MySQL Workbench 5.2
Abstract

This is the archived MySQL™ Workbench 5.2 Reference Manual. It documents both MySQL Workbench SE and MySQL Workbench OSS editions 5.2 through 5.2.47.

If you have not yet installed MySQL Workbench OSS please download your free copy from the download site. MySQL Workbench OSS is available for Windows, Mac OS X, and Linux.

For release notes detailing the changes in each release, see the MySQL Workbench Release Notes.

For legal information, see the Legal Notices.

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# Table of Contents

Preface and Legal Notices .............................................................................................................. ix  
1. MySQL Workbench Introduction ........................................................................................... 1  
2. What is new in MySQL Workbench 6.0 ................................................................................. 3  
3. MySQL Workbench Editions ..................................................................................................... 17  
4. Installing and Launching MySQL Workbench ...................................................................... 19  
  4.1. Hardware Requirements ...................................................................................................... 19  
  4.2. Software Requirements ...................................................................................................... 19  
  4.3. Starting MySQL Workbench ............................................................................................... 20  
    4.3.1. Installing MySQL Workbench on Windows ............................................................... 21  
    4.3.2. Launching MySQL Workbench on Windows ............................................................. 21  
    4.3.3. Uninstalling MySQL Workbench on Windows ........................................................ 22  
    4.3.4. Installing MySQL Workbench on Linux .................................................................... 23  
    4.3.5. Launching MySQL Workbench on Linux ................................................................. 23  
    4.3.6. Uninstalling MySQL Workbench on Linux ............................................................... 23  
    4.3.7. Installing MySQL Workbench on Mac OS X ............................................................ 24  
    4.3.8. Launching MySQL Workbench on Mac OS X .......................................................... 24  
    4.3.9. Uninstalling MySQL Workbench on Mac OS X ......................................................... 25  
5. Getting Started Tutorial ........................................................................................................... 27  
  5.1. Administering a MySQL Server .......................................................................................... 27  
  5.2. Creating a Model .............................................................................................................. 39  
  5.3. Adding Data to Your Database ......................................................................................... 44  
6. The Home Window .................................................................................................................... 49  
  6.1. Workbench Central ........................................................................................................... 50  
  6.2. Workspace ....................................................................................................................... 51  
  6.3. Workbench Application Minimum Window Size ............................................................ 51  
  6.4. Workbench Preferences .................................................................................................... 51  
    6.4.1. The General Tab ........................................................................................................... 51  
    6.4.2. The Administrator Tab ............................................................................................... 53  
    6.4.3. The SQL Editor Tab .................................................................................................... 54  
    6.4.4. The SQL Queries Tab ............................................................................................... 55  
    6.4.5. The Model Tab ........................................................................................................... 57  
    6.4.6. The Model:MySQL Tab .............................................................................................. 59  
    6.4.7. The Diagram Tab ....................................................................................................... 60  
    6.4.8. The Appearance Tab ................................................................................................. 61  
7. SQL Development .................................................................................................................... 65  
  7.1. Open Connection to Start Querying .................................................................................. 65  
  7.2. New Connection ............................................................................................................... 66  
  7.3. Edit Table Data ................................................................................................................. 66  
  7.4. Edit SQL Script .................................................................................................................. 66  
  7.5. Manage Connections ...................................................................................................... 66  
  7.6. Manage DB Connections Dialog ..................................................................................... 66  
    7.6.1. The Password Storage Vault ...................................................................................... 67  
    7.6.2. Standard TCP/IP Connection ................................................................................... 68  
    7.6.3. Local Socket/Pipe Connection ................................................................................... 69  
    7.6.4. Standard TCP/IP over SSH Connection .................................................................... 69  
  7.7. SQL Editor ....................................................................................................................... 70  
    7.7.1. Main Menu .................................................................................................................. 71  
    7.7.2. Toolbar ...................................................................................................................... 72  
    7.7.3. SQL Query Panel ....................................................................................................... 73  
    7.7.4. Main Tabsheets .......................................................................................................... 74  
    7.7.5. Sidebar ..................................................................................................................... 77  
8. Data Modeling .......................................................................................................................... 83  
  8.1. Open an Existing EER Model ............................................................................................ 84  
  8.2. Create New EER Model ..................................................................................................... 84  
  8.3. Create EER Model from Existing Database ..................................................................... 84
# MySQL Workbench 5.2

10.7.5. The Variables Tab ................................................................. 192
10.7.6. The Data Dump Tab ............................................................... 193
10.7.7. The Logs Tab .................................................................. 196
11. Database Migration Wizard ...................................................... 199
  11.1. General installation requirements ........................................... 200
  11.1.1. ODBC Libraries ................................................................. 200
  11.1.2. ODBC Drivers ................................................................. 201
  11.2. Migration Overview ............................................................. 201
  11.2.1. A visual guide to performing a database migration ................. 202
  11.2.2. Migrating from supported databases ................................... 212
  11.2.3. Migrating from unsupported (generic) databases .................. 213
  11.3. Conceptual DBMS equivalents ................................................. 213
  11.4. Microsoft SQL Server migration .............................................. 215
     11.4.1. Preparations ................................................................. 215
     11.4.2. Drivers ................................................................. 215
     11.4.3. Connection Setup ........................................................ 216
     11.4.4. Microsoft SQL Server Type Mapping ................................. 216
  11.5. PostgreSQL migration ............................................................ 218
     11.5.1. Preparations ................................................................. 218
     11.5.2. Drivers ................................................................. 220
     11.5.3. Connection Setup ........................................................ 220
     11.5.4. PostgreSQL Type Mapping .............................................. 220
  11.6. MySQL migration ................................................................. 222
  11.7. Using the MySQL Workbench Migration Wizard ......................... 222
     11.7.1. Connecting to the databases ......................................... 222
     11.7.2. Schemata Retrieval and Selection ................................... 222
     11.7.3. Reverse Engineering ...................................................... 222
     11.7.4. Object Selection ............................................................ 222
     11.7.5. Migration ................................................................. 223
     11.7.6. Manual Editing ............................................................ 223
     11.7.7. Target Creation Options ............................................... 223
     11.7.8. Schema Creation ............................................................ 223
     11.7.9. Create Target Results ..................................................... 223
     11.7.10. Data Migration Setup .................................................... 224
     11.7.11. Bulk Data Transfer ....................................................... 224
     11.7.12. Migration Report .......................................................... 224
  11.8. MySQL Workbench Migration Wizard FAQ .................................. 224
12. Extending Workbench .................................................................. 225
  12.1. GRT and Workbench Data Organization ..................................... 225
  12.2. Modules ........................................................................ 226
  12.3. Plugins ........................................................................ 227
  12.4. Adding a GUI to a Plugin Using MForms .................................. 228
  12.5. The Workbench Scripting Shell .............................................. 229
     12.5.1. Exploring the Workbench Scripting Shell ......................... 229
     12.5.2. The Shell Window .......................................................... 230
     12.5.3. The Files, Globals, Classes, and Modules Tabs .................. 230
  12.6. Tutorial: Writing Plugins ........................................................ 231
13. Keyboard Shortcuts ..................................................................... 233
14. MySQL Utilities ......................................................................... 237
  14.1. Preface ........................................................................ 237
  14.1.1. Preface ........................................................................ 237
  14.2. Introduction ....................................................................... 238
     14.2.1. Introduction to MySQL Utilities ...................................... 238
     14.2.2. Connection Parameters ............................................... 239
     14.2.3. Introduction to extending the MySQL Utilities .................. 239
  14.3. Commands ......................................................................... 245
     14.3.1. mysql.utilities.command.grep — Search Databases for Objects 245
     14.3.2. mysql.utilities.command.proc — Search Processes on Servers 246
14.4.1. MySQL Utilities Overview — Brief overview of command-line utilities ................................................. 248
14.4.2. mysqlauditadmin — Allows users to perform maintenance action on the audit log ............................... 250
14.4.3. mysqlauditgrep — Allows users to search the current or an archived audit log ........................................ 254
14.4.4. mysqldbcompare — Compare Two Databases and Identify Differences ................................................. 261
14.4.5. mysqldbcopy — Copy Database Objects Between Servers ................................................................. 267
14.4.6. mysqldbexport — Export Object Definitions or Data from a Database .............................................. 272
14.4.7. mysqldbimport — Import Object Definitions or Data into a Database ............................................... 279
14.4.8. mysqldiff — Identify Differences Among Database Objects ........................................................... 283
14.4.9. mysqldiskusage — Show Database Disk Usage ...................................................................................... 287
14.4.10. mysqlfailover — Automatic replication health monitoring and failover .............................................. 290
14.4.11. mysqlindexcheck — Identify Potentially Redundant Table Indexes ..................................................... 297
14.4.12. mysqlmetagrep — Search Database Object Definitions .................................................................. 300
14.4.13. mysqlproccgrep — Search Server Process Lists .................................................................................. 303
14.4.14. mysqlreplicate — Set Up and Start Replication Between Two Servers .............................................. 306
14.4.15. mysqlrpladmin — Administration utility for MySQL replication ..................................................... 309
14.4.16. mysqlrplcheck — Check Replication Prerequisites ............................................................................. 318
14.4.17. mysqlrplshow — Show Slaves for Master Server ............................................................................... 321
14.4.18. mysqlrplsh — Command line client for running MySQL Utilities ............................................................. 329
14.4.19. mysqlservercloner — Clone Existing Server to Create New Server .................................................. 325
14.4.20. mysqluc — Import Object Definitions or Data into a Database .......................................................... 329
14.4.21. mysqluserclone — Clone Existing User to Create New User ............................................................. 332
14.5. Parsers ....................................................................................................................................................... 334
14.5.1. mysql.utilities.parser — Parse MySQL Log Files .............................................................................. 334
14.6. Related tools ............................................................................................................................................. 336
14.6.1. mut — MySQL Utilities Testing ........................................................................................................... 336
14.7. Appendix .................................................................................................................................................. 338
14.7.1. MySQL Utilities FAQ ......................................................................................................................... 338
14.7.2. MySQL Utilities copy_server.py sample ............................................................................................ 340
A. Third Party Licenses ....................................................................................................................................... 343
A.1. .NET Flat TabControl License .................................................................................................................. 344
A.2. ANTLR License .......................................................................................................................................... 344
A.3. Bitstream Vera License ................................................................................................................................ 345
A.4. Boost Library License ................................................................................................................................ 346
A.5. Cairo License ............................................................................................................................................ 346
A.6. CTkernel (Google Template System) License ............................................................................................. 347
A.7. cURL (libcurl) License ................................................................................................................................ 347
A.8. DockPanel Suite License ........................................................................................................................... 348
A.9. Dojo Toolkit v1.7.0b1 License .................................................................................................................... 348
A.10. GLib License (for MySQL Workbench) ...................................................................................................... 349
A.11. Glib License ............................................................................................................................................ 349
A.12. GNU Lesser General Public License Version 2.1, February 1999 ............................................................. 349
A.14. IODBC License ......................................................................................................................................... 357
A.15. Libiconv License ....................................................................................................................................... 358
A.16. Libint1 License .......................................................................................................................................... 358
A.17. Libxml2 License ...................................................................................................................................... 359
A.18. Libzip License .......................................................................................................................................... 360
A.19. Lua (liblua) License .................................................................................................................................. 360
A.20. Paramiko License ..................................................................................................................................... 360
A.21. PCRE License .......................................................................................................................................... 361
A.22. Pixman License ........................................................................................................................................ 362
A.23. PyCrypto License .................................................................................................................................... 363
A.24. PyODBC License .................................................................................................................................... 364
A.25. Python License ...................................................................................................................................... 364
A.26. Scintilla License .......................................................................................................................... 374
A.27. ScintillaNET License ................................................................................................................... 375
A.28. TinyXML License ........................................................................................................................ 376
A.29. TreeViewAdv for .NET License .................................................................................................. 376
A.30. VSQLite++ License ..................................................................................................................... 377
A.31. zlib License ................................................................................................................................. 377
B. MySQL Workbench FAQ .................................................................................................................. 379
C. MySQL Workbench and Utilities Change History ........................................................................... 381
   C.1. MySQL Workbench Change History ......................................................................................... 381
   C.2. MySQL Utilities Change History ............................................................................................. 381
Preface and Legal Notices

This is the User Manual for the MySQL Workbench.

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Chapter 1. MySQL Workbench Introduction

MySQL Workbench provides a graphical tool for working with MySQL Servers and databases. MySQL Workbench fully supports MySQL Server versions 5.1 and above. It is also compatible with MySQL Server 5.0, but not every feature of 5.0 may be supported. It does not support MySQL Server versions 4.x.

MySQL Workbench provides three main areas of functionality:

- **SQL Development**: Enables you to create and manage connections to database servers. As well as enabling you to configure connection parameters, MySQL Workbench provides the capability to execute SQL queries on the database connections using the built-in SQL Editor. This functionality replaces that previously provided by the Query Browser standalone application.

- **Data Modeling**: Enables you to create models of your database schema graphically, reverse and forward engineer between a schema and a live database, and edit all aspects of your database using the comprehensive Table Editor. The Table Editor provides easy-to-use facilities for editing Tables, Columns, Indexes, Triggers, Partitioning, Options, Inserts and Privileges, Routines and Views.

- **Server Administration**: Enables you to create and administer server instances.

MySQL Workbench is available in two editions, the Community Edition and the Standard Edition. The Community Edition is available free of charge. The Standard Edition provides additional Enterprise features, such as database documentation generation, at low cost.

For release notes detailing changes made in each release of MySQL Workbench, see Appendix C, *MySQL Workbench and Utilities Change History*. 
Chapter 2. What is new in MySQL Workbench 6.0

This section summarizes how MySQL Workbench 6.0 is different than MySQL Workbench 5.2.

Note

This manual documents MySQL Workbench through version 5.2.47, but will be updated to reflect MySQL Workbench 6.0 in the future.

A new home screen

A new, modernized "Home" screen where major functionality of MySQL Workbench can be accessed, including connections to MySQL servers, modeling, migration, and the command-line utilities.

Figure 2.1. Home Screen: Workbench 5.2
Unified SQL Editor and Administration interface

In the new user interface, the Server Administration functionality (such as start/stop server, managing user accounts etc) is now accessible directly from the SQL Editor interface, located near where the schema information can be browsed and queries executed.

The image below contains three screenshots of the Schema window in the SQL Editor. The first is from MySQL Workbench 5.2, the second is MySQL Workbench 6.0 with the management tab collapsed, and the third shows what the merged management tab looks like. Toggle the merged and tabbed views by clicking the new merge button next to the refresh button.
Table data search

You can select schemas and/or tables to perform client-side searches for user specified strings and patterns. To access this new search feature, right click select a schema or a table in the left sidebar and select Search Table Data... .

This screenshot demonstrates the search feature, along with an example search. Multiple tables were selected and searched in this example:
Context Sensitive help for the SQL Editor

Select a keyword or function in your query and after a delay it will show formatted help information from the MySQL Server (equivalent to using the help command from the command-line MySQL Client).
New Schema Inspector feature allows you to browse general information from schema objects. For tables, it's also possible to perform maintenance tasks such as ANALYZE, OPTIMIZE, CHECK, and CHECKSUM TABLE. To access the inspector, right-click a schema and select the Schema Inspector.
Figure 2.6. Schema Inspector

And choosing **Maintenance** for a table:
Figure 2.7. Schema Inspector: Maintenance

Cascaded DELETE statements generator

You can generate a series of DELETE statements needed to delete a row from that table, which includes rows from other tables that reference it, recursively. The SELECT version allows you to preview what rows would be deleted. Right click a table and select Copy to Clipboard, Delete with References.
Table templates

Define templates of tables with commonly used columns, to be used to create new tables in a live connection or in an EER model. In the SQL Editor, choose Create Table Like..., or in Modeling, use the right sidebar.

Vertical Text

A Vertical Text output option for queries (equivalent to \G from the command-line Client) was added. To execute, choose Query, Execute Current Statement (Vertical Text Output).
Figure 2.9. Vertical Text (I/G)
Improved Visual Explain

Figure 2.10. Visual Explain: Workbench 5.2
Improved Server Status

Additional server status information was added, and the user interface was improved. Select **Server Status** from the **Management** tab to open this window.
**Figure 2.12. Server Status: Workbench 5.2**

![Server Status](image-url)
Enterprise Features

Support for MySQL Enterprise features in the Commercial edition of MySQL Workbench was added. From within the Management tab for an open connection, look for the following products under the heading MySQL Enterprise:

MySQL Enterprise Backup (MEB): A GUI frontend for the MEB tool. After installing a commercial version of MySQL Workbench and MySQL Enterprise Backup, MySQL Workbench will check for and handle the pre-requisites. Backup recovery is also supported. This plugin supports MEB with local and remote installations of Linux and Mac OS X, and locally for MySQL Windows.

MySQL Audit Log Inspector: A GUI for browsing the contents of generated logs by the commercial Audit Log Plugin. Powerful filtering and search capabilities are available. Fast browsing is provided by caching the log data locally in an encrypted file. This plugin supports MEB with local and remote installations of Linux and Mac OS X, and locally for MySQL Windows.

Database Migration Features

SQL Anywhere and SQLite are now supported.
Chapter 3. MySQL Workbench Editions

The Community Edition (OSS)

The Community Edition is the foundation of all MySQL Workbench editions—versions that are currently available or those that will become available in the future. All editions of MySQL Workbench are based on the Community Edition and all future improvements to the base framework and feature set will be included in this version. The Community Edition is a full feature product that puts a powerful database management tool into the hands of the MySQL community.

The Standard Edition

The Standard Edition is a commercial extension that builds on top of the OSS Edition and adds modules and plugins, enabling an optimized work flow. The highlights of this edition are:

- MySQL Specific Schema Validation
- Model Validation
- General Schema Validation
- DBDoc

DBDoc provides the following features:

- Document complex database schemata
- Document all SQL object types
- Document output available in different file formats

A comparison of edition features can be found at MySQL Workbench Developer Central.
Chapter 4. Installing and Launching MySQL Workbench

Table of Contents

4.1. Hardware Requirements ............................................................................................................. 19
4.2. Software Requirements ............................................................................................................. 19
4.3. Starting MySQL Workbench .................................................................................................... 20
  4.3.1. Installing MySQL Workbench on Windows ................................................................. 21
  4.3.2. Launching MySQL Workbench on Windows .............................................................. 21
  4.3.3. Uninstalling MySQL Workbench on Windows ............................................................ 22
  4.3.4. Installing MySQL Workbench on Linux ...................................................................... 23
  4.3.5. Launching MySQL Workbench on Linux ..................................................................... 23
  4.3.6. Uninstalling MySQL Workbench on Linux ............................................................... 23
  4.3.7. Installing MySQL Workbench on Mac OS X ............................................................... 24
  4.3.8. Launching MySQL Workbench on Mac OS X ............................................................. 24
  4.3.9. Uninstalling MySQL Workbench on Mac OS X ........................................................... 25

MySQL Workbench is available for the following platforms:

- Windows
- Linux
- Mac OS X

Binary distributions of MySQL Workbench are available for the preceding platforms. Source code distributions are also available as a tar.gz package or an RPM package.

The following sections explain the installation process for each of these platforms.

4.1. Hardware Requirements

MySQL Workbench requires a system that runs smoothly. The minimum hardware requirements are:

- CPU: 32-bit or 64-bit
- Cores: Single (Single Core 3GHz or higher, Dual Core 2GHz or higher recommended)
- RAM: 4 GB (6 GB or higher recommended)
- Graphic Accelerators: nVidia or ATI with support of OpenGL 2 or higher
- Display Resolution: 1280×1024 minimum (1920×1200 or higher recommended)

4.2. Software Requirements

The following operating systems are officially supported:

- Apple Mac OS X v10.6.1+ (32-bit/64-bit)
- Fedora 15 (32-bit/64-bit)
- Microsoft Windows 7 (32-bit/64-bit)
- Oracle Linux 6 (32-bit/64-bit)
- Ubuntu 10.04 LTS (32-bit/64-bit)
Starting MySQL Workbench

- Ubuntu 11.04 (32-bit/64-bit)

MySQL Workbench also has the following general requirements:

![Note]
On startup, the application checks the OpenGL version and chooses between software and hardware rendering. To determine which rendering method is being used, open the Help menu and choose the System Info item.

Requirements for Linux:

- The requirements for Linux are embedded within their respective packages. Use the platform specific tool (for example, yum or apt) to install the package and their dependencies.

Requirements for Microsoft Windows:

- Microsoft .NET 4.0 Framework
- Microsoft Visual C++ 2010 Redistributable Package (x86)

![Note]
For convenience, the Windows libraries are available as the download “Dependencies for Compiling in Windows”.

4.3. Starting MySQL Workbench

The procedure for launching MySQL Workbench depends on the platform. Generally, there are two ways to launch MySQL Workbench: either from the command line or from the graphical user interface of the host operating system. Using the command-line launching facility is useful when you want to customize some aspects of the way MySQL Workbench operates. The following sections describe how to launch MySQL Workbench for each of the supported platforms.

In addition to platform-specific command-line options, MySQL Workbench has the following command-line options:

![Note]
On Microsoft Windows, the command-line options contain one leading dash instead of two. For example, use --log-level for Microsoft Windows and --log-level for Linux and Mac OS X.

- **--log-level level**: Controls the verbosity level for logging output from Workbench.

With increasingly levels of verbosity, the valid values for level are: error, warning, info, debug1, debug2, and debug3.

The location of the generated log files, such as wb.log, are as follows:

<table>
<thead>
<tr>
<th>Platform</th>
<th>Default location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linux</td>
<td>~/.mysql/workbench/log/</td>
</tr>
<tr>
<td>Mac OS X</td>
<td>~/Library/Application Support/Workbench/log/</td>
</tr>
<tr>
<td>Microsoft Windows</td>
<td>C:\Users\user_nameAppData\Roaming\MySQL\Workbench\log</td>
</tr>
</tbody>
</table>

- **--admin instance**: Load the server instance specified.
- **--query connection**: Load the connection specified.
- **--model modelfile**: Load the model specified.
Installing MySQL Workbench on Windows

4.3.1. Installing MySQL Workbench on Windows

MySQL Workbench for Windows can be installed using the Windows Installer package or installed manually from a Zip file.

Important

Installing MySQL Workbench using the Installer package requires either Administrator or Power User privileges. If you are using the Zip file without an installer, you do not need Administrator or Power User privileges.

Installing MySQL Workbench Using the Installer Package

MySQL Workbench can be installed using the Windows Installer (.msi) installation package. The MSI package bears the name mysql-workbench-version-win32.msi, where version indicates the MySQL Workbench version number.

Improving the MySQL Installation Wizard depends on the support and feedback of users. If you find that the MySQL Installation Wizard lacks some feature important to you, or if you discover a bug, please report it in our bugs database. Select the Report a Bug item from the Help menu.

1. To install MySQL Workbench, right-click the MSI file and select the Install item from the pop-up menu, or double-click the file.

2. In the Setup Type window you may choose a Complete or Custom installation. To use all features of MySQL Workbench choose the Complete option.

3. Unless you choose otherwise, MySQL Workbench is installed in C:\%PROGRAMFILES%\MySQL\MySQL Workbench 5.1 edition_type, where %PROGRAMFILES% is the default directory for programs for your locale. The %PROGRAMFILES% directory may be C:\Program Files or C:\programme.

Installing from the Zip File

If you have problems running the Installer package, an alternative is to install from a Zip file without an installer. That file is called mysql-workbench-version-win32.zip.

To install using the Zip file, download the Zip file to a convenient location and decompress the file using a Zip utility. You can place the resulting directory anywhere on your system. You need not install or configure the application before using it. You may want to create a shortcut on your desktop or the quick launch bar.

4.3.2. Launching MySQL Workbench on Windows

To start MySQL Workbench on Windows, select Start, Programs, MySQL, then select MySQL Workbench.

Alternatively, start MySQL Workbench from the command line. To view the available command-line options, issue the command MySQLWorkbench -help | more from the MySQL Workbench installation directory. You will see the following output:

MySQL Workbench 5.2.34 SE. (C) 2006-2011 by Oracle Corporation.
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Usage: MySQLWorkbench [options] [model file]
Options
- --admin instance .... Open an admin tab to the named server instance at startup
- --open filename ....... Open the given filename at startup
- --query server ....... Open a DB query tab to the named server connection at startup
- --run script ........ Executes the given Workbench script at startup
- --run-lua script .... Executes the given Workbench Lua script at startup
- --script scriptfile .... Executes the given Workbench script file at startup
- --quit-when-done ..... Quits Workbench once the given script finishes executing
- --swrendering ....... Force the canvas to use software rendering instead of OpenGL
- --nologo ............ Do not display the splash screen
- --log ............... Instruction to save messages (other debug info) to file
- --verbose (-v) ...... Print verbose output in the GRT Shell
- --version ........... Print the version information
- --grtversion ........ Print the GRT (Generic RunTime) shell version number
- --help (-h) .......... Print this output

The MySQL Workbench help output includes a version number, a usage message, and the option descriptions. Use the --swrendering option if your video card does not support OpenGL 1.5. The --version option can be used to display the MySQL Workbench version number. The --grtversion can be used to display the GRT (Generic RunTime) shell version number. The other options are self-explanatory.

Note
When using the --help and --version, command-line options that display output to a console window, be sure that you pipe the output through the more command. Otherwise, nothing will be displayed.

4.3.3. Uninstalling MySQL Workbench on Windows

The method for uninstalling MySQL Workbench depends on how you installed MySQL Workbench in the first place.

Removing MySQL Workbench After Installation Using the Installer Package

1. To uninstall MySQL Workbench, open the Control Panel and Choose Add or Remove Programs. Find the MySQL Workbench entry and choose the Remove button. This will remove MySQL Workbench.

2. Any modules added to the C:\%PROGRAMFILES%\MySQL\MySQL Workbench version\modules directory will not be deleted.

Note
If you installed MySQL Workbench using the Installer package, it is not possible to remove MySQL Workbench from the command line. Although you can manually remove some of the components, there is no command-line option for removing MySQL Workbench.

Removing the MySQL Workbench directory manually will not remove all the files belonging to MySQL Workbench.

Removing MySQL Workbench After Installation from a Zip File

To remove MySQL Workbench, just delete the MySQL Workbench directory.

Note
If you installed any additional modules within the modules directory and you want to keep them, make sure you copy those modules to a different directory before deleting the MySQL Workbench directory.
4.3.4. Installing MySQL Workbench on Linux

There are binary distributions of MySQL Workbench available for several variants of Linux, including Fedora, Oracle Linux, and Ubuntu.

In addition to the binary distributions, it is also possible to download the MySQL Workbench source code as a tar.gz or RPM package.

Check the MySQL Workbench download page for the latest packages.

The procedure for installing on Linux depends on which Linux distribution you are using.

Installing DEB packages

On Ubuntu, and other systems that use the Debian package scheme, you can install MySQL Workbench using a command such as:

```
shell> sudo dpkg -i package.deb
```

*Note*

You may be warned that certain libraries are not available, depending on what you already have installed. Install the required libraries and then install the MySQL Workbench package again.

Installing RPM packages

On Red Hat-based systems, and other systems that use the RPM package format, MySQL Workbench can be installed by a command such as:

```
shell> sudo rpm -i package.rpm
```

*Note*

You may be warned that certain libraries are not available, depending on what you already have installed. Install the required libraries and then install the MySQL Workbench package again.

4.3.5. Launching MySQL Workbench on Linux

After MySQL Workbench has been installed, it can be launched by selecting Applications, Programming, MySQL Workbench from the main menu.

MySQL Workbench can also be launched from the command line on Linux. Type the command:

```
shell> /usr/bin/mysql-workbench --help
```

This will display the available command-line options:

```
mysql-workbench [options] [model file]
Options:
  --force-sw-render  Force Xlib rendering
  --force-opengl-render  Force OpenGL rendering
  --help, -h  Show command line options and exit
```

4.3.6. Uninstalling MySQL Workbench on Linux

The procedure for uninstalling MySQL Workbench on Linux depends on the package you are using.

Uninstalling DEB packages

To uninstall a Debian package, use this command:
4.3.7. Installing MySQL Workbench on Mac OS X

MySQL Workbench for Mac OS X is distributed as a DMG file. The file is named `mysql-workbench-oss-version-osx10.5-1686.dmg`, where `version` is the MySQL Workbench version.

To install MySQL Workbench on Mac OS X, download the file. Double-click the downloaded file. You will be presented with the installation window.

Figure 4.1. MySQL Workbench Mac OS X Installation Window

Drag the MySQL Workbench icon onto the Applications icon as instructed. MySQL Workbench is now installed.

You can now launch MySQL Workbench from the Applications folder.

4.3.8. Launching MySQL Workbench on Mac OS X

To launch MySQL Workbench on Mac OS X, open the Applications folder in the Finder, then double-click MySQL Workbench.

It is also possible to start MySQL Workbench from the command line:

```
shell> open MySQLWorkbench.app model_file
```

A model file must be specified.
4.3.9. Uninstalling MySQL Workbench on Mac OS X

To uninstall MySQL Workbench for Mac OS X, locate MySQL Workbench in the Applications folder, right-click, and select Move to Trash.
Chapter 5. Getting Started Tutorial

Table of Contents

5.1. Administering a MySQL Server .............................................................................................................. 27
5.2. Creating a Model ....................................................................................................................................... 39
5.3. Adding Data to Your Database .................................................................................................................. 44

This tutorial provides a quick hands-on introduction to using MySQL Workbench for beginners. If you have used MySQL Workbench before you can safely skip this tutorial.

This tutorial uses a locally installed MySQL Server. If you only have access to a remote MySQL server, you must enter appropriate connection parameters as necessary. This tutorial requires MySQL Workbench 5.2.16 or above. It is assumed that you have a basic understanding of MySQL concepts. This tutorial demonstrates the procedures on Microsoft Windows, but they are the same for all supported platforms.

5.1. Administering a MySQL Server

In this section, you will use MySQL Workbench to carry out administrative functions, such as starting and stopping the server.

1. Launch MySQL Workbench. You will be presented with the Home window.
2. To administer your MySQL Server, you must first create a Server Instance. The instance contains information about the target server, including how to connect to it. From the MySQL Workbench Home window, click **New Server Instance**. The **Create New Server Instance Profile** wizard will be displayed.

3. In this tutorial, you will connect to a locally installed server, so click **Next**.
4. Next you will set up a connection, or select an existing connection to use to connect to the server. Assuming that you have not already created a connection, you can use the default values here, although if your MySQL Server has a password set for the root account, you can enter it here by clicking Store in Vault. This enables you to connect to the server without needing to enter a password each time. It is also possible to use a different account to connect to the server by setting the user name and password here, if required.
Figure 5.3. Getting Started Tutorial - Database Connection

You can now click **Next**.

5. The connection will now be tested. You should see that the connection was successful. If not click **Back** and check that you have entered the information required.
If the connection test was successful, click **Next**.

6. Optionally, you may configure a method for remote management if a Remote Host was specified. Setting these options enables MySQL Workbench to determine the location of configuration files, and the correct start and stop commands to use for the server.

   SSH login based management and Native Windows remote management types are available. The Operating System and MySQL Installation Type are configured for the SSH login variant.
Figure 5.5. Getting Started Tutorial - Management and OS

Set the configuration method, then click **Next**.

7. If the SSH login based management was chosen, then you will configure its parameters which includes the User Name, Host Name, and optionally the SSH key for authentication.
Check that everything is in order, then click **Next**.

8. If a Windows server is used, then the Windows configuration parameters must be set.
Check that everything is in order, then click **Next**.

9. The wizard will now check that it is able to access the MySQL Server configuration file, and access the start and stop commands.
Figure 5.8. Getting Started Tutorial - Test Host Settings

Check that everything is in order, then click **Next**.

10. You now have a chance to review the configuration settings so far. The information displayed varies slightly depending on platform, connection method and installation type.
**Figure 5.9. Getting Started Tutorial - Review Settings**

Review the information, then click **Next**.

11. Finally you can give the server instance a suitable name. This will be used to select this particular instance from a list of available instances.
Figure 5.10. Getting Started Tutorial - Instance Name

![Create New Server Instance Profile]

Set the desired name, then click Finish to complete the server instance creation process.

12. You will now be returned to the Home window. You will see the new server instance you created, along with the new connection you created as part of the preceding procedure.
You are now ready to test your new server instance.

13. From the Home window, double-click the Server Instance you created. The Administrator will open on the **Startup** configuration page.
14. Click the Stop Server button. The message window will show that the server has stopped.

15. Click the Start Server button to resume the server. The message window will confirm that the server is running.

You have now seen how to create a server instance to enable you to manage a MySQL server.

For further information, see Chapter 10, *Server Administration*.

### 5.2. Creating a Model

In this section, you will learn how to create a new database model, create a table, create an EER Diagram of your model, and then forward engineer your model to the live database server.

1. Start MySQL Workbench. On the Home window, select **Create new EER Model**. A model can contain multiple schemata. Note that when you create a new model, it contains the *mydb* schema by default. You can change the name of this schema to serve your own purposes, or delete it.
2. On the Physical Schemata toolbar, click the button + to add a new schema. This will create a new schema and display a tabsheet for the schema. In the tabsheet, change the name of the schema to "dvd_collection", by typing into the field called Name. Ensure that this change is reflected on the Physical Schemata tab. Now you are ready to add a table to your schema.
3. In the Physical Schemata section, double-click **Add Table**.

4. This will automatically load the table editor, with the default table name being **table1**. In the table editor, change the name of the table from “table1” to “movies”.

5. Next, add several columns. Double click a cell within the **Column Name** column, and the first field will default to “moviesid” because MySQL Workbench appends “id” to the table name as the default for the initial field. Change the name to “movie_id” and keep the **Datatype** as **INT**. Then, be sure **PK** (PRIMARY KEY), **NN** (NOT NULL), and **AI** (AUTO_INCREMENT) are all checked.

6. Add two additional columns using the same method as described above:

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Data Type</th>
<th>Column Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>movie_title</td>
<td>VARCHAR(45)</td>
<td>NN</td>
</tr>
<tr>
<td>release_date</td>
<td>DATE (YYYY-MM-DD)</td>
<td>None</td>
</tr>
</tbody>
</table>
7. Now you can obtain a visual representation of this schema so far. From the main menu, select **Model**, Create Diagram from Catalog Objects. The EER Diagram will be created and displayed.
8. In the table editor, change the name of the column “movie_title” to “title”. Note that the EER Diagram is automatically updated to reflect this change.

9. At this point, you can save your model. Click the main toolbar button Save Model to Current File. You have not yet saved this file so you will be prompted to enter a model file name. For this tutorial, enter “Home_Media”. The Home_Media model may contain further schemata in addition to dvd_collection, such as cd_collection. Click Save to save the model.

10. You can synchronize your model with the live database server. First, you must tell MySQL Workbench how to connect to the live server. From the main menu, select Database, Manage Connections....

11. In the Manage DB Connections dialog, click New.

12. Enter “Big Iron Server” for the connection name. This enables you to identify the server to which this connection corresponds, although it is possible to create multiple connections to the same server.

13. Enter the user name for the account you will use to connect to the server.

14. Click on the Store in Vault... button and enter the password for the user name you entered in the previous step. You can optionally ignore this step, and you will be prompted for this password whenever MySQL Workbench connects to the server.

15. Click Test Connection to test your connection parameters. If everything is okay at this point, you can click Close.

Figure 5.17. Getting Started Tutorial - Manage Connections

16. You are now ready to forward engineer your model to the live server. From the main menu, select Database, Forward Engineer.... The Forward Engineer to Database wizard will be displayed.

17. The Options page of the wizard shows various advanced options. For this tutorial, you can ignore these and simply click Next.

18. On the next page, you can select the object you want to export to the live server. In this case, you only have a table, so no other objects need be selected. Click Next.
19. The next page, Review SQL Script, displays the script that will be run on the live server to create your schema. Review the script to make sure that you understand the operations that will be carried out. Click Next.

**Figure 5.18. Getting Started Tutorial - Review Script**

![Review the SQL Script to be Executed](image)

20. Select the connection you created earlier, “Big Iron Server”. Click Execute. Check the messages for any errors, then click Close to exit the wizard.

21. Ensure that the script ran without error on the server, then click Close. As a simple test that the script worked launch the MySQL Command Line Client (`mysql`). Enter `SHOW DATABASES;` and identify your schema. Enter `USE dvd_collection;` to select your schema. Now enter `SHOW TABLES;`. Enter `SELECT * FROM movies;`, this will return the empty set as you have not yet entered any data into your database. Note that it is possible to use MySQL Workbench to carry out such checks, and you will see how to do this later, but the MySQL Command Line Client has been used here as you have probably used it previously.

22. Ensure that your model is saved. Click Save Model to Current File on the main toolbar.

### 5.3. Adding Data to Your Database

In the previous section, you created a model, schema, and table. You also forward engineered your model to the live server. In this section, you will see how you can use MySQL Workbench to add data into your database on the live server.

1. On the Home window, click the link **Edit Table Data** in the SQL Development area of the Workspace. This launches **Edit Table Data** wizard.
2. In the wizard, select the “Big Iron Server” connection from the stored connection list. Click Next.

3. Select the schema, `dvd_collection`. Select the table to edit, `movies`. Click Finish.

4. You will see a data grid. This is where you can enter the data for your database. Remember that the `movie_id` was set to be autoincrement, so you need not enter values directly for this column. In the data grid, enter the movie information shown in the following table.

<table>
<thead>
<tr>
<th>title</th>
<th>release_date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gone with the Wind</td>
<td>1939-04-17</td>
</tr>
<tr>
<td>The Hound of the Baskervilles</td>
<td>1939-03-31</td>
</tr>
<tr>
<td>The Matrix</td>
<td>1999-06-11</td>
</tr>
<tr>
<td>Above the Law</td>
<td>1988-04-08</td>
</tr>
</tbody>
</table>

Note

Do not modify any values in the `movie_id` column.

5. Now click the Apply button in the toolbar located in the bottom right corner. A list of SQL statements will be displayed. Confirm that you understand the operations to be carried out. Click Apply to apply these changes to the live server.

6. Confirm that the script was executed correctly, then click Finish.

7. View the data grid again and observe that the autoincrement values have been generated.
8. Now you will check that the data really has been applied to the live server. Launch the MySQL Command Line Client. Enter `SELECT * FROM movies;` to see the data just entered.

9. You can also carry out a similar check from within MySQL Workbench. Click on the Home window tab.

10. Click the link Open Connection to start Querying in the SQL Development section of the Workspace. This will launch the Connect to Database dialog. Select “Big Iron Server” from the list. Click OK.

11. A new SQL Editor tab will be displayed. In the SQL Statements area, enter the following code:

```sql
USE dvd_collection;
SELECT * FROM movies;
```

12. Now click the Execute toolbar button. This resembles a small lightning bolt. The SQL Editor will display a new Result tab contain the result of executing the SQL statements.
In this section of the tutorial, you have learned how to add data to your database, and also how to execute SQL statements using MySQL Workbench.
When MySQL Workbench first starts, it presents the **Home window**, which has two main sections:

- Workbench Central
- Workspace

**Note**

MySQL Workbench 5.2 introduced the **Home window**. MySQL Workbench 5.1 displays the MySQL Model workspace rather than the Home window. Note that 5.1 does not support the SQL Editor and Server Administration functionality of 5.2.

The two sections can be seen in the following screenshot. For more information, see the following sections.
6.1. Workbench Central

Workbench Central enables you to keep up to date with MySQL Workbench news, events, and resources. You can read the developer blogs, find out what's new in the release, access the forums, check for updates, and file a bug report.

Workbench Central includes the following facilities:

- **What's new**: A list of bug fixes and changes
- **MySQL Doc Library**: Built-in documentation
- **MySQL Bug Reporter**: Links to the MySQL bug system, where you can report bugs
- **Workbench Team Blog**: Links to the Workbench team blog
- **Planet MySQL**: Links to MySQL-related blogs and news
- **Workbench forums**: Links to the MySQL user and developer forums
6.2. Workspace

The Workspace is designed to enable you to quickly get to the task you would like to carry out. In alignment with MySQL Workbench functionality, it is divided into three main areas:

- **SQL Development**. For further information, see Chapter 7, *SQL Development*.
- **Data Modeling**. For further information, see Chapter 8, *Data Modeling*.
- **Server Administration**. For further information, see Chapter 10, *Server Administration*.

6.3. Workbench Application Minimum Window Size

As of version 5.2.10, the MySQL Workbench application features a fixed minimum window size of 1024x768. You cannot reduce the size of the application to less than this resolution.

6.4. Workbench Preferences

MySQL Workbench preferences and default settings are set by the *Preferences* menu. This menu is divided sections, as described below:

- **General**: Configuration of general-purpose options
- **Administrator**: Configuration of tools used by the Administrator functionality
- **SQL Editor**: Configuration of the SQL Editor
- **SQL Queries**: Preferences specific to the queries
- **Model**: Default model attributes
- **Model: MySQL**: MySQL specific model attributes, including the MySQL storage engine and targeted MySQL version
- **Diagram**: EER diagram settings
- **Appearance**: Change colors and fonts used by various Workbench components

A more detailed discussion of these options follows.

6.4.1. The General Tab

The General tab enables you to set the following options:
Figure 6.2. The General Preferences Dialog Box

- **Automatically Reopen Previous Model When Started**: Check this if you want the model on which you previously worked to be automatically reopened when you start MySQL Workbench.

- **Force use of software rendering for EER diagrams**: MySQL Workbench will use OpenGL for rendering when available. However, due to faulty drivers, problems do occasionally occur. These issues can be resolved by selecting the software rendering option here.

- **Model Undo History Size**: You can limit the size of the undo history here. Set this value to 0 to have an unlimited undo history.

- **Auto-save model interval**: An open model that has not been saved will automatically be saved after this period. On loading a model file, MySQL Workbench will notify the user if the file was not previously saved correctly, due to a crash or power failure. MySQL Workbench can then attempt to recover the last auto-saved version. For automatic recovery to be available for a new file, it will have to have been saved at least once by the user.

- **Save snapshot of open editors on close**: Enabling will save and reload the SQL Editor tabs after closing/opening MySQL Workbench (including after an unexpected crash).

- **Auto-save scripts interval**: Frequency of the auto-saves.

- **Create new tabs as Query tabs instead of File**: By default, opening a new SQL Editor tab opens as an SQL File tab. Check this option if you prefer the simpler Query tabs that, for example, will not prompt to be saved when closed. Added as of MySQL Workbench 5.2.45.
• **Place Sidebar on the Right Side**: By default, the Sidebar is placed on the left-hand side of the MySQL Workbench application. Select this option to place it on the right-hand side.

• **Allow more than once instance of MySQL Workbench to run**: Disabled by default.

• **Interactive GRT Shell Language**: You can select the language to be used in the GRT (Generic RunTime) shell by choosing a language from the list **Interactive GRT Shell Language**. Currently, the choices are Lua and Python. Python is the recommended option.

• **Internal Workbench Schema**: Defaults to `.mysqlworkbench`

### 6.4.2. The Administrator Tab

This section provides configuration options that affect the Administrator functionality in MySQL Workbench.

• **Path to mysqldump tool**: Path to your local mysqldump binary. Leave it blank to use the bundled mysqldump binary.

• **Path to mysql tool**: Path to your local mysql client binary. Leave it blank to use the bundled mysql binary.

• **Export Directory Path**: Directory where your exported mysql dumps are located.

**Figure 6.3. The Administrator Preferences Dialog Box**
6.4.3. The SQL Editor Tab

This section provides configuration options that affect the SQL Editor functionality in MySQL Workbench.

**Note**

There is also an SQL Editor section in the General preference tab, with preference settings for how the SQL Editor tabs are saved, and opened.

The SQL Editor is divided into three sections: General, Productivity, and SQL Parsing in Text Editors, as seen in the following screenshot:

**Figure 6.4. The SQL Editor Preferences**

<table>
<thead>
<tr>
<th>SQL Editor Preferences</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
</tr>
<tr>
<td>Show Schema Contents in Schema Tree</td>
</tr>
<tr>
<td>Show Metadata Schemata</td>
</tr>
<tr>
<td>DBMS connection keep-alive interval (in seconds): 600</td>
</tr>
<tr>
<td>DBMS connection read time out (in seconds): 600</td>
</tr>
<tr>
<td><strong>Productivity</strong></td>
</tr>
<tr>
<td>Enable Code Completion in Editors</td>
</tr>
<tr>
<td>Reformat SQL for Views</td>
</tr>
<tr>
<td>Max syntax error count: 100</td>
</tr>
<tr>
<td><strong>SQL Parsing in Text Editors</strong></td>
</tr>
<tr>
<td>Default SQL_MODE for syntax checker:</td>
</tr>
<tr>
<td>SQL Identifiers are Case Sensitive</td>
</tr>
<tr>
<td>Non-standard SQL Delimiter:</td>
</tr>
</tbody>
</table>

**General**

- **Show Schema Contents in Schema Tree**: Enumerating, populating, and drawing large numbers of items can significantly increase loading times. For this reason, this facility can be switched off for models containing large numbers of schemata and tables.

- **Show Metadata Schemata**: By default metadata schemata are not displayed. To display them, for example to troubleshoot or check metadata information, select this option.

- **DBMS connection keep-alive interval (in seconds)**: When executing long running queries over a slow connection, you may need to increase this value to prevent the connection being lost. Defaults to 600.
The SQL Queries Tab

- **DBMS connection read time out (in seconds):** Maximum amount of time that the query can take to return data from the DBMS. Defaults to 600.

**Productivity**

The query results properties that can be set include the following:

- **Enable Code Completion in Editors:** The SQL Editor offers Auto-complete functionality by either pressing the keyboard shortcut (**Modifier** + **Space**), or it will start automatically if the **Automatically Start Code Completion** preference is enabled.

- **Automatically Start Code Completion:** Enabled by default, this will automatically execute the code auto-completion feature while editing SQL in the SQL Editor. If disabled, you will instead use the keyboard shortcut **Modifier** + **Space** to execute the auto-completion routine.

- **Reformat DDL for Views:** Whether to automatically reformat the View DDL that is returned by the MySQL Server.

  **Note**
  
  The MySQL Server does not store the formatting information for View definitions.

- **Max syntax error count:** Large complex scripts may contain errors. Further, a syntax error early on can lead to subsequent syntax errors. For these reasons, it is possible to limit the number of errors displayed using this option. The default is 100 error messages.

**SQL**

SQL properties that can be set include the **SQL_MODE**, case sensitivity of identifiers, and the SQL delimiter used.

The document property **SqlMode** defines **SQL_MODE** for all operations affecting SQL parsing at the document scope. The purpose of this option is to preserve the consistency of SQL statements within the document.

The property has the following functions:

- Sets the **SQL_MODE** DBMS session variable to the value stored in the **SqlMode** property of the document when performing reverse engineering, forward engineering, or synchronization operations.

- Honors the **SQL_MODE** values defined in **SqlMode** so that SQL parsing is correct.

Only a subset of all possible **SQL_MODE** values affect the MySQL Workbench SQL parser. These values are: **ANSI_QUOTES, HIGH_NOT_PRECEDENCE, IGNORE_SPACE, NO_BACKSLASH_ESCAPES, PIPES_AS_CONCAT**. Other values do not affect the MySQL Workbench SQL parser and are ignored.

If the value of **SqlMode** is not set, the default value of the **SQL_MODE** session variable defined by the server stays unchanged during operations with the server. However, the MySQL Workbench SQL parser behaves as if **SQL_MODE** is also not set. This may potentially lead to inconsistencies in parsing of SQL statements stored in the document. If you choose to not set the **SqlMode** property, ensure that the default **SQL_MODE** variable defined by the server does not contain any values from the following list: **ANSI_QUOTES, HIGH_NOT_PRECEDENCE, IGNORE_SPACE, NO_BACKSLASH_ESCAPES, PIPES_AS_CONCAT**.

The **SqlMode** property is defined in two locations: globally and at document scope. MySQL Workbench uses the global property to initialize the document property for each new document created. For each document, the property value defined at document scope always has higher priority over the one defined globally.

### 6.4.4. The SQL Queries Tab

Preferences related to the SQL Editor, and how query viewing behaves.
The SQL Queries Tab

Figure 6.5. The SQL Queries Preferences

General

- **Max query length to store in history (in bytes)**: Queries that exceed this size will not be saved in the history when executed. The default is 65536 bytes, and setting to 0 means there is no limit (all queries will be saved).

- **Continue on SQL Script Error**: Should an error occur while executing a script, this option causes execution to continue for the remainder of the script.

- **"Safe Updates". Forbid UPDATEs and DELETEs with no key in WHERE clause, or no LIMIT clause. Requires connection**: This enables the `sql_safe_updates` MySQL Server option for the MySQL Workbench session. Changing this option requires a reconnection to the server, which can be performed by *Query*, Reconnect to Server.

- **Progress status update interval**: When executing long running queries over a slow connection, you may need to increase this value to prevent excess load on the connection. Defaults to 500 milliseconds.

Online DDL

- **Default algorithm for ALTER table**: The default algorithm selected when performing `ALTER TABLE` operations in MySQL Workbench. The setting can also be adjusted for each `ALTER TABLE` operation. Options include "In-Place" (preferred) and "Copy", see the online DDL documentation for more information.

Added in MySQL Workbench 5.2.46.
• **Default lock for ALTER table**: The default lock setting for allowing concurrent queries with `ALTER TABLE` in MySQL Workbench. This setting can also be adjusted for each `ALTER TABLE` operation. Options include "None", "Shared", and "Exclusive", see the online DDL documentation for more information.

  Added in MySQL Workbench 5.2.46.

**Query Results**

• **Limit Rows**: Queries can sometimes return an excessive number of rows, which can heavily load the connection, and take time to display in MySQL Workbench. To prevent this, you can set a more moderate value here. This limit is defined by the **Limit Rows Count** option.

• **Limit Rows Count**: Specify the maximum number of result rows to return. Defaults to 1000.

• **Max. Field Value Length to Display**: To avoid display problems due to excessive field length, it is possible to set the maximum field length to display (in bytes). Defaults to 256.

• **Treat BINARY/VARBINARY as non-binary character string**: Binary byte string values are not displayed by default in the results grid, but are instead marked as `BLOB` values. These can then be viewed or edited with the `BLOB` editor. Nonbinary character string values are displayed in the results grid, and can be edited in the grid cell or using the `BLOB` editor.

  If this option is turned on, data truncation may result: Binary byte string values may contain null bytes as part of their valid data, whereas for nonbinary character strings, a null byte terminates the string.

• **Confirm Data Changes**: In the SQL Editor, if you edit table data and then click the **Applying changes to data** button, MySQL Workbench launches a wizard to step you through applying your changes. This gives you a chance to review the SQL that will be applied to the live server to make the requested changes. If this option is deselected, the changes will be applied to the server without the wizard being displayed and without giving you a chance to review the changes that will be made.

6.4.5. The Model Tab

This section provides configuration options that affect the Modeling functionality in MySQL Workbench.
Use the When Deleting Physical Model Figures in Diagram section to determine the behavior when deleting objects from the EER diagram canvas. Choose Ask and whenever you delete an object, you will be asked whether you wish to remove the object from an EER diagram only or also from the catalog. The Keep Database Object in Catalog is the safest option. You also have the option of deleting the object from both the EER diagram and the catalog.

Note

If you choose the Ask option, a confirmation dialog box opens only when you are deleting an object from an EER Diagram. When deleting in the MySQL Model view, there is no confirmation dialog window and the delete action always removes the object from the catalog.

There are a variety of ways to delete an object from an EER canvas: using the eraser tool; choosing a pop-up menu item; using the delete key; and by choosing the delete option from the Edit menu. In each case, the action performed by the delete key is determined by the option chosen from the When Deleting Physical Model Figures in Diagram section.

Use the Model tab to set the default value for various object names and the primary key data type. The following table shows the object names and their default values.

<table>
<thead>
<tr>
<th>Object Name</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PK Column Name</td>
<td>id@table%</td>
</tr>
</tbody>
</table>
The Model: MySQL Tab

<table>
<thead>
<tr>
<th>Object Name</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PK Column Type</td>
<td>INT</td>
</tr>
<tr>
<td>Column Name</td>
<td>%table%col</td>
</tr>
<tr>
<td>Column Type</td>
<td>VARCHAR(45)</td>
</tr>
<tr>
<td>FK Name</td>
<td>fk%stable_%dtable%</td>
</tr>
<tr>
<td>Foreign Key Column Name</td>
<td>%table%_%column%</td>
</tr>
<tr>
<td>ON UPDATE</td>
<td>NO ACTION</td>
</tr>
<tr>
<td>ON DELETE</td>
<td>NO ACTION</td>
</tr>
<tr>
<td>Associative Table Name</td>
<td>%stable%<em>has</em>%dtable%</td>
</tr>
</tbody>
</table>

The **PK Column Name**, **PK Column Type**, **Column Name**, and **Column Type** values are the defaults used by the table editor, and only function on Microsoft Windows and Mac OS X. The others are the default names used when using the relationship tools on an EER diagram.

Within object values items enclosed by percentage signs are variables. Their meanings are as follows:

- **%table%**: The table associated with the object
- **%stable%**: The source table associated with the object
- **%dtable%**: The destination table associated with the object
- **%column%**: The column associated with the object

Legitimate values for the foreign key update or delete rules are:

- RESTRICT
- CASCADE
- SET NULL
- NO ACTION (default)

For more information about these actions, see Section 8.7.1.3.4, “The Foreign Keys Tab”.

### 6.4.6. The Model: MySQL Tab

This enables you to set the default table storage engine, MySQL Server version, and SQL_MODE to be used for generated scripts.
Figure 6.7. The **Model:MySQL Preferences**

- **Default Target MySQL Version**: Certain features will utilize options for this MySQL Version. This option was added in MySQL Workbench 5.2.45.

- **Default Storage Engine**: Tables created in MySQL Workbench will be defined using this default storage engine.

- **SQL Mode to be used in generated scripts**: Defaults to "TRADITIONAL,ALLOW_INVALID_DATES", this defines the SQL_MODE used by Forward Engineering and Synchronization.

### 6.4.7. The Diagram Tab

Use this tab to determine display settings for an EER diagram.
Select whether to expand new objects by checking the **Expand New Objects** check box and select whether to draw line crossings by checking the **Draw Line Crossings** check box.

This tab also enables you to set the maximum number of characters for the following items:

- Column Names
- Column Types
- Routine Names

Changes to these values change the display properties only, not the objects themselves.

### 6.4.8. The Appearance Tab

Use this tab to set the available colors for the objects that appear on an EER diagram canvas. You can also add colors if you wish.
The Appearance Tab

Figure 6.9. The Appearance Preferences

Changes made here affect the list of colors that appears on the toolbar when adding objects to an EER diagram canvas. For information about using this list, see Section 8.5.2.1, “Tool-Specific Toolbar Items”.

You can also use this tab to set the font face, size, and style for the following items:

- Editor
- Layer Title
- Text Figure Text
- Text Figure Title
- Connection Caption
- Routine Group Figure Item
- Routine Group Figure Title
- Table Figure Items
- Table Figure Section
- Table Figure Title
- View Figure Title
Note

On Windows, the default font for the editor supports only latin-1 characters. If you need to use characters not supported by the latin-1 character set, you must change the font here.
Chapter 7. SQL Development

Table of Contents

7.1. Open Connection to Start Querying ................................................................. 65
7.2. New Connection ............................................................................................... 66
7.3. Edit Table Data ............................................................................................... 66
7.4. Edit SQL Script ............................................................................................... 66
7.5. Manage Connections ....................................................................................... 66
7.6. Manage DB Connections Dialog ................................................................. 66
  7.6.1. The Password Storage Vault .................................................................. 67
  7.6.2. Standard TCP/IP Connection ............................................................... 68
  7.6.3. Local Socket/Pipe Connection .............................................................. 69
  7.6.4. Standard TCP/IP over SSH Connection ............................................. 69
7.7. SQL Editor ........................................................................................................ 70
  7.7.1. Main Menu ............................................................................................... 71
  7.7.2. Toolbar ..................................................................................................... 72
  7.7.3. SQL Query Panel ..................................................................................... 73
  7.7.4. Main Tabsheets ....................................................................................... 74
  7.7.5. Sidebar ..................................................................................................... 77

MySQL Workbench provides extensive facilities for working directly with SQL code. Before working directly with a live server, a connection must be created. After a connection is established, it is possible to execute SQL code directly on the server and manipulate the server using SQL code.

The starting point for embarking on SQL Development work is the SQL Development area of the Home window, which has the following action items:

- Open Connection to start Querying
- New Connection
- Edit Table Data
- Edit SQL Script
- Manage Connections

The following sections describe each of these action items.

![Note]

The SQL Development facility in MySQL Workbench provides the functionality that was formerly available in MySQL Query Browser.

7.1. Open Connection to Start Querying

Clicking this action item launches the Connect to Database Wizard. From this wizard, you can select a predefined connection. A new SQL Editor tab is launched.

If you already have created a connection to a database, it will appear in this panel as an icon. Double-clicking the icon directly launches an SQL Editor tab, and connects you to the database as defined by the connection.

To read more about the SQL Editor, see Section 7.7, “SQL Editor”.

65
7.2. New Connection

Clicking the New Connection action item launches the Manage DB Connections wizard. This wizard enables you to create a new connection. Note that the wizard when launched from here does not display existing connections, it only enables you to create a new connection.

To read more about creating and managing connections, see Section 7.6, “Manage DB Connections Dialog”.

7.3. Edit Table Data

Clicking this action item launches the Edit Table Data wizard, which enables you to edit table data. This is a two-stage wizard. The first stage enables you to select a Stored Connection. The second stage enables you to select the Schema and Table you want to edit. After the wizard is completed, an SQL Editor tab is launched, which displays a data grid that enables you to interactively edit table data as required.

To read more about the SQL Editor, see Section 7.7, “SQL Editor”.

7.4. Edit SQL Script

Clicking this action item launches the Edit SQL Script wizard. This is a two-stage wizard. The first stage enables you to select a Stored Connection. The second stage enables you to select an SQL Script file, and optionally have the script executed after it is opened. After the wizard is completed, an SQL Editor tab will be launched, with the script displayed. If you selected to run the script, MySQL Workbench runs the script and displays the results.

Working with large data sets

The Edit SQL Script wizard is not well-suited for executing large dump files, and instead the Server Administration, Manage Import/Export feature should be used.

7.5. Manage Connections

Clicking this action item launches the Manage DB Connections wizard. This wizard also displays Stored Connections, which can be selected and changed as desired. This wizard can also be used to create new connections.

To read more about managing connections, see Section 7.6, “Manage DB Connections Dialog”.

7.6. Manage DB Connections Dialog

MySQL Workbench provides a Manage DB Connections dialog for creating and managing connections to servers. The connections created can then be used from the wizards that must connect to a server, such as the wizard used to reverse engineer a live database. However, it is still possible to set connection parameters from these wizards if required, without invoking the Manage DB Connections dialog directly.

The Manage DB Connections dialog is invoked by selecting Database, Manage Connections from the main menu. It can also be invoked from any of the wizards requiring access to a live database. This is achieved by using the Manage Stored Connections item, found in the wizard’s Stored Connection list.

After the Manage DB Connections dialog is launched, you are presented with the following dialog, which enables you to create or delete connections.
Figure 7.1. Manage DB Connections - Dialog

Click New to create a new connection. Once created, the connection can be selected from the Stored Connections list. You can then set various parameters for the connection, including the following:

- **Connection Name**: The name used to refer to this connection. This connection can then be selected from a list in other wizards requiring a connection.

- **Connection Method**: The methods available are Standard TCP/IP, Local Socket/Pipe, and Standard TCP/IP over SSH.

After you select a connection method, the fields available in the Parameters tab and the Advanced tab of the dialog changes accordingly. More details about these options and parameters are available in the following sections.

After all parameters have been set as required, you can click the Test Connection button to test the connection to the live server. After you are satisfied that the connection works as expected, you can close the wizard by clicking the Close button. The stored connection then is available for use from any of the wizards requiring a connection to a live server.

You can duplicate an existing connection using the Duplicate button. This is an easy way to begin setting up a new connection that differs only slightly from an existing one.

### 7.6.1. The Password Storage Vault

The vault provides a convenient secure storage for passwords used to access MySQL servers. By using the vault, you need not enter credentials every time MySQL Workbench attempts to connect to a server. The vault is implemented differently on each platform:

- **Windows**: The vault is an encrypted file in the MySQL Workbench data directory. This is where connections.xml and related files are located. The file is encrypted using a Windows API which performs the encryption based on the current user, so only the current user can decrypt it. As a result it is not possible to decrypt the file on any other computer. It is possible to delete the file, in which case all stored passwords are lost, but MySQL Workbench will otherwise perform as expected. You then must re-enter passwords as required.

- **Mac OS X**: The vault is implemented using the Mac OS X Secure Keychain. The keychain contents can be viewed using the Keychain Access.app utility.
• **Linux**: The vault works by storing passwords using the `gnome-keyring` daemon, which must be running for password persistency to work. The daemon is automatically started in GNOME desktops, but normally is not in KDE and others. The `gnome-keyring` daemon can be used for password storage in MySQL Workbench on non-GNOME platforms, but must be started manually.

### 7.6.2. Standard TCP/IP Connection

This connection method enables MySQL Workbench to connect to MySQL Server using TCP/IP.

**Parameters tab**

- **Hostname**: The host name or IP address of the MySQL server.
- **Username**: User name to use for the connection.
- **Password**: Optional password for the account used. If you enter no password here, you will be prompted to enter the password when MySQL Workbench attempts to establish the connection. MySQL Workbench can store the password in a vault (see Section 7.6.1, “The Password Storage Vault”).
- **Port**: The TCP/IP port on which the MySQL server is listening (the default is 3306).
- **Default Schema**: When the connection to the server is established, this is the schema that will be used by default. It becomes the default schema for use in other parts of MySQL Workbench.

**Advanced tab**

More parameters can be set for the connection by using the **Advanced** tab.

**Figure 7.2. Manage DB Connections - Advanced Tab**

The **Advanced** tab includes these check boxes:

- **Use compression protocol**: If checked, the communication between the application and the MySQL server will be compressed, which may increase transfer rates. This corresponds to starting a MySQL command-line client with the `--compress` option.
• **Use SSL if available:** This option turns on SSL encryption. The client library must support this option. Note: This feature is currently not supported.

• **Use ANSI quotes to quote identifiers:** Treat """" as an identifier quote character (like the `"` quote character) and not as a string quote character. You can still use `"` to quote identifiers with this mode enabled. With this option enabled, you cannot use double quotation marks to quote literal strings, because it is interpreted as an identifier. Note: If this option is selected, it overrides the server setting.

### 7.6.3. Local Socket/Pipe Connection

This connection method enables MySQL Workbench to connect to MySQL Server using a socket file (on Unix) or a named pipe (on Windows).

**Parameters**

The unique field here is **Socket/Pipe Path**. Enter the name of the socket or pipe here. If the field is left blank, the default socket or pipe name is used. On Unix, the default socket name is `/tmp/mysql.sock`. On Microsoft Windows, the default pipe name is `MySQL`.

This option can be seen in the following screenshot.

**Figure 7.3. Manage DB Connections - Socket/Pipe Parameters**

![Socket/Pipe Parameters](image)

**Advanced**

The only option available in this tab is **Use ANSI quotes to quote identifiers**. This option was discussed in Section 7.6.2, “Standard TCP/IP Connection”.

### 7.6.4. Standard TCP/IP over SSH Connection

This connection method enables MySQL Workbench to connect to MySQL Server using TCP/IP over an SSH connection.

**Parameters**

In addition to a number of parameters that are in common with Standard TCP/IP connections, this connection method features a number of specialized parameters. These are listed here:
• **SSH Hostname**: This is the name of the SSH server. An optional port number can also be provided.

• **SSH Username**: This is the name of the SSH user name to connect with.

• **SSH Password**: The SSH password. It is recommended that an SSH key file is also used.

• **SSH Key File**: A path to the SSH key file. Note: Only key files in OpenSSH format are currently supported.

These options can be seen in the following screenshot.

**Figure 7.4. Manage DB Connections - SSH Parameters**

![SSH Parameters Screenshot]

### Advanced

The options here are the same as for the Standard TCP/IP connection. See Section 7.6.2, “Standard TCP/IP Connection”.

### 7.7. SQL Editor

MySQL Workbench 5.2 introduced the SQL Editor facility. The SQL Editor can be launched using various action items on the Home window. It can also be launched by selecting Database, Query Database from the main menu, or by using the keyboard shortcut Control+U on Windows, or Command+U on Mac OS X. At this point, you will be asked to either select a stored connection or enter the details for a new connection. After a connection has been made to the server, a new tab called **SQL Editor (schema)** is displayed.
The SQL Editor user interface has these main elements:

- Main Menu
- Toolbar
- SQL Query Panel
- Main Tabsheets (Overview, Output, History, Snippets, Results)
- Sidebar
- Auto-completion (in the Main Menu)

The following sections describe each of these elements.

### 7.7.1. Main Menu

When an SQL Editor tab is selected, the most important items on the main menu bar are the Query and Edit menus.

**Query Menu**

The Query menu features the following items:

- Execute (All or Selection): Executes all statements in the SQL Query area, or only the selected statements.
- Execute Current Statement: Executes the current SQL statement.
- Explain (All or Selection): Describes all statements, or the selected statement.
• Explain Current Statement: Describes the current statement.

• Visual Explain Current Statement: Visually describes the current statement, based on EXPLAIN information provided by MySQL Server 5.6 and above.

  This feature was added in MySQL Workbench 5.2.45.

• Stop: Stops executing the currently running script.

• Reconnect to Server: Reconnects to the MySQL server.

• New Tab: Creates a duplicate of the current SQL Editor tab.

• Commit Transaction: Commits a database transaction.

• Rollback Transaction: Rolls back a database transaction.

• Refresh: Synchronizes with the live server and refreshes views such as the live Overview tabsheet.

• Commit Result Edits: Commits any changes you have made to the server.

• Discard Result Edits: Discards any changes you have made.

• Export Results: Exports result sets to a file. Selecting this option displays the Export Query Results to File dialog. The dialog enables you to select which result set you wish to export, the file format (CSV, HTML, XML), and the name and location of the output file. Then click Export to export the data.

Edit Menu

The Edit menu features the Format submenu. The Format submenu includes the following menu items that are of importance when in SQL Editor mode:

• Beautify Query: Reformats the query selected in the query tab and lays it out in nicely indented fashion.

• UPCASE Keywords: Converts keywords to uppercase in the currently selected query in the query tab.

• lowercase Keywords: Converts keywords to lowercase in the currently selected query in the query tab.

• Indent Lines: Indents the lines selected in the query tab.

• Unindent Lines: Unindents the lines selected in the query tab.

• Un/Comment Selection: Comments the lines currently selected in the query tab. If the lines are already commented, this operation removes the comments.

• Auto-complete: Triggers the auto-completion wizard. This is enabled (and triggered) by default, and can be disabled with Preferences, SQL Editor, Automatically Start Code Completion. Auto-completion will list functions, keywords, schema names, table names and column names.

  Note

  This feature was added in MySQL Workbench 5.2.41.

7.7.2. Toolbar

The toolbar features buttons in two locations, in the main toolbar and within the SQL Editor itself. The SQL Editor buttons are described below.
Figure 7.6. SQL Editor - Toolbar

From left to right, these buttons are:

- **Open a SQL Script File**: Loads a saved SQL script to be ready for execution. The script is displayed in the SQL Query area.

- **Save SQL Script to File**: Saves the currently loaded SQL script to a file specified by the user.

- **Execute SQL Script**: Executes the selected portion of the query, or the entire query if nothing is selected.

- **Execute Current SQL script**: Execute the statement under the keyboard cursor.

- **Explain (All or Selection)**: Execute the EXPLAIN command on the query under the keyboard cursor.

- **Stop the query being executed**: Halts execution of the currently executing SQL script. Note: the database connection will not be restarted, and open transactions will remain open.

- **Toggle whether execution of SQL script should continue after failed statements**: If the red “breakpoint” circle is displayed, the script terminates on a statement that fails. If the button is depressed so that the green arrow is displayed, execution continues past the failed code, possibly generating additional result sets. In either case, any error generated from attempting to execute the faulty statement is recorded in the Output tabsheet.

- **Commit**: Commits the current transaction. Note: All query tabs in the same connection share the same transactions. To have independent transactions, a new connection must be opened.

- **Rollback**: Rolls back the current transaction. Note: All query tabs in the same connection share the same transactions. To have independent transactions, a new connection must be opened.

- **Toggle Auto-Commit Mode**: If selected, each statement will be committed independently. Note: All query tabs in the same connection share the same transactions. To have independent transactions, a new connection must be opened.

- **Beautify SQL**: Beautify/reformat the SQL script.

- **Find panel**: Show the Find panel for the editor.

- **Invisible characters**: Toggle display of invisible characters, such as newlines, tabs, spaces.

### 7.7.3. SQL Query Panel

In this area, you can enter SQL statements directly. The statements entered can be saved to a file or snippet for later use. At any point, you can also execute the statements you have entered.

To save a snippet of code entered into the SQL Query panel, click the Save SQL to Snippets List icon in the Snippets panel, enter a name (optional), and click OK. The snippet can be inserted into the SQL Query panel at any time by double-clicking the snippet in the SQL Snippets panel.
Executing a `SELECT` query will display the associated result set in the SQL View panel, directly below the SQL Query panel. These cells are editable if MySQL Workbench is able to determine how, as for example they are editable if a Primary or Unique key exists within the result set. If not, MySQL Workbench will display a "read-only" icon at the bottom-right corner of the SQL View panel, and hovering the mouse cursor over this icon will provide a hint as to why it's not editable.

**Note**
To quickly enter the name of a table, view, or column, double-click the item in the Schemata Palette. The item name will be inserted into the SQL Query panel.

### 7.7.4. Main Tabsheets

The main tabsheets area contains several tabs:

- Output and History Tabsheet
- Results Tabsheets
- Live Editing Tabsheet

### 7.7.4.1. Output and History Tabsheet

The Output and History tabsheet is located at the bottom of MySQL Workbench, and can be toggled on or off. It contains a select box that includes **Action Output**, **Text Output**, and **History** options.
The Action Output tabsheet displays a summary of the communication between the script and the server. The messages displayed can be information or errors. Each message displays the time, the action that was carried out, and the response from the server. This output is useful for troubleshooting scripts.

The Text Output tabsheet will display a textual representation of the query, as displayed using the MySQL Console. Use Query, Execute (All or Selection) to Text to send output to this tabsheet.

The History tabsheet provides a history of SQL operations carried out. The time and SQL code for each operation is recorded. To view the SQL executed, click the time, and the SQL code executed will be displayed in the SQL column.

7.7.4.2. Results Tabsheets

The results area of the screen shows the results from any queries that have been executed. If the script contains multiple queries, a result tab will be generated for each query that returns results.

Figure 7.9. SQL Editor - Results Tabsheets

Controls are provided to enable you to easily move over the results. These are shown in the following screenshot.

Figure 7.10. SQL Editor - Results Tabsheets Navigation Controls

From left to right, the controls are:

- **Move to first row**: Highlights the first row in the current result set.
- **Move to previous row**: Highlights the previous row.
- **Move to next row**: Highlights the next row.
- **Move to last row**: Highlights the last row in the current result set.
- **Toggle wrapping of cell contents**: Toggles between truncating or wrapping the data in a cell.
Main Tabsheets

- **Sort Ascending**: Sorts the selected column in ascending order.
- **Sort Descending**: Sorts the selected column in descending order.
- **Export record set to an external file**: Writes a result set to a CSV, HTML, or XML file as required.
- **Refresh Data from Data Source**: Refreshes the current result set from the data source.
- **Search for substring within data**: Searches the data for the string entered in the search box.

### 7.7.4.3. Live Editing Tabsheets

It is possible to edit data in real time using the Live Editing tabsheets. The live editor is the default view type, so it will be displayed after running a `SELECT` query or by right-clicking a table in the Schema Viewer and choosing `Edit Data Table`.

The top part of the result set may be resized to reveal the `SELECT` query that it originated from. This query can be altered to show only columns you want, which might mean adding a `WHERE` clause.

In addition to the controls offered by the Results tabsheet, the Live Editor tab features some additional controls. These controls are highlighted in the following screenshot.

**Figure 7.11. SQL Editor - Live Editing Tabsheet Navigation Controls**

These additional controls enable you to make changes other than simple edits, like inserting/removing rows and exporting the data.

From left to right, the additional controls are:

- **Edit current row**: Enters edit mode for the currently selected row. Double-clicking a cell has the same effect.

**Note**

It is possible to enter a function, or other expression, into a field. Use the prefix `\func` to prevent MySQL Workbench from escaping quotation marks.
For example, for the expression `md5('fred')`, MySQL Workbench normally would generate the code `md5('fred')`. To prevent this, enter the expression as `\func md5('fred')` to ensure that the quoting is not escaped.

- **Insert new row**: Inserts a new row and enables you to enter data. Your changes will not be reflected on the live server until you click **Apply changes to data**.

- **Delete selected rows**: Removes the selected rows. Your changes will not be reflected on the live server until you click **Apply changes to data**.

- **Export recordset to an external file**: Exports the result set as a file to a defined location. The same as choosing **Query», Export Results...** from the main menu. Data may be exported as several formats, including CSV, CSV (; separated), HTML, JSON, SQL, and XML.

- **Import records from an external file**: Imports data from a CSV file. Data is separated by a comma, and not the alternative **CSV (; separated)** MySQL Workbench export option.

  This feature was added in MySQL Workbench 5.2.45.

See also Section 8.7.1.3.8, "The Inserts Tab".

### 7.7.5. Sidebar

The Sidebar contains these panels:

- Session (connection) Information
- Snippets
- Schemas

The following sections describe each panel in more detail.

#### 7.7.5.1. Snippets panel

The Snippets sidebar offers both built-in and custom snippets. The sidebar contains a select box, with **My Snippets** for custom snippets, and built-in options titled **DB Mgmt** (Database Management), **SQL DDL** (SQL Data Definition Language), and **SQL DML** (SQL Data Manipulation Language).

Snippets may be given names, and these snippets can be viewed and edited from the Snippets sidebar. To load a snippet into the SQL Query area, either choose the Snippets Insert icon or right-click on the desired snippet and choose Insert. Double-click a snippet to open an edit context, to edit the snippet body or title. This example shows two snippets, with only the first having defined a name.
7.7.5.2. Session and Object Information Panel

This panel summarizes the current connection to the server.

Figure 7.13. SQL Editor - Connection Information Palette

This panel also summarizes information about the object.
7.7.5.3. Object Browser

The Object Browser contains an Actions list and a Schemata list, as seen in the following screenshot.

Object Browser Actions List

The Object Browser contains an Actions list. The actions are:

- **Execute SQL File**: Opens an "Open File" dialog that enables you to select an SQL script to execute.
- **Add Schema**: Enables you to add a new schema to your server.
- **Add Table**: Enables you to create a new table via the `new_table` dialog.
- **Add View**: Enables you to create a new view via the `new_view` dialog.
• **Add Routine**: Enables you to create a new routine via the `new_routine` dialog.

**Schemata List**

The Schemata list shows available schemata on the currently connected server. These can be explored to show tables, views, and routines within the schema.

![Figure 7.16. SQL Editor - Schemata Explorer](image)

It is possible to set a schema as the default schema by right-clicking the schema and selecting the Set As Default Schema menu item. This executes a `USE schema_name` statement so that subsequent statements without schema qualifiers are executed against this schema. This setting applies only to the query session. To set a default schema for multiple MySQL Workbench sessions, you must set the default schema for the stored connection. From the Home screen, click **Manage Connections**, then in the **Manage DB Connection** dialog, set the desired default schema on the **Parameters** tab.

A useful feature that was introduced in MySQL Workbench 5.2.9 is the ability to rapidly enter table, view, or column names into the SQL Statement area. Double-clicking a table, view, or column name in the schemata explorer inserts the name into the SQL Query area. This reduces typing significantly when entering SQL statements containing references to several tables, views, or columns.
The Object Browser also features a context menu which can be displayed by right-clicking an object. For example, right-clicking a table displays the following menu items:

- Select Rows - Limit 1000: Pulls up to 1000 rows of table data from the live server into a Results tabsheet.
- Edit Table Data: Pulls table data from the live server into a named tabsheet, and enables editing. Data can be saved directly to the live server.
- Copy to Clipboard: There are various submenus, each of which copies information to the clipboard:
  - Name (short): Copies the table name.
  - Name (long): Copies the qualified table name in the form `schema`.`table`.
  - Column Names: Copies qualified column names the form `table`.`column1`, `table`.`column2`, ...
  - Select All Statement: Copies a statement to select all columns in this form:
    
    ```sql
    SELECT `table`.`column1`,
    `table`.`column2`,
    ...
    FROM `schema`.`table`;
    ```
  - Insert Statement: Copies an INSERT statement to insert all columns.
  - Update Statement: Copies an UPDATE statement to update all columns.
  - Delete Statement: Copies a DELETE statement in the form DELETE FROM `world`.`country`
    WHERE <where_condition>;
  - Send to SQL Editor: Provides functionality similar to Copy to Clipboard. However, this item inserts the SQL code directly into the SQL Query panel, where it can be edited further as required.
  - Alter Table: Displays the table editor loaded with the details of the table.
  - Create Table: Launches a dialog to enable you to create a new table.
  - Drop Table: Drops the table. All data in the table will be lost if this operation is carried out.
  - Refresh All: Refreshes all schemata in the explorer by resynchronizing with the server.

Right-clicking an empty area inside the object browser displays the following menu items:

- Create Schema: Enables you to create a new schema on the connected server. You can apply your changes to synchronize with the live server by clicking the Apply button.
- Refresh All: Synchronizes with the live server to update the information displayed by the schemata explorer.
Chapter 8. Data Modeling

Table of Contents

8.1. Open an Existing EER Model ................................................................. 84
8.2. Create New EER Model ................................................................. 84
8.3. Create EER Model from Existing Database ........................................ 84
8.4. Create EER Model from SQL Script .................................................. 84
8.5. Model Editor ......................................................................................... 85
  8.5.1. Modeling Menus ............................................................................. 86
  8.5.2. The Toolbar .................................................................................... 95
  8.5.3. EER Diagrams ............................................................................... 96
  8.5.4. The Physical Schemata Panel .......................................................... 96
  8.5.5. The Schema Privileges Panel .......................................................... 96
  8.5.6. The SQL Scripts Panel ................................................................. 98
  8.5.7. The Model Notes Panel ................................................................. 98
  8.5.8. The History Palette ....................................................................... 98
  8.5.9. The Model Navigator Panel .......................................................... 98
  8.5.10. The Catalog Tree Palette .............................................................. 99
  8.5.11. The Layers Palette ..................................................................... 99
  8.5.12. The Properties Palette ................................................................. 100
8.6. EER Diagram Editor ............................................................................ 100
  8.6.1. The Vertical Toolbar ................................................................... 100
8.7. Working with Models ............................................................................ 104
  8.7.1. Creating Tables ........................................................................... 104
  8.7.2. Creating Foreign Key Relationships ............................................. 115
  8.7.3. Creating Views ........................................................................... 119
  8.7.4. Creating Routines and Routine Groups ........................................ 121
  8.7.5. Creating Layers ........................................................................ 124
  8.7.6. Creating Notes ........................................................................... 125
  8.7.7. Creating Text Objects .................................................................. 126
  8.7.8. Creating Images .......................................................................... 127
  8.7.9. Reverse Engineering .................................................................... 128
  8.7.10. Forward Engineering ................................................................ 137
8.8. Modeling Tutorials ................................................................................ 156
  8.8.1. Importing a Data Definition SQL Script ....................................... 156
  8.8.2. Using the Default Schema ............................................................. 158
  8.8.3. Basic Modeling ........................................................................... 159
  8.8.4. Documenting the sakila Database ................................................ 160
8.9. Printing ................................................................................................. 162
  8.9.1. Printing Options ......................................................................... 162
8.10. MySQL Workbench Schema Validation Plugins (Commercial Version) ...................................................................................... 162
  8.10.1. General Validation ..................................................................... 162
  8.10.2. MySQL-Specific Validation .......................................................... 163
8.11. The DBDoc Model Reporting Dialog Window (Commercial Version) .............................................................................................. 163
8.12. Customizing DBDoc Model Reporting Templates .................................. 166
  8.12.1. Supported Template Markers ...................................................... 169
  8.12.2. Creating a Custom Template ........................................................ 173

MySQL Workbench provides extensive capabilities for creating and manipulating database models, including these:

- Create and manipulate a model graphically
- Reverse engineer a live database to a model
- Forward engineer a model to a script or live database
• Create and edit tables and insert data

This is not an exhaustive list. The following sections discuss these and additional data-modeling capabilities.

The Home window is the typical starting point for work with data modeling. In the Data Modeling section of the Workspace, you can use the action items there to create and manage models, forward and reverse engineer, and compare and synchronize schemata:

• Open an Existing EER Model
• Create new EER Model
• Create EER Model from Existing Database
• Create EER Model from SQL Script

The following sections describe these action items.

8.1. Open an Existing EER Model

Clicking this action item launches a file browser. You can then select the model file you wish to load. A new MySQL Model tab will then be created, and your model displayed.

If you have already created one or more model files, each will appear in this panel as an icon. Double-clicking the item of the model you wish to load creates a new MySQL Model tab and displays your model.

If you already have created a connection to a database, it will appear in this panel as an icon. Double-clicking the icon directly launches an SQL Editor tab, and connects you to the database as defined by the connection.

To read more about modeling, see Section 8.5, “Model Editor”.

8.2. Create New EER Model

Clicking this action item launches a new MySQL Model tab, with a blank model ready for you to work on.

To read more about modeling, see Section 8.5, “Model Editor”.

8.3. Create EER Model from Existing Database

This action item enables you to create an EER Model from an existing live database. Clicking this action item launches the Reverse Engineer Database. This is a multi-stage wizard that enables you to select a connection to a live server, and select the schema and objects you wish to reverse engineer into your new model. This is a convenient way to see how an existing database is structured.

For further information about reverse engineering, see Section 8.7.9.2, “Reverse Engineering a Live Database”.

8.4. Create EER Model from SQL Script

This action item enables you to create a model from an SQL Create script. Such a script may have been created by hand or as a result of reverse engineering an existing database. The script may then be modified according to requirements. Clicking this action item launches the Reverse Engineer SQL Script wizard. This is a multi-stage wizard that enables you to select the script you want to create your model from.
8.5. Model Editor

When the Model Editor is executed from the Home window, MySQL Workbench displays the MySQL Model page. The MySQL Model page has three main panels, as shown in the following screenshot: Description Editor, User Types List/History panel, and Model Overview.

Figure 8.1. The MySQL Model Page

The Description Editor and User Types List/History panel are contained within the Sidebar. The Sidebar is located on the left by default, but can be relocated to the right using a setting in the Workbench Preferences dialog.

The Model Overview panel has several sections:

- EER Diagrams
- Physical Schemata

For further information, see Section 8.7.9.1, “Reverse Engineering Using a Create Script”.
• Schema Privileges
• SQL Scripts
• Model Notes

For each of these sections, add objects to a project by clicking the appropriate add-object icon. You may also rename, edit, cut, copy, or delete objects on this page by right-clicking to open a pop-up menu.

The following sections further discuss the MySQL Model page.

8.5.1. Modeling Menus

Some menu items are not available in the OSS version of this application, and are available only in the Standard Edition. This is indicated where applicable.

8.5.1.1. The File Menu

Use the File menu to open a project, begin a new project, or save a project. Choosing New Model opens the default schema, mydb. Choosing Open Model opens a file dialog box with the default file type set to MySQL Workbench Models (.mwb extension). To display a list of recently opened MWB files, choose the Open Recent menu item. The keyboard shortcut to create a new project is Control+N and the command to open an existing project is Control+O.

To close the currently active MySQL Model or EER Diagram tab, use the Close Tab menu item. You can also do this from the keyboard by pressing Control+W. To reopen the MySQL Model tab, see Section 8.5.1.3, “The View Menu”. To reopen an EER Diagram tab, double-click the EER Diagram icon in the EER Diagrams section of the MySQL Model page.

Use the Save Model or Save Model As menu items to save a model. When you save a model, its name appears in the title bar of the application. If you have made changes to a project and have not saved those changes, an asterisk appears in the title bar following the model name. When you save a model, it is saved as a MySQL Workbench file with the extension .mwb.

Use the Import menu item to import a MySQL data definition (DDL) script file. For example, this might be a file created by issuing the command `mysqldump --no-data`. MySQL Workbench handles the script as follows:

• If the script does not contain a `CREATE DATABASE db_name;` statement, the schema objects are copied to the default schema, mydb.

• If the script creates a database, a new tab bearing the database name is added to the Physical Schemata section of the MySQL Model page.

• If the script contains data, the data is ignored.

For details about importing a DDL script, see Section 8.7.9.1, “Reverse Engineering Using a Create Script”.

Under the Import submenu, you can also import DBDesigner4 files.

There are variety of items under the Export submenu. You may generate the SQL statements necessary to create a new database or alter an existing one. For more information about these menu items, see Section 8.7.10.1, “Forward Engineering Using an SQL Script”.

Using the Export submenu, you can also export an EER diagram as a PNG, SVG, PDF, or Postscript file. For an example of a PNG file, see Figure 8.50, “The sakila Database EER Diagram”.

The Page Setup menu item enables you to set the paper size, orientation, and margins for printing purposes.

86
The printing options are enabled only if the **EER Diagrams** tab is selected. You have the choice of printing your model directly to your printer, printing it as a PDF file, or creating a PostScript file. For more information, see Section 8.9, “Printing”.

**Note**
The printing options are available only in commercial versions of MySQL Workbench.

Use the Document Properties menu item to set the following properties of your project:

- **Name**: The model name (default is **MySQL Model**)
- **Version**: The project version number
- **Author**: The project author
- **Project**: The project name
- **Created**: Not editable; determined by the MWB file attributes
- **Last Changed**: Not editable; determined by the MWB file attributes
- **Description**: A description of your project

### 8.5.1.2. The Edit Menu

Use the **Edit** menu to make changes to objects. The text description for several of the menu items changes to reflect the name of the currently selected object.

This menu has items for cutting, copying, and pasting. These actions can also be performed using the **Control+X**, **Control+C**, and **Control+V** key combinations. Undo a deletion using the Undo Delete ‘object_name’ item. The **Control+Z** key combination can also be used to undo an operation. It is also possible to carry out a Redo operation using either the menu item, or the key combination **Control+Y**.

Also find a Delete ‘object_name’ menu item for removing the currently selected object. The keyboard command for this action is **Control+Delete**. You can also right-click an object and choose the delete option from the pop-up menu.

The Delete ‘object_name’ menu item behaves differently depending upon circumstances. For example, if an **EER Diagram** is active and a table on the canvas is the currently selected object, a dialog box may open asking whether you want to remove the table from the canvas only or from the database as well. For information about setting the default behavior when deleting from an EER Diagram, see Section 6.4.5, “The Model Tab”.

**Warning**
If the **MySQL Model** page is active, the selected object is deleted from the catalog and there will be no confirmation dialog box.

Choose Edit Selected to edit the currently selected object. You can also perform edits in a new window by selecting Edit Selected in New Window. The keyboard shortcuts for Edit Selected and Edit Selected in New Window are **Control+E** and **Control+Shift+E**, respectively.

The Select item has the following submenus:

- **Select All** (Keyboard shortcut, **Control+A**): Selects all the objects on the active EER diagram.
- **Similar Figures** (Objects of the same type): Finds objects similar to the currently selected object.
- **Connected Figures**: Finds all the objects connected to the currently selected object.
These menu items are active only when an EER Diagram tab is selected. The Similar Figures and the Connected Figures menu items are disabled if no object is currently selected on an EER diagram.

When multiple objects have been selected using one of these menu items, you can navigate between selected items by choosing the Go to Next Selected or Go to previous Selected menu item.

Selecting objects changes some of the Edit menu items. If only one object is selected, that object's name appears after the Cut, Copy and Delete menu items. If more than one object is selected, these menu items show the number of objects selected.

8.5.1.2.1. Find Dialog Window

Each MySQL Workbench window includes search functionality. The Find panel with Find & Replace enabled is shown below:

**Figure 8.2. The Find Panel with Find & Replace**

Find options

The Find dialogue options are described below:

- **String Matching** (default) or **Regular Expression**: Search by matching a string, or a PCRE regular expression.

- **Ignore Case**: A case-insensitive search. Works with both the String Matching and Regular Expression search methods. Enabled by default.

- **Match Whole Words**: If enabled, only whole strings are matched. For example, a search for "home" would not match "home_id". Disabled by default.
• **Wrap Around**: The search will wrap around to the beginning of the document, as otherwise it will only search from the cursor position to the end of the document. Enabled by default.

• And the arrows jump to the discovered search terms, and behave according to the **Wrap Around** option.

The Standard Edition of MySQL Workbench includes a more advanced Find facility:

**Figure 8.3. The Find Window**

You can search the following locations:

• Entire Model: Searches the entire model.

• Current View: Searches the current view only. This may be the MySQL Model page.

• All Views: Searches the MySQL Model Page and all EER diagrams.

• Database Objects: Searches database objects only.

• Selected Figures: Searches the currently selected objects. This feature works only for EER diagrams.

Enter the text you wish to search for in the **Find Text** list. You may also select any or all of the following check boxes:

• Match Case

• Whole Word

• Use Regular Expression

• Search in Comments

• Search in SQL for Views, SPs etc.

Any text you enter into the **Find Text** list is retained for the duration of your session. Use the Next or Previous buttons to find occurrences of your search criterion.

Clicking the **Find All** button opens a **Find Results** window anchored at the bottom of the application. If you wish, you may undock this window as you would any other.

Use this window to navigate to objects. For example, double-clicking the Description of an object located on an EER diagram navigates to the specific diagram and selects the object. Notice that the properties of the object are displayed in the Properties palette.

The **Find** dialog window can also be opened using the **Control+F** key combination. Use **Control+Shift+G** to find the next occurrence and **Control+Shift+G** to find a previous occurrence. Close the **Find** dialog window by clicking the x in the top right corner or by pressing the **Esc** key.
8.5.1.2.2. **Workbench Preferences**

This menu item enables you to set global preferences for the MySQL Workbench application.

For further information, see Section 6.4, “Workbench Preferences”.

8.5.1.3. **The View Menu**

The **View** menu has these items:

- **Home**: Selects the Home window
- **Windows**: A submenu with items that provide a means for opening the windows associated with them:
  - **Model Navigator**: Opens the Model Navigator palette
  - **Catalog**: Opens the Catalog palette
  - **Layers**: Opens the Layers palette
  - **User Datatypes**: Opens the User Datatypes palette
  - **Object Descriptions**: Opens the Description palette
  - **Object Properties**: Opens the Properties palette
  - **Undo History**: Opens the History palette
- **Output**: Displays the console output. The keyboard shortcut for this menu item is Control+F2.
- **Reset Window Layout**: Resets all windows to their default layout
- **Zoom 100%**: The default level of detail of an EER diagram
- **Zoom In**: Zooms in on an EER diagram.
- **Zoom Out**: Zooms out from an EER diagram.

The ability to zoom in on an EER diagram is also available using the slider tool in the Model Navigator palette. See Section 8.5.9, “The Model Navigator Panel”.

- **Set Marker**: Bookmarks an object. From the keyboard, select the object you wish to bookmark, then use the key combination Control+Shift and the number of the marker (1 through 9). You may create up to nine markers.
- **Go To Marker**: Returns to a marker. From the keyboard, use the Control key and the number of the marker.
- **Toggle Grid**: Displays grid lines on an EER diagram.
- **Toggle Page Guides**: Toggles Page Guides.

8.5.1.4. **The Arrange Menu**

The **Arrange** menu items apply only to objects on an EER diagram canvas and are enabled only if an EER diagram view is active. The **Arrange** menu has these items:

- **Align to Grid**: Aligns items on the canvas to the grid lines
- **Bring to Front**: Brings objects to the foreground
- **Send to Back**: Sends objects to the background
• Center Diagram Contents: Centers objects on the canvas

• Autolayout: Automatically arranges objects on the canvas

• Reset Object Size: Expands an object on an EER diagram. For example, if a table has a long column name that is not fully displayed, this menu item expands the table to make the column visible. This menu item is not enabled unless an object is selected.

• Expand All: Use this item to expand all objects on an EER diagram. This item will display a table’s columns if the object notation supports expansion. Some object notations, such as Classic, do not permit expansion or contraction. Indexes will not automatically be expanded unless they were previously expanded and have been collapsed using the Collapse All menu item.

• Collapse All: Undo the operation performed by Expand All.

8.5.1.5. The Model Menu

The Model menu has these items:

• Add Diagram: Creates a new EER Diagram. The keyboard shortcut is Control+T.

• Create Diagram From Catalog Objects: Creates an EER diagram from all the objects in the catalog.

• DBDoc – Model Reporting...: For information about this menu item, see Section 8.5.1.5.1, “The DBDoc Model Reporting Dialog Window (Commercial Version)”. Commercial version only.

• User Defined Types: Presents a dialog box that enables you to add and delete user defined data types.

• Object Notation: For information about this menu item, see Section 8.5.1.5.3, “The Object Notation Submenu”.

• Relationship Notation: For information about this menu item, see Section 8.5.1.5.4, “The Relationship Notation Submenu”.

• Diagram Properties and Size: Opens a diagram size dialog box that enables you to adjust the width or height of the canvas. The unit of measure is pages; the default value is two.

When you have tables with numerous columns, use this menu item to increase the size of the EER.

• Validation: For information about this menu item, see Section 8.5.1.5.2, “The Validation Submenus (Commercial Version)”. Commercial version only.

• Model Options: Sets options at the model level. These options should not be confused with the options that are set globally for the Workbench application, and which are referred to as Workbench Preferences. The available model options are a subset of the Workbench Preferences options.

For more information about Workbench Preferences, see Section 6.4.5, “The Model Tab”.

8.5.1.5.1. The DBDoc Model Reporting Dialog Window (Commercial Version)

This dialog window is found by navigating to the Model menu and choosing the DBDoc - Model Reporting... item.

Note
The DBDoc - Model Reporting... item is not available in the MySQL Workbench OSS version.

Use this dialog window to set the options for creating documentation of your database models. For more information, see Section 8.11, “The DBDoc Model Reporting Dialog Window (Commercial Version)”.
8.5.1.5.2. The Validation Submenus (Commercial Version)

The Model menu has two validation submenus, Validation and Validation (MySQL). Use these submenus for general validation and MySQL-specific validation of the objects and relationships defined in your model.

Note
These items are not available in the MySQL Workbench OSS version.

The Validation submenu has these items:

- Validate All: Performs all available validation checks
- Empty Content Validation: Checks for objects with no content, such as a table with no columns
- Table Efficiency Validation: Checks the efficiency of tables, such as a table with no primary key defined
- Duplicate Identifiers Validation: Checks for duplicate identifiers, such as two tables with the same name
- Consistency Validation: Checks for consistent naming conventions
- Logic Validation: Checks, for example, that a foreign key does not reference a nonprimary key column in the source table

The Validation (MySQL) submenu has these items:

- Validate All: Performs all available validation checks
- Integrity Validation: Checks for invalid references, such as a table name longer than the maximum permitted
- Syntax validation: Checks for correct SQL syntax
- Duplicate Identifiers Validation (Additions): Checks for objects with the same name

For detailed information about validation, see Section 8.10, “MySQL Workbench Schema Validation Plugins (Commercial Version)”.

8.5.1.5.3. The Object Notation Submenu

The items under the Object Notation submenu apply exclusively to an EER diagram. They are not enabled unless an EER diagram tab is selected.

The Object Notation submenu has these items:

- Workbench (Default): Displays table columns, indexes, and triggers
- Workbench (Simplified): Shows only a table's columns
- Classic: Similar to the Workbench (Simplified) style showing only the table's columns
- IDEF1X: The ICAM DEFinition language information modeling style

The object notation style that you choose persists for the duration of your MySQL Workbench session and is saved along with your model. When MySQL Workbench is restarted, the object notation reverts to the default.

Note
If you plan to export or print an EER diagram be sure to decide on a notation style first. Changing notation styles after objects have been placed on a diagram can significantly change the appearance of the diagram.
8.5.1.5.4. The Relationship Notation Submenu

The items under the Relationship Notation submenu apply exclusively to an EER diagram. They are not enabled unless an EER diagram tab is selected.

The Relationship Notation submenu has these items:

• Crow's Foot (IE): The default modeling style. For an example, see Figure 8.47, “Adding Tables to the Canvas”.

• Classic: Uses a diamond shape to indicate cardinality.

• Connect to Columns

• UML: Universal Modeling Language style.

• IDEF1X: The ICAM DEFinition language information modeling method

To view the different styles, set up a relationship between two or more tables and choose the different menu items.

The relationship notation style that you choose persists for the duration of your MySQL Workbench session and is saved along with your model. When MySQL Workbench is restarted, the relationship notation reverts to the default, the Crow's Foot style.

Note

If you plan to export or print an EER diagram, be sure to decide on a notation style first. Changing notation styles after objects have been placed on a diagram can significantly change the appearance of the diagram.

8.5.1.6. The Database Menu

The Database menu has these items:

• Query Database: Launches the SQL Editor, which enables you to create SQL code and execute it on a live server. For more information, see Section 7.7, “SQL Editor”.

• Manage Connections: Launches the Manage DB Connections dialog, which enables you to create and manage multiple connections. For more information, see Section 7.6, “Manage DB Connections Dialog”

• Reverse Engineer: Creates a model from an existing database. For more information, see Section 8.7.9.2, “Reverse Engineering a Live Database”.

• Forward Engineer: Creates a database from a model. For more information, see Section 8.7.10.2, “Forward Engineering to a Live Server”.

• Synchronize with Any Source: Allows you to compare a target database or script with the open model, external script, or a second database, and apply these changes back to the target.

• Synchronize Model: Synchronizes your database model with an existing database. For more information, see Section 8.7.10.3, “Database Synchronization”.

• Generate Catalog Diff Report: Compares your schema model with a live database or a script file. Section 8.7.10.4, “Creating a Catalog Diff Report”.

8.5.1.7. The Plugins Menu

The Plugins menu lists any plugins that you may have installed. For more information about this menu, see Section 12.3, “Plugins”.
8.5.1.8. The Scripting Menu

The Scripting menu has these items:

- **Scripting Shell**: Launches the MySQL Workbench Scripting Shell
- **New Script**: Opens a **New Script File** dialogue, with options to create a Python Script, Lua Script, Python Plugin, or Python Module.
- **Open Script**: Opens a **Open GRT Script** dialogue, which defaults to the Workbench scripts directory. Files are opened into the **Workbench Scripting Shell** window.
- **Run Workbench Script File**: Executes the specified script
- **Install Plugin/Module File**: Loads and installs a plugin or module file
- **Plugin Manager**: Displays information about the plugins that are installed, and allows disabling and uninstalling the plugins.

8.5.1.9. The Community Menu

The Community menu has the following items. Use them to go online and learn more about MySQL Workbench.

- **Workbench Blog**
- **FAQs About Workbench**
- **Learn How To Code For Workbench**
- **Discuss Workbench Topics**
- **Contribute To Workbench**

8.5.1.10. The Help Menu

The Help menu has the following items. Use them to go online and learn more about MySQL Workbench.

- **Help Index**: Opens a window showing the MySQL Workbench documentation. Read, search, or print the documentation from this window.
- **MySQL.com Website**: Opens your default browser on the MySQL Web site home page.
- **Workbench Product Page**: Opens your default browser on the MySQL Workbench product page.
- **System Info**: Displays information about your system, which is useful when reporting a bug. For more information, see Section 8.5.1.10.1, “System Info”.
- **Report a Bug**: Opens a form to submit a bug to bugs.mysql.com, and optionally attaches the log file to the report. Additional information such as the MySQL Workbench version, configuration and data directory paths, operating system, and more, are appended to the report but is made private so only those with proper permissions (such as MySQL developers) can view this helpful debugging information.
- **View Reported Bugs**: Opens your default browser to see a list of current bugs.
- **Locate log file**: Opens up the directory that contains the MySQL Workbench log files.
- **Check For Updates**: Opens the MySQL Workbench website using your default browser, and checks for a newer version.
- **About Workbench**: Displays the MySQL Workbench **About** window.
8.5.1.10.1. System Info

Use the System Info menu item to display information about your system. This item is especially useful for determining your rendering mode. Sample output follows.

```
read_mysql_cfg_file  C:\Program Files\MySQL\MySQL Server 5.1\my.ini
[['tmp_table_size', '9M'],
 ['myisam_sort_buffer_size', '18M'],
 ['table_cache', '256'],
 ['read_rnd_buffer_size', '256K'],
 ['port', '3306'],
 [('max_connections', '100'),
 ['innodb_buffer_pool_size', '18M'],
 ['myisam_max_sort_file_size', '100G'],
 ['sql-mode', '"STRICT_TRANS_TABLES,NO_AUTO_CREATE_USER,NO_ENGINE_SUBSTITUTION"'],
 ['basedir', '"C:/Program Files/MySQL/MySQL Server 5.1/"'],
 ['default-character-set', 'latin1'],
 ['datadir', '"C:/ProgramData/MySQL/MySQL Server 5.1/Data/"'],
 ['innodb_log_buffer_size', '1M'],
 ['innodb_log_file_size', '10M'],
 ['innodb_thread_concurrency', '8'],
 ['read_buffer_size', '64K'],
 ['innodb_additional_mem_pool_size', '2M'],
 ['thread_cache_size', '8'],
 ['innodb_flush_log_at_trx_commit', '1'],
 ['query_cache_size', '0'],
 ['sort_buffer_size', '256K'],
 ['default-storage-engine', 'INNODB'],
 ['key_buffer_size', '11M']]
```

MySQL Workbench OSS for Windows version 5.2.8
Cairo Version: 1.8.6
Rendering Mode: GDI requested (create a diagram to confirm)
OpenGL Driver Version: Not Detected
OS: unknown
CPU: Intel(R) Core(TM)2 Duo CPU T9300 @ 2.50GHz, 1.0 GB RAM
Video adapter info:
Adapter type: VirtualBox Graphics Adapter
Chip Type: VBOX
BIOS String: Version 0x80C2 or later
Video Memory: 12288 KB

8.5.2. The Toolbar

The MySQL Workbench toolbar is located immediately below the menu bar. Click the tools in the toolbar to perform the following actions:

- The new document icon: Creates a new document
- The folder icon: Opens a MySQL Workbench file (mwb extension)
- The save icon: Saves the current MySQL Workbench project
- The right and left arrows: The left arrow performs an “Undo” operation. The right arrow performs a “Redo” operation.

Other tools appear on the toolbar depending upon the context.

8.5.2.1. Tool-Specific Toolbar Items

When an EER diagram canvas is selected, the following icons appear to the right of the arrow icons:

- The toggle grid icon: Turns the grid on and off
- The grid icon: Aligns objects on the canvas with the grid
- The new EER diagram icon: Creates a new EER diagram tab.

The toolbar also changes depending upon which tool from the vertical toolbar is active. For discussion of these tools, see Section 8.6.1, “The Vertical Toolbar”.

95
If the **Table** tool is active, schemata lists, engine types, and collations appear on the toolbar. The table properties can be modified using the Properties Editor.

When an object is selected, the object's properties, such as color, can be changed in the Properties Editor.

### 8.5.3. EER Diagrams

Use the **Add new Diagram** icon in the **MySQL Model** area to create EER diagrams. When you add an EER diagram, a new tab appears below the toolbar. Use this tab to navigate to the newly created EER diagram. For further discussion of EER Diagrams, see Section 8.6, “EER Diagram Editor”.

### 8.5.4. The Physical Schemata Panel

The **Physical Schemata** panel of the **MySQL Model** page shows the active schemata and the objects that they contain.

Expand and contract the **Physical Schemata** section by double-clicking the arrow on the left of the **Physical Schemata** title bar. When the **Physical Schemata** section is expanded, it displays all currently loaded schemata.

Each schema shows as a tab. To select a specific schema, click its tab. When MySQL Workbench is first opened, a default schema, **mydb**, is selected. You can start working with this schema or you can load a new MySQL Workbench Model file (models use the **.mwb** extension.)

There are a variety of ways to add schema to the **Physical Schemata** panel. You can open an **.MWB** file, reverse engineer a MySQL create script, or, if you are using a commercial version of MySQL Workbench, you can reverse engineer a database by connecting to a MySQL server.

You can also add a new schema by clicking the **+** button on the top right of the **Physical Schemata** panel. To remove a schema, click its tab and use the **-** button found to the immediate left of the **+** button. To the left of these buttons are three buttons that control how database object icons are displayed:

- The left button displays database objects as large icons.
- The middle button displays small icons in multiple rows.
- The right button displays small icons in a single list.

### 8.5.4.1. The Schema Objects Panel

The **Physical Schemata** panel has the following sections:

- Tables
- Views
- Routines
- Routine Groups

Each section contains the specified database objects and an icon used for creating additional objects.

Any database objects added to an EER diagram canvas also show up in the **Physical Schemata** section. For information about adding objects to an EER diagram canvas, see Section 8.6, “EER Diagram Editor”.

### 8.5.5. The Schema Privileges Panel

The **Schema Privileges** panel has the following sections, used to create users for your schemata and to define roles —:
The Schema Privileges Panel

- Users
- Roles

The following image displays the Schema Privileges section of the MySQL Model tab.

**Figure 8.4. Roles and Privileges**

8.5.5.1. Adding Roles

To add a role, double-click the Add Role icon. This creates a role with the default name role1. Right-clicking a role opens a pop-up menu with the following items:

- Cut 'role_name': Cuts the role
- Copy 'role_name': Copies the role
- Edit Role...: Opens the role editor
- Edit in New Window...: Opens the role editor in a new editor window
- Delete 'role_name': Removes the role
- Copy SQL to Clipboard: Currently not implemented

To rename a role, click the role name. Then you will be able to edit the text.

All roles that have been defined are listed under Roles on the left side of the role editor. Double-clicking a role object opens the role editor docked at the bottom of the page.

**Figure 8.5. Role Editor**

Select the role to which you wish to add objects. You may drag and drop objects from the Physical Schemata to the Objects section of the role editor. To assign privileges to a role, select it from the Roles section, then select an object in the Objects section. In the Privileges section, check the rights you wish to assign to this role. For example, a web_user role might have only SELECT privileges and only for database objects exposed through a web interface. Creating roles can make the process of assigning rights to new users much easier.
8.5.5.2. Adding Users

To add a user, double-click the Add User icon. This creates a user with the default name user1. Double-clicking this user opens the user editor docked at the bottom of the application.

In the User Editor, set the user’s name and password using the Name and Password fields. Assign one role or a number of roles to the user by selecting the desired roles from the field on the right and then clicking the button. Roles may be revoked by moving them in the opposite direction.

Right-clicking a user opens a pop-up menu. The items in the menu function as described in Section 8.5.5.1, “Adding Roles”.

8.5.6. The SQL Scripts Panel

Use the SQL Scripts panel to load and modify SQL scripts. If you created your project from an SQL script and plan to create an ALTER script, you may want to add the original script here, since it will be needed to create an ALTER script. For more information, see Section 8.7.10.1.2, “Altering a Schema”.

8.5.7. The Model Notes Panel

Use the Model Notes panel to write project notes. Any scripts or notes added will be saved with your project.

8.5.8. The History Palette

Use the History palette to review the actions that you have taken. Left-clicking an entry opens a pop-up menu with the item, Copy History Entries to Clipboard. Choose this item to select a single entry. You can select multiple contiguous entries by pressing the Shift key and clicking the entries you wish to copy. Select noncontiguous entries by using the Control key.

Only actions that alter the MySQL model or change an EER diagram are captured by the History palette.

8.5.9. The Model Navigator Panel

Docked at the top left of the application is the Model Navigator, or Bird’s Eye panel. This panel provides an overview of the objects placed on an EER diagram canvas and for this reason it is most useful when an EER diagram is active. Any objects that you have placed on the canvas should be visible in the navigator.

The Model Navigator shows the total area of an EER diagram. A black rectangular outline indicates the view port onto the visible area of the canvas. To change the view port of an EER diagram, left-click this black outline and drag it to the desired location. You can zoom in on selected areas of an EER diagram by using the slider tool at the bottom of this window. The dimensions of the view port change as you zoom in and out. If the slider tool has the focus, you can also zoom using the arrow keys.

The default size of the Model Navigator is two pages. To change this, use the Model menu, Diagram Size menu item.

Figure 8.6. The Model Navigator Palette
8.5.10. The Catalog Tree Palette

The Catalog Tree palette shows all the schemata that are present in the Physical Schemata section of the MySQL Model page. Expand the view of the objects contained in a specific schema by clicking the + button to the left of the schema name. This displays the following folder icons:

- Tables
- Views
- Routine Groups

Expand each of these in turn by clicking the + button to the left of the folder icon.

Selecting an object in this palette displays its properties in the Properties palette, which can be found in the lower left corner of the page.

The Catalog Tree palette is primarily used to drag and drop objects onto an EER diagram canvas.

Note

On Linux, there is a quirk in the GTK tree control, where a simple click always generates a new selection. To drag multiple objects from the Catalog Tree to the EER diagram canvas, you must perform the operation as follows:

1. Click the first item in the tree.
2. Hold the Shift key, click the last item, and do not release the Shift key.
3. Keep the Shift key depressed and commence the dragging operation.
4. Release the Shift key before you release the mouse button to drop selected objects onto the canvas.

This procedure also applies to use of the Control key when selecting multiple nonadjacent elements in the Catalog Tree.

You can toggle the sidebar on and off using the Toggle Sidebar button, which is located in the top right of the application.

8.5.11. The Layers Palette

This palette shows all the layers and figures that have been placed on an EER diagram. If a layer or figure is currently selected, an × appears beside the name of the object and its properties are displayed in the Properties palette. This can be especially useful in determining which objects are selected when you have selected multiple objects using the various options under the Select menu item. For more information on this topic, see Section 8.5.1.2, “The Edit Menu”.

Selecting an object in the Layers palette also adjusts the view port to the area of the canvas where the object is located.

8.5.11.1. Finding Invisible Objects Using the Layers Palette

In some circumstances, you may want to make an object on an EER diagram invisible. Select the object and, in the Properties palette, set the visible property to False.

The Layer palette provides an easy way to locate an object, such as a relationship, that has been set to hidden. Open the Layers palette and select the object by double-clicking it. You can then edit the object and change its visibility setting to Fully Visible.
8.5.12. The Properties Palette

The Properties palette is used to display and edit the properties of objects on an EER diagram. It is especially useful for editing display objects such as layers and notes.

All objects except connections have the following properties except as noted:

- **color**: The color accent of the object, displayed as a hexadecimal value. Change the color of the object by changing this value. Only characters that are legal for hexadecimal values may be entered. You can also change the color by clicking the ... button to open a color changing dialog box.

- **description**: Applicable to layers only. A means of documenting the purpose of a layer.

- **expanded**: This attribute applies to objects such as tables that can be expanded to show columns, indexes, and triggers.

- **height**: The height of the object. Depending upon the object, this property may be read only or read/write.

- **left**: The number of pixels from the object to the left side of the canvas.

- **locked**: Whether the object is locked. The value for this attribute is either true or false.

- **manualSizing**: Whether the object has been manually sized. The value for this attribute is either true or false.

- **name**: The name of the object.

- **top**: The number of pixels from the object to the top of the canvas.

- **visible**: Whether the object shows up on the canvas. Use ‘1’ for true and ‘0’ for false. It is currently used only for relationships.

- **width**: The width of the object. Depending upon the object, this property may be read only or read/write.

Tables have the following additional properties:

- **indexesExpanded**: Whether indexes are displayed when a table is placed on the canvas. Use ‘1’ for true and ‘0’ for false.

- **triggersExpanded**: Whether triggers are displayed when a table is placed on the canvas. Use ‘1’ for true and ‘0’ for false.

For a discussion of connection properties, see Section 8.7.2.3, “Connection Properties”.

8.6. EER Diagram Editor

EER diagrams are created by double-clicking the Add Diagram icon. You may create any number of EER diagrams just as you may create any number of physical schemata. Each EER diagram shows as a tab below the toolbar; a specific EER diagram is selected by clicking its tab.

Clicking an EER diagram tab navigates to the canvas used for graphically manipulating database objects. The Vertical Toolbar is on the left side of this page.

8.6.1. The Vertical Toolbar

The vertical toolbar shows on the left sidebar when an EER diagram tab is selected. The tools on this toolbar assist in creating EER diagrams.
Clicking a tool changes the mouse pointer to a pointer that resembles the tool icon, indicating which tool is active. These tools can also be activated from the keyboard by pressing the key associated with the tool. Hover the mouse pointer over a toolbar icon to display a description of the tool and its shortcut key.

A more detailed description of each of these tools follows.

**8.6.1.1. The Standard Mouse Pointer**

The standard mouse pointer, located at the top of the vertical toolbar, is the default mouse pointer for your operating system. Use this tool to revert to the standard mouse pointer after using other tools.

To revert to the default pointer from the keyboard, use the Esc key.

**8.6.1.2. The Hand Tool**

The hand tool is used to move the entire EER diagram. Left-click on this tool and then left-click anywhere on the EER diagram canvas. Moving the mouse while holding down the mouse button changes the view port of the canvas.

To determine your position on the canvas, look at the Model Navigator panel on the upper right. If the Model Navigator panel is not open, use View, Windows, Model Navigator to open it.
To activate the hand tool from the keyboard, use the H key.

You can also change the view port of an EER diagram using the Model Navigator panel. See Section 8.5.9, “The Model Navigator Panel”.

8.6.1.3. The Eraser Tool

Use the eraser tool to delete objects from the EER Diagram canvas. Change the mouse pointer to the eraser tool, then click the object you wish to delete. Depending upon your settings, the delete dialog box should open, asking you to confirm the type of deletion.

Note

The delete action of the eraser tool is controlled by the general option setting for deletion. Before using the eraser tool, be sure that you understand the available options described in Section 6.4.5, “The Model Tab”.

To activate the eraser tool from the keyboard, use the D key.

You can also delete an object by selecting it and pressing Control+Delete or by right-clicking it and choosing Delete from the pop up menu.

8.6.1.4. The Layer Tool

The layer tool is the rectangular icon with a capital L in the lower left corner. Use the layer tool to organize the objects on an EER Diagram canvas. It is useful for grouping similar objects. For example, you may use it to group all your views.

Click the layer tool and use it to draw a rectangle on the canvas. Change to the standard mouse pointer tool and pick up any objects you would like to place on the newly created layer.

To change the size of a layer, first select it by clicking it. When a layer is selected, small rectangles appear at each corner and in the middle of each side. Adjust the size by dragging any of these rectangles.

You can also make changes to a layer by selecting the layer and changing properties in the Properties panel. Using the Properties panel is the only way to change the name of a layer.

To activate the layer tool from the keyboard, use the L key. For more information about layers, see Section 8.7.5, “Creating Layers”.

8.6.1.5. The Text Tool

The text tool is the square icon with a capital N in the top left corner. Use this tool to place text objects on the EER diagram canvas. Click the tool, then click the desired location on the canvas. After a text object has been dropped on the canvas, the mouse pointer reverts to its default.

To add text to a text object, right-click the text object and choose Edit Note... or Edit in New Window... from the pop-up menu.

You can manipulate the properties of a text object by selecting it and then changing its properties in the Properties panel.

To activate the text tool from the keyboard, use the N key. For more information about text objects, see Section 8.7.7, “Creating Text Objects”.

8.6.1.6. The Image Tool

Use the image tool to place an image on the canvas. When this tool is selected and you click the canvas, a dialog box opens enabling you to select the desired graphic file.
To activate the image tool from the keyboard, use the I key. For more information about images, see Section 8.7.8, “Creating Images”.

8.6.1.7. The Table Tool

Use this tool to create a table on the EER Diagram canvas.

Clicking the canvas creates a table. To edit the table with MySQL Table Editor, right-click it and choose Edit Table... or Edit in New Window... from the pop-up menu. You can also double-click the table to load it into the table editor.

To activate the table tool from the keyboard, use the T key.

For more information about creating and editing tables, see Section 8.7.1.3, “The MySQL Table Editor”.

8.6.1.8. The View Tool

Use this tool to create a view on an EER Diagram canvas. When the table tool is activated, a schema list appears on the toolbar below the main menu, enabling you to associate the new view with a specific schema. You can also select a color for the object by choosing from the color list to the right of the schema list.

After selecting this tool, clicking the canvas creates a new view. To edit this view, right-click it and choose Edit View... or Edit in New Window... from the pop-up menu.

To activate the view tool from the keyboard, use the V key.

For more information about creating and editing views, see Section 8.7.3, “Creating Views”.

8.6.1.9. The Routine Group Tool

Use this tool to create a routine group on the EER Diagram canvas. When this tool is activated, a schema list appears on the toolbar below the main menu, enabling you to associate the routine group with a specific schema. You can also select a color for the routine group by choosing from the color list to the right of the schema list.

After selecting this tool, clicking the canvas creates a new group. To edit this view, right-click it and choose Edit Routine Group... or Edit in New Window... from the pop-up menu.

To activate the routine group tool from the keyboard, use the G key.

For more information about creating and editing routine groups, see Section 8.7.4.2, “Routine Groups”.

8.6.1.10. The Relationship Tools

The five relationship tools are used to represent the following relationships:

• One-to-many nonidentifying relationships
• One-to-one nonidentifying relationships
• One-to-many identifying relationships
• One-to-one identifying relationships
• Many-to-many identifying relationships

These tools appear at the bottom of the vertical tool bar. Hover the mouse pointer over each tool to see a text hint that describes its function.
For more information about relationships, see Section 8.7.2, "Creating Foreign Key Relationships".

8.7. Working with Models

8.7.1. Creating Tables

8.7.1.1. Adding Tables to the Physical Schemata

Double-clicking the Add table icon in the Physical Schemata section of the MySQL Model page adds a table with the default name of table1. If a table with this name already exists, the new table is named table2.

Adding a new table automatically opens the table editor docked at the bottom of the application. For information about using the table editor, see Section 8.7.1.3, "The MySQL Table Editor".

Right-clicking a table opens a pop-up menu with the following items:

- Cut 'table_name'
- Copy 'table_name'
- Edit Table...
- Edit in New Window...
- Copy SQL to Clipboard
- Copy Insert to Clipboard: Copies INSERT statements based on the model's inserts. Nothing is copied to the clipboard if the table has no inserts defined.
- Copy Insert Template to Clipboard: Copies a generic INSERT statement that is based on the model.
- Delete 'table_name'

If the table editor is not open, the Edit Table... item opens it. If it is already open, the selected table replaces the previous one. Edit in New Window... opens a new table editor tab.

The cut and copy items are useful for copying tables between different schemata.

**Warning**

Use the Delete 'table_name' item to remove a table from the database. There will be no confirmation dialog box.

Any tables added to the Physical Schemata section also show up in the Catalog palette on the right side of the application. They may be added to an EER Diagram by dragging and dropping them from this palette.

8.7.1.2. Adding Tables to an EER Diagram

Tables can also be added to an EER Diagram using the table tool on the vertical toolbar. Make sure that the EER Diagram tab is selected, then right-click the table icon on the vertical toolbar. The table icon is the rectangular tabular icon.

Clicking the mouse on this icon changes the mouse pointer to a table pointer. You can also change the mouse pointer to a table pointer by pressing the T key.

Choosing the table tool changes the contents of the toolbar that appears immediately below the menu bar. When the Tables pointer is active, this toolbar contains a schemata list, an engines list, a collations list, and a color chart list. Use these lists to select the appropriate schema, engine, collation,
Creating Tables

and color accent for the new table. Make sure that you associate the new table with a database. The
engine and collation of a table can be changed using the table editor. The color of your table can be
changed using the Properties palette. The Default Engine and Default Collation values refer to the database defaults.

Create a table by clicking anywhere on the EER Diagram canvas. This creates a new table with the
default name table1. To revert to the default mouse pointer, click the arrow icon at the top of the
vertical toolbar.

Figure 8.8. A Table on an EER Diagram

As shown in the preceding diagram, the primary key is indicated by a key icon and indexed fields are
indicated by a different colored diamond icon. Click the arrow to the right of the table name to toggle
the display of the fields. Toggle the display of indexes and triggers in the same way.

Right-clicking a table opens a pop-up menu with the following items:

- Cut ‘table_name’
- Copy ‘table_name’
- Edit Table...
- Edit in New Window...
- Copy SQL to Clipboard
- Copy Insert to Clipboard
- Delete ‘table_name’

With the exception of the deletion item, these menu items function as described in Section 8.7.1.1,
“Adding Tables to the Physical Schemata”. The behavior of the delete option is determined by your
MySQL Workbench options settings. For more information, see Section 6.4.5, “The Model Tab”.

8.7.1.3. The MySQL Table Editor

The MySQL Table Editor is a component that enables the creation and modification of tables. You can
add or modify a table's columns or indexes, change the engine, add foreign keys, or alter the table's name.

The MySQL Table Editor can be accessed in several ways, and most commonly by right-clicking on
a table name within the Object Viewer and choosing ALTER TABLE. This will open a new tab within
the main SQL Editor window. You can also access the MySQL Table Editor from an EER Diagram by
double-clicking a table object.
8.7.1.3.1. The Main Editor Window

Any number of tables may be edited in the MySQL Table Editor at any one time. Adding another table creates a new tab at the top of the editor. By default, the MySQL Table Editor appears docked at the top of the table editor tab, within the SQL editor.

The MySQL Table Editor is shown on top of the following figure.

Figure 8.9. The Table Editor

The MySQL Table Editor provides a work space that has tabs used to perform these actions:

- **Columns**: Add or modify columns
- **Indexes**: Add or modify indexes
- **Foreign Keys**: Add or modify foreign keys
- **Triggers**: Add or modify triggers
- **Partitioning**: Manage partitioning
- **Options**: Add or modify various general, table, and row options

The following sections discuss these tabs in further detail.

8.7.1.3.2. The Columns Tab

Use the Columns tab to display and edit all the column information for a table. With this tab, you can add, drop, and alter columns.
You can also use the **Columns** tab to change column properties such as name, data type, and default value.

**Figure 8.10. The Columns Tab**

Right-click a row under the **Column Name** column to open a pop-up menu with the following items:

- **Move Up**: Move the selected column up.
- **Move Down**: Move the selected column down.
- **Copy**: Copies the column for a model. Added in MySQL Workbench 5.2.45.
- **Cut**: Copies and then deletes the column for a model. Added in MySQL Workbench 5.2.45.
- **Paste**: Pastes the column. If a column with the same name already exists, then `_copy1` is appended to the column name. Added in MySQL Workbench 5.2.45.
- **Delete Selected Columns**: Select multiple contiguous columns by right-clicking and pressing the **Shift** key. Use the **Control** key to select noncontiguous columns.
- **Refresh**: Update all information in the **Columns** tab.
- **Clear Default**: Clear the assigned default value.
- **Default NULL**: Set the column default value to **NULL**.
- **Default 0**: Set the column default value to **0**.
- **Default CURRENT_TIMESTAMP**: Available for **TIMESTAMP** data types.
- **Default CURRENT_TIMESTAMP ON UPDATE CURRENT_TIMESTAMP**: Available for **TIMESTAMP** data types.

To add a column, click the **Column Name** field in an empty row and enter an appropriate value. Select a data type from the **Datatype** list. Select the column property check boxes as required according to
Creating Tables

the list of column properties below, and also read the CREATE TABLE documentation for information about what these options mean.

- **PK**: PRIMARY KEY
- **NN**: NOT NULL
- **UQ**: UNIQUE INDEX
- **BIN**: BINARY
- **UN**: UNSIGNED
- **ZF**: ZEROFILL
- **AI**: AUTO_INCREMENT

To change the name, data type, default value, or comment of a column, double-click the value you wish to change. The content then becomes editable.

You can also add column comments to the Column Comment field. It is also possible to set the column collation, using the list in the Column Details panel.

To the left of the column name is an icon that indicates whether the column is a member of the primary key. If the icon is a small key, that column belongs to the primary key, otherwise the icon is a blue diamond or a white diamond. A blue diamond indicates the column has NN set. To add or remove a column from the primary key, double-click the icon. You can also add a primary key by checking the PRIMARY KEY check box in the Column Details section of the table editor.

If you wish to create a composite primary key you can select multiple columns and check the PK check box. However, there is an additional step that is required, you must click the Indexes tab, then in the Index Columns panel you must set the desired order of the primary keys.

**Note**

When entering default values, in the case of CHAR and VARCHAR data types MySQL Workbench will attempt to automatically add quotation marks, if the user does not start their entry with one. For other data types the user must manage quoting if required, as it will not be handled automatically by MySQL Workbench.

**Caution**

Care must be taken when entering a default value for ENUM columns because a nonnumeric default will not be automatically quoted. You must manually add single quote characters for the default value. Note that MySQL Workbench will not prevent you from entering the default value without the single quotation marks. If a nonnumeric default value is entered without quotation marks, this will lead to errors. For example, if the model is reverse engineered, the script will contain unquoted default values for ENUM columns and will fail if an attempt is made to run the script on MySQL Server.

8.7.1.3.3. The Indexes Tab

The Indexes tab holds all index information for your table. Use this tab to add, drop, and modify indexes.
Select an index by right-clicking it. The **Index Columns** section displays information about the selected index.

To add an index, click the last row in the index list. Enter a name for the index and select the index type from the list. Select the column or columns that you wish to index by checking the column name in the **Index Columns** list. You can remove a column from the index by removing the check mark from the appropriate column.

You can also specify the order of an index by choosing **ASC** or **DESC** under the **Order** column. Create an index prefix by specifying a numeric value under the **Length** column. You cannot enter a prefix value for fields that have a data type that does not support prefixing.

To drop an index, right-click the row of the index you wish to delete, then select the Delete Selected Indexes menu item.

### 8.7.1.3.4. The Foreign Keys Tab

The **Foreign Keys** tab is organized in much the same fashion as the **Indexes** tab and adding or editing a foreign key is similar to adding or editing an index.
To add a foreign key, click the last row in the **Foreign Key Name** list. Enter a name for the foreign key and select the column or columns that you wish to index by checking the column name in the **Column** list. You can remove a column from the index by removing the check mark from the appropriate column.

Under **Foreign Key Options**, choose an action for the update and delete events. The options are:

- RESTRICT
- CASCADE
- SET NULL
- NO ACTION

To drop a foreign key, right-click the row you wish to delete, then select the Delete Selected FKs menu item.

To modify properties of a foreign key, select it and make the desired changes.

### 8.7.1.3.5. The Triggers Tab

The **Triggers** tab opens a field for editing an existing trigger or creating a new trigger. Create a trigger as you would from the command line.
8.7.1.3.6. The Partitioning Tab

To enable partitioning for your table, check the **Enable Partitioning** check box. This enables the partitioning options.

**Figure 8.14. The Partitioning Tab**
The **Partition By** pop-up menu displays the types of partitions you can create:

- HASH
- LINEAR HASH
- KEY
- LINEAR KEY
- RANGE
- LIST

Use the **Parameters** field to define any parameters to be supplied to the partitioning function, such as an integer column value.

Choose the number of partitions from the **Partition Count** list. To manually configure your partitions, check the **Manual** check box. This enables entry of values into the partition configuration table. The entries in this table are:

- **Partition**
- **Values**
- **Data Directory**
- **Index Directory**
- **Min Rows**
- **Max Rows**
- **Comment**

Subpartitioning is also available. For more information about partitioning, see **Partitioning**.

### 8.7.1.3.7. The Options Tab

The **Options** tab enables you to set several types of options.
which are grouped into the following sections:

- General Options
- Row Options
- Storage Options
- Merge Table options

The following discussion describes these options in more detail.

**General Options Section**

In the **General Options** section, choose a pack keys option. The options are **Default**, **Pack None**, and **Pack All**. You may also encrypt the definition of a table. The **AUTO_INCREMENT** and delayed key update behaviors apply only to **MyISAM** tables.

**Row Options Section**

To set the row format, choose the desired row format from the list. For more information about the different row formats that are available, see **MyISAM Table Storage Formats**.

These options are:

- Default
- Dynamic
- Fixed
Creating Tables

- Compressed
- Redundant
- Compact

When you expect a table to be particularly large, use the **Avg. Row, Min. Rows**, and **Max. Rows** options to enable the MySQL server to better accommodate your data. See [CREATE TABLE Syntax](#) for more information on how to use these options.

**Storage Options Section**

The **Storage Options** section is available only for **MyISAM** tables. Use it to configure a custom path to the table storage and data files. This can help improve server performance by locating different tables on different hard drives.

**Merge Table Options Section**

Use the **Merge Table Options** section to configure **MERGE** tables. To create a **MERGE** table, select **MERGE** as your storage engine and then specify the **MyISAM** tables you wish to merge in the **Union Tables** dialog.

You may specify the action the server should take when users attempt to perform **INSERT** statements on the merge table. You may also select the **Merge Method** by selecting from the list. For more information about **MERGE** tables, see [The MERGE Storage Engine](#).

8.7.1.3.8. The Inserts Tab

Use the **Inserts** tab to insert rows into the table.

To edit a row, click the field you wish to change and enter the new data. Right-clicking a row displays a menu with the following items:

- **Set Field(s) to NULL**: Set the column value to **NULL**.
- **Delete Row(s)**: Delete the selected row or rows.
- **Copy Row Content**: Copies the row to the clipboard. Strings are copied quoted, and **NULL** values are preserved.
- **Copy Row Content (unquoted)**: Copies the row to the clipboard. Strings are not quoted and **NULL** are copied as a space.
- **Copy Field Content**: Copies the value of the selected field to the clipboard. Strings are quoted.
- **Copy Field Content (unquoted)**: Copies the value of the selected field to the clipboard. Strings are not quoted.

Note that the insert editor features a toolbar. This has the same functionality as explained in [Section 7.7.4.2, “Results Tabsheets”](#) and [Section 7.7.4.3, “Live Editing Tabsheets”](#). You can also hover the cursor over the toolbar to display tooltips.

Any rows you add will be inserted when you forward engineer the database (if you choose the **Generate INSERT statements for tables** option).

---

**Note**

When entering string values that there is slightly different behavior between the 5.0, 5.1, and 5.2 versions of MySQL Workbench.

For 5.0 and 5.1, if a string is entered without leading and trailing quotation marks, the Inserts Editor adds quoting and escapes characters that require it.
Creating Foreign Key Relationships

However, if quoted text is entered, the Inserts Editor performs no further checks and assumes that a correctly escaped and quoted sequence has been entered.

5.2 features a new Inserts Editor. In this case, the user enters the string without quoting or escaping and the Inserts Editor takes care of all quoting and escaping as required.

Note
It is possible to enter a function, or other expression, into a field. Use the prefix `\func` to prevent MySQL Workbench from escaping quotation marks. For example, for the expression `md5('fred')`, MySQL Workbench normally would generate the code `md5('fred')`. To prevent this, enter the expression as `\func md5('fred')` to ensure that the quoting is not escaped.

8.7.1.3.9. The Privileges Tab

Use the Privileges tab to assign specific roles and privileges to a table. You may also assign privileges to a role using the role editor. For a discussion of this topic, see Section 8.5.5.1, “Adding Roles”.

When this tab is first opened, all roles that have been created are displayed in the list on the right. Move the roles you wish to associate with this table to the Roles list on the left. Do this by selecting a role and then clicking the < button. Use the Shift key to select multiple contiguous roles and the Control key to select noncontiguous roles.

To assign privileges to a role, click the role in the Roles list. This displays all available privileges in the Assigned Privileges list. The privileges that display are:

- ALL
- CREATE
- DROP
- GRANT OPTION
- REFERENCES
- ALTER
- DELETE
- INDEX
- INSERT
- SELECT
- UPDATE
- TRIGGER

You can choose to assign all privileges to a specific user or any other privilege as listed previously. Privileges irrelevant to a specific table, such as the FILE privilege, are not shown.

If a role has already been granted privileges on a specific table, those privileges show as already checked in the Assigned Privileges list.

8.7.2. Creating Foreign Key Relationships

Foreign key constraints are supported for the InnoDB storage engine only. For other storage engines, the foreign key syntax is correctly parsed but not implemented. For more information, see Foreign Key Differences.
Creating Foreign Key Relationships

Using MySQL Workbench you may add a foreign key from within the table editor or by using the relationship tools on the vertical toolbar of an EER Diagram. This section deals with adding a foreign key using the foreign key tools. To add a foreign key using the table editor, see Section 8.7.1.3.4, “The Foreign Keys Tab”.

The graphical tools for adding foreign keys are most effective when you are building tables from the ground up. If you have imported a database using an SQL script and need not add columns to your tables, you may find it more effective to define foreign keys using the table editor.

8.7.2.1. Adding Foreign Key Relationships Using an EER Diagram

The vertical toolbar on the left side of an EER Diagram has six foreign key tools:

• one-to-one non-identifying relationship
• one-to-many non-identifying relationship
• one-to-one identifying relationship
• one-to-many identifying relationship
• many-to-many identifying relationship
• Place a Relationship Using Existing Columns

An identifying relationship is one where the child table cannot be uniquely identified without its parent. Typically this occurs where an intermediary table is created to resolve a many-to-many relationship. In such cases, the primary key is usually a composite key made up of the primary keys from the two original tables. An identifying relationship is indicated by a solid line between the tables and a nonidentifying relationship is indicated by a broken line.

Create or drag and drop the tables that you wish to connect. Ensure that there is a primary key in the table that will be on the “one” side of the relationship. Click on the appropriate tool for the type of relationship you wish to create. If you are creating a one-to-many relationship, first click the table that is on the “many” side of the relationship, then on the table containing the referenced key. This creates a column in the table on the many side of the relationship. The default name of this column is table_name_key_name where the table name and the key name both refer to the table containing the referenced key.

When the many-to-many tool is active, double-clicking a table creates an associative table with a many-to-many relationship. For this tool to function there must be a primary key defined in the initial table.

Use the Model menu, Menu Options menu item to set a project-specific default name for the foreign key column (see Section 8.5.1.5.4, “The Relationship Notation Submenu”). To change the global default, see Section 6.4.5, “The Model Tab”.

To edit the properties of a foreign key, double-click anywhere on the connection line that joins the two tables. This opens the relationship editor.

Mousing over a relationship connector highlights the connector and the related keys as shown in the following figure. The film and the film_actor tables are related on the film_id field and these fields are highlighted in both tables. Since the film_id field is part of the primary key in the film_actor table, a solid line is used for the connector between the two tables.
Creating Foreign Key Relationships

Figure 8.16. The Relationship Connector

If the placement of a connection’s caption is not suitable, you can change its position by dragging it to a different location. If you have set a secondary caption, its position can also be changed. For more information about secondary captions, see Section 8.7.2.3, “Connection Properties”. Where the notation style permits, Classic for example, the cardinality indicators can also be repositioned.

The relationship notation style in Figure 8.16, “The Relationship Connector” is the default, crow’s foot. You can change this if you are using a commercial version of MySQL Workbench. For more information, see Section 8.5.1.5.4, “The Relationship Notation Submenu”.

You can select multiple connections by holding down the Control key as you click a connection. This can be useful for highlighting specific relationships on an EER diagram.

8.7.2.2. The Relationship Editor

Double-clicking a relationship on the EER diagram canvas opens the relationship editor. This has two tabs: Relationship, and Foreign Key.

The Relationship Tab

In the Relationship tab, you can set the caption of a relationship using the Caption field. This name displays on the canvas and is also the name used for the constraint itself. The default value for this name is fk_source_table_destination_table. Use the Model menu, Menu Options menu item to set a project-specific default name for foreign keys. To change the global default, see Section 6.4.5, “The Model Tab”.

You can also add a secondary caption and a caption to a relationship.

The Visibility Settings section is used to determine how the relationship is displayed on the EER Diagram canvas. Fully Visible is the default but you can also choose to hide relationship lines or to use split lines. The split line style is pictured in the following figure.

Figure 8.17. The Split Connector
Creating Foreign Key Relationships

**Note**

A broken line connector indicates a nonidentifying relationship. The split line style can be used with either an identifying relationship or a nonidentifying relationship. It is used for display purposes only and does not indicate anything about the nature of a relationship.

To set the notation of a relationship use the **Model** menu, Relationship Notation menu item. For more information, see Section 8.5.1.5.4, “The Relationship Notation Submenu”.

**The Foreign Key Tab**

The **Foreign Key** tab contains several sections: **Referencing Table**, **Cardinality** and **Referenced Table**.

The **Mandatory** check boxes are used to select whether the referencing table and the referenced table are mandatory. By default, both of these constraints are **true** (indicated by the check boxes being checked).

The **Cardinality** section has a set of radio buttons that enable you to choose whether the relationship is one-to-one or one-to-many. There is also a check box that enables you to specify whether the relationship is an identifying relationship.

**8.7.2.3. Connection Properties**

Right-click a connection to select it. When a connection is selected, it is highlighted and its properties are displayed in the properties palette. Connection properties are different from the properties of other objects. The following list describes them:

- **caption**: The name of the connection. By default, the name is the name of the foreign key and the property is centered above the connection line.

- **captionXOffs**: The X offset of the caption.

- **captionYOffs**: The Y offset of the caption.

- **comment**: The comment associated with the relationship.

- **drawSplit**: Whether to show the relationship as a continuous line.

- **endCaptionXOffs**: The X termination point of the caption offset.

- **endCaptionYOffs**: The Y termination point of the caption offset.

- **extraCaption**: A secondary caption. By default, this extra caption is centered beneath the connection line.

- **extraCaptionXOffs**: The X offset of the secondary caption.

- **extraCaptionYOffs**: The Y offset of the secondary caption.

- **mandatory**: Whether the entities are mandatory. For more information, see **Section 8.7.2.2, “The Relationship Editor”**.

- **many**: False if the relationship is a one-to-one relationship.

- **middleSegmentOffset**: The offset of the middle section of the connector.

- **modelOnly**: Set when the connection will not be propagated to the DDL. It is just a logical connection drawn on a diagram. This is used, for example, when drawing **MyISAM** tables with a visual relationship, but with no foreign keys.
Creating Views

- **name**: The name used to identify the connection on the EER Diagram canvas. Note that this is not the name of the foreign key.

- **referredMandatory**: Whether the referred entity is mandatory.

- **startCaptionXOffs**: The start of the X offset of the caption.

- **startCaptionYOffs**: The start of the Y offset of the caption.

In most cases, you can change the properties of a relationship using the relationship editor rather than the Properties palette.

If you make a relationship invisible by hiding it using the relationship editor's Visibility Settings, and then close the relationship editor, you will no longer be able to select the relationship to bring up its relationship editor. To make the relationship visible again, you must expand the table object relating to the relationship in the Layers palette and select the relationship object. To edit the selected object, right-click it, then select Edit Object. You can then set the Visibility Settings to Fully Visible. The relationship will then be visible in the EER Diagram window.

### 8.7.3. Creating Views

You can add views to a database either from the Physical Schemata section of the MySQL Model page or from the EER Diagram.

#### 8.7.3.1. Adding Views to the Physical Schemata

To add a view, double-clicking the Add View icon in the Physical Schemata section of the MySQL Model page. The default name of the view is `view1`. If a view with this name already exists, the new view is named `view2`.

Adding a new view automatically opens the view editor docked at the bottom of the application. For information about using the view editor, see Section 8.7.3.3, “The View Editor”.

Right-clicking a view opens a pop-up menu with the following items:

- **Cut 'view_name'**

  As of MySQL Workbench 5.2.45, the 'view_name' is only cut from the EER canvas. Before, it was also removed from the schema.

- **Copy 'view_name'**

- **Paste**

- **Edit View...**

- **Edit in New Window...**

- **Copy SQL to Clipboard**

- **Delete 'view_name'**: deletes from both the EER canvas and schema.

- **Remove 'view_name'**: deletes from the EER canvas, but not the schema.

  This option exists as of MySQL Workbench 5.2.45.

If the table editor is not open, the Edit View... item opens it. If it is already open, the selected table replaces the previous one. Edit in New Window... opens a new view editor tab.

The cut and copy items are useful for copying views between different schemata. Copy SQL to Clipboard copies the CREATE VIEW statement to the clipboard.
Creating Views

Warning
Use the Delete 'view_name' item to remove a view from the database. There will be no confirmation dialog box.

Any views added to the Physical Schemata section also show up in the Catalog palette on the left side of the application. They may be added to an EER Diagram, when in the EER Diagram tab, by dragging and dropping them from this palette.

8.7.3.2. Adding Views to an EER Diagram

Views can also be added to an EER Diagram using the View tool on the vertical toolbar. Make sure that the EER Diagram tab is selected, then left-click the view icon on the vertical toolbar. The view icon is the two overlapping rectangles found below the table icon.

Clicking this icon changes the mouse pointer to a view pointer. To change the mouse pointer to a view pointer from the keyboard, use the V key.

Choosing the View tool changes the contents of the toolbar that appears immediately below the main menu bar. When the Views pointer is active, this toolbar contains a schemata list and a color chart list. Use these lists to select the appropriate schema and color accent for the new view. Make sure that you associate the new view with a database. The color of your view can be changed using the Properties palette.

Create a view by clicking anywhere on the EER Diagram canvas. This creates a new view with the default name view1. To revert to the default mouse pointer, click the arrow icon at the top of the vertical toolbar.

Right-clicking a view opens a pop-up menu. With the exception of the delete item, these menu items function as described in Section 8.7.3.1, “Adding Views to the Physical Schemata”. The behavior of the delete option is determined by your MySQL Workbench options settings. For more information, see Section 6.4.5, “The Model Tab”.

8.7.3.3. The View Editor

To invoke the view editor, double-click a view object on the EER Diagram canvas or double-click a view in the Physical Schemata section on the MySQL Model page. This opens the view editor docked at the bottom of the application. Double-clicking the title bar undocks the editor. Do the same to redock it. Any number of views may be open at the same time. Each additional view appears as a tab at the top of the view editor.

There are three tabs at the bottom of the view editor: View, Comments, and Privileges. Navigate between different tabs using the mouse or from the keyboard by pressing Control+Alt+Tab.

The View Tab

Use the View tab to perform the following tasks:

• Rename the view using the Name text box.
• Enter the SQL to create a view using the SQL field.
• Comment a view using the Comments text area.

The Comments Tab

This tab enables you to enter comments for a particular view.

The Privileges Tab

The Privileges tab of the view editor functions in exactly the same way as the Privileges tab of the table editor. For more information, see Section 8.7.1.3.9, “The Privileges Tab”.
8.7.3.4. Modifying a View Using the Properties Palette

When you select a view on the EER Diagram canvas, its properties are displayed in the Properties palette. Most of the properties accessible from the Properties palette apply to the appearance of a view on the EER Diagram canvas.

For a list of properties accessible through the Properties palette, see Section 8.5.12, “The Properties Palette”.

8.7.4. Creating Routines and Routine Groups

You can add Routine Groups to a database either from the Physical Schemata section of the MySQL Model page or from an EER Diagram. Routines may be added only from the Physical Schemata section of the MySQL Model page.

To view an existing schema, along with its Routines and Routine Groups, choose Database, Reverse Engineer... from the main menu. After the schema has been added to the current model, you can see the schema objects on the Physical Schemata panel on the MySQL Model page. The Routines and Routine Groups are listed there.

MySQL Workbench unifies both stored procedures and stored functions into one logical object called a Routine. Routine Groups are used to group routines that are related. You can decide how many Routine Groups you want to create and you can use the Routine Group Editor to assign specific routines to a group, using a drag and drop interface.

When designing an EER Diagram, you can place the Routine Groups on the canvas by dragging them from the Catalog Palette. Placing individual routines on the diagram is not permitted, as it would clutter the canvas.

8.7.4.1. Routines

8.7.4.1.1. Adding Routines to the Physical Schemata

To add a routine, double-click the Add Routine icon in the Physical Schemata section of the MySQL Model page. The default name of the routine is routine1. If a routine with this name already exists, the new routine is named routine2.

Adding a new routine automatically opens the routine editor docked at the bottom of the application. For information about using the routine editor, see Section 8.7.4.1.2, “The Routine Editor”.

Right-clicking a routine opens a pop-up menu with the following items:

- Rename
- Cut ‘routine_name’
- Copy ‘routine_name’
- Paste
- Edit Routine...
- Edit in New Window...
- Copy SQL to Clipboard
- Delete ‘routine_name’

The Edit Routine... item opens the routine editor.

The cut and paste items are useful for copying routines between different schemata.
Creating Routines and Routine Groups

Note
Deleting the code for a routine from the Routines tab of the Routine Group Editor results in removal of the routine object from the model.

Note
To remove a routine from a routine group, use the controls on the Routine Group tab of the Routine Group Editor.

The action of the delete option varies depending upon how you have configured MySQL Workbench. For more information, see Section 6.4.5, “The Model Tab”.

8.7.4.1.2. The Routine Editor

To invoke the routine editor, double-click a routine in the Physical Schemata section on the MySQL Model page. This opens the routine editor docked at the bottom of the application. Any number of routines may be open at the same time. Each additional routine appears as a tab at the top of the routine editor.

Routine and Privileges tabs appear at the bottom of the routine editor. Navigate between different tabs using the mouse or from the keyboard by pressing Control+Alt+Tab.

8.7.4.1.2.1. The Routine Tab

Use the Routine tab of the routine editor to perform the following tasks:

• Rename the routine using the Name field.

• Enter the SQL to create a routine using the SQL field.

8.7.4.1.2.2. The Privileges Tab

The Privileges tab of the routine editor functions in exactly the same way as the Privileges tab of the table editor. For more information, see Section 8.7.1.3.9, “The Privileges Tab”.

Note
Privileges are available only in the Standard Edition of MySQL Workbench.

8.7.4.2. Routine Groups

8.7.4.2.1. Adding Routine Groups to the Physical Schemata

Double-clicking the Add Routine Group icon in the Physical Schemata section of the MySQL Model page adds a routine group with the default name of routines1. If a routine group with this name already exists, the new routine group is named routines2.

Adding a new routine group automatically opens the routine groups editor docked at the bottom of the application. For information about using the routine groups editor, see Section 8.7.4.2.3, “The Routine Group Editor”.

Right-clicking a routine group opens a pop-up menu with the following items:

• Rename

• Cut 'routine_group_name'

• Copy 'routine_group_name'

• Edit Routine...
Creating Routines and Routine Groups

- Edit in New Window...
- Copy SQL to Clipboard
- Delete 'routine_group_name'

The Edit Routine Group... item opens the routine group editor, which is described in Section 8.7.4.2.3, “The Routine Group Editor”.

The cut and paste items are useful for copying routine groups between different schemata.

Deleting a routine group from the MySQL Model page removes the group but does not remove any routines contained in that group.

Any routine groups added to the Physical Schemata also show up in the Catalog palette on the right side of the application. They may be added to an EER Diagram by dragging and dropping them from this palette.

8.7.4.2.2. Adding Routine Groups to an EER Diagram

To add routine groups to an EER Diagram, use the Routine Groups tool on the vertical toolbar. Make sure that the EER Diagram tab is selected, then right-click the routine groups icon on the vertical toolbar. The routine groups icon is immediately above the lowest toolbar separator.

Clicking the mouse on this icon changes the mouse pointer to a routine group pointer. You can also change the mouse pointer to a routine pointer by pressing the G key.

Choosing the Routine Group tool changes the contents of the toolbar that appears immediately below the menu bar. When the Routine Groups pointer is active, this toolbar contains a schemata list and a color chart list. Use these lists to select the appropriate schema and color accent for the new routine group. Make sure that you associate the new routine group with a database. The color of your routine group can be changed later using the Properties palette.

Create a routine group by clicking anywhere on the EER Diagram canvas. This creates a new routine group with the default name routines1. To revert to the default mouse pointer, click the arrow icon at the top of the vertical toolbar.

Right-clicking a routine group opens a pop-up menu. With the exception of the delete option and rename options, these menu options function as described in Section 8.7.4.2.1, “Adding Routine Groups to the Physical Schemata”. There is no rename option, and the behavior of the delete option is determined by your MySQL Workbench options settings. For more information, see Section 6.4.5, “The Model Tab”.

8.7.4.2.3. The Routine Group Editor

To invoke the routine group editor, double-click a routine group object on the EER Diagram canvas or double-click a routine group in the Physical Schemata section on the MySQL Model page. This opens the routine group editor docked at the bottom of the application. Double-clicking the title bar undocks the editor. Do the same to redock it. Any number of routine groups may be open at the same time. Each additional routine group appears as a tab at the top of the routine editor.

Routine group and Privileges tabs appear at the bottom of the routine editor. Navigate between different tabs using the mouse or from the keyboard by pressing Control+Alt+Tab.

8.7.4.2.3.1. The Routine Groups Tab

Use the Routine Groups tab of the routine groups editor to perform the following tasks:

- Rename the routine group using the Name field.
- Add routines to the group by dragging and dropping them.
• Add comments to the routine group.

### 8.7.4.2.3.2. The Privileges Tab

The **Privileges** tab of the routine group editor functions in exactly the same way as the **Privileges** tab of the table editor. For more information, see Section 8.7.1.3.9, "The Privileges Tab".

**Note**
Privileges are available only in the Standard Edition of MySQL Workbench.

### 8.7.4.2.3.3. Modifying a Routine Group Using the Properties Palette

When you select a routine group on the EER Diagram canvas, its properties are displayed in the **Properties** palette. All of the properties accessible from the **Properties** palette apply to the appearance of a routine group on the EER Diagram canvas.

For a list of properties accessible through the **Properties** palette, see Section 8.5.12, "The Properties Palette".

### 8.7.5. Creating Layers

You can add layers to a database only from an EER Diagram. Layers are used to help organize objects on the canvas. Typically, related objects are added to the same layer; for example, you may choose to add all your views to one layer.

#### 8.7.5.1. Adding Layers to an EER Diagram

To add layers to an EER Diagram, use the **Layer** tool on the vertical toolbar. Select an **EER Diagram** tab and right-click the layer icon on the vertical toolbar. The layer icon is the rectangle with an 'L' in the lower left corner and it is found below the eraser icon.

Clicking the mouse on this icon changes the mouse pointer to a layer pointer. You can also change the mouse pointer to a layer pointer by pressing the L key.

Choosing the **Layer** tool changes the contents of the toolbar that appears immediately below the menu bar. When the **Layers** pointer is active, this toolbar contains a color chart list. Use this list to select the color accent for the new layer. The color of your layer can be changed later using the **Properties** palette.

Create a layer by clicking anywhere on the EER Diagram canvas and, while holding the left mouse button down, draw a rectangle of a suitable size. This creates a new layer with the default name **layer1**. To revert to the default mouse pointer, click the arrow icon at the top of the vertical toolbar.

The following image shows a layer containing a number of views.

**Figure 8.18. The Layer Object**

![Layer Object Image]

To change the name of a layer, use the **name** property of the **Properties** palette.
Right-clicking a layer opens a pop-up menu with the following items:

- Cut `layer_name`
- Copy `layer_name`
- Delete `layer_name`

The cut and copy items are useful for copying layers between different schemata.

Since layers are not schema objects, no confirmation dialog box opens when you delete a layer regardless of how you have configured MySQL Workbench. Deleting a layer does not delete schema objects from the catalog.

8.7.5.1.1. Adding Objects to a Layer

To add an object to a layer, drag and drop it directly from the Catalog palette onto a layer. If you pick up an object from an EER diagram, you must press Control as you drag it onto the layer, otherwise it will not be "locked" inside the layer.

Locking objects to a layer prevents their accidental removal. You cannot remove them by clicking and dragging; to remove an object, you also must press the Control key while dragging it.

As a visual cue that the object is being "locked", the outline of the layer is highlighted as the object is dragged over it.

If you drag a layer over a table object, the table object will automatically be added to the layer. This also works for multiple table objects.

Layers cannot be nested. That is, a layer cannot contain another layer object.

8.7.5.2. Modifying a Layer Using the Properties Palette

When you select a layer on the EER Diagram canvas, its properties are displayed in the Properties palette. The properties accessible from the Properties palette apply to the appearance of a layer on the EER Diagram canvas.

In some circumstances, you may want to make a layer invisible. Select the layer and, in the Properties palette, set the visible property to False. To locate an invisible object, open the Layers palette and select the object by double-clicking it. After an object is selected, you can reset the visible property from the Properties palette.

For a list of properties accessible through the Properties palette, see Section 8.5.12, "The Properties Palette". In addition to the properties listed there, a layer also has a description property. Use this property to document the purpose of the layer.

8.7.6. Creating Notes

You can add notes to a database only from the Model Notes section of the MySQL Model page. Notes are typically used to help document the design process.

8.7.6.1. Adding Notes

Double-clicking the Add Note icon in the Model Notes section of the MySQL Model page adds a note with the default name of note1. If a note with this name already exists, the new note is named note2.

Adding a new note automatically opens the note editor docked at the bottom of the application. For information about using the note editor, see Section 8.7.6.2, "The Note Editor".
Right-clicking a note opens a pop-up menu with the following items:

- Rename
- Cut 'note_name'
- Copy 'note_name'
- Delete 'note_name'

The Edit Note... item opens the note editor. For information about using the note editor, see Section 8.7.6.2, "The Note Editor".

The cut and copy items are useful for copying notes between different schemata.

Notes can be added only on the MySQL Model page.

8.7.6.2. The Note Editor

To invoke the note editor, double-click a note object in the Model Note section on the MySQL Model page. This opens the note editor docked at the bottom of the application. Double-clicking the note tab undocks the editor. Double-click the title bar to redock it. Any number of notes may be open at the same time. Each additional note appears as a tab at the top of the note editor.

Use the editor to change the name of a note or its contents.

8.7.7. Creating Text Objects

Text objects are applicable only to an EER diagram. They can be used for documentation purposes; for example, to explain a grouping of schema objects. They are also useful for creating titles for an EER diagram should you decide to export a diagram as a PDF or PNG file.

8.7.7.1. Adding Text Objects to an EER Diagram

To add text objects to an EER Diagram, use the Text Object tool on the vertical toolbar. Make sure that the EER Diagram tab is selected, then right-click the text object icon on the vertical toolbar. The text object icon is the rectangular icon found below the label icon.

Clicking the mouse on this icon changes the mouse pointer to a text object pointer. You can also change the mouse pointer to a text object pointer by pressing the N key.

Choosing the Text Object tool changes the contents of the toolbar that appears immediately below the menu bar. When the Text Object pointer is active, this toolbar contains a color chart list. Use this list to select the color accent for the new text object. The color of your text object can be changed later using the Properties palette.

Create a text object by clicking anywhere on the EER Diagram canvas. This creates a new text object with the default name text1. To revert to the default mouse pointer, click the arrow icon at the top of the vertical toolbar.

Right-clicking a text object opens a pop-up menu. These menu options are identical to the options for other objects. However, since a text object is not a database object, there is no confirmation dialog box when you delete a text object.

8.7.7.2. The Text Object Editor

To invoke the text object editor, double-click a text object on the EER Diagram canvas. This opens the editor docked at the bottom of the application. Double-clicking the text object table undocks the editor.
Double-click the title bar to redock it. Any number of text objects may be open at the same time. Each additional text object appears as a tab at the top of the text editor.

Use the editor to change the name of a text object or its contents.

8.7.7.2.1. Modifying a Text Object Using the Properties Palette

When you select a text object on the EER Diagram canvas, its properties are displayed in the Properties palette. Most of the properties accessible from the Properties palette apply to the appearance of a view on the EER Diagram canvas.

For a list of properties accessible through the Properties palette, see Section 8.5.12, “The Properties Palette”.

There is no property in the Properties palette for changing the font used by a text object. To do so, choose the Appearance tab of the Workbench Preferences dialog. For more information, see Section 6.4.8, “The Appearance Tab”.

8.7.8. Creating Images

Images exist only on the EER Diagram canvas; you can add them only from the EER Diagram window.

8.7.8.1. Adding Images to an EER Diagram

To add images to an EER Diagram, use the Image tool on the vertical toolbar. Make sure that the EER Diagram tab is selected, then right-click the image icon on the vertical toolbar. The image icon is the icon just above the table icon.

Clicking the mouse on this icon changes the mouse pointer to an image pointer. You can also change the mouse pointer to an image pointer by pressing the I key.

Create an image by clicking anywhere on the EER Diagram canvas. This opens a file open dialog box. Select the desired image, then close the dialog box to create an image on the canvas. To revert to the default mouse pointer, click the arrow icon at the top of the vertical toolbar.

Right-clicking this object opens a pop-up menu with the following items:

- Cut ‘Image’
- Copy ‘Image’
- Edit Image...
- Edit in New Window...
- Delete ‘Image’

These menu items function in exactly the same way as they do for other objects on an EER diagram. However, images are not database objects so there is no confirmation dialog box when they are deleted.

8.7.8.2. The Image Editor

To invoke the image editor, double-click an image object on an EER Diagram canvas. This opens the image editor docked at the bottom of the application. Double-clicking the image editor tab undocks the editor. Double-click the title bar to redock it. Any number of images may be open at the same time. Each additional image appears as a tab at the top of the image editor.

8.7.8.2.1. The Image Tab

Use the Image tab of the image editor to perform the following tasks:
8.7.9. Reverse Engineering

With MySQL Workbench, you can reverse engineer a database using a MySQL create script or you can connect to a live MySQL server and import a single database or a number of databases. All versions of MySQL Workbench can reverse engineer using a MySQL DDL script. Only commercial versions of MySQL Workbench can reverse engineer a database directly from a MySQL server.

8.7.9.1. Reverse Engineering Using a Create Script

To reverse engineer using a create script, choose the **File**, Import, Reverse Engineer MySQL Create Script... menu items. This opens a file open dialog box with the default file type set to an SQL script file, a file with the extension `sql`.

You can create a data definition (DDL) script by executing the `mysqldump db_name --no-data > script_file.sql` command. Using the `--no-data` option ensures that the script contains only DDL statements. However, if you are working with a script that also contains DML statements you need not remove them; they will be ignored.

**Note**

If you plan to redesign a database within MySQL Workbench and then export the changes, be sure to retain a copy of the original DDL script. You will need the original script to create an `ALTER` script. For more information, see Section 8.7.10.1.2, “Altering a Schema”.

Use the `--databases` option with `mysqldump` if you wish to create the database as well as all its objects. If there is no `CREATE DATABASE db_name` statement in your script file, you must import the database objects into an existing schema or, if there is no schema, a new unnamed schema is created.

If your script creates a database, MySQL Workbench creates a new physical schemata tab on the MySQL Model page.

Any database objects may be imported from a script file in this fashion: tables, views, routines, and routine groups. Any indexes, keys, and constraints are also imported. Objects imported using an SQL script can be manipulated within MySQL Workbench the same as other objects.

Before exiting, be sure to save the schema. Choose the **File**, Save menu item and the reverse-engineered database will be saved as a MySQL Workbench file with the extension `mwb`.

See Section 8.8.1, “Importing a Data Definition SQL Script”, for a tutorial on reverse engineering the `sakila` database.

8.7.9.2. Reverse Engineering a Live Database

To reverse engineer a live database, choose the **Database**, Reverse Engineer... menu item from the main menu. This opens the Reverse Engineer Database wizard.
The first page of the wizard enables you to set up a connection to the live database you wish to reverse engineer. You can set up a new connection or select a previously created stored connection. Typical information required for the connection includes host name, user name and password.

After this information has been entered, or you have selected a stored connection, click the Next button to proceed to the next page.
Review the displayed information to make sure that the connection did not generate errors, then click **Next**.

The next page displays the schemata available on the server. Click the check box or check boxes for any schemata you wish to process.
Figure 8.21. Select Schemata

After you have selected the desired schemata, click the Next button to continue.

The wizard then displays the tasks it carried out and summarizes the results of the operation.
Figure 8.22. Retrieve Object Information

Review the results before clicking Next to continue.

The next page is the Select Objects page. It has a section for each object type present in the schema (tables, views, routines, and so forth). This page is of special interest if you do not wish to import all the objects from the existing database. It gives you the option of filtering which objects are imported. Each section has a Show Filter button. Click this button if you do not want to import all the objects of a specific type.
Figure 8.23. Select Objects

For the **Import MySQL Table Objects** section, if you click the **Show Filter** button, the following page is displayed.
This page enables you to select specific tables for import. Having selected the desired tables, you can optionally hide the filter by clicking the Hide Filter button.

The other sections, such as MySQL Routine Objects, have similar filters available.

Click Execute to continue to the next page.

The wizard then imports objects, displaying the tasks that have been carried out and whether the operation was successful. If errors were generated, you can click the Show Logs button to see the nature of the errors.
Figure 8.25. Progress

Click Next to continue to the next page.

The final page of the wizard provides a summary of the reverse engineered objects.
Click **Finish** to exit the wizard.

Before exiting MySQL Workbench be sure to save the schema. Choose the **File** > **Save** menu item to save the reverse-engineered database as a MySQL Workbench file with the extension mwb.

### 8.7.9.2.1. Errors During Reverse Engineering

During reverse engineering, the application checks for tables and views that duplicate existing names and disallows duplicate names if necessary. If you attempt to import an object that duplicates the name of an existing object you will be notified with an error message. To see any errors that have occurred during reverse engineering, you can click the button **Show Logs**. This will create a panel containing a list of messages, including any error messages than may have been generated. Click the **Hide Logs** button to close the panel.
If you wish to import an object with the same name as an existing object, rename the existing object before reverse engineering.

If you import objects from more than one schema, there will be a tab in the Physical Schemata section of the MySQL Model page for each schema imported.

You cannot reverse engineer a live database that has the same name as an existing schema. If you wish to do this, first rename the existing schema.

8.7.10. Forward Engineering

It is possible to forward engineer a database using an SQL script or by connecting to a live database.

8.7.10.1. Forward Engineering Using an SQL Script

To create a script of your database model, choose the Export item from the File menu. You may export a script to alter an existing database or create a new database. The script to create a database is similar to the one created using the mysql dump db_name command.

If you choose to create a database, there are several export options available.
8.7.10.1.1. Creating a Schema

Select the File, Export, Forward Engineer SQL CREATE Script menu item to start the Forward Engineer SQL Script wizard. The following figure shows the first page of the wizard.

**Figure 8.28. SQL Export Options**

The SQL Export Options displays the following facilities:

- **Output SQL Script File**

  To specify the output file name, enter it into the *Output SQL Script File* field, or use the *Browse* button to select a file. If this field is left blank, you will be able to view the generated script, but it will not be saved to a file.

- **Generate DROP Statements Before Each CREATE Statement**

  Select this option to generate a statement to drop each object before the statement that creates it. This ensures that any existing instance of each object is removed when the output is executed.

- **Omit Schema Qualifier in Object Names**

  Select this option to generate unqualified object names in SQL statements.

- **Generate Separate CREATE INDEX Statements**
Select this option to create separate statements for index creation instead of including index definitions in `CREATE TABLE` statements.

- **Add SHOW WARNINGS after every DDL statement**

Select this option to add `SHOW WARNINGS` statements to the output. This causes display of any warnings generated when the output is executed, which can be useful for debugging.

- **Do Not Create Users. Only Export Privileges**

Select this option to update the privileges of existing users, as opposed to creating new users. Exporting privileges for nonexistent users will result in errors when you execute the `CREATE` script. Exporting users that already exist will also result in an error.

- **Generate INSERT Statements for Tables**

Select this option if you have added any rows to a table. For more information about inserting rows, see Section 8.7.1.3.8, “The Inserts Tab”.

Clicking Next takes you to the **SQL Object Export Filter** page where you select the objects you wish to export.

**Figure 8.29. SQL Object Export Filter**
Precise control over the objects to export can be fine tuned by clicking the Show Filter button. After the objects to export have been selected, it is possible to reduce the expanded panel by clicking the same button, now labeled Hide Filter.

After selecting the objects to export, click the Next button to review the script that has been generated.

**Figure 8.30. Review Generated Script**

You may return to the previous page using the Back button.

The Finish button saves the script file and exits. You can then use the saved script to create a database.

### 8.7.10.1.2. Altering a Schema

The menu item for altering a schema, Forward Engineer SQL ALTER Script..., is used for updating a database that has been redesigned within MySQL Workbench. Typically, this option is used when the SQL script of a database has been imported into MySQL Workbench and changed, and then you want to create a script that can be run against the database to alter it to reflect the adjusted model.

For instructions on importing a DDL script, see Section 8.7.9.1, “Reverse Engineering Using a Create Script”.

Select the File, Export, Forward Engineer SQL ALTER Script menu item to start the Forward Engineer an ALTER Script wizard. You will be presented with the first page showing the available options.
This first page enables you to select an SQL script and compare it with the model currently in MySQL Workbench. The difference between the two models will be used to create an alter script that can be used to modify the target schema to match the model held in MySQL Workbench. To view the script generated, rather than saving it to a file, leave the Output File field empty.

**Note**

The script selected as the Input File must use full schema qualifiers, such as `schema_name.table_name`. Otherwise, MySQL Workbench cannot generate a useable alter script.

Clicking **Next** brings you to the **Review SQL Script** page.
Here you can review and change the alter script that will be generated. Make any changes you wish and, if you are happy with the changes, save the ALTER script to file using the Save to File... button. You can also click the Execute button to tell MySQL Workbench to write the script to the previously specified output file.

The generated script can then be used to update the database.

### 8.7.10.2. Forward Engineering to a Live Server

Use forward engineering to export your schema design to a MySQL server.

Select the schema that you wish to forward engineer and then choose the Database, Forward Engineer... menu item from the main menu.

The first page to be displayed is Catalog Validation (validation is available only in the Standard Edition).
Figure 8.33. Catalog Validation

Click **Run Validations** to validate the catalog.

Click **Next** to continue.

The next page enables you to set options for the database to be created. These options are as described in Section 8.7.10.1.1, “Creating a Schema”. 
Figure 8.34. Options

Select the required options and then click Next.

The next page enables you to select the objects to forward engineer.
To select a subset of objects to forward engineer, use the Show Filter/Hide Filter button, then select specific objects. After you have selected your objects, click Next to continue.

On the Review Script page you may review and edit the SQL script that will be executed.
The next step of the process is to connect to a MySQL server in order to create the new database schema. This page enables you to use a previously stored connection, or enter the connection parameters.
Figure 8.37. Set Parameters for Connecting to a DBMS

After the connection parameters have been set, click **Execute**. The next page of the wizard displays the results of the forward engineering process.
You can confirm that the script created the schema by connecting to the target MySQL server and issuing a `SHOW DATABASES` statement.

### 8.7.10.3. Database Synchronization

It is possible to synchronize a model in MySQL Workbench with a live database. By default, the synchronization process will change the live database to be the same as the model, but this is configurable during the synchronization process.

**Caution**

Because MySQL databases correspond to directories within the data directory, you must consider case sensitivity for database, table, and trigger names, which follow the case sensitivity rules of the underlying file system for your operating system. Synchronizing models with objects that differ in case may lead to MySQL Workbench producing a `DROP` statement for that object, before recreating it as lowercase. For more information, see Identifier Case Sensitivity

Workarounds include using a consistent convention, where the most portable code uses lower case database and table names. Or a temporary workaround is to delete the `DROP SCHEMA IF EXISTS` line from the generated query.
MySQL Workbench enables control over the direction of synchronization, and which objects to synchronize, in a completely flexible way. You can choose to synchronize only certain tables, enable synchronization to the live database only, enable synchronization from the live database to the model only, or a combination of directions. In effect you have complete control as to whether the synchronization is unidirectional or bidirectional, and which objects exactly are subject to synchronization. This is all controlled in the **Select Changes to Apply** page of the synchronization wizard.

**Figure 8.39. Model and Database Differences**

In the preceding example, the live database consists of `table1`, `table2` and `table3`. In MySQL Workbench an additional table, `table4`, has been created, along with a relationship between it and `table3`. Further, `table5` exists in the live database, but not in the model. The actions that are configured to occur would result in `table3` being altered (to include the relationship with `table4`), `table4` being created and `table5` being dropped, in the live database. It is possible to reconfigure this, though.

The next example shows how the direction of synchronization can be changed.
In this case, the synchronization direction has been changed so that rather than the default action of *table5* being dropped from the live database, it will be incorporated into the MySQL Workbench model.

For convenience, the wizard provides three additional buttons to enable synchronization directions to be applied to a group of selected changes. The **Update Model** button causes the selected changes to be applied only to the model itself. In the following example, *table7* would be added to the model.
The **Ignore** button causes the selected changes to be ignored. No synchronization will take place for those changes. In the following example, no changes would take place.
Figure 8.42. Ignore Button

The **Update Source** button causes the selected changes to be applied only to the live database. In the following example, `table6` would be added to the live database and `table7` would be dropped from the live database.
It is also possible to control individual changes by clicking the arrows. Clicking an arrow causes it to change between the three available synchronization directions: from model to source, from source to model, or bidirectionally. In the following example, `table6` will be created in the live database, and `table7` will be created in the model.
8.7.10.4. Creating a Catalog Diff Report

This facility enables you to create a report detailing the differences between your MySQL Workbench model, and a live database or script. Choose Database, Generate Catalog Diff Report from the main menu to run the Compare and Report Differences in Catalogs wizard.

The first step in the wizard is to specify which catalogs to compare. For example, you may wish to compare your live database against your current MySQL Workbench model.
You then proceed through the wizard, providing connection information if accessing a live database. The wizard then produces a catalog diff report showing the differences between the compared catalogs.
8.8. Modeling Tutorials

This chapter contains three short tutorials intended to familiarize you with the basics of MySQL Workbench. These tutorials show how MySQL Workbench can be used both to design and to document databases.

Creating a database from scratch is the focus of Section 8.8.2, “Using the Default Schema” and exploring the graphic design capabilities of MySQL Workbench is touched upon in Section 8.8.3, “Basic Modeling”. Both these tutorials show the database design capabilities of MySQL Workbench.

Importing an SQL data definition script is probably the quickest way to familiarize yourself with MySQL Workbench—this tutorial makes use of the sakila database and emphasizes the use of MySQL Workbench as a documentation tool. Examples taken from the sakila database are used throughout the documentation, so doing this tutorial can be very helpful in understanding MySQL Workbench.

8.8.1. Importing a Data Definition SQL Script

For this tutorial, use the sakila database script, which you can find by visiting the http://dev.mysql.com/doc/ page, selecting the Other Docs tab, and looking in the Example Databases section
After downloading the file, extract it to a convenient location. Open MySQL Workbench and find the Reverse Engineer MySQL Create Script menu item by first choosing File and then Import. Find and import the sakila-schema.sql file. This is the script that contains the data definition statements for the sakila database. The file filter for the file open dialog window defaults to *.sql so you should be able to view only files with the sql extension.

If the file was successfully imported, the application's status bar reads, Import MySQL Create Script done. To view the newly imported script, expand the Physical Schemata section by double-clicking the arrow on the left of the Physical Schemata title bar. Select the tab labeled sakila.

You may also wish to remove the default schema tab, mydb. Select this tab, then click the - button on the upper right in the Physical Schemata panel.

To view all the objects in the sakila schema, you may need to expand the Physical Schemata window. Move the mouse pointer anywhere over the gray area that defines the lower edge of the Physical Schemata window. Hold down the right mouse button and move the mouse to adjust the size of the window.

After you have expanded the window, all the objects in the sakila database should be visible. Tables appear at the top followed by views and then routines. There are no routine groups in this schema, but you should see the Routine Groups section and an Add Group icon.

For a complete description of importing a MySQL create script, see Section 8.7.9.1, “Reverse Engineering Using a Create Script”.

8.8.1.1. Adding an EER Diagram

To create an EER diagram for the sakila database, first add an EER diagram by double-clicking the Add Diagram icon in the EER Diagrams panel to create and open a new EER Diagram editor.

The EER Diagram canvas is where object modeling takes place. To add a table to the canvas, select the Catalog tab in the middle panel on the right side of the application to display any schemata that appear in the MySQL Model tab. Find the sakila schema and expand the view of its objects by clicking the + button to the left of the schema name. Expand the tables list in the same way.

You can add tables to the EER canvas by dragging them from the Catalog panel dropping them onto the canvas. Drop the address table and the city table onto the canvas.

Figure 8.47. Adding Tables to the Canvas

MySQL Workbench automatically discovers that address.city_id has been defined as a foreign key referencing the city.city_id field. Drop the country table onto the canvas and immediately you should see the relationship between the country table and the city table. (To view all the relationships in the sakila database, see Figure 8.50, “The sakila Database EER Diagram”.

157
Click the **Properties** tab of the panel on the lower right, then click one of the tables on the canvas. This displays the properties of the table in the **Properties** window. While a table is selected, you can use the **Properties** window to change a table's properties. For example, entering #FF0000 for the color value will change the color accent to red.

Changing the color of a table is a good way to identify a table quickly—something that becomes more important as the number of tables increases. Changing the color of a table is also an easy way to identify a table in the **Model Navigator** panel. This panel, the uppermost panel on the left side of the page, gives a bird's eye view of the entire EER canvas.

Save your changes to a **MySQL Workbench Models** file (mwb extension) by choosing **Save** from the **File** menu or by using the keyboard command **Control+S**.

### 8.8.2. Using the Default Schema

When you first open MySQL Workbench a default schema, *mydb* appears as the leftmost tab of the **Physical Schemata** section of MySQL Workbench. You can begin designing a database by using this default schema.

![Figure 8.48. The Default Schema](image)

To change the name of the default schema, double-click the schema tab. This opens a schema editor window docked at the bottom of the application. To undock or redock this window, double-click anywhere in the editor title bar.

To rename the schema, use the field labeled **Name**. After you have renamed the schema, a lightning bolt icon appears right aligned in the **Name** field, indicating that other changes are pending. Click the **Comments** field and a dialog box opens asking if you wish to rename all schema occurrences. Clicking **Yes** ensures that your changes are propagated throughout the application. Add comments to the database and change the collation if you wish. Close the schema editor by clicking the **x** button.

### 8.8.2.1. Creating a New Table

Create a new table by double-clicking the **Add Table** icon in the **Physical Schemata** panel. This opens the table editor docked at the bottom of the application. If you wish, you can undock or dock this editor in exactly the same way as the schema editor window.

Use the first tab of the table editor to change the name, collation, and engine. You may also add a comment.

Add columns to the new table by selecting the **Columns** tab. Use the default column name or enter a new name of your choosing. Use the **Tab** key to move to the next column and set the column's data type.

Altering the table by adding indexes or other features is also easily done using the table editor.

### 8.8.2.2. Creating Other Schema Objects

Additional objects such as views or routines can be added in the same way as tables.
Any objects you have created can be found in the Catalog palette on the right. To view these schema objects, select the Catalog tab in the middle palette on the right. View all the objects by clicking the + button to the left of the schema name.

Save your changes to a MySQL Workbench Models file (.mwb extension) by choosing Save from the File menu or by using the keyboard command Control+S.

8.8.3. Basic Modeling

On the MySQL Model page, double-click the Add Diagram icon. This creates and opens a new EER Diagram canvas.

Figure 8.49. Adding an EER Diagram

From an EER diagram page you can graphically design a database.

8.8.3.1. Adding a Table

The tools in the vertical toolbar on the left of the EER Diagram tab are used for designing an EER diagram. Start by creating a table using the table tool. The table tool is the rectangular grid in the middle of the vertical toolbar. Mousing over it shows the message, Place a New Table (T).

Clicking this tool changes the mouse pointer to a hand with a rectangular grid. Create a table on the canvas by clicking anywhere on the EER Diagram grid.

Right-click the table and choose Edit in New Window from the pop-up menu. This opens the table editor, docked at the bottom of the application.

The table name defaults to table1. Change the name by entering invoice into the Name: field. Changes here affect the name of the tab in the table editor and the name of the table on the canvas.

Pressing Tab or Enter while the cursor is in the table name field selects the Columns tab of the table editor and creates a default column named idinvoice.

Pressing Tab or Enter again sets the focus on the Datatype list with INT selected. Notice that a field has been added to the table on the EER canvas.

Pressing Tab yet again and the focus shifts to adding a second column. Add a Description and a Customer_id column. When you are finished, close the table editor, by clicking the x button on the top left of the table editor.

8.8.3.2. Creating a Foreign Key

Select the table tool again and place another table on the canvas. Name this table invoice_item. Next click the 1:n Non-Identifying Relationship tool.

First, click the invoice_item table; notice that a red border indicates that this table is selected. Next, click the invoice table. This creates a foreign key in the invoice_item table, the table on the “many” side of the relationship. This relationship between the two tables is shown graphically in crow’s foot notation.
Revert to the default mouse pointer by clicking the arrow at the top of the vertical toolbar. Click on the `invoice_item` table and select the **Foreign keys** tab.

Click the **Foreign key Name** field. The referenced table should show in the **Referenced Table** column and the appropriate column in the **Referenced Column** column.

To delete the relationship between two tables, click the line joining the tables and then press **Control +Delete**.

Experiment with the other tools on the vertical toolbar. Delete a relationship by selecting the eraser tool and clicking the line joining two tables. Create a view, add a text object, or add a layer.

Save your changes to a **MySQL Workbench Models** file (mwb extension) by choosing **Save** from the **File** menu or by using the keyboard command **Control+S**.

### 8.8.4. Documenting the **sakila** Database

This chapter highlights the capabilities of MySQL Workbench as a documentation tool using the **sakila** database as an example. This is a sample database provided by MySQL that you can find by visiting the [http://dev.mysql.com/doc/](http://dev.mysql.com/doc/) page, selecting the **Other Docs** tab, and looking in the **Example Databases** section.

An EER diagram is an invaluable aid to a quick understanding of any database. There is no need to read through table definition statements; glancing at an EER diagram can immediately indicate that various tables are related.

You can also see how tables are related; what the foreign keys are and what the nature of the relationship is.

#### 8.8.4.1. A PNG File of the **sakila** Database

Find following an EER diagram showing all the tables in the **sakila** database. This image was created using the **File**, **Export**, **Export as PNG...** menu item.
Figure 8.50. The sakila Database EER Diagram

The object notation style used in Figure 8.50, “The sakila Database EER Diagram” is Workbench (PKs only). This notation shows only primary keys and no other columns, which is especially useful where space is at a premium. The relationship notation is the default, Crow’s Foot.

As the connection lines show, each table is related to at least one other table in the database (with the exception of the film_text table). Some tables have two foreign keys that relate to the same table. For example the film table has two foreign keys that relate to the language table, namely fk_film_language_original and fk_film_language. Where more than one relationship exists between two tables, the connection lines run concurrently.

Identifying and nonidentifying relationships are indicated by solid and broken lines respectively. For example, the foreign key category_id is part of the primary key in the film_category table so its relationship to the category table is drawn with a solid line. On the other hand, in the city table, the foreign key, country_id, is not part of the primary key so the connection uses a broken line.
8.9. Printing

The printing options used to create printouts of your EER Diagrams are found under the File menu. To create documentation of your models, see Section 8.5.1.5.1, “The DBDoc Model Reporting Dialog Window (Commercial Version)”.

8.9.1. Printing Options

The printing menu items not enabled unless an EER Diagram is active. These items are available:

- **Page Setup...**
  Enables you to choose the paper size, orientation, and margins.

- **Print**
  Sends your EER Diagram directly to the printer. This option generates a preview before printing. From the preview you can adjust the scale of the view and also choose a multi-page view. Clicking the printer icon at the top left of this window, prints the currently selected EER Diagram. Close the print preview window if you need to adjust the placement of objects on the EER Diagram canvas.

- **Print to PDF...**
  Creates a PDF file of your EER Diagram.

- **Print to PS...**
  Creates a PostScript file of your EER Diagram.

8.10. MySQL Workbench Schema Validation Plugins (Commercial Version)

MySQL Workbench provides validation modules so that you can test your models before implementing them.

The validation plugins are accessed from the Model menu. One plugin performs general validation for any Relational Database Management System (RDMS) and the other is MySQL specific. Beneath these menu items are a number of specific validation tests. Running any one of these tests opens an output window docked at the bottom of the application. Warning messages are displayed on the left side of this window and the tests performed are displayed on the right.

The following sections outline the tasks performed by the validation modules.

8.10.1. General Validation

The following list names the general validation types and gives examples of specific violations:

- **Empty Content Validation**
  - A table with no columns
  - A routine or view with no SQL code defined
  - A routine group containing no routines
  - A table, view, or routine not referenced by at least one role
  - A user with no privileges
  - Objects such as tables that do not appear on at least one EER Diagram

- **Table Efficiency Validation**
MySQL-Specific Validation

- A table with no primary key
- A primary key that does not use an integer-based data type
- A foreign key that refers to a column with a different data type

Duplicated Identifiers Validation
- Duplicate object names
- Duplicate role or user names
- Duplicate index or routine names

Consistency Validation
- Use of the same column with columns of differing data types

Logic Validation
- A foreign key that refers to a column other than the primary key in the source table
- Any object that is object is either read only or write only by role definition
- Placeholder objects left over from reverse engineering

8.10.2. MySQL-Specific Validation

The following list names the MySQL-specific validation types and gives examples of specific violations:

- Integrity Violation
  - An object name longer than the maximum permitted
  - A foreign key defined for an engine type that does not support foreign keys (not yet implemented)
  - A view or routine that references a nonexistent table (not yet implemented)
  - A default value that does not match a column's data type
  - An invalid partitioning scheme

- Syntax Violation
  - A routine, trigger, or view with incorrect SQL syntax
  - A reserved keyword used as an identifier
  - Use of an invalid character

8.11. The DBDoc Model Reporting Dialog Window (Commercial Version)

This dialog window is found by navigating to the Model menu and choosing the DBDoc - Model Reporting... item.

Note
The DBDoc - Model Reporting... item is not available in the MySQL Workbench OSS version.

Use this dialog window to set the options for creating documentation of your database models.
You can choose from four available templates:

- **HTML Basic Frames**: Model documentation in HTML format that makes use of frames
- **HTML Basic Single Page**: Single Page HTML documentation, not using frames
- **HTML Detailed Frames**: Detailed HTML documentation, using frames
- **Text Basic**: Text file documentation

When you click a template, a preview image displays on the right side of the page. For the **HTML Basic Frames** template, you can select either the Colorful or the Restrained Colors option from the **Style** list. The **HTML Basic Single Page** template offers only the Colorful style. The **HTML Detailed Frames** template offers the Vibrant style, and also the more subdued Coated style. The **Text Basic** template offers only the Fixed Size Font style.

From the **Base Options** frame choose the report title and the output directory for the report files.

As of MySQL Workbench 5.1.17, it is possible to specify variables in the output path:

- ~: The user's home directory. Available on Linux and Mac OS X versions only.
• %desktopfolder%: The user's desktop.

• %documentsfolder%: The user's Documents folders. The following table shows typical values for various platforms.

<table>
<thead>
<tr>
<th>Platform</th>
<th>Typical Default Documents Folder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>C:\Documents and Settings \user_name\My Documents</td>
</tr>
<tr>
<td>Linux</td>
<td>~/Documents</td>
</tr>
<tr>
<td>Mac OS X</td>
<td>Users/user_name/Documents</td>
</tr>
</tbody>
</table>

• %date%: The date in the format YYYY-MM-DD.

• %time%: The time in the format HHMM.

• %year%: The year in the format YYYY.

• %month%: The month in the format MM. January is 01 and December is 12.

• %monthname%: The name of the month, rather than the number.

• %day%: The day number in the format DD. For example, the 12th would be 12.

Content options can also be set:

- **Render Table Columns**: Display all the columns.
- **Render Table Indices**: Display all the indexes.
- **Render Foreign Keys**: Display all the foreign keys.
- **List Foreign Keys that refer to that table**: Display the tables that foreign keys reference.
- **Include DDL code for objects**: Generates DDL code.

Clicking the Generate button creates the directory defined in the **Output directory** text box. If you chose to create **HTML Basic Frames**, you will find the following files in this directory:

- basic.css: The style sheet for the overview.html page.
- index.html: The main page.
- overview.html: The model overview, the navigation links shown in the sidebar.
- restrained.css: The CSS file used if the **Restrained Colors** style option was chosen.
- table_details.html: The main frame of the model report.

Choosing the **HTML Basic Single Page** option creates a style sheet and an index.html file.

Choosing the **HTML Detailed Frames** option creates the following files:

- basic.css: The style sheet for the overview.html page. This is used if the **vibrant** style is chosen.
- coated.css: The CSS file used if the **Coated** style option was chosen.
- index.html: The main page.
- overview.html: Overview information for the report such as report title, project name and author.
- overview_list.html: A summary of schema in the model along with a list of tables contained in each schema.
**8.12. Customizing DBDoc Model Reporting Templates**

This section provides an overview of creating and modifying DBDoc Model Reporting templates, as used by MySQL Workbench.

The MySQL Workbench DBDoc Model Reporting system is based on the Google Template System. This discussion does not attempt to explain the Google Template System in detail. For a useful overview of how the Google Template System works, see the Google document, *How To Use the Google Template System*.
The templates employed by the DBDoc Model Reporting system are text files that contain Markers. These text files are processed by the template system built into MySQL Workbench, and the markers replaced by actual data. The output files are then generated. It is these output files, typically HTML or text, that are then viewed by the user.

Markers can be of six types:

- Template Include
- Comment
- Set delimiter
- Pragma
- Variable
- Section start and Section end

The last two are the most commonly used in MySQL Workbench templates and these important markers are briefly described in the following sections.

**Variables**

The use of variables in the templates is straightforward. Any variables denoted by markers in the template file are replaced by their corresponding data prior to the output file being generated. The mapping between variables and their corresponding data is stored by MySQL Workbench in what is known as a data dictionary. In the data dictionary, the variable name is the key and the variable's corresponding data is the value. The data dictionaries are built by MySQL Workbench and filled with the data contained in the model being processed.

By way of example, the following code snippet shows part of a template file:

```text
Total number of Schemata: {{SCHEMA_COUNT}}
```

In the generated output file, the variable `{{SCHEMA_COUNT}}` is replaced by the number of schemata in the model:

```
Total number of Schemata: 2
```

A variable can appear as many times as required in the template file.

**Sections**

Sections are used to perform iteration in the templates. When MySQL Workbench exchanges the variables in a section for data, it does so iteratively, using all data in the data dictionary in which the variable is defined. MySQL Workbench builds the data dictionaries according to the model currently being processed.

Consider the following code snippet:

```text
{{#SCHEMATA}}
Schema: {{SCHEMA_NAME}}
{{/SCHEMATA}}
```

In the preceding snippet, the section start and end are indicated by the `{{#SCHEMATA}}` and `{{/SCHEMATA}}` markers. When MySQL Workbench processes the template, it notes the section and iterates it until the variable data for `{{SCHEMA_NAME}}` in the corresponding data dictionary is exhausted. For example, if the model being processed contains two schemata, the output for the section might resemble the following:

```
Schema: Airlines
Schema: Airports
```
Data Dictionaries

It is important to understand the relationship between sections and data dictionaries in more detail. In a data dictionary the key for a variable is the variable name, a marker. The variable value is the variable’s data. The entry for a section in a data dictionary is different. For a section entry in a data dictionary, the key is the section name, the marker. However, the value associated with the key is a list of data dictionaries. In MySQL Workbench each section is usually associated with a data dictionary. You can think of a section as activating its associated dictionary (or dictionaries).

When a template is processed, data dictionaries are loaded in a hierarchical pattern, forming a tree of data dictionaries. This is illustrated by the following table.

<table>
<thead>
<tr>
<th>Data Dictionary</th>
<th>Loads Data Dictionary</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIN</td>
<td>SCHEMATA</td>
</tr>
<tr>
<td>SCHEMATA</td>
<td>TABLES, COLUMNS (Detailed is true), FOREIGN_KEYS (Detailed is true), INDICES (Detailed is true)</td>
</tr>
<tr>
<td>TABLES</td>
<td>REL_LISTING, INDICES_LISTING, COLUMNS_LISTING, TABLE_COMMENT_LISTING, DDL_LISTING</td>
</tr>
<tr>
<td>COLUMNS_LISTING</td>
<td>COLUMNS (Detailed is false)</td>
</tr>
<tr>
<td>REL_LISTING</td>
<td>REL (Detailed is false)</td>
</tr>
<tr>
<td>INDICES_LISTING</td>
<td>INDICES (Detailed is false)</td>
</tr>
</tbody>
</table>

The root of the tree is the main dictionary. Additional dictionaries are loaded from the root to form the dictionary tree.

Note

If a template has no sections, any variables used in the template are looked up in the main dictionary. If a variable is not found in the main dictionary (which can be thought of as associated with the default, or main, section), no data is generated in the output file for that marker.

Evaluation of variables

The tree structure of the data dictionaries is important with respect to variable evaluation. As variables are defined in data dictionaries, their associated values have meaning only when that particular data dictionary is active, and that means when the section associated with that data dictionary is active. When a variable lookup occurs, the system checks the data dictionary associated with the current section. If the variable value can be found there, the replacement is made. However, if the variable’s value is not found in the current data dictionary, the parent data dictionary is checked for the variable’s value, and so on up the tree until the main data dictionary, or root, is reached.

Suppose that we want to display the names of all columns in a model. Consider the following template as an attempt to achieve this:

```
Report
------
Column Name: {{COLUMN_NAME}}
```

This template produces no output, even for a model that contains many columns. In this example, the only data dictionary active is the main dictionary. However, COLUMN_NAME is stored in the COLUMNS data dictionary, which is associated with the COLUMNS section.

With this knowledge, the template can be improved as follows:

```
Report
------
{{#COLUMNS}}
Column Name: {{COLUMN_NAME}}
{{/COLUMNS}}
```
This still does not produce output. To see why, see Table 8.1, “Data Dictionaries Tree”. The COLUMNS data dictionary has the parent dictionary COLUMNS_LISTING, COLUMNS_LISTING has the parent TABLES, which has the parent SCHEMATA, whose parent is the main dictionary. Remember that for a dictionary to be involved in variable lookup, its associated section must currently be active.

To achieve the desired output, the template must be something like the following:

```
Report
------
{{#SCHEMATA}}
{{#TABLES}}
{{#COLUMNS_LISTING}}
{{#COLUMNS}}
  Column Name: {{COLUMN_NAME}}
{{/COLUMNS}}
{{/COLUMNS_LISTING}}
{{/TABLES}}
{{/SCHEMATA}}
```

The following template is the same, but with explanatory comments added:

```
Report
------
{{! Main dictionary active}}
{{#SCHEMATA}}  {{! SCHEMATA dictionary active}}
{{#TABLES}}  {{! TABLES dictionary active}}
{{#COLUMNS_LISTING}} {{! COLUMNS_LISTING dictionary active}}
{{#COLUMNS}}  {{! COLUMNS dictionary active}}
  Column Name: {{COLUMN_NAME}} {{! COLUMN_NAME variable is looked-up, and found, in COLUMNS data dictionary}}
{{/COLUMNS}}
{{/COLUMNS_LISTING}}
{{/TABLES}}
{{/SCHEMATA}}
```

Imagine now that for each column name displayed you also wanted to display its corresponding schema name, the template would look like this:

```
Report
------
{{#SCHEMATA}}
{{#TABLES}}
{{#COLUMNS_LISTING}}
{{#COLUMNS}}
  Schema Name: {{SCHEMA_NAME}} Column Name: {{COLUMN_NAME}}
{{/COLUMNS}}
{{/COLUMNS_LISTING}}
{{/TABLES}}
{{/SCHEMATA}}
```

When variable lookup is performed for SCHEMA_NAME, the COLUMNS dictionary is checked. As the variable is not found there the parent dictionary will be checked, COLUMNS_LISTING, and so on, until the variable is eventually found where it is held, in the SCHEMATA dictionary.

If there are multiple schemata in the model, the outer section is iterated over a matching number of times, and SCHEMA_NAME accordingly has the correct value on each iteration.

It’s important to always consider which dictionary must be active (and which parents) for a variable to be evaluated correctly. The following section has a table that helps you identify section requirements.

### 8.12.1. Supported Template Markers

The following table shows the supported markers. These markers can be used in any template, including custom templates.

**Using the table**
The table shows which variables are defined in which sections. The variable should be used in its correct section or its value will not be displayed. If a variable type is a variable, then the table describes its data dictionary, and a parent dictionary if type is a section. Also remember that the data dictionaries used to perform variable lookups form a hierarchical tree, so it is possible to use a variable in a child section that is defined in a parent section.

**Table 8.2. Supported Template Markers**

<table>
<thead>
<tr>
<th>Marker text</th>
<th>Type</th>
<th>Data Dictionary or Parent Dictionary</th>
<th>Corresponding data</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE</td>
<td>Variable</td>
<td>MAIN</td>
<td>Title of the report</td>
</tr>
<tr>
<td>GENERATED</td>
<td>Variable</td>
<td>MAIN</td>
<td>Date and time when the report was generated</td>
</tr>
<tr>
<td>STYLE_NAME</td>
<td>Variable</td>
<td>MAIN</td>
<td>The name of the style selected in MySQL Workbench, this is typically used to load the corresponding CSS file, depending on the name of the style selected in MySQL Workbench</td>
</tr>
<tr>
<td>SCHEMA_COUNT</td>
<td>Variable</td>
<td>MAIN</td>
<td>The number of schemata in the model</td>
</tr>
<tr>
<td>PROJECT_TITLE</td>
<td>Variable</td>
<td>MAIN</td>
<td>Project title as set for the model in Document Properties</td>
</tr>
<tr>
<td>PROJECT_NAME</td>
<td>Variable</td>
<td>MAIN</td>
<td>Project name as set for the model in Document Properties</td>
</tr>
<tr>
<td>PROJECT_AUTHOR</td>
<td>Variable</td>
<td>MAIN</td>
<td>Project author as set for the model in Document Properties</td>
</tr>
<tr>
<td>PROJECT_VERSION</td>
<td>Variable</td>
<td>MAIN</td>
<td>Project version as set for the model in Document Properties</td>
</tr>
<tr>
<td>PROJECT_DESCRIPTION</td>
<td>Variable</td>
<td>MAIN</td>
<td>Project description as set for the model in Document Properties</td>
</tr>
<tr>
<td>PROJECT_CREATED</td>
<td>Variable</td>
<td>MAIN</td>
<td>Automatically set for the model project, but as displayed in Document Properties</td>
</tr>
<tr>
<td>PROJECT_CHANGED</td>
<td>Variable</td>
<td>MAIN</td>
<td>Automatically set for the model project, but as displayed in Document Properties</td>
</tr>
<tr>
<td>TOTAL_TABLE_COUNT</td>
<td>Variable</td>
<td>MAIN</td>
<td>The number of tables in all schemata in the model</td>
</tr>
<tr>
<td>TOTAL_COLUMN_COUNT</td>
<td>Variable</td>
<td>MAIN</td>
<td>The number of columns in all tables in all schemata in the model</td>
</tr>
<tr>
<td>TOTAL_INDEX_COUNT</td>
<td>Variable</td>
<td>MAIN</td>
<td>The number of indexes in the model</td>
</tr>
<tr>
<td>Marker text</td>
<td>Type</td>
<td>Data Dictionary or Parent Dictionary</td>
<td>Corresponding data</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------</td>
<td>--------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>TOTAL_FK_COUNT</td>
<td>Variable</td>
<td>MAIN</td>
<td>The number of foreign keys in the model</td>
</tr>
<tr>
<td>SCHEMATA</td>
<td>Section</td>
<td>MAIN</td>
<td>Used to mark the start and end of a SCHEMATA section; the SCHEMATA data dictionary becomes active in this section</td>
</tr>
<tr>
<td>SCHEMA_NAME</td>
<td>Variable</td>
<td>SCHEMATA</td>
<td>The schema name</td>
</tr>
<tr>
<td>SCHEMA_ID</td>
<td>Variable</td>
<td>SCHEMATA</td>
<td>The schema ID</td>
</tr>
<tr>
<td>TABLE_COUNT</td>
<td>Variable</td>
<td>SCHEMATA</td>
<td>The number of tables in the current schema</td>
</tr>
<tr>
<td>COLUMN_COUNT</td>
<td>Variable</td>
<td>SCHEMATA</td>
<td>The number of columns in the current schema</td>
</tr>
<tr>
<td>INDICES_COUNT</td>
<td>Variable</td>
<td>SCHEMATA</td>
<td>The number of indexes in the current schema</td>
</tr>
<tr>
<td>FOREIGN_KEYS_COUNT</td>
<td>Variable</td>
<td>SCHEMATA</td>
<td>The number of foreign keys in the current schema</td>
</tr>
<tr>
<td>TABLES</td>
<td>Section</td>
<td>SCHEMATA</td>
<td>Marks the start and end of a TABLES section; the TABLES data dictionary becomes active in this section</td>
</tr>
<tr>
<td>TABLE_NAME</td>
<td>Variable</td>
<td>TABLES</td>
<td>The table name</td>
</tr>
<tr>
<td>TABLE_ID</td>
<td>Variable</td>
<td>TABLES</td>
<td>The table ID</td>
</tr>
<tr>
<td>COLUMNS_LISTING</td>
<td>Section</td>
<td>TABLES</td>
<td>Marks the start and end of a COLUMNS_LISTING section; the COLUMNS_LISTING data dictionary becomes active in this section</td>
</tr>
<tr>
<td>COLUMNS</td>
<td>Section</td>
<td>COLUMNS_LISTING</td>
<td>Marks the start and end of a COLUMNS section; the COLUMNS data dictionary becomes active in this section</td>
</tr>
<tr>
<td>COLUMN_KEY</td>
<td>Variable</td>
<td>COLUMNS</td>
<td>Whether the column is a primary key</td>
</tr>
<tr>
<td>COLUMN_NAME</td>
<td>Variable</td>
<td>COLUMNS</td>
<td>The column name</td>
</tr>
<tr>
<td>COLUMN_DATATYPE</td>
<td>Variable</td>
<td>COLUMNS</td>
<td>The column data type</td>
</tr>
<tr>
<td>COLUMN_NONNULL</td>
<td>Variable</td>
<td>COLUMNS</td>
<td>Whether the column permits NULL values</td>
</tr>
<tr>
<td>COLUMN_DEFAULTVALUE</td>
<td>Variable</td>
<td>COLUMNS</td>
<td>The column default value</td>
</tr>
<tr>
<td>COLUMN_COMMENT</td>
<td>Variable</td>
<td>COLUMNS</td>
<td>The column comment</td>
</tr>
<tr>
<td>COLUMN_ID</td>
<td>Variable</td>
<td>COLUMNS</td>
<td>The column ID</td>
</tr>
<tr>
<td>COLUMN_KEY_PART</td>
<td>Variable</td>
<td>COLUMNS (if detailed)</td>
<td>The column key type</td>
</tr>
<tr>
<td>COLUMN_NONNULLABLE</td>
<td>Variable</td>
<td>COLUMNS (if detailed)</td>
<td>Can the column contain NULL values</td>
</tr>
<tr>
<td>Marker text</td>
<td>Type</td>
<td>Data Dictionary or Parent Dictionary</td>
<td>Corresponding data</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------</td>
<td>--------------------------------------</td>
<td>--------------------------------------------------------------</td>
</tr>
<tr>
<td>COLUMN_AUTO_INC</td>
<td>Variable</td>
<td>COLUMNS (if detailed)</td>
<td>Does the column auto-increment</td>
</tr>
<tr>
<td>COLUMN_CHARSET</td>
<td>Variable</td>
<td>COLUMNS (if detailed)</td>
<td>The column character set</td>
</tr>
<tr>
<td>COLUMN_COLLATION</td>
<td>Variable</td>
<td>COLUMNS (if detailed)</td>
<td>The column collation</td>
</tr>
<tr>
<td>COLUMN_IS_USERTYPE</td>
<td>Variable</td>
<td>COLUMNS (if detailed)</td>
<td>Whether the column is a user type</td>
</tr>
<tr>
<td>INDICES_LISTING</td>
<td>Section</td>
<td>TABLES</td>
<td>Marks the start and end of an INDICES_LISTING section; the INDICES_LISTING data dictionary becomes active in this section</td>
</tr>
<tr>
<td>INDICES</td>
<td>Section</td>
<td>INDICES_LISTING</td>
<td>Marks the start and end of an INDICES section; the INDICES data dictionary becomes active in this section</td>
</tr>
<tr>
<td>INDEX_NAME</td>
<td>Variable</td>
<td>INDICES</td>
<td>The index name</td>
</tr>
<tr>
<td>INDEX_PRIMARY</td>
<td>Variable</td>
<td>INDICES</td>
<td>Whether this is a primary key</td>
</tr>
<tr>
<td>INDEX_UNIQUE</td>
<td>Variable</td>
<td>INDICES</td>
<td>Whether this is a unique index</td>
</tr>
<tr>
<td>INDEX_TYPE</td>
<td>Variable</td>
<td>INDICES</td>
<td>The index type; for example, PRIMARY</td>
</tr>
<tr>
<td>INDEX_KIND</td>
<td>Variable</td>
<td>INDICES</td>
<td>The index kind</td>
</tr>
<tr>
<td>INDEX_COMMENT</td>
<td>Variable</td>
<td>INDICES</td>
<td>The index comment</td>
</tr>
<tr>
<td>INDEX_ID</td>
<td>Variable</td>
<td>INDICES</td>
<td>The index ID</td>
</tr>
<tr>
<td>INDEX_COLUMNS</td>
<td>Section</td>
<td>INDICES</td>
<td>Marks the start and end of an INDEX_COLUMNS section; the INDEX_COLUMNS data dictionary becomes active in this section</td>
</tr>
<tr>
<td>INDEX_COLUMN_NAME</td>
<td>Variable</td>
<td>INDEX_COLUMNS</td>
<td>The index column name</td>
</tr>
<tr>
<td>INDEX_COLUMN_ORDER</td>
<td>Variable</td>
<td>INDEX_COLUMNS</td>
<td>The index column order; for example, ascending, descending</td>
</tr>
<tr>
<td>INDEX_COLUMN_COMMENT</td>
<td>Variable</td>
<td>INDEX_COLUMNS</td>
<td>The index comment</td>
</tr>
<tr>
<td>INDEX_KEY_BLOCK_SIZE</td>
<td>Variable</td>
<td>INDEX_COLUMNS (if detailed)</td>
<td>The index key-block size</td>
</tr>
<tr>
<td>REL_LISTING</td>
<td>Section</td>
<td>TABLES</td>
<td>Marks the start and end of a REL_LISTING section; the REL_LISTING data dictionary becomes active in this section</td>
</tr>
<tr>
<td>REL</td>
<td>Section</td>
<td>REL_LISTING</td>
<td>Marks the start and end of a REL section; the REL data dictionary becomes active in this section</td>
</tr>
<tr>
<td>REL_NAME</td>
<td>Variable</td>
<td>REL, FOREIGN_KEYS</td>
<td>The relationship name</td>
</tr>
</tbody>
</table>
8.12.2. Creating a Custom Template

In the simplest case, a template consists of two files: a template file, which has a .tpl extension, and a special file info.xml. The info.xml file has important metadata about the template. A third file is optional, which is the preview image file. This preview file provides a thumbnail image illustrating the appearance of the generated report.

One of the easiest ways to create a custom template is to make a copy of any existing template.

For example, the following procedure describes how to make a custom template based on the Text Basic template.

1. Navigate to the folder where the templates are stored. Assuming that MySQL Workbench has been installed into the default location on Windows, this would be C:\Program Files\MySQL\MySQL Workbench 5.0 SE\modules\data\wb_model_reporting.

2. Copy the Text_Basic.tpl folder. The copy can be given any suitable name; for example, Custom_Basic.tpl.

3. Edit the info.xml file to reflect your custom template. The unedited file in this case is shown here:

```xml
<?xml version="1.0"?>
```

---

**Marker text** | **Type** | **Data Dictionary or Parent Dictionary** | **Corresponding data**
---|---|---|---
REL_TYPE | Variable | REL, FOREIGN_KEYS | The relationship type
REL_PARENTTABLE | Variable | REL, FOREIGN_KEYS | The relationship parent table
REL_CHILDTABLE | Variable | REL, FOREIGN_KEYS | The relationship child table
REL_CARD | Variable | REL, FOREIGN_KEYS | The relationship cardinality
FOREIGN_KEY_ID | Variable | REL, FOREIGN_KEYS | Foreign key ID
FOREIGN.Keys | Section | SCHEMATA | Marks the start and end of a FOREIGN.Keys section; the FOREIGN.Keys data dictionary becomes active in this section
FK_DELETE_RULE | Variable | FOREIGN.Keys | The foreign key delete rule
FK_UPDATE_RULE | Variable | FOREIGN.Keys | The foreign key update rule
FK_MANDATORY | Variable | FOREIGN.Keys | Whether the foreign key is mandatory
TABLE_COMMENT_LISTING | Section | TABLES | Marks the start and end of a TABLE_COMMENT_LISTING section; the TABLE_COMMENT_LISTING data dictionary becomes active in this section
TABLE_COMMENT | Variable | TABLE_COMMENT_LISTING | The table comment
DDL_LISTING | Section | TABLES | Marks the start and end of a DDL_LISTING section; the DDL_LISTING data dictionary becomes active in this section
DDL_SCRIPT | Variable | DDL_LISTING | Display the DDL script of the currently active entity; for example, SCHEMATA, TABLES
Creating a Custom Template

The file defines two objects: the TemplateInfo object and the TemplateStyleInfo object. These objects contain information about the template that will be displayed in the DBDoc Model Reporting wizard main page.

4. Change the object GUIDs that are used in the file. In this example, there are two that need replacing:

   id="{BD6879ED-814C-4CA3-A869-9864F83B88DF}"
   ...
   id="{7550655C-CD4B-4EB1-8FAB-AAEE49B2261E}" 

   Generate two new GUIDS. This can be done using any suitable command-line tool. There are also free online tools that can be used to generate GUIDs. Another way to generate GUIDs is by using the MySQL UUID() function:

   mysql> SELECT UUID();
   +------------------------+
   | UUID()                |
   +------------------------+
   | 648f4240-7d7a-11e0-870b-89c43de3bd0a |
   +------------------------+

   Once you have the new GUID values, edit the info.xml file accordingly.

5. Edit the textual information for the TemplateInfo and TemplateStyleInfo objects to reflect the purpose of the custom template.

6. The modified file will now look something like the following:

   <?xml version="1.0"?>
   <data>
   <value type="object" struct-name="workbench.model.reporting.TemplateInfo"
   id="{cac9ba3f-ee2a-49f0-b5f6-32580fab1640}" struct-checksum="0xb46b524d">
   <value type="string" key="description">
   Custom basic TEXT report listing schemata and objects.
   </value>
   <value type="string" key="name">Custom Basic text report</value>
   <value type="list" content-type="object"
   content-struct-name="workbench.model.reporting.TemplateStyleInfo"
   key="styles">
   <value type="object" struct-name="workbench.model.reporting.TemplateStyleInfo"
   id="{39e3b7e7-a832-4016-873b-b4cb32a25d56}" struct-checksum="0xame08451b">
   <value type="string" key="description">
   Designed to be viewed with a fixed sized font.
   </value>
   <value type="string" key="name">Fixed Size Font</value>
   <value type="string" key="previewImageFileName">
   preview_basic.png
   </value>
   <value type="string" key="styleTagValue">fixed</value>
   </value>
   </value>
   </value>
   <value type="string" key="mainFileName">report.txt</value>
   </value>
   </data>
7. Create the new template file. This too may best be achieved, depending on your requirements, by editing an existing template. In this example the template file `report.txt.tpl` is shown here:

```
+--------------------------------------------+
| MySQL Workbench Report                     |
+--------------------------------------------+

Total number of Schemata: {{SCHEMA_COUNT}}

# SCHEMATA
| Schema: {{SCHEMA_NAME}}
# TABLES
## Tables ({{TABLE_COUNT}}) ##
| Table: {{TABLE_NAME}}
| [COLUMN_NAME] Datatype Not Null Default Comment

# INDICES
## Indexes ##
| Name | Columns | Primary | Unique | Type | Kind | Comment

# REL
## Relationships ##
| Relationship | Type | Parent Table | Child Table | Cardinality
```

This template shows details for all schemata in the model.

8. The preceding template file can be edited in any way you like, with new markers being added, and existing markers being removed as required. For the custom template example, you might want to create a much simpler template, such as the one following:

```
+--------------------------------------------+
| MySQL Workbench Custom Report              |
+--------------------------------------------+

Total number of Schemata: {{SCHEMA_COUNT}}

# SCHEMATA
| Schema Name: {{SCHEMA_NAME}}
# TABLES
| Table Name: {{TABLE_NAME}}
```

Report Generated On: {{GENERATED}}
This simplified report just lists the schemata and the tables in a model. The date and time the report was generated is also displayed as a result of the use of the \{ {{GENERATED}} \} variable.

9. The custom template can then be tested. Start MySQL Workbench, load the model to generate the report for, select the Model, DBDOC - Model Reporting menu item. Then select the new custom template from the list of available templates, select an output directory, and click Finish to generate the report. Finally, navigate to the output directory to view the finished report.
Chapter 9. Generating code overview

Table of Contents

9.1. Generating SQL queries ................................................................. 177
9.2. Generating PHP code ................................................................. 177

This document provides a quick hands-on introduction to using MySQL Workbench to generate code for later use, for either in or outside of MySQL Workbench.

9.1. Generating SQL queries

MySQL Workbench can be used to generate SQL, most typically as either INSERT or SELECT queries.

Below are the most common methods to generated SQL statements in MySQL Workbench.

• Right-clicking on a table or column name within the schema view will offer many different SQL generating options.

  For example, right-clicking on a table name will allow creating "SELECT All", "INSERT", "UPDATE", "DELETE", and "CREATE" queries. And with the option to either send these queries to the system’s clipboard, or to the SQL Editor window.

• Right-clicking on a field within a cell in the SQL Editor offers the "Copy Row Content" and "Copy Field Content" options, and includes the option to leave the chosen values unquoted.

• All of the MySQL Workbench Export options include the option to export as SQL.

9.2. Generating PHP code

MySQL Workbench can be used to generate PHP code with the bundled PHP plugin, by using the Plugins, Utilities, Copy as PHP Code menu option.

Below is an example scenario for how to create PHP code. It is a SELECT statement, and optionally uses SET to set variables.

SQL @variables will generate PHP variables in the code, which will then be bounded to the statement before execution.

1. Generate or type in the desired SQL query into the SQL editor. This example will use the sakila database, with the query being:

   ```sql
   SET @last_update = '2006-02-14';
   SELECT actor_id, first_name, last_name, last_update
   FROM actor
   WHERE last_update > @last_update;
   ```

2. While in the SQL editor, choose Plugins, Utilities, Copy as PHP Code (Iterate SELECT Results) from the main menu. This will copy PHP code to the clipboard.

3. Paste the code to the desired location.

Additionally, PHP code that connects to the MySQL database can also be generated by choosing Plugins, Utilities, Copy as PHP Code (Connect to Server).

The generated code will look like this:
<?php
$host     = "localhost";
$port     = 3306;
$socket   = "";
$user     = "nobody";
$password = "";
$dbname   = "sakila";
$con = new mysqli($host, $user, $password, $dbname, $port, $socket)
    or die ('Could not connect to the database server' . mysqli_connect_error());

//$con->close();
$query = "SELECT actor_id, first_name, last_name, last_update
    FROM   actor
    WHERE  last_update > ?";
$last_update = "";
$stmt->bind_param('s', $last_update);
if ($stmt = $con->prepare($query)) {
    $stmt->execute();
    $stmt->bind_result($actor_id, $first_name, $last_name, $last_update);
    while ($stmt->fetch()) {
        // printf("%s, %s, %s, %s\n",
        //   $actor_id, $first_name, $last_name, $last_update);
    }
    $stmt->close();
}
?>

Note that the PHP code uses the mysqli PHP extension. This extension must be enabled in your PHP distribution for this code to work. For additional details, see MySQL Improved Extension (Mysqli).
Chapter 10. Server Administration

Table of Contents

10.1. Server Administration ................................................................. 179
10.2. New Server Instance ................................................................. 180
10.3. Manage Data Import/Export ....................................................... 180
10.4. Manage Security ...................................................................... 180
10.5. Manage Server Instances ......................................................... 180
10.6. Creating and Managing Server Instances ................................. 180
  10.6.1. New Server Instance Wizard .................................................. 180
  10.6.2. Manage Server Instances Dialog ........................................... 182
10.7. Server Administration and Configuration ................................... 185
  10.7.1. The Startup Tab .................................................................. 186
  10.7.2. The Configuration Tab .......................................................... 187
  10.7.3. The Accounts Tab .............................................................. 189
  10.7.4. The Connections Tab .......................................................... 191
  10.7.5. The Variables Tab .............................................................. 192
  10.7.6. The Data Dump Tab ............................................................ 193
  10.7.7. The Logs Tab ................................................................... 196

Since version 5.2.6, MySQL Workbench has included functionality for managing server instances. A server instance is created to provide a way of connecting to a server to be managed. The first step is to create a server instance if none exists, or to work with an existing server instance.

MySQL Workbench also provides functionality to administer and configure a server using these server instances. Thus, the Server Administrator functionality can be broadly grouped into two main areas:

- Creating and managing server instances
- Administration and configuration functions using a server instance

The Workspace section of the Home window has an area for Server Administration tasks. This section of the Workspace has the following action items:

- Server Administration
- Server Administration (icon)
- New Server Instance
- Manage Data Import/Export
- Manage Security
- Manage Server Instances

The following sections describe each of these action items.

10.1. Server Administration

This action item enables you to quickly connect to a predefined server instance and carry out administration functions on the associated server. Clicking this item launches the Server Administration dialog, from which you can select the server instance to which you wish to connect. A new Admin tab will be launched, which displays the Server Status and Configuration.

Server Administration (icon)
If you have already created server instances, you can most quickly launch these by clicking the icon for the Server Instance you wish to access. A new Admin tab will be launched, which displays Server Status and Configuration.

For further details, see Section 10.7, “Server Administration and Configuration”.

10.2. New Server Instance

This action item enables you to create a new server instance. A server instance is primarily a combination of connection and configuration details for a specific server that you wish to manage. When you click this item, a wizard is launched that enables you to specify the connection and various other configuration parameters. After completion of the wizard, a new Admin tab is launched, which displays Server Status and Configuration.

For further details, see Section 10.6.1, “New Server Instance Wizard”.

10.3. Manage Data Import/Export

This action item enables you to create a dump file from a database, or restore data from a file to a live database. Clicking this item launches the Import/Export MySQL Data wizard. This enables you to select a server instance to connect to.

For further details, see Section 10.7.6, “The Data Dump Tab”.

10.4. Manage Security

This action item takes you quickly to the page that enables you to manage user accounts. It launches an Admin page and locates you on the Accounts tab. For further details, see Section 10.7.3, “The Accounts Tab”.

10.5. Manage Server Instances

Clicking this action item launches the Manage Server Instances dialog. Within this dialog, you can change the configuration of existing server instances or create a new server instance. For further details, see Section 10.6, “Creating and Managing Server Instances”.

10.6. Creating and Managing Server Instances

Server instances can be created and managed from the Home page. To create new server instances, use one of these methods:

- Click the New Server Instance action item from the Server Administration section of the Home window. This launches the Create a new server instance wizard. For further details, see Section 10.6.1, “New Server Instance Wizard”.

- Click the Manage Server Instances action item from the Server Administration section of the Home window. This launches the Manage Server Instances dialog, from within which a new server instance can be created. For further details, see Section 10.6.2, “Manage Server Instances Dialog”.

10.6.1. New Server Instance Wizard

Clicking the New Server Instance action item launches the Create a new server instance wizard. The wizard provides a step-by-step approach to creating a new server instance. This is most suitable for beginners. Users who are familiar with the various settings and parameters can also quickly create a new instance from the Manage Server Instances dialog discussed later.

The steps presented in the wizard are as follows:
1. Specify Host Machine
2. Database Connection
3. Test DB Connection
4. Management and OS
5. SSH Configuration
6. Windows Management
7. Test Settings
8. Review Settings
9. MySQL Config File
10. Specify Commands
11. Complete Setup

**Specify host machine**

On this page you can select **Localhost** if you intend to manage a server on your local machine. If you select **Remote Host**, you must provide the IP address or the network name of the remote server. Or, **Take Parameters from Existing Database Connection** utilizes a pre-existing connection as defined within MySQL Workbench. Click **Next** to continue.

**Database Connection**

This page enables you to select a connection to a specific database. The settings entered previously have been concerned with the connection to the server required for administrative purposes. This page is concerned with connecting to a specific database. You can either launch the Manage DB Connections dialog or select a pre-existing connection from a list. The former is most useful if you have not created any connections. If you must create a connection at this point, refer to **Section 7.6, “Manage DB Connections Dialog”**. After a connection has been selected, click **Next** to continue.

**Test DB Connection**

On this page, MySQL Workbench tests your database connection and displays the results. If an error occurs, you are directed to view the logs, which can be done by clicking the **Show Logs** button.

**Management and OS**

Used to specify a remote management type and target operating system, which is available when the Host Machine is defined as a remote host.

The SSH login based management option includes configuration entries for the Operating System and MySQL Installation Type.

**SSH Configuration**

If you specified a Remote Host on the Specify Host Machine page, you will be presented with the Host SSH Connection page, that enables you to use SSH for the connection to the server instance. This facility enables you to create a secure connection to remotely administer and configure the server instance. You must enter the host name and user name of the account that will be used to log in to the server for administration and configuration activities. If you do not enter the optional SSH Key for use with the server, then you will be prompted for the password when the connection is established by MySQL Workbench.
Note
This connection is to enable remote administration and configuration of the MySQL Server itself. It is not the same as the connection used to connect to a server for general database manipulation.

Note
You must use an SSH connection type when managing a remote server if you wish to start or stop the server or edit its configuration file. Other administrative functions do not require an SSH connection.

Windows Management
If a Windows server is used, then the Windows configuration parameters must be set. Windows management requires a user account with the required privileges to query the system status, and to control services. And read/write access to the configuration file is needed to allow editing of the file.

Test Settings
On the next page your settings are tested and the wizard reports back the results after attempting to connect to the server. If an error occurs, you are directed to view the logs, which can be done by clicking the Show Logs button.

MySQL Workbench must know where the MySQL Server configuration file is located to be able to display configuration information. The wizard is able to determine the most likely location of the configuration file, based on the selection made on the Operating System page of the wizard. However, it is possible to test that this information is correct by clicking the Check path and Check section buttons. The wizard then reports whether the configuration file and server configuration section can in fact be accessed. It is also possible to manually enter the location of the configuration file, and the section pertaining to MySQL Server data; these manually entered values should be tested using the buttons provided. Click the Next button to continue.

Review Settings
The modified settings may be reviewed, which also includes the default values. Check the Change Parameters checkbox if the MySQL Config File section will be edited, and then click Next to continue.

MySQL Config File
Allows configuration of the MySQL server version. It also allows the editing and validation of the configuration file path, and validation of the server instance section. Click Next to continue.

Specify Commands
This page enables you to set the commands required to start, stop, and check the status of the running server instance. It is possible to customize the commands if required, but the defaults should be suitable in most cases. The defaults are set based on the options selected in the Operating System page of the wizard. Click Next to continue.

Complete Setup
On this page, you finally assign a name to the server instance. This name is used in various parts of the GUI to enable you to refer to this instance. After setting a suitable name, click Finish to save the instance.

10.6.2. Manage Server Instances Dialog
The Manage Server Instances dialog enables you to create, delete, and manage server instances. The Connection tab of the wizard enables you to select a predefined connection to use for connecting to a server to be managed. It is also possible to connect to a remote server using an SSH connection.
The **System Profile** tab of the wizard enables you to specify server-specific information. This is achieved primarily through selecting a Profile Template. A Profile Template contains standard information used in managing the server instance. The following Profile Templates are available:

- Fedora Linux (MySQL Package)
- Fedora Linux (Vendor Package)
- FreeBSD (MySQL Package)
- Generic Linux (MySQL tar package)
- Mac OS X (MySQL Package)
- OpenSolaris (MySQL Package)
- RHEL (MySQL Package)
- SLES (MySQL Package)
Manage Server Instances Dialog

- Ubuntu Linux (MySQL Package)
- Ubuntu Linux (Vendor Package)
- Windows (MySQL 5.0 Installer Package)
- Windows (MySQL 5.1 Installer Package)
- Windows (MySQL zip package)
- Custom

After you select a profile, a number of default parameters will be set, including commands used to start and stop MySQL, commands to check server status, and the location of the `my.ini` or `my.cnf` configuration file.

**Figure 10.2. Manage Server Instances Dialog**

After an instance has been created, it can be launched by double-clicking its icon in the **Server Administration** panel of the **Home** page. This creates an Admin page, which has two main panels,
10.7. Server Administration and Configuration

The Administrator functionality in MySQL Workbench is grouped into several tabs:

- **Startup**: Enables you to start and stop the MySQL server, and view the startup message log
- **Configuration**: Enables you to view and edit the MySQL Configuration file (*my.ini* or *my.cnf*) using GUI controls
- **Accounts**: Enables you to create user accounts and assign roles and privileges
- **Connections**: Displays connections to MySQL Server
- **Variables**: Displays system and status variables
- **Data Dump**: Import and export of data
- **Logs**: Displays server log file entries

The Administrator also displays system and server status. System status includes:

- CPU utilization
- Memory usage
- Connection Health

For server health, the following are displayed:

- Connection Usage
- Traffic
- Query Cache Hit Rate
- Key Efficiency
10.7.1. The Startup Tab

The Startup tab has several purposes:

- To display database server status
- To start up and shut down the server
- To display the Startup Message log
- To select whether the server starts when the system starts
The Configuration Tab

10.7.2. The Configuration Tab

The Configuration tab enables you to edit the `my.ini` or `my.cnf` configuration file by selecting check boxes and other GUI controls. This tab also features a number of subtabs, which provide access to various sub-sections within the configuration file. The subtabs are:

- General
- MyISAM
- InnoDB
- Performance
- Log Files
- Replication
- Networking
The Configuration Tab

- Security
- Advanced

General Tab

Figure 10.5. Administrator - Configuration - General Tab
Security Tab

As of MySQL Workbench 5.2.45, the Password Validation Plugin (available as of MySQL Server 5.6.6) is supported in Workbench. For information about what these settings mean, see The Password Validation Plugin.

10.7.3. The Accounts Tab

The Accounts tab has two subtabs:

- Server Access Management
- Schema Privileges

Server Access Management enables you to list existing user accounts. You can also add and delete accounts. You can allocate administrative roles and also set account limits.

Schema Privileges enables you to set specific privileges on a user basis.
10.7.3.1. Administrative Roles

To aid in assigning privileges to MySQL Server users, MySQL Workbench introduces the concept of Administrative Roles. Roles are a quick way of granting a set of privileges to a user, based on the work the user must carry out on the server. It is also possible to assign multiple roles to a user. To assign roles, click the User Account you wish to modify, then click the Administrative Roles tab. Then click the check boxes according to the roles you wish to allocate to the user. After you select a role to a user, you will see the accumulated privileges in the Global Privileges Assigned to User panel. For example, if you select the role BackupAdmin, the privileges granted include EVENT, LOCK TABLES, SELECT, SHOW DATABASES. If you also select the role of ReplicationAdmin, the list of privileges expands to include REPLICATION CLIENT, REPLICATION SLAVE and SUPER.

Note

In the current version of MySQL Workbench, it is not possible to manage privileges below the schema level. For example, it is not possible to view or manage grants at the table, column, or procedure level.
These roles are available:

- **DBA**: Grants all privileges
- **MaintenanceAdmin**: Grants privileges to maintain the server
- **ProcessAdmin**: Grants privileges to monitor and kill user processes
- **UserAdmin**: Grants privileges to create users and reset passwords
- **SecurityAdmin**: Grants privileges to manage logins and grant and revoke server privileges
- **MonitorAdmin**: Grants privileges to monitor the server
- **DBManager**: Grants privileges to manage databases
- **DBDesigner**: Grants privileges to create and reverse engineer any database schema
- **ReplicationAdmin**: Grants privileges to set up and manage replication
- **BackupAdmin**: Grants privileges required to back up databases

### 10.7.4. The Connections Tab

The Connections tab lists all current connections to the monitored server.
10.7.5. The Variables Tab

The Variables tab displays a list of all server and status variables.
10.7.6. The Data Dump Tab

The Import/Export Server Data tab enables you to create a dump file, or restore data from a dump file. Clicking the Import/Export Server Data action item launches a new Admin page, at the Data Dump tab.

Within the Data Dump tab are three further tabbed windows:

- Export to Disk
- Import from Disk
- Advanced Options

10.7.6.1. Export to Disk

The Export to Disk tab enables you to select the schema and tables to export. You also have the option to export tables to their own files, or all tables to a single file. Exporting tables to individual files enables you to restore on a per-table basis.
10.7.6.2. Import from Disk

The Import from Disk tab enables you to import a previously exported project. You can select to import a project where tables were stored in individual files. In this case, you will also be able to select which of these tables to import. You can also import a project saved to a single file.
10.7.6.3. Advanced Export Options

The Advanced Export Options tab contains a number of options to enable you to control the export operation. These options control the SQL generated during the operation.
10.7.7. The Logs Tab

The Logs tab features two subtabs:

- General
- Slow Query Log

The **General** tab shows entries from the server’s general log file.

The **Slow Query Log** tab displays entries from the server’s slow query log file.
Figure 10.13. Administrator - Logs Tab

Your current Log Destination is set to FILE.
For logs to be viewed within Workbench they must be configured to be sent to TABLE.
This option is only available in MySQL version 5.1 and newer.
For more information read http://dev.mysql.com/doc/refman/5.1/en/log-tables.html
Chapter 11. Database Migration Wizard

Table of Contents

11.1. General installation requirements ................................................................. 200
  11.1.1. ODBC Libraries ....................................................................................... 200
  11.1.2. ODBC Drivers ......................................................................................... 201
11.2. Migration Overview ......................................................................................... 201
  11.2.1. A visual guide to performing a database migration ...................................... 202
  11.2.2. Migrating from supported databases ......................................................... 212
  11.2.3. Migrating from unsupported (generic) databases ....................................... 213
11.3. Conceptual DBMS equivalents ......................................................................... 213
11.4. Microsoft SQL Server migration ....................................................................... 215
  11.4.1. Preparations .............................................................................................. 215
  11.4.2. Drivers ...................................................................................................... 215
  11.4.3. Connection Setup ....................................................................................... 216
  11.4.4. Microsoft SQL Server Type Mapping .......................................................... 216
11.5. PostgreSQL migration ...................................................................................... 218
  11.5.1. Preparations .............................................................................................. 218
  11.5.2. Drivers ...................................................................................................... 220
  11.5.3. Connection Setup ....................................................................................... 220
  11.5.4. PostgreSQL Type Mapping ......................................................................... 220
11.6. MySQL migration ............................................................................................. 222
11.7. Using the MySQL Workbench Migration Wizard .............................................. 222
  11.7.1. Connecting to the databases ...................................................................... 222
  11.7.2. Schemata Retrieval and Selection .............................................................. 222
  11.7.3. Reverse Engineering .................................................................................. 222
  11.7.4. Object Selection ....................................................................................... 222
  11.7.5. Migration .................................................................................................. 223
  11.7.6. Manual Editing ......................................................................................... 223
  11.7.7. Target Creation Options ............................................................................ 223
  11.7.8. Schema Creation ....................................................................................... 223
  11.7.9. Create Target Results .............................................................................. 223
  11.7.10. Data Migration Setup .............................................................................. 224
  11.7.11. Bulk Data Transfer .................................................................................. 224
  11.7.12. Migration Report ..................................................................................... 224
11.8. MySQL Workbench Migration Wizard FAQ .................................................... 224

MySQL Workbench provides the ability to migrate ODBC compliant databases to MySQL.

The MySQL Workbench Migration Wizard was added in MySQL Workbench 5.2.41.

• Convert (migrate) different database types, including MySQL, across servers
• Convert tables and copy data, but will not convert stored procedures, views, or triggers
• Allows customization and editing during the migration process
• Works on Linux, Mac OS X, and Microsoft Windows

This is not an exhaustive list. The following sections discuss these and additional migration capabilities.

Set up may be the most challenging aspect of using the MySQL Workbench Migration Wizard. There is the installation section, which describes setting up ODBC requirements for Linux, Mac OS X, and Microsoft Windows, and the Database Product Specific Notes section that references setup conditions for each RDBMS.
11.1. General installation requirements

The MySQL Workbench Migration Wizard uses ODBC to connect to a source database, except for MySQL. You will need the ODBC driver installed that corresponds to the database you want to migrate from. For example, PostgreSQL can be migrated with the psqlodbc ODBC driver; Microsoft SQL Server can be migrated using the native Microsoft SQL Server driver on Windows or with FreeTDS on Linux and Mac OS X.

The following diagram shows the general components involved in an ODBC connection:

![MySQL Workbench migration installation diagram]

When specifying the source RDBMS, you can either use a data source configured externally, or provide the individual connection parameters to MySQL Workbench. If you already have an ODBC Data Source configured in your system, then you can use that in MySQL Workbench.

11.1.1. ODBC Libraries

This section may be skipped when using a MySQL Workbench binary that is provided by Oracle.

An ODBC Driver Manager library must be present. Both Windows and Mac OS X provides one.

**Linux**

- **iODBC**: MySQL Workbench binaries provided by Oracle already include iODBC and no additional action is required. If you compile it yourself, you must install IODBC or unixODBC. iODBC is recommended. You can use the iODBC library provided by your distribution.

- **pyodbc**: is the Python module used by MySQL Workbench to interface with ODBC, and may be used to migrate ODBC compliant databases such as PostgreSQL and DB2. In Windows and Mac OS X, it is included with Workbench. In Linux, binaries provided by Oracle also include pyodbc.

If you’re using a self-compiled binary, make sure you have the latest version, and that it is compiled against the ODBC manager library that you chose, whether it is IODBC or unixODBC. As of version 3.0.6, pyodbc will compile against unixODBC by default. If you are compiling against IODBC then you must perform the following steps:

1. Install the development files for iODBC. Usually you just need to install the libiodbc-devel or libiodbc2-dev package provided by your distribution.

2. In the pyodbc source directory, edit the setup.py file and around line 157, replace the following line:

   ```python
   settings['libraries'].append('odbc')
   ```

   with

   ```python
   settings['libraries'].append('iodbc')
   ```
3. Execute the following command as the root user:

```bash
CFLAGS=`iodbc-config --cflags`
LDFLAGS=`iodbc-config --libs` python setup.py install
```

## 11.1.2. ODBC Drivers

For each RDBMS, you need its corresponding ODBC driver, which must also be installed on the same machine that MySQL Workbench is running on. This driver is usually provided by the RDBMS manufacturer, but in some cases they can also be provided by third party vendors or open source projects.

Operating systems usually provide a graphical interface to help set up ODBC drivers and data sources. Use that to install the driver (i.e., make the ODBC Manager "see" a newly installed ODBC driver). You can also use it to create a data source for a specific database instance, to be connected using a previously configured driver. Typically you need to provide a name for the data source (the DSN), in addition to the database server IP, port, username, and sometimes the database the user has access to.

If MySQL Workbench is able to locate an ODBC manager GUI for your system, a Plugins, Start ODBC - Administrator menu item be present under the Plugins menu as a convenience shortcut to start it.

- **Linux**: There are a few GUI utilities, some of which are included with unixODBC. Refer to the documentation for your distribution. iODBC provides `iodbcadm-gtk`. Official binaries of MySQL Workbench include it and it can be accessed through the Plugins, Start ODBC Administrator menu item.

- **Mac OS X**: You can use the ODBC Administrator tool, which is provided as a separate download from Apple. If the tool is installed in the /Applications/Utilities folder, you can start it through the Plugins, Start ODBC Administrator menu item.

- **Microsoft Windows**: You can use the Data Sources (ODBC) tool under Administrative Tools. And it can be started through the Plugins, Start ODBC Administrator menu item.

### ODBC Driver architecture

Since the ODBC driver needs to be installed in the client side, you will need an ODBC driver that supports your clients operating system and architecture. For example, if you are running MySQL Workbench from Linux x64, then you need a Linux x64 ODBC driver for your RDBMS. In Mac OS X, MySQL Workbench is built as a 32-bit application, so you need the 32-bit drivers.

## 11.2. Migration Overview

The Migration Wizard performs the following steps when migrating a database to MySQL:

1. Connects to the source RDBMS and retrieves a list of available databases/schemas.

2. Reverse engineers selected database/schemas into a internal representation specific to the source RDBMS. This step will also perform the renaming of objects/schemas depending on the type of object name mapping method that is chosen.

3. Automatically migrates the source RDBMS objects into MySQL specific objects.
   a. Target schema objects are created.
   b. Target table objects are created.
      i. Columns for each table are copied.
         A. Datatypes are mapped to MySQL datatypes.
         B. Default values are mapped to a MySQL supported default value, if possible.
ii. Indexes are converted.

iii. Primary Keys are converted.

iv. Triggers are copied, and commented out if the source is not MySQL.

c. Foreign Keys for all tables (of all schemas) are converted.

d. View objects are copied, and commented out if the source is not MySQL.

e. Stored Procedure and Function objects are copied, and commented out if the source is not MySQL.

4. Provides an opportunity to review the changes, for editing and correcting errors in the migrated objects.

5. Creates the migrated objects in the target MySQL server. If there are errors, you can return to the previous step and correct them, and retry the target creation.

6. Copy data of the migrated tables from the source RDBMS to MySQL.

MySQL Workbench provides support for migrating from some specific RDBMS products. The Migration Wizard will provide the best results when migrating from such products. However, in some cases, other unsupported database products can also be migrated by using its Generic database support, as long as you have an ODBC driver for it. In this case, the migration will be less automatic, but should still work nonetheless.

11.2.1. A visual guide to performing a database migration

This example will migrate a Microsoft SQL Server database to MySQL, and include a screenshot for each step.

From MySQL Workbench, choose **Database, Migrate** to open the migration wizard. The opening screen will look like this:

Overview

Figure 11.2. MySQL Workbench migration: Overview
A visual guide to performing a database migration

It describes the prerequisites and requirements that should be understood before proceeding further. The Open ODBC Administrator option will load `odbcad32.exe`, and is used to confirm that the ODBC Driver for SQL Server is installed, and to make configuration changes if needed.

Click **Start Migration** to continue.

**Source Selection**

The source is the RDBMS that will be migrated to MySQL. Define the connection parameters and related information here by first choosing the **Database System**, as the other parameters will change accordingly to this choice.

**Figure 11.3. MySQL Workbench migration: Source Selection (Parameters)**

The optional **Store connection** option will save the connection details. It must be set before proceeding to the next step by clicking **Next**.

**Target Selection**

The target is the MySQL database that will contain the newly migrated database. The current Workbench MySQL connections will be available here, or you can choose **Manage DB Connections** to create a new connection.
Fetch Schemata List

The Schemata list is retrieved from both the source and target RDBMS. This is an automated and informational step that reports connection related errors and/or general log information. Press Next to continue.

Schemata Selection

Choose the schemata you want to migrate.
“Schema Name Mapping Method” options while migrating Microsoft SQL Server:

- **Keep schemata as they are**: Catalog.Schema.Table -> Schema.Table: This will create multiple databases, one per schema.
- **Only one schema**: Catalog.Schema.Table -> Catalog.Table: Merges each schema into a single database.
- **Only one schema, keep current schema names as a prefix**: Catalog.Schema.Table -> Catalog.Schema_table: Preserves the schema name as a prefix.

**Figure 11.6. MySQL Workbench migration: Schemata Selection**

**Reverse Engineer Source**

The source metadata is fetched from the source RDBMS, and reverse engineered. This is an automated and informational step that reports related errors and/or general log information. View the logs and then press Next to continue.
Source Objects

The discovered objects from the **Reverse Engineer Source** stage are revealed and made available. This includes Table, View, and Routine objects, with only the Table objects being selected by default.
Migration

The migration process now converts the selected objects into MySQL compatible objects. View the logs and then proceed.

Figure 11.9. MySQL Workbench migration: Migration

Manual Editing

There are three sections to edit here, which are selected via the View select box on the top right. The Show Code and Messages button is available with every view, and it will show the generated MySQL code that corresponds to the selected object.

- **Migration Problems**: This will either report problems or display "No mapping problems found." It is an informational screen.

- **All Objects**: An object view that allows you to view and edit the object definitions. Double-click on a row to modify a target objects name.

- **Column Mappings**: Shows all of the table column mappings, and allows you to individually review and fix the mapping for all column types, default values, and other attributes.
Figure 11.10. MySQL Workbench migration: Manual Editing (All Objects)

Figure 11.11. MySQL Workbench migration: Manual Editing (Column Mappings)

Target Creation Options

The schema may be created by either adding it to the target RDBMS, creating an SQL script file, or both.
Create Schemata

Now the schemata is created. The complete log is also available here.

Create Target Results

The generated objects are listed here, along with the error messages if any exist.

The migration code may also be viewed and edited here. To make changes, select an object, edit the query code, and press Apply. Repeat this process for each object that will be edited. And then, press Recreate Objects to save the results.
A visual guide to performing a database migration

Note
The **Recreate Objects** operation is required to save any changes here. It will then execute the previous migration step (**Create Schemata**) with the modified code, and then continue the migration process. This also means that the previously saved schema will be dropped.

Figure 11.14. MySQL Workbench migration: Create Target Results

Data Transfer Setup

The next steps involve transferring data from the source RDBMS to the target MySQL database. The setup screen includes the following options:

**Data Copy:**
- Online copy of table data to target RDBMS: This (default) will copy the data to the target RDBMS.
- Create a batch file to copy the data at another time: The data may also be dumped to a file that can be executed at a later time, or be used as a backup.

**Options:**
- Truncate target tables before copying data: In case the target database already exists, this will delete said data.
- Worker tasks: The default value is 2. This is the number of tasks (database connections) used while copying the data.
- Enable debug output for table copy: Shows debugging information.
Bulk Data Transfer

And now the data is transferred to the target RDBMS. Optionally, view the logs to confirm.

Migration Report

And finally, the migration report is available and summarizes the entire migration process.
Pressing Finish will close the migration window. The database may now be viewed within the MySQL Workbench SQL editor.

If a MySQL Workbench SQL Editor tab is already opened, then the schema list within the Object Browser must be refreshed in order to view the newly imported schema.

### 11.2.2. Migrating from supported databases

When a supported RDBMS product is being migrated, the MySQL Workbench Migration Wizard will automatically convert as much information as it can, but you may still be required to manually edit the automatically migrated schema for difficult cases, or when the default mapping is not as desired.

Generally speaking, only table information and its data are automatically converted to MySQL. Code objects such as views, stored procedures, and triggers, are not. But supported RDBMS products will be retrieved and displayed in the wizard. You can then manually convert them, or save them for converting at a later time.

The following RDBMS products and versions are currently tested and supported by the MySQL Workbench Migration Wizard, although other RDBMS products can also be migrated with Section 11.2.3, “Migrating from unsupported (generic) databases”

- Microsoft SQL Server 2000
- Microsoft SQL Server 2005
- Microsoft SQL Server 2008
- Microsoft SQL Server 2012
- MySQL Server 4.1 and greater as the source, and MySQL Server 5.1 and greater as the target
- PostgreSQL 8.0 and greater
• Sybase Adaptive Server Enterprise 15.x and greater

11.2.3. Migrating from unsupported (generic) databases

Most ODBC compliant databases may be migrated using the generic database support. In this case, code objects will not be retrieved from the source database; only tables and data.

When using the generic support, column datatypes are mapped using the following steps:

1. It searches for the first entry in the Generic Datatype Mapping Table for the source type name. If the length/scale ranges of the entry matches the source column, it will pick that type. Otherwise, it continues searching.

2. If no matches were found in the generic table, then it tries to directly map the source type to a MySQL type of the same name.

3. If the source type name doesn't match any of the MySQL datatypes, then it will not be converted and an error is logged. You can then manually specify the target datatype in the Manual Object Editing step of the wizard.

11.3. Conceptual DBMS equivalents

Table 11.1. Conceptual equivalents between supported DBMS products and MySQL

<table>
<thead>
<tr>
<th>Concept</th>
<th>MS SQL Server</th>
<th>Sybase ASE</th>
<th>PostgreSQL</th>
<th>MySQL</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authentication</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Auto_Increment</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>PostgreSQL uses sequences for Auto_Increment.</td>
</tr>
<tr>
<td>Backup</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>See MySQL Enterprise Backup</td>
</tr>
<tr>
<td>Catalog</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>You can map a catalog into a schema and drop the , use the owner as the schema name or merge the owner and object name together. ownerobject</td>
</tr>
<tr>
<td>Constraints</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Data Dictionary</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Database</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Database Instance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dump</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>mysqldump</td>
</tr>
<tr>
<td>Events</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Foreign Keys</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Full Text Search</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>In InnoDB as of MySQL Server 5.6, and in all versions of MyISAM</td>
</tr>
<tr>
<td>Index</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Information Schema</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Object Names Case Sensitivity</td>
<td>Depends on collation</td>
<td>Depends on collation</td>
<td>Mixed</td>
<td>Mixed</td>
<td>MySQL: sensitivity of database, table, and trigger names OS dependent; other object names are case insensitive. PostgreSQL: as specified in the SQL-99 standard, unquoted object names are treated as case insensitive while quoted object names are case sensitive.</td>
</tr>
<tr>
<td>Concept</td>
<td>MS SQL Server</td>
<td>Sybase ASE</td>
<td>PostgreSQL</td>
<td>MySQL</td>
<td>Note</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------</td>
<td>------------</td>
<td>-------------</td>
<td>-------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Object Naming Conventions</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Unlike the standard, unquoted object names are converted to lowercase instead of uppercase.</td>
</tr>
<tr>
<td>Packages</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Partitioning</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Performance Schema</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Permissions</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Primary Key</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Referential Integrity</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Sybase ASE: referential integrity only through triggers.</td>
</tr>
<tr>
<td>Replication</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Role</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>Roles are not available in MySQL at the database level.</td>
</tr>
<tr>
<td>Schema</td>
<td>Yes</td>
<td>Yes*</td>
<td>Yes</td>
<td>Yes</td>
<td>Equivalent to database in MySQL. Sybase ASE: Schemata corresponds to user names.</td>
</tr>
<tr>
<td>Sequences</td>
<td>Yes*</td>
<td>Yes*</td>
<td>Yes</td>
<td>Yes*</td>
<td>Standalone sequence objects are not supported in MySQL. Similar functionality can be obtained with IDENTITY columns in MSSQL and AUTO_INCREMENT columns in MySQL</td>
</tr>
<tr>
<td>SQL Modes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td>SET_ANSI_* in MSSQL</td>
</tr>
<tr>
<td>Storage Engines</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes*</td>
<td>Yes</td>
<td>PostgreSQL itself supports and uses only one storage engine (Postgresql). Other companies have added extra storage engines to PostgreSQL.</td>
</tr>
<tr>
<td>Stored Procedures</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Synonyms</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Table</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Tablespace</td>
<td>Yes</td>
<td>Yes*</td>
<td>Yes</td>
<td>N/A</td>
<td>MSSQL groups tables in schemata (unless referring to CREATE TABLESPACE). Sybase ASE: tables are grouped in schemata which are more like user names.</td>
</tr>
<tr>
<td>Temporary Tables</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Transactions</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Triggers</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>UDFs</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Unicode</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Unique Key</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>User</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Views</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
Handling Microsoft SQL Server and MySQL structural differences

A Microsoft SQL Server database is made up of one catalog and one or more schemata. MySQL only supports one schema for each database (or rather, a MySQL database is a schema) so this difference in design must be planned for. The Migration Wizard must know how to handle the migration of schemata for the source (Microsoft SQL Server) database. It can either keep all of the schemata as they are (the Migration Wizard will create one database per schema), or merge them into a single MySQL database. Additional configure options include: either remove the schema names (the Migration Wizard will handle the possible name collisions that may appear along the way), and an option to add the schema name to the database object names as a prefix.

11.4. Microsoft SQL Server migration

Introduction.

The MySQL Workbench Migration Wizard is tested against the following Microsoft SQL Server versions: 2000, 2005, 2008, and 2012.

11.4.1. Preparations

To be able to migrate from Microsoft SQL Server, ensure the following:

• The source SQL Server instance is running, and accepts TCP connections

• You know the IP and port of the source SQL server instance. If you will be migrating using a Microsoft ODBC driver for SQL Server (the default in Windows), you will need to know the host and the name of the SQL Server instance.

• Make sure that the SQL Server is reachable from where you will be running MySQL Workbench. More specifically, check the firewall settings.

• Make sure that the account you will use has proper privileges to the database that will be migrated.

11.4.2. Drivers

General thoughts on the topic.

11.4.2.1. Windows

Microsoft Windows XP or newer includes an ODBC driver for Microsoft SQL Server, so there are no additional actions required.

11.4.2.2. Linux

Setting up drivers on Linux.

FreeTDS

FreeTDS version 0.92 or greater is required. Note that many distributions ship older versions of FreeTDS, so it may need to be installed separately. Additionally, the FreeTDS version provided by distributions may also be compiled for the wrong ODBC library (usually to unixODBC instead of iODBC, which MySQL Workbench uses). Because of that you will probably need to build this library yourself.

Important: using FreeTDS with iODBC

When compiling FreeTDS for use with iODBC (the default with the official binaries), you must compile it with the --enable-odbc-wide command line option for the configure script. Failing to do so will result in crashes and other unpredictable errors.
A script is provided to compile FreeTDS using the options required for MySQL Workbench. You can find it in the `/usr/share/mysql-workbench/extras/build_freetds.sh` directory in Linux or `MySQLWorkbench.app/Contents/SharedSupport/build_freetds.sh` folder in the Mac. To use it, follow these steps:

1. Make sure you have the iODBC headers installed. In Linux, install the `libiodbc-devel` or `libiodbc2-dev` package from your distribution. In Mac OS X, the headers come with the system and no additional action is required for this step.

2. `mkdir ~/freetds` to create a directory - within the users home directory.

3. Copy the `build_freetds.sh` script to `~/freetds`.

4. Get the latest FreeTDS sources from `ftp://ftp.freetds.org/pub/freetds/` and place it in the `~/freetds` directory. Make sure to get version 0.92 or newer.

5. `cd ~/freetds`


7. After compilation is done, install it using `make install` from the path given by the script.

8. Install the driver in the ODBC Administrator, to make the ODBC subsystem to recognize it. The name of the driver file is `libtdsodbc.so` and is located in `/usr/lib` or `/usr/local/lib`.

Once the driver is installed, you should be able to create data sources for it from the ODBC Administrator GUI.

### Protocol version selection in FreeTDS

When using FreeTDS, `TDS_VERSION=7.0` is needed in the connection string. If you pick a FreeTDS specific connection method option in the connection dialog, that option is added to the connection string automatically.

#### 11.4.2.3. Mac OS X

See the FreeTDS setup notes for Linux.

#### 11.4.3. Connection Setup

Using an ODBC DataSource

Using Connection Parameters

#### 11.4.4. Microsoft SQL Server Type Mapping

<table>
<thead>
<tr>
<th>Source Type</th>
<th>MySQL Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>INT</td>
<td>INT</td>
<td></td>
</tr>
<tr>
<td>TINYINT</td>
<td>TINYINT</td>
<td>UNSIGNED flag set in MySQL</td>
</tr>
<tr>
<td>SMALLINT</td>
<td>SMALLINT</td>
<td></td>
</tr>
<tr>
<td>BIGINT</td>
<td>BIGINT</td>
<td></td>
</tr>
<tr>
<td>BIT</td>
<td>TINYINT(1)</td>
<td></td>
</tr>
<tr>
<td>FLOAT</td>
<td>FLOAT</td>
<td>Precision value is used for storage size in both</td>
</tr>
<tr>
<td>REAL</td>
<td>FLOAT</td>
<td></td>
</tr>
<tr>
<td>NUMERIC</td>
<td>DECIMAL</td>
<td></td>
</tr>
<tr>
<td>DECIMAL</td>
<td>DECIMAL</td>
<td></td>
</tr>
<tr>
<td>MONEY</td>
<td>DECIMAL</td>
<td></td>
</tr>
<tr>
<td>Source Type</td>
<td>MySQL Type</td>
<td>Comment</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>SMALLMONEY</td>
<td>DECIMAL</td>
<td></td>
</tr>
<tr>
<td>CHAR</td>
<td>CHAR/LONGTEXT</td>
<td>Depending on its length. MySQL Server 5.5 and above can have CHAR columns with a length up to 255 characters. Anything larger is migrated as LONGTEXT</td>
</tr>
<tr>
<td>NCHAR</td>
<td>CHAR/LONGTEXT</td>
<td>Depending on its length. MySQL Server 5.5 and above can have VARCHAR columns with a length up to 65535 characters. Anything larger is migrated to one of the TEXT blob types. In MySQL, character set of strings depend on the column character set instead of the datatype.</td>
</tr>
<tr>
<td>VARCHAR</td>
<td>VARCHAR/ MEDIUMTEXT/ LONGTEXT</td>
<td></td>
</tr>
<tr>
<td>NVARCHAR</td>
<td>VARCHAR/ MEDIUMTEXT/ LONGTEXT</td>
<td>Depending on its length. MySQL Server 5.5 and above can have VARCHAR columns with a length up to 65535 characters. Anything larger is migrated to one of the TEXT blob types. In MySQL, character set of strings depend on the column character set instead of the datatype.</td>
</tr>
<tr>
<td>DATE</td>
<td>DATE</td>
<td></td>
</tr>
<tr>
<td>DATETIME</td>
<td>DATETIME</td>
<td></td>
</tr>
<tr>
<td>DATETIME2</td>
<td>DATETIME</td>
<td>Date range in MySQL is '1000-01-01 00:00:00' to '9999-12-31 23:59:59'. Note: fractional second values are only stored as of MySQL Server 5.6.4</td>
</tr>
<tr>
<td>SMALLDATETIME</td>
<td>DATETIME</td>
<td></td>
</tr>
<tr>
<td>DATETIMEOFFSET</td>
<td>DATETIME</td>
<td></td>
</tr>
<tr>
<td>TIME</td>
<td>TIME</td>
<td></td>
</tr>
<tr>
<td>TIMESTAMP</td>
<td>TIMESTAMP</td>
<td></td>
</tr>
<tr>
<td>ROWVERSION</td>
<td>TIMESTAMP</td>
<td></td>
</tr>
<tr>
<td>BINARY</td>
<td>BINARY/ MEDIUMBLOB/ LONGBLOB</td>
<td>Depending on its length</td>
</tr>
<tr>
<td>VARBINARY</td>
<td>VARBINARY/ MEDIUMBLOB/ LONGBLOB</td>
<td>Depending on its length</td>
</tr>
<tr>
<td>TEXT</td>
<td>VARCHAR/ MEDIUMTEXT/ LONGTEXT</td>
<td>Depending on its length</td>
</tr>
<tr>
<td>NTEXT</td>
<td>VARCHAR/ MEDIUMTEXT/ LONGTEXT</td>
<td>Depending on its length</td>
</tr>
<tr>
<td>IMAGE</td>
<td>TINYBLOB/ MEDIUMBLOB/ LONGBLOB</td>
<td>Depending on its length</td>
</tr>
<tr>
<td>SQL_VARIANT</td>
<td>not migrated</td>
<td>There is not specific support for this datatype.</td>
</tr>
<tr>
<td>TABLE</td>
<td>not migrated</td>
<td>There is not specific support for this datatype.</td>
</tr>
</tbody>
</table>
### 11.5. PostgreSQL migration

Native support for PostgreSQL 8.x and 9.x was added in MySQL Workbench 5.2.44. MySQL Workbench versions prior to this would migrate PostgreSQL using the generic migration support.

#### 11.5.1. Preparations

Before proceeding, you will need the following:

- Follow the installation guide for installing iODBC on your system. For more information, see Section 11.1, “General installation requirements”.
- Access to a running PostgreSQL instance with privileges to the database you want to migrate, otherwise known as the "source database." The Migration Wizard officially supports PostgreSQL 8.0 and above, although older versions may work.
- Access to a running MySQL Server instance with privileges to the database you want to migrate. The Migration Wizard officially supports MySQL 5.0 and above.
- MySQL Workbench 5.2.44 or newer.

##### 11.5.1.1. Microsoft Windows

Download and install the MSI package for psqlODBC. Choose the newest file from http://www.postgresql.org/ftp/odbc/versions/msi/, which will be at the bottom of the downloads page. This will install psqlODBC on your system and allow you to migrate from PostgreSQL to MySQL using MySQL Workbench.

##### 11.5.1.2. Linux

After installing iODBC, proceed to install the PostgreSQL ODBC drivers.

Download the psqlODBC source tarball file from http://www.postgresql.org/ftp/odbc/versions/src/. Use the latest version available for download, which will be at the bottom of the downloads page. The file will look similar to psqlodbc-09.01.0200.tar.gz. Extract this tarball to a temporary location, open a terminal, and cd into that directory. The installation process is:

```
shell> cd the/src/directory
shell> ./configure --with-iodbc --enable-pthreads
shell> make
shell> sudo make install
```

Verify the installation by confirming that the file psqlodbcw.so is in the /usr/local/lib directory.

Next, you must register your new ODBC Driver.

Open the iODBC Data Source Administrator application by either executing iodbcadm-gtk in the command-line, or by launching it from the Overview page of the MySQL Workbench Migration Wizard by clicking the Open ODBC Administrator button.

Go to the ODBC Drivers tab in the iODBC Data Source Administrator. It should look similar to:

<table>
<thead>
<tr>
<th>Source Type</th>
<th>MySQL Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIERARCHYID</td>
<td>not migrated</td>
<td>There is not specific support for this datatype.</td>
</tr>
<tr>
<td>UNIQUEIDENTIFIER</td>
<td>VARCHAR(64)</td>
<td>A unique flag set in MySQL. There is not specific support for inserting unique identifier values.</td>
</tr>
<tr>
<td>SYSNAME</td>
<td>VARCHAR(160)</td>
<td></td>
</tr>
<tr>
<td>XML</td>
<td>TEXT</td>
<td></td>
</tr>
</tbody>
</table>
Click Add a driver then fill out the form with the following values:

- **Description of the driver**: psqlODBC
- **Driver file name**: /usr/local/lib/psqlodbcw.so
- **Setup file name**: No value is needed here

And lastly, clicking OK will complete the psqlODBC driver registration.

### 11.5.1.3. Mac OS X

To compile psqlODBC on Mac OS X, you will need to have Xcode and its "Command Line Tools" component installed on your system, as this includes the required gcc compiler. Xcode is free, and available from the AppStore. And after installing Xcode, open it and go to Preferences, Downloads, Components, and then install the "Command Line Tools" component.
Drivers

Download the psqlODBC source tarball file from http://www.postgresql.org/ftp/odbc/versions/src/. Use the latest version available for download, which will be at the bottom of the downloads page. The file will look similar to psqlodbc-09.01.0200.tar.gz. Extract this tarball to a temporary location, open a terminal, and cd into that directory. The installation process is:

```shell
shell> cd the/src/directory
shell> ./configure --with-iodbc --enable-pthreads
shell> CFLAGS="-arch i386 -arch x86_64" make
shell> sudo make install
```

11.5.2. Drivers

If you are compiling psqlodbc, first configure with the --without-libpq option.

11.5.3. Connection Setup

After loading the Migration Wizard, click on the Start Migration button in the Overview page to begin the migration process. You will first connect to the source PostgreSQL database. Here you will provide the information about the PostgreSQL RDBMS that you are migrating from, the ODBC driver that will be used for the migration, and all of the parameters required for the connection. The name of the ODBC driver is the one you set up when you registered your psqlODBC driver with the driver manager.

Opening the Database System dropdown will reveal each RDBMS that is supported on your system. Select PostgreSQL from the list. Below that is the Stored Connection dropdown, which is optional. Stored connections will be listed here, which are connections saved after defining a connection with the Store connection for future use as checkbox enabled.

The three Connection Method options are:

- **ODBC (manually entered parameters)**: Each parameter, like a username, is defined separately
- **ODBC Data Source**: For pre-configured data sources (DSN)
- **ODBC (direct connection string)**: A full ODBC connection string

**Note**: The psqlODBC driver does not allow a connection without specifying a database name.

The migration process is similar to other databases. See Section 11.5.4, “PostgreSQL Type Mapping” for information on how the migration wizard migrates types from PostgreSQL to MySQL, and Section 11.2.1, “A visual guide to performing a database migration” for a general migration guide.

11.5.4. PostgreSQL Type Mapping

<table>
<thead>
<tr>
<th>Source Type</th>
<th>MySQL Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>INT</td>
<td>INT</td>
<td></td>
</tr>
<tr>
<td>SMALLINT</td>
<td>SMALLINT</td>
<td></td>
</tr>
<tr>
<td>BIGINT</td>
<td>BIGINT</td>
<td></td>
</tr>
<tr>
<td>SERIAL</td>
<td>INT</td>
<td>Sets AUTO_INCREMENT in its table definition.</td>
</tr>
<tr>
<td>SMALLSERIAL</td>
<td>SMALLINT</td>
<td>Sets AUTO_INCREMENT in its table definition.</td>
</tr>
<tr>
<td>BIGSERIAL</td>
<td>BIGINT</td>
<td>Sets AUTO_INCREMENT in its table definition.</td>
</tr>
<tr>
<td>BIT</td>
<td>BIT</td>
<td></td>
</tr>
<tr>
<td>BOOLEAN</td>
<td>TINYINT(1)</td>
<td></td>
</tr>
<tr>
<td>REAL</td>
<td>FLOAT</td>
<td></td>
</tr>
<tr>
<td>Source Type</td>
<td>MySQL Type</td>
<td>Comment</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>DOUBLE PRECISION</td>
<td>DOUBLE</td>
<td></td>
</tr>
<tr>
<td>NUMERIC</td>
<td>DECIMAL</td>
<td></td>
</tr>
<tr>
<td>DECIMAL</td>
<td>DECIMAL</td>
<td></td>
</tr>
<tr>
<td>MONEY</td>
<td>DECIMAL(19,2)</td>
<td></td>
</tr>
<tr>
<td>CHAR</td>
<td>CHAR/LONGTEXT</td>
<td>Depending on its length. MySQL Server 5.5 and above can have CHAR columns with a length up to 255 characters. Anything larger is migrated as LONGTEXT</td>
</tr>
<tr>
<td>NATIONAL CHARACTER</td>
<td>CHAR/LONGTEXT</td>
<td>Depending on its length. MySQL Server 5.5 and above can have VARCHAR columns with a length up to 65535 characters. Anything larger is migrated to one of the TEXT blob types. In MySQL, character set of strings depend on the column character set instead of the datatype.</td>
</tr>
<tr>
<td>VARCHAR</td>
<td>VARCHAR/ MEDIUMTEXT/ LONGTEXT</td>
<td>Depending on its length. MySQL Server 5.5 and above can have VARCHAR columns with a length up to 65535 characters. Anything larger is migrated to one of the TEXT blob types.</td>
</tr>
<tr>
<td>NATIONAL CHARACTER VARYING</td>
<td>VARCHAR/ MEDIUMTEXT/ LONGTEXT</td>
<td>Depending on its length. MySQL Server 5.5 and above can have VARCHAR columns with a length up to 65535 characters. Anything larger is migrated to one of the TEXT blob types. In MySQL, character set of strings depend on the column character set instead of the datatype.</td>
</tr>
<tr>
<td>DATE</td>
<td>DATE</td>
<td></td>
</tr>
<tr>
<td>TIME</td>
<td>TIME</td>
<td></td>
</tr>
<tr>
<td>TIMESTAMP</td>
<td>DATETIME</td>
<td></td>
</tr>
<tr>
<td>INTERVAL</td>
<td>TIME</td>
<td></td>
</tr>
<tr>
<td>BYTEA</td>
<td>LONGBLOB</td>
<td></td>
</tr>
<tr>
<td>TEXT</td>
<td>LONGTEXT</td>
<td></td>
</tr>
<tr>
<td>CIDR</td>
<td>VARCHAR(43)</td>
<td></td>
</tr>
<tr>
<td>INET</td>
<td>VARCHAR(43)</td>
<td></td>
</tr>
<tr>
<td>MACADDR</td>
<td>VARCHAR(17)</td>
<td></td>
</tr>
<tr>
<td>UUID</td>
<td>VARCHAR(36)</td>
<td></td>
</tr>
<tr>
<td>XML</td>
<td>LONGTEXT</td>
<td></td>
</tr>
<tr>
<td>JSON</td>
<td>LONGTEXT</td>
<td></td>
</tr>
<tr>
<td>TSVVECTOR</td>
<td>LONGTEXT</td>
<td></td>
</tr>
<tr>
<td>TQUERY</td>
<td>LONGTEXT</td>
<td></td>
</tr>
<tr>
<td>ARRAY</td>
<td>LONGTEXT</td>
<td></td>
</tr>
<tr>
<td>POINT</td>
<td>VARCHAR</td>
<td></td>
</tr>
<tr>
<td>LINE</td>
<td>VARCHAR</td>
<td></td>
</tr>
<tr>
<td>LSEG</td>
<td>VARCHAR</td>
<td></td>
</tr>
<tr>
<td>BOX</td>
<td>VARCHAR</td>
<td></td>
</tr>
<tr>
<td>PATH</td>
<td>VARCHAR</td>
<td></td>
</tr>
<tr>
<td>POLYGON</td>
<td>VARCHAR</td>
<td></td>
</tr>
</tbody>
</table>
11.6. MySQL migration

Introduction

Notes about copying MySQL, and what you can do with it.

11.7. Using the MySQL Workbench Migration Wizard

Introduction, and general usage notes.

11.7.1. Connecting to the databases

A connection is made to the source and target database servers.

Source Connection Setup

The Source Connection offers the MySQL, Microsoft SQL Server, and Generic RDBMS database system options. This selection determines the available Parameters and Advanced configuration options.

This connection definition may be saved using the Store connection for future use as option, and there is also the Test Connection option.

Target Connection Setup

The MySQL Server that will be home to the newly migrated database.

11.7.2. Schemata Retrieval and Selection

General thoughts.

Fetch Schemata List

The names of available schemas will be retrieved from the source RDBMS. The account used for the connection will need to have appropriate privileges for listing and reading the schemas you want to migrate. Target RDBMS connection settings will also be validated.

The steps that are performed include: connects to the source DBMS, checks the connection, and retrieves the schema list from the source.

Schemata Selection

Select the schemata that you want to migrate.

11.7.3. Reverse Engineering

This is an automated step, where the actions include: Connect to the source DBMS, Reverse engineer the selected schemata, and perform post-processing if needed.

11.7.4. Object Selection

By default, all table objects will be migrated. Use the Show Selection button in order to disable individual table objects from being migrated.
11.7.5. Migration

Reverse engineered objects from the source RDBMS will be automatically converted to MySQL compatible objects. Default datatype and default column value mappings will be used. You will be able to review and edit the generated objects and column definitions in the next step, which is Section 11.7.6, “Manual Editing”.

The steps performed include Migrating the selected objects, and generating the SQL CREATE statements.

11.7.6. Manual Editing

The migrated objects may be reviewed and edited here. You can manually edit the generated SQL before applying them to the target database. Target schemas and tables may be renamed, and column definitions may be changed, by double-clicking on them.

By default, the All Objects View is loaded. Other View options include Migration Problems and Column Mappings.

- All Objects: Shows all objects, which can also be edited by double-clicking.
- Migration Problem: Will list all of the migration problems, or report that no mapping problems were found.
- Column Mappings: Displays all of the schema columns, which may also be edited. There is an advanced Show Code and Messages option that displays the SQL CREATE script for the selected object.

11.7.7. Target Creation Options

Defines addition settings for the target schema.

Configuration options include:

- Create schema in target RDBMS:
- Create a SQL script file:
- An option to keep the schemata if they already exist. Objects that already exist will not be recreated or update.

11.7.8. Schema Creation

The SQL scripts generated for the migrated schema objects will now be executed in the target database. You can monitor execution in the logs, if errors exist then they will be fixed in the next step. Table data will be migrated in a later step as well.

This is an automated step, where the actions include: Create Script File, Connect to Target Database, and Create Schemata and Objects.

11.7.9. Create Target Results

Scripts to create the target schemas were executed, but the data has not yet been migrated. This step allows reviewing a creation report. If there are any errors, then you can manually fix the scripts and click Recreate Objects to retry the schema creation or return to the Manual Editing page to correct them there, and then retry the target creation.

To edit, first select the object, and then the SQL CREATE Script will be shown for the selected object. Edit it there, then press Apply to save.
11.7.10. **Data Migration Setup**

Provides additional options for data transfer, including the ability to set up a script to automate this transfer in the future.

11.7.11. **Bulk Data Transfer**

The transfer is executed here.

11.7.12. **Migration Report**

Displays the final report, that can be reviewed to ensure a proper migration was executed.

11.8. **MySQL Workbench Migration Wizard FAQ**

Frequently Asked Questions with answers.

**Questions**

- **11.8.1:** While using the Postgresql psqodbc driver, I see the following error: ('08001', '08001] Already connected. (202) (SQLDriverConnect)')

**Questions and Answers**

11.8.1: While using the Postgresql psqodbc driver, I see the following error: ('08001', '08001] Already connected. (202) (SQLDriverConnect)')

This means that PostgreSQL is not configured to accept connections from the source IP.
Chapter 12. Extending Workbench

Table of Contents

12.1. GRT and Workbench Data Organization ................................................................. 225
12.2. Modules ................................................................................................................... 226
12.3. Plugins .................................................................................................................. 227
12.4. Adding a GUI to a Plugin Using MForms ................................................................. 228
12.5. The Workbench Scripting Shell .............................................................................. 229
  12.5.1. Exploring the Workbench Scripting Shell ...................................................... 229
  12.5.2. The Shell Window ............................................................................................. 230
  12.5.3. The Files, Globals, Classes, and Modules Tabs .............................................. 230
12.6. Tutorial: Writing Plugins ....................................................................................... 231

MySQL Workbench provides an extension and scripting system that enables the developer to extend MySQL Workbench capabilities. While the core of MySQL Workbench is developed using C++, it is possible to harness this core functionality using both the Lua and Python scripting languages. MySQL Workbench also provides access to a cross-platform GUI library, MForms, which enables the creation of extensions that feature a graphical user interface.

The extension system enables the following capabilities:

- Automate common tasks
- Extend the Workbench user-interface
- Create plugins (code which can be invoked from the Workbench menu system)
- Manipulate schemata
- Create custom Workbench features

12.1. GRT and Workbench Data Organization

The GRT, or Generic RunTime, is the internal system used by Workbench to hold model document data. It is also the mechanism by which Workbench can interact with Modules and Plugins. Workbench model data, such as diagrams, schemata, and tables, is stored in a hierarchy of objects that can be accessed by any plugin. The information is represented using standard data types: integers, doubles, strings, dicts, lists, and objects.

The GRT can be accessed using external scripting languages such as Lua and Python. Awareness is required of how the GRT data types map into the scripting language. In Python, for example, the GRT integer, double, and string data types are seen as corresponding Python data types. Lists and dicts are kept in their internal representation, but can generally be treated as Python lists and dicts, and accessed in the usual way. Objects contain data fields and methods, but the GRT recognizes only objects from a pre-registered class hierarchy.

It is possible to fully examine the classes contained within the GRT using the Workbench Scripting Shell. Dots in class names are changed to underscores in their Python counterparts. For example, `db.mysql.Table` becomes `db_mysql_Table` in Python.

The Application Objects Tree (GRT Tree)

As mentioned previously, Workbench document data is stored in an object hierarchy. This hierarchy is known as the GRT Tree. The GRT Tree can be accessed and modified from supported external scripting languages such as Python. Care should be taken when modifying the GRT Tree, to prevent a
mistake from leading to corruption of the document. Backups should be made before manipulating the
tree. Read-only access to the tree is the safest approach, and is sufficient in most cases.

The main nodes in the Application Object Tree

Table 12.1. The main nodes in the Application Object Tree

<table>
<thead>
<tr>
<th>Node</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>wb.registry</td>
<td>Application data such as plugin registry, list of editors, and options.</td>
</tr>
<tr>
<td>wb.customData</td>
<td>A generic dictionary for data you can use to store your own data. This dictionary is saved and reloaded with Workbench and is global (not document specific).</td>
</tr>
<tr>
<td>wb.options</td>
<td>Contains some default options that are used by Workbench.</td>
</tr>
<tr>
<td>wb.rdbmsMgmt</td>
<td>Internal registry of supported RDBMS modules, known data types.</td>
</tr>
<tr>
<td>wb.doc</td>
<td>The currently loaded model document.</td>
</tr>
<tr>
<td>wb.doc.physicalModels[0]</td>
<td>The currently loaded model object, containing the database catalog and diagrams.</td>
</tr>
<tr>
<td>wb.doc.physicalModels[0].catalog</td>
<td>The database catalog for the model. Contains the list of schemata.</td>
</tr>
<tr>
<td>wb.doc.physicalModels[0].catalog.schemata</td>
<td>List of schemata in the model. Individual schema can be accessed as a list: schemata[0], schemata[1] ...</td>
</tr>
<tr>
<td>wb.doc.physicalModels[0].catalog.schemata[0].tables (views, routines, ...)</td>
<td>Lists of tables, views, routines in the schema.</td>
</tr>
<tr>
<td>wb.doc.physicalModels[0].diagrams</td>
<td>List of EER diagrams in the model.</td>
</tr>
<tr>
<td>wb.doc.physicalModels[0].diagrams[0].figures (layers, connections, ...)</td>
<td>List of figures, layers, connections (relationships) in the diagram.</td>
</tr>
</tbody>
</table>

12.2. Modules

In the GRT Modules are libraries containing a list of functions that are exported for use by code in other modules, scripts, or Workbench itself. Modules can currently be written in C++, Lua, or Python, but the data types used for arguments and the return value must be GRT types.

GRT modules are similar to Python modules, but are imported from the built-in grt module, instead of directly from an external file. The list of modules loaded into the grt module is obtained from grt.modules. Modules can be imported in Python using statements such as `from grt.modules import WbModel`.

To export functions as a module from Python code, you must carry out the following steps:

1. The source file must be located in the user modules folder. This path is displayed in the Workbench Scripting Shell with the label **Looking for user plugins in...** It is also possible to install the file using the main menu item **Scripting**, Install Plugin/Module File.

2. The source file name must have the extension `_grt.py`; for example, `my_module_grt.py`.

3. Some module metadata must be defined. This can be done using the DefineModule function from the wb module:

```python
from wb import *
```
4. Functions to be exported require their signature to be declared. This is achieved using the export decorator in the previously created ModuleInfo object:

```python
@ModuleInfo.export(grt.INT, grt.STRING)
def checkString(s):
    ...  
```

For the `export` statement, the return type is listed first, followed by the input parameter types, specified as GRT typenames. The following typenames can be used:

- **grt.INT**: An integer value. Also used for boolean values.
- **grt.DOUBLE**: A floating-point numeric value.
- **grt.STRING**: UTF-8 or ASCII string data.
- **grt.DICT**: A key/value dictionary item. Keys must be strings.
- **grt.LIST**: A list of other values. It is possible to specify the type of the contents as a tuple in the form `(grt.LIST, <type-or-class>)`. For example, `(grt.LIST, grt.STRING)` for a list of strings. For a list of table objects, the following would be specified: `(grt.LIST, grt.classes.db_table)`.
- **grt.OBJECT**: An instance of a GRT object or a GRT class object, from `grt.classes`.

Note that these types are defined in the `grt` module, which must be imported before they can be used.

The following code snippet illustrates declaring a module that exports a single function:

```python
from wb import *
import grt

@ModuleInfo.export(grt.DOUBLE, grt.STRING, (grt.LIST, grt.DOUBLE))
def printListSum(message, doubleList):
    sum = 0
    for d in doubleList:
        sum = sum + d
    print message, sum
    return sum
```

### 12.3. Plugins

Plugins are special Modules that are exposed to the user through the Workbench GUI. This is typically done using the main menu, or the context-sensitive menu. Much of the MySQL Workbench functionality is implemented using plugins; for example, table, view, and routine editors are native C++ plugins, as are the forward and reverse engineering wizards. The Administrator facility in MySQL Workbench is implemented entirely as a plugin in Python.

A plugin can be a simple function that performs some action on an input, and ends without further interaction with the user. Examples of this include auto-arranging a diagram, or making batch changes to objects. To create a simple plugin, the function must be located in a module and declared as a plugin using the `plugin` decorator of the `ModuleInfo` object.

Plugins can have an indefinite runtime, such as when they are driven by the user through a graphical user interface. This is the case for the object editors and wizards within MySQL Workbench. Although the wizard type of plugin must be declared in the usual way, only the entry point of the plugin will need to be executed in the plugin function, as most of the additional functionality will be invoked as a result of the user interacting with the GUI.
Note

Reloading a plugin requires MySQL Workbench to be restarted.

Declare a plugin using this syntax:

```python
@ModuleInfo.plugin(plugin_name, caption, [input], [groups], [pluginMenu])
```

These parameters are defined as follows:

- **plugin_name**: A unique name for the plugin. It may contain only alphanumeric characters, dots, and underscores.
- **caption**: A caption to use for the plugin in menus.
- **input**: An optional list of input arguments.
- **groups**: Optional list of groups the plugin belongs to. Recognized values are:
  - **Overview/Utility**: The Context menu in the Model Overview.
  - **Model/Utility**: The menu for diagram objects.
  - **Menu/<category>**: The Plugins menu in the main menu.
- **pluginMenu**: Optional name of a submenu in the Plugins menu where the plugin should appear. For example, Catalog, Objects, Utilities. This is equivalent to adding a **Menu/<category>** in the groups list.

### 12.4. Adding a GUI to a Plugin Using MForms

MySQL Workbench is implemented with a C++ core back-end, and a native front-end for each supported platform. Currently the front-end is implemented with Windows Forms on Microsoft Windows, GTK+ on Linux, and Cocoa on Mac OS X. This approach permits the application to have a native look and feel, while reducing the amount of work required to maintain the project. However, the GUI functionality required by MySQL Workbench can be met by a subset of graphical operations. These are implemented in a cross-platform GUI library, MForms. This further reduces the development effort because plugin developers can use MForms rather than writing front-end specific code for each supported platform. This also helps consistency of operation across all platforms. MForms is coded in C++, but provides a Python interface. To use it, the Python code must import the `mforms` module.

**MForms Containers**

Given the problems of using an absolute coordinate system across different platforms, MForms employs containers that perform automatic layout. The basic containers that MForms provides include:

- **Form**: A top-level window which can contain a single control, usually another container. The window will be sized automatically to fit its contents, but can also be sized statically.

- **Box**: This is a container that can be filled with one or more controls in a vertical or horizontal layout. Each child control can be set to use either the minimum of required space, or fill the box in the direction of the layout. In the direction perpendicular to the layout, for example vertical in a horizontal layout, the smallest possible size that can accommodate all child controls will be employed. So, in this example, the smallest height possible to accommodate the controls would be used.

- **Table**: This is a container that can organize one or more controls in a grid. The number of rows and columns in the table, and the location of controls within the grid, can be set by the developer.

- **ScrollView**: This is a container that can contain a single child control, and will add scrollbars if the contents do not fit the available space.
12.5. The Workbench Scripting Shell

The Workbench Scripting Shell provides a means for entering and executing scripts. Through the use of the scripting shell, MySQL Workbench can support new behavior and data sources using code written in Lua and Python. The shell can also be used to explore the current Workbench GRT (Generic RunTime) facilities.

The scripting shell is not only useful for expanding MySQL Workbench. You can use a script file from the scripting shell command line to perform repetitive tasks programmatically.

The development language can be either Python or Lua. The default programming language used in Workbench Scripting Shell is defined in the General tab of the MySQL Workbench Preferences dialog, and defaults to Python.

Note
Although they serve a different purpose, the MySQL Utilities are also bundled with MySQL Workbench. For more information, see Chapter 14, MySQL Utilities.

12.5.1. Exploring the Workbench Scripting Shell

To open the Workbench Scripting Shell, select Scripting, Scripting Shell from the main menu. You can also open the Workbench Scripting Shell using the Control+F3 key combination on Windows and Linux, Command+F3 on Mac OS X, or by clicking the shell button above the EER diagram navigator. The Workbench Scripting Shell will then open in a new dialog.

The following screenshot shows the Workbench Scripting Shell dialog.

Figure 12.1. The Workbench Scripting Shell
12.5.2. The Shell Window

The Workbench Scripting Shell is primarily used for running Python or Lua scripts, or typing commands in these languages directly. However, you can also use it to access the Workbench Scripting Shell Scripting Library functions and global functions and objects. To see the available commands, type "?". You can also cut and paste text to and from the shell window.

The Snippets tab is a scratch pad for saving code snippets. This makes it easy to reuse code and does away with the need to retype it at the command line.

If you have opened script files, each will have its own tab to the right of the Snippets tab. These tabs will be labeled with the names of the script files, or Unnamed for snippets without a name. As with the Snippets tab you can cut and paste to or from any of the tabs. This gives you the opportunity to test code from the command line. Right clicking on a snippet opens a dialog with options to Execute Snippet, Send to Script Editor, or Copy To Clipboard.

While individual commands can be entered into the shell, it is also possible to run a longer script, stored in an external file, using the main menu item Scripting, Run Workbench Script File. When scripts are run outside of the shell, to see the output use the main menu item View, Output.

It is also possible to run script files directly from the shell. For details on running script files, type ? run at the Workbench Scripting Shell prompt. The following message is displayed:

```
Help Topics
-----------
grt        General information about the Workbench runtime
scripting  Practical information when working on scripts and modules for Workbench
wbdata     Summary about Workbench model data organization
modules    Information about Workbench module usage
plugins    Information about writing Plugins and Modules for Workbench
Type '? [topic]' to get help on the topic.
```

Custom Python Modules
---------------------
grt         Module to work with Workbench runtime (grt) objects
grt.root    The root object in the internal Workbench object hierarchy
grt.modules Location where Workbench modules are available
grt.classes List of classes known to the GRT system
mforms      A Module to access the cross-platform UI toolkit used in some Workbench features
wb          Utility module for creating Workbench plugins
Type 'help(module/object/function)' to get information about a module, object or function.
Type 'dir(object)' to get a quick list of methods an object has.

For an introductory tutorial on the Python language, visit http://docs.python.org/tutorial/
For general Python and library reference documentation, visit http://python.org/doc/

Within the Workbench Scripting Shell, there are four tabs on the top of the left side panel: Files, Globals, Classes, and Modules. Discussion of these additional tabs follows.

### Note
An exception is thrown while attempting to use `input()` or read from `stdin`.

12.5.3. The Files, Globals, Classes, and Modules Tabs

The Workbench Scripting Shell features the Files, Globals, Classes and Modules tabs, in addition to the main Shell tab.

**The Files Tab**

Lists folders and files for user-defined (custom) script files. The categories are User Scripts, User Modules, and User Libraries.
The Globals Tab

At the top of the window is a list that is used to select the starting point, or root, of the GRT Globals tree displayed beneath it. By default, this starting point is the root of the tree, that is, '/'. You can expand or collapse the GRT Globals tree as desired. The GRT Globals tree is the structure in which MySQL Workbench stores document data. Clicking any item results in its name and value being displayed in the panel below the tree.

The Classes Tab

A class is a user-defined data type formed by combining primitive data types: integers, doubles, strings, dicts, lists, and objects. This tab shows the definitions of the classes used by the objects in the Modules tab. Clicking a class causes a brief description of the class to be displayed in a panel below the classes explorer.

When the Classes tab is selected, the list displays the following items:

- **Group by Name**: Group by the object name
- **Group by Hierarchy**: Group by inheritance
- **Group by Package**: Group by functionality

The default view for this tab is **Group By Name**. This view shows all the different objects arranged alphabetically. Click the + icon or double-click a package to show the properties of the struct.

If you switch to the hierarchical view, you will see **GrtObject**: the parent object from which all other objects are derived.

The Modules Tab

The Modules tab enables you to browse the MySQL Workbench installed modules and their functions. Clicking a module within the explorer causes its details to be displayed in a panel below the explorer. This facility is useful for exploring the available modules, and their supported functions. It is also a way to check whether custom modules have been correctly installed.

12.6. Tutorial: Writing Plugins

This tutorial shows you how to extend MySQL Workbench by creating a plugin.

The Sample Plugin

EER Diagrams are useful for visualizing complex database schemata. They are often created for existing databases, to clarify their purpose or document them. MySQL Workbench provides facilities for reverse engineering existing databases, and then creating an EER Diagram automatically. In this case, relationship lines between foreign keys in the table will automatically be drawn. This graphical representation makes the relationships between the tables much easier to understand. However, one of the most popular storage engines for MySQL, MyISAM, does not include support for foreign keys. This means that MyISAM tables that are reverse engineered will not automatically have the relationship lines drawn between tables, making the database harder to understand. The plugin that will be created in this tutorial gets around this problem by using the fact that a naming convention is very often used for foreign keys: `tablename_primarykeyname`. Using this convention, foreign keys can automatically be created after a database is reverse engineered, which will result in relationship lines being drawn in the EER diagram.

Algorithm

The basic algorithm for this task would be as follows:

```plaintext
for each table in the schema
  for each column in the table
```
look for another table whose name and primary key name match the current column name
if such a table is found, add a foreign key referencing it

As iterating the complete table list to find a match can be slow for models with a large number of tables,
it is necessary to optimize by pre-computing all possible foreign key names in a given schema.

```python
import grt
def auto_create_fks(schema):
    fk_name_format = "%(table)s_%(pk)s"
    possible_fks = {}
    # create the list of possible foreign keys from the list of tables
    for table in schema.tables:
        format_args = {"table":table.name, "pk":table.primaryKey.name}
        fkname = fk_name_format % format_args
        possible_fks[fkname] = table
    # go through all tables in schema, this time to find columns that may be a fk
    for table in schema.tables:
        for column in table.columns:
            if possible_fks.has_key(column.name):
                ref_table = possible_fks[column.name]
                if ref_table.primaryKey.formattedType != column.type:
                    continue
                fk = table.createForeignKey(column.name+'_fk')
                fk.referencedTable = ref_table
                fk.columns.append(column)
                fk.referencedColumn.append(ref_table.primaryKey)
                print "Created foreign key %s from %s.%s to %s.%s" %
                    (fk.name, table.name, column.name, ref_table.name, ref_table.primaryKey.name)
    auto_create_fks(grt.root.wb.doc.physicalModels[0].catalog.schemata[0])
```

Creating a Plugin from a Script

To create a plugin from an arbitrary script, it is first necessary to make the file a module, and export the
required function from it. It is then necessary to declare the module as a plugin, and specify the return
type and input arguments.

```python
from wb import *
import grt

ModuleInfo = DefineModule(name="AutoFK", author="John Doe", version="1.0")
@ModuleInfo.plugin("sample.createGuessedForeignKeys",
caption="Create Foreign Keys from ColumnNames",
input=[wbinputs.objectOfClass("db.mysql.schema")],
groups=["Overview/Utility"])
@ModuleInfo.export(grt.INT, grt.classes.db_mysql_Schema)
def auto_create_fks(schema):
    ...
```

With the addition of the preceding code, the `auto_create_fks()` function is exported and will be
added to the schema context menu in the model overview. When invoked, it receives the currently
selected schema as its input.
Chapter 13. Keyboard Shortcuts

The following tables list keyboard shortcuts for MySQL Workbench commands. Modifier in the tables stands for the platform-specific modifier key. This is Command on Mac OS X, Control on other platforms. On Mac OS X, the Alt key is Option.

There are keyboard shortcut tables for the File, Edit, View, Arrange, Model, Query, Database, Scripting, Help, and EER Diagram Mode menus.

File Menu

Table 13.1. File menu keyboard shortcuts

<table>
<thead>
<tr>
<th>Function</th>
<th>Keyboard Shortcut</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Model</td>
<td>Modifier+N</td>
<td>All</td>
</tr>
<tr>
<td>Open Model</td>
<td>Modifier+O</td>
<td>All</td>
</tr>
<tr>
<td>Open SQL Script</td>
<td>Modifier+Shift+O</td>
<td>SQL Editor</td>
</tr>
<tr>
<td>Close Tab</td>
<td>Modifier+W, Modifier+F4 on Windows</td>
<td>All</td>
</tr>
<tr>
<td>Save Model</td>
<td>Modifier+S</td>
<td>Model</td>
</tr>
<tr>
<td>Save Script</td>
<td>Modifier+S</td>
<td>SQL Editor</td>
</tr>
<tr>
<td>Save Model As</td>
<td>Modifier+Shift+S</td>
<td>Model</td>
</tr>
<tr>
<td>Save Script As</td>
<td>Modifier+Shift+S</td>
<td>SQL Editor</td>
</tr>
<tr>
<td>Forward Engineer SQL CREATE Script</td>
<td>Modifier+Shift+G</td>
<td>Model</td>
</tr>
<tr>
<td>Forward Engineer SQL ALTER Script</td>
<td>Modifier+Alt+Y</td>
<td>Model</td>
</tr>
<tr>
<td>Synchronize With SQL CREATE Script</td>
<td>Modifier+Shift+Y</td>
<td>Model</td>
</tr>
<tr>
<td>Print</td>
<td>Modifier+P</td>
<td>EER Diagram mode only</td>
</tr>
<tr>
<td>Exit</td>
<td>Modifier+Q</td>
<td>All</td>
</tr>
</tbody>
</table>

Edit Menu

Table 13.2. Edit menu keyboard shortcuts

<table>
<thead>
<tr>
<th>Function</th>
<th>Keyboard Shortcut</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undo</td>
<td>Modifier+Z</td>
<td>Model, EER Diagram</td>
</tr>
<tr>
<td>Redo</td>
<td>Modifier+Y, Modifier+Shift+Z (Mac OS X)</td>
<td>Model, EER Diagram</td>
</tr>
<tr>
<td>Cut</td>
<td>Modifier+X</td>
<td>All</td>
</tr>
<tr>
<td>Copy</td>
<td>Modifier+C</td>
<td>All</td>
</tr>
<tr>
<td>Paste</td>
<td>Modifier+V</td>
<td>All</td>
</tr>
<tr>
<td>Delete</td>
<td>Modifier+Delete, Command +BackSpace (Mac OS X)</td>
<td>All</td>
</tr>
<tr>
<td>Edit Selected</td>
<td>Modifier+E</td>
<td>Model, EER Diagram</td>
</tr>
<tr>
<td>Edit Selected in New Window</td>
<td>Modifier+Shift+E</td>
<td>Model, EER Diagram</td>
</tr>
<tr>
<td>Select All</td>
<td>Modifier+A</td>
<td>EER Diagram</td>
</tr>
<tr>
<td>Find</td>
<td>Modifier+F</td>
<td>All</td>
</tr>
<tr>
<td>Find Advanced</td>
<td>Modifier+Alt+F</td>
<td>All</td>
</tr>
<tr>
<td>Function</td>
<td>Keyboard Shortcut</td>
<td>Context</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Find Next</td>
<td>F3</td>
<td>All</td>
</tr>
<tr>
<td>Find Previous</td>
<td>Shift+F3</td>
<td>All</td>
</tr>
<tr>
<td>Search and Replace</td>
<td>Modifier+Shift+F</td>
<td>All</td>
</tr>
<tr>
<td>Comment/Uncomment lines of SQL</td>
<td>Modifier+/</td>
<td>SQL Editor</td>
</tr>
<tr>
<td>Auto-Complete SQL</td>
<td>Modifier+Space</td>
<td>SQL Editor</td>
</tr>
</tbody>
</table>

**View Menu**

Table 13.3. View menu keyboard shortcuts

<table>
<thead>
<tr>
<th>Function</th>
<th>Keyboard Shortcut</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Window</td>
<td>Modifier+F2, Modifier+Option+2 (Mac OS X)</td>
<td>All</td>
</tr>
<tr>
<td>Set Marker n</td>
<td>Modifier+Shift+n (n is integer 1..9)</td>
<td>EER Diagram</td>
</tr>
<tr>
<td>Go to Marker n</td>
<td>Modifier+n (n is integer 1..9)</td>
<td>EER Diagram</td>
</tr>
</tbody>
</table>

**Arrange Menu**

Table 13.4. Arrange menu keyboard shortcuts

<table>
<thead>
<tr>
<th>Function</th>
<th>Keyboard Shortcut</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bring to Front</td>
<td>Modifier+Shift+F</td>
<td>EER Diagram</td>
</tr>
<tr>
<td>Send to Back</td>
<td>Modifier+Shift+B</td>
<td>EER Diagram</td>
</tr>
</tbody>
</table>

**Model Menu**

Table 13.5. Model menu keyboard shortcuts

<table>
<thead>
<tr>
<th>Function</th>
<th>Keyboard Shortcut</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Diagram</td>
<td>Modifier+T</td>
<td>Model, EER Diagram</td>
</tr>
<tr>
<td>Validate All</td>
<td>Modifier+Alt+V</td>
<td>Model, EER Diagram</td>
</tr>
<tr>
<td>Validate All (MySQL)</td>
<td>Modifier+Alt+B</td>
<td>Model, EER Diagram</td>
</tr>
<tr>
<td>Model Options</td>
<td>Command+Alt+, (Shortcut available only on Mac OS X)</td>
<td>Model, EER Diagram</td>
</tr>
</tbody>
</table>

**Query Menu**

Table 13.6. Query menu keyboard shortcuts

<table>
<thead>
<tr>
<th>Function</th>
<th>Keyboard Shortcut</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Execute statement</td>
<td>Modifier+Return</td>
<td>SQL Editor</td>
</tr>
<tr>
<td>Execute statements</td>
<td>Modifier+Shift+Return</td>
<td>SQL Editor</td>
</tr>
<tr>
<td>New Tab</td>
<td>Modifier+T</td>
<td>SQL Editor</td>
</tr>
</tbody>
</table>

**Database Menu**

Table 13.7. Database menu keyboard shortcuts

<table>
<thead>
<tr>
<th>Function</th>
<th>Keyboard Shortcut</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Query Database</td>
<td>Modifier+U</td>
<td>All</td>
</tr>
<tr>
<td>Reverse Engineer</td>
<td>Modifier+R</td>
<td>Model, EER Diagram</td>
</tr>
</tbody>
</table>
### Table 13.8. Scripting menu keyboard shortcuts

<table>
<thead>
<tr>
<th>Function</th>
<th>Keyboard Shortcut</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Engineer</td>
<td>Modifier+G</td>
<td>Model, EER Diagram</td>
</tr>
<tr>
<td>Synchronize Model</td>
<td>Modifier+Y</td>
<td>Model, EER Diagram</td>
</tr>
</tbody>
</table>

### Table 13.9. Help menu keyboard shortcuts

<table>
<thead>
<tr>
<th>Function</th>
<th>Keyboard Shortcut</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help Index</td>
<td>F1, Command+Option+question (on Mac OS X)</td>
<td>All</td>
</tr>
</tbody>
</table>

### EER Diagram Mode

In the EER Diagram view, a number of other keyboard shortcuts are available.

### Table 13.10. EER diagram mode keyboard shortcuts

<table>
<thead>
<tr>
<th>Function</th>
<th>Keyboard Shortcut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selection tool</td>
<td>Escape</td>
</tr>
<tr>
<td>Hand tool</td>
<td>H</td>
</tr>
<tr>
<td>Delete tool</td>
<td>D</td>
</tr>
<tr>
<td>Layer tool</td>
<td>L</td>
</tr>
<tr>
<td>Note tool</td>
<td>N</td>
</tr>
<tr>
<td>Image tool</td>
<td>I</td>
</tr>
<tr>
<td>Table tool</td>
<td>T</td>
</tr>
<tr>
<td>View tool</td>
<td>V</td>
</tr>
<tr>
<td>Routine Group tool</td>
<td>G</td>
</tr>
<tr>
<td>Non-Identifying Relationship 1:1</td>
<td>1</td>
</tr>
<tr>
<td>Non-Identifying Relationship 1:n</td>
<td>2</td>
</tr>
<tr>
<td>Identifying Relationship 1:1</td>
<td>3</td>
</tr>
<tr>
<td>Identifying Relationship 1:n</td>
<td>4</td>
</tr>
<tr>
<td>Identifying Relationship n:m</td>
<td>5</td>
</tr>
<tr>
<td>Relationship Using Existing Columns</td>
<td>6</td>
</tr>
</tbody>
</table>

### Table 13.11. Keyboard shortcut changes

<table>
<thead>
<tr>
<th>MySQL Workbench version</th>
<th>The Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2.45</td>
<td>The &quot;Modifier+&quot; shortcut was added to comment/uncomment SQL in the SQL editor</td>
</tr>
<tr>
<td></td>
<td>On Microsoft Windows, the &quot;Modifier+W&quot; shortcut was changed to &quot;Control+F4&quot; -- this shortcut closes MySQL Workbench tabs</td>
</tr>
</tbody>
</table>
Chapter 14. MySQL Utilities

Table of Contents

14.1. Preface .................................................................................................................. 237
  14.1.1. Preface .................................................................................................................. 237
14.2. Introduction ........................................................................................................... 238
  14.2.1. Introduction to MySQL Utilities ........................................................................... 238
  14.2.2. Connection Parameters ......................................................................................... 239
  14.2.3. Introduction to extending the MySQL Utilities ...................................................... 239
14.3. Commands .............................................................................................................. 245
  14.3.1. mysql.utilities.command.grep — Search Databases for Objects ....................... 245
  14.3.2. mysql.utilities.command.proc — Search Processes on Servers ....................... 246
  14.4.1. MySQL Utilities Overview — Brief overview of command-line utilities .............. 248
  14.4.2. mysqlauditadmin — Allows users to perform maintenance action on the audit log .......................................................................................................................... 250
  14.4.3. mysqlauditgrep — Allows users to search the current or an archived audit log .... 254
  14.4.4. mysqldbcompare — Compare Two Databases and Identify Differences .......... 261
  14.4.5. mysqldbcCopy — Copy Database Objects Between Servers ............................... 267
  14.4.6. mysqldbexport — Export Object Definitions or Data from a Database .......... 272
  14.4.7. mysqldbimport — Import Object Definitions or Data into a Database .............. 279
  14.4.8. mysqlldiff — Identify Differences Among Database Objects .......................... 283
  14.4.9. mysqlldiskusage — Show Database Disk Usage ............................................... 287
  14.4.10. mysqlfailover — Automatic replication health monitoring and failover ........... 290
  14.4.11. mysqlindexcheck — Identify Potentially Redundant Table Indexes ................. 297
  14.4.12. mysqlmetagrep — Search Database Object Definitions ..................................... 300
  14.4.13. mysqlprocgrep — Search Server Process Lists ................................................. 303
  14.4.15. mysqlrpladmin — Administration utility for MySQL replication ...................... 309
  14.4.16. mysqlrplcheck — Check Replication Prerequisites ........................................... 318
  14.4.17. mysqlrplshow — Show Slaves for Master Server ............................................. 321
  14.4.18. mysqlserverclone — Clone Existing Server to Create New Server ................. 325
  14.4.19. mysqlserverinfo — Display Common Diagnostic Information from a Server .... 326
  14.4.20. mysqluc — Command line client for running MySQL Utilities .......................... 329
  14.4.21. mysqluserclone — Clone Existing User to Create New User ............................ 332
14.5. Parsers .................................................................................................................... 334
  14.5.1. mysql.utilities.parser — Parse MySQL Log Files ............................................ 334
14.6. Related tools ......................................................................................................... 336
  14.6.1. mut — MySQL Utilities Testing ........................................................................... 336
14.7. Appendix ............................................................................................................... 338
  14.7.1. MySQL Utilities FAQ ........................................................................................ 338
  14.7.2. MySQL Utilities copy_server.py sample ............................................................ 340

This chapter describes the MySQL Utilities for MySQL Workbench, a set of Python tools for working with MySQL Server.

14.1. Preface

14.1.1. Preface

MySQL Utilities is both a set of command-line utilities as well as a Python library for making the common tasks easy to accomplish. The library is written entirely in Python, meaning that it is not necessary to have any other tools or libraries installed to make it work. It is currently designed to work with Python v2.6 or later and there is no support (yet) for Python v3.1.
In this Manual, you will find from an overview to a deep description of all the utilities and commands that are part of the MySQL Utilities.

14.2. Introduction

14.2.1. Introduction to MySQL Utilities

What are the MySQL Utilities?

It is a package of utilities that are used for maintenance and administration of MySQL servers. These utilities encapsulate a set of primitive commands, and bundles them so they can be used to perform macro operations with a single command. They can be installed via MySQL Workbench, or as a standalone package.

The utilities are written in Python, available under the GPLv2 license, and are extendable using the supplied library. They are designed to work with Python versions 2.6 or later and there is no support (yet) for Python v3.1.

How do we access the MySQL Utilities?

There are two ways to access the utilities from within the MySQL Workbench. Either use Plugins, Start Shell for MySQL Utilities from the main Workbench toolbar, or click the MySQL Utilities icon from the main Workbench page. Both methods will open a terminal/shell window, and list the available commands.

Figure 14.1. Starting MySQL Utilities from Workbench

You can launch any of the utilities listed by typing the name of the command. To find out what options are available, use the option, or read the appropriate manual page.

The utilities are designed to work on MySQL systems with grants enabled but can also operate on servers started with the --skip-grant-tables startup option. However, this practice is strongly discouraged and should be used only in situations where it is appropriate or deemed a last resort.
14.2.2. Connection Parameters

To connect to a server, it is necessary to specify connection parameters such as user name, host name, password, and perhaps also port or socket.

Whenever connection parameters are required, they can be specified three different ways:

- As a dictionary containing the connection parameters.
- As a connection specification string containing the connection parameters.
- As a Server instance.

When providing the connection parameters as a dictionary, the parameters are passed unchanged to the connector's connect function. This enables you to pass parameters not supported through the other interfaces, but at least these parameters are supported:

- **user**
  
  The name of the user to connect as. The default if no user is supplied is login name of the user, as returned by getpass.getuser.

- **passwd**
  
  The password to use when connecting. The default if no password is supplied is the empty password.

- **host**
  
  The domain name of the host or the IP address. The default if no host name is provided is 'localhost'. This field accepts host names, and IPv4 and IPv6 addresses. It also accepts quoted values which are not validated and passed directly to the calling methods. This enables users to specify host names and IP addresses that are outside of the supported validation mechanisms.

- **port**
  
  The port to use when connecting to the server. The default if no port is supplied is 3306 (which is the default port for the MySQL server as well).

- **unix_socket**
  
  The socket to connect to (instead of using the host and port parameters).

Providing the connection parameters as a string requires the string to have the format `user[:passwd]@host[:port][:socket]`, where some values are optional. If a connection specification string is provided, it is parsed using the options.parse_connection function.

14.2.3. Introduction to extending the MySQL Utilities

Administration and maintenance on the MySQL server can at times be complicated. Sometimes tasks require tedious or even repetitive operations that can be time consuming to type and re-type. For these reasons and more, the MySQL Utilities were created to help both beginners and experienced database administrators perform common tasks.

What are the internals of the MySQL Utilities?

MySQL Utilities are designed as a collection of easy to use Python scripts that can be combined to provide more powerful features. Internally, the scripts use the mysql.utilities module library to perform its various tasks. Since a library of common functions is available, it is easy for a database administrator to create scripts for common tasks. These utilities are located in the /scripts folder of the installation or source tree.
Introduction to extending the MySQL Utilities

If you have a task that is not met by these utilities or one that can be met by combining one or more of the utilities or even parts of the utilities, you can easily form your own custom solution. The following sections present an example of a custom utility, discussing first the anatomy of a utility and then what the mysql.utilities module library has available.

Anatomy of a MySQL Utility

MySQL Utilities use a three-tier module organization. At the top is the command script, which resides in the /scripts folder of the installation or source tree. Included in the script is a command module designed to encapsulate and isolate the bulk of the work performed by the utility. The command module resides in the /mysql/utilities/command folder of the source tree. Command modules have names similar to the script. A command module includes classes and methods from one or more common modules where the abstract objects and method groups are kept. The common modules reside in the /mysql/utilities/common folder of the source tree. The following illustrates this arrangement using the mysqlserverinfo utility:

```
/scripts/mysqlserverinfo.py
    |   --- /mysql/utilities/command/serverinfo.py
    |       --- /mysql/utilities/common/options.py
    |       --- /mysql/utilities/common/server.py
    |       --- /mysql/utilities/common/tools.py
    |       --- /mysql/utilities/common/format.py
```

Each utility script is designed to process the user input and option settings and pass them on to the command module. Thus, the script contains only such logic for managing and validating options. The work of the operation resides in the command module.

Command modules are designed to be used from other Python applications. For example, one could call the methods in the serverinfo.py module from another Python script. This enables developers to create their own interfaces to the utilities. It also permits developers to combine several utilities to form a macro-level utility tailored to a specified need. For example, if there is a need to gather server information as well as disk usage, it is possible to import the serverinfo.py and diskusage.py modules and create a new utility that performs both operations.

Common modules are the heart of the MySQL Utilities library. These modules contain classes that abstract MySQL objects, devices, and mechanisms. For example, there is a server class that contains operations to be performed on servers, such as connecting (logging in) and running queries.

The MySQL Utilities Library

While the library is growing, the following lists the current common modules and the major classes and methods as of the 1.0.1 release:

<table>
<thead>
<tr>
<th>Module</th>
<th>Class/Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>database</td>
<td>Database</td>
<td>Perform database-level operations</td>
</tr>
<tr>
<td>dbcompare</td>
<td>get_create_object</td>
<td>Retrieve object create statement</td>
</tr>
<tr>
<td></td>
<td>diff_objects</td>
<td>Diff definitions of two objects</td>
</tr>
<tr>
<td></td>
<td>check_consistency</td>
<td>Check data consistency of two tables</td>
</tr>
<tr>
<td>format</td>
<td>format_tabular_list</td>
<td>Format list in either GRID or delimited format to a file</td>
</tr>
<tr>
<td></td>
<td>format_vertical_list</td>
<td>Format list in a vertical format to a file</td>
</tr>
<tr>
<td></td>
<td>print_list</td>
<td>Print list based on format (CSV, GRID, TAB, or VERTICAL)</td>
</tr>
<tr>
<td>options</td>
<td>setup_common_options</td>
<td>Set up option parser and options common to all MySQL Utilities</td>
</tr>
<tr>
<td></td>
<td>add_skip_options</td>
<td>Add common --skip options</td>
</tr>
<tr>
<td></td>
<td>check_skip_options</td>
<td>Check skip options for validity</td>
</tr>
<tr>
<td></td>
<td>check_format_option</td>
<td>Check format option for validity</td>
</tr>
</tbody>
</table>
General Interface Specifications and Code Practices

The MySQL Utilities are designed and coded using mainstream coding practices and techniques common to the Python community. Effort has been made to adhere to the most widely accepted specifications and techniques. This includes limiting the choice of libraries used to the default libraries found in the Python distributions. This ensures easier installation, enhanced portability, and fewer problems with missing libraries. Similarly, external libraries that resort to platform-specific native code are also not used.

The class method and function signatures are designed to make use of a small number of required parameters and all optional parameters as a single dictionary. Consider the following method:

```python
def do_something_wonderful(position, obj1, obj2, options={}):
    """Does something wonderful
    A fictional method that does something to object 2 based on the
    location of something in object 1.
    position[in]   Position in obj1
    obj1[in]       First object to manipulate
    obj2[in]       Second object to manipulate
    options[in]    Option dictionary
    width          width of printout (default 75)
    iter           max iterations (default 2)
    ok_to_fail     if True, do not throw exception
                    (default True)
    """
    Returns bool - True = success, Fail = failed
```

This example is typical of the methods and classes in the library. Notice that this method has three required parameters and a dictionary of options that may exist.

Each method and function that uses this mechanism defines its own default values for the items in the dictionary. A quick look at the method documentation shows the key names for the dictionary. This can be seen in the preceding example where the dictionary contains three keys and the documentation lists their defaults.
To call this method and pass different values for one or more of the options, the code may look like this:

```python
opt_dictionary = {
    'width'      : 100,
    'iter'       : 10,
    'ok_to_fail' : False,
}
result = do_something_wonderful(1, obj_1, obj_2, opt_dictionary)
```

The documentation block for the preceding method is the style used throughout the library.

Example

Now that you are familiar with the MySQL utilities and the supporting library modules, let us take a look at an example that combines some of these modules to solve a problem.

Suppose that you want to develop a new database solution and need to use real world data and user accounts for testing. The `mysqlserverclone` MySQL utility looks like a possibility but it makes only an instance of a running server. It does not copy data. However, `mysqldbcopy` makes a copy of the data and `mysqluserclone` clones the users. You could run each of these utilities in sequence, and that would work, but we are lazy at heart and want something that not only copies everything but also finds it for us. That is, we want a one-command solution.

The good news is that this is indeed possible and very easy to do. Let us start by breaking the problem down into its smaller components. In a nutshell, we must perform these tasks:

- Connect to the original server
- Find all of the databases
- Find all of the users
- Make a clone of the original server
- Copy all of the databases
- Copy all of the users

If you look at the utilities and the modules just listed, you see that we have solutions and primitives for each of these operations. So you need not even call the MySQL utilities directly (although you could). Now let us dive into the code for this example.

The first task is to connect to the original server. We use the same connection mechanism as the other MySQL utilities by specifying a `--server` option like this:

```python
parser.add_option("--server", action="store", dest="server",
    type="string", default="root@localhost:3306",
    help="connection information for original server in " + \n    "the form: <user>:<password>@<host>:<port>:<socket>"
)
```

Once we process the options and arguments, connecting to the server is easy: Use the `parse_connection` method to take the server option values and get a dictionary with the connection values. All of the heavy diagnosis and error handling is done for us, so we just need to check for exceptions:

```python
from mysql.utilities.common.options import parse_connection
try:
    conn = parse_connection(opt.server)
except:
    parser.error("Server connection values invalid or cannot be parsed.")
```

Now that we have the connection parameters, we create a class instance of the server using the `Server` class from the `server` module and then connect. Once again, we check for exceptions:
from mysql.utilities.common.server import Server

server_options = {
    'conn_info': conn,
    'role': "source",
}
server1 = Server(server_options)
try:
    server1.connect()
except UtilError, e:
    print "ERROR:", e.errmsg

The next item is to get a list of all of the databases on the server. We use the new server class instance to retrieve all of the databases on the server:

db_list = []
for db in server1.get_all_databases():
    db_list.append((db[0], None))

If you wanted to supply your own list of databases, you could use an option like the following. You could also add an else clause which would enable you to either get all of the databases by omitting the --databases option or supply your own list of databases (for example, --databases=db1,db2,db3):

parser.add_option("-d", "--databases", action="store", dest="dbs_to_copy",
         type="string", help="comma-separated list of databases "
         "to include in the copy (omit for all databases)",
         default=None)
if opt.dbs_to_copy is None:
    for db in server1.get_all_databases():
        db_list.append((db[0], None))
else:
    for db in opt.dbs_to_copy.split(","): 
        db_list.append((db, None))

Notice we are creating a list of tuples. This is because the dbcopy module uses a list of tuples in the form (old_db, new_db) to enable you to copy a database to a new name. For our purposes, we do not want a rename so we leave the new name value set to None.

Next, we want a list of all of the users. Once again, you could construct the new solution to be flexible by permitting the user to specify the users to copy. We leave this as an exercise.

In this case, we do not have a primitive for getting all users created on a server. But we do have the ability to run a query and process the results. Fortunately, there is a simple SQL statement that can retrieve all of the users on a server. For our purposes, we get all of the users except the root and anonymous users, then add each to a list for processing later:

users = server1.exec_query("SELECT user, host 
""FROM mysql.user 
""WHERE user != 'root' and user != ''")
for user in users:
    user_list.append(user[0]+'&'+user[1])

Now we must clone the original server and create a viable running instance. When you examine the mysqlserverclone utility code, you see that it calls another module located in the /mysql/utilities/command sub folder. These modules are where all of the work done by the utilities take place. This enables you to create new combinations of the utilities by calling the actual operations directly. Let's do that now to clone the server.

The first thing you notice in examining the serverclone module is that it takes a number of parameters for the new server instance. We supply those in a similar way as options:

parser.add_option("--new-data", action="store", dest="new_data",
         type="string", help="the full path to the location "
         "of the data directory for the new instance")
parser.add_option("--new-port", action="store", dest="new_port",}
from mysql.utilities.command import serverclone

try:
    res = serverclone.clone_server(conn, opt.new_data, opt.new_port, opt.new_id, "root", None, False, True)
except exception.UtilError, e:
    print "ERROR: %s", e.errmsg
    sys.exit()

As you can see, the operation is very simple. We just added a few options we needed like --new-data, --new-port, and --new-id (much like mysqlserverclone) and supplied some default values for the other parameters.

Next, we need to copy the databases. Once again, we use the command module for mysqldbcopy to do all of the work for us. First, we need the connection parameters for the new instance. This is provided in the form of a dictionary. We know the instance is a clone, so some of the values are going to be the same and we use a default root password, so that is also known. Likewise, we specified the data directory and, since we are running on a Linux machine, we know what the socket path is. (For Windows machines, you can leave the socket value None.) We pass this dictionary to the copy method:

def dest_values = {
    "user" : conn.get("user"),
    "passwd" : "root",
    "host" : conn.get("host"),
    "port" : opt.new_port,
    "unix_socket" : os.path.join(opt.new_data, "mysql.sock")
}

In this case, a number of options are needed to control how the copy works (for example, if any objects are skipped). For our purposes, we want all objects to be copied so we supply only the minimal settings and let the library use the defaults. This example shows how you can 'fine tune' the scripts to meet your specific needs without having to specify a lot of additional options in your script. We enable the quiet option on so as not to clutter the screen with messages, and tell the copy to skip databases that do not exist (in case we supply the --databases option and provide a database that does not exist):

    options = {
        "quiet" : True,
        "force" : True
    }

The actual copy of the databases is easy. Just call the method and supply the list of databases:

    from mysql.utilities.command import dbcopy
    try:
        dbcopy.copy_db(conn, dest_values, db_list, options)
    except exception.UtilError, e:
        print "ERROR: %s", e.errmsg
        sys.exit()

Lastly, we copy the user accounts. Once again, we must provide a dictionary of options and call the command module directly. In this case, the userclone module provides a method that clones one user to one or more users so we must loop through the users and clone them one at a time:

    from mysql.utilities.command import userclone
    options = {
        "overwrite" : True,
        "quiet" : True,
        "globals" : True
    }
for user in user_list:
    try:
        res = userclone.clone_user(conn, dest_values, user,
                                   (user,), options)
    except exception.UtilError, e:
        print "ERROR:", e.errmsg
        sys.exit()

We are done. As you can see, constructing new solutions from the MySQL utility command and common modules is easy and is limited only by your imagination.

Enhancing the Example

A complete solution for the example named copy_server.py is located in the Appendix section. It is complete in so far as this document explains, but it can be enhanced in a number of ways. The following briefly lists some of the things to consider adding to make this example utility more robust.

- Table locking: Currently, databases are not locked when copied. To achieve a consistent copy of the data on an active server, you may want to add table locking or use transactions (for example, if you are using InnoDB) for a more consistent copy.
- Skip users not associated with the databases being copied.
- Do not copy users with only global privileges.
- Start replication after all of the users are copied (makes this example a clone and replicate scale out solution).
- Stop new client connections to the server during the copy.

Conclusion

If you find some primitives missing or would like to see more specific functionality in the library or scripts, please contact us with your ideas or better still, write them yourselves! We welcome all suggestions in code or text. To file a feature request or bug report, visit http://bugs.mysql.com. For discussions, visit http://forums.mysql.com/list.php?155.

14.3. Commands

14.3.1. mysql.utilities.command.grep — Search Databases for Objects

This module provides utilities to search for objects on a server. The module defines a set of object types that can be searched by searching the fields of each object. The notion of an object field is very loosely defined and means any names occurring as part of the object definition. For example, the fields of a table include the table name, the column names, and the partition names (if it is a partitioned table).

Constants

The following constants denote the object types that can be searched.

- mysql.utilities.command.grepROUTINE
- mysql.utilities.command.grepEVENT
- mysql.utilities.command.grepTRIGGER
- mysql.utilities.command.grepTABLE
- mysql.utilities.command.grepDATABASE
- mysql.utilities.command.grepVIEW
The following constant is a sequence of all the object types that are available. It can be used to generate a version-independent list of object types that can be searched; for example, options and help texts.

- `mysql.utilities.command.grep.OBJECT_TYPES`

**Classes**

```python
class mysql.utilities.command.grep.ObjectGrep(pattern[, database_pattern=None, types=OBJECT_TYPES, check_body=False, use_regexp=False])
```

Search MySQL server instances for objects where the name (or content, for routines, triggers, or events) matches a given pattern.

**sql()** - string

Return the SQL code for executing the search in the form of a `SELECT` statement.

<table>
<thead>
<tr>
<th>Returns</th>
<th>SQL code for executing the operation specified by the options.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return type</td>
<td>string</td>
</tr>
</tbody>
</table>

**execute(connections[, output=sys.output, connector=mysql.connector])**

Execute the search on each of the connections in turn and print an aggregate of the result as a grid table.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>connections</code></td>
<td>Sequence of connection specifiers to send the query to</td>
</tr>
<tr>
<td><code>output</code></td>
<td>File object to use for writing the result</td>
</tr>
<tr>
<td><code>connector</code></td>
<td>Connector to use for connecting to the servers</td>
</tr>
</tbody>
</table>

**14.3.2. mysql.utilities.command.proc — Search Processes on Servers**

This module searches processes on a server and optionally kills either the query or the connection for all matching processes.

Processes are matched by searching the fields of the `INFORMATION_SCHEMA.PROCESSLIST` table (which is available only for servers from MySQL 5.1.7 and later). Internally, the module operates by constructing a `SELECT` statement for finding matching processes, and then sending it to the server. Instead of performing the search, the module can return the SQL code that performs the query. This can be useful if you want to execute the query later or feed it to some other program that processes SQL queries further.

**Constants**

The following constants correspond to columns in the `INFORMATION_SCHEMA.PROCESSLIST` table. They indicate which columns to examine when searching for processes matching the search conditions.

- `mysql.utilities.command.proc.ID`
- `mysql.utilities.command.proc.USER`
- `mysql.utilities.command.proc.HOST`
- `mysql.utilities.command.proc.DB`
- `mysql.utilities.command.proc.COMMAND`
•  mysql.utilities.command.proc.TIME
•  mysql.utilities.command.proc.STATE
•  mysql.utilities.command.proc.INFO

The following constants indicate actions to perform on processes that match the search conditions.
•  mysql.utilities.command.proc.KILL_QUERY
  Kill the process query
•  mysql.utilities.command.proc.KILL_CONNECTION
  Kill the process connection
•  mysql.utilities.command.proc.PRINT_PROCESS
  Print the processes

Classes

class mysql.utilities.command.proc.ProcessGrep(matches, actions=[], use_regexp=False)

This class searches the INFORMATION_SCHEMA.PROCESSLIST table for processes on MySQL servers and optionally kills them. It can both be used to actually perform the search or kill operation, or to generate the SQL statement for doing the job.

To kill all queries with user 'mats', the following code can be used:

```python
>>> from mysql.utilities.command.proc import *
>>> grep = ProcessGrep(matches=[(USER, "mats")], actions=[KILL_QUERY])
>>> grep.execute("root@server-1.example.com", "root@server-2.example.com")
```

Parameters:
•  matches (List of (var, pat) pairs) Sequence of field comparison conditions. In each condition, var is one of the constants listed earlier that specify PROCESSLIST table fields and pat is a pattern. For a process to match, all field conditions must match.

sql(only_body=False)

Return the SQL code for executing the search (and optionally, the kill).

If only_body is True, only the body of the function is shown. This is useful if the SQL code is to be used with other utilities that generate the routine declaration. If only_body is False, a complete procedure will be generated if there is any kill action supplied, and just a select statement if it is a plain search.

Parameters:
•  only_body (boolean) Show only the body of the procedure. If this is False, a complete procedure is returned.

Returns:
SQL code for executing the operation specified by the options.

Return type:
string

execute(connections, ...[, output=sys.stdout, connector=mysql.connector])

Execute the search on each of the connections supplied. If output is not None, the value is treated as a file object and the result of the execution is printed on that stream. Note that the output and connector arguments must be supplied as keyword arguments. All other arguments are treated as connection specifiers.

Parameters:
•  connections Sequence of connection specifiers to send the search to
14.4. Manual Pages

14.4.1. MySQL Utilities Overview — Brief overview of command-line utilities

This is a brief overview of the MySQL command-line utilities. See their respective manual pages for further details and examples:

- `mysqlauditadmin`
  - Monitor the audit log
  - Copy, rotate, and configure the audit log

- `mysqlauditgrep`
  - Search the audit log
  - Output results to different formats

- `mysqldbcompare`
  - Compare databases on two servers or the same server
  - Compare definitions and data
  - Generate a difference report
  - Generate SQL transformation statements

- `mysqldbcopy`
  - Copy databases between servers
  - Clone databases on the same server
  - Supports rename

- `mysqldbexport`
  - Export metadata and/or data from one or more databases
  - Formats: SQL, CSV, TAB, Grid, Vertical

- `mysqldbimport`
  - Import metadata and data from one or more files
  - Reads all formats from mysqldbexport

- `mysqldiff`
  - Compare object definitions
  - Generate a difference report

- `mysqldiskusage`
  - Show disk usage for databases
MySQL Utilities Overview — Brief overview of command-line utilities

- Generate reports in SQL, CSV, TAB, Grid, Vertical

**mysqlfailover**
- Provides automatic failover on a replication topology
- Uses Global Transaction Identifiers (GTID, MySQL Server 5.6.5+)

**mysqlindexcheck**
- Read indexes for one or more tables
- Check for redundant and duplicate indexes
- Generate reports in SQL, CSV, TAB, Grid, Vertical

**mysqlmetagrep**
- Search metadata
- Regexp, database search
- Generate SQL statement for search query

**mysqlprocgrep**
- Search process information
- Generate SQL statement for search
- Kill processes that match query

**mysqlreplicate**
- Setup replication
- Start from beginning, current, specific binlog, pos

**mysqlrpladmin**
- Administers the replication topology
- Allows recovery of the master
- Commands include elect, failover, gtid, health, start, stop, and switchover

**mysqlrplcheck**
- Check replication configuration
- Tests binary logging on master

**mysqlrplshow**
- Show slaves attached to master
- Can search recursively
- Show the replication topology as a graph or list

**mysqlserverclone**
- Start a new instance of a running server
**mysqlauditadmin** — Allows users to perform maintenance action on the audit log

- **mysqlserverinfo**
  - Show server information
  - Can search for running servers on a host
  - Access online or offline servers

- **mysqluserclone**
  - Clone a user account, to the same or different server
  - Show user grants

- **mysqluc**
  - Command line client for running MySQL Utilities
  - Allows a persistent connection to a MySQL Server
  - Tab completion for utility names and options
  - Allows calling the commands with shorter names, such as using "serverinfo" instead of mysqlserverinfo

- **mut**
  - Tests for all utilities
  - Similar to MTR
  - Comparative and value result support
  - Tests written as Python classes

### 14.4.2. mysqlauditadmin — Allows users to perform maintenance action on the audit log

This utility allow you to maintain the audit log, allowing you to monitor the audit log file growth and control its rotation. Rotation refers to the action of replacing the current audit log file by a new one for continuous use, renaming (with a timestamp extension) and copying the previously used audit log file to a defined location.

This utility allows you to view and modify a subset of audit log control variables, display the audit log file status, perform on-demand rotation of the log file, and copy files to other locations. These features enable you to easily monitor the audit log file growth and control its rotation (automatically based on the defined file size threshold, or manually by a on-demand command).

The available actions include the following:

1. **copy**
   - This command copies the audit log specified by `--audit-log-name` to the destination path specified by `--copy-to`. The `--remote-login` option can be used to copy log files from a remote location. Note: the destination path must be locally accessible by the current user.

2. **policy**
   - The policy command is used to change the audit logging policy. The accepted values are the following, which are set using the `--value` option.
**mysqlauditadmin** — Allows users to perform maintenance action on the audit log

---

**Note**

The **--server** option is also required to execute this command.

- **ALL**: log all events
- **NONE**: log nothing
- **LOGINS**: only log login events
- **QUERIES**: only log query events
- **DEFAULT**: sets the default log policy

3. **rotate_on_size**

This command sets the file size threshold for automatic rotation of the audit log (the `audit_log_rotate_on_size` variable). The value is set using the **--value** option, and must be in the range (0, 4294967295). This command also requires the **--server** option to be specified. Note: if the variable is set with a value that is not a multiple of 4096, then it is truncated to the nearest multiple.

4. **rotate**

This command is used to perform an on-demand audit log rotation, and only requires the **--server** option to be passed. Note: this command has no effect if the audit log file size is smaller than 4096, which is the minimum value allowed that is greater than 0 for the `audit_log_rotate_on_size` variable.

**OPTIONS**

**mysqlauditadmin** accepts the following command-line options:

- **--audit-log-name=<AUDIT_LOG_FILE>**
  
  Full path and file name for the audit log file. Used by the **--file-stats** option, and the `copy` command.

- **--copy-to=<COPY_DESTINATION>**
  
  The location to copy the specified audit log file. The path must be locally accessible for the current user.

- **--file-stats**
  
  Display the audit log file statistics.

- **--help**
  
  Display a help message and exit.

- **--remote-login=<REMOTE_LOGIN>**
  
  User name and host to be used for the remote login, for copying log files. It is defined using the following format: `<user>:<host or IP>`. Usage will prompt for the password.

- **--server=<SERVER>**
  
  Connection information for the server in the format: `<user>[:<passwd>][:<host>][:<port>][:<socket>]` or `<login-path>[:<port>][:<socket>]`.
mysqlauditadmin — Allows users to perform maintenance action on the audit log

Display the audit log system variables.

- --value=<VALUE>

Value used to set variables based on the specified commands, such as policy and rotate_on_size.

- --server1=<source>

Connection information for the first server in the format: <user>[:<passwd>]@<host>[:<port>] [:<socket>] or <login-path>[:<port>][:<socket>].

- --verbose, -v

Specify how much information to display. Use this option multiple times to increase the amount of information. For example, -v = verbose, -vv = more verbose, -vvv = debug.

- --version

Display version information and exit.

NOTES

This utility is available as of μ 1.2.0.

This utility can only be applied to servers with the audit log plugin enabled. And the audit log plugin is available as of MySQL Server versions 5.5.28 and 5.6.10.

This utility requires Python version 2.6 or higher, but does not support Python 3.

The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the my_print_defaults tools, which is required to read the login-path values from the login configuration file (.mylogin.cnf). This feature exists as of MySQL Server 5.6.6, see mysql_config_editor — MySQL Configuration Utility.

LIMITATIONS

The --remote-login option is not supported on Microsoft Windows platforms. For Microsoft Windows, use UNC paths and perform a local copy operation, omitting the --remote-login option.

EXAMPLES

To display the audit log system variables, run the following command:

```bash
$ mysqlauditadmin --show-options --server=root@localhost:3310
```

```
# Audit Log Variables and Options
#
+---------------------------+---------------+
| Variable_name             | Value         |
+---------------------------+---------------+
| audit_log_buffer_size     | 1048576       |
| audit_log_file            | audit.log    |
| audit_log_flush           | OFF           |
| audit_log_policy          | ALL           |
| audit_log_rotate_on_size  | 0             |
| audit_log_strategy        | ASYNCHRONOUS  |
```

To perform a (manual) rotation of the audit log file, use the following command:
MySQLAuditAdmin — Allows users to perform maintenance actions on the audit log

shell> mysqlauditadmin --server=root@localhost:3310 rotate

# Executing ROTATE command.

To display the audit log file statistics, run the following command:

shell> mysqlauditadmin --file-stats --audit-log-name=../SERVER/data/audit.log

<table>
<thead>
<tr>
<th>File</th>
<th>Size</th>
<th>Created</th>
<th>Last Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>audit.log.13486539046497235</td>
<td>47317</td>
<td>Wed Sep 26 11:05:04 2012</td>
<td>Wed Sep 26 11:05:04 2012</td>
</tr>
</tbody>
</table>

To change the audit log policy to log only query events, and show the system variables before and after the execution of the policy command, use the following command:

shell> mysqlauditadmin --show-options --server=root@localhost:3310 policy --value=QUERIES

# Showing options before command.
# Audit Log Variables and Options
#
<table>
<thead>
<tr>
<th>Variable_name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>audit_log_buffer_size</td>
<td>1048576</td>
</tr>
<tr>
<td>audit_log_file</td>
<td>audit.log</td>
</tr>
<tr>
<td>audit_log_flush</td>
<td>OFF</td>
</tr>
<tr>
<td>audit_log_policy</td>
<td>ALL</td>
</tr>
<tr>
<td>audit_log_rotate_on_size</td>
<td>0</td>
</tr>
<tr>
<td>audit_log_strategy</td>
<td>ASYNCHRONOUS</td>
</tr>
</tbody>
</table>

# Executing POLICY command.
#

# Showing options after command.
# Audit Log Variables and Options
#
<table>
<thead>
<tr>
<th>Variable_name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>audit_log_buffer_size</td>
<td>1048576</td>
</tr>
<tr>
<td>audit_log_file</td>
<td>audit.log</td>
</tr>
<tr>
<td>audit_log_flush</td>
<td>OFF</td>
</tr>
<tr>
<td>audit_log_policy</td>
<td>QUERIES</td>
</tr>
<tr>
<td>audit_log_rotate_on_size</td>
<td>0</td>
</tr>
<tr>
<td>audit_log_strategy</td>
<td>ASYNCHRONOUS</td>
</tr>
</tbody>
</table>

To change the audit log automatic file rotation size to 32535, and show the system variables before and after the execution of the rotate_on_size command, use the following command. (Notice that the value set is actually 28672 because the specified rotate_on_size value is truncated to a multiple of 4096):

shell> mysqlauditadmin --show-options --server=root@localhost:3310 rotate_on_size --value=32535
To perform a copy of a audit log file to another location, use the following command:

```shell
shell> mysqlauditadmin --audit-log-name=../SERVER/data/audit.log.13486539046497235 \
copy --copy-to=/BACKUP/Audit_Logs
```

To copy a audit log file from a remote server/location to the current location (user password will be prompted), use the following command:

```shell
shell> mysqlauditadmin --audit-log-name=audit.log.13486539046497235 \
copy --remote-login=user:host --copy-to=.
```

### 14.4.3. `mysqlauditgrep` — Allows users to search the current or an archived audit log

This utility allows you to search the current or archived audit logs, allowing you to display data from the audit log file according to the defined search criterion. It also allows you to output the results in different formats, namely GRID (default), TAB, CSV, VERTICAL, and RAW (the original XML format).

This utility allows you to search and filter the returned audit log records by: users (``--users`` [258]), date and time ranges (``--start-date`` [258] and ``--end-date`` [257]), SQL query types (``--query-type`` [257]), logged event and record types (``--event-type`` [257]), status (``--status`` [258]), and matching patterns (``--pattern`` [257]). Any of these search options can be combined and used together, with the retrieved records resulting from all passed in options being true.

The ``--pattern`` [257] supports two types of pattern matching: standard SQL, used with the SQL `LIKE` operator (SQL patterns), and standard `REGEXP` (POSIX regular expression patterns).

This utility always requires an audit log file to be passed in, so the `AUDIT_LOG_FILE` argument is searched as a full path and file name for the audit log file. If not specified, a notification concerning this
mysqlauditgrep — Allows users to search the current or an archived audit log

requirement will be printed. And if `--format [257]` is passed in without search parameters, then all
the records of the audit log are displayed in the specified format.

The `--file-stats [257]` option is not considered a search criteria, and is used to display the file
statistics of a specified audit log. Other search options will be ignored when the `--file-stats [257]`
option is used, except the `--format [257]` option will continue to format the results accordingly.

To specify the format of the generated results, use one of the following values with the `--
format [257]` option:

1. **GRID** *(default)*
   Display output in grid or table format like that of the `mysql` monitor.

2. **CSV**
   Display output in comma-separated values format.

3. **VERTICAL**
   Display output in single-column format like that of the `\G` command for the `mysql` monitor.

4. **RAW**
   Display output results in the original raw format of the audit log records, which is written in XML.

### Standard SQL Pattern Matching

The simple patterns defined by the SQL standard enables users to use two characters with special
meanings: "%" (percent) matches zero or more characters, and "_" (underscore) matches exactly one
arbitrary character. In standard SQL, these types of patterns are used with the `LIKE` comparison
operator, and they are case-insensitive by default. This utility assumes that they are case-insensitive.

For example:

- "audit%"
  Match any string that starts with "audit".
- "%log%"
  Match any string containing the word "log".
- "%_"
  Match any string consisting of one or more characters.

For documentation about the standard SQL pattern matching syntax, see Pattern Matching.

### REEXP Pattern Matching (POSIX)

Standard `REEXP` patterns are more powerful than the simple patterns defined in the SQL standard.
A regular expression is a string of ordinary and special characters specified to match other strings.
Unlike SQL Patterns, `REEXP` patterns are case-sensitive. The `REEXP` syntax defines the following
characters with special meaning:

- .
  Match any character.
- ^
  Match the beginning of a string.
mysqlauditgrep — Allows users to search the current or an archived audit log

- $  
  Match the end of a string.

- \  
  Match zero or more repetitions of the preceding regular expression.

- +  
  Match one or more repetitions of the preceding regular expression.

- ?  
  Match zero or one repetition of the preceding regular expression.

- |  
  Match either the regular expressions from the left or right of |.

- []  
  Indicates a set of characters to match. Note that, special characters lose their special meaning inside sets. In particular, ^ acquires a different meaning if it is the first character of the set, matching the complementary set (i.e., all the characters that are not in the set will be matched).

- {m}  
  Match m repetitions of the preceding regular expression.

- {m,n}  
  Match from m to n repetitions of the preceding regular expression.

- ()  
  Define a matching group, and matches the regular expression inside the parentheses.

For example:
- "a\*"  
  Match a sequence of zero or more a.

- "a+"  
  Match a sequence of one or more a.

- "a?"  
  Match zero or one a.

- "ab|cd"  
  Match ab or cd.

- "[axy]"  
  Match a, x or y.

- "[a-f]"  
  Match any character in the range a to f (that is, a, b, c, d, e, or f).

- "[^axy]"
mysqlauditgrep — Allows users to search the current or an archived audit log

Match any character except a, x or y.

- "a(5)"
  Match exactly five copies of a.

- "a(2,5)"
  Match from two to five copies of a.

- "(abc) +"
  Match one or more repetitions of abc.

This is a brief overview of regular expressions that can be used to define this type of patterns. The full syntax is described in the Python "re" module docs, supporting the definition of much more complex pattern matching expression.

OPTIONS

mysqlauditgrep accepts the following command-line options:

- --end-date=<END_DATE>
  End date/time to retrieve log entries until the specified date/time range. If not specified or the value is 0, all entries to the end of the log are displayed. Accepted formats: "yyyy-mm-ddThh:mm:ss" or "yyyy-mm-dd".

- --event-type=<EVENT_TYPE>
  Comma-separated list of event types to search in all audit log records matching the specified types. Supported values are: Audit, Binlog Dump, Change user, Close stmt, Connect Out, Connect, Create DB, Daemon, Debug, Delayed insert, Drop DB, Execute, Fetch, Field List, Init DB, Kill, Long Data, NoAudit, Ping, Prepare, Processlist, Query, Quit, Refresh, Register Slave, Reset stmt, Set option, Shutdown, Sleep, Statistics, Table Dump, Time.

- --file-stats
  Display the audit log file statistics.

- --format=FORMAT, -f FORMAT
  Output format to display the resulting data. Supported format values: GRID (default), TAB, CSV, VERTICAL and RAW.

- --help
  Display a help message and exit.

- --pattern=<PATTERN>, -e <PATTERN>
  Search pattern to retrieve all entries with at least one attribute value matching the specified pattern. By default the standard SQL LIKE patterns are used for matching. If the --regexp option is set, then REGEXP patterns must be specified for matching.

- --query-type=<QUERY_TYPE>
  Comma-separated list of SQL statements/commands to search for and match. Supported values: CREATE, ALTER, DROP, TRUNCATE, RENAME, GRANT, REVOKE, SELECT, INSERT, UPDATE, DELETE, COMMIT, SHOW, SET, CALL, PREPARE, EXECUTE, DEALLOCATE.

- --regexp, --basic-regexp, -G
Indicates that pattern matching will be performed using a regular expression `REGEXP` (from the Python `re` module). By default, the simple standard SQL `LIKE` patterns are used for matching. This affects how the value specified by the `--pattern` option is interpreted.

- `--start-date=<START_DATE>`
  Starting date/time to retrieve log entries from the specified date/time range. If not specified or the value is 0, all entries from the start of the log are displayed. Accepted formats: `yyyy-mm-ddThh:mm:ss` or `yyyy-mm-dd`.

- `--status=<STATUS>`
  Comma-separated list of status values or intervals to search for all audit log records with a matching status. Status values are non-negative integers (corresponding to MySQL error codes). Status intervals are closed (i.e., include both endpoints) and defined simply using a dash between its endpoints. For Example: `1051,1068-1075,1109,1146`.
  The `--status` option is available as of MySQL Utilities 1.2.4 / 1.3.3.

- `--users=<USERS>, -u <USERS>`
  Comma-separated list of user names, to search for their associated log entries. For example: "dan,jon,john,paul,philip,stefan".

- `--verbose, -v`
  Specify how much information to display. Use this option multiple times to increase the amount of information. For example, `-v = verbose, -vv = more verbose, -vvv = debug`.

- `--version`
  Display version information and exit.

**NOTES**

This utility is available as of `μ 1.2.0`.

This utility can only be applied to servers with the audit log plugin enabled. And the audit log plugin is available as of MySQL Server versions `5.5.28` and `5.6.10`.

This utility requires the use of Python version `2.6` or higher, but does not support Python `3`.

Single or double quote characters (respectively, `‘` or `”`) can be used around option values. In fact, quotes are required to set some options values correctly, such as values with whitespace. For example, to specify the event types `Create DB` and `Drop DB` for the `--event-type` option, the following syntax must be used: `--event-type='Create DB,Drop DB'` or `--event-type="Create DB,Drop DB"`.

**EXAMPLES**

To display the audit log file statistics and output the results in CSV format, run the following command:

```shell
shell> mysqlauditgrep --file-stats --format=CSV /SERVER/data/audit.log
```

```shell
# Audit Log File Statistics:
# File,Size,Created,Last Modified
```

```shell
# Audit Log Startup Entries:
```
To display the audit log entries of specific users, use the following command:

```
shell> mysqlauditgrep --users=tester1,tester2 /SERVER/data/audit.log
```

To display the audit log file statistics, run the following command:

```
shell> mysqlauditgrep /SERVER/data/audit.log
```

To display the audit log entries for a specific date/time range, use the following command:

```
shell> mysqlauditgrep --start-date=2012-09-27T13:33:47 --end-date=2012-09-28 /SERVER/data/audit.log
```

To display the audit log entries matching a specific SQL LIKE pattern, use the following command:

```
shell> mysqlauditgrep --pattern="% = ___"; /SERVER/data/audit.log
```

To display the audit log entries matching a specific REGEXP pattern, use the following command:

```
shell> mysqlauditgrep --pattern=".* = .*" --regexp /SERVER/data/audit.log
```
<table>
<thead>
<tr>
<th>STATUS</th>
<th>NAME</th>
<th>TIMESTAMP</th>
<th>CONNECTION_ID</th>
<th>HOST</th>
<th>USER</th>
<th>PRIV_USER</th>
<th>IP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Connect</td>
<td>2012-09-27T13:33:39</td>
<td>7</td>
<td>localhost</td>
<td>root</td>
<td>root</td>
<td>127.0.0.1</td>
</tr>
<tr>
<td>0</td>
<td>Ping</td>
<td>2012-09-27T13:33:39</td>
<td>7</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>Ping</td>
<td>2012-09-27T13:33:39</td>
<td>7</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>Ping</td>
<td>2012-09-27T13:33:39</td>
<td>7</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>Connect</td>
<td>2012-09-27T13:33:39</td>
<td>8</td>
<td>localhost</td>
<td>root</td>
<td>root</td>
<td>127.0.0.1</td>
</tr>
<tr>
<td>0</td>
<td>Ping</td>
<td>2012-09-27T13:33:39</td>
<td>8</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>Ping</td>
<td>2012-09-27T13:33:39</td>
<td>8</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>Ping</td>
<td>2012-09-27T13:33:39</td>
<td>8</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>Connect</td>
<td>2012-09-28T11:26:50</td>
<td>9</td>
<td>localhost</td>
<td>root</td>
<td>tester</td>
<td>127.0.0.1</td>
</tr>
<tr>
<td>0</td>
<td>Ping</td>
<td>2012-09-28T11:26:50</td>
<td>9</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>Ping</td>
<td>2012-09-28T11:26:50</td>
<td>9</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>Connect</td>
<td>2012-09-28T11:26:50</td>
<td>10</td>
<td>localhost</td>
<td>root</td>
<td>root</td>
<td>127.0.0.1</td>
</tr>
<tr>
<td>0</td>
<td>Ping</td>
<td>2012-09-28T11:26:50</td>
<td>10</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>Ping</td>
<td>2012-09-28T11:26:50</td>
<td>10</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>Ping</td>
<td>2012-09-28T11:26:50</td>
<td>10</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>Connect</td>
<td>2012-10-01T05:55:55</td>
<td>11</td>
<td>localhost</td>
<td>tester</td>
<td>root</td>
<td>127.0.0.1</td>
</tr>
<tr>
<td>0</td>
<td>Connect</td>
<td>2012-10-01T07:35:42</td>
<td>12</td>
<td>localhost</td>
<td>tester</td>
<td>root</td>
<td>127.0.0.1</td>
</tr>
</tbody>
</table>

To display the audit log entries of specific query types, use the following command:

```
shell> mysqlauditgrep --query-type=show,SET /SERVER/data/audit.log
```

<table>
<thead>
<tr>
<th>STATUS</th>
<th>NAME</th>
<th>TIMESTAMP</th>
<th>CONNECTION_ID</th>
<th>SQLTEXT</th>
<th>CONNECTION_ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Query</td>
<td>2012-09-28T11:26:50</td>
<td>9</td>
<td>SET NAMES 'latin1' COLLATE 'latin1_swedish_ci'</td>
<td>9</td>
</tr>
<tr>
<td>0</td>
<td>Query</td>
<td>2012-09-28T11:26:50</td>
<td>9</td>
<td>SHOW VARIABLES LIKE 'datadir'</td>
<td>9</td>
</tr>
<tr>
<td>0</td>
<td>Query</td>
<td>2012-09-28T11:26:50</td>
<td>9</td>
<td>SHOW VARIABLES LIKE 'basedir'</td>
<td>9</td>
</tr>
<tr>
<td>0</td>
<td>Query</td>
<td>2012-09-27T12:20:00</td>
<td>10</td>
<td>SHOW VARIABLES LIKE 'READ_ONLY'</td>
<td>10</td>
</tr>
<tr>
<td>0</td>
<td>Query</td>
<td>2012-09-27T12:20:00</td>
<td>10</td>
<td>SET @@GLOBAL.audit_log_flush = ON</td>
<td>10</td>
</tr>
<tr>
<td>0</td>
<td>Query</td>
<td>2012-09-27T12:20:00</td>
<td>10</td>
<td>SHOW VARIABLES LIKE 'READ_ONLY'</td>
<td>10</td>
</tr>
<tr>
<td>0</td>
<td>Query</td>
<td>2012-09-27T12:20:00</td>
<td>10</td>
<td>SET @@session.autocommit = OFF</td>
<td>10</td>
</tr>
<tr>
<td>0</td>
<td>Query</td>
<td>2012-09-27T12:20:00</td>
<td>10</td>
<td>SHOW VARIABLES LIKE 'READ_ONLY'</td>
<td>10</td>
</tr>
<tr>
<td>0</td>
<td>Query</td>
<td>2012-09-27T12:20:00</td>
<td>10</td>
<td>SET @@session.autocommit = OFF</td>
<td>10</td>
</tr>
<tr>
<td>0</td>
<td>Query</td>
<td>2012-09-27T12:20:00</td>
<td>10</td>
<td>SHOW VARIABLES LIKE 'READ_ONLY'</td>
<td>10</td>
</tr>
</tbody>
</table>

To display the audit log entries of specific event types, use the following command:

```
shell> mysqlauditgrep --event-type="Ping,Connect" /SERVER/data/audit.log
```

<table>
<thead>
<tr>
<th>STATUS</th>
<th>NAME</th>
<th>TIMESTAMP</th>
<th>CONNECTION_ID</th>
<th>SQLTEXT</th>
<th>CONNECTION_ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Connect</td>
<td>2012-09-27T12:21:00</td>
<td>11</td>
<td>SET NAMES 'latin1' COLLATE 'latin1_swedish_ci'</td>
<td>11</td>
</tr>
<tr>
<td>0</td>
<td>Connect</td>
<td>2012-09-27T12:21:00</td>
<td>11</td>
<td>SHOW VARIABLES LIKE 'basedir'</td>
<td>11</td>
</tr>
<tr>
<td>0</td>
<td>Connect</td>
<td>2012-09-27T12:21:00</td>
<td>11</td>
<td>SHOW VARIABLES LIKE 'basepath'</td>
<td>11</td>
</tr>
<tr>
<td>0</td>
<td>Connect</td>
<td>2012-09-27T12:21:00</td>
<td>11</td>
<td>SHOW VARIABLES LIKE 'datadir'</td>
<td>11</td>
</tr>
<tr>
<td>0</td>
<td>Connect</td>
<td>2012-09-27T12:21:00</td>
<td>11</td>
<td>SHOW VARIABLES LIKE 'basedir'</td>
<td>11</td>
</tr>
</tbody>
</table>

To display the audit log entries with a specific status, use the following command:
mysqldbcompare — Compare Two Databases and Identify Differences

This utility compares the objects and data from two databases to find differences. It identifies objects having different definitions in the two databases and presents them in a diff-style format of choice. Differences in the data are shown using a similar diff-style format. Changed or missing rows are shown in a standard format of GRID, CSV, TAB, or VERTICAL.

Use the notation db1:db2 to name two databases to compare, or, alternatively just db1 to compare two databases with the same name. The latter case is a convenience notation for comparing same-named databases on different servers.

The comparison may be run against two databases of different names on a single server by specifying only the `--server1` option. The user can also connect to another server by specifying the `--server2` option. In this case, db1 is taken from server1 and db2 from server2.

Those objects considered in the database include tables, views, triggers, procedures, functions, and events. A count for each object type can be shown with the `-vv` option.

The check is performed using a series of steps called tests. By default, the utility stops on the first failed test, but you can specify the `--run-all-tests` option to cause the utility to run all tests regardless of their end state.

Note: Using `--run-all-tests` may produce expected cascade failures. For example, if the row counts differ among two tables being compared, the data consistency will also fail.

The tests include the following:

1. Check database definitions

   A database existence precondition check ensures that both databases exist. If they do not, no further processing is possible and the `--run-all-tests` option is ignored.

2. Check existence of objects in both databases

   The test for objects in both databases identifies those objects missing from one or another database. The remaining tests apply only to those objects that appear in both databases. To skip
this test, use the \texttt{--skip-object-compare} \cite{264} option. That can be useful when there are known missing objects among the databases.

3. Compare object definitions

The definitions (the \texttt{CREATE} statements) are compared and differences are presented. To skip this test, use the \texttt{--skip-diff} \cite{264} option. That can be useful when there are object name differences only that you want to ignore.

4. Check table row counts

This check ensures that both tables have the same number of rows. This does not ensure that the table data is consistent. It is merely a cursory check to indicate possible missing rows in one table or the other. The data consistency check identifies the missing rows. To skip this test, use the \texttt{--skip-row-count} \cite{264} option.

5. Check table data consistency

This check identifies both changed rows as well as missing rows from one or another of the tables in the databases. Changed rows are displayed as a diff-style report with the format chosen (GRID by default) and missing rows are also displayed using the format chosen. To skip this test, use the \texttt{--skip-data-check} \cite{264} option.

You may want to use the \texttt{--skip-xxx} options to run only one of the tests. This might be helpful when working to bring two databases into synchronization, to avoid running all of the tests repeatedly during the process.

Each test completes with one of the following states:

- \textbf{pass}
  
  The test succeeded.
- \textbf{FAIL}
  
  The test failed. Errors are displayed following the test state line.
- \textbf{SKIP}
  
  The test was skipped due to a missing prerequisite or a skip option.
- \textbf{WARN}
  
  The test encountered an unusual but not fatal error.
- 
  The test is not applicable to this object.

To specify how to display diff-style output, use one of the following values with the \texttt{--difftype} \cite{264} option:

- \texttt{unified} (default)
  
  Display unified format output.
- \texttt{context}
  
  Display context format output.
- \texttt{differ}
  
  Display differ-style format output.
• **sql**
  
  Display SQL transformation statement output.

To specify how to display output for changed or missing rows, use one of the following values with the **--format** option:

• **grid** (default)
  
  Display output in grid or table format like that of the *mysql* monitor.

• **csv**
  
  Display output in comma-separated values format.

• **tab**
  
  Display output in tab-separated format.

• **vertical**
  
  Display output in single-column format like that of the \G command for the *mysql* monitor.

The **--changes-for** option controls the direction of the difference (by specifying the object to be transformed) in either the difference report (default) or the transformation report (designated with the **--difftype=sql** option). Consider the following command:

```
mysqldbcompare --server1=root@host1 --server2=root@host2 --difftype=sql "db1:dbx"
```

The leftmost database (db1) exists on the server designated by the **--server1** option (host1). The rightmost database (dbx) exists on the server designated by the **--server2** option (host2).

• **--changes-for=server1** (default): Produce output that shows how to make the definitions of objects on server1 like the definitions of the corresponding objects on server2.

• **--changes-for=server2** (default): Produce output that shows how to make the definitions of objects on server2 like the definitions of the corresponding objects on server1.

The default direction is *server1*.

You must provide connection parameters (user, host, password, and so forth) for an account that has the appropriate privileges to access all objects in the operation.

If the utility is to be run on a server that has binary logging enabled, and you do not want the comparison steps logged, use the **--disable-binary-logging** option.

**OPTIONS**

*mysqldbcompare* accepts the following command-line options:

• **--help**
  
  Display a help message and exit.

• **--changes-for=<direction>**
  
  Specify the server to show transformations to match the other server. For example, to see the transformation for transforming object definitions on server1 to match the corresponding definitions on server2, use **--changes-for=server1**. Permitted values are *server1* and *server2*. The default is *server1*.  

263
• --difftype=<difftype>, -d<difftype>

Specify the difference display format. Permitted format values are unified, context, differ, and sql. The default is unified.

• --disable-binary-logging

If binary logging is enabled, disable it during the operation to prevent comparison operations from being written to the binary log. Note: Disabling binary logging requires the SUPER privilege.

• --format=<format>, -f<format>

Specify the display format for changed or missing rows. Permitted format values are grid, csv, tab, and vertical. The default is grid.

• --quiet, -q

Do not print anything. Return only an exit code of success or failure.

• --run-all-tests, -a

Do not halt at the first difference found. Process all objects.

• --server1=<source>

Connection information for the first server in the format: <user>[:<passwd>@<host>[:<port>][:<socket>]] or <login-path>[:<port>][:<socket>].

• --server2=<source>

Connection information for the second server in the format: <user>[:<passwd>@<host>[:<port>][:<socket>]] or <login-path>[:<port>][:<socket>].

• --show-reverse

Produce a transformation report containing the SQL statements to conform the object definitions specified in reverse. For example, if --changes-for is set to server1, also generate the transformation for server2. Note: The reverse changes are annotated and marked as comments.

• --skip-data-check

Skip the data consistency check.

• --skip-diff

Skip the object definition difference check.

• --skip-object-compare

Skip the object comparison check.

• --skip-row-count

Skip the row count check.

• --span-key-size=<number of bytes to use for key>

Change the size of the key used for compare table contents. A higher value can help to get more accurate results comparing large databases, but may slow the algorithm.

Default value is 8.

• --verbose, -v
Specify how much information to display. Use this option multiple times to increase the amount of information. For example, --v = verbose, --vv = more verbose, --vvv = debug.

- --version
  Display version information and exit.
- --width=<number>
  Change the display width of the test report. The default is 75 characters.

NOTES

The login user must have the appropriate permissions to read all databases and tables listed.

For the --difftype [264] option, the permitted values are not case sensitive. In addition, values may be specified as any unambiguous prefix of a valid value. For example, --difftype=d [264] specifies the differ type. An error occurs if a prefix matches more than one valid value.

The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the my_print_defaults tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).

If any database identifier specified as an argument contains special characters or is a reserved word, then it must be appropriately quoted with backticks (`). In turn, names quoted with backticks must also be quoted with single or double quotes depending on the operating system, i.e. (‘) in Windows or (‘) in non-Windows systems, in order for the utilities to read backtick quoted identifiers as a single argument. For example, to compare a database with the name weird db.name with other:weird db.name, the database pair must be specified using the following syntax (in non-Windows): ‘weird``db.name`:`other:weird``db.name’.

EXAMPLES

Use the following command to compare the emp1 and emp2 databases on the local server, and run all tests even if earlier tests fail:

```
$ mysqldbcompare --server1=root@localhost emp1:emp2 --run-all-tests
# server1 on localhost: ... connected.
# Checking databases emp1 on server1 and emp2 on server2
WARNING: Objects in server2:emp2 but not in server1:emp1:
  TRIGGER: trg
  PROCEDURE: p1
  TABLE: t1
  VIEW: v1

Type    Object Name Defn  Row  Data
--------------------------
FUNCTION f1     pass  -  -
TABLE    departments pass  pass   FAIL

Data differences found among rows:
--- emp1.departments
+++ emp2.departments
@@ -1,4 +1,4 @@
  1. row ******************
    - dept_no: d002
    - dept_name: dunno
    + dept_name: Finance
  1 rows.

Rows in emp1.departments not in emp2.departments
```
**mysqldbcompare** — Compare Two Databases and Identify Differences

Given: two databases with the same table layout. Data for each table contains:

```
mysql> SELECT * FROM db1.t1;
+---+---------------+
| a | b             |
|---+---------------+
| 1 | Test 789      |
| 2 | Test 456      |
| 3 | Test 123      |
| 4 | New row - db1 |
+---+---------------+
```

```
mysql> SELECT * FROM db2.t1;
+---+---------------+
| a | b             |
|---+---------------+
| 1 | Test 123      |
| 2 | Test 456      |
| 3 | Test 789      |
| 5 | New row - db2 |
+---+---------------+
```

To generate the SQL statements for data transformations to make db1.t1 the same as db2.t1, use the `--changes-for=server1` option. We must also include the `-a` option to ensure that the data consistency test is run. The following command illustrates the options used and an excerpt from the results generated:

```
$ mysqldbcompare --server1=root:root@localhost --server2=root:root@localhost db1:db2 --changes-for=server1 -a --difftype=sql
```

```
# Type Object Name Defn Row Data
# TABLE t1 pass pass FAIL
```

```
# Data differences found among rows: UPDATE db1.t1 SET b = 'Test 123'
WHERE a = '1'; UPDATE db1.t1 SET b = 'Test 789' WHERE a = '3'; DELETE 
FROM db1.t1 WHERE a = '4'; INSERT INTO db1.t1 (a, b) VALUES('5', 'New 
row - db2');
```

Similarly, when the same command is run with `--changes-for=server2` and `--difftype=sql`, the following report is generated:

```
$ mysqldbcompare --server1=root:root@localhost --server2=root:root@localhost db1:db2 --changes-for=server2 -a --difftype=sql
```

mysqldbcopy — Copy Database Objects Between Servers

--server2=root:root@localhost db1:db2 --changes-for=server2 -a \
--diff-type=sql

[...]

# Type      Object Name                             Diff    Count
# TABLE     t1                                      pass    pass    FAIL
# Data transformations for direction = server2:
# Data differences found among rows: UPDATE db2.t1 SET b = 'Test 789'
WHERE a = '1'; UPDATE db2.t1 SET b = 'Test 123' WHERE a = '3'; DELETE
FROM db2.t1 WHERE a = '5'; INSERT INTO db2.t1 (a, b) VALUES('4', 'New
row - db1');

With the --diff-type=sql SQL generation option set, --show-reverse shows the
object transformations in both directions. Here is an excerpt of the results:

$ mysqldbcompare --server1=root:root@localhost \
--server2=root:root@localhost db1:db2 --changes-for=server1 \
--show-reverse -a --diff-type=sql

[...]

# Type      Object Name                             Diff    Count
# TABLE     t1                                      pass    pass    FAIL
# Data transformations for direction = server1:
# Data differences found among rows: UPDATE db1.t1 SET b = 'Test 123'
WHERE a = '1'; UPDATE db1.t1 SET b = 'Test 789' WHERE a = '3'; DELETE
FROM db1.t1 WHERE a = '4'; INSERT INTO db1.t1 (a, b) VALUES('5', 'New
row - db2');

# Data transformations for direction = server2:
# Data differences found among rows: UPDATE db2.t1 SET b = 'Test 789'
WHERE a = '1'; UPDATE db2.t1 SET b = 'Test 123' WHERE a = '3'; DELETE
FROM db2.t1 WHERE a = '5'; INSERT INTO db2.t1 (a, b) VALUES('4', 'New
row - db1');

# Database consistency check failed.  # # ...done

14.4.5. mysqldbcopy — Copy Database Objects Between Servers

This utility copies a database on a source server to a database on a destination server. If the source
and destination servers are different, the database names can be the same or different. If the source
and destination servers are the same, the database names must be different.

The utility accepts one or more database pairs on the command line. To name a database pair,
use \texttt{db\_name:new\_db\_name} syntax to specify the source and destination names explicitly. If the
source and destination database names are the same, \texttt{db\_name} can be used as shorthand for
\texttt{db\_name:db\_name}.

By default, the operation copies all objects (tables, views, triggers, events, procedures, functions, and
database-level grants) and data to the destination server. There are options to turn off copying any or
all of the objects as well as not copying the data.

To exclude specific objects by name, use the \texttt{--exclude} option with a name in \texttt{db\_name:obj\_name} format, or you can supply a search pattern. For example, \texttt{--exclude=db1.trig1} excludes
the single trigger and \texttt{--exclude=trig_} excludes all objects from all databases having a
name that begins with \texttt{trig} and has a following character.
By default, the utility creates each table on the destination server using the same storage engine as the original table. To override this and specify the storage engine to use for all tables created on the destination server, use the `--new-storage-engine` option. If the destination server supports the new engine, all tables use that engine.

To specify the storage engine to use for tables for which the destination server does not support the original storage engine on the source server, use the `--default-storage-engine` option.

The `--new-storage-engine` option takes precedence over `--default-storage-engine` if both are given.

If the `--new-storage-engine` or `--default-storage-engine` option is given and the destination server does not support the specified storage engine, a warning is issued and the server’s default storage engine setting is used instead.

By default, the operation uses a consistent snapshot to read the source databases. To change the locking mode, use the `--locking` option with a locking type value. Use a value of `no-locks` to turn off locking altogether or `lock-all` to use only table locks. The default value is `snapshot`. Additionally, the utility uses WRITE locks to lock the destination tables during the copy.

You can include replication statements for copying data among a master and slave or between slaves. The `--rpl` option permits you to select from the following replication statements to include in the export.

- master

  Include the CHANGE MASTER statement to start a new slave with the current server acting as the master. This executes the appropriate STOP and START slave statements. The STOP SLAVE statement is executed at the start of the copy and the CHANGE MASTER followed by the START SLAVE statements are executed after the copy.

- slave

  Include the CHANGE MASTER statement to start a new slave using the current server’s master information. This executes the appropriate STOP and START slave statements. The STOP SLAVE statement is executed at the start of the copy and the CHANGE MASTER followed by the START SLAVE statements follow the copy.

To include the replication user in the CHANGE MASTER statement, use the `--rpl-user` option to specify the user and password. If this option is omitted, the utility attempts to identify the replication user. In the event that there are multiple candidates or the user requires a password, the utility aborts with an error.

If you attempt to copy databases on a server with GTIDs enabled (GTID_MODE = ON), a warning will be generated if the copy does not include all databases. This is because the GTID statements generated include the GTIDs for all databases and not only those databases in the export.

The utility will also generate a warning if you copy databases on a GTID enabled server but use the `--skip-gtid` option.

To make the most use of GTIDs, you should copy all of the databases on the server with the `--all` option.

**OPTIONS**

`mysqldbcopy` accepts the following command-line options:

- `--help`

  Display a help message and exit.
mysqldbcopy — Copy Database Objects Between Servers

• --default-storage-engine=<def_engine>

  The engine to use for tables if the destination server does not support the original storage engine on
  the source server.

• --destination=<destination>

  Connection information for the destination server in the format: <user>[:<passwd>]<host>[:<port>] [:<socket>] or <login-path>[:<port>][:<socket>]  (where <passwd> is optional and either <port> or <socket> must be provided).

• --exclude=<exclude>, -x<exclude>

  Exclude one or more objects from the operation using either a specific name such as db1.t1 or a
  search pattern. Use this option multiple times to specify multiple exclusions. By default, patterns use
  LIKE matching. With the --regexp [269] option, patterns use REGEXP matching.

  This option does not apply to grants.

• --force

  Drop each database to be copied if exists before copying anything into it. Without this option, an
  error occurs if you attempt to copy objects into an existing database.

• --locking=<locking>

  Choose the lock type for the operation. Permitted lock values are no-locks (do not use any
  table locks), lock-all (use table locks but no transaction and no consistent read), and snapshot
  (consistent read using a single transaction). The default is snapshot.

• --new-storage-engine=<new_engine>

  The engine to use for all tables created on the destination server.

• --quiet, -q

  Turn off all messages for quiet execution.

• --regexp, --basic-regexp, -G

  Perform pattern matches using the REGEXP operator. The default is to use LIKE for matching.

• --rpl=<dump_option>, --replication=<dump_option>

  Include replication information. Permitted values are master (include the CHANGE MASTER
  statement using the source server as the master), slave (include the CHANGE MASTER statement
  using the destination server's master information), and both (include the master and slave options
  where applicable).

• --rpl-user=<replication_user>

  The user and password for the replication user requirement in the form: <user>[:<password>] or
  <login-path>. E.g. rpl:passwd Default = None.

• --skip-gtid

  Skip creation and execution of GTID statements during the copy operation.

• --all

  Copy all of the databases on the server.

• --skip=<objects>
Specify objects to skip in the operation as a comma-separated list (no spaces). Permitted values are
CREATE_DB, DATA, EVENTS, FUNCTIONS, GRANTS, PROCEDURES, TABLES, TRIGGERS, and VIEWS.

- --source=<source>

Connection information for the destination server in the format: <user>[:<passwd>]@<host>[:<port>]
[:<socket>] or <login-path>:<port>:<socket> (where <passwd> is optional and either <port> or
<socket> must be provided).

- --threads

Use multiple threads for cross-server copy. The default is 1.

- --verbose, -v

Specify how much information to display. Use this option multiple times to increase the amount of
information. For example, -v = verbose, -vv = more verbose, -vvv = debug.

- --version

Display version information and exit.

NOTES

You must provide connection parameters (user, host, password, and so forth) for an account that has
the appropriate privileges to access all objects in the operation.

To copy all objects from a source, the user must have these privileges: SELECT and SHOW VIEW for
the database, and SELECT for the mysql database.

To copy all objects to a destination, the user must have these privileges: CREATE for the database,
SUPER (when binary logging is enabled) for procedures and functions, and GRANT OPTION to copy
grants.

Actual privileges required may differ from installation to installation depending on the security privileges
present and whether the database contains certain objects such as views or events and whether binary
logging is enabled.

The --new-storage-engine [269] and --default-storage-engine [269] options apply to
all destination tables in the operation.

Some option combinations may result in errors during the operation. For example, eliminating tables
but not views may result in an error a the view is copied.

The --rpl [269] option is not valid for copying databases on the same server. An error will be
generated.

When copying data and including the GTID commands, you may encounter an error similar to
"GTID_PURGED can only be set when GTID_EXECUTED is empty". This occurs because the
destination server is not in a clean replication state. To aleviate this problem, you can issue a "RESET
MASTER" command on the destination prior to executing the copy.

Cloning databases that contain foreign key constraints does not change the constraint in the cloned
table. For example, if table db1.t1 has a foreign key constraint on table db1.t2, when db1 is cloned to
db2, table db2.t1 will have a foreign key constraint on db1.t2.

The path to the MySQL client tools should be included in the PATH environment variable in
order to use the authentication mechanism with login-paths. This will allow the utility to use the
mysqldbcopy — Copy Database Objects Between Servers

my_print_defaults tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).

If any database identifier specified as an argument contains special characters or is a reserved word, then it must be appropriately quoted with backticks (`). In turn, names quoted with backticks must also be quoted with single or double quotes depending on the operating system, i.e. (”) in Windows or (‘) in non-Windows systems, in order for the utilities to read backtick quoted identifiers as a single argument. For example, to copy a database with the name weird db.name with other:weird db.name, the database pair must be specified using the following syntax (in non-Windows): "weird \"db.name\" : other:weird \"db.name\"".

EXAMPLES

The following example demonstrates how to use the utility to copy a database named util_test to a new database named util_test_copy on the same server:

```
$ mysqldbcopy \
--source=root:pass@localhost:3310:/test123/mysql.sock \
--destination=root:pass@localhost:3310:/test123/mysql.sock \
util_test:util_test_copy
# Source on localhost: ... connected.
# Destination on localhost: ... connected.
# Copying database util_test renamed as util_test_copy
# Copying TABLE util_test.t1
# Copying table data.
# Copying TABLE util_test.t2
# Copying table data.
# Copying TABLE util_test.t3
# Copying table data.
# Copying TABLE util_test.t4
# Copying table data.
# Copying VIEW util_test.v1
# Copying TRIGGER util_test.trg
# Copying PROCEDURE util_test.pl
# Copying FUNCTION util_test.fl
# Copying EVENT util_test.el
# Copying GRANTS from util_test
#...done.
```

If the database to be copied does not contain only InnoDB tables and you want to ensure data integrity of the copied data by locking the tables during the read step, add a `--locking=lock-all` [269] option to the command:

```
$ mysqldbcopy \
--source=root:pass@localhost:3310:/test123/mysql.sock \
--destination=root:pass@localhost:3310:/test123/mysql.sock \
util_test:util_test_copy --locking=lock-all
# Source on localhost: ... connected.
# Destination on localhost: ... connected.
# Copying database util_test renamed as util_test_copy
# Copying TABLE util_test.t1
# Copying table data.
# Copying TABLE util_test.t2
# Copying table data.
# Copying TABLE util_test.t3
# Copying table data.
# Copying TABLE util_test.t4
# Copying table data.
# Copying VIEW util_test.v1
# Copying TRIGGER util_test.trg
# Copying PROCEDURE util_test.pl
# Copying FUNCTION util_test.fl
# Copying EVENT util_test.el
# Copying GRANTS from util_test
#...done.
```

To copy one or more databases from a master to a slave, you can use the following command to copy the databases. Use the master as the source and the slave as the destination:
mysqldbexport — Export Object Definitions or Data from a Database

This utility exports metadata (object definitions) or data or both from one or more databases. By default, the export includes only definitions.

mysqldbexport differs from mysqldump in that it can produce output in a variety of formats to make your data extraction/transport much easier. It permits you to export your data in the format most suitable to an external tool, another MySQL server, or other use without the need to reformat the data.

To exclude specific objects by name, use the --exclude [274] option with a name in db.*obj* format, or you can supply a search pattern. For example, --exclude=db1.trig1 [274] excludes the single trigger and --exclude=trig_ [274] excludes all objects from all databases having a name that begins with trig and has a following character.

To skip objects by type, use the --skip [275] option with a list of the objects to skip. This enables you to extract a particular set of objects, say, for exporting only events (by excluding all other types). Similarly, to skip creation of UPDATE statements for BLOB data, specify the --skip-blobs [276] option.

To specify how to display output, use one of the following values with the --format [275] option:

- **sql** (default)
  Display output using SQL statements. For definitions, this consists of the appropriate CREATE and GRANT statements. For data, this is an INSERT statement (or bulk insert if the --bulk-insert [274] option is specified).

- **grid**
  Display output in grid or table format like that of the mysql monitor.

- **csv**
Display output in comma-separated values format.

- **tab**
  Display output in tab-separated format.

- **vertical**
  Display output in single-column format like that of the `\G` command for the `mysql` monitor.

To specify how much data to display, use one of the following values with the **--display** option:

- **brief**
  Display only the minimal columns for recreating the objects.

- **full**
  Display the complete column list for recreating the objects.

- **names**
  Display only the object names.

Note: For SQL-format output, the **--display** option is ignored.

To turn off the headers for **csv** or **tab** display format, specify the **--no-headers** option.

To turn off all feedback information, specify the **--quiet** option.

To write the data for individual tables to separate files, use the **--file-per-table** option. The name of each file is composed of the database and table names followed by the file format. For example, the following command produces files named `db1.*table_name*.csv`:

```
mysqldbexport --server=root@server1:3306 --format=csv db1 --export=data
```

By default, the operation uses a consistent snapshot to read the source databases. To change the locking mode, use the **--locking** option with a locking type value. Use a value of **no-locks** to turn off locking altogether or **lock-all** to use only table locks. The default value is **snapshot**. Additionally, the utility uses WRITE locks to lock the destination tables during the copy.

You can include replication statements for exporting data among a master and slave or between slaves. The **--rpl** option permits you to select from the following replication statements to include in the export.

- **master**
  Include the `CHANGE MASTER` statement to start a new slave with the current server acting as the master. This places the appropriate STOP and START slave statements in the export whereby the `STOP SLAVE` statement is placed at the start of the export and the `CHANGE MASTER` followed by the `START SLAVE` statements are placed after the export stream.

- **slave**
  Include the `CHANGE MASTER` statement to start a new slave using the current server’s master information. This places the appropriate STOP and START slave statements in the export whereby the `STOP SLAVE` statement is placed at the start of the export and the `CHANGE MASTER` followed by the `START SLAVE` statements are placed after the export stream.

- **both**
Include both the ‘master’ and ‘slave’ information for \texttt{CHANGE MASTER} statements for either spawning a new slave with the current server’s master or using the current server as the master. All statements generated are labeled and commented to enable the user to choose which to include when imported.

To include the replication user in the \texttt{CHANGE MASTER} statement, use the \texttt{--rpl-user [275]} option to specify the user and password. If this option is omitted, the utility attempts to identify the replication user. In the event that there are multiple candidates or the user requires a password, these statements are placed inside comments for the \texttt{CHANGE MASTER} statement.

You can also use the \texttt{--comment-rpl [274]} option to place the replication statements inside comments for later examination.

If you specify the \texttt{--rpl-file [275]} option, the utility writes the replication statements to the file specified instead of including them in the export stream.

If you attempt to export databases on a server with GTIDs enabled (\texttt{GTID\_MODE = ON}), a warning will be generated if the export does not include all databases. This is because the GTID statements generated include the GTIDs for all databases and not only those databases in the export.

The utility will also generate a warning if you export databases on a GTID enabled server but use the \texttt{--skip-gtid [276]} option.

To make the most use of GTIDs and export/import, you should export all of the databases on the server with the \texttt{--all [276]} option. This will generate an export file with all of the databases and the GTIDs executed to that point.

Importing this file on another server will ensure that server has all of the data as well as all of the GTIDs recorded correctly in its logs.

\textbf{OPTIONS}

\texttt{mysqldbexport} accepts the following command-line options:

- \texttt{--help}
  Display a help message and exit.

- \texttt{--bulk-insert, -b}
  Use bulk insert statements for data.

- \texttt{--comment-rpl}
  Place the replication statements in comment statements. Valid only with the \texttt{--rpl [275]} option.

- \texttt{--display=<display>, -d<display>}
  Control the number of columns shown. Permitted display values are \texttt{brief} (minimal columns for object creation), \texttt{full} (all columns), and \texttt{**names} (only object names; not valid for \texttt{--format=sql [275]}). The default is \texttt{brief}.

- \texttt{--exclude=<exclude>, -x<exclude>}
  Exclude one or more objects from the operation using either a specific name such as \texttt{db1.t1} or a search pattern. Use this option multiple times to specify multiple exclusions. By default, patterns use \texttt{LIKE} matching. With the \texttt{--regexp [275]} option, patterns use \texttt{REGEXP} matching.

  This option does not apply to grants.

- \texttt{--export=<export>, -e<export>}

274
mysqldbexport — Export Object Definitions or Data from a Database

Specify the export format. Permitted format values are definitions = export only the definitions (metadata) for the objects in the database list, data = export only the table data for the tables in the database list, and both = export the definitions and the data. The default is definitions.

- --file-per-table
  Write table data to separate files. This is Valid only if the export output includes data (that is, if --export=data [274] or --export=both [274] are given). This option produces files named db_name.*tbl_name*.*format*. For example, a csv export of two tables named t1 and t2 in database d1, results in files named db1.t1.csv and db1.t2.csv. If table definitions are included in the export, they are written to stdout as usual.

- --format=<format>, -f<format>
  Specify the output display format. Permitted format values are sql, grid, tab, csv, and vertical. The default is sql.

- --locking=<locking>
  Choose the lock type for the operation. Permitted lock values are no-locks (do not use any table locks), lock-all (use table locks but no transaction and no consistent read), and snapshot (consistent read using a single transaction). The default is snapshot.

- --no-headers, -h
  Do not display column headers. This option applies only for csv and tab output.

- --quiet, -q
  Turn off all messages for quiet execution.

- --regexp, --basic-regexp, -G
  Perform pattern matches using the REGEXP operator. The default is to use LIKE for matching.

- --rpl=<dump_option>, --replication=<dump_option>
  Include replication information. Permitted values are master (include the CHANGE MASTER statement using the source server as the master), slave (include the CHANGE MASTER statement using the destination server's master information), and both (include the master and slave options where applicable).

- --rpl-file=RPL_FILE, --replication-file=RPL_FILE
  The path and file name where the generated replication information should be written. Valid only with the --rpl [275] option.

- --rpl-user=<replication_user>
  The user and password for the replication user requirement, in the format: <user>[:<password>] or <login-path>. For example, rpl:passwd. The default is None.

- --server=<server>
  Connection information for the server in <user>[:<password>]<host>[:<port>][:<socket>] or <login-path>[:<port>][:<socket>].

- --skip=<skip-objects>
  Specify objects to skip in the operation as a comma-separated list (no spaces). Permitted values are CREATE_DB, DATA, EVENTS, FUNCTIONS, GRANTS, PROCEDURES, TABLES, TRIGGERS, and VIEWS.
• --skip-blobs
  Do not export BLOB data.

• --skip-gtid
  Skip creation of GTID_PURGED statements.

• --all
  Generate an export file with all of the databases and the GTIDs executed to that point.

• --verbose, -v
  Specify how much information to display. Use this option multiple times to increase the amount of information. For example, -v = verbose, -vv = more verbose, -vvv = debug.

• --version
  Display version information and exit.

NOTES

You must provide connection parameters (user, host, password, and so forth) for an account that has the appropriate privileges to access all objects in the operation.

To export all objects from a source database, the user must have these privileges: SELECT and SHOW VIEW on the database as well as SELECT on the mysql database.

Actual privileges needed may differ from installation to installation depending on the security privileges present and whether the database contains certain objects such as views or events.

Some combinations of the options may result in errors when the export is imported later. For example, eliminating tables but not views may result in an error when a view is imported on another server.

For the --format [275], --export [274], and --display [274] options, the permitted values are not case sensitive. In addition, values may be specified as any unambiguous prefix of a valid value. For example, --format=g [275] specifies the grid format. An error occurs if a prefix matches more than one valid value.

The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the my_print_defaults tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).

If any database identifier specified as an argument contains special characters or is a reserved word, then it must be appropriately quoted with backticks (`). In turn, names quoted with backticks must also be quoted with single or double quotes depending on the operating system, i.e. (`) in Windows or (`) in non-Windows systems, in order for the utilities to read backtick quoted identifiers as a single argument. For example, to export a database with the name weird db.name, it must be specified as argument using the following syntax (in non-Windows): "weird\'db.name".

EXAMPLES

To export the definitions of the database dev from a MySQL server on the local host via port 3306, producing output consisting of CREATE statements, use this command:

```bash
$ mysqldbexport --server=root:pass@localhost \
  --skip=GRANTS --export=DEFINITIONS util_test
# Source on localhost: ... connected.
# Exporting metadata from util_test
DROP DATABASE IF EXISTS util_test;
```
CREATE DATABASE util_test;
USE util_test;
# TABLE: util_test.t1
CREATE TABLE `t1` (  
  `a` char(30) DEFAULT NULL  
) ENGINE=MEMORY DEFAULT CHARSET=latin1;
# TABLE: util_test.t2
CREATE TABLE `t2` (  
  `a` char(30) DEFAULT NULL  
) ENGINE=MyISAM DEFAULT CHARSET=latin1;
# TABLE: util_test.t3
CREATE TABLE `t3` (  
  `a` int(11) NOT NULL AUTO_INCREMENT,  
  `b` char(30) DEFAULT NULL,  
  PRIMARY KEY (`a`)  
) ENGINE=InnoDB AUTO_INCREMENT=4 DEFAULT CHARSET=latin1;
# TABLE: util_test.t4
CREATE TABLE `t4` (  
  `c` int(11) NOT NULL,  
  `d` int(11) NOT NULL,  
  KEY `ref_t3` (`c`),  
  CONSTRAINT `ref_t3` FOREIGN KEY (`c`) REFERENCES `t3` (`a`)  
) ENGINE=InnoDB DEFAULT CHARSET=latin1;
# VIEW: util_test.v1

Similarly, to export the data of the database `util_test`, producing bulk insert statements, use this command:

```bash
$ mysqldbexport --server=root:pass@localhost --export=DATA --bulk-insert util_test
```

If the database to be exported does not contain only InnoDB tables and you want to ensure data integrity of the exported data by locking the tables during the read step, add a `--locking=lock-all` option to the command:

```bash
$ mysqldbexport --server=root:pass@localhost --export=DATA --bulk-insert util_test --locking=lock-all
```
mysqldbexport — Export Object Definitions or Data from a Database

To export a database and include the replication commands to use the current server as the master (for example, to start a new slave using the current server as the master), use the following command:

```bash
$ mysqldbexport --server=root@localhost:3311 util_test \
  --export=both --rpl-user=rpl:rpl --rpl=master -v
```

Similarly, to export a database and include the replication commands to use the current server's master (for example, to start a new slave using the same the master), use the following command:

```bash
$ mysqldbexport --server=root@localhost:3311 util_test \
  --export=both --rpl-user=rpl:rpl --rpl=slave -v
```
USE util_test;

# TABLE: util_test.t1
CREATE TABLE `t1` (  
  `a` char(30) DEFAULT NULL
) ENGINE=MEMORY DEFAULT CHARSET=latin1;
#...done.
# Source on localhost: ... connected.
USE util_test;

# Exporting data from util_test
# Data for table util_test.t1:
INSERT INTO util_test.t1 VALUES ('01 Test Basic database example');
INSERT INTO util_test.t1 VALUES ('02 Test Basic database example');
INSERT INTO util_test.t1 VALUES ('03 Test Basic database example');
INSERT INTO util_test.t1 VALUES ('04 Test Basic database example');
INSERT INTO util_test.t1 VALUES ('05 Test Basic database example');
INSERT INTO util_test.t1 VALUES ('06 Test Basic database example');
INSERT INTO util_test.t1 VALUES ('07 Test Basic database example');
#...done.

# Connecting to the current server's master
CHANGE MASTER TO MASTER_HOST = 'localhost',  
  MASTER_USER = 'rpl',  
  MASTER_PASSWORD = 'rpl',  
  MASTER_PORT = 3310,  
  MASTER_LOG_FILE = 'clone-bin.000001',  
  MASTER_LOG_POS = 1739;

# Starting slave
START SLAVE;

14.4.7. **mysqldbimport** — Import Object Definitions or Data into a Database

This utility imports metadata (object definitions) or data or both for one or more databases from one or more files.

If an object exists on the destination server with the same name as an imported object, it is dropped first before importing the new object.

To skip objects by type, use the `--skip` option with a list of the objects to skip. This enables you to extract a particular set of objects, say, for importing only events (by excluding all other types). Similarly, to skip creation of `UPDATE` statements for `BLOB` data, specify the `--skip-blobs` option.

To specify the input format, use one of the following values with the `--format` option. These correspond to the output formats of the `mysqldbexport` utility:

- **sql** (default)
  
  Input consists of SQL statements. For definitions, this consists of the appropriate `CREATE` and `GRANT` statements. For data, this is an `INSERT` statement (or bulk insert if the `--bulk-insert` option is specified).

- **grid**
  
  Display output in grid or table format like that of the `mysql` monitor.

- **csv**
  
  Input is formatted in comma-separated values format.

- **raw_csv**
  
  Input is a simple CSV file containing uniform rows with values separated with commas. The file can contain a header (the first row) that lists the table columns. The option `--table` is required to use this format.
mysqldbimport — Import Object Definitions or Data into a Database

- **tab**
  Input is formatted in tab-separated format.

- **vertical**
  Display output in single-column format like that of the \G command for the mysql monitor.

To indicate that input in csv or tab format does not contain column headers, specify the **--no-headers** option.

To turn off all feedback information, specify the **--quiet** option.

By default, the utility creates each table on the destination server using the same storage engine as the original table. To override this and specify the storage engine to use for all tables created on the destination server, use the **--new-storage-engine** option. If the destination server supports the new engine, all tables use that engine.

To specify the storage engine to use for tables for which the destination server does not support the original storage engine on the source server, use the **--default-storage-engine** option.

The **--new-storage-engine** option takes precedence over **--default-storage-engine** if both are given.

If the **--new-storage-engine** or **--default-storage-engine** option is given and the destination server does not support the specified storage engine, a warning is issued and the server’s default storage engine setting is used instead.

You must provide connection parameters (user, host, password, and so forth) for an account that has the appropriate privileges to access all objects in the operation. For details, see NOTES.

If you attempt to import databases on a server with GTIDs enabled (GTID_MODE = ON), a warning will be generated if the import file did not include the GTID statements generated by mysqldbexport.

The utility will also generate a warning if you import databases on a server without GTIDs enabled and there are GTID statements present in the file. Use the **--skip-gtid** option to ignore the GTID statements.

To make the most use of GTIDs and export/import, you should export all of the databases on the server with the **--all** option. This will generate an export file with all of the databases and the GTIDs executed to that point. Importing this file on another server will ensure that server has all of the data as well as all of the GTIDs recorded correctly in its logs.

**OPTIONS**

**mysqldbimport** accepts the following command-line options:

- **--help**
  Display a help message and exit.

- **--bulk-insert, -b**
  Use bulk insert statements for data.

- **--default-storage-engine=<def_engine>**
  The engine to use for tables if the destination server does not support the original storage engine on the source server.

- **--drop-first, -d**
  Drop all existing tables before beginning the import.
mysqldbimport — Import Object Definitions or Data into a Database

Drop each database to be imported if exists before importing anything into it.

- --dryrun
  Import the files and generate the statements but do not execute them. This is useful for testing input file validity.

- --format=<format>, -f<format>
  Specify the input format. Permitted format values are sql, grid, tab, csv, raw_csv, and vertical. The default is sql.

- --import=<import_type>, -i<import_type>
  Specify the import format. Permitted format values are definitions = import only the definitions (metadata) for the objects in the database list, data = import only the table data for the tables in the database list, and both = import the definitions and the data. The default is definitions.

If you attempt to import objects into an existing database, the result depends on the import format. If the format is definitions or both, an error occurs unless --drop-first [280] is given. If the format is data, imported table data is added to existing table data.

- --new-storage-engine=<new_engine>
  The engine to use for all tables created on the destination server.

- --no-headers, -h
  Input does not contain column headers. This option applies only for csv and tab output.

- --quiet, -q
  Turn off all messages for quiet execution.

- --server=<server>
  Connection information for the server in the format: <user>[:<passwd>@]<host>[:<port>][:<socket>] or <login-path>[:<port>][:<socket>].

- --skip=<skip_objects>
  Specify objects to skip in the operation as a comma-separated list (no spaces). Permitted values are CREATE_DB, DATA, EVENTS, FUNCTIONS, GRANTS, PROCEDURES, TABLES, TRIGGERS, and VIEWS.

- --skip-blobs
  Do not import BLOB data.

- --skip-gtid
  Skip execution of GTID_PURGED statements.

- --skip-rpl
  Do not execute replication commands.

- --table=<db>,<table>
  Specify the table for importing. This option is required while using --format=raw_csv.

- --verbose, -v
Specify how much information to display. Use this option multiple times to increase the amount of information. For example, \(-v\) = verbose, \(-vv\) = more verbose, \(-vvv\) = debug.

- \(--version\)

Display version information and exit.

**NOTES**

The login user must have the appropriate permissions to create new objects, access (read) the mysql database, and grant privileges. If a database to be imported already exists, the user must have read permission for it, which is needed to check the existence of objects in the database.

Actual privileges needed may differ from installation to installation depending on the security privileges present and whether the database contains certain objects such as views or events and whether binary logging is enabled.

Some combinations of the options may result in errors during the operation. For example, excluding tables but not views may result in an error when a view is imported.

The \(--new-storage-engine\) and \(--default-storage-engine\) options apply to all destination tables in the operation.

For the \(--format\) and \(--import\) options, the permitted values are not case sensitive. In addition, values may be specified as any unambiguous prefix of a valid value. For example, \(--format=g\) specifies the grid format. An error occurs if a prefix matches more than one valid value.

When importing data and including the GTID commands, you may encounter an error similar to "GTID_PURGED can only be set when GTID_EXECUTED is empty". This occurs because the destination server is not in a clean replication state. To alleviate this problem, you can issue a "RESET MASTER" command on the destination prior to executing the import.

The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the my_print_defaults tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).

**EXAMPLES**

To import the metadata from the **util_test** database to the server on the local host using a file in CSV format, use this command:

```
$ mysqldbimport --server=root@localhost --import=definitions \   
   --format=csv data.csv
# Source on localhost: ... connected.
# Importing definitions from data.csv.
#...done.
```

Similarly, to import the data from the **util_test** database to the server on the local host, importing the data using bulk insert statements, use this command:

```
$ mysqldbimport --server=root@localhost --import=data \   
   --bulk-insert --format=csv data.csv
# Source on localhost: ... connected.
# Importing data from data.csv.
#...done.
```

To import both data and definitions from the **util_test** database, importing the data using bulk insert statements from a file that contains SQL statements, use this command:

```
$ mysqldbimport --server=root@localhost --import=both --bulk-insert --format=sql data.sql
```
**mysqldiff** — Identify Differences Among Database Objects

This utility reads the definitions of objects and compares them using a diff-like method to determine whether they are the same. The utility displays the differences for objects that are not the same.

Use the notation `db1:db2` to name two databases to compare, or, alternatively just `db1` to compare two databases with the same name. The latter case is a convenience notation for comparing same-named databases on different servers.

The comparison may be run against two databases of different names on a single server by specifying only the `--server1` [284] option. The user can also connect to another server by specifying the `--server2` [284] option. In this case, `db1` is taken from server1 and `db2` from server2.

When a database pair is specified, all objects in one database are compared to the corresponding objects in the other. Any objects not appearing in either database produce an error.

To compare a specific pair of objects, add an object name to each database name in `db.obj` format. For example, use `db1.obj1:db2.obj2` to compare two named objects, or `db1.obj1` to compare an object with the same name in databases with the same name. It is not legal to mix a database name with an object name. For example, `db1.obj1:db2` and `db1:db2.obj2` are illegal.

The comparison may be run against a single server for comparing two databases of different names on the same server by specifying only the `--server1` [284] option. Alternatively, you can also connect to another server by specifying the `--server2` [284] option. In this case, the first object to compare is taken from server1 and the second from server2.

By default, the utility generates object differences as a difference report. However, you can generate a transformation report containing SQL statements for transforming the objects for conformity instead. Use the 'sql' value for the `--difftype` [284] option to produce a listing that contains the appropriate ALTER commands to conform the object definitions for the object pairs specified. If a transformation cannot be formed, the utility reports the diff of the object along with a warning statement. See important limitations in the NOTES section.

To specify how to display diff-style output, use one of the following values with the `--difftype` [284] option:

- **unified** (default)
  Display unified format output.

- **context**
  Display context format output.

- **differ**
  Display differ-style format output.

- **sql**
  Display SQL transformation statement output.

The `--changes-for` [284] option controls the direction of the difference (by specifying the object to be transformed) in either the difference report (default) or the transformation report (designated with the `--difftype=sql` [284] option). Consider the following command:

```
mysqldiff --server1=root@host1 --server2=root@host2 --difftype=sql \
  db1.table1:dbx.table3
```
The leftmost database (db1) exists on the server designated by the `--server1` option (host1). The rightmost database (dbx) exists on the server designated by the `--server2` option (host2).

- `--changes-for=server1`: Produce output that shows how to make the definitions of objects on `server1` like the definitions of the corresponding objects on `server2`.

- `--changes-for=server2`: Produce output that shows how to make the definitions of objects on `server2` like the definitions of the corresponding objects on `server1`.

The default direction is `server1`.

For `sql` difference format, you can also see the reverse transformation by specifying the `--show-reverse` option.

The utility stops on the first occurrence of missing objects or when an object does not match. To override this behavior, specify the `--force` option to cause the utility to attempt to compare all objects listed as arguments.

**OPTIONS**

`mysqldiff` accepts the following command-line options:

- `--help`
  Display a help message and exit.

- `--changes-for=<direction>`
  Specify the server to show transformations to match the other server. For example, to see the transformation for transforming object definitions on server1 to match the corresponding definitions on server2, use `--changes-for=server1`. Permitted values are `server1` and `server2`. The default is `server1`.

- `--difftype=<difftype>, -d<difftype>`
  Specify the difference display format. Permitted format values are `unified`, `context`, `differ`, and `sql`. The default is `unified`.

- `--force`
  Do not halt at the first difference found. Process all objects to find all differences.

- `--quiet, -q`
  Do not print anything. Return only an exit code of success or failure.

- `--server1=<source>`
  Connection information for the first server in the format: `<user>[:<passwd>]<host>[:<port>][:<socket>] or <login-path>[:<port>][:<socket>]`.

- `--server2=<source>`
  Connection information for the second server in the format: `<user>[:<passwd>]<host>[:<port>][:<socket>] or <login-path>[:<port>][:<socket>]`.

- `--show-reverse`
  Produce a transformation report containing the SQL statements to conform the object definitions specified in reverse. For example, if `--changes-for` is set to server1, also generate the transformation for server2. Note: The reverse changes are annotated and marked as comments.
• --verbose, -v
   Specify how much information to display. Use this option multiple times to increase the amount of
   information. For example, -v = verbose, -vv = more verbose, -vvv = debug.

• --version
   Display version information and exit.

• --width=<number>
   Change the display width of the test report. The default is 75 characters.

NOTES

You must provide connection parameters (user, host, password, and so forth) for an account that has
the appropriate privileges to access all objects to be compared.

The SQL transformation feature has these known limitations:

• When tables with partition differences are encountered, the utility generates the \texttt{ALTER TABLE}
  statement for all other changes but prints a warning and omits the partition differences.

• If the transformation detects table options in the source table (specified with the \texttt{--changes-}
  for [284] option) that are not changed or do not exist in the target table, the utility generates
  the \texttt{ALTER TABLE} statement for all other changes but prints a warning and omits the table option
differences.

• Rename for events is not supported. This is because \texttt{mysqldiff} compares objects by name. In this
  case, depending on the direction of the diff, the event is identified as needing to be added or a \texttt{DROP
  EVENT} statement is generated.

• Changes in the definer clause for events are not supported.

• SQL extensions specific to MySQL Cluster are not supported.

For the \texttt{--difftype [284]} option, the permitted values are not case sensitive. In addition, values
may be specified as any unambiguous prefix of a valid value. For example, \texttt{--difftype=d [284]}
specifies the differ type. An error occurs if a prefix matches more than one valid value.

The path to the MySQL client tools should be included in the \texttt{PATH} environment variable in
order to use the authentication mechanism with login-paths. This will allow the utility to use the
my\_print\_defaults tools which is required to read the login-path values from the login configuration file
(.mylogin.cnf).

If any database object identifier specified as an argument contains special characters or is a
reserved word, then it must be appropriately quoted with backticks (``). In turn, names quoted
with backticks must also be quoted with single or double quotes depending on the operating
system, i.e. (*) in Windows or (*) in non-Windows systems, in order for the utilities to read
backtick quoted identifiers as a single argument. For example, to show the difference between
table \texttt{weird\_table1} from database \texttt{weird\_db.name} and table \texttt{weird\_table2} from database
\texttt{other:weird\_db.name}, the objects pair must be specified using the following syntax (in non-Windows):
\texttt{"weird\_db.name\_weird\_table1\_other:weird\_db.name\_weird\_table2"}.

EXAMPLES

To compare the \texttt{employees} and \texttt{emp} databases on the local server, use this command:

```bash
$ mysqldiff --server1=root@localhost employees:empl
# server1 on localhost: ... connected.
WARNING: Objects in server1:employees but not in server2:empl:
   EVENT: e1
Compare failed. One or more differences found.
```
$ mysqldiff --server1=root@localhost \ 
  employees.t1:empl.t1 employees.t3:empl.t3
# server1 on localhost: ... connected.
# Comparing employees.t1 to empl.t1                  [PASS]
# server1 on localhost: ... connected.
# Comparing employees.t3 to empl.t3                  [PASS]
Success. All objects are the same.

$ mysqldiff --server1=root@localhost \ 
  employees.salaries:empl.salaries --differ
# server1 on localhost: ... connected.
# Comparing employees.salaries to empl.salaries       [FAIL]
# Object definitions are not the same:
# CREATE TABLE `salaries` (  
#   `emp_no` int(11) NOT NULL,
#   `salary` int(11) NOT NULL,
#   `from_date` date NOT NULL,
#   `to_date` date NOT NULL,
#   PRIMARY KEY (`emp_no`,`from_date`),
#   KEY `emp_no` (`emp_no`) 
# ) ENGINE=InnoDB DEFAULT CHARSET=latin1
?           ^^^^^
+ ) ENGINE=MyISAM DEFAULT CHARSET=latin1
?          ++ ^^^
Compare failed. One or more differences found.

The following examples show how to generate a transformation report. Assume the following object definitions:

**Host1:**

```
CREATE TABLE db1.table1 (num int, misc char(30));
```

**Host2:**

```
CREATE TABLE dbx.table3 (num int, notes char(30), misc char(55));
```

To generate a set of SQL statements that transform the definition of `db1.table1` to `dbx.table3`, use this command:

```
$ mysqldiff --server1=root@host1 --server2=root@host2 \
  --changes-for=server1 --difftype=sql \ 
  db1.table1:dbx.table3
# server1 on host1: ... connected.
# server2 on host2: ... connected.
# Comparing db1.table1 to dbx.table3                  [FAIL]
# Transformation statements:

ALTER TABLE db1.table1
ADD COLUMN notes char(30) AFTER a,
CHANGE COLUMN misc misc char(55);
```

Compare failed. One or more differences found.

To generate a set of SQL statements that transform the definition of `dbx.table3` to `db1.table1`, use this command:

```
$ mysqldiff --server1=root@host1 --server2=root@host2 \
  --changes-for=server2 --difftype=sql \ 
  db1.table1:dbx.table3
# server1 on host1: ... connected.
# server2 on host2: ... connected.
# Comparing db1.table1 to dbx.table3                  [FAIL]
# Transformation statements:

ALTER TABLE dbx.table3
DROP COLUMN notes,
CHANGE COLUMN misc misc char(30);
```
To generate a set of SQL statements that transform the definitions of `dbx.table3` and `db1.table1` in both directions, use this command:

```bash
$ mysqldiff --server1=root@host1 --server2=root@host2  
    --show-reverse --difftype=sql 
   db1.table1:dbx.table3
# server1 on host1: ... connected.
# server2 on host2: ... connected.
# Comparing db1.table1 to dbx.table3                     [FAIL]
# Transformation statements:

#  --destination=server1:
ALTER TABLE db1.table1
    ADD COLUMN notes char(30) AFTER a,
    CHANGE COLUMN misc misc char(55);

#  --destination=server2:
# ALTER TABLE dbx.table3
#    DROP COLUMN notes,
#    CHANGE COLUMN misc misc char(30);
```

### 14.4.9. `mysqldiskusage` — Show Database Disk Usage

This utility displays disk space usage for one or more databases. The utility optionally displays disk usage for the binary log, slow query log, error log, general query log, relay log, and InnoDB tablespaces. The default is to show only database disk usage.

If the command line lists no databases, the utility shows the disk space usage for all databases.

Sizes displayed without a unit indicator such as MB are in bytes.

The utility determines the location of the data directory by requesting it from the server. For a local server, the utility obtains size information directly from files in the data directory and InnoDB home directory. In this case, you must have file system access to read those directories. Disk space usage shown includes the sum of all storage engine-specific files such as the .MYI and .MYD files for MyISAM and the tablespace files for InnoDB.

If the file system read fails, or if the server is not local, the utility cannot determine exact file sizes. It is limited to information that can be obtained from the system tables, which therefore should be considered an estimate. For information read from the server, the account used to connect to the server must have the appropriate permissions to read any objects accessed during the operation.

If information requested requires file system access but is not available that way, the utility prints a message that the information is not accessible. This occurs, for example, if you request log usage but the server is not local and the log files cannot be examined directly.

To specify how to display output, use one of the following values with the `--format` option:

- **grid** (default)
  Display output in grid or table format like that of the `mysql` monitor.

- **csv**
  Display output in comma-separated values format.

- **tab**
  Display output in tab-separated format.

- **vertical**
  Display output vertically.
mysqldiskusage — Show Database Disk Usage

Display output in single-column format like that of the \G command for the mysql monitor.
To turn off the headers for csv or tab display format, specify the --no-headers[288] option.

OPTIONS

mysqldiskusage accepts the following command-line options:

- --help
  Display a help message and exit.

- --all, -a
  Display all disk usage. This includes usage for databases, logs, and InnoDB tablespaces.

- --binlog, -b
  Display binary log usage.

- --empty, -m
  Include empty databases.

- --format=<format>, -f<format>
  Specify the output display format. Permitted format values are grid, csv, tab, and vertical. The default is grid.

- --innodb, -i
  Display InnoDB tablespace usage. This includes information about the shared InnoDB tablespace as well as .idb files for InnoDB tables with their own tablespace.

- --logs, -l
  Display general query log, error log, and slow query log usage.

- --no-headers, -h
  Do not display column headers. This option applies only for csv and tab output.

- --quiet, -q
  Suppress informational messages.

- --relaylog, -r
  Display relay log usage.

- --server=<server>
  Connection information for the server in the format: <user>[:<passwd>]<host>[::<port>][::<socket>]
or <login-path>[:<port>][::<socket>].

- --verbose, -v
  Specify how much information to display. Use this option multiple times to increase the amount of information. For example, -v = verbose, -vv = more verbose, -vvv = debug.

- --version
  Display version information and exit.
For the \texttt{--format} [288] option, the permitted values are not case sensitive. In addition, values may be specified as any unambiguous prefix of a valid value. For example, \texttt{--format=g} [288] specifies the grid format. An error occurs if a prefix matches more than one valid value.

\textbf{NOTES}

You must provide connection parameters (user, host, password, and so forth) for an account that has the appropriate privileges for all objects accessed during the operation.

The path to the MySQL client tools should be included in the \texttt{PATH} environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the \texttt{my_print_defaults} tools which is required to read the login-path values from the login configuration file \texttt{(.mylogin.cnf)}.

\textbf{EXAMPLES}

To show only the disk space usage for the \texttt{employees} and \texttt{test} databases in grid format (the default), use this command:

\begin{verbatim}
$ mysqldiskusage --server=root@localhost employees test
# Source on localhost: ... connected.
# Database totals:
+------------+--------------+
| db_name    |       total  |
+------------+--------------+
| employees  | 205,979,648  |
| test       |       4,096  |
+------------+--------------+
Total database disk usage = 205,983,744 bytes or 196.00 MB
#...done.
\end{verbatim}

To see all disk usage for the server in CSV format, use this command:

\begin{verbatim}
$ mysqldiskusage --server=root@localhost --format=csv -a -vv
# Source on localhost: ... connected.
# Database totals:
db_name,db_dir_size,data_size,misc_files,total
backup_test,0,0,0,0
db3,0,0,0,0
db2,0,0,0,0
db1,0,0,0,0
employees,242519463,205979648,242519463,448499111
mysql,867211,657669,191720,849389
t1,9849,1024,8825,9849
test,56162,4096,52066,56162
util_test_a,19625,2048,17577,19625
util_test_b,17347,0,17347,17347
util_test_c,19623,2048,17575,19623
employees,205,979,648,4,096

Total database disk usage = 449,490,516 bytes or 428.00 MB
# Log information.
# The general_log is turned off on the server.
# The slow_query_log is turned off on the server.
# binary log information:
Current binary log file = ./mysql-bin.000076
log_file,size
/data/mysql-bin.000076,125
/data/mysql-bin.000077,125
/data/mysql-bin.000078,556
/data/mysql-bin.000079,16839823
/data/mysql-bin.index,76

Total size of binary logs = 168,399,105 bytes or 160.00 MB
\end{verbatim}
This utility permits users to perform replication health monitoring and automatic failover on a replication topology consisting of a master and its slaves. The utility is designed to run interactively or continuously refreshing the health information at periodic intervals. Its primary mission is to monitor the master for failure and when a failure occurs, execute failover to the best slave available. The utility accepts a list of slaves to be considered the candidate slave.

This utility is designed to work exclusively for servers that support global transaction identifiers (GTIDs) and have GTID_MODE=ON. MySQL server versions 5.6.9 and higher support GTIDs. See the MySQL server online reference manual for more information about setting up replication with GTIDs enabled.

The user can specify the interval in seconds to use for detecting the master status and generating the health report using the `--interval` option. At each interval, the utility will check to see if the server is alive via a ping operation followed by a check of the connector to detect if the server is still reachable. The ping operation can be controlled with the `--ping` option (see below).

If the master is found to be offline or unreachable, the utility will execute one of the following actions based on the value of the `--failover-mode` option.

**auto** Execute automatic failover to the list of candidates first and if no slaves are viable, continue to locate a viable candidate from the list of slaves. If no slaves are found to be a viable candidate, the utility will generate and error and exit.

Once a candidate is found, the utility will conduct failover to the best slave. The command will test each candidate slave listed for the prerequisites. Once a candidate slave is elected, it is made a slave of each of the other slaves thereby collecting any transactions executed on other slaves but not the candidate. In this way, the candidate becomes the most up-to-date slave.

**fail** This mode produces an error and does not failover when the master is downed. This mode is used to provide periodic health monitoring without the failover action taken.

For all options that permit specifying multiple servers, the options require a comma-separated list of connection parameters in the following form (where the password, port, and socket are optional):

```
<user>[:<password>@]<host>[:<port>][:<socket>] or
<login-path>[:<port>][:<socket>]
```

The utility permits users to discover slaves connected to the master. In order to use the discover slaves feature, all slaves must use the `--report-host` and `--report-port` startup variables to specify the correct hostname and ip port of the slave. If these are missing or report the incorrect information, the slaves...
health may not be reported correctly or the slave may not be listed at all. The discover slaves feature ignores any slaves it cannot connect to.

The discover slaves feature is run automatically on each interval.

The utility permits the user to specify an external script to execute before and after the switchover and failover commands. The user can specify these with the --exec-before [292] and --exec-after [292] options. The return code of the script is used to determine success thus each script must report 0 (success) to be considered successful. If a script returns a value other than 0, the result code is presented in an error message.

The utility also permits the user to specify a script to be used for detecting a downed master or an application-level event to trigger failover. This can be specified using the --exec-fail-check [292] option. The return code for the script is used to invoke failover. A return code of 0 indicates failover should not take place. A return code other than 0 indicates failover should take place. This is checked at the start of each interval if a script is supplied. The timeout option is not used in this case and the script is run once at the start of each interval.

The utility permits the user to log all actions taken during the commands. The --log [293] option requires a valid path and file name of the file to use for logging operations. The log is active only when this option is specified. The option --log-age [293] specifies the age in days that log entries are kept. The default is seven (7) days. Older entries are automatically deleted from the log file (but only if the --log [293] option is specified).

The format of the log file includes the date and time of the event, the level of the event (informational - INFO, warning - WARN, error - ERROR, critical failure - CRITICAL), and the message reported by the utility.

The interface provides the user with a number of options for displaying additional information. The user can choose to see the replication health report (default), or choose to see the list of GTIDs in use, the UUIDs in use, and if logging is enabled the contents of the log file. Each of these reports is described below.

**health** Display the replication health of the topology. This report is the default view for the interface. By default, this includes the host name, port, role (MASTER or SLAVE) of the server, state of the server (UP = is connected, WARN = not connected but can ping, DOWN = not connected and cannot ping), the GTID_MODE, and health state.

The master health state is based on the following: if GTID_MODE=ON, the server must have binary log enabled, and there must exist a user with the REPLICATE SLAVE privilege.

The slave health state is based on the following; the IO_THREAD and SQL_THREADS must be running, it must be connected to the master, there are no errors, the slave delay for non-gtid enabled scenarios is not more than the threshold provided by the --max-position [293] and the slave is reading the correct master log file, and slave delay is not more than the --seconds-behind [293] threshold option.

At each interval, if the discover slaves option was specified at startup and new slaves are discovered, the health report is refreshed.

**gtid:** Display the master's list of executed GTIDs, contents of the GTID variables; @@GLOBAL.GTID_EXECUTED, @@GLOBAL.GTID_PURGED, and @@GLOBAL.GTID_OWNED. Thus, the user can toggle through four screens by pressing the 'G' key repeatedly. The display will cycle through all four screens restarting after the fourth screen.

**UUID:** Display universally unique identifiers (UUIDs) for all servers.

**Log:** This option is visible only if the --log [293] option is specified. Show the contents of the log file. This can be helpful to see at a later time when failover occurred and the actions or messages recorded at the time.
The user interface is designed to match the size of the terminal window in which it is run. A refresh option is provided to permit users to resize their terminal windows or refresh the display at any time. However, the interface will automatically resize to the terminal window on each interval.

The interface will display the name of the utility, the master’s status including binary log file, position, and filters as well as the date and time of the next interval event.

The interface will also permit the user to scroll up or down through a list longer than what the terminal window permits. When a long list is presented, the scroll options become enabled. The user can scroll the list up with the up arrow key and down with the down arrow key.

Use the --verbose option to see additional information in the health report and additional messages during failover.

OPTIONS

mysqlfailover accepts the following command-line options:

- --help
  Display a help message and exit.

- --candidates=<candidate slave connections>
  Connection information for candidate slave servers for failover in the form: <user>[:<passwd>]|<host>[:<port>[:<socket>]] or <login-path>[:<port>[:<socket>]]. Valid only with failover command. List multiple slaves in comma-separated list.

- --discover-slaves-login=<user:password>
  At startup, query master for all registered slaves and use the user name and password specified to connect. Supply the user and password in the form <user>[:<passwd>] or <login-path>. For example, --discover=joe:secret will use 'joe' as the user and 'secret' as the password for each discovered slave.

- --exec-after=<script>
  Name of script to execute after failover or switchover. Script name may include the path.

- --exec-before=<script>
  Name of script to execute before failover or switchover. Script name may include the path.

- --exec-fail-check=<script>
  Name of script to execute on each interval to invoke failover.

- --exec-post-failover=<script>
  Name of script to execute after failover is complete and the utility has refreshed the health report.

- --failover-mode=<mode>, -f <mode>
  Action to take when the master fails. 'auto' = automatically fail to best slave, 'elect' = fail to candidate list or if no candidate meets criteria fail, 'fail' = take no action and stop when master fails. Default = 'auto'.

- --force
  Override the registration check on master for multiple instances of the console monitoring the same master. See notes.

- --interval=<seconds>, -i <seconds>
Interval in seconds for polling the master for failure and reporting health. Default = 15 seconds. Minimum is 5 seconds.

- **--log=<log_file>**
  Specify a log file to use for logging messages

- **--log-age=<days>**
  Specify maximum age of log entries in days. Entries older than this will be purged on startup. Default = 7 days.

- **--master=<connection>**
  Connection information for the master server in the format: `<user>[:<passwd>]@[<host>[:<port>]] [:<socket>] or `<login-path>[:<port>][:<socket>]`.

- **--max-position=<position>**
  Used to detect slave delay. The maximum difference between the master's log position and the slave's reported read position of the master. A value greater than this means the slave is too far behind the master. Default = 0.

- **--pedantic, -p**
  Used to stop failover if some inconsistencies are found (e.g. errant transactions on slaves or SQL thread errors) during servers checks. By default, the utility will only issue warnings if issues are found when checking slaves status during failover and will continue its execution unless this option is specified.

- **--ping=<number>**
  Number of ping attempts for detecting downed server. Note: on some platforms this is the same as number of seconds to wait for ping to return. Default is 3 seconds.

- **--rpl-user=:<replication_user>**
  The user and password for the replication user requirement, in the form: `<user>[:<password>]` or `<login-path>`. E.g. rpl:passwd
  Default = None.

- **--script-threshold=<return_code>**
  Value for external scripts to trigger aborting the operation if result is greater than or equal to the threshold.
  Default = None (no threshold checking).

- **--seconds-behind=<seconds>**
  Used to detect slave delay. The maximum number of seconds behind the master permitted before slave is considered behind the master. Default = 0.

- **--slaves=<slave connections>**
  Connection information for slave servers in the form: `<user>[:<passwd>]@[<host>[:<port>]] [:<socket>] or `<login-path>[:<port>][:<socket>]`. List multiple slaves in comma-separated list. The list will be evaluated literally whereby each server is considered a slave to the master listed regardless if they are a slave of the master.

- **--timeout=<seconds>**
mysqlfailover — Automatic replication health monitoring and failover

**Maximum timeout in seconds to wait for each replication command to complete. For example, timeout for slave waiting to catch up to master.**

Default = 3.

- **--verbose, -v**

  Specify how much information to display. Use this option multiple times to increase the amount of information. For example, -v = verbose, -vv = more verbose, -vvv = debug.

- **--version**

  Display version information and exit.

**NOTES**

The login user must have the appropriate permissions to execute SHOW SLAVE STATUS, SHOW MASTER STATUS, and SHOW VARIABLES on the appropriate servers as well as grant the REPlicate SLave privilege. Different permission are required by the failover utility to run successfully for master and slaves. In particular, users connectioned to slaves and candidates require SUPER, GRANT OPTION, REPLICATION SLAVE, and RELOAD privileges.

In addition, the user connected to the master requires DROP, CREATE, INSERT and SELECT privileges to register the failover console. The utility checks permissions for the master, slaves, and candidates at startup.

At startup, the console will attempt to register itself with the master. If another console is already registered, and the failover mode is auto or elect, the console will be blocked from running failover. When a console quits, it deregisters itself from the master. If this process is broken, the user may override the registration check by using the --force [292] option.

Mixing IP and hostnames is not recommended. The replication-specific utilities will attempt to compare hostnames and IP addresses as aliases for checking slave connectivity to the master. However, if your installation does not support reverse name lookup, the comparison could fail. Without the ability to do a reverse name lookup, the replication utilities could report a false negative that the slave is (not) connected to the master.

For example, if you setup replication using MASTER_HOST=ubuntu.net on the slave and later connect to the slave with mysqlrplcheck and have the master specified as --master=192.168.0.6 using the valid IP address for ubuntu.net, you must have the ability to do a reverse name lookup to compare the IP (192.168.0.6) and the hostname (ubuntu.net) to determine if they are the same machine.

Similarly, in order to avoid issues mixing local IP '127.0.0.1' with 'localhost', all the addresses '127.0.0.1' will be internally converted to 'localhost' by the utility. Nevertheless, It is best to use the actual hostname of the master when connecting or setting up replication.

The utility will check to see if the slaves are using the option --master-info-repository=TABLE. If they are not, the utility will stop with an error.

The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the my_print_defaults tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).

The console creates a special table in the mysql database that is used to keep track of which instance is communicating with the master. If you use the --force [292] option, the console will remove the rows in this table. The table is constructed with:

```sql
CREATE TABLE IF NOT EXISTS mysql.failover_console (host char(30), port char(10))
```
When the console starts, a row is inserted containing the hostname and port of the master. On startup, if a row matches these values, the console will not start. If you use the --force option, the row is deleted.

EXAMPLES

To launch the utility, you must specify at a minimum the --master option and either the --discover-slaves-login or the --slaves option. The option: option can be used in conjunction with the --slaves option to specify a list of known slaves (or slaves that do not report their host and ip) and to discover any other slaves connected to the master.

An example of the user interface and some of the report views are shown in the following examples.

```
$ mysqlfailover --master=root@localhost:3331 --discover-slaves-login=root --log=log.txt
```

MySQL Replication Monitor and Failover Utility
Failover Mode = auto     Next Interval = Mon Mar 19 15:56:03 2012

Master Information
------------------
Binary Log File   Position  Binlog_Do_DB  Binlog_Ignore_DB
mysql-bin.000001  571

GTID Executed Set
2A67DE00-2DA1-11E2-A711-00764F2BE90F:1-7 [...]

Replication Health Status
+------------+-------+---------+--------+------------+---------+
| host       | port  | role    | state  | gtid_mode  | health  |
+------------+-------+---------+--------+------------+---------+
| localhost  | 3331  | MASTER  | UP     | ON         | OK      |
| localhost  | 3332  | SLAVE   | UP     | ON         | OK      |
| localhost  | 3333  | SLAVE   | UP     | ON         | OK      |
| localhost  | 3334  | SLAVE   | UP     | ON         | OK      |
+------------+-------+---------+--------+------------+---------+
Q-quit R-refresh H-health G-GTID Lists U-UUIDs L-log entries

Pressing the 'q' key will exit the utility. Pressing the 'y' key will refresh the current display. Pressing the 'h' key will return to the replication health report.

If the user presses the 'g' key, the gtid report is shown like the following. The first page shown is the master’s executed GTID set:

```
MySQL Replication Monitor and Failover Utility
Failover Mode = auto     Next Interval = Mon Mar 19 15:59:33 2012

Master Information
------------------
Binary Log File   Position  Binlog_Do_DB  Binlog_Ignore_DB
mysql-bin.000001  571

GTID Executed Set
2A67DE00-2DA1-11E2-A711-00764F2BE90F:1-7 [...]

Master GTID Executed Set
------------------------
```

Note

The “GTID Executed Set” will display the first GTID listed in the SHOW MASTER STATUS view. If there are multiple GTIDs listed, the utility shall display [...] to indicate there are additional GTIDs to view. You can view the complete list of GTIDs on the GTID display screens.
If the user continues to press the 'g' key, the display will cycle through the three gtid lists.

If the list is longer than the screen permits as shown in the example above, the scroll up and down help is also shown. In this case, if the user presses the down arrow, the list will scroll down.

If the user presses the 'u' key, the list of UUIDs used in the topology are shown:

MySQL Replication Monitor and Failover Utility
Failover Mode = auto     Next Interval = Mon Mar 19 16:02:34 2012

Master Information
------------------

Binary Log File   Position  Binlog_Do_DB  Binlog_Ignore_DB
mysql-bin.000001  571

GTID Executed Set
2A67DE00-2DA1-11E2-A711-00764F2BE90F:1-7 [...]

UUIDs
<table>
<thead>
<tr>
<th>host</th>
<th>port</th>
<th>role</th>
<th>uuid</th>
</tr>
</thead>
<tbody>
<tr>
<td>localhost</td>
<td>3331</td>
<td>MASTER</td>
<td>55c65a00-71fd-11e1-9f80-ac64ef85c961</td>
</tr>
<tr>
<td>localhost</td>
<td>3332</td>
<td>SLAVE</td>
<td>5dd30888-71fd-11e1-9f80-dc242138b7ec</td>
</tr>
<tr>
<td>localhost</td>
<td>3333</td>
<td>SLAVE</td>
<td>65ccbb38-71fd-11e1-9f80-bda8146ddb0a</td>
</tr>
<tr>
<td>localhost</td>
<td>3334</td>
<td>SLAVE</td>
<td>6dd6abf4-71fd-11e1-9f80-d406a0117519</td>
</tr>
</tbody>
</table>

If, once the master is detected as down and failover mode is auto or elect and there are viable candidate slaves, the failover feature will engage automatically and the user will see the failover messages appear. When failover is complete, the interface returns to monitoring replication health after 5 seconds. The following shows an example of failover occurring:

Failover starting...
# Candidate slave localhost:3332 will become the new master.
# Preparing candidate for failover.
# Creating replication user if it does not exist.
# Stopping slaves.
# Performing STOP on all slaves.
# Switching slaves to new master.
# Starting slaves.
# Performing START on all slaves.
# Checking slaves for errors.
# Failover complete.
# Discovering slaves for master at localhost:3332

Failover console will restart in 5 seconds.

After the failover event, the new topology is shown in the replication health report:

MySQL Replication Monitor and Failover Utility
Failover Mode = auto     Next Interval = Mon Mar 19 16:05:12 2012

Master Information
------------------

Binary Log File   Position  Binlog_Do_DB  Binlog_Ignore_DB
mysql-bin.000001  1117

GTID Executed Set
2A67DE00-2DA1-11E2-A711-00764F2BE90F:1-7 [...]

296
14.4.11. `mysqlindexcheck` — Identify Potentially Redundant Table Indexes

This utility reads the indexes for one or more tables and identifies duplicate and potentially redundant indexes.

To check all tables in a database, specify only the database name. To check a specific table, name the table in `db.table` format. It is possible to mix database and table names.

You can scan tables in any database except the internal databases `mysql`, `INFORMATION_SCHEMA`, and `performance_schema`.

Depending on the index type, the utility applies the following rules to compare indexes (designated as `idx_a` and `idx_b`):

- **BTREE**
  
  `idx_b` is redundant to `idx_a` if and only if the first `n` columns in `idx_b` also appear in `idx_a`. Order and uniqueness count.

- **HASH**
  
  `idx_a` and `idx_b` are duplicates if and only if they contain the same columns in the same order. Uniqueness counts.

- **SPATIAL**
  
  `idx_a` and `idx_b` are duplicates if and only if they contain the same column (only one column is permitted).

- **FULLTEXT**
idx_b is redundant to idx_a if and only if all columns in idx_b are included in idx_a. Order counts.

To see DROP statements to drop redundant indexes, specify the --show-drops [298] option. To examine the existing indexes, use the --verbose [299] option, which prints the equivalent CREATE INDEX (or ALTER TABLE for primary keys).

To display the best or worst nonprimary key indexes for each table, use the --best [298] or --worst [299] option. This causes the output to show the best or worst indexes from tables with 10 or more rows. By default, each option shows five indexes. To override that, provide an integer value for the option.

To change the format of the index lists displayed for the --show-indexes [299], --best [298], and --worst [299] options, use one of the following values with the --format [298] option:

- grid (default)
  Display output in grid or table format like that of the mysql monitor.
- csv
  Display output in comma-separated values format.
- tab
  Display output in tab-separated format.
- sql
  print SQL statements rather than a list.
- vertical
  Display output in single-column format like that of the \G command for the mysql monitor.

Note: The --best [298] and --worst [299] lists cannot be printed as SQL statements.

OPTIONS

mysqlindexcheck accepts the following command-line options:

- --help
  Display a help message and exit.
- --best=<N>
  If --stats [299] is given, limit index statistics to the best N indexes. The default value of N is 5 if omitted.
- --format=<index_format>, -f<index_format>
  Specify the index list display format for output produced by --stats [299]. Permitted format values are grid, csv, tab, sql, and vertical. The default is grid.
- --server=<source>
  Connection information for the server in the format: <user>[:<passwd>]<host>[:<port>][:<socket>] or <login-path>[:<port>][:<socket>].
- --show-drops, -d
  Display DROP statements for dropping indexes.
• --show-indexes, -i
  Display indexes for each table.
• --skip, -s
  Skip tables that do not exist.
• --stats
  Show index performance statistics.
• --verbose, -v
  Specify how much information to display. Use this option multiple times to increase the amount of information. For example, -v = verbose, -vv = more verbose, -vvv = debug.
• --version
  Display version information and exit.
• --worst[=<N>]
  If --stats is given, limit index statistics to the worst N indexes. The default value of N is 5 if omitted.

NOTES

You must provide connection parameters (user, host, password, and so forth) for an account that has the appropriate privileges to read all objects accessed during the operation.

For the --format option, the permitted values are not case sensitive. In addition, values may be specified as any unambiguous prefix of a valid value. For example, --format=g specifies the grid format. An error occurs if a prefix matches more than one valid value.

The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the my_print_defaults tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).

EXAMPLES

To check all tables in the employees database on the local server to see the possible redundant and duplicate indexes, use this command:

```bash
$ mysqlindexcheck --server=root@localhost employees
# Source on localhost: ... connected.
# The following indexes are duplicates or redundant \ for table employees.dept_emp:
# CREATE INDEX emp_no ON employees.dept_emp (emp_no) USING BTREE
# may be redundant or duplicate of:
# ALTER TABLE employees.dept_emp ADD PRIMARY KEY (emp_no, dept_no)
# The following indexes are duplicates or redundant \ for table employees.dept_manager:
# CREATE INDEX emp_no ON employees.dept_manager (emp_no) USING BTREE
# may be redundant or duplicate of:
# ALTER TABLE employees.dept_manager ADD PRIMARY KEY (emp_no, dept_no)
# The following indexes are duplicates or redundant \ for table employees.salaries:
# CREATE INDEX emp_no ON employees.salaries (emp_no) USING BTREE
# may be redundant or duplicate of:
# ALTER TABLE employees.salaries ADD PRIMARY KEY (emp_no, from_date)
```
# The following indexes are duplicates or redundant 
for table employees.titles:
#
CREATE INDEX emp_no ON employees.titles (emp_no) USING BTREE
# may be redundant or duplicate of:
ALTER TABLE employees.titles ADD PRIMARY KEY (emp_no, title, from_date)

14.4.12. mysqlmetagrep — Search Database Object Definitions

This utility searches for objects matching a given pattern on all the servers specified using instances of the `--server` option. It produces output that displays the matching objects. By default, the first nonoption argument is taken to be the pattern unless the `--pattern` option is given. If the `--pattern` option is given, all nonoption arguments are treated as connection specifications.

Internally, the utility generates an SQL statement for searching the necessary tables in the `INFORMATION_SCHEMA` database on the designated servers and executes it in turn before collecting the result and printing it as a table. Use the `--sql` option to have the utility display the statement rather than execute it. This can be useful if you want to feed the output of the statement to another application such as the `mysql` monitor.

The MySQL server supports two forms of patterns when matching strings: SQL Simple Patterns (used with the `LIKE` operator) and POSIX Regular Expressions (used with the `REGEXP` operator).

By default, the utility uses the `LIKE` operator to match the name (and optionally, the body) of objects. To use the `REGEXP` operator instead, use the `--regexp` option.

Note that since the `REGEXP` operator does substring searching, it is necessary to anchor the expression to the beginning of the string if you want to match the beginning of the string.

To specify how to display output, use one of the following values with the `--format` option:

- `grid` (default)
  Display output in grid or table format like that of the `mysql` monitor.

- `csv`
  Display output in comma-separated values format.

- `tab`
  Display output in tab-separated format.

- `vertical`
  Display output in single-column format like that of the \G command for the `mysql` monitor.

**SQL Simple Patterns**

The simple patterns defined by the SQL standard consist of a string of characters with two characters that have special meaning: `%` (percent) matches zero or more characters and `_` (underscore) matches exactly one character.

For example:

- `'mats%'`
  Match any string that starts with 'mats'.

- `'%%kindahl%'`
  Match any string containing the word 'kindahl'.
• ‘%_’
  Match any string consisting of one or more characters.

**POSIX Regular Expressions**

POSIX regular expressions are more powerful than the simple patterns defined in the SQL standard. A regular expression is a string of characters, optionally containing characters with special meaning:

• .
  Match any character.

• ^
  Match the beginning of a string.

• $
  Match the end of a string.

• [axy]
  Match a, x, or y.

• [a-f]
  Match any character in the range a to f (that is, a, b, c, d, e, or f).

• [^axy]
  Match any character except a, x, or y.

• a*
  Match a sequence of zero or more a.

• a+
  Match a sequence of one or more a.

• a?
  Match zero or one a.

• ab|cd
  Match ab or cd.

• a{5}
  Match five instances of a.

• a{2,5}
  Match from two to five instances of a.

• (abc)+
  Match one or more repetitions of abc.

This is but a brief set of examples of regular expressions. The full syntax is described in the MySQL manual, but can often be found in regex(7).
**OPTIONS**

`mysqlmetagrep` accepts the following command-line options:

- **--help**
  Display a help message and exit.

- **--body, -b**
  Search the body of stored programs (procedures, functions, triggers, and events). The default is to match only the name.

- **--database=<pattern>**
  Look only in databases matching this pattern.

- **--format=<format>, -f<format>**
  Specify the output display format. Permitted format values are `grid`, `csv`, `tab`, and `vertical`. The default is `grid`.

- **--object-types=<types>, --search-objects=<types>**
  Search only the object types named in `types`, which is a comma-separated list of one or more of the values `procedure`, `function`, `event`, `trigger`, `table`, and `database`. The default is to search in objects of all types.

- **--pattern=<pattern>, -e=<pattern>**
  The pattern to use when matching. This is required when the first nonoption argument looks like a connection specification rather than a pattern.

  If the **--pattern** option is given, the first nonoption argument is treated as a connection specifier, not as a pattern.

- **--regexp, --basic-regexp, -G**
  Perform pattern matches using the **REGEXP** operator. The default is to use **LIKE** for matching. This affects the **--database** and **--pattern** options.

- **--server=<source>**
  Connection information for a server to search in the format: `<user>[:<passwd>]<host>[:<port>]` `[:<socket>]` or `<login-path>[:<port>]`: `[:<socket>]`. Use this option multiple times to search multiple servers.

- **--sql, --print-sql, -p**
  Print rather than executing the SQL code that would be executed to find all matching objects. This can be useful to save the statement for later execution or to use it as input for other programs.

- **--version**
  Display version information and exit.

**NOTES**

For the **--format** option, the permitted values are not case sensitive. In addition, values may be specified as any unambiguous prefix of a valid value. For example, **--format=g** specifies the grid format. An error occurs if a prefix matches more than one valid value.
The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the my_print_defaults tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).

**EXAMPLES**

Find all objects with a name that matches the pattern 't_' (the letter t followed by any single character):

```bash
$ mysqlmetagrep --pattern="t_" --server=mats@localhost
```

<table>
<thead>
<tr>
<th>Connection</th>
<th>Object Type</th>
<th>Object Name</th>
<th>Database</th>
</tr>
</thead>
<tbody>
<tr>
<td>mats:*@localhost:3306</td>
<td>TABLE</td>
<td>t1</td>
<td>test</td>
</tr>
<tr>
<td>mats:*@localhost:3306</td>
<td>TABLE</td>
<td>t2</td>
<td>test</td>
</tr>
<tr>
<td>mats:*@localhost:3306</td>
<td>TABLE</td>
<td>t3</td>
<td>test</td>
</tr>
</tbody>
</table>

To find all object that contain 't2' in the name or the body (for routines, triggers, and events):

```bash
$ mysqlmetagrep -b --pattern="%t2%" --server=mats@localhost:3306
```

<table>
<thead>
<tr>
<th>Connection</th>
<th>Object Type</th>
<th>Object Name</th>
<th>Database</th>
</tr>
</thead>
<tbody>
<tr>
<td>root:*@localhost:3306</td>
<td>TRIGGER</td>
<td>tr_foo</td>
<td>test</td>
</tr>
<tr>
<td>root:*@localhost:3306</td>
<td>TABLE</td>
<td>t2</td>
<td>test</td>
</tr>
</tbody>
</table>

In the preceding output, the trigger name does not match the pattern, but is displayed because its body does.

This is the same as the previous example, but using the `REGEXP` operator. Note that in the pattern it is not necessary to add wildcards before or after t2:

```bash
$ mysqlmetagrep -Gb --pattern="t2" --server=mats@localhost
```

<table>
<thead>
<tr>
<th>Connection</th>
<th>Object Type</th>
<th>Object Name</th>
<th>Database</th>
</tr>
</thead>
<tbody>
<tr>
<td>root:*@localhost:3306</td>
<td>TRIGGER</td>
<td>tr_foo</td>
<td>test</td>
</tr>
<tr>
<td>root:*@localhost:3306</td>
<td>TABLE</td>
<td>t2</td>
<td>test</td>
</tr>
</tbody>
</table>

14.4.13. mysqlprocgrep — Search Server Process Lists

This utility scans the process lists for the servers specified using instances of the `--server` option and selects those that match the conditions specified using the `--age` and `--match-xxx` options. For a process to match, all conditions given must match. The utility then either prints the selected processes (the default) or executes certain actions on them.

If no `--age` or `--match-xxx` options are given, the utility selects all processes.

The `--match-xxx` options correspond to the columns in the INFORMATION_SCHEMA.PROCESSLIST table. For example, `--match-command` specifies a matching condition for PROCESSLIST.COMMAND column values. There is no `--match-time` option. To specify a condition based on process time, use `--age`.

Processes that can be seen and killed are subject to whether the account used to connect to the server has the `PROCESS` and `SUPER` privileges. Without `PROCESS`, the account cannot see processes belonging to other accounts. Without `SUPER`, the account cannot kill processes belonging to other accounts.

To specify how to display output, use one of the following values with the `--format` option:
mysqlprocgrep — Search Server Process Lists

- **grid** (default)
  Display output in grid or table format like that of the `mysql` monitor.

- **csv**
  Display output in comma-separated values format.

- **tab**
  Display output in tab-separated format.

- **vertical**
  Display output in single-column format like that of the `\G` command for the `mysql` monitor.

**Options**

`mysqlprocgrep` accepts the following command-line options:

- **--help**
  Display a help message and exit.

- **--age=<time>**
  Select only processes that have been in the current state more than a given time. The time value can be specified in two formats: either using the `hh:mm:ss` format, with hours and minutes optional, or as a sequence of numbers with a suffix giving the period size.

  The permitted suffixes are `s` (second), `m` (minute), `h` (hour), `d` (day), and `w` (week). For example, `4h15m` mean 4 hours and 15 minutes.

  For both formats, the specification can optionally be preceded by `+` or `−`, where `+` means older than the given time, and `−` means younger than the given time.

- **--format=<format>, -f<format>**
  Specify the output display format. Permitted format values are `grid`, `csv`, `tab`, and `vertical`. The default is `grid`.

- **--kill-connection**
  Kill the connection for all matching processes (like the `KILL CONNECTION` statement).

- **--kill-query**
  Kill the query for all matching processes (like the `KILL QUERY` statement).

- **--match-command=<pattern>**
  Match all processes where the `Command` field matches the pattern.

- **--match-db=<pattern>**
  Match all processes where the `Db` field matches the pattern.

- **--match-host=<pattern>**
  Match all processes where the `Host` field matches the pattern.

- **--match-info=<pattern>**
  Match all processes where the `Info` field matches the pattern.
• --match-state=<pattern>
  Match all processes where the **State** field matches the pattern.

• --match-user=<pattern>
  Match all processes where the **User** field matches the pattern.

• --print
  Print information about the matching processes. This is the default if no **--kill-connection** [304] or **--kill-query** [304] option is given. If a kill option is given, **--print** [305] prints information about the processes before killing them.

• --regexp, --basic-regexp, -G
  Perform pattern matches using the **REGEXP** operator. The default is to use **LIKE** for matching. This affects the **--match-xxx** options.

• --server=<source>
  Connection information for a server to search in the format: `<user>[:<passwd>]@<host>[:<port>] [:<socket>] or <login-path>[:<port>][:<socket>]`. Use this option multiple times to search multiple servers.

• --sql, --print-sql, -Q
  Instead of displaying the selected processes, emit the **SELECT** statement that retrieves information about them. If the **--kill-connection** [304] or **--kill-query** [304] option is given, the utility generates a stored procedure named `kill_processes()` for killing the queries rather than a **SELECT** statement.

• --sql-body
  Like **--sql** [305], but produces the output as the body of a stored procedure without the **CREATE PROCEDURE** part of the definition. This could be used, for example, to generate an event for the server Event Manager.

  When used with a kill option, code for killing the matching queries is generated. Note that it is not possible to execute the emitted code unless it is put in a stored routine, event, or trigger. For example, the following code could be generated to kill all idle connections for user **www-data**:

  ```
  $ mysqlprocgrep --kill-connection --sql-body \\
  >   --match-user=www-data --match-state=sleep
  DECLARE kill_done INT;
  DECLARE kill_cursor CURSOR FOR
      SELECT
          Id, User, Host, Db, Command, Time, State, Info
      FROM
          INFORMATION_SCHEMA.PROCESSLIST
      WHERE
          user LIKE 'www-data'
          AND
          State LIKE 'sleep'
  OPEN kill_cursor;
  BEGIN
      DECLARE id BIGINT;
      DECLARE EXIT HANDLER FOR NOT FOUND SET kill_done = 1;
      kill_loop: LOOP
          FETCH kill_cursor INTO id;
          KILL CONNECTION id;
      END LOOP kill_loop;
  END;
  CLOSE kill_cursor;
  ```

• --verbose, -v
mysqlreplicate — Set Up and Start Replication Between Two Servers

Specify how much information to display. Use this option multiple times to increase the amount of information. For example, -v = verbose, -vv = more verbose, -vvv = debug.

• --version
  Display version information and exit.

NOTES

For the --format option, the permitted values are not case sensitive. In addition, values may be specified as any unambiguous prefix of a valid value. For example, --format=g specifies the grid format. An error occurs if a prefix matches more than one valid value.

The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the my_print_defaults tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).

EXAMPLES

For each example, assume that the root user on localhost has sufficient privileges to kill queries and connections.

Kill all queries created by user mats that are younger than 1 minute:

```
mysqlprocgrep --server=root@localhost \
  --match-user=mats --age=-1m --kill-query
```

Kill all connections that have been idle for more than 1 hour:

```
mysqlprocgrep --server=root@localhost \
  --match-command=sleep --age=1h --kill-connection
```

14.4.14. mysqlreplicate — Set Up and Start Replication Between Two Servers

This utility permits an administrator to start replication from one server (the master) to another (the slave). The user provides login information for the slave and connection information for connecting to the master. It is also possible to specify a database to be used to test replication.

The utility reports conditions where the storage engines on the master and the slave differ. It also reports a warning if the InnoDB storage engine differs on the master and slave. For InnoDB to be the same, both servers must be running the same “type” of InnoDB (built-in or the InnoDB Plugin), and InnoDB on both servers must have the same major and minor version numbers and enabled state.

By default, the utility issues warnings for mismatches between the sets of storage engines, the default storage engine, and the InnoDB storage engine. To produce errors instead, use the --pedantic option, which requires storage engines to be the same on the master and slave.

The -vv option displays any discrepancies between the storage engines and InnoDB values, with or without the --pedantic option.

Replication can be started using one of the following strategies.

• Start from the current position (default)
  Start replication from the current master binary log file and position. The utility uses the SHOW MASTER STATUS statement to retrieve this information.
mysqlreplicate — Set Up and Start Replication Between Two Servers

- Start from the beginning

Start replication from the first event recorded in the master binary log. To do this, use the `--start-from-beginning [307]` option.

- Start from a binary log file

Start replication from the first event in a specific master binary log file. To do this, use the `--master-log-file [307]` option.

- Start from a specific event

Start replication from specific event coordinates (specific binary log file and position). To do this, use the `--master-log-file [307]` and `--master-log-pos [307]` options.

OPTIONS

`mysqlreplicate` accepts the following command-line options:

- `--help`
  Display a help message and exit.

- `--master=<master>`
  Connection information for the master server in the format: `<user>[:<passwd>]@<host>[:<port>][:<socket>]` or `<login-path>[:<port>][:<socket>]`.

- `--master-log-file=<master_log_file>`
  Begin replication from the beginning of this master log file.

- `--master-log-pos=<master_log_pos>`
  Begin replication from this position in the master log file. This option is not valid unless `--master-log-file [307]` is given.

- `--pedantic, -p`
  Fail if both servers do not have the same set of storage engines, the same default storage engine, and the same InnoDB storage engine.

- `--rpl-user=<replication_user>`
  The user and password for the replication user, in the format: `<user>[:<password>]` or `<login-path>`. The default is `rpl:rpl`.

- `--slave=<slave>`
  Connection information for the slave server in the format: `<user>[:<passwd>]@<host>[:<port>][:<socket>]` or `<login-path>[:<port>][:<socket>]`.

- `--start-from-beginning, -b`
  Start replication at the beginning of events logged in the master binary log. This option is not valid unless both `--master-log-file [307]` and `--master-log-pos [307]` are given.

- `--test-db=<test_database>`
  The database name to use for testing the replication setup. If this option is not given, no testing is done, only error checking.

- `--verbose, -v`
Specify how much information to display. Use this option multiple times to increase the amount of information. For example, \(-v\) = verbose, \(-vv\) = more verbose, \(-vvv\) = debug.

- **--version**

Display version information and exit.

**NOTES**

The login user for the master server must have the appropriate permissions to grant access to all databases and the ability to create a user account. For example, the user account used to connect to the master must have the WITH GRANT OPTION privilege.

The server IDs on the master and slave must be nonzero and unique. The utility reports an error if the server ID is 0 on either server or the same on the master and slave. Set these values before starting this utility.

Mixing IP and hostnames is not recommended. The replication-specific utilities will attempt to compare hostnames and IP addresses as aliases for checking slave connectivity to the master. However, if your installation does not support reverse name lookup, the comparison could fail. Without the ability to do a reverse name lookup, the replication utilities could report a false negative that the slave is (not) connected to the master.

For example, if you setup replication using MASTER_HOST=ubuntu.net on the slave and later connect to the slave with mysqlrplcheck and have the master specified as --master=192.168.0.6 using the valid IP address for ubuntu.net, you must have the ability to do a reverse name lookup to compare the IP (192.168.0.6) and the hostname (ubuntu.net) to determine if they are the same machine.

The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the my_print_defaults tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).

**EXAMPLES**

To set up replication between two MySQL instances running on different ports of the same host using the default settings, use this command:

```bash
$ mysqlreplicate --master=root@localhost:3306 \
   --slave=root@localhost:3307 --rpl-user=rpl:rpl
```

The following command uses --pedantic [307] to ensure that replication between the master and slave is successful if and only if both servers have the same storage engines available, the same default storage engine, and the same InnoDB storage engine:

```bash
$ mysqlreplicate --master=root@localhost:3306 \
   --slave=root@localhost:3307 --rpl-user=rpl:rpl -vv --pedantic
```

The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the my_print_defaults tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).
The following command starts replication from the current position of the master (which is the default):

```bash
$ mysqlreplicate --master=root@localhost:3306
  --slave=root@localhost:3307 --rpl-user=rpl:rpl
  # master on localhost: ... connected.
  # slave on localhost: ... connected.
  # Checking for binary logging on master...
  # Setting up replication...
  # ...done.
```

The following command starts replication from the beginning of recorded events on the master:

```bash
$ mysqlreplicate --master=root@localhost:3306
  --slave=root@localhost:3307 --rpl-user=rpl:rpl
  --start-from-beginning
  # master on localhost: ... connected.
  # slave on localhost: ... connected.
  # Checking for binary logging on master...
  # Setting up replication...
  # ...done.
```

The following command starts replication from the beginning of a specific master binary log file:

```bash
$ mysqlreplicate --master=root@localhost:3306
  --slave=root@localhost:3307 --rpl-user=rpl:rpl
  --master-log-file=my_log.000003
  # master on localhost: ... connected.
  # slave on localhost: ... connected.
  # Checking for binary logging on master...
  # Setting up replication...
  # ...done.
```

The following command starts replication from specific master binary log coordinates (specific log file and position):

```bash
$ mysqlreplicate --master=root@localhost:3306
  --slave=root@localhost:3307 --rpl-user=rpl:rpl
  --master-log-file=my_log.000001 --master-log-pos=96
  # master on localhost: ... connected.
  # slave on localhost: ... connected.
  # Checking for binary logging on master...
  # Setting up replication...
  # ...done.
```

**RECOMMENDATIONS**

You should set `read_only=1` in the `my.cnf` file for the slave to ensure that no accidental data changes, such as `INSERT`, `DELETE`, `UPDATE`, and so forth, are permitted on the slave other than those produced by events read from the master.

Use the `--pedantic` and `-vv` options for setting up replication on production servers to avoid possible problems with differing storage engines.

**14.4.15. mysqlrpladmin — Administration utility for MySQL replication**

This utility permits users to perform administrative actions on a replication topology consisting of a master and its slaves. The utility is designed to make it easy to recover from planned maintenance of the master or from an event that takes the master offline unexpectedly.

The act of taking the master offline intentionally and switching control to another slave is called switchover. In this case, there is no loss of transactions as the master is locked and all slaves are
mysqlrpladmin — Administration utility for MySQL replication

allowed to catch up to the master. Once the slaves have read all events from the master, the master is shutdown and control switched to a slave (in this case called a candidate slave).

Recovering from the loss of a downed master is more traumatic and since there is no way to know what transactions the master may have failed to send, the new master (called a candidate slave) must be the slave that is most up-to-date. How this is determined depends on the version of the server (see below). However, it can result in the loss of some transactions that were executed on the downed master but not sent. The utility accepts a list of slaves to be considered the candidate slave. If no slave is found to meet the requirements, the operation will search the list of known slaves.

The utility also provides a number of useful commands for managing a replication topology including the following.

**elect** This command is available to only those servers supporting global transaction identifiers (GTIDs), perform best slave election and report best slave to use in the event a switchover or failover is required. Best slave election is simply the first slave to meet the prerequisites. GTIDs are supported in version 5.6.5 and higher. This command requires the options **--master [313]** and either **--slaves [313]** or **--discover-slaves-login [312]**.

**failover** This command is available to only those servers supporting GTIDs. Conduct failover to the best slave. The command will test each candidate slave listed for the prerequisites. Once a candidate slave is elected, it is made a slave of each of the other slaves thereby collecting any transactions executed on other slaves but not the candidate. In this way, the candidate becomes the most up-to-date slave. This command requires the **--slaves [313]** option. The **--discover-slaves-login [312]** option is not allowed because, for failover, the master is presumed to be offline or otherwise unreachable (so there is no way to discover the slaves). The **--master [313]** option is ignored for this command.

**gtid** This command is available to only those servers supporting GTIDs. It displays the contents of the GTID variables, @@GLOBAL.GTID_EXECUTED, @@GLOBAL.GTID_PURGED, and @@GLOBAL.GTID_OWNED. The command also displays universally unique identifiers (UUIDs) for all servers. This command requires one of the following combinations: **--master [313]** and **--slaves [313]**, or **--master [313]** and **--discover-slaves-login [312]**.

**health** Display the replication health of the topology. By default, this includes the host name, port, role (MASTER or SLAVE) of the server, state of the server (UP = is connected, WARN = not connected but can ping, DOWN = not connected and cannot ping), the GTID_MODE, and health state. This command requires one of the following combinations:

- **--master [313]** and **--slaves [313]**;
- **--master [313]** and **--discover-slaves-login [312]**;

The master health state is based on the following; if GTID_MODE=ON, the server must have binary log enabled, and there must exist a user with the REPLICATE SLAVE privilege.

The slave health state is based on the following; the IO_THREAD and SQL_THREADS must be running, it must be connected to the master, there are no errors, the slave delay for non-gtid enabled scenarios is not more than the threshold provided by the **--max-position [313]** and the slave is reading the correct master log file, and slave delay is not more than the **--seconds-behind [313]** threshold option.

**reset** Execute the STOP SLAVE and RESET SLAVE commands on all slaves. This command requires the **--slaves [313]** option. The **--discover-slaves-login [312]** option is not allowed because it might not provide the expected result, excluding slaves with the IO thread stopped. Optionally, the **--master [313]** option can also be used and in this case the utility will perform an additional check to verify if the specified slaves are associated (i.e. replication configured) to the given master.

**start** Execute the START SLAVE command on all slaves. This command requires the **--slaves [313]** option. The **--discover-slaves-login [312]** option is not allowed because it
might not provide the expected result, excluding slaves with the IO thread stopped. Optionally, the --master [313] option can also be used and in this case the utility will perform an additional check to verify if the specified slaves are associated (i.e. replication configured) to the given master.

**stop** Execute the STOP SLAVE command on all slaves. This command requires the --slaves [313] option. The --discover-slaves-login [312] option is not allowed because it might not provide the expected result, excluding slaves with the IO thread stopped. Optionally, the --master [313] option can also be used and in this case the utility will perform an additional check to verify if the specified slaves are associated (i.e. replication configured) to the given master.

**switchover** Perform slave promotion to a specified candidate slave as designated by the --new-master [313] option. This command is available for both gtid-enabled servers and non-gtid-enabled scenarios. This command requires one of the following combinations:

- --master [313], --new-master [313] and --slaves [313];
- --master [313], --new-master [313] and --discover-slaves-login [312];

Detection of a downed master is performed as follows. If the connection to the master is lost, wait --ping [313] seconds and check again. If the master connection is lost and the master cannot be pinged or reconnected, the failover event occurs.

For all commands that require specifying multiple servers, the options require a comma-separated list of connection parameters in the following form (where the password, port, and socket are optional):

```
<user>[:<passwd>]<@<host>][:<port>][:<socket>]] or
<login-path>[:<port>][:<socket>]]
```

The utility permits users to discover slaves connected to the master. In order to use the discover slaves feature, all slaves must use the --report-host and --report-port startup variables to specify the correct hostname and ip port of the slave. If these are missing or report the incorrect information, the slaves health may not be reported correctly or the slave may not be listed at all. The discover slaves feature ignores any slaves it cannot connect to or with the IO thread stopped (i.e. not connected to the master).

The utility permits the user to demote a master to a slave during the switchover operation. The --demote-master [312] option tells the utility to, once the new master is established, make the old master a slave of the new master. This permits rotation of the master role among a set of servers.

The utility permits the user to specify an external script to execute before and after the switchover and failover commands. The user can specify these with the --exec-before [312] and --exec-after [312] options. The return code of the script is used to determine success thus each script must report 0 (success) to be considered successful. If a script returns a value other than 0, the result code is presented in an error message.

The utility permits the user to log all actions taken during the commands. The --log [313] option requires a valid path and file name of the file to use for logging operations. The log is active only when this option is specified. The option --log-age [313] specifies the age in days that log entries are kept. The default is seven (7) days. Older entries are automatically deleted from the log file (but only if the --log [313] option is specified).

The format of the log file includes the date and time of the event, the level of the event (informational - INFO, warning - WARN, error - ERROR, critical failure - CRITICAL), and the message reported by the utility.

The utility has a number of options each explained in more detail below. Some of the options are specific to certain commands. Warning messages are issued whenever an option is used that does not apply to the command requested. A brief overview of each command and its options is presented in the following paragraphs.

The start, stop, and reset commands require the --slaves [313] option to list all of the slaves in the topology. Optionally, the --master [313] option can be specified for the utility to check if the
specified slaves are associated to the given master before executing the command, making sure that
the command is only applied to slaves connected to the right replication master.

The options required for the elect, health and gtid commands include the `--master` option
to specify the existing master, and either the `--slaves` option to list all of the slaves in the
topology or the `--discover-slaves-login` option to provide the user name and password
to discover any slaves in the topology that are registered and connected to the master.

The options required for switchover include the `--master` option to specify the existing
master, the `--new-master` option to specify the candidate slave (the slave to become the new
master), and either the `--slaves` option to list the considered slaves in the topology or the `--
discover-slaves-login` option to provide the user name and password to discover any
slaves in the topology that are registered and connected to the master.

The failover command requires only the `--slaves` option to explicitly list all of the slaves in the
topology because it is expected that the master is down when this command is used.

Use the `--verbose` option to see additional information in the health report and additional
messages during switchover or failover.

**OPTIONS**

`mysqlrpladmin` accepts the following command-line options:

- **--help**
  Display a help message and exit.

- **--candidates=<candidate slave connections>**
  Connection information for candidate slave servers for failover in the form:
  `<user>[:<passwd>]@<host>[:<port>][::<socket>]` or `<login-path>[:<port>][::<socket>]`. Valid only with
  failover command. List multiple slaves in comma-separated list.

- **--demote-master**
  Make master a slave after switchover.

- **--discover-slaves-login=<slave_login>**
  At startup, query master for all registered slaves and use the user name and password specified to
  connect. Supply the user and password in the form `<user>[:<passwd>]|[login-path]>`. For example,
  `--discover=joe:secret` will use 'joe' as the user and 'secret' as the password for each discovered
  slave.

- **--exec-after=<script>**
  Name of script to execute after failover or switchover. Script name may include the path.

- **--exec-before=<script>**
  Name of script to execute before failover or switchover. Script name may include the path.

- **--force**
  Ignore prerequisite checks or any inconsistencies found (e.g. errant transactions on the slaves or
  SQL thread errors) forcing the execution of the specified command. This option need to be used
carefully as it will not solve any detected issue, but will only ignore them displaying a warning
  message.

- **--format=<format>, -f <format>**
  Display the replication health output in either grid (default), tab, csv, or vertical format.
• --log=<log_file>
  Specify a log file to use for logging messages

• --log-age=<days>
  Specify maximum age of log entries in days. Entries older than this will be purged on startup. Default = 7 days.

• --master=<connection>
  Connection information for the master server in the format: <user>[:<passwd>]@[host][:<port>][:<socket>] or <login-path>[:<port>][:<socket>].

• --max-position=<position>
  Used to detect slave delay. The maximum difference between the master's log position and the slave's reported read position of the master. A value greater than this means the slave is too far behind the master. Default = 0.

• --new-master=<connection>
  Connection information for the slave to be used to replace the master for switchover in the form: <user>[:<passwd>]@[host][:<port>][:<socket>] or <login-path>[:<port>][:<socket>]. Valid only with switchover command.

• --no-health
  Turn off health report after switchover or failover.

• --ping=<number>
  Number of ping attempts for detecting downed server. Note: on some platforms this is the same as number of seconds to wait for ping to return. This value is also used to check down status of master. Failover will wait ping seconds to check master response. If no response, failover event occurs.

• --quiet, -q
  Turn off all messages for quiet execution.

• --rpl-user=<replication_user>
  The user and password for the replication user requirement, in the format: <user>[:<password>] or <login-path>. E.g. rpl:passwd Default = None.

• --script-threshold=<return_code>
  Value for external scripts to trigger aborting the operation if result is greater than or equal to the threshold.
  Default = None (no threshold checking).

• --seconds-behind=<seconds>
  Used to detect slave delay. The maximum number of seconds behind the master permitted before slave is considered behind the master. Default = 0.

• --slaves=<slave connections>
  Connection information for slave servers in the form: <user>[:<passwd>]@[host][:<port>][:<socket>] or <login-path>[:<port>][:<socket>]. List multiple slaves in comma-separated list. The list will be evaluated literally whereby each server is considered a slave to the master listed regardless if they are a slave of the master.
• --timeout=<seconds>
  Maximum timeout in seconds to wait for each replication command to complete. For example, timeout for slave waiting to catch up to master. Default = 300 seconds.

• --verbose, -v
  Specify how much information to display. Use this option multiple times to increase the amount of information. For example, -v = verbose, -vv = more verbose, -vvv = debug.

• --version
  Display version information and exit.

NOTES

The login user must have the appropriate permissions to execute SHOW SLAVE STATUS, SHOW MASTER STATUS, and SHOW VARIABLES on the appropriate servers as well as grant the REPLICATE SLAVE privilege. The utility checks permissions for the master, slaves, and candidates at startup.

Mixing IP and hostnames is not recommended. The replication-specific utilities will attempt to compare hostnames and IP addresses as aliases for checking slave connectivity to the master. However, if your installation does not support reverse name lookup, the comparison could fail. Without the ability to do a reverse name lookup, the replication utilities could report a false negative that the slave is (not) connected to the master.

For example, if you setup replication using MASTER_HOST=ubuntu.net on the slave and later connect to the slave with mysqlrplcheck and have the master specified as --master=192.168.0.6 using the valid IP address for ubuntu.net, you must have the ability to do a reverse name lookup to compare the IP (192.168.0.6) and the hostname (ubuntu.net) to determine if they are the same machine.

Similarly, if you use localhost to connect to the master, the health report may not show all of the slaves. It is best to use the actual hostname of the master when connecting or setting up replication.

If the user does not specify the --rpl-user [313] and the user has specified the switchover or failover command, the utility will check to see if the slaves are using --master-info-repository=TABLE. If they are not, the utility will stop with an error.

All the commands require either the --slaves[313] or --discover-slaves-login [312] option but both cannot be used at the same time. In fact, some commands only allow the use of the --slaves [313] option which is safer to specify the list slaves, because --discover-slaves-login [312] might not provide an up to date list of available slaves.

The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the my_print_defaults tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).

EXAMPLES

To perform best slave election for a topology with GTID_MODE=ON (server version 5.6.5 or higher) where all slaves are specified with the --slaves[313] option, run the following command.:

```bash
$ mysqlrpladmin --master=root@localhost:3331 --slaves=root@localhost:3332,root@localhost:3333,root@localhost:3334 elect
# Electing candidate slave from known slaves.
# Best slave found is located on localhost:3332.
# ...done.
```

To perform best slave election supplying a candidate list, use the following command.:

```bash
$ mysqlrpladmin --master=root@localhost:3331 --rpl-user=
```
To perform failover after a master has failed, use the following command:

```bash
$ mysqlrpladmin \
  --slaves=root@localhost:3332,root@localhost:3333,root@localhost:3334 \
  --candidates=root@localhost:3333,root@localhost:3334 failover
# Performing failover.
# Candidate slave localhost:3333 will become the new master.
# Preparing candidate for failover.
# Creating replication user if it does not exist.
# Stopping slaves.
# Performing STOP on all slaves.
# Switching slaves to new master.
# Starting slaves.
# Performing START on all slaves.
# Checking slaves for errors.
# Failover complete.
# ...done.
```

To see the replication health of a topology with GTID_MODE=ON (server version 5.6.5 or higher) and discover all slaves attached to the master, run the following command. We use the result of the failover command above:

```bash
$ mysqlrpladmin --master=root@localhost:3333 \
  --slaves=root@localhost:3332,root@localhost:3334 health
# Getting health for master: localhost:3333.
# Replication Topology Health:
+------------+-------+---------+--------+------------+---------+
| host       | port  | role    | state  | gtid_mode  | health  |
+------------+-------+---------+--------+------------+---------+
| localhost  | 3333  | MASTER  | UP     | ON         | OK      |
| localhost  | 3332  | SLAVE   | UP     | ON         | OK      |
| localhost  | 3334  | SLAVE   | UP     | ON         | OK      |
+------------+-------+---------+--------+------------+---------+
# ...done.
```

To view a detailed replication health report but with all of the replication health checks revealed, use the `--verbose` option as shown below. In this example, we use vertical format to make viewing easier:

```bash
$ mysqlrpladmin --master=root@localhost:3331 \
  --slaves=root@localhost:3332,root@localhost:3333,root@localhost:3334 \
  --verbose health
# Getting health for master: localhost:3331.
# Attempting to contact localhost ... Success
# Attempting to contact localhost ... Success
# Attempting to contact localhost ... Success
# Replication Topology Health:
+------------+-------+---------+--------+------------+---------+------------+-------+----------+-------------------+-------------------+---------+
| host       | port  | role    | state  | gtid_mode  | health  | host       | port  | role    | state  | gtid_mode  | health  |
+------------+-------+---------+--------+------------+---------+------------+-------+---------+--------+------------+---------+
| localhost  | 3331  | MASTER  | UP     | ON         | OK      | localhost  | 3332  | SLAVE   | UP     | ON         | OK      |
| localhost  | 3331  | MASTER  | UP     | ON         | OK      | localhost  | 3334  | SLAVE   | UP     | ON         | OK      |
+------------+-------+---------+--------+------------+---------+------------+-------+---------+--------+------------+---------+
1. row
```
**mysqlrpladmin** — Administration utility for MySQL replication

IO_Error:

```
*************************       2. row *************************
  host: localhost
  port: 3332
  role: SLAVE
  state: UP
  gtid_mode: ON
  health: OK
  version: 5.6.5-m8-debug-log
  master_log_file: mysql-bin.000001
  master_log_pos: 571
  IO_Thread: Yes
  SQL_Thread: Yes
  Secs_Behind: 0
  Remaining_Delay: No
  IO_Error_Num: 0
IO_Error:

*************************       3. row *************************
  host: localhost
  port: 3333
  role: SLAVE
  state: UP
  gtid_mode: ON
  health: OK
  version: 5.6.5-m8-debug-log
  master_log_file: mysql-bin.000001
  master_log_pos: 571
  IO_Thread: Yes
  SQL_Thread: Yes
  Secs_Behind: 0
  Remaining_Delay: No
  IO_Error_Num: 0
IO_Error:

*************************       4. row *************************
  host: localhost
  port: 3334
  role: SLAVE
  state: UP
  gtid_mode: ON
  health: OK
  version: 5.6.5-m8-debug-log
  master_log_file: mysql-bin.000001
  master_log_pos: 571
  IO_Thread: Yes
  SQL_Thread: Yes
  Secs_Behind: 0
  Remaining_Delay: No
  IO_Error_Num: 0
IO_Error:
```

4 rows.

# ...done.

To run the same failover command above, but specify a log file, use the following command:

```
$ mysqlrpladmin  \
--slaves=root@localhost:3332,root@localhost:3333,root@localhost:3334 \ 
--candidates=root@localhost:3333,root@localhost:3334 \ 
--log=test_log.txt failover
# Performing failover.
# Candidate slave localhost:3333 will become the new master.
# Preparing candidate for failover.
# Creating replication user if it does not exist.
# Stopping slaves.
# Performing STOP on all slaves.
# Switching slaves to new master.
# Starting slaves.
# Performing START on all slaves.
# Checking slaves for errors.
# Failover complete.
# ...done.
```

After this command, the log file will contain entries like the following:
2012-03-19 14:44:17 PM INFO Executing failover command...
2012-03-19 14:44:17 PM INFO Performing failover.
2012-03-19 14:44:17 PM INFO Candidate slave localhost:3333 will become the new master.
2012-03-19 14:44:17 PM INFO Preparing candidate for failover.
2012-03-19 14:44:19 PM INFO Creating replication user if it does not exist.
2012-03-19 14:44:19 PM INFO Stopping slaves.
2012-03-19 14:44:19 PM INFO Performing STOP on all slaves.
2012-03-19 14:44:19 PM INFO Switching slaves to new master.
2012-03-19 14:44:20 PM INFO Starting slaves.
2012-03-19 14:44:20 PM INFO Performing START on all slaves.
2012-03-19 14:44:20 PM INFO Checking slaves for errors.
2012-03-19 14:44:21 PM INFO Failover complete.
2012-03-19 14:44:21 PM INFO ...done.

To perform switchover and demote the current master to a slave, use the following command.:

```bash
$ mysqlrpladmin --master=root@localhost:3331 \
  --slaves=root@localhost:3332,root@localhost:3333,root@localhost:3334 \
  --new-master=root@localhost:3332 --demote-master switchover
```

# Performing switchover from master at localhost:3331 to slave at localhost:3332.
# Checking candidate slave prerequisites.
# Waiting for slaves to catch up to old master.
# Stopping slaves.
# Performing STOP on all slaves.
# Demoting old master to be a slave to the new master.
# Switching slaves to new master.
# Starting all slaves.
# Performing START on all slaves.
# Checking slaves for errors.
# Switchover complete.
# ...done.

If the replication health report is generated on the topology following the above command, it will display the old master as a slave as shown below.:

```bash
$ mysqlrpladmin --master=root@localhost:3332 --discover-slaves-login=root  health
```

# Discovering slaves for master at localhost:3332
# Discovering slave at localhost:3331
# Found slave: localhost:3331
# Discovering slave at localhost:3333
# Found slave: localhost:3333
# Discovering slave at localhost:3334
# Found slave: localhost:3334
# Checking privileges.
# Replication Topology Health:

<table>
<thead>
<tr>
<th>host</th>
<th>port</th>
<th>role</th>
<th>state</th>
<th>gtid_mode</th>
<th>health</th>
</tr>
</thead>
<tbody>
<tr>
<td>localhost</td>
<td>3332</td>
<td>MASTER</td>
<td>UP</td>
<td>ON</td>
<td>OK</td>
</tr>
<tr>
<td>localhost</td>
<td>3331</td>
<td>SLAVE</td>
<td>UP</td>
<td>ON</td>
<td>OK</td>
</tr>
<tr>
<td>localhost</td>
<td>3333</td>
<td>SLAVE</td>
<td>UP</td>
<td>ON</td>
<td>OK</td>
</tr>
<tr>
<td>localhost</td>
<td>3334</td>
<td>SLAVE</td>
<td>UP</td>
<td>ON</td>
<td>OK</td>
</tr>
</tbody>
</table>
# ...done.

You can use the discover slaves feature, if and only if all slaves report their host and port to the master. A sample command to generate a replication health report with discovery is shown below. Note that the option `--discover-slaves-login [312]` cannot be used in conjunction with the `--slaves [313]` option.:

```bash
$ mysqlrpladmin --master=root@localhost:3332 --discover-slaves-login=root health
```

# Discovering slaves for master at localhost:3332
# Discovering slave at localhost:3331
# Found slave: localhost:3331
# Discovering slave at localhost:3333
# Found slave: localhost:3333
# Discovering slave at localhost:3334
# Found slave: localhost:3334
# Checking privileges.
# Replication Topology Health:

<table>
<thead>
<tr>
<th>host</th>
<th>port</th>
<th>role</th>
<th>state</th>
<th>gtid_mode</th>
<th>health</th>
</tr>
</thead>
<tbody>
<tr>
<td>localhost</td>
<td>3332</td>
<td>MASTER</td>
<td>UP</td>
<td>ON</td>
<td>OK</td>
</tr>
<tr>
<td>localhost</td>
<td>3331</td>
<td>SLAVE</td>
<td>UP</td>
<td>ON</td>
<td>OK</td>
</tr>
<tr>
<td>localhost</td>
<td>3333</td>
<td>SLAVE</td>
<td>UP</td>
<td>ON</td>
<td>OK</td>
</tr>
<tr>
<td>localhost</td>
<td>3334</td>
<td>SLAVE</td>
<td>UP</td>
<td>ON</td>
<td>OK</td>
</tr>
</tbody>
</table>
# ...done.
14.4.16. **mysqlrplcheck** — Check Replication Prerequisites

This utility checks the prerequisites for replication between a master and a slave. These checks (called tests) are designed to ensure a healthy replication setup. The utility performs the following tests:

1. Is the binary log enabled on the master?
2. Are there binary logging exceptions (such as *_do_db or *_ignore_db settings)? If so, display them.
3. Does the replication user exist on the master with the correct privileges?
4. Are there server_id conflicts?
5. Is the slave connected to this master? If not, display the master host and port.
6. Are there conflicts between the master.info file on the slave and the values shown in `SHOW SLAVE STATUS` on the master?
7. Are the InnoDB configurations compatible (plugin vs. native)?
8. Are the storage engines compatible (have same on slave as master)?
9. Are the lower_case_tables_names settings compatible? Warn if there are settings for lowercase/uppercase table names that can cause problems. See Bug #59240.
10. Is the slave behind the master?

The utility runs each test in turn unless there is a fatal error preventing further testing, such as a loss of connection to the servers.

Each test can complete with one of the following states: pass (the prerequisites are met), fail (the prerequisites were met but one or more errors occurred or there are exceptions to consider), or warn (the test found some unusual settings that should be examined further but may not be in error).

Use the `--verbose` option to see additional information such as server IDs, lower_case_table_name settings, and the contents of the master information file on the slave.

To see the values from the `SHOW SLAVE STATUS` statement, use the `--show-slave-status` option.

**OPTIONS**

`mysqlrplcheck` accepts the following command-line options:

- `--help`
  Display a help message and exit.
- `--master=<source>`
  Connection information for the master server in the format: `<user>[:<passwd>]@<host>[:<port>] [[:<socket>]] or <login-path>[:<port>]:<socket>.
- `--master-info-file=<file>`
  The name of the master information file on the slave. The default is master.info read from the data directory. Note: This option requires that you run the utility on the slave and that you have appropriate read access for the file.
- `--quiet, -q`
Turn off all messages for quiet execution. Note: Errors and warnings are not suppressed.

- **--show-slave-status, -s**
  Display the values from **SHOW SLAVE STATUS** on the master.

- **--slave=<source>**
  Connection information for the slave server in the format: `<user>[:<passwd>]<host>[:<port>] [:<socket>]or `<login-path>[:<port>][:<socket>]`.

- **--suppress**
  Suppress warning messages.

- **--verbose, -v**
  Specify how much information to display. Use this option multiple times to increase the amount of information. For example, `-v` = verbose, `-vv` = more verbose, `-vvv` = debug.

- **--version**
  Display version information and exit.

- **--width=<number>**
  Change the display width of the test report. The default is 75 characters.

**NOTES**

The login user must have the appropriate permissions to execute **SHOW SLAVE STATUS**, **SHOW MASTER STATUS**, and **SHOW VARIABLES** on the appropriate servers.

Mixing IP and hostnames is not recommended. The replication-specific utilities will attempt to compare hostnames and IP addresses as aliases for checking slave connectivity to the master. However, if your installation does not support reverse name lookup, the comparison could fail. Without the ability to do a reverse name lookup, the replication utilities could report a false negative that the slave is (not) connected to the master.

For example, if you setup replication using `MASTER_HOST=ubuntu.net` on the slave and later connect to the slave with `mysqlrplcheck` and have the master specified as `--master=192.168.0.6` using the valid IP address for ubuntu.net, you must have the ability to do a reverse name lookup to compare the IP (192.168.0.6) and the hostname (ubuntu.net) to determine if they are the same machine.

The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the `my_print_defaults` tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).

**EXAMPLES**

To check the prerequisites of a master and slave that currently are actively performing replication, use the following command:

```
$ mysqlrplcheck --master=root@host1:3310 --slave=root@host2:3311
# master on host1: ... connected.
# slave on host2: ... connected.
+-----------------------------+-------------------------+
| Test Description            | Status                  |
+-----------------------------+-------------------------+
| Checking for binary logging on master | [pass]                 |
| Are there binlog exceptions? | [pass]                 |
| Replication user exists?    | [pass]                 |
+-----------------------------+-------------------------+
```
Checking server_id values [pass]
Is slave connected to master? [pass]
Check master information file [pass]
Checking InnoDB compatibility [pass]
Checking storage engines compatibility [pass]
Checking lower_case_table_names settings [pass]
Checking slave delay (seconds behind master) [pass]
# ...done.

As shown in the example, you must provide valid login information for both the master and the slave.

To perform the same command but also display the contents of the master information file on the slave and the values of SHOW SLAVE STATUS as well as additional details, use this command:

```bash
$ mysqlrplcheck --master=root@host1:3310 --slave=root@host2:3311 --show-slave-status -vv
```

As shown in the example, you must provide valid login information for both the master and the slave.

To perform the same command but also display the contents of the master information file on the slave and the values of SHOW SLAVE STATUS as well as additional details, use this command:

```
$ mysqlrplcheck --master=root@host1:3310 --slave=root@host2:3311
```

As shown in the example, you must provide valid login information for both the master and the slave.

To perform the same command but also display the contents of the master information file on the slave and the values of SHOW SLAVE STATUS as well as additional details, use this command:

```
$ mysqlrplcheck --master=root@host1:3310 --slave=root@host2:3311
```
Slave_SQL_Running : Yes
Replicate_Do_DB :
Replicate_Ignore_DB :
Replicate_Do_Table :
Replicate_Ignore_Table :
Replicate_Wild_Do_Table :
Replicate_Wild_Ignore_Table :
  Last_Errno : 0
  Last_Error :
  Skip_Counter : 0
Exec_Master_Log_Pos : 482
Relay_Log_Space : 551
Until_Condition : None
  Until_Log_File :
  Until_Log_Pos : 0
Master_SSL_Allowed : No
Master_SSL_CA_File :
Master_SSL_CA_Path :
Master_SSL_Cert :
Master_SSL_Cipher :
Master_SSL_Key :
Seconds_Behind_Master : 0
Master_SSL_Verify_Server_Cert : No
Last_IO_Errno : 0
Last_IO_Error :
Last_SQL_Errno : 0
Last_SQL_Error :
# ...done.

14.4.17. mysqlrplshow — Show Slaves for Master Server

This utility shows the replication slaves for a master. It prints a graph of the master and its slaves labeling each with the host name and port number.

You must specify the --discover-slaves-login [322] option to provide the user name and password to discover any slaves in the topology.

To explore the slaves for each client, use the --recurse [323] option. This causes the utility to connect to each slave found and attempt to determine whether it has any slaves. If slaves are found, the process continues until the slave is found in the list of servers serving as masters (a circular topology). The graph displays the topology with successive indents. A notation is made for circular topologies.

If you use the --recurse [323] option, the utility attempts to connect to the slaves using the user name and password provided for the master. By default, if the connection attempt fails, the utility throws an error and stops. To change this behavior, use the --prompt [323] option, which permits the utility to prompt for the user name and password for each slave that fails to connect. You can also use the --num-retries=n [322] option to reattempt a failed connection 'n' times before the utility fails.

An example graph for a typical topology with relay slaves is shown here:

```bash
# Replication Topology Graph::
localhost:3311 (MASTER)
  |  ---- localhost:3310 - (SLAVE)
  |       ---- localhost:3312 - (SLAVE + MASTER)
  |             ---- localhost:3313 - (SLAVE)
```

MASTER, SLAVE, and SLAVE+MASTER indicate that a server is a master only, slave only, and both slave and master, respectively.

A circular replication topology is shown like this, where <-> indicates circularity:
MySQLrplshow — Show Slaves for Master Server

To produce a column list in addition to the graph, specify the --show-list option. In this case, to specify how to display the list, use one of the following values with the --format option:

- **grid** (default)
  Display output in grid or table format like that of the `mysql` monitor.
- **csv**
  Display output in comma-separated values format.
- **tab**
  Display output in tab-separated format.
- **vertical**
  Display output in single-column format like that of the `\G` command for the `mysql` monitor.

The utility uses the `SHOW SLAVE HOSTS` statement to determine which slaves the master has. If you want to use the --recurse option, slaves should have been started with the --report-host and --report-port options set to their actual host name and port number or the utility may not be able to connect to the slaves to determine their own slaves.

**OPTIONS**

`mysqlrplshow` accepts the following command-line options:

- **--help**
  Display a help message and exit.
- **--discover-slaves-login=<slave-login>**
  Supply the user and password in the form `<user>[:<passwd>]` or `<login-path>` for discovering slaves and relay slaves in the topology. For example, --discover=joe:secret will use 'joe' as the user and 'secret' as the password for each discovered slave.
- **--format=<format>, -f<format>**
  Specify the display format for column list output. Permitted format values are grid, csv, tab, and vertical. The default is grid. This option applies only if --show-list is given.
- **--master=<source>**
  Connection information for the master server in the format: `<user>[:<passwd>]@[<host>][:<port>]` [:<socket>] or `<login-path>[:<port>][:<socket>]`.
- **--max-depth=<N>**
  The maximum recursion depth. This option is valid only if --recurse is given.
- **--num-retries=<num_retries>, -n<num_retries>**
The number of retries permitted for failed slave login attempts. This option is valid only if `--prompt [323]` is given.

- `--prompt`, `-p`
  Prompt for the slave user and password if different from the master user and password.

  If you give this option, the utility sets `--num-retries [322]` to 1 if that option is not set explicitly. This ensures at least one attempt to retry and prompt for the user name and password should a connection fail.

- `--quiet`, `-q`
  Turn off all messages for quiet execution. This option does not suppress errors or warnings.

- `--recurse`, `-r`
  Traverse the list of slaves to find additional master/slave connections. Use this option to map a replication topology.

- `--show-list`, `-l`
  Display a column list of the topology.

- `--verbose`, `-v`
  Specify how much information to display. If this option is used, the IO thread status of each slave is also displayed. Use this option multiple times to increase the amount of information. For example, `-v` = verbose, `-vv` = more verbose, `-vvv` = debug. If you use `-vv`, the output will contain the state of the IO and SQL threads for each slave.

- `--version`
  Display version information and exit.

**NOTES**

The login user must have the `REPLICATE SLAVE` and `REPLICATE CLIENT` privileges to successfully execute this utility. Specifically, the login user must have appropriate permissions to execute `SHOW SLAVE STATUS`, `SHOW MASTER STATUS`, and `SHOW SLAVE HOSTS`.

For the `--format [322]` option, the permitted values are not case sensitive. In addition, values may be specified as any unambiguous prefix of a valid value. For example, `--format=g [322]` specifies the grid format. An error occurs if a prefix matches more than one valid value.

Mixing IP and hostnames is not recommended. The replication-specific utilities will attempt to compare hostnames and IP addresses as aliases for checking slave connectivity to the master. However, if your installation does not support reverse name lookup, the comparison could fail. Without the ability to do a reverse name lookup, the replication utilities could report a false negative that the slave is (not) connected to the master.

For example, if you setup replication using `MASTER_HOST=ubuntu.net` on the slave and later connect to the slave with `mysqlrplcheck` and have the master specified as `--master=192.168.0.6` using the valid IP address for `ubuntu.net`, you must have the ability to do a reverse name lookup to compare the IP (192.168.0.6) and the hostname (`ubuntu.net`) to determine if they are the same machine.

The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the `my_print_defaults` tools which is required to read the login-path values from the login configuration file (`.mylogin.cnf`).
EXAMPLES

To show the slaves for a master running on port 3311 on the local host, use the following command:

```bash
$ mysqlrplshow --master=root@localhost:3311 --discover-slaves-login=root
# master on localhost: ... connected.
# Finding slaves for master: localhost:3311

# Replication Topology Graph
localhost:3311 (MASTER)
    +--- localhost:3310 - (SLAVE)
    |   +--- localhost:3312 - (SLAVE)
```

As shown in the example, you must provide valid login information for the master.

To show additional information about the IO thread status (to confirm if the slaves are really connected to the master) use the option `--verbose`:

```bash
$ mysqlrplshow --master=root@localhost:3311 --discover-slaves-login=root --verbose
# master on localhost: ... connected.
# Finding slaves for master: localhost:3311

# Replication Topology Graph
localhost:3311 (MASTER)
    +--- localhost:3310 [IO: Yes, SQL: Yes] - (SLAVE)
    |   +--- localhost:3312 [IO: Yes, SQL: Yes] - (SLAVE)
```

To show the full replication topology of a master running on the local host, use the following command:

```bash
$ mysqlrplshow --master=root@localhost:3311 --recurse --discover-slaves-login=root
# master on localhost: ... connected.
# Finding slaves for master: localhost:3311

# Replication Topology Graph
localhost:3311 (MASTER)
    +--- localhost:3310 - (SLAVE)
    |   +--- localhost:3312 - (SLAVE + MASTER)
    |       +--- localhost:3313 - (SLAVE)
```

To show the full replication topology of a master running on the local host, prompting for the user name and password for slaves that do not have the same user name and password credentials as the master, use the following command:

```bash
$ mysqlrplshow --recurse --prompt --num-retries=1 \   --master=root@localhost:3331 --discover-slaves-login=root
Server localhost:3331 is running on localhost.
# master on localhost: ... connected.
Server localhost:3332 is running on localhost.
# master on localhost: ... FAILED.
Connection to localhost:3332 has failed.
Please enter the following information to connect to this server.
User name: root
Password: 
Server localhost:3333 is running on localhost.
# master on localhost: ... FAILED.
Connection to localhost:3333 has failed.
Please enter the following information to connect to this server.
User name: root
Password:
```
mysqlserverclone — Clone Existing Server to Create New Server

This utility permits an administrator to clone an existing MySQL server instance to start a new server instance on the same host. The utility creates a new datadir (--new-data [325]), and starts the server with a socket file. You can optionally add a password for the login user account on the new instance.

If the user does not have read and write access to the folder specified by the --new-data [325] option, the utility shall issue an error.

Similarly, if the folder specified by --new-data [325] exists and is not empty, the utility will not delete the folder and will issue an error message. Users must specify the --delete-data [325] option to permit the utility to remove the folder prior to starting the cloned server.

OPTIONS

mysqlserverclone accepts the following command-line options:

- --help
  Display a help message and exit.

- --delete-data
  Delete the folder specified by --new-data if it exists and is not empty.

- --mysqld=<options>

  Additional options for mysqld. To specify multiple options, separate them by spaces. Use appropriate quoting as necessary. For example, to specify --log-bin=binlog and --general-log-file="mylogfile", use:

  --mysqld="--log-bin=binlog --general-log-file='my log file'"

- --new-data=<path_to_new_datadir>
  The full path name of the location of the data directory for the new server instance. If the directory does not exist, the utility will create it.

- --new-id=<server_id>
  The server_id value for the new server instance. The default is 2.

- --new-port=<port>
The port number for the new server instance. The default is 3307.

- --quiet, -q
  Turn off all messages for quiet execution.

- --root-password=<password>
  The password for the root user of the new server instance.

- --server=<source>
  Connection information for the server to be cloned in <user>[:<passwd>]@<host>[:<port>][:<socket>] format.

- --start-timeout=<timeout_in_seconds>
  Number of seconds to wait for server to start. Default = 10 seconds.

- --verbose, -v
  Specify how much information to display. Use this option multiple times to increase the amount of information. For example, -v = verbose, -vv = more verbose, -vvv = debug.

- --version
  Display version information and exit.

- --write-command=<file_name>, -w<file_name>
  Path name of file in which to write the command used to launch the new server instance.

**EXAMPLES**

The following command demonstrates how to create a new instance of a running server, set the root user password and enable binary logging:

```
$ mkdir /source/test123
$ mysqlserverclone --server=root:pass@localhost --new-data=/Users/cbell/source/test123 --new-port=3310 --root-password=pass --mysqld=--log-bin=mysql-bin
# Cloning the MySQL server running on localhost.
# Creating new data directory...
# Configuring new instance...
# Locating mysql tools...
# Setting up empty database and mysql tables...
# Starting new instance of the server...
# Testing connection to new instance...
# Success!
# Setting the root password...
# ...done.
```

**14.4.19. mysqlserverinfo — Display Common Diagnostic Information from a Server**

This utility displays critical information about a server for use in diagnosing problems. The information displayed includes the following:

- Server connection information
- Server version number
- Data directory path name
mysqlserverinfo — Display Common Diagnostic Information from a Server

- Base directory path name
- Plugin directory path name
- Configuration file location and name
- Current binary log coordinates (file name and position)
- Current relay log coordinates (file name and position)

This utility can be used to see the diagnostic information for servers that are running or offline. If you want to see information about an offline server, the utility starts the server in read-only mode. In this case, you must specify the --basedir, --datadir, and --start options to prevent the utility from starting an offline server accidentally. Note: Be sure to consider the ramifications of starting an offline server on the error and similar logs. It is best to save this information prior to running this utility.

To specify how to display output, use one of the following values with the --format option:

- **grid** (default)
  Display output in grid or table format like that of the `mysql` monitor.
- **csv**
  Display output in comma-separated values format.
- **tab**
  Display output in tab-separated format.
- **vertical**
  Display output in single-column format like that of the `\G` command for the `mysql` monitor.

To turn off the headers for csv or tab display format, specify the --no-headers option.

To see the common default settings for the local server's configuration file, use the --show-defaults option. This option reads the configuration file on the machine where the utility is run, not the machine for the host that the --server option specifies.

To run the utility against several servers, specify the --server option multiple times. In this case, the utility attempts to connect to each server and read the information.

To see the MySQL servers running on the local machine, use the --show-servers option. This shows all the servers with their process ID and data directory. On Windows, the utility shows only the process ID and port.

**OPTIONS**

`mysqlserverinfo` accepts the following command-line options:

- **--help**
  Display a help message and exit.
- **--basedir=`<basedir>`**
  The base directory for the server. This option is required for starting an offline server.

  Is also used to access server tools, such as my_print_defaults that is required to read the login-path values from the login configuration file (.mylogin.cnf).
mysqlserverinfo — Display Common Diagnostic Information from a Server

- --datadir=<datadir>
  The data directory for the server. This option is required for starting an offline server.

- --format=<format>, -f<format>
  Specify the output display format. Permitted format values are grid, csv, tab, and vertical. The default is grid.

- --no-headers, -h
  Do not display column headers. This option applies only for csv and tab output.

- --port-range=<start:end>
  The port range to check for finding running servers. This option applies only to Windows and is ignored unless --show-servers [328] is given. The default range is 3306:3333.

- --server=<server>
  Connection information for a server in the format: <user>[::<passwd>@]<host>[::<port>][::<socket>] or <login-path>[:<port>][::<socket>]. Use this option multiple times to see information for multiple servers.

- --show-defaults, -d
  Display default settings for mysqld from the local configuration file. It uses my_print_defaults to obtain the options.

- --show-servers
  Display information about servers running on the local host. The utility examines the host process list to determine which servers are running.

- --start, -s
  Start the server in read-only mode if it is offline. With this option, you must also give the --basedir [327] and --datadir [328] options.

- --start-timeout
  Number of seconds to wait for the server to be online when started in read-only mode using the --start [328] option. The default value is 10 seconds.

  The --start-timeout option is available as of MySQL Utilities 1.2.4 / 1.3.3.

- --verbose, -v
  Specify how much information to display. Use this option multiple times to increase the amount of information. For example, -v = verbose, -vv = more verbose, -vvv = debug.

- --version
  Display version information and exit.

For the --format [328] option, the permitted values are not case sensitive. In addition, values may be specified as any unambiguous prefix of a valid value. For example, --format=g [328] specifies the grid format. An error occurs if a prefix matches more than one valid value.

The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the my_print_defaults tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).
EXAMPLES

To display the server information for the local server and the settings for `mysqld` in the configuration file with the output in a vertical list, use this command:

```bash
$ mysqlserverinfo --server=root:pass@localhost -d --format=vertical
```

```
** Source on localhost: ... connected.
*************************       1. row *************************
    server: localhost:3306
    version: 5.1.50-log
    datadir: /usr/local/mysql/data/
    basedir: /usr/local/mysql-5.1.50-osx10.6-x86_64/
    plugin_dir: /usr/local/mysql-5.1.50-osx10.6-x86_64/lib/plugin
    config_file: /etc/my.cnf
    binary_log: my_log.000068
    binary_log_pos: 212383
    relay_log: None
    relay_log_pos: None
    1 rows.
```

Defaults for server localhost:3306
--port=3306
--basedir=/usr/local/mysql
--datadir=/usr/local/mysql/data
--server_id=5
--log-bin=my_log
--general_log
--slow_query_log
<ENTER>

The console has a list of console or base commands. These allow the user to interact with the features of the console itself. The list of base commands is shown below along with a brief description:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>help utilities</td>
<td>Display list of all utilities supported.</td>
</tr>
<tr>
<td>help &lt;utility&gt;</td>
<td>Display help for a specific utility.</td>
</tr>
<tr>
<td>exit</td>
<td>Exit the console.</td>
</tr>
<tr>
<td>set &lt;variable&gt;=&lt;value&gt;</td>
<td>Store a variable for recall in commands.</td>
</tr>
<tr>
<td>show options</td>
<td>Display list of options specified by the user on launch.</td>
</tr>
<tr>
<td>show variables</td>
<td>Display list of variables.</td>
</tr>
<tr>
<td>&lt;ENTER&gt;</td>
<td>Press ENTER to execute command.</td>
</tr>
<tr>
<td>&lt;ESCAPE&gt;</td>
<td>Press ESCAPE to clear the command entry.</td>
</tr>
<tr>
<td>&lt;DOWN&gt;</td>
<td>Press DOWN to retrieve the previous command.</td>
</tr>
<tr>
<td>&lt;UP&gt;</td>
<td>Press UP to retrieve the next command in history.</td>
</tr>
<tr>
<td>&lt;TAB&gt;</td>
<td>Press TAB for type completion of utility, option, or variable names.</td>
</tr>
<tr>
<td>&lt;TAB&gt;&lt;TAB&gt;</td>
<td>Press TAB twice for list of matching type completion (context sensitive).</td>
</tr>
</tbody>
</table>

One of the most helpful base commands is the ability to see the options for a given utility by typing 'help <utility>'. When the user types this command and presses ENTER, the console will display a list of all of the options for the utility.

The console provides tab completion for all commands, options for utilities, and user-defined variables. Tab completion for commands allows users to specify the starting N characters of a command and
press TAB to complete the command. If there are more than one command that matches the prefix, and the user presses TAB twice, a list of all possible matches is displayed.

Tab completion for options is similar. The user must first type a valid MySQL Utility command then types the first N characters of a command and presses TAB, for example —verb<TAB>. In this case, the console will complete the option. For the cases where an option requires a value, the console will complete the option name and append the '=' character. Tab completion for options works for both the full name and the alias (if available). If the user presses TAB twice, the console will display a list of matching options. Pressing TAB twice immediately after typing the name of a MySQL Utility will display a list of all options for that utility.

Tab completion for variables works the same as that for options. In this case, the user must first type the '$' character then press TAB. For example, if a variable $SERVER1 exists, when the user types —server=+$SER<TAB>, the console will complete the $SERVER variable name. For cases where there are multiple variables, pressing TAB twice will display a list of all matches to the first $+N characters. Pressing TAB twice after typing only the $ character will display a list of all variables.

Note: the console does not require typing the 'mysql' prefix for the utility. For example, if the user types 'disku<TAB>' the console will complete the command with 'diskusage'.

Executing utilities is accomplished by typing the complete command and pressing ENTER. The user does not have to type 'python' or provide the '.py' file extension. The console will add these if needed.

The user can also run commands using the option --execute [331]. The value for this option is a semi-colon separated list of commands to execute. These can be base commands or MySQL Utility commands. The console will execute each command and display the output. All commands to be run by the console must appear inside a quoted string and separated by semi-colons. Commands outside of the quoted string will be treated as arguments for the mysqluc utility itself and thus ignored for execution.

Note: if there is an error in the console or related code, the console will stop executing commands at the point of failure. Commands may also be piped into the console using a mechanism like 'echo "<commands>" | mysqluc'.

The console also allows users to set user-defined variables for commonly used values in options. The syntax is simply 'set VARNAME=VALUE'. The user can see a list of all variables by entering the 'show variables' command. To use the values of these variables in utility commands, the user must prefix the value with a '$'. For example, --server=$SERVER1 will substitute the value of the SERVER1 user-defined variable when the utility is executed.

Note: user-defined variables have a session lifetime. They are not saved from one execution to another of the users console.

User-defined variables may also be set by passing them as arguments to the mysqluc command. For example, to set the SERVER1 variable and launch the console, the user can launch the console using this command.:

$ mysqluc SERVER1=root@localhost

The user can provide any number of user-defined variables but they must contain a value and no spaces around the '=' character. Once the console is launched, the user can see all variables using the 'show variables' command.

OPTIONS

- --version
  show program's version number and exit
- --help
mysqluc — Command line client for running MySQL Utilities

show the program’s help page

• --verbose, -v

control how much information is displayed. For example, -v = verbose, -vv = more verbose, -vvv = debug

• --quiet

suppress all informational messages

• --execute <commands>, -e <commands>

Execute commands and exit. Multiple commands are separated with semi-colons. Note: some platforms may require double quotes around command list.

• --utildir <path>

location of utilities

• --width <number>

Display width

NOTES

Using the --execute option or piping commands to the console may require quotes or double quotes (for example, on Windows).

EXAMPLES

To launch the console, use this command:

$ mysqluc

The following demonstrates launching the console and running the console command 'help utilities' to see a list of all utilities supported. The console will execute the command then exit.:

$ mysqluc -e "help utilities"

<table>
<thead>
<tr>
<th>Utility</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>mysqlindexcheck</td>
<td>check for duplicate or redundant indexes</td>
</tr>
<tr>
<td>mysqlrplcheck</td>
<td>check replication</td>
</tr>
<tr>
<td>mysqluserclone</td>
<td>clone a MySQL user account to one or more new users</td>
</tr>
<tr>
<td>mysqldbcompare</td>
<td>compare databases for consistency</td>
</tr>
<tr>
<td>mysqldiff</td>
<td>compare object definitions among objects where the difference is how db1.obj1 differs from db2.obj2</td>
</tr>
<tr>
<td>mysqldbcopy</td>
<td>copy databases from one server to another</td>
</tr>
<tr>
<td>mysqlreplicate</td>
<td>establish replication with a master</td>
</tr>
<tr>
<td>mysqldbexport</td>
<td>export metadata and data from databases</td>
</tr>
<tr>
<td>mysqldbimport</td>
<td>import metadata and data from files</td>
</tr>
<tr>
<td>mysqlmetagrep</td>
<td>search metadata</td>
</tr>
<tr>
<td>mysqlprocgrep</td>
<td>search process information</td>
</tr>
<tr>
<td>mysqldiskusage</td>
<td>show disk usage for databases</td>
</tr>
<tr>
<td>mysqlserverinfo</td>
<td>show server information</td>
</tr>
<tr>
<td>mysqlserverclone</td>
<td>start another instance of a running server</td>
</tr>
</tbody>
</table>

The following demonstrates launching the console to run several commands using the --execute option to including setting a variable for a server connection and executing a utility using variable substitution. Note: it may be necessary to escape the ‘$’ on some platforms (for example, Linux). Output below is an excerpt and is representational only.:

$ mysqluc -e "set SERVER=root@host123; mysqldiskusage --server="\"$SERVER""
# Source on host123: ... connected.

NOTICE: Your user account does not have read access to the datadir. Data sizes will be calculated and actual file sizes may be omitted. Some features may be unavailable.

# Database totals:

<table>
<thead>
<tr>
<th>db_name</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>world</td>
<td>0</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>+--------</td>
<td>-------</td>
</tr>
</tbody>
</table>

Total database disk usage = 1,072,359,052 bytes or 1022.00 MB

#...done.

The following demonstrates launching the console using the commands shown above but piped into the console on the command line. The results are the same as above:

$ echo "set SERVER=root@host123; mysqldiskusage --server=\$SERVER" | mysqluc

The following demonstrates launching the console and setting variables via the command line:

$ mysqluc SERVER=root@host123 VAR_A=57 -e "show variables"

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SERVER</td>
<td>root@host123</td>
</tr>
<tr>
<td>VAR_A</td>
<td>57</td>
</tr>
</tbody>
</table>

14.4.21. mysqluserclone — Clone Existing User to Create New User

This utility uses an existing MySQL user account on one server as a template, and clones it to create one or more new user accounts with the same privileges as the original user. The new users can be created on the original server or a different server.

To list users for a server, specify the --list option. This prints a list of the users on the source (no destination is needed). To control how to display list output, use one of the following values with the --format option:

• grid (default)
  Display output in grid or table format like that of the mysql monitor.

• csv
  Display output in comma-separated values format.

• tab
  Display output in tab-separated format.

• vertical
  Display output in single-column format like that of the \G command for the mysql monitor.

OPTIONS

mysqluserclone accepts the following command-line options:

• --help
mysqluserclone — Clone Existing User to Create New User

Display a help message and exit.

• --destination=<destination>
  Connection information for the destination server in the format: <user>[:<passwd>@<host>[::<port>][:<socket>]] or <login-path>[:<port>][:<socket>].

• --dump, -d
  Display the GRANT statements to create the account rather than executing them. In this case, the utility does not connect to the destination server and no --destination option is needed.

• --format=<list_format>, -f<list_format>
  Specify the user display format. Permitted format values are grid, csv, tab, and vertical. The default is grid. This option is valid only if --list is given.

• --force
  Drop the new user account if it exists before creating the new account. Without this option, it is an error to try to create an account that already exists.

• --include-global-privileges
  Include privileges that match base_user@% as well as base_user@host.

• --list
  List all users on the source server. With this option, a destination server need not be specified.

• --quiet, -q
  Turn off all messages for quiet execution.

• --source=<source>
  Connection information for the source server in the format: <user>[:<passwd>@<host>[::<port>][:<socket>]] or <login-path>[:<port>][:<socket>].

• --verbose, -v
  Specify how much information to display. Use this option multiple times to increase the amount of information. For example, -v = verbose, -vv = more verbose, -vvv = debug.

• --version
  Display version information and exit.

NOTES

You must provide connection parameters (user, host, password, and so forth) for an account that has the appropriate privileges to access all objects in the operation.

The account used to connect to the source server must have privileges to read the mysql database.

The account used to connect to the destination server must have privileges to execute CREATE USER (and DROP USER if the --force option is given), and privileges to execute GRANT for all privileges to be granted to the new accounts.

For the --format option, the permitted values are not case sensitive. In addition, values may be specified as any unambiguous prefix of a valid value. For example, --format=g specifies the grid format. An error occurs if a prefix matches more than one valid value.
The path to the MySQL client tools should be included in the PATH environment variable in order to use the authentication mechanism with login-paths. This will allow the utility to use the my_print_defaults tools which is required to read the login-path values from the login configuration file (.mylogin.cnf).

EXAMPLES

To clone joe as sam and sally with passwords and logging in as root on the local machine, use this command:

```
$ mysqluserclone --source=root@localhost \
    --destination=root@localhost \
    joe@localhost sam:secret1@localhost sally:secret2@localhost
# Source on localhost: ... connected.
# Destination on localhost: ... connected.
# Cloning 2 users...
# Cloning joe@localhost to user sam:secret1@localhost
# Cloning joe@localhost to user sally:secret2@localhost
# ...done.
```

The following command shows all users on the local server in the most verbose output in CSV format:

```
$ mysqluserclone --source=root@localhost --list --format=csv -vvv
# Source on localhost: ... connected.
user,host,database
joe,localhost,util_test
rpl,localhost,
sally,localhost,util_test
sam,localhost,util_test
joe,user,util_test
```

14.5. Parsers

14.5.1. mysql.utilities.parser — Parse MySQL Log Files

This module provides classes for parsing MySQL log files. Currently, Slow Query Log and General Query Log are supported.

Classes

```python
class mysql.utilities.parser.GeneralQueryLog(stream)
```

This class parses the MySQL General Query Log. Instances are iterable, but the class does not provide multiple independent iterators.

For example, to read the log and print the entries:

```python
>>> general_log = open("/var/lib/mysql/mysql.log")
>>> log = GeneralQueryLog(general_log)
>>> for entry in log:
...     print entry
```

Parameters:

- **stream** *(file type)* — a valid file type; for example, the result of the built-in Python function `open()`

version

Returns: Version of the MySQL server that produced the log

Return type: tuple

program
### Returns:
**Full path of the MySQL server executable**

**Return type:** `str`

### port

Returns: TCP/IP port on which the MySQL server was listening

Return type: `int`

### socket

Returns: Full path of the MySQL server Unix socket

Return type: `str`

### start_datetime

Returns: Date and time of the first read log entry

Return type: `datetime.datetime`

### lastseen_datetime

Returns: Date and time of the last read log entry

Return type: `datetime.datetime`

---

**class mysql.utilities.parser.SlowQueryLog(stream)**

This class parses the MySQL Slow Query Log. Instances are iterable, but the class does not provide multiple independent iterators.

For example, to read the log and print the entries:

```python
>>> slow_log = open("/var/lib/mysql/mysql-slow.log")
>>> log = SlowQueryLog(slow_log)
>>> for entry in log:
...     print entry
...     print entry
```

Parameters:
- **stream (file type)** – a valid file type; for example, the result of the built-in Python function `open()`

### version

Returns: Version of the MySQL server that produced the log

Return type: `tuple`

### program

Returns: Full path of the MySQL server executable

Return type: `str`

### port

Returns: TCP/IP port on which the MySQL server was listening
14.6. Related tools

14.6.1. mut — MySQL Utilities Testing

This utility executes predefined tests to test the MySQL Utilities. The tests are located under the /mysql-test directory and divided into suites (stored as folders). By default, all tests located in the /t folder are considered the ‘main’ suite.

You can select any number of tests to run, select one or more suites to restrict the tests, exclude suites and tests, and specify the location of the utilities and tests.

The utility requires the existence of at least one server to clone for testing purposes. You must specify at least one server, but you may specify multiple servers for tests designed to use additional servers.

The utility has a special test suite named ‘performance’ where performance-related tests are placed. This suite is not included by default and must be specified with the --suite [337] option to execute the performance tests.

OPTIONS

mut accepts the following command-line options:

- --help
  Display a help message and exit.
- --do-tests=<prefix>
  Execute all tests that begin with prefix.
- --force
  Do not abort when a test fails.
- --record
  Record the output of the specified test if successful. With this option, you must specify exactly one test to run.
- --server=<server>
Connection information for the server to use in the tests, in `<user>[:<passwd>@]<host>[:<port>][:<socket>]` format. Use this option multiple times to specify multiple servers.

- **--skip-long**
  Exclude tests that require greater resources or take a long time to run.

- **--skip-suite=<name>**
  Exclude the named test suite. Use this option multiple times to specify multiple suites.

- **--skip-test=<name>**
  Exclude the named test. Use this option multiple times to specify multiple tests.

- **--skip-tests=<prefix>**
  Exclude all tests that begin with `prefix`.

- **--sort**
  Execute tests sorted by suite.name either ascending (asc) or descending (desc). Default is ascending (asc).

- **--start-port=<port>**
  The first port to use for spawned servers. If you run the entire test suite, you may see up to 12 new instances created. The default is to use ports 3310 to 3321.

- **--start-test=<prefix>**
  Start executing tests that begin with `prefix`.

- **--stop-test=<prefix>**
  Stop executing tests at the first test that begins with `prefix`.

- **--suite=<name>**
  Execute the named test suite. Use this option multiple times to specify multiple suites.

- **--testdir=<path>**
  The path to the test directory.

- **--utildir=<path>**
  The location of the utilities.

- **--verbose, -v**
  Specify how much information to display. Use this option multiple times to increase the amount of information. For example, `–v` = verbose, `–vv` = more verbose, `–vvv` = debug. To diagnose test execution problems, use `–vvv` to display the actual results of test cases and ignore result processing.

- **--version**
  Display version information and exit.

- **--width=<number>**
  Specify the display width. The default is 75 characters.
NOTES

The connection specifier must name a valid account for the server.

Any test named ???.template.py is skipped. This enables the developer to create a base class to import for a collection of tests based on a common code base.

EXAMPLES

The following example demonstrates how to invoke mut to execute a subset of the tests using an existing server which is cloned. The example displays the test name, status, and relative time:

```
$ mut --server=root@localhost --do-tests=clone_user --width=70
```

```
MySQL Utilities Testing - MUT

Parameters used:
    Display Width     = 70
    Sorted             = True
    Force              = False
    Test directory     = './t'
    Utilities directory = '../scripts'
    Starting port      = 3310
    Test wildcard      = 'clone_user%' 

Servers:
    Connecting to localhost as user root on port 3306: CONNECTED

----------------------------------------------------------------------

<table>
<thead>
<tr>
<th>TEST NAME</th>
<th>STATUS</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>main.clone_user</td>
<td>[pass]</td>
<td>54</td>
</tr>
<tr>
<td>main.clone_user_errors</td>
<td>[pass]</td>
<td>27</td>
</tr>
<tr>
<td>main.clone_user_parameters</td>
<td>[pass]</td>
<td>17</td>
</tr>
</tbody>
</table>

----------------------------------------------------------------------

Testing completed: Friday 03 December 2010 09:50:06
All 3 tests passed.
```

14.7. Appendix

14.7.1. MySQL Utilities FAQ

Frequently Asked Questions with answers.

Questions

- **14.7.1.1.1**: [339] Are these utilities present in the community version of MySQL?
- **14.7.1.2.1**: [339] Can the utilities be used with MyISAM or CSV?
- **14.7.1.3.1**: [339] Can the .frm reader read a .frm file without the associated data files?
- **14.7.1.3.2**: [339] Will the .frm reader modify my original .frm file?
- **14.7.1.3.3**: [339] What is diagnostic mode and why doesn't it produce the same output as the default mode?
- **14.7.1.3.4**: [339] If the diagnostic mode is only a best-effort compilation, why use it?
- **14.7.1.3.5**: [339] Why does the default mode require a server?
- **14.7.1.3.6**: [339] Can the .frm reader read any .frm file?
- **14.7.1.3.7**: [339] My .frm files are tucked away in a restricted folder. How do I get access to them to run the .frm reader without copying or modifying file privileges?
• 14.7.1.3.8: [339] Will the default mode display a 100% accurate CREATE statement?

Questions and Answers

14.7.1.1: Are these utilities present in the community version of MySQL?

They are included in the community version of MySQL Workbench, and available from Launchpad.

14.7.1.2: Can the utilities be used with MyISAM or CSV?

Yes. There are no storage engine specific limitations in using the utilities. There are some features written specifically for InnoDB so those may not apply but in general no utility is storage engine specific. For example, the `mysqldiskusage` utility shows exact sizes for MyISAM and InnoDB files but uses estimated sizes for any other storage engine based on number of rows and row size.

14.7.1.3: Can the .frm reader read a .frm file without the associated data files?

Yes! The .frm reader was designed to read the contents of an .frm file without requiring the data files.

14.7.1.4: Will the .frm reader modify my original .frm file?

No, it does not modify the original .frm file in either default or diagnostic mode.

14.7.1.5: What is diagnostic mode and why doesn’t it produce the same output as the default mode?

The diagnostic mode does not use a spawned server to read the .frm file. Instead, it attempts to read the contents of the file byte-by-byte and forms a best-effort approximation of the CREATE statement. Due to the many complexities of the server code, the diagnostic mode does not currently process all features of a table. Future revisions will improve the accuracy of the diagnostic mode.

14.7.1.6: If the diagnostic mode is only a best-effort compilation, why use it?

The diagnostic mode is used to attempt to read corrupt or otherwise damaged .frm files. You would also use it if you had no access to a server installation on the local machine.

14.7.1.7: Why does the default mode require a server?

The default mode uses a server to create a temporary working copy of the server instance. It does not access the donor server in any way other than to execute the mysqld[.exe] process.

14.7.1.8: Can the .frm reader read any .frm file?

While it can read most .frm files, there are known limits to which storage engines it can process correctly. Currently, tables with storage engines partition and performance_schema cannot be read. However, these .frm files can be read by the diagnostic mode,

14.7.1.9: My .frm files are tucked away in a restricted folder. How do I get access to them to run the .frm reader without copying or modifying file privileges?

You can use elevated privileges such as su or sudo to execute the .frm reader. You must use the --user option to specify a user to launch the spawned server, however. This will permit the .frm reader to read the original .frm file and copy it to the spawned server and access the copy without requiring additional privileges.

14.7.1.10: Will the default mode display a 100% accurate CREATE statement?

For most tables and all views, yes. However, there are at least two features that are not stored in the .frm file and therefore will not be included. These are autoincrement values and foreign keys. That being said, the CREATE statement produced will be syntactically correct.
This file contains an example of how to build a customized utility using the MySQL Utilities scripts and libraries.

import optparse
import os
import sys
from mysql.utilities import VERSION_FRM
from mysql.utilities.command import dbcopy
from mysql.utilities.command import serverclone
from mysql.utilities.command import userclone
from mysql.utilities.common.server import Server
from mysql.utilities.common.options import parse_connection
from mysql.utilities.exception import UtilError

# Constants
NAME = "example - copy_server"
DESCRIPTION = "copy_server - copy an existing server"
USAGE = "%prog --server=\"user:pass\@host:port:socket\" "
"--new-dir=\"path\" --new-id=\"server_id\" "
"--new-port=\"port\" --databases=\"db list\" "
"--users=\"user list\""

# Setup the command parser
parser = optparse.OptionParser(
    version=VERSION_FRM.format(program=os.path.basename(sys.argv[0])),
    description=DESCRIPTION,
    usage=USAGE,
    add_help_option=False)
parser.add_option("--help", action="help", action="help")

# Setup utility-specific options:

# Connection information for the source server
parser.add_option("--server", action="store", dest="server",
    type="string", default="root@localhost:3306",
    help="connection information for original server in " + 
    "the form: <user>:<password>@<host>:<port>:<socket>")

# Data directory for new instance
parser.add_option("--new-data", action="store", dest="new_data",
    type="string", help="the full path to the location 
of the data directory for the new instance")

# Port for the new instance
parser.add_option("--new-port", action="store", dest="new_port",
    type="string", default="3307", help="the new port 
    "for the new instance - default=%default")

# Server id for the new instance
parser.add_option("--new-id", action="store", dest="new_id", type="string", default="2", help="the server_id for " "the new instance - default=%default")

# List of databases
parser.add_option("-d", "--databases", action="store", dest="dbs_to_copy", type="string", help="comma-separated list of databases " "to include in the copy (omit for all databases)", default=None)

# List of users
parser.add_option("-u", "--users", action="store", dest="users_to_copy", type="string", help="comma-separated list of users " "to include in the copy (omit for all users)", default=None)

# Now we process the rest of the arguments.
opt, args = parser.parse_args()

# Parse source connection values
try:
    conn = parse_connection(opt.server)
except:
    parser.error("Server connection values invalid or cannot be parsed.")

# Get a server class instance
print "# Connecting to server..."
server_options = {
    'conn_info' : conn,
    'role'      : "source",
}
server1 = Server(server_options)
try:
    server1.connect()
except UtilError, e:
    print "ERROR: ", e.errmsg

# Get list of databases from the server if not specified in options
print "# Getting databases...
" db_list = []
if opt.dbs_to_copy is None:
    for db in server1.get_all_databases():
        db_list.append((db[0], None))
else:
    for db in opt.dbs_to_copy.split(","):  
        db_list.append((db, None))

# Get list of all users from the server
print "# Getting users...
" user_list=[]
if opt.users_to_copy is None:
    users = server1.exec_query("SELECT user, host 
    "FROM mysql.user 
    "WHERE user != 'root' and user != '"")
    for user in users:
        user_list.append(user[0]+'@'+user[1])
else:
    for user in opt.users_to_copy.split(","):  
        user_list.append(user)

# Build options
options = {
    'new_data'   : opt.new_data,
    'new_port'   : opt.new_port,
    'new_id'     : opt.new_id,
    'root_pass'  : 'root',
    'mysqld_options': '--report-host=localhost --report-port=%s' % opt.new_port,
}

# Clone the server
print "# Cloning server instance...
 try:
res = serverclone.clone_server(conn, options)
except UtilError, e:
    print "ERROR:", e.errmsg
    sys.exit()

# Set connection values
dest_values = {
    "user"   : conn.get("user"),
    "passwd" : "root",
    "host"   : conn.get("host"),
    "port"   : opt.new_port,
    "unix_socket" : os.path.join(opt.new_data, "mysql.sock")
}

# Build dictionary of options
options = {
    "quiet" : True,
    "force" : True
}

print "# Copying databases..."
try:
    dbcopy.copy_db(conn, dest_values, db_list, options)
except UtilError, e:
    print "ERROR:", e.errmsg
    sys.exit()

# Build dictionary of options
options = {
    "overwrite" : True,
    "quiet"     : True,
    "globals"   : True
}

print "# Cloning the users..."
for user in user_list:
    try:
        res = userclone.clone_user(conn, dest_values, user,
                                   (user,), options)
    except UtilError, e:
        print "ERROR:", e.errmsg
        sys.exit()

print "# ...done."
Appendix A. Third Party Licenses

Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>License</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1</td>
<td>.NET Flat TabControl License</td>
<td>344</td>
</tr>
<tr>
<td>A.2</td>
<td>ANTLR License</td>
<td>344</td>
</tr>
<tr>
<td>A.3</td>
<td>Bitstream Vera License</td>
<td>345</td>
</tr>
<tr>
<td>A.4</td>
<td>Boost Library License</td>
<td>346</td>
</tr>
<tr>
<td>A.5</td>
<td>Cairo License</td>
<td>346</td>
</tr>
<tr>
<td>A.6</td>
<td>CTemplate (Google Template System) License</td>
<td>347</td>
</tr>
<tr>
<td>A.7</td>
<td>cURL (libcurl) License</td>
<td>347</td>
</tr>
<tr>
<td>A.8</td>
<td>DockPanel Suite License</td>
<td>348</td>
</tr>
<tr>
<td>A.9</td>
<td>Dojo Toolkit v1.7.0b1 License</td>
<td>348</td>
</tr>
<tr>
<td>A.10</td>
<td>GLib License (for MySQL Workbench)</td>
<td>349</td>
</tr>
<tr>
<td>A.11</td>
<td>Glitz License</td>
<td>349</td>
</tr>
<tr>
<td>A.12</td>
<td>GNU Lesser General Public License Version 2.1, February 1999</td>
<td>349</td>
</tr>
<tr>
<td>A.13</td>
<td>HtmlRenderer (System.Drawing.Html)</td>
<td>357</td>
</tr>
<tr>
<td>A.14</td>
<td>iODBC License</td>
<td>357</td>
</tr>
<tr>
<td>A.15</td>
<td>Libiconv License</td>
<td>358</td>
</tr>
<tr>
<td>A.16</td>
<td>Libintl License</td>
<td>358</td>
</tr>
<tr>
<td>A.17</td>
<td>Libxml2 License</td>
<td>359</td>
</tr>
<tr>
<td>A.18</td>
<td>Libzip License</td>
<td>360</td>
</tr>
<tr>
<td>A.19</td>
<td>Lua (liblua) License</td>
<td>360</td>
</tr>
<tr>
<td>A.20</td>
<td>Paramiko License</td>
<td>360</td>
</tr>
<tr>
<td>A.21</td>
<td>PCRE License</td>
<td>361</td>
</tr>
<tr>
<td>A.22</td>
<td>Pixman License</td>
<td>362</td>
</tr>
<tr>
<td>A.23</td>
<td>PyCrypto License</td>
<td>363</td>
</tr>
<tr>
<td>A.24</td>
<td>PyODBC License</td>
<td>364</td>
</tr>
<tr>
<td>A.25</td>
<td>Python License</td>
<td>364</td>
</tr>
<tr>
<td>A.26</td>
<td>Scintilla License</td>
<td>374</td>
</tr>
<tr>
<td>A.27</td>
<td>Scintilla.NET License</td>
<td>375</td>
</tr>
<tr>
<td>A.28</td>
<td>TinyXML License</td>
<td>376</td>
</tr>
<tr>
<td>A.29</td>
<td>TreeViewAdv for .NET License</td>
<td>376</td>
</tr>
<tr>
<td>A.30</td>
<td>VSQLite++ License</td>
<td>377</td>
</tr>
<tr>
<td>A.31</td>
<td>zlib License</td>
<td>377</td>
</tr>
</tbody>
</table>

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---------------------------
Written by: Philip Hazel
Email local part: ph10
Email domain: cam.ac.uk

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--amk
(www.amk.ca)

/** FILE: rmd160.c */
* CONTENTS: A sample C-implementation of the RIPEMD-160 hash-function.
* TARGET: any computer with an ANSI C compiler
* AUTHOR: Antoon Bosselaers, Dept. Electrical Eng.-ESAT/COSIC
* DATE: 1 March 1996 VERSION: 1.0
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In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see http://www.cnri.reston.va.us) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation, see http://www.zope.com). In 2001, the Python Software Foundation (PSF, see http://www.python.org/psf/) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation is a sponsoring member of the PSF.

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Mersenne Twister
----------------


The following are the verbatim comments from the original code:

A C-program for MT19937, with initialization improved 2002/1/26.
Coded by Takuji Nishimura and Makoto Matsumoto.

Before using, initialize the state by using init_genrand(seed)
or init_by_array(init_key, key_length).

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Any feedback is very welcome.
http://www.math.keio.ac.jp/matumoto/emt.html
email: matumoto@math.keio.ac.jp

Sockets
=======
The socket module uses the functions, getaddrinfo(), and getnameinfo(), which are coded in separate source files from the WIDE Project, http://www.wide.ad.jp/.

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L. Peter Deutsch
ghost@aladdin.com

Independent implementation of MD5 (RFC 1321).

This code implements the MD5 Algorithm defined in RFC 1321, whose text is available at:

http://www.ietf.org/rfc/rfc1321.txt

The code is derived from the text of the RFC, including the test suite (section A.5) but excluding the rest of Appendix A. It does not include any code or documentation that is identified in the RFC as being copyrighted.

The original and principal author of md5.h is L. Peter Deutsch <ghost@aladdin.com>. Other authors are noted in the change history that follows (in reverse chronological order):

2002-04-13 lpd Removed support for non-ANSI compilers; removed references to Ghostscript; clarified derivation from RFC 1321; now handles byte order either statically or dynamically.
1999-11-04 lpd Fixed typo in header comment (ansi2knr rather than md5);
1999-10-18 lpd Fixed typo in header comment (ansi2knr rather than md5);
1999-10-18 lpd Fixed typo in header comment (ansi2knr rather than md5);
1999-05-03 lpd Original version.

Asynchronous socket services
============================

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Modified by Jack Jansen, CWI, July 1995:
- Use binascii module to do the actual line-by-line conversion
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- Arguments more compliant with Python standard

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Appendix B. MySQL Workbench FAQ

Frequently Asked Questions with answers.

Questions

• B.1: [379] How does MySQL Workbench increase import performance?

• B.2: [379] MySQL Workbench 5.0 appears to run slowly. How can I increase performance?

• B.3: [380] I get errors when creating or placing objects on an EER Diagram. I am using OpenGL rendering, AMD processor, and ATI graphics hardware.

• B.4: [380] What do the column flag acronyms (PK, NN, UQ, BIN, UN, ZF, AI) in the MySQL Workbench Table Editor mean?

Questions and Answers

B.1: How does MySQL Workbench increase import performance?

When a model is exported using the main menu item File, Export, Forward Engineer SQL CREATE Script, some server variables are temporarily set to enable faster SQL import by the server. The statements added at the start of the code are:

```sql
SET @OLD_UNIQUE_CHECKS=@@UNIQUE_CHECKS, UNIQUE_CHECKS=0;
SET @OLD_FOREIGN_KEY_CHECKS=@@FOREIGN_KEY_CHECKS, FOREIGN_KEY_CHECKS=0;
SET @OLD_SQL_MODE=@@SQL_MODE, SQL_MODE='TRADITIONAL';
```

These statements function as follows:

• `SET @OLD_UNIQUE_CHECKS=@@UNIQUE_CHECKS, UNIQUE_CHECKS=0;`: Determines whether InnoDB performs duplicate key checks. Import is much faster for large data sets if this check is not performed.

• `SET @OLD_FOREIGN_KEY_CHECKS=@@FOREIGN_KEY_CHECKS, FOREIGN_KEY_CHECKS=0;`: Determines whether the server should check that a referenced table exists when defining a foreign key. Due to potential circular references, this check must be turned off for the duration of the import, to permit defining foreign keys.

• `SET @OLD_SQL_MODE=@@SQL_MODE, SQL_MODE='TRADITIONAL';`: Sets SQL_MODE to TRADITIONAL, causing the server to operate in a more restrictive mode.

These server variables are then reset at the end of the script using the following statements:

```sql
SET SQL_MODE=@OLD_SQL_MODE;
SET FOREIGN_KEY_CHECKS=@OLD_FOREIGN_KEY_CHECKS;
SET UNIQUE_CHECKS=@OLD_UNIQUE_CHECKS;
```

B.2: MySQL Workbench 5.0 appears to run slowly. How can I increase performance?

Although graphics rendering may appear slow, there are several other reasons why performance may be less than expected. The following tips may offer improved performance:

• Upgrade to the latest version. MySQL Workbench 5.0 is still being continually maintained and some performance-related issues may have been resolved.

• Limit the number of steps to save in the Undo History facility. Depending on the operations performed, having an infinite undo history can use a lot of memory after a few hours of work. In Tools, Options, General, enter a number in the range 10 to 20 into the Undo History Size spinbox.

• Disable relationship line crossing rendering. In large diagrams, there may be a significant overhead when drawing these line crossings. In Tools, Options, Diagram, uncheck the option named Draw Line Crossings.
• Check your graphics card driver. The GDI rendering used in MySQL Workbench 5.0 is not inherently slow, as most video drivers support hardware acceleration for GDI functions. It can help if you have the latest native video drivers for your graphics card.

• Upgrade to MySQL Workbench 5.1. MySQL Workbench 5.1 has had many operations optimized. For example, opening an object editor, such as the table editor, is much faster, even with a large model loaded. However, these core optimizations will not be back-ported to 5.0.

B.3: I get errors when creating or placing objects on an EER Diagram. I am using OpenGL rendering, AMD processor, and ATI graphics hardware.

To solve this problem renew the ATI drivers pack, which can be downloaded from the AMD Web site.

B.4: What do the column flag acronyms (PK, NN, UQ, BIN, UN, ZF, AI) in the MySQL Workbench Table Editor mean?

Checking these boxes will alter the table column by assigning the checked constraints to the designated columns.

Hover over an acronym to view a description, and see the MySQL Workbench Table Editor and MySQL CREATE TABLE documentation for further information.
Appendix C. MySQL Workbench and Utilities Change History

Table of Contents

C.1. MySQL Workbench Change History ................................................................. 381
C.2. MySQL Utilities Change History ................................................................. 381

This appendix lists the changes from version to version in the MySQL Workbench and MySQL Utilities source code.

Note that we tend to update the manual at the same time we make changes to MySQL. If you find a recent version of the MySQL Workbench or Utilities listed here that you can't find on our download page (http://dev.mysql.com/downloads/), it means that the version has not yet been released.

The date mentioned with a release version is the date of the last Bazaar ChangeSet on which the release was based, not the date when the packages were made available. The binaries are usually made available a few days after the date of the tagged ChangeSet, because building and testing all packages takes some time.

The manual included in the source and binary distributions may not be fully accurate when it comes to the release changelog entries, because the integration of the manual happens at build time. For the most up-to-date release changelog, please refer to the online version instead.

C.1. MySQL Workbench Change History

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Release notes for the changes in each release of MySQL Workbench are located at MySQL Workbench Release Notes.

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