to monitor servers securely, or to monitor agents over a public connection.

You enable SSL by pressing Y when prompted during installation:

Is SSL support required? [y/N]:

5. Set the repository (embedded MySQL server) configuration options. For more details on these parameters, see Section 5.2.1, “Service Manager Installation Common Parameters”.

Repository Configuration

Please specify the following parameters for the bundled MySQL server

Repository Username [service_manager]:
Password :
Re-enter :
Bundled MySQL Database Port [13306]:

6. Before the final installation process, you receive the location of the file that contains a copy of all of the settings. Follow the instructions and store this report in a secure location. There is no password recovery feature.
Note:
The settings you specified will be saved here:
/opt/mysql/enterprise/monitor/configuration_report.txt
Press [Enter] to continue:

7. Confirm the installation process.

Setup is now ready to begin installing MySQL Enterprise Monitor on your computer.
Do you want to continue? [Y/n]: Y
Please wait while Setup installs MySQL Enterprise Monitor on your computer.

The installation process could take a few minutes to complete. Upon completion, you see:

Completed installing files
Setup has completed installing MySQL Enterprise files on your computer
Uninstalling the MySQL Enterprise files can be done by invoking:
/opt/mysql/enterprise/monitor/uninstall
To complete the installation, launch the MySQL Enterprise Dashboard and complete the initial setup and product activation information. Refer to the readme file for additional information and a list of known issues.
Press [Enter] to continue:

8. Finally, you can read the Readme file that contains important information about how to use and start your MySQL Enterprise Service Manager.

----------------------------------------------------------------------------------------------
Setup has finished installing MySQL Enterprise Monitor on your computer.
View Readme File [Y/n]: n

Once the Readme file has been displayed, or if you did not elect to read the file, the installation provides information about how to continue with your installation.

Info: To access the MySQL Enterprise Monitor please visit the following page: http://localhost:18080/Auth.action
Press [Enter] to continue:

The Enterprise Dashboard does not start up automatically if you perform a text mode installation. For more information on starting and stopping MySQL Enterprise Service Manager, see Section 5.2.4, “Starting/Stopping the MySQL Enterprise Monitor Service on Unix”.

5.2.3 Installing the Service Manager on Windows

On Windows, the installation modes are win32 and unattended only. Use unattended mode to do multiple installations. For more information on this topic see Section 5.4, “Unattended Installation”.
Installing the Service Manager on Windows

**Note**

To install the Service Manager as a Windows service, perform the installation as a privileged user.

On Windows Vista or later, if user account control is on, an operating system dialog box requests confirmation of the installation.

To install the Service Manager on Windows, find the executable file named mysqlmonitor-version-windows-installer.exe (where version represents the three-part version number).

1. Double-click the MySQL Monitor installer. Select the language to use for the installer and click OK.

2. With the installation language selected, the remainder of the installation sets up the installation location and the main configuration parameters required by MySQL Enterprise Service Manager. Click Next to continue.

3. Select the installation directory to install the MySQL Enterprise Service Manager components. By default on Windows, the directory is C:\Program Files\MySQL\Enterprise\Monitor. Click the button next to the installation directory field to select a directory using the File chooser, or type the directory manually. Click Next to continue.

4. Configure the options that set the network ports used by the Tomcat server. For more information, see Section 5.2.1, “Service Manager Installation Common Parameters”. Click Next to continue.

5. Configure the repository settings, setting the user name, password and port for the bundled MySQL server that stores the information and statistics for your installation. For more information, see Section 5.2.1, “Service Manager Installation Common Parameters”. Click Next to continue.

**Note**

If the Windows firewall is enabled, unblock ports for Apache/Tomcat and the MySQL server.
Figure 5.2 MySQL Enterprise Monitor: Installing Monitor on Windows: Repository Configuration

6. You receive information and a warning about the configuration options and how they are stored in the `configuration_report.txt` file, and its location. Record the full path to this file for future reference. Click Next to continue.

7. You are now prompted to start the installation process. Click Next to continue.

8. Once the installation is completed, you receive information on how to uninstall MySQL Enterprise Service Manager. Click Next to continue.

9. To complete the installation and set up your MySQL Enterprise Service Manager, login to the Dashboard. You can do this automatically by leaving the box checked on the final window before clicking Finish. To skip the Dashboard at this time, uncheck the box and click Finish.

For instructions on starting the MySQL Enterprise Monitor services under Windows, see Section 5.2.5, “Starting/Stopping the MySQL Enterprise Monitor Service on Windows”.

5.2.4 Starting/Stopping the MySQL Enterprise Monitor Service on Unix

The services incorporated into the MySQL Enterprise Service Manager are:

- The MySQL Server.
- The Apache/Tomcat Server.

To start, stop, or restart the MySQL Enterprise Service Manager, run the script `/opt/mysql/enterprise/monitor/mysqlmonitorctl.sh` with the command-line parameter `start`, `stop`, or `restart`. To see the available options, issue the command `mysqlmonitorctl.sh help`.

The `help` parameter produces the following output:

```
usage: ./mysqlmonitorctl.sh help
./mysqlmonitorctl.sh {start|stop|status|restart} mysql
./mysqlmonitorctl.sh {start|stop|status|restart} tomcat
```
help      - this screen
start     - start the service(s)
stop      - stop the service(s)
restart   - restart or start the service(s)
status    - report the status of the service

To autostart all the Service Manager components, call the `mysqlmonitorctl.sh start` from your start-up script.

To start the service:

```
shell> ./mysqlmonitorctl.sh start
./mysqlmonitorctl.sh : mysql started
nohup: redirecting stderr to stdout
Starting mysqld daemon with databases from /opt/mysql/enterprise/monitor/mysql/data/
Using CATALINA_BASE: /opt/mysql/enterprise/monitor/apache-tomcat
Using CATALINA_HOME: /opt/mysql/enterprise/monitor/apache-tomcat
Using CATALINA_TMPDIR: /opt/mysql/enterprise/monitor/apache-tomcat/temp
Using JRE_HOME:       /opt/mysql/enterprise/monitor/java
```

If you try to start the service and it is already running, you are warned that the services are already running.

The `restart` command is equivalent to executing a `stop` and then `start` operation.

This script can also check the status of the Tomcat web server or the MySQL repository.

```
shell> ./mysqlmonitorctl.sh status
MySQL Network MySQL is running
MySQL Network Tomcat is running
```

After the Service Manager is installed, you can configure the Dashboard, as explained in Section 5.2.6, “MySQL Enterprise Service Manager Configuration Settings and Advisor Installation”.

### 5.2.5 Starting/Stopping the MySQL Enterprise Monitor Service on Windows

You can choose to start up the MySQL Enterprise Service Manager on installation. The corresponding Windows services are called:

- MySQL Enterprise Tomcat
- MySQL Enterprise MySQL

You can stop or start these services from the Microsoft Management Console Services window.

**Note**

On Windows Vista or later, starting these services requires administrative privileges. To start or stop a service, right-click it and choose the Run as Administrator menu option. The same restriction applies to the pop-up menu options discussed in the following section, and to starting the services from the command line. To open an administrator cmd window, right-click the cmd icon and choose the Run as Administrator menu option.

To start or stop a service, right-click it and choose from the options in the pop-up menu.

To start or stop the services from the menu, navigate to the Program, MySQL, MySQL Enterprise Monitor, Services entry to stop or start the services.

to start the Tomcat service from the command line, type:

```
shell> sc start MySQLEnterpriseTomcat
```
or:

```shell
net start MySQLEnterpriseTomcat
```

To stop this service type:

```shell
sc stop MySQLEnterpriseTomcat
```

or:

```shell
net stop MySQLEnterpriseTomcat
```

In similar fashion, you can stop or start the MySQL server from the command line. The service name is `MySQLEnterpriseMySQL`.

You can also start, stop, and restart a specific service or both services using the `mysqlmonitorctl.bat` file. To execute this file, go to the command line and navigate to the `C:\Program Files\MySQL\Enterprise\Monitor` directory. Typing `mysqlmonitorctl.bat help` produces the following output:

```
usage: mysqlmonitorctl.bat help
    mysqlmonitorctl.bat (start|stop|restart|install|uninstall)
    mysqlmonitorctl.bat (start|stop|restart) tomcat
    mysqlmonitorctl.bat (start|stop|restart) mysql

  help       - this screen
  start      - start the service(s)
  stop       - stop the service(s)
  restart    - restart or start the service(s)
  install    - install the service(s)
  uninstall  - uninstall the service(s)
```

To stop a specific service, pass the argument `tomcat` or `mysql` in addition to the status change argument. To change the status of both services, do not specify a service name. You can also uninstall the services using this batch file.

After the Service Manager is installed, you can configure the Dashboard, as explained in Section 5.2.6, “MySQL Enterprise Service Manager Configuration Settings and Advisor Installation”.

### 5.2.6 MySQL Enterprise Service Manager Configuration Settings and Advisor Installation

The Enterprise Dashboard is the web-based interface to the Service Manager. The procedure for starting the dashboard is identical for all platforms. From the dashboard, you can configure the settings necessary for receiving updates from MySQL Enterprise.

If you installed the Service Manager using a graphical interface, you have the option of launching the dashboard on the final installation screen (as long as the `Launch MySQL Enterprise Monitor Now` checkbox is checked).

Otherwise, you can view the dashboard by typing `http://localhost:18080/Auth.action` into the address bar of your web browser. To see the host name and port to use, check the `configuration_report.txt` file.

Under Windows, you can also open the dashboard by choosing the `MySQL` menu item and finding the `MySQL Enterprise Monitor` entry. Under this entry, choose `Start Service Manager`.

### 5.2.6.1 Initial Dashboard Log-In

If this is the first time logging in to the dashboard, you see a screen similar to the following:
Use this screen to perform the following tasks:

- Set up your My Oracle Support credentials.
- Create a user name and password for the dashboard administrator.
- Create a user name and password for the Monitor Agent.

To import the Advisors file, click the **Browse** button and locate it. The advisor file is named, `AdvisorScript-version.jar`. If you do not allow Internet access from the dashboard, you must install the advisors in this way. Although we strongly recommend that you install the Advisors at this point, you can also do so later. For instructions on doing this, see Section 5.2.6.3, “Installing, Updating or Upgrading Advisors After Initial Login”.

In the **Create Manager User** section of this screen, enter credentials for the dashboard administrator. This creates the Manager user described in Section 5.1.3, “Users Created on First Log-in”. Record the user name and password, as these credentials are required for any future login.

In the **Create Agent User** section of this screen, enter the credentials for the agent. This is the user described in Section 5.1.3, “Users Created on First Log-in”. The agent must log in to report its findings. Record the agent's credentials; this information is required when installing the agent.

After specifying all settings, click the **complete setup** button. When you log in, a message reports how many graphs and advisors were imported.
5.2.6.2 Setting the Timezone and Locale

If this is the first time that you have launched the dashboard, you are asked to set your time zone and locale. Choose the appropriate values from the drop-down list boxes. Setting the time zone ensures that you have an accurate time reference for any notifications from the MySQL Enterprise Advisors.

Warning

Make sure to set the time zone (and the system clock) correctly because this setting affects the way the graphs display. To change the time zone or locale, see Section 2.8.2, “User Preferences”.

The locale chosen determines the default language displayed when logging in to the Dashboard. This overrides the default browser settings whenever this specific user logs in.

After specifying your time zone and locale, the dashboard opens on the Monitor tab. For a detailed examination of the Monitor Screen, see Section 2.1, “MySQL Enterprise Dashboard”.

5.2.6.3 Installing, Updating or Upgrading Advisors After Initial Login

The Advisors interpret the data sent by the Monitor Agents and display the results in the dashboard. A full set of Advisors is preinstalled with the Service Manager. You can download any new or updated Advisors from the My Oracle Support site.

If you did not install the Advisors when you first logged in to the MySQL Enterprise Monitor User Interface, open the dashboard, find the Advisors tab, and choose the Check for Updates link. Doing this downloads the latest version of the Advisors from an Oracle web site.

If you do not allow Internet access from the dashboard, install the Advisors from a local file. You need an advisor file named AdvisorScript-version.jar. If you do not already have this file, download it from the My Oracle Support site. Download the Advisors file to a location that is accessible from the dashboard. Use the Browse button to find the Advisors file and then choose import to load the advisors.

5.3 Monitor Agent Installation

A MySQL Enterprise Monitor Agent monitors a MySQL server and sends data to the Advisors. The data is interpreted and displayed in the Dashboard. The following section describes how to install the Agent on all platforms.

Note

As of MySQL Enterprise Monitor Agent 2.3.13, the MySQL Enterprise Monitor Agent Installer no longer checks the PATH for a local MySQL Client installation. Instead, the Installer will use the bundled MySQL Client. And as of MySQL Enterprise Monitor Agent 2.3.13, the Installer bundles MySQL client version 5.6.

However, the MySQL Enterprise Monitor Agent Installer for Solaris 9 and Solaris 10 bundle MySQL Client version 5.1.

5.3.1 Creating a MySQL User Account for the Monitor Agent

The MySQL Enterprise Monitor Agent requires a user configured within each MySQL instance that is being monitored with suitable privileges to collect information about the server, including variable names, replication, and storage engine status information. The agent installer creates a suitable user for you during installation if you supply the installer with a user/password for a privileged user (such as the root user). This account information is used only during the installation to create the user, and is not written to any file. If you use this option, skip the remainder of this section.
Creating the Agent Account Manually

If you do not supply the root user information to the installer, create a user manually within your MySQL server and provide these credentials as the agent user/password combination during installation. The privileges required for this user account vary depending on the information you gather using the MySQL Enterprise Monitor Agent. The following privileges allow the Monitor Agent to perform its assigned duties without limitation:

- **SHOW DATABASES**: The MySQL Enterprise Monitor Agent can gather inventory about the monitored MySQL server.

- **REPLICATION CLIENT**: The MySQL Enterprise Monitor Agent can gather Replication master/slave status data. This privilege is only needed if you use the MySQL Replication Advisor Rules.

- **SELECT**: The MySQL Enterprise Monitor Agent can collect statistics for table objects.

- **SUPER**: The MySQL Enterprise Monitor Agent can execute `SHOW ENGINE INNODB STATUS` to collect data about InnoDB tables. This privilege is also required to obtain replication information using `SHOW MASTER STATUS`, and to temporarily switch off replication when populating the `mysql.inventory` table used to identify the MySQL instance.

- **PROCESS**: When monitoring a MySQL server running MySQL 5.1.24 or above with InnoDB, the `PROCESS` privilege is required to execute `SHOW ENGINE INNODB STATUS`.

- **INSERT**: Required to create the UUID required by the agent.

- **CREATE**: The MySQL Enterprise Monitor Agent can create tables. During discovery, the agent creates the table `inventory` within the `mysql` database that stores the UUID for the server. Without this table, the agent cannot determine the UUID of the server, which it sends along with other information to MySQL Enterprise Service Manager.

For example, the following `GRANT` statement gives the agent the required SELECT, REPLICATION CLIENT, SHOW DATABASES and SUPER rights:

```sql
GRANT SELECT, REPLICATION CLIENT, SHOW DATABASES, SUPER, PROCESS
ON `*.*`
TO 'mysqluser'@'localhost'
IDENTIFIED BY 'agent_password';
```

For security reasons, you might limit the CREATE and INSERT privileges to the agent so that it can only create tables within the `mysql` database:

```sql
GRANT CREATE, INSERT
ON mysql.*
TO 'mysqluser'@'localhost'
IDENTIFIED BY 'agent_password';
```

To let replication discovery work, grant the SELECT privilege on the `mysql.inventory` table for each user with replication privileges on the corresponding replication master. This is required to let the MySQL Enterprise Monitor Agent read the replication master UUID. For example:

```sql
GRANT SELECT
ON mysql.inventory
TO 'replicationuser'@'localhost'
IDENTIFIED BY 'replication_password';
```

**Note**

Perform this step after after running the agent on the corresponding MySQL server to ensure that the `mysql.inventory` table is created correctly. Run the
agent, shut the agent down, run the above \texttt{GRANT} statement, and then restart the agent.

If the agent cannot access the information from the table, a warning containing this information is written to the agent log.

\textbf{Note}

You might disable logging for the grant statement to prevent the grant information being replicated to the slaves. In this case, execute the statement \texttt{SET SQL_LOG_BIN=0} before executing the above \texttt{GRANT} statement.

In a typical configuration, the agent runs on the same machine as the MySQL server it is monitoring, so the host name is \texttt{localhost}. If the agent is running on a machine other than the one that hosts the monitored MySQL server, change \texttt{localhost} to the appropriate value. For more information about remote monitoring, see Section 5.3.6, “Configuring an Agent to Monitor a Remote MySQL Server”.

### 5.3.2 Installing the Monitor Agent on Unix and Linux

\textbf{Note}

To install the MySQL Enterprise Monitor Agent on Linux systems, you must have the Linux Standards Base (LSB) initialization functions installed. To check the existence of the LSB components, look for an LSB package within your Linux package management environment. For example, on RedHat and other RPM-based distributions:

\begin{verbatim}
shell> rpm -qa | grep -i lsb
redhat-lsb-3.1-19.fc8.x86_64
\end{verbatim}

Under Debian/Ubuntu:

\begin{verbatim}
shell> dpkg -l|grep -i lsb
   ii  lsb-base                                   3.2-20ubuntu4
   ii  lsb-release                                3.2-20ubuntu4
   ii  lsb-release                                3.2-20ubuntu4
   ii  lsb-base                                   3.2-20ubuntu4
   ii  lsb-release                                3.2-20ubuntu4
\end{verbatim}

Alternatively, you can use the \texttt{lsb_release} command. Existence of this command normally indicates that the current distribution is LSB compliant.

To install the agent, navigate to the directory that contains the file \texttt{mysqlmonitoragent-version-installer.bin} (where \texttt{version} indicates the three-part version number, the OS, and the architecture). Ensure that this file is executable by typing:

\begin{verbatim}
shell> chmod +x mysqlmonitoragent-version-installer.bin
\end{verbatim}

\textbf{Note}

To install to the default directory (/opt/mysql/enterprise/agent), log in as \texttt{root} first. Installing as an unprivileged user installs to the /home/user\_name/mysql/enterprise/agent directory.

To automatically start the agent upon rebooting, you must install while logged in as root. If you install as an unprivileged user, you must start the agent yourself after each reboot.

The following section covers installation from the command line. You can install the Monitor Agent graphically by running the installer from within a windows manager. In both cases, the steps are identical.
You can also install the Monitor Agent in **unattended** mode, for example to do multiple installations. For more information on unattended installation, see Section 5.4, “Unattended Installation”.

**Note**

To install multiple agents on the same machine, use the `servicename` option to the installer to set a unique service name each time. For more information, see `installer_servicename`

Begin installation from the command line by typing:

```
shell> ./mysqlmonitoragent-version-installer.bin --mode text
```

The following section shows the various options. Default values are indicated by square brackets; to select them, press Enter. Otherwise, enter a value of your choosing.

1. First, select the Language you want to use during the installation process:

   **Language Selection**

   Please select the installation language
   [1] English
   Please choose an option [1] :

2. Next, specify the directory in which to install the agent:

   Welcome to the MySQL Enterprise Monitor Agent Setup Wizard.

   Please specify the directory where MySQL Enterprise Monitor Agent will be installed

   Installation directory [/opt/mysql/enterprise/agent]:

3. If the installer identifies that an existing version of the MySQL Enterprise Monitor Agent is installed, provide an alternative name for the installation. This defines the name of the file created in `/etc/init.d` used to start the agent. You can enter a different name to perform multiple installations.

4. Specify the MySQL server to monitor. First, specify whether to use a TCP/IP or a socket-based connection to communicate with the MySQL Server:

   How will the agent connect to the database it is monitoring?

   [1] TCP/IP
   [2] Socket
   Please choose an option [1] :

5. Choose one or more operations for this agent to perform:

   - Enable monitoring a MySQL Server: This is the main operation of monitoring the MySQL server in terms of performance, security and availability.

   - Enable the MySQL Enterprise Agent Aggregator: It is used for future Connector plugins or user-written methods of transmitting Query Analyzer data to the MySQL Enterprise Service Manager.

   - Enable the MySQL Enterprise Agent Proxy Service: To study Query Analyzer information by sending your queries through the MySQL Enterprise Agent Proxy Service, switch this option on.

6. If you chose to monitor a MySQL server, next you provide the connection options for communicating with the server.
If you selected TCP/IP, you enter the TCP/IP address and port number:

Monitored Database Information

MySQL hostname or IP address [127.0.0.1]:

Validate MySQL hostname or IP address [Y/n]:

MySQL Port [3306]:

If you select Socket, then you provide the path name to the MySQL socket. Typical values are /tmp/mysql.sock, /var/lib/mysql.sock, or /var/run/mysql.sock.

Monitored Database Information

MySQL Socket []:

Note

The monitor agent always associates “localhost” with the TCP/IP address 127.0.0.1, not the MySQL socket. This is in contrast to the MySQL Command Line Tool, which connects via the MySQL socket by default on Unix, if the hostname “localhost” is specified.

If the MySQL server to monitor was started with the \texttt{--skip-networking} option, then you cannot connect to it via TCP/IP, as the server does not listen for TCP/IP connections. In this case, configure the monitor agent to use the MySQL socket. During installation, select “socket” rather than “TCP/IP” and then specify the MySQL socket name. Or, after installation, edit the \texttt{agent-instance.ini} configuration file. For further information, refer to Section C.2.2, “MySQL Server (agent-instance.ini) Configuration”.

If the MySQL server to be monitored was started using the command option \texttt{--bind-address}, then the server only listens for connections on the IP address specified, that is, the IP address of the MySQL server. If the monitor agent was started using TCP/IP networking and the default address of 127.0.0.1, it cannot connect to the server to be monitored. Also, if “localhost” is specified as the host name during agent configuration, a connection is not established, as the server listens for connections on the address specified with the \texttt{--bind-address} option, not 127.0.0.1.

7. Specify the user credentials for the MySQL server that you want to monitor:

MySQL Username []: \texttt{service_agent}

MySQL Password :

Re-enter :

8. The installer can create the MySQL Enterprise Monitor Agent user on the MySQL server that is required to connect to the server and obtain statistical information. The installer can create an
account for you, or you can use an existing account. If you want the installer to create the user, enter the credentials of a user (such as the root user) that has the privileges to create the new user and grant it the privileges to monitor the server.

9. If you want to use Query Analyzer with the MySQL Enterprise Agent Aggregator, configure the aggregator port and SSL settings. For more information on Query Analyzer, see Section 2.6, “The Query Analyzer Tab”.

When MySQL Enterprise Agent Aggregator is enabled, the MySQL Enterprise Monitor Agent listens on a network port for connections from Connector plugins providing query analyzer data, forwarding the query analyzer information to MySQL Enterprise Service Manager. You can change the port number that MySQL Enterprise Monitor Agent listens for connections from connectors. If you configure the aggregator to support SSL connections, you must provide the location of the PEM and CA certificate files to be used for SSL support.

The default port is 14000 for non-SSL communication, and 14443 for SSL communication.

10. If you enable the MySQL Enterprise Agent Proxy Service for Query Analyzer, enter the configuration information. (the port on which the agent listens for queries).

11. Enter the details of the MySQL Enterprise Service Manager to use with this agent. You can retrieve this configuration information from the configuration_report.txt file generated when you installed MySQL Enterprise Service Manager.

The agent and MySQL Enterprise Service Manager support using SSL for communication. To enable SSL communication between the agent and the MySQL Enterprise Service Manager, reply Y to the following question.
Use SSL? [y/N]:
Agent Username [agent]:
Agent Password :
Re-enter :

12. Before installation starts, you receive a summary of the installation settings that you specified:

Here are the settings you specified:

Installation directory: /opt/mysql/enterprise/agent

Monitored MySQL Database:
--------------------------------
Hostname or IP address: 127.0.0.1
Port: 3306
MySQL username: mysql_user
MySQL password: password

Query Analyzer Configuration
---------------------------
Proxy Enabled: yes
Proxy Port: 6446

MySQL Enterprise Manager:
--------------------------------
Hostname or IP address: 192.168.0.197
Tomcat Server Port: 18080
Tomcat SSL Port: 18443
Use SSL: 0
Agent username: agent

Press [Enter] to continue :

Setup is now ready to begin installing MySQL Enterprise Monitor Agent on your computer.
Do you want to continue? [Y/n]: y

13. The installer copies the necessary files and creates the configuration file required to run the agent:

Please wait while Setup installs MySQL Enterprise Monitor Agent on your computer.

Installing
0% ______________ 50% ______________ 100%
#########################################

Info to start MySQL Agent

The MySQL agent was successfully installed. To start the MySQL Agent please invoke:
/opt/mysql/enterprise/agent/etc/init.d/mysql-monitor-agent start

Press [Enter] to continue :
Installing the Agent on Microsoft Windows

Setup has finished installing MySQL Enterprise Monitor Agent on your computer.

14. Finally, you can read the supplied README file. The README is the share/doc/README_en.txt file within the agent installation directory.

For information on starting the agent, see Section 5.3.4.2, “Starting/Stopping the Agent on Unix”.

5.3.3 Installing the Agent on Microsoft Windows

To install the MySQL Enterprise Monitor Agent on Windows, double-click the mysqlmonitoragent-version-windows-installer.exe (where version indicates the three-part version number) installer.

Note

To install the agent as a Windows service, you must do the installation as a privileged user.

On Windows Vista or later, if user account control is on, an operating system dialog box requests confirmation of the installation.

You can install the Monitor Agent in unattended mode, for example, to do multiple installations. For more information on this topic, see Section 5.4, “Unattended Installation”.

Note

To install multiple agents on the same machine, use the servicename option to the installer to install each agent with a unique service name. For more information, see installer_servicename if the installer identifies an existing installation and you do not specify an alternative service name, the installer stops.

1. First, select the language for the MySQL Enterprise Monitor Agent installation. Click OK to continue installation.

2. Click Next to start the installation process.

3. Select the installation directory. The default installation directory is C:\Program Files\MySQL\Enterprise\Agent. Select the installation directory, or type the new directory location. Click Next to continue the installation process.

4. Choose one or more operations for this agent to perform:

   • Enable monitoring a MySQL Server: This is the main operation of monitoring the MySQL server in terms of performance, security and availability.

   • Enable the MySQL Enterprise Agent Aggregator: It is used for future Connector plugins or user-written methods of transmitting query analyzer data to the MySQL Enterprise Service Manager.

   • Enable the MySQL Enterprise Agent Proxy Service: To study your query analyzer information by sending your queries through the MySQL Enterprise Agent Proxy Service, switch this option on.

5. You specify the information about the MySQL server that you want to monitor. Enter the IP address or host name of the host you want to monitor, and the port, user name and password to connect to the MySQL server. To confirm that the MySQL server is currently reachable using the information, ensure that the Validate MySQL host name or IP address checkbox is selected.

Note

Currently, on Windows, the monitor agent only includes support for connecting to the server to be monitored via TCP/IP, so you cannot monitor a server running with the --skip-networking.
If the MySQL server to be monitored has been started using the command option `--bind-address`, the server only listens for connections on the IP address specified, that is, the IP address of the MySQL server. If the monitor agent is started using TCP/IP networking and the default address of 127.0.0.1, it cannot connect to the server to be monitored. Also, if "localhost" is specified as the host name during agent configuration, a connection is not established, as the server listens for connections on the address specified with the `--bind-address` option, not 127.0.0.1.

Figure 5.4 MySQL Enterprise Monitor: Installing Agent on Windows: Monitored Database Information

Click Next to continue the installation.

6. The installer can create the MySQL Enterprise Monitor Agent user on the MySQL server that is required to connect to the server and obtain statistical information. The installer can create an account for you, or you can use an existing account. If you want the installer to create the user,
enter the credentials of a user (such as the root user) that has the privileges to create the new user and grant it the privileges to monitor the server.

7. The MySQL Enterprise Service Manager that you want to use must be configured during installation. The host name, port and agent authentication information must be entered. If you have already installed MySQL Enterprise Service Manager, you can locate the information in the installation report file created during installation. Enter the required information and then click Next to continue.

Figure 5.5 MySQL Enterprise Monitor: Installing Agent on Windows: MySQL Enterprise Service Manager Options

8. To use Query Analyzer with the MySQL Enterprise Agent Aggregator, configure the aggregator port and SSL settings. For more information on Query Analyzer, see Section 2.6, “The Query Analyzer Tab”.

When MySQL Enterprise Agent Aggregator is enabled, the MySQL Enterprise Monitor Agent listens on a network port for connections from Connector plugins providing query analyzer data, forwarding the query analyzer information to MySQL Enterprise Service Manager. You can change the port
number that MySQL Enterprise Monitor Agent listens for connections from connectors. You can also configure the aggregator to support SSL connections, in which case you must provide the location of the PEM and CA certificate files to be used for SSL support.

The default port is 14000 for non-SSL communication, and 14443 for SSL communication.

9. To use Query Analyzer with the MySQL Enterprise Agent Proxy Service, enable the MySQL Enterprise Monitor Agent Proxy service and configure the port and other information. If you disable the Proxy during installation, you must enable it later before you can use Query Analyzer. For more information on Query Analyzer, see Section 2.6, “The Query Analyzer Tab”.

When Proxy is enabled, MySQL Enterprise Monitor Agent listens on a network port for client applications, and forwards the connections to the backend MySQL server. You can change the port number that MySQL Enterprise Monitor Agent listens for connections.

The default port is 6446.

10. You receive a Configuration Report containing the information that you have entered during the installation. Check the information provided in the report. If the information is correct, click Next to continue. If you see a problem, use Back to go back to the configuration screen and change the information.

11. You have a final opportunity to change the installation parameters. Click Next to start the installation process.

12. Once the agent is installed, you get a confirmation message. Click Next to finalize the installation.

13. You can start the MySQL Enterprise Monitor Agent automatically now that the installation is complete. To start the agent now, leave the checkbox selected. To start the agent separately, uncheck the checkbox. Click Finish to exit the installation.

Once the Monitor Agent is installed, you must start it. For information on how to start and stop the Agent, see Section 5.3.4.1, “Starting/Stopping the Agent on Windows”.

5.3.4 Starting/Stopping the MySQL Enterprise Monitor Agent

The MySQL Enterprise Monitor Agent can be started and stopped at any time. When not running, information about the current status of your server is not available, and MySQL Enterprise Service Manager provides a warning if an agent and the MySQL server that it monitors is unavailable.

Warning
If you are using Query Analyzer, turning off the agent prevents your applications from communicating with the MySQL server. See Section 2.6, “The Query Analyzer Tab”.

5.3.4.1 Starting/Stopping the Agent on Windows

You have the option of starting the Monitor Agent from the final installation screen. Otherwise you can do this by going to the Start Menu and under Programs find MySQL and then the MySQL Enterprise Monitor Agent entry. Simply select the Start MySQL Enterprise Monitor Agent option.

Note
On Windows Vista or later, starting the agent requires administrative privileges—you must be logged in as an administrator. To start or stop the agent right-click the menu item and choose the Run as Administrator menu option. The same restriction applies to starting the agent from the command line. To open an administrator cmd window right-click the cmd icon and choose the Run as Administrator menu option.
To report its findings, the agent needs to be able to connect to the dashboard through the port specified during installation. The default value for this port is 18080; ensure that this port is not blocked. If you need help troubleshooting the agent installation see, Section 5.3.9, “Troubleshooting the Agent”.

Alternately, you can start the agent from the command line by entering:

```
shell> sc start MySQLEnterpriseMonitorAgent
```
or:

```
shell> net start MySQLEnterpriseMonitorAgent
```

You can also start the agent by issuing the command, `agentctl.bat start`. Stop the agent by passing the argument, `stop`. This batch file is found in the `Agent` directory.

For confirmation that the service is running you can open the Microsoft Management Console Services window. To do this go to the Control Panel, find Administrative Tools and click the link to Services. Locate the service named MySQL Enterprise Monitor Agent and look under the Status column.

You can also start the agent from this window rather than from the Start menu or the command line. Simply right-click MySQL Enterprise Monitor Agent and choose Start from the pop-up menu. Starting the agent from this window opens an error dialog box if the agent cannot connect to the MySQL server it is monitoring. No error is displayed if the agent is unable to connect to the MySQL Enterprise Service Manager.

The pop-up menu for starting the agent also offers the option of stopping the agent. To stop the agent from the command line you only need type:

```
shell> sc stop MySQLEnterpriseMonitorAgent
```
or:

```
shell> net stop MySQLEnterpriseMonitorAgent
```

**Note**

`MySQLEnterpriseMonitorAgent` is the default name of the Monitor Agent service. If you have added an additional agent as described in Section C.2.2, “MySQL Server (agent-instance.ini) Configuration”, replace `MySQLEnterpriseMonitorAgent` with the appropriate agent name.

### 5.3.4.2 Starting/Stopping the Agent on Unix

When installation is finished, you can start the monitor agent from the command line by typing:

```
shell> /opt/mysql/enterprise/agent/etc/init.d/mysql-monitor-agent start
```

For a non-root installation the command would be:

```
shell> /home/<user name>/mysql/enterprise/agent/etc/init.d/mysql-monitor-agent start
```

To stop the agent, use the `stop` command:

```
shell> ./mysql-monitor-agent stop
```
If the agent cannot be stopped because the pid file that contains the agent's process ID cannot be found, you can use kill to send a TERM signal to the running process:

```
shell> kill -TERM PID
```

If you run more than one agent on a specific machine, you must also specify the path to the ini file when you stop the agent. Executing mysql-monitor-agent stop without an ini file only stops the agent associated with the default ini file. Likewise, when checking the status of an agent, specify its ini file.

To verify that the agent is running, use the following command:

```
shell> ./mysql-monitor-agent status
```

The resulting message indicates whether the agent is running. If the agent is not running, use the following command to view the last ten entries in the agent log file:

```
shell> tail /opt/mysql/enterprise/agent/log/mysql-monitor-agent.log
```

For further information on troubleshooting the agent, see Section 5.3.9, “Troubleshooting the Agent”.

Installation creates the directory /opt/mysql/enterprise/agent with the settings stored in the mysql-monitor-agent.ini file located directly below this directory in the etc directory. The log directory is also located immediately below the agent directory.

To see all the command-line options available when running the monitor agent, navigate to the /opt/mysql/enterprise/agent/etc/init.d directory and execute mysql-monitor-agent help, which displays the usage message:

```
Usage: ./mysql-monitor-agent {start|stop|restart|status} [ini-file-name]
```

The ini-file-name option only needs to be used if the ini file is not installed to the default location or you have changed the name of the ini file. You will need to use this option if you are installing more than one agent on the same machine. Pass the full path to the ini file. For example, after navigating to the /opt/mysql/enterprise/agent/etc/init.d directory, issue the command:

```
shell> ./mysql-monitor-agent start /opt/mysql/enterprise/agent/etc/new-mysql-monitor-agent.ini
```

If you installed the agent as root, on reboot the mysql-monitor-agent daemon starts up automatically. If you installed the agent as an unprivileged user, you must manually start the agent on reboot or write a script to perform this task. Likewise, if you added an additional agent as described in Section C.2.2, “MySQL Server (agent-instance.ini) Configuration”, to start this agent on reboot, create a system initialization script appropriate to your operating system. To determine whether the agent is running, navigate to the init.d directory and issue the command ./mysql-monitor-agent status.

**Warning**

To report its findings, the agent connects to the dashboard through the port specified during installation. The default value for this port is 18080; ensure that this port is not blocked. To troubleshoot the agent installation, see Section 5.3.9, “Troubleshooting the Agent”.

### 5.3.5 Monitoring Multiple MySQL Servers

You can monitor multiple MySQL servers (either on the same machine, or across different machines) using two different methods:
• Using multiple copies of the MySQL Enterprise Monitor Agent to monitor each server individually. Using this method requires additional overhead to monitor each server, while also allowing you to supply Query Analyzer data.

• Using a single agent instance to monitor multiple MySQL servers. Query Analysis is not available for the additional servers. As the number of monitored servers increases, graphs might begin to lag (for >10 servers) or become blank (for >20 servers).

**Using Multiple Agent Instances**

To use multiple agents to monitor multiple MySQL servers you need to create a new configuration structure for both the agent and the MySQL server instances you need to monitor, including the binaries and configuration files, and then update the configuration to set the corresponding parameters to monitor the new server. Using this method lets you enable query analysis by redirecting requests to the target server using the built-in proxy service within the agent.

For example, the following directory structure shows the configuration directory for two agents monitoring a single MySQL server each:

```
./init.d
./init.d/mysql-monitor-agent
./instances
./instances/agent
./instances/agent/agent-instance.ini
./instances-second/agent
./instances-second/agent/agent-instance.ini
./mysql-monitor-agent.ini
./mysql-second-agent.ini
```

The `mysql-monitor-agent.ini` file contains the configuration for the first agent, with the MySQL servers monitored defined within the `instances` directory. The `mysql-second-agent.ini` file contains the configuration information for the second agent, with the MySQL servers monitor defined within the `instances-second` directory.

To set up multiple agents:

1. Make sure that the MySQL instance that you want to monitor has a suitable user to use for connecting to the server. For more information, see Section 5.3.1, “Creating a MySQL User Account for the Monitor Agent”.

2. You need to generate a new UUID for the new agent:

   ```shell
   shell> /opt/mysql/enterprise/agent/bin/mysql-proxy --plugins=agent --agent-generate-uuid ee9296d7-f7cd-4f3e-8b26-eaad8e4ebf398
   2009-03-05 11:49:37: (critical) shutting down normally
   ```

   Keep a record of the UUID to update the configuration file.

   Note, the agent should not be running when the UUID is generated.

3. Copy the main agent configuration file, which is by default in `/opt/mysql/enterprise/agent/etc/mysql-monitor-agent.ini`:

   ```shell
   shell> cp mysql-monitor-agent.ini mysql-second-agent.ini
   ```

4. Edit the new configuration file, changing the following settings:

   • Change the `mysqld-instance-dir` to the new directory for the individual MySQL server configuration files.

   • Change the `proxy-address` to a different value than the first agent configuration.
- Change the `proxy-backend-addresses` to specify the IP address and MySQL port number for the MySQL server.
- Change the `agent-uuid` to the new value obtained in an earlier step.
- Change the `log-file` parameter to specify a different file to use when logging errors and problems. You cannot log to the same file from two different agents.
- Change the `pid-file` parameter to specify the file in which to store the process ID of the agent.

5. Copy an existing configuration directory and configuration files to the new directory:

```bash
shell> cp -R etc/instances etc/instances-second
```

6. Edit the configuration file, `instances/second/agent/agent-instance.ini` within the new directory, and set the `user`, `password` and either the `hostname` and `port`, or `socket` parameters.

7. With multiple instances, you start each agent individually, specifying the location of the main configuration file. For example, to start the original (default) service:

```bash
shell> /opt/mysql/enterprise/agent/etc/init.d/mysql-monitor-agent start /opt/mysql/monitor/agent/etc/mysql-monitor-agent.ini
```

To start the second instance:

```bash
shell> /opt/mysql/enterprise/agent/etc/init.d/mysql-monitor-agent start /opt/mysql/monitor/agent/etc/mysql-second-agent.ini
```

### Using a Single Agent Instance

**Warning**

Do not use the single agent instance method if you intend to use Query Analyzer. If you set your application to use the proxy port provided by the single instance then the queries might not be directed to the correct server. Using Query Analyzer, the proxy, and the single agent instance method is not supported.

**Warning**

When using the single agent instance method, the agent attempts to determine the right information about the backend server that it is monitoring in order to use the information when applying rule and advisor information. Currently, this operation is performed for only one of the servers in the list of configured servers. If the servers being monitoring are using different MySQL versions then the rules applied to the servers might be incorrect, and you could get wrong or misleading advice about issues or problems on a given server.

To use a single agent to monitor multiple instances, you can create additional directories and configuration files within the `instances` directory for the agent. For example, you can see the default structure of the agent configuration directory:

```
./init.d
./init.d/mysql-monitor-agent
./instances
./instances/agent
./instances/agent/agent-instance.ini
./mysql-monitor-agent.ini
```

Within the `instances` directory, you can add further directories, one for each monitored server. Each additional directory must have a suitable `agent-instance.ini` file containing the connection
Configuring an Agent to Monitor a Remote MySQL Server

information for the new MySQL server instance. For example, the following structure demonstrates an agent monitoring four MySQL servers:

```
./init.d
./init.d/mysql-monitor-agent
./instances
./instances/agent
./instances/agent/agent-instance.ini
./instances/mysql2
./instances/mysql2/agent-instance.ini
./instances/mysql-rep
./instances/mysql-rep/agent-instance.ini
./instances/mysql-backup
./instances/mysql-backup/agent-instance.ini
./mysql-monitor-agent.ini
```

To add another MySQL monitored server, follow these steps:

1. Make sure that the MySQL instance that you want to monitor has a suitable user to use for connecting to the server. For more information, see Section 5.3.1, "Creating a MySQL User Account for the Monitor Agent".

2. Copy an existing configuration directory and configuration files to the new directory:

   ```shell>
   cp -R etc/instances/agent etc/instances/mysql2
   ```

3. Edit the configuration file within the new directory, for example `mysql2/agent-instance.ini`, and set the `user`, `password` and either the `hostname` and `port`, or `socket` parameters.

4. Restart the agent:

   ```shell>
   mysql-monitor-agent restart
   ```

5.3.6 Configuring an Agent to Monitor a Remote MySQL Server

Typically, the agent runs on the same machine as the MySQL server it is monitoring. Fortunately, this is not a requirement. If you want to monitor a MySQL server running on an operating system for which there is no agent available, you can install the agent on a machine other than the one hosting the MySQL server.

The process for installing an agent to monitor a MySQL server on a remote machine is identical to the process described in Section 5.3, "Monitor Agent Installation". Follow the directions given there, being careful to specify the correct IP address or host name for the MySQL Enterprise Service Manager and likewise for the MySQL server—since the agent is not running on the same machine as the MySQL server, it cannot be the default, `localhost`.

Don't forget that the agent must be given rights to log in to the MySQL server from a host other than `localhost` and that the port used by the MySQL server, typically `3306` must be open for remote access. For more information about the database credentials required by agents see, Section 5.3.1, "Creating a MySQL User Account for the Monitor Agent".

The agent also needs to be able to log in to the MySQL Enterprise Service Manager, typically using port `18080`, so ensure that the appropriate port is open.

**Note**

Remote agents do not report the OS information for either the host or the agent.

For replication autodiscovery, do not use remote monitoring with replication slaves or masters. The agent must be installed on the same machine as the server you are monitoring in order for discovery to work properly. For more information, see Section 2.7, "The Replication Tab".
5.3.7 Monitoring Outside the Firewall with an SSH Tunnel

If you run an SSH server on the machine that hosts the MySQL Enterprise Service Manager and an
SSH client on the machine that hosts the agent, you can create an SSH tunnel so that the agent can
bypass your firewall. First, you need to make an adjustment to the hostname value specified in the
[mysql-proxy] section of the .ini file. (For more information about the contents and location of the
.ini file see Section C.2.1, “MySQL Enterprise Monitor Agent Configurable Options”.) Stop the agent
and change the hostname value as shown in the following:

```
hostname = http://agent_name:password@localhost:18080/heartbeat
```

Replace the agent_name and password with suitable values. Likewise replace port 18080 if you
are not running the dashboard on this port. Use localhost for the host name, since the agent is
connecting through an SSH tunnel.

Next, execute the following command on the machine where the agent is running:

```
shell> ssh -L 18080:Dashboard_Host:18080 -l user_name -N Dashboard_Host
```

When prompted, enter the password for user_name.

If you are not running the MySQL Enterprise Service Manager on port 18080, substitute the
appropriate port number. Likewise, replace Dashboard_Host with the correct value. user_name
represents a valid operating system user on the machine that hosts the MySQL Enterprise Service
Manager.

Be sure to restart the agent so that the new value for the hostname takes effect. For instructions on
restarting the agent see:

• Under Windows see, Section 5.3.4.1, “Starting/Stopping the Agent on Windows”.

• Under Unix see, Section 5.3.4.2, “Starting/Stopping the Agent on Unix”.

5.3.8 Generating a New UUID

For MySQL Enterprise Monitor to operate correctly, each agent must have a unique UUID in order to
uniquely identify the agent with the MySQL Enterprise Service Manager.

```
shell> bin/mysql-proxy --plugins=agent --agent-generate-uuid
```

This should display a line similar to the following:

```
ee9296d7-f7cd-4fee-8b26-ead884ebf398
```

Paste this line into the [mysql-proxy] section of the mysql-monitor-agent.ini file for the
agent-uuid parameter:

```
[mysql-proxy]
...
agent-uuid=ee9296d7-f7cd-4fee-8b26-ead884ebf398
```
Troubleshooting the Agent

In Windows, go to the command line and change to the MySQL Enterprise Monitor Agent installation directory and update the UUID by executing:

```
C:\> cd C:\Program Files\MySQL\Enterprise\Agent
C:\> mysql-monitor-agent -uf mysql-monitor-agent.ini
```

This updates the configuration file directly with the new UUID.

5.3.9 Troubleshooting the Agent

The first step in troubleshooting the agent is finding out whether it is running or not. To do this see:

- Windows: Section 5.3.4.1, “Starting/Stopping the Agent on Windows”
- Unix: Section 5.3.4.2, “Starting/Stopping the Agent on Unix”

Some additional tips are:

- To diagnose any issues with the agent, start by looking at the Logs link under the Settings tab, as described in Section 2.8.6, “Logs”. This page consolidates troubleshooting information across all the MySQL Enterprise Monitor components.

- To run on start-up, the agent requires correct login credentials for the monitored MySQL server. Log in to the monitored MySQL server and check the agent's credentials. Compare the values of the Host, User, and Password fields in the mysql.user table with the values shown in the [mysqld] section of the etc/instances/mysql/agent-instance.ini file. If incorrect credentials are specified in the ini file, simply correct them and restart the agent. Remember, changes to the ini file do not take effect until the agent is restarted.

- The agent will not start up if incorrect credentials are specified for the service manager login. Using incorrect credentials for logging in to the service manager creates an entry in the agent log file. For the location of this log file see Section C.2.3, “Agent Log and pid Files”.

- If the agent starts up but no server appears in the dashboard, check the hostname specified in the [mysql-proxy] portion of the mysql-monitor-agent.ini file. Incorrect credentials, IP address, or port will all cause the MySQL server to fail to appear in the dashboard. Also, ensure that the port specified in this file is not blocked on the machine hosting the MySQL Enterprise Service Manager.

- An easy way to confirm that the agent can log in to the service manager is to type `http://Dashboard_Host:18080/heartbeat` into the address bar of your web browser, substituting the appropriate host name and port. When the HTTP authentication dialog box opens, enter the agent user name and password. The following message indicates a successful login:

```
<exceptions>
<error>E0401: NullAgentPayloadException: []</error>
</exceptions>
```

Note

Despite the fact that the preceding listing shows an error, you have logged in successfully. This error appears because you have logged in but with no “payload”.

If you can log in successfully in the way described above and the agent is running, then there are errors in the mysql-monitor-agent.ini file. Compare the host name, port, agent name, and password found in the ini file with the values you entered into the address bar of your web browser.

- If HTTP authentication fails then you are using incorrect credentials for the agent. Attempting to log in to the service manager using incorrect credentials creates an entry in the agent log file. For the location of this log file see Section C.2.3, “Agent Log and pid Files”.
If no HTTP authentication dialog box appears, and you are unable to connect at all, then the host name or port might be specified incorrectly. Confirm the values you entered against those described as the Application hostname and port in the configuration_report.txt file. Failure to connect could also indicate that the port is blocked on the machine hosting the MySQL Enterprise Service Manager.

- To check if a blocked port is the problem, temporarily bring down your firewall. If the agent is then able to connect, open up the port specified during installation and restart the agent. If necessary you can monitor outside the firewall using an SSH tunnel. For more information, see Section 5.3.7, “Monitoring Outside the Firewall with an SSH Tunnel”.

- You can also check the agent error log file to help determine any problems. An error such as the following might indicate a blocked port:

```
(critical) connection to merlin-server
'http://agent:agent@172.11.1.1:18080/heartbeat' failed: "connect() timed out!" error.
```

For the location of the agent error log file, see Section C.2.3, “Agent Log and pid Files”.

- Setting the log-level entry in your ini file is also a good debugging technique. For more information on this subject see, Section C.2.1, “MySQL Enterprise Monitor Agent Configurable Options”.

- Running the agent from the command line sometimes displays errors that fail to appear in the log file or on the screen when the agent is started from a menu option. To start the agent from the command line see the instructions given at the start of this section.

- If you have more than one agent running on the same machine, the UUID must be unique and the log-file and pid-file values must be different. For more information, see Section C.2.2, “MySQL Server (agent-instance.ini) Configuration”.

- If the agent and the MySQL server it is monitoring are running on different machines, ensure that the correct host is specified for the agent account. The correct port, typically 3306, must also be open for remote login. For more information about remote monitoring see, Section 5.3.6, “Configuring an Agent to Monitor a Remote MySQL Server”.

- The MySQL Enterprise Monitor Agent and MySQL Enterprise Service Manager use the unique host ID, stored within the mysql.inventory table on the monitored MySQL Server, to determine whether the instance being monitored is a clone. The host ID of the current server is checked against the stored value when the agent starts. If the generated host ID and stored host ID do not match, you get an error similar to the following in the agent log file:

```
$s: [%s] the hostid from mysql.inventory doesn't match our agent's host-id (%s != %s)
We assume that this is a cloned host and shutdown now.
Please TRUNCATE TABLE mysql.inventory on this mysql-instance and restart the agent.
If this is a master for replication, please also run SET SQL_LOG_BIN = 0; first.
```

To fix the problem, connect to the MySQL server using the credentials configured when you installed the agent, and then truncate the mysql.inventory table:

```
mysql> TRUNCATE mysql.inventory;
```

Now restart the agent, which recreates the mysql.inventory table with the updated instance UUID and hostid information.

- If the MySQL Enterprise Monitor Agent is restarted after being terminated ungracefully (for example, by the kill command), you might see a DuplicateAgentUuidException error until the original registration of the previous instance of the agent expires.
5.4 Unattended Installation

This section explains how to automate the install and upgrade procedures for the MySQL Enterprise Service Manager and MySQL Enterprise Monitor Agent components, to perform those operations across one or multiple machines without any user interaction.

To perform an unattended installation, specify the installation mode as `unattended` by using the `mode` command line option. In this mode, you specify all the installation parameters, such as the installation directory, and user, password, and network options, through command-line options. For convenient scripting, you can save these options in a text file and run the installer using the `optionfile` option.

Before performing an unattended installation, familiarize yourself with the options by doing at least one interactive MySQL Enterprise Monitor install. Read the regular installation instructions, since some tasks still remain after an unattended installation: you must configure the MySQL Enterprise settings, import the advisors, and start up all the services/daemons.

5.4.1 Performing an Unattended Installation

The basic process for performing an unattended installation is the same for both the MySQL Enterprise Monitor Agent and MySQL Enterprise Service Manager installers, with the only difference being the options supported by each installer. For information on the options for MySQL Enterprise Service Manager, see Section 5.4.2, “MySQL Enterprise Service Manager Options”. For information on the options for MySQL Enterprise Monitor Agent, see Section 5.4.3, “MySQL Enterprise Monitor Agent Options”.

There are two methods for installation: either specify the option on the command line, or use an options file containing the relevant options and their values.

For example, using the command-line method, you could install the MySQL Enterprise Monitor Agent using:

```shell
shell> mysqlmonitoragent-version-linux-glibc2.3-x86-64bit-installer.bin
--installdir /data0/mysql/agent
--mysqlhost 127.0.0.1 --mysqliport 3306 --mysqluser agent --mysqlpassword mysql --checkmysqlhost yes
--managerhost localhost --managerport 48080 --agentuser AGENTUSER --agentpassword PASSWORD
--proxyport 44044 --mode unattended --enableproxy 1
--createaccount 1 --rootuser ROOTUSER --rootpassword PASSWORD
```

For unattended installation using an option file, create a text file that contains the definition for the installation. The following example uses a sample configuration file named `options.server.txt`:

```plaintext
debugtrace=/opt/mysql/enterprise/install.debugtrace.monitor.log
mode=unattended
installdir=/opt/mysql/enterprise/monitor
tomcatport=8080
tomcatshutdownport=8005
tomcatsslport=8443
adminpassword=myadminpassword
dbport=3300
```

This file identifies a directory and file name for a log file, sets the `mode` to `unattended`, and uses the `installdir` option to specify an installation directory.

**Note**

Set the `installdir` and `debugtrace` options to values appropriate to your locale and operating system.

The only options that must be specified in an option file when installing the MySQL Enterprise Service Manager are `mode` (if not specified at the command line), `installdir`, and `adminpassword`. 

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Check the options in your option file closely before installation; problems during unattended installation do not produce any error messages.

Put the monitor installer file and the options file in the same directory.

The following examples show how to start the unattended installation from the command line.

On Windows within a command shell:

```plaintext
C:\> mysqlmonitor-version-windows-installer.exe --optionfile options.server.txt
```

On Unix, use a command-line of the form:

```plaintext
shell> mysqlmonitor-version-installer.bin --optionfile options.server.txt
```

When installing MySQL Enterprise Monitor Agent, the same basic process can be followed using the MySQL Enterprise Monitor Agent installer and the corresponding agent options.

As a minimum for the MySQL Enterprise Monitor Agent installation, specify the `mode` (if not specified at the command line), `mysqluser`, `installdir`, `mysqlpassword`, and `agentpassword` options. Create a file containing these values and use it with the `optionfile` option for unattended agent installation.

### 5.4.2 MySQL Enterprise Service Manager Options

The following options let you customize the installation process for MySQL Enterprise Service Manager. The MySQL Enterprise Service Manager supports using a bundled MySQL server, or a separate MySQL server provided by the user. To use your own MySQL server, the server must be installed and running before installation. For more information, see Section 5.2.1, “Service Manager Installation Common Parameters”.

**Table 5.1 MySQL Enterprise Service Manager Installer Options**

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--adminpassword</code></td>
<td>Password for the database repository</td>
</tr>
<tr>
<td><code>--adminuser</code></td>
<td>Username for the database repository</td>
</tr>
<tr>
<td><code>--dbhost</code></td>
<td>Hostname or IP address of the MySQL server</td>
</tr>
<tr>
<td><code>--dbport</code></td>
<td>TCP/IP port for the MySQL server</td>
</tr>
<tr>
<td><code>--debuglevel</code></td>
<td>Set the debug information level</td>
</tr>
<tr>
<td><code>--debugtrace</code></td>
<td>File for a debug trace of the installation</td>
</tr>
<tr>
<td><code>--forceRestart</code></td>
<td>Upgrade only. Restarts the services after the upgrade process completes.</td>
</tr>
<tr>
<td><code>--help</code></td>
<td>Display the list of valid options</td>
</tr>
<tr>
<td><code>--installdir</code></td>
<td>Installation directory</td>
</tr>
<tr>
<td><code>--installer-language</code></td>
<td>Language selection</td>
</tr>
<tr>
<td><code>--mode</code></td>
<td>Installation mode</td>
</tr>
<tr>
<td><code>--mysql_installation_type</code></td>
<td>MySQL server to be used by the MySQL Enterprise Monitor</td>
</tr>
<tr>
<td><code>--mysql_ssl</code></td>
<td>Use SSL when connecting to the database</td>
</tr>
<tr>
<td><code>--optionfile</code></td>
<td>Installation option file</td>
</tr>
<tr>
<td><code>--tomcatport</code></td>
<td>Server port for the Tomcat component</td>
</tr>
<tr>
<td><code>--tomcatshutdownport</code></td>
<td>Shutdown TCP/IP port for the Tomcat component</td>
</tr>
<tr>
<td><code>--tomcatsslport [139]</code></td>
<td>SSL TCP/IP port for the Tomcat component</td>
</tr>
</tbody>
</table>
MySQL Enterprise Service Manager Options

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--unattendedmodeui</td>
<td>Unattended mode user interface</td>
</tr>
<tr>
<td>--usessl</td>
<td>Enable SSL support</td>
</tr>
<tr>
<td>--version</td>
<td>Display the product information</td>
</tr>
</tbody>
</table>

* --help

**Command-Line Format** --help

Display the list of valid installer options.

* --version

**Command-Line Format** --version

Display product and version information.

* --optionfile

**Command-Line Format** --optionfile

The path to the option file containing the information for the installation.

* --mode

**Command-Line Format** --mode

The installation mode to use for this installation.

* --debugtrace
MySQL Enterprise Service Manager Options

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>Permitted Values</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--debugtrace</code></td>
<td>Type string</td>
</tr>
<tr>
<td></td>
<td>The filename to use for a debug trace of the installation.</td>
</tr>
<tr>
<td><code>--debuglevel</code></td>
<td>Type numeric</td>
</tr>
<tr>
<td></td>
<td>Default 2</td>
</tr>
<tr>
<td></td>
<td>Min Value 0</td>
</tr>
<tr>
<td></td>
<td>Max Value 4</td>
</tr>
<tr>
<td></td>
<td>Set the debug information level for log data written to the file specified by <code>debugtrace</code>.</td>
</tr>
<tr>
<td><code>--installer-language</code></td>
<td>Type string</td>
</tr>
<tr>
<td></td>
<td>Default en</td>
</tr>
<tr>
<td></td>
<td>Valid Values en (English) ja (Japanese)</td>
</tr>
<tr>
<td></td>
<td>The installer language.</td>
</tr>
<tr>
<td><code>--installdir</code></td>
<td>Type string</td>
</tr>
<tr>
<td></td>
<td>Default /Applications/mysql/enterprise/monitor/</td>
</tr>
<tr>
<td></td>
<td>(OS X, &lt;= 2.3.19)</td>
</tr>
<tr>
<td></td>
<td>Default /opt/mysql/enterprise/monitor/</td>
</tr>
<tr>
<td></td>
<td>(Unix)</td>
</tr>
<tr>
<td></td>
<td>Default C:\Program Files\MySQL\Enterprise\Monitor</td>
</tr>
<tr>
<td></td>
<td>(Windows)</td>
</tr>
<tr>
<td></td>
<td>The installation directory for MySQL Enterprise Service Manager.</td>
</tr>
<tr>
<td><code>--tomcatport</code></td>
<td>Type numeric</td>
</tr>
<tr>
<td></td>
<td>Default 18080</td>
</tr>
<tr>
<td></td>
<td>The TCP/IP port for the MySQL Enterprise Service Manager. This port is used by MySQL Enterprise Monitor Agent and as the port for the interface to the MySQL Enterprise Monitor User Interface.</td>
</tr>
<tr>
<td><code>--tomcatshutdownport</code></td>
<td>Type string</td>
</tr>
<tr>
<td></td>
<td>Default</td>
</tr>
<tr>
<td></td>
<td>(OS X, &lt;= 2.3.19)</td>
</tr>
<tr>
<td></td>
<td>(Unix)</td>
</tr>
<tr>
<td></td>
<td>(Windows)</td>
</tr>
<tr>
<td></td>
<td>The TCP/IP port for the MySQL Enterprise Service Manager. This port is used by MySQL Enterprise Monitor Agent and as the port for the interface to the MySQL Enterprise Monitor User Interface.</td>
</tr>
</tbody>
</table>
The MySQL Enterprise Service Manager Tomcat shutdown port.

- **--tomcatsslport**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--tomcatsslport</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Permitted Values</strong></td>
<td><strong>Type</strong> numeric</td>
</tr>
<tr>
<td></td>
<td><strong>Default</strong> 18005</td>
</tr>
</tbody>
</table>

The TCP/IP port to use for SSL communication to the MySQL Enterprise Service Manager.

- **--usessl**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--usessl</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Permitted Values</strong></td>
<td><strong>Type</strong> boolean</td>
</tr>
<tr>
<td></td>
<td><strong>Default</strong> 0</td>
</tr>
<tr>
<td></td>
<td><strong>Valid Values</strong> 0 (Do not use SSL for the user interface and monitoring agent) 1 (Use SSL for the user interface (https) and monitoring agent)</td>
</tr>
</tbody>
</table>

Enable SSL communication between MySQL Enterprise Monitor Agent and MySQL Enterprise Service Manager, and enforce https connections for the user interface.

- **--mysql_ssl**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--mysql_ssl</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Permitted Values</strong></td>
<td><strong>Type</strong> boolean</td>
</tr>
<tr>
<td></td>
<td><strong>Default</strong> 0</td>
</tr>
<tr>
<td></td>
<td><strong>Valid Values</strong> 0 (Do not use SSL when connecting to the database) 1 (Use SSL when connecting to the database)</td>
</tr>
</tbody>
</table>

Enable SSL for the connection between MySQL Enterprise Service Manager and the repository.

- **--adminuser**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--adminuser</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Permitted Values</strong></td>
<td><strong>Type</strong> string</td>
</tr>
<tr>
<td></td>
<td><strong>Default</strong> service_manager</td>
</tr>
</tbody>
</table>

The user name to use for connecting to the database repository used by MySQL Enterprise Service Manager. If you install the bundled MySQL server, this user is configured in the new database. If you use an existing MySQL server, specify an existing user with rights to access the database.

**Warning**

The repository user name and password are stored in unencrypted form in the `config.properties` file. To locate this file on your operating system see Section C.1.5, "The `config.properties` file".

- **--unattendedmodeui**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--unattendedmodeui</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MySQL Enterprise Service Manager Options

<table>
<thead>
<tr>
<th>Permitted Values</th>
<th>Type</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>string</td>
<td>none</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Valid Values</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>none (No dialogs)</td>
<td></td>
<td>none</td>
</tr>
<tr>
<td>minimal (Critical dialogs)</td>
<td></td>
<td>minimal</td>
</tr>
<tr>
<td>minimalWithDialogs (Minimal UI with dialogs)</td>
<td></td>
<td>minimalWithDialogs</td>
</tr>
</tbody>
</table>

The UI elements to use when performing an unattended installation. The options are none, show no UI elements during the installation; minimal, show minimal elements during installation; minimalWithDialogs, show minimal UI elements, but include the filled-dialog boxes.

- **--adminpassword**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--adminpassword</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>string</td>
</tr>
</tbody>
</table>

The MySQL Enterprise Service Manager password for connecting to the MySQL database repository.

- **--mysql_installation_type**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--mysql_installation_type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>string</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Default</th>
<th>bundled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Values</td>
<td>bundled (Use the bundled MySQL server)</td>
</tr>
<tr>
<td></td>
<td>existing (Use an existing (user supplied) MySQL server)</td>
</tr>
</tbody>
</table>

Specifies whether the installer should configure MySQL Enterprise Service Manager to install the bundled MySQL server, or use a MySQL server that you have already installed to store the repository data.

- **--dbport**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--dbport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>numeric</td>
</tr>
</tbody>
</table>

| Default             | 13306    |

The TCP/IP port for the MySQL database used to store MySQL Enterprise Service Manager repository data. If you install the bundled MySQL server, this is the port where the new database listens for connections. If you use an existing MySQL server, specify the port used for connections by that MySQL server.

- **--dbhost**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--dbhost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>string</td>
</tr>
</tbody>
</table>

| Default             | 127.0.0.1 |

The hostname for the MySQL database. When installing MySQL Enterprise Service Manager to use an existing MySQL server, this should be the hostname of the server that will store the database repository.

- **--forceRestart**
5.4.3 MySQL Enterprise Monitor Agent Options

To view all the options available for an unattended agent installation, invoke the agent installer file passing in the help option. The available options are detailed in the following table.

Table 5.2 MySQL Enterprise Monitor Agent Installer Options

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--agentpassword</td>
<td>Password of the agent user for connecting to the monitored MySQL server</td>
</tr>
<tr>
<td>--agentuser</td>
<td>Username of the agent for connecting to the monitored MySQL server</td>
</tr>
<tr>
<td>--aggregatorport</td>
<td>TCP/IP port for the Aggregator component</td>
</tr>
<tr>
<td>--aggregatorsslcafile</td>
<td>CA certificate file for SSL support in the Aggregator component</td>
</tr>
<tr>
<td>--aggregatorsslcertfile</td>
<td>PEM certificate file for SSL support in the Aggregator component</td>
</tr>
<tr>
<td>--aggregatorsslport</td>
<td>SSL port for the Aggregator component</td>
</tr>
<tr>
<td>--checkmysqlhost</td>
<td>Validate the supplied MySQL hostname</td>
</tr>
<tr>
<td>--createaccount</td>
<td>Create an account on the monitored MySQL server to be used by the agent</td>
</tr>
<tr>
<td>--debuglevel</td>
<td>Set the debug information level</td>
</tr>
<tr>
<td>--debugtrace</td>
<td>File for a debug trace of the installation</td>
</tr>
<tr>
<td>--enableagent</td>
<td>Enable the agent to monitor a MySQL server</td>
</tr>
<tr>
<td>--enableaggregator</td>
<td>Enable the Aggregator to aggregate Query Analyzer data from an external source</td>
</tr>
<tr>
<td>--enableproxy</td>
<td>Enable query analyzer data to be captured using the proxy service</td>
</tr>
<tr>
<td>--help</td>
<td>Display the list of valid options</td>
</tr>
<tr>
<td>--installdir</td>
<td>Installation directory</td>
</tr>
<tr>
<td>--installer-language</td>
<td>Language selection</td>
</tr>
<tr>
<td>--managerhost</td>
<td>Hostname of IP address of the MySQL Enterprise Monitor server</td>
</tr>
<tr>
<td>--managerport</td>
<td>TCP/IP port of the MySQL Enterprise Monitor server</td>
</tr>
<tr>
<td>--managerssslport</td>
<td>TCP/IP port of the MySQL Enterprise Monitor server for SSL communication</td>
</tr>
<tr>
<td>--mode</td>
<td>Installation mode</td>
</tr>
<tr>
<td>--mysqlconnmethod</td>
<td>Connection method to the monitored MySQL server</td>
</tr>
<tr>
<td>--mysqlhost</td>
<td>MySQL hostname/IP address</td>
</tr>
<tr>
<td>--mysqlpassword</td>
<td>MySQL password for the monitored agent</td>
</tr>
<tr>
<td>--mysqlport</td>
<td>TCP/IP port for the monitored MySQL server</td>
</tr>
</tbody>
</table>
### MySQL Enterprise Monitor Agent Options

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--mysqlsocket</td>
<td>Unix socket/Named pipe for the monitored MySQL server</td>
</tr>
<tr>
<td>--mysqluser</td>
<td>MySQL Administrative username for the monitored MySQL server</td>
</tr>
<tr>
<td>--optionfile</td>
<td>Installation option file</td>
</tr>
<tr>
<td>--proxyport</td>
<td>TCP/IP port for the Proxy module</td>
</tr>
<tr>
<td>--proxyuser</td>
<td>User account for the proxy service</td>
</tr>
<tr>
<td>--rootpassword</td>
<td>Password for root user</td>
</tr>
<tr>
<td>--rootuser</td>
<td>User with root privileges on the monitored MySQL server</td>
</tr>
<tr>
<td>--servicename</td>
<td>Service name for the Agent</td>
</tr>
<tr>
<td>--unattendedmodeui</td>
<td>Unattended mode user interface</td>
</tr>
<tr>
<td>--usessl</td>
<td>Enable use of SSL communication with MySQL Enterprise Monitor server</td>
</tr>
<tr>
<td>--version</td>
<td>Display the product information</td>
</tr>
</tbody>
</table>

- **--agentpassword**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--agentpassword</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
</tbody>
</table>

Specify the agent password to use to communicate with the MySQL Enterprise Service Manager.

- **--agentuser**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--agentuser</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
<tr>
<td></td>
<td>Default agent</td>
</tr>
</tbody>
</table>

Specify the agent username to use to communicate with the MySQL Enterprise Service Manager.

- **--aggregatorport**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--aggregatorport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type numeric</td>
</tr>
<tr>
<td></td>
<td>Default 14000</td>
</tr>
</tbody>
</table>

Specify the TCP/IP port to use to communicate with the MySQL Enterprise Service Manager. Enter the same TCP/IP port number as in the MySQL Enterprise Service Manager installation.

- **--aggregatorsslcafile**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--aggregatorsslcafile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
</tbody>
</table>

Specify the path to the CA certificate file for SSL support in the Aggregator component. Only needed when using SSL.

- **--aggregatorsslcertfile**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--aggregatorsslcertfile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
</tbody>
</table>
Specify the path to the PEM certificate file for SSL support in the Aggregator component. Only needed when using SSL.

- **--aggregatorsslport**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>--aggregatorsslport</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Permitted Values</th>
<th>Type</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>numeric</td>
<td>14443</td>
</tr>
</tbody>
</table>

Specify the SSL port for the Aggregator component to use to communicate with the MySQL Enterprise Service Manager. Enter the same SSL port number as in the MySQL Enterprise Service Manager installation.

- **--checkmysqlhost**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>--checkmysqlhost</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Permitted Values</th>
<th>Type</th>
<th>Default</th>
<th>Valid Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>string</td>
<td>yes (Check host)</td>
<td>no (Do not check host)</td>
</tr>
</tbody>
</table>

Validate the MySQL hostname or IP address

- **--createaccount**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>--createaccount</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Permitted Values</th>
<th>Type</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>boolean</td>
<td>1</td>
</tr>
</tbody>
</table>

Create the user account specified by the `agentuser` and `agentpassword` options to use when the agent connects to the monitored MySQL server. To use this option, you must also specify a suitable root account with privileges to create the new user using the `rootuser` and `rootpassword` options.

The user create will have the correct privileges for the agent to collect all the necessary information. For more information, see Section 5.3.1, “Creating a MySQL User Account for the Monitor Agent”.

- **--debuglevel**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>--debuglevel</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Permitted Values</th>
<th>Type</th>
<th>Default</th>
<th>Min Value</th>
<th>Max Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>numeric</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

Set the debug information level for log data written to the file specified by `debugtrace`.

- **--debugtrace**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>--debugtrace</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Permitted Values</th>
<th>Type</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>string</td>
<td></td>
</tr>
</tbody>
</table>
Set the filename to use when recording debug information during the installation.

- **--enableagent**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--enableagent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type boolean</td>
</tr>
<tr>
<td>Default</td>
<td>1</td>
</tr>
</tbody>
</table>

Enable the agent to monitor a MySQL server. If this option is set to false, the agent is installed without enabling the monitoring of MySQL server. You can use this to configure a proxy service using an agent for collecting Query Analyzer information.

- **--enableaggregator**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--enableaggregator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type boolean</td>
</tr>
<tr>
<td>Default</td>
<td>0</td>
</tr>
</tbody>
</table>

Enable the optional Aggregator component that collects data from certain data sources, such as user-written scripts or instrumented application servers.

- **--enableproxy <enableproxy>**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--enableproxy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type boolean</td>
</tr>
<tr>
<td>Default</td>
<td>1</td>
</tr>
</tbody>
</table>

Enable the Proxy service. The proxy service can be used to collect query data to use through the Query Analyzer. For more information, see Section 3.1.5, “Using the Agent Proxy”.

- **--installdir**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--installdir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
<tr>
<td>Default</td>
<td>/Applications/mysql/enterprise/agent/</td>
</tr>
</tbody>
</table>

Specify the directory into which to install the software.

- **--installer-language**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--installer-language</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
<tr>
<td>Default</td>
<td>en</td>
</tr>
</tbody>
</table>

Set the language to use for the installation process.

- **--managerhost**
MySQL Enterprise Monitor Agent Options

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--managerhost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>string</td>
</tr>
<tr>
<td>The hostname or IP address of the MySQL Enterprise Service Manager.</td>
<td></td>
</tr>
</tbody>
</table>

- --managerport

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--managerport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>numeric</td>
</tr>
<tr>
<td>Default</td>
<td>18080</td>
</tr>
<tr>
<td>The port number of the MySQL Enterprise Service Manager.</td>
<td></td>
</tr>
</tbody>
</table>

- --mode

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>string</td>
</tr>
<tr>
<td>Default</td>
<td>gtk</td>
</tr>
<tr>
<td>Valid Values</td>
<td>gtk (GTK (X Windows))</td>
</tr>
<tr>
<td></td>
<td>xwindow (X Windows (native))</td>
</tr>
<tr>
<td></td>
<td>text (Text (command-line))</td>
</tr>
<tr>
<td></td>
<td>unattended (Unattended (no dialogs/prompts))</td>
</tr>
<tr>
<td>(Linux)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>osx</td>
</tr>
<tr>
<td></td>
<td>text (Text (command-line))</td>
</tr>
<tr>
<td></td>
<td>unattended (Unattended (no dialogs/prompts))</td>
</tr>
<tr>
<td>(OS X, &lt;= 2.3.19)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>xwindow</td>
</tr>
<tr>
<td></td>
<td>text (Text (command-line))</td>
</tr>
<tr>
<td></td>
<td>unattended (Unattended (no dialogs/prompts))</td>
</tr>
<tr>
<td>(Unix)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>win32</td>
</tr>
<tr>
<td></td>
<td>text (Text (command-line))</td>
</tr>
<tr>
<td></td>
<td>unattended (Unattended (no dialogs/prompts))</td>
</tr>
<tr>
<td>(Windows)</td>
<td></td>
</tr>
</tbody>
</table>

Specify the installation mode to use for this installation.

- --mysqlconnmethod

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--mysqlconnmethod</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>string</td>
</tr>
<tr>
<td>Default</td>
<td>tcpip</td>
</tr>
<tr>
<td>Valid Values</td>
<td>tcpip (Use TCP/IP)</td>
</tr>
<tr>
<td></td>
<td>socket (Use Unix Socket/Named Pipe)</td>
</tr>
</tbody>
</table>
Specify the connection method to use to connect to MySQL. If you specify `tcpip`, the value of the `mysqlport` option is used. If you specify `socket`, the value of the `mysqlsocket` option is used to connect to the MySQL server to be monitored.

- **--mysqlhost**
  
  **Command-Line Format**  
  `--mysqlhost`

  **Permitted Values**  
  Type: `string`

  Default: `127.0.0.1`

  Hostname or IP address of the MySQL server to be monitored.

- **--mysqlpassword**
  
  **Command-Line Format**  
  `--mysqlpassword`

  **Permitted Values**  
  Type: `string`

  Specify the password to use when connecting to the monitored MySQL instance.

- **--mysqlport**
  
  **Command-Line Format**  
  `--mysqlport`

  **Permitted Values**  
  Type: `numeric`

  Default: `3306`

  The TCP/IP port to use when connecting to the monitored MySQL server.

- **--mysqlsocket**
  
  **Command-Line Format**  
  `--mysqlsocket`

  **Permitted Values**  
  Type: `string`

  Specify the filename of the MySQL socket to use when communicating with the monitored MySQL instance.

- **--mysqluser**
  
  **Command-Line Format**  
  `--mysqluser`

  **Permitted Values**  
  Type: `string`

  Specify the username to use when connecting to the monitored MySQL instance.

- **--optionfile <optionfile>**
  
  **Command-Line Format**  
  `--optionfile`

  Specify the location of an option file containing the configuration options for this installation.

- **--proxyport**
  
  **Command-Line Format**  
  `--proxyport`

  **Permitted Values**  
  Type: `numeric`

  Default: `6446`
MySQL Enterprise Monitor Agent Options

Specify the TCP/IP port to use for the MySQL Enterprise Agent Proxy Service, if you also specified the `--enableproxy` option.

- **--proxyuser**

  **Command-Line Format**
  
  `--proxyuser`

  **Permitted Values**
  
<table>
<thead>
<tr>
<th>Type</th>
<th>string</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>root</td>
</tr>
</tbody>
</table>

  The OS user that the MySQL Enterprise Agent Proxy Service runs as. For example, you can specify a special account such as `daemon`. Applies to Unix and Linux, but not to Windows where the proxy runs as a service. For this option to work, run the installer as root and also specify the `--enableproxy` option.

- **--unattendedmodeui**

  **Command-Line Format**
  
  `--unattendedmodeui`

  **Permitted Values**
  
<table>
<thead>
<tr>
<th>Type</th>
<th>string</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>none</td>
</tr>
<tr>
<td>Valid Values</td>
<td>none (No dialogs)</td>
</tr>
<tr>
<td></td>
<td>minimal (Critical dialogs)</td>
</tr>
<tr>
<td></td>
<td>minimalWithDialogs (Minimal UI with dialogs)</td>
</tr>
</tbody>
</table>

  The UI elements to use when performing an unattended installation. The options are `none`, show no UI elements during the installation; `minimal`, show minimal elements during installation; `minimalWithDialogs`, show minimal UI elements, but include the filled-dialog boxes.

- **--use-external-glib**

  **Permitted Values**
  
<table>
<thead>
<tr>
<th>Type</th>
<th>string</th>
</tr>
</thead>
</table>

  Specifies to use the `glib` library already present on the installation machine, and not to install the one bundled with MySQL Enterprise Monitor Agent.

- **--usessl**

  **Command-Line Format**
  
  `--usessl`

  **Permitted Values**
  
<table>
<thead>
<tr>
<th>Type</th>
<th>boolean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>0</td>
</tr>
</tbody>
</table>

  Specifies whether SSL should be used to communicate with the MySQL Enterprise Service Manager.

- **--version**

  **Command-Line Format**
  
  `--version`

  Display product information, including the version number of the installer.

- **--rootpassword**

  **Command-Line Format**
  
  `--rootpassword`

  **Permitted Values**
  
<table>
<thead>
<tr>
<th>Type</th>
<th>string</th>
</tr>
</thead>
</table>

  The password of a root account for the installer to use to create the agent user.
Postinstallation Considerations

• **--rootuser**

  **Command-Line Format**  
  ```bash
  --rootuser
  ```

  **Permitted Values**

<table>
<thead>
<tr>
<th>Type</th>
<th>Permitted Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>string</td>
<td>Default: root</td>
</tr>
</tbody>
</table>

  The root account for the installer to use to create the agent user.

• **--servicename**

  **Command-Line Format**  
  ```bash
  --servicename
  ```

  **Permitted Values**

<table>
<thead>
<tr>
<th>Type</th>
<th>Permitted Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>string</td>
<td>Default:</td>
</tr>
<tr>
<td></td>
<td>(Linux) mysql-monitor-agent</td>
</tr>
<tr>
<td></td>
<td>(OS X, &lt;= 2.3.19) mysql.monitor.agent</td>
</tr>
<tr>
<td></td>
<td>(Unix) mysql-monitor-agent</td>
</tr>
<tr>
<td></td>
<td>(Windows) MySQL Enterprise Monitor Agent</td>
</tr>
</tbody>
</table>

  When the MySQL Enterprise Monitor Agent is installed, a new service is created (Windows), or on Unix a new startup script is created within the corresponding startup directory (for example /etc/init.d). When installing multiple agents on the same host, you can use this option to create each agent installation with a unique identifier. During an upgrade installation, you then use this identifier to specify which installation of the agent to update.

• **--help**

  **Command-Line Format**  
  ```bash
  --help
  ```

  Display the list of valid options to the installer.

5.5 Postinstallation Considerations

Depending upon your use of MySQL Enterprise Monitor, you might perform some or all of these tasks after installation:

• **Email settings**: Test email notification by deliberately triggering an alert.

• **Auto Startup**: On Unix systems, the MySQL Enterprise Service Manager does not automatically restart when the system is rebooted. To enable automatic startup, create a system initialization script appropriate to your operating system.

• **Log files**: Check the log files for any irregularities. For the locations of the various log files see Section C.1.3, “Log Files for the MySQL Enterprise Service Manager”.

• **Agent Log file rotation**: Implement log file rotation for the monitor agent.

• **Back up the repository**: For details, see Section B.5, “Backing up MySQL Enterprise Service Manager”.

• **Configuration backup**: Back up the mysql-monitor-agent.ini file and the associated instances directory and contents.

For more information about the mysql-monitor-agent.ini file see Section C.2, “MySQL Enterprise Monitor Agent Reference”.

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• **Configuration file**: Store the `configuration_report.txt` in a safe place. There is no mechanism for retrieving the password stored in this file.

• **Repository credentials**: The repository user name and password are stored in unencrypted form in the `config.properties` file. Take care to protect this file.

• **Disk management**: Remove installation files, and monitor the space used by the repository. Ensure that you have adequate disk space by regularly purging data. For more information, see Data Purge Behavior.

• **Firewall changes**: Consider limiting or expanding access to the MySQL Enterprise Service Manager.

• **Open ports**: As with firewall changes, consider limiting or expanding access to the MySQL Enterprise Service Manager. The dashboard uses nonstandard ports, none of which are usually open by default.

• **Server upgrades**: See Section 5.7.2.1, “Upgrading the Monitored MySQL Server” for instructions on upgrading a server.

• **Repository access**: Add any other needed users.

### 5.6 Installing SSL Certificates

These instructions guide you through the process of installing SSL certificates for your MySQL Enterprise Monitor installation. The `$INSTALL_ROOT` represents the root path of your installation, which defaults to:

<table>
<thead>
<tr>
<th>Operating System</th>
<th>Default Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft Windows</td>
<td>C:\Program Files\MySQL\Enterprise\Monitor\</td>
</tr>
<tr>
<td>Linux / Solaris</td>
<td>home/mysql/enterprise/monitor/</td>
</tr>
<tr>
<td>Mac OS X</td>
<td>/Applications/mysql/enterprise/monitor/</td>
</tr>
</tbody>
</table>

**Important**
The self-signed certificates delivered with your MySQL Enterprise Monitor installation are set to expire after 365 days. Every upgrade is delivered with new certificates set to expire 365 days after the day the upgrade package was built. In the unlikely event you are running a version of MySQL Enterprise Service Manager using the default certificates for more than a year, you must generate new certificates. If you do not generate new certificates, the SSL connection between MySQL Enterprise Service Manager and the repository will fail. This section describes how to generate those certificates.

**Generating SSL Key and Certificate**

To use SSL, you must generate a certificate and private key. These can be verified and signed through a third-party authority, such as Thawte or Entrust, or generated locally and self-signed. The recommended tool for locally-generated SSL key and certificates is the OpenSSL Toolkit. The OpenSSL libraries are delivered by default with UNIX, Linux and Mac OS X platforms, but must be obtained separately for Microsoft Windows from [http://slproweb.com/products/Win32OpenSSL.html](http://slproweb.com/products/Win32OpenSSL.html). The Windows installation also requires the Visual C++ 2008 Redistributables libraries.

**Important**
For security reasons, we recommend you install the latest, compatible version of the OpenSSL Toolkit.
If you intend to use a Certificate Authority to verify your organisation's identity and sign your certificate, you must generate a private key, which is used to create a Certificate Signing Request (CSR), and send the CSR file to the Certificate Authority.

To generate the RSA private key, run the following command:

```bash
openssl genrsa -out insertName.key 2048
```

This generates a 2048-bit, RSA private key.

To generate the Certificate Signing Request (CSR), run the following command:

```bash
openssl req -new -nodes -key insertName.key -out insertName.csr
```

This command prompts for input. Complete the fields as required.

![Important](image)

The **CN** field must correspond to the hostname. It is recommended that you use the fully-qualified server name, rather than **localhost**.

If you intend to use a self-signed certificate, you can generate the key and certificate with a single command:

```bash
openssl req -x509 -newkey rsa:2048 -keyout key.pem -out cert.pem -days 365
```

This command generates a 2048-bit RSA key, `key.pem`, and a certificate, `cert.pem`, which is valid for 365 days.

---

**MySQL Enterprise Service Manager**

To install an SSL certificate for the MySQL Enterprise Service Manager:

Save the certificate and private key, both in PEM format, in the following location:

```
$INSTALL_ROOT/apache-tomcat/conf/ssl/tomcat.cert.pem
$INSTALL_ROOT/apache-tomcat/conf/ssl/tomcat.key.pem
```

Restart the service manager.

If you are using a chained certificate implementation, you must add the following attribute to the **Connector** element of Tomcat's `server.xml`:

```
SSLCertificateChainFile="/opt/mysql/enterprise/monitor/apache-tomcat/conf/ssl/tomcat.int.pem"
```

---

**SSL for the Repository**

For information on SSL and MySQL Server, see [Creating SSL and RSA Certificates and Keys](#).

---

**5.7 Upgrading, Re-Installing or Changing Your Installation**

You can upgrade MySQL Enterprise Monitor in a number of different ways:

- For instructions on upgrading your existing installation, see [Section 5.7.1, “Upgrading MySQL Enterprise Monitor”](#).
- For more information on re-installing an existing installation, see [Section 5.8, “Uninstalling the MySQL Enterprise Monitor”](#).
- To change an existing installation, such as changing the monitored server, see [Section 5.7.2, “Changing Your MySQL Enterprise Monitor Installation”](#).
5.7.1 Upgrading MySQL Enterprise Monitor

This section describes how to perform an update for the MySQL Enterprise Service Manager or the MySQL Enterprise Monitor Agent, when updates are available for these components.

Upgrade Restrictions

You cannot use the update installers to change to a different operating system or chip architecture. For example, you cannot update a 32-bit Linux installation to a 64-bit version using an update installer. Do a fresh installation instead.

You also cannot use the upgrader if you installed the MySQL server for the MySQL Enterprise Service Manager instance outside the MySQL Enterprise Service Manager installation directory.

The installation and configuration of MySQL Enterprise Monitor Agent must be standard before you start the installation. The update installer will not upgrade agents where you have changed or modified the filenames or directory layout of the installed agent, configuration files, or the startup files.

Important

The upgrade installer overwrites `items-mysql-monitor.xml`. On Windows, this file is in the `C:\Program Files\MySQL\Enterprise\Agent\share\mysql-monitor-agent` directory and on Unix, in the `/opt/mysql/enterprise/agent/share/mysql-monitor-agent` directory. Back this file up if you have made any changes to it.

Warning

The Upgrade installer for MySQL Enterprise Service Manager overwrites any changes you made to the `my.cnf` within your MySQL Enterprise Service Manager installation. Copy the existing `my.cnf` file before starting the upgrade installer.

SSL Considerations

The Upgrade installer for MySQL Enterprise Service Manager overwrites any changes you made to the CA certificate files within your MySQL Enterprise Service Manager installation. This includes `cacerts` for the bundled JRE, and `myKeystore` for the bundled Tomcat web server. These files are replaced with the bundled CA certificate files, so if custom changes exist (e.g., for an LDAP server with a self-signed certificate) then you must manually re-import the custom changes. These files are backed up during the upgrade, and the locations are logged within the `configuration_report.txt` log file.

The following example imports one root CA from the backed up file, and uses the default password for keystores in Java which is "changeit". The alias names and path locations may also be different.

```bash
$ pwd
/opt/mysql/enterprise/monitor/java/bin

$ ./keytool -importkeystore
  -srckeystore /opt/mysql/enterprise/monitor/backup/java/lib/security/cacerts
  -destkeystore /opt/mysql/enterprise/monitor/java/lib/security/cacerts
  -srcstorepass changeit
  -deststorepass changeit
  -srcalias myorigrootca
  -destalias myrootca
```

Version Considerations

Warning

The method you use for upgrading MySQL Enterprise Monitor components depends on the upgrade you are performing.
To upgrade between major versions (for example, from MySQL Enterprise Monitor 1.3 to MySQL Enterprise Monitor 2.0), start by shutting down the MySQL Enterprise Service Manager and each connected MySQL Enterprise Monitor Agent. First, update the MySQL Enterprise Service Manager, then update the MySQL Enterprise Monitor Agent on each monitored client.

To upgrade between the same major version, for example, MySQL Enterprise Monitor 2.2 to MySQL Enterprise Monitor 2.3, or a minor version, such as MySQL Enterprise Monitor 2.3.11 to MySQL Enterprise Monitor 2.3.12, you can shut down only the component (agent, or server) you are updating. Using this method, you can perform a ‘rolling’ upgrade, where you shut down a single MySQL Enterprise Monitor Agent, upgrade it to the latest agent version, and then restart the agent before moving on to the next monitored instance.

Running the Update Installer

The name of the update file varies, but it shows the target operating system, the version the update applies to, and the component name. (There are separate update installers for the Service Manager and the Agent.) For example, a file named `mysqlenterprisemanager-2.3.11-windows-update-installer.exe` updates MySQL Enterprise Service Manager on Windows to version 2.3.11.

You install an update in the same way that you initially installed the service manager or the agent; in `win32` or `unattended` mode on Windows; in `gtk`, `text`, `xwindow`, or `unattended` mode on Unix.

Run the installation file and choose the directory of your current installation and whether or not you wish to back up your current installation. The time required to complete the process varies depending upon the nature of the update.

You can run an unattended upgrade, the same way you run an unattended install. To see all the options you can specify during the upgrade process, run the update installer with the `--help` option.

Undoing an Upgrade

If you chose to back up your current installation, a directory named `backup` is created in the current installation directory. This directory contains copies of the directory or directories that are replaced during the update. In cases where only specific files are replaced, the `backup` directory may contain only these files. To undo the update, stop both the MySQL Enterprise Service Manager and MySQL Enterprise Monitor Agent, then overwrite the new files or directories with the originals found in the `backup` directory. You can delete or archive this directory after you confirm that the update was successful.

If you choose to back up your current installation, the installer checks that there is adequate disk space for your repository backup. If there is not enough space, you are given the option of choosing another location; you can also choose not to back up the repository.

Upgrading Advisors

To update your Advisors, see Section 5.2.6.3, “Installing, Updating or Upgrading Advisors After Initial Login”.

5.7.1.1 Upgrading from MySQL Enterprise Monitor 1.3 to 2.x

To upgrade your existing installation from MySQL Enterprise Monitor 1.3 to MySQL Enterprise Monitor 2.0 or higher, upgrade both the MySQL Enterprise Service Manager and the MySQL Enterprise Monitor Agent on each machine that you are monitoring.

To perform the update process, use an `update` installer. This ensures that your current configuration information is migrated to the new version of MySQL Enterprise Service Manager.
Before you start the migration, shut down your MySQL Enterprise Service Manager and MySQL Enterprise Monitor Agent on each monitored host. Then, install the updated MySQL Enterprise Service Manager application to migrate the configuration and data of the main application and repository. Once the new MySQL Enterprise Service Manager is running, you can start to update and migrate each agent.

For more information on upgrading your MySQL Enterprise Service Manager, see Upgrading to MySQL Enterprise Service Manager 2.x. For more information on upgrading an MySQL Enterprise Monitor Agent, see Upgrading to MySQL Enterprise Monitor Agent 2.0.

**Upgrading to MySQL Enterprise Service Manager 2.x**

Upgrading MySQL Enterprise Service Manager from 1.x to 2.0 or higher requires one of the update installers. The update installer performs a number of operations during installation:

- A new database, required to support 2.0 functionality, is created.
- Your core dashboard, user, and rule information is migrated from the old database to the new database.
- The core configuration parameters for the MySQL Enterprise Service Manager are migrated from MySQL Enterprise Monitor 1.3 are migrated to MySQL Enterprise Monitor 2.x.

The installation of the new software using the update installer follows this basic sequence:

1. Request the installation language.
2. Confirm the location of the current MySQL Enterprise Service Manager installation.
3. Specify whether you want to keep a copy of the old server, application, and database files.
4. Configure the Tomcat server settings, including whether the new server should support SSL connections from agents.
5. If requested, the application and database information is backed up and upgraded, before the new application is installed.

The installation process is consistent for all platforms. The following example illustrates the process:

1. Double-click the update installer. The update installer has update in the file name.
2. Confirm the language to use when installing the software.
3. An information screen shows the application you are installing. Click Next to continue.
4. Specify, or locate, the previous installation of MySQL Enterprise Service Manager. If you installed the server within the default location, the current version of the application is located automatically.
5. The installer can keep a backup copy of your existing application, including keeping a complete backup of the data stored within your MySQL Enterprise Monitor repository database.

Specify the location of the backup (default is to use the backup directory within your installation directory). Note that backing up the database in addition to the main application increases the installation time, as the files are copied. The more data in your repository, the longer the installation process takes.

6. Specify the Tomcat Server options. The Tomcat Server Port is the default port where you access the MySQL Enterprise Monitor User Interface. If you want to support agents using SSL to communicate to MySQL Enterprise Service Manager, check the Is SSL support required?
7. Confirm that you want to continue the installation. Once installation has started, the backup of your existing application (and database) starts. This process may take some time. Wait until the process completes.

8. Once the process has completed, you receive a notification of the installation process, including how to uninstall the application if you want to do so in the future. If any errors occurred, they are reported here.

9. The installation has now completed. You can automatically start the MySQL Enterprise Service Manager and view the attached Readme file by ensuring the checkboxes on this page are selected.

10. You can now quit the installer.

Once the installation is completed, the first time you login to MySQL Enterprise Monitor User Interface, provide your login credentials, if they do not already exist in the server configuration, or provide a copy of the Advisor jar suitable for your MySQL Enterprise Service Manager version.
Welcome to the MySQL Enterprise Dashboard Setup.
To complete installation and configuration, please complete the form below. You can modify these values at any time.

### Create Manager User

The user and password for the Dashboard administrator. You can optionally add DBA, Read-only or additional Manager users on the Settings page.

<table>
<thead>
<tr>
<th>Username</th>
<th>Password</th>
<th>Confirm Password</th>
</tr>
</thead>
</table>

### Online Updates

Using a direct internet connection or an HTTP proxy, the Dashboard can occasionally check for updates. You can also use the link "open My Oracle Support Service Requests (see below)."

- [ ] Enable automatic checking for online updates
- [ ] Use HTTP Proxy

### My Oracle Support Credentials

These credentials are used to retrieve and display your open Service Requests (for those with an Oracle Support Customer ID).

<table>
<thead>
<tr>
<th>My Oracle Support Login (Email Address)</th>
<th>Password</th>
<th>Confirm Password</th>
</tr>
</thead>
</table>

### Advisors

**Current Advisors Version**

2.3.4.2075

**Advisor .jar File**

Choose File: No file chosen

### Data Purge Behavior

<table>
<thead>
<tr>
<th>Remove History</th>
<th>Remove Query</th>
<th>4 weeks</th>
</tr>
</thead>
</table>

**Complete Setup**

[complete setup]
MySQL Enterprise Monitor is now updated. Update each of your agents to MySQL Enterprise Monitor Agent 2.x to ensure that they are providing the correct information to MySQL Enterprise Service Manager.

Upgrading to MySQL Enterprise Monitor Agent 2.0

To upgrade an agent, use an update installer, which migrates your configuration information while it updates the application files.

Note

The agent log file, mysql-monitor-agent.log, if it exists, is preserved during the upgrade. A new log file, mysql-monitor-agent.log is used by MySQL Enterprise Monitor Agent 2.0.

The core sequence is the same on all platforms. The following section shows the update process on Linux:

1. Start the update installer.

```
shell> ./mysqlmonitoragent-2.0.0.7101-linux-glibc2.3-x86-32bit-update-installer.bin
```

For MySQL Enterprise Monitor Agent 2.2 and higher, If you have multiple instances of MySQL Enterprise Monitor Agent installed, you can specify a unique name for the agent, which is used to identify the agent startup script (in /etc/init.d and other configuration information. To specify the installation, use the --servicename=mysql-monitor-agent option.

2. Set the language for the installation process.

```
Language Selection

Please select the installation language
[1] English
Please choose an option [1] :
```

3. Confirm or update the location of the installation directory of the previous version.

```
Welcome to the setup wizard for the MySQL Enterprise Monitor Agent Update

Please specify the directory that contains the previous installation of the MySQL Enterprise Monitor Agent
Installation directory [/opt/mysql/enterprise/agent]:
```

4. Specify whether you want to create a backup of the current application and configuration information, and if so, where the backup directory should be created.

```
Current installation backup

Do you want to create a backup during the update process?
Backup the current installation [Y/n]: Y
Backup directory [/opt/mysql/enterprise/agent/patchbackup]:
```

5. Choose whether to enable the Query Analyzer. The Query Analyzer lets you monitor the execution statistics for individual queries executed through your MySQL servers. To enable it, specify the
proxy port, MySQL server and MySQL server port that you want to use. If you do not enable Query Analyzer now, you can enable it later. See Section 2.6, “The Query Analyzer Tab”.

---

Query Analyzer Configuration

MySQL Proxy enables query monitoring and analysis by listening on the port specified below for client connections that are then passed through to a backend MySQL database server. It is not needed for basic monitoring functionality, but is required for query monitoring and analysis.

...  
Enable Proxy (recommended) [Y/n]:

Proxy Port [6446]:

Backend Host: 127.0.0.1 (cannot be changed)
Backend Port: 3306 (cannot be changed)

6. You are now ready to complete the installation. Confirm that you want to continue.

---

Setup is now ready to begin installing MySQL Enterprise Monitor Agent Update on your computer.

Do you want to continue? [Y/n]:

---

Please wait while Setup installs MySQL Enterprise Monitor Agent Update on your computer.

Installing

0% 50% 100%  

---

Setup has finished installing MySQL Enterprise Monitor Agent Update on your computer.

Restart MySQL Enterprise Monitor Agent now [Y/n]:

View Readme File [Y/n]: n

Before connecting your MySQL Enterprise Monitor Agent to your MySQL server, update the grants for the MySQL Enterprise Monitor Agent. Connect to the MySQL server and run this statement to update the required grants:

```
GRANT CREATE, INSERT
ON mysql.*
TO 'mysqluser'@'localhost'
IDENTIFIED BY 'agent_password';
```

In the preceding command, replace the mysqluser and agent_password parameters with the values used for connecting your agent to your MySQL server.

Once the update agent has communicated with the MySQL Enterprise Service Manager, the core information about the agent and the MySQL server it is monitoring is migrated to the new data format required by MySQL Enterprise Service Manager 2.x. To migrate the existing stored data, see Section B.6, “Migrating 1.3.x Historical Data to MySQL Enterprise Monitor 2.0”.

5.7.1.2 Upgrading to MySQL Enterprise Monitor 2.1

When upgrading to MySQL Enterprise Monitor 2.1, be aware of the following issues:
• During the upgrade process, if you previously had a Query Analyzer data purge value that was greater than the standard data purge value, the historical data collection purge period is set to the Query Analyzer purge period. This is logged in the upgrade log with the following notice:

```
getDataCollectionPurgeLifespan now: 4 weeks (was: 2 weeks)
```

5.7.1.3 Upgrading to MySQL Enterprise Monitor 2.2

When upgrading to MySQL Enterprise Monitor 2.2, be aware of the following issues:

- If you are upgrading to MySQL Enterprise Monitor 2.2, upgrade from MySQL Enterprise Monitor 2.0 or higher. If you are using MySQL Enterprise Monitor 1.3 or lower, upgrade to MySQL Enterprise Monitor 2.0 first before upgrading to MySQL Enterprise Monitor 2.2.

- Rules and advisors in MySQL Enterprise Monitor 2.2 now support auto-close functionality if the issue that raised the notification is no longer causing a problem. Review all your existing rules schedules and confirm whether the auto-close feature is useful in each case.

- The MySQL Enterprise Service Manager supports the use of a separate, self-managed, MySQL server in place of the MySQL server bundled with the MySQL Enterprise Service Manager installation for storing repository data. For more information, see Section 5.2.1, “Service Manager Installation Common Parameters”.

- If you are upgrading a MySQL Enterprise Service Manager that uses a remote, self-managed MySQL database to store the MySQL Enterprise Monitor repository data, then perform the installation as follows:

  1. Shut down MySQL Enterprise Service Manager.
  2. Shut down the MySQL instance supporting your MySQL Enterprise Monitor repository.
  3. Upgrade the MySQL server as you would any other MySQL server instance. See Upgrading MySQL.

    Ensure when performing the upgrade that the MySQL server instance is configured with support for InnoDB and that the InnoDB storage engine is enabled. Also ensure that support for partitioning is available within the server.

  4. Run the `mysql_upgrade` to ensure that the system tables have been correctly updated.
  5. Restart the MySQL repository instance.
  6. Restart MySQL Enterprise Service Manager and confirm that it was able to connect to the MySQL server.

- When upgrading MySQL Enterprise Service Manager, the installer tries to determine if you are using a local MySQL server (as bundled with the MySQL Enterprise Service Manager) or a remote and self-managed MySQL server instance to store your repository data.

  To determine whether the existing installation is using a local MySQL server, the installer examines the existing MySQL Enterprise Service Manager configuration file. If the value of the `mysql.server` configuration parameter is set to `127.0.0.1` or `localhost`, the installer assumes the MySQL server is local. If any value is identified, the installer assumes that the server is remote/self-managed and it does not upgrade the MySQL server component.

  If the correct MySQL server version and supported functionality (partitioning) are not supported by the MySQL server you are using, the installer stops.

- The storage tables used for storing MySQL Enterprise Service Manager data, and the rules and methods required for purging old information, have changed in MySQL Enterprise Service
Manager 2.2. You can improve the purging and disk space usage for these data tables by using the techniques shown in Section B.7, “Improving Disk Space Usage with Purge in 2.1 and 2.2”.

- For MySQL Enterprise Monitor Agent installations, the installer can now create a user on your MySQL server with suitable credentials. To perform this operation, the installer requests the root login and password for your MySQL server so that the user and other details can be updated.

### 5.7.1.4 Upgrading to MySQL Enterprise Monitor 2.3

When upgrading to MySQL Enterprise Monitor 2.3, be aware of the following issues:

- By default, the upgrade preserves the choice you made for the Use SSL checkbox in the original installation. You can change this setting during the upgrade. If you enable SSL connections, the repository database you select during the upgrade must also have SSL enabled. (The bundled MySQL server is configured with SSL enabled.)

### 5.7.2 Changing Your MySQL Enterprise Monitor Installation

This section describes the best practices to employ when changing your MySQL Enterprise Monitor installation.

#### 5.7.2.1 Upgrading the Monitored MySQL Server

When upgrading a monitored MySQL server, first stop the agent, as explained in:

- Unix and Linux: Section 5.3.4.2, “Starting/Stopping the Agent on Unix”
- Windows: Section 5.3.4.1, “Starting/Stopping the Agent on Windows”

Stop the MySQL server, then perform the upgrade.

To stop and restart the MySQL daemon under Unix or Linux see, Section 5.2.4, “Starting/Stopping the MySQL Enterprise Monitor Service on Unix”.

For instructions on stopping and restarting the MySQL service under Windows, see Section 5.2.5, “Starting/Stopping the MySQL Enterprise Monitor Service on Windows”.

Once the service/daemon is stopped, upgrade your MySQL server, using the instructions from the reference manual the new server version. When the upgrade is complete, restart the MySQL server.

---

**Note**

The agent's log file shows that the server was down during the upgrade process.

#### 5.7.2.2 Changing the Server That an Agent Monitors

You need not reinstall the MySQL Enterprise Monitor Agent in order to change the MySQL server that it monitors. It is possible to adapt an existing agent so that it monitors a different server.

To do this you must stop the monitor agent and then remove the server that it is monitoring. To stop the agent see:

- Windows: Section 5.3.4.1, “Starting/Stopping the Agent on Windows”
- Unix: Section 5.3.4.2, “Starting/Stopping the Agent on Unix”

For instructions on removing a server see, Section 2.8.3.3, “Removing a Server From the Dashboard”.

Once the agent is stopped and the server is removed from the Dashboard, you can change the `mysql-monitor-agent.ini`, or the `agent-instance.ini` file within the agent instances
Uninstalling the MySQL Enterprise Monitor

instances directory. To find this directory, examine the content of the `mysql-monitor-agent.ini` and check the value of the `mysqld-instance-dir` parameter.

To make changes to the monitored MySQL server, edit the `agent-instance.ini` file. Change the `user`, `password`, `hostname`, and `port` values if required. For more information, see Section C.2.2, “MySQL Server (agent-instance.ini) Configuration”.

To change other settings, such as enabling proxy support (required for Query Analyzer), the management host, or the port number used by the agent, modify the `mysql-monitor-agent.ini` file. For more information, see Section C.2.1, “MySQL Enterprise Monitor Agent Configurable Options”.

To restart the agent, see:

- Unix and Linux: Section 5.3.4.2, “Starting/Stopping the Agent on Unix”.
- Windows: Section 5.3.4.1, “Starting/Stopping the Agent on Windows”.

**Note**

When adapting an existing agent to monitor a remote server, make sure that the agent has the credentials for remote access and that the port on the remote MySQL server instance is open. For more information, see Section 5.3.6, “Configuring an Agent to Monitor a Remote MySQL Server”.

If you have trouble starting the agent, check Section 5.3.9, “Troubleshooting the Agent”.

Log in to the Dashboard and find your new server in the All Servers group.

### 5.7.2.3 Temporarily Suspending the Agent

When bringing down a monitored MySQL server, stop the agent first, to avoid generating a misleading “Server is unreachable” event.

For instance, if you stop the server to do a backup, follow these steps:

1. Stop the agent.
2. Stop the service/daemon.
3. Perform the backup.
4. Restart the service/daemon.
5. Restart the agent.

To stop or start the agent, see:

- Unix and Linux: Section 5.3.4.2, “Starting/Stopping the Agent on Unix”.
- Windows: Section 5.3.4.1, “Starting/Stopping the Agent on Windows”.

To stop the MySQL service/daemon, see the MySQL reference manual for your server version, on the web site [http://dev.mysql.com/doc](http://dev.mysql.com/doc).

Or, to blackout all events associated with a specific server or group of servers, see Section 4.4, “Advisor Blackout Periods”.

### 5.8 Uninstalling the MySQL Enterprise Monitor

Removing the MySQL Enterprise Monitor requires removing the MySQL Enterprise Service Manager and the MySQL Enterprise Monitor Agent Service. In some circumstances, such as when running
Removing the MySQL Enterprise Monitor: Windows

5.8.1 Removing the MySQL Enterprise Monitor: Windows

Removing the MySQL Enterprise Service Manager

Remove the MySQL Enterprise Service Manager by going to the Control Panel and choosing Add or Remove Programs. Find the entry for MySQL Enterprise Monitor and remove it. During the uninstall process you will be given the option of saving existing data and log files. Choose this option if you plan to reinstall the MySQL Enterprise Monitor.

If you are not saving existing data, you can delete the C:\Program Files\MySQL\Enterprise\Monitor directory after removing MySQL Enterprise Service Manager.

Warning

If you did not remove existing data and log files when uninstalling MySQL Enterprise Service Manager, do not remove the C:\Program Files\MySQL\Enterprise\Monitor directory. Doing so will delete these files.

If you added the Tomcat/Apache web server to the list of Windows firewall exceptions, remove this service by opening the Windows Firewall from the Control Panel. Choose the Exceptions tab and delete the Tomcat/Apache entry.

Removing MySQL Enterprise Monitor Services Only

When the MySQL Enterprise Service Manager is installed, the Tomcat/Apache and MySQL server services are started. You can remove these services without also removing your MySQL Enterprise Service Manager installation. For more information about these services, see Section 5.2.5, “Starting/Stopping the MySQL Enterprise Monitor Service on Windows”.

Do this by finding the MySQL Enterprise Monitor menu option and choosing Services and then Uninstall MySQL Enterprise Monitor Services. This removes all the services associated with MySQL Enterprise Service Manager.

To confirm that these services have been removed, check in the Microsoft Management Console Services window.

To reinstall these services, use the Install MySQL Enterprise Monitor Services menu option.

You can also remove services using the mysqlmonitorctl.bat file found in the C:\Program Files\MySQL\Enterprise\Monitor directory. To see the available options, go to the command line and type: mysqlnetworkctl help. This batch file is discussed in more detail in Section 5.2.5, “Starting/Stopping the MySQL Enterprise Monitor Service on Windows”.

Removing the Monitor Agent

To remove the Monitor Agent itself, open the Control Panel and choose Add or Remove Programs. Find the entry for MySQL Enterprise Monitor Agent and remove it. This executes the uninstall program located in the C:\Program Files\MySQL\Enterprise\Agent directory.

Warning

To remove only one of the agents from a machine that is running several agents, do not remove the MySQL Enterprise Monitor Agent entry from the Add or Remove Programs menu. To remove a single agent, see Removing a Single Agent.
Removing the Monitor Agent automatically deletes its associated .log and .pid files. After removing the Monitor Agent, you might need to remove the directories, C:\Program Files\MySQL\Enterprise and C:\Program Files\MySQL\Enterprise\Agent.

Removing the Monitor Agent this way removes the default service. If you are running additional Monitor Agents as described in Section C.2.2, "MySQL Server (agent-instance.ini) Configuration", you must remove those agents manually. See the next section for instructions on doing this.

**Removing a Single Agent**

To remove only one of the agents from a machine that is running several agents, do not remove the MySQL Enterprise Monitor Agent entry from the Add or Remove Programs menu. To remove a single agent and leave other agents intact, follow these steps:

1. Stop the agent.
2. Confirm the location of the log files.
3. Remove the agent as a service.
4. Remove/Archive the associated files.

It is best to stop the agent before removing it; for instructions on stopping an agent see, Section 5.3.4.1, "Starting/Stopping the Agent on Windows".

To confirm the location of the agent log files, check the ini file. For more information on this topic, see Section C.2.1, "MySQL Enterprise Monitor Agent Configurable Options".

Go to the command line and remove the MySQL Enterprise Monitor Agent as a Windows service by typing:

```shell
sc delete AgentName
```

To confirm that the agent has been removed, check that there is no longer any entry for that agent in the Microsoft Management Console Services window.

Also remove or archive any log or configuration files associated with this agent. If you have installed any additional agents, remove them in the same way.

**5.8.2 Removing the MySQL Enterprise Monitor: Unix**

**Removing the MySQL Enterprise Service Manager**

To remove the MySQL Enterprise Service Manager, find the uninstall file in the /opt/mysql/enterprise/monitor directory.

Execute this file by typing:

```shell
./uninstall
```

During the uninstall process you will be given the option of saving existing data and log files. Choose this option if you plan to reinstall the MySQL Enterprise Monitor.

If you are not saving existing data, you can remove the /opt/mysql/enterprise/monitor directory after uninstalling the MySQL Enterprise Service Manager.

**Warning**

If you did not remove existing data and log files when uninstalling the MySQL Enterprise Monitor, do not remove the /opt/mysql/enterprise/monitor directory; doing so will delete these files.
On Red Hat Enterprise Linux 4 and Fedora Core 4, the uninstall script might not stop the Tomcat server. Do this manually if necessary. To do this, see Section 5.2.4, “Starting/Stopping the MySQL Enterprise Monitor Service on Unix”.

Be careful not to accidentally stop any other Java processes running on your system.

On some Unix platforms, you might have to manually delete the `uninstall` application and the installation directory after you execute the uninstall process.

### Removing the Monitor Agent

Prior to removal of the Monitor Agent Service, stop any agents by changing to the `init.d` directory and issuing the command `./mysql-monitor-agent stop`.

You will find the `uninstall` file in the `/opt/mysql/enterprise/agent` directory. Execute this file by navigating to this directory and typing:

```
shell> ./uninstall
```

Removing the Monitor Agent automatically deletes its associated `.log` and `.pid` files. After uninstalling the Monitor Agent, you can remove the `/opt/mysql/enterprise/agent` directory.

Removing the Monitor Agent this way removes the default service, and all the configuration files for different instances.

### Removing a Single Agent

To remove only one of the agents from a machine that is running several agents, do **not** run the uninstall program. To remove a single agent and leave other agents intact, follow these steps:

1. Stop the agent.
2. Confirm the location of the log files.
3. Remove the agent as a service.
4. Remove/Archive associated files.

It is best to stop the agent before removing it; for instructions on stopping an agent, see Section 5.3.4.2, “Starting/Stopping the Agent on Unix”.

To confirm the location of the agent log files, check the `ini` file. For more information on this topic, see Section C.2.1, “MySQL Enterprise Monitor Agent Configurable Options”.

To remove the agent as a daemon, remove its entry in the `init.d` directory. Also remove or archive any log or configuration files associated with this agent.

If you have installed any additional agents, remove them in the same way.
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From dso/aix/dso.c:

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From strings/apr_strnatcmp.c, include/apr_strings.h:

strnatcmp.c – Perform 'natural order' comparisons of strings in C.
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Appendix B MySQL Enterprise Monitor General Reference

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This appendix contains reference information for MySQL Enterprise Monitor.

**B.1 MySQL Enterprise Monitor Limitations**

The following items are known limitations within MySQL Enterprise Monitor:

- The maximum size for each data item stored within the `mysql.inventory` table is 64 bytes.

- The MySQL Enterprise Monitor Agent, when operating for Query Analyzer as a proxy, does not support clients using the MySQL protocol older than MySQL 5.0.

- The MySQL Enterprise Monitor Agent, when operating for Query Analyzer as a proxy, affects the authentication of clients. As the proxy is the real client connecting to the backend MySQL server, authenticate using the hostname of the proxy, not the original client.

- Fonts used for MySQL Enterprise Service Manager graphs might not be displayed properly if a required font is missing.

To specify a custom font, you set a custom property within the embedded MySQL Server to a known working font. Connect to your embedded MySQL Server using the information provided by the `configuration_report.txt` file. Once connected, execute the following statement:

```sql
mysql> INSERT INTO map_entries VALUES (1,'Helvetica','graph.font');
```

Replacing `Helvetica` with the font to use.

The font used for graph rendering is selected as follows, in this order:

1. The user override value.
2. The MySQL Enterprise Service Manager default of Arial.
3. The graph engine default of SansSerif.

- You cannot monitor more than one MySQL Enterprise Monitor User Interface instance hosted on the same machine simultaneously within the same browser, even if each MySQL Enterprise Monitor User Interface uses a different port for access. The effect of this limitation can be more significant on certain browsers.

- When monitoring multiple MySQL instances with one MySQL Enterprise Monitor Agent, if any of the MySQL instances are down when the agent is started, the agent does not attempt to reconnect to the servers. This could lead to indications that MySQL instances were down when in fact they were
running and available. To avoid this problem, ensure all of the monitored instances are available before starting the agent.

B.2 Supported Browsers

The MySQL Enterprise Monitor User Interface is known to work within the following browser environments:

- Microsoft Internet Explorer 7.x, 8.x, 9.x, and higher.

  **Note**

  MySQL Enterprise Monitor User Interface is not compatible with the Compatibility View option within Internet Explorer 8.x, and higher. Disable this option before using MySQL Enterprise Monitor User Interface.

- Safari 3.2, 4.x, and higher.
- Firefox 3.0, 3.5, and higher.
- Google Chrome 4.0 and higher.

The MySQL Enterprise Monitor User Interface is known **not** to work within the following browser environments:

- Microsoft Internet Explorer 6.x and lower.
- Opera.

B.3 Installation Requirements

The Service Manager is available for Windows and a variety of Unix and Linux operating systems. In most cases, the standard operating system and packages are supported without further libraries and modules. All the required components are installed automatically.

**Windows Notes**

- Installation requires approximately 260MB of disk space for MySQL Enterprise Service Manager.

**Unix/Linux Notes**

- Installation requires approximately 450MB of disk space for MySQL Enterprise Service Manager.
- On FreeBSD, you must have **bind8** installed.

**General Notes**

- MySQL Server 5.5.10 and greater depends on the **libaio** library being available on the server. Solaris and Windows enable AIO functionality by default.

  This dependency affects the bundled MySQL Server.

**Note**

Disk-space usage requirements are approximate for the base application. During usage, the service manager records detailed information about your MySQL servers and environment, and disk space usage increases with time to record this historical data. You can control how long information is stored once the service manager has been installed.

Running MySQL Enterprise Service Manager places a reasonable load on your system, and this load increases linearly as you add more agents monitoring more servers. Ideally, use a dedicated
Machine for MySQL Enterprise Service Manager rather than running it alongside other applications and services.

**Minimum System Requirements**
- 2 or more CPU cores
- 2 or more GB of RAM
- Disk I/O subsystem applicable for a write-intensive database

**Recommended System Requirements (if monitoring 100 or more MySQL servers)**
- 4 or more CPU cores
- 8 or more GB of RAM
- Disk I/O subsystem applicable for a write-intensive database (RAID10, RAID 0+1)

The Monitor Agent is available for a wide range of operating systems. For an up-to-date list please see the http://www.mysql.com/products/enterprise/. The agent can be used to monitor any MySQL server from version 4.0.x through 5.6.x.

**B.4 Configuring Tomcat Parameters**

The parameters for the Tomcat hosting system used to support MySQL Enterprise Service Manager and MySQL Enterprise Monitor User Interface can have an affect on the performance of the system.

The default settings for Java for Tomcat are as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial heap size</td>
<td>-Xms</td>
<td>768MB</td>
</tr>
<tr>
<td>Maximum heap size</td>
<td>-Xmx</td>
<td>768MB</td>
</tr>
<tr>
<td>Java stack size</td>
<td>-Xss</td>
<td>128MB</td>
</tr>
</tbody>
</table>

You can change these parameters to higher values by editing the **JAVA_OPTS** setting within the corresponding platform script.

- **On Unix/Linux:**
  Edit the values within `apache-tomcat/bin/setenv.sh` file within your MySQL Enterprise Service Manager directory. Avoid setting maximum figures higher than the physical memory of your system as this may reduce, rather than increase the performance.

  If you change these parameters, shut down and restart MySQL Enterprise Service Manager for the changes to take effect.

- **Windows**
  Edit the **JAVA_OPTS** settings within the `apache-tomcat/bin/setenv.bat` file.

  To enable the changes, re-install your service. Shut down your MySQL Enterprise Service Manager service and then reinstall the service by running:

  ```
  shell> mysqlmonitorctl.bat uninstall
  shell> mysqlmonitorctl.bat install
  ```

  On all platforms, upgrading the MySQL Enterprise Service Manager service using the above methods should preserve any changes to **JAVA_OPTS**.

  If you change these parameters, restart MySQL Enterprise Service Manager for the changes to take effect.
B.5 Backing up MySQL Enterprise Service Manager

To back up the data stored within your MySQL Enterprise Service Manager, you can use any of the typical backup solutions, such as the MySQL Enterprise Backup product or the `mysqldump` command, to back up the repository database. Once this database grows to substantial size, you might find that the binary copy technique of the MySQL Enterprise Backup product is faster (especially for restoring) than a logical backup using the `mysqldump` command. For details, see http://dev.mysql.com/doc/mysql-enterprise-backup/en/.

To back up the MySQL Enterprise Monitor data, you specify the host name, user name, and password that were set during the installation of the MySQL Enterprise Service Manager. Locate this information in the `configuration_report.txt` file that was generated when MySQL Enterprise Service Manager was installed. The following example shows a typical report file:

```
MySQL Enterprise Monitor (Version 2.0.0.7088 : 20081031_152749_r7088)

Here are the settings you specified:
Application hostname and port: http://127.0.0.1:18080
Tomcat Ports: 18080 - 18443 (SSL)
MySQL Port : 13306

Repository Credentials (bundled MySQL):
---------------------------------------
service_manager/Password

Use the following command to login to the MySQL Enterprise Monitor database:
mysql -uservice_manager -pPassword -P13306 -h127.0.0.1
```

The last line provides the information about how to connect to the server using the standard `mysql` command line client.

All the MySQL Enterprise Monitor repository information, including your configuration, rule and historical data is stored within the `mem` database.

To back up this information using `mysqldump`, you might use the following command:

```
shell> mysqldump --single-transaction -uservice_manager -pPassword -P13306 -h127.0.0.1 mem >mem.dump
```

The above command creates a file, `mem.dump`, containing all of the MySQL Enterprise Monitor data.

To ensure consistency in a recovery situation, you may also want to back up the agent configuration and metadata stored on each monitored MySQL server. To do this:

- Copy the `etc` subdirectory of each agent to a backup location. This directory contains the main configuration file, `mysql-monitor-agent.ini`, and the configuration information for each server being monitored, which is stored within the `etc/instances` subdirectory.

- On each server being monitored, back up the `mysql.inventory` table, which contains the unique ID of the MySQL server.

In case the backup process makes the Service Manager unresponsive for a time, you might also adjust the `agent-backlog-timeout` setting as appropriate, to avoid losing data from the agents during a backup of the repository database.

B.6 Migrating 1.3.x Historical Data to MySQL Enterprise Monitor 2.0

You can migrate the data generated during a MySQL Enterprise Monitor 1.3.x installation using the Data Migration functionality of the Server Configuration panel.

To use the data migration feature, you must have installed MySQL Enterprise Service Manager using an `update` installer. The update installer performs the initial migration of your configuration, rules,
schedule, and events data. The historical data is not migrated until you explicitly request the migration of information within the Manage Servers section of the Settings panel.

Data migration works on a single server, allowing you to select on which servers you want to migrate information. The migration is subject to the following:

- You must elect to migrate the data from each server individually.
- Migration takes approximately 5-6 hours, for each month, for each server. Therefore, if you have six months of data on 10 servers it could take between 300 and 360 hours (15 days) to migrate all of your historical data on one server at a time.
- To limit the data migration, set the Data Purge Behavior within the Settings page, as shown in Section 2.8.1, “Global Settings”. Only data more recent than the specified purge period is migrated. Data older than the purge period is ignored.
- To prevent performance issues, migrate only one or a small number of servers concurrently.
- You can start and stop the migration of the data at any time. As a general guide, avoid stopping the data migration process and allow it to complete unless:
  - Run out of disk space.
  - MySQL Enterprise Service Manager becomes too slow and unresponsive.
  - Migration never completes.

With the last item, where the migration never completes, occasionally there are some aspects of the data that cannot be migrated successfully. This prevents the migration process completing, but does not affect the conversion of any data that could be migrated.

Starting Historical Data Migration

To start data migration:

- Switch to the Manage Servers display of the Settings panel within MySQL Enterprise Monitor User Interface.
- Ensure that the data migration functionality has been enabled. The Start and Stop buttons next to Historical Data Migration are visible.

**Figure B.1 MySQL Enterprise Monitor: Historical Data Migration Availability**

- Select the servers you want to migrate by using the checkbox next to each server name. You can select one or more servers to migrate. Servers that are suitable for migration show their migration status within the Migration Status column. If the server cannot be migrated, N/A is shown.
• Click **Start** next to **Historical Data Migration**.

• To start the migration, click **start migration** in the confirmation dialog box. To cancel migration, click **cancel**.

• The servers to migrate show **Queued for Migration** in the **Migration Status** column.

**Figure B.2 MySQL Enterprise Monitor: Confirming Historical Data Migration**

Monitoring Historical Data Migration

To check the migration status of any individual server, examine the **Migration Status** column for each server, as shown in the following figure:

**Figure B.3 MySQL Enterprise Monitor: Historical Data Migration Progress**

Note that the migration status is shown according to the state of migration at the time the page was loaded. The actual migration continues in the background, and the current state may not match the state of the migration at the time it is viewed.

Servers showing **Done** in the **Migration Status** column have already completed their migration.

You can check the overall migration status by examining the **Upgrade Status** display.

Stopping Historical Data Migration

You can stop the migration process for any server that is still migrating data. The migration can be restarted at any time without causing any problems.

To stop the historical data migration:

1. Select the servers you want to stop migrating by using the checkbox next to each server name. You can select one or more servers to stop migrating.
2. Click Stop next to Historical Data Migration.

You receive confirmation that the migration has been stopped, or a notification if migration has already completed.

Removing Old Data

Once data migration has been completed for all the servers you want to migrate, you may want to delete or remove access to the old data within your MySQL Enterprise Monitor repository. Data for MySQL Enterprise Monitor 1.3 was stored in a database called merlin within the MySQL repository. Data for MySQL Enterprise Monitor 2.0 is stored within a database called mem.

To create a backup of the old information, use mysqldump:

```
shell> mysqldump -uservice_manager -pPassword -P13306 -h127.0.0.1 merlin >data-1.3.sql
```

The above creates a file, data-1.3.sql containing all of the MySQL Enterprise Monitor 1.3 information.

If you remove access to the old data, then the data migration options for old servers are removed from the Manage Servers panel within MySQL Enterprise Service Manager. To remove access, REVOKE access to the merlin database:

```
mysql> REVOKE ALL on merlin.* FROM 'service_manager';
```

Revoking access to the old data does not reclaim any of the disk space used by the old data.

To delete the data from the database and free up the space being used by the historical information, DROP the merlin database:

```
mysql> DROP DATABASE merlin;
```

Once all the data has been migrated you can hide the migration user interface by clicking the hide migration interface button.

B.7 Improving Disk Space Usage with Purge in 2.1 and 2.2

In MySQL Enterprise Monitor 2.1, the data received by the MySQL Enterprise Service Manager from MySQL Enterprise Monitor Agent instances is inserted into tables, with the information within the tables purged periodically to remove the old data, according to the defined purging interval.

In installations with a large volume of data, the purging of old information can take a considerable amount of time, slowing down the MySQL Enterprise Service Manager and using up valuable disk space.

In MySQL Enterprise Monitor 2.2, the tables used for storing this information are changed, and the older tables are used only when viewing historical information. The information within the table is not purged until all of the table data is older than the specified purge period, when the old tables are dropped.

Note

The following instructions are designed to reduce the disk space usage for customers that are either using MySQL Enterprise Monitor 2.1 currently, or that have already upgraded an existing MySQL Enterprise Monitor 2.1 installation to MySQL Enterprise Monitor 2.2. When you perform a new (not upgrade) installation of MySQL Enterprise Monitor 2.2, these steps are not required.
To reduce the space used by the tables in both 2.1 and 2.2 until the data is finally purged, follow these steps:

1. If you are running MySQL Enterprise Monitor 2.1, upgrade to MySQL Enterprise Monitor 2.2 using an upgrade installer. This migrates the existing table data and prepare you for the next stage.

   **Warning**
   
   Performing a upgrade installation from MySQL Enterprise Monitor 2.1 to MySQL Enterprise Monitor 2.2 requires approximately 150% of your current disk space requirements while the information is migrated. Once the migration is complete, your disk space usage returns to a value slightly higher than within your MySQL Enterprise Monitor 2.1 installation.

2. Start up your MySQL Enterprise Service Manager and MySQL Enterprise Monitor Agent instances.

3. Connect to the MySQL server being used by your MySQL Enterprise Service Manager. You can find a sample `mysql` command for connecting to your server within the `configuration_report.txt` file within your MySQL Enterprise Service Manager installation.

4. Once connected to MySQL, change to the `mem` database:

   ```
   mysql> use mem;
   ```

5. Now execute the following `ALTER TABLE` statements to change the original InnoDB tables to use MyISAM:

   ```
   ALTER TABLE dc_ng_double_age0 ENGINE=MYISAM;
   ALTER TABLE dc_ng_double_age1 ENGINE=MYISAM;
   ALTER TABLE dc_ng_double_age2 ENGINE=MYISAM;
   ALTER TABLE dc_ng_double_now ENGINE=MYISAM;
   ALTER TABLE dc_ng_long_age0 ENGINE=MYISAM;
   ALTER TABLE dc_ng_long_age1 ENGINE=MYISAM;
   ALTER TABLE dc_ng_long_age2 ENGINE=MYISAM;
   ALTER TABLE dc_ng_long_now ENGINE=MYISAM;
   ALTER TABLE dc_ng_string_now ENGINE=MYISAM;
   ```

   **Note**
   
   Please keep in mind the following points when running these statements:
   
   - Performing this operation should not affect the operation of your MySQL Enterprise Service Manager, since new data is written into different tables.
   - The time required to perform the conversation depends on the size of your original tables. It may take a considerable amount of time if you have a large volume of old data.
   - You need slightly more than twice the amount of disk space currently being used by the tables until the conversion completes.

   Once the conversion has completed, you can continue to use your MySQL Enterprise Service Manager without restarting or any further administration. The existing old table data is removed as soon as the data in the old table is older than your selected purging interval. The new MyISAM tables should take up approximately 60% of the space of the InnoDB tables.

**B.8 Regular MySQL Enterprise Monitor Maintenance**

MySQL Enterprise Monitor is generally self-managing and does not need much maintenance. To keep your MySQL Enterprise Monitor running efficiently, automate or manually perform these maintenance tasks:
• Set the purge interval for your data to an appropriate value according to duration and history of data that you want to keep. For more information, see Data Purge Behavior.

• Check, and delete, the contents of the temporary directory with your MySQL Enterprise Service Manager installation directory.

B.9 Advisor/Graph Reference

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  • 32-Bit Binary Running on 64-Bit AMD Or Intel System
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  • InnoDB Tablespace Cannot Automatically Expand
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  • Insecure Password Authentication Option Is Enabled
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B.9.1 Advisors

The following items describe individual advisors.

- **32-Bit Binary Running on 64-Bit AMD Or Intel System**

  The chip architecture and operating system installed on a machine both impact the performance of software running on the system. While it is possible to run 32-bit software on many 64-bit systems, in general, software built to run on a 64-bit system runs better on such a system than software built to run on a 32-bit system.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **Account Has An Overly Broad HostSpecifier**

  The MySQL server has user accounts with overly broad host specifiers. A MySQL account is identified by both a username and a hostname, which are found in the User and Host columns of the mysql.user table. The User value is the name that a client must supply when connecting to the server. The Host value indicates the host or hosts from which the user is allowed to connect. If this is a literal hostname, the account is limited to connections only from that host. If the hostname contains the ‘%’ wildcard character, the user can connect from any host that matches the wildcard character and potentially from any host at all.

  From a security standpoint, literal host values are best and ‘%’ is worst. Accounts that have Host values containing wildcards are more susceptible to attack than accounts with literal host values, because attackers can attempt to connect from a broader range of machines.
For example, if an account has user and host values of root and %, it means that you can connect as the root user from any machine if you know the password. By contrast, if the host name is localhost or 127.0.0.1, the attacker can only attempt to connect as the root user from the server host.

Default frequency 00:05:00
Default auto-close enabled no

- **Account Has Global Privileges**

A MySQL server may have user accounts with privileges on all databases and tables (*.*) In most cases global privileges should be allowed only for the MySQL root user, and possibly for users that you trust or use for backup purposes. Global privileges such as DROP, ALTER, DELETE, UPDATE, INSERT, and LOCK TABLES may be dangerous as they may cause other users to be affected adversely.

Default frequency 00:05:00
Default auto-close enabled no

- **Account Has Old Insecure Password Hash**

Prior to MySQL 4.1, password hashes computed by the PASSWORD() function were 16 bytes long. As of MySQL 4.1 (and later), PASSWORD() was modified to produce a longer 41-byte hash value to provide enhanced security.

Default frequency 06:00:00
Default auto-close enabled no

- **Account Has Strong MySQL Privileges**

Certain account privileges can be dangerous and should only be granted to trusted users when necessary. For example, the FILE privilege allows a user to read and write files on the database server (which includes sensitive operating system files), the PROCESS privilege allows currently executing statements to be monitored, and the SHUTDOWN privilege allows a user to shut down the server. In addition, the GRANT privilege allows a user to grant privileges to others.

Default frequency 00:05:00
Default auto-close enabled no

- **Account Requires Unavailable Authentication Plugins**

MySQL now supports many forms of authentication as of the 5.5 release, including external authentication mechanisms using PAM, or Windows native authentication with commercial releases of MySQL version 5.5.16 or greater. If a user is configured to use an authentication plugin, and that plugin does not get loaded with server start, this will block access to the database for those users.

Default frequency 06:00:00
Default auto-close enabled yes

- **Agent Host Time Out of Sync Relative to Dashboard**

To maintain data consistency and to facilitate day-to-day system management operations, which often require comparing logs, files, and timestamps across servers, it is important that the server clocks across all your systems and data centers be synchronized with respect to each other relative to UTC time (which takes timezones into account). When the clock on one server is minutes or hours behind another server, any timestamps created in the databases or on the file systems of those
two servers will differ by that amount. Thus if you depend on timestamps to test the freshness of some data item, or if you are trying to diagnose a problem and need to compare timestamps across systems, your task will be more complicated due to this time difference.

In addition, the data and graphs shown in the MySQL Enterprise Monitor Dashboard will be skewed by the difference in time between the machine hosting the Service Manager and the machines running the Agents. For example, if the time on an Agent machine is one hour behind the time on the Service Manager machine, the MySQL server that Agent is monitoring will appear to be down (see Bug #45937) and no data will appear in the graphs for that server for the first hour after the Agent is started.

Default frequency 00:05:00
Default auto-close enabled yes

• Attempted Connections To The Server Have Failed

Aborted connection attempts to MySQL may indicate an issue with respect to the server or network, or could be indicative of DoS or password-cracking attempts against the MySQL Server. The aborted-connects count is incremented when:

• A client does not have privileges to access a database
• A client uses the wrong password
• A malformed packet is received
• The connect_timeout variable is exceeded

Default frequency 00:05:00
Default auto-close enabled no

• AUTO_INCREMENT Field Limit Nearly Reached

Many applications need to generate unique numbers and sequences for identification purposes (e.g. customer IDs, bug or trouble ticket tags, membership or order numbers, etc). MySQL's mechanism for doing this is the AUTO_INCREMENT column attribute, which enables you to generate sequential numbers automatically.

However, the range of numbers that can be generated is limited by the underlying data type. For example, the maximum value possible for a TINYINT UNSIGNED column is 255. If you try to generate a number that exceeds the maximum allowed by the underlying data type (e.g. by inserting a NULL value into the AUTO_INCREMENT column), you will trigger database errors and your application may not behave properly.

Note that the primary purpose of AUTO_INCREMENT in MySQL is to generate a sequence of positive integers. The use of non-positive numbers in an AUTO_INCREMENT column is unsupported, so you may as well define those columns to be UNSIGNED, which effectively doubles their allowable range.

Default frequency 06:00:00
Default auto-close enabled no

• Binary Log Checksums Disabled

Binary logs written and read by the MySQL Server are now crash-safe, because only complete events (or transactions) are logged or read back. By default, the server logs the length of the event as well as the event itself and uses this information to verify that the event was written correctly.
You can also cause the server to write checksums for the events using CRC32 checksums by setting the `binlog_checksum` system variable, to add an extra level of safety to the logs and the replication process. To cause the server to read checksums from the binary log, use the `master_verify_checksum` system variable. The `slave_sql_verify_checksum` system variable causes the slave SQL thread to read checksums from the relay log.

**Default frequency** 06:00:00

**Default auto-close enabled** yes

- **Binary Log Debug Information Disabled**

  The binary log captures DML, DDL, and security changes that occur and stores these changes in a binary format. The binary log enables point-in-time recovery, preventing data loss during a disaster recovery situation. It also enables you to review all alterations made to your database.

  The `binlog_rows_query_log_events` system variable affects row-based logging only. When enabled, it causes a MySQL 5.6.2 or later server to write informational log events such as row query log events into its binary log. This information can be used for debugging and related purposes; such as obtaining the original query issued on the master when it cannot be reconstructed from the row updates.

  These events are normally ignored by MySQL 5.6.2 and later programs reading the binary log and so cause no issues when replicating or restoring from backup. This is not true for a `mysqld` or `mysqlbinlog` from MySQL 5.6.1 or earlier: When the older version of the program reading the log encounters an informational log event, it fails, and stops reading at that point. To make the binary log readable by slave replication MySQL servers and other readers (for example, `mysqlbinlog`) from a MySQL 5.6.1 or earlier distribution, `binlog_rows_query_log_events` must be disabled during logging.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **Binary Log File Count Exceeds Specified Limit**

  The binary log captures DML, DDL, and security changes that occur and stores these changes in a binary format. The binary log enables replication as well as point-in-time recovery, preventing data loss during a disaster recovery situation. It also enables you to review all alterations made to your database. However, binary logs consume disk space and file system resources, and can be removed from a production server after they are no longer needed by the slaves connecting to this master server, and after they have been backed up.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **Binary Log Row Based Images Excessive**

  As of MySQL Server 5.6, row-based replication now supports row image control. By logging only those columns required for uniquely identifying and executing changes on each row (as opposed to all columns) for each row change, it is possible to save disk space, network resources, and memory usage. You can determine whether full or minimal rows are logged by setting the `binlog_row_image` server system variable to one of the values `minimal` (log required columns only), `full` (log all columns), or `noblob` (log all columns except for unneeded BLOB or TEXT columns).

  **Default frequency** 06:00:00

  **Default auto-close enabled** yes
• **Binary Log Space Exceeds Specified Limit**

The binary log captures DML, DDL, and security changes that occur and stores these changes in a binary format. The binary log enables replication as well as point-in-time recovery, preventing data loss during a disaster recovery situation. It also enables you to review all alterations made to your database. However, binary logs consume disk space and can be removed from a production server after they are no longer needed by the slaves connecting to this master server, and after they have been backed up.

**Default frequency** 06:00:00

**Default auto-close enabled** no

• **Binary Log Usage Exceeding Disk Cache Memory Limits**

When binary log usage exceeds the binary log cache memory limits, it is performing excessive disk operations. For optimal performance, transactions that move through the binary log should be contained within the binary log cache.

**Default frequency** 00:05:00

**Default auto-close enabled** no

• **Binary Logging Is Limited**

The binary log captures DML, DDL, and security changes that occur and stores these changes in a binary format. The binary log enables point-in-time recovery, preventing data loss during a disaster recovery situation. It also enables you to review all alterations made to your database.

Binary logging can be limited to specific databases with the `--binlog-do-db` and the `--binlog-ignore-db` options. However, if these options are used, your point-in-time recovery options are limited accordingly, along with your ability to review alterations made to your system.

**Default frequency** 06:00:00

**Default auto-close enabled** no

• **Binary Logging Not Enabled**

The binary log captures DML, DDL, and security changes that occur and stores these changes in a binary format. The binary log enables point-in-time recovery, preventing data loss during a disaster recovery situation. It also enables you to review all alterations made to your database.

**Default frequency** 06:00:00

**Default auto-close enabled** no

• **Binary Logging Not Synchronized To Disk At Each Write**

By default, the binary log is not synchronized to disk at each write. If the server host, operating system, or MySQL server crash, there is a chance that the latest statements in the binary log are not written to disk. To prevent this, you can cause the binary log to be synchronized to disk after every Nth binary log entry using the `sync_binlog` global variable. 1 is the safest value, but also the slowest.

**Default frequency** 06:00:00

**Default auto-close enabled** no

• **Binary Logs Automatically Removed Too Quickly**
The binary log captures DML, DDL, and security changes that occur and stores these changes in a binary format. The binary log enables point-in-time recovery, preventing data loss during a disaster recovery situation. It is used on master replication servers as a record of the statements to be sent to slave servers. It also enables you to review all alterations made to your database.

However, the number of log files and the space they use can grow rapidly, especially on a busy server, so it is important to remove these files on a regular basis when they are no longer needed, as long as appropriate backups have been made. The `expire_logs_days` parameter enables automatic binary log removal.

**Default frequency** 12:00:00

**Default auto-close enabled** no

- **Cluster Data Node Data Memory Getting Low**

  Advises when the amount of Data Memory configured for the data nodes starts to run low. Database inserts will start to fail if all of the memory is consumed.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **Cluster Data Node Has Been Restarted**

  To perform useful work, the cluster data nodes must be up-and-running continuously. It is normal for a production system to run continuously for weeks, months, or longer. If a data node has been restarted recently, it may be the result of planned maintenance, but it may also be due to an unplanned event that should be investigated.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **Cluster Data Node Index Memory Getting Low**

  Advises when the amount of Index Memory configured for the data nodes starts to run low. Database inserts will start to fail if all of the memory is consumed.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **Cluster Data Node Redo Buffer Space Getting Low**

  Advises when the redo buffers start to fill up.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **Cluster Data Node Redo Log Space Getting Low**

  Advises when the redo log spaces start to fill up.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **Cluster Data Node Undo Buffer Space Getting Low**

  Advises when the undo buffers start to fill up.
• **Cluster Data Node Undo Log Space Getting Low**
  Advises when the undo log spaces start to fill up.
  
  **Default frequency** 00:05:00
  **Default auto-close enabled** no

• **Cluster DiskPageBuffer Hit Ratio Is Low**
  Advises when the hit-rate for the DiskPageBuffer falls below a threshold. May happen temporarily after restarting one or more data nodes. This is the average ratio since the last sample period.
  
  **Default frequency** 00:05:00
  **Default auto-close enabled** no

• **Cluster Has Stopped**
  Indicates a cluster has completely stopped.
  
  **Default frequency** 00:02:00
  **Default auto-close enabled** no

• **Connection Usage Excessive**
  Once the maximum connection limit for the MySQL server has been reached, no other user connections can be established and errors occur on the client side of the application.
  
  **Default frequency** 00:01:00
  **Default auto-close enabled** no

• **CPU I/O Usage Excessive**
  CPU I/O usage should be low on a properly configured and well-tuned system. Excessive CPU I/O usage is often indicative of poor disk or network performance.
  
  **Default frequency** 00:01:00
  **Default auto-close enabled** no

• **CPU Usage Excessive**
  CPU usage should be low-to-moderate on a properly configured and well-tuned system. Excessive CPU usage can be indicative of many problems: insufficient RAM, fragmented disks, poorly-tuned queries, etc.
  
  **Default frequency** 00:01:00
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- **CREATE TABLE LIKE Does Not Require Any Privileges On Source Table**

  Due to bug #25578, a user who does not have any access to a database can still clone the structure of tables in that database. Knowing the structure of tables in a database may give a determined hacker insight that allows him or her to proceed with other exploits.

  This bug has been fixed in later versions of the MySQL server.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **Data Flushed To Disk After Each SQL Statement**

  MySQL updates its data files on disk with the write() system call after every SQL statement and lets the operating system handle the synchronizing to disk. You can force MySQL to flush everything to disk after every SQL statement with the `--flush` option, however, this will have an adverse effect on performance.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **Database May Not Be Portable Due To Identifier Case Sensitivity**

  The case sensitivity of the underlying operating system determines the case sensitivity of database and table names. If you are using MySQL on only one platform, you don't normally have to worry about this. However, depending on how you have configured your server you may encounter difficulties if you want to transfer tables between platforms that differ in filesystem case sensitivity.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **Date-Handling Bugs Can Crash The Server**

  Two bugs related to date-handling operations can crash the server leading to potential Denial of Service (DoS) attacks:

  - `STR_TO_DATE(1(NULL)` caused a server crash (Bug#15828);
  - Invalid arguments to DATE_FORMAT() caused a server crash (Bug#20729).

    These bugs have been fixed in later versions of the MySQL server.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **Default Value Being Used For max_prepared_stmt_count**

  Prepared statements may increase performance in applications that execute similar statements more than once, primarily because the query is parsed only once. Prepared statements can also reduce network traffic because it is only necessary to send the data for the parameters for each execution rather than the whole statement.

  However, prepared statements consume memory in the MySQL server until they are closed, so it is important to use them properly and to limit the number of statements that can be open at any one
time. The default value for max_prepared_stmt_count may not be appropriate for your application and environment.

Default frequency 06:00:00

Default auto-close enabled no

- **Disabling Next-Key Locking In InnoDB Can Crash The Server**

Due to several bugs, the server could crash if next-key locking in InnoDB was disabled.

These bugs have been fixed in later versions of the MySQL server.

Default frequency 06:00:00

Default auto-close enabled no

- **Event Scheduler Disabled**

The Event Scheduler is a very useful feature when enabled. It is a framework for executing SQL commands at specific times or at regular intervals. Conceptually, it is similar to the idea of the Unix crontab (also known as a “cron job”) or the Windows Task Scheduler.

The basics of its architecture are simple. An event is a stored routine with a starting date and time, and a recurring tag. Once defined and activated, it will run when requested. Unlike triggers, events are not linked to specific table operations, but to dates and times. Using the event scheduler, the database administrator can perform recurring events with minimal hassle. Common uses are the cleanup of obsolete data, the creation of summary tables for statistics, and monitoring of server performance and usage.

Default frequency 00:05:00

Default auto-close enabled no

- **Excessive Disk Temporary Table Usage Detected**

If the space required to build a temporary table exceeds either tmp_table_size or max_heap_table_size, MySQL creates a disk-based table in the server's tmpdir directory. Also, tables that have TEXT or BLOB columns are automatically placed on disk.

For performance reasons it is ideal to have most temporary tables created in memory, leaving exceedingly large temporary tables to be created on disk.

Default frequency 00:05:00

Default auto-close enabled no

- **Excessive Number of Locked Processes**

Depending on the circumstances, storage engines, and other factors, one process may be using or accessing a resource (e.g. a table or row) required by another process in such a way that the second process cannot proceed until the first process releases the resource. In this case the second process is in a "locked" state until the resource is released. If many processes are in a locked state it may be a sign of serious trouble related to resource contention, or a long running session that is not releasing currently held locks when it should have.

Default frequency 00:01:00

Default auto-close enabled no

- **Excessive Number of Long Running Processes**
Most applications and databases are designed to execute queries very quickly. If many queries are taking a long time to execute (e.g. more than a few seconds) it can be a sign of trouble. In such cases queries may need to be tuned or rewritten, or indexes added to improve performance. In other cases the database schema may have to be redesigned.

Default frequency 00:01:00
Default auto-close enabled no

• Excessive Number of Long Running Processes Locked

Most applications and databases are designed to execute queries very quickly, and to avoid resource contention where one query is waiting for another to release a lock on some shared resource. If many queries are locked and taking a long time to execute (e.g. more than a few seconds), it can be a sign of performance trouble and resource contention. In such cases queries may need to be tuned or rewritten, or indexes added to improve performance. In other cases the database schema may have to be redesigned.

Default frequency 00:01:00
Default auto-close enabled no

• Excessive Percentage Of Attempted Connections To The Server Have Failed

Excess aborted connection attempts to MySQL may indicate an issue with respect to the server or network, or could be indicative of DoS or password-cracking attempts against the MySQL Server. The aborted-connects count is incremented when:

• A client does not have privileges to access a database
• A client uses the wrong password
• A malformed packet is received
• The connect_timeout variable is exceeded

Default frequency 00:05:00
Default auto-close enabled no

• Flush Time Set To Non-Zero Value

If flush_time is set to a non-zero value, all tables are closed every flush_time seconds to free up resources and synchronize unflushed data to disk. If your system is unreliable and tends to lock up or restart often, forcing out table changes this way degrades performance but can reduce the chance of table corruption or data loss. We recommend that this option be used only on Windows, or on systems with minimal resources.

Default frequency 06:00:00
Default auto-close enabled no

• General Query Log Enabled

The general query log is a general record of what mysqld is doing. The server writes information to this log when clients connect or disconnect, and it logs each SQL statement received from clients. The general query log can be very useful when you suspect an error in a client and want to know exactly what the client sent to mysqld.

However, the general query log should not be enabled in production environments because:
• It adds overhead to the server;

• It logs statements in the order they were received, not the order they were executed, so it is not reliable for backup/recovery;

• It grows fast and can use a lot of disk space;

• You cannot stop logging to the general query log without stopping the server (for versions previous to 5.1).

You should use the binary log instead.

Default frequency 06:00:00

Default auto-close enabled no

• Host Cache Size Not Sufficient

The MySQL server maintains a host cache in memory that contains IP address, host name, and error information about clients. It uses the host cache for several purposes:

• By caching the results of IP-to-host name lookups, the server avoids doing a DNS lookup for each client connection, thereby improving performance.

• The cache contains information about errors that occur during the connection process. Some errors are considered "blocking." If too many of these occur successively from a given host without a successful connection, the server blocks further connections from that host.

If the host cache is not large enough to handle all the hosts from which clients may connect, performance may suffer and you may lose information about client connection errors.

Default frequency 00:05:00

Default auto-close enabled no

• Improper key_cache_block_size Setting Can Corrupt MyISAM Tables

The server deducts some bytes from the key_cache_block_size option value and reduces it to the next lower 512 byte boundary. The resulting block size is not a power of two. Setting the key_cache_block_size system variable to a value that is not a power of two results in MyISAM table corruption.

This bug has been fixed in later versions of the MySQL server.

Default frequency 06:00:00

Default auto-close enabled no

• In-Memory Temporary Table Size Limited By Maximum Heap Table Size

If the space required to build a temporary table exceeds either tmp_table_size or max_heap_table_size, MySQL creates a disk-based table in the server's tmpdir directory. For performance reasons it is ideal to have most temporary tables created in memory, leaving exceedingly large temporary tables to be created on disk. Many DBAs configure tmp_table_size appropriately, but forget that max_heap_table_size also plays a role.

Default frequency 06:00:00

Default auto-close enabled no

• Incorrect InnoDB Flush Method On Windows
If `innodb_file_per_table` is enabled and `innodb_flush_method` is not set to `unbuffered` on Windows, MySQL may not start and you may see operating system error code 87.

**Default frequency** 06:00:00

**Default auto-close enabled** no

- **Incremental MySQL Enterprise Backups Not Enabled**

  Advises when MySQL Enterprise Backup is not using the incremental backup option.

  **Default frequency** 06:00:00

  **Default auto-close enabled** yes

- **Indexes Not Being Used Efficiently**

  The target server does not appear to be using indexes efficiently. The values of `Handler_read_rnd_next` and `Handler_read_rnd` together - which reflect the number of rows read via full table scans - are high compared to the `Handler` variables which denote index accesses - such as `Handler_read_key`, `Handler_read_next` etc. You should examine your tables and queries for proper use of indexes.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **InnoDB Buffer Cache Has Sub-Optimal Hit Rate**

  Logical I/O is many times faster than physical I/O, and therefore a DBA should strive to keep physical I/O to a minimum. It is true that logical I/O is not free, and that the DBA should work to keep all I/O to a minimum, but it is best if most data access is performed in memory. When using InnoDB, most data access should occur in RAM, and therefore the InnoDB buffer cache hit rate should be high.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **InnoDB Buffer Pool Writes May Be Performance Bottleneck**

  For optimal performance, InnoDB should not have to wait before writing pages into the InnoDB buffer pool.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **InnoDB Change Buffering Is Not Entirely Crash-Safe**

  Due to bug #66819, InnoDB change buffer modifications are not entirely crash-safe. If a crash happens at a specific point when a change buffer entry is being merged into the page, the transaction log and the change buffer are left in an inconsistent state, so InnoDB will crash after a restart after reading the corresponding secondary index page.

  This bug has been fixed in later versions of the MySQL server.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **InnoDB Doublewrite Buffer Enabled**
InnoDB uses a novel file flush technique called **doublewrite**. It adds safety to recovery following an operating system crash or a power outage, and improves performance on most varieties of Unix by reducing the need for fsync() operations.

Doublewrite means that before writing pages to a data file, InnoDB first writes them to a contiguous tablespace area called the doublewrite buffer. Only after the write and the flush to the doublewrite buffer has completed does InnoDB write the pages to their proper positions in the data file. If the operating system crashes in the middle of a page write, during recovery InnoDB can find a good copy of the page from the doublewrite buffer.

**Default frequency** 06:00:00

**Default auto-close enabled** no

- **InnoDB Fast Shutdown Enabled**

Once you use the InnoDB Plugin on a set of database files, care must be taken to avoid crashes and corruptions when using those files with an earlier version of InnoDB, as might happen by opening the database with MySQL when the plugin is not installed. It is **strongly** recommended that you use a "slow shutdown" (SET GLOBAL innodb_fast_shutdown=0) when stopping the MySQL server when the InnoDB Plugin is enabled. This will ensure log files and other system information written by the plugin will not cause problems when using a prior version of InnoDB.

The reason "slow" shutdown (innodb_fast_shutdown=0) is recommended is because the InnoDB Plugin may write special records to the transaction undo log that will cause problems if the built-in InnoDB in MySQL attempts to read the log. Specifically, these special records will be written when a record in a COMPRESSED or DYNAMIC table is updated or deleted and the record contains columns stored off-page. The built-in InnoDB in MySQL cannot read these undo log records. Furthermore, the built-in InnoDB in MySQL will fail to roll back incomplete transactions that affect tables that it is unable to read (tables in COMPRESSED or DYNAMIC format).

Also note that a "normal" shutdown will not necessarily empty the undo log. A normal shutdown occurs when innodb_fast_shutdown=1, the default. When InnoDB is shut down, some active transactions may have uncommitted modifications, or they may be holding a read view that prevents the purging of some version information from the undo log. The next time InnoDB is started after a normal shutdown (innodb_fast_shutdown=1), it will roll back any incomplete transactions and purge old version information. Therefore, it is important to perform a "slow" shutdown (innodb_fast_shutdown=0) as part of the downgrade process.

**Default frequency** 12:00:00

**Default auto-close enabled** no

- **InnoDB File Format Check Disabled Or Incorrect**

To prevent possible crashes or data corruptions when the InnoDB Plugin opens an ib-file set, it will check that it can fully support the file formats in use within the ib-file set. If the system is restarted following a crash, or a "fast shutdown" (i.e., innodb_fast_shutdown is greater than zero), there may be on-disk data structures (such as redo or undo entries, or doublewrite pages) that are in a "too-new" format for the current software. During the recovery process, serious damage can be done to your data files if these data structures are accessed. The startup check of the file format occurs before any recovery process begins, thereby preventing the problems described in the "Possible Problems" section of the InnoDB Plugin documentation.

Setting innodb_file_format_check to OFF, or to a different format than the one in use, is very dangerous, as it permits the recovery process to run, possibly corrupting your database if the previous shutdown was a crash or "fast shutdown". You should only set innodb_file_format_check in this manner if you are sure that the previous shutdown was done with innodb_fast_shutdown=0, so that essentially no recovery process will occur.
• **InnoDB Flush Method May Not Be Optimal**

Different values for `innodb_flush_method` can have a marked effect on InnoDB performance. In some versions of GNU/Linux and Unix, flushing files to disk by invoking `fsync()` (which InnoDB uses by default) or other similar methods, can be surprisingly slow. If you are dissatisfied with database write performance, you might try setting the `innodb_flush_method` parameter to `O_DIRECT` or `O_DSYNC`.

• **InnoDB INFORMATION_SCHEMA Plugins Missing**

Several INFORMATION_SCHEMA tables -- `INNODB_CMP`, `INNODB_CMPMEM`, `INNODB_TRX`, `INNODB_LOCKS`, and `INNODB_LOCK_WAITS` -- contain live information about compressed InnoDB tables, the compressed InnoDB buffer pool, all transactions currently executing inside InnoDB, the locks that transactions hold and those that are blocking transactions waiting for access to a resource (a table or row). These tables are very useful for monitoring the activity and performance of the InnoDB Plugin storage engine.

However, these INFORMATION_SCHEMA tables are themselves plugins to the MySQL server. As such, they need to be INSTALLED as described in the InnoDB Plugin User’s Guide. If they are not installed, you will not be able to use them to monitor the InnoDB storage engine.

• **InnoDB Log Buffer Flushed To Disk After Each Transaction**

By default, InnoDB’s log buffer is written out to the log file at each transaction commit and a flush-to-disk operation is performed on the log file, which enforces ACID compliance. In the event of a crash, if you can afford to lose a second’s worth of transactions, you can achieve better performance by setting `innodb_flush_log_at_trx_commit` to either 0 or 2. If you set the value to 2, then only an operating system crash or a power outage can erase the last second of transactions. This can be very useful on slave servers, where the loss of a second’s worth of data can be recovered from the master server if needed.

• **InnoDB Log Waits May Be Performance Bottleneck**

For optimal performance, InnoDB should not have to wait before writing DML activity to the InnoDB log buffer.

• **InnoDB Not Using Newest File Format**

The InnoDB Plugin has two new features that can be very useful -- **compressed tables** and **long variable-length columns stored off-page**. Under the right circumstances, both of these features can
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improve the performance of your system. However, in order to take advantage of these new features you must configure InnoDB to use the new file format that enables them.

**Default frequency** 12:00:00

**Default auto-close enabled** no

- **InnoDB Status Truncation Detected**

  InnoDB primarily uses the SHOW ENGINE INNODB STATUS command to dump diagnostics information. As this SHOW statement can output a lot of data when running in a system with very many concurrent sessions, the output is limited to 64 kilobytes in versions < 5.5.7, and 1 megabyte on versions greater than 5.5.7. You are running a version where the truncation limit should be 1 megabyte, however truncation is still occurring in your system, and the MEM Agent relies on this output to pass back a number of key InnoDB statistics.

  However, InnoDB provides a startup option called innodb_status_file, which dumps the same output as SHOW ENGINE INNODB STATUS to a file called innodb_status.<mysql pid> in the datadir. The MEM Agent (in versions > 2.3.0) will read this file automatically if it exists before executing the SHOW statement.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **InnoDB Strict Mode Is Off**

  To guard against ignored typos and syntax errors in SQL, or other unintended consequences of various combinations of operational modes and SQL commands, the InnoDB Plugin provides a "strict mode" of operations. In this mode, InnoDB will raise error conditions in certain cases, rather than issue a warning and process the specified command (perhaps with some unintended defaults). This is analogous to MySQL's sql_mode, which controls what SQL syntax MySQL will accept, and determines whether it will silently ignore errors, or validate input syntax and data values.

  Using the new clauses and settings for ROW_FORMAT and KEY_BLOCK_SIZE on CREATE TABLE and ALTER TABLE commands and the CREATE INDEX command can be confusing when not running in strict mode. Unless you run in strict mode, InnoDB will ignore certain syntax errors and will create the table or index, with only a warning in the message log. However if InnoDB strict mode is on, such errors will generate an immediate error and the table or index will not be created, thus saving time by catching the error at the time the command is issued.

  **Default frequency** 12:00:00

  **Default auto-close enabled** no

- **InnoDB Tablespace Cannot Automatically Expand**

  If the InnoDB tablespace is not allowed to automatically grow to meet incoming data demands and your application generates more data than there is room for, out-of-space errors will occur and your application may experience problems.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **InnoDB Transaction Logs Not Sized Correctly**

  To avoid frequent checkpoint activity and reduce overall physical I/O, which can slow down write-heavy systems, the InnoDB transaction logs should be approximately 50-100% of the size of the InnoDB buffer pool, depending on the size of the buffer pool.
• **Insecure Password Authentication Option Is Enabled**

Prior to MySQL 4.1, password hashes computed by the PASSWORD() function were 16 bytes long. As of MySQL 4.1 (and later), PASSWORD() was modified to produce a longer 41-byte hash value to provide enhanced security. However, in order to allow backward-compatibility with user tables that have been migrated from pre-4.1 systems, you can configure MySQL to accept logins for accounts that have password hashes created using the old, less-secure PASSWORD() function, but this is not recommended.

`Default frequency 06:00:00`

`Default auto-close enabled no`

• **Insecure Password Generation Option Is Enabled**

Prior to MySQL 4.1, password hashes computed by the PASSWORD() function were 16 bytes long. As of MySQL 4.1 (and later), PASSWORD() was modified to produce a longer 41-byte hash value to provide enhanced security. In order to allow backward-compatibility with older client programs, you can configure MySQL to generate short (pre-4.1) password hashes for new passwords, however, this is not recommended.

`Default frequency 06:00:00`

`Default auto-close enabled no`

• **INSERT ON DUPLICATE KEY UPDATE Bug May Break Replication**

For INSERT ... ON DUPLICATE KEY UPDATE statements where some AUTO_INCREMENT values were generated automatically for inserts and some rows were updated, one auto-generated value was lost per updated row, leading to faster exhaustion of the range of the AUTO_INCREMENT column. Affected versions of MySQL include 5.0.24 to 5.0.34, and 5.1.12 to 5.1.17 (inclusive).

Because the original problem can affect replication (different values on master and slave), it is recommended that the master and its slaves be upgraded to the current version.

`Default frequency 06:00:00`

`Default auto-close enabled no`

• **Key Buffer Size Greater Than 4 GB**

To minimize disk I/O, the MyISAM storage engine employs a key cache (or key buffer) to keep the most frequently accessed index blocks in memory. However, prior to MySQL version 5.0.52 this key buffer is limited in size to 4 GB, **even on 64-bit operating systems**. If set to a larger value, mysqld may crash when it tries to increase the actual buffer beyond 4 GB. Note that key_buffer_size remains limited to 4GB on 64-bit Windows systems until MySQL version 5.1.31.

`Default frequency 06:00:00`

`Default auto-close enabled no`

• **Key Buffer Size May Not Be Optimal For Key Cache**

The key cache hit ratio represents the proportion of keys that are being read from the key cache in memory instead of from disk. This should normally be greater than 99% for optimum efficiency.

`Default frequency 00:05:00`
• **Key Buffer Size May Not Be Optimal For System RAM**

The target server does not appear to have sufficient memory devoted to the key cache. On a dedicated server, this cache is commonly about 25%-50% of total RAM, when the MyISAM storage engine is in use within the database instance. This advisor also checks whether the Key Buffer usage has been greater than 75% full since the instance started, by default.

**Default frequency** 06:00:00

**Default auto-close enabled** no

• **Last Full MySQL Enterprise Backup Too Old**

Advises when the last successful full backup taken by MySQL Enterprise Backup is older than the threshold number of days.

**Default frequency** 06:00:00

**Default auto-close enabled** yes

• **LOCAL Option Of LOAD DATA Statement Is Enabled**

The LOAD DATA statement can load a file that is located on the server host, or it can load a file that is located on the client host when the LOCAL keyword is specified.

There are two potential security issues with supporting the LOCAL version of LOAD DATA statements:

• The transfer of the file from the client host to the server host is initiated by the MySQL server. In theory, a patched server could be built that would tell the client program to transfer a file of the server's choosing rather than the file named by the client in the LOAD DATA statement. Such a server could access any file on the client host to which the client user has read access.

• In a Web environment where the clients are connecting from a separate web server, a user could use LOAD DATA LOCAL to read any files that the web server process has read access to (assuming that a user could run any statement against the SQL server). In this environment, the client with respect to the MySQL server actually is the web server, not the remote program being run by the user who connects to the web server.

**Default frequency** 00:05:00

**Default auto-close enabled** no

• **Lock Contention Excessive**

Performance can be degraded if the percentage of table operations that have to wait for a lock is high compared to the overall number of locks. This can happen when using a table-level locking storage engine, such as MyISAM, instead of a row-level locking storage engine.

**Default frequency** 00:05:00

**Default auto-close enabled** no

• **Malformed Password Packet In Connection Protocol Can Crash Server**

Due to bug #28984, a malformed password packet in the connection protocol could cause the server to crash. This can lead to denial of service (DoS) attacks.
This bug has been fixed in later versions of the MySQL server.

**Default frequency** 06:00:00

**Default auto-close enabled** no

- **Master Not Verifying Checksums When Reading From Binary Log**

  Binary logs written and read by the MySQL Server are now crash-safe, because only complete events (or transactions) are logged or read back. By default, the server logs the length of the event as well as the event itself and uses this information to verify that the event was written correctly.

  You can also cause the server to write checksums for the events using CRC32 checksums by setting the `binlog_checksum` system variable, to add an extra level of safety to the logs and the replication process. To cause the server to read checksums from the binary log, use the `master_verify_checksum` system variable. The `slave_sql_verify_checksum` system variable causes the slave SQL thread to read checksums from the relay log.

  **Default frequency** 06:00:00

  **Default auto-close enabled** yes

- **Maximum Connection Limit Nearing Or Reached**

  Once the maximum connection limit for the MySQL server has been reached, no other user connections can be established and errors occur on the client side of the application.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **Missing Security Improvements In GRANT Options**

  The GRANT statement is used to create MySQL user accounts and to grant rights to accounts. Due to bugs 15756 and 14385, rights may be granted erroneously in certain circumstances:

  - In grant table comparisons, improper use of a latin1 collation caused some hostname matches to be true that should have been false (Bug#15756).
  
  - GRANTs to users with wildcards in their host information could be erroneously applied to similar users with the same username and similar wildcards. For example, a privilege granted to foo@% is also applied to user foo@192.% (Bug#14385).

    These bugs have been fixed in later versions of the MySQL server.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **Multi-Byte Encoding Processing Can Lead To SQL Injection**

  Due to bug 8378, the server incorrectly parsed strings escaped with the `mysql_real_escape_string()` C API function. As a result, even when the character set-aware `mysql_real_escape_string()` function was used, SQL injection was possible.

  This bug has been fixed in later versions of the MySQL server.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **Multiple Threads Used When Repairing MyISAM Tables**
Using multiple threads when repairing MyISAM tables can improve performance, but it can also lead to table and index corruption as reported by several bugs (#11527, #11684, #18874). Even though these bugs have been fixed, this feature is still considered beta-quality, as noted in the manual.

**Default frequency** 06:00:00

**Default auto-close enabled** no

- **MyISAM Concurrent Insert Setting May Not Be Optimal**

MyISAM uses table-level locking, which can adversely affect performance when there are many concurrent INSERT and SELECT statements because INSERTs will block all SELECTs until the INSERT is completed. However, MyISAM can be configured to allow INSERT and SELECT statements to run concurrently in certain situations.

- If `concurrent_insert` is set to 1 (the default, or AUTO as of MySQL 5.5.3 or later), MySQL allows INSERT and SELECT statements to run concurrently for MyISAM tables that have no free blocks in the middle of the data file.

- If `concurrent_insert` is set to 2 (available in MySQL 5.0.6 and later, or ALWAYS as of MySQL 5.5.3 or later), MySQL allows concurrent inserts for all MyISAM tables, even those that have holes. For a table with a hole, new rows are inserted at the end of the table if it is in use by another thread. Otherwise, MySQL acquires a normal write lock and inserts the row into the hole.

Note that setting concurrent_insert to 2 allows tables to grow even when there are holes in the middle. This can be bad for applications that delete large chunks of data but continue to issue many SELECTs, thus effectively preventing INSERTs from filling the holes.

**Default frequency** 06:00:00

**Default auto-close enabled** no

- **MyISAM Indexes Found with No Statistics**

The MySQL optimizer needs index statistics to help make choices about whether to use indexes to satisfy SQL queries. Having no statistics or outdated statistics limits the optimizer's ability to make smart and informed access plan choices.

**Default frequency** 12:00:00

**Default auto-close enabled** no

- **MyISAM Key Cache Has Sub-Optimal Hit Rate**

The key cache hit ratio represents the proportion of index values that are being read from the key cache in memory instead of from disk. This should normally be greater than 99% for optimum efficiency.

**Default frequency** 00:05:00

**Default auto-close enabled** no

- **MySQL Agent Memory Usage Excessive**

The memory needed by the MySQL Agent for basic monitoring is fairly small and consistent, and depends on the number of rules you have enabled. However, when the Query Analyzer is enabled, the Agent can use significantly more memory to monitor and analyze whatever queries you direct through it. In this case, the amount of memory used depends on the number of unique normalized queries, example queries and example explains being processed, plus the network bandwidth required to send query data to the Service Manager. In general, the amount of memory used for the
Query Analyzer is small and well-bounded, but under some circumstances it can become excessive, especially on older versions of Linux.

**Default frequency** 00:01:00

**Default auto-close enabled** no

- **MySQL Agent Not Communicating With Database Server**

  The MySQL Enterprise Service Agent must be able to communicate with the local MySQL database server in order to monitor the server and provide advice on enforcement of best practices.

  **Default frequency** 00:01:00

  **Default auto-close enabled** yes

- **MySQL Agent Not Reachable**

  In order to monitor a MySQL server, a Service Agent must be running and communicating with the Service Manager. If the Agent cannot communicate with the Service Manager, the Service Manager has no way of knowing if the MySQL database server being monitored is running, and it cannot collect current statistics to properly evaluate the rules scheduled against that server.

  **Default frequency** 00:00:01

  **Default auto-close enabled** no

- **MySQL Enterprise Backup Failed**

  When using MySQL Enterprise Backup with the --user and --password options to mysqlbackup, history tables are created within the `mysql.backup_history` and `mysql.backup_progress` tables. This advisor monitors for failures logged within these tables.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **MySQL Enterprise Backup Lock Time Excessive**

  Advises when MySQL Enterprise Backup globally locks the database for longer than X seconds. Each threshold should be set to your own requirements for query response times whilst taking backups.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **MySQL Enterprise Backup Succeeded**

  Advises when MySQL Enterprise Backup completes a backup successfully.

  **Default frequency** 00:05:00

  **Default auto-close enabled** yes

- **MySQL Server Has Been Restarted**

  To perform useful work, a database server must be up-and-running continuously. It is normal for a production server to run continuously for weeks, months, or longer. If a server has been restarted recently, it may be the result of planned maintenance, but it may also be due to an unplanned event that should be investigated.

  **Default frequency** 00:05:00
• MySQL Server Not Reachable

To perform useful work, it must be possible to connect to the local MySQL database server. If the MySQL Enterprise Service Agent cannot communicate with the server, it is likely the server is not running.

**Default frequency** 00:01:00

**Default auto-close enabled** yes

• Next-Key Locking Disabled For InnoDB But Binary Logging Enabled

Next-key locking in InnoDB can be disabled, which may improve performance in some situations. However, this may result in inconsistent data when recovering from the binary logs in replication or recovery situations. Starting from MySQL 5.0.2, this option is even more unsafe than it was in version 4.1.x.

**Default frequency** 06:00:00

**Default auto-close enabled** no

• No Limit On Total Number Of Prepared Statements

Due to bug #16365, there is no limit to the number of prepared statements that can be open per connection. This can lead to a Denial Of Service (DoS) attack, as the server will crash with out-of-memory (OOM) errors when the amount of statements becomes very large.

This bug has been fixed in later versions of the MySQL server.

**Default frequency** 06:00:00

**Default auto-close enabled** no

• No Value Set For MyISAM Recover Options

The `myisam-recover-options` option (named `myisam-recover` before MySQL 5.5.3) enables automatic MyISAM crash recovery should a MyISAM table become corrupt for some reason. If this option is not set, then a table will be "Marked as crashed" if it becomes corrupt, and no sessions will be able to SELECT from it, or perform any sort of DML against it.

**Default frequency** 06:00:00

**Default auto-close enabled** no

• Non-Authorized User Has DB, Table, Or Index Privileges On All Databases

Privileges such as SELECT, INSERT, ALTER, and so forth allow a user to view and change data, as well as impact system performance. Such operations should be limited to only those databases to which a user truly needs such access so the user cannot inadvertently affect other people's applications and data stores.

**Default frequency** 01:00:00

**Default auto-close enabled** no

• Non-Authorized User Has GRANT Privileges On All Databases

The `GRANT` privilege, when given on all databases as opposed to being limited to a few specific databases, enables a user to give to other users those privileges that the grantor possesses on all databases. It can be used for databases, tables, and stored routines. Such a privilege should be
limited to as few users as possible. Users who do indeed need the GRANT privilege should have that privilege limited to only those databases they are responsible for, and not for all databases.

**Default frequency** 01:00:00

**Default auto-close enabled** no

- **Non-Authroized User Has Server Admin Privileges**

  Certain privileges, such as SHUTDOWN and SUPER, are primarily used for server administration. Some of these privileges can have a dramatic effect on a system because they allow someone to shutdown the server or kill running processes. Such operations should be limited to a small set of users.

  **Default frequency** 01:00:00

  **Default auto-close enabled** no

- **Object Changed: Database Has Been Altered**

  For development environments, changes to databases and objects may be a normal occurrence, but not for production environments. It is wise to know when any changes occur in a production environment with respect to any database structures and investigate the reasons for the changes.

  **Default frequency** 00:10:00

  **Default auto-close enabled** no

- **Object Changed: Database Has Been Created**

  For development environments, changes to databases and objects may be a normal occurrence, but not for production environments. It is wise to know when any changes occur in a production environment with respect to any database structures and investigate the reasons for the changes.

  **Default frequency** 00:10:00

  **Default auto-close enabled** no

- **Object Changed: Database Has Been Dropped**

  For development environments, changes to databases and objects may be a normal occurrence, but not for production environments. It is wise to know when any changes occur in a production environment with respect to any database structures and investigate the reasons for the changes.

  **Default frequency** 00:10:00

  **Default auto-close enabled** no

- **Object Changed: Function Has Been Created**

  For development environments, changes to databases and objects may be a normal occurrence, but not for production environments. It is wise to know when any changes occur in a production environment with respect to any database structures and investigate the reasons for the changes.

  **Default frequency** 00:10:00

  **Default auto-close enabled** no

- **Object Changed: Function Has Been Dropped**

  For development environments, changes to databases and objects may be a normal occurrence, but not for production environments. It is wise to know when any changes occur in a production environment with respect to any database structures and investigate the reasons for the changes.
environment with respect to any database structures or functions and investigate the reasons for the changes.

Default frequency 00:10:00

Default auto-close enabled no

- **Object Changed: Index Has Been Created**

For development environments, changes to databases and objects may be a normal occurrence, but not for production environments. It is wise to know when any changes occur in a production environment with respect to any database structures and investigate the reasons for the changes.

Default frequency 00:10:00

Default auto-close enabled no

- **Object Changed: Index Has Been Dropped**

For development environments, changes to databases and objects may be a normal occurrence, but not for production environments. It is wise to know when any changes occur in a production environment with respect to any database structures and investigate the reasons for the changes.

Default frequency 00:10:00

Default auto-close enabled no

- **Object Changed: Table Has Been Altered**

For development environments, changes to databases and objects may be a normal occurrence, but not for production environments. It is wise to know when any changes occur in a production environment with respect to database structures and investigate the reasons for the changes.

Default frequency 00:10:00

Default auto-close enabled no

- **Object Changed: Table Has Been Created**

For development environments, changes to databases and objects may be a normal occurrence, but not for production environments. It is wise to know when changes occur in a production environment with respect to database structures and investigate the reasons for the changes.

Default frequency 00:10:00

Default auto-close enabled no

- **Object Changed: Table Has Been Dropped**

For development environments, changes to databases and objects may be a normal occurrence, but not for production environments. It is wise to know when changes occur in a production environment with respect to database structures and investigate the reasons for the changes.

Default frequency 00:10:00

Default auto-close enabled no

- **Object Changed: User Has Been Dropped**

For development environments, changes to databases and objects may be a normal occurrence, but not for production environments. It is wise to know when changes occur in a production environment with respect to database structures and investigate the reasons for the changes.
• **Object Changes Detected**

For development environments, changes to databases and objects may be a normal occurrence, but not for production environments. It is wise to know when any changes occur in a production environment with respect to any database structures and investigate the reasons for the changes.

**Default frequency** 00:10:00

**Default auto-close enabled** no

• **Policy-Based Password Validation Does Not Perform Dictionary Checks**

When users create weak passwords (e.g., 'password' or 'abcd') it compromises the security of the server, making it easier for unauthorized people to guess the password and gain access to the server. Starting with MySQL Server 5.6, MySQL offers the 'validate_password' plugin that can be used to test passwords and improve security. With this plugin you can implement and enforce a policy for password strength (e.g. passwords must be at least 8 characters long, have both lowercase and uppercase letters, contain at least one special nonalphanumeric character, and do not match commonly-used words).

**Default frequency** 06:00:00

**Default auto-close enabled** no

• **Policy-Based Password Validation Is Weak**

When users create weak passwords (e.g., 'password' or 'abcd') it compromises the security of the server, making it easier for unauthorized people to guess the password and gain access to the server. Starting with MySQL Server 5.6, MySQL offers the 'validate_password' plugin that can be used to test passwords and improve security. With this plugin you can implement and enforce a policy for password strength (e.g. passwords must be at least 8 characters long, have both lowercase and uppercase letters, and contain at least one special nonalphanumeric character).

**Default frequency** 06:00:00

**Default auto-close enabled** no

• **Policy-Based Password Validation Not Enabled**

When users create weak passwords (e.g., 'password' or 'abcd') it compromises the security of the server, making it easier for unauthorized people to guess the password and gain access to the server. Starting with MySQL Server 5.6, MySQL offers the 'validate_password' plugin that can be used to test passwords and improve security. With this plugin you can implement and enforce a policy for password strength (e.g. passwords must be at least 8 characters long, have both lowercase and uppercase letters, and contain at least one special nonalphanumeric character).

**Default frequency** 06:00:00

**Default auto-close enabled** no

• **Prepared Statements Not Being Closed**

Prepared statements may increase performance in applications that execute similar statements more than once, primarily because the query is parsed only once. Prepared statements can also reduce network traffic because it is only necessary to send the data for the parameters for each execution rather than the whole statement.
However, prepared statements take time to prepare and consume memory in the MySQL server until they are closed, so it is important to use them properly. If you are not closing prepared statements when you are done with them, you are needlessly tying up memory that could be put to use in other ways.

**Default frequency** 00:05:00

**Default auto-close enabled** no

- **Prepared Statements Not Being Used Effectively**

Prepared statements may increase performance in applications that execute similar statements more than once, primarily because the query is parsed only once. Prepared statements can also reduce network traffic because it is only necessary to send the data for the parameters for each execution rather than the whole statement.

However, prepared statements take time to prepare and consume memory in the MySQL server until they are closed, so it is important to use them properly. If you are only executing a statement a few times, the overhead of creating a prepared statement may not be worthwhile.

**Default frequency** 00:05:00

**Default auto-close enabled** no

- **Privilege Alterations Detected: Privileges Granted**

For development environments, changes to database security privileges may be a normal occurrence, but for production environments it is wise to know when any security changes occur with respect to database privileges, and to ensure that those changes are authorized and required.

**Default frequency** 00:05:00

**Default auto-close enabled** no

- **Privilege Alterations Detected: Privileges Revoked**

For development environments, changes to database security privileges may be a normal occurrence, but for production environments it is wise to know when any security changes occur with respect to database privileges, and to ensure that those changes are authorized and required.

**Default frequency** 00:05:00

**Default auto-close enabled** no

- **Privilege Alterations Have Been Detected**

For development environments, changes to database security privileges may be a normal occurrence, but for production environments it is wise to know when any security changes occur with respect to database privileges, and to ensure that those changes are authorized and required.

**Default frequency** 00:05:00

**Default auto-close enabled** no

- **Query Cache Has Sub-Optimal Hit Rate**

When enabled, the query cache should experience a high degree of “hits”, meaning that queries in the cache are being reused by other user connections. A low hit rate may mean that not enough memory is allocated to the cache, identical queries are not being issued repeatedly to the server, or that the statements in the query cache are invalidated too frequently by INSERT, UPDATE or DELETE statements.
Advisors

This advisor triggers when more than 25% of the Query Cache is being used, and the ratio of Query Cache hits to Query Cache inserts is low.

Default frequency 00:05:00
Default auto-close enabled no

• Query Cache Is Excessively Fragmented

Enabling the query cache can significantly increase performance for SELECT queries that are identically executed across many connections, returning the same result set. However, performance can be adversely affected if the memory used for the query cache is excessively fragmented, causing the server to pause while it is removing entries from the cache or searching the free block list for a good block to use to insert a new query into the cache.

Default frequency 00:05:00
Default auto-close enabled no

• Query Cache Not Available

MySQL can cache the results of SELECT statements in memory so that they do not have to constantly be parsed and executed. If your application often runs the same queries over and over, caching the results can increase performance significantly. It's important to use a version or binary of MySQL that supports the query cache.

Default frequency 06:00:00
Default auto-close enabled no

• Query Cache Not Enabled

Enabling the query cache can significantly increase performance for SELECT queries that are executed often and have large result sets.

Default frequency 00:05:00
Default auto-close enabled no

• Query Cache Potentially Undersized

When the Query Cache is full, and needs to add more queries to the cache, it will make more room in the cache by freeing the least recently used queries from the cache, and then inserting the new queries. If this is happening often then you should increase the size of the cache to avoid this constant "swapping".

Default frequency 00:05:00
Default auto-close enabled no

• RAM Usage Excessive

A reasonable amount of free memory is required for a system to perform well. Without free memory, new processes and threads cannot start, and the operating system may do excessive paging (swapping blocks of memory to and from disk).

Default frequency 00:01:00
Default auto-close enabled no

• Root Account Can Login Remotely
By default, MySQL includes a root account with unlimited privileges that is typically used to administer the MySQL server. If possible, accounts with this much power should not allow remote logins in order to limit access to only those users able to login to the machine on which MySQL is running. This helps prevent unauthorized users from accessing and changing the system.

**Default frequency** 00:05:00

**Default auto-close enabled** no

- **Root Account Without Password**

  The root user account has unlimited privileges and is intended for administrative tasks. Privileged accounts should have strong passwords to prevent unauthorized users from accessing and changing the system.

  **Default frequency** 00:05:00

  **Default auto-close enabled** yes

- **Row-based Replication Broken For UTF8 CHAR Columns Longer Than 85 Characters**

  Due to bug #37426, row-based replication breaks when CHAR() UTF8 fields with a length greater than 85 characters are used.

  This bug has been fixed in later versions of the MySQL server.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **Security Risk with BINLOG Statement**

  Due to bug #31611, any user can execute BINLOG statements, which effectively gives them the ability to execute any SQL statement regardless of the privileges associated with their user account (i.e. as given by the GRANT statement). This allows any connected user to get any privileges they want, edit any data they want, add and drop tables, etc.

  This bug has been fixed in later versions of the MySQL server.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **Server Contains Default "test" Database**

  By default, MySQL comes with a database named test that anyone can access. This database is intended only for testing and should be removed before moving into a production environment. Because the default test database can be accessed by any user and has permissive privileges, it should be dropped immediately as part of the installation process.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **Server Has Accounts Without A Password**

  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.

  **Default frequency** 00:05:00
Default auto-close enabled yes

- **Server Has Anonymous Accounts**

Anonymous MySQL accounts allow clients to connect to the server without specifying a username. Since anonymous accounts are well known in MySQL, removing them helps prevent unauthorized users from accessing the system.

**Default frequency** 00:05:00

**Default auto-close enabled** yes

- **Server Has No Locally Authenticated Root User**

MySQL 5.5 supports both built-in authentication and external authentication via other methods such as PAM (LDAP, Unix user authentication) and Windows native authentication. However, if all 'root' users are configured to use external authentication, if this external authentication were to fail (such as the LDAP server losing power), then all administrator access to the MySQL Server will be denied.

**Default frequency** 06:00:00

**Default auto-close enabled** no

- **Server Includes A Root User Account**

By default, MySQL includes a root account with unlimited privileges that is typically used to administer the MySQL server. There is no reason this account must be named 'root'. Accounts with this much power should not be easily discovered. Since the root account is well known in MySQL, changing its name helps prevent unauthorized users from accessing and changing the system.

**Default frequency** 00:05:00

**Default auto-close enabled** no

- **Server-Enforced Data Integrity Checking Disabled**

SQL Modes define what SQL syntax MySQL should support and what kind of data validation checks it should perform. If no SQL modes are enabled this means there is no form of server-enforced data integrity, which means incoming data that is invalid will not be rejected by the server, but instead will be changed to conform to the target column's default datatype. Note, however, that beginning with MySQL 4.1, any client can change its own session SQL mode value at any time.

**Default frequency** 06:00:00

**Default auto-close enabled** no

- **Server-Enforced Data Integrity Checking Not Strict**

SQL Modes define what SQL syntax MySQL should support and what kind of data validation checks it should perform. There are many possible options that can be used in conjunction with each other to specify varying degrees of syntax and data validation checks the MySQL server will perform. However, to ensure the highest level of confidence for data integrity, at least one of the following should be included in the list: TRADITIONAL, STRICT_TRANS_TABLES, or STRICT_ALL_TABLES.

Note, however, that beginning with MySQL 4.1, any client can change its own session SQL mode value at any time.

**Default frequency** 06:00:00

**Default auto-close enabled** no
• **SHA-256 Password Authentication Not Enabled**

To help keep the server secure, each user's password is encrypted, and the stronger the encryption method, the more secure the server will be. Starting with MySQL Server 5.6, MySQL offers a new encryption algorithm that performs authentication using SHA-256 password hashing. This is stronger encryption than that available with native authentication (i.e. the standard encryption method).

**Default frequency** 06:00:00

**Default auto-close enabled** no

• **Slave Detection Of Network Outages Too High**

Slaves must deal with network connectivity outages that affect the ability of the slave to get the latest data from the master, and hence cause replication to fall behind. However, the slave notices the network outage only after receiving no data from the master for `slave_net_timeout` seconds. You may want to decrease `slave_net_timeout` so the outages -- and associated connection retries -- are detected and resolved faster. The default for this parameter is 3600 seconds (1 hour), which is too high for many environments.

**Default frequency** 06:00:00

**Default auto-close enabled** no

• **Slave Error: Unknown or Incorrect Time Zone**

In order to use time zone names in conjunction with certain statements, functions, and data types, you must configure the server to understand those names by loading information from the operating system's time zone files into a set of tables in the mysql database. However, while the MySQL installation procedure creates those time zone tables, it does not load them; they must be loaded manually after installation.

**Default frequency** 00:05:00

**Default auto-close enabled** no

• **Slave Execution Position Too Far Behind Read Position**

When a slave receives updates from its master, the I/O thread stores the data in local files known as relay logs. The slave’s SQL thread reads the relay logs and executes the updates they contain. If the position from which the SQL thread is reading is way behind the position to which the I/O thread is currently writing, it is a sign that replication is getting behind and results of queries directed to the slave may not reflect the latest changes made on the master.

**Default frequency** 00:05:00

**Default auto-close enabled** no

• **Slave Has Been Stopped**

If replication on a slave has been stopped, it means the slave is not retrieving the latest statements from the master and it is not executing those statements on the slave.

**Default frequency** 00:01:00

**Default auto-close enabled** yes

• **Slave Has Experienced A Replication Error**

When a slave receives updates from its master it must apply those updates locally so the data on the slave matches that on the server. If an error occurs while applying an update on a slave, the data on the slave may not match that on the master and it is an indication that replication may be broken.
- **Slave Has Login Accounts With Inappropriate Privileges**

  Altering and dropping tables on a slave can break replication. Unless the slave also hosts non-replicated tables, there is no need for accounts with these privileges. As an alternative, you should set the `read_only` flag ON so the server allows no updates except from users that have the SUPER privilege or from updates performed by slave threads.

  Default frequency 06:00:00

  Default auto-close enabled no

- **Slave Has Problem Communicating With Master**

  Slaves must connect to a master to get the latest data from the master. If they cannot connect, or periodically have trouble connecting, replication may fall behind (i.e. the slave may not have the latest data that was written to the master).

  Default frequency 00:05:00

  Default auto-close enabled no

- **Slave Has Stopped Replicating**

  If neither the slave I/O thread nor the slave SQL threads are running, it means the slave is not getting the latest statements from the master and it is not executing those statements on the slave, and thus replication has stopped entirely.

  Default frequency 00:01:00

  Default auto-close enabled yes

- **Slave I/O Thread Not Running**

  The slave I/O thread is the thread that retrieves statements from the master's binary log and records them into the slave's relay log. If this thread isn't running, it means the slave is not able to retrieve the latest data from the master.

  Default frequency 00:01:00

  Default auto-close enabled yes

- **Slave Master Info/Relay Log Info Not Crash Safe**

  MySQL now supports logging of master connection information and of slave relay log information to tables as well as files. In order for replication to be crash-safe, that information must be logged to tables and those tables must each use a transactional storage engine such as InnoDB.

  Default frequency 06:00:00

  Default auto-close enabled yes

- **Slave Not Configured As Read Only**

  Arbitrary or unintended updates to a slave may break replication or cause a slave to be inconsistent with respect to its master. Making a slave `read_only` can be useful to ensure that a slave accepts updates only from its master server and not from clients; it minimizes the possibility of unintended updates.
• Slave Not Verifying Checksums When Reading From Relay Log

Binary logs written and read by the MySQL Server are now crash-safe, because only complete events (or transactions) are logged or read back. By default, the server logs the length of the event as well as the event itself and uses this information to verify that the event was written correctly.

You can also cause the server to write checksums for the events using CRC32 checksums by setting the `binlog_checksum` system variable, to add an extra level of safety to the logs and the replication process. To cause the server to read checksums from the binary log, use the `master_verify_checksum` system variable. The `slave_sql_verify_checksum` system variable causes the slave SQL thread to read checksums from the relay log.

• Slave Relay Log Space Is Very Large

When a slave receives updates from its master, the I/O thread stores the data in local files known as relay logs. The slave’s SQL thread reads the relay logs and executes the updates they contain. After the SQL thread has executed all the updates in a relay log, the file is no longer needed and can be deleted to conserve disk space.

• Slave Relay Logs Not Automatically Purged

When a slave receives updates from its master, the I/O thread stores the data in local files known as relay logs. The slave’s SQL thread reads the relay logs and executes the updates they contain. After the SQL thread has executed all the updates in a relay log, the file is no longer needed and can be deleted to conserve disk space.

• Slave SQL Processing Not Multi-Threaded

As of MySQL Server version 5.6, replication now supports parallel execution of transactions with multi-threading on the slave. When parallel execution is enabled, the slave SQL thread acts as the coordinator for a number of slave worker threads as determined by the value of the `slave_parallel_workers` server system variable.

Note that the current implementation of multi-threading on the slave assumes that data and updates are partitioned on a per-database basis, and that updates within a given database occur in the same relative order as they do on the master. However, it is not necessary to coordinate transactions between different databases. Transactions can then also be distributed per database, which means that a worker thread on the slave slave can process successive transactions on a given database without waiting for updates to other databases to complete.

Also note that since transactions on different databases can occur in a different order on the slave than on the master, simply checking for the most recently executed transaction is not a guarantee that all previous transactions on the master have been executed on the slave. This has implications for logging and recovery when using a multi-threaded slave.
Advisors

- **Default frequency** 06:00:00
- **Default auto-close enabled** yes

**Slave SQL Thread Not Running**

The slave SQL thread is the thread that reads statements from the slave's relay log and executes them to bring the slave in sync with the master. If this thread isn't running, it means the slave is not able to apply the latest changes it has read from the master, and results of queries directed to the slave may not reflect the latest changes made on the master.

- **Default frequency** 00:01:00
- **Default auto-close enabled** yes

**Slave SQL Thread Reading From Older Relay Log Than I/O Thread**

When a slave receives updates from its master, the I/O thread stores the data in local files known as relay logs. The slave's SQL thread reads the relay logs and executes the updates they contain. If the SQL thread is reading from an older relay log than the one to which the I/O thread is currently writing, it is a sign that replication is getting behind and results of queries directed to the slave may not reflect the latest changes made on the master.

- **Default frequency** 00:05:00
- **Default auto-close enabled** no

**Slave Too Far Behind Master**

If a slave is too far behind the master, results of queries directed to the slave may not reflect the latest changes made on the master.

- **Default frequency** 00:01:00
- **Default auto-close enabled** yes

**Slave Waiting To Free Relay Log Space**

For slaves with limited disk space you can place a limit on how large the replication relay log can grow. When the limit is reached, the I/O thread stops reading binary log events from the master server until the SQL thread has caught up and deleted some unprocessed relay logs. While this protects MySQL from filling up the disk, it means replication is delayed and the slave will fall behind the master.

- **Default frequency** 00:05:00
- **Default auto-close enabled** no

**Slave Without REPLICATION SLAVE Accounts**

If the master ever fails, you may want to use one of the slaves as the new master. An account with the REPLICATION SLAVE privilege must exist for a server to act as a replication master (so a slave can connect to it), so it's a good idea to create this account on your slaves to prepare it to take over for a master if needed.

- **Default frequency** 06:00:00
- **Default auto-close enabled** no

**Slow Query Log Not Enabled**

The slow query log can be used to identify queries that take a long time to complete.
**Advisors**

- **Stored Procedures Found With SELECT * Syntax**

  Best practices for SQL coding state that no query should be issued with SELECT *. Reasons include:

  - To ensure that only the necessary columns are returned from a SQL statement, the actual column names should be specifically entered. This cuts down on unwanted network traffic as only columns necessary for query satisfaction are present.

  - If the underlying table has columns added or removed, the query itself may malfunction if cursors or other such application objects are used.

- **Stored Routine Runs In Definer’s Rather Than Caller’s Security Context**

  Due to bug 18630, a stored routine created by one user and then made accessible to a different user using GRANT EXECUTE could be executed by that user with the privileges of the routine's definer.

  This bug has been fixed in later versions of the MySQL server.

- **Symlinks Are Enabled**

  You can move tables and databases from the database directory to other locations and replace them with symbolic links to the new locations. You might want to do this, for example, to move a database to a file system with more free space or to increase the speed of your system by spreading your tables to different disks.

  However, symlinks can compromise security. This is especially important if you run mysqld as root, because anyone who has write access to the server's data directory could then delete any file in the system!

- **Table Cache Not Optimal**

  MySQL is multi-threaded, so there may be many clients issuing queries for a given table simultaneously. To minimize the problem with multiple client threads having different states on the same table, the table is opened independently by each concurrent thread.

  The table cache is used to cache file descriptors for open tables and there is a single cache shared by all clients. Increasing the size of the table cache allows mysqld to keep more tables open simultaneously by reducing the number of file open and close operations that must be done. If the value of `Open_tables` is approaching the value of `table_cache`, this may indicate performance problems.
Advisors

• **Table Cache Set Too Low For Startup**

  The table cache size controls the number of open tables that can occur at any one time on the server. MySQL will work to open and close tables as needed, however you should avoid having the table cache set too low, causing MySQL to constantly open and close tables to satisfy object access.

  If the table cache limit has been exceeded by the number of tables opened in the first three hours of service, then the table cache size is likely set too low.

  **Default frequency 00:30:00**

  **Default auto-close enabled no**

• **Table Lock Contention Excessive**

  Performance can be degraded if the percentage of table operations that have to wait for a lock is high compared to the overall number of locks. This can happen when using a table-level locking storage engine, such as MyISAM, instead of a row-level locking storage engine.

  **Default frequency 00:05:00**

  **Default auto-close enabled no**

• **Table Scans Excessive**

  The target server does not appear to be using indexes efficiently. The values of Handler_read_rnd_next and Handler_read_rnd together - which reflect the number of rows read via full table scans - are high compared to the sum of Handler variables which denote all row accesses - such as Handler_read_key, Handler_read_next etc. You should examine your tables and queries for proper use of indexes.

  **Default frequency 00:05:00**

  **Default auto-close enabled no**

• **Tables Found with No Primary or Unique Keys**

  A primary or unique key of a relational table uniquely identifies each record in the table. Except in very unusual circumstances, every database table should have one or more columns designated as the primary key or as a unique key, and it is common practice to declare one.

  **Default frequency 12:00:00**

  **Default auto-close enabled no**

• **Temporary Tables To Disk Ratio Excessive**

  If the space required to build a temporary table exceeds either `tmp_table_size` or `max_heap_table_size`, MySQL creates a disk-based table in the server’s tmpdir directory. Also, tables that have TEXT or BLOB columns are automatically placed on disk.

  For performance reasons it is ideal to have most temporary tables created in memory, leaving exceedingly large temporary tables to be created on disk.

  **Default frequency 00:05:00**

  **Default auto-close enabled no**

• **Thread Cache Not Enabled**
Each connection to the MySQL database server runs in its own thread. Thread creation takes time, so rather than killing the thread when a connection is closed, the server can keep the thread in its thread cache and use it for a new connection later.

**Default frequency** 00:05:00

**Default auto-close enabled** no

- **Thread Cache Size May Not Be Optimal**

Each connection to the MySQL database server runs in its own thread. Thread creation takes time, so rather than killing the thread when a connection is closed, the server can keep the thread in its thread cache and use it for a new connection later.

**Default frequency** 00:05:00

**Default auto-close enabled** no

- **Thread Pool Stall Limit Too Low**

The `thread_pool_stall_limit` variable enables the thread pool to handle long-running statements. If a long-running statement was permitted to block a thread group, all other connections assigned to the group would be blocked and unable to start execution until the long-running statement completed. In the worst case, this could take hours or even days.

The value of `thread_pool_stall_limit` should be chosen such that statements that execute longer than its value are considered stalled. Stalled statements generate a lot of extra overhead since they involve extra context switches and in some cases even extra thread creations. On the other hand, setting the `thread_pool_stall_limit` parameter too high means that long-running statements will block a number of short-running statements for longer than necessary. Short wait values permit threads to start more quickly. Short values are also better for avoiding deadlock situations. Long wait values are useful for workloads that include long-running statements, to avoid starting too many new statements while the current ones execute.

**Default frequency** 00:05:00

**Default auto-close enabled** no

- **Thread Pooling Not Enabled**

As of MySQL 5.5.16, commercial distributions of MySQL include a thread pool plugin that provides an alternative thread-handling model designed to reduce overhead and improve performance. It implements a thread pool that increases server performance by efficiently managing statement execution threads for large numbers of client connections.

With servers that have many concurrent active connections (generally, more than the number of CPUs within the machine) it can be beneficial for performance to enable the Thread Pool plugin. This keeps the number of actively executing threads within the server lower, generally leaving less contention for locks and resources, whilst still maintaining very high connection counts from applications.

**Default frequency** 00:05:00

**Default auto-close enabled** no

- **Time Zone Data Not Loaded**

The MySQL server supports multiple time zones and provides various date and time functions, including a function that converts a datetime value from one time zone to another (CONVERT_TZ). However, while the MySQL installation procedure creates the time zone tables in the mysql
database, it does not load them; you must do so manually after installation. If the time zone tables are not loaded, certain time zone functions such as CONVERT_TZ will not work.

**Default frequency** 12:00:00  
**Default auto-close enabled** no  

- **Too Many Concurrent Queries Running**
  Too many active queries indicates there is a severe load on the server, and may be a sign of lock contention or unoptimized SQL queries.  
**Default frequency** 00:05:00  
**Default auto-close enabled** no  

- **UDF Support Can Be Used To Execute Arbitrary Code**
  In versions 4.1 and 5.0 of MySQL, by default, User Defined Functions (UDFs) are loaded from the system library path (e.g. /usr/lib). It has been determined that the security filter used does not guard properly against certain attacks using existing system libraries. As a result, it is possible for users with privileged access to execute arbitrary code. This problem can also be exploited on systems that are not actively using UDFs, if any untrusted remote users have DBA privileges on MySQL. To properly protect against this problem, a new variable has been introduced, `plugin_dir`, which can be used to specify a different directory from which to load plugins.  
**Default frequency** 12:00:00  
**Default auto-close enabled** no  

- **UDFs Loaded From Insecure Location**
  User Defined Functions (UDFs) allow you to add features and extend the functionality of your MySQL server, but they also pose a danger if they can be loaded from an insecure location.  
  To protect against this problem the `plugin_dir` variable was introduced, which can be used to specify the directory from which to load plugins. If the value is non-empty, user-defined function object files must be located in that directory. If the value is empty, the UDF object files can be located in any directory that is searched by your system's dynamic linker, which does not guard properly against certain attacks using existing system libraries. As a result, it is possible for users with privileged access to execute arbitrary code. This problem can also be exploited on systems that are not actively using UDFs, if any untrusted remote users have DBA privileges on MySQL.  
**Default frequency** 12:00:00  
**Default auto-close enabled** no  

- **Use Of View Overrides Column Update Privileges On Underlying Table**
  Due to bug #27878, by using a view, a user who only has privileges to update a given column of a table is able to update any column of that table, even though the view is defined with SQL SECURITY INVOKER. Also, use of a view could allow a user to gain update privileges for tables in other databases.  
  This bug has been fixed in later versions of the MySQL server.  
**Default frequency** 06:00:00  
**Default auto-close enabled** no  

- **User Can Gain Privileges By Running Stored Routine Declared Using SQL SECURITY INVOKER**
Due to bug #27337, if a stored routine was declared using SQL SECURITY INVOKER, a user who invoked the routine could gain privileges. For example, a user without the CREATE privilege on a certain database could gain that privilege after invoking a stored routine.

This bug has been fixed in later versions of the MySQL server.

**Default frequency** 06:00:00

**Default auto-close enabled** no

- **User Has Rights To Database That Does Not Exist**

  When a database is dropped, user privileges on the database are not automatically dropped. This has security implications as that user will regain privileges if a database with the same name is created in the future, which may not be the intended result.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **User Has Rights To Table That Does Not Exist**

  When a table is dropped, user privileges on the table are not automatically dropped. This has security implications as that user will regain privileges if a table with the same name in the same database is created in the future, which may not be the intended result.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **User With Only ALTER Privilege On Partitioned Table Can Obtain SELECT Privilege Information**

  Due to bug #23675, a user with only the ALTER privilege on a partitioned table could obtain information about the table that should require the SELECT privilege.

  This bug has been fixed in later versions of the MySQL server.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

- **Users Can View All Databases On MySQL Server**

  The SHOW DATABASES privilege should be granted only to users who need to see all the databases on a MySQL Server. It is recommended that the MySQL Server be started with the **--skip-show-database** option enabled to prevent anyone from using the SHOW DATABASES statement unless they have been specifically granted the SHOW DATABASES privilege.

  Note: If a user is granted any global privilege, such as CREATE TEMPORARY TABLES or LOCK TABLES, they are automatically given the ability to show databases unless the server is started with the **--skip-show-database** option enabled. DBAs should be aware of this fact, in the event that any applications make use of temporary tables.

  **Default frequency** 00:05:00

  **Default auto-close enabled** no

- **Warnings Not Being Logged**
Error conditions encountered by a MySQL server are always logged in the error log, but warning conditions are only logged if `log_warnings` is set to a value greater than 0. If warnings are not logged you will not get valuable information about aborted connections and various other communication errors. This is especially important if you use replication so you get more information about what is happening, such as messages about network failures and reconnections.

**Default frequency** 12:00:00

**Default auto-close enabled** no

- XA Distributed Transaction Support Enabled For InnoDB

  XA Distributed Transaction support is turned on by default. If you are not using this feature, note that it adds an extra fsync for each transaction and may adversely affect performance.

  **Default frequency** 06:00:00

  **Default auto-close enabled** no

### B.9.2 Graph Definition Reference

The following items describe individual graphs.

**Agent Reporting Delay**

<table>
<thead>
<tr>
<th>Name</th>
<th>Agent Reporting Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>milliseconds</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Delay</td>
<td>agent_delay</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>agent_delay</td>
<td><code>mysql:Agent:agent.latency</code></td>
</tr>
</tbody>
</table>

**Backup Locked Time**

<table>
<thead>
<tr>
<th>Name</th>
<th>Backup Locked Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>seconds</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Locked Time</td>
<td>lock_time</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>lock_time</td>
<td><code>mysql:meb_timing:lock_time</code></td>
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</table>

**Backup Run Time**

<table>
<thead>
<tr>
<th>Name</th>
<th>Backup Run Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>seconds</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Total Time</td>
<td>total_time</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>total_time</td>
<td><code>mysql:meb_timing:total_time</code></td>
</tr>
</tbody>
</table>

**Binlog Cache Efficiency**

<table>
<thead>
<tr>
<th>Name</th>
<th>Binlog Cache Efficiency</th>
</tr>
</thead>
</table>
### Graph Definition Reference

<table>
<thead>
<tr>
<th>Range Label</th>
<th>avg cache ops/sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Cache Writes</td>
<td>((\text{binlog_memory}/60))</td>
</tr>
<tr>
<td>Disk Writes</td>
<td>((\text{binlog_disk}/60))</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>\text{binlog_disk}</td>
<td>\text{mysql:status:Binlog_cache_disk_use}</td>
</tr>
<tr>
<td>\text{binlog_memory}</td>
<td>\text{mysql:status:Binlog_cache_use}</td>
</tr>
</tbody>
</table>

### Binlog IO Usage

<table>
<thead>
<tr>
<th>Name</th>
<th>Binlog IO Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg MB/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Read</td>
<td>(((\text{bytes_read} / (1024*1024))/60))</td>
</tr>
<tr>
<td>Total</td>
<td>(((\text{bytes_read} + \text{bytes_written}) / (1024*1024))/60)</td>
</tr>
<tr>
<td>Write</td>
<td>(((\text{bytes_written} / (1024*1024))/60)</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>\text{bytes_read}</td>
<td>\text{mysql:binary_log_io:bytes_read}</td>
</tr>
<tr>
<td>\text{bytes_written}</td>
<td>\text{mysql:binary_log_io:bytes_written}</td>
</tr>
</tbody>
</table>

### Binlog Space Usage

<table>
<thead>
<tr>
<th>Name</th>
<th>Binlog Space Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Total Size</td>
<td>((\text{fileSum} / (1024*1024)))</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>\text{fileSum}</td>
<td>\text{mysql:masterlogs:filesize_sum}</td>
</tr>
</tbody>
</table>

### Cluster Data Node Data Memory Use

<table>
<thead>
<tr>
<th>Name</th>
<th>Cluster Data Node Data Memory Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Avail</td>
<td>\text{cluster_data_node_config_data_memory}/1024/1024</td>
</tr>
<tr>
<td>Used</td>
<td>\text{cluster_data_node_used_data_memory}/1024/1024</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>\text{cluster_data_node_config_data_memory}</td>
<td>\text{mysql:cluster_data_node_data_memory:data_mem_total}</td>
</tr>
<tr>
<td>\text{cluster_data_node_used_data_memory}</td>
<td>\text{mysql:cluster_data_node_data_memory:data_mem_used}</td>
</tr>
</tbody>
</table>

### Cluster Data Node DiskPageBuffer Hit Ratio

<table>
<thead>
<tr>
<th>Name</th>
<th>Cluster Data Node DiskPageBuffer Hit Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>%</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
</tbody>
</table>
### DiskPageBuffer

\[
\text{DiskPageBuffer} = \frac{\text{cluster\_data\_node\_hits}}{(\text{cluster\_data\_node\_hits} + \text{cluster\_data\_node\_miss})} \times 100
\]

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>cluster_data_node_hits</td>
<td>mysql:cluster_data_node_diskpagebuffer_total_hits_period</td>
</tr>
<tr>
<td>cluster_data_node_miss</td>
<td>mysql:cluster_data_node_diskpagebuffer_total_hits_period</td>
</tr>
</tbody>
</table>

### Cluster Data Node Index Memory Use

<table>
<thead>
<tr>
<th>Name</th>
<th>Cluster Data Node Index Memory Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Avail</td>
<td>cluster_data_node_config_index_memory/1024/1024</td>
</tr>
<tr>
<td>Used</td>
<td>cluster_data_node_used_index_memory/1024/1024</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>cluster_data_node_config_index_memory</td>
<td>mysql:cluster_data_node_index_memory:index_mem_total</td>
</tr>
<tr>
<td>cluster_data_node_used_index_memory</td>
<td>mysql:cluster_data_node_index_memory:index_mem_used</td>
</tr>
</tbody>
</table>

### Cluster Data Node Redo Buffer Use

<table>
<thead>
<tr>
<th>Name</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
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</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Avail</td>
<td>cluster_data_node_config_redo_buffer/1024/1024</td>
</tr>
<tr>
<td>Used</td>
<td>cluster_data_node_used_redo_buffer/1024/1024</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>cluster_data_node_config_redo_buffer</td>
<td>mysql:cluster_data_node_redo_buffer:redo_buffer_total</td>
</tr>
<tr>
<td>cluster_data_node_used_redo_buffer</td>
<td>mysql:cluster_data_node_redo_buffer:redo_buffer_used</td>
</tr>
</tbody>
</table>

### Cluster Data Node Redo Log Space Use

<table>
<thead>
<tr>
<th>Name</th>
<th>Cluster Data Node Redo Log Space Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Avail</td>
<td>cluster_data_node_config_redo_logspace/1024/1024</td>
</tr>
<tr>
<td>Used</td>
<td>cluster_data_node_used_redo_logspace/1024/1024</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>cluster_data_node_config_redo_logspace</td>
<td>mysql:cluster_data_node_redo_logspace:redo_logspace_total</td>
</tr>
<tr>
<td>cluster_data_node_used_redo_logspace</td>
<td>mysql:cluster_data_node_redo_logspace:redo_logspace_used</td>
</tr>
</tbody>
</table>

### Cluster Data Node Undo Buffer Use

<table>
<thead>
<tr>
<th>Name</th>
<th>Cluster Data Node Undo Buffer Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Avail</td>
<td>cluster_data_node_config_undo_buffer/1024/1024</td>
</tr>
<tr>
<td>Used</td>
<td>cluster_data_node_used_undo_buffer/1024/1024</td>
</tr>
</tbody>
</table>
### Cluster Data Node Undo Log Space Use

<table>
<thead>
<tr>
<th>Name</th>
<th>Cluster Data Node Undo Log Space Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Avail</td>
<td>cluster_data_node_config_undo_logspace/1024/1024</td>
</tr>
<tr>
<td>Used</td>
<td>cluster_data_node_used_undo_logspace/1024/1024</td>
</tr>
</tbody>
</table>

### Cluster Data Nodes in Ready State

<table>
<thead>
<tr>
<th>Name</th>
<th>Cluster Data Nodes in Ready State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td># Nodes</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Nodes</td>
<td>Ndb_number_of_ready_data_nodes</td>
</tr>
</tbody>
</table>

### Connections

Displays the number of client connections by displaying the number of connected threads, active threads, and cached threads.

<table>
<thead>
<tr>
<th>Name</th>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td># connections</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Cached</td>
<td>cached</td>
</tr>
<tr>
<td>Running</td>
<td>running</td>
</tr>
<tr>
<td>Total</td>
<td>connected</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>cached</td>
<td>mysql:status:Threads_cached</td>
</tr>
<tr>
<td>connected</td>
<td>mysql:status:Threads_connected</td>
</tr>
<tr>
<td>running</td>
<td>mysql:status:Threads_running</td>
</tr>
</tbody>
</table>

### Connections - Aborted

Shows the number of client connections that have been aborted, either during connection, or aborted active connections. This information is useful to determine if your server is overloaded (and therefore aborting connections), or if there is a network fault. Aborted connections also indicate those which did not disconnect properly, for example during a timeout.

<table>
<thead>
<tr>
<th>Name</th>
<th>Connections - Aborted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total/min</td>
</tr>
</tbody>
</table>
### Connections - Cache
Displays the thread cache information, comparing new thread creations against all database connections.

<table>
<thead>
<tr>
<th>Name</th>
<th>Connections - Cache</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total/min</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Connections</td>
<td>connections</td>
</tr>
<tr>
<td>Threads Created</td>
<td>tcreated</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>connections</td>
<td>mysql:status:Connections</td>
</tr>
<tr>
<td>tcreated</td>
<td>mysql:status:Threads_created</td>
</tr>
</tbody>
</table>

### Connections - Maximum
Shows the maximum number of connections, and the maximum number of used connections.

<table>
<thead>
<tr>
<th>Name</th>
<th>Connections - Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Allowed</td>
<td>max_connections_allowed</td>
</tr>
<tr>
<td>Used</td>
<td>max_connections_used</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>max_connections_allowed</td>
<td>mysql:variables:max_connections</td>
</tr>
<tr>
<td>max_connections_used</td>
<td>mysql:status:Max_used_connections</td>
</tr>
</tbody>
</table>

### CPU Utilization
Displays the CPU usage statistics over time for the machine hosting the MySQL server. The graph shows the aggregate system, user, wait and idle times for your CPU(s). You can use this information to help determine your CPU utilization and whether you are getting the most efficient use of your CPU power.

**Note**
The FreeBSD and Windows operating systems do not provide information for the IO-wait component of these graphs, so they will always yield 0 in the CPU utilization graph.

<table>
<thead>
<tr>
<th>Name</th>
<th>CPU Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>%</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
</tbody>
</table>
### Kernel

<table>
<thead>
<tr>
<th>Data Item</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>sys</td>
<td>(sys/(sys+user+wait+idle)) * 100</td>
</tr>
<tr>
<td>user</td>
<td>(user/(sys+user+wait+idle)) * 100</td>
</tr>
<tr>
<td>total</td>
<td>((sys+user+wait)/(sys+user+wait+idle)) * 100</td>
</tr>
<tr>
<td>wait i/o</td>
<td>(wait/(sys+user+wait+idle)) * 100</td>
</tr>
</tbody>
</table>

### Variables

<table>
<thead>
<tr>
<th>Data Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>idle</td>
<td>os:cpu:cpu_idle</td>
</tr>
<tr>
<td>sys</td>
<td>os:cpu:cpu_sys</td>
</tr>
<tr>
<td>user</td>
<td>os:cpu:cpu_user</td>
</tr>
<tr>
<td>wait</td>
<td>os:cpu:cpu_wait</td>
</tr>
</tbody>
</table>

### Database Activity

Displays the database activity, by showing the individual counts over time of different DML statements per minute. For example, you can monitor the number of SELECT statements executed per minute over time and gain an understanding of your server throughput. This information can be used to monitor the activity level, and provide a useful quick reference for your server operation.

<table>
<thead>
<tr>
<th>Name</th>
<th>Database Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg statements/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Call</td>
<td>((call_proc)/60)</td>
</tr>
<tr>
<td>Delete</td>
<td>((deletes+delete_multi)/60)</td>
</tr>
<tr>
<td>Insert</td>
<td>((inserts+insert_selects)/60)</td>
</tr>
<tr>
<td>Replace</td>
<td>((replaces+replace_selects)/60)</td>
</tr>
<tr>
<td>Select</td>
<td>(selects/60)</td>
</tr>
<tr>
<td>Update</td>
<td>((updates+update_multi)/60)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>call_proc</td>
<td>mysql:status:Com_call_procedure</td>
</tr>
<tr>
<td>delete_multi</td>
<td>mysql:status:Com_delete_multi</td>
</tr>
<tr>
<td>deletes</td>
<td>mysql:status:Com_delete</td>
</tr>
<tr>
<td>insert_selects</td>
<td>mysql:status:Com_insert_select</td>
</tr>
<tr>
<td>inserts</td>
<td>mysql:status:Com_insert</td>
</tr>
<tr>
<td>replace_selects</td>
<td>mysql:status:Com_replace_select</td>
</tr>
<tr>
<td>replaces</td>
<td>mysql:status:Com_replace</td>
</tr>
<tr>
<td>selects</td>
<td>mysql:status:Com_select</td>
</tr>
<tr>
<td>update_multi</td>
<td>mysql:status:Com_update_multi</td>
</tr>
<tr>
<td>updates</td>
<td>mysql:status:Com_update</td>
</tr>
</tbody>
</table>

### Database Transactions

<table>
<thead>
<tr>
<th>Name</th>
<th>Database Transactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg statements/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Begin</td>
<td>(begin/60)</td>
</tr>
<tr>
<td>Commit</td>
<td>(commit/60)</td>
</tr>
<tr>
<td>Release Savepoint</td>
<td>(releaseSavepoint/60)</td>
</tr>
</tbody>
</table>
Rollback

(rollback/60)

Rollback Savepoint

(rollbackSavepoint/60)

Savepoint

(savepoint/60)

Variables

<table>
<thead>
<tr>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>begin</td>
</tr>
<tr>
<td>mysql:status:com_begin</td>
</tr>
<tr>
<td>commit</td>
</tr>
<tr>
<td>mysql:status:com_commit</td>
</tr>
<tr>
<td>releaseSavepoint</td>
</tr>
<tr>
<td>mysql:status:com_release_savepoint</td>
</tr>
<tr>
<td>rollback</td>
</tr>
<tr>
<td>mysql:status:com_rollback</td>
</tr>
<tr>
<td>rollbackSavepoint</td>
</tr>
<tr>
<td>mysql:status:com_rollback_to_savepoint</td>
</tr>
<tr>
<td>savepoint</td>
</tr>
<tr>
<td>mysql:status:com_savepoint</td>
</tr>
</tbody>
</table>

Disk IO Operations

<table>
<thead>
<tr>
<th>Name</th>
<th>Disk IO Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg ops/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Read</td>
<td>read / 60</td>
</tr>
<tr>
<td>Total</td>
<td>((read+write) / 60)</td>
</tr>
<tr>
<td>Write</td>
<td>write / 60</td>
</tr>
</tbody>
</table>

Variables

<table>
<thead>
<tr>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>read</td>
</tr>
<tr>
<td>os:disk:disk_reads</td>
</tr>
<tr>
<td>write</td>
</tr>
<tr>
<td>os:disk:disk_writes</td>
</tr>
</tbody>
</table>

Disk IO Usage

Displays the disk usage activity, by showing the disk input and output ratios over time.

⚠️ Note

The FreeBSD and Windows operating systems do not provide this information.

<table>
<thead>
<tr>
<th>Name</th>
<th>Disk IO Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg MB/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Read</td>
<td>((read / (1024*1024))/60)</td>
</tr>
<tr>
<td>Total</td>
<td>(((read+write) / (1024*1024))/60)</td>
</tr>
<tr>
<td>Write</td>
<td>((write / (1024*1024))/60)</td>
</tr>
</tbody>
</table>

Variables

<table>
<thead>
<tr>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>read</td>
</tr>
<tr>
<td>os:disk:disk_bytes_read</td>
</tr>
<tr>
<td>write</td>
</tr>
<tr>
<td>os:disk:disk_bytes_written</td>
</tr>
</tbody>
</table>

Disk Space Usage

<table>
<thead>
<tr>
<th>Name</th>
<th>Disk Space Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>GB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Total Size</td>
<td>(total / (1024<em>1024</em>1024))</td>
</tr>
</tbody>
</table>
Graph Definition Reference

**Hit Ratios**

Shows the cache hit ratios (as a percentage) for the query cache, MyISAM and InnoDB tables, and the connection and thread cache information. The information provided by the hit ratios can provide indicators of whether your cache is working effectively, or is of a size suitable for the data that you are storing and retrieving. Low hit ratios indicate that your cache are inefficient and may need to be investigated.

<table>
<thead>
<tr>
<th>Name</th>
<th>Hit Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>%</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>InnoDB Buffer</td>
<td>100-((iReads / (iReadRequests+1))*100)</td>
</tr>
<tr>
<td>Key Cache</td>
<td>(100-((keyReads / (keyReadRequests+1))*100)) * (keyReadRequests &gt;= keyReads)</td>
</tr>
<tr>
<td>Query Cache</td>
<td>(qHits/(qHits+qInserts+1)) * 100</td>
</tr>
<tr>
<td>Thread Cache</td>
<td>100-((tcreated / (connections+1))*100)</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>connections</td>
<td>mysql:status:Connections</td>
</tr>
<tr>
<td>iReadRequests</td>
<td>mysql:status:Innodb_buffer_pool_read_requests</td>
</tr>
<tr>
<td>iReads</td>
<td>mysql:status:Innodb_buffer_pool_reads</td>
</tr>
<tr>
<td>keyReadRequests</td>
<td>mysql:status:Key_read_requests</td>
</tr>
<tr>
<td>keyReads</td>
<td>mysql:status:Key_reads</td>
</tr>
<tr>
<td>qHits</td>
<td>mysql:status:Qcache_hits</td>
</tr>
<tr>
<td>qInserts</td>
<td>mysql:status:Qcache_inserts</td>
</tr>
<tr>
<td>tcreated</td>
<td>mysql:status:Threads_created</td>
</tr>
</tbody>
</table>

**InnoDB Adaptive Hash Index Memory**

Shows the size of the InnoDB adaptive hash index. These are used to hold the data from tables in memory providing the size of the indexes is small enough to fit in memory. The graph shows the memory usage of the adaptive hash index.

<table>
<thead>
<tr>
<th>Name</th>
<th>InnoDB Adaptive Hash Index Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Hash Node Size</td>
<td>( hash_size * 16384 ) / 1024 / 1024</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>hash_size</td>
<td>mysql:innodbstatus:innodb_hash_node_heap</td>
</tr>
</tbody>
</table>

**InnoDB Adaptive Hash Index Searches**

Displays the number of InnoDB adaptive hash index searches and those searches not using the adaptive hash index. You can use this to determine if your adaptive hash index is being used correctly, and is of a suitable size of the information and tables that are being accessed.
### Graph Definition Reference

#### InnoDB Adaptive Hash Index Searches

<table>
<thead>
<tr>
<th>Name</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>InnoDB Adaptive Hash Index Searches</td>
</tr>
<tr>
<td>Range Label</td>
<td>searches/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Hash Searches</td>
<td>hash</td>
</tr>
<tr>
<td>Non-Hash Searches</td>
<td>nonhash</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>hash</td>
<td>mysql:innodbstatus:innodb_hash Searches_per_sec</td>
</tr>
<tr>
<td>nonhash</td>
<td>mysql:innodbstatus:innodb_non_hash Searches_per_sec</td>
</tr>
</tbody>
</table>

#### InnoDB Buffer Pool

Displays the size and page usage of the InnoDB buffer pool, providing information on the cache usage and performance. The graph shows the buffer pool size, active pages, and the number of modified pages.

<table>
<thead>
<tr>
<th>Name</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>InnoDB Buffer Pool</td>
</tr>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Modified</td>
<td>(modified<em>16384)/(1024</em>1024)</td>
</tr>
<tr>
<td>Old</td>
<td>(old<em>16384)/(1024</em>1024)</td>
</tr>
<tr>
<td>Total Size</td>
<td>(size<em>16384)/(1024</em>1024)</td>
</tr>
<tr>
<td>Used</td>
<td>(used<em>16384)/(1024</em>1024)</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>modified</td>
<td>mysql:innodbstatus:innodb_bp Modified_pages</td>
</tr>
<tr>
<td>old</td>
<td>mysql:innodbstatus:innodb_bp Old_db_pages</td>
</tr>
<tr>
<td>size</td>
<td>mysql:innodbstatus:innodb_bp Size</td>
</tr>
<tr>
<td>used</td>
<td>mysql:innodbstatus:innodb_bp Db_pages</td>
</tr>
</tbody>
</table>

#### InnoDB Buffer Pool Page Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>InnoDB Buffer Pool Page Activity</td>
</tr>
<tr>
<td>Range Label</td>
<td>avg pages/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Created</td>
<td>created / 60</td>
</tr>
<tr>
<td>Read</td>
<td>reads / 60</td>
</tr>
<tr>
<td>Written</td>
<td>written / 60</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>created</td>
<td>mysql:innodbstatus:innodb_bp Pages Created</td>
</tr>
<tr>
<td>reads</td>
<td>mysql:innodbstatus:innodb_bp Pages Read</td>
</tr>
<tr>
<td>written</td>
<td>mysql:innodbstatus:innodb_bp Pages Written</td>
</tr>
</tbody>
</table>

#### InnoDB Buffer Pool Pending Operations

<table>
<thead>
<tr>
<th>Name</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>InnoDB Buffer Pool Pending Operations</td>
</tr>
<tr>
<td>Range Label</td>
<td>pending ops</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Reads</td>
<td>reads</td>
</tr>
<tr>
<td>Write Flush List</td>
<td>write_flush_list</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Write LRU</td>
<td>write_lru</td>
</tr>
<tr>
<td>Write Single Page</td>
<td>write_single_page</td>
</tr>
</tbody>
</table>

**Variables**

<table>
<thead>
<tr>
<th>Data Item</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>reads</td>
<td>mysql:innodbstat:innodb_bp_pending_pages</td>
</tr>
<tr>
<td>write_flush_list</td>
<td>mysql:innodbstat:innodb_bp_pending_writes_flush_list</td>
</tr>
<tr>
<td>write_lru</td>
<td>mysql:innodbstat:innodb_bp Pending_writes_lru</td>
</tr>
<tr>
<td>write_single_page</td>
<td>mysql:innodbstat:innodb_bp Pending_writes_single_page</td>
</tr>
</tbody>
</table>

**InnoDB Change Buffer Activity**

<table>
<thead>
<tr>
<th>Name</th>
<th>InnoDB Change Buffer Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg operations/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Inserts</td>
<td>inserts / 60</td>
</tr>
<tr>
<td>Merges</td>
<td>merges / 60</td>
</tr>
</tbody>
</table>

**Variables**

<table>
<thead>
<tr>
<th>Data Item</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>inserts</td>
<td>mysql:innodbstat:innodb_ibuf Inserts</td>
</tr>
<tr>
<td>merges</td>
<td>mysql:innodbstat:innodb_ibuf Merges</td>
</tr>
</tbody>
</table>

**InnoDB Change Buffer Activity**

<table>
<thead>
<tr>
<th>Name</th>
<th>InnoDB Change Buffer Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg operations/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Delete Discarded</td>
<td>delete_discarded / 60</td>
</tr>
<tr>
<td>Delete Mark Discarded</td>
<td>delete_mark_discarded / 60</td>
</tr>
<tr>
<td>Delete Mark Merges</td>
<td>delete_mark_merges / 60</td>
</tr>
<tr>
<td>Delete Merges</td>
<td>delete_merges / 60</td>
</tr>
<tr>
<td>Insert Discarded</td>
<td>insert_discarded / 60</td>
</tr>
<tr>
<td>Insert Merges</td>
<td>insert_merges / 60</td>
</tr>
</tbody>
</table>

**Variables**

<table>
<thead>
<tr>
<th>Data Item</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>delete_discarded</td>
<td>mysql:innodbstat:innodb_cbuf_delete_discarded</td>
</tr>
<tr>
<td>delete_mark_discarded</td>
<td>mysql:innodbstat:innodb_cbuf_delete_mark_discarded</td>
</tr>
<tr>
<td>delete_mark_merges</td>
<td>mysql:innodbstat:innodb_cbuf_delete_mark_merges</td>
</tr>
<tr>
<td>delete_merges</td>
<td>mysql:innodbstat:innodb_cbuf_delete_merges</td>
</tr>
<tr>
<td>insert_discarded</td>
<td>mysql:innodbstat:innodb_cbuf_insert_discarded</td>
</tr>
<tr>
<td>insert_merges</td>
<td>mysql:innodbstat:innodb_cbuf_insert_merges</td>
</tr>
</tbody>
</table>

**InnoDB Change Buffer Usage**

<table>
<thead>
<tr>
<th>Name</th>
<th>InnoDB Change Buffer Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Total Size</td>
<td>(total * 16384) / (1024 * 1024)</td>
</tr>
</tbody>
</table>
### InnoDB Compression Time

Shows the time spent by InnoDB compressing and uncompressing data in compressed tables.

<table>
<thead>
<tr>
<th>Name</th>
<th>InnoDB Compression Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>secs per min</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Compressing</td>
<td>compress</td>
</tr>
<tr>
<td>Uncompressing</td>
<td>uncompress</td>
</tr>
</tbody>
</table>

**Variables**

<table>
<thead>
<tr>
<th>Data Item</th>
<th>mysql:innodbstatus:innodb_ibuf_free_list_len</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mysql:innodbstatus:innodb_ibuf_seg_size</td>
</tr>
</tbody>
</table>

### InnoDB Data Dictionary Memory

<table>
<thead>
<tr>
<th>Name</th>
<th>InnoDB Data Dictionary Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Dictionary Memory Allocated</td>
<td>(dict)/(1024*1024)</td>
</tr>
</tbody>
</table>

**Variables**

<table>
<thead>
<tr>
<th>Data Item</th>
<th>mysql:innodbstatus:innodb_bp_dictionary_alloc</th>
</tr>
</thead>
</table>

### InnoDB Datafile IO Usage

<table>
<thead>
<tr>
<th>Name</th>
<th>InnoDB Datafile IO Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg MB/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Read</td>
<td>(((bytes_read / (1024*1024))/60)</td>
</tr>
<tr>
<td>Total</td>
<td>(((bytes_read + bytes_written) / (1024*1024))/60)</td>
</tr>
<tr>
<td>Write</td>
<td>(((bytes_written / (1024*1024))/60)</td>
</tr>
</tbody>
</table>

**Variables**

<table>
<thead>
<tr>
<th>Data Item</th>
<th>mysql:innodb_datafile_io:bytes_read</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mysql:innodb_datafile_io:bytes_written</td>
</tr>
</tbody>
</table>

### InnoDB Doublewrite Buffer Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>InnoDB Doublewrite Buffer Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Pages Written</td>
<td>pages_written/60</td>
</tr>
<tr>
<td>Writes</td>
<td>writes/60</td>
</tr>
</tbody>
</table>

**Variables**

<table>
<thead>
<tr>
<th>Data Item</th>
<th></th>
</tr>
</thead>
</table>

---

Used

\[((\text{total} - \text{free}) \times 16384) / (1024 \times 1024)\]
<table>
<thead>
<tr>
<th>Name</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>pages_written</td>
<td>mysql:status:Innodb_dblwr_pages_written</td>
</tr>
<tr>
<td>writes</td>
<td>mysql:status:Innodb_dblwr_writes</td>
</tr>
</tbody>
</table>

### InnoDB Open Files

<table>
<thead>
<tr>
<th>Name</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>InnoDB Open Files</td>
</tr>
<tr>
<td>Range Label</td>
<td>total</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Currently Open</td>
<td>open</td>
</tr>
<tr>
<td>Max Allowed</td>
<td>max</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>max</td>
<td>mysql:variables:innodb_open_files</td>
</tr>
<tr>
<td>open</td>
<td>mysql:status:innodb_num_open_files</td>
</tr>
</tbody>
</table>

### InnoDB OS File Access

Displays the InnoDB I/O counts showing the number of `fsync`, read, and write operations used to support InnoDB tables.

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>InnoDB OS File Access</td>
</tr>
<tr>
<td>Range Label</td>
<td>avg operations/sec</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>fsync</td>
<td>mysql:innodbstatus:innodb_io_os_file_fsyncs</td>
</tr>
<tr>
<td>log</td>
<td>mysql:innodbstatus:innodb_log_io_total</td>
</tr>
<tr>
<td>read</td>
<td>mysql:innodbstatus:innodb_io_os_file_reads</td>
</tr>
<tr>
<td>write</td>
<td>mysql:innodbstatus:innodb_io_os_fileWrites</td>
</tr>
</tbody>
</table>

### InnoDB Redo Log Checkpoint Lag

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>InnoDB Redo Log Checkpoint Lag</td>
</tr>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>checkpointed</td>
<td>mysql:innodbstatus:innodb_log_checkpoint_lsn64</td>
</tr>
<tr>
<td>flushed</td>
<td>mysql:innodbstatus:innodb_log_flushed_lsn64</td>
</tr>
<tr>
<td>log_count</td>
<td>mysql:variables:innodb_log_files_in_group</td>
</tr>
<tr>
<td>log_size</td>
<td>mysql:variables:innodb_log_file_size</td>
</tr>
<tr>
<td>lsn</td>
<td>mysql:innodbstatus:innodb_log_sequence_lsn64</td>
</tr>
</tbody>
</table>
### InnoDB Redo Log IO Usage

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg MB/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Read</td>
<td>Read</td>
</tr>
<tr>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td>Write</td>
<td>Write</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>bytes_read</td>
<td>mysql:innodb_log_io:bytes_read</td>
</tr>
<tr>
<td>bytes_written</td>
<td>mysql:innodb_log_io:bytes_written</td>
</tr>
</tbody>
</table>

### InnoDB Redo Log Pending Writes

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>I/O ops</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Checkpoint Writes</td>
<td>checkpoint</td>
</tr>
<tr>
<td>Log Writes</td>
<td>log</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>checkpoint</td>
<td>mysql:innodbstatus:innodb_log_pending_checkpoint_writes</td>
</tr>
<tr>
<td>log</td>
<td>mysql:innodbstatus:innodb_log_pending_log_writes</td>
</tr>
</tbody>
</table>

### InnoDB Row Details

Shows the row counts per minute for individual SQL operations (READ, INSERT, UPDATE and DELETE).

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg rows/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Rows Deleted</td>
<td>(deleted/60)</td>
</tr>
<tr>
<td>Rows Inserted</td>
<td>(inserted/60)</td>
</tr>
<tr>
<td>Rows Read</td>
<td>(read/60)</td>
</tr>
<tr>
<td>Rows Updated</td>
<td>(updated/60)</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>deleted</td>
<td>mysql:innodbstatus:innodb_rows_deleted</td>
</tr>
<tr>
<td>inserted</td>
<td>mysql:innodbstatus:innodb_rows_inserted</td>
</tr>
<tr>
<td>read</td>
<td>mysql:innodbstatus:innodb_rows_read</td>
</tr>
<tr>
<td>updated</td>
<td>mysql:innodbstatus:innodb_rows_updated</td>
</tr>
</tbody>
</table>

### InnoDB Row Lock Time

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>milliseconds</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Total</td>
<td>lock_time_total</td>
</tr>
</tbody>
</table>
### Variables

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>lock_time_total</td>
<td>mysql:status:Innodb_row_lock_time</td>
</tr>
</tbody>
</table>

### InnoDB Row Lock Time Statistics

<table>
<thead>
<tr>
<th>Name</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>milliseconds</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Avg</td>
<td>lock_time_avg</td>
</tr>
<tr>
<td>Max</td>
<td>lock_time_max</td>
</tr>
</tbody>
</table>

### InnoDB Row Lock Waits

<table>
<thead>
<tr>
<th>Name</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Row Lock Waits</td>
<td>row_lock_waits</td>
</tr>
</tbody>
</table>

### InnoDB Semaphores

Displays the InnoDB semaphore status. The graph indicates the amount of time that different InnoDB threads have spent waiting due to the locks used to prevent the same structures being updated at the same time. A large number of threads waiting for the semaphores may be a result of disk I/O or connection problems inside InnoDB. You may want to modify your InnoDB thread concurrency.

<table>
<thead>
<tr>
<th>Name</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg waits/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>OS Waits</td>
<td>(oswaits/60)</td>
</tr>
<tr>
<td>Spin Rounds</td>
<td>(srounds/60)</td>
</tr>
</tbody>
</table>
### Spin Waits

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>oswaits</td>
<td>mysql:innodbstatus:innodb_sem_mutex_os_waits</td>
</tr>
<tr>
<td>srounds</td>
<td>mysql:innodbstatus:innodb_sem_mutex_rounds</td>
</tr>
<tr>
<td>swaits</td>
<td>mysql:innodbstatus:innodb_sem_mutex_spin_waits</td>
</tr>
</tbody>
</table>

### InnoDB Transaction History

The size of the InnoDB transaction history. A high number may indicate a large number of open (uncommitted) transactions.

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>Undo Entries</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Undo Log Size</td>
<td>hist_len</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>hist_len</td>
<td>mysql:innodbstatus:innodb_trx_history_list_length</td>
</tr>
</tbody>
</table>

### InnoDB Transaction Lock Memory

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Total Lock Memory</td>
<td>(bytes_total / (1024*1024))</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>bytes_total</td>
<td>mysql:innodb_current_trxs:lock_memory_bytes_total</td>
</tr>
</tbody>
</table>

### InnoDB Transactions

The number of blocked, locked, and active transactions. You can use this to determine the contention on tables for InnoDB transactions.

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Committing</td>
<td>committing</td>
</tr>
<tr>
<td>Lock Waiting</td>
<td>lock_waiting</td>
</tr>
<tr>
<td>Rolling Back</td>
<td>rolling_back</td>
</tr>
<tr>
<td>Running</td>
<td>running</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>committing</td>
<td>mysql:innodb_transactions:committing_count</td>
</tr>
<tr>
<td>lock_waiting</td>
<td>mysql:innodb_transactions:lock_wait_count</td>
</tr>
<tr>
<td>rolling_back</td>
<td>mysql:innodb_transactions:rolling_back_count</td>
</tr>
<tr>
<td>running</td>
<td>mysql:innodb_transactions:running_count</td>
</tr>
</tbody>
</table>

### InnoDB Undo Logs

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total</td>
</tr>
</tbody>
</table>
### Load Average

The load average of the server hosting the MySQL server. The load average shows the number of processes using or waiting for CPU time in the last 1, 5 and 15 minutes. Load averages showing a load higher than the number of CPU cores may indicate an overloaded server.

<table>
<thead>
<tr>
<th>Name</th>
<th>Load Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>Load Average</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>1</td>
<td>zero</td>
</tr>
<tr>
<td>15</td>
<td>two</td>
</tr>
<tr>
<td>5</td>
<td>one</td>
</tr>
</tbody>
</table>

### Memory Usage - Agent

Displays the current amount of memory used by the agent, and by the Lua component of the agent.

<table>
<thead>
<tr>
<th>Name</th>
<th>Memory Usage - Agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Agent</td>
<td>agent_mem_size / 1024 / 1024</td>
</tr>
<tr>
<td>Lua</td>
<td>lua_mem_size / 1024 / 1024</td>
</tr>
</tbody>
</table>

### Memory Usage - OS Resident

Displays the RAM usage on the server for the monitored MySQL instance. You should compare the total and used RAM values to ensure that you are not exceeding your available RAM, which will lead to swapping and performance issues.

<table>
<thead>
<tr>
<th>Name</th>
<th>Memory Usage - OS Resident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Total</td>
<td>ram_total/(1024*1024)</td>
</tr>
<tr>
<td>Used</td>
<td>(ram_total-ram_unused)/(1024*1024)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>agent_mem_size</td>
<td>agent:proc:mem_resident</td>
</tr>
<tr>
<td>lua_mem_size</td>
<td>agent:lua:mem_size</td>
</tr>
</tbody>
</table>
### Memory Usage - OS Virtual

Displays the use of swap space on the server for the monitored MySQL instance. High swap usage may indicate that your server needs more RAM or that your MySQL configuration needs to be modified, as high levels of swap will have a negative impact on performance.

<table>
<thead>
<tr>
<th>Name</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td><code>swap_total/(1024*1024)</code></td>
</tr>
<tr>
<td>Used</td>
<td><code>(swap_total-swap_unused)/(1024*1024)</code></td>
</tr>
</tbody>
</table>

### MyISAM Data File IO Usage

<table>
<thead>
<tr>
<th>Name</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read</td>
<td><code>((bytes_read / (1024*1024))/60)</code></td>
</tr>
<tr>
<td>Total</td>
<td><code>(((bytes_read + bytes_written) / (1024*1024))/60)</code></td>
</tr>
<tr>
<td>Write</td>
<td><code>((bytes_written / (1024*1024))/60)</code></td>
</tr>
</tbody>
</table>

### MyISAM Index File IO Usage

<table>
<thead>
<tr>
<th>Name</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read</td>
<td><code>((bytes_read / (1024*1024))/60)</code></td>
</tr>
<tr>
<td>Total</td>
<td><code>(((bytes_read + bytes_written) / (1024*1024))/60)</code></td>
</tr>
<tr>
<td>Write</td>
<td><code>((bytes_written / (1024*1024))/60)</code></td>
</tr>
</tbody>
</table>

### MyISAM Key Buffer Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read</td>
<td>avg cache ops/sec</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>bytes_read</code></td>
<td><code>mysql:myisam_data_file_io:bytes_read</code></td>
</tr>
<tr>
<td><code>bytes_written</code></td>
<td><code>mysql:myisam_data_file_io:bytes_written</code></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>bytes_read</code></td>
<td><code>mysql:myisam_index_file_io:bytes_read</code></td>
</tr>
<tr>
<td><code>bytes_written</code></td>
<td><code>mysql:myisam_index_file_io:bytes_written</code></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>bytes_read</code></td>
<td><code>mysql:myisam_key_buffer_activity:bytes_read</code></td>
</tr>
<tr>
<td><code>bytes_written</code></td>
<td><code>mysql:myisam_key_buffer_activity:bytes_written</code></td>
</tr>
</tbody>
</table>
## Graph Definition Reference

<table>
<thead>
<tr>
<th>Series</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk Reads</td>
<td>(reads/60)</td>
</tr>
<tr>
<td>Disk Writes</td>
<td>(writes/60)</td>
</tr>
<tr>
<td>Read Requests</td>
<td>(read_requests/60)</td>
</tr>
<tr>
<td>Write Requests</td>
<td>(write_requests/60)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>read_requests</td>
<td>mysql:status:Key_read_requests</td>
</tr>
<tr>
<td>reads</td>
<td>mysql:status:Key_reads</td>
</tr>
<tr>
<td>write_requests</td>
<td>mysql:status:Key_write_requests</td>
</tr>
<tr>
<td>writes</td>
<td>mysql:status:Key_writes</td>
</tr>
</tbody>
</table>

### MyISAM Key Buffer Usage

Displays the efficiency of the MyISAM key index buffer usage. On a system using a lot of MyISAM tables, low usage indicates that your MyISAM key buffer size is too high (reducing the RAM available for other buffering). High usage may indicate that you need to increase your MyISAM key buffer size to help improve performance.

<table>
<thead>
<tr>
<th>Name</th>
<th>MyISAM Key Buffer Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>MB</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Modified</td>
<td>(blk_size*not_flushed)/1024/1024</td>
</tr>
<tr>
<td>Total Size</td>
<td>key_buffer/1024/1024</td>
</tr>
<tr>
<td>Used</td>
<td>(key_buffer - (blk_size*unused))/1024/1024</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>blk_size</td>
<td>mysql:variables:key_cache_block_size</td>
</tr>
<tr>
<td>key_buffer</td>
<td>mysql:variables:key_buffer_size</td>
</tr>
<tr>
<td>not_flushed</td>
<td>mysql:status:Key_blocks_not_flushed</td>
</tr>
<tr>
<td>unused</td>
<td>mysql:status:Key_blocks_unused</td>
</tr>
</tbody>
</table>

### Network - Database Throughput

Displays the total Kilobytes per minute of bytes transferred to/from the server by client applications. Spikes in this output may indicate an unusual application operation or connection.

<table>
<thead>
<tr>
<th>Name</th>
<th>Network - Database Throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg kbytes/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Received</td>
<td>(((bytesIn/1024)/60)</td>
</tr>
<tr>
<td>Sent</td>
<td>(((bytesOut/1024)/60)</td>
</tr>
<tr>
<td>Total</td>
<td>(((bytesIn+bytesOut)/1024)/60)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>bytesIn</td>
<td>mysql:status:Bytes_received</td>
</tr>
<tr>
<td>bytesOut</td>
<td>mysql:status:Bytes_sent</td>
</tr>
</tbody>
</table>

### Network - Interface Throughput

<table>
<thead>
<tr>
<th>Name</th>
<th>Network - Interface Throughput</th>
</tr>
</thead>
</table>

303
### Received

Series: Expression

\( \frac{(read / 1024)}{60} \)

**Variables**

- read
  - `os:net:rx_bytes`

### Sent

Series: Expression

\( \frac{(write / 1024)}{60} \)

**Variables**

- write
  - `os:net:tx_bytes`

### Total

Series: Expression

\( \frac{((read+write) / 1024)}{60} \)

**Variables**

- `read`
- `write`

### Opened Tables

The number of tables in the open state per minute.

<table>
<thead>
<tr>
<th>Name</th>
<th>Opened Tables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total/min</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Opened Table Definitions</td>
<td><code>openedTableDefs</code></td>
</tr>
<tr>
<td>Opened Tables</td>
<td><code>openedTables</code></td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td><code>openedTableDefs</code></td>
<td><code>mysql:status:Opened_table_definitions</code></td>
</tr>
<tr>
<td><code>openedTables</code></td>
<td><code>mysql:status:Opened_tables</code></td>
</tr>
</tbody>
</table>

### Prepared Statement API

<table>
<thead>
<tr>
<th>Name</th>
<th>Prepared Statement API</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total/min</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td><code>stmt_close</code></td>
<td><code>(close_api - dealloc_sql)</code></td>
</tr>
<tr>
<td><code>stmt_execute</code></td>
<td><code>(execute_api - execute_sql)</code></td>
</tr>
<tr>
<td><code>stmt_fetch</code></td>
<td><code>fetch_api</code></td>
</tr>
<tr>
<td><code>stmt_prepare</code></td>
<td><code>((prepare_api - reprepare_api) - prepare_sql)</code></td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td><code>close_api</code></td>
<td><code>mysql:status:Com_stmt_close</code></td>
</tr>
<tr>
<td><code>dealloc_sql</code></td>
<td><code>mysql:status:Com_dealloc_sql</code></td>
</tr>
<tr>
<td><code>execute_api</code></td>
<td><code>mysql:status:Com_stmt_execute</code></td>
</tr>
<tr>
<td><code>execute_sql</code></td>
<td><code>mysql:status:Com_execute_sql</code></td>
</tr>
<tr>
<td><code>fetch_api</code></td>
<td><code>mysql:status:Com_stmt_fetch</code></td>
</tr>
<tr>
<td><code>prepare_api</code></td>
<td><code>mysql:status:Com_stmt_prepare</code></td>
</tr>
<tr>
<td><code>prepare_sql</code></td>
<td><code>mysql:status:Com_prepare_sql</code></td>
</tr>
<tr>
<td><code>reprepare_api</code></td>
<td><code>mysql:status:Com_stmt_reprepare</code></td>
</tr>
</tbody>
</table>

### Prepared Statement API Invalidations

<table>
<thead>
<tr>
<th>Name</th>
<th>Prepared Statement API Invalidations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total/min</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>stmt_reprepare</td>
<td>reprepare_api</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>reprepare_api</td>
<td>mysql:status:Com_stmt_reprepare</td>
</tr>
</tbody>
</table>

**Prepared Statement SQL**

<table>
<thead>
<tr>
<th>Name</th>
<th>Prepared Statement SQL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total/min</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>DEALLOCATE PREPARE</td>
<td>dealloc_sql</td>
</tr>
<tr>
<td>EXECUTE</td>
<td>execute_sql</td>
</tr>
<tr>
<td>PREPARE</td>
<td>prepare_sql</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>dealloc_sql</td>
<td>mysql:status:Com_dealloc_sql</td>
</tr>
<tr>
<td>execute_sql</td>
<td>mysql:status:Com_execute_sql</td>
</tr>
<tr>
<td>prepare_sql</td>
<td>mysql:status:Com_prepare_sql</td>
</tr>
</tbody>
</table>

**Prepared Statement Utilization**

<table>
<thead>
<tr>
<th>Name</th>
<th>Prepared Statement Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Max Prepared Statements</td>
<td>max_allowed</td>
</tr>
<tr>
<td>Open Prepared Statements</td>
<td>open</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>max_allowed</td>
<td>mysql:variables:max_prepared_stmt_count</td>
</tr>
<tr>
<td>open</td>
<td>mysql:status:Prepared_stmt_count</td>
</tr>
</tbody>
</table>

**Query Cache Average Free Block Size**

<table>
<thead>
<tr>
<th>Name</th>
<th>Query Cache Average Free Block Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>kBytes</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Average Free Block Size</td>
<td>free_memory/free_blocks/1024</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>free_blocks</td>
<td>mysql:status:Qcache_free_blocks</td>
</tr>
<tr>
<td>free_memory</td>
<td>mysql:status:Qcache_free_memory</td>
</tr>
</tbody>
</table>

**Query Cache Average Query Size**

<table>
<thead>
<tr>
<th>Name</th>
<th>Query Cache Average Query Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>kBytes</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Average Query Size</td>
<td>((size - free)/queries)/1024</td>
</tr>
<tr>
<td>Min Block Size</td>
<td>min_res_unit/1024</td>
</tr>
</tbody>
</table>
Variables | Data Item
---|---
free | $\text{mysql}::\text{status}:\text{Qcache\_free\_memory}$
\text{min\_res\_unit} | $\text{mysql}::\text{variables}:\text{query\_cache\_min\_res\_unit}$
queries | $\text{mysql}::\text{status}:\text{Qcache\_queries\_in\_cache}$
size | $\text{mysql}::\text{variables}:\text{query\_cache\_size}$

**Query Cache Efficiency**

Displays the hits, inserts and queries not cacheable in the query cache. Low cache hits may indicate that your queries are being expired from the cache before they can be used, which may mean they are unsuitable for storing in the query cache.

<table>
<thead>
<tr>
<th>Name</th>
<th>Query Cache Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg cache ops/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Hits</td>
<td>$(\text{hits}/60)$</td>
</tr>
<tr>
<td>Inserts</td>
<td>$(\text{inserts}/60)$</td>
</tr>
<tr>
<td>Not Cached</td>
<td>$(\text{not_cached}/60)$</td>
</tr>
</tbody>
</table>

**Variables** | **Data Item**
---|---
| hits | $\text{mysql}::\text{status}:\text{Qcache\_hits}$ |
| inserts | $\text{mysql}::\text{status}:\text{Qcache\_inserts}$ |
| not\_cached | $\text{mysql}::\text{status}:\text{Qcache\_not\_cached}$ |

**Query Cache Fragmentation**

<table>
<thead>
<tr>
<th>Name</th>
<th>Query Cache Fragmentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td># of Free Blocks</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Free Blocks</td>
<td>$\text{QCache_free_blocks}$</td>
</tr>
</tbody>
</table>

**Variables** | **Data Item**
---|---
| $\text{QCache\_free\_blocks}$ | $\text{mysql}::\text{status}:\text{QCache\_free\_blocks}$ |

**Query Cache Lowmem Prunes**

Displays the number of queries removed from the cache because the size of the query cache was not large enough to store the queries that can be cached. Try increasing your query cache size.

<table>
<thead>
<tr>
<th>Name</th>
<th>Query Cache Lowmem Prunes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg cache ops/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Lowmem Prunes</td>
<td>$(\text{deletes}/60)$</td>
</tr>
</tbody>
</table>

**Variables** | **Data Item**
---|---
| deletes | $\text{mysql}::\text{status}:\text{Qcache\_lowmem\_prunes}$ |

**Query Cache Memory**

Displays the free space and total size of the query cache.

<p>| Name | Query Cache Memory |</p>
<table>
<thead>
<tr>
<th>Range Label</th>
<th>MB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Total Size</td>
<td>size/(1024*1024)</td>
</tr>
<tr>
<td>Used</td>
<td>((size-free)/(1024*1024))</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>free</td>
<td>mysql:status:Qcache_free_memory</td>
</tr>
<tr>
<td>size</td>
<td>mysql:variables:query_cache_size</td>
</tr>
</tbody>
</table>

**Query Cache Queries**

Shows the number of queries stored in the query cache. In normal operation this should be a relatively constant figure. A large number of switches between high and low numbers may indicate that differently sized queries are being inserted into the query cache, and then later removed as a high number of smaller queries are added to the cache. Try increasing the size of your query cache.

<table>
<thead>
<tr>
<th>Name</th>
<th>Query Cache Queries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>num queries</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Queries in Cache</td>
<td>queries</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>queries</td>
<td>mysql:status:Qcache_queries_in_cache</td>
</tr>
</tbody>
</table>

**Replication Master Semi-Sync Transactions**

<table>
<thead>
<tr>
<th>Name</th>
<th>Replication Master Semi-Sync Transactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td># of trxs</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>_transactions Acknowledged</td>
<td>trxs_yes</td>
</tr>
<tr>
<td>transactions Unacknowledged</td>
<td>trxs_no</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>trxs_no</td>
<td>mysql:rpl_semi_sync_status:Rpl_semi_sync_master_no_tx</td>
</tr>
<tr>
<td>trxs_yes</td>
<td>mysql:rpl_semi_sync_status:Rpl_semi_sync_master_yes_tx</td>
</tr>
</tbody>
</table>

**Replication Master Semi-Sync Wait Time Averages**

<table>
<thead>
<tr>
<th>Name</th>
<th>Replication Master Semi-Sync Wait Time Averages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>milliseconds</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Average Slave Wait Time</td>
<td>slave_waits / 1000</td>
</tr>
<tr>
<td>Average Transaction Wait Time</td>
<td>trx_waits / 1000</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>slave_waits</td>
<td>mysql:rpl_semi_sync_status:Rpl_semi_sync_master_net_avg_wait_time</td>
</tr>
<tr>
<td>trx_waits</td>
<td>mysql:rpl_semi_sync_status:Rpl_semi_sync_master_tx_avg_wait_time</td>
</tr>
</tbody>
</table>

**Replication Master Semi-Sync Waiting Sessions**

<table>
<thead>
<tr>
<th>Name</th>
<th>Replication Master Semi-Sync Waiting Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td># of sessions</td>
</tr>
</tbody>
</table>
### Waiting Sessions

<table>
<thead>
<tr>
<th>Series</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Waiting Sessions</strong></td>
<td>sessions_waiting</td>
</tr>
</tbody>
</table>

### Replication Master Semi-Sync Waits

<table>
<thead>
<tr>
<th>Name</th>
<th>Replication Master Semi-Sync Waits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range Label</strong></td>
<td># waits</td>
</tr>
<tr>
<td><strong>Series</strong></td>
<td>Expression</td>
</tr>
<tr>
<td>Slave Waits</td>
<td>slave_waits</td>
</tr>
<tr>
<td>Transaction Waits</td>
<td>trx_waits</td>
</tr>
</tbody>
</table>

### Replication Slave Delay

Displays the number of seconds behind the master for a given slave in a replication scenario. An increasing value means that your slave is unable to keep up with your master.

<table>
<thead>
<tr>
<th>Name</th>
<th>Replication Slave Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range Label</strong></td>
<td>total seconds</td>
</tr>
<tr>
<td><strong>Series</strong></td>
<td>Expression</td>
</tr>
<tr>
<td>Seconds Behind Master</td>
<td>sbehind</td>
</tr>
<tr>
<td><strong>Variables</strong></td>
<td>Data Item</td>
</tr>
<tr>
<td>sbehind</td>
<td>mysql:slavestatus:Seconds_Behind_Master</td>
</tr>
</tbody>
</table>

### Replication Slave Relay Log Space Usage

<table>
<thead>
<tr>
<th>Name</th>
<th>Replication Slave Relay Log Space Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range Label</strong></td>
<td>MB</td>
</tr>
<tr>
<td><strong>Series</strong></td>
<td>Expression</td>
</tr>
<tr>
<td>Total Size</td>
<td>(fileSum / (1024*1024))</td>
</tr>
<tr>
<td><strong>Variables</strong></td>
<td>Data Item</td>
</tr>
<tr>
<td>fileSum</td>
<td>mysql:slavestatus:Relay_Log_Space</td>
</tr>
</tbody>
</table>

### Row Access Statistics

Shows the average of the number of accesses for data for different query operations for all table reads, regardless of the storage engine being used, against the number of queries being executed.

<table>
<thead>
<tr>
<th>Name</th>
<th>Row Access Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range Label</strong></td>
<td>rows</td>
</tr>
<tr>
<td><strong>Series</strong></td>
<td>Expression</td>
</tr>
<tr>
<td>Average Rows Per Query</td>
<td>(((first+key+next+prev+hread_rnd +hread_rnd_next+sort_rows) / questions)</td>
</tr>
<tr>
<td><strong>Variables</strong></td>
<td>Data Item</td>
</tr>
<tr>
<td>first</td>
<td>mysql:status:Handler_read_first</td>
</tr>
</tbody>
</table>
Row Accesses
Displays the aggregated row access statistics per minute. Information is shown both in terms of the full table scans (which are expensive to perform), and index based accesses.

<table>
<thead>
<tr>
<th>Name</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rows Read via Full Scan</td>
<td>(((hread_rnd+hread_rnd_next)/60)</td>
</tr>
<tr>
<td>Rows Read via Indexes</td>
<td>(((first+key+next+prev)/60)</td>
</tr>
</tbody>
</table>

Variables
<table>
<thead>
<tr>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>first</td>
</tr>
<tr>
<td>hread_rnd</td>
</tr>
<tr>
<td>hread_rnd_next</td>
</tr>
<tr>
<td>key</td>
</tr>
<tr>
<td>next</td>
</tr>
<tr>
<td>prev</td>
</tr>
</tbody>
</table>

Row Accesses Index Usage Ratio

<table>
<thead>
<tr>
<th>Name</th>
<th>Row Accesses Index Usage Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>%</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Index Usage</td>
<td>(100-(((hread_rnd_next + hread_rnd) / (hread_rnd_next + hread_rnd + first + next + key + prev))*100))</td>
</tr>
</tbody>
</table>

Variables
<table>
<thead>
<tr>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>first</td>
</tr>
<tr>
<td>hread_rnd</td>
</tr>
<tr>
<td>hread_rnd_next</td>
</tr>
<tr>
<td>key</td>
</tr>
<tr>
<td>next</td>
</tr>
<tr>
<td>prev</td>
</tr>
</tbody>
</table>

Row Writes
Shows the number of delete, write (INSERT), and update operations on rows per minute on all tables regardless of storage engine.

<table>
<thead>
<tr>
<th>Name</th>
<th>Row Writes</th>
</tr>
</thead>
</table>

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### Graph Definition Reference

<table>
<thead>
<tr>
<th>Range Label</th>
<th>avg rows/sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Rows Deleted</td>
<td>(delete/60)</td>
</tr>
<tr>
<td>Rows Inserted</td>
<td>(write/60)</td>
</tr>
<tr>
<td>Rows Updated</td>
<td>(update/60)</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>delete</td>
<td>mysql:status:Handler_delete</td>
</tr>
<tr>
<td>update</td>
<td>mysql:status:Handler_update</td>
</tr>
<tr>
<td>write</td>
<td>mysql:status:Handler_write</td>
</tr>
</tbody>
</table>

### Rows Returned

<table>
<thead>
<tr>
<th>Name</th>
<th>Rows Returned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg rows/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Rows Returned</td>
<td>rows/60</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>rows</td>
<td>mysql:statement_digest_statistics:total_rows_returned</td>
</tr>
</tbody>
</table>

### Slow Queries

<table>
<thead>
<tr>
<th>Name</th>
<th>Slow Queries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total/min</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Slow Queries</td>
<td>slow_queries/60</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>slow_queries</td>
<td>mysql:status:Slow_queries</td>
</tr>
</tbody>
</table>

### Sort Activity

Shows the number of different sort operations performed on queries.

<table>
<thead>
<tr>
<th>Name</th>
<th>Sort Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total/min</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Merge Passes</td>
<td>Sort_merge_passes</td>
</tr>
<tr>
<td>Range</td>
<td>Sort_range</td>
</tr>
<tr>
<td>Scan</td>
<td>Sort_scan</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>Sort_merge_passes</td>
<td>mysql:status:Sort_merge_passes</td>
</tr>
<tr>
<td>Sort_range</td>
<td>mysql:status:Sort_range</td>
</tr>
<tr>
<td>Sort_scan</td>
<td>mysql:status:Sort_scan</td>
</tr>
</tbody>
</table>

### Statement Errors and Warnings

<table>
<thead>
<tr>
<th>Name</th>
<th>Statement Errors and Warnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>Count</td>
</tr>
</tbody>
</table>
### Statement Statistics

<table>
<thead>
<tr>
<th>Name</th>
<th>Series</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>milliseconds</td>
<td></td>
</tr>
<tr>
<td>Avg Lock Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(total_lock_time/statements)</td>
<td></td>
</tr>
<tr>
<td>Avg Response Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(total_wait_time/statements)</td>
<td></td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
<td></td>
</tr>
<tr>
<td>statements</td>
<td>mysql:statement_digest_statistics:total_statements</td>
<td></td>
</tr>
<tr>
<td>total_lock_time</td>
<td>mysql:statement_digest_statistics:total_lock_time_ms</td>
<td></td>
</tr>
<tr>
<td>total_wait_time</td>
<td>mysql:statement_digest_statistics:total_wait_time_ms</td>
<td></td>
</tr>
</tbody>
</table>

### Swap IO Operations

<table>
<thead>
<tr>
<th>Name</th>
<th>Series</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg pages/sec</td>
<td></td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
<td></td>
</tr>
<tr>
<td>Pages In</td>
<td>in / 60</td>
<td></td>
</tr>
<tr>
<td>Pages Out</td>
<td>out / 60</td>
<td></td>
</tr>
<tr>
<td>Total Pages</td>
<td>((in+out) / 60)</td>
<td></td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
<td></td>
</tr>
<tr>
<td>in</td>
<td>os:mem:swap_page_in</td>
<td></td>
</tr>
<tr>
<td>out</td>
<td>os:mem:swap_page_out</td>
<td></td>
</tr>
</tbody>
</table>

### Table Lock Wait Ratio

Shows the percentage of table locks that have had to wait before an operation can continue. High lock ratios can indicate high contention in your tables, with too many operations having to wait, affecting the performance.

<table>
<thead>
<tr>
<th>Name</th>
<th>Series</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>lock wait %</td>
<td></td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
<td></td>
</tr>
<tr>
<td>Wait Ratio</td>
<td>((lock_waits/lock_immediate)*100)</td>
<td></td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
<td></td>
</tr>
<tr>
<td>lock_immediate</td>
<td>mysql:status:Table_locks_immediate</td>
<td></td>
</tr>
<tr>
<td>lock_waits</td>
<td>mysql:status:Table_locks_waited</td>
<td></td>
</tr>
</tbody>
</table>

### Table Locks

Shows the average number of table locks per second.
Table Locks

<table>
<thead>
<tr>
<th>Name</th>
<th>Table Locks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg locks/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Immediate</td>
<td>(locks_immediate/60)</td>
</tr>
<tr>
<td>Waited</td>
<td>(locks_waited/60)</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>locks_immediate</td>
<td>mysql:status:Table_locks_immediate</td>
</tr>
<tr>
<td>locks_waited</td>
<td>mysql:status:Table_locks_waited</td>
</tr>
</tbody>
</table>

Temporary Tables

Displays the number of memory temporary tables and disk temporary tables. Disk temporary tables are slower to create, populate, and read back. You may want to increase your memory temporary table size or check your queries to determine whether the use of temporary tables can be minimized.

<table>
<thead>
<tr>
<th>Name</th>
<th>Temporary Tables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>total/min</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Disk Temp Tables</td>
<td>diskTempTables</td>
</tr>
<tr>
<td>Memory Temp Tables</td>
<td>memoryTempTables</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>diskTempTables</td>
<td>mysql:status:Created_tmp_disk_tables</td>
</tr>
<tr>
<td>memoryTempTables</td>
<td>mysql:status:Created_tmp_tables</td>
</tr>
</tbody>
</table>

Thread Pool Current Threads

<table>
<thead>
<tr>
<th>Name</th>
<th>Thread Pool Current Threads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>thread count</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Active</td>
<td>active_threads</td>
</tr>
<tr>
<td>Consumable</td>
<td>consumer_thread</td>
</tr>
<tr>
<td>Reserved</td>
<td>reserve_threads</td>
</tr>
<tr>
<td>Stalled</td>
<td>stalled_threads</td>
</tr>
<tr>
<td>Total</td>
<td>total_threads</td>
</tr>
<tr>
<td>Variables</td>
<td>Data Item</td>
</tr>
<tr>
<td>active_threads</td>
<td>mysql:thread_pool_state:active_threads</td>
</tr>
<tr>
<td>consumer_threads</td>
<td>mysql:thread_pool_state:consumer_threads</td>
</tr>
<tr>
<td>reserve_threads</td>
<td>mysql:thread_pool_state:reserve_threads</td>
</tr>
<tr>
<td>stalled_threads</td>
<td>mysql:thread_pool_state:stalled_threads</td>
</tr>
<tr>
<td>total_threads</td>
<td>mysql:thread_pool_state:total_threads</td>
</tr>
</tbody>
</table>

Thread Pool Queue Age

<table>
<thead>
<tr>
<th>Name</th>
<th>Thread Pool Queue Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>milliseconds</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Oldest Query Wait Time</td>
<td>oldest_queued_ms</td>
</tr>
</tbody>
</table>
### Variables

<table>
<thead>
<tr>
<th>Data Item</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>oldest_queued_ms</td>
<td>mysql:thread_pool_state:oldest_queued_ms</td>
</tr>
</tbody>
</table>

### Thread Pool Queues

<table>
<thead>
<tr>
<th>Name</th>
<th>Thread Pool Queues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td># of statements</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>High-Priority Queue</td>
<td>queued_queries</td>
</tr>
<tr>
<td>Low-Priority Queue</td>
<td>queued_trxs</td>
</tr>
</tbody>
</table>

### Thread Pool Stall Rate

<table>
<thead>
<tr>
<th>Name</th>
<th>Thread Pool Stall Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>%</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Last Interval</td>
<td>( \frac{\text{stalled_queries_executed}}{\text{queries_executed}} ) * 100</td>
</tr>
</tbody>
</table>

### Thread Pool Statement Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>Thread Pool Statement Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Label</td>
<td>avg statements/sec</td>
</tr>
<tr>
<td>Series</td>
<td>Expression</td>
</tr>
<tr>
<td>Executed</td>
<td>( \frac{\text{executed}}{60} )</td>
</tr>
<tr>
<td>Immediately Queued</td>
<td>( \frac{\text{queued}}{60} )</td>
</tr>
<tr>
<td>Marked Stalled</td>
<td>( \frac{\text{stalled}}{60} )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>executed</td>
<td>mysql:thread_pool_stats:queries_executed</td>
</tr>
<tr>
<td>queued</td>
<td>mysql:thread_pool_stats:queries_queued</td>
</tr>
<tr>
<td>stalled</td>
<td>mysql:thread_pool_stats:stalled_queries_executed</td>
</tr>
</tbody>
</table>
Appendix C MySQL Enterprise Monitor Component Reference

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C.1 MySQL Enterprise Service Manager Reference

C.1.1 Configuring Tomcat Parameters

The parameters for the Tomcat hosting system that supports MySQL Enterprise Service Manager and MySQL Enterprise Monitor User Interface can have an affect on the performance of the system.

The default settings for Java for Tomcat are as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Parameter</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial heap size</td>
<td>-Xms</td>
<td>768MB</td>
</tr>
<tr>
<td>Maximum heap size</td>
<td>-Xmx</td>
<td>768MB</td>
</tr>
<tr>
<td>Java stack size</td>
<td>-Xss</td>
<td>128MB</td>
</tr>
</tbody>
</table>

You can change these parameters to higher values, by editing the JAVA_OPTS setting within the corresponding platform script.

• On Unix/Linux:

  Edit the values within apache-tomcat/bin/setenv.sh file within your MySQL Enterprise Service Manager directory. Avoid setting maximum figures higher than the physical memory of your system as this may reduce, rather than increase the performance.

  If you change these parameters, shut down and restart MySQL Enterprise Service Manager for the changes to take effect.

• Windows

  Edit the JAVA_OPTS settings within the apache-tomcat/bin/setenv.bat file.

  To enable the changes, re-install your service. Shut down your MySQL Enterprise Service Manager service and then reinstall the service by running:

  ```shell
  shell> mysqlmonitorctl.bat uninstall
  shell> mysqlmonitorctl.bat install
  ```

  On all platforms, upgrading the MySQL Enterprise Service Manager service using the above methods should preserve any changes to JAVA_OPTS.

  If you are running the MySQL repository and the Tomcat service on the same machine, take the memory allocated to MySQL into consideration when setting these values.
C.1.2 Creating a new SSL KeyStore

The SSL certificate that is provided with the server during installation is a sample certificate only. To use SSL for communicating with your MySQL Enterprise Service Manager and MySQL Enterprise Monitor User Interface, replace the supplied certificate with your own certificate.

The certificate keystore is located in the `apache-tomcat/conf/myKeystore` file within your MySQL Enterprise Service Manager installation.

To create a new self-signed certificate, use the `keytool` command (provided with Java SE Security) to create a new certificate file:

```
shell> keytool -genkey -alias tomcat -keyalg RSA -validity 1825 -keystore newKeystore
```

You will be prompted to fill in the certificate information and to provide a unique password for the certificate.

The `-validity` specifies the length of the certificate created, specified in days. The `-alias` is required to ensure that the certificate is associated with `tomcat`.

Once you have created the new keystore, shut down MySQL Enterprise Service Manager, copy the new keystore file to `apache-tomcat/conf/myKeystore`, and restart MySQL Enterprise Service Manager.

If you have an existing certificate that you would like to import into your keystore, you need to import the certificate using the following command:

```
shell> keytool -import -alias tomcat -keystore newKeystore -file public.pem
```

For more information on using SSL certificates in Tomcat see Apache Tomcat 6.0: SSL Configuration HOW-TO.

C.1.3 Log Files for the MySQL Enterprise Service Manager

This section shows the location of the log and configuration files associated with the various components that make up the MySQL Enterprise Service Manager. These files can prove useful for debugging purposes.

All log files except `catalina.out` are rotated to ensure they do not grow beyond 10MB in size.

Table C.1 MySQL Enterprise Monitor: Log File Locations: Windows

<table>
<thead>
<tr>
<th>Component</th>
<th>File Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apache/Tomcat</td>
<td>C:\Program Files\MySQL\Enterprise\Monitor\apache-tomcat\logs\catalina.out</td>
</tr>
<tr>
<td>Repository</td>
<td>C:\Program Files\MySQL\Enterprise\Monitor\mysql\data</td>
</tr>
<tr>
<td>Configuration</td>
<td>C:\Program Files\MySQL\Enterprise\Monitor\configuration_report.txt</td>
</tr>
<tr>
<td>Report</td>
<td></td>
</tr>
<tr>
<td>Service Manager</td>
<td>C:\Program Files\MySQL\Enterprise\Monitor\apache-tomcat\logs\mysql-monitor.log</td>
</tr>
</tbody>
</table>

Table C.2 MySQL Enterprise Monitor: Log File Locations: Unix

<table>
<thead>
<tr>
<th>Component</th>
<th>File Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apache/Tomcat</td>
<td>/opt/mysql/enterprise/monitor/apache-tomcat/logs/catalina.out</td>
</tr>
<tr>
<td>Repository</td>
<td>/opt/mysql/enterprise/monitor/mysql/data</td>
</tr>
<tr>
<td>Configuration</td>
<td>/opt/mysql/enterprise/monitor/configuration_report.txt</td>
</tr>
<tr>
<td>Report</td>
<td></td>
</tr>
</tbody>
</table>
The Management Information Base (MIB) File

<table>
<thead>
<tr>
<th>Component</th>
<th>File Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Manager</td>
<td>/opt/mysql/enterprise/monitor/apache-tomcat/logs/mysql-monitor.log</td>
</tr>
</tbody>
</table>

All of these logs are viewable within MySQL Enterprise Monitor User Interface. For more information, see Section 2.8.6, “Logs”.

On all operating systems, the Apache/Tomcat, and Repository directories contain both access and error files.

C.1.4 The Management Information Base (MIB) File

A MIB file is a requirement for using SNMP traps. A table showing the location of this file follows.

Table C.3 MySQL Enterprise Monitor: MIB File Locations

<table>
<thead>
<tr>
<th>Operating System</th>
<th>File Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>C:\Program Files\MySQL\Enterprise\Monitor\support-files \MONITOR.MIB</td>
</tr>
<tr>
<td>Unix</td>
<td>/opt/mysql/enterprise/monitor/support-files/MONITOR.MIB</td>
</tr>
</tbody>
</table>

C.1.5 The config.properties file

File location

The repository user name and password are stored in the config.properties file. The following table shows the location of this file on various operating systems:

Table C.4 MySQL Enterprise Monitor: Default path of the config.properties File

<table>
<thead>
<tr>
<th>Operating System</th>
<th>File Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>C:\Program Files\MySQL\Enterprise\Monitor\apache-tomcat \webapps\ROOT\WEB-INF</td>
</tr>
<tr>
<td>Linux and Unix</td>
<td>/opt/mysql/enterprise/monitor/apache-tomcat/webapps/ROOT/WEB-INF</td>
</tr>
</tbody>
</table>

Make sure that the file is secured at the filesystem level so that it cannot be read by anybody but the administrator, or MySQL Enterprise Monitor.

Usage

A generated config.properties file will look similar to:

```plaintext
#SymmetricKey was auto generated. #Wed Feb 27 17:32:14 PST 2013
mysql.port=13306
mysql.user=service_manager
quanal.collect=00:01:00
mysql.db=mem
default.maxActive=70
mysql.use_ssl=true
mysql.server=127.0.0.1
mysql.pass=l33t
key=8E15928C7732FA85
mysql.verify_server_cert=false
```
The application has two connection pools, one to service agent traffic, and the other for the UI. You can configure them as one logical pool with a 85/15 (agent/ui) percentage split, and use "dbPool" as the pool name in the further settings. Or, you can configure each pool separately, where the pool names are "default" and "ui". Note that the names after the "." come verbatim from DBCP at [http://commons.apache.org/proper/commons-dbcp/configuration.html](http://commons.apache.org/proper/commons-dbcp/configuration.html).

### Table C.5 Optional config.properties values

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Property Type</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>data_collection_interval</td>
<td>string</td>
<td>00:01:00</td>
</tr>
<tr>
<td>dbpool.default.initialSize</td>
<td>integer</td>
<td>20</td>
</tr>
<tr>
<td>dbpool.default.maxActive</td>
<td>integer</td>
<td>70</td>
</tr>
<tr>
<td>dbpool.default.maxIdle</td>
<td>integer</td>
<td>20</td>
</tr>
<tr>
<td>dbpool.default.maxWaitMillis</td>
<td>string</td>
<td>30 seconds</td>
</tr>
<tr>
<td>dbpool.default.minEvictableIdleTimeMillis</td>
<td>string</td>
<td>15 seconds</td>
</tr>
<tr>
<td>dbpool.default.minIdle</td>
<td>integer</td>
<td>0</td>
</tr>
<tr>
<td>dbpool.default.timeBetweenEvictionRunsMillis</td>
<td>string</td>
<td>5 seconds</td>
</tr>
<tr>
<td>dbpool.ui.initialSize</td>
<td>integer</td>
<td>5</td>
</tr>
<tr>
<td>dbpool.ui.maxActive</td>
<td>integer</td>
<td>15</td>
</tr>
<tr>
<td>dbpool.ui.maxIdle</td>
<td>integer</td>
<td>5</td>
</tr>
<tr>
<td>dbpool.ui.maxWaitMillis</td>
<td>string</td>
<td>30 seconds</td>
</tr>
<tr>
<td>dbpool.ui.minEvictableIdleTimeMillis</td>
<td>string</td>
<td>15 seconds</td>
</tr>
<tr>
<td>dbpool.ui.minIdle</td>
<td>integer</td>
<td>0</td>
</tr>
<tr>
<td>dbpool.ui.timeBetweenEvictionRunsMillis</td>
<td>string</td>
<td>5 seconds</td>
</tr>
<tr>
<td>graph.cache.period.minutes</td>
<td>string</td>
<td>1</td>
</tr>
<tr>
<td>internal_perf_enable</td>
<td>boolean</td>
<td>false</td>
</tr>
<tr>
<td>internal_perf_server_id</td>
<td>integer</td>
<td></td>
</tr>
<tr>
<td>notify_thread_pool_size</td>
<td>integer</td>
<td>4</td>
</tr>
<tr>
<td>quanal.collect</td>
<td>string</td>
<td>00:01:00</td>
</tr>
<tr>
<td>supportReport.retention.minutes</td>
<td>string</td>
<td>6 hours</td>
</tr>
<tr>
<td>thread_pool_size</td>
<td>integer</td>
<td>8</td>
</tr>
<tr>
<td>ui.javascript.useClientSideStorage</td>
<td>boolean</td>
<td>false</td>
</tr>
</tbody>
</table>

- **graph.cache.period.minutes(1)**

  **Permitted Values**
  
<table>
<thead>
<tr>
<th>Type</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>string</td>
<td>1</td>
</tr>
</tbody>
</table>
  
  Length of time that the graph images are cached in the service monitor.

- **notify_thread_pool_size(4)**

  **Permitted Values**
  
<table>
<thead>
<tr>
<th>Type</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>integer</td>
<td>4</td>
</tr>
</tbody>
</table>
  
  SMTP and SNMP notifications are sent asynchronously, this controls how many threads are used for this process.

- **thread_pool_size(8)**
The `config.properties` file

<table>
<thead>
<tr>
<th>Permitted Values</th>
<th>Type</th>
<th>Permitted Values</th>
<th>Type</th>
<th>Used to handle background jobs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>data_collection_interval(00:01:00)</td>
<td>string</td>
<td>Default</td>
<td>00:01:00</td>
<td>Defaults to one minute, and is never less than one minute. May be set to a value larger than one minute by use of the data_collection_interval property, in hh:mm:ss interval format.</td>
</tr>
<tr>
<td>internal_perf_enable(false)</td>
<td>boolean</td>
<td>Default</td>
<td>false</td>
<td>Enables internal performance monitoring for MySQL Enterprise Monitor (requires deploying some graphs from the resources/ directory).</td>
</tr>
<tr>
<td>quanal.collect(00:01:00)</td>
<td>string</td>
<td>Default</td>
<td>00:01:00</td>
<td>The rate that the service manager asks for query analysis data from the agent and plugins. It is expressed using the hh:mm:ss interval format.</td>
</tr>
<tr>
<td>ui.javascript.useClientSideStorage(false)</td>
<td>boolean</td>
<td>Default</td>
<td>false</td>
<td>Use this instead of cookies to store UI state (not login, but graph selection, etc.) Generally only needed if using a broken proxy that truncates cookie length.</td>
</tr>
<tr>
<td>supportReport.retention.minutes(6 hours)</td>
<td>string</td>
<td>Default</td>
<td>6 hours</td>
<td>The length of time that MySQL Enterprise Monitor will retain the reports generated when using &quot;Support diagnostics&quot; from &quot;Manage Servers&quot;.</td>
</tr>
<tr>
<td>dbpool.ui.initialSize(5)</td>
<td>integer</td>
<td>Default</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
The `config.properties` file

<table>
<thead>
<tr>
<th>Default</th>
<th>5</th>
</tr>
</thead>
</table>

- **dbpool.ui.maxActive(15)**
  - Permitted Values: **integer**
  - Default: 15

- **dbpool.ui.minIdle(0)**
  - Permitted Values: **integer**
  - Default: 0

- **dbpool.ui.maxIdle(5)**
  - Permitted Values: **integer**
  - Default: 5

- **dbpool.ui.maxWaitMillis(30 seconds)**
  - Permitted Values: **string**
  - Default: 30 seconds

- **dbpool.ui.timeBetweenEvictionRunsMillis(5 seconds)**
  - Permitted Values: **string**
  - Default: 5 seconds

- **dbpool.ui.minEvictableIdleTimeMillis(15 seconds)**
  - Permitted Values: **string**
  - Default: 15 seconds

- **dbpool.default.initialSize(20)**
  - Permitted Values: **integer**
  - Default: 20

- **dbpool.default.maxActive(70)**
  - Permitted Values: **integer**
  - Default: 70

- **dbpool.default.minIdle(0)**
  - Permitted Values: **integer**
  - Default: 0
### C.2 MySQL Enterprise Monitor Agent Reference

MySQL Enterprise Monitor Agent provides all of the information from a monitored MySQL server to MySQL Enterprise Service Manager. The MySQL Enterprise Monitor Agent can provide MySQL Enterprise Agent Proxy Service functionality for relaying query analyzer data.

The MySQL Enterprise Monitor Agent is configured through files located within the `etc` subdirectory under the agent installation directory.

Configuration is stored in multiple files, according to a predetermined file and directory layout. The primary configuration file contains specific information about the agent and how the agent communicates with MySQL Enterprise Service Manager. The main configuration is located within the `mysql-monitor-agent.ini` file.

Additional configuration files contain information about the MySQL server that is being monitored. You can configure which directory is used for storing this information within the `mysql-monitor-agent.ini` file. The default location is the `etc/instances` subdirectory within the MySQL Enterprise Monitor Agent directory.

The server you want to monitor should have a directory within the specified location, optionally using the name of the server you are monitoring, and within that directory, an `agent-instance.ini` file. This file contains the configuration information for connecting to the MySQL server, including the host name, port, user credentials and display name.

You can see an example of the file layout of the `etc` directory:

```bash
./init.d
./init.d/mysql-monitor-agent
./instances
./instances/agent
./instances/agent/agent-instance.ini
./mysql-monitor-agent.ini
```

For more information on the configuration of the `mysql-monitor-agent.ini` file, see Section C.2.1, "MySQL Enterprise Monitor Agent Configurable Options". For details on the content of the individual

<table>
<thead>
<tr>
<th>dbpool.default.maxIdle</th>
<th>Type</th>
<th>integer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>dbpool.default.maxWaitMillis</th>
<th>Type</th>
<th>string</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>30 seconds</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>dbpool.default.timeBetweenEvictionRunsMillis</th>
<th>Type</th>
<th>string</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>5 seconds</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>dbpool.default.minEvictableIdleTimeMillis</th>
<th>Type</th>
<th>string</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>15 seconds</td>
<td></td>
</tr>
</tbody>
</table>
C.2.1 MySQL Enterprise Monitor Agent Configurable Options

The `mysql-monitor-agent.ini` file contains the base configuration information for the MySQL Enterprise Monitor Agent. The file sets the core information about the supported functionality for the entire agent. Its format is shown in the following example:

```ini
[mysql-proxy]
# Common Parameters
plugins = proxy,agent,aggr
keepalive = true

log-file = mysql-monitor-agent.log
pid-file = /opt/mysql/enterprise/agent/mysql-monitor-agent.pid

# Agent Parameters
agent-mgmt-hostname = http://localhost:18080/heartbeat
agent-mgmt-username = agent
agent-mgmt-password = foo
agent-uuid = 68b4892c-1310-4f07-8924-3a8b3c0e850b
mysqld-instance-dir = etc/instances

# Aggregator Parameters
aggr-address = :14000
aggr-lua-script = lib/mysql-aggregator/lua/aggr.lua
aggr-mem-baseurl = http://localhost:18080/v2/rest

# Proxy Parameters
proxy-address = :6446
proxy-backend-addresses = 127.0.0.1:3306
proxy-lua-script = lib/mysql-monitor-agent/lua/quan.lua
```

Note
---
Do not copy the agent configuration information from one machine to another without changing the `agent-uuid`. Each agent instance must have a unique agent id.

The main configuration information must be located within the `[mysql-proxy]` section of the configuration file. The main configurable parameters within this file are:

File names in configuration files
---
The MySQL Enterprise Monitor configuration files use the glib file parser to parse settings that define file names. This means that leading and trailing
The MySQL Enterprise Monitor Agent supports the following configurable options:

---

### Table C.6 `mysql-monitor-agent` Help Options

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--help-admin</code></td>
<td>Show options for the admin-module</td>
</tr>
<tr>
<td><code>--help-agent</code></td>
<td>Show agent options</td>
</tr>
<tr>
<td><code>--help-all</code></td>
<td>Show all help options</td>
</tr>
<tr>
<td><code>--help-monitor</code></td>
<td>Show monitor options</td>
</tr>
<tr>
<td><code>--help-proxy</code></td>
<td>Show options for the proxy-module</td>
</tr>
</tbody>
</table>

### Table C.7 `mysql-monitor-agent` Admin Options

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--admin-address</code></td>
<td>Defines the listening address and port for the admin module</td>
</tr>
<tr>
<td><code>--admin-lua-script</code></td>
<td>Script to execute by the admin module</td>
</tr>
<tr>
<td><code>--admin-password</code></td>
<td>Password for authentication for admin module</td>
</tr>
<tr>
<td><code>--admin-username</code></td>
<td>Username for authentication for admin module</td>
</tr>
<tr>
<td><code>--proxy-address</code></td>
<td>Listening address:port of the proxy server</td>
</tr>
</tbody>
</table>

### Table C.8 `mysql-monitor-agent` Agent Options

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--agent-backlog-timeout</code></td>
<td>Maximum time in seconds that the agent keeps data when it cannot communicate with the Service Manager</td>
</tr>
<tr>
<td><code>--agent-collector-plugins</code></td>
<td>Load the specified collector plugins</td>
</tr>
<tr>
<td><code>--agent-connect-timeout</code></td>
<td>The timeout for the agent to connect to the MySQL server</td>
</tr>
<tr>
<td><code>--agent-DNS-cachetimeout</code></td>
<td>The timeout for cache operations</td>
</tr>
<tr>
<td><code>--agent-force-uncorking</code></td>
<td>Forcibly turn off corking (randomization of data collection intervals)</td>
</tr>
<tr>
<td><code>--agent-generate-uuid</code></td>
<td>Generate a UUID for use with the agent-uuid</td>
</tr>
<tr>
<td><code>--agent-heartbeat-interval</code></td>
<td>The interval for generating heartbeat operations</td>
</tr>
<tr>
<td><code>--agent-host-id</code></td>
<td>The host ID for the agent</td>
</tr>
<tr>
<td><code>--agent-host-id-commandline</code></td>
<td>The command to use to generate the agent host id</td>
</tr>
<tr>
<td><code>--agent-hostname</code></td>
<td>Hostname of the agent</td>
</tr>
<tr>
<td><code>--agent-IP-version</code></td>
<td>IP version (4 or 6) to force</td>
</tr>
<tr>
<td><code>--agent-item-files</code></td>
<td>List of data items for additional collections</td>
</tr>
<tr>
<td><code>--agent-master-uuid-discovery</code></td>
<td>Disable the use of the master uuid for topology discovery</td>
</tr>
<tr>
<td><code>--agent-max-response-size</code></td>
<td>Maximum response size for agent data</td>
</tr>
<tr>
<td><code>--agent-mgmt-hostname</code></td>
<td>URL of the management server</td>
</tr>
<tr>
<td><code>--agent-mgmt-password</code></td>
<td>Password for the management server</td>
</tr>
<tr>
<td><code>--agent-mgmt-username</code></td>
<td>User name with the management server</td>
</tr>
</tbody>
</table>
## MySQL Enterprise Monitor Agent Configurable Options

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
<th>Introduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>--agent-net-timeout</td>
<td>The timeout for the agent for established connections to the MySQL server</td>
<td></td>
</tr>
<tr>
<td>--agent-report-network-fs</td>
<td>Enable data collection for networked file systems</td>
<td></td>
</tr>
<tr>
<td>--agent-report-offset</td>
<td>Set the second after the minute when the data is sent to the server</td>
<td></td>
</tr>
<tr>
<td>--agent-run-os-tests</td>
<td>Run the operating system tests and shutdown</td>
<td></td>
</tr>
<tr>
<td>--agent-ssh-keygen-attempts</td>
<td>Number of attempts that the agent should retry, for a failed ssh-keygen</td>
<td>2.3.10</td>
</tr>
<tr>
<td>--agent-ssh-keygen-retry</td>
<td>Time interval (in seconds) between attempts for a failed ssh-keygen attempt</td>
<td>2.3.10</td>
</tr>
<tr>
<td>--agent-sync-attempts</td>
<td>Synchronize the attempts to connect at resync</td>
<td></td>
</tr>
<tr>
<td>--agent-track-alloc</td>
<td>Enable the tracking of the allocation sizes</td>
<td></td>
</tr>
<tr>
<td>--agent-uuid</td>
<td>UUID of this agent</td>
<td></td>
</tr>
<tr>
<td>--mysqld-instance-dir</td>
<td>Location of the MySQL instance configuration (mysql.cnf/mysql.ini) files</td>
<td></td>
</tr>
</tbody>
</table>

### Table C.9 mysql-monitor-agent Monitor Options

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--monitor-interval</td>
<td>Interval for executing queries against the backend</td>
</tr>
<tr>
<td>--monitor-lua-script</td>
<td>Script filename for the monitor</td>
</tr>
<tr>
<td>--monitor-password</td>
<td>Set the password for the monitored MySQL Server</td>
</tr>
<tr>
<td>--monitor-username</td>
<td>Set the username for the monitored MySQL Server</td>
</tr>
</tbody>
</table>

### Table C.10 mysql-monitor-agent Proxy Options

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
<th>Introduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>--no-proxy</td>
<td>Don't start the proxy module</td>
<td></td>
</tr>
<tr>
<td>--proxy-backend-addresses</td>
<td>Address:port of the remote MySQL server</td>
<td></td>
</tr>
<tr>
<td>--proxy-connect-timeout [ ]</td>
<td>Defines the default timeout, for proxy connection operations</td>
<td>2.3.10</td>
</tr>
<tr>
<td>--proxy-fix-bug-25371</td>
<td>Enable the fix for Bug #25371 (for mysqld &gt; 2.0.0.12) for older libmysql versions</td>
<td></td>
</tr>
<tr>
<td>--proxy-lua-script [ ]</td>
<td>Filename for Lua script for proxy operations</td>
<td></td>
</tr>
<tr>
<td>--proxy-pool-no-change-user</td>
<td>Don't use the protocol CHANGE_USER to reset the connection when coming from the connection pool</td>
<td></td>
</tr>
<tr>
<td>--proxy-read-only-backend-addresses</td>
<td>Address:port of the remote MySQL server (read-only)</td>
<td></td>
</tr>
<tr>
<td>--proxy-read-timeout [ ]</td>
<td>Defines the default timeout, for proxy read operations</td>
<td>2.3.10</td>
</tr>
<tr>
<td>--proxy-skip-profiling</td>
<td>Disabled profiling of queries</td>
<td></td>
</tr>
<tr>
<td>--proxy-write-timeout [ ]</td>
<td>Defines the default timeout, for proxy write operations</td>
<td>2.3.10</td>
</tr>
</tbody>
</table>

### Table C.11 mysql-monitor-agent Aggregator Options

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
<th>Introduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>--aggr-address</td>
<td>Listening address:port combination</td>
<td>2.3.0</td>
</tr>
<tr>
<td>--aggr-flush-interval</td>
<td>The interval in seconds between flushes of query data to the MySQL Enterprise Service Manager</td>
<td>2.3.0</td>
</tr>
</tbody>
</table>
MySQL Enterprise Monitor Agent Configurable Options

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
<th>Introduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>--aggr-lua-script</td>
<td>Path to the Lua script</td>
<td>2.3.0</td>
</tr>
<tr>
<td>--aggr-max-request-body-size</td>
<td>Limits the maximum size of requests sent to the Aggregator, to avoid potential out-of-memory errors</td>
<td>2.3.8</td>
</tr>
<tr>
<td>--aggr-mem-baseurl</td>
<td>Base URL of the server</td>
<td>2.3.0</td>
</tr>
<tr>
<td>--aggr-ssl-address</td>
<td>Listening port:address combination for SSL connections</td>
<td>2.3.0</td>
</tr>
<tr>
<td>--aggr-ssl-ca-file</td>
<td>CA certificate file</td>
<td>2.3.0</td>
</tr>
<tr>
<td>--aggr-ssl-cert-file</td>
<td>Server certificate (PEM)</td>
<td>2.3.0</td>
</tr>
<tr>
<td>--aggr-ssl-ciphers</td>
<td>Supported ciphers for SSL</td>
<td>2.3.0</td>
</tr>
<tr>
<td>--aggr-test-mode</td>
<td>Start the aggregator in test mode</td>
<td>2.3.0</td>
</tr>
</tbody>
</table>

Table C.12 mysql-monitor-agent Application Options

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--basedir</td>
<td>Specify the base directory to prepend to paths in the config</td>
</tr>
<tr>
<td>--daemon</td>
<td>Start in daemon-mode</td>
</tr>
<tr>
<td>--defaults-file</td>
<td>Specify the configuration file</td>
</tr>
<tr>
<td>--keepalive</td>
<td>Try to restart the proxy if a crash occurs</td>
</tr>
<tr>
<td>--log-backtrace-on-crash</td>
<td>Try to invoke the debug and generate a backtrace on crash</td>
</tr>
<tr>
<td>--log-file</td>
<td>Specify the file for logging error messages</td>
</tr>
<tr>
<td>--log-level</td>
<td>Logging level</td>
</tr>
<tr>
<td>--log-use-syslog</td>
<td>Log errors to syslog (UNIX/Linux only).</td>
</tr>
<tr>
<td>--lua-cpath</td>
<td>Set the LUA_CPATH</td>
</tr>
<tr>
<td>--lua-path</td>
<td>Set the LUA_PATH</td>
</tr>
<tr>
<td>--max-open-files</td>
<td>Specify the maximum number of open files to support</td>
</tr>
<tr>
<td>--pid-file</td>
<td>PID file to store the process ID (when in daemon mode)</td>
</tr>
<tr>
<td>--plugin-dir</td>
<td>Path to the plugin files</td>
</tr>
<tr>
<td>--plugins</td>
<td>List of plugins to load</td>
</tr>
<tr>
<td>--user</td>
<td>Specify the user to use when running mysql-monitor-agent</td>
</tr>
<tr>
<td>--verbose-shutdown</td>
<td>Report shutdown in the logs regardless of log level</td>
</tr>
<tr>
<td>--version</td>
<td>Show the version information</td>
</tr>
</tbody>
</table>

* --help

**Command-Line Format**  
```
--help
```

Show available help options.

* --help-all

**Command-Line Format**  
```
--help-all
```

Show all help options.

* --help-admin

**Command-Line Format**  
```
--help-admin
```

Show options for the admin-module.
MySQL Enterprise Monitor Agent Configurable Options

- **--help-proxy**

  **Command-Line Format**  
  --help-proxy

  Show options for the proxy-module.

- **--help-monitor**

  **Command-Line Format**  
  --help-monitor

  Show options for the monitor module.

- **--help-agent**

  **Command-Line Format**  
  --help-agent

  Show options for the agent module.

- **--admin-address=host:port**

  **Command-Line Format**  
  --admin-address

  **Permitted Values**
  
  - Type: string
  - Default: :4041

  Specify the host name (or IP address) and port for the administration port. The default is localhost:4041.

- **--admin-lua-script=script**

  **Command-Line Format**  
  --admin-lua-script

  **Permitted Values**
  
  - Type: file name
  - Default

  Specify the script to use for the administration module for the proxy.

- **--admin-password=pass**

  **Command-Line Format**  
  --admin-password

  **Permitted Values**
  
  - Type: string
  - Default

  Define the password to use to authenticate users wanting to connect to the administration module of mysql-monitor-agent. The administration module uses the MySQL protocol to request a username and password for connections.

- **--admin-username=user**

  **Command-Line Format**  
  --admin-username

  **Permitted Values**
  
  - Type: string
  - Default: root

  Define the username to use to authenticate users wanting to connect to the administration module of mysql-monitor-agent. The default username is root. The administration module uses the MySQL protocol to request a username and password for connections.

- **--agent-collector-plugins=user**
MySQL Enterprise Monitor Agent Configurable Options

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--agent-collector-plugins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type numeric</td>
</tr>
<tr>
<td></td>
<td>Default collect_lua</td>
</tr>
</tbody>
</table>

A comma-separated list of the plugins to be used and loaded by the agent and used to provide collector items.

When monitoring servers you must have the agent plugin configured. To support Query Analyzer, you must also have the proxy module enabled. Plugins should be specified as a comma separated list of plugin names.

If you enabled Query Analyzer during installation of the agent, the default value is proxy,agent. If you disabled Query Analyzer during installation, the default value is agent.

- **--agent-connect-timeout=seconds**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--agent-connect-timeout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type numeric</td>
</tr>
<tr>
<td></td>
<td>Default 10</td>
</tr>
</tbody>
</table>

The timeout for the agent to connect to the MySQL server before a failure is reported.

- **--agent-DNS-cachetimeout=seconds**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--agent-DNS-cachetimeout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type numeric</td>
</tr>
<tr>
<td></td>
<td>Default 0, -1 (Never timeout)</td>
</tr>
</tbody>
</table>

The timeout for caching the IP address of a given DNS name. By default, the operating system caching of the address is used and no caching in the agent is performed at all. If you specify -1, caching is enabled and never times out. Any other positive value specifies the timeout value. If you specify this option in the mysql-monitor-agent.ini configuration file, the value is preserved during an upgrade install.

- **--agent-net-timeout=seconds**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--agent-net-timeout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type numeric</td>
</tr>
<tr>
<td></td>
<td>Default 10</td>
</tr>
</tbody>
</table>

The timeout for the agent to get a response from a MySQL server to which it is already connected before the failure is reported.

- **--agent-report-network-fs**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--agent-report-network-fs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type boolean</td>
</tr>
<tr>
<td></td>
<td>Default off</td>
</tr>
</tbody>
</table>

Enables data collection for network file systems. The reporting of network file system information is disabled because the latency in determining and reporting the information can delay the collection
MySQL Enterprise Monitor Agent Configurable Options

and reporting of other information. You must manually enable collection if you need or use advisor and graphs that perform custom data collection on networked file systems.

•  **--agent-force-uncorking**

  **Command-Line Format**

  | **--agent-force-uncorking** |

  Forcibly turn off the corking of responses sent to MySQL Enterprise Service Manager. The corking mechanism tries to randomize the reporting interval of data sent up to the server to prevent flooding the server with information.

  You can combine this option with the **--agent-report-offset** to specify the offset when data is reported to the server. For more information, see **agent-report-offset**.

  The frequency of collecting the data is not modified by this setting.

•  **--agent-generate-uuid**

  **Command-Line Format**

  | **--agent-generate-uuid** |

  Regenerates a UUID for the agent. You can use this to generate a new UUID if you have copied configuration information for an agent from one machine to another. To use:

  shell> /opt/mysql/enterprise/agent/bin/mysql-monitor-agent --agent-generate-uuid ee9296d7-f7cd-4fee-8b26-ead884ebf398

  2009-03-05 11:49:37: (critical) shutting down normally

  For more information, see Section 5.3.5, “Monitoring Multiple MySQL Servers”.

•  **--agent-heartbeat-interval=#**

  **Command-Line Format**

  | **--agent-heartbeat-interval** |

  **Permitted Values**

<table>
<thead>
<tr>
<th><strong>Type</strong></th>
<th><strong>Default</strong></th>
<th><strong>Valid Values</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>numeric</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

  Specify the heartbeat interval. The agent sends heartbeat messages to MySQL Enterprise Service Manager to indicate that it is alive and still running and monitoring servers. The MySQL Enterprise Service Manager uses this information to help identify when an agent is available or not.

•  **--agent-host-id=HOSTID**

  **Command-Line Format**

  | **--agent-host-id** |

  Define the agent host ID. The host ID should be a unique identifier for the host on which the agent is running, and is different to the agent UUID. You can override the host ID for use within HA environments where you have two identical agent configurations, one on a live server, and one on a backup server to be brought into use if the primary server fails. The host ID is used to identify the host by the server, and during failover you want the host ID to remain constant as you monitor either the original or failover (replacement) server.

•  **--agent-ip-version=VERSION**

  **Command-Line Format**

  | **--agent-IP-version** |

  **Permitted Values**

<table>
<thead>
<tr>
<th><strong>Type</strong></th>
<th><strong>Default</strong></th>
<th><strong>Valid Values</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>numeric</td>
<td>any</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>
Specify the IP version to be used and supported by MySQL Enterprise Monitor Agent. By default, the agent supports both IPv4 and IPv6, or you can specify the version by specifying 4 or 6. If you specify this option in the `mysql-monitor-agent.ini` configuration file, the value is preserved during an upgrade install.

- **--host-id-commandline**

  **Command-Line Format**  
  `--agent-host-id-commandline`

  Specify the command line to generate the host ID. By default, the host ID is generated by using a variety of methods configured for a specific platform, including using SSH keys and embedded host ID information. You can replace this with an alternative command-line.

- **--agent-hostname**

  **Command-Line Format**  
  `--agent-hostname`

  Override the automatically determined hostname. You can use this to specify an alternate hostname for the agent. This can be useful if your host has multiple hostnames and you want the machine identified by a specific hostname.

  **Note**

  Setting the hostname using the Manage Servers tab within MySQL Enterprise Monitor User Interface overrides this setting.

- **--agent-item-files**

  **Command-Line Format**  
  `--agent-item-files`

  A comma-separated list of the item files used to load data items that are then collected and sent to MySQL Enterprise Service Manager. For more information, see Section 4.1.10, “Creating a Custom Data Collection Item”.

  The default value includes `share/mysql-monitor-agent/items/quan.lua` (which provides Query Analyzer data) and `share/mysql-monitor-agent/items/items-mysql-monitor.xml` (which provides the core agent monitoring data).

- **--agent-max-response-size**

  **Command-Line Format**  
  `--agent-max-response-size`

  **Permitted Values**  
  Type: numeric

  **Default**  
  65536

  Specify the maximum size of the response packet sent to MySQL Enterprise Service Manager.

- **--agent-ssh-keygen-attempts**

  **Introduced**  
  2.3.10

  **Command-Line Format**  
  `--agent-ssh-keygen-attempts`

  **Permitted Values**  
  Type: numeric

  **Default**  
  10

  Number of attempts that the agent should retry, for a failed ssh-keygen.

- **--agent-ssh-keygen-retry**
### MySQL Enterprise Monitor Agent Configurable Options

<table>
<thead>
<tr>
<th>Introduced</th>
<th>2.3.10</th>
</tr>
</thead>
</table>

#### Command-Line Format

**--agent-ssh-keygen-retry**

**Permitted Values**

<table>
<thead>
<tr>
<th>Type</th>
<th>numeric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>3</td>
</tr>
</tbody>
</table>

Time interval (in seconds) between attempts for a failed ssh-keygen attempt.

- **--agent-master-uuid-discovery**

**Permitted Values**

<table>
<thead>
<tr>
<th>Type</th>
<th>boolean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>true</td>
</tr>
</tbody>
</table>

By default, the MySQL Enterprise Monitor Agent uses the UUID of the replication master to aid in identifying the replication topology. Setting this option to false prevents the agent from accessing the master.info and using the UUID obtained from the replication master. Instead, the hostname and port information is used to determine the topology and match the instance and master information.

- **--agent-mgmt-hostname**

**Permitted Values**

<table>
<thead>
<tr>
<th>Type</th>
<th>string</th>
</tr>
</thead>
</table>

Set the URL of the MySQL Enterprise Service Manager where collected data is sent. The URL should include the username and password for the agents, for example:

```
http://agent:password@memserver:18080/heartbeat
```

**Note**

If you have the `http_proxy` environment variable configured within your environment, add the value of `agent-mgmt-hostname` to the `no_proxy` variable to ensure that data is correctly transmitted to MySQL Enterprise Service Manager and not redirected through the configured proxy address.

- **--agent-mgmt-username**

**Permitted Values**

<table>
<thead>
<tr>
<th>Type</th>
<th>string</th>
</tr>
</thead>
</table>

The username to be used when communicating with MySQL Enterprise Service Manager.

- **--agent-mgmt-password**

**Permitted Values**

<table>
<thead>
<tr>
<th>Type</th>
<th>string</th>
</tr>
</thead>
</table>

The password to be used when communicating with MySQL Enterprise Service Manager.

- **--agent-report-offset**

**Permitted Values**

<table>
<thead>
<tr>
<th>Type</th>
<th>numeric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>random</td>
</tr>
</tbody>
</table>

---

330
The offset, in seconds, past the minute when data is sent up to MySQL Enterprise Service Manager. You can use this to harmonize or synchronize agent report across multiple machines, which can improve performance.

For example, if you set `--agent-report-offset=15`, then data is reported at 15 seconds past each minute. For example, at 12:00:15, 12:01:15, and so on.

- `--agent-run-os-tests`

**Command-Line Format**

```
--agent-run-os-tests
```

Runs the internal operating system tests, and then exits. Using this option generates a large body of information about the various operating system information that can be collected about the host. You can use this to determine whether the agent is collecting the right amount, quantity and quality of information to the server.

The following truncated example shows the format of the output:

```
2010-01-22 16:15:45: (critical) MySQL Monitor Agent 2.2.1.1138 started.
sigar-test-all.c.128 ():
  pid = 1353
sigar-test-all.c.110 ():
  mem.ram = 6080,
  mem.total = 6374154240,
  mem.used = 3356090368,
  mem.free = 3018063872,
  mem.actual_free = 3018063872,
  mem.actual_used = 3356090368
sigar-test-all.c.143 ():
  swap.total = 28523896832,
  swap.used = 710623232,
  swap.free = 27813273600
sigar-test-all.c.169 ():
  cpu.user = 24544920,
  cpu.sys = 136764840,
  cpu.nice = 0,
  cpu.idle = 1234759920,
  cpu.wait = 0,
  cpu.total = 349015500
siger-test-all.c.194 ():
  [0]
    cpu.user = 8516770,
    cpu.sys = 56838970,
    cpu.nice = 0,
    cpu.idle = 283667220,
    cpu.wait = 0,
    cpu.total = 349022960
  [1]
    cpu.user = 6130420,
    cpu.sys = 12671090,
    cpu.nice = 0,
    ...
```

- `--agent-sync-attempts`

**Command-Line Format**

```
--agent-sync-attempts
```

Attempt to synchronize with the server during the resynchronization.

- `--track-alloc`

**Command-Line Format**

```
--agent-track-alloc
```

Track the memory allocation in the various modules of the agent to help monitor the memory usage.
MySQL Enterprise Monitor Agent Configurable Options

- **--agent-uuid**

  **Command-Line Format**
  ```
  --agent-uuid
  ```

  **Permitted Values**
  ```
  Type  string
  ```

  Specify the agent UUID. A UUID is automatically generated for each agent during installation, with the UUID automatically added to the configuration. You can generate a new UUID using the `agent-generate-uuid` command line option.

  If you are setting up multiple hosts and copying the configuration between hosts, make sure that the `agent-uuid` is unique. You can have the agent create a new UUID by leaving this configuration property blank.

- **--basedir**

  **Command-Line Format**
  ```
  --basedir
  ```

  **Permitted Values**
  ```
  Type  file name
  ```

  Specify a base directory that is prepended to all other filename configuration options. Use an absolute (not relative) directory name, otherwise `mysql-monitor-agent` generates an error during startup.

- **--defaults-file**

  **Command-Line Format**
  ```
  --defaults-file
  ```

  Specify a file to use as the file with configuration information. If not specified, configuration options are only taken from the command line.

- **--event-threads=#**

  **Command-Line Format**
  ```
  --event-threads
  ```

  **Permitted Values**
  ```
  Type  numeric
  Default  1
  ```

  Specify the number of event threads reserved to handle incoming requests.

- **--keepalive**

  **Command-Line Format**
  ```
  --keepalive
  ```

  Creates an angel process surrounding the main `mysql-monitor-agent` that attempts to restart the true `mysql-monitor-agent` process in the event a crash or other failure.

  If the agent stops unexpectedly, the angel revives the agent.

  An expected shutdown is:

  - MySQL Enterprise Monitor Agent terminates normally.
  - Shutdown with `SIGTERM`.
  - Startup errors.

  If the angel receives one of `SIGHUP`, `SIGTERM`, or `SIGINT` signals, the signal is forwarded to the agent to initiate shutdown.

- **--agent-backlog-timeout=VALUE**
MySQL Enterprise Monitor Agent Configurable Options

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--agent-backlog-timeout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type numeric</td>
</tr>
</tbody>
</table>

The time in seconds that data is kept by the agent if the agent is unable to communicate with MySQL Enterprise Service Manager. Once the agent reconnects, the data is sent up to MySQL Enterprise Service Manager. Data older than the specified value is discarded. The default value is 600 seconds.

- **--aggr-address=host:port**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--aggr-address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
<tr>
<td></td>
<td>Default *:14000</td>
</tr>
</tbody>
</table>

Specify the listening hostname, port, or both for the MySQL Enterprise Agent Aggregator.

- **--log-backtrace-on-crash**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--log-backtrace-on-crash</th>
</tr>
</thead>
</table>

Logs the backtrace to the error log and tries to initialize the debugger in the event of a failure.

- **--aggr-lua-script=SCRIPT**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--aggr-lua-script</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
</tbody>
</table>

Specify the script to be used for MySQL Enterprise Agent Aggregator operations.

- **--aggr-max-request-body-size=bytes**

  | Introduced                   | 2.3.8                        |
  | Command-Line Format          | --aggr-max-request-body-size |
  | Permitted Values             | Type numeric                 |
  |                              | Default 1048576              |

Limits the maximum size of requests sent to the Aggregator, to avoid potential out-of-memory errors on the system running the Agent (and its Aggregator component).

- **--aggr-mem-baseurl=URL**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--aggr-mem-baseurl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
</tbody>
</table>

Base URL of the MySQL Enterprise Service Manager to be used when sending aggregated queries collected from client plugins.

- **--aggr-ssl-address=host:port**

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--aggr-ssl-address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
<tr>
<td></td>
<td>Default *:14001</td>
</tr>
</tbody>
</table>

The listening hostname, port, or both to be used when listening for SSL connections.

- **--aggr-ssl-ca-file=FILENAME**
### MySQL Enterprise Monitor Agent Configurable Options

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--aggr-ssl-ca-file</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
</tbody>
</table>

The CA chain file to be used for SSL communication.

- `--aggr-ssl-cert-file=FILENAME`

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--aggr-ssl-cert-file</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
</tbody>
</table>

The server certificate for the MySQL Enterprise Agent Aggregator. This should be in the form of a PEM file, consisting of a combination of the private key and the signing certificate.

- `--aggr-ssl-ciphers=STRING`

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--aggr-ssl-ciphers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
</tbody>
</table>

List of the ciphers to be used for secure communication using SSL.

- `--aggr-test-mode`

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--aggr-test-mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
</tbody>
</table>

Start MySQL Enterprise Agent Aggregator in test mode.

- `--log-file=filename`

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--log-file</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type file name</td>
</tr>
</tbody>
</table>

Specify the name of a file to be used to record log information. If you do not specify a full path name, then the log file location is considered to be relative to the installation directory of the agent.

- `--log-level=level`

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--log-level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type enumeration</td>
</tr>
<tr>
<td>Default</td>
<td>critical</td>
</tr>
<tr>
<td>Valid Values</td>
<td>error (Show error messages)</td>
</tr>
<tr>
<td></td>
<td>warning (Show only warning messages)</td>
</tr>
<tr>
<td></td>
<td>info (Show informational messages)</td>
</tr>
<tr>
<td></td>
<td>message (Show information about agent and basic processing)</td>
</tr>
<tr>
<td></td>
<td>critical (Show critical messages highlighting agent problems)</td>
</tr>
<tr>
<td></td>
<td>debug (Show detailed information, including info provided to server)</td>
</tr>
</tbody>
</table>

The log level used when outputting error messages. Messages of that level (or lower) are output. For example, `message` also outputs `info`, `warning`, and `error` messages.
**Warning**

Be careful when setting the `log-level` to `debug`. Doing this rapidly increases the size of your `mysql-monitor-agent.log` file. To avoid disk space problems, put the log files on a different drive from your MySQL server and the MySQL Enterprise Monitor User Interface.

It is strongly recommended that you use a `log-level` of `critical` or `error` in a production server. Use the higher-levels to provide more detailed information only for debugging problems with your agent.

Under Windows, if you restart the agent from the command line after setting the `log-level` to `debug`, extensive debug information is displayed to the console as well as to the log file.

- **--log-use-syslog**

  **Command-Line Format**  
  `--log-use-syslog`

  Causes errors to be sent to the syslog (Unix/Linux only).

- **--lua-cpath=path**

  **Command-Line Format**  
  `--lua-cpath`

  **Permitted Values**

<table>
<thead>
<tr>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>file name</td>
</tr>
</tbody>
</table>

  Specify the `LUA_CPATH` to be used when loading compiled modules or libraries for Lua scripts.

- **--lua-path=path**

  **Command-Line Format**  
  `--lua-path`

  **Permitted Values**

<table>
<thead>
<tr>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>file name</td>
</tr>
</tbody>
</table>

  Specify the `LUA_CPATH` to be used when loading modules for Lua.

- **--max-open-files=#**

  **Command-Line Format**  
  `--max-open-files`

  **Permitted Values**

<table>
<thead>
<tr>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>numeric</td>
</tr>
</tbody>
</table>

  The maximum number of open files and sockets supported by the `mysql-monitor-agent` process. Increase the value if required to run particular scripts.

- **--monitor-interval=#**

  **Command-Line Format**  
  `--monitor-interval`

  **Permitted Values**

<table>
<thead>
<tr>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>numeric</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Default</th>
<th>Min</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

  Execute queries against the backends at this interval. The default is 1.

- **--monitor-lua-script=SCRIPT**

  **Command-Line Format**  
  `--monitor-lua-script`
<table>
<thead>
<tr>
<th>Permitted Values</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filename of the Lua script to use for the monitor module.</td>
<td>string</td>
</tr>
</tbody>
</table>

- `--monitor-password=PASS`

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--monitor-password</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
</tbody>
</table>

The password for the monitoring user account.

- `--monitor-username=USER`

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--monitor-username</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
<tr>
<td>Default</td>
<td>monitor</td>
</tr>
</tbody>
</table>

The username for the monitoring user account.

- `--mysqld-instance-dir=PATH`

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--mysqld-instance-dir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type string</td>
</tr>
</tbody>
</table>

The path to the configuration files for the MySQL instance.

- `--agent-IP-version=VER`

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--agent-IP-version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type numeric</td>
</tr>
<tr>
<td>Default</td>
<td>any</td>
</tr>
<tr>
<td>Valid Values</td>
<td>4</td>
</tr>
</tbody>
</table>

Explicitly sets the IP version to be used for addressing. By default, the agent uses either version. Set the value by specifying 4 (for IPv4) or 6 (for IPv6).

- `--aggr-flush-interval=seconds`

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--aggr-flush-interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type numeric</td>
</tr>
<tr>
<td>Default</td>
<td>60</td>
</tr>
</tbody>
</table>

The interval at which queries are flushed to the MySQL Enterprise Service Manager. The default value is 60.

- `--no-proxy`

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--no-proxy</th>
</tr>
</thead>
</table>

Disable the proxy module.

- `--plugin-dir=path`

<table>
<thead>
<tr>
<th>Command-Line Format</th>
<th>--plugin-dir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permitted Values</td>
<td>Type</td>
</tr>
<tr>
<td>------------------</td>
<td>------------</td>
</tr>
<tr>
<td>--plugins=plugin,...</td>
<td>file name</td>
</tr>
</tbody>
</table>

- **--plugins=plugin,...**

  **Command-Line Format**: `--plugins`
  **Permitted Values**: `Type string`

  A comma-separated list of the plugins to be loaded.

- **--proxy-address=host:port**

  **Command-Line Format**: `--proxy-address`
  **Permitted Values**: `Type string`
  | Default | :6446 |

  The listening host name (or IP address) and port of the proxy service. The default is :6446 (all IPs on port 6446). The setting is used when employing Query Analysis as the address/port that you must configure your application to use in place of your normal MySQL server. By default this item is set during installation.

- **--proxy-read-only-backend-addresses=host:port**

  **Command-Line Format**: `--proxy-read-only-backend-addresses`
  **Permitted Values**: `Type string`

  The listening host name (or IP address) and port of the proxy server for read-only connections. The default is for this information not to be set.

- **--proxy-backend-addresses=host:port**

  **Command-Line Format**: `--proxy-backend-addresses`
  **Permitted Values**: `Type string`
  | Default | 127.0.0.1:3306 |

  The host name (or IP address) and port of the MySQL server to connect to. You can specify multiple backend servers by supplying multiple options. Clients are connected to each backend server in round-robin fashion. For example, if you specify two servers A and B, the first client connection goes to server A; the second client connection goes to server B; and the third client connection goes to server A.

- **--proxy-pool-no-change-user**

  **Command-Line Format**: `--proxy-pool-no-change-user`

  Disables the use of the MySQL protocol `CHANGE_USER` when re-using a connection from the pool of connections specified by the `backend-addresses` list.

- **--proxy-skip-profiling**

  **Command-Line Format**: `--proxy-skip-profiling`

  Disables profiling of queries (tracking time statistics). The default is for tracking to be enabled.

- **--proxy-fix-bug-25371**
**Command-Line Format**  
`--proxy-fix-bug-25371`

Gets round an issue when connecting to a MySQL server later than 5.1.12 when using a MySQL client library of any earlier version.

-  
-  
-  
-  
-  
-  

**Command-Line Format**  
`--daemon`

Starts the proxy in daemon mode.

-  

**Command-Line Format**  
`--pid-file=file`

**Permitted Values**  

<table>
<thead>
<tr>
<th>Type</th>
<th>file name</th>
</tr>
</thead>
</table>

Sets the name of the file that stores the process ID. This is used by the script that shuts down the agent to identify the process to be shut down. The default value is the `mysql-monitor-agent.pid` file within the base installation directory as created by the agent.

-  

**Command-Line Format**  
`--user=user`

**Permitted Values**  

<table>
<thead>
<tr>
<th>Type</th>
<th>string</th>
</tr>
</thead>
</table>

Run `mysql-monitor-agent` as the specified user.

-  

**Command-Line Format**  
`--version`

Show the version number.

-  

**Command-Line Format**  
`--verbose-shutdown`

**Permitted Values**  

<table>
<thead>
<tr>
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<th>boolean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>off</td>
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</tbody>
</table>

By default, agent shutdown messages are only logged if you have set `log-level` to `message` or higher. You can force shutdown messages to be reported regardless of the log level using this option.

### C.2.2 MySQL Server *(agent-instance.ini)* Configuration

This section provides reference information about the `agent-instance.ini` configuration file, supplementing the usage information in Section 5.3, "Monitor Agent Installation".

For each MySQL server that you want to monitor, create an `agent-instance.ini` file in the directory specified by the `mysql-instance-dir` configuration parameter inside the main `mysql-monitor-agent.ini` file. This file contains the host name and user credentials for connecting to the MySQL server to monitor. The format of the file is as follows:
# To use this .ini file as a template for configuring additional instances to monitor, do not simply copy and re-start the agent without first modifying the parameters below to match the login credentials for the new instance.

# Refer to the documentation for more detailed information and instructions.

```ini
[mysqld]
user     = agent
password = somepass
hostname = 127.0.0.1
port     = 3306

[replication]
discovery-username = agentdiscovery
discovery-password = password
```

The individual configuration parameters can be defined as follows, as either a [replication] or [mysqld] option.

### [mysqld]

- **hostname**: The host name of the MySQL server to monitor.
- **port**: The TCP/IP port of the MySQL server to monitor.
- **user**: The user ID that connects to the MySQL server to monitor.
- **password**: The password for the user ID specified by the `user` option.
- **connection-init-retry-attempts**: The number of times to retry when the initial connection to the monitored MySQL server fails. The default is 10. Do not specify this option and the following `connection-init-retry-delay-ms` option are only needed if some combination of database load and network traffic cause intermittent connection failures for the Agent, and you need to increase the default values.
- **connection-init-retry-delay-ms**: The number of milliseconds to wait before trying again after a connection failure.
- **socket**: To configure the agent to use sockets, during installation, select “socket” rather than “TCP/IP” from the menu, then specify the socket name. To switch to a socket connection after installation, edit the `agent-instance.ini` configuration file and add the line:

```
socket = /full/path/to/mysql.sock
```

- **inventory-schema**: If your system configuration does not allow creating tables inside the `mysql` schema, specify another schema to hold the inventory table that records the server UUID:

```
inventory-schema = schema_name
```

### [replication]

Replication topology discovery for an instance is determined by the agent using the `master.info` file for the instance, extracting the username/password to connect to the master, and then retrieving the MySQL Enterprise Monitor generated UUID of the replication master. The MySQL Enterprise Monitor Agent can then match the slave and master in the replication topology.

- **agent-master-uuid-discovery**: To switch off the use of the master UUID entirely when determining the replication topology, see also `agent-master-uuid-discovery` option.
- **discovery-password**: Alternative password used for retrieving the master UUID.
- **discovery-username**: Alternative username used for retrieving the master UUID.
• **master-info-file**: A file path to the `master.info`, that will override the value in the database.

### C.2.3 Agent Log and pid Files

The locations of the agent log files are as follows:

- **Windows**: `C:\Program Files\MySQL\Enterprise\Agent\mysql-monitor-agent.log`
- **Unix**: `/opt/mysql/enterprise/agent/mysql-monitor-agent.log`

On any platform, you can change the name and location of the agent log file. To confirm the location and the name, check the settings in the `mysql-monitor-agent.ini` file.

The maximum size of a log file may be limited to 2GB. If MySQL Enterprise Monitor Agent cannot add information to the configured logfile, information is sent to the standard output instead.

Because the log files can become quite large, you can use a tool such as `logrotate` (Unix/Linux) or `logadm` (Solaris) to automatically rotate the logs. The following example shows a sample `logrotate` definition:

```plaintext
/opt/mysql/enterprise/agent/mysql-monitor-agent.log {
  rotate 5
  daily
  minsize 1G
  postrotate
    /usr/bin/killall -HUP mysql-monitor-agent
  endscript
}
```

The above rotates the log before it reaches 1GB in size, keeping up to 5 files at a time.

To use your own system, you can copy the log file, flush the contents, and then send the `SIGHUP` signal to the agent process. On Windows, shut down before copying the log, then restart the agent afterward.

The locations of the agent pid files are as follows:

- **Windows**: `C:\Program Files\MySQL\Enterprise\Agent\agent\mysql-monitor-agent.pid`
- **Unix**: `/opt/mysql/enterprise/agent/mysql-monitor-agent.pid`

On any platform, you can change the name and location of the agent log file. To confirm the location and the name, check the settings in the `mysql-monitor-agent.ini` file.
Appendix D Data Collection Items

Note
MySQL Enterprise subscription, MySQL Enterprise Monitor, MySQL Replication Monitor, and MySQL Query Analyzer are only available to commercial customers. To learn more, see: http://www.mysql.com/products/.

This appendix documents the data collection items used to create rules and graphs. These items are listed in the order that they appear in the Data Item drop-down list box when creating a rule definition. For more information about creating and editing rules, see Section 2.3.3, “Editing Built-in Rules” and Section 4.1.3, “Overview of Rule Creation”.

Table D.1 MySQL Monitor Data Items

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<th>Namespace Type</th>
<th>Attribute</th>
<th>Type</th>
<th>Description</th>
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<td>Whether NULL is allowed.</td>
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<td>Attribute</td>
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<td>Description</td>
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<td>long</td>
<td>An estimate of the number of unique values (cardinality) in the index.</td>
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<td>mysql</td>
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<td>Collation</td>
<td>string</td>
<td>How the column is sorted in the index.</td>
</tr>
<tr>
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<td>index</td>
<td>Column_name</td>
<td>string</td>
<td>The column name.</td>
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<td>index</td>
<td>Comment</td>
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<td>Remarks about the index.</td>
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<td>mysql</td>
<td>index</td>
<td>Index_type</td>
<td>string</td>
<td>The index method used (BTREE, FULLTEXT, HASH, RTREE)</td>
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<td>Key_name</td>
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<td>The name of the index.</td>
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<tr>
<td>mysql</td>
<td>index</td>
<td>Non_unique</td>
<td>long</td>
<td>Whether the index can contain duplicates.</td>
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<tr>
<td>mysql</td>
<td>index</td>
<td>Null</td>
<td>string</td>
<td>Whether the column may contain NULL values.</td>
</tr>
<tr>
<td>mysql</td>
<td>index</td>
<td>Packed</td>
<td>string</td>
<td>Whether the key is packed.</td>
</tr>
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<td>index</td>
<td>Seq_in_index</td>
<td>long</td>
<td>The column sequence number in the index, starting with 1</td>
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<td>mysql</td>
<td>index</td>
<td>Sub_part</td>
<td>string</td>
<td>The number of indexed characters if the column is only partly indexed.</td>
</tr>
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<td>mysql</td>
<td>index</td>
<td>Table</td>
<td>string</td>
<td>The name of the table associated with the index.</td>
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<td>mysql</td>
<td>innodb_compression_time</td>
<td>innodb_compression_seconds</td>
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<td>The total memory allocated for the additional buffer pool measured in bytes.</td>
</tr>
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<td>innodb_lock_wait_transactions</td>
<td>innodb_lock_wait_transactions</td>
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</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_created_per_sec</td>
<td>double</td>
<td>The number of buffer pool pages created per second.</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_db_pages</td>
<td>long</td>
<td>The current number of buffer pool pages.</td>
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<tr>
<td>mysql</td>
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<td>innodb_bp_dictionary_alloc</td>
<td>long</td>
<td>Size in bytes allocated to the data dictionary tables/indexes.</td>
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<td>innodbstatus</td>
<td>innodb_bp_free_buffers</td>
<td>long</td>
<td>The current number of free buffer pool pages.</td>
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<td>innodbstatus</td>
<td>innodb_bp_hit_rate</td>
<td>long</td>
<td>The buffer pool hit rate.</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_io_cur_pages</td>
<td>long</td>
<td>The number of Buffer Pool LRU list pages accessed total, for the last second.</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_io_sum_pages</td>
<td>long</td>
<td>The number of Buffer Pool LRU list pages accessed total, for the last 50 seconds.</td>
</tr>
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<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_io_unzip_cur_pages</td>
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<td>The number of Buffer Pool unzip LRU list pages accessed total, for the last second.</td>
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<td>Namespace</td>
<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
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</tr>
<tr>
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<td>innodbstatus</td>
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<td>long</td>
<td>The number of Buffer Pool unzip LRU list pages accessed total, for the last 50 seconds</td>
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<tr>
<td>mysql</td>
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<td>innodb_bp_lru_len</td>
<td>long</td>
<td>The size in 16Kb pages of the Buffer Pool LRU list</td>
</tr>
<tr>
<td>mysql</td>
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<td>long</td>
<td>The current number of pages modified.</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_not_young_hit_rate</td>
<td>long</td>
<td>The rate at which pages have been made not young for the past 15 seconds</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_old_db_pages</td>
<td>long</td>
<td>The total number of pages created.</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_pages_created</td>
<td>long_counter</td>
<td>The average number of pages evicted without being accessed for the last 15 seconds</td>
</tr>
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<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_pages_evicted_no_access_per_sec</td>
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<td>The number of pages made not young in the Buffer Pool LRU list</td>
</tr>
<tr>
<td>mysql</td>
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<td>innodb_bp_pages_not_young</td>
<td>long_counter</td>
<td>The per second average of the pages made young in the Buffer Pool LRU list for the last 15 seconds</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_pages_not_young_per_sec</td>
<td>double</td>
<td>The total number of pages read.</td>
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<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
<td>Description</td>
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<tr>
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<td>The average of read ahead operations per second for the last 15 seconds</td>
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<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_pages_written</td>
<td>long_counter</td>
<td>The total number of pages written.</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_pages_young</td>
<td>long_counter</td>
<td>The number of pages made young in the Buffer Pool LRU list</td>
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<td>innodb_bp_pages_young_per_sec</td>
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<td>mysql</td>
<td>innodbstatus</td>
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<td>long</td>
<td>The number of pending page writes.</td>
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<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_pending_writes_filling_list</td>
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<td>The number of pages to be flushed during checkpointing.</td>
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<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_pending_writes_lru</td>
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<td>The number of old dirty pages to be written from the bottom of the LRU list.</td>
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<tr>
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<td>The number of pending independent page writes.</td>
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<td>The number of buffer pool reads per second.</td>
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<tr>
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<td>innodb_bp_size</td>
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<td>The total buffer pool size in bytes.</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_total_alloc</td>
<td>long</td>
<td>The total memory allocated for the buffer pool.</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_unzip_lru_len</td>
<td>long</td>
<td>The size in 16Kb pages of the Buffer Pool unzip_LRU list</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_written_per_sec</td>
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<td>The number of buffer pool</td>
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<th>Namespace</th>
<th>Namespace Type</th>
<th>Attribute</th>
<th>Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_bp_young_hit_rate</td>
<td>long</td>
<td>The rate at which pages have been made young for the past 15 seconds.</td>
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<td>innodb_bytes_per_read</td>
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<td>The number of bytes per read.</td>
</tr>
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<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_datetime</td>
<td>string</td>
<td>The date and time the SHOW ENGINE INNODB STATUS snapshot was taken.</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_hash_node_heap</td>
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<td>Number of buffer pool pages reserved for the Adaptive Hash Index.</td>
</tr>
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<td>innodb_hash_searches_per_sec</td>
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<td>The number of hash searches per second.</td>
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<td>innodbstatus</td>
<td>innodb_hash_table_size</td>
<td>long</td>
<td>The size of the hash table.</td>
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<td>innodb_hash_used_cells</td>
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<td>Number of buffer pool pages used for the Adaptive Hash Index.</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_ibuf_free_list_len</td>
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<td>The length of the free list for the Insert Buffer index.</td>
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<td>innodb_ibuf_inserts</td>
<td>long_counter</td>
<td>The number of change buffer inserts.</td>
</tr>
<tr>
<td>mysql</td>
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<td>innodb_ibuf_merged_recs</td>
<td>long_counter</td>
<td>The number of change buffer merged records.</td>
</tr>
<tr>
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<td>innodb_ibuf_merges</td>
<td>long_counter</td>
<td>The number of change</td>
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<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
<td>Description</td>
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<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_ibuf_seg_size</td>
<td>long</td>
<td>The Insert Buffer index header and tree size, in 16Kb pages</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_ibuf_size</td>
<td>long</td>
<td>The Insert Buffer index tree size, in 16Kb pages</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_io_ibuf_logs</td>
<td>long</td>
<td>The number of pending log I/Os.</td>
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<td>innodb_io_ibuf_reads</td>
<td>long</td>
<td>The number of pending change buffer reads.</td>
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<td>innodbstatus</td>
<td>innodb_io_ibuf_syncs</td>
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</tr>
<tr>
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<td>innodb_io_os_file_fsyncs</td>
<td>long_counter</td>
<td>The number of OS fsyncs.</td>
</tr>
<tr>
<td>mysql</td>
<td>innodbstatus</td>
<td>innodb_io_os_file_reads</td>
<td>long_counter</td>
<td>The number of OS file reads.</td>
</tr>
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<td>innodbstatus</td>
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<td>long_counter</td>
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<td>innodb_io_pending_flush_bp</td>
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<td>The number of pending buffer pool flush operations.</td>
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<td>innodb_io_syncs_per_sec</td>
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<td>The number of fsyncs() per second.</td>
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<td>The 64-bit variant of innodb_log_checkpoint_lsn (2.3.10+).</td>
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<td>The point up to which the log was last flushed.</td>
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<td>The number of nonadaptive hash index searches.</td>
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<td>innodbstatus innodb_per_sec_avg</td>
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<td>The number of seconds the averages for SHOW INNODB STATUS were calculated from.</td>
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<td>The number of reads per second.</td>
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<td>innodbstatus innodb_row_queries_inside</td>
<td>long</td>
<td>The number of queries executing inside InnoDB.</td>
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<tr>
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<td>long_counter</td>
<td>The number of rows deleted from InnoDB tables.</td>
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<td>The number of rows inserted into InnoDB tables.</td>
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<td>The number of rows updated per second in InnoDB tables.</td>
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<td>The number of semaphore/mutex waits</td>
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<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
<td>Description</td>
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<td>The number of semaphore/ mutex round for the internal sync array.</td>
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<td>The number of semaphore/ mutexspin waits for the internal sync array.</td>
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<td>The number of times a mutex wait was added to the internal sync array.</td>
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<tr>
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<td>The number of exclusive (write) semaphore waits yielded to the OS.</td>
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<td>Performance. InnoDB</td>
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<td>The transaction history list length.</td>
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<td>mysql</td>
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<td>long_counter</td>
<td>Decoded decimal representation of the hex transaction ID counter in the latest InnoDB</td>
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<td>The transaction counter roll over variable.</td>
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<td>mysql</td>
<td>innodbstatus</td>
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<td>The main transaction count.</td>
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<td>The hex string based transaction ID counter in the latest InnoDB</td>
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<td>The transaction count that is already purged.</td>
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<td>The number of InnoDB writes per second.</td>
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<td>long</td>
<td>The size of a binary log file.</td>
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<td>filecount</td>
<td>long</td>
<td>The number of binary log files.</td>
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| mysql     | masterlogs     | filesizesum | long           | The total size of all the
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<th>Namespace Type</th>
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<td>user_spec</td>
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<td>processlist</td>
<td>Command</td>
<td>string</td>
<td>The type of command the thread is executing.</td>
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<td>db</td>
<td>string</td>
<td>The default database, if one is selected.</td>
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<td>processlist</td>
<td>Host</td>
<td>string</td>
<td>The host name of the client issuing the statement.</td>
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<tr>
<td>Namespace</td>
<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
<td>Description</td>
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<td>Id</td>
<td>long</td>
<td>The connection identifier.</td>
</tr>
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<td>processlist</td>
<td>Info</td>
<td>string</td>
<td>The statement that the thread is executing.</td>
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<td>processlist</td>
<td>State</td>
<td>string</td>
<td>An action, event, or state that indicates what the thread is doing.</td>
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<td>processlist</td>
<td>Time</td>
<td>long</td>
<td>The time in seconds that the thread has been in its current state.</td>
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<td>User</td>
<td>string</td>
<td>The MySQL user who issued the statement.</td>
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<td>blackout</td>
<td>string</td>
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<td>Server</td>
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<td>string</td>
<td>The display name of the server in the Dashboard.</td>
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<td>Server</td>
<td>server.connected</td>
<td>long</td>
<td>Whether the server is connected.</td>
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<td>mysql</td>
<td>Server</td>
<td>server.last_errno</td>
<td>string</td>
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<td>Count of XA COMMIT statements.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Com_xa_end</td>
<td>long_counter</td>
<td>Count of XA END statements.</td>
</tr>
<tr>
<td>Namespace</td>
<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
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<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Com_xa_prepare</td>
<td>long_counter</td>
<td>Count of XA PREPARE statements.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Com_xa_recover</td>
<td>long_counter</td>
<td>Count of XA RECOVER statements.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Com_xa_rollback</td>
<td>long_counter</td>
<td>Count of XA ROLLBACK statements.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Com_xa_start</td>
<td>long_counter</td>
<td>Count of XA START statements.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Compression</td>
<td>string</td>
<td>General.Features</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Connections</td>
<td>long_counter</td>
<td>The number of connection attempts.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Created_tmp_disk_tables</td>
<td>long_counter</td>
<td>General.Temporary</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Created_tmp_files</td>
<td>long_counter</td>
<td>How many temporary files mysqld has created.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Created_tmp_tables</td>
<td>long_counter</td>
<td>How many temporary tables mysqld has created.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Delayed_errors</td>
<td>long_counter</td>
<td>Performance.Delayed</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Delayed_insert_threads</td>
<td>long</td>
<td>The number of INSERT DELAYED thread handlers in use. For non-transactional tables only.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Delayed_writes</td>
<td>long_counter</td>
<td>The number of INSERT DELAYED rows written. For non-transactional tables only.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>displayname</td>
<td>string</td>
<td>The display name of the server in the Dashboard.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Flush_commands</td>
<td>long_counter</td>
<td>The number of FLUSH statements executed.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>groupname</td>
<td>string</td>
<td>The name of the group</td>
</tr>
<tr>
<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
<td>Description</td>
<td></td>
</tr>
<tr>
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<td>-----------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>mysql status</td>
<td>Handler_commit</td>
<td>long_counter</td>
<td>The number of internal COMMIT statements.</td>
<td></td>
</tr>
<tr>
<td>mysql status</td>
<td>Handler_delete</td>
<td>long_counter</td>
<td>The number of times that rows have been deleted from tables.</td>
<td></td>
</tr>
<tr>
<td>mysql status</td>
<td>Handler_discover</td>
<td>long_counter</td>
<td>The number of times that tables have been discovered.</td>
<td></td>
</tr>
<tr>
<td>mysql status</td>
<td>Handler_prepare</td>
<td>long_counter</td>
<td>A counter for the prepare phase of two-phase commit operations.</td>
<td></td>
</tr>
<tr>
<td>mysql status</td>
<td>Handler_read_first</td>
<td>long_counter</td>
<td>The number of times the first entry was read from an index.</td>
<td></td>
</tr>
<tr>
<td>mysql status</td>
<td>Handler_read_key</td>
<td>long_counter</td>
<td>The number of requests to read a row based on a key.</td>
<td></td>
</tr>
<tr>
<td>mysql status</td>
<td>Handler_read_next</td>
<td>long_counter</td>
<td>The number of requests to read the next row in key order.</td>
<td></td>
</tr>
<tr>
<td>mysql status</td>
<td>Handler_read_prev</td>
<td>long_counter</td>
<td>The number of requests to read the previous row in key order.</td>
<td></td>
</tr>
<tr>
<td>mysql status</td>
<td>Handler_read_rnd</td>
<td>long_counter</td>
<td>The number of requests to read a row based on a fixed position.</td>
<td></td>
</tr>
<tr>
<td>mysql status</td>
<td>Handler_read_rnd_next</td>
<td>long_counter</td>
<td>The number of requests to read the next row in the data file.</td>
<td></td>
</tr>
<tr>
<td>Namespace</td>
<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
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<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Handler_rollback</td>
<td>long_counter</td>
<td>Miscellaneous.Handler</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Handler_savepoint</td>
<td>long_counter</td>
<td>The number of requests for a storage engine to place a savepoint.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Handler_savepoint_rollback</td>
<td>long_counter</td>
<td>The number of requests for a storage engine to roll back to a savepoint.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Handler_update</td>
<td>long_counter</td>
<td>The number of requests to update a row in a table.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Handler_write</td>
<td>long_counter</td>
<td>The number of requests to insert a row in a table.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_buffer_pool_pages_data</td>
<td>long</td>
<td>The number of pages containing data (dirty or clean)</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_buffer_pool_pages_dirty</td>
<td>long</td>
<td>The number of pages currently dirty in the InnoDB buffer pool.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_buffer_pool_pages_filed</td>
<td>long_counter</td>
<td>The number of page flush requests in the InnoDB buffer pool.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_buffer_pool_pages_free</td>
<td>long</td>
<td>The number of InnoDB buffer pool pages free.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_buffer_pool_pages_latched</td>
<td>long</td>
<td>The number of latched pages in InnoDB buffer pool.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_buffer_pool_pages_make</td>
<td>long</td>
<td>Performance.InnoDB</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_buffer_pool_pages_to_orig</td>
<td>long</td>
<td>The total size of the InnoDB buffer pool, in pages.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_buffer_pool_read_ahead</td>
<td>long_counter</td>
<td>The number of random</td>
</tr>
<tr>
<td>Namespace</td>
<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
<td>Description</td>
</tr>
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</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_buffer_pool_read_ahead_seq</td>
<td>long_counter</td>
<td>The number of sequential read-aheads initiated by InnoDB.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_buffer_pool_read_requests</td>
<td>long_counter</td>
<td>The number of logical read requests InnoDB has done.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_buffer_pool_reads</td>
<td>long_counter</td>
<td>Performance.InnoDB</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_buffer_pool_wait_free</td>
<td>long_counter</td>
<td>Number of waits for pages to be flushed.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_buffer_pool_write_requests</td>
<td>long_counter</td>
<td>The number of writes done to the InnoDB buffer pool.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_data_fsyncs</td>
<td>long_counter</td>
<td>The number of fsync() operations so far.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_data_pending_fsyncs</td>
<td>long</td>
<td>The current number of pending fsync() operations.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_data_pending_reads</td>
<td>long</td>
<td>The current number of pending reads.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_data_pending_writes</td>
<td>long</td>
<td>The number of pending writes.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_data_read</td>
<td>long_counter</td>
<td>The amount of data read so far, in bytes.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_data_reads</td>
<td>long_counter</td>
<td>The total number of data reads.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_data_writes</td>
<td>long_counter</td>
<td>The total number of data writes.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_data_written</td>
<td>long_counter</td>
<td>The amount of data written in bytes.</td>
</tr>
<tr>
<td>Namespace</td>
<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
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<td>---------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_dblwr_pages_written</td>
<td>long_counter</td>
<td>The number of doublewrite pages that have been written.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_dblwr_writes</td>
<td>long_counter</td>
<td>The number of doublewrite operations that have been performed.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_log_waits</td>
<td>long_counter</td>
<td>Performance.InnoDB</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_log_write_requests</td>
<td>long_counter</td>
<td>The number of log write requests.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_log_writes</td>
<td>long_counter</td>
<td>The number of physical writes to the log.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_os_log_fsyncs</td>
<td>long_counter</td>
<td>The number of fsync() writes done to the log file.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_os_log_pending_fsync</td>
<td>long_counter</td>
<td>The number of pending log file fsync() operations.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_os_log_pending_writes</td>
<td>long_counter</td>
<td>The number of pending log file writes.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_os_log_written</td>
<td>long_counter</td>
<td>The number of bytes written to the log file.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_page_size</td>
<td>long</td>
<td>The compiled-in InnoDB page size.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_pages_created</td>
<td>long_counter</td>
<td>The number of pages created.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_pages_read</td>
<td>long_counter</td>
<td>The number of pages read.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_pages_written</td>
<td>long_counter</td>
<td>The number of pages written.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_row_lock_current_waits</td>
<td>long</td>
<td>The number of row locks currently being waited for.</td>
</tr>
<tr>
<td>Namespace</td>
<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
<td>Description</td>
</tr>
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</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_row_lock_time</td>
<td>long_counter</td>
<td>The total time spent in acquiring row locks, in milliseconds.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_row_lock_time_avg</td>
<td>long</td>
<td>The average time to acquire a row lock, in milliseconds.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_row_lock_time_max</td>
<td>long</td>
<td>The maximum time to acquire a row lock, in milliseconds.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_row_lock_waits</td>
<td>long_counter</td>
<td>The number of times a row lock had to be waited for.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_rows_deleted</td>
<td>long_counter</td>
<td>The number of rows deleted from InnoDB tables.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_rows_inserted</td>
<td>long_counter</td>
<td>The number of rows inserted into InnoDB tables.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_rows_read</td>
<td>long_counter</td>
<td>The number of rows read from InnoDB tables.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Innodb_rows_updated</td>
<td>long_counter</td>
<td>The number of rows updated in InnoDB tables.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Key_blocks_not_flushed</td>
<td>long</td>
<td>Performance.Keys</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Key_blocks_unused</td>
<td>long</td>
<td>The number of unused blocks in the key cache.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Key_blocks_used</td>
<td>long</td>
<td>The number of used blocks in the key cache.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Key_read_requests</td>
<td>long_counter</td>
<td>The number of requests to read a key block from the cache.</td>
</tr>
<tr>
<td>Namespace</td>
<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
<td>Description</td>
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<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Key_reads</td>
<td>long_counter</td>
<td>The number of physical reads of a key block from disk.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Key_write_requests</td>
<td>long_counter</td>
<td>The number of requests to write a key block to the cache.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Key_writes</td>
<td>long_counter</td>
<td>The number of physical writes of a key block to disk.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Last_query_cost</td>
<td>long</td>
<td>Performance.Cost</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Max_used_connections</td>
<td>long</td>
<td>Networking.Overview</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Ndb_number_of_data_nodes</td>
<td>long</td>
<td></td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Ndb_number_of_ready_data_nodes</td>
<td>long</td>
<td></td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Not_flushed_delayed_rows</td>
<td>long</td>
<td>The number of rows waiting to be written in INSERT DELAY queues. For non-transactional tables only.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Open_files</td>
<td>long</td>
<td>The number of files that are open.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Open_streams</td>
<td>long</td>
<td>The number of streams that are open (used mainly for logging)</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Open_table_definitions</td>
<td>long</td>
<td>The number of table definitions that have been opened.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Open_tables</td>
<td>long</td>
<td>The number of tables that are open.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Opened_files</td>
<td>long_counter</td>
<td>The number of tables that have been opened.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Opened_table_definitions</td>
<td>long_counter</td>
<td></td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Opened_tables</td>
<td>long_counter</td>
<td></td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Prepared_stmt_count</td>
<td>long</td>
<td>The current number of prepared statements.</td>
</tr>
<tr>
<td>Namespace</td>
<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
<td>Description</td>
</tr>
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<td>---------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Qcache_free_blocks</td>
<td>long</td>
<td>The number of free memory blocks in the query cache.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Qcache_free_memory</td>
<td>long</td>
<td>The amount of free memory for the query cache.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Qcache_hits</td>
<td>long_counter</td>
<td>The number of query cache hits.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Qcache_inserts</td>
<td>long_counter</td>
<td>The number of query cache inserts.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Qcache_lowmem_prunes</td>
<td>long_counter</td>
<td>Performance.Query Cache</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Qcache_not_cached</td>
<td>long_counter</td>
<td>Performance.Query Cache</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Qcache_queries_in_cache</td>
<td>long</td>
<td>The number of queries registered in the query cache.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Qcache_total_blocks</td>
<td>long</td>
<td>The total number of blocks in the query cache.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Queries</td>
<td>long_counter</td>
<td>The number of statements that clients have sent to the server.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Questions</td>
<td>long_counter</td>
<td>The number of statements that clients have sent to the server.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Rpl_status</td>
<td>long</td>
<td>The status of fail-safe replication (not yet implemented)</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Select_full_join</td>
<td>long_counter</td>
<td>Performance.Selects</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Select_full_range_join</td>
<td>long_counter</td>
<td>The number of joins that used a range search on a reference table.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Select_range</td>
<td>long_counter</td>
<td>The number of joins that used ranges</td>
</tr>
<tr>
<td>Namespace</td>
<td>Namespace Type</td>
<td>Attribute</td>
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</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Select_range_check</td>
<td>long_counter</td>
<td>The number of joins without keys that check for key usage after each row.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Select_scan</td>
<td>long_counter</td>
<td>The number of joins that did a full scan of the first table.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Slave_open_temp_tables</td>
<td>long</td>
<td>Networking.Replication</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Slave_retried_transactions</td>
<td>long_counter</td>
<td>Networking.Replication</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Slave_running</td>
<td>string</td>
<td>This is ON if this server is a slave that is connected to a master.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Slow_launch_threads</td>
<td>long_counter</td>
<td>Performance.Slow Items</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Slow_queries</td>
<td>long_counter</td>
<td>The number of queries that have taken more than long_query_time seconds.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Sort_merge_passes</td>
<td>long_counter</td>
<td>The number of merge passes that the sort algorithm has had to do.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Sort_range</td>
<td>long_counter</td>
<td>The number of sorts that were done using ranges.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Sort_rows</td>
<td>long_counter</td>
<td>The number of sorted rows.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Sort_scan</td>
<td>long_counter</td>
<td>The number of sorts that were done by scanning the table.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Ssl_accept_renegotiates</td>
<td>long_counter</td>
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<tr>
<td>mysql status</td>
<td>Ssl_accepts</td>
<td>long_counter</td>
<td>The number of attempted SSL connections.</td>
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<tr>
<td>mysql status</td>
<td>Ssl_callback_cache_hits</td>
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<td>The number of callback cache hits.</td>
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<tr>
<td>mysql status</td>
<td>Ssl_cipher</td>
<td>string</td>
<td>SSL cipher to use (implies --ssl).</td>
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</tr>
<tr>
<td>mysql status</td>
<td>Ssl_cipher_list</td>
<td>string</td>
<td>The list of SSL cipher strings.</td>
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</tr>
<tr>
<td>mysql status</td>
<td>Ssl_client_connects</td>
<td>long_counter</td>
<td>The number of attempted connections to an SSL-enabled master.</td>
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</tr>
<tr>
<td>mysql status</td>
<td>Ssl_connect_renegotiates</td>
<td>long_counter</td>
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<tr>
<td>mysql status</td>
<td>Ssl_ctx_verify_depth</td>
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<td>The SSL context verification depth.</td>
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<td>mysql status</td>
<td>Ssl_ctx_verify_mode</td>
<td>long</td>
<td>The SSL certificate verification mode used by the server.</td>
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<tr>
<td>mysql status</td>
<td>Ssl_default_timeout</td>
<td>long</td>
<td>The SSL default timeout.</td>
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</tr>
<tr>
<td>mysql status</td>
<td>Ssl_finished_accepts</td>
<td>long_counter</td>
<td>The number of successful SSL connections to the server.</td>
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</tr>
<tr>
<td>mysql status</td>
<td>Ssl_finished_connects</td>
<td>long_counter</td>
<td>The number of successful SSL slave connections to the server.</td>
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</tbody>
</table>
| mysql status   | Ssl_session_cache_hits        | long_counter  | The number of SSL.
<table>
<thead>
<tr>
<th>Namespace</th>
<th>Namespace Type</th>
<th>Attribute</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
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<tr>
<td>mysql</td>
<td>status</td>
<td>Ssl_session_cache_misses</td>
<td>long_counter</td>
<td>The number of SSL session cache misses.</td>
</tr>
<tr>
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<td>status</td>
<td>Ssl_session_cache_mode</td>
<td>string</td>
<td>The SSL session cache mode.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Ssl_session_cache_overflows</td>
<td>long_counter</td>
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<tr>
<td>mysql</td>
<td>status</td>
<td>Ssl_session_cache_size</td>
<td>long</td>
<td>The size of the SSL session cache.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Ssl_session_cache_timeouts</td>
<td>long_counter</td>
<td>The number of session cache timeouts.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Ssl_sessions_reused</td>
<td>long</td>
<td>The number of SSL sessions from the cache that were reused.</td>
</tr>
<tr>
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<td>status</td>
<td>Ssl_used_session_cache_entries</td>
<td>string</td>
<td>The number of SSL session cache entries used.</td>
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<tr>
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<td>status</td>
<td>Ssl_verify_depth</td>
<td>long</td>
<td>Depth of verification for replication SSL connections.</td>
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<td>Mode of verification for replication SSL connections.</td>
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<td>mysql</td>
<td>status</td>
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<td>The SSL version number.</td>
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<tr>
<td>mysql</td>
<td>status</td>
<td>Table_locks_immediate</td>
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<td>The number of times that a table lock was acquired immediately.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Table_locks_waited</td>
<td>long_counter</td>
<td>Performance.Locks</td>
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<tr>
<td>mysql</td>
<td>status</td>
<td>Tc_log_max_pages_used</td>
<td>long</td>
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</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Tc_log_page_size</td>
<td>long</td>
<td>General.Logging</td>
</tr>
<tr>
<td>Namespace</td>
<td>Namespace Type</td>
<td>Attribute</td>
<td>Type</td>
<td>Description</td>
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<td>-------------------------------------------------------</td>
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<tr>
<td>mysql</td>
<td>status</td>
<td>Tc_log_page_waits</td>
<td>long</td>
<td>General.Logging</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Threads_cached</td>
<td>long</td>
<td>The number of threads in the thread cache.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Threads_connected</td>
<td>long</td>
<td>The number of currently open connections.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Threads_created</td>
<td>long_counter</td>
<td>The number of threads created to handle connections.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Threads_running</td>
<td>long</td>
<td>The number of threads that are not sleeping.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Uptime</td>
<td>long</td>
<td>The number of seconds the server has been up.</td>
</tr>
<tr>
<td>mysql</td>
<td>status</td>
<td>Uptime_since_flush_status</td>
<td>long_counter</td>
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</tr>
<tr>
<td>mysql</td>
<td>strong_privileges</td>
<td>user</td>
<td>string</td>
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</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>num_rows</td>
<td>long</td>
<td>MySQL Network.Table Data</td>
</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>table_auto_increment</td>
<td>long</td>
<td>The next AUTO_INCREMENT value.</td>
</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>table_avg_row_length</td>
<td>long</td>
<td>The average row length.</td>
</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>table_collation</td>
<td>string</td>
<td>The table's character set and collation.</td>
</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>table_comment</td>
<td>string</td>
<td>The table comment.</td>
</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>table_create_time</td>
<td>string</td>
<td>When the data file was created.</td>
</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>table_data_free</td>
<td>long</td>
<td>The number of allocated but unused bytes.</td>
</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>table_data_length</td>
<td>long</td>
<td>The length of the data file.</td>
</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>table_engine</td>
<td>string</td>
<td>The storage engine used by a table.</td>
</tr>
<tr>
<td>Namespace</td>
<td>Namespace Type</td>
<td>Attribute</td>
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<td>Description</td>
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<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>table_index_length</td>
<td>long</td>
<td>The length of the index file.</td>
</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>table_max_data_length</td>
<td>long</td>
<td>The maximum length of the data file.</td>
</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>table_name</td>
<td>string</td>
<td>The name of a table.</td>
</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>table_row_format</td>
<td>string</td>
<td>The row storage format (Fixed, Dynamic, Compressed, Redundant, Compact)</td>
</tr>
<tr>
<td>mysql</td>
<td>table</td>
<td>table_version</td>
<td>long</td>
<td>The version number of the table's .frm file.</td>
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<td>mysql</td>
<td>tables_no_myisam_index_stats</td>
<td>table_list</td>
<td>string</td>
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<tr>
<td>mysql</td>
<td>tables_no_unique_keys</td>
<td>table_list</td>
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<td>The next AUTO_INCREMENT value.</td>
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<td>tablestatus</td>
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<td>long</td>
<td>The average row length.</td>
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<tr>
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<tr>
<td>mysql</td>
<td>tablestatus</td>
<td>Checksum</td>
<td>string</td>
<td>The live checksum value (if any)</td>
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<td>mysql</td>
<td>tablestatus</td>
<td>Collation</td>
<td>string</td>
<td>The table's character set.</td>
</tr>
<tr>
<td>mysql</td>
<td>tablestatus</td>
<td>Comment</td>
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<td>The comment used when creating the table.</td>
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<tr>
<td>mysql</td>
<td>tablestatus</td>
<td>Create_options</td>
<td>string</td>
<td>Extra options used with CREATE TABLE</td>
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<tr>
<td>mysql</td>
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<td>Data_free</td>
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<td>The number of allocated but unused bytes.</td>
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<td>mysql</td>
<td>tablestatus</td>
<td>Engine</td>
<td>string</td>
<td>The storage engine for the table.</td>
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<td>tablestatus</td>
<td>Index_length</td>
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<td>Max_data_length</td>
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<td>tablestatus</td>
<td>Name</td>
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<td>The table name.</td>
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<td>Rows</td>
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<td>The number of rows in the table.</td>
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<td>Update_time</td>
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<td>mysql</td>
<td>user_on_missing_db</td>
<td>user</td>
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<td>variables</td>
<td>auto_increment_increment</td>
<td>long</td>
<td>Auto-increment columns are incremented by this value.</td>
</tr>
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<tr>
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<tr>
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<td>character_set_client</td>
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<tr>
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<td>Current connection character set.</td>
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<tr>
<td>mysql</td>
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<tr>
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<td>character_set_results</td>
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<tr>
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<tr>
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<td>variables</td>
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<td>The collation of the connection.</td>
</tr>
<tr>
<td>mysql</td>
<td>variables</td>
<td>collation_database</td>
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<td>The collation used by the default database.</td>
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<tr>
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<td>variables</td>
<td>collation_server</td>
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<td>Set the default collation.</td>
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<tr>
<td>Namespace</td>
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<td>Attribute</td>
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<td>Whether mysqld supports spatial data types.</td>
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<tr>
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<td>string</td>
<td>Whether mysqld supports InnoDB tables. No longer used as of MEM 2.3.13.</td>
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<tr>
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<td>Whether mysqld supports isam tables.</td>
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<td>Whether mysqld supports merge tables.</td>
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<td>Whether mysqld supports NDB Cluster tables.</td>
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<td>Whether mysqld supports query cache.</td>
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<td>have_raid</td>
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<td>Is symbolic link support enabled.</td>
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<td>Read SQL commands from this file at startup.</td>
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<tr>
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<td>init_slave</td>
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<td>Command(s) that are executed when a slave connects to a master.</td>
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<tr>
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<td>innodb_autoextend_increment</td>
<td>long</td>
<td>Amount by which InnoDB auto-extends the data files for a tablespace, in megabytes.</td>
</tr>
<tr>
<td>mysql</td>
<td>variables</td>
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<tr>
<td>mysql</td>
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<td>long</td>
<td>Helps in performance tuning in heavily concurrent environments.</td>
</tr>
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<td>Path to individual files and their sizes.</td>
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<td>The common location for InnoDB tablespaces</td>
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<td>Enable InnoDB doublewrite buffer</td>
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<td>innodb_fast_shutdown</td>
<td>long</td>
<td>Speeds up the shutdown process of the InnoDB storage engine by deferring cleanup operations until the server restarts.</td>
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<td>Number of file I/O threads in InnoDB.</td>
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<tr>
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<td>Stores each InnoDB table and associated indexes in an .ibd file in the database directory.</td>
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<td>Where full logs should be archived.</td>
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<td>Percentage of dirty pages allowed in InnoDB buffer pool.</td>
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<td>Desired maximum length of the purge queue (0 = no limit)</td>
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<td>Number of identical copies of log groups to keep for the database.</td>
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<td>innodb_open_files</td>
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<td>The maximum number of files that InnoDB keeps open at the same time.</td>
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<td>innodb_support_xa</td>
<td>string</td>
<td>Enable InnoDB support for the XA two-phase commit.</td>
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<td>Count of spin-loop rounds in InnoDB mutexes</td>
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<td>string</td>
<td>Enable InnoDB locking in LOCK TABLES</td>
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<td>innodb_use_legacy_cardinality</td>
<td>string</td>
<td>Applies only to MySQL 5.1 and earlier.</td>
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<td>innodb_use_sys_malloc</td>
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<td>innodb_write_io_threads</td>
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<td>join_buffer_size</td>
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<td>The size of the buffer that is used for full joins.</td>
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<tr>
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<td>The size of the buffer used for index blocks for MyISAM tables.</td>
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<tr>
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<td>key_cache_block_size</td>
<td>long</td>
<td>The default size of key cache blocks.</td>
</tr>
<tr>
<td>mysql</td>
<td>variables</td>
<td>key_cache_division_limit</td>
<td>long</td>
<td>The minimum percentage of warm blocks in the key cache.</td>
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<tr>
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<tr>
<td>mysql</td>
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<td>language</td>
<td>string</td>
<td>Client error messages in given language. May be given as a full path.</td>
</tr>
<tr>
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<td>variables</td>
<td>large_files_support</td>
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<td>Whether large files are supported.</td>
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<tr>
<td>mysql</td>
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<td>Enable support for large pages.</td>
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<td>lc_time_names</td>
<td>string</td>
<td>Type of license for the server.</td>
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<tr>
<td>mysql</td>
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<td>string</td>
<td>Enable/ disable LOAD DATA LOCAL INFILE (takes values 1</td>
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<td>string</td>
<td>Log connections and queries to file.</td>
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<td>log_bin</td>
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<td>Enables binary log.</td>
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<td>log_bin_trust_routine_creators</td>
<td>string</td>
<td>(deprecated) Use log-bin-trust-function-creators.</td>
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<td>log_warnings</td>
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<td>Log some not critical warnings to the log file.</td>
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<tr>
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<tr>
<td>mysql variables</td>
<td>low_priority_updates</td>
<td>string</td>
<td>For non-transactional tables, INSERT, DELETE, and UPDATE statements have lower priority than SELECT statements.</td>
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</tr>
<tr>
<td>mysql variables</td>
<td>lower_case_file_system</td>
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<td>Max packet length to send/receive from to server.</td>
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<td>mysql variables</td>
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<td>mysql variables</td>
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<td>The number of simultaneous clients allowed.</td>
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<td>mysql variables</td>
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<td>mysql variables</td>
<td>max_error_count</td>
<td>long</td>
<td>Max number of errors/warnings to store for a statement.</td>
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<tr>
<td>mysql variables</td>
<td>max_heap_table_size</td>
<td>long</td>
<td>Don't allow creation of heap tables bigger than this.</td>
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<tr>
<td>mysql variables</td>
<td>max_insert_delayed_threads</td>
<td>long</td>
<td>Maximum number of prepared statements</td>
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<tr>
<td>mysql variables</td>
<td>max_insert_delayed_threads</td>
<td>long</td>
<td>This variable is a synonym for max_delayed_threads.</td>
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<tr>
<td>mysql variables</td>
<td>max_join_size</td>
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<td>mysql variables</td>
<td>max_length_for_sort_data</td>
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<td>Max number of bytes in sorted records.</td>
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<tr>
<td>mysql variables</td>
<td>max_prepared_stmt_count</td>
<td>long</td>
<td>Maximum number of prepared statements.</td>
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<td>max_seeks_for_key</td>
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<td>Limit assumed max number of seeks when looking up rows based on a key.</td>
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<tr>
<td>mysql</td>
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<td>The number of bytes to use when sorting BLOB or TEXT values.</td>
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<tr>
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<td>max_sp_recursion_depth</td>
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<td>Maximum stored procedure recursion depth.</td>
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<tr>
<td>mysql</td>
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<td>max_tmp_tables</td>
<td>long</td>
<td>Maximum number of temporary tables a client can keep open at a time.</td>
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<tr>
<td>mysql</td>
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<td>max_user_connections</td>
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<td>max_write_lock_count</td>
<td>long</td>
<td>After this many write locks, allow some read locks to run in between.</td>
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<tr>
<td>mysql</td>
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<td>min_examined_row_limit</td>
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<tr>
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<td>multi_range_count</td>
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<td>Default pointer size to be used for MyISAM tables.</td>
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<td>myisam_data_pointer_size</td>
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<td>The value of the --myisam-recover option.</td>
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<tr>
<td>mysql</td>
<td>variables</td>
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<tr>
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<td>variables</td>
<td>myisam_stats_method</td>
<td>string</td>
<td>Specifies how MyISAM index statistics collection code should treat NULLs.</td>
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<tr>
<td>mysql</td>
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<td>myisam_use_mmap</td>
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<td>Indicates whether the server supports connections over named pipes.</td>
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<td>Buffer length for TCP/IP and socket communication.</td>
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<tr>
<td>mysql</td>
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<tr>
<td>mysql</td>
<td>variables</td>
<td>new</td>
<td>string</td>
<td>Use very new, possibly 'unsafe' functions.</td>
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<tr>
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<td>variables</td>
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<tr>
<td>mysql</td>
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<td>old_passwords</td>
<td>string</td>
<td>Use old password encryption method (needed for 4.0 and older clients)</td>
</tr>
<tr>
<td>mysql</td>
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<td>open_files_limit</td>
<td>long</td>
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<tr>
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<td>optimizer_prune_level</td>
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<td>optimizer_search_depth</td>
<td>long</td>
<td>Maximum depth of search performed by the query optimizer.</td>
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<td>optimizer_switch</td>
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<tr>
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<td>pid_file</td>
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<td>Pid file used by safe_mysqld.</td>
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<td>plugin_dir</td>
<td>string</td>
<td>Port number to use for connection.</td>
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<tr>
<td>mysql</td>
<td>variables</td>
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<td>The size of the buffer that is allocated when preloading indexes.</td>
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<tr>
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<td>preload_buffer_size</td>
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<td>The current number of prepared statements.</td>
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<tr>
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<td>The version of the client/server protocol used by the MySQL server.</td>
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<td>Allocation block size for query parsing and execution.</td>
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<td>profiling_history_size</td>
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<td>Don't cache results that are bigger than this.</td>
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<tr>
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<td>The memory allocated to store results from old queries.</td>
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<tr>
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<td>query_cache_size</td>
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<td>Query cache type.</td>
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<td>Invalidate queries in query cache on LOCK for write.</td>
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<td>query_cache_wlock_invalidate</td>
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<tr>
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<td>for query parsing and execution.</td>
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<td>range_alloc_block_size</td>
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<td>Allocation block size for storing ranges during optimization.</td>
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<td>read_only</td>
<td>string</td>
<td>Make all nontemporary tables read only.</td>
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<tr>
<td>mysql</td>
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<td>relay_log_purge</td>
<td>string</td>
<td>Determines whether relay logs are purged.</td>
</tr>
<tr>
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<td>relay_log_space_limit</td>
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<td>Maximum space to use for all relay logs.</td>
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<tr>
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<tr>
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<td>rpl_recovery_rank</td>
<td>long</td>
<td>Not used.</td>
</tr>
<tr>
<td>mysql</td>
<td>variables</td>
<td>secure_auth</td>
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<td>Disallow authentication for accounts that have old (pre-4.1) passwords.</td>
</tr>
<tr>
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<td>secure_file_priv</td>
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<tr>
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<td>shared_memory</td>
<td>string</td>
<td>Whether the server allows shared-memory connections.</td>
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<tr>
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<td>shared_memory_base_name</td>
<td>string</td>
<td>The name of shared memory</td>
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<td>Namespace</td>
<td>Name</td>
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</tr>
<tr>
<td>mysql</td>
<td>variables</td>
<td>skip_external_locking</td>
<td>string Skip system (external) locking.</td>
<td></td>
</tr>
<tr>
<td>mysql</td>
<td>variables</td>
<td>skip_name_resolve</td>
<td>string Don't allow SHOW DATABASE commands.</td>
<td></td>
</tr>
<tr>
<td>mysql</td>
<td>variables</td>
<td>skip_networking</td>
<td>string Don't allow connection with TCP/IP.</td>
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</tr>
<tr>
<td>mysql</td>
<td>variables</td>
<td>skip_show_database</td>
<td>string Use compression on master/slave protocol.</td>
<td></td>
</tr>
<tr>
<td>mysql</td>
<td>variables</td>
<td>slave_compressed_protocol</td>
<td>string Use compression on master/slave protocol.</td>
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<tr>
<td>mysql</td>
<td>variables</td>
<td>slave_exec_mode</td>
<td>string General.Replication</td>
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<td>string General.Replication</td>
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<td>slave_skip_errors</td>
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<td>slave_transaction_retries</td>
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<td>mysql</td>
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</tr>
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<td>mysql</td>
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<td>slow_query_log</td>
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</tr>
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<td>mysql</td>
<td>variables</td>
<td>slow_query_log_file</td>
<td>string General.Performance</td>
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<td>variables</td>
<td>socket</td>
<td>string Socket file to use for connection.</td>
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<td>variables</td>
<td>sort_buffer_size</td>
<td>long Each thread that needs to do a sort allocates a buffer of this size.</td>
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</tr>
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<td>mysql</td>
<td>variables</td>
<td>sql_auto_is_null</td>
<td>string General.Features</td>
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<td>variables</td>
<td>sql_buffer_result</td>
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<td>sql_log_update</td>
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<td>sql_max_join_size</td>
<td>long General.Performance</td>
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<td>Type</td>
<td>Description</td>
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<td>-----------------------------------------------------------------------------</td>
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<td>variables</td>
<td>sql_mode</td>
<td>string</td>
<td>Set the SQL server mode.</td>
</tr>
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<td>variables</td>
<td>sql_notes</td>
<td>string</td>
<td>If set to 1, warnings of Note level are recorded.</td>
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<td>sql_quote_show_create</td>
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<td>General.Miscellaneous</td>
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<td>mysql</td>
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<td>ssl_ca</td>
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<td>CA file in PEM format (check OpenSSL docs, implies --ssl)</td>
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<td>ssl_capath</td>
<td>string</td>
<td>CA directory (check OpenSSL docs, implies --ssl)</td>
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<td>mysql</td>
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<td>ssl_cert</td>
<td>string</td>
<td>X509 certification in PEM format (implies --ssl)</td>
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<td>ssl_cipher</td>
<td>string</td>
<td>SSL cipher to use (implies --ssl)</td>
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<td>string</td>
<td>X509 key in PEM format (implies ssl)</td>
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<td>mysql</td>
<td>variables</td>
<td>storage_engine</td>
<td>string</td>
<td>The default storage engine.</td>
</tr>
<tr>
<td>mysql</td>
<td>variables</td>
<td>sync_binlog</td>
<td>long</td>
<td>Synchronously flush binary log to disk after every #th event.</td>
</tr>
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<td>mysql</td>
<td>variables</td>
<td>sync_frm</td>
<td>string</td>
<td>Sync .frm to disk on create. Enabled by default.</td>
</tr>
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<td>variables</td>
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<td>long</td>
<td>Deprecated.</td>
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<td>system_time_zone</td>
<td>string</td>
<td>The server system time zone.</td>
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<td>variables</td>
<td>table_cache</td>
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<td>Deprecated; use table_open_cache instead.</td>
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<td>variables</td>
<td>table_definition_cache</td>
<td>long</td>
<td>General.Miscellaneous</td>
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<td>table_lock_wait_timeout</td>
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<td>mysql</td>
<td>variables</td>
<td>table_type</td>
<td>string</td>
<td>A synonym for storage_engine.</td>
</tr>
<tr>
<td>mysql</td>
<td>variables</td>
<td>thread_cache_size</td>
<td>long</td>
<td>How many threads to keep in a cache for reuse.</td>
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<tr>
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<td>variables</td>
<td>thread_handling</td>
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<td>mysql</td>
<td>variables</td>
<td>thread_stack</td>
<td>long</td>
<td>The stack size for each thread.</td>
</tr>
<tr>
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<td>variables</td>
<td>time_format</td>
<td>string</td>
<td>The TIME format (for future)</td>
</tr>
<tr>
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<td>variables</td>
<td>time_zone</td>
<td>string</td>
<td>The current time zone.</td>
</tr>
<tr>
<td>mysql</td>
<td>variables</td>
<td>timed_mutexes</td>
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<td>General.Miscellaneous</td>
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<td>timestamp</td>
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<td>variables</td>
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<td>Memory.Overview</td>
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<td>string</td>
<td>Path for temporary files.</td>
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<td>transaction_alloc_block_size</td>
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<td>Allocation block size for transactions to be stored in binary log.</td>
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<td>Persistent buffer for transactions to be stored in binary log.</td>
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<td>The default transaction isolation level.</td>
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<td>unique_checks</td>
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<td>updatable_views_with_limit</td>
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<td>SQL.Overview</td>
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<td>string</td>
<td>Output version</td>
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<td>The type of machine or architecture on which MySQL was built.</td>
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<td>The type of operating system on which MySQL was built.</td>
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<td>long</td>
<td>The size of the CPU cache.</td>
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<td>cpu_idle</td>
<td>long_counter</td>
<td>The CPU idle time.</td>
</tr>
<tr>
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<td>cpu</td>
<td>cpu_mhz</td>
<td>long</td>
<td>The MHz rating of the CPU.</td>
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<td>cpu_name</td>
<td>string</td>
<td>The CPU name.</td>
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<td>CPU system / kernel time.</td>
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<td>long_counter</td>
<td>CPU user space time.</td>
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<td>The name of the CPU vendor.</td>
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<td>CPU IO wait time.</td>
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<td>disk_bytes_read</td>
<td>long_counter</td>
<td>The number of bytes read from disk.</td>
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<td>Attribute</td>
<td>Type</td>
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<td>The size of the disk IO queue.</td>
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<td>The host unique identifier.</td>
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<td>The total amount of available RAM.</td>
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<td>The total amount of unused RAM.</td>
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<td>swap_total</td>
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<td>The total amount of available swap memory.</td>
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<td>Namespace</td>
<td>Namespace Type</td>
<td>Attribute</td>
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<td>string</td>
<td>The address of the network interface.</td>
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<td>broadcast</td>
<td>string</td>
<td>The network interface broadcast address.</td>
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<td>net</td>
<td>description</td>
<td>string</td>
<td>The network interface description.</td>
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<td>The network interface destination address.</td>
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<td>The network interface flags.</td>
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<td>net</td>
<td>hwaddr</td>
<td>string</td>
<td>The network interface MAC address.</td>
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<td>metric</td>
<td>long</td>
<td>Operating System.Net</td>
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<td>os</td>
<td>net</td>
<td>mtu</td>
<td>long</td>
<td>The Maximum Transmission Unit.</td>
</tr>
<tr>
<td>os</td>
<td>net</td>
<td>name</td>
<td>string</td>
<td>The network interface name (eth0, eth1 etc.)</td>
</tr>
<tr>
<td>os</td>
<td>net</td>
<td>netmask</td>
<td>string</td>
<td>The network interface subnet mask.</td>
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<td>net</td>
<td>rx_bytes</td>
<td>long_counter</td>
<td>The number of bytes received.</td>
</tr>
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<td>net</td>
<td>rx_dropped</td>
<td>long_counter</td>
<td>The number of received packets dropped.</td>
</tr>
<tr>
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<td>rx_errors</td>
<td>long_counter</td>
<td>The number of received packet errors.</td>
</tr>
<tr>
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<td>rx_frame</td>
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<td>The number received packet frame errors.</td>
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<td>Namespace Type</td>
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<td>The network interface connection speed.</td>
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<td>The number of bytes transmitted.</td>
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</tr>
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<td>The number of packets transmitted.</td>
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<td>string</td>
<td>The network interface type (ethernet, loopback etc.)</td>
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### Appendix E Error codes

The following table documents error codes reported by the GUI and the messages associated with each code.

#### Table E.1 MySQL Enterprise Dashboard: GUI Error Codes and Messages

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>U0001</td>
<td>&quot;replaceable_value&quot; is a required field.</td>
</tr>
<tr>
<td>U0002</td>
<td>You must log in to access the requested resource.</td>
</tr>
<tr>
<td>U0003</td>
<td>You do not have permissions to access this resource.</td>
</tr>
<tr>
<td>U0004</td>
<td>The user field &quot;replaceable_value&quot; must not be null. Either the submission was broken or you have accessed this resource improperly.</td>
</tr>
<tr>
<td>U0005</td>
<td>A non-numeric value was submitted for the field &quot;replaceable_value&quot;. Either the submission was broken or you have accessed this resource improperly.</td>
</tr>
<tr>
<td>U0007</td>
<td>Unable to connect to download Advisors. replaceable_value</td>
</tr>
<tr>
<td>U0009</td>
<td>The uploaded Advisor jar was invalid.</td>
</tr>
<tr>
<td>U0010</td>
<td>The username and password combination was not found.</td>
</tr>
<tr>
<td>U0011</td>
<td>The user &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>U0012</td>
<td>You may not log into the interface with agent credentials.</td>
</tr>
<tr>
<td>U0013</td>
<td>At least one agent is required to use the application.</td>
</tr>
<tr>
<td>U0014</td>
<td>At least one admin is required to use the application.</td>
</tr>
<tr>
<td>U0018</td>
<td>You must provide an admin password.</td>
</tr>
<tr>
<td>U0019</td>
<td>The admin passwords do not match.</td>
</tr>
<tr>
<td>U0020</td>
<td>You must provide an agent password.</td>
</tr>
<tr>
<td>U0021</td>
<td>The agent passwords do not match.</td>
</tr>
<tr>
<td>U0023</td>
<td>You must provide a non-zero interval.</td>
</tr>
<tr>
<td>U0024</td>
<td>&quot;replaceable_value&quot; is an invalid &quot;To&quot; date. Dates are in the format YYYY-MM-DD.</td>
</tr>
<tr>
<td>U0025</td>
<td>&quot;replaceable_value&quot; is an invalid &quot;From&quot; date. Dates are in the format YYYY-MM-DD.</td>
</tr>
<tr>
<td>U0026</td>
<td>Your &quot;To&quot; and &quot;From&quot; dates cannot be the same date.</td>
</tr>
<tr>
<td>U0027</td>
<td>You must provide a graph id for display.</td>
</tr>
<tr>
<td>U0028</td>
<td>You have exceeded the maximum number of graphs for display. You may only select replaceable_value graphs.</td>
</tr>
<tr>
<td>U0029</td>
<td>No graphs ids were found.</td>
</tr>
<tr>
<td>U0030</td>
<td>You must provide a non-zero interval.</td>
</tr>
<tr>
<td>U0031</td>
<td>Your full-sized width must be greater than or equal to replaceable_value.</td>
</tr>
<tr>
<td>U0032</td>
<td>&quot;replaceable_value&quot; is not a valid value for full-sized width.</td>
</tr>
<tr>
<td>U0033</td>
<td>Your full-sized height must be greater than or equal to replaceable_value.</td>
</tr>
<tr>
<td>U0034</td>
<td>&quot;replaceable_value&quot; is not a valid value for full-sized height.</td>
</tr>
<tr>
<td>U0035</td>
<td>Your thumbnail width must be greater than or equal to replaceable_value.</td>
</tr>
<tr>
<td>U0036</td>
<td>&quot;replaceable_value&quot; is not a valid value for thumbnail width.</td>
</tr>
<tr>
<td>U0037</td>
<td>Your thumbnail height must be greater than or equal to replaceable_value.</td>
</tr>
<tr>
<td>U0038</td>
<td>&quot;replaceable_value&quot; is not a valid value for thumbnail height.</td>
</tr>
<tr>
<td>U0039</td>
<td>You must select one or more events to close.</td>
</tr>
<tr>
<td>Error Code</td>
<td>Message</td>
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<tr>
<td>U0041</td>
<td>&quot;replaceable_value&quot; is an invalid &quot;From&quot; date. Dates are in the format YYYY-MM-DD.</td>
</tr>
<tr>
<td>U0042</td>
<td>&quot;replaceable_value&quot; is an invalid &quot;To&quot; date. Dates are in the format YYYY-MM-DD.</td>
</tr>
<tr>
<td>U0043</td>
<td>You must provide a non-zero interval.</td>
</tr>
<tr>
<td>U0044</td>
<td>Your width must be greater than or equal to replaceable_value.</td>
</tr>
<tr>
<td>U0045</td>
<td>&quot;replaceable_value&quot; is not a valid value for width.</td>
</tr>
<tr>
<td>U0046</td>
<td>Your height must be greater than or equal to replaceable_value.</td>
</tr>
<tr>
<td>U0047</td>
<td>&quot;replaceable_value&quot; is not a valid value for height.</td>
</tr>
<tr>
<td>U0048</td>
<td>You must provide a non-zero interval.</td>
</tr>
<tr>
<td>U0049</td>
<td>&quot;replaceable_value&quot; is an invalid &quot;To&quot; date. Dates are in the format YYYY-MM-DD.</td>
</tr>
<tr>
<td>U0050</td>
<td>&quot;replaceable_value&quot; is an invalid &quot;From&quot; date. Dates are in the format YYYY-MM-DD.</td>
</tr>
<tr>
<td>U0051</td>
<td>Your &quot;To&quot; and &quot;From&quot; dates cannot be the same date.</td>
</tr>
<tr>
<td>U0052</td>
<td>Your width must be greater than or equal to replaceable_value.</td>
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<tr>
<td>U0053</td>
<td>&quot;replaceable_value&quot; is not a valid value for width.</td>
</tr>
<tr>
<td>U0054</td>
<td>Your height must be greater than or equal to replaceable_value.</td>
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<tr>
<td>U0055</td>
<td>&quot;replaceable_value&quot; is not a valid value for height.</td>
</tr>
<tr>
<td>U0056</td>
<td>You must select one or more advisors.</td>
</tr>
<tr>
<td>U0057</td>
<td>No schedule was found with id &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0058</td>
<td>You must select one or more rules to schedule.</td>
</tr>
<tr>
<td>U0059</td>
<td>There was a problem scheduling &quot;replaceable_value&quot; against &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0060</td>
<td>No rule was found with the uuid &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0061</td>
<td>Advisor name must not be empty.</td>
</tr>
<tr>
<td>U0062</td>
<td>Advisor &quot;replaceable_value&quot; already exists.</td>
</tr>
<tr>
<td>U0063</td>
<td>New advisor name must not be empty.</td>
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<tr>
<td>U0064</td>
<td>Advisor id must not be null.</td>
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<tr>
<td>U0065</td>
<td>No advisor was found with the id replaceable_value.</td>
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<td>U0066</td>
<td>Rule uuid must not be null.</td>
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<tr>
<td>U0067</td>
<td>No rule was found with the uuid &quot;replaceable_value&quot;.</td>
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<tr>
<td>U0068</td>
<td>One or more variables is required to make a functioning rule.</td>
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<tr>
<td>U0069</td>
<td>Each defined variable must be mapped to an instance. The variable &quot;replaceable_value&quot; is missing the instance to collect against.</td>
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<tr>
<td>U0070</td>
<td>Please choose an existing Advisor or create a new one with a non-empty name.</td>
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<td>The default frequency must be a non-zero value.</td>
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<td>You must enter a rule name.</td>
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<td>You must provide an email address.</td>
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<td>The provided email address appears to be invalid.</td>
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<td>A valid SMTP server address must be given.</td>
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<td>Your passwords do not match.</td>
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<td>A valid SNMP target must be given.</td>
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<td>A valid SNMP port must be given.</td>
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</tr>
<tr>
<td>U0090</td>
<td>An invalid data life span was given.</td>
</tr>
<tr>
<td>U0091</td>
<td>An invalid re-inventory frequency was given.</td>
</tr>
<tr>
<td>U0093</td>
<td>The user name is missing.</td>
</tr>
<tr>
<td>U0095</td>
<td>An invalid time zone was given.</td>
</tr>
<tr>
<td>U0096</td>
<td>An invalid locale was given.</td>
</tr>
<tr>
<td>U0097</td>
<td>The group name is invalid.</td>
</tr>
<tr>
<td>U0098</td>
<td>The recipients list is empty.</td>
</tr>
<tr>
<td>U0099</td>
<td>Cannot find the e-mail target.</td>
</tr>
<tr>
<td>U0100</td>
<td>The given target id is invalid.</td>
</tr>
<tr>
<td>U0101</td>
<td>The group name must not be empty.</td>
</tr>
<tr>
<td>U0102</td>
<td>The server name must not be empty.</td>
</tr>
<tr>
<td>U0103</td>
<td>An invalid group id was given.</td>
</tr>
<tr>
<td>U0104</td>
<td>The group already exists.</td>
</tr>
<tr>
<td>U0105</td>
<td>This group name is already in use. Enter a different name.</td>
</tr>
<tr>
<td>U0106</td>
<td>Cannot find group with id \textit{replaceable	extunderscore value}.</td>
</tr>
<tr>
<td>U0107</td>
<td>Cannot find server with id \textit{replaceable	extunderscore value}.</td>
</tr>
<tr>
<td>U0108</td>
<td>An invalid server id was given.</td>
</tr>
<tr>
<td>U0109</td>
<td>Invalid Username</td>
</tr>
<tr>
<td>U0110</td>
<td>Invalid user role specified.</td>
</tr>
<tr>
<td>U0111</td>
<td>A user with the given name already exists.</td>
</tr>
<tr>
<td>U0112</td>
<td>The password must not be empty.</td>
</tr>
<tr>
<td>U0113</td>
<td>The user &quot;\textit{replaceable	extunderscore value}&quot; does not exist.</td>
</tr>
<tr>
<td>U0114</td>
<td>The log name must not be empty.</td>
</tr>
<tr>
<td>U0115</td>
<td>An invalid log level was given.</td>
</tr>
<tr>
<td>U0117</td>
<td>An invalid filter was set.</td>
</tr>
<tr>
<td>U0118</td>
<td>&quot;\textit{replaceable	extunderscore value}&quot; is an invalid &quot;From&quot; date. Dates are in the format YYYY-MM-DD.</td>
</tr>
<tr>
<td>U0119</td>
<td>&quot;\textit{replaceable	extunderscore value}&quot; is an invalid &quot;To&quot; date. Dates are in the format YYYY-MM-DD.</td>
</tr>
<tr>
<td>U0120</td>
<td>No event was found with the id &quot;\textit{replaceable	extunderscore value}&quot;.</td>
</tr>
<tr>
<td>U0121</td>
<td>No category was found with the id &quot;\textit{replaceable	extunderscore value}&quot;.</td>
</tr>
<tr>
<td>U0122</td>
<td>You must select one or more servers to add.</td>
</tr>
<tr>
<td>U0123</td>
<td>No log was found with the name &quot;\textit{replaceable	extunderscore value}&quot;.</td>
</tr>
<tr>
<td>U0124</td>
<td>No schedule was found with the id &quot;\textit{replaceable	extunderscore value}&quot;.</td>
</tr>
<tr>
<td>Error Code</td>
<td>Message</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>U0125</td>
<td>No notification group was found with the id &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0126</td>
<td>Unable to retrieve Advisors at this time.</td>
</tr>
<tr>
<td>U0128</td>
<td>You must specify a file for upload.</td>
</tr>
<tr>
<td>U0129</td>
<td>The uploaded Graph XML was invalid.</td>
</tr>
<tr>
<td>U0130</td>
<td>The uploaded Graph had an insufficient version number, and was not loaded.</td>
</tr>
<tr>
<td>U0131</td>
<td>No group was found with the id &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0132</td>
<td>No user was found with the name &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0133</td>
<td>No log was found with the key &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0134</td>
<td>An invalid e-mail address was given.</td>
</tr>
<tr>
<td>U0135</td>
<td>No user was found with the id &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0136</td>
<td>No graph was found with the id &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0137</td>
<td>You must provide a query summary id for display.</td>
</tr>
<tr>
<td>U0138</td>
<td>No query summary was found with the id &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0139</td>
<td>&quot;replaceable_value&quot; is not a valid UUID.</td>
</tr>
<tr>
<td>U0140</td>
<td>You are not authorized to access this resource.</td>
</tr>
<tr>
<td>U0141</td>
<td>No graph was found with the uuid &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0142</td>
<td>The target name is already in use.</td>
</tr>
<tr>
<td>U0143</td>
<td>No key was provided to sort on.</td>
</tr>
<tr>
<td>U0145</td>
<td>U0120 Unable to import Advisor Jar. You may download the jar manually from the My Oracle Support website and import it on this page.</td>
</tr>
<tr>
<td>U0146</td>
<td>Unable to schedule rule &quot;replaceable_value&quot; due to &quot;replaceable_value.replaceable_value&quot; data not being collected from server &quot;replaceable_value&quot;. It may be an unsupported collection for that server.</td>
</tr>
<tr>
<td>U0147</td>
<td>The requested feature, replaceable_value, has not been implemented.</td>
</tr>
<tr>
<td>U0148</td>
<td>You must select one or more servers.</td>
</tr>
<tr>
<td>U0149</td>
<td>You must provide a non-empty alias.</td>
</tr>
<tr>
<td>U0150</td>
<td>No server was found with the id &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0151</td>
<td>Server already exists with name &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0152</td>
<td>No server name provided</td>
</tr>
<tr>
<td>U0154</td>
<td>Query Analyzer Data purge value cannot be greater than Historic Data purge value.</td>
</tr>
<tr>
<td>U0156</td>
<td>The database cannot parse the regular expression: replaceable_value.</td>
</tr>
<tr>
<td>U0157</td>
<td>Query Explain support requires Query Example capture to be enabled.</td>
</tr>
<tr>
<td>U0159</td>
<td>This Role does not have permission to configure Query Analyzer. Please contact an Administrator.</td>
</tr>
<tr>
<td>U0162</td>
<td>The admin and agent usernames must be different.</td>
</tr>
<tr>
<td>U0163</td>
<td>The requested alias is too long; aliases must be less than replaceable_value characters.</td>
</tr>
<tr>
<td>U0164</td>
<td>&quot;replaceable_value&quot; is not a DNS resolvable hostname or IP address.</td>
</tr>
<tr>
<td>U0165</td>
<td>Heat chart rule &quot;replaceable_value&quot; scheduled against &quot;replaceable_value&quot; may not be unscheduled. This rule is required for the product to function properly.</td>
</tr>
<tr>
<td>U0166</td>
<td>Heat chart rule &quot;replaceable_value&quot; scheduled against &quot;replaceable_value&quot; may not be disabled. This rule is required for the product to function properly.</td>
</tr>
<tr>
<td>U0167</td>
<td>Bad graph identifier.</td>
</tr>
<tr>
<td>Error Code</td>
<td>Message</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>U0168</td>
<td>There is no graph with the given identifier.</td>
</tr>
<tr>
<td>U0169</td>
<td>Graph width &quot;replaceable_value&quot; is invalid.</td>
</tr>
<tr>
<td>U0170</td>
<td>Graph height &quot;replaceable_value&quot; is invalid.</td>
</tr>
<tr>
<td>U0171</td>
<td>Graph width &quot;replaceable_value&quot; is below minimum &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0172</td>
<td>Graph height &quot;replaceable_value&quot; is below minimum &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0173</td>
<td>Interval &quot;replaceable_value&quot; is not valid.</td>
</tr>
<tr>
<td>U0175</td>
<td>A HTTP proxy host is required; the port is optional.</td>
</tr>
<tr>
<td>U0176</td>
<td>Unable to parse the HTTP host &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0177</td>
<td>Unable to parse the HTTP proxy port number &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>U0178</td>
<td>An invalid hostname or port was given.</td>
</tr>
<tr>
<td>U0179</td>
<td>The HTTP proxy passwords must match.</td>
</tr>
<tr>
<td>U0180</td>
<td>You cannot change the role of the logged-in user.</td>
</tr>
<tr>
<td>U0181</td>
<td>No updates are available to install at this time.</td>
</tr>
<tr>
<td>U0182</td>
<td>There was an error formatting the Advisor Readme.</td>
</tr>
<tr>
<td>U0183</td>
<td>You must provide a primary hostname.</td>
</tr>
<tr>
<td>U0184</td>
<td>Invalid value for LDAP encryption.</td>
</tr>
<tr>
<td>U0185</td>
<td>Invalid value for LDAP referrals.</td>
</tr>
<tr>
<td>U0186</td>
<td>You must provide a login when not using anonymous binds.</td>
</tr>
<tr>
<td>U0187</td>
<td>You must provide a password attribute when using comparison mode.</td>
</tr>
<tr>
<td>U0188</td>
<td>You must provide a password digest when using comparison mode.</td>
</tr>
<tr>
<td>U0189</td>
<td>Unknown password digest provided.</td>
</tr>
<tr>
<td>U0190</td>
<td>LDAP passwords do not match.</td>
</tr>
<tr>
<td>U0191</td>
<td>User or role pattern required when using role mapping.</td>
</tr>
<tr>
<td>U0192</td>
<td>You must provide a role search pattern attribute.</td>
</tr>
<tr>
<td>U0193</td>
<td>You must provide at least one mapping for the &quot;admin&quot; role.</td>
</tr>
<tr>
<td>U0194</td>
<td>You must provide at least one mapping for the &quot;dba&quot; role.</td>
</tr>
<tr>
<td>U0195</td>
<td>You must provide at least one mapping for the &quot;agent&quot; role.</td>
</tr>
<tr>
<td>U0196</td>
<td>Disabling LDAP authentication for a user requires a new password to be created.</td>
</tr>
<tr>
<td>U0197</td>
<td>LDAP authentication can not be disabled when LDAP is configured to be authoritative.</td>
</tr>
<tr>
<td>U0198</td>
<td>The password can not be changed for users authenticated via LDAP.</td>
</tr>
<tr>
<td>U0200</td>
<td>The user name can not be changed when LDAP is authoritative.</td>
</tr>
<tr>
<td>U0201</td>
<td>You must provide at least one mapping for the &quot;read-only&quot; role.</td>
</tr>
<tr>
<td>U0202</td>
<td>replaceable_value heat chart {0,choice,1#rule</td>
</tr>
<tr>
<td>U0203</td>
<td>No schedules were found for the rule.</td>
</tr>
<tr>
<td>U0204</td>
<td>Delete without confirmation disallowed.</td>
</tr>
<tr>
<td>U0205</td>
<td>Nothing is selected.</td>
</tr>
<tr>
<td>U0206</td>
<td>No file was provided.</td>
</tr>
<tr>
<td>U0207</td>
<td>Unable to determine the type of this file.</td>
</tr>
<tr>
<td>Error Code</td>
<td>Message</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>U0208</td>
<td>Nothing is selected.</td>
</tr>
<tr>
<td>U0209</td>
<td>The selection is invalid.</td>
</tr>
<tr>
<td>U0210</td>
<td>A version (e.g., &quot;1.0&quot;) is required.</td>
</tr>
<tr>
<td>U0211</td>
<td>replaceable_value heat chart {0,choice,1#rule}1&lt;rules} against replaceable_value {1,choice,1#server}1&lt;servers} will not be disabled. {0,choice,1#This rule is}1&lt;These rules are} required for the product to function properly.</td>
</tr>
<tr>
<td>U0212</td>
<td>You must specify user search criteria.</td>
</tr>
<tr>
<td>U0213</td>
<td>You must choose user search by pattern or by criteria.</td>
</tr>
<tr>
<td>U0214</td>
<td>The uploaded Advisor jar is a Custom Rule/Graph Export Bundle, and must be uploaded to the Import/Export page.</td>
</tr>
<tr>
<td>U0215</td>
<td>Changing the frequency for this rule is not supported.</td>
</tr>
<tr>
<td>U0216</td>
<td>Notes provided were too long (limit 10000 characters)</td>
</tr>
<tr>
<td>U0217</td>
<td>No notes provided</td>
</tr>
<tr>
<td>U0218</td>
<td>No servers were selected, please select the servers you want to modify and try again.</td>
</tr>
<tr>
<td>U0219</td>
<td>The interval &quot;replaceable_value&quot; could not be parsed. Intervals must be in hh:mm:ssreplaceable_value_usec format.</td>
</tr>
<tr>
<td>U0220</td>
<td>You must provide at least one substitution expression when selecting the transform with substitution expression option.</td>
</tr>
<tr>
<td>U0221</td>
<td>Invalid entry in substitution expression field &quot;replaceable_value&quot;. Entry is not a well formed substitution expression.</td>
</tr>
<tr>
<td>U0222</td>
<td>Invalid entry in substitution expression field &quot;replaceable_value&quot;. The substitution pattern &quot;replaceable_value&quot; is not valid.</td>
</tr>
<tr>
<td>U0223</td>
<td>Invalid entry in substitution expression field &quot;replaceable_value&quot;. The substitution text &quot;replaceable_value&quot; is not valid.</td>
</tr>
</tbody>
</table>

The following table documents error codes reported by the Enterprise server and the messages associated with each code.

**Table E.2 MySQL Enterprise Monitor: Server Codes and Messages**

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>E0001</td>
<td>Internal Error: replaceable_value</td>
</tr>
<tr>
<td>E0100</td>
<td>Invalid user role &quot;replaceable_value&quot;. Only &quot;manager&quot;, &quot;dba&quot;, and &quot;agent&quot; are valid.</td>
</tr>
<tr>
<td>E0101</td>
<td>Invalid user name &quot;replaceable_value&quot;. User names must be alphanumeric and between 1-32 characters in length.</td>
</tr>
<tr>
<td>E0102</td>
<td>Invalid user password. Passwords must contain at least one number.</td>
</tr>
<tr>
<td>E0103</td>
<td>Can not delete manager user.</td>
</tr>
<tr>
<td>E0104</td>
<td>User can not change role.</td>
</tr>
<tr>
<td>E0105</td>
<td>User &quot;replaceable_value&quot; already exists.</td>
</tr>
<tr>
<td>E0106</td>
<td>User &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E0107</td>
<td>User role &quot;replaceable_value&quot; is not authorized.</td>
</tr>
<tr>
<td>E0108</td>
<td>User &quot;replaceable_value&quot; has been previously deleted and is disabled.</td>
</tr>
<tr>
<td>E0200</td>
<td>No mapping exists to map the user &quot;replaceable_value&quot; to a MySQL Network user.</td>
</tr>
<tr>
<td>Error Code</td>
<td>Message</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>E0201</td>
<td>A mapping already exists for the user &quot;replaceable_value&quot; to a MySQL Network user.</td>
</tr>
<tr>
<td>E0202</td>
<td>MySQL Network is currently unavailable or could not be reached.</td>
</tr>
<tr>
<td>E0203</td>
<td>MySQL Network reported no alerts.</td>
</tr>
<tr>
<td>E0204</td>
<td>MySQL Network Advisor returned no data. Reason: &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E0205</td>
<td>Your Advisors are currently up to date.</td>
</tr>
<tr>
<td>E0206</td>
<td>Your MySQL Enterprise trial expired after &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E0207</td>
<td>The MySQL Enterprise subscription key is not valid.</td>
</tr>
<tr>
<td>E0208</td>
<td>No MySQL Enterprise subscription information is installed.</td>
</tr>
<tr>
<td>E0209</td>
<td>The MySQL Enterprise subscription key has expired.</td>
</tr>
<tr>
<td>E0210</td>
<td>User: replaceable_value Requires role: replaceable_value</td>
</tr>
<tr>
<td>E0211</td>
<td>You do not have permissions to access this resource.</td>
</tr>
<tr>
<td>E0212</td>
<td>The import of a duplicate MySQL Enterprise subscription trial key was rejected.</td>
</tr>
<tr>
<td>E0213</td>
<td>Unable to decode key from file: replaceable_value.</td>
</tr>
<tr>
<td>E0300</td>
<td>Can not delete default group.</td>
</tr>
<tr>
<td>E0301</td>
<td>Group &quot;replaceable_value&quot; already exists.</td>
</tr>
<tr>
<td>E0302</td>
<td>Group &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E0303</td>
<td>Invalid group name &quot;replaceable_value&quot;. Group name must be alphanumeric and less than 128 characters.</td>
</tr>
<tr>
<td>E0304</td>
<td>Group element &quot;replaceable_value&quot; already exists.</td>
</tr>
<tr>
<td>E0305</td>
<td>Group element &quot;replaceable_value&quot; does not exist in the group &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E0400</td>
<td>Agent &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E0401</td>
<td>Agent payload parameter NULL.</td>
</tr>
<tr>
<td>E0402</td>
<td>Agent task &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E0403</td>
<td>There has been a problem de-serializing this agent&quot;s request. Please ensure all agents are version replaceable_value or greater.</td>
</tr>
<tr>
<td>E0500</td>
<td>Server &quot;replaceable_value&quot; already exists.</td>
</tr>
<tr>
<td>E0501</td>
<td>Server &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E0502</td>
<td>Server &quot;replaceable_value&quot; is actively being monitored and cannot be deleted. The last agent contact for this server was on replaceable_value.</td>
</tr>
<tr>
<td>E0503</td>
<td>Server &quot;replaceable_value&quot; is being migrated and cannot be deleted. Please halt the active migration first.</td>
</tr>
<tr>
<td>E0600</td>
<td>Database &quot;replaceable_value&quot; already exists.</td>
</tr>
<tr>
<td>E0601</td>
<td>Database &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E0700</td>
<td>Threshold &quot;replaceable_value&quot; already exists.</td>
</tr>
<tr>
<td>E0701</td>
<td>Threshold &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E0702</td>
<td>Data collection item does not exist.</td>
</tr>
<tr>
<td>E0703</td>
<td>serverName or groupName have to be set.</td>
</tr>
<tr>
<td>E0800</td>
<td>Data collection item does not exist.</td>
</tr>
<tr>
<td>E0801</td>
<td>Data collection is already occurring for &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E0802</td>
<td>Data collection does not exist for &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>Error Code</td>
<td>Message</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>E0803</td>
<td>Invalid lifespan. Data life must be greater than 0 days.</td>
</tr>
<tr>
<td>E0804</td>
<td>Invalid namespace. Supported namespaces include &quot;mysql&quot; and &quot;os&quot;.</td>
</tr>
<tr>
<td>E0805</td>
<td>Invalid instance. The instance must be a valid for data collection.</td>
</tr>
<tr>
<td>E0806</td>
<td>Invalid source. The source must be valid for data collection.</td>
</tr>
<tr>
<td>E0807</td>
<td>Invalid attribute. The attrib must be valid for data collection.</td>
</tr>
<tr>
<td>E0808</td>
<td>Invalid frequency: &quot;replaceable_value&quot;. The frequency must be at least 1 minute and be in the format HH:MM.</td>
</tr>
<tr>
<td>E0809</td>
<td>Invalid port. If the URI uses the MYSQL namespace it must include a server port.</td>
</tr>
<tr>
<td>E0810</td>
<td>Invalid server. The server &quot;replaceable_value&quot; must exist in the current inventory.</td>
</tr>
<tr>
<td>E0811</td>
<td>Invalid server. For an OS namespace, the server must not include the MySQL server port.</td>
</tr>
<tr>
<td>E0812</td>
<td>A SQL failure occurred while saving the data collection schedule. &quot;replaceable_value&quot; Please see the error logs for details.</td>
</tr>
<tr>
<td>E0813</td>
<td>Invalid server id &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E0814</td>
<td>No data items exist for server &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E0815</td>
<td>Value &quot;replaceable_value&quot; not valid for &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E0816</td>
<td>categoryName has to be set</td>
</tr>
<tr>
<td>E0817</td>
<td>You must specify either a server or group in the data collection schedule.</td>
</tr>
<tr>
<td>E0818</td>
<td>The server &quot;replaceable_value&quot; does not support item(s) &quot;replaceable_value&quot; required by monitor &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E0819</td>
<td>Invalid data type: &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E0900</td>
<td>Advisor id &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E0901</td>
<td>Advisor name &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E0902</td>
<td>Advisor XML is invalid.</td>
</tr>
<tr>
<td>E0903</td>
<td>Category &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E0904</td>
<td>Invalid server list.</td>
</tr>
<tr>
<td>E0905</td>
<td>SKIPPED &quot;replaceable_value&quot; for replaceable_value because Agent for replaceable_value is down.</td>
</tr>
<tr>
<td>E0906</td>
<td>SKIPPED &quot;replaceable_value&quot; for replaceable_value because mysqld on replaceable_value is down.</td>
</tr>
<tr>
<td>E0907</td>
<td>Category &quot;replaceable_value&quot; cannot be modified.</td>
</tr>
<tr>
<td>E0908</td>
<td>Category &quot;replaceable_value&quot; cannot be deleted.</td>
</tr>
<tr>
<td>E0909</td>
<td>Category &quot;replaceable_value&quot; already exists.</td>
</tr>
<tr>
<td>E0910</td>
<td>Advisor bundle version replaceable_value is incompatible with server version replaceable_value.</td>
</tr>
<tr>
<td>E0911</td>
<td>Heat chart rule &quot;replaceable_value&quot; scheduled against &quot;replaceable_value&quot; may not be unscheduled.</td>
</tr>
<tr>
<td>E0912</td>
<td>Heat chart rule &quot;replaceable_value&quot; scheduled against &quot;replaceable_value&quot; may not be disabled.</td>
</tr>
<tr>
<td>E1100</td>
<td>Graph time format &quot;replaceable_value&quot; is invalid. Must be in the format HH:MM:SS.</td>
</tr>
<tr>
<td>E1101</td>
<td>Graph size height and width must be specified.</td>
</tr>
<tr>
<td>Error Code</td>
<td>Message</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>E1102</td>
<td>Graph &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E1103</td>
<td>Graph &quot;replaceable_value&quot; already exists.</td>
</tr>
<tr>
<td>E1104</td>
<td>Graph &quot;replaceable_value&quot; contains a data collection item that can not be identified.</td>
</tr>
<tr>
<td>E1200</td>
<td>Failed to retrieve identity column.</td>
</tr>
<tr>
<td>E1201</td>
<td>Required parameter &quot;replaceable_value&quot; was NULL.</td>
</tr>
<tr>
<td>E1202</td>
<td>Only SELECT and SHOW commands are allowed via this interface.</td>
</tr>
<tr>
<td>E1203</td>
<td>Invalid timezone &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E1204</td>
<td>Invalid interval &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E1205</td>
<td>Could not find object &quot;replaceable_value&quot; in cache &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E1206</td>
<td>Feature is not implemented. Parameters: replaceable_value</td>
</tr>
<tr>
<td>E1300</td>
<td>Advisor &quot;replaceable_value&quot; already exists.</td>
</tr>
<tr>
<td>E1301</td>
<td>Advisor &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E1302</td>
<td>Schedule does not exist. &quot;replaceable_value&quot; &quot;replaceable_value&quot;</td>
</tr>
<tr>
<td>E1303</td>
<td>JEP error: expression : &quot;replaceable_value&quot;, message: &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E1304</td>
<td>Advisor &quot;replaceable_value&quot; contains a data collection item that can not be identified.</td>
</tr>
<tr>
<td>E1305</td>
<td>Alarm level &quot;replaceable_value&quot; is not valid.</td>
</tr>
<tr>
<td>E1306</td>
<td>Schedule already exists. &quot;replaceable_value&quot; &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E1307</td>
<td>Advisor &quot;replaceable_value&quot; is a read only MySQL Network certified Advisor. Please copy the rule before editing.</td>
</tr>
<tr>
<td>E1308</td>
<td>Advisor &quot;replaceable_value&quot; is currently scheduled against one or more monitored MySQL servers and cannot be removed.</td>
</tr>
<tr>
<td>E1309</td>
<td>Could not render text. &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E1310</td>
<td>No open event for &quot;replaceable_value&quot; on server &quot;replaceable_value&quot;. Perhaps already closed.</td>
</tr>
<tr>
<td>E1311</td>
<td>Alarm with id &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E1400</td>
<td>Invalid missed agent heartbeat threshold value.</td>
</tr>
<tr>
<td>E1401</td>
<td>Notification entry &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E1402</td>
<td>Agent &quot;replaceable_value&quot; is using session &quot;replaceable_value&quot; but session &quot;replaceable_value&quot; was requested.</td>
</tr>
<tr>
<td>E1403</td>
<td>Server name &quot;replaceable_value&quot; is in use by another agent with uuid &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E1500</td>
<td>Notification target &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E1501</td>
<td>Invalid email address &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E1502</td>
<td>Notification target &quot;replaceable_value&quot; already exists.</td>
</tr>
<tr>
<td>E1503</td>
<td>Invalid notification target name &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E1504</td>
<td>Invalid monitor name, it must not be empty.</td>
</tr>
<tr>
<td>E1505</td>
<td>No variable assignments given, you must define at least one.</td>
</tr>
<tr>
<td>E1506</td>
<td>SMTP authentication failed.</td>
</tr>
<tr>
<td>E1507</td>
<td>SMTP send failed</td>
</tr>
<tr>
<td>E1508</td>
<td>Invalid SNMP target &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>Error Code</td>
<td>Message</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>E1509</td>
<td>Invalid SNMP trap type &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E1600</td>
<td>Log &quot;replaceable_value&quot; does not exist.</td>
</tr>
<tr>
<td>E1700</td>
<td>Authentication Mechanism was null</td>
</tr>
<tr>
<td>E1701</td>
<td>Unsupported Authentication Mechanism replaceable_value</td>
</tr>
<tr>
<td>E1702</td>
<td>Incorrect password for user replaceable_value</td>
</tr>
<tr>
<td>E1800</td>
<td>Invalid data type: &quot;replaceable_value&quot;, new value: &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E1801</td>
<td>Invalid value: &quot;replaceable_value&quot; for data type &quot;replaceable_value&quot; for item &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E1802</td>
<td>Invalid expression: &quot;replaceable_value&quot;, exception: &quot;replaceable_value&quot;, raw expression: &quot;replaceable_value&quot;. substitute values: &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E1900</td>
<td>History not found id: &quot;replaceable_value&quot;, schedule: &quot;replaceable_value&quot;, expression: &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E2000</td>
<td>Tag not found, id: &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E2101</td>
<td>Unable to collect &quot;replaceable_value&quot; on &quot;replaceable_value&quot; for instance &quot;replaceable_value&quot;.</td>
</tr>
<tr>
<td>E9000</td>
<td>replaceable_value</td>
</tr>
<tr>
<td>E9001</td>
<td>replaceable_value from: replaceable_value</td>
</tr>
</tbody>
</table>
Appendix F MySQL Enterprise Monitor Frequently Asked Questions

**Note**
MySQL Enterprise subscription, MySQL Enterprise Monitor, MySQL Replication Monitor, and MySQL Query Analyzer are only available to commercial customers. To learn more, see: [http://www.mysql.com/products/](http://www.mysql.com/products/).

FAQ Categories

- **General Usage** [417]
- **MySQL Monitor** [419]
- **MySQL Query Analyzer** [421]

**General Usage Questions**

- F.1: [417] My MySQL Enterprise Service Manager is behind a firewall but it cannot communicate with the Oracle support web site. I normally use a proxy service to access external web sites. How do I configure the proxy settings for MySQL Enterprise Monitor User Interface?

- F.2: [418] How do I change the name of a server?

- F.3: [418] I have started a Data Migration of my old data for a server to MySQL Enterprise Service Manager 2.0, but I have noticed that the performance of the monitor server has degraded significantly. Can I stop the migration?

- F.4: [418] I have set the graphs to update every 5 minutes, and the page refresh to occur every minute. The page is refreshing correctly, but the graphs do not seem to update.

- F.5: [418] During query analysis, I am unable to obtain **EXAMPLE** or **EXPLAIN** information when examining the detail of the analyzed query within the **Query Analyzer** panel.

- F.6: [418] I have enabled **EXPLAIN** queries for Query Analyzer, but no queries with the **EXPLAIN** data are showing up in the display.

- F.7: [419] Does Query Analyzer work with all versions of MySQL and the MySQL Client Libraries?

- F.8: [419] Why do some rules appear to have a **Severity** of **Unknown**?

- F.9: [419] Can I run MySQL Enterprise Service Manager on machine with other applications running?

- F.10: [419] Why does the file `apache-tomcat/logs/tomcat.log` show error messages saying **This is very likely to create a memory leak.**? Is that anything to be concerned about?

- F.11: [419] Why does monitoring a MySQL instance with FEDERATED tables cause extra connections, and decreased performance?

**Questions and Answers**

F.1: My MySQL Enterprise Service Manager is behind a firewall but it cannot communicate with the Oracle support web site. I normally use a proxy service to access external web sites. How do I configure the proxy settings for MySQL Enterprise Monitor User Interface?

To configure a proxy service, edit the `apache-tomcat/conf/catalina.properties` file within the MySQL Enterprise Service Manager installation directory. Change the `http.proxyHost` and `http.proxyPort` properties:
http.proxyHost=proxy.example.com
http.proxyPort=8080

Restart the MySQL Enterprise Service Manager for the change to take effect:

shell> mysqlmonitorctl.sh restart

F.2: How do I change the name of a server?

Go to the Manage Servers panel within Settings and click Rename server.

Renaming the server in this way will override all other server naming, including changes to the agent configuration.

F.3: I have started a Data Migration of my old data for a server to MySQL Enterprise Service Manager 2.0, but I have noticed that the performance of the monitor server has degraded significantly. Can I stop the migration?

You can stop the migration of your historical data at any time. Go to the Manage Servers display of the Settings panel and click Stop next to each server that is being migrated. You can restart the migration at any point.

F.4: I have set the graphs to update every 5 minutes, and the page refresh to occur every minute. The page is refreshing correctly, but the graphs do not seem to update.

The graph refresh and page refresh are two different parameters. The graphs are updated according to their refresh period, regardless of the refresh period set for the main display page.

F.5: During query analysis, I am unable to obtain EXAMPLE or EXPLAIN information when examining the detail of the analyzed query within the Query Analyzer panel.

You must explicitly enable the EXAMPLE and EXPLAIN query functionality. Make sure that you have enabled both panels. See Section 3.2.3, “Query Analyzer Settings”.

F.6: I have enabled EXPLAIN queries for Query Analyzer, but no queries with the EXPLAIN data are showing up in the display.

Query Analyzer only obtains EXPLAIN information when the MySQL Enterprise Monitor Agent identifies a long running query. If none of your queries exceed the defined threshold, then the EXPLAIN information is not obtained and provided to the Query Analyzer for display.

To change the query duration at which an EXPLAIN is triggered, you must edit the share/mysql-proxy/quan.lua file within the MySQL Enterprise Monitor Agent directory on each server. You need to change the value configured in the auto_explain_min_exec_time_us. The default is 500ms:

```lua
---
-- configuration
--
-- SET GLOBAL analyze_query.auto_filter = 0
if not proxy.global.config.quan then
    proxy.global.config.quan = {
        analyze_queries   = true,  -- track all queries
        query_cutoff      = 160,   -- only show the first 160 chars of the query
        num_worst_queries = 5,
        auto_explain      = true,
        auto_explain_min_exec_time_us = 500 * 1000
    }
end
```

The value is expressed in microseconds, which is why the value must be multiplied by 1000. To reduce this value to 100ms, modify this line:

```lua
auto_explain_min_exec_time_us = 100 * 1000
```

These changes take effect without restarting MySQL Enterprise Monitor Agent.
F.7: Does Query Analyzer work with all versions of MySQL and the MySQL Client Libraries?

The MySQL Proxy component, and Query Analyzer, require that clients connecting through MySQL Enterprise Monitor Agent are using MySQL 5.0 or later. Clients that use the `libmysqlclient` library provided with MySQL 4.1 or earlier do not work with MySQL Enterprise Monitor Agent.

F.8: Why do some rules appear to have a Severity of Unknown?

Due to timing issues, certain rules such as “32-Bit Binary Running on 64-Bit AMD Or Intel System” and “Key Buffer Size Greater Than 4 GB” do not evaluate correctly due to timing issues. This is a known issue that is expected to be resolved in future versions of MySQL Enterprise Monitor.

F.9: Can I run MySQL Enterprise Service Manager on machine with other applications running?

You can, but Oracle recommends running your MySQL Enterprise Service Manager on a dedicated machine, especially when monitoring many agents.

F.10: Why does the file `apache-tomcat/logs/tomcat.log` show error messages saying This is very likely to create a memory leak. ? Is that anything to be concerned about?

This message is sometimes produced by underlying components of the web stack on web application reload or shutdown, and is not a cause for concern. It is not practical to shut off these spurious messages within Tomcat.

F.11: Why does monitoring a MySQL instance with FEDERATED tables cause extra connections, and decreased performance?

When the agent starts, it executes a discovery process that performs a number of `INFORMATION_SCHEMA` queries that gather table information for rules. These `INFORMATION_SCHEMA` queries can be costly on instances with many tables, particularly with large numbers of FEDERATED tables to another instance, as each table has a new session opened for it on the target machine.

If you do not want these statements to execute on agent startup, any statement relating to the `INFORMATION_SCHEMA` can be removed from the agent's `share/mysql-proxy/items/items-mysql-monitor.xml` file. However, this will cause some of the rules provided with your subscription to not work, as they rely on this information.

MySQL Monitor

Questions

• F.1: [420] What is MySQL Enterprise Monitor?
• F.2: [420] What are the features and related benefits of the MySQL Enterprise Monitor?
• F.3: [420] What are the immediate benefits of implementing the MySQL Enterprise Monitor?
• F.4: [420] What are the long-term benefits of the MySQL Enterprise Monitor?
• F.5: [420] How is the MySQL Enterprise Monitor installed and deployed?
• F.6: [420] How is the Enterprise Monitor web application architected?
• F.7: [421] What makes MySQL Enterprise unique?
• F.8: [421] What versions of MySQL are supported by the MySQL Enterprise Monitor?
• F.9: [421] What operating system platforms are supported by the MySQL Enterprise Monitor?
• F.10: [421] What are the MySQL Enterprise Advisors and Advisor Rules?
Questions and Answers

F.1: What is MySQL Enterprise Monitor?

Included as part of a MySQL Enterprise subscription, the MySQL Enterprise Monitor is a distributed, web-based application that helps customers reduce downtime, tighten security and increase throughput of their MySQL servers by telling them about problems in their database applications before they occur. It is downloadable from the Oracle Software Delivery Cloud web site and is deployed within the safety of the customer data center.

F.2: What are the features and related benefits of the MySQL Enterprise Monitor?

The MySQL Enterprise Monitor is like having a "Virtual DBA Assistant" at your side to recommend best practices to eliminate security vulnerabilities, improve replication, and optimize performance. For the complete features and benefits, visit the http://www.mysql.com/products/enterprise/monitor-features.html.

F.3: What are the immediate benefits of implementing the MySQL Enterprise Monitor?

Often MySQL installations are implemented with default settings that may not be best suited for specific applications or usage patterns. The MySQL Advisors go to work immediately in these environments to identify potential problems and proactively notify and advise DBAs on key MySQL settings that can be tuned to improve availability, tighten security, and increase the throughput of their existing MySQL servers.

F.4: What are the long-term benefits of the MySQL Enterprise Monitor?

Over time, the task of managing even medium-scale MySQL server farms becomes exponentially more complicated, especially as the load of users, connections, application queries, and objects on each MySQL server increases. The Enterprise Monitor continually monitors the dynamic security, performance, replication and schema relevant metrics of all MySQL servers, so as the number of MySQL continues to grow, DBAs are kept up to date on potential problems and proactive measures that can be implemented to ensure each server continues to operate at the highest levels of security, performance and reliability.

F.5: How is the MySQL Enterprise Monitor installed and deployed?

The Enterprise Monitor is powered by a distributed web application that is installed and deployed within the confines of the corporate firewall.

F.6: How is the Enterprise Monitor web application architected?

The Enterprise Monitor web application comprises three components:

- Monitor Agent: A lightweight C program that is installed on each of the monitored MySQL servers. Its purpose is to collect MySQL SQL and operating system metrics that allow the DBA to monitor the overall health, availability and performance of the MySQL server. The Monitor Agent is the only component within the application that touches or connects to the MySQL Server. It reports the data it collects via XML over HTTP to the centralized Service Manager.

- Service Manager: The main server of the application. The Service Manager manages and stores the data collections that come in from each monitor agent. It analyzes these collections using MySQL provided best practice Advisor rules to determine the health, security, availability and performance of each of the monitored MySQL Servers. The Service Manager also provides the content for the Enterprise Dashboard which serves as the client user interface for the distributed web application.

- Repository: A MySQL database that is used to stored data collections and application-level configuration data.
F.7: What makes MySQL Enterprise unique?

Of the products on the market that monitor MySQL, SQL code and OS specific metrics, the MySQL Enterprise Monitor is the only solution that is built and supported by the engineers at MySQL. Unlike other solutions that report on raw MySQL and OS level metrics, the MySQL Enterprise Monitor is designed to optimize the use of MySQL by proactively monitoring MySQL instances and providing notifications and ‘MySQL DBA expertise in a box’ advice on corrective measures DBAs can take before problems occur.

F.8: What versions of MySQL are supported by the MySQL Enterprise Monitor?

The MySQL Enterprise Monitor supports MySQL versions 5.1 and above.

F.9: What operating system platforms are supported by the MySQL Enterprise Monitor?

The Enterprise Monitor Service Manager is fully supported on most current versions of Linux, Windows and Windows Server Editions, and Solaris. The Monitor Agent supports any platform supported by the MySQL Enterprise server. For the complete list of MySQL Enterprise supported operating systems and CPUs, visit MySQL Supported Platforms and select MySQL Enterprise Monitor.

F.10: What are the MySQL Enterprise Advisors and Advisor Rules?

The MySQL Enterprise Advisors are a set of best practice guidelines for the optimal use of MySQL. Advisors are spread across database specific disciplines and comprise a set of MySQL Advisor Rules that proactively monitor all MySQL servers and report on database application problems before they occur. Each Advisor Rule provides a detailed overview of the problem it is designed to identify, advise on how to correct the problem, specify commands to implement the recommended fix and links to additional resources for additional research into the issue at hand.

F.11: How are subscribers notified about the availability of new or updated MySQL Enterprise Monitor, MySQL Enterprise Advisors and Advisor Rules?

Customers will receive notifications of new and updated MySQL Enterprise Monitor and Advisors as they become available via the MySQL Enterprise Software Update Service. Notifications will be generated and sent based on the customer profile and the MySQL Enterprise subscription level.

MySQL Query Analyzer

Questions

- F.1: [422] What is the MySQL Query Analyzer?
- F.2: [422] How is the MySQL Query Analyzer installed and enabled?
- F.3: [422] What overhead can I expect when the MySQL Query Analyzer is installed and enabled?
- F.4: [422] Can I leave the MySQL Query Analyzer enabled at all times?
- F.5: [422] What are the main features and benefits of the MySQL Query Analyzer?
- F.6: [422] What are the typical use cases of the MySQL Query Analyzer?
- F.7: [422] How are subscribers notified about updates to the MySQL Query Analyzer application components?
- F.8: [422] What makes the MySQL Query Analyzer unique?
- F.9: [423] How can I get the MySQL Query Analyzer?
- F.10: [423] Does Query Analyzer work with MySQL Cluster?
- F.11: [423] Does Query Analyzer enable me to monitor the disk reads and writes during a query?
Questions and Answers

F.1: What is the MySQL Query Analyzer?

The MySQL Query Analyzer allows DBAs, developers and system administrators to improve application performance by collecting, monitoring, and analyzing queries as they run on their MySQL servers. http://www.mysql.com/products/enterprise/query.html

F.2: How is the MySQL Query Analyzer installed and enabled?

The Query Analyzer feature is installed with the Monitor Agent. It is enabled during agent installation and can be toggled between collection and pass-thru modes from the Query Analysis page of the Enterprise Monitor.

F.3: What overhead can I expect when the MySQL Query Analyzer is installed and enabled?

The average overhead when in active collection mode is in the 15-20% range. In pass-thru mode the overhead is minimal, weighing in at 1-5% on most MySQL systems of average load.

F.4: Can I leave the MySQL Query Analyzer enabled at all times?

We have customers who have the Query Analyzer enabled and collecting queries on their development and QA servers so they can tune their code and monitor the fixes as part of the development process. For production systems, Query collection and analysis can easily be toggled on when a slowdown occurs. To avoid collection mode overhead many users are using simple scripts to enable the Query Analyzer to sample queries during non-peak hours, typically during 30 minute windows. They can then view the collected queries using the date/time or interval filter options.

F.5: What are the main features and benefits of the MySQL Query Analyzer?

For the complete features and benefits, visit the http://www.mysql.com/products/enterprise/monitor-features.html

F.6: What are the typical use cases of the MySQL Query Analyzer?

The typical use cases for developers, DBAs and system administrators are:

• Developers – Monitor and tune application queries during development before they are promoted to production.

• DBAs and System Administrators – Identify problem SQL code as it runs in production and advise development teams on how to tune. This use case benefits the most from regular sampling of queries as they are running, most often during non-peak hours.

F.7: How are subscribers notified about updates to the MySQL Query Analyzer application components?

Customers will receive notifications of the MySQL Query Analyzer updates as they become available via the MySQL Enterprise Software Update and Alert Service. Notifications will be generated and sent based on the customer profile and the MySQL Enterprise subscription level.

F.8: What makes the MySQL Query Analyzer unique?

Other products (free, open source and commercial) that provide MySQL query monitoring are dependent on the MySQL Slow Query Log being enabled and available for sampling. While this
provides some time savings over the DBA collecting and parsing the Log, the Slow Query Log comes with overhead and does not capture sub millisecond executions. The log data also grows very large very quickly.

The MySQL Query Analyzer collects queries and execution statistics with no dependence on the SQL Query Log, it captures all SQL statements sent to the MySQL server and provides an aggregated view into the most expensive queries in number of executions and total execution time. It is also fully supported as part of the MySQL Enterprise subscription.

F.9: How can I get the MySQL Query Analyzer?

The MySQL Query Analyzer is built into the MySQL Enterprise Monitor.

To experience the MySQL Enterprise Monitor for 30 days, visit the http://www.mysql.com/trials/

F.10: Does Query Analyzer work with MySQL Cluster?

Yes, providing that exact node is monitored with an agent and query analyzer has been enabled for that node. Note that you must be accessing your cluster data through a standard MySQL node for this to work.

F.11: Does Query Analyzer enable me to monitor the disk reads and writes during a query?

No, that information is not available to the query analyzer.

F.12: How much degradation in performance does mysql-proxy introduce?

At the very least it's equivalent to a network hop in latency. The degradation is directly related to your average query execution time. If your queries execute in microseconds (which can happen if served from query cache) then the degradation will be higher, and noticeable. We've seen some applications that actually do work when they execute queries, the degradation is much less, and in some limited cases because of scheduling, the application actually has better throughput.

F.13: Does the query analyzer look at all queries? Or only queries which would show up in the in the slow-queries log?

The Query Analyzer sees all queries routed through the agent/proxy that performs the query analysis and aggregate them directly.

F.14: Do the MySQL clients have to connect to the port of the mysql proxy to enable the Query Analyzer?

Yes, or you can re-direct them in various ways, by reconfiguring mysqld to listen to some other port, and the proxy to 3306, use iptables redirection, etc. We have some examples in the manual for the product on how to do it (semi)-transparently.
Appendix G Files associated with configuring, debugging, and using MySQL Enterprise Monitor

This links to the sections that discuss MySQL Enterprise Monitor generated files.

- Log files for the MySQL Enterprise Service Manager which includes `mysql-monitor.log` (service manager), `catalina.out` (Apache/Tomcat), and `configuration_report.txt` (during the installation or upgrade). See Section C.1.3, “Log Files for the MySQL Enterprise Service Manager”.

- Agent log and pid files, which includes `mysql-monitor-agent.log` and `mysql-monitor-agent.pid`. See Section C.2.3, “Agent Log and pid Files”.

- The Management Information Base (MIB) file, which is `MONITOR.MIB`. See Section C.1.4, “The Management Information Base (MIB) File”.

- The Service Manager configuration file, which is `config.properties`. See Section C.1.5, “The config.properties file”.

- The Service Manager may be started/stopped with `mysqlmonitorctl.sh` on Linux, and `mysqlmonitorctl.bat` on Microsoft Windows.

- The agent may be started/stopped with `mysql-monitor-agent` on Linux, and `agentctl.bat` on Microsoft Windows.
Appendix H MySQL Enterprise Monitor Release Notes

Release notes for MySQL Enterprise Monitor are published separately. See MySQL Enterprise Monitor 2.3 Release Notes.
MySQL Enterprise Monitor Glossary

These terms are commonly used in information about the MySQL Enterprise Monitor product.

A

advisor

A rule and the alarms and notifications associated with it. Sets of advisors that perform related measurements are grouped together into collections. Advisors are a crucial aspect of the monitoring system. The MySQL Enterprise Monitor product comes with a number of standard advisors. Based on your organization’s particular needs, you may create or adapt custom advisors.

See Also Advisors tab, alarm, collection, custom, notification, rule, schedule, standard.

advisor group

A collection of similar advisors shown on the Advisors tab. For example, there are predefined advisor groups such as Administration, Cluster, and Heat Chart.

See Also advisor, Advisors tab.

Advisors tab

A page within the UI where you can manage advisors, both standard and custom ones. See Section 2.3, “The Advisors Tab”.

See Also advisor, custom, Dashboard, standard.

Agent

The MySQL Enterprise Monitor component that actively collects data from MySQL server instances. The data is transmitted to the Service Manager. The Agent includes an optional subcomponent, the Aggregator, which can intercept query data as it passes between applications and the database, and again transmit that data to the Service Manager.

See Also instance, Service Manager.

Aggregator

An optional subcomponent of the Agent. It can intercept query data as it passes between applications and the database, and transmit that data to the Service Manager. To collect query data from applications requires using a MySQL Enterprise Plugin for the appropriate Connector based on the application language or framework.

See Also Agent, Connector, plugin, Service Manager.

alarm

The persistent record of an event, including its severity: critical, warning, or informational. Alarms are displayed in the Heat Chart and on the Events tab. Serious alarms produce notifications.

See Also alert, Critical, event, Informational, notification, Warning.

alert

A kind of notification caused by rule evaluation within an advisor. Displayed on the Events tab.

See Also advisor, alarm, event, Events tab, notification, SMTP, Warning.

Apache

The web server that runs the Tomcat servlet container that powers the UI. The MySQL Enterprise Monitor Service Manager installation includes the Apache web server.

See Also Dashboard, Service Manager, Tomcat.

asset

A component that the MySQL Enterprise Monitor product monitors, such as a MySQL server instance, or a CPU or file system within a server machine. Contrast with metric, which is a property within the component that is measured.

See Also instance, metric.

Asset Selector

The Groups shown in the Asset Selector are the ones you create and manage (on the MySQL Instances Dashboard, or during Agent installation) and those that are discovered automatically from monitoring
replication topologies. It is on the left side of many UI pages that controls content in the main-body of the page.
See Also asset, Dashboard, graph.

autodiscovery
The mechanism that detects the set of master, slave, and master/slave servers in a replication configuration, and displays the topology in the Server tree.
See Also Asset Selector, master, replication, Server tree, slave, topology.

B

best practice
Within the MySQL Enterprise Monitor product, a best practice is a specific rule backed up by a metric. When a threshold value is reached, the Service Manager raises an alarm.
See Also alarm, metric, rule, Service Manager, threshold.

blackout period
A time period where an Agent stops reporting information from a MySQL server instance. Typically, this is during a maintenance period when the database might go through an unusual workload that does not require raising any alarms.
See Also Agent, instance, notification.

circuit replication
In replication, a kind of topology where each server acts as a master/slave server, connected to at most two other servers.
See Also circular replication, master/slave, replication, topology.

circular replication
In a replication configuration, a topology where every server is both a master and a slave, connected to two other servers, forming a ring structure. Forms a ring structure.
See Also replication, ring replication, topology.

collection
A set of related advisors.
See Also advisor.

Connector
A software component (analogous to a “driver”) that provide connectivity to the MySQL server for client programs. MySQL comes with connectors for several programming languages and frameworks. The MySQL
Enterprise Monitor product includes plugins for certain collectors, to help monitor queries sent by application programs and use that data within the Query Analyzer.

See Also Connector/J, Connector/Net, Connector/PHP, query, Query Analyzer.

Connector/J

The Connector for applications written in the Java programming language. It communicates directly with the MySQL server without going through the libmysqlclient shared library.

See Also Connector, Java.

Connector/Net

The Connector for applications written with the .NET programming framework. It communicates directly with the MySQL server without going through the libmysqlclient shared library.

See Also .NET, Connector.

Connector/PHP

The Connector for applications written in the PHP programming language. The mechanism for communicating with the MySQL server may differ depending on the version of PHP involved.

See Also Connector, PHP.

credentials

The MySQL Enterprise Monitor product interfaces with many different databases and other kinds of servers. Each of these components can have its own login and security credentials. MySQL Enterprise Monitor pulls performance data from the MySQL servers that you monitor, stores the resulting data in a repository that is also a MySQL server, and sends alerts by communicating through other kinds of servers such as SMTP for e-mail alerts and NMS for SNMP traps. It pulls support-related data from the My Oracle Support site. You view the results in the UI, which is protected by its own login and optionally by LDAP authentication.

See Also Dashboard, LDAP, NMS, repository, SMTP, SNMP.

Critical

A high severity level for alarms. Within a rule, you can designate the threshold values that specify whether an alarm triggers a Critical, Warning, or Informational alert.

See Also advisor, alarm, event, Informational, rule, threshold, Warning.

custom

User-created rules and graphs. Contrast with standard.

See Also graph, rule, standard.

D

Dashboard

The MySQL Enterprise Dashboard is a web-based interface to the MySQL Enterprise Service Manager. The user interface consists of a series of tab pages. The back end is a Java application powered by the Tomcat server.

See Also Advisors tab, Events tab, Graphs tab, Monitor tab, Query Analyzer tab, Replication tab, Service Manager, Settings tab, Tomcat, What's New tab.

data collection item

Data values derived from server status variables, operating system status information, and MySQL table information. You can reference these items using mnemonic names in expressions when you create or edit rules.

See Also expression, rule.

E

event

A slightly more comprehensive synonym for alarm. Evaluating a rule generates an event. The result of an event can be “success” if everything is OK. An alarm is raised only if something goes wrong. You monitor events using the Events tab.
See Also alarm, alert, Critical, Events tab, Informational, notification, Warning.

Events tab
A page within the UI, for monitoring events. See Section 2.4, “The Events Tab”. See Also Dashboard, event.

EXPLAIN plan
A textual report showing the internal mechanisms used by a query, and estimates for the “cost”, such as amount of data to process, involved in each step. Performance monitoring involves checking whether queries that are slow or frequently run could be sped up or made less resource-intensive, by examining the EXPLAIN plan to check if the MySQL optimizer has chosen the most efficient ways to process indexes, order join clauses, and so on. The MySQL Enterprise Monitor product includes a number of features for visualizing EXPLAIN plans. These features are language-dependent, relying on support in the various Connectors for programming languages and frameworks. See Also query.

equation
The part of a rule that tests a metric against a threshold value. See Also alarm, metric, rule, threshold.

F
firewall
Additional considerations apply when the server you are monitoring is separated from the Service Manager by a firewall.
See Also remote, Service Manager, SSL.

full table scan
An aspect of a SELECT query that often indicates a performance or scalability issue. The query scans every row in a table, rather than using an index to look up a subset of rows. It can be a non-issue for small tables that are cached in memory. It can be unavoidable when querying large tables to prepare reports. Performance issues are most likely when the table being scanned is involved in a join operation, when the query is run frequently, or when the result set only references a small fraction of the rows in the table.

To diagnose possible issues due to full table scans, choose a time period of heavy SQL activity from one of the graphs, use the Query Analyzer to locate queries that process large numbers of rows, and examine the explain plan for the queries. The notation in the explain plan that indicates a full table scan is Type=ALL. See Also EXPLAIN plan, graph, query, Query Analyzer.

G
graph
A visual representation of server activity, resources, or other metrics over time. You monitor graphs using the Graphs tab.
See Also Graphs tab, Heat Chart, metric.

Graphs tab
A page within the Dashboard that displays graphs of server activity and resources. See Section 2.5, “The Graphs Tab”. See Also Dashboard, graph.

H
heartbeat
A periodic signal sent from each agent to the Service Manager, so that the Service Manager can verify that the agents are still running and able to connect. You typically use URLs containing “heartbeat” to verify a network connection between machines running different MySQL Enterprise Monitor components. See Also Agent, Service Manager.
Heat Chart
A special chart that shows the status of critical rules. These rules are grouped together as an advisor, known as the Heat Chart Advisor. It can be displayed as part of the Dashboard or remain permanently open in its own window. See Section 2.2.2, “The Heat Chart”.
See Also advisor, Dashboard.

host
A computer running one or more instances of MySQL server.
See Also instance, MySQL server.

I

Informational
A low severity level for alarms. Within a rule, you can designate the threshold values that specify the severity level that is triggered.
See Also advisor, Critical, event, rule, threshold, Warning.

instance
A mysqld daemon running on a MySQL server. There might be multiple instances running on the same server machine. An instance is one of the kinds of asset that the MySQL Enterprise Monitor product can monitor.
See Also asset.

instrument
A persisted instance of a run-time metric evaluation. These may store the raw metric data, or the result of an expression or function against a metric. Instruments are generally stored for things that will show in the GUI, such as graph data.
See Also graph, metric.

inventory
Core information about a host or MySQL server instance. This data is collected by the Agent. The inventory includes details such as the MySQL server version number, supported storage engines and replication configuration. The data in the inventory helps to determine what other kinds of data can be collected from the hosts and MySQL servers.
See Also Agent, instance, replication.

J

Java
The MySQL Enterprise Plugin for Connector/J enables any application using the Connector/J JDBC driver to supply query analyzer information directly to MySQL Enterprise Service Manager. Information is sent to the MySQL Enterprise Service Manager for analysis without any need to modify your applications.

The MySQL Enterprise Monitor product is also partly built on Java technology, using the Tomcat servlet container for the web-based GUI. It uses a JVM on the machine that runs the Service Manager, its performance is affected by the Tomcat configuration parameters, and during troubleshooting you might use diagnostic information from the Java environment.
See Also Connector/J, Dashboard, JDBC, plugin, Query Analyzer, Tomcat.

JDBC
The underlying database API used by many Java applications, including the Connector/J component.
See Also Connector/J, Java.

L

LDAP
An authentication mechanism that can control access to the UI. On Linux, Unix, and OS X systems, you might have a separate LDAP server where each user has their own credentials. On Windows systems, the LDAP protocol is used to connect to an Active Directory server for the same authentication purposes.
Typically, you map LDAP roles to corresponding MySQL Enterprise Monitor roles, to enable groups of users to have basic or administrative access to the Dashboard without configuring each user individually, or giving them a new user ID and password, or requiring extra work to revoke access when they leave the organization. See Also credentials, Dashboard, role.

log file
The MySQL Enterprise Monitor product manages log files for the Tomcat, repository, and Service Manager components, as well as a configuration report pertaining to the initial installation. You can view each of these configuration files through the UI, or by examining the physical file. See Also Dashboard, repository, Service Manager, Tomcat.

Lua
A programming language that is used for parts of the Agent, Aggregator, Service Manager, and Query Analyzer components. Although you do not need to know this language to operate the MySQL Enterprise Monitor product, sometimes you specify options containing file paths related to Lua scripts or libraries. See Also Agent, Aggregator, Query Analyzer, Service Manager.

M

master
In a replication configuration, a database server that sends updates to a set of slave servers. It typically dedicates most of its resources to write operations, leaving user queries to the slaves. In complex topologies, a server can be both a master and a slave, known as a master/slave. See Also master/slave, replication, slave, topology.

master/slave
In replication, a server that acts as a slave to receive updates from another server, and also acts as a master to propagate changes to another set of slave servers. Keeps the top-level master from having to service too many slaves, and allows certain kinds of changes to be propagated to a subset of slaves. This topology is represented as a tree, with all the intermediate nodes being master/slave servers. See Also master, replication, slave, topology, tree.

metric
Any property that is measured using a numeric value. Within MySQL Enterprise Monitor, such measurements can be displayed over time as a graph, or an alert can be sent when a threshold value is reached. Each metric is collected from an asset. For example, how much time is taken by a database query, or how full is the file system on a server machine. See Also alert, asset, graph, threshold.

mixed replication
In a replication configuration, a kind of topology consisting of different combinations of master, slave, and dual-purpose master/slave servers. See Also chain replication, circular replication, master, master/slave, replication, slave, topology, tree.

monitor
To view information about the state, health, activity, and history of a resource such as a MySQL server instance. Monitoring can help to diagnose problems, spot worrisome trends before they turn into problems, reassure when systems are operating normally, and notify when an operator needs to take corrective action. With MySQL Enterprise Monitor, the component you interact with during monitoring is the UI. See Also Dashboard, instance.

Monitor tab
A page within the UI that provides a quick overview of your current monitoring information. It can serve as an instant health check for all the MySQL servers across the enterprise. See Also Dashboard.

My Oracle Support
The web site for filing bugs and service requests with Oracle Support. (Commercial customers such as MySQL Enterprise Monitor users now use the official Oracle support channel rather than the MySQL bug database.) In MySQL Enterprise Monitor, you interact with the support site through the What’s New tab.
MySQL server

The MySQL database instance running on a host computer. More than one MySQL instance can run on the same computer, either as separate mysqld processes or through virtualization.

See Also instance.

N

.NET

A programming framework used by many Windows applications, including the Connector/Net component.

See Also Connector/Net.

NMS

Acronym for Network Management System, a type of monitoring system that is separate from the MySQL Enterprise Monitor product. If your network has this kind of monitoring capability, MySQL Enterprise Monitor can notify the NMS of network issues by translating events into SNMP traps.

See Also event, SNMP.

normalized query

A condensed form of the query text used to treat similar queries as if they were identical, for monitoring performance. When MySQL Enterprise Monitor normalizes queries, it disregards differences in keyword capitalization, whitespace, and most comments. It replaces literal values with placeholders and transforms multi-row insert statements and IN clauses, to group similar statements with different parameters when measuring how much time is consumed by a particular type of query.

See Also canonical query, query.

notification

The e-mail or other form of communication triggered by an alarm. Notifications are defined using Event Handlers.

See Also alarm.

notification group

A collection of users who should receive a notification when advisor alerts occur. These users might have login credentials for the UI, but this is not a requirement.

See Also alert, Dashboard, notification.

P

PHP

A scripting language typically embedded within web pages.

See Also Connector/PHP.

plugin

In the MySQL Enterprise Monitor product, a component that sits between the database and applications that use a particular language-based Connector. It collects query data from both standalone and web-based applications, for MySQL Enterprise Monitor to monitor. For example, there is the MySQL Enterprise Plugin for Connector/Net, and the MySQL Enterprise Plugin for Connector/J. The mechanism for transferring the data, such as whether the data flows through the Aggregator or the Proxy, depends on the particular connector.

See Also Aggregator, Connector, proxy.

proxy

An optional subcomponent of the Agent. It can accept queries from user applications, forward them to a MySQL server, and return the query results back to the application. The agent records statistical information about the queries and results. You rearrange the TCP/IP ports so that the application communicates with the proxy instead of the database, either by changing the port where the application communicates with the database, or the port where the database listens.

See Also Agent.
Q

QUAN
An abbreviation for Query Analyzer used in some keyword names.
See Also Query Analyzer.

query
In the MySQL Enterprise Monitor context, any SQL statement whose performance might be monitored.
Includes not just SQL SELECT queries, but also DML statements such as INSERT, UPDATE, and DELETE, and DDL statements such as CREATE TABLE and TRUNCATE TABLE.
See Also normalized query, slow query log.

Query Analyzer
The MySQL Enterprise Monitor component that tracks data about MySQL queries and summarizes that data using graphs and tables. You interact with it (for example, filtering the displayed queries or selecting a specific time period) using the Query Analyzer tab in the UI.
See Also Dashboard, graph, query, Query Analyzer tab.

Query Analyzer tab
A page within the UI that displays output and controls the options for the Query Analyzer component. See Section 2.6, “The Query Analyzer Tab” for an overview and Chapter 3, Using the Query Analyzer for usage information.
See Also Dashboard, Query Analyzer.

R

remote
Additional considerations apply when the server you are monitoring is separated from the Service Manager, for example by a wide-area network or by a firewall.
See Also firewall, SSL.

replication
A set of database features that mirrors the same data across a set of servers. Used for reliability in case of server failure, and to speed up queries by dividing the work across servers. Because replication involves so many aspects of reliability and performance, it is an important aspect to monitor and has a dedicated Replication tab in the UI.
See Also Dashboard, Replication tab, topology.

Replication tab
A page within the UI that monitors aspects of replication. See Section 2.7, “The Replication Tab”.
See Also Dashboard, replication.

repository
The database that stores the monitoring data collected by the MySQL Enterprise Monitor product. It can be a separate database instance that is part of the MySQL Enterprise Monitor installation (the bundled MySQL server), or you can use an existing database of your own. The bundled MySQL server is a level of MySQL database that is fully tested with the MySQL Enterprise Monitor product, and can be kept separate from your other databases to avoid any extra load on them. You might use an existing server that has spare capacity, fast storage devices, tuned configuration parameters, a backup system, or other conveniences that can benefit the MySQL Enterprise Monitor data storage as well.
See Also bundled, instance.

ring replication
See circular replication.

role
A level of access privilege for the UI. One of manager (highest privilege), dba, read-only, or agent (specialized privilege for sending data). Each user account registered with the Dashboard must have one of
these roles. Components such as the *Agent* and the *Aggregator* use the *agent* role. To simplify the process of granting *credentials* for large numbers of users, you can map *LDAP* roles to these MySQL Enterprise Monitor roles.

See Also *Agent*, *Aggregator*, *credentials*, *Dashboard*, *LDAP*.

**rule**

A test consisting of an *expression* and one or more *threshold* values that correspond to different *alert levels*. When the value of the expression reaches one of the threshold values, an event is generated. Depending on how you configure the rule, the event can result in an *alarm*, a *notification*, or both.

See Also *advisor*, *alarm*, *event*, *expression*, *notification*, *threshold*.

**S**

**schedule**

Determines how often each *advisor* is evaluated.

See Also *advisor*.

**scope**

A dynamic filter against an *asset* class.

See Also *asset*.

**Server tree**

A section of the *UI* window that shows individual and groups of MySQL servers. Significant aspects of the Server Tree include the host names of the servers (including the port number if different than the default), and the tooltip information when you hover the mouse pointer over an item in the tree. Selecting one or more items in the tree determines the scope of the information displayed in *graphs*, *Heat Chart*, and so on the *Monitor tab*.

See Also *Dashboard*, *graph*, *Heat Chart*, *Monitor tab*.

**Service Manager**

The core MySQL Enterprise Monitor component that receives the monitoring data from the *Agent*, *Aggregator*, and *Query Analyzer* components. It displays this information through the GUI web-interface, and manages all the *advisors*, *rules*, and *alerts*.

See Also *advisor*, *Agent*, *Aggregator*, *alert*, *Dashboard*, *Query Analyzer*, *rule*.

**service request**

Generic term for a bug that you have filed or a support request that you have opened, on the *My Oracle Support* site. Formerly, we referred to these as *support issues*.

See Also *My Oracle Support*, *support issue*.

**Settings tab**

A page in the *UI* where you see or change configuration settings for the *Service Manager*.

See Also *Dashboard*, *Service Manager*.

**severity**

A measure of the seriousness of an *alert*. Serious alerts trigger *alarms*.

See Also *alarm*, *alert*, *rule*.

**slave**

In a *replication* configuration, a database server that receives updates from a *master* server. Typically used to service user queries, to minimize the query load on the master. In complex *topologies*, a server can be both a master and a slave, known as a *master/slave*.

See Also *master*, *master/slave*, *replication*, *topology*.

**slow query log**

A MySQL Server facility for tracking *queries* that consume considerable time and resources. MySQL Enterprise Monitor provides more information about query performance than the slow query log, and does not currently use the slow query log itself.

See Also *query*.
SMTP
The e-mail protocol for sending alerts as e-mail messages. To send alerts this way, you configure e-mail settings similar to those in an e-mail client.
See Also alert.

SNMP
A protocol for sending event notifications ("SNMP traps") to an NMS. The MySQL Enterprise Monitor product can turn notifications for selected rules into SNMP traps. In contrast to typical alerts that are only raised when some issue occurs, SNMP traps are broadcast for all state changes, so that corrective action can be cancelled when an issue is cleared.
See Also alert, NMS, notification.

SSL
For MySQL Enterprise Monitor, the default port used for SSL connections is 18443. If you are connecting using SSL, the built-in MySQL Enterprise Monitor certificate is self-signed and may be highlighted as “unsafe” within the browser on initial connection. To prevent problems accessing the site, add an exception for the certificate to your browser for this server.

standard
The predefined rules and graphs supplied as part of the MySQL Enterprise Monitor product. Contrast with custom.
See Also custom, graph, rule.

support issue
Former term for bugs and service requests. In the My Oracle Support system, now known as a service request, which is the preferred term.
See Also service request.

T
table scan
See full table scan.

threshold
The cutoff value in a rule. When the rule’s expression passes this value, an alert is triggered. There can be different threshold values to trigger the different level alerts.
See Also alert, Critical, expression, Informational, rule, Warning.

Tomcat
A component of the Service Manager, the servlet engine that powers the UI.
See Also Apache, Dashboard, Java, Service Manager.

topology
In a replication configuration, the way in which the different master, slave, and dual-purpose master/slave servers are connected. In MySQL Enterprise Monitor, the configurations are classified in the Replication Tab as one of TREE, RING, or MIXED.
See Also master, master/slave, replication, Replication tab, slave.

tree
A data structure often used to represent relationships between MySQL servers. In the UI, servers are displayed in the Server Tree sidebar. In a replication configuration, setting up some machines as dual-purpose master/slave servers produces a nesting relationship that is represented in the Server Tree.
See Also Asset Selector, Dashboard, master/slave, replication, Server tree.

U
UI
The UI is a web-based interface to the MySQL Enterprise Service Manager. The back end is a Java application powered by the Tomcat server.
See Also Dashboard.

UUID

A unique identifier used to distinguish each MySQL instance, host machine, and agent. Because there is so much flexibility in spreading components across multiple systems or running multiple instances and agents on the same system, the combination of these different UUIDs identifies where information came from and the source of any issues. Always generate a new UUID for any one of these components, rather than copying or reusing an existing UUID value.

In MySQL Enterprise Monitor, the UUID for a MySQL server is stored in the table mysql.inventory. When a component such as the Agent or a Connector plugin connects to that MySQL server, the applicable MySQL user must have privileges to read this table.

See Also Agent, instance.

Warning

A medium severity level for alarms. Within a rule, you can designate the threshold values that specify for each severity level.

See Also advisor, alarm, alert, Critical, event, Informational, notification, rule, threshold.

What's New tab

A page within the UI that provides updates and news related to MySQL Enterprise Monitor and your My Oracle Support account.

See Also Dashboard, My Oracle Support.
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