MySQL Workbench

MySQL Workbench

Abstract

This manual documents the MySQL Workbench SE version 5.2 and the MySQL Workbench OSS version 5.2.

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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Preface and Legal Notices

This is the User Manual for the MySQL Workbench.

For license information, see the Legal Notices. This product may contain third-party code. For license information on third-party code, see Appendix A, *Third Party Licenses*.

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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. 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 3. Installing and Launching MySQL Workbench

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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.

3.1. 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)

3.2. 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)
- 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”.

3.3. 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:

- `--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 are as follows: Linux: `~/.mysql/workbench/log/wb.log`, Mac: `~/Library/Application Support/Workbench/log/wb.log`, and on Windows: `C:\Users\[your user id]\AppData\Roaming\MySQL\Workbench\wb.log`
- `--admin` *`instance`*: Load the server instance specified.
- `--query` *`connection`*: Load the connection specified.
- `--model` *`modelfile`*: Load the model specified.
- `--script` *`script`*: Run the script specified.
- `--run` *`code`*: Run the code snippet specified.

- `--quit-when-done`: Quits MySQL Workbench after `--script` or `--run` finishes.

3.3.1. 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 you 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.

3.3.2. 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.
All rights reserved.

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-python script . Executes the given Workbench Python 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 version information
-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.

3.3.3. 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.

3.3.4. 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
```

package`.deb` is the MySQL Workbench package name; for example, `mysql-workbench-oss-`*version*`_i386.deb`, where *version* is the MySQL Workbench version number.

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
```

package`.rpm` is the MySQL Workbench package name; for example, `mysql-workbench-oss-`*version*`-1fc10.x86_64.rpm`, where *version* is the MySQL Workbench version number.

3.3.5. 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
```

3.3.6. 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:

```
shell> sudo dpkg -r mysql-workbench-oss
```

This command does not remove the configuration files. If you wish to also remove the configuration files, use this command:

```
shell> sudo dpkg --purge mysql-workbench-oss
```

Uninstalling RPM packages

To uninstall an RPM package, use this command:

```
shell> sudo rpm -e mysql-workbench-oss
```

This command does not remove the configuration files.

3.3.7. 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-i686.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 3.1. 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.

3.3.8. 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.

3.3.9. 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 4. Getting Started Tutorial

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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.

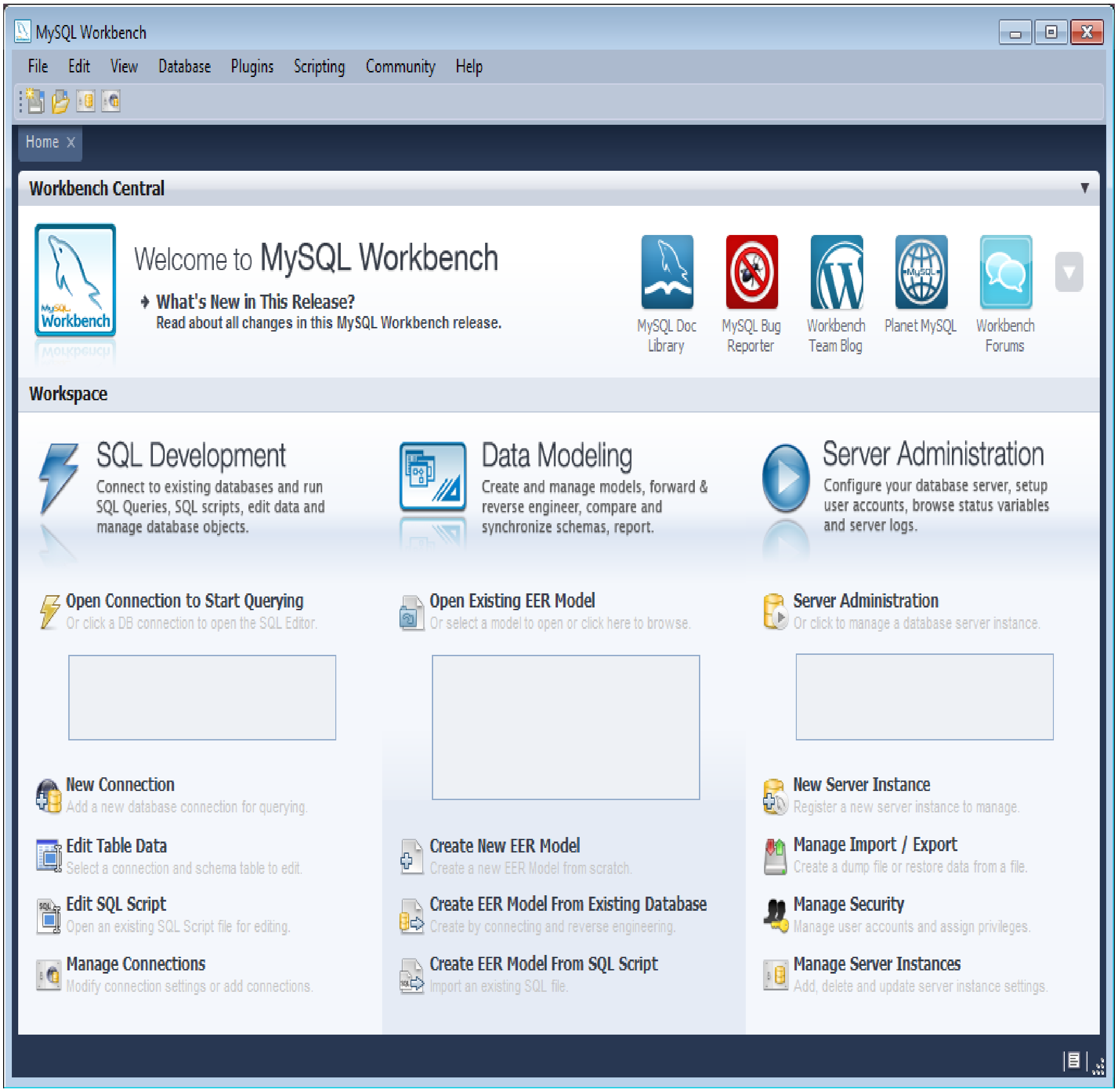
This tutorial uses a locally installed MySQL Server. If you only have access to a remote MySQL server, you must enter appropriate connection parameters as necessary. This tutorial requires MySQL Workbench 5.2.16 or above. It is assumed that you have a basic understanding of MySQL concepts. This tutorial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

4.1. 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.

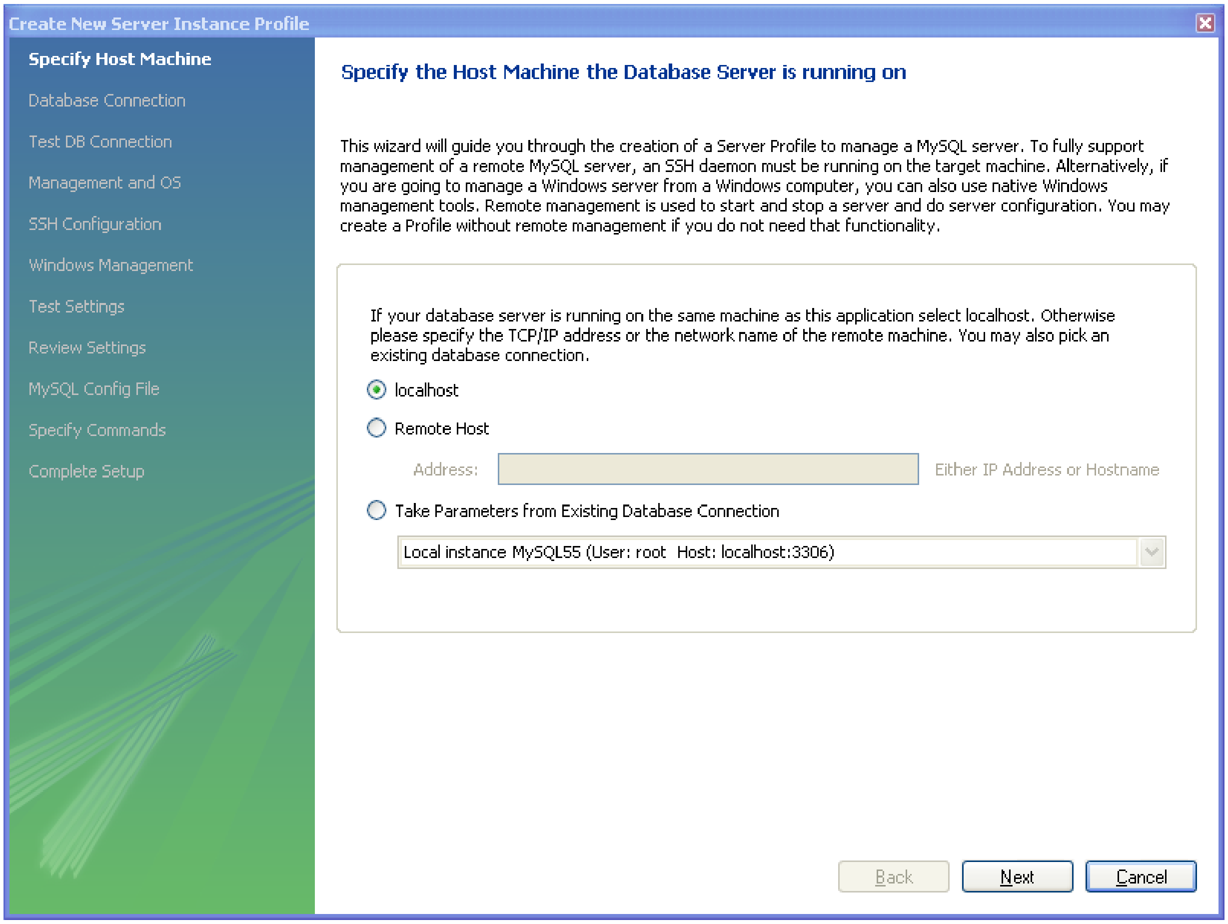
Figure 4.1. Getting Started Tutorial - Home Window



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.

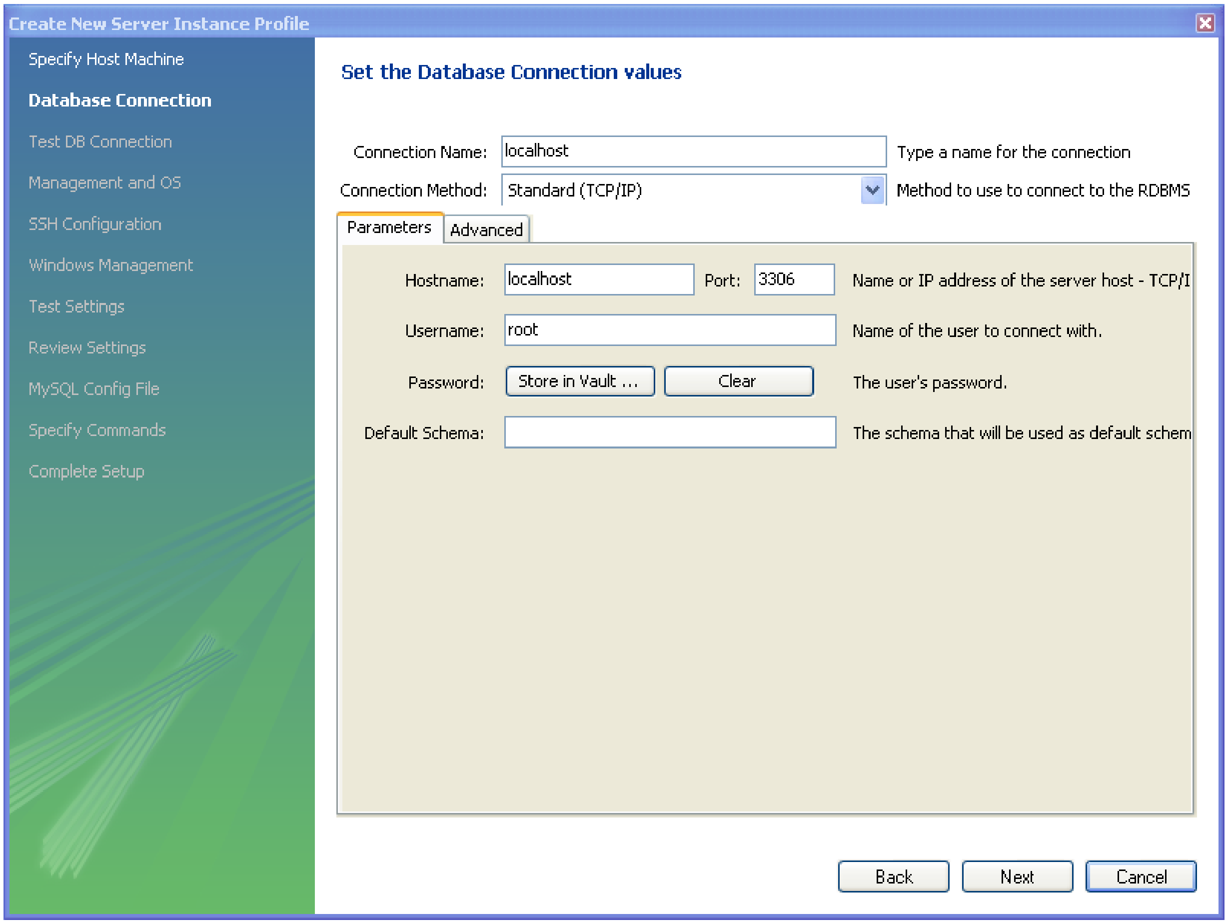
3. In this tutorial, you will connect to a locally installed server, so click Next.

Figure 4.2. Getting Started Tutorial - Specify Host Machine



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.

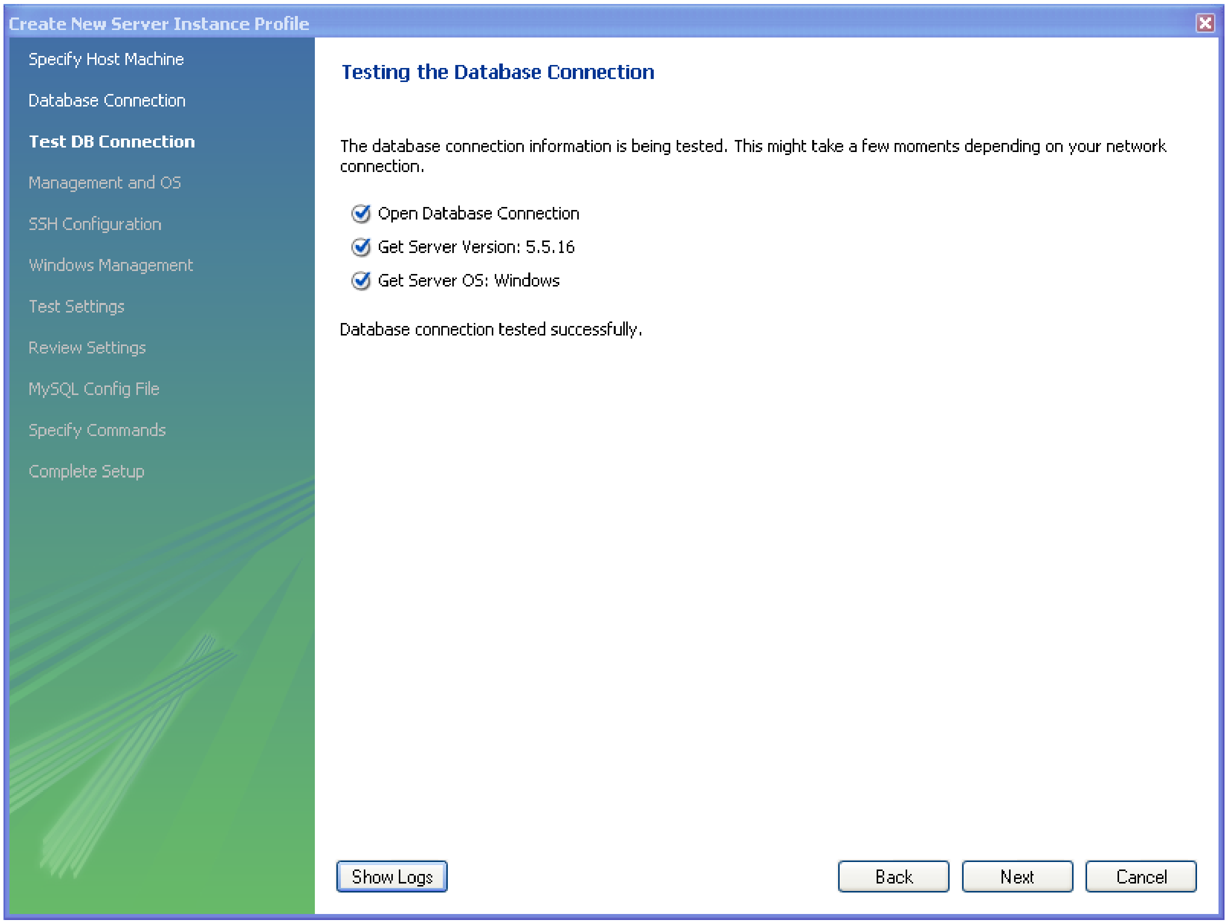
Figure 4.3. Getting Started Tutorial - Database Connection



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.

Figure 4.4. Getting Started Tutorial - Connection Test

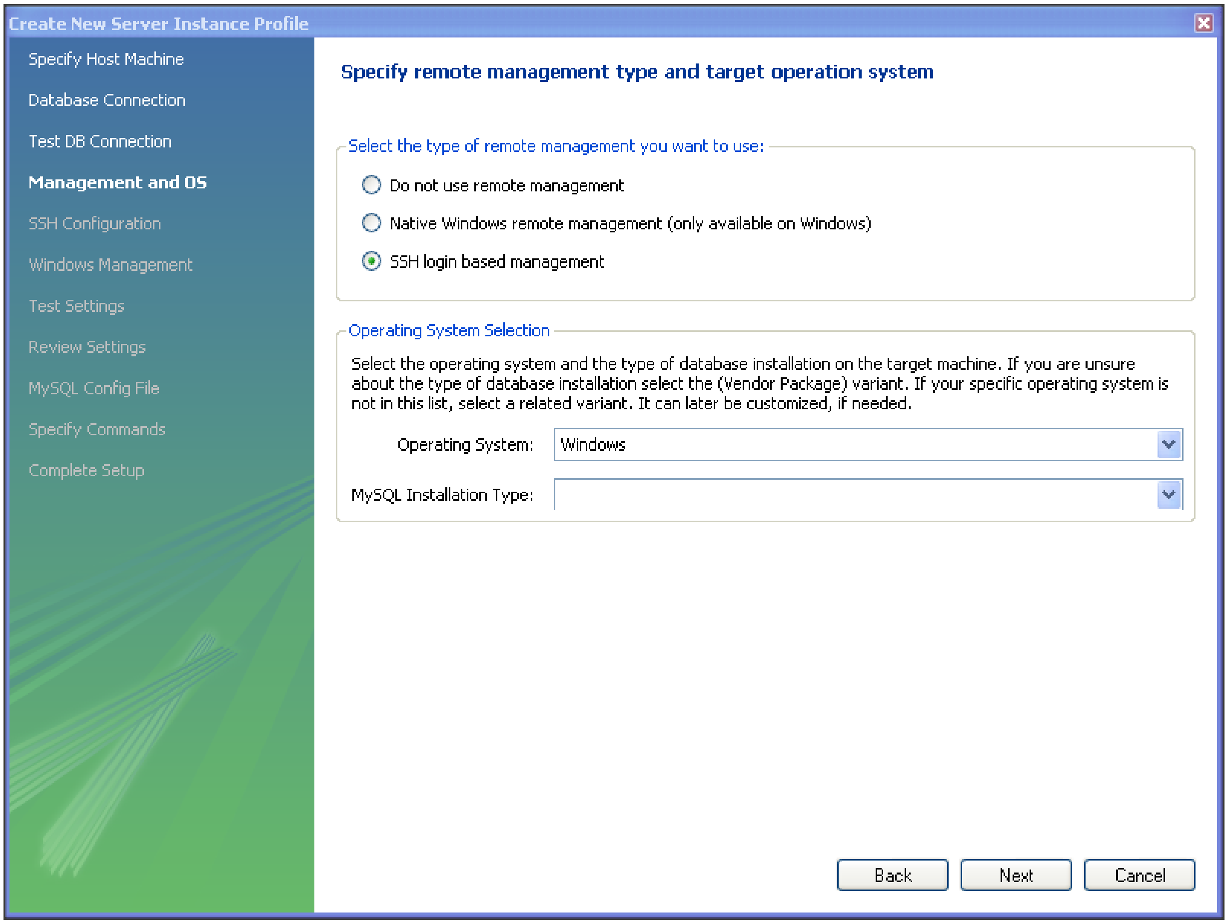


If the connection test was successful, click Next.

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.

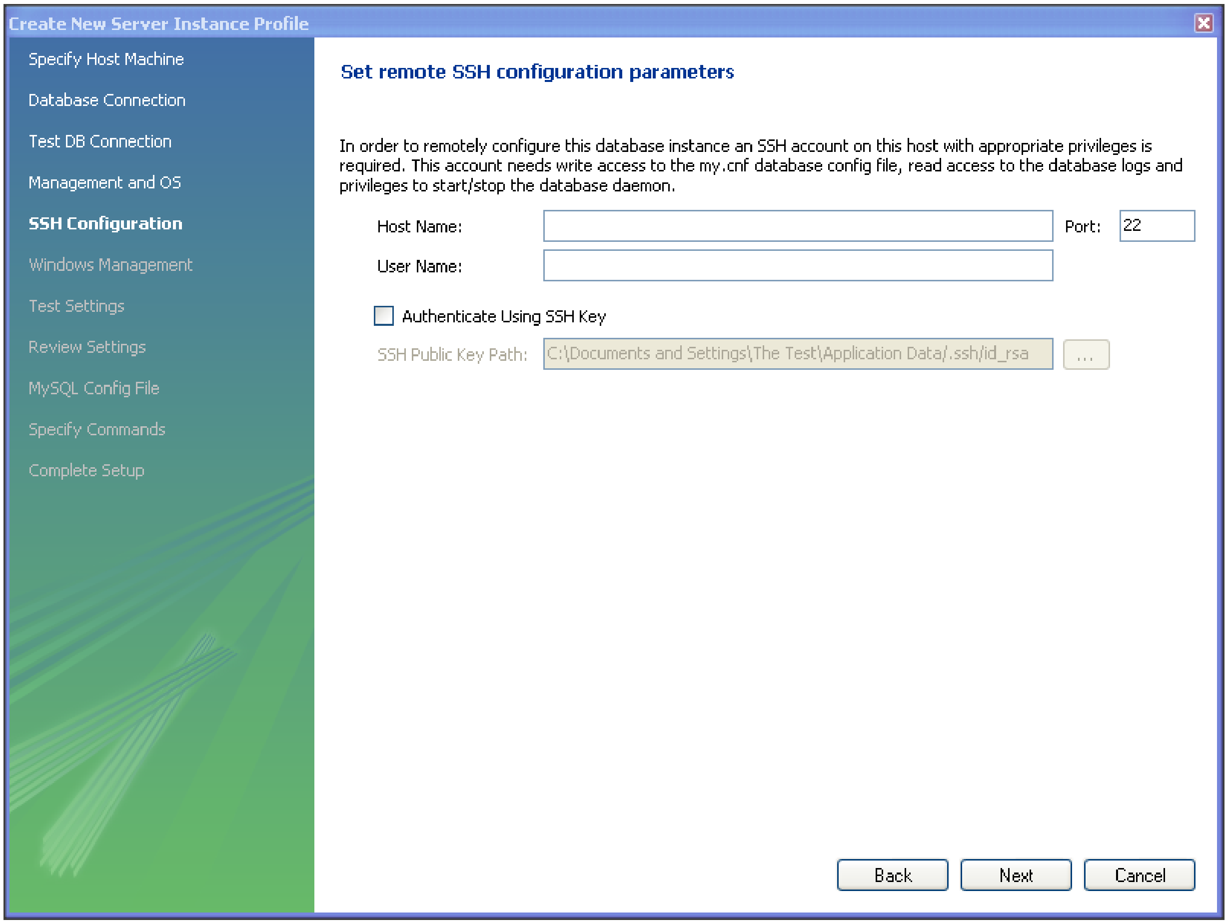
Figure 4.5. Getting Started Tutorial - Management and OS



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.

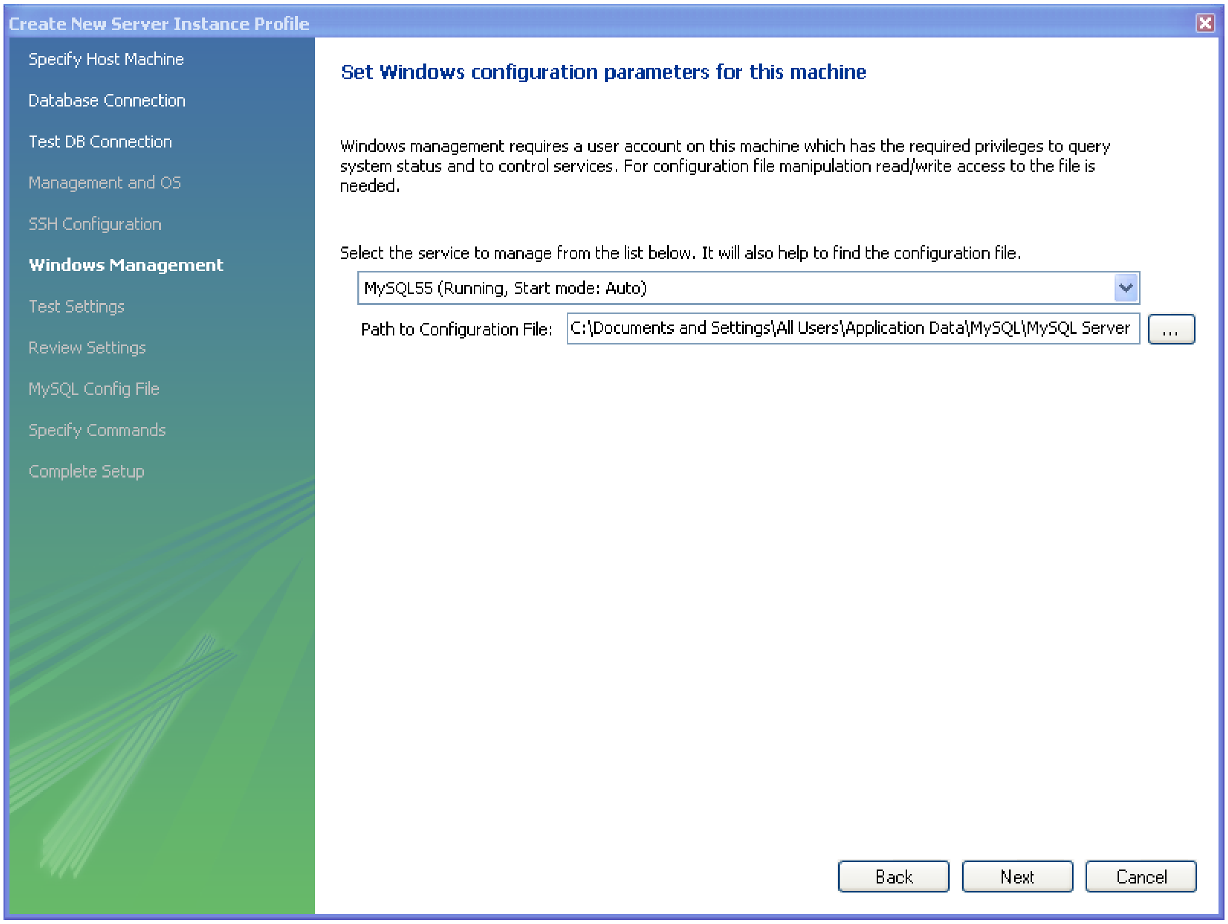
Figure 4.6. Getting Started Tutorial - SSH Configuration



Check that everything is in order, then click Next.

8. If a Windows server is used, then the Windows configuration parameters must be set.

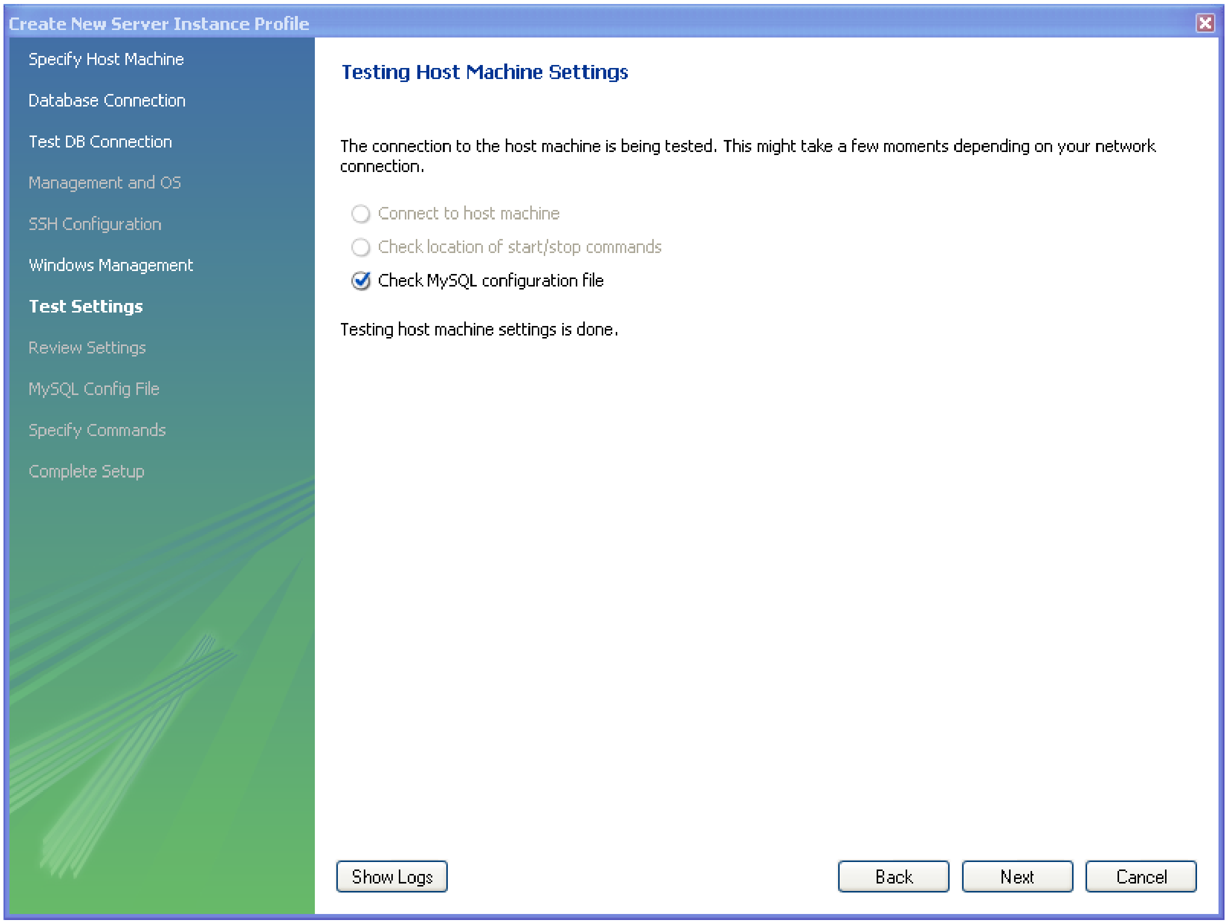
Figure 4.7. Getting Started Tutorial - Windows Management



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.

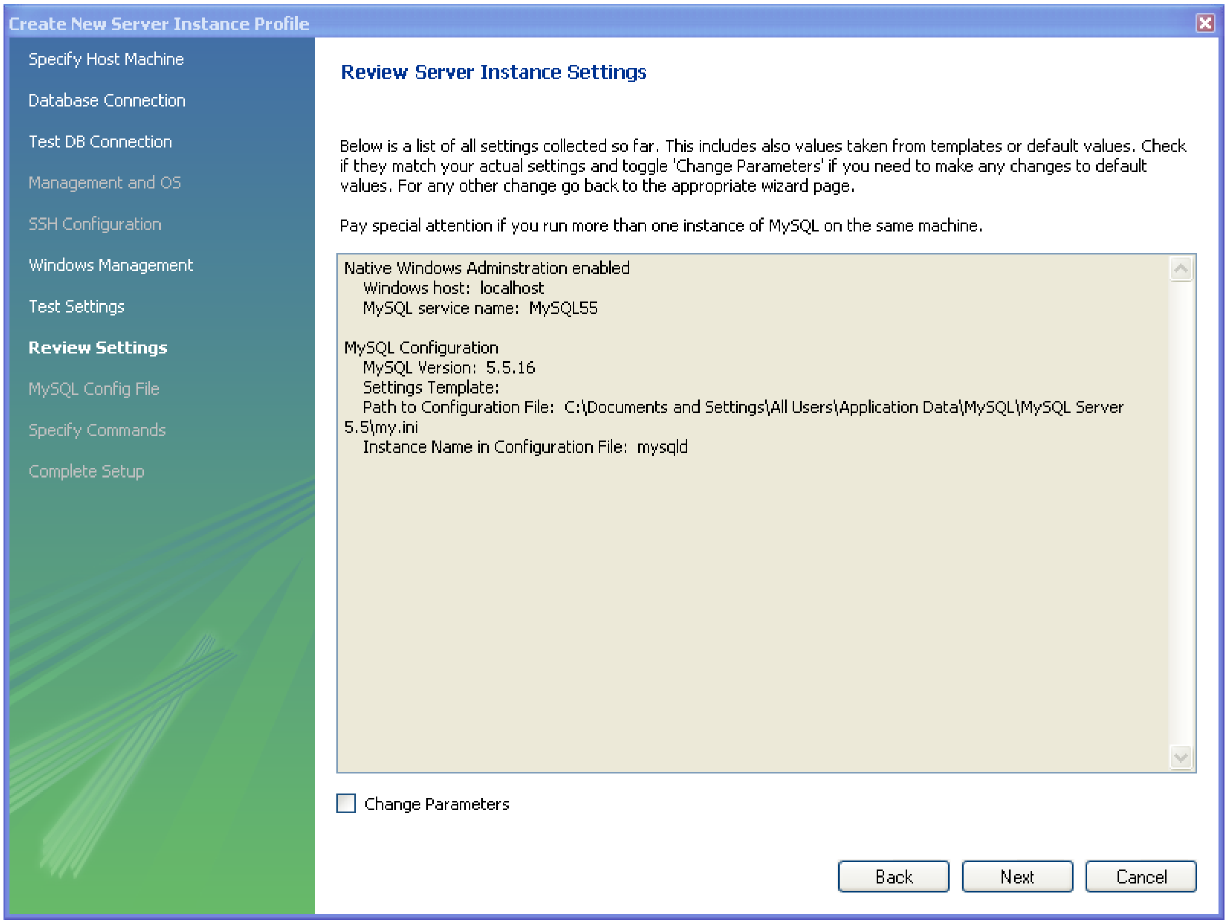
Figure 4.8. Getting Started Tutorial - Test Host Settings



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.

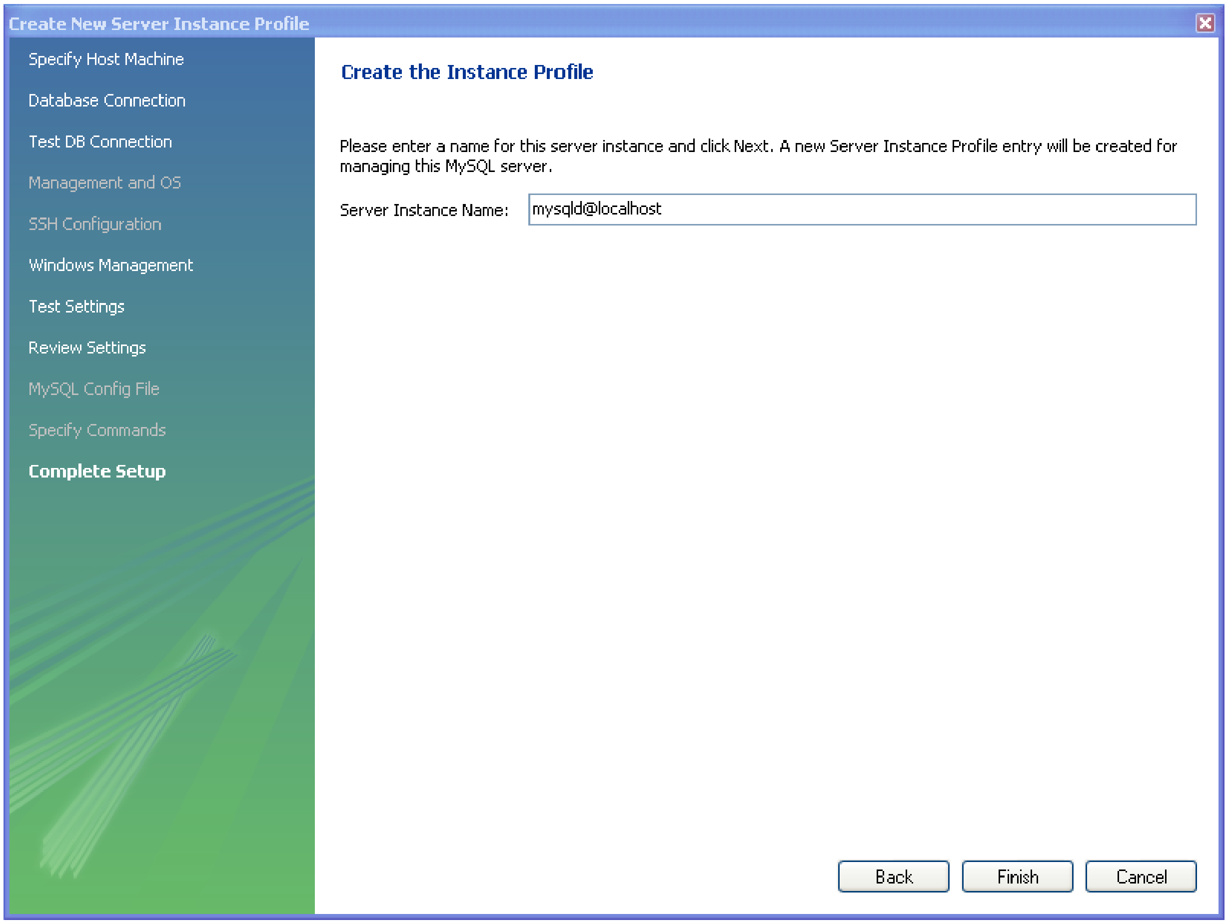
Figure 4.9. Getting Started Tutorial - Review Settings



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.

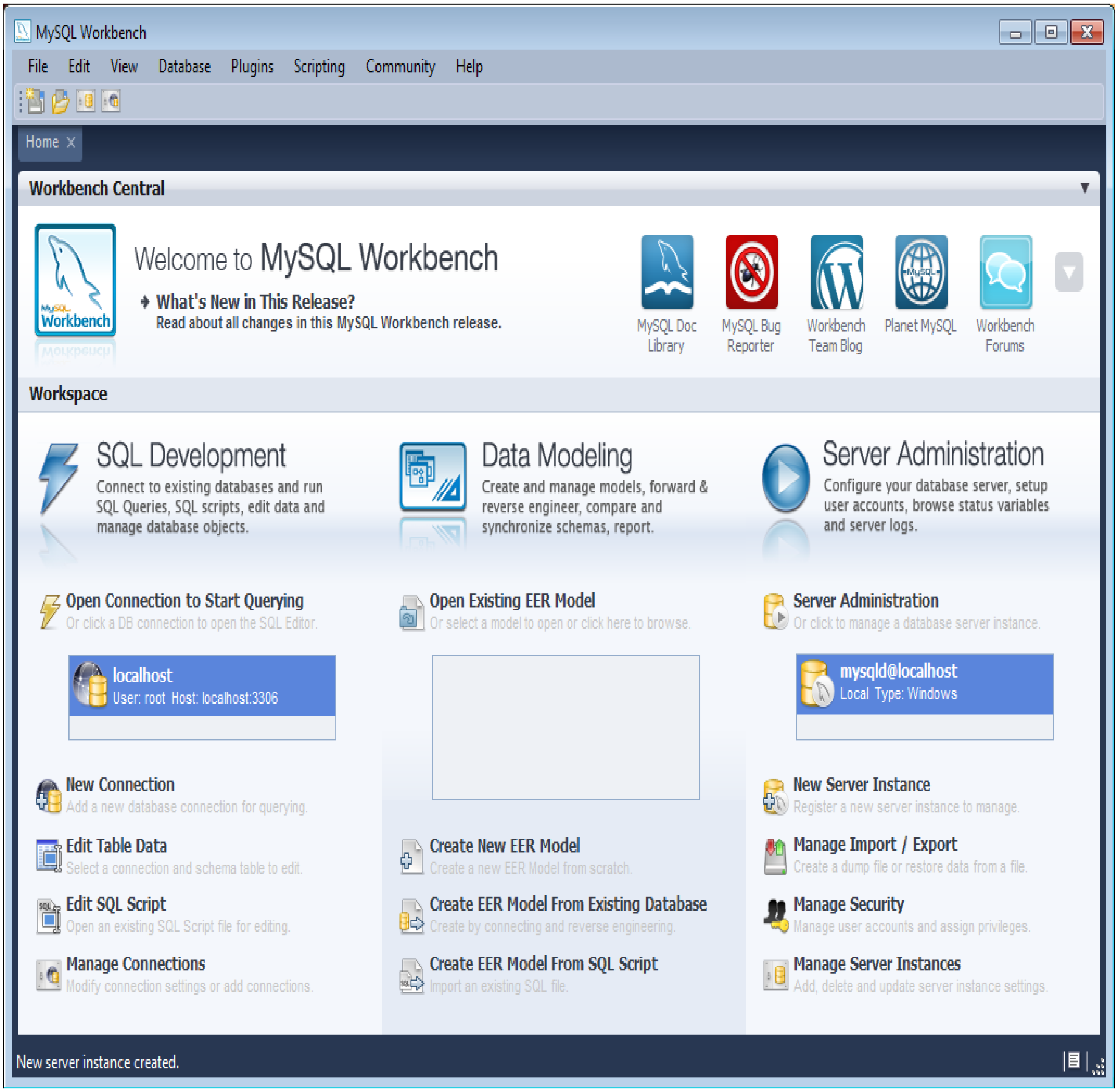
Figure 4.10. Getting Started Tutorial - Instance Name



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.

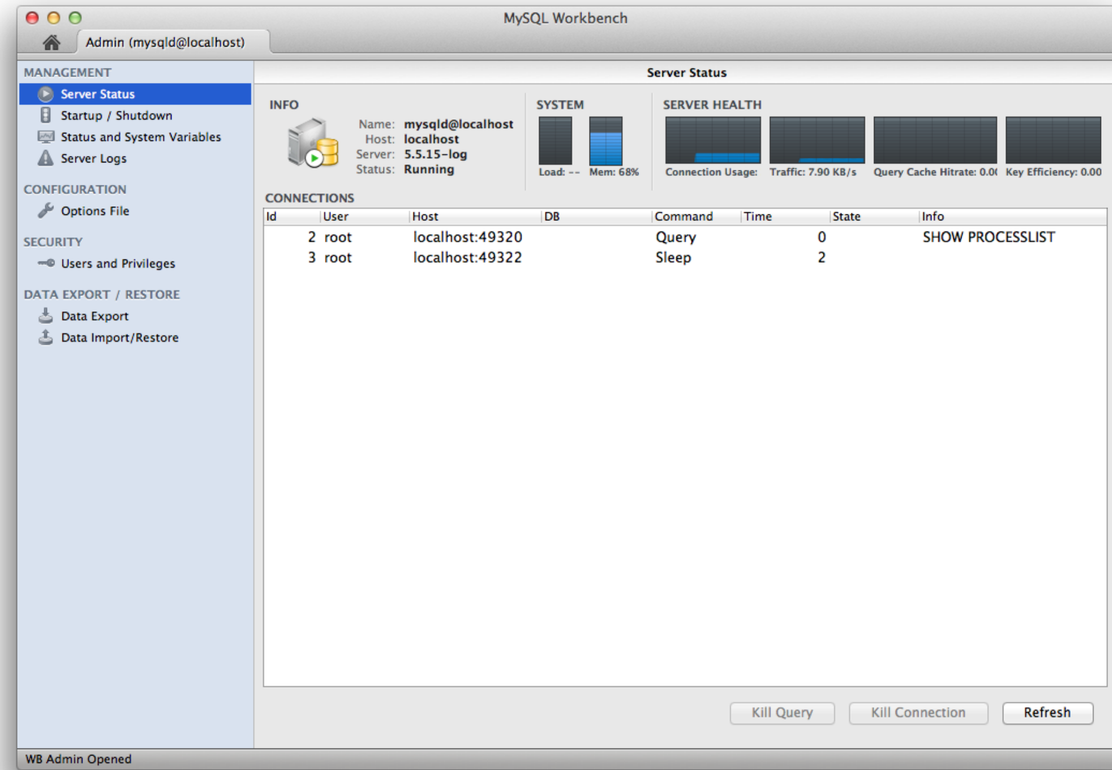
Figure 4.11. Getting Started Tutorial - Home Window Instance



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.

Figure 4.12. Getting Started Tutorial - Admin Startup



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.

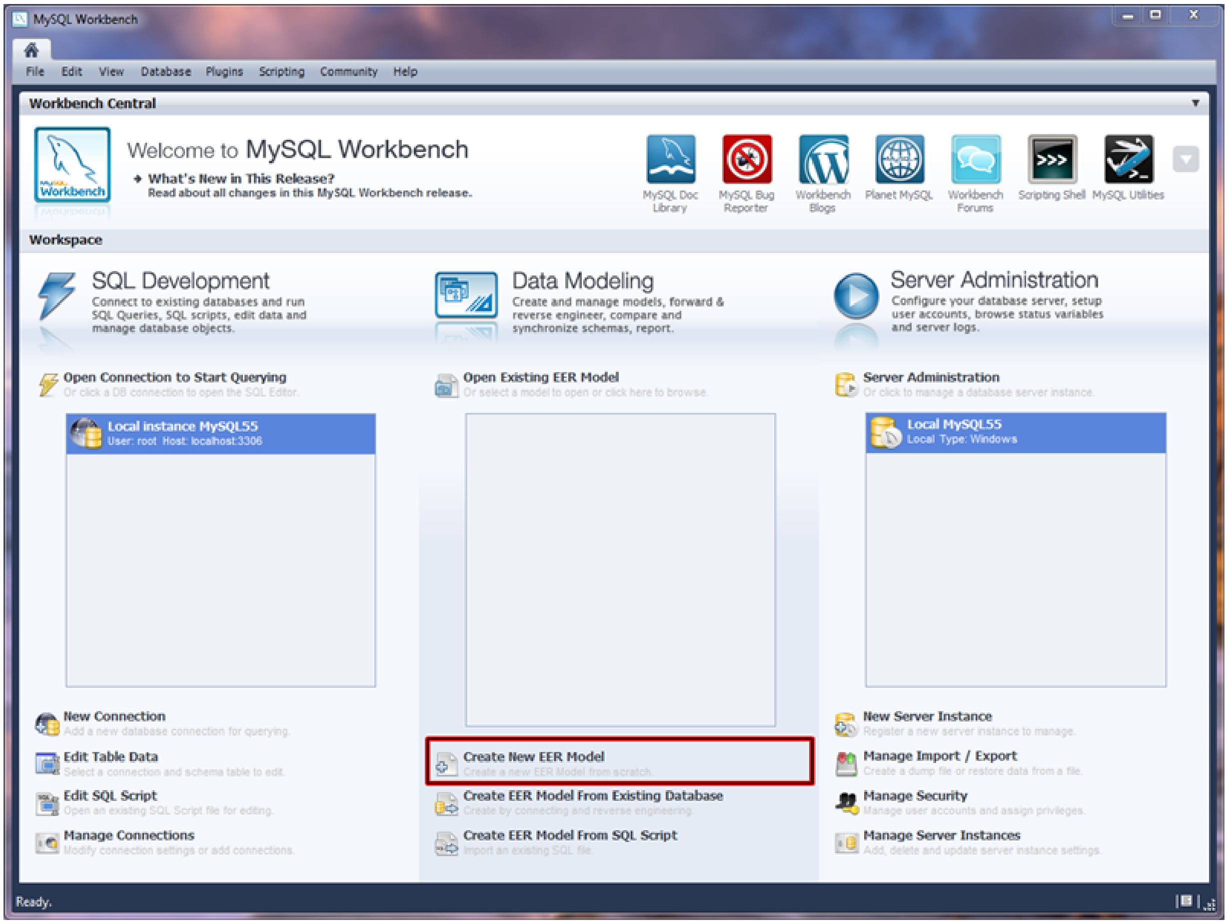
For further information, see Chapter 9, *Server Administration*.

4.2. 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.

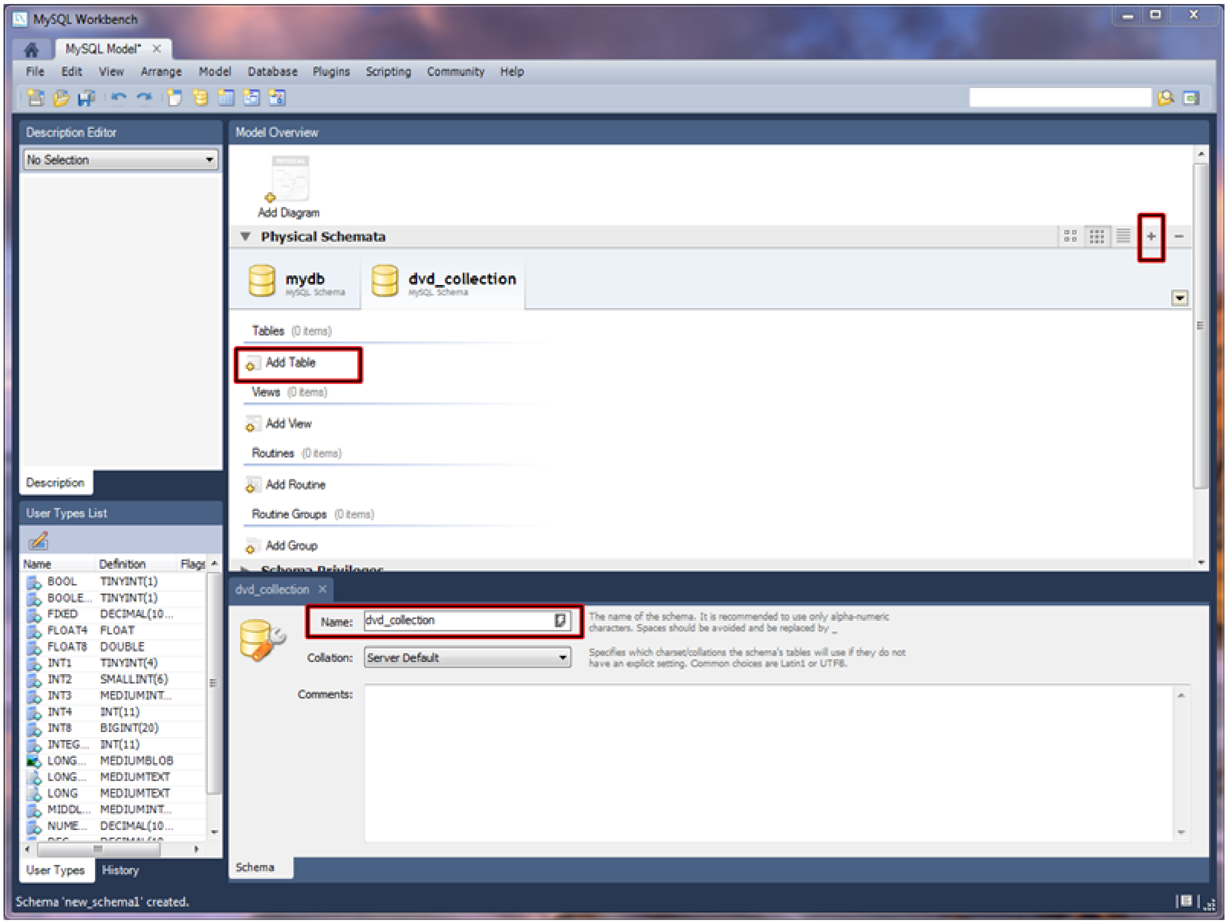
1. Start MySQL Workbench. On the Home window, select **Create new EER Model**. A model can contain multiple schemata. Note that when you create a new model, it contains the `mydb` schema by default. You can change the name of this schema to serve your own purposes, or delete it.

Figure 4.13. Getting Started Tutorial - Home Window



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.

Figure 4.14. Getting Started Tutorial - New Schema



3. In the Physical Schemata section, double-click **Add Table**.

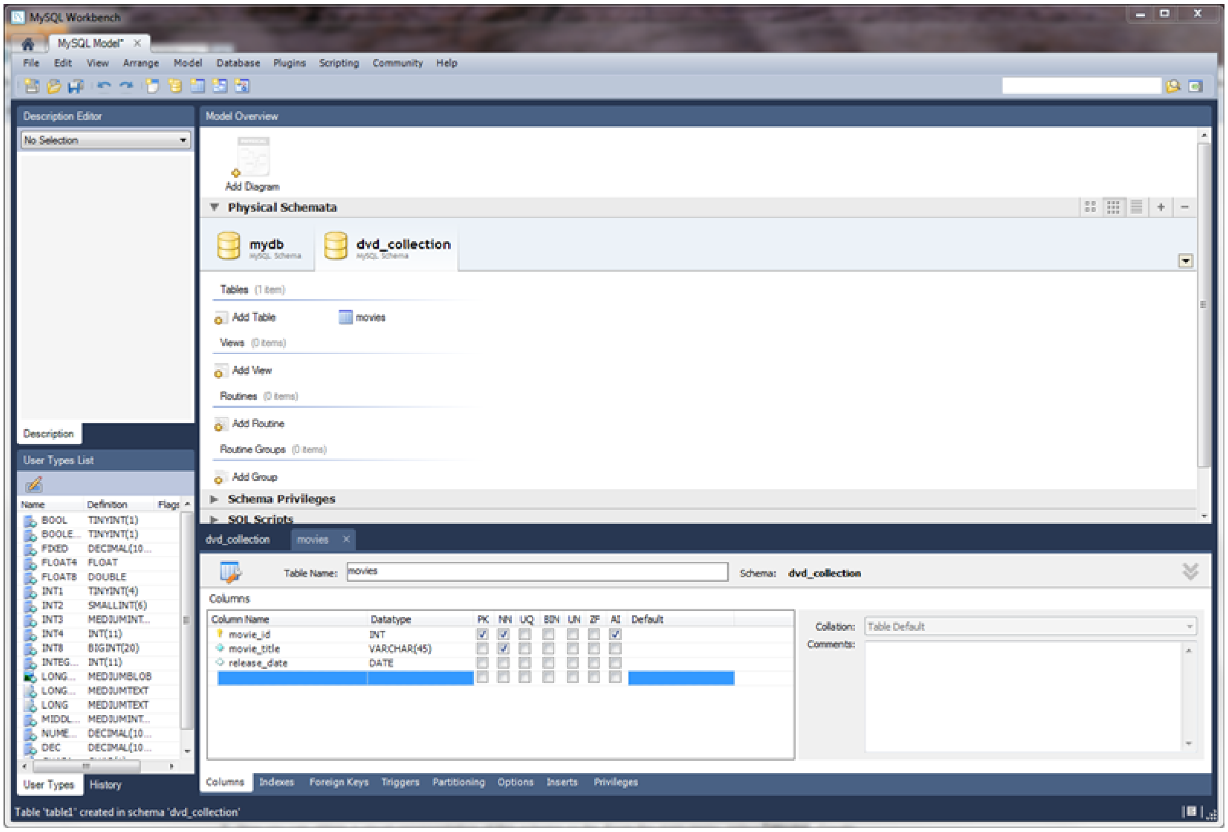
4. This will automatically load the table editor, with the default table name being **table1**. In the table editor, change the name of the table from “table1” to “movies”.

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:

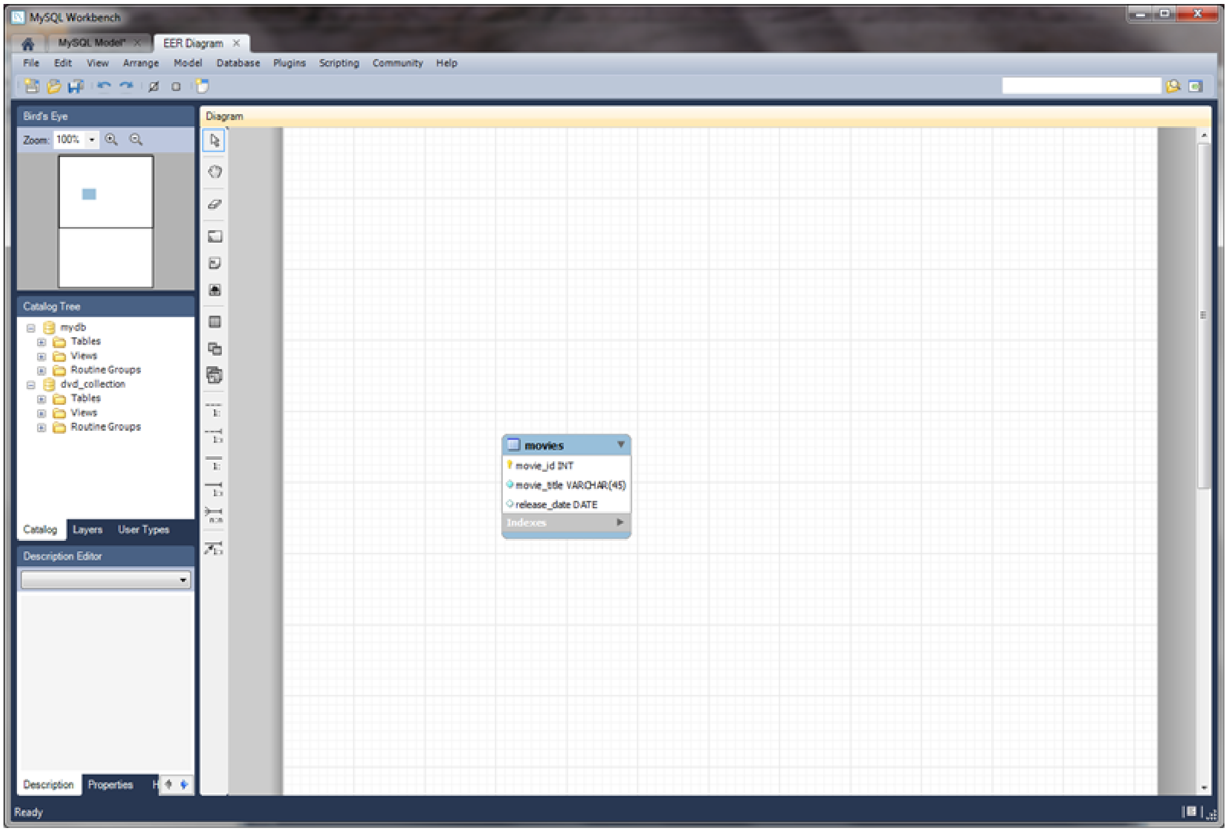
Column Name	Data Type	Column Properties
movie_title	VARCHAR(45)	NN
release_date	DATE (YYYY-MM-DD)	None

Figure 4.15. Getting Started Tutorial - Columns



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.

Figure 4.16. Getting Started Tutorial - EER Diagram



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.

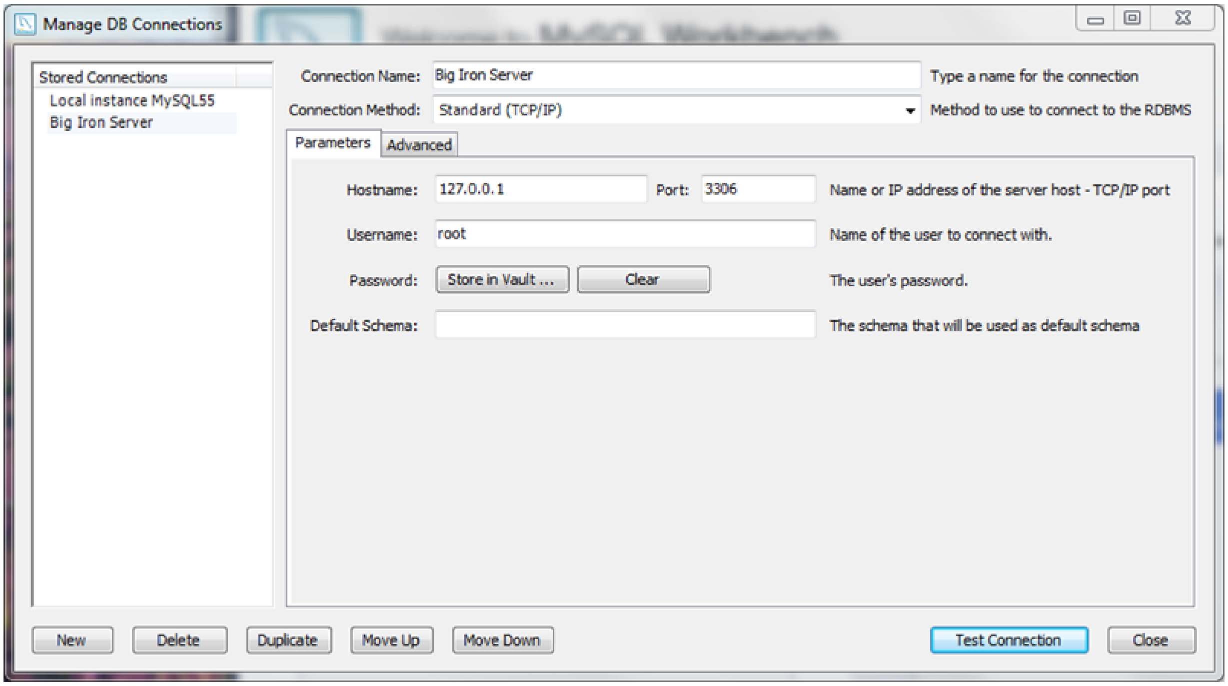
12. Enter “Big Iron Server” for the connection name. This enables you to identify the server to which this connection corresponds, although it is possible to create multiple connections to the same server.

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 4.17. Getting Started Tutorial - Manage Connections



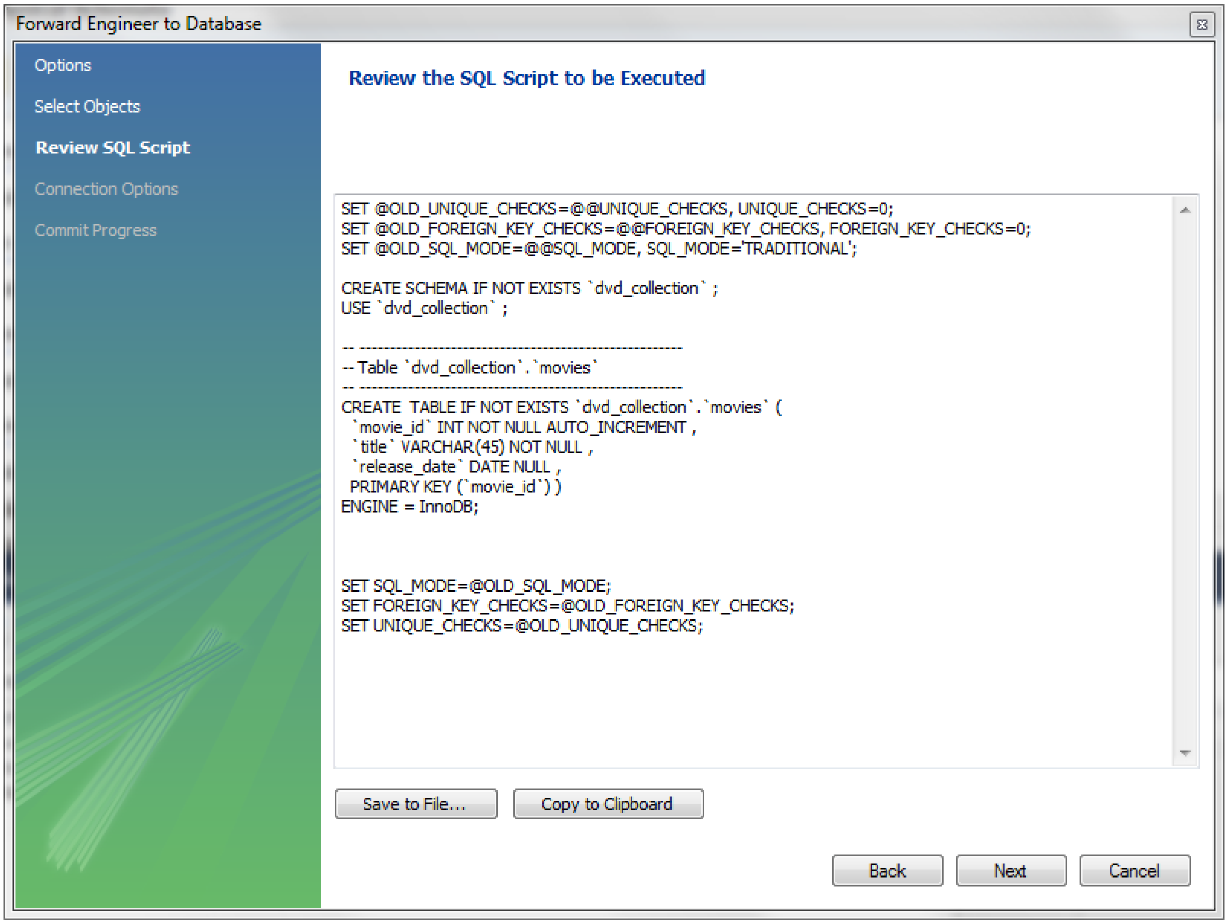
16. You are now ready to forward engineer your model to the live server. From the main menu, select Database, Forward Engineer.... The **Forward Engineer to Database** wizard will be displayed.

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 4.18. Getting Started Tutorial - Review Script



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.

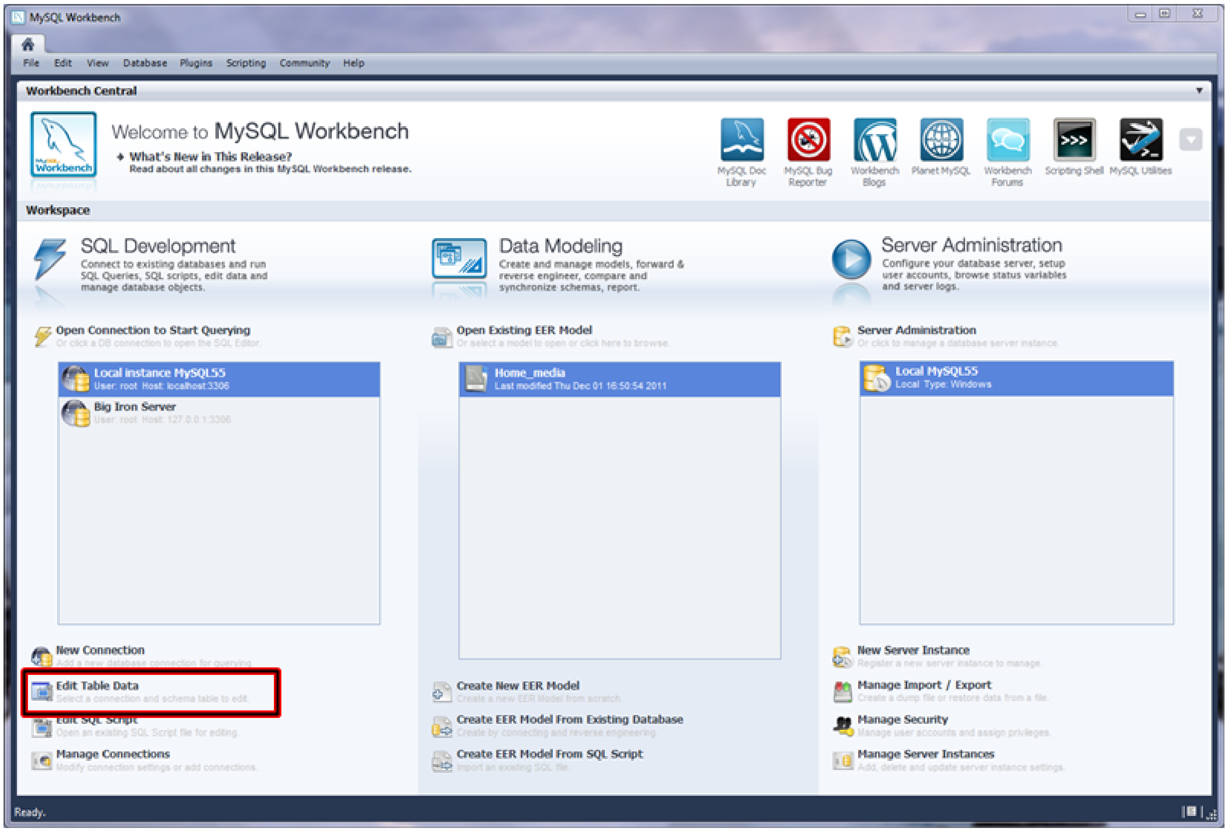
22. Ensure that your model is saved. Click **Save Model to Current File** on the main toolbar.

4.3. 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.

Figure 4.19. Getting Started Tutorial - Edit Table Data



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.

title	release_date
Gone with the Wind	1939-04-17
The Hound of the Baskervilles	1939-03-31
The Matrix	1999-06-11
Above the Law	1988-04-08

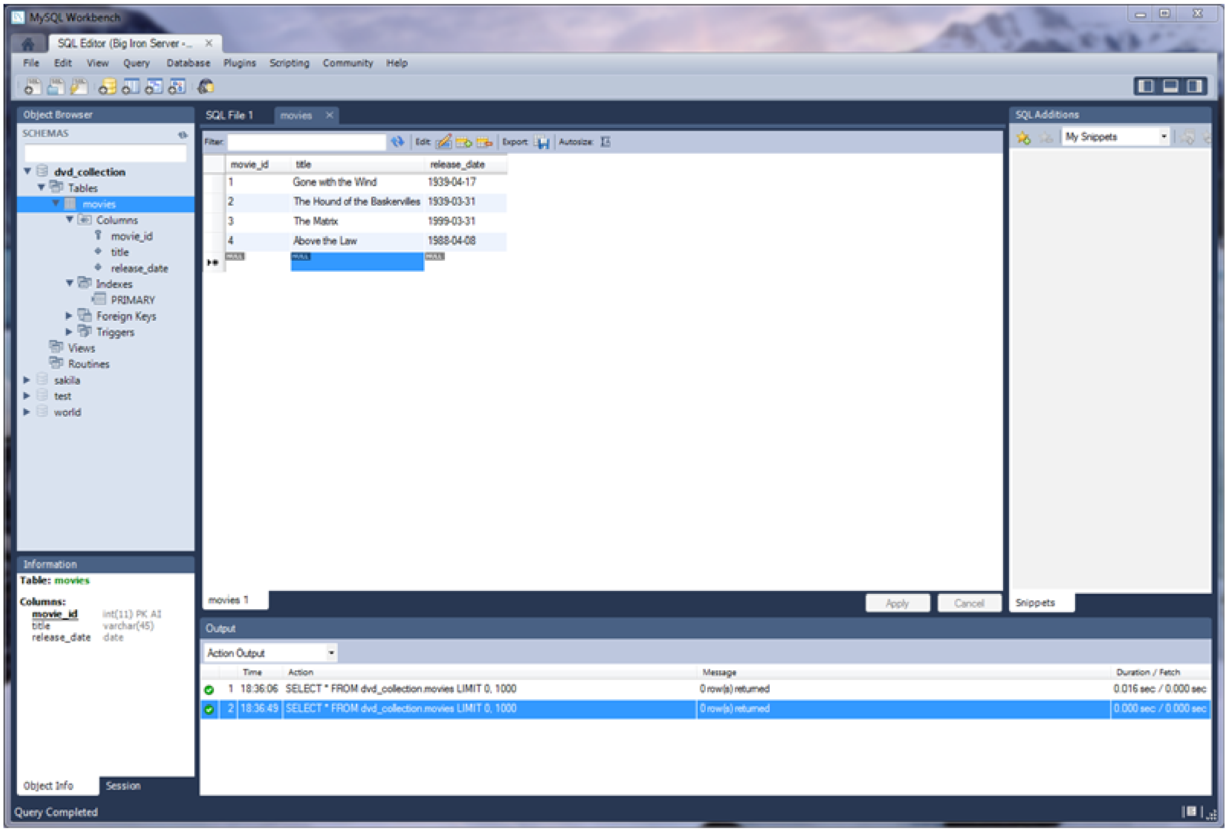
> **Note**
>
> Do not modify any values in the `movie_id` column.

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.

Figure 4.20. Getting Started Tutorial - Edit Data



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.

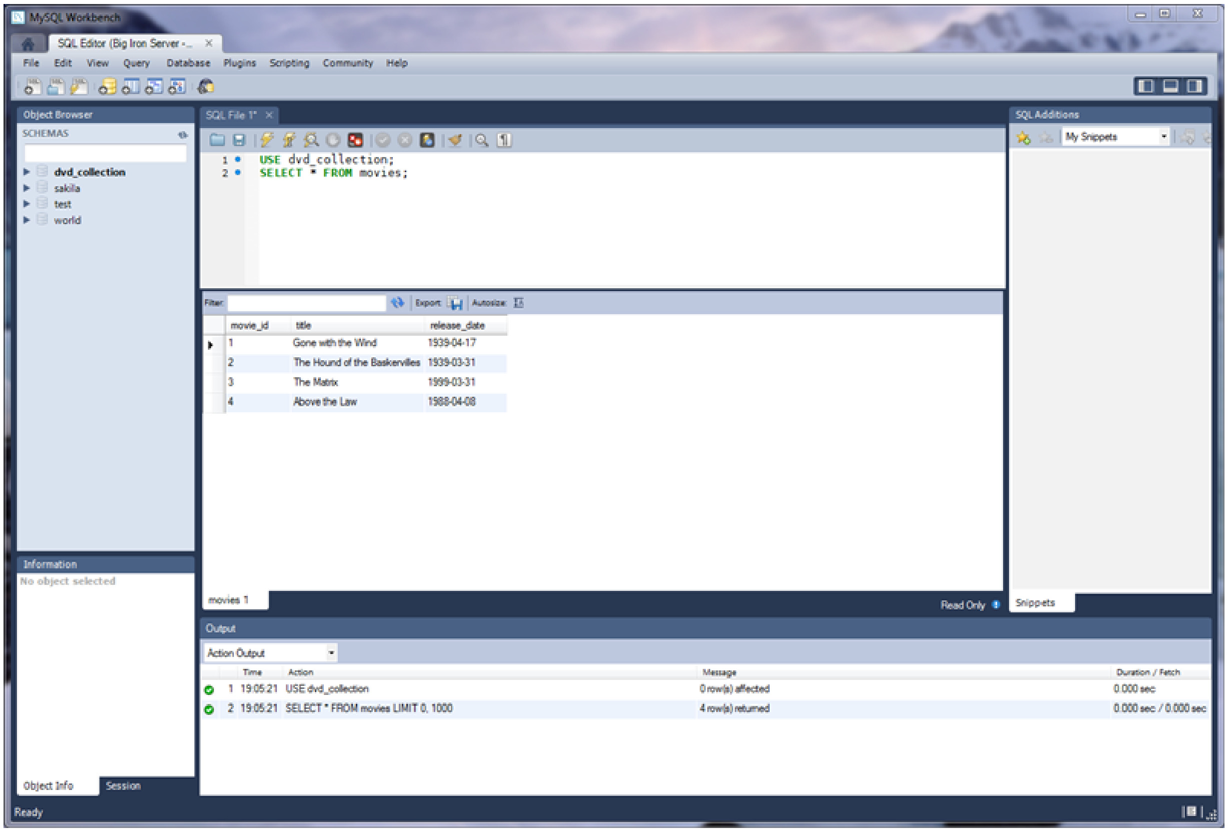
10. Click the link **Open Connection to start Querying** in the SQL Development section of the Workspace. This will launch the **Connect to Database** dialog. Select “Big Iron Server” from the list. Click OK.

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

```
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.

Figure 4.21. Getting Started Tutorial - Results



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.

Chapter 5. The Home Window

Table of Contents

When MySQL Workbench first starts, it presents the **Home** window, which has two main sections:

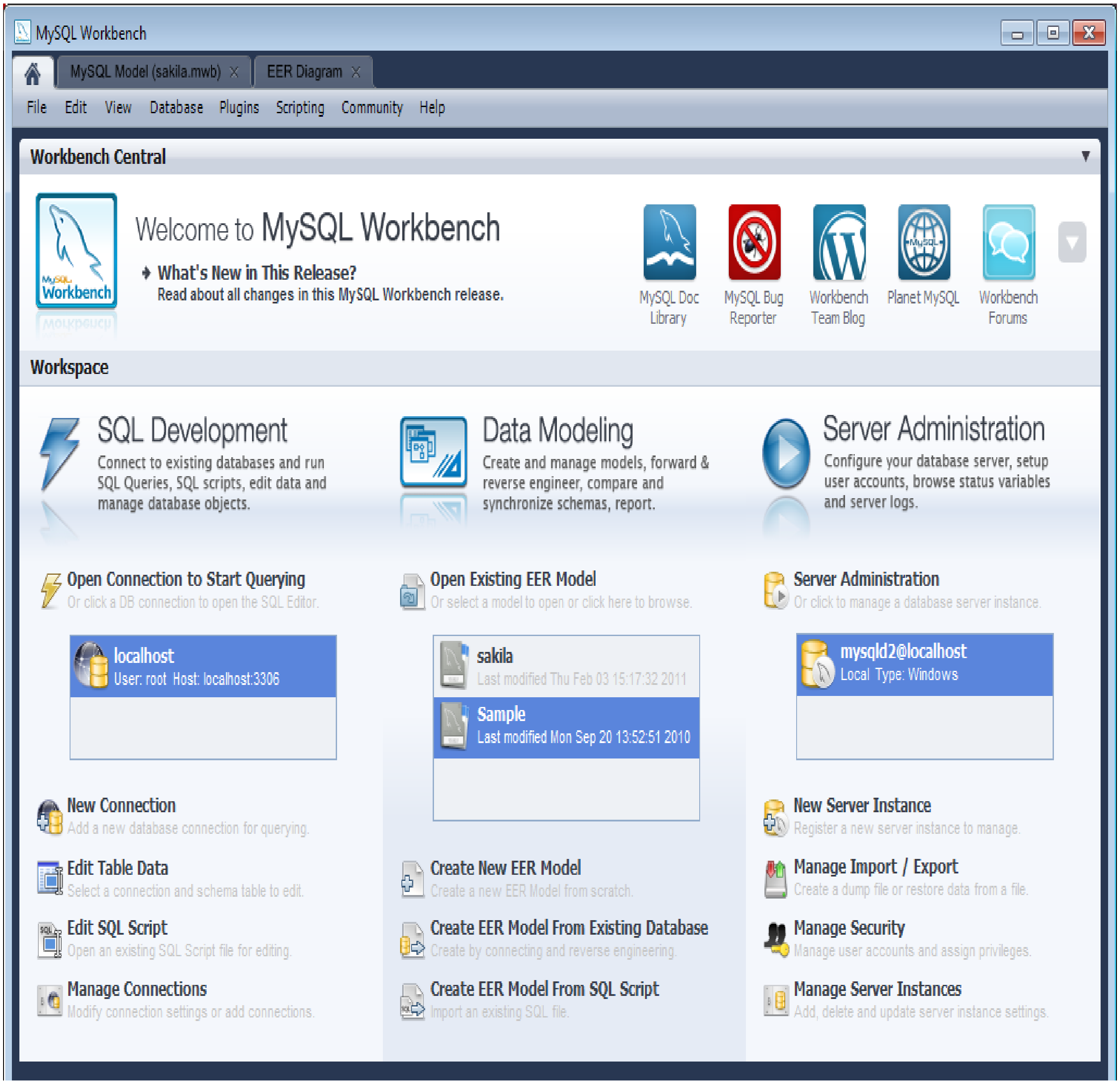
- Workbench Central
- Workspace

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.

Figure 5.1. The Home Window



5.1. 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

5.2. 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 6, *SQL Development*.
- **Data Modeling**. For further information, see Chapter 7, *Data Modeling*.
- **Server Administration**. For further information, see Chapter 9, *Server Administration*.

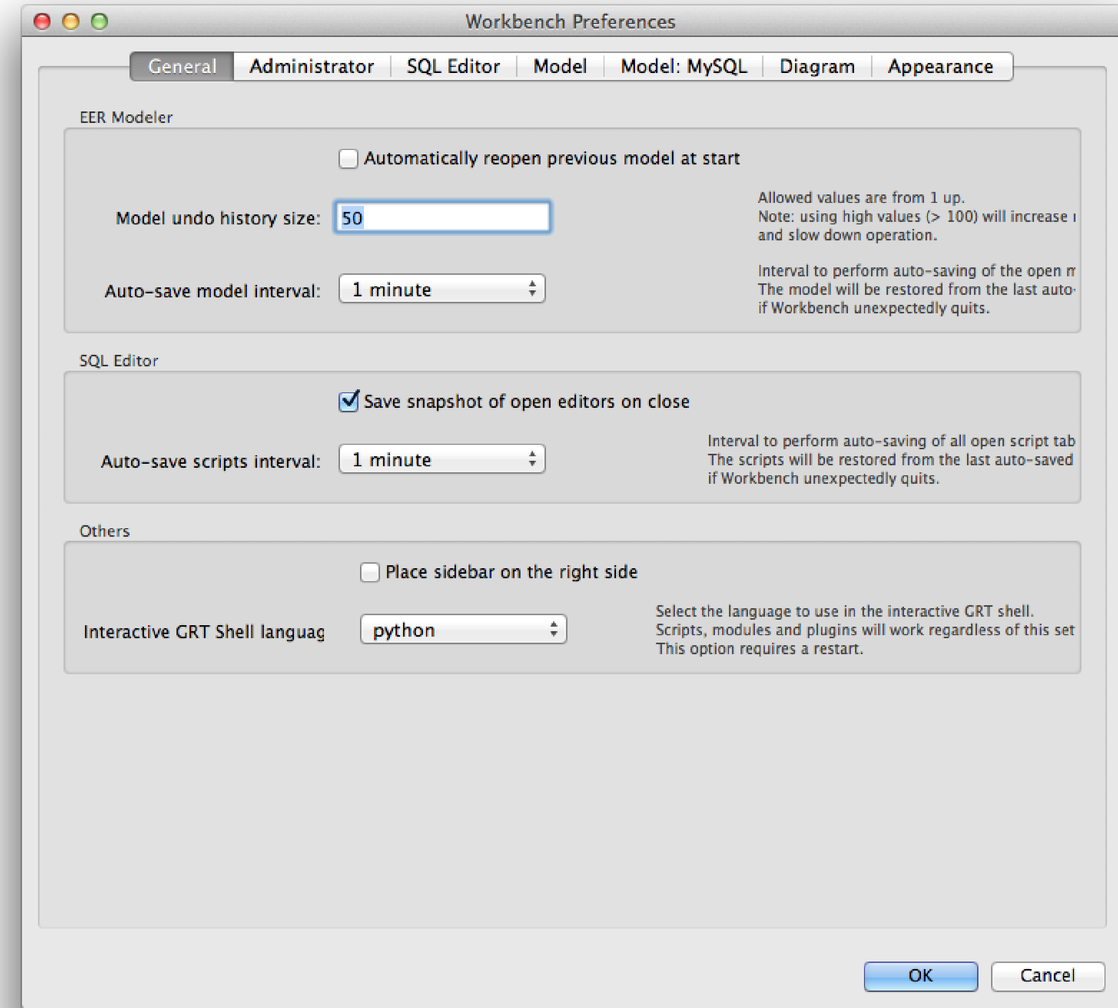
5.3. Workbench Application Minimum Window Size

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.

5.4. Workbench Preferences

The Preferences menu sets MySQL Workbench defaults. Choosing this menu item opens the following dialog box.

Figure 5.2. The `Preferences` Dialog Box



The preferences dialog box contains the following tabs:

- General: Configuration of general-purpose options
- Administrator: Configuration of tools used by the Administrator functionality
- SQL Editor: Configuration of the SQL Editor
- Model: Default object names
- MySQL: Configuration of the default storage engine
- Diagram: EER diagram settings
- Appearance: Change colors and fonts used by various Workbench components

A more detailed discussion of these options follows.

5.4.1. The General Tab

The General tab enables you to set the following options:

- **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.
- **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.
- **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.
- **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.
- **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.
- **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.

5.4.2. The Administrator Tab

This section provides configuration options that affect the Administrator functionality in MySQL Workbench. It enables you to set paths to the `mysqldump` and `mysql` tools. If these paths are left blank, the defaults are used. This panel also enables you to set the directory for export dump files.

5.4.3. The SQL Editor Tab

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

There are three main groups of parameters that can be set here:

- SQL properties
- Query Editor
- Query Results

SQL Properties

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.

Query Editor

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

- **Show Live Schema Overview**: This option enables a simplification of the user interface by removing the Overview tab from the SQL Editor. This is extremely useful if schemata have a large number of tables, or a model has a large number of schemata. In each of these cases, load times would be greatly increased as the tables and schemata are enumerated and drawn.
- **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.
- **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.
- **Forbid UPDATE and DELETE statements without a WHERE clause**: This option enables the `SQL_SAFE_UPDATES` option for the session, preventing `UPDATE` and `DELETE` statements from being executed if a `WHERE` clause is not present. This can avoid potentially dangerous situations where a statement could accidentally update or delete all rows in a table.
- **Max syntax error count**: Large complex scripts can contain many errors. Further, a syntax error early on can lead to many 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.
- **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.
- **DBMS connection keep-alive interval**: When executing long running queries over a slow connection, you may need to increase this value to prevent the connection being lost.

Query Results

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

- **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.
- **Limit Rows Count**: Specify the maximum number of result rows to return.
- **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).
- **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.
- **Enable Data Changes Commit Wizard**: 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.

5.4.4. 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.

Object Name	Default Value
`PK Column Name`	`id%table%`
`PK Column Type`	`INT`

Object Name	Default Value
`Column Name`	`%table%col`
`Column Type`	`VARCHAR(45)`
`FK Name`	`fk%stable_%dtable%`
`Foreign Key Column Name`	`%table%_%column%`
`ON UPDATE`	`NO ACTION`
`ON DELETE`	`NO ACTION`
`Associative Table Name`	`%stable%_has_%dtable%`

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 7.7.1.3.4, “The Foreign Keys Tab”.

5.4.5. The MySQL Tab

This enables you to set the default table storage engine.

5.4.6. 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.

5.4.7. 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.

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 7.5.2.1, “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 6. SQL Development

Table of Contents

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.

6.1. 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 6.7, “SQL Editor”.

6.2. 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 6.6, “Manage DB Connections Dialog”.

6.3. 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 6.7, “SQL Editor”.

6.4. 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.

6.5. 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 6.6, “Manage DB Connections Dialog”.

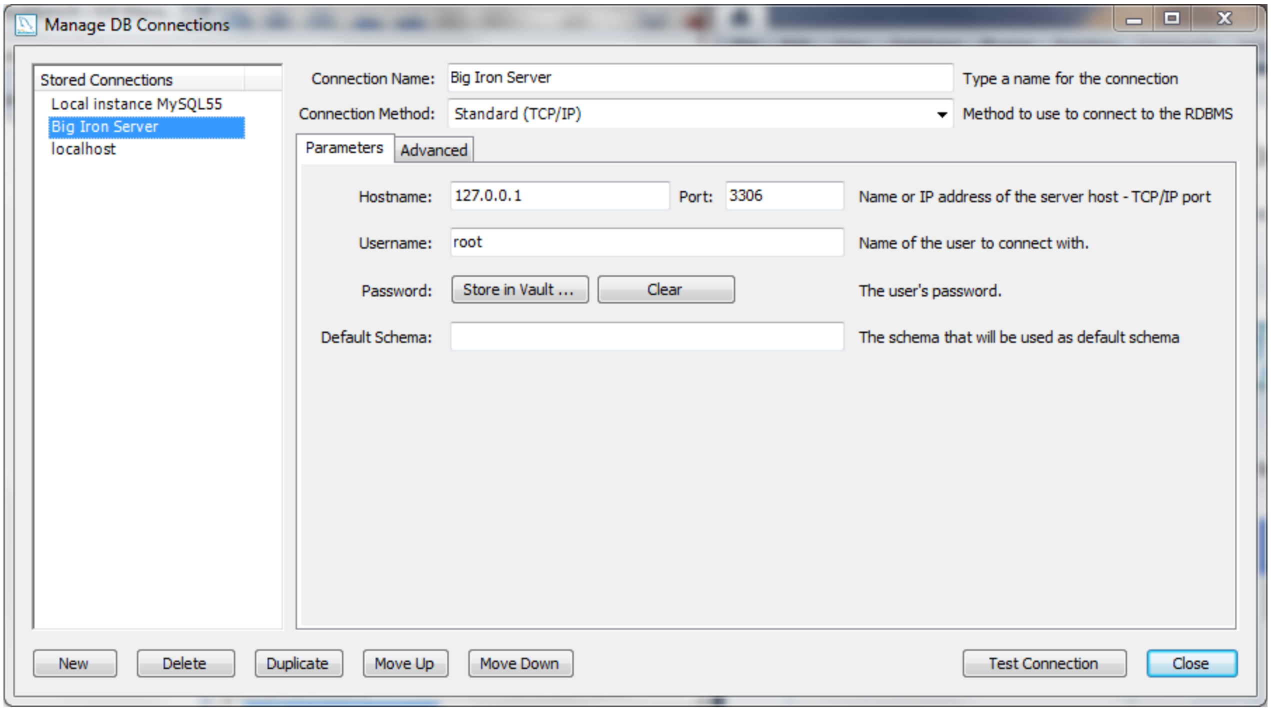
6.6. Manage DB Connections Dialog

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 6.1. 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.

6.6.1. 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.

6.6.2. Standard TCP/IP Connection

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

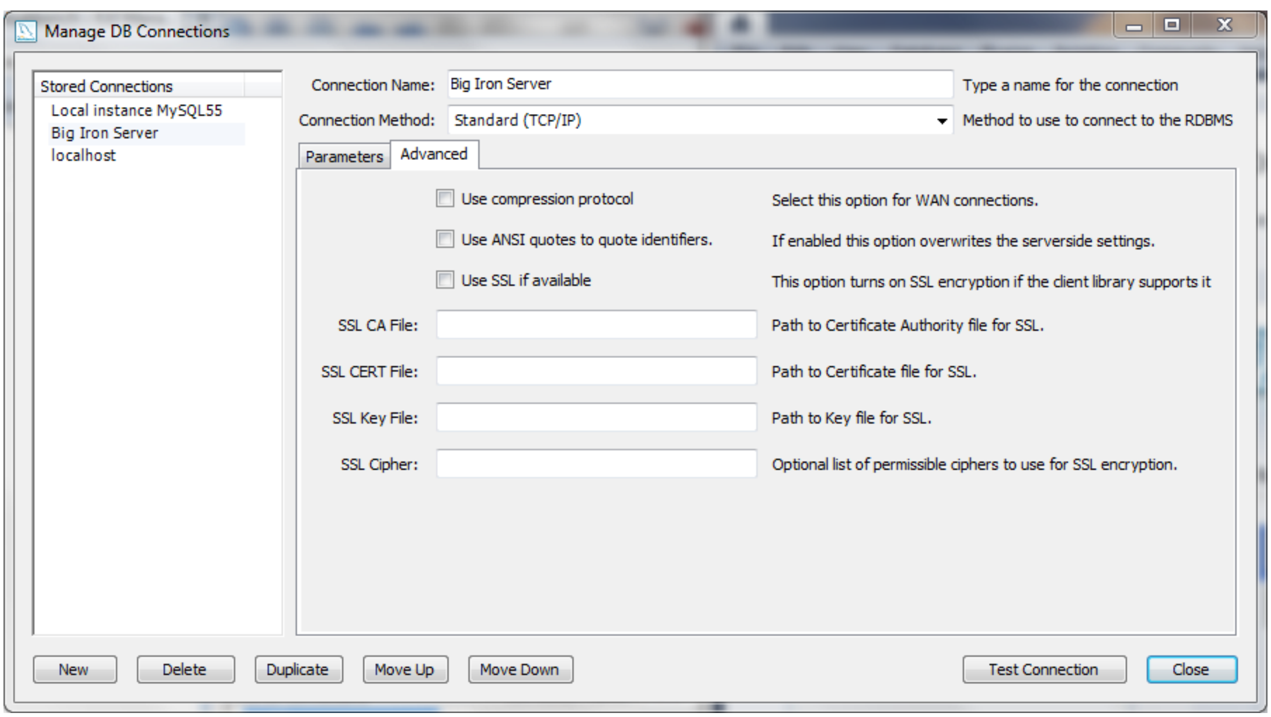
Parameters tab

- **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 6.6.1, "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 6.2. 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.

6.6.3. Local Socket/Pipe Connection

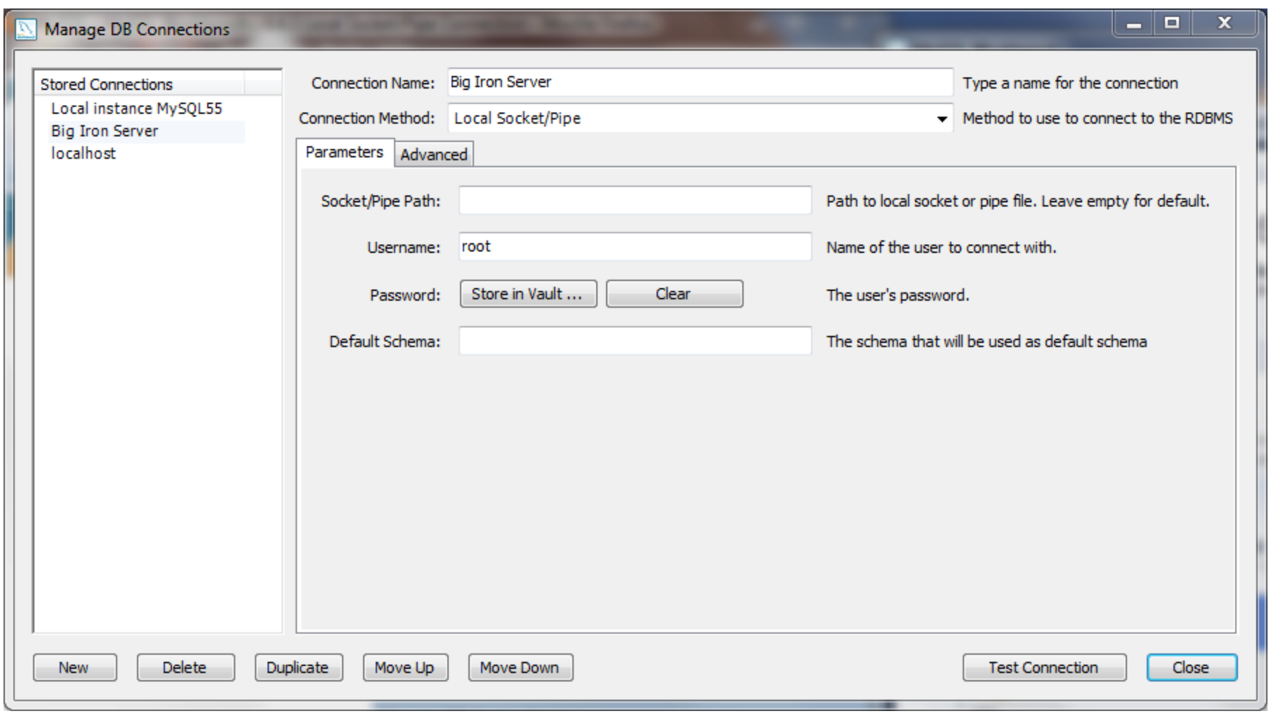
This connection method enables MySQL Workbench to connect to MySQL Server using a socket file (on Unix) or a named pipe (on Windows).

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 Microsft Windows, the default pipe name is `MySQL`.

This option can be seen in the following screenshot.

Figure 6.3. Manage DB Connections - Socket/Pipe Parameters



Advanced

The only option available in this tab is **Use ANSI quotes to quote identifiers**. This option was discussed in Section 6.6.2, "Standard TCP/IP Connection".

6.6.4. Standard TCP/IP over SSH Connection

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

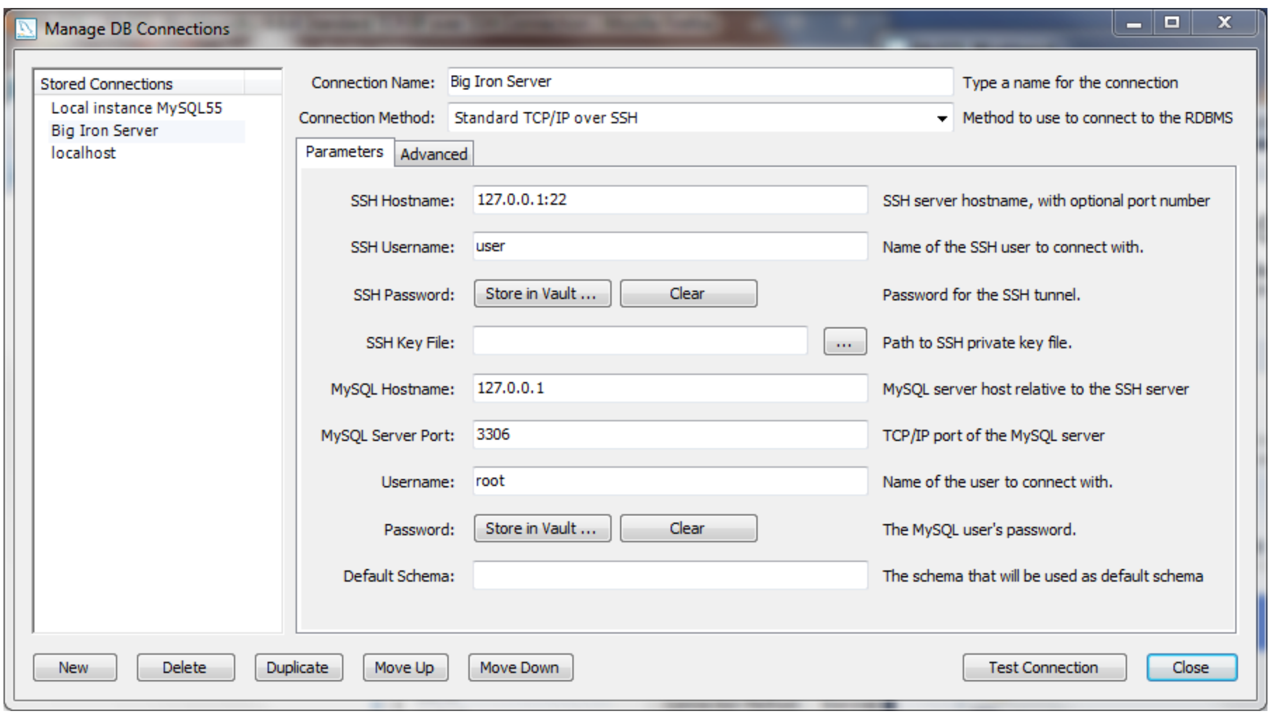
Parameters

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 6.4. Manage DB Connections - SSH Parameters



Advanced

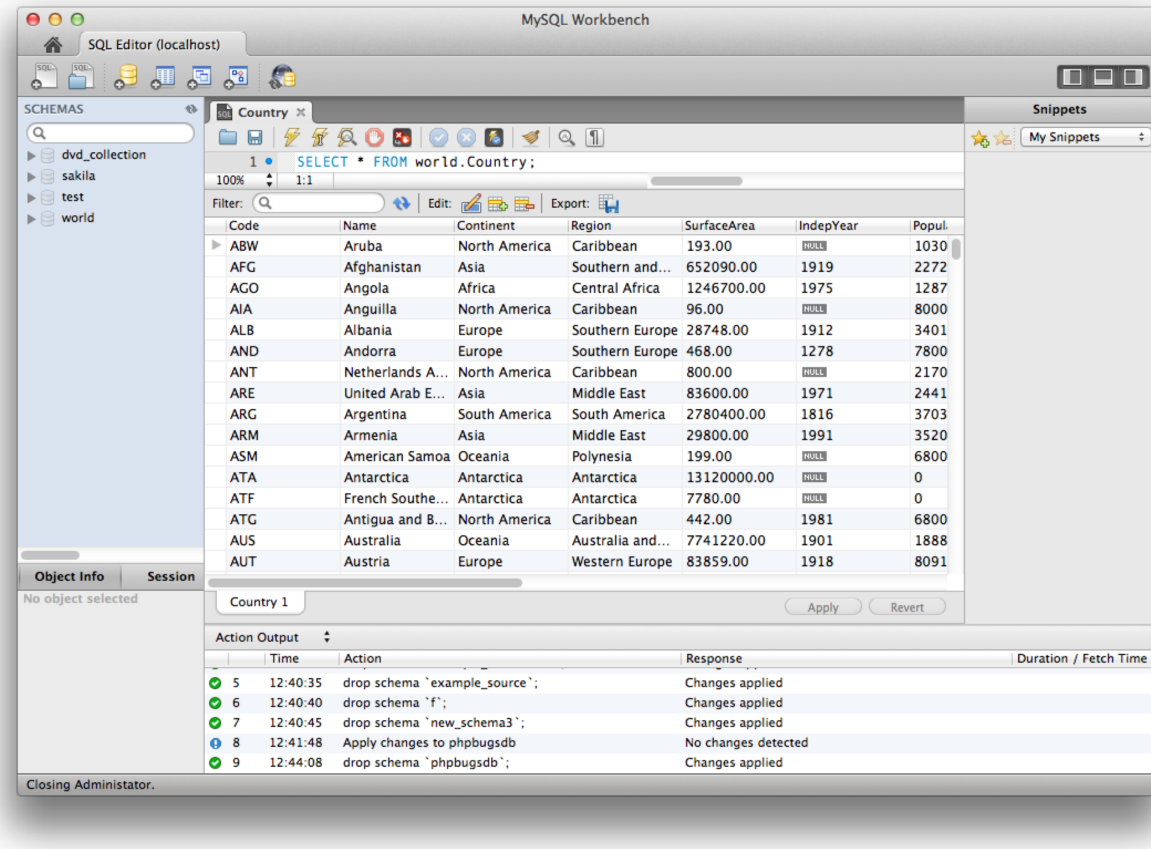
The options here are the same as for the Standard TCP/IP connection. See Section 6.6.2, “Standard TCP/IP Connection”.

6.7. 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.

Figure 6.5. SQL Editor



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.

6.7.1. 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.
- 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.

6.7.2. 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 6.6. SQL Editor - Toolbar

From left to right, these buttons are:

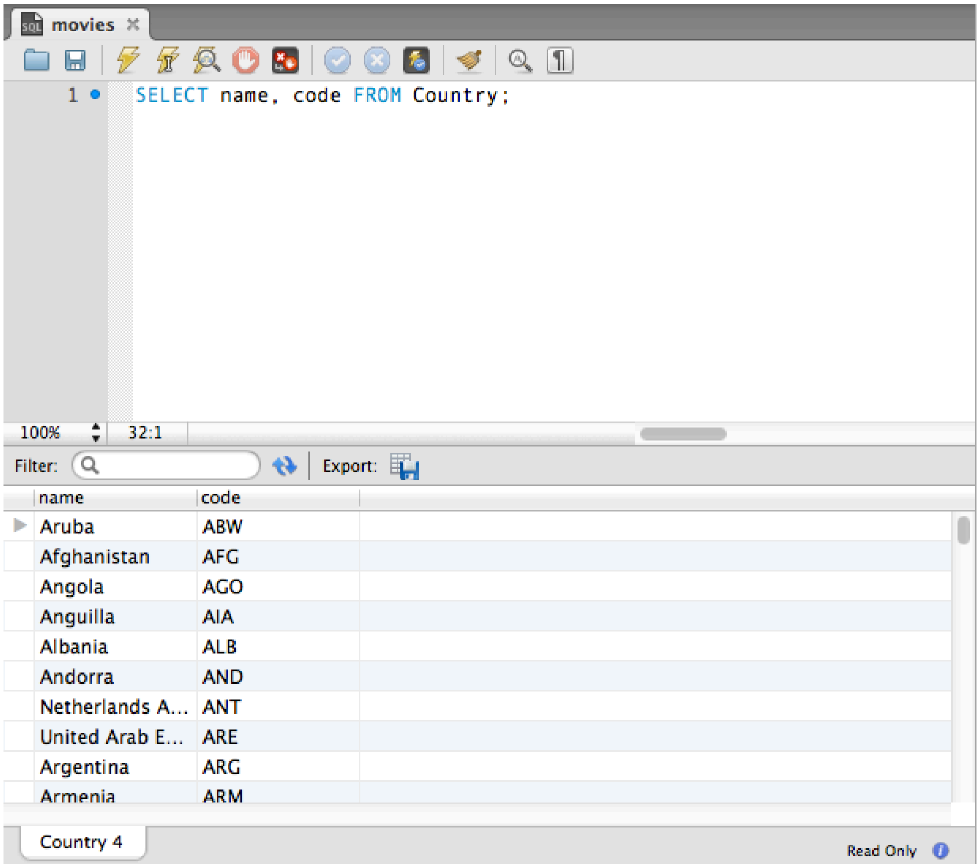
- **Open a SQL Script File**: Loads a saved SQL script to be ready for execution. The script is displayed in the **SQL Query** area.
- **Save SQL Script to File**: Saves the currently loaded SQL script to a file specified by the user.
- **Execute SQL Script**: Executes the selected portion of the query, 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.

6.7.3. 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.

Figure 6.7. SQL Editor - SQL Query 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.

6.7.4. Main Tabsheets

The main tabsheets area contains several tabs:

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

Figure 6.8. SQL Editor - Main Tabsheets

The following sections describe each of these in more detail.

6.7.4.1. 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.

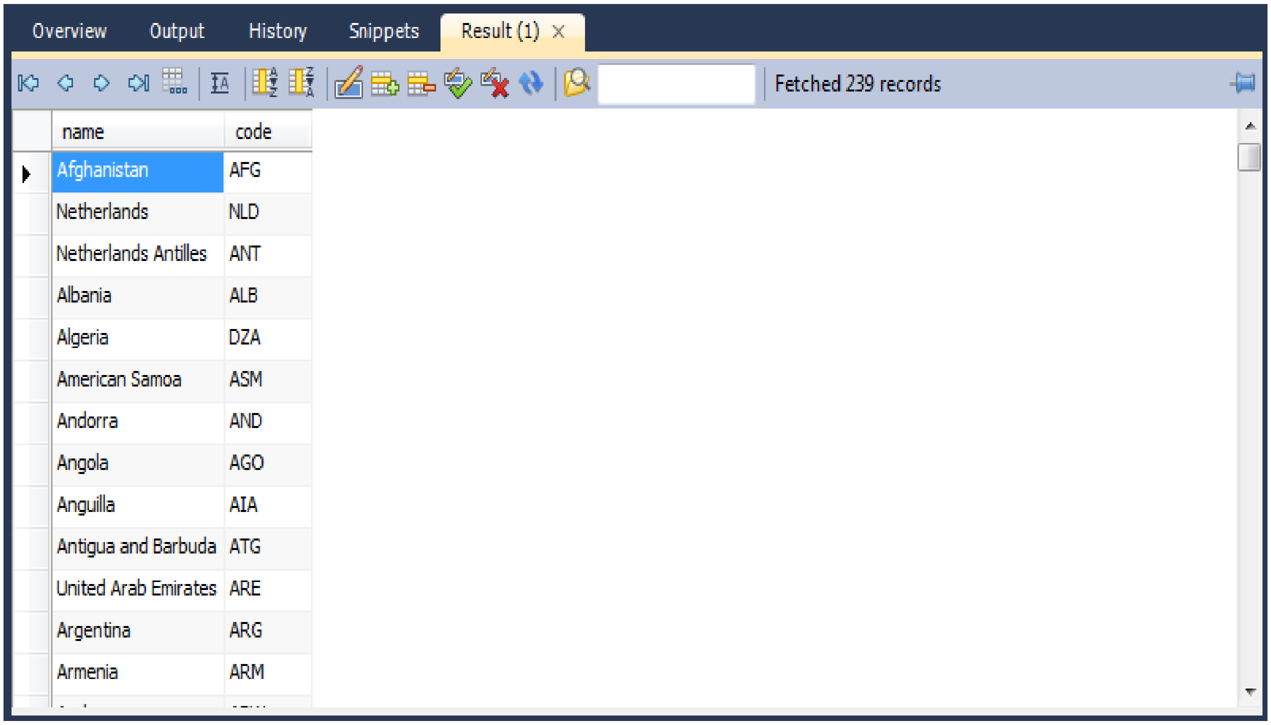
The Text Output tabsheet will display a textual representation of the query, as displayed using the MySQL Console. Use Query, Execute (All or Selection) to Text to send output to this tabsheet.

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.

6.7.4.2. Results Tabsheets

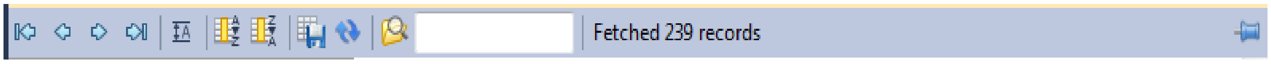
The results area of the screen shows the results from any queries that have been executed. If the script contains multiple queries, a result tab will be generated for each query that returns results.

Figure 6.9. SQL Editor - Results Tabsheets



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

Figure 6.10. 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.
- **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.

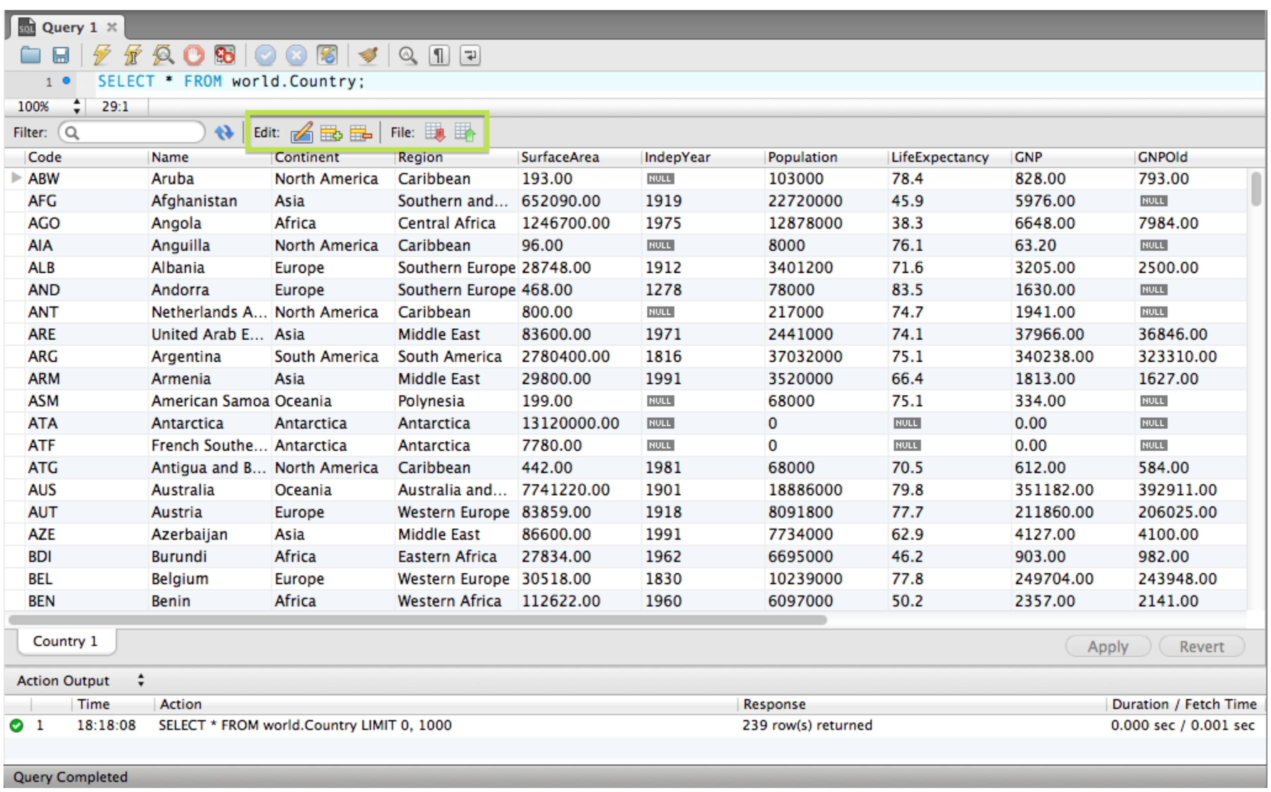
6.7.4.3. Live Editing Tabsheets

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 6.11. 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 7.7.1.3.8, “The Inserts Tab”.

6.7.5. Sidebar

The Sidebar contains these panels:

- Session (connection) Information
- Snippets
- Schemas

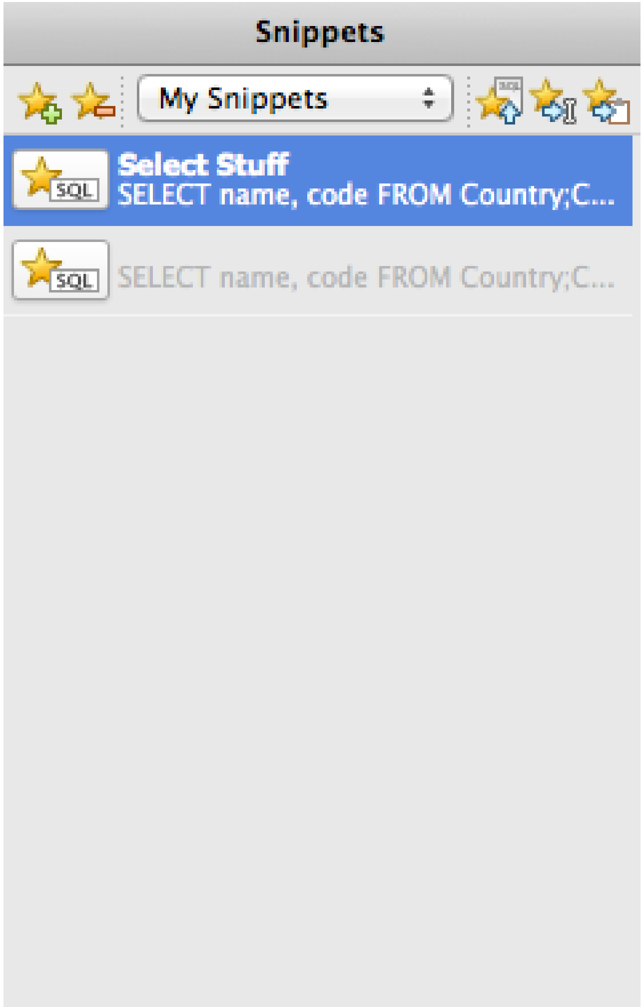
The following sections describe each panel in more detail.

6.7.5.1. 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.

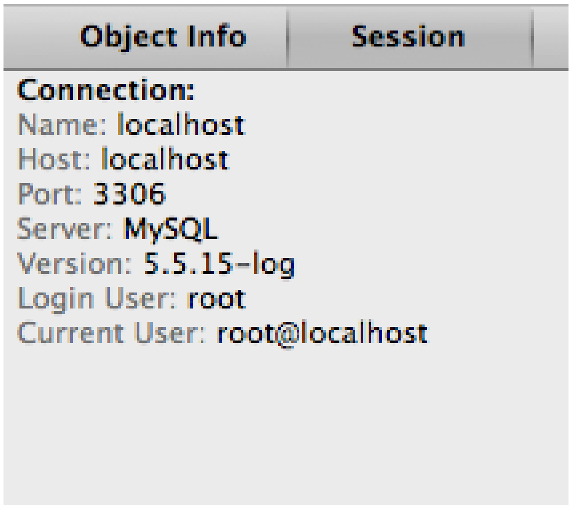
Figure 6.12. SQL Editor - Snippets Palette



6.7.5.2. Session and Object Information Panel

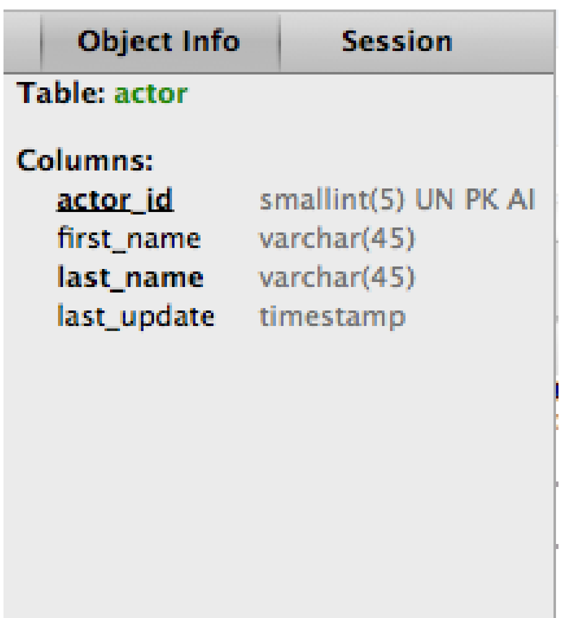
This panel summarizes the current connection to the server.

Figure 6.13. SQL Editor - Connection Information Palette



This panel also summarizes information about the object.

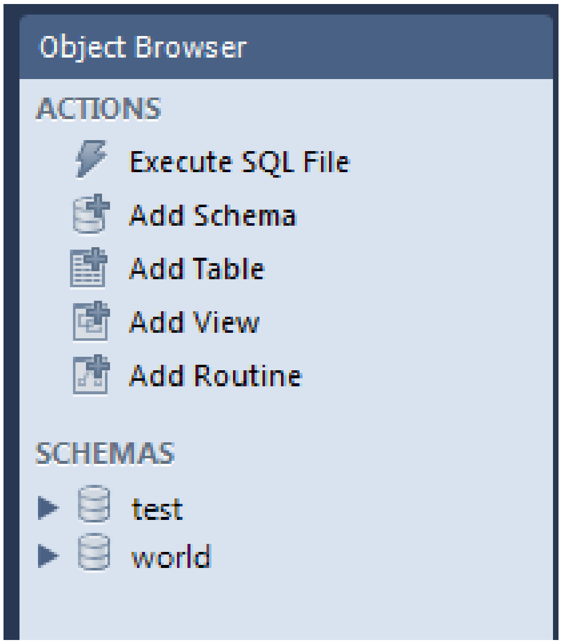
Figure 6.14. SQL Editor - Object Info



6.7.5.3. Object Browser

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

Figure 6.15. SQL Editor - Object Browser



Object Browser Actions List

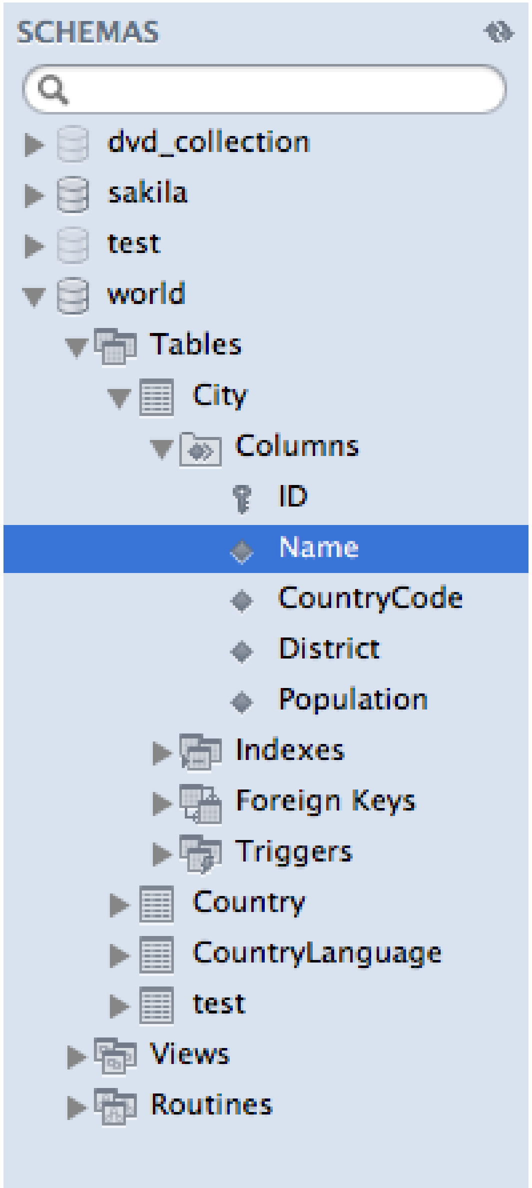
The Object Browser contains an Actions list. The actions are:

- **Execute SQL File**: Opens a file chooser 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 6.16. SQL Editor - Schemata Explorer



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:

    ```
    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 7. Data Modeling

Table of Contents

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 capablities.

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.

7.1. 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 7.5, “Model Editor”.

7.2. 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 7.5, “Model Editor”.

7.3. 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 7.7.9.2, “Reverse Engineering a Live Database”.

7.4. Create EER Model from SQL Script

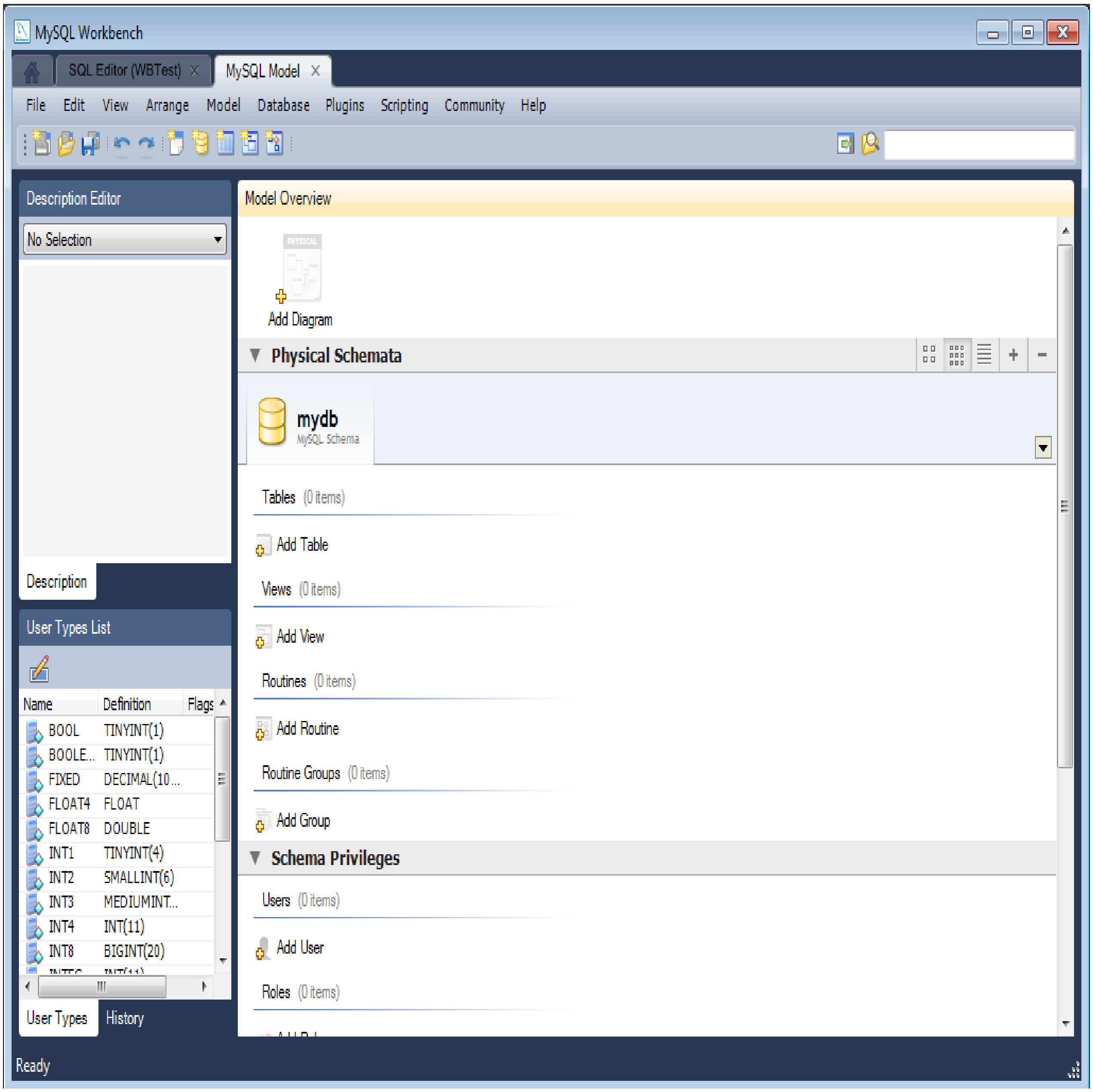
This action item enables you to create a model from an SQL Create script. Such a script may have been created by hand or as a result of reverse engineering an existing database. The script may then be modified according to requirements. Clicking this action item launches the Reverse Engineer SQL Script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

For further information, see Section 7.7.9.1, “Reverse Engineering Using a Create Script”.

7.5. 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 7.1. 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
- 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.

7.5.1. 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.

7.5.1.1. 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 7.5.1.3, “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 7.7.9.1, “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 7.7.10.1, “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 7.50, “The `sakila` Database EER Diagram”.

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

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 7.9, “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

7.5.1.2. 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 5.4.4, "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.

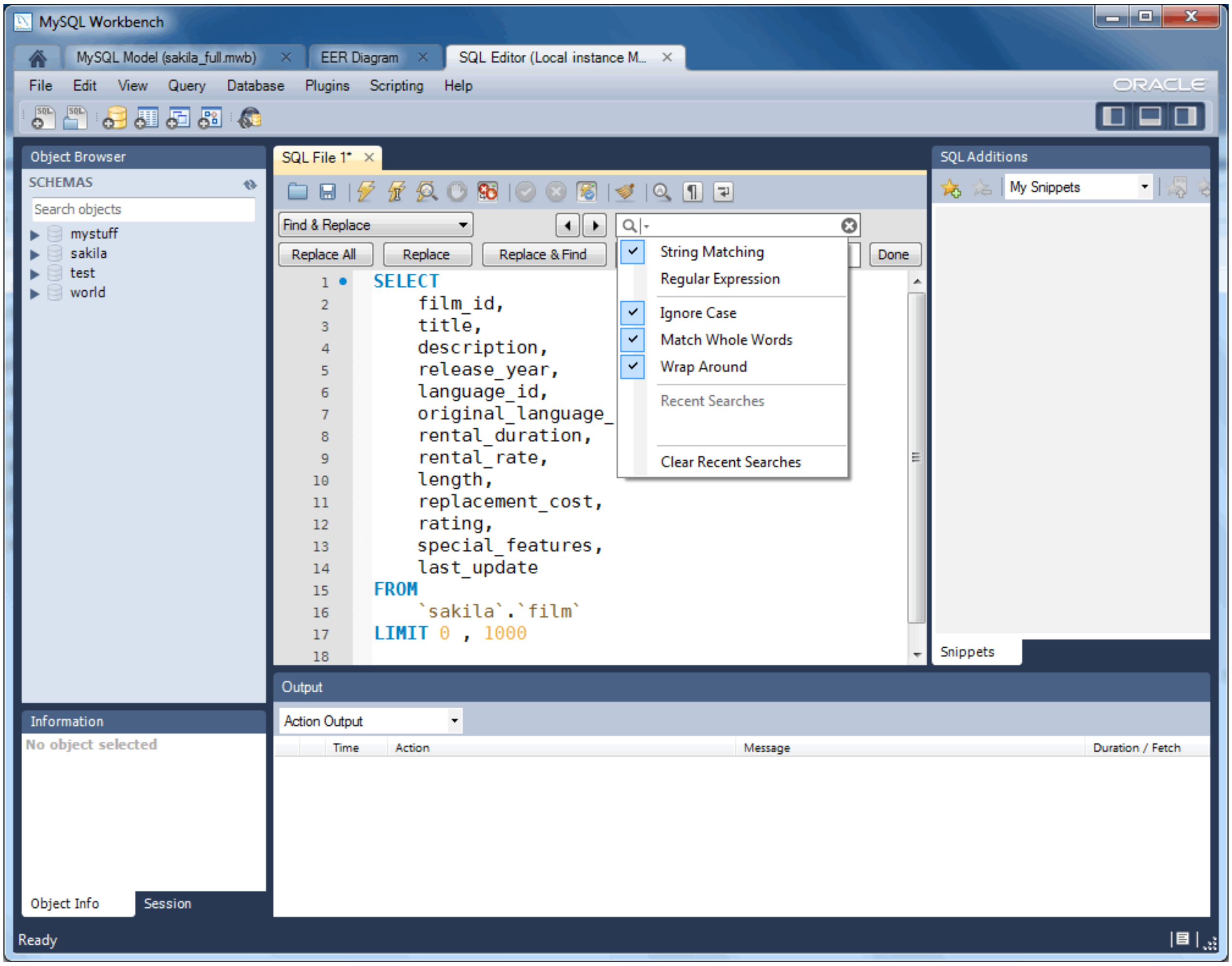
When multiple objects have been selected using one of these menu items, you can navigate between selected items by choosing the Go to Next Selected or Go to previous Selected menu item.

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.

7.5.1.2.1. Find Dialog Window

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

Figure 7.2. The Find Panel with Find & Replace



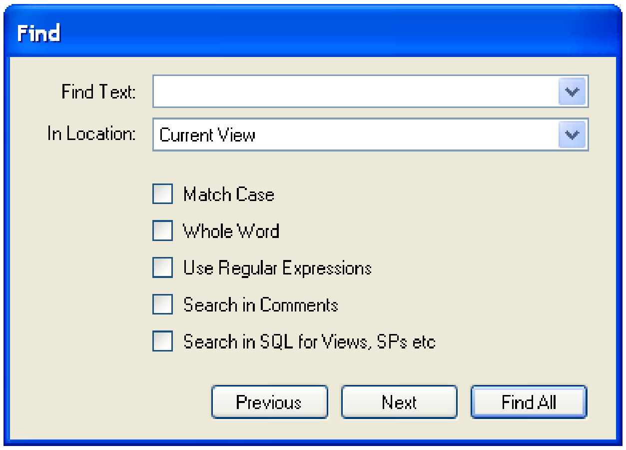
Find options

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 7.3. 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+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.

7.5.1.2.2. Workbench Preferences

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

For further information, see Section 5.4, “Workbench Preferences”.

7.5.1.3. 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 7.5.9, “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.

7.5.1.4. 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.

7.5.1.5. 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 7.5.1.5.1, "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 7.5.1.5.3, "The Object Notation Submenu".
- Relationship Notation: For information about this menu item, see Section 7.5.1.5.4, "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 7.5.1.5.2, "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 5.4.4, "The Model Tab".

7.5.1.5.1. 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 7.11, "The DBDoc Model Reporting Dialog Window (Commercial Version)".

7.5.1.5.2. 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 7.10, "MySQL Workbench Schema Validation Plugins (Commercial Version)".

7.5.1.5.3. 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.

7.5.1.5.4. 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 7.47, “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.

7.5.1.6. 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 6.7, “SQL Editor”.
- Manage Connections: Launches the Manage DB Connections dialog, which enables you to create and manage multiple connections. For more information, see Section 6.6, “Manage DB Connections Dialog”
- Reverse Engineer: Creates a model from an existing database. For more information, see Section 7.7.9.2, “Reverse Engineering a Live Database”.
- Forward Engineer: Creates a database from a model. For more information, see Section 7.7.10.2, “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 7.7.10.3, “Database Synchronization”.

- Generate Catalog Diff Report: Compares your schema model with a live database or a script file. Section 7.7.10.4, “Creating a Catalog Diff Report”.

7.5.1.7. The Plugins Menu

The Plugins menu lists any plugins that you may have installed. For more information about this menu, see Section 11.3, “Plugins”.

7.5.1.8. 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 are installed, and allows disabling and uninstalling the plugins.

7.5.1.9. 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

7.5.1.10. 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 7.5.1.10.1, “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.

7.5.1.10.1. 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 0xB0C2 or later
Video Memory: 12288 KB
```

7.5.2. 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.

7.5.2.1. 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 7.6.1, “The Vertical Toolbar”.

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.

7.5.3. 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 7.6, “EER Diagram Editor”.

7.5.4. 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 Models file (`mwb` extensiona.)

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.

7.5.4.1. 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 7.6, “EER Diagram Editor”.

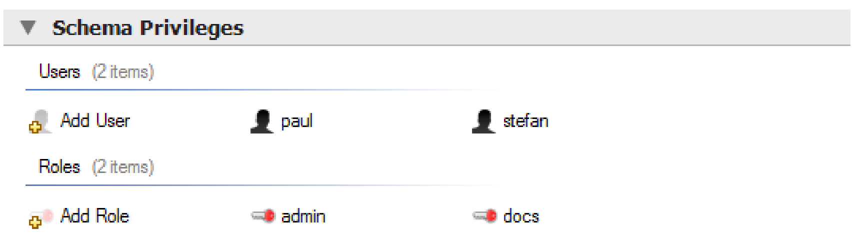
7.5.5. The Schema Privileges Panel

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

- Users
- Roles

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

Figure 7.4. Roles and Privileges



7.5.5.1. Adding Roles

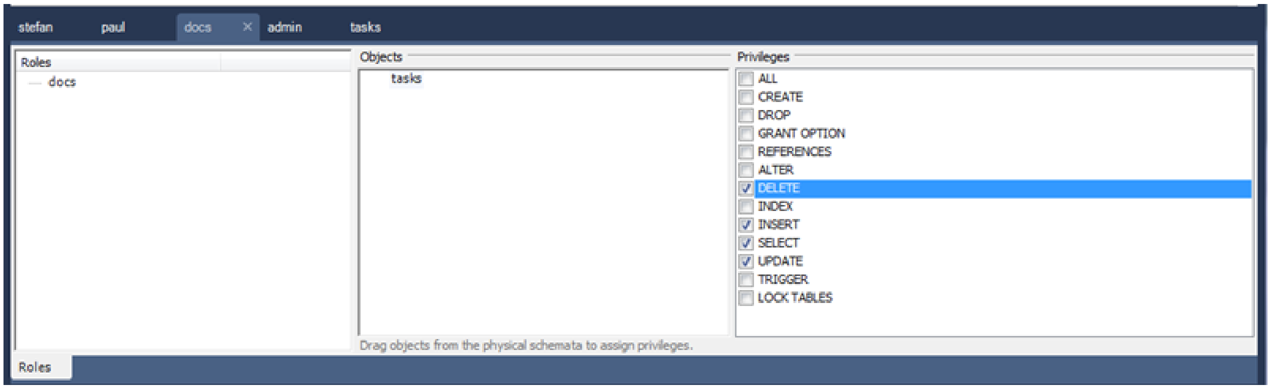
To add a role, double-click the `Add Role` icon. This creates a role with the default name `role1`. Right-clicking a role opens a pop-up menu with the following items:

- 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 7.5. 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.

7.5.5.2. 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 7.5.5.1, “Adding Roles”.

7.5.6. 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 7.7.10.1.2, “Altering a Schema”.

7.5.7. The Model Notes Panel

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

7.5.8. 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.

7.5.9. 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 7.6. The Model Navigator Palette

7.5.10. 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.

7.5.11. 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 `X` 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 7.5.1.2, “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.

7.5.11.1. 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`.

7.5.12. 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 changer 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 7.7.2.3, "Connection Properties".

7.6. EER Diagram Editor

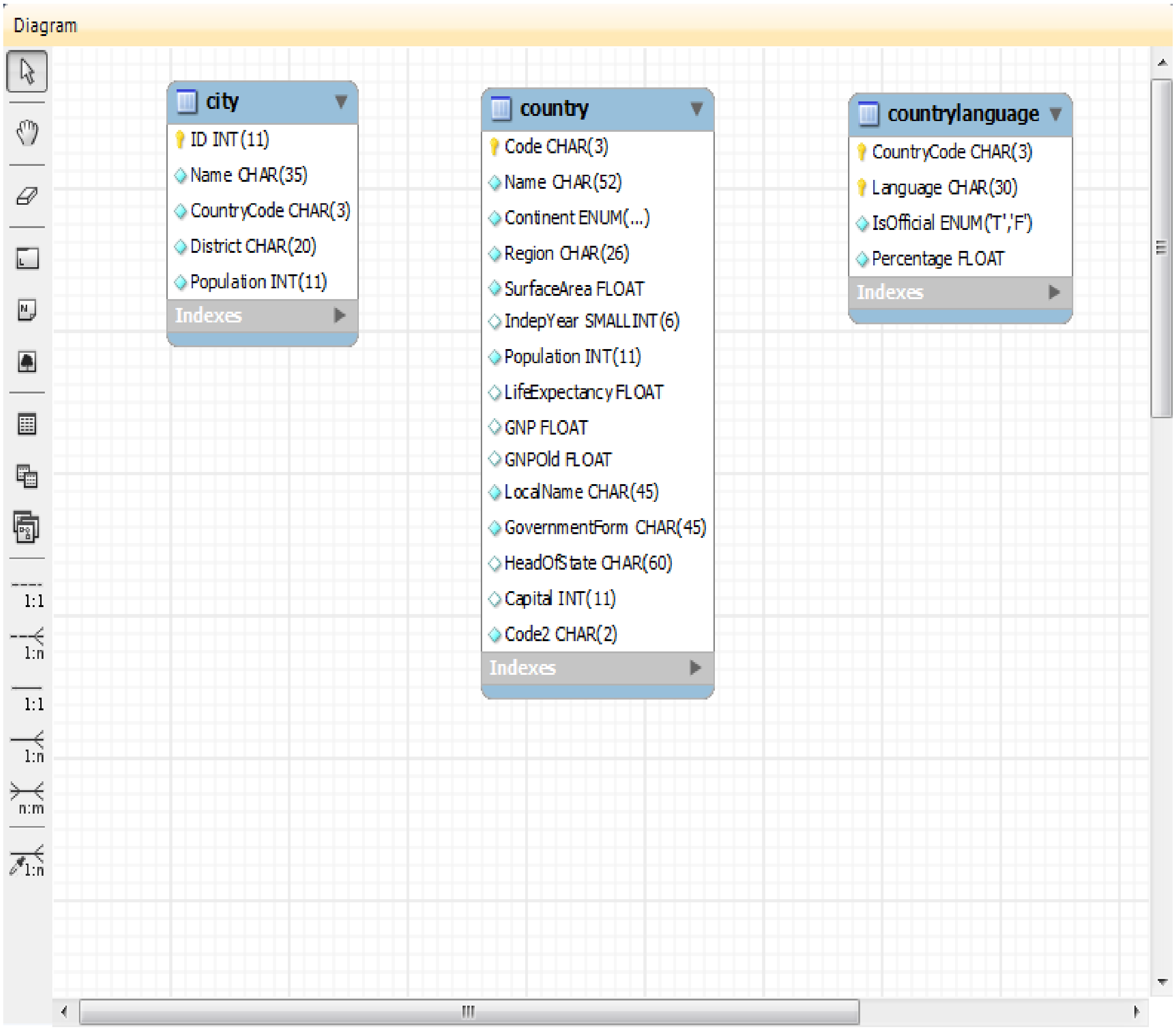
EER diagrams are created by double-clicking the `Add Diagram` icon. You may create any number of EER diagrams just as you may create any number of physical schemata. Each EER diagram shows as a tab below the toolbar; a specific EER diagram is selected by clicking its tab.

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.

7.6.1. 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.

Figure 7.7. The Vertical Toolbar



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.

7.6.1.1. 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.

7.6.1.2. 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 7.5.9, “The Model Navigator Panel”.

7.6.1.3. 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 5.4.4, “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.

7.6.1.4. 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 7.7.5, “Creating Layers”.

7.6.1.5. 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 7.7.7, “Creating Text Objects”.

7.6.1.6. 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 7.7.8, “Creating Images”.

7.6.1.7. 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 7.7.1.3, “The MySQL Table Editor”.

7.6.1.8. 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 7.7.3, “Creating Views”.

7.6.1.9. 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 7.7.4.2, “Routine Groups”.

7.6.1.10. 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 7.7.2, “Creating Foreign Key Relationships”.

7.7. Working with Models

7.7.1. Creating Tables

7.7.1.1. 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 7.7.1.3, “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.

7.7.1.2. Adding Tables to an EER Diagram

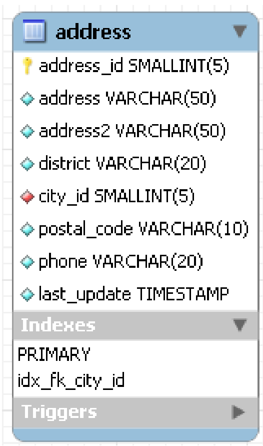
Tables can also be added to an EER Diagram using the `table` tool on the vertical toolbar. Make sure that the **EER Diagram** tab is selected, then right-click the table icon on the vertical toolbar. The table icon is the rectangular tabular icon.

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, 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 7.8. 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 7.7.1.1, “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 5.4.4, “The Model Tab”.

7.7.1.3. 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.

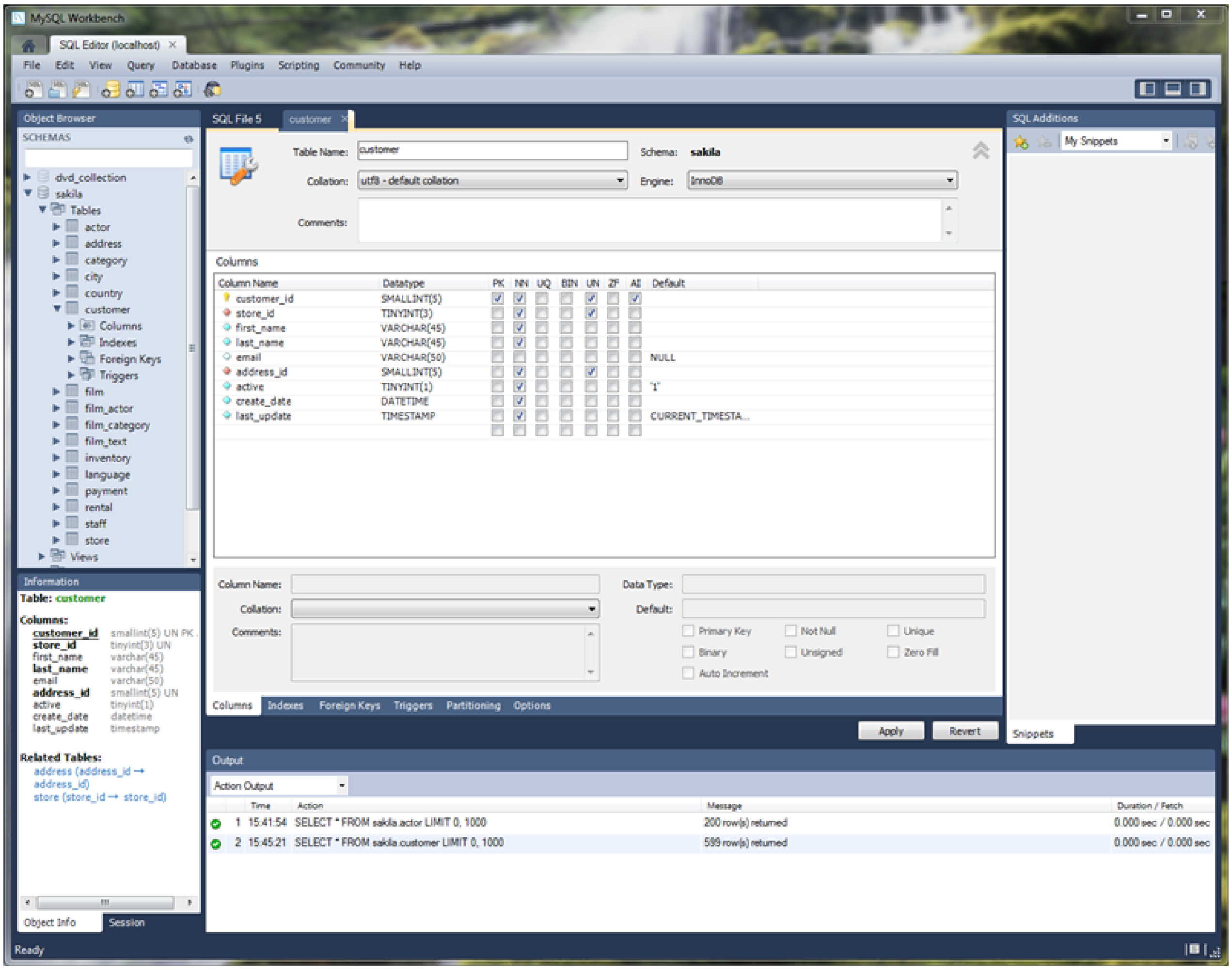
The MySQL Table Editor can be accessed in several ways, and most commonly by right-clicking on a table name within the **Object Viewer** and choosing **ALTER TABLE**. This will open a new tab within the main **SQL Editor** window. You can also access the MySQL Table Editor from an EER Diagram by double-clicking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

7.7.1.3.1. 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 7.9. 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

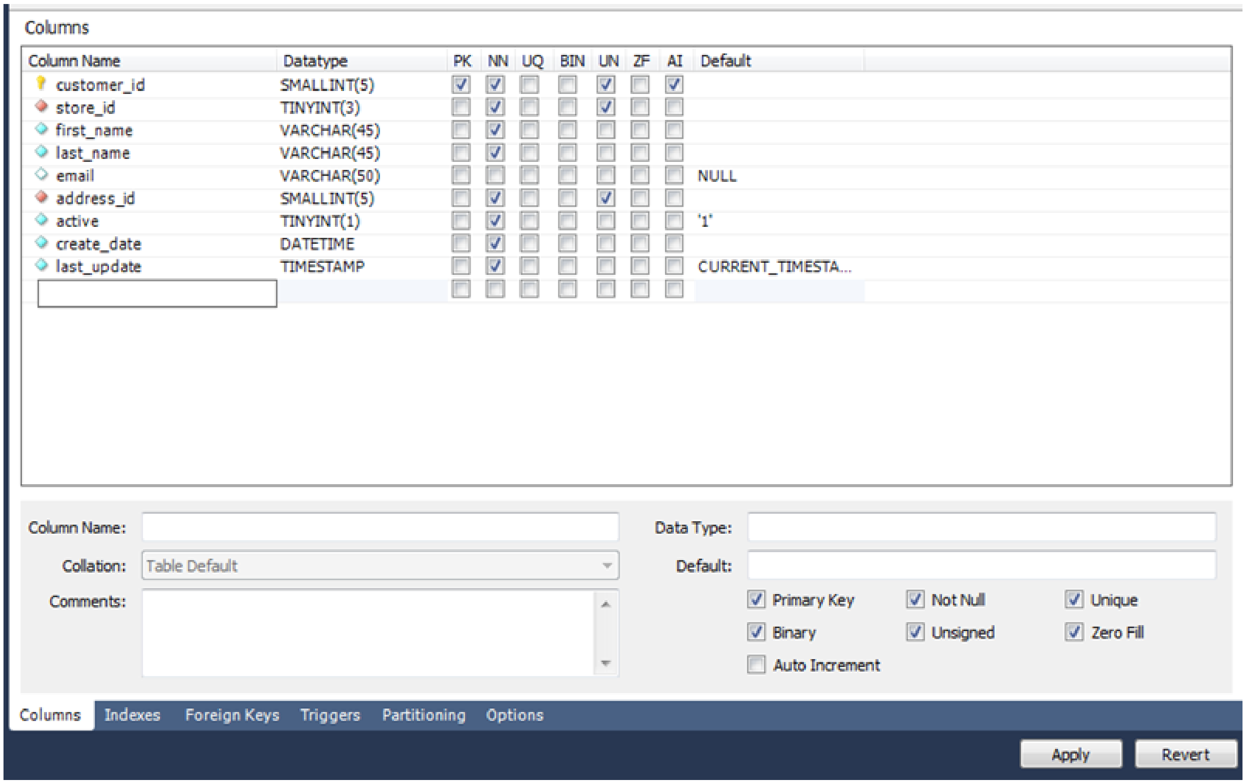
The following sections discuss these tabs in further detail.

7.7.1.3.2. 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 7.10. 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 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.

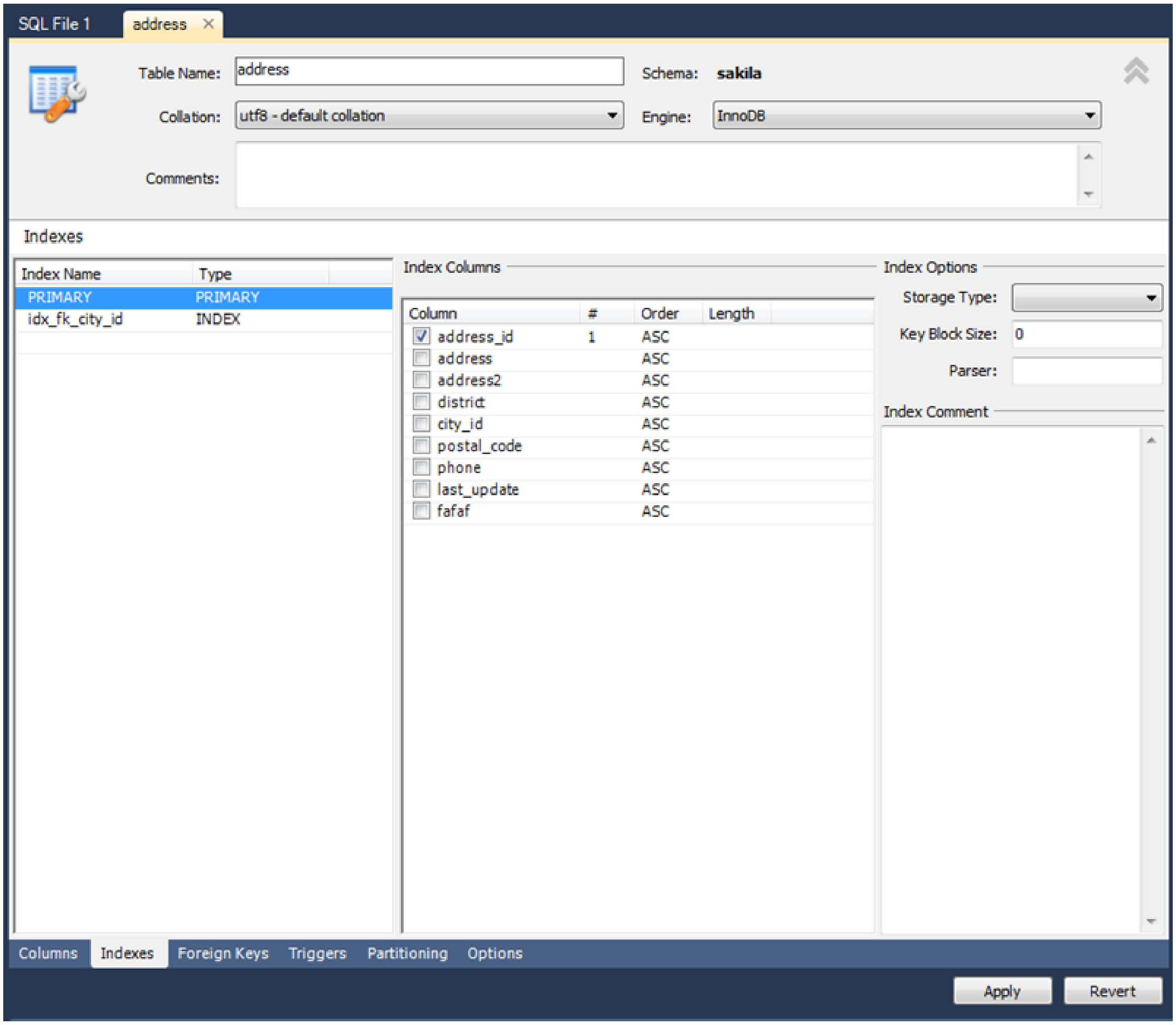
Caution

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.

7.7.1.3.3. The Indexes Tab

The **Indexes** tab holds all index information for your table. Use this tab to add, drop, and modify indexes.

Figure 7.11. The Indexes Tab



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.

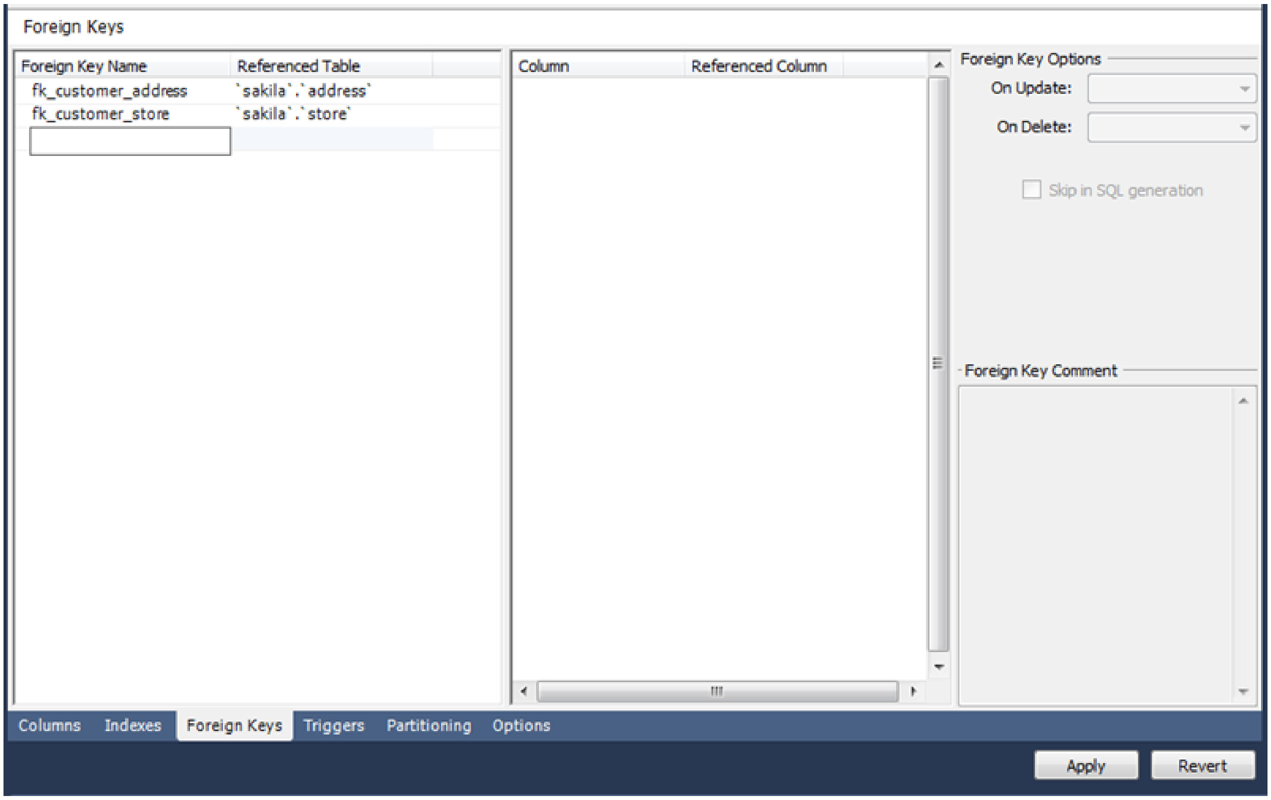
You can also specify the order of an index by choosing `ASC` or `DESC` under the `Order` column. Create an index prefix by specifying a numeric value under the `Length` column. You cannot enter a prefix value for fields that have a data type that does not support prefixing.

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

7.7.1.3.4. 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.

Figure 7.12. The Foreign Keys Tab



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

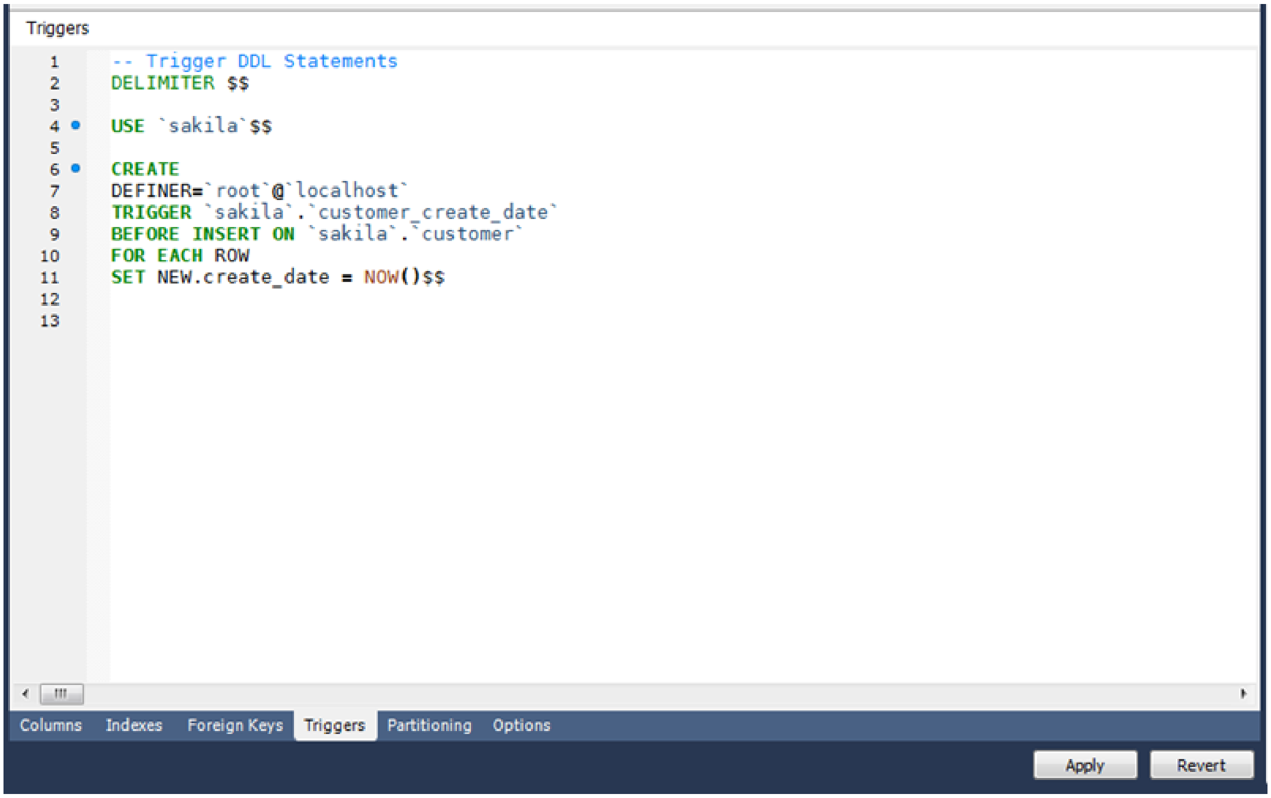
To drop a foreign key, right-click the row you wish to delete, then select the Delete Selected FKs menu item.

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

7.7.1.3.5. 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.

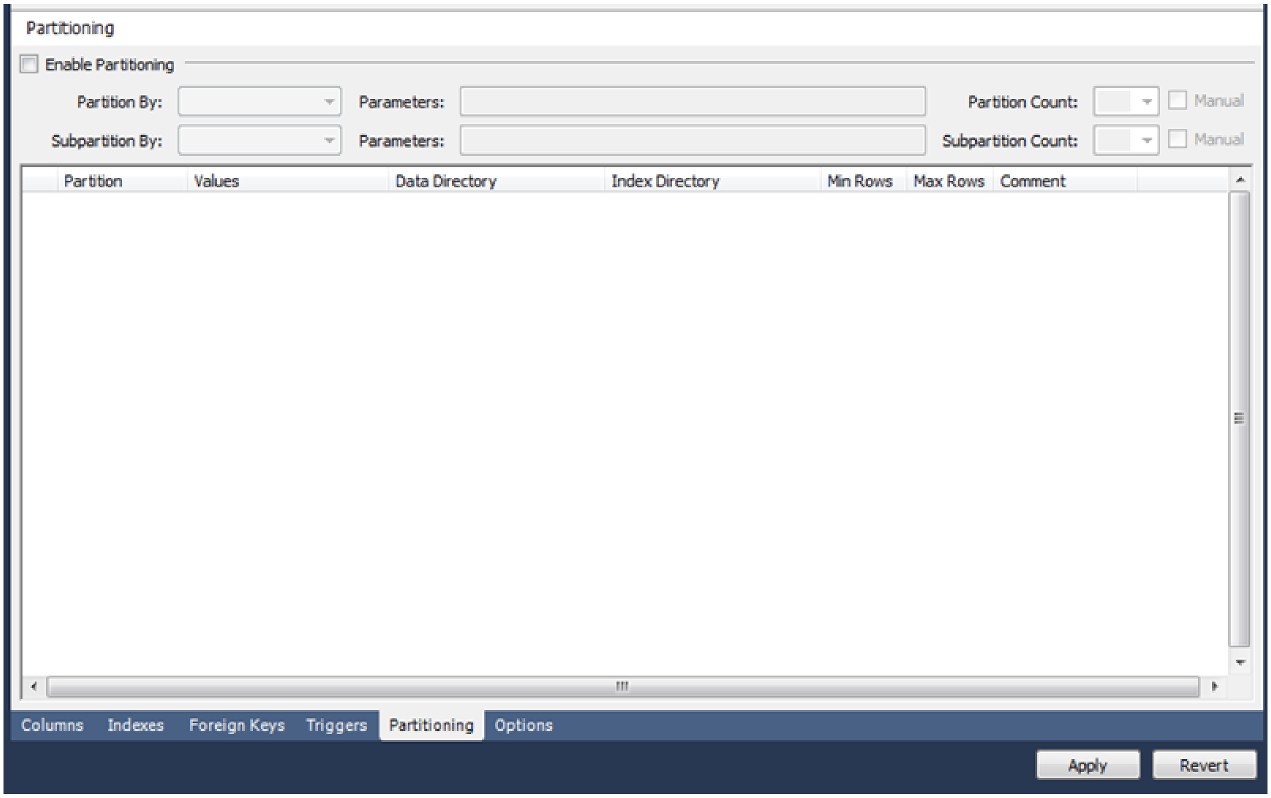
Figure 7.13. The Triggers Tab



7.7.1.3.6. The Partitioning Tab

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

Figure 7.14. 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`

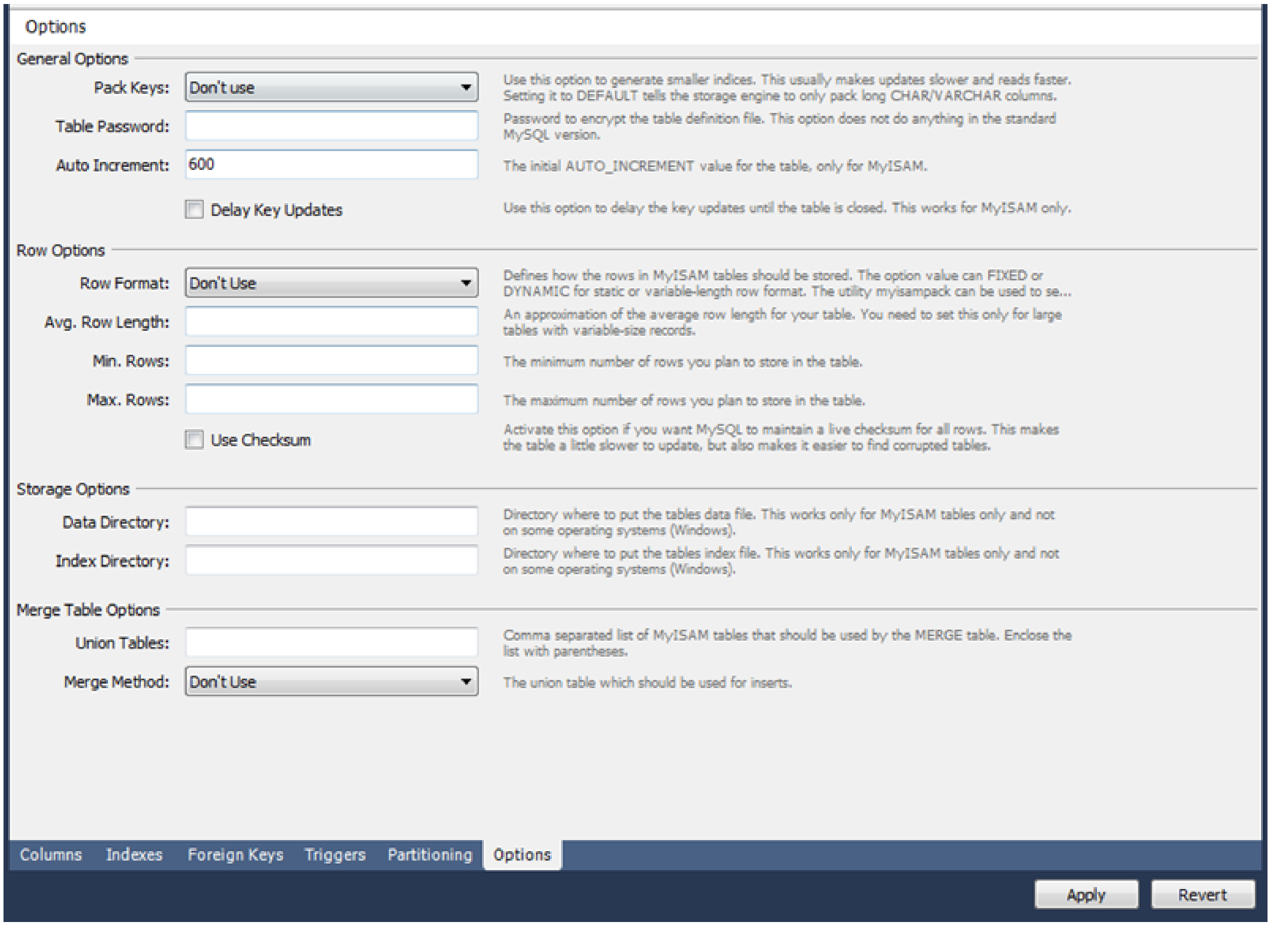
- `Max Rows`
- `Comment`

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

7.7.1.3.7. The Options Tab

The **Options** tab enables you to set several types of options.

Figure 7.15. The Options Tab



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
- 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.

7.7.1.3.8. 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 6.7.4.2, "Results Tabsheets" and Section 6.7.4.3, "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. 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.

7.7.1.3.9. 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 7.5.5.1, "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.

7.7.2. 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.

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 7.7.1.3.4, “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.

7.7.2.1. 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.

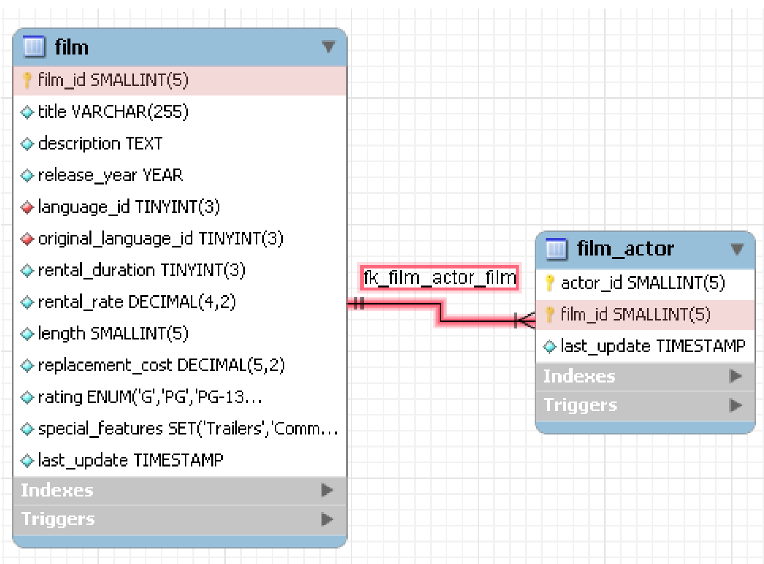
When the many-to-many tool is active, double-clicking a table creates an associative table with a many-to-many relationship. For this tool to function there must be a primary key defined in the initial table.

Use the Model menu, Menu Options menu item to set a project-specific default name for the foreign key column (see Section 7.5.1.5.4, “The Relationship Notation Submenu”). To change the global default, see Section 5.4.4, “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.

Figure 7.16. 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 7.7.2.3, “Connection Properties”. Where the notation style permits, `Classic` for example, the cardinality indicators can also be repositioned.

The relationship notation style in Figure 7.16, “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 7.5.1.5.4, “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.

7.7.2.2. The Relationship Editor

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

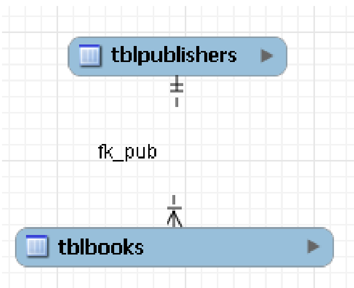
The Relationship Tab

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 5.4.4, "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 7.17. The Split Connector



> **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 7.5.1.5.4, "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.

7.7.2.3. 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 quite 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 7.7.2.2, “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.
- `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.

7.7.3. 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.

7.7.3.1. 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 7.7.3.3, “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.

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.

7.7.3.2. 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 7.7.3.1, “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 5.4.4, “The Model Tab”.

7.7.3.3. 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 7.7.1.3.9, “The Privileges Tab”.

7.7.3.4. 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 7.5.12, “The Properties Palette”.

7.7.4. 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.

7.7.4.1. Routines

7.7.4.1.1. 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 7.7.4.1.2, "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.

> **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 5.4.4, "The Model Tab".

7.7.4.1.2. 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**.

7.7.4.1.2.1. 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.

7.7.4.1.2.2. 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 7.7.1.3.9, “The Privileges Tab”.

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

7.7.4.2. Routine Groups

7.7.4.2.1. 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 7.7.4.2.3, “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...
- 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 7.7.4.2.3, “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 Digram by dragging and dropping them from this palette.

7.7.4.2.2. 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 7.7.4.2.1, “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 5.4.4, “The Model Tab”.

7.7.4.2.3. 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**.

7.7.4.2.3.1. 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.

7.7.4.2.3.2. 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 7.7.1.3.9, “The Privileges Tab”.

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

7.7.4.2.3.3. 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 7.5.12, “The Properties Palette”.

7.7.5. 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.

7.7.5.1. 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.

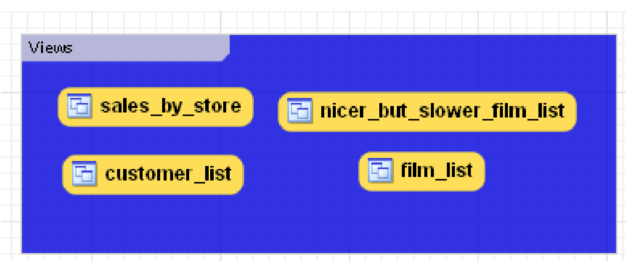
Clicking the mouse on this icon changes the mouse pointer to a layer pointer. You can also change the mouse pointer to a layer pointer by pressing the **L** key.

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 7.18. The Layer Object



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.

7.7.5.1.1. 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.

7.7.5.2. 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 7.5.12, “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.

7.7.6. 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.

7.7.6.1. 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 7.7.6.2, “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 7.7.6.2, “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.

7.7.6.2. 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.

7.7.7. 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.

7.7.7.1. 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.

7.7.7.2. 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 objects 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.

7.7.7.2.1. 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 7.5.12, “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 5.4.7, “The Appearance Tab”.

7.7.8. Creating Images

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

7.7.8.1. 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.

7.7.8.2. 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.

7.7.8.2.1. The Image Tab

Use the **Image** tab of the image editor to perform the following tasks:

- Rename the image using the **Name** text box.
- Browse for an image using the Browse button.

7.7.9. 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.

7.7.9.1. 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 7.7.10.1.2, “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.

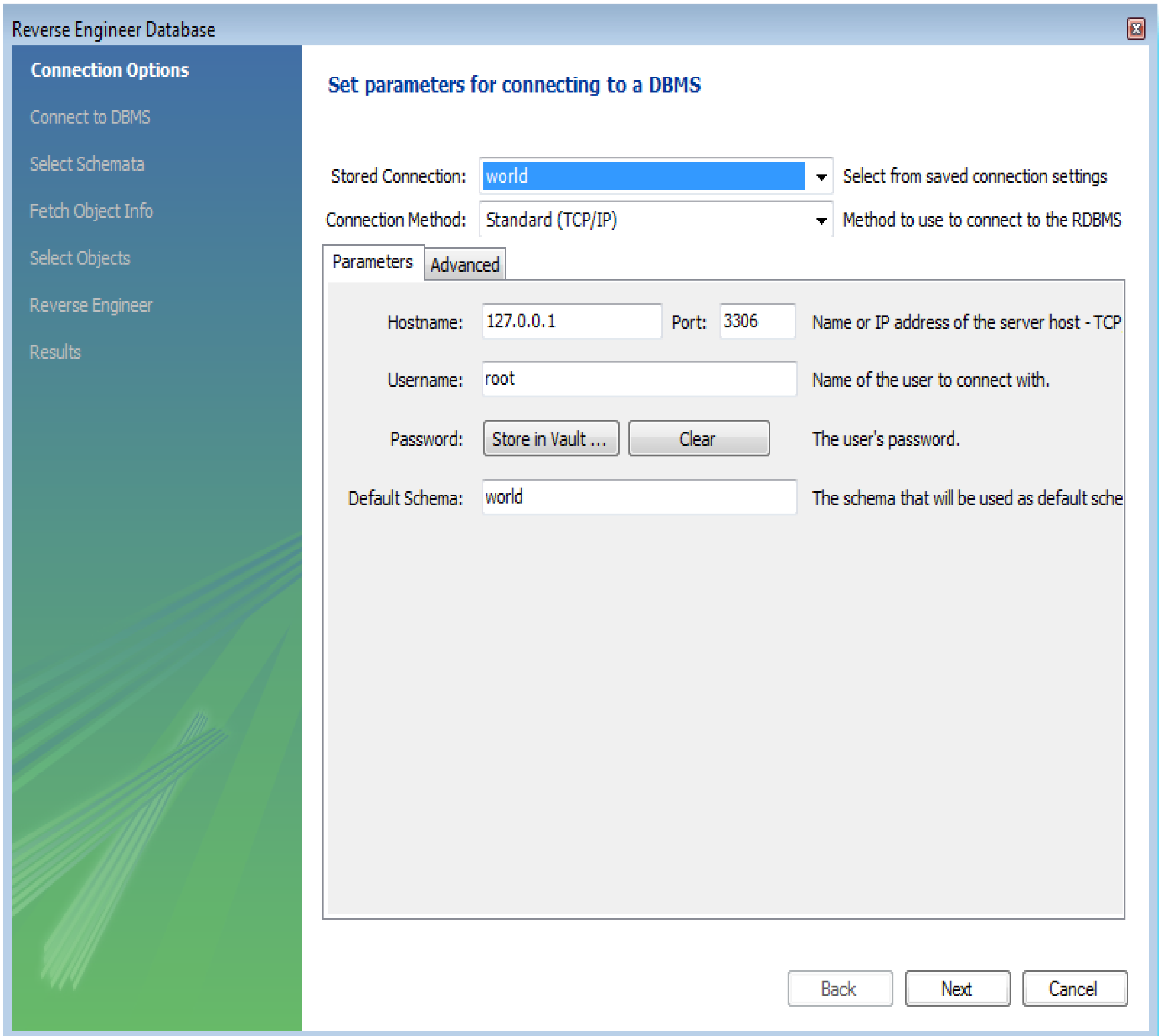
Before exiting, be sure to save the schema. Choose the File, Save menu item and the reverse-engineered database will be saved as a MySQL Workbench file with the extension `mwb`.

See Section 7.8.1, “Importing a Data Definition SQL Script”, for a tutorial on reverse engineering the `sakila` database.

7.7.9.2. 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.

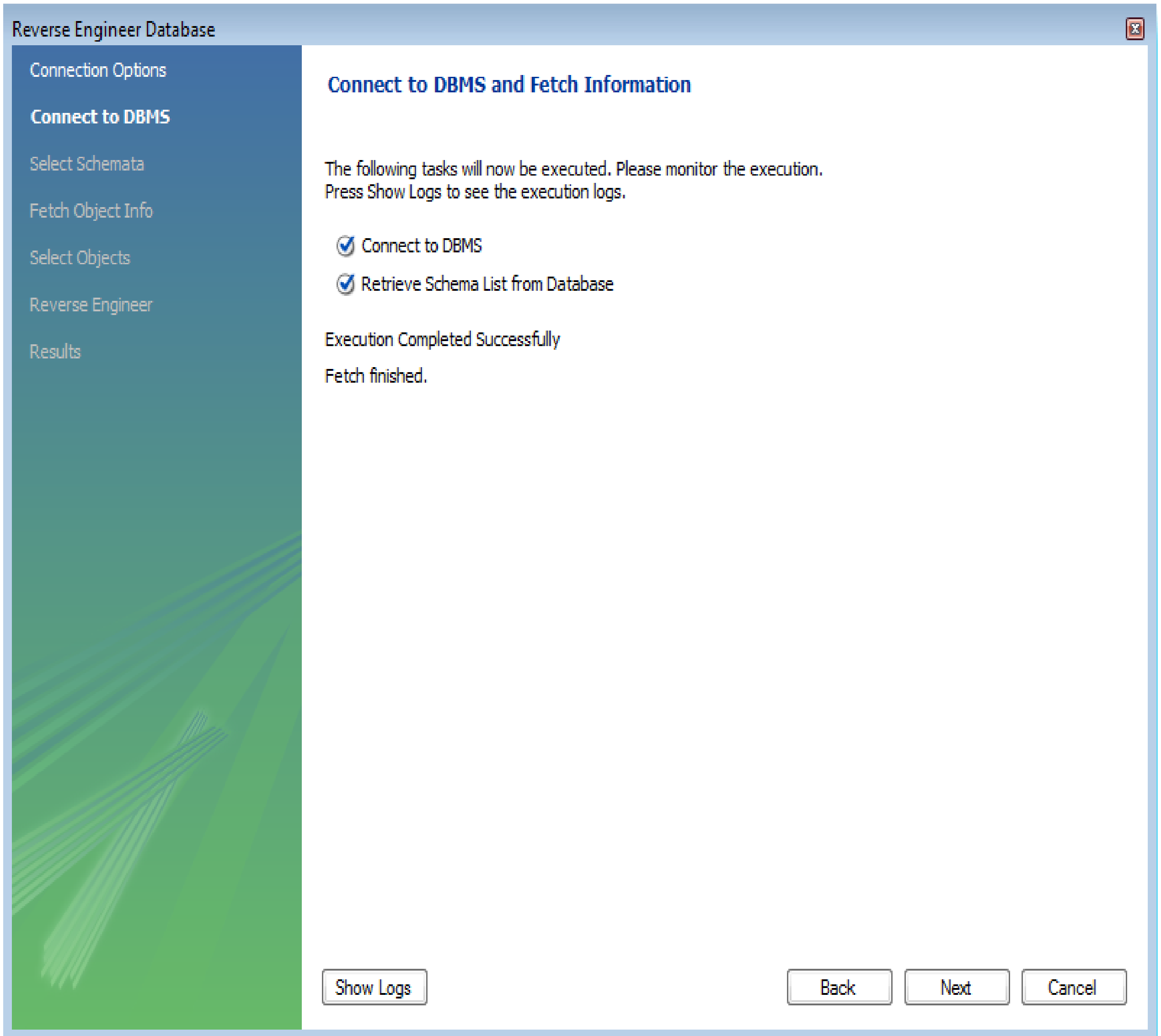
Figure 7.19. Reverse Engineer Database Wizard



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.

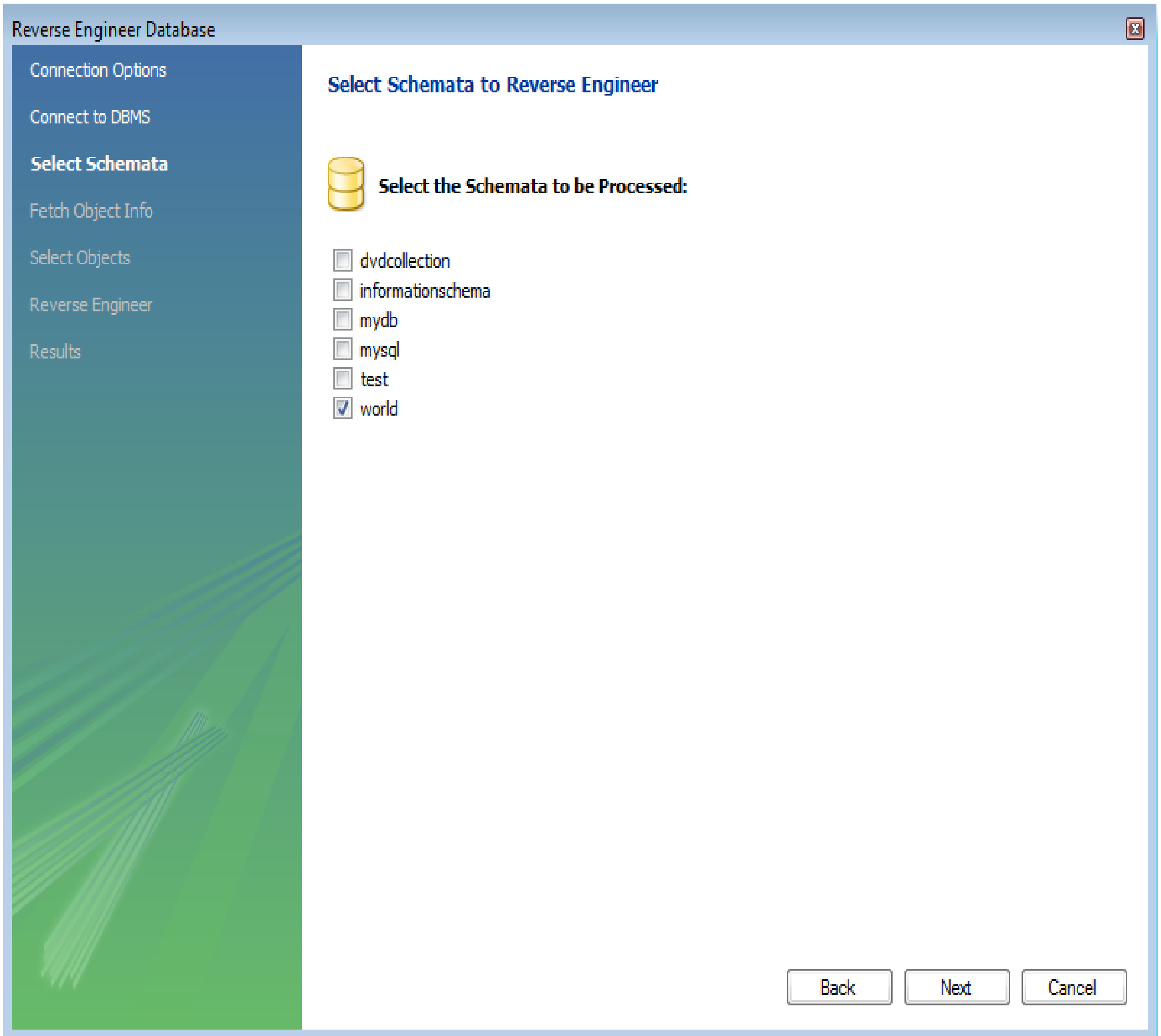
Figure 7.20. Connect to DBMS



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.

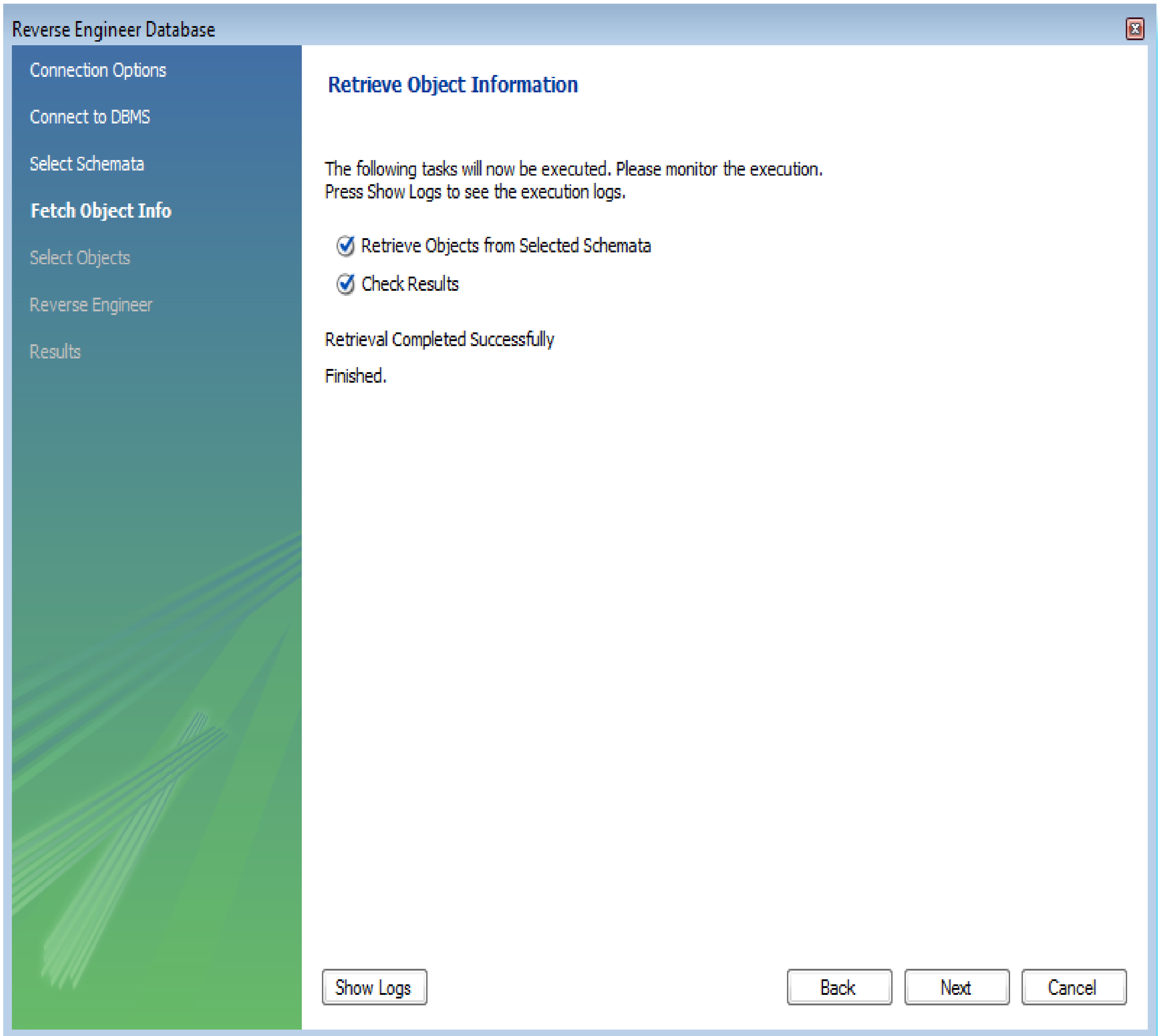
Figure 7.21. Select Schemata



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.

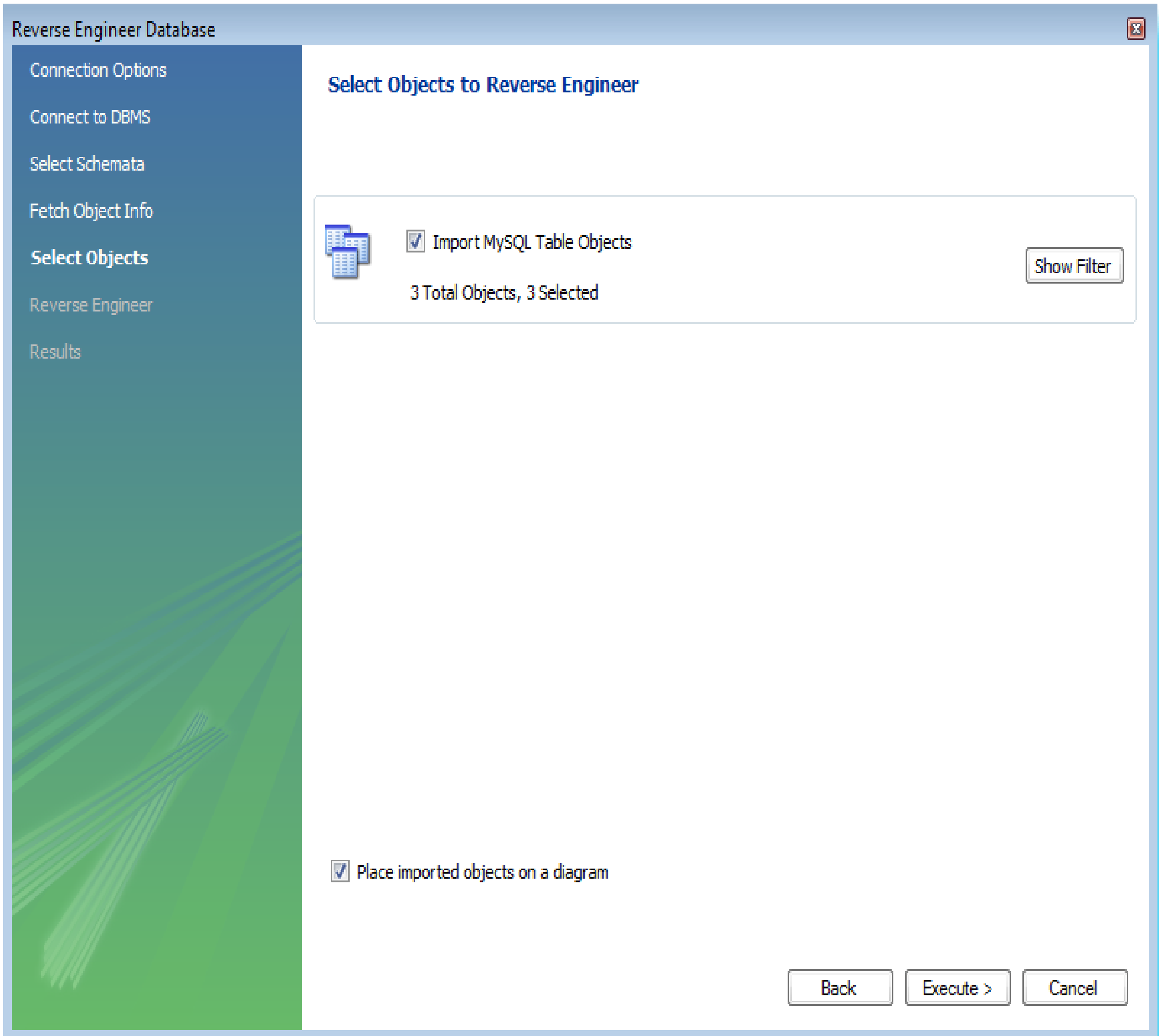
Figure 7.22. Retrieve Object Information



Review the results before clicking Next to continue.

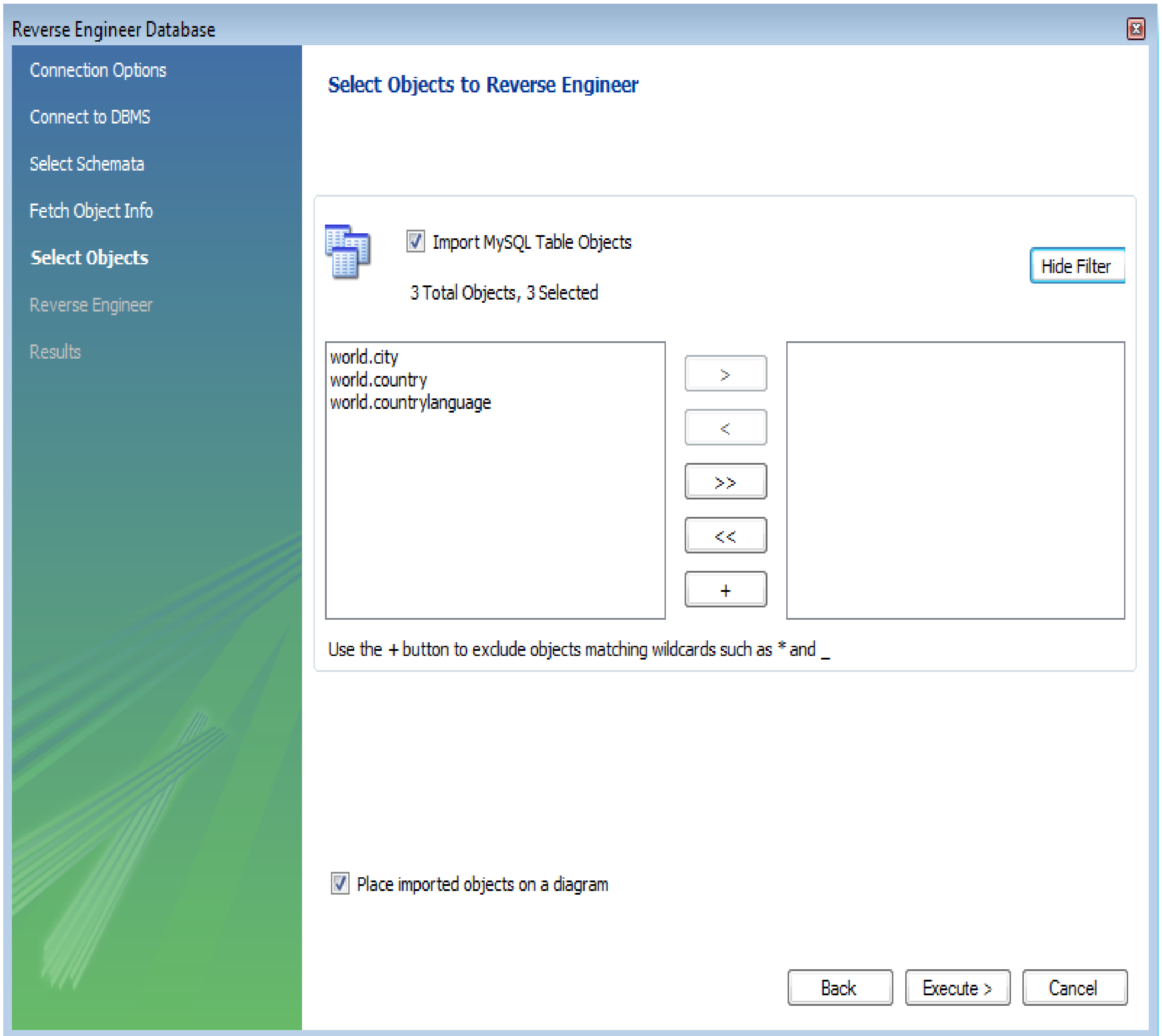
The next page is the `Select Objects` page. It has a section for each object type present in the schema (tables, views, routines, and so forth). This page is of special interest if you do not wish to import all the objects from the existing database. It gives you the option of filtering which objects 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 7.23. Select Objects



For the **Import MySQL Table Objects** section, if you click the Show Filter button, the following page is displayed.

Figure 7.24. Show Filter



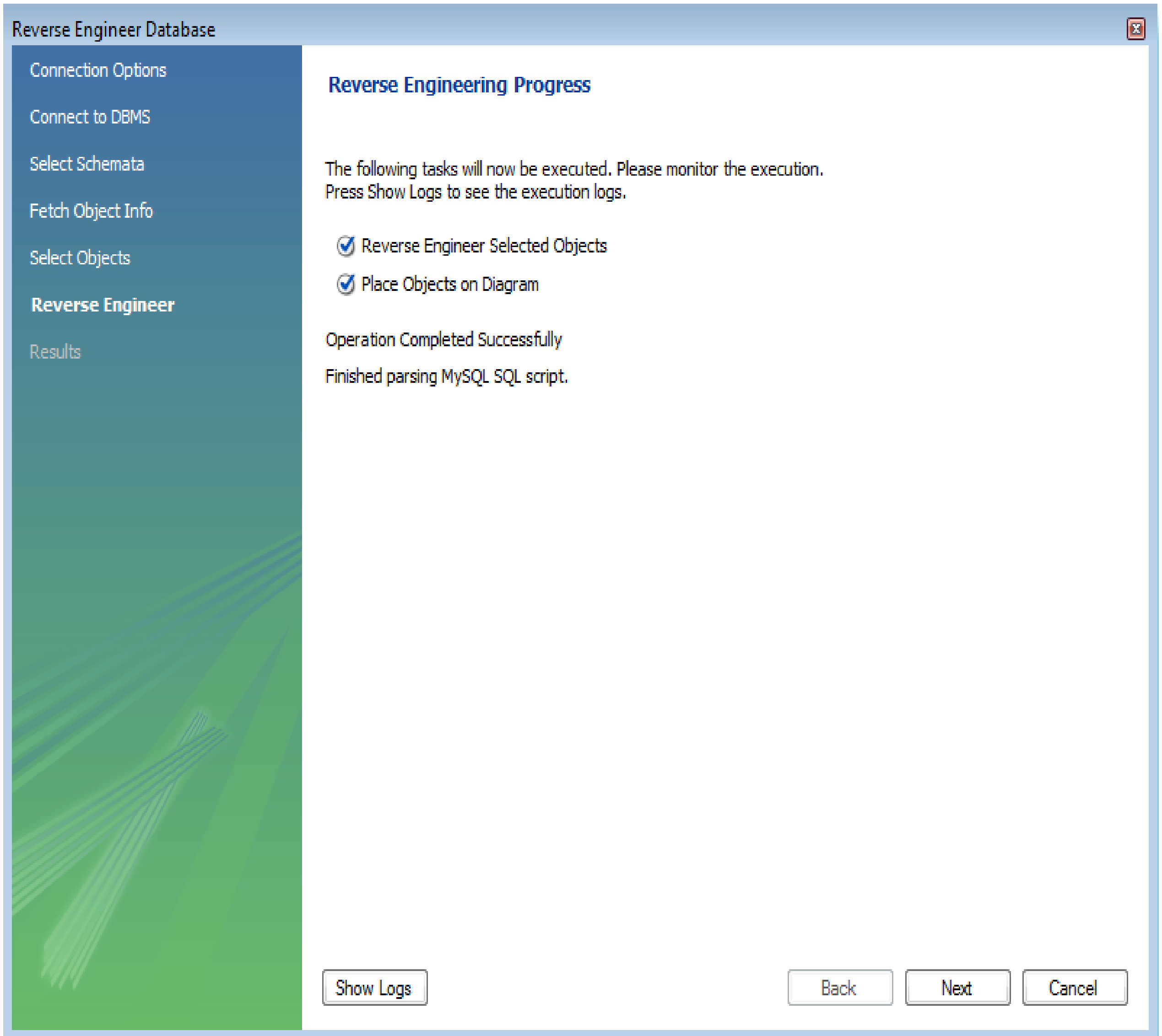
This page enables you to select specific tables for import. Having selected the desired tables, you can optionally hide the filter by clicking the Hide Filter button.

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.

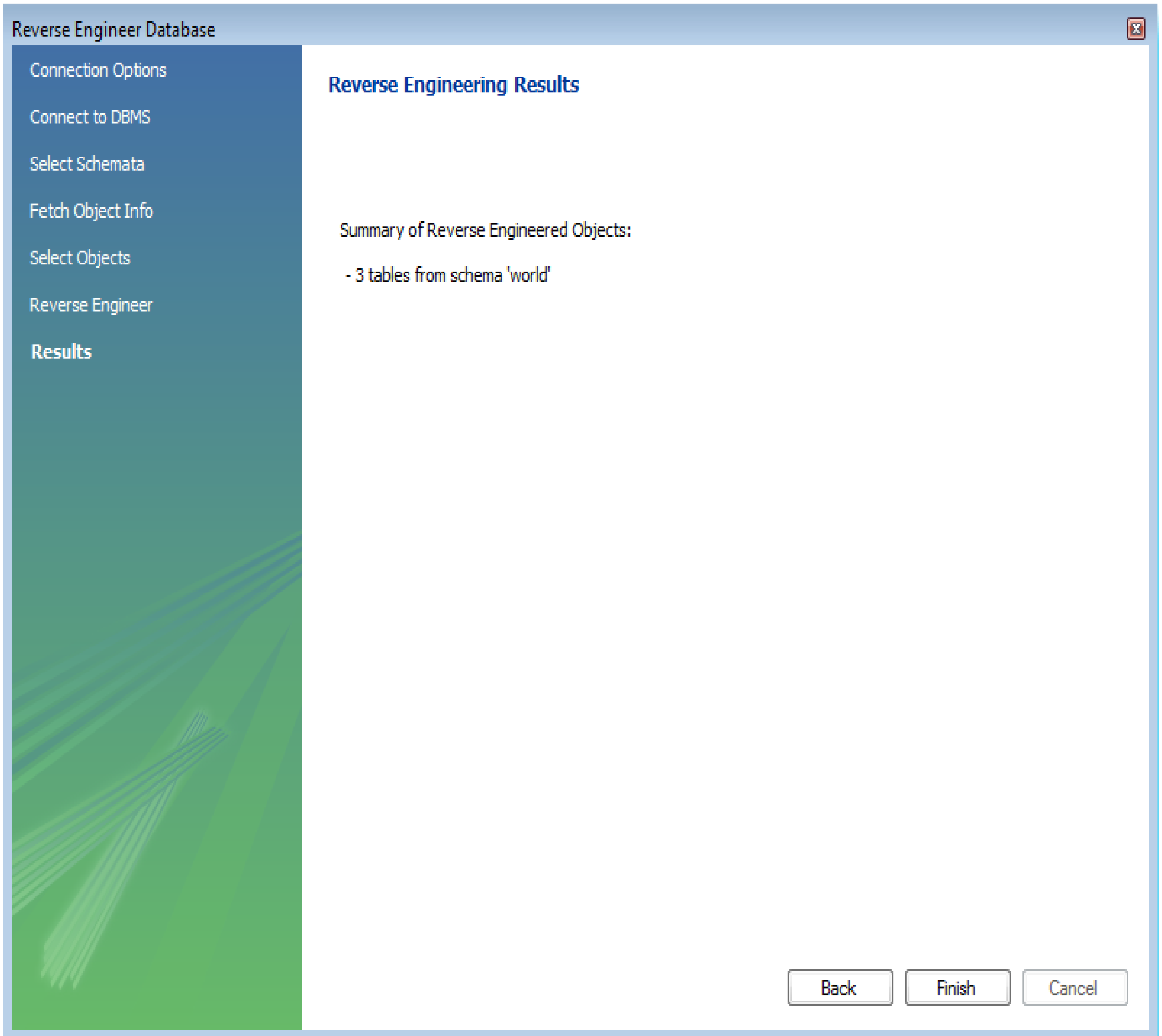
Figure 7.25. Progress



Click Next to continue to the next page.

The final page of the wizard provides a summary of the reverse engineered objects.

Figure 7.26. Results



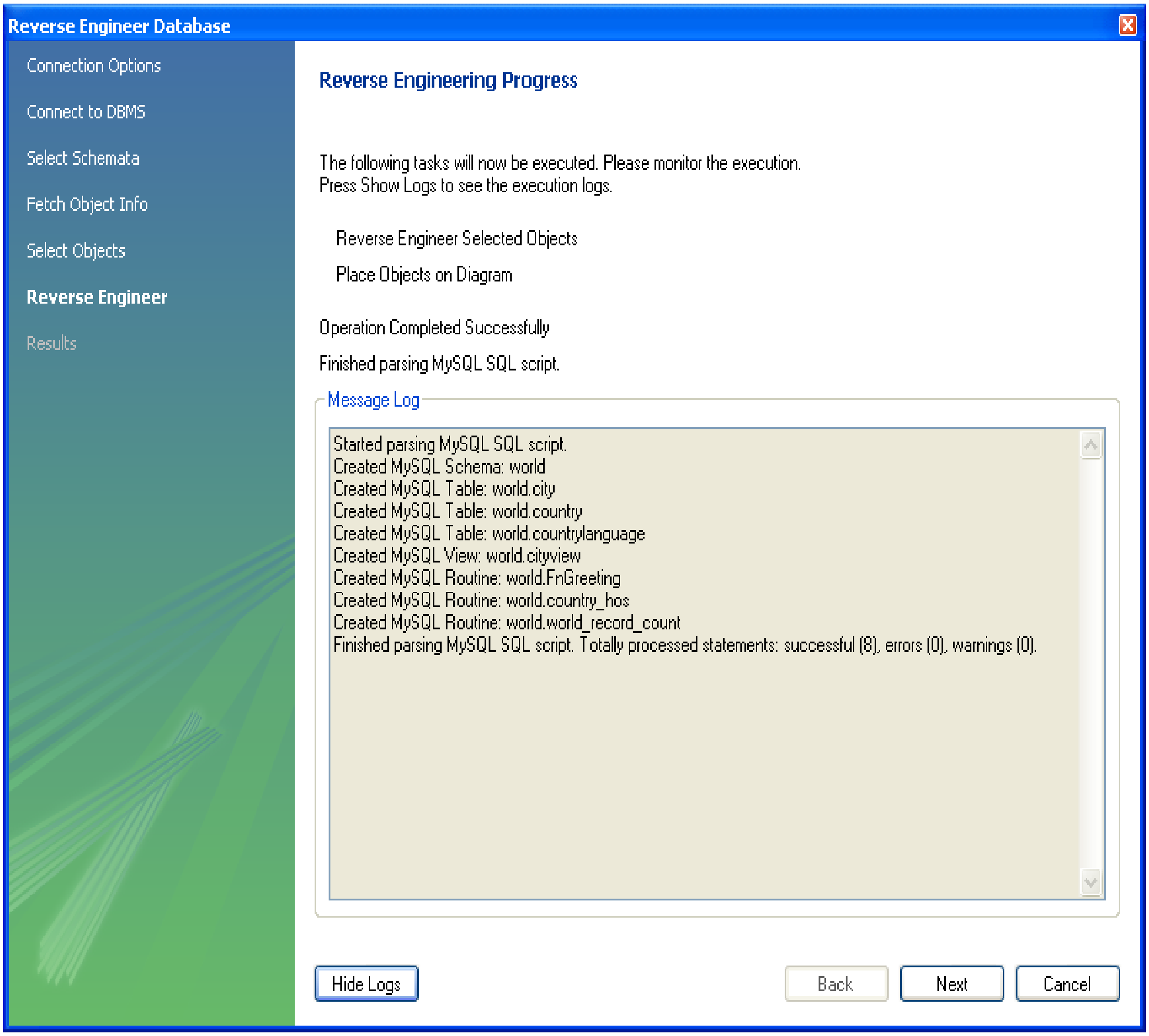
Click Finish to exit the wizard.

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`.

7.7.9.2.1. 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.

Figure 7.27. Message Log



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.

7.7.10. Forward Engineering

It is possible to forward engineer a database using an SQL script or by connecting to a live database.

7.7.10.1. Forward Engineering Using an SQL Script

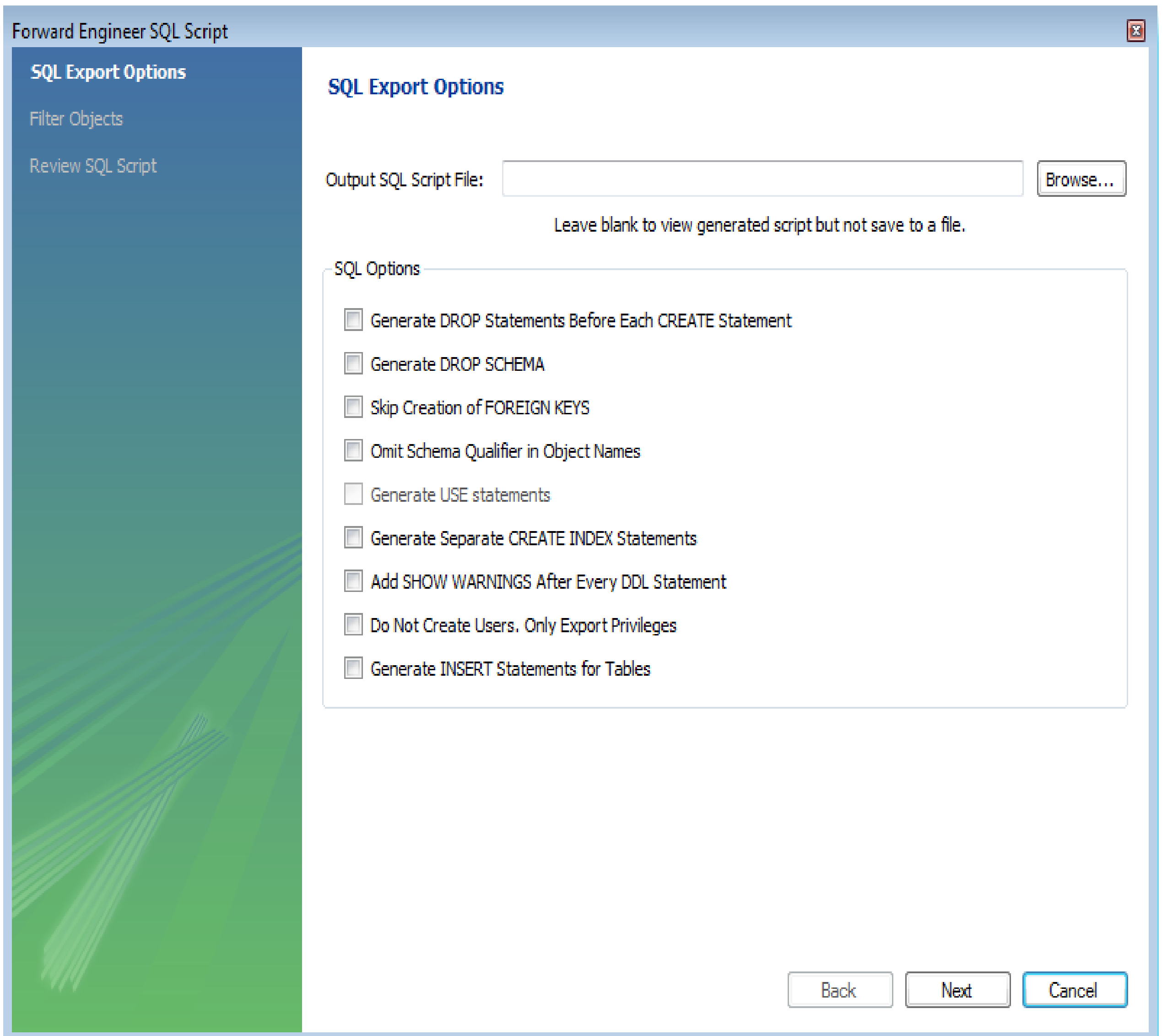
To create a script of your database model, choose the Export item from the File menu. You may export a script to alter an existing database or create a new database. The script to create a database is similar to the one created using the `mysqldump db_name` command.

If you choose to create a database, there are several export options available.

7.7.10.1.1. 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 7.28. 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`

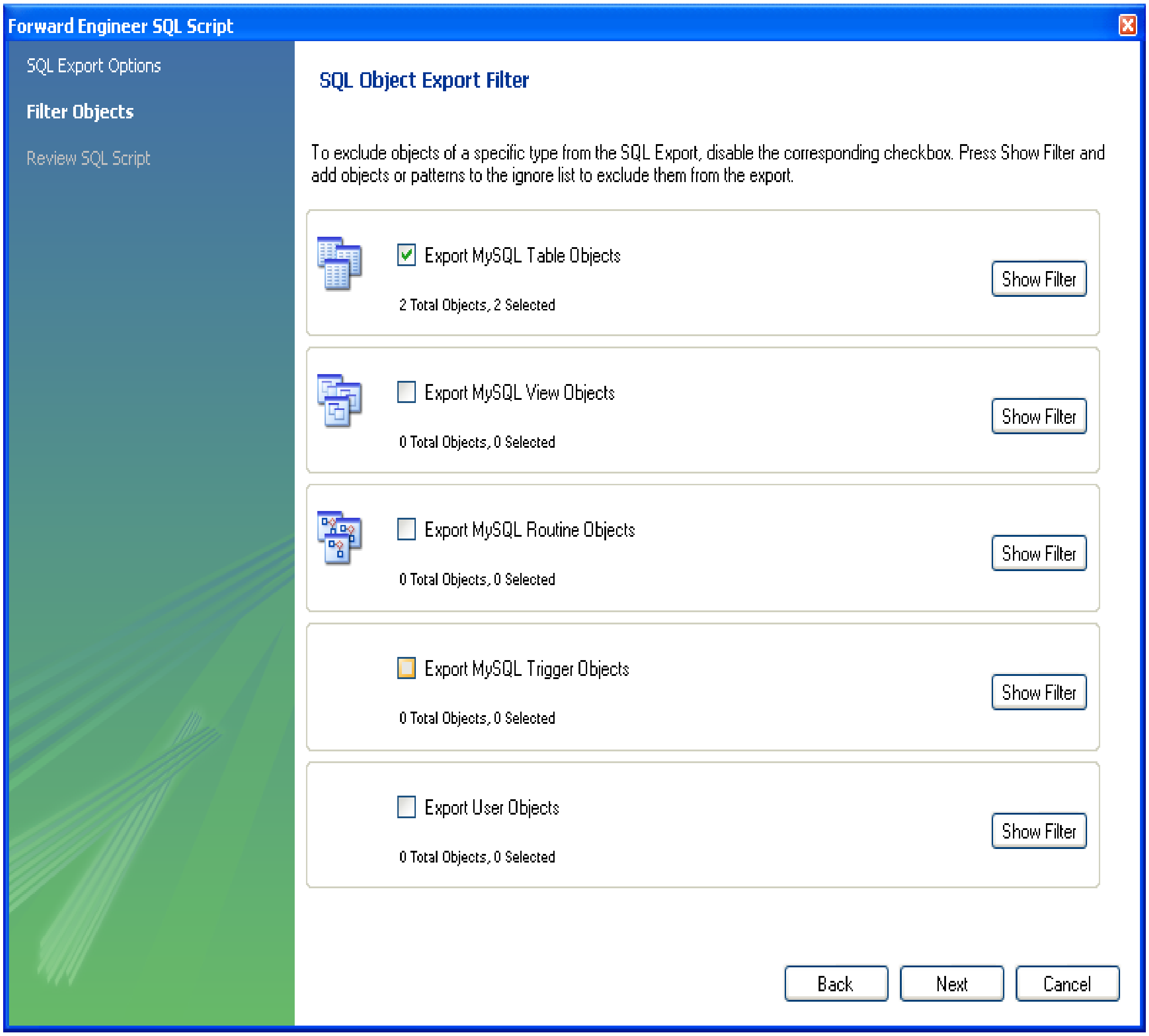
  Select this option to update the privileges of existing users, as opposed to creating new users. Exporting privileges for nonexistent users will result in errors when you execute the `CREATE` script. Exporting users that already exist will also result in an error.

- `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 7.7.1.3.8, “The Inserts Tab”.

Clicking Next takes you to the **SQL Object Export Filter** page where you select the objects you wish to export.

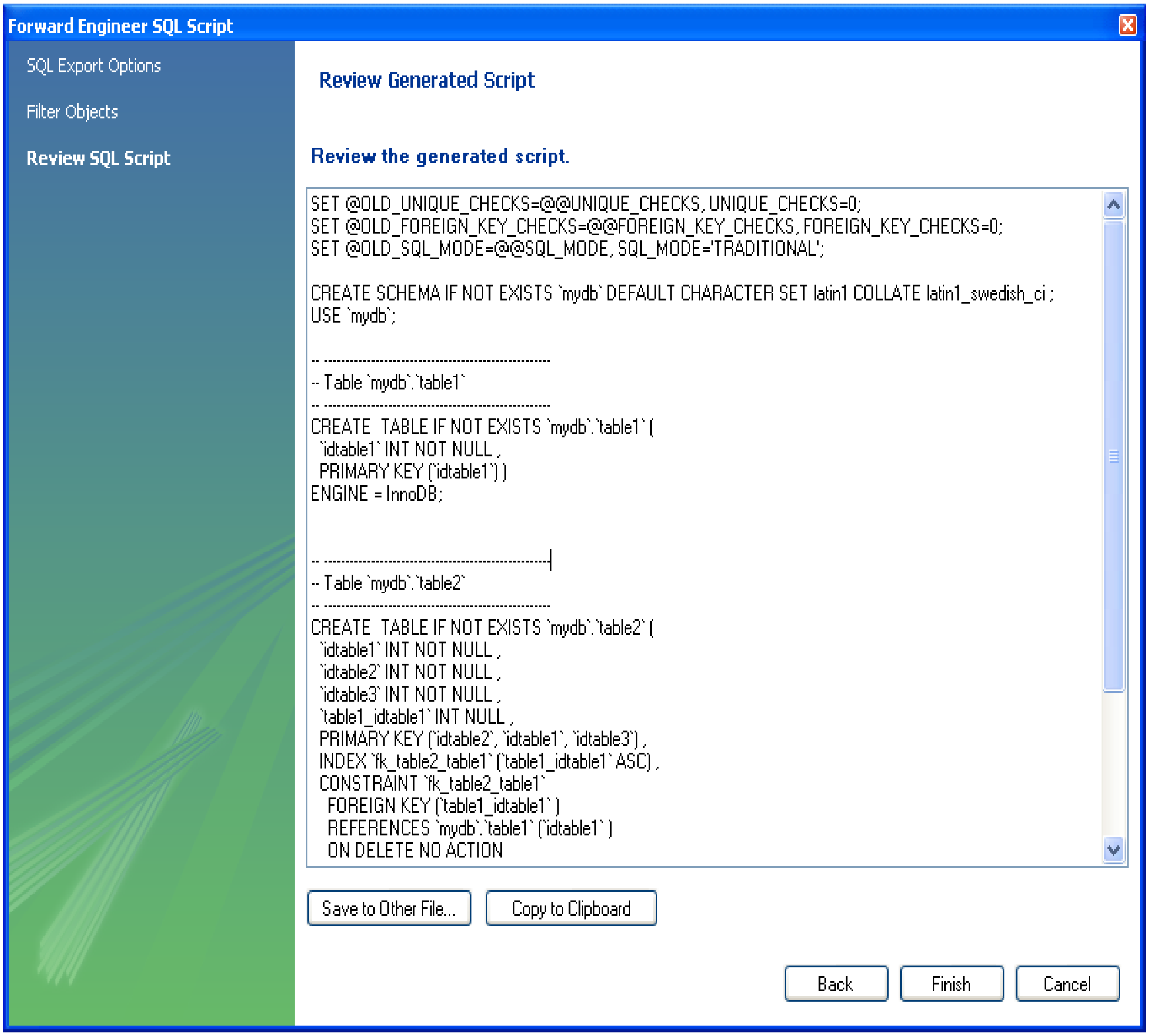
Figure 7.29. SQL Object Export Filter



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 7.30. Review Generated Script



You may return to the previous page using the Back button.

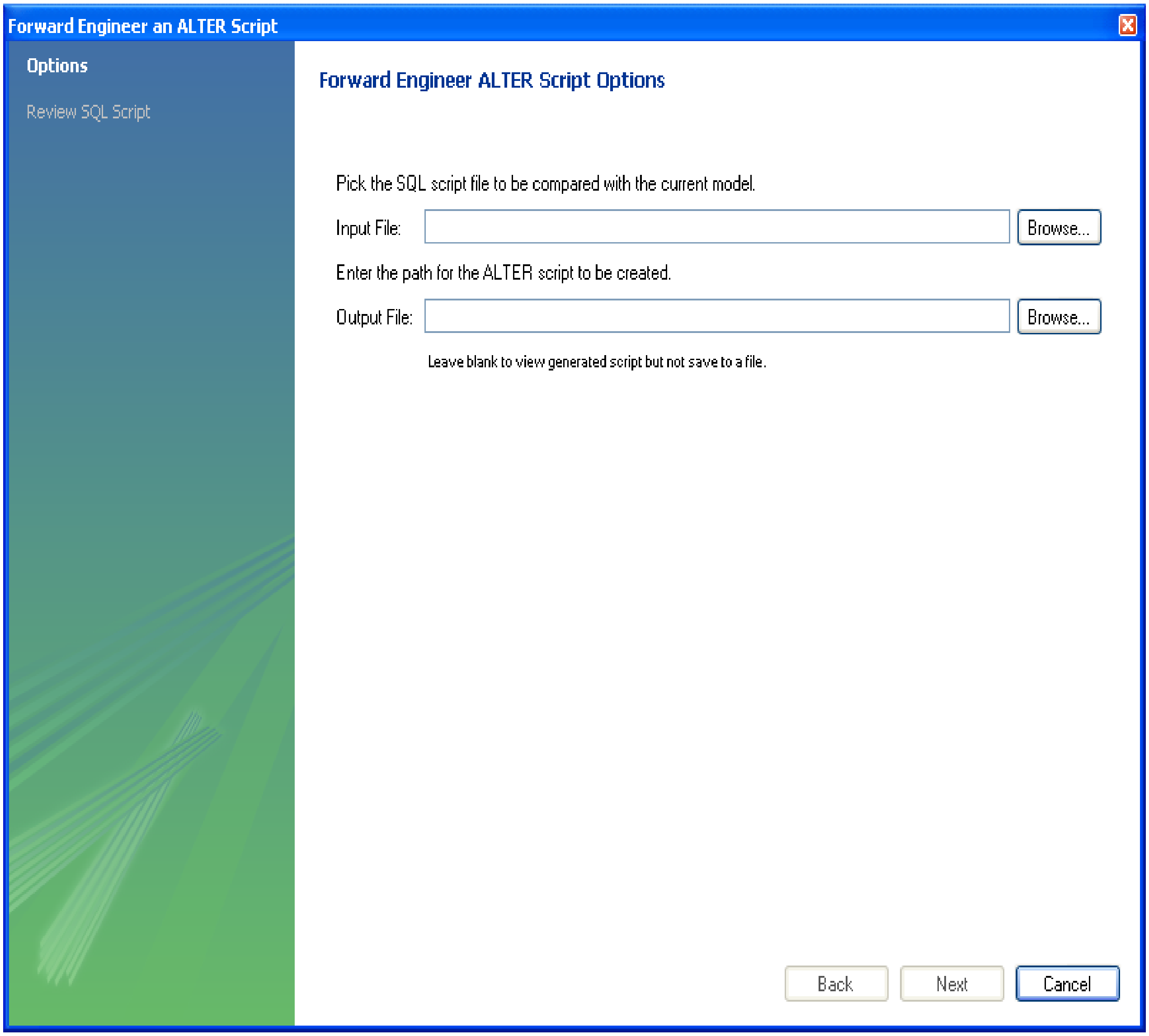
The Finish button saves the script file and exits. You can then use the saved script to create a database.

7.7.10.1.2. 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 7.7.9.1, “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.

Figure 7.31. Options



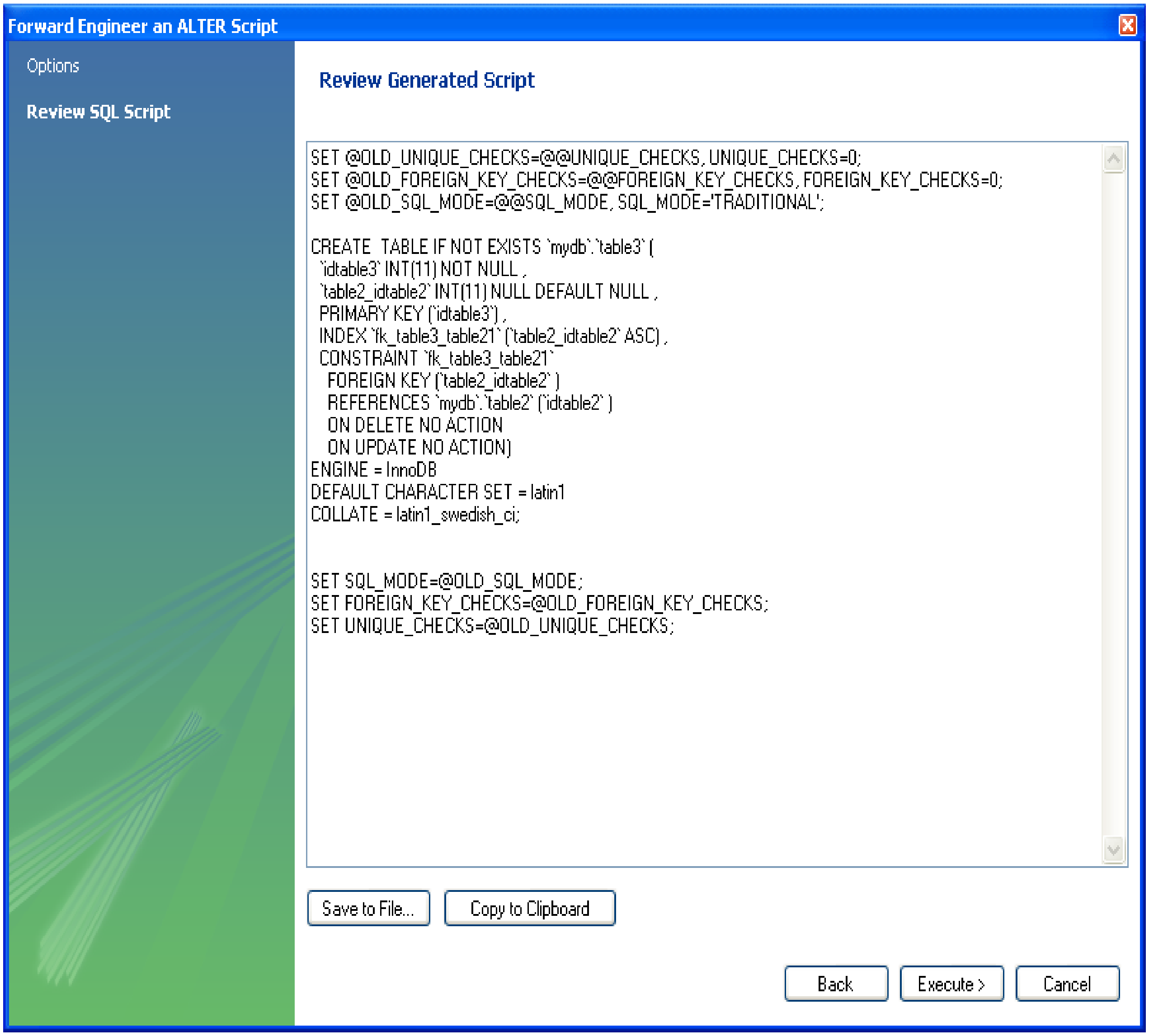
This first page enables you to select an SQL script and compare it with the model currently in MySQL Workbench. The difference between the two models will be used to create an alter script that can be used to modify the target schema to match the model held in MySQL Workbench. To view the script generated, 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.

Figure 7.32. Script



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.

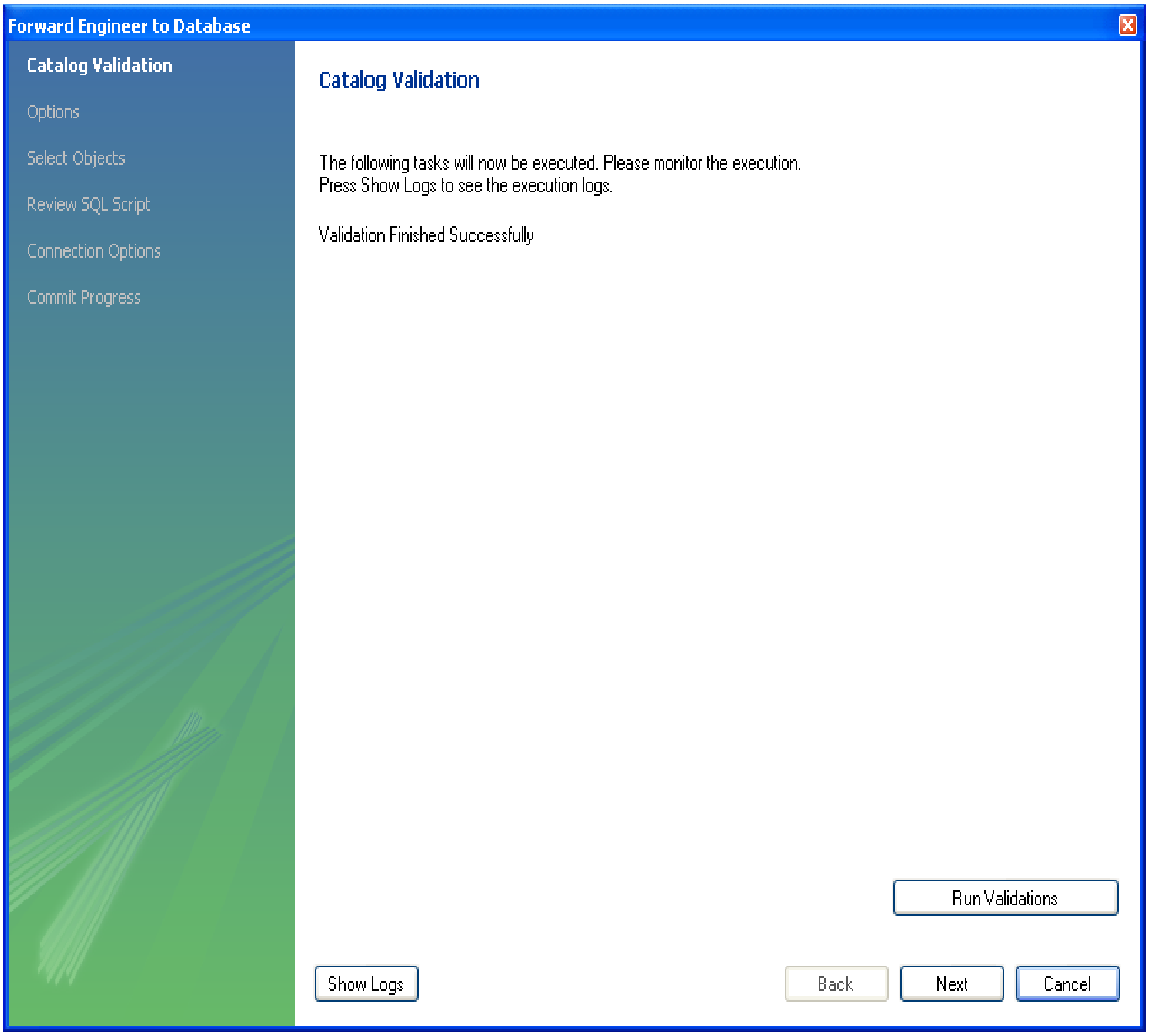
7.7.10.2. Forward Engineering to a Live Server

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 7.33. Catalog Validation

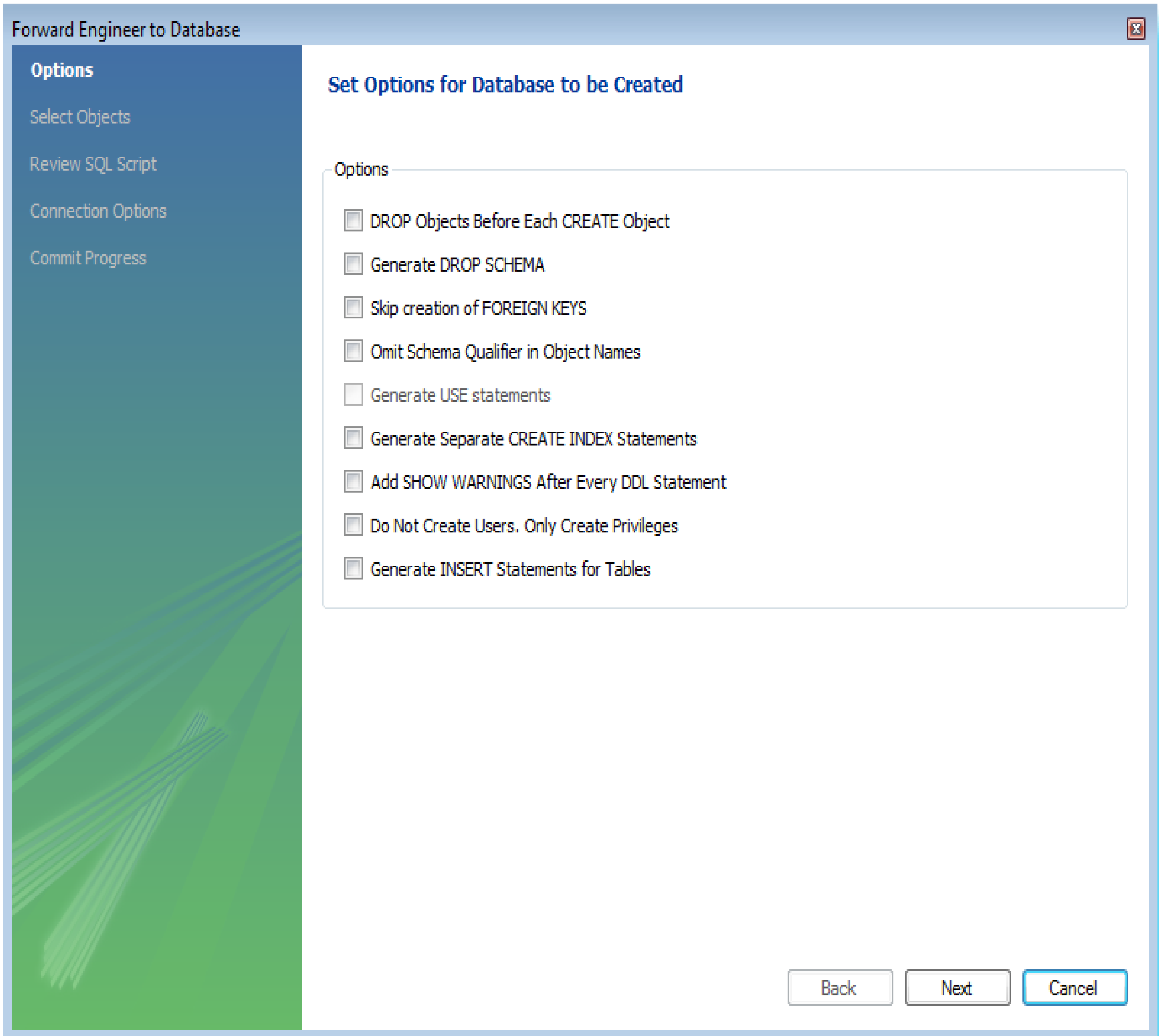


Click Run Validations to validate the catalog.

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 7.7.10.1.1, "Creating a Schema".

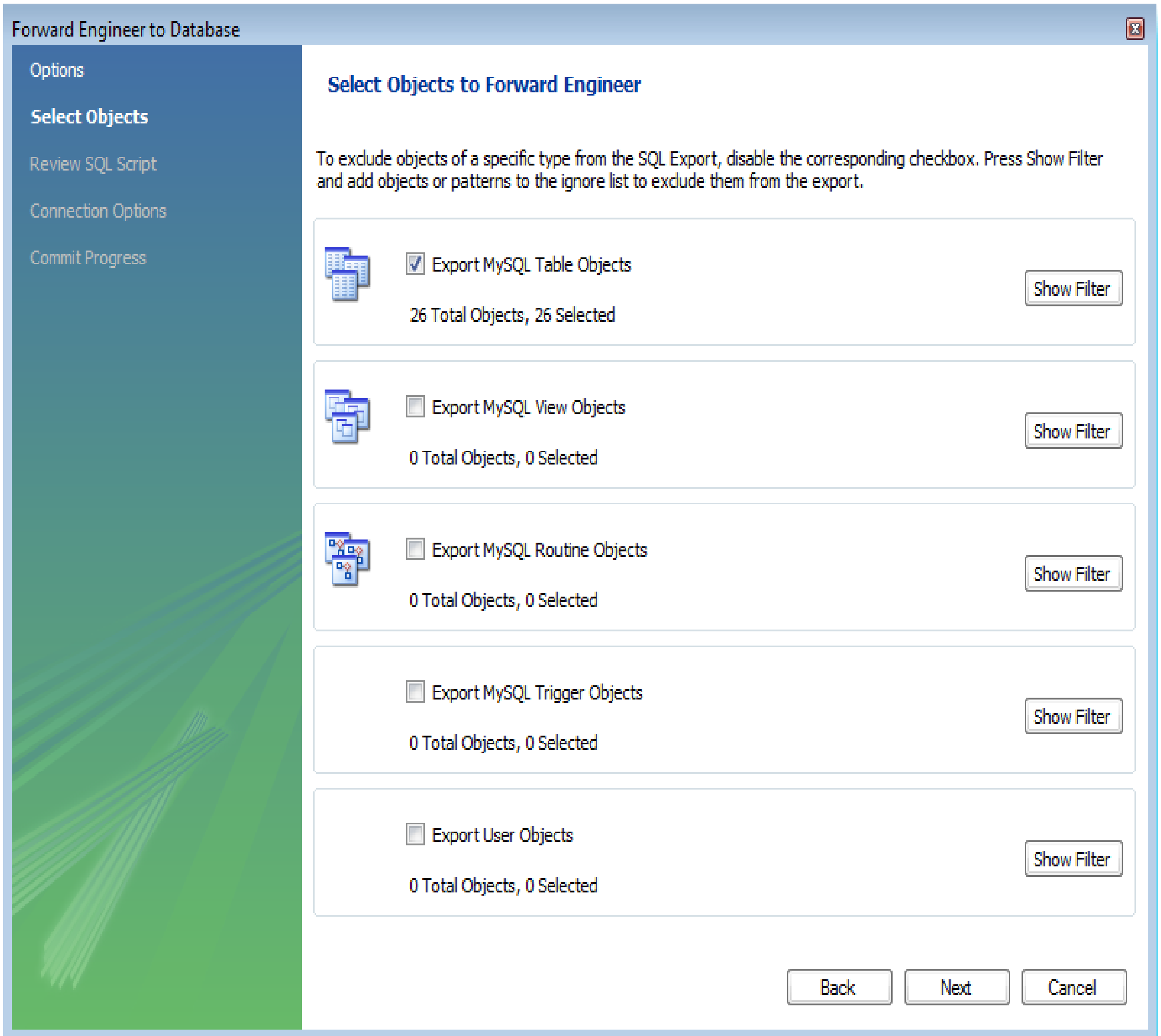
Figure 7.34. Options



Select the required options and then click Next.

The next page enables you to select the objects to forward engineer.

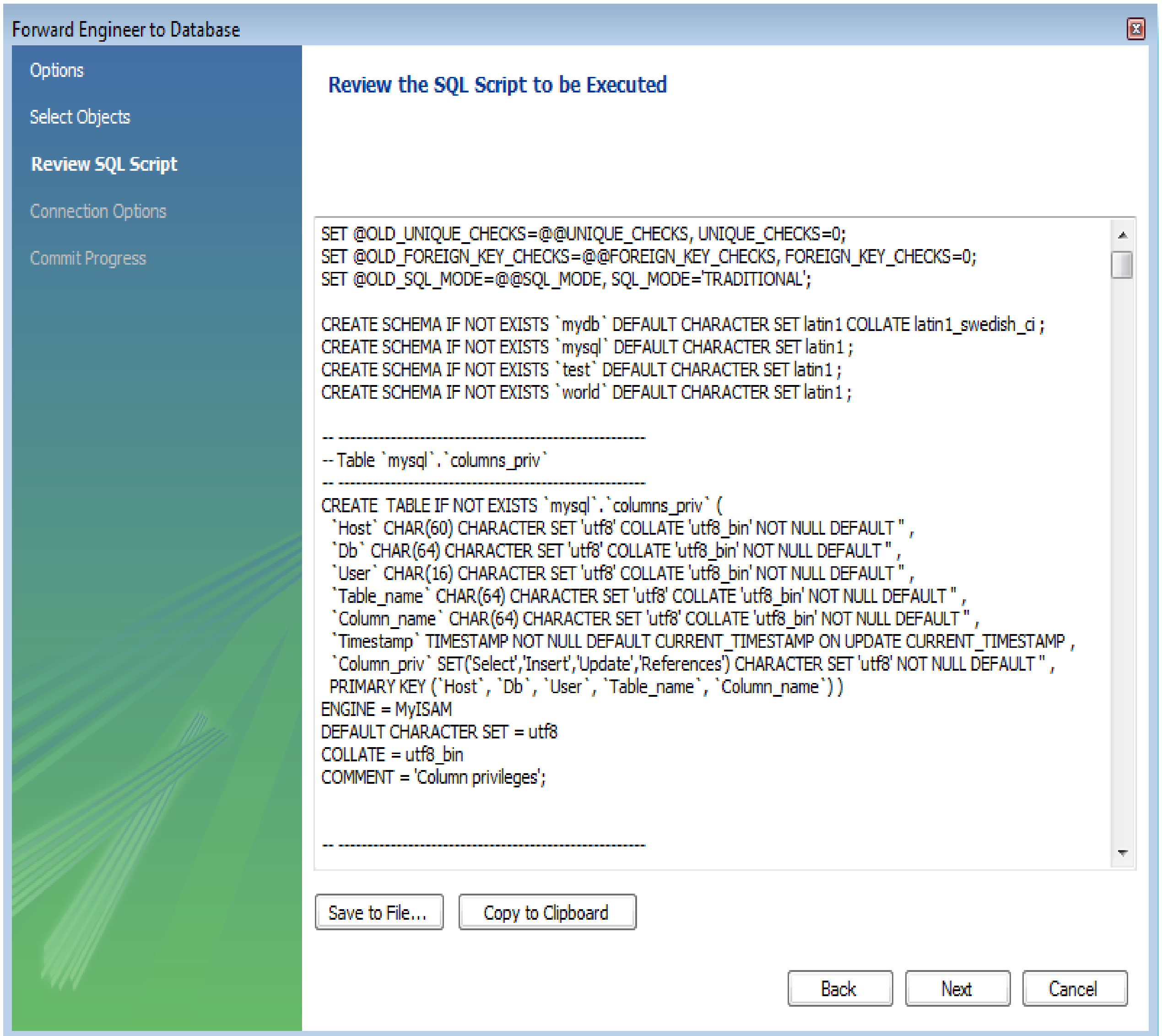
Figure 7.35. Select Objects to Forward Engineer



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.

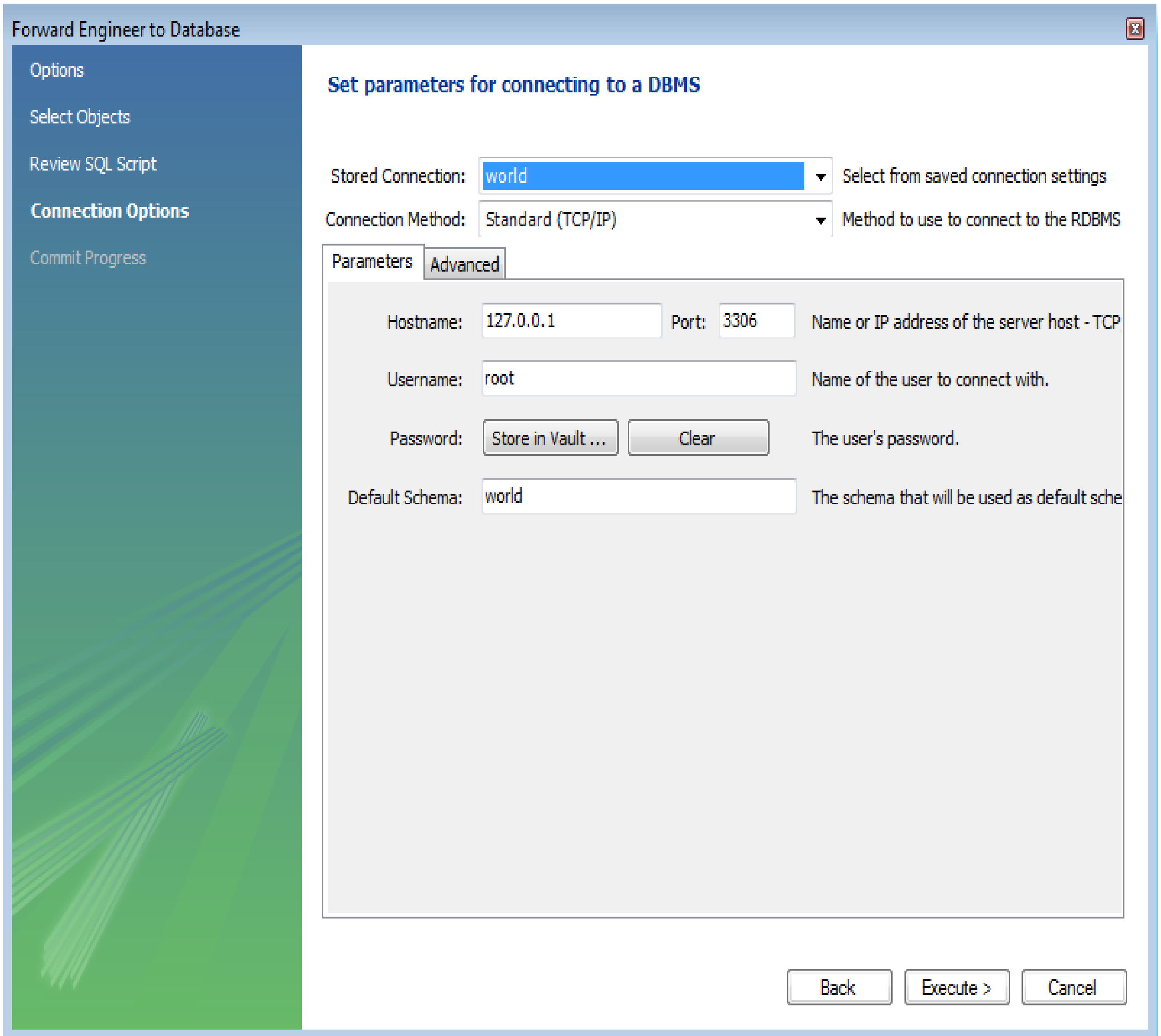
Figure 7.36. Review Script



Click Next to continue if you are satisfied with the generated script.

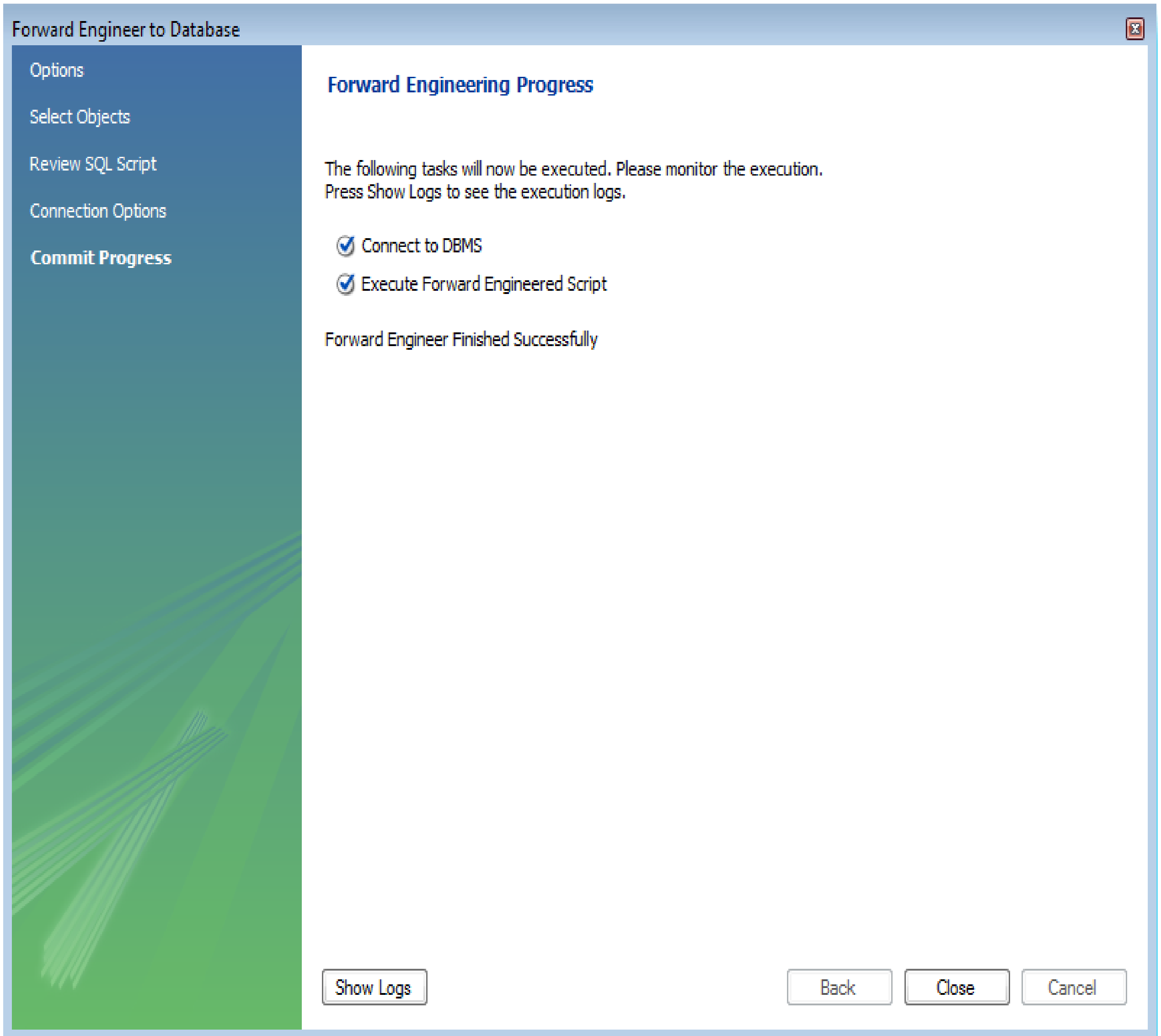
The next step of the process is to connect to a MySQL server in order to create the new database schema. This page enables you to use a previously stored connection, or enter the connection parameters.

Figure 7.37. 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.

Figure 7.38. Forward Engineering Progress



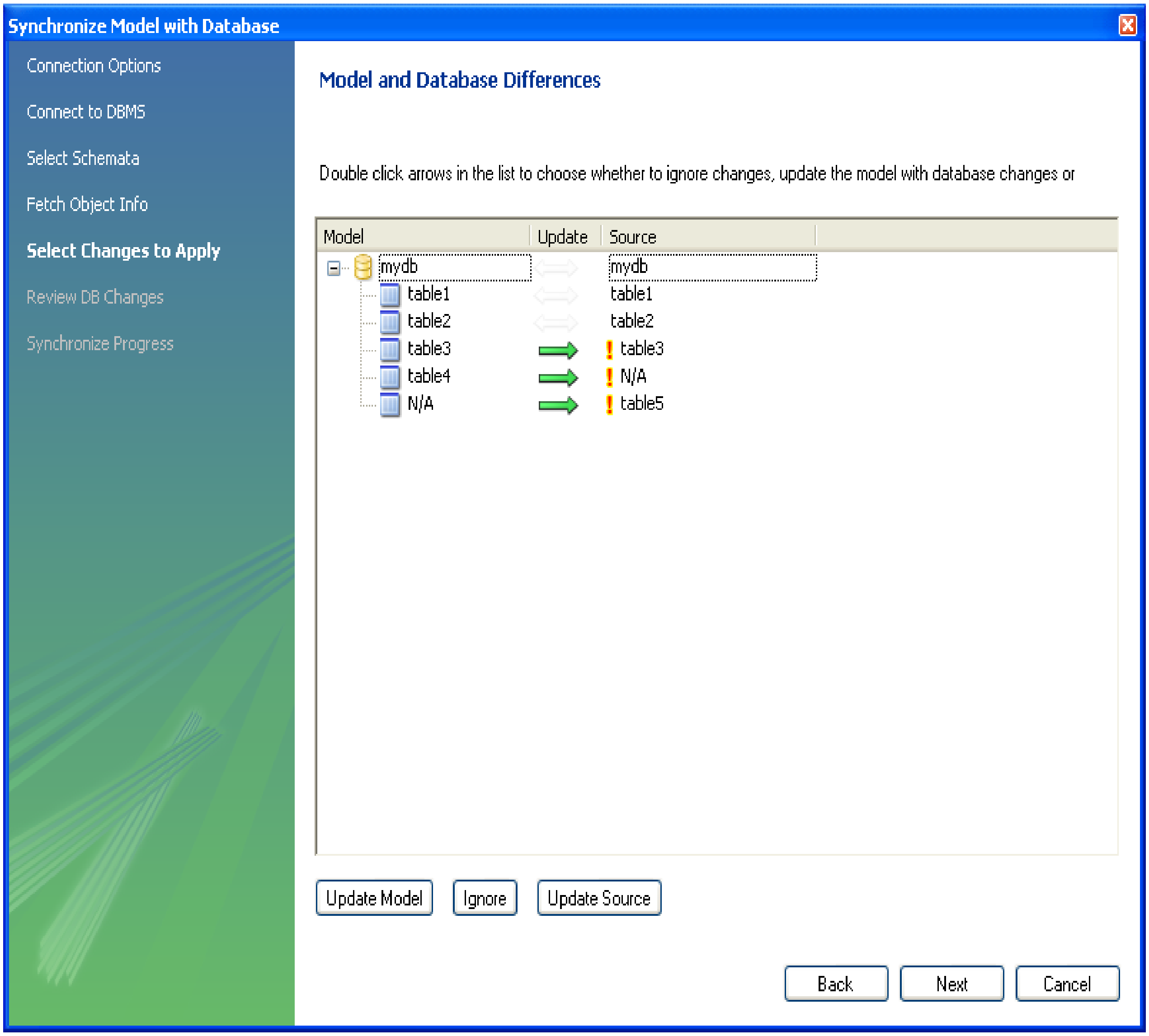
You can confirm that the script created the schema by connecting to the target MySQL server and issuing a `SHOW DATABASES` statement.

7.7.10.3. 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.

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.

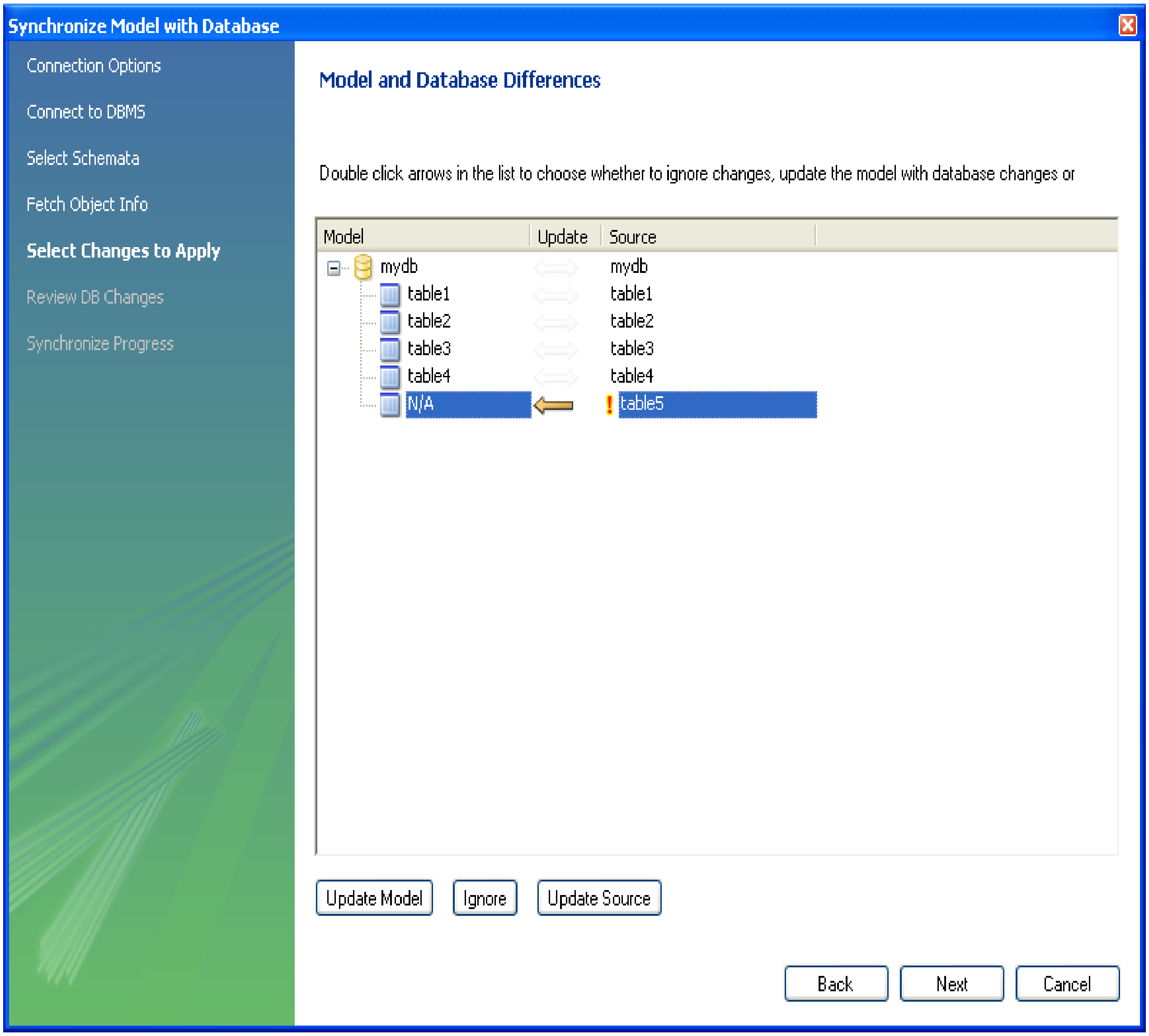
Figure 7.39. Model and Database Differences



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.

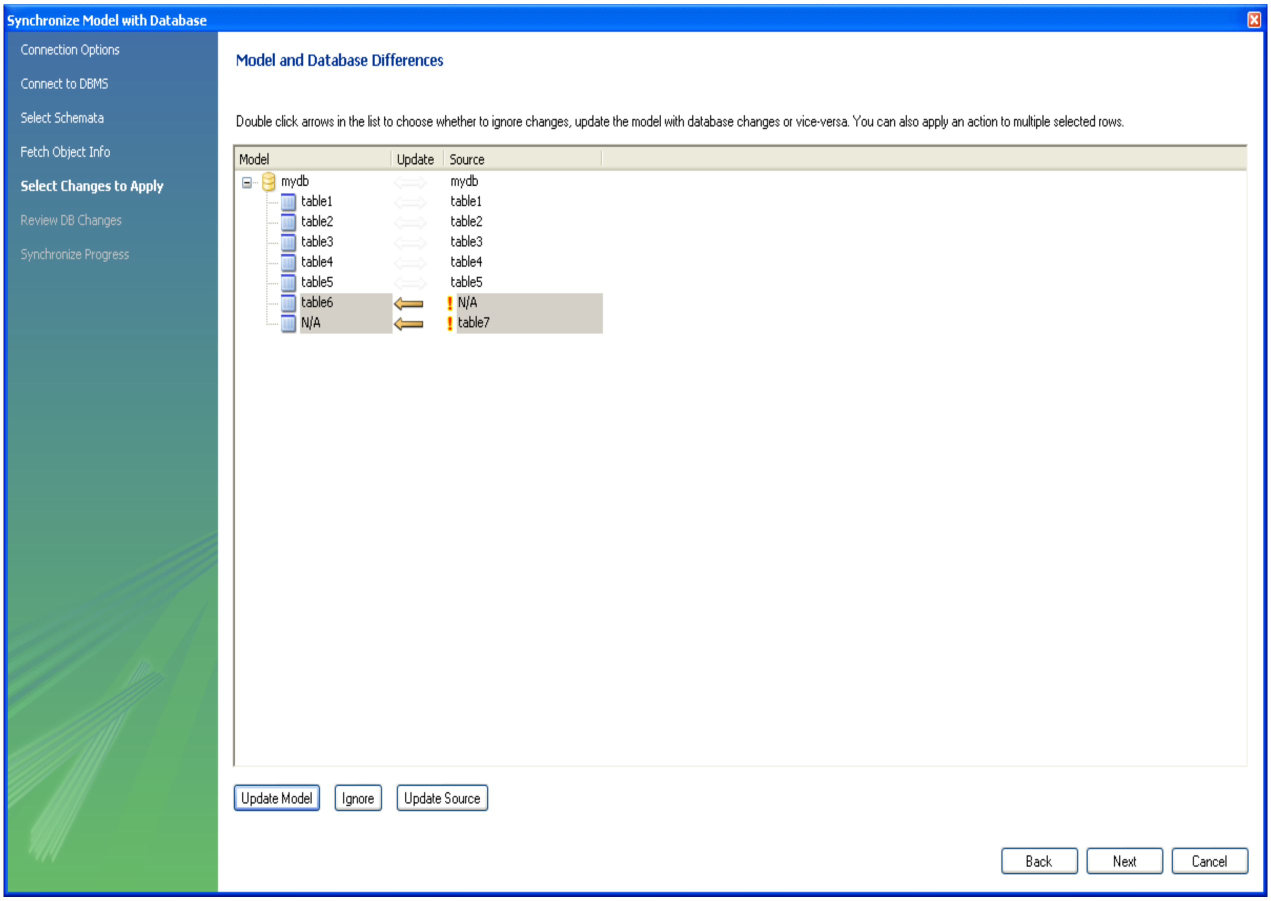
Figure 7.40. Controlling Synchronization Direction



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.

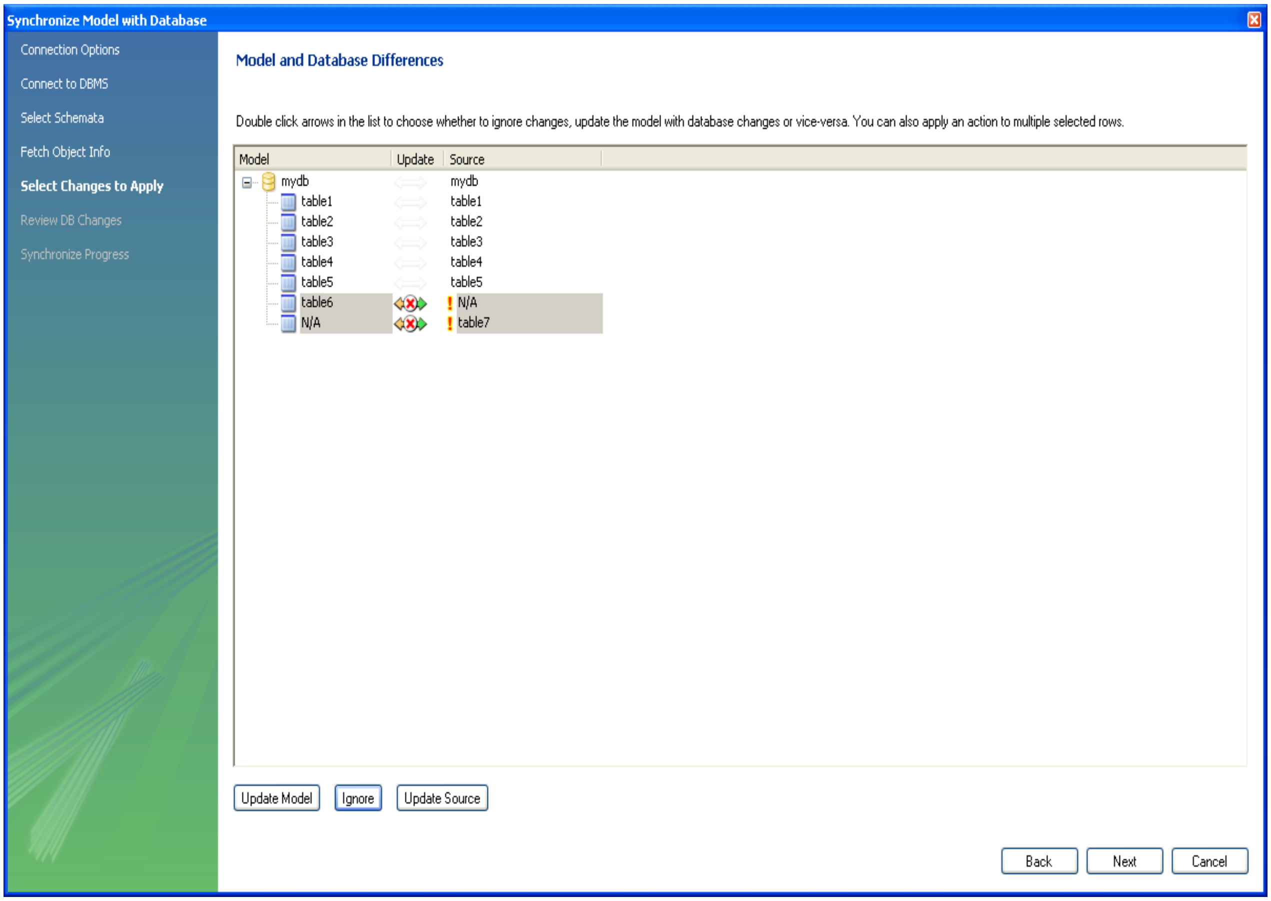
For convenience, the wizard provides three additional buttons to enable synchronization directions to be applied to a group of selected changes. The Update Model button causes the selected changes to be applied only to the model itself. In the following example, `table7` would be added to the model.

Figure 7.41. Update Model Button



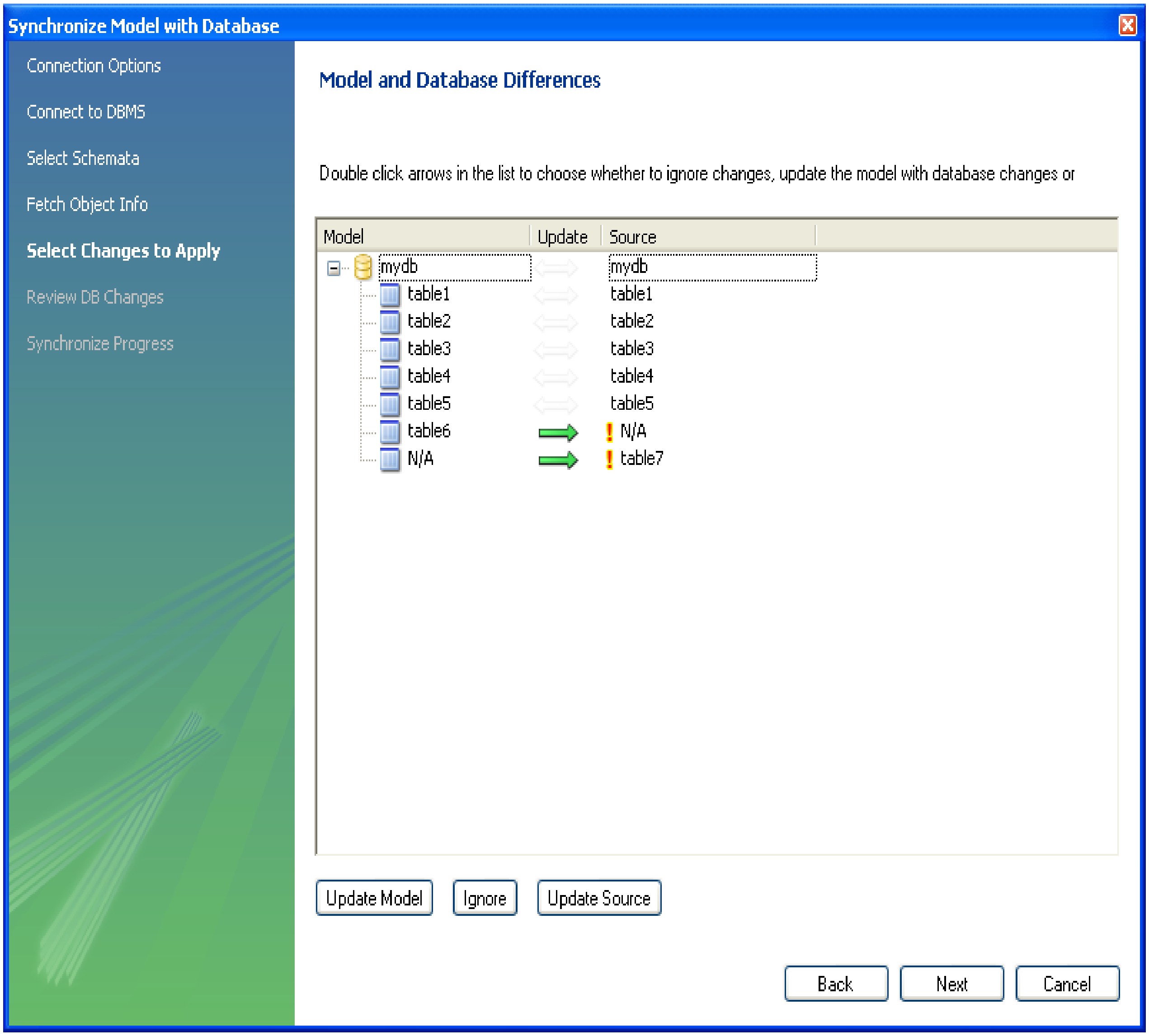
The Ignore button causes the selected changes to be ignored. No synchronization will take place for those changes. In the following example, no changes would take place.

Figure 7.42. Ignore Button



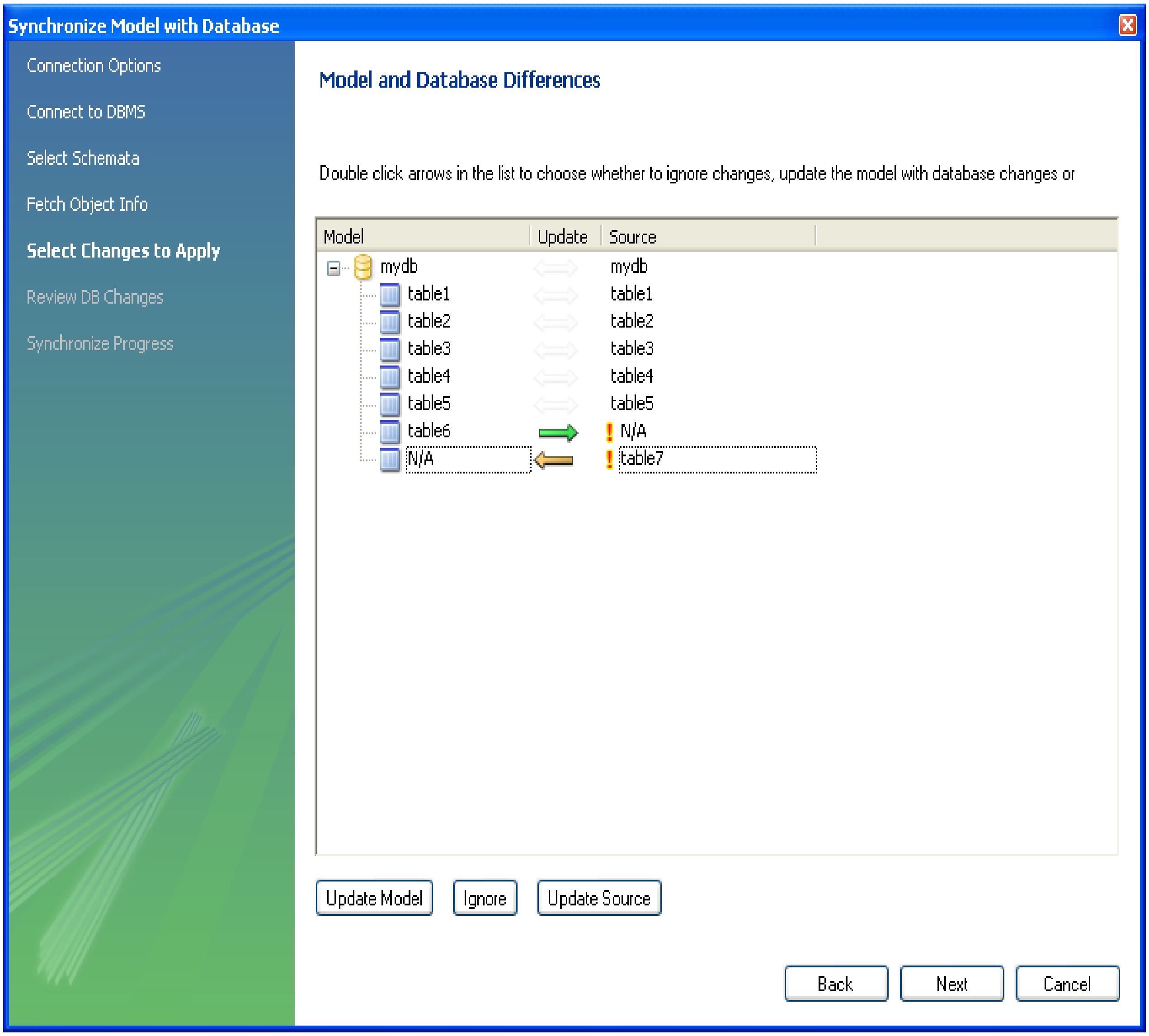
The Update Source button causes the selected changes to be applied only to the live database. In the following example, `table6` would be added to the live database and `table7` would be dropped from the live database.

Figure 7.43. Update Source Button



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.

Figure 7.44. Click Arrows to Change Direction of Synchronization

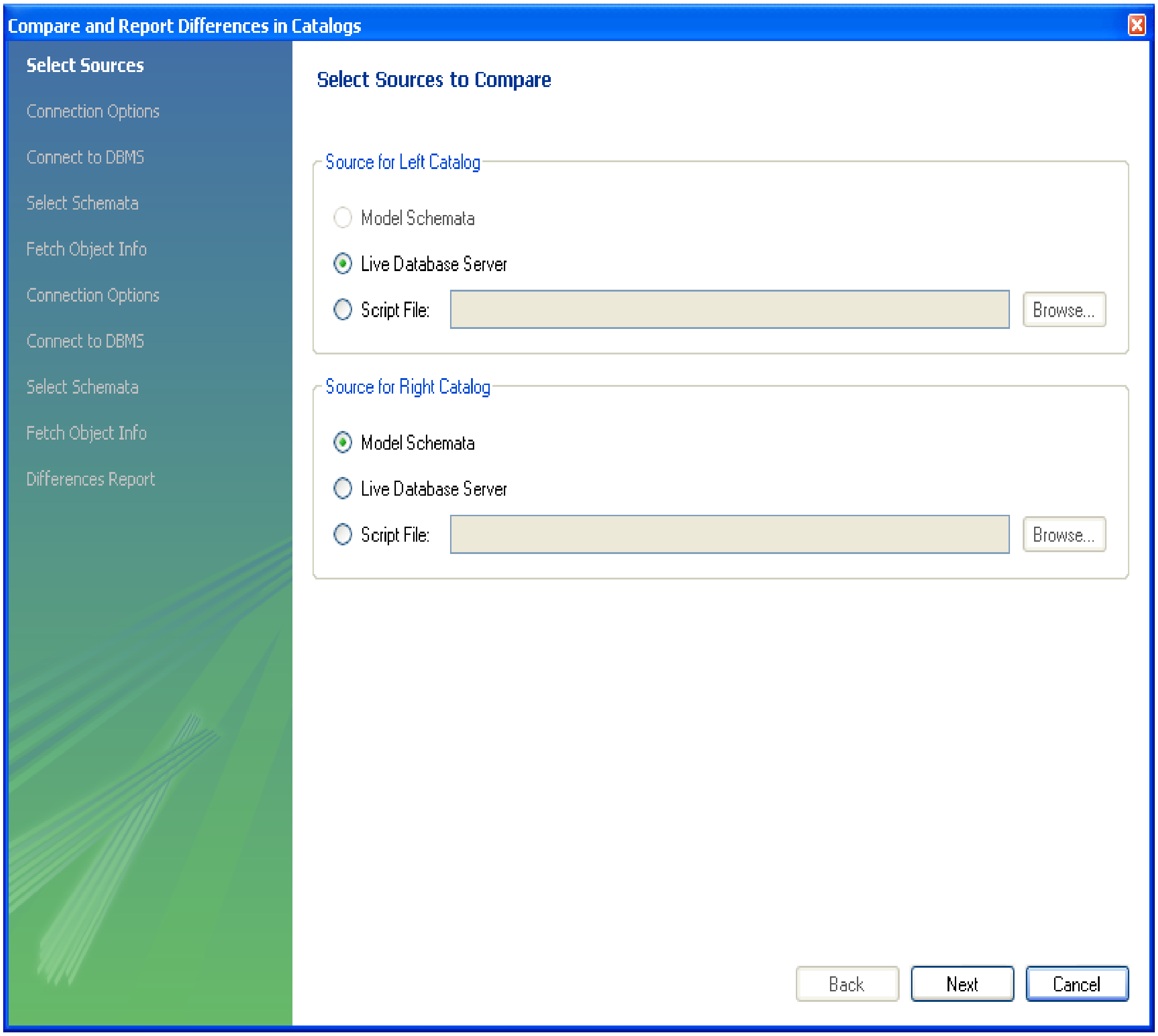


7.7.10.4. Creating a Catalog Diff Report

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.

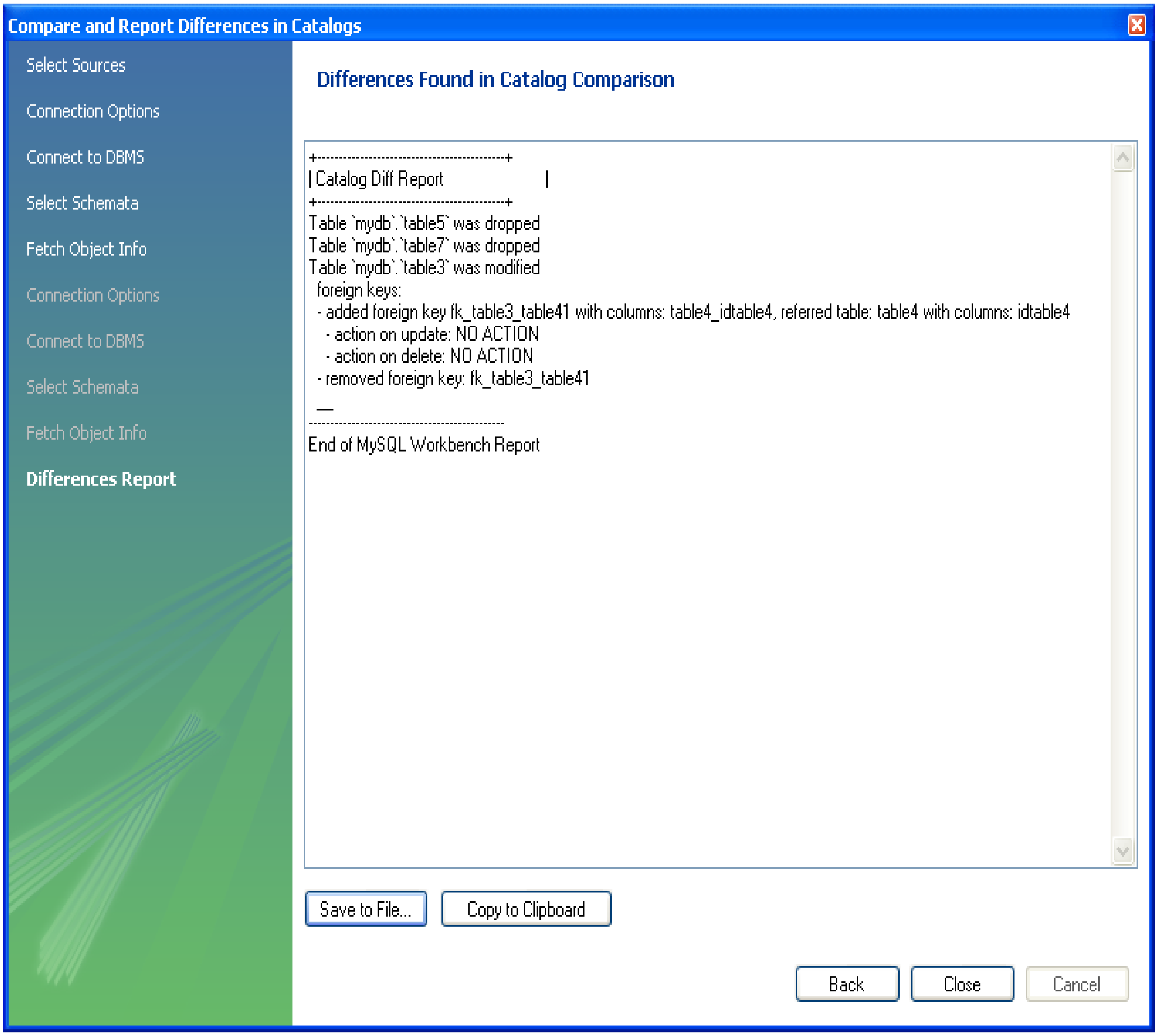
The first step in the wizard is to specify which catalogs to compare. For example, you may wish to compare your live database against your current MySQL Workbench model.

Figure 7.45. Catalog Sources



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.

Figure 7.46. Catalog Diff Report



7.8. 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 7.8.2, "Using the Default Schema" and exploring the graphic design capabilities of MySQL Workbench is touched upon in Section 7.8.3, "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.

7.8.1. 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 7.7.9.1, "Reverse Engineering Using a Create Script".

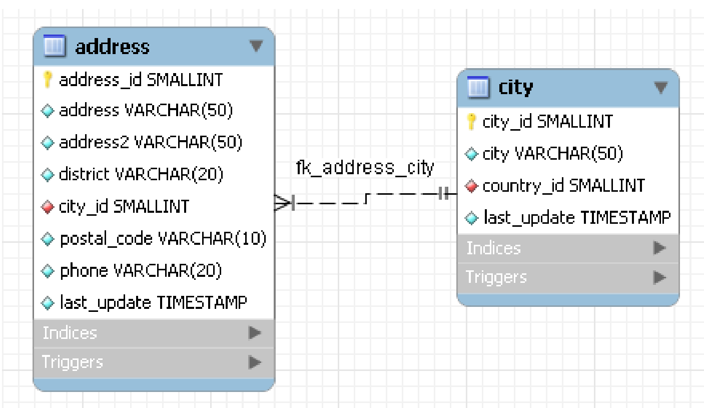
7.8.1.1. Adding an EER Diagram

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 7.47. 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 7.50, "The `sakila` Database EER Diagram".)

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.

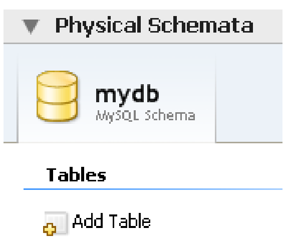
Changing the color of a table is a good way to identify a table quickly—something that becomes more important as the number of tables increases. Changing the color of a table is also an easy way to identify a table in the `Model Navigator` panel. This panel, the uppermost panel on the left side of the 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**.

7.8.2. 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 7.48. The Default Schema



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.

7.8.2.1. 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.

7.8.2.2. Creating Other Schema Objects

Additional objects such as views or routines can be added in the same way as tables.

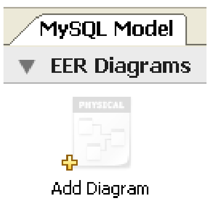
Any objects you have created can be found in the **Catalog** palette on the right. To view these schema objects, select the **Catalog** tab in the middle palette on the right. View all the objects by clicking the + button to the left of the schema name.

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**.

7.8.3. Basic Modeling

On the `MySQL Model` page, double-click the **Add Diagram** icon. This creates and opens a new `EER Diagram` canvas.

Figure 7.49. Adding an EER Diagram



From an EER diagram page you can graphically design a database.

7.8.3.1. 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.

7.8.3.2. 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**.

7.8.4. 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/ page, selecting the `Other Docs` tab, and looking in the `Example Databases` section

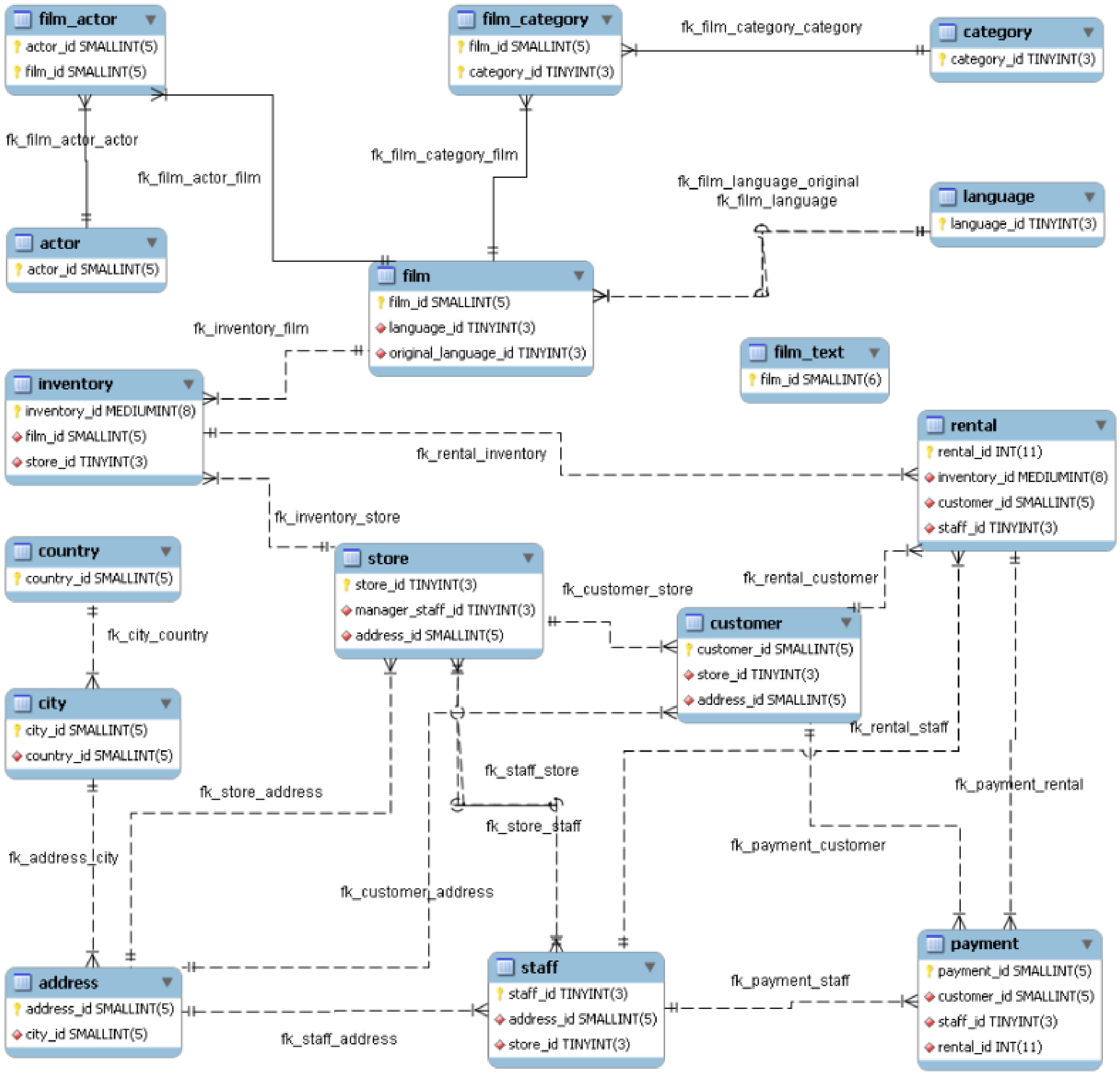
An EER diagram is an invaluable aid to a quick understanding of any database. There is no need to read through table definition statements; glancing at an EER diagram can immediately indicate that various tables are related.

You can also see how tables are related; what the foreign keys are and what the nature of the relationship is.

7.8.4.1. A PNG File of the `sakila` Database

Find following an EER digram showing all the tables in the `sakila` database. This image was created using the File, Export, Export as PNG... menu item.

Figure 7.50. The sakila Database EER Diagram



The object notation style used in Figure 7.50, "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.

7.9. 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 7.5.1.5.1, “The DBDoc Model Reporting Dialog Window (Commercial Version)”.

7.9.1. 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.

7.10. 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.

7.10.1. 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**
  - 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

7.10.2. 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

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

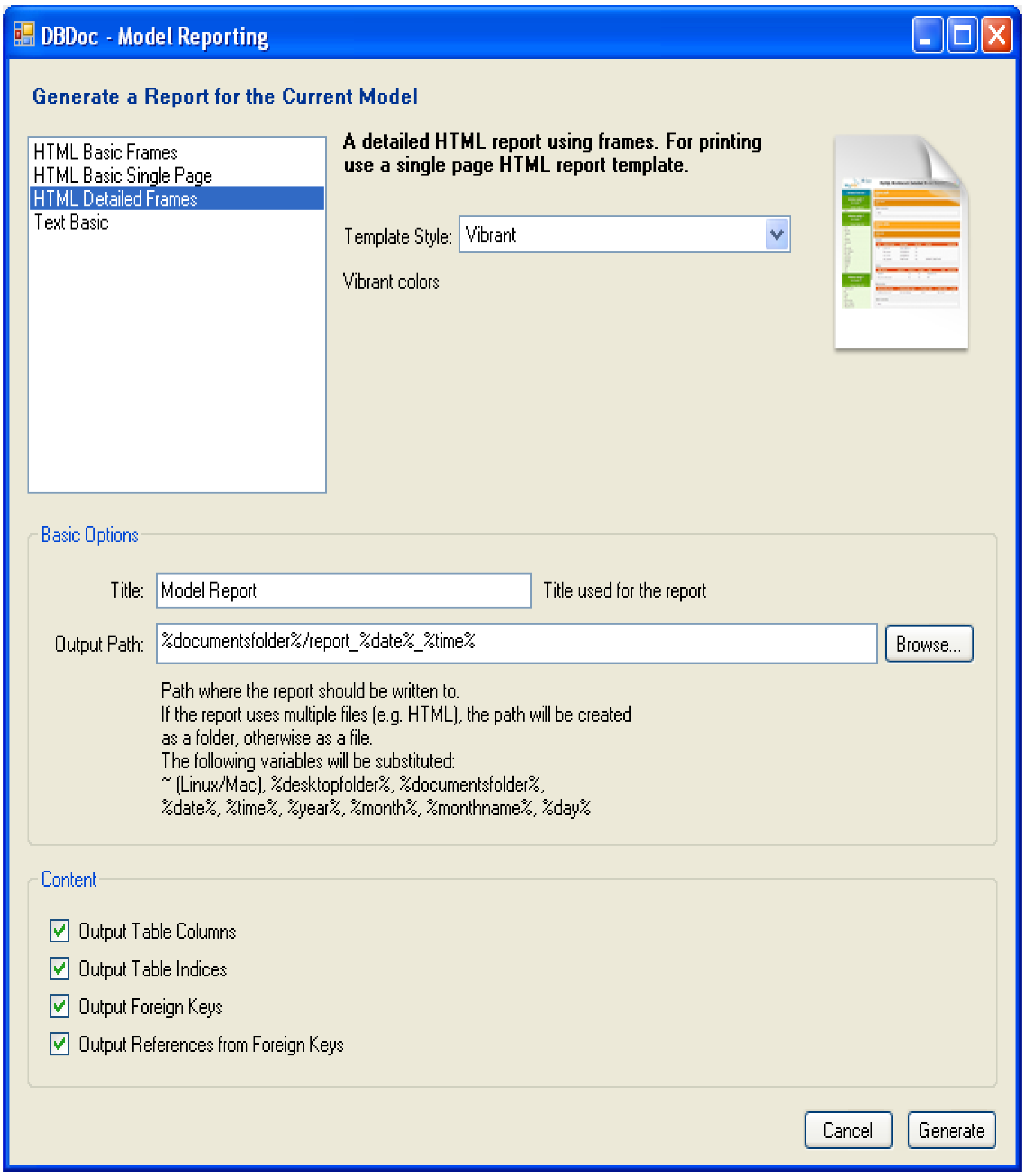
This dialog window is found by navigating to the Model menu and choosing the DBDoc - Model Reporting... item.

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.

Figure 7.51. The DBDoc Model Reporting Main Wizard



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.

Platform	Typical Default Documents Folder
Windows	`C:\Documents and Settings\`*`user_name`*`\My Documents`
Linux	`~/Documents`
Mac OS X	`Users/`*`user_name`*`/Documents`

- **%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.

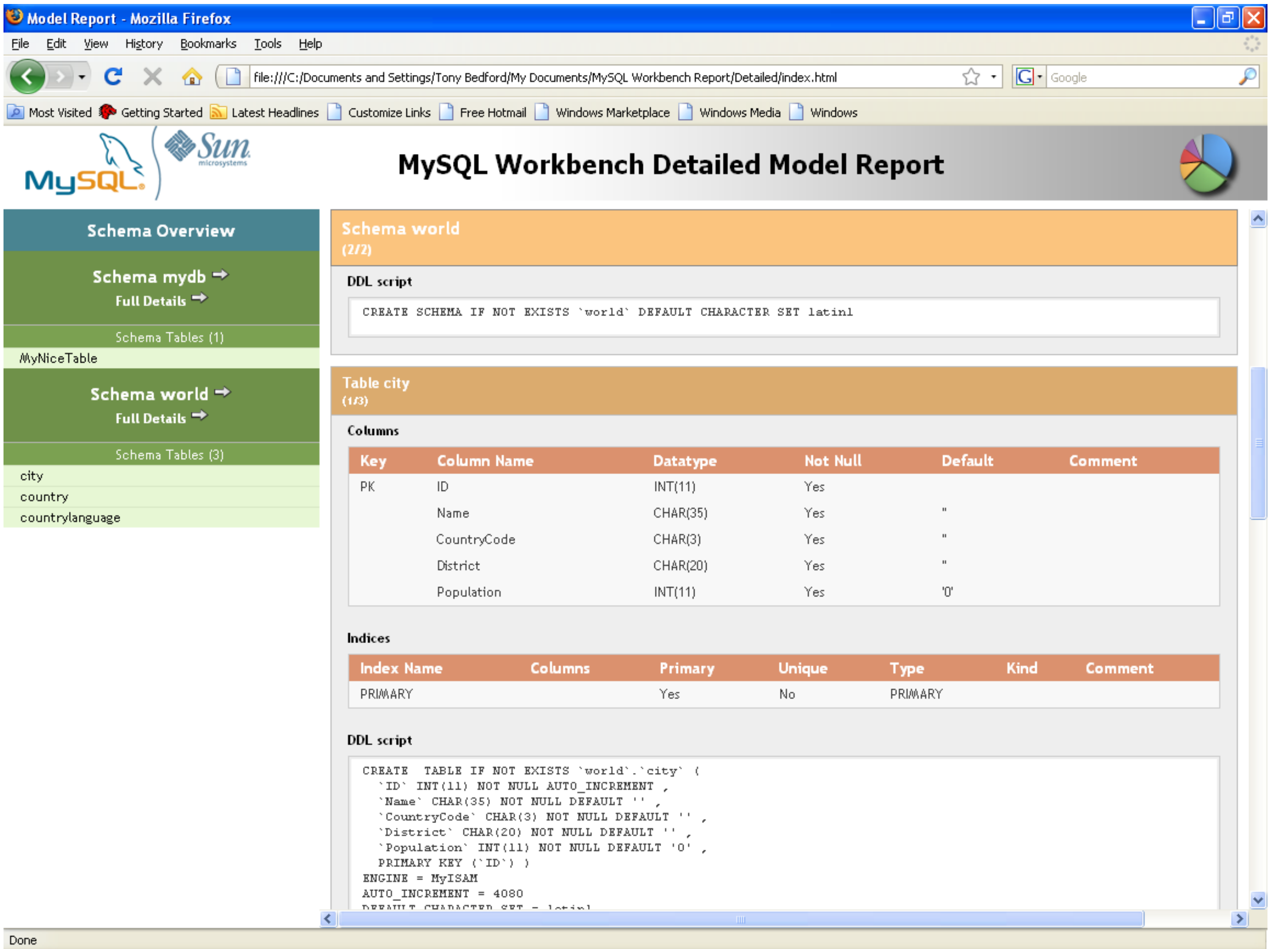
Choosing the `HTML Detailed Frames` option creates the following files:

- `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.
- `routine_details.html`: List of all routines for the schema.
- `table_details.html`: The main report details.
- `table_details_list.html`: A Schema overview along with details of columns, indexes and foreign keys for each schema.
- `table_element_details.html`: The details for every element of the table.
- `top.html`: The top frame of the report.
- `view_details.html`: List of all columns and indexes for the schema.

Choosing the `Text Basic` option creates a directory containing one text file.

You can click `index.html` to view a report. The following screenshot shows the `HTML Detailed Frames` report being displayed:

Figure 7.52. The DBDoc Model Report



If you wish to create custom templates please refer to Section 7.12, “Customizing DBDoc Model Reporting Templates”.

7.12. 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:

  ```
  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:

  ```
  {{#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 7.1. Data Dictionaries Tree

Data Dictionary	Loads Data Dictionary
MAIN	SCHEMATA
SCHEMATA	TABLES, COLUMNS (Detailed is true), FOREIGN_KEYS (Detailed is true), INDICES (Detailed is true)
TABLES	REL_LISTING, INDICES_LISTING, COLUMNS_LISTING, TABLE_COMMENT_LISTING, DDL_LISTING
COLUMNS_LISTING	COLUMNS (Detailed is false)
REL_LISTING	REL (Detailed is false)
INDICES_LISTING	INDICES (Detailed is false)

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 7.1, “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.

7.12.1. 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 7.2. Supported Template Markers

Marker text	Type	Data Dictionary or Parent Dictionary	Corresponding data
TITLE	Variable	MAIN	Title of the report
GENERATED	Variable	MAIN	Date and time when the report was generated
STYLE_NAME	Variable	MAIN	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
SCHEMA_COUNT	Variable	MAIN	The number of schemata in the model
PROJECT_TITLE	Variable	MAIN	Project title as set for the model in Document Properties
PROJECT_NAME	Variable	MAIN	Project name as set for the model in Document Properties
PROJECT_AUTHOR	Variable	MAIN	Project author as set for the model in Document Properties
PROJECT_VERSION	Variable	MAIN	Project version as set for the model in Document Properties
PROJECT_DESCRIPTION	Variable	MAIN	Project description as set for the model in Document Properties
PROJECT_CREATED	Variable	MAIN	Automatically set for the model project, but as displayed in Document Properties
PROJECT_CHANGED	Variable	MAIN	Automatically set for the model project, but as displayed in Document Properties
TOTAL_TABLE_COUNT	Variable	MAIN	The number of tables in all schemata in the model

Marker text	Type	Data Dictionary or Parent Dictionary	Corresponding data
TOTAL_COLUMN_COUNT	Variable	MAIN	The number of columns in all tables in all schemata in the model
TOTAL_INDEX_COUNT	Variable	MAIN	The number of indexes in the model
TOTAL_FK_COUNT	Variable	MAIN	The number of foreign keys in the model
SCHEMATA	Section	MAIN	Used to mark the start and end of a SCHEMATA section; the SCHEMATA data dictionary becomes active in this section
SCHEMA_NAME	Variable	SCHEMATA	The schema name
SCHEMA_ID	Variable	SCHEMATA	The schema ID
TABLE_COUNT	Variable	SCHEMATA	The number of tables in the current schema
COLUMN_COUNT	Variable	SCHEMATA	The number of columns in the current schema
INDICES_COUNT	Variable	SCHEMATA	The number of indexes in the current schema
FOREIGN_KEYS_COUNT	Variable	SCHEMATA	The number of foreign keys in the current schema
TABLES	Section	SCHEMATA	Marks the start and end of a TABLES section; the TABLES data dictionary becomes active in this section
TABLE_NAME	Variable	TABLES	The table name
TABLE_ID	Variable	TABLES	The table ID
COLUMNS_LISTING	Section	TABLES	Marks the start and end of a COLUMNS_LISTING section; the COLUMNS_LISTING data dictionary becomes active in this section
COLUMNS	Section	COLUMNS_LISTING	Marks the start and end of a COLUMNS section; the COLUMNS data dictionary becomes active in this section
COLUMN_KEY	Variable	COLUMNS	Whether the column is a primary key
COLUMN_NAME	Variable	COLUMNS	The column name
COLUMN_DATATYPE	Variable	COLUMNS	The column data type
COLUMN_NOTNULL	Variable	COLUMNS	Whether the column permits `NULL` values
COLUMN_DEFAULTVALUE	Variable	COLUMNS	The column default value

Marker text	**Type**	**Data Dictionary or Parent Dictionary**	**Corresponding data**
COLUMN_COMMENT	Variable	COLUMNS	The column comment
COLUMN_ID	Variable	COLUMNS	The column ID
COLUMN_KEY_PART	Variable	COLUMNS (if detailed)	The column key type
COLUMN_NULLABLE	Variable	COLUMNS (if detailed)	Can the column contain `NULL` values
COLUMN_AUTO_INC	Variable	COLUMNS (if detailed)	Does the column auto-increment
COLUMN_CHARSET	Variable	COLUMNS (if detailed)	The column character set
COLUMN_COLLATION	Variable	COLUMNS (if detailed)	The column collation
COLUMN_IS_USERTYPE	Variable	COLUMNS (if detailed)	Whether the column is a user type
INDICES_LISTING	Section	TABLES	Marks the start and end of an INDICES_LISTING section; the INDICES_LISTING data dictionary becomes active in this section
INDICES	Section	INDICES_LISTING	Marks the start and end of an INDICES section; the INDICES data dictionary becomes active in this section
INDEX_NAME	Variable	INDICES	The index name
INDEX_PRIMARY	Variable	INDICES	Whether this is a primary key
INDEX_UNIQUE	Variable	INDICES	Whether this is a unique index
INDEX_TYPE	Variable	INDICES	The index type; for example, PRIMARY
INDEX_KIND	Variable	INDICES	The index kind
INDEX_COMMENT	Variable	INDICES	The index comment
INDEX_ID	Variable	INDICES	The index ID
INDEX_COLUMNS	Section	INDICES	Marks the start and end of an INDEX_COLUMNS section; the INDEX_COLUMNS data dictionary becomes active in this section
INDEX_COLUMN_NAME	Variable	INDEX_COLUMNS	The index column name
INDEX_COLUMN_ORDER	Variable	INDEX_COLUMNS	The index column order; for example, ascending, descending
INDEX_COLUMN_COMMENT	Variable	INDEX_COLUMNS	The index comment
INDEX_KEY_BLOCK_SIZE	Variable	INDEX_COLUMNS (if detailed)	The index key-block size
REL_LISTING	Section	TABLES	Marks the start and end of a REL_LISTING section; the

Marker text	Type	Data Dictionary or Parent Dictionary	Corresponding data
			REL_LISTING data dictionary becomes active in this section
REL	Section	REL_LISTING	Marks the start and end of a REL section; the REL data dictionary becomes active in this section
REL_NAME	Variable	REL, FOREIGN_KEYS	The relationship name
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 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

7.12.2. 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 version="1.0"?>
<data>
  <value type="object" struct-name="workbench.model.reporting.TemplateInfo"
  id="{BD6879ED-814C-4CA3-A869-9864F83B88DF}" struct-checksum="0xb46b524d">
    <value type="string" key="description">
      A basic TEXT report listing schemata and objects.
    </value>
    <value type="string" key="name">HTML Basic Frame 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="{7550655C-CD4B-4EB1-8FAB-AAEE49B2261E}" struct-checksum="0xab08451b">
        <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 type="string" key="mainFileName">report.txt</value>
  </value>
</data>
```

   The file defines wwo 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="{39e3b767-a832-4016-8753-b4cb93aa2dd6}" struct-checksum="0xab08451b">
        <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 type="string" key="mainFileName">custom_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_NR}}. Schema: {{SCHEMA_NAME}}
----------------------------------------------
## Tables ({{TABLE_COUNT}}) ##
{{#TABLES}}{{TABLE_NR_FMT}}. Table: {{TABLE_NAME}}
{{#COLUMNS_LISTING}}## Columns ##
Key  Column  Name  Datatype  Not Null  Default  Comment
{{#COLUMNS}}{{COLUMN_KEY}}{{COLUMN_NAME}}{{COLUMN_DATATYPE}} »
{{COLUMN_NOTNULL}}{{COLUMN_DEFAULTVALUE}}{{COLUMN_COMMENT}}
{{/COLUMNS}}{{/COLUMNS_LISTING}}
{{#INDICES_LISTING}}## Indices ##
Index  Name  Columns  Primary  Unique  Type  Kind  Comment
{{#INDICES}}{{INDEX_NAME}}{{#INDICES_COLUMNS}}{{INDEX_COLUMN_NAME}} »
{{INDEX_COLUMN_ORDER}}{{INDEX_COLUMN_COMMENT}}{{/INDICES_COLUMNS}} »
{{INDEX_PRIMARY}}{{INDEX_UNIQUE}}{{INDEX_TYPE}}{{INDEX_KIND}}{{INDEX_COMMENT}}
{{/INDICES}}{{/INDICES_LISTING}}
{{#REL_LISTING}}## Relationships ##
Relationship  Name  Relationship  Type  Parent Table  Child Table Cardinality
{{#REL}}{{REL_NAME}}{{REL_TYPE}}{{REL_PARENTTABLE}}{{REL_CHILDTABLE}}{{REL_CARD}}
{{/REL}}{{/REL_LISTING}}
---------------------------------------------

{{/TABLES}}
{{/SCHEMATA}}
=============================================
End of MySQL Workbench Report
```

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_COUNT}}) ##

{{#TABLES}}
Table Name: {{TABLE_NAME}}
{{/TABLES}}
{{/SCHEMATA}}

Report Generated On: {{GENERATED}}
=============================================
End of MySQL Workbench Custom Report
```

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 8. Generating code overview

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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.

8.1. 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.

8.2. 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:

   ```
   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 9. Server Administration

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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.

9.1. 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 9.7, “Server Administration and Configuration”.

9.2. 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 9.6.1, “New Server Instance Wizard”.

9.3. 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 9.7.6, “The Data Dump Tab”.

9.4. 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 9.7.3, “The Accounts Tab”.

9.5. 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 9.6, “Creating and Managing Server Instances”.

9.6. 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 9.6.1, “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 9.6.2, “Manage Server Instances Dialog”.

9.6.1. 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 6.6, “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.

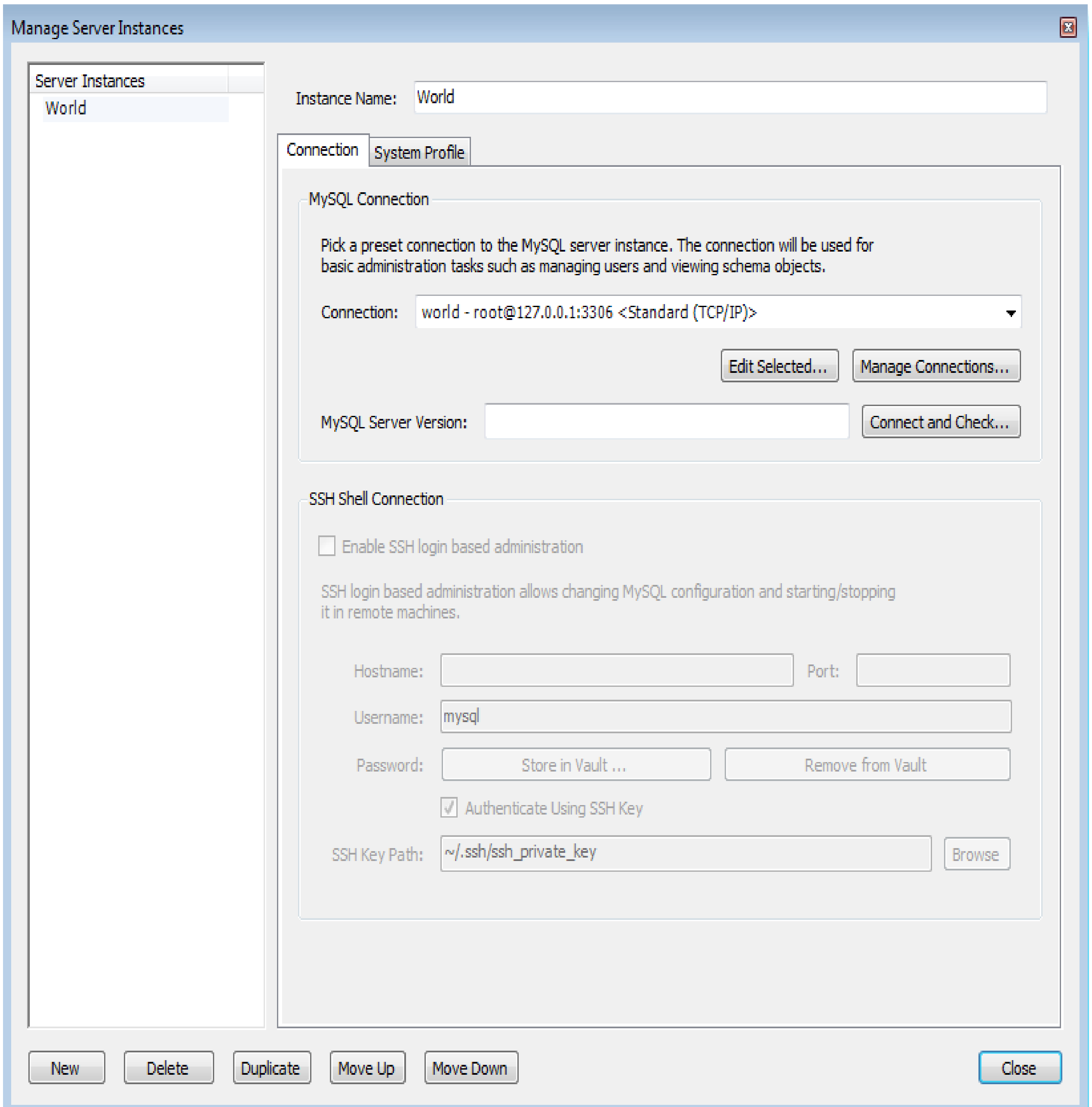
Complete Setup

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.

9.6.2. 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.

Figure 9.1. Manage Server Instances Dialog

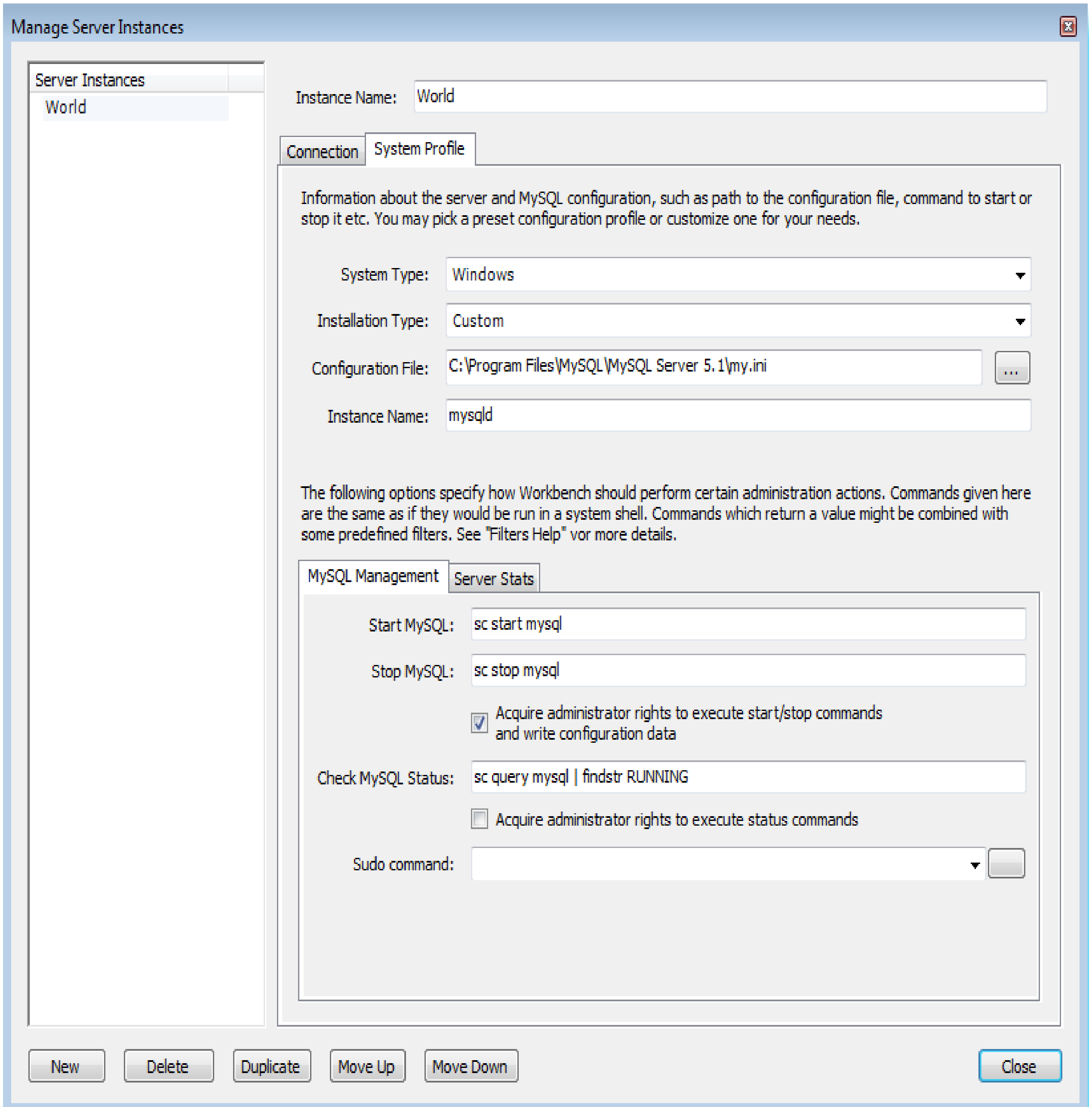


The **System Profile** tab of the wizard enables you to specify server-specific information. This is achieved primarily through selecting a Profile Template. A Profile Template contains standard information used in managing the server instance. The following Profile Templates are available:

- 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)
- 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 9.2. 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, **Server Status** and **Configuration**. The **Configuration** panel features multiple tabs: **Startup**, **Configuration**, **Accounts**, **Connections**, **Variables**, **Data Dump**, and **Logs**.

9.7. 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

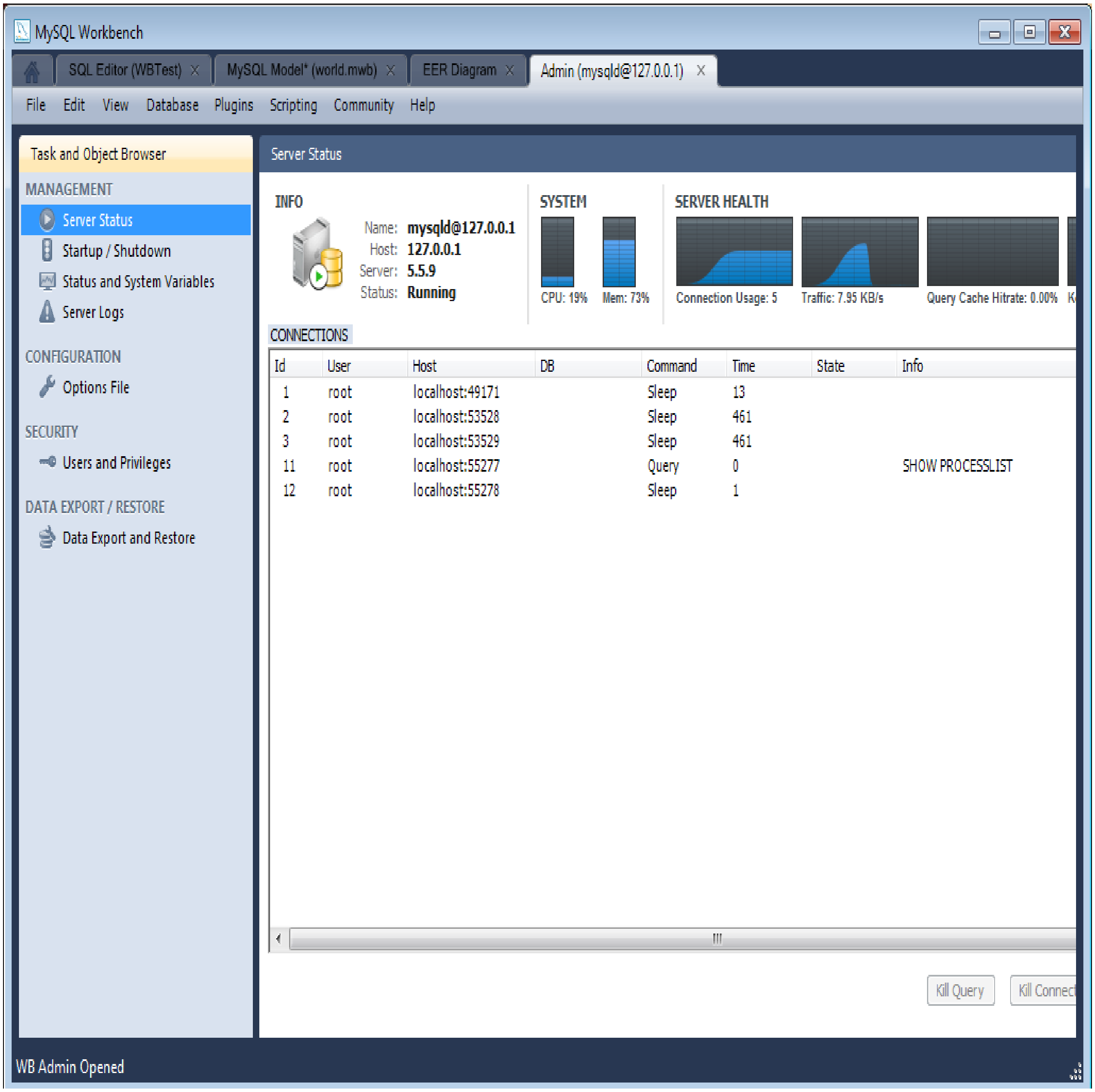
The Administrator also displays system and server status. System status includes:

- CPU utilization
- Memory usage
- Connection Health

For server health, the following are displayed:

- Connection Usage
- Traffic
- Query Cache Hit Rate
- Key Efficiency

Figure 9.3. MySQL Workbench - Admin Page

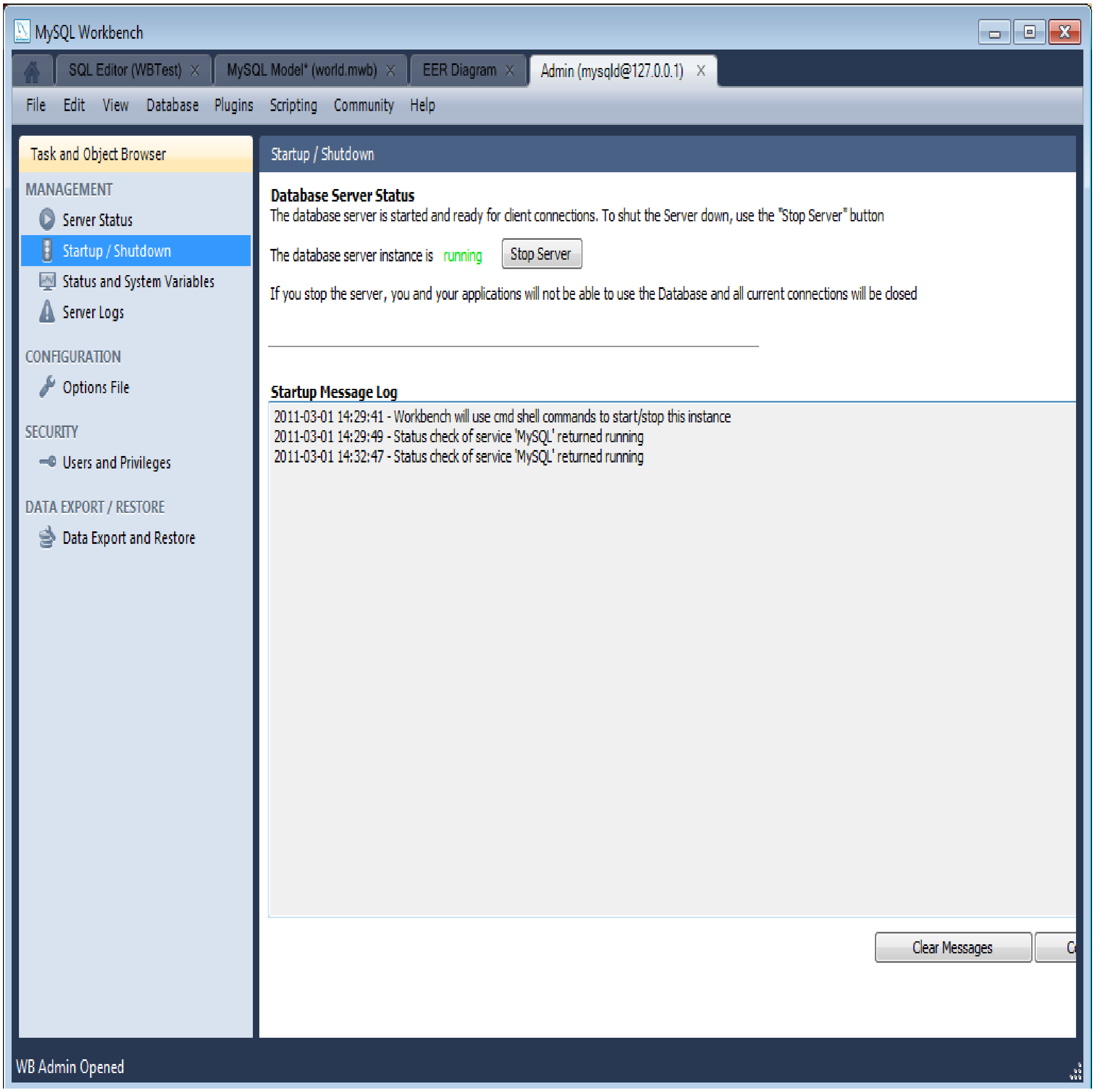


9.7.1. The Startup Tab

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

Figure 9.4. Administrator - Startup Tab



9.7.2. The Configuration Tab

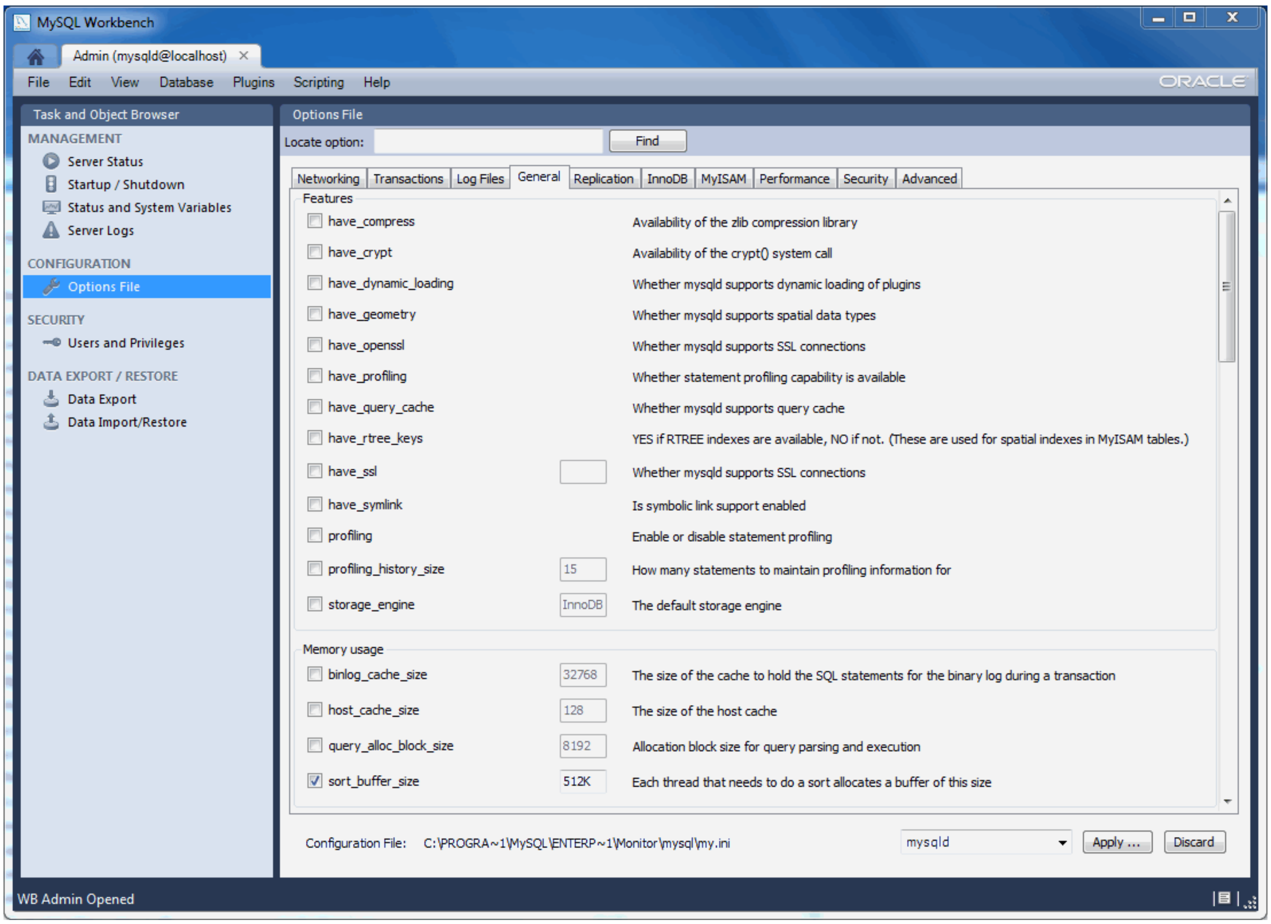
The Configuration tab enables you to edit the `my.ini` or `my.cnf` configuration file by selecting check boxes and other GUI controls. This tab also features a number of subtabs, which provide access to various sub-sections within the configuration file. The subtabs are:

- General
- MyISAM
- InnoDB
- Performance

- Log Files
- Replication
- Networking
- Security
- Advanced

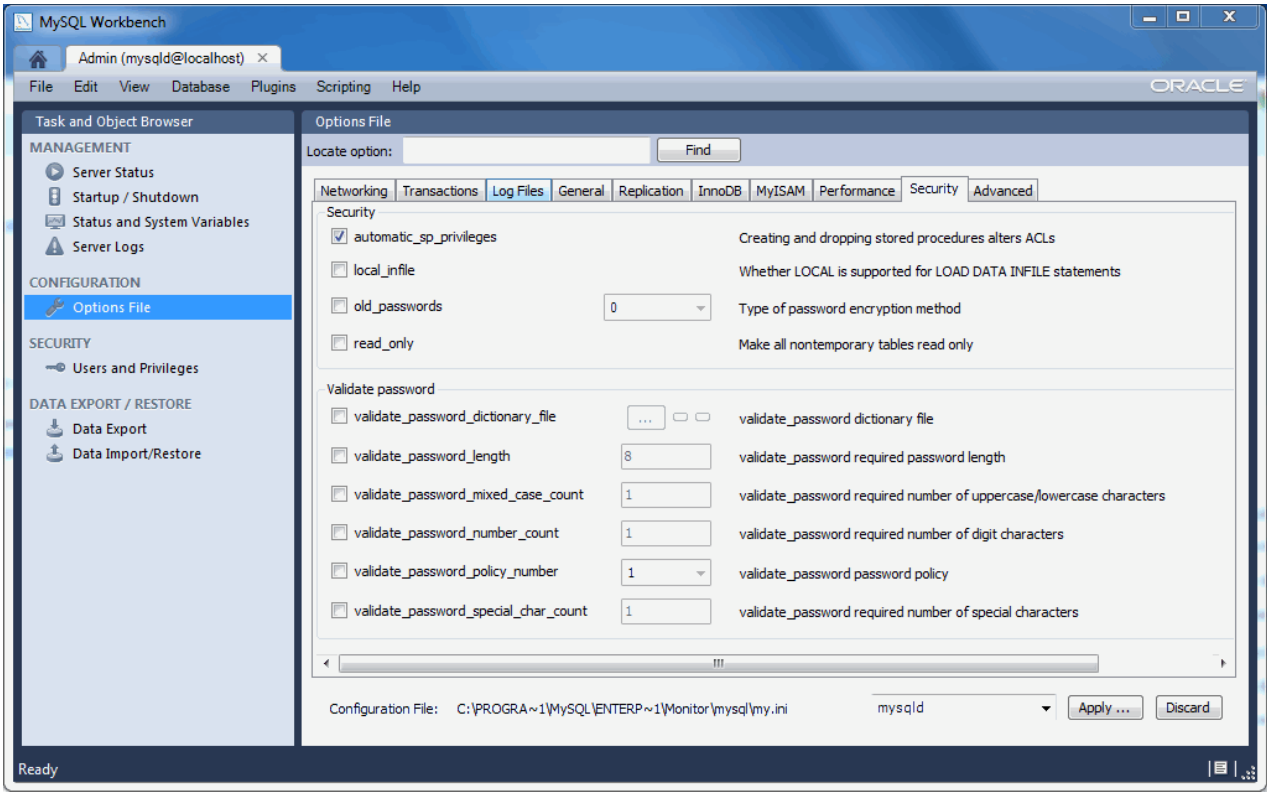
General Tab

Figure 9.5. Administrator - Configuration - General Tab



Security Tab

Figure 9.6. Administrator - Configuration - 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.

9.7.3. The Accounts Tab

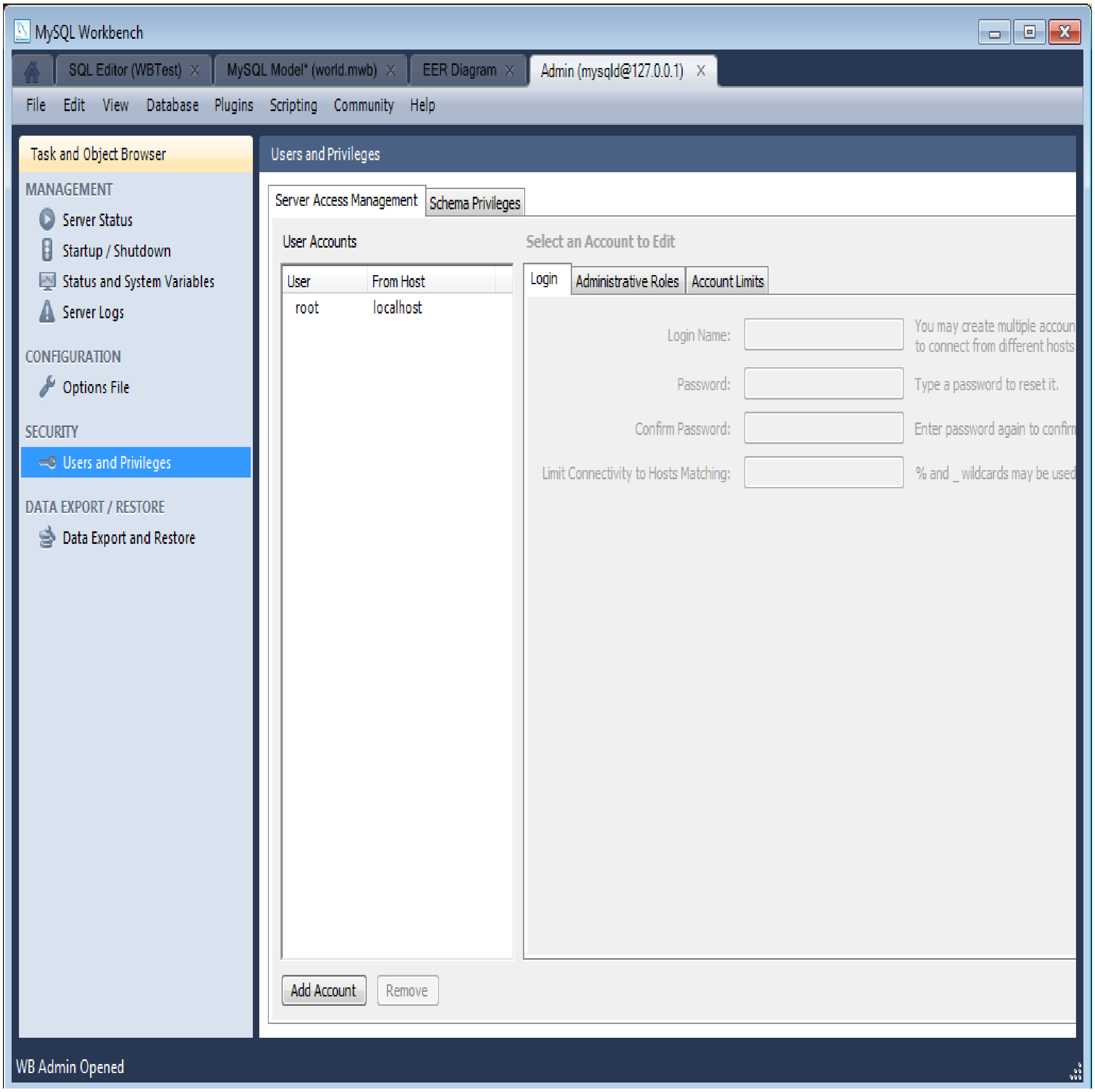
The Accounts tab has two subtabs:

- 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.

Figure 9.7. Administrator - Accounts Tab



> **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.

9.7.3.1. 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`.

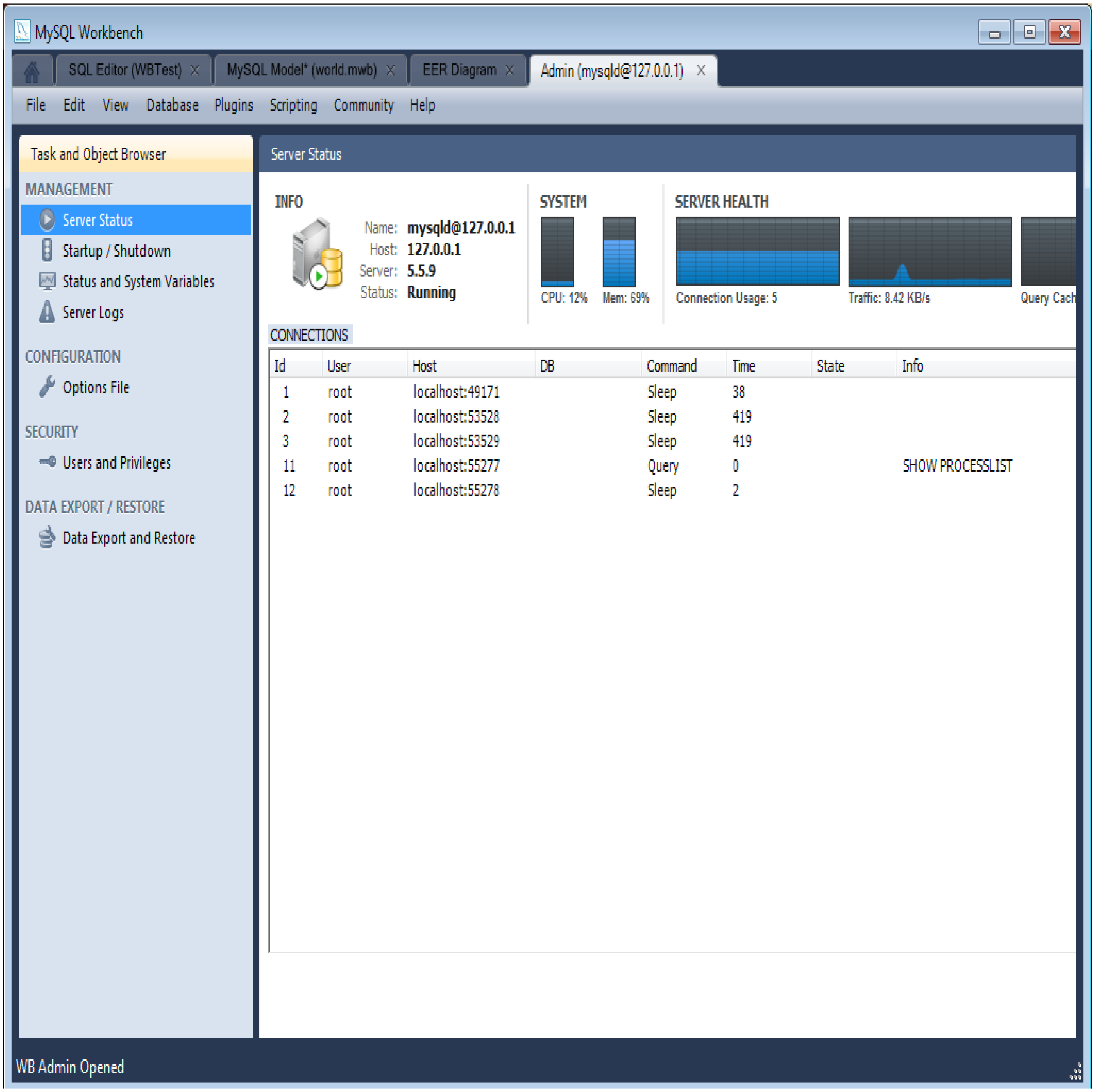
These roles are available:

- **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

9.7.4. The Connections Tab

The Connections tab lists all current connections to the monitored server.

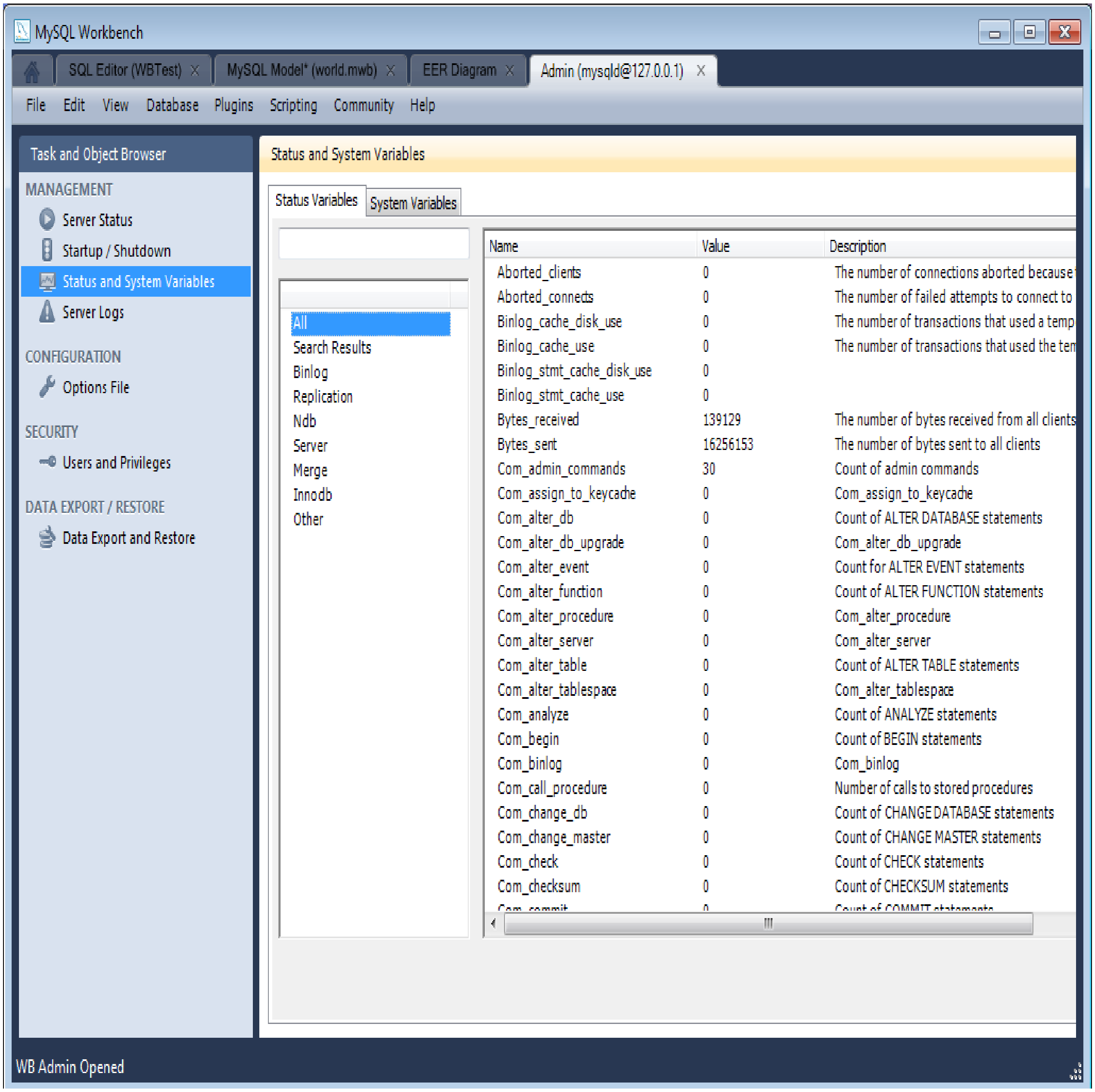
Figure 9.8. Administrator - Connections Tab



9.7.5. The Variables Tab

The Variables tab displays a list of all server and status variables.

Figure 9.9. Administrator - Variables Tab



9.7.6. 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.

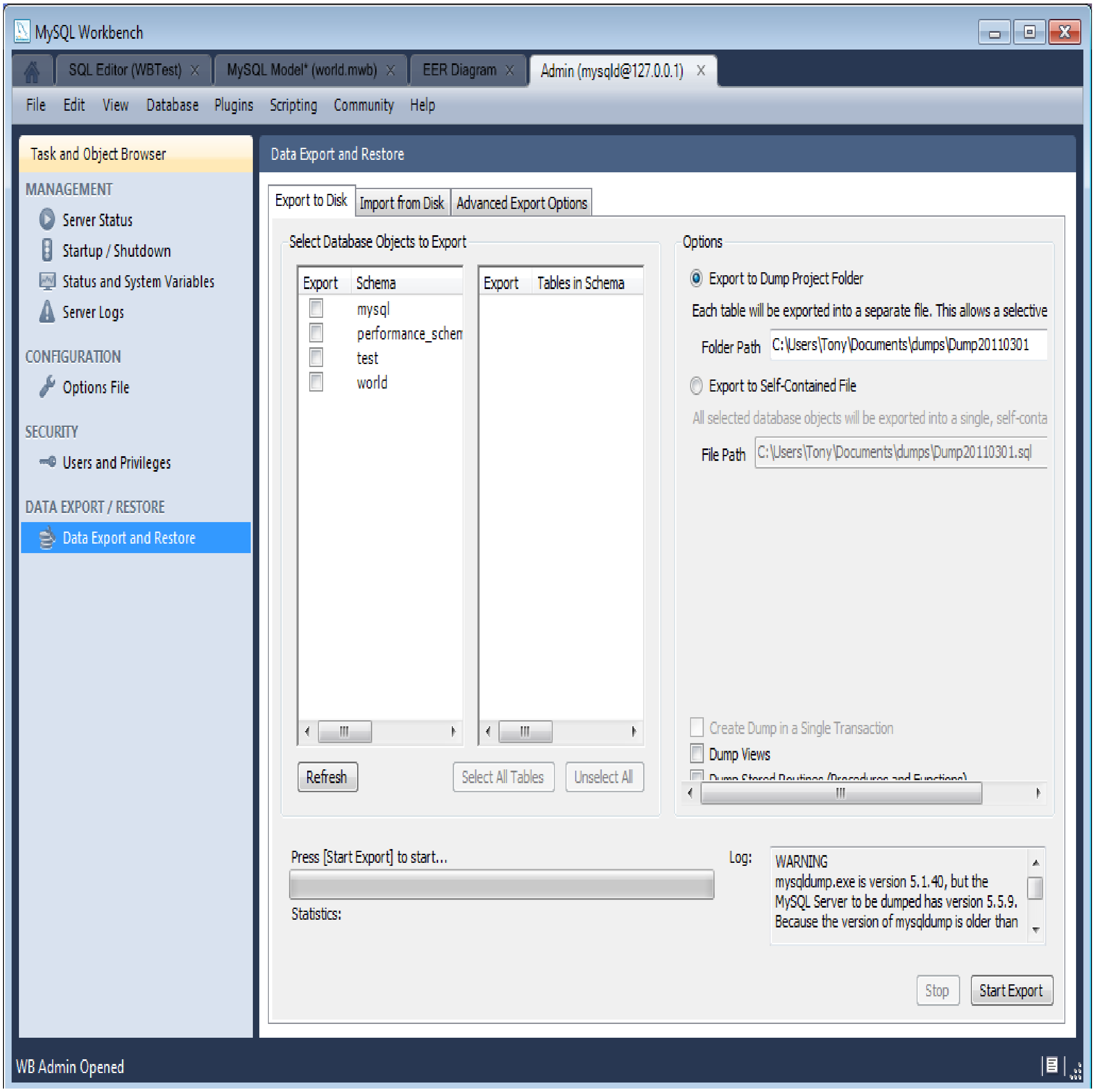
Within the Data Dump tab are three further tabbed windows:

- Export to Disk
- Import from Disk
- Advanced Options

9.7.6.1. 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.

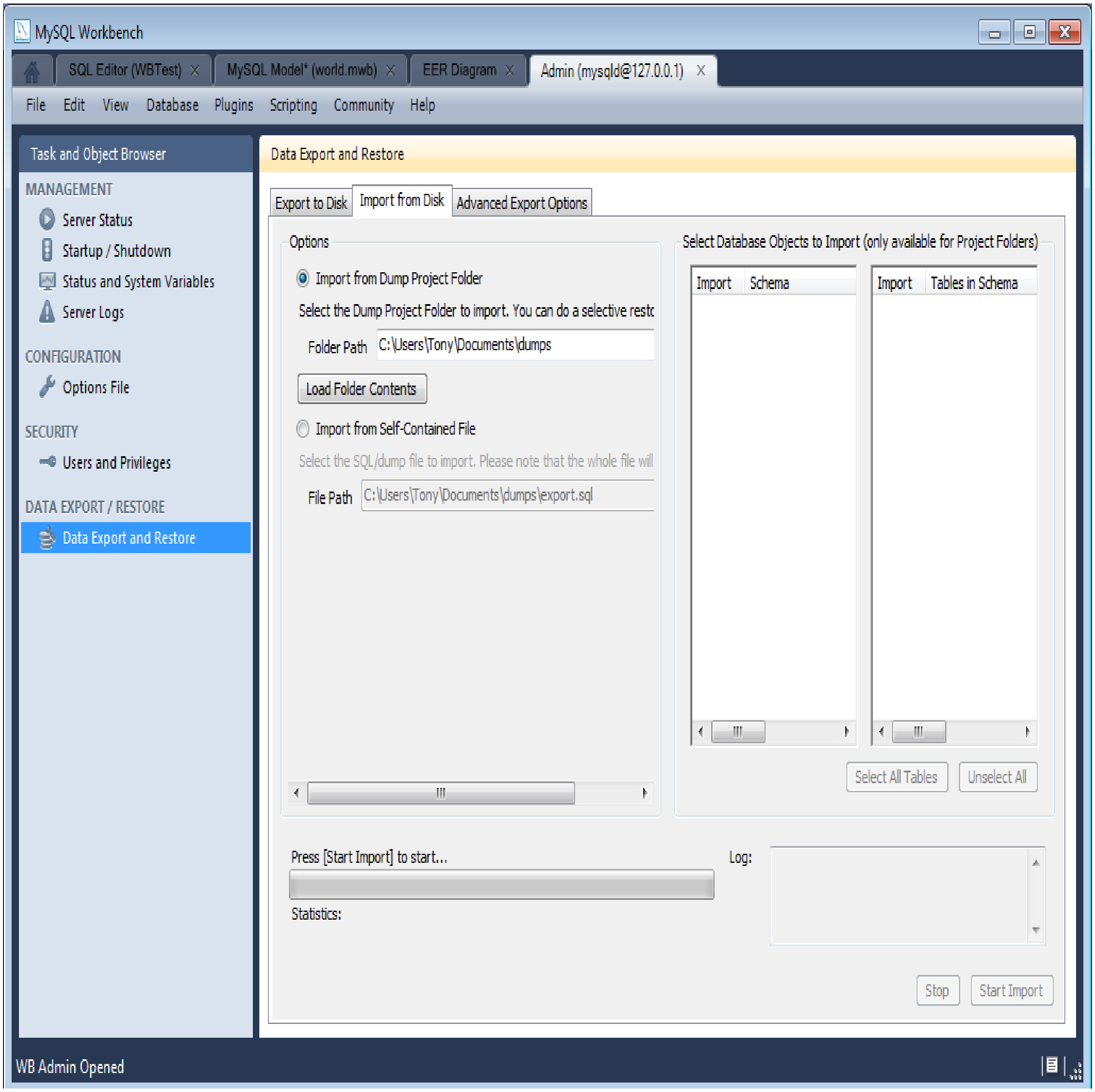
Figure 9.10. Administrator - Export to Disk



9.7.6.2. 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.

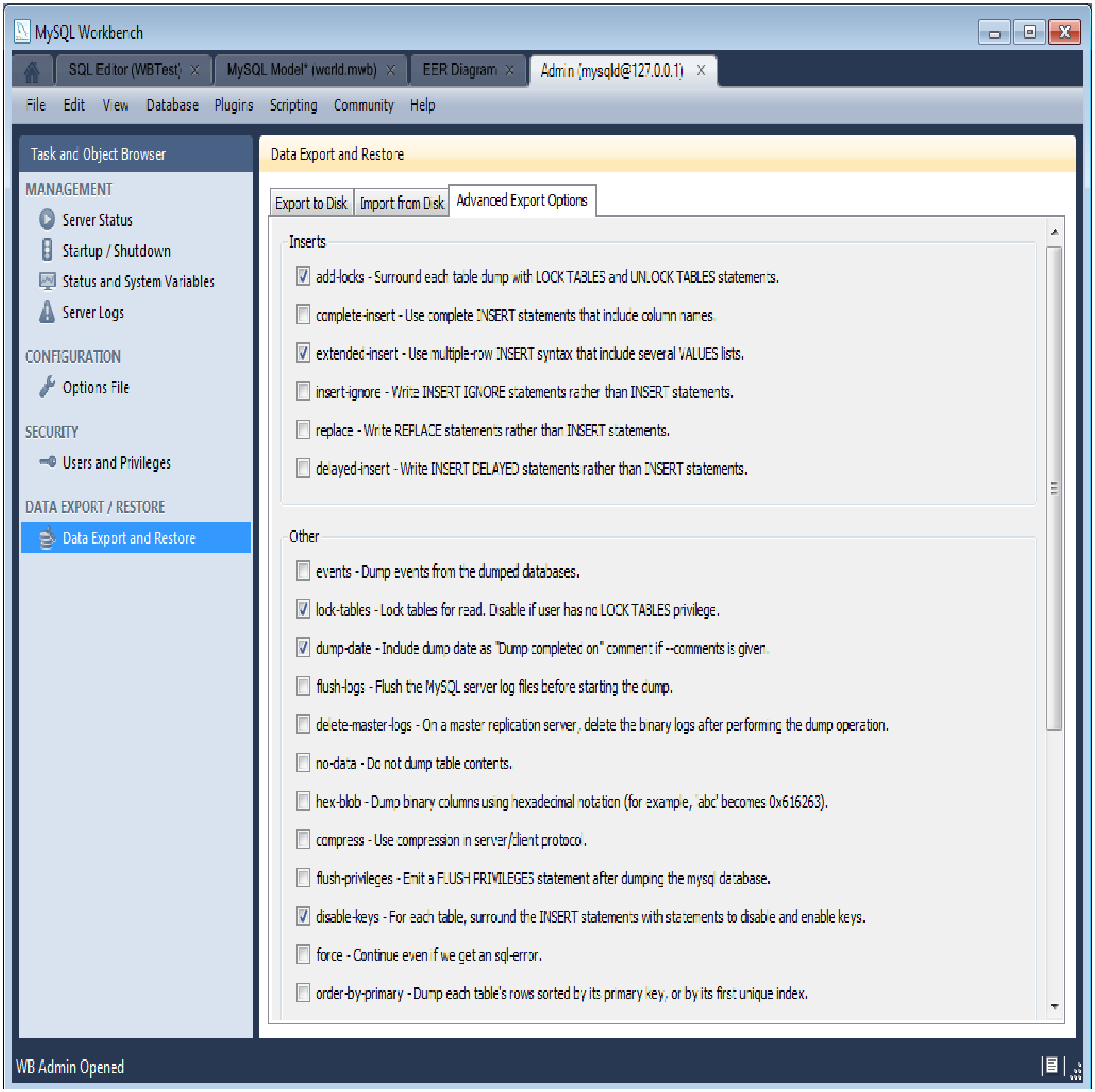
Figure 9.11. Administrator - Import from Disk



9.7.6.3. 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.

Figure 9.12. Administrator - Advanced Options



9.7.7. The Logs Tab

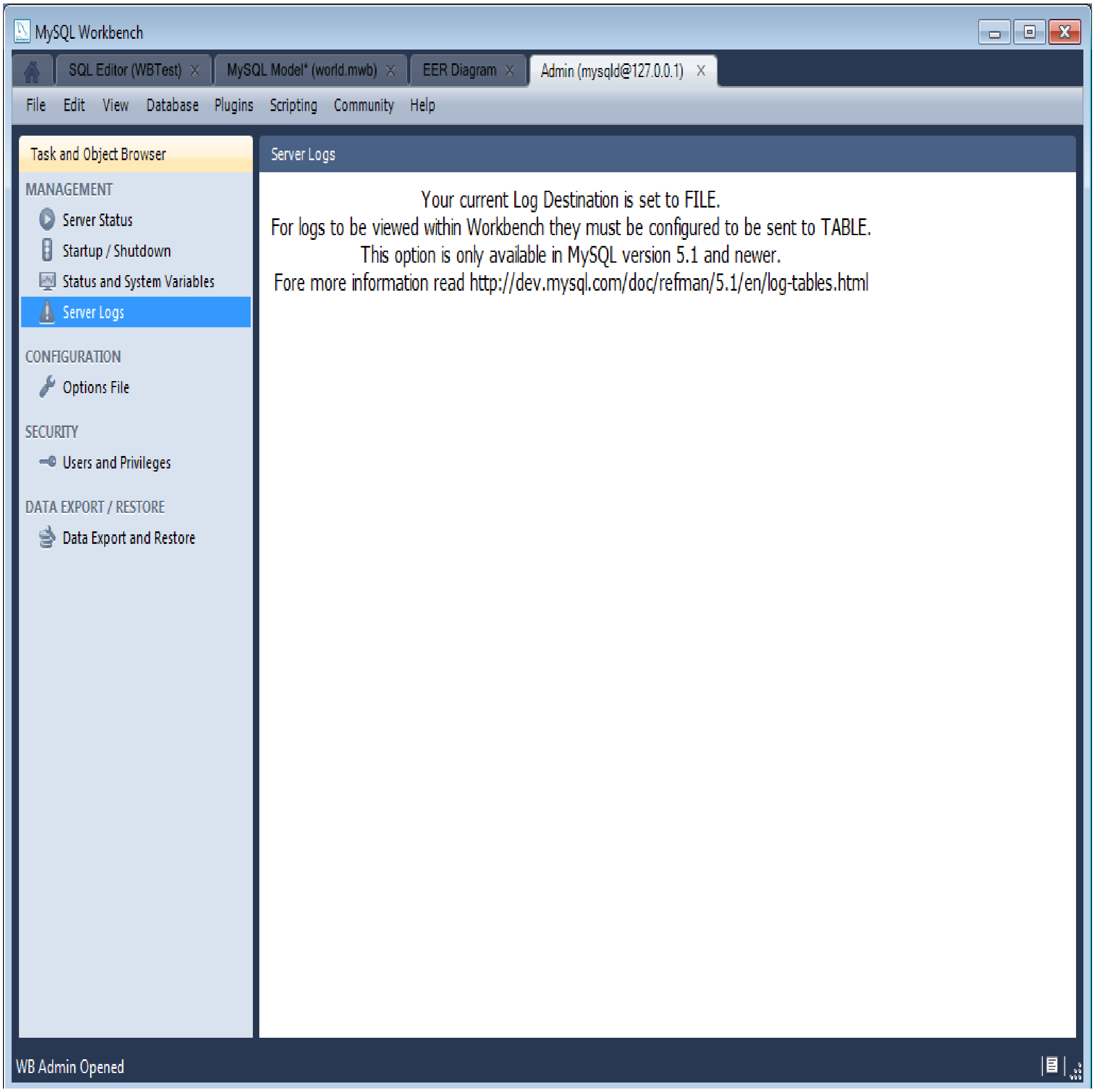
The Logs tab features two subtabs:

- 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 9.13. Administrator - Logs Tab



Chapter 10. Database Migration Wizard

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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

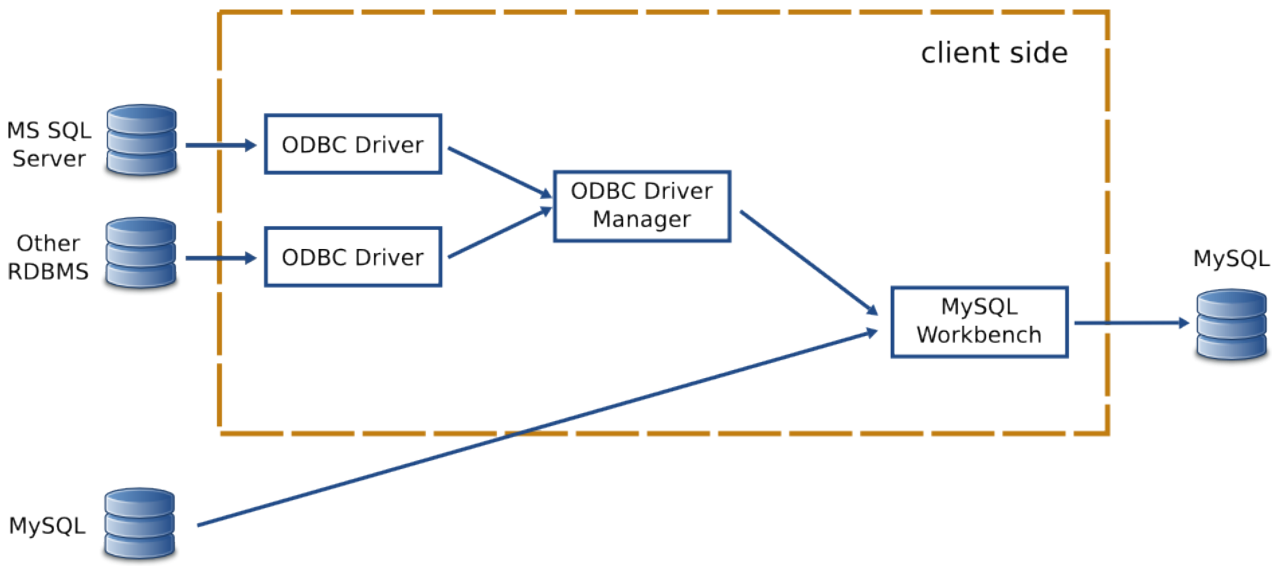
Windows, and the Database Product Specific Notes section that references setup conditions for each RDBMS.

10.1. 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:

Figure 10.1. 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.

10.1.1. ODBC Libraries

Note

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: `settings['libraries'].append('odbc')` with `settings['libraries'].append('iodbc')`
3. Execute the following command as the root user: ``CFLAGS=`iodbc-config --cflags` LDFLAGS=`iodbc-config --libs` python setup.py install``

10.1.2. 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.

10.2. 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.

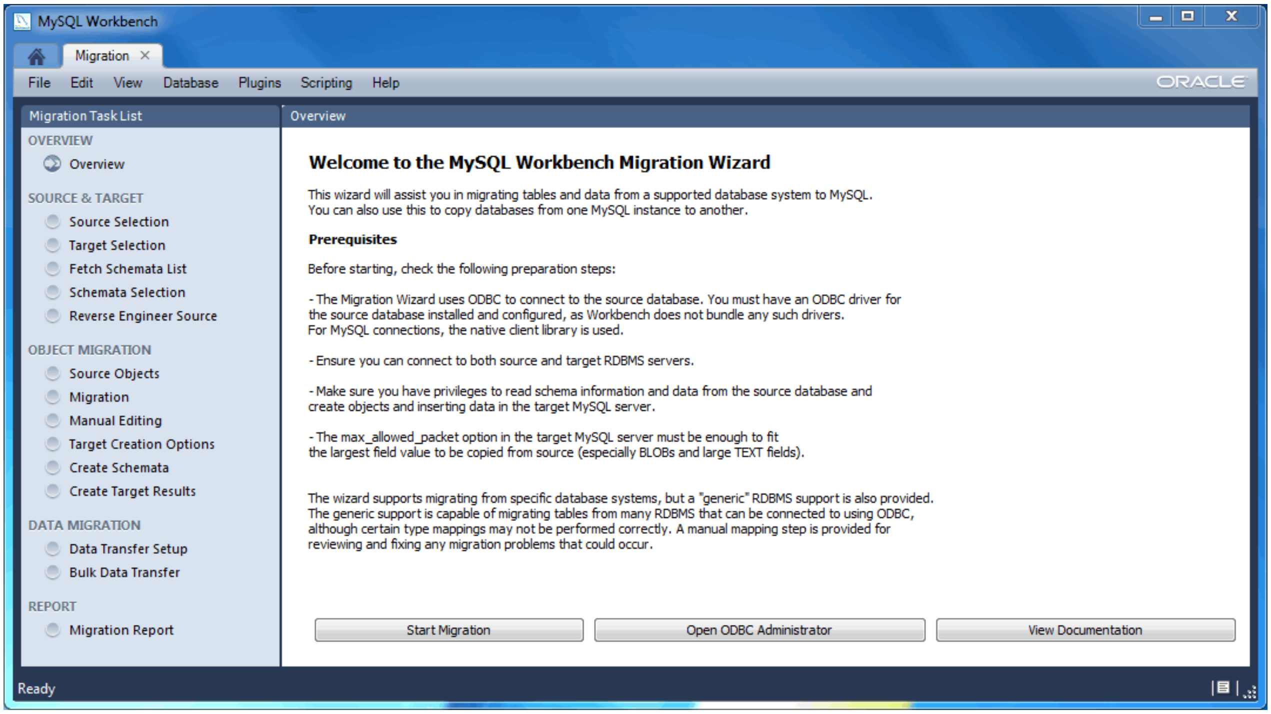
10.2.1. A visual guide to performing a database migration

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 10.2. MySQL Workbench migration: Overview



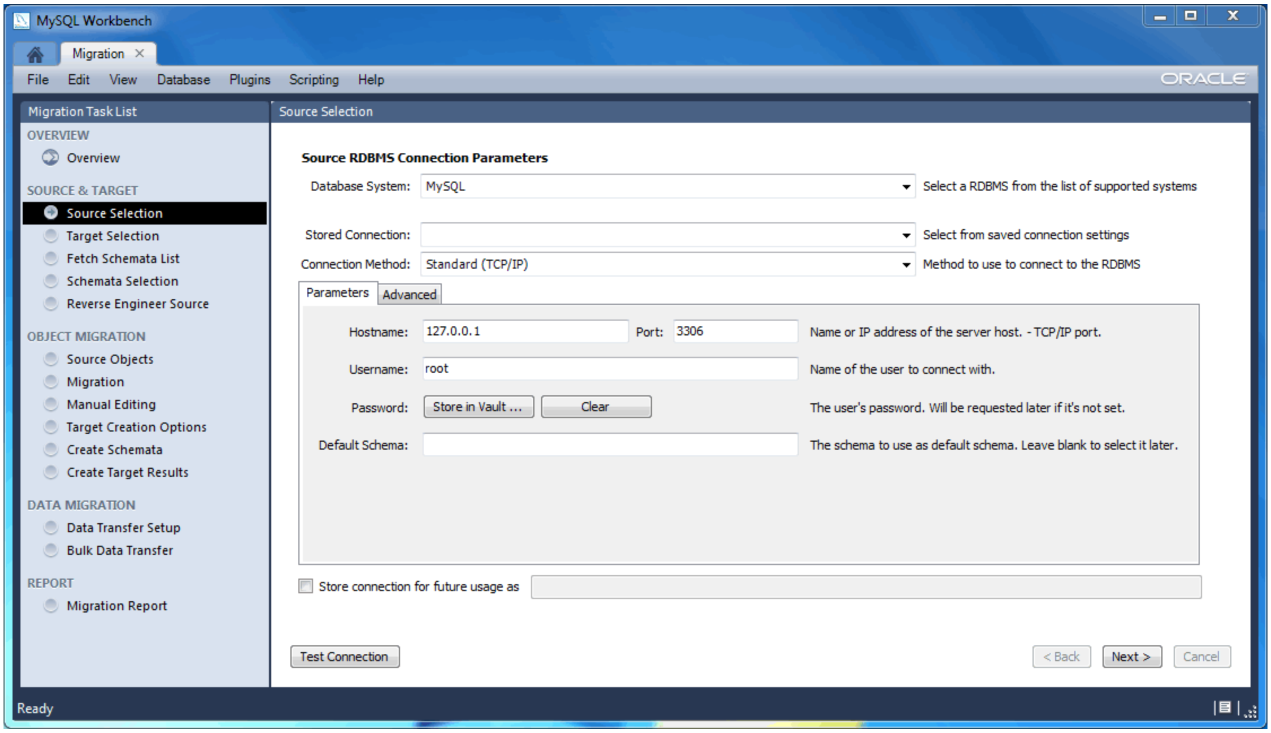
It describes the prerequisites and requirements that should be understood before proceeding further. The Open ODBC Administrator option will load `odbcad32.exe`, and is used to confirm that the ODBC Driver for SQL Server is installed, and to make configuration changes if needed.

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 10.3. MySQL Workbench migration: Source Selection (Parameters)

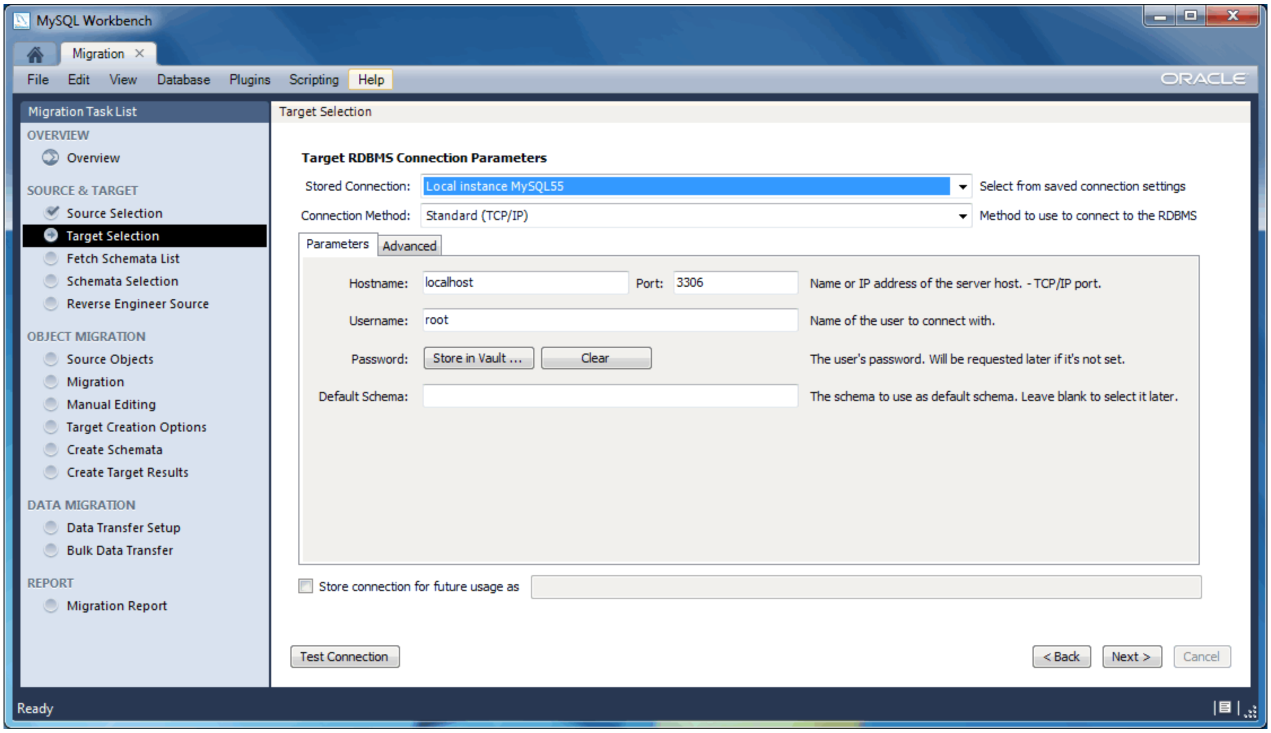


The optional **Store connection** option will save the connection details. It must be set before proceeding to the next step by clicking Next.

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.

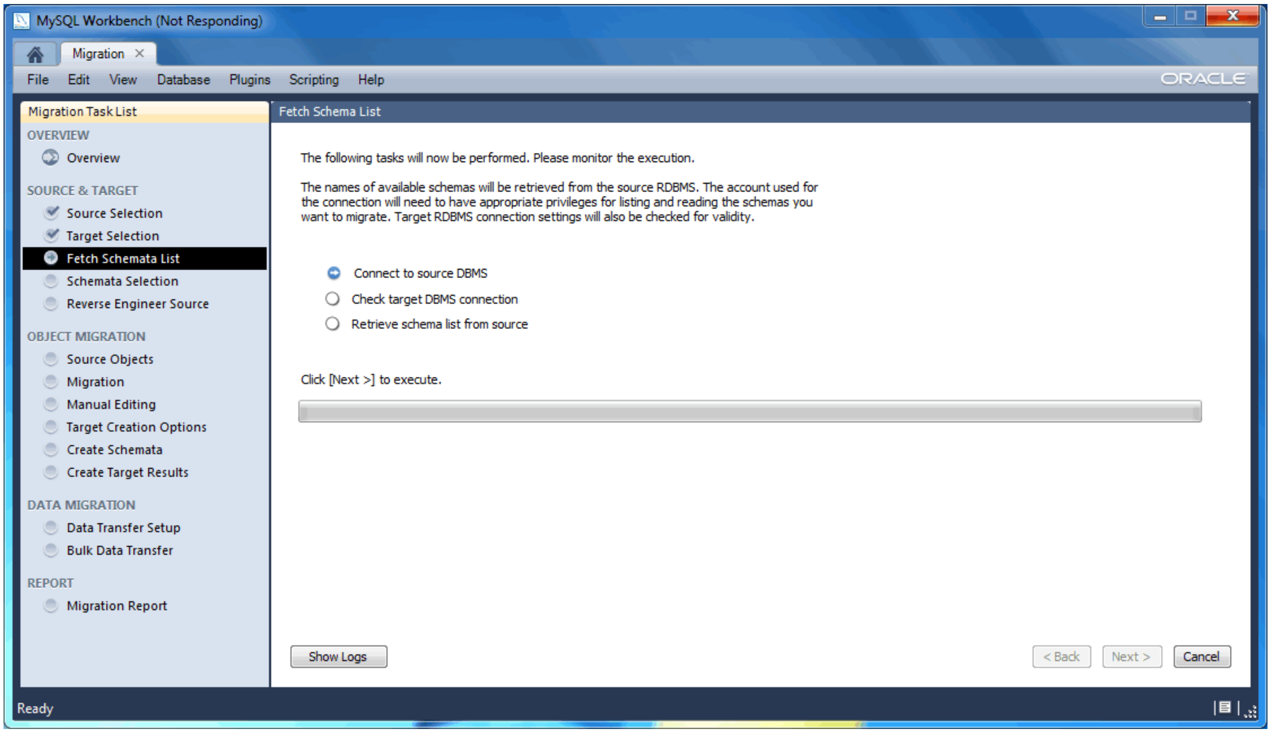
Figure 10.4. MySQL Workbench migration: Target selection



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.

Figure 10.5. MySQL Workbench migration: Fetch Schemata List



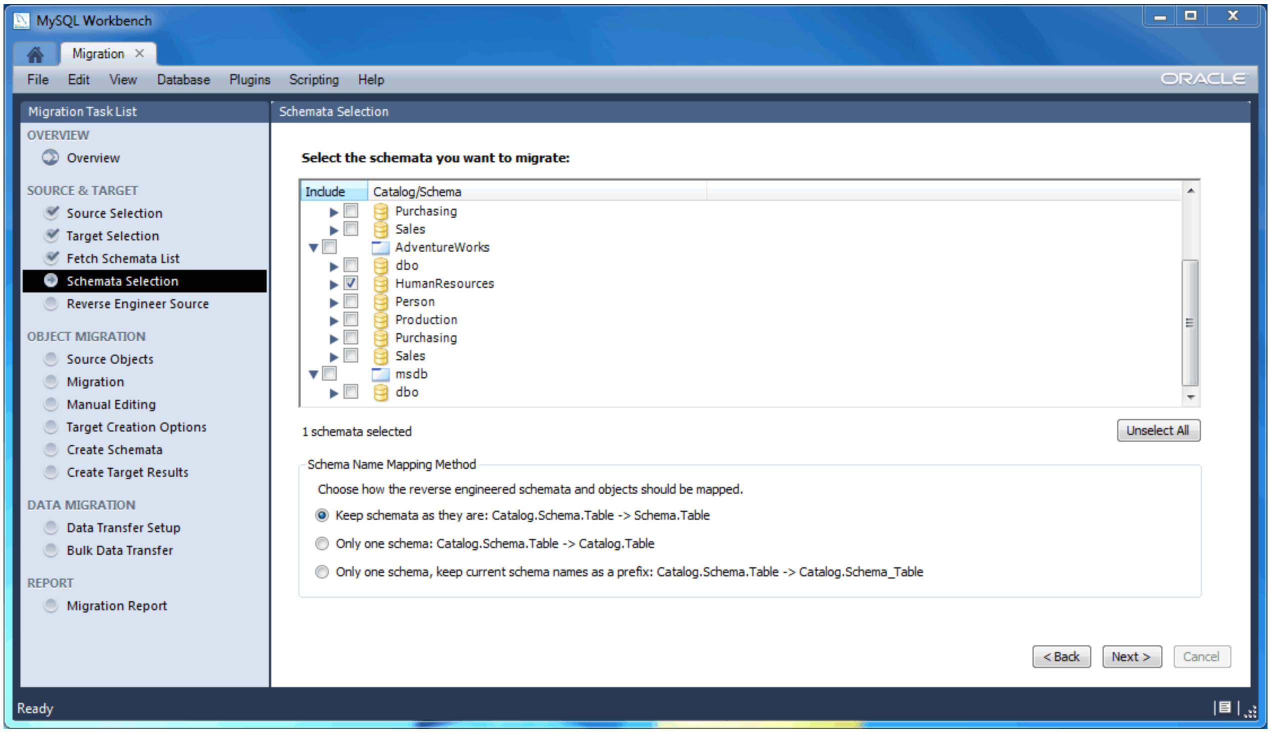
Schemata Selection

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.

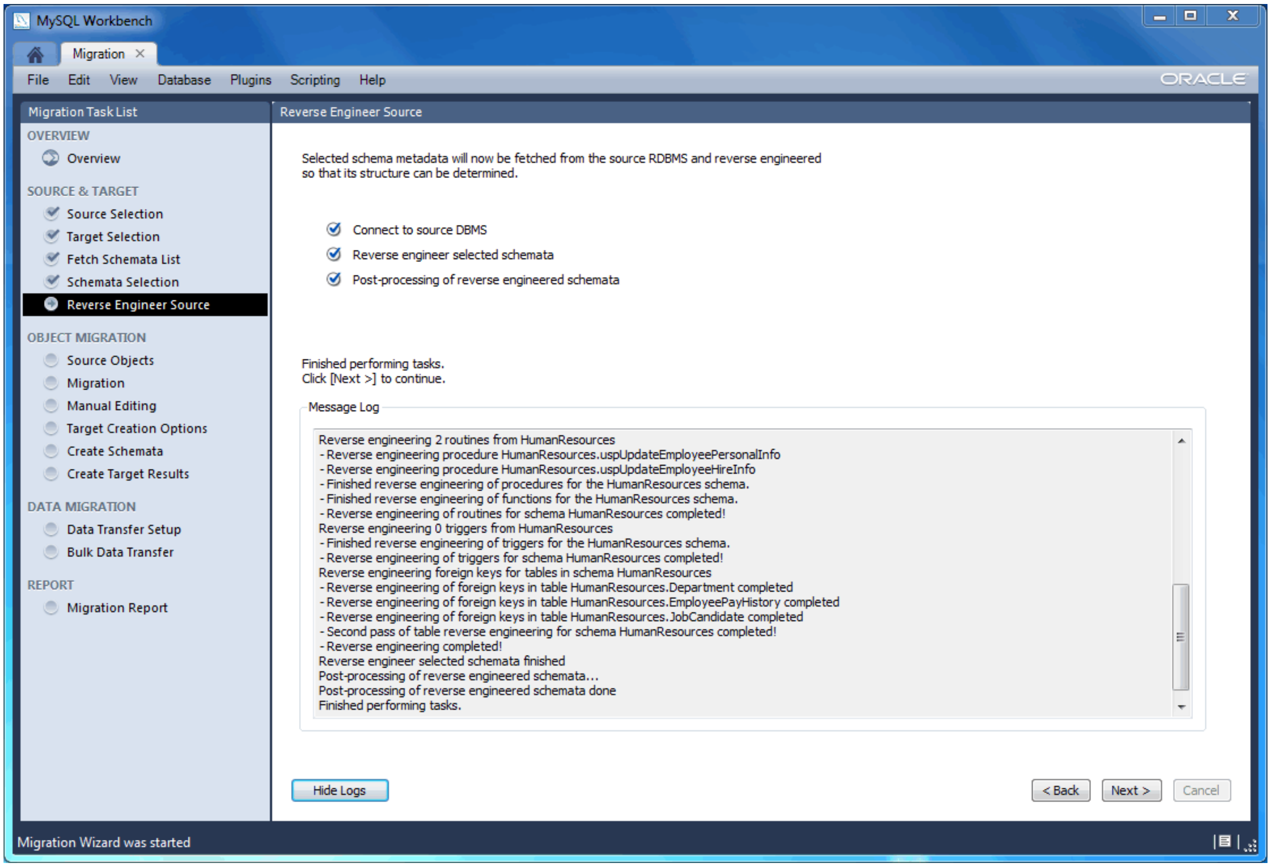
Figure 10.6. MySQL Workbench migration: Schemata Selection



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.

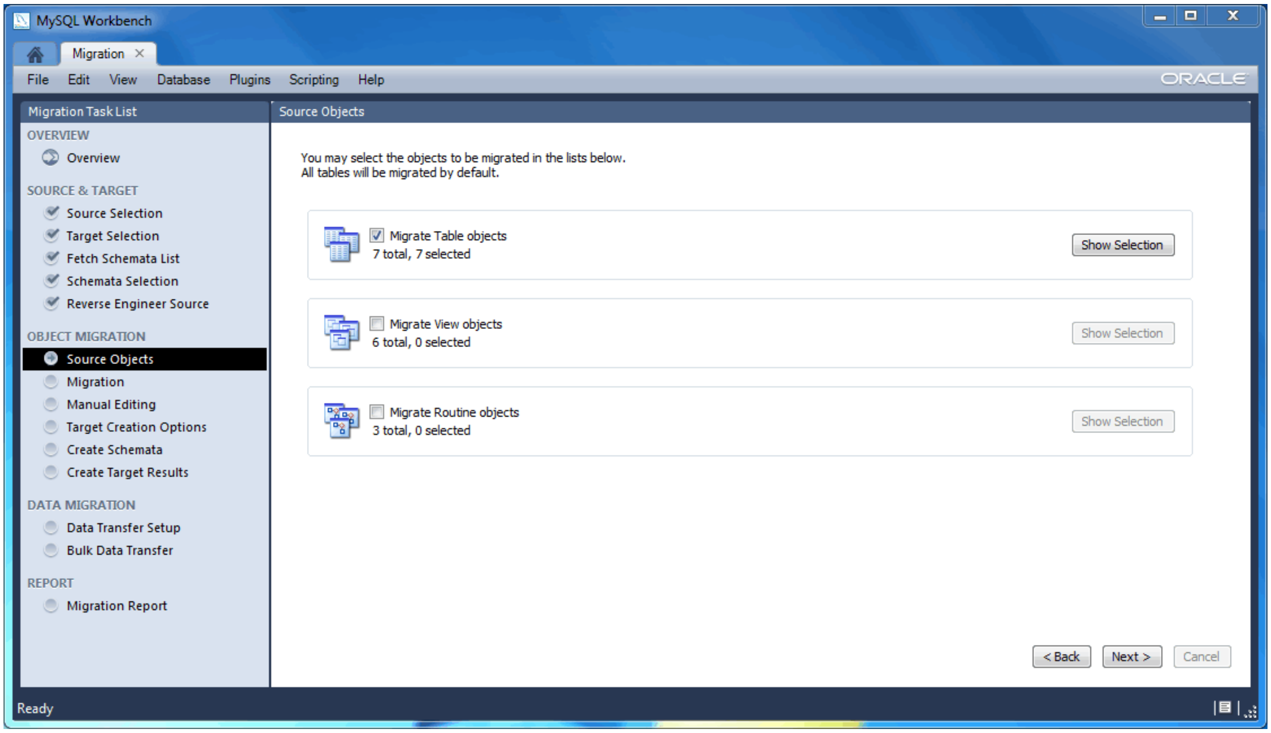
Figure 10.7. MySQL Workbench migration: Reverse Engineer Source



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.

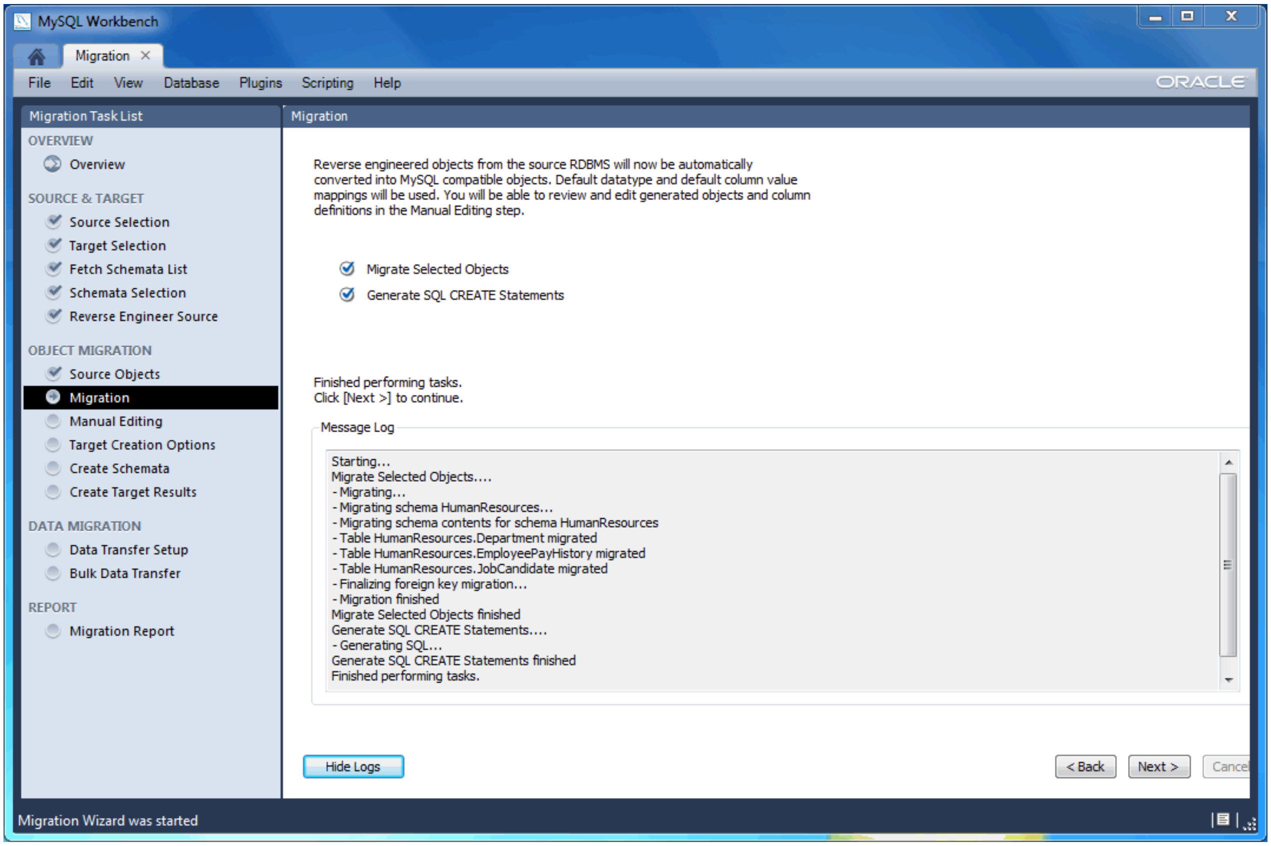
Figure 10.8. MySQL Workbench migration: Source Objects



Migration

The migration process now converts the selected objects into MySQL compatible objects. View the logs and then proceed.

Figure 10.9. 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 10.10. MySQL Workbench migration: Manual Editing (All Objects)

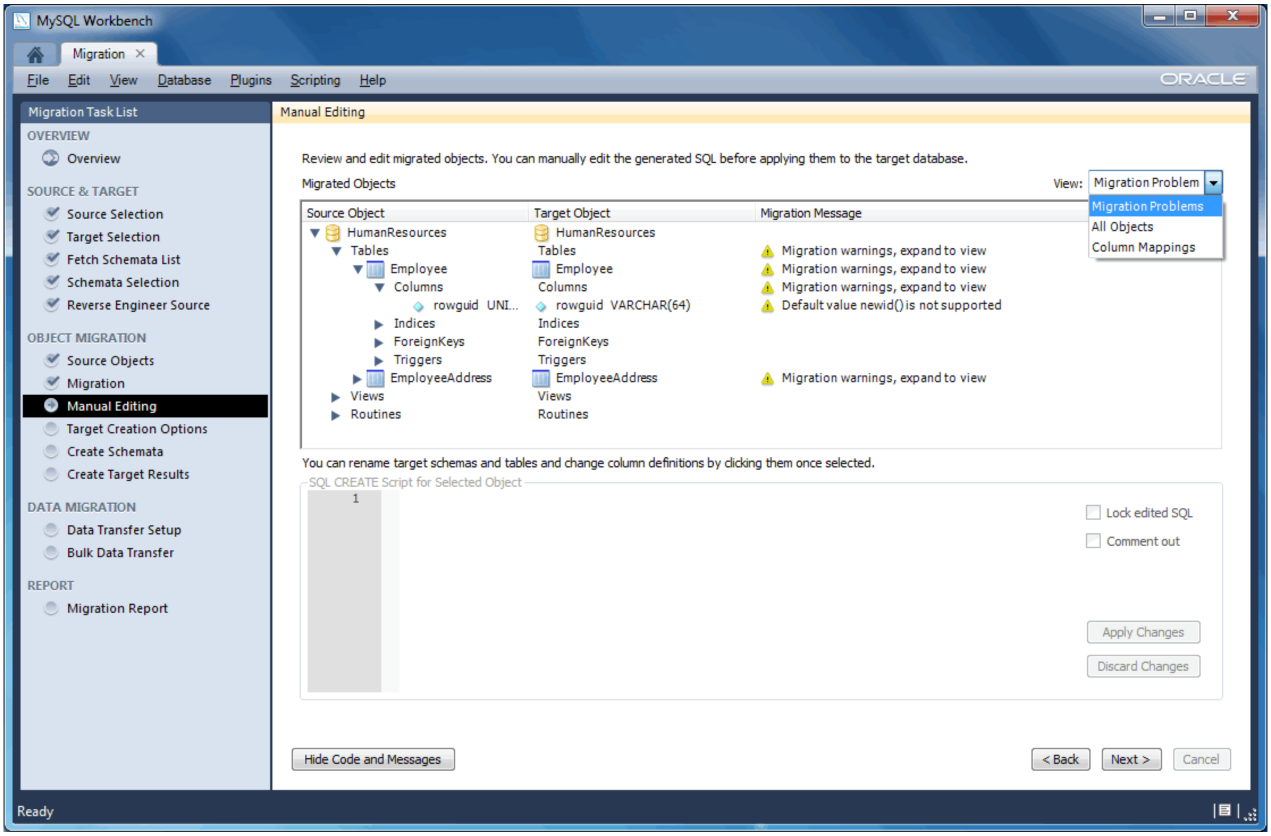
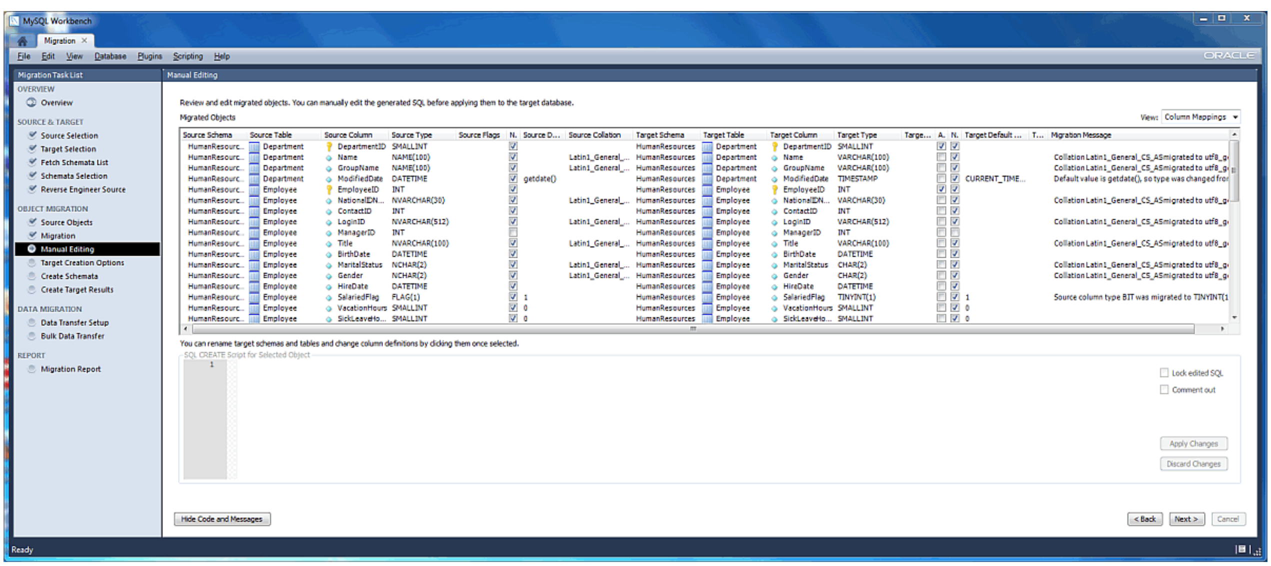


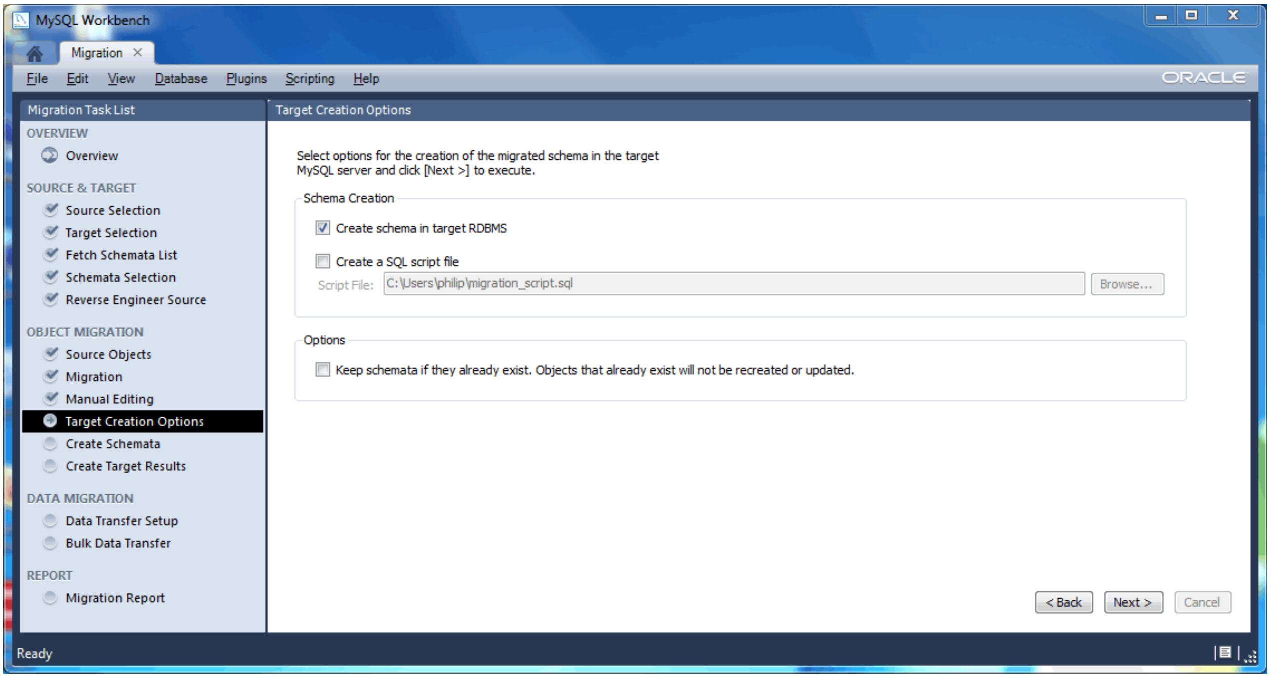
Figure 10.11. MySQL Workbench migration: Manual Editing (Column Mappings)



Target Creation Options

The schema may be created by either adding it to the target RDBMS, creating an SQL script file, or both.

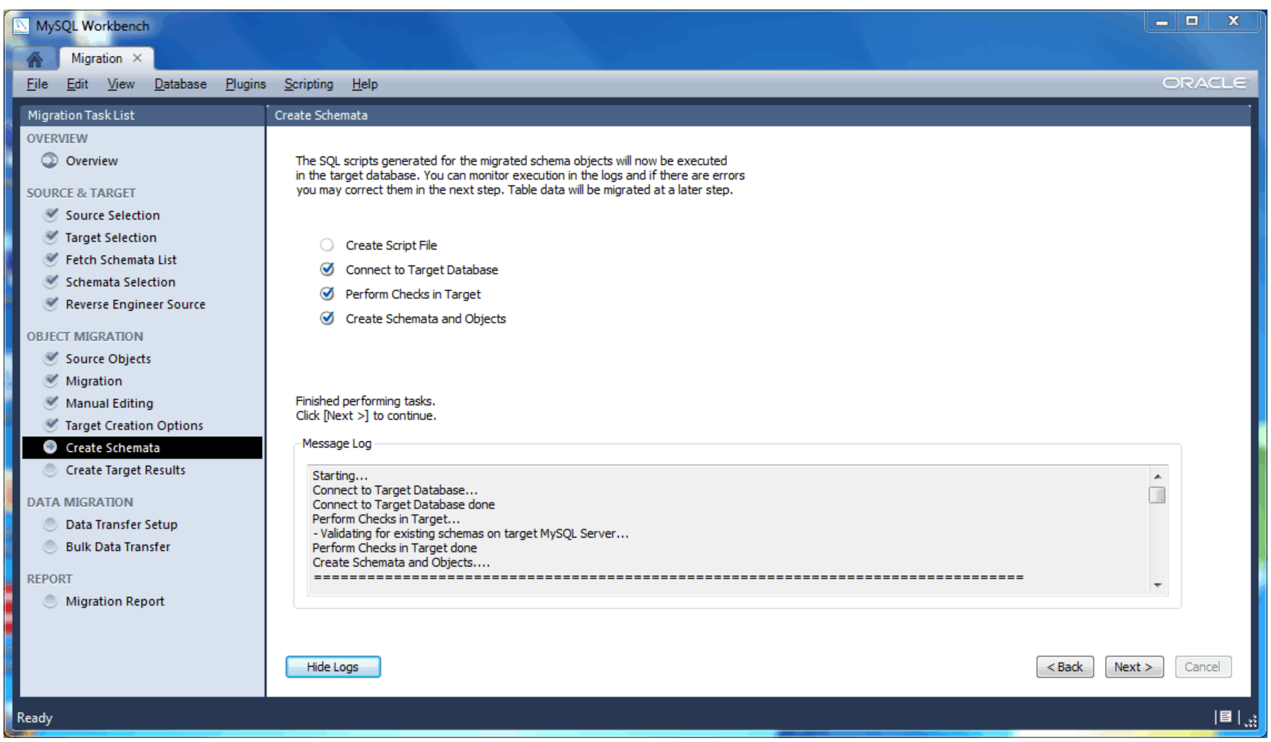
Figure 10.12. MySQL Workbench migration: Target Creation Options



Create Schemata

Now the schemata is created. The complete log is also available here.

Figure 10.13. MySQL Workbench migration: Create Schemata



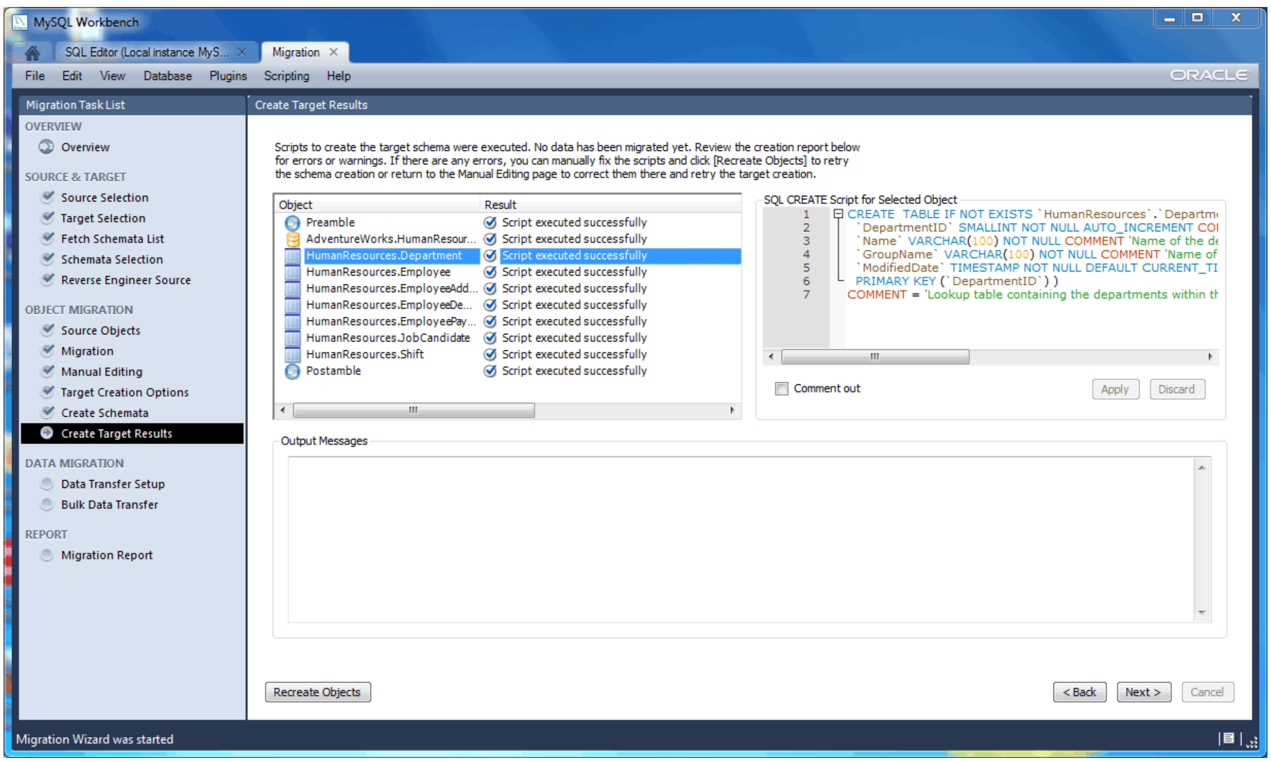
Create Target Results

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.

> **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 10.14. 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:

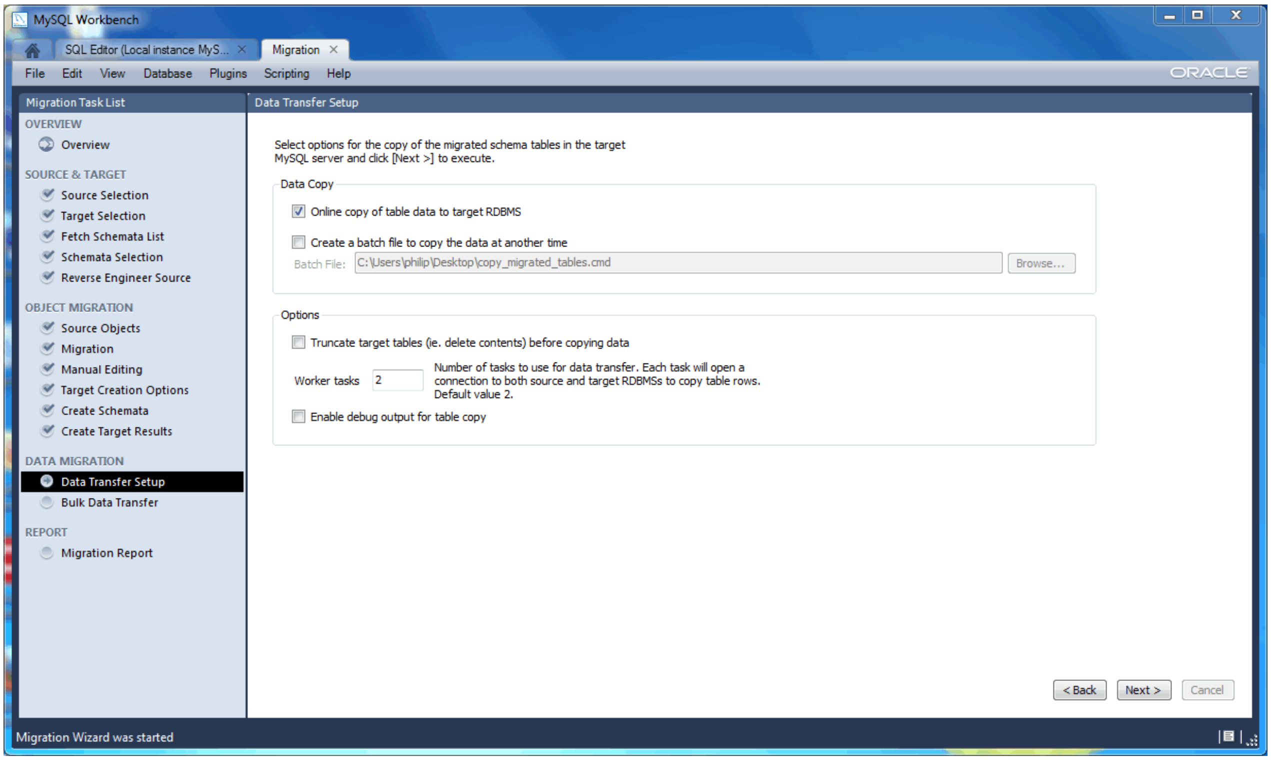
Data Copy:

- 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.

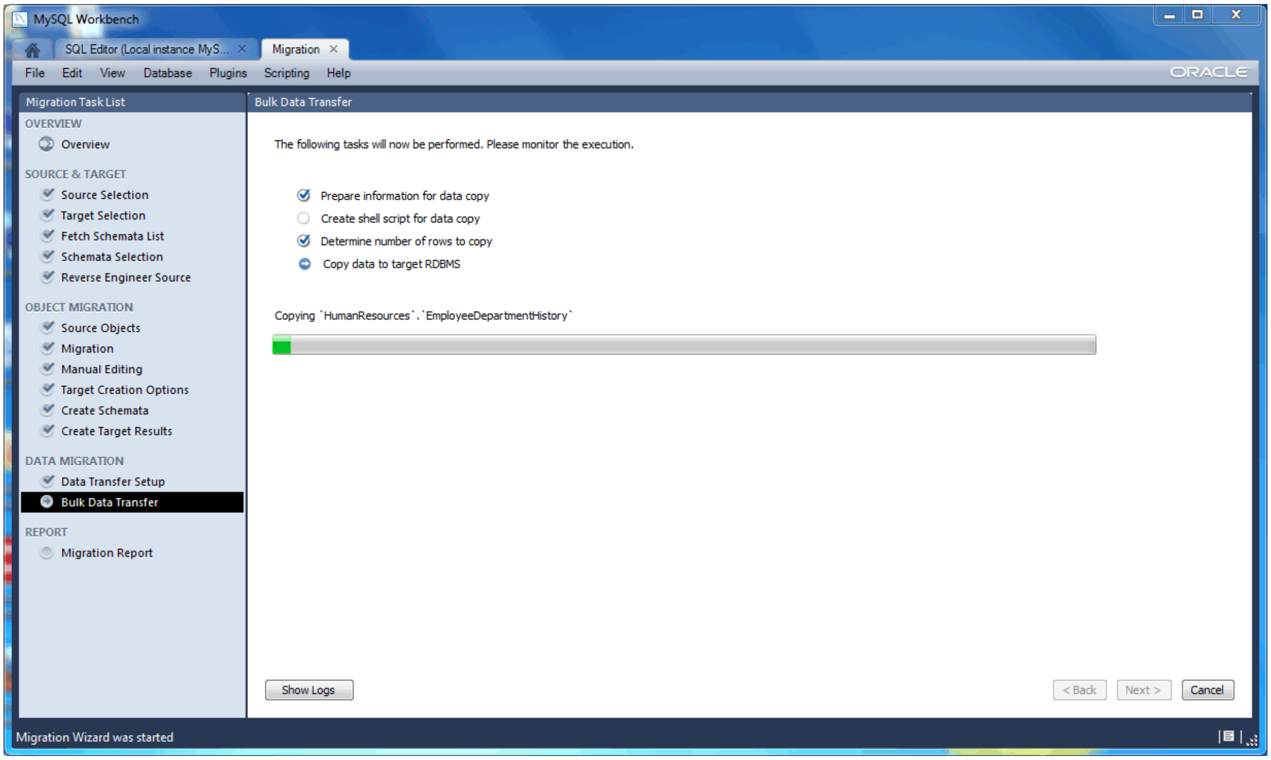
Figure 10.15. MySQL Workbench migration: Data Transfer Setup



Bulk Data Transfer

And now the data is transferred to the target RDBMS. Optionally, view the logs to confirm.

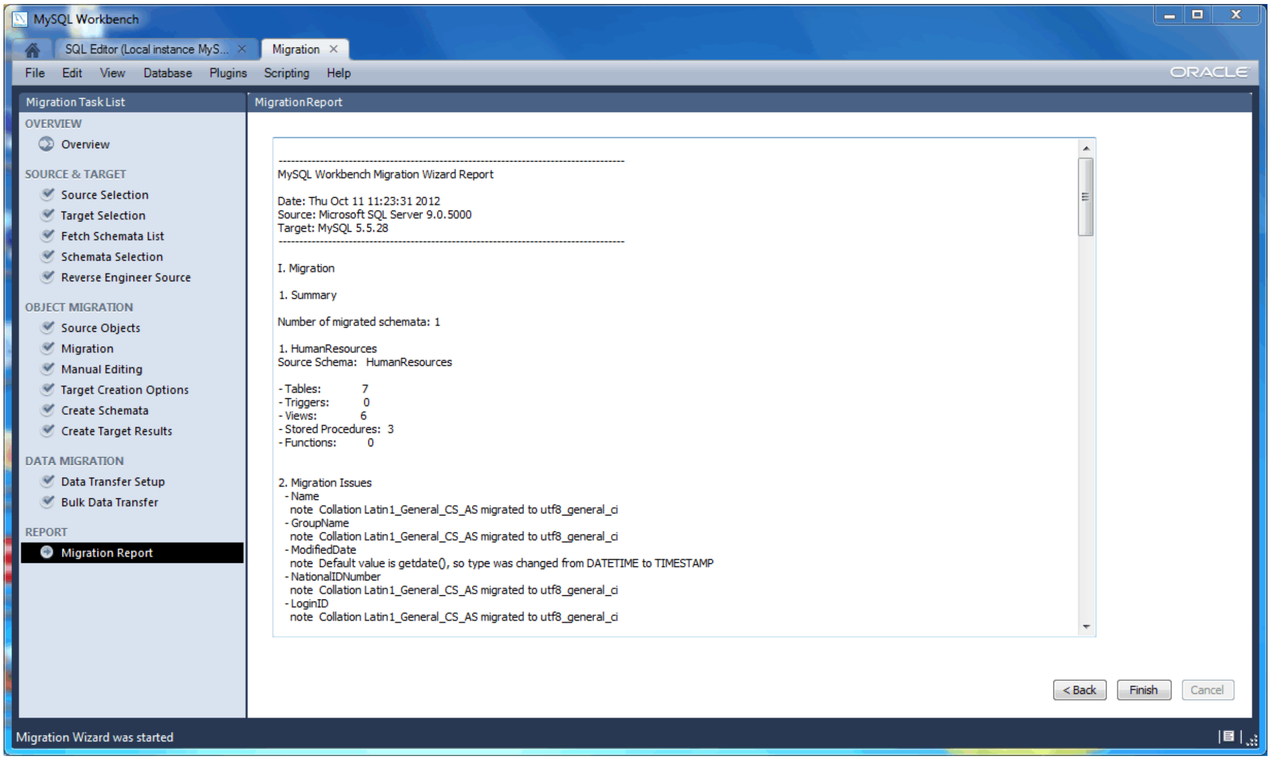
Figure 10.16. MySQL Workbench migration: Bulk Data Transfer



Migration Report

And finally, the migration report is available and summarizes the entire migration process.

Figure 10.17. MySQL Workbench migration: Migration Report



Pressing Finish will close the migration window. The database may now be viewed within the MySQL Workbench SQL editor.

Note

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.

10.2.2. 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 10.2.3, “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

10.2.3. 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, thenit 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.

10.3. Conceptual DBMS equivalents

Table 10.1. Conceptual equivalents between supported DBMS products and MySQL

Concept	MS SQL Server	Sybase ASE	PostgreSQL	MySQL	Note
Authentication	Yes	Yes	Yes	Yes	
Auto_Increment	Yes	Yes	Yes	Yes	PostgreSQL uses sequences for Auto_Increment.
Backup	Yes	Yes	Yes	Yes	See MySQL Enterprise Backup
Catalog	Yes	Yes	Yes	N/A	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
Constraints	Yes	Yes	Yes	Yes	
Data Dictionary				N/A	
Database	Yes	Yes	Yes	Yes	
Database Instance					
Dump	Yes	Yes	Yes	Yes	`mysqldump`
Events	Yes	Yes	Yes	Yes	
Foreign Keys	Yes	Yes	Yes	Yes	
Full Text Search	Yes	Yes	Yes	Yes	In InnoDB as of MySQL Server 5.6, and in all versions of MyISAM
Index	Yes	Yes	Yes	Yes	

Concept	MS SQL Server	Sybase ASE	PostgreSQL	MySQL	Note
Information Schema	Yes	No	Yes	Yes	
Object Names Case Sensitivity	Depends on collation	Depends on collation	Mixed	Mixed	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. Unlike the standard, unquoted object names are converted to lowercase instead of uppercase.
Object Naming Conventions	Yes	Yes	Yes	Yes	
Packages	N/A	N/A	N/A	N/A	
Partitioning	Yes	Yes	Yes	Yes	
Performance Schema	N/A	N/A	Yes	Yes	
Permissions	Yes	Yes	Yes	Yes	
Primary Key	Yes	Yes	Yes	Yes	
Referential Integrity	Yes	Yes	Yes	Yes	Sybase ASE: referential integrity only through triggers.
Replication	Yes	Yes	Yes	Yes	
Role	Yes	Yes	Yes	N/A	Roles are not available in MySQL at the database level.
Schema	Yes	Yes*	Yes	Yes	Equivalent to database in MySQL. Sybase ASE: Schemata corresponds to user names.
Sequences	Yes*	Yes*	Yes	Yes*	Standalone sequence objects are not supported in MySQL. Similar functionality can be obtained with IDENTITY columns in MSSQL and AUTO_INCREMENT columns in MySQL
SQL Modes	Yes		Yes	Yes	SET_ANSI_* in MSSQL
Storage Engines	N/A	N/A	Yes*	Yes	PostgreSQL itself supports and uses only one storage engine (Postgresql). Other companies have added extra storage engines to PostgreSQL.
Stored Procedures	Yes	Yes	Yes	Yes	
Synonyms	N/A	N/A	N/A	N/A	
Table	Yes	Yes	Yes	Yes	
Tablespace	Yes	Yes*	Yes	N/A	MSSQL groups tables in schemata (unless referring to CREATE

Concept	MS SQL Server	Sybase ASE	PostgreSQL	MySQL	Note
					TABLESPACE). Sybase ASE: tables are grouped in schemata which are more like user names.
Temporary Tables	Yes	Yes	Yes	Yes	
Transactions	Yes	Yes	Yes	Yes	
Triggers	Yes	Yes	Yes	Yes	
UDFs	Yes	Yes	Yes	Yes	
Unicode	Yes	Yes	Yes	Yes	
Unique Key	Yes	Yes	Yes	Yes	
User	Yes	Yes	Yes	Yes	
Views	Yes	Yes	Yes	Yes	

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.

10.4. Microsoft SQL Server migration

Introduction.

The MySQL Workbench Migration Wizard is tested against the following Microsoft SQL Server versions: 2000, 2005, 2008, and 2012.

10.4.1. 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.

10.4.2. Drivers

General thoughts on the topic.

10.4.2.1. Windows

Microsoft Windows XP or newer includes an ODBC driver for Microsoft SQL Server, so there are no additional actions required.

10.4.2.2. 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`
6. Execute `build_freetds.sh`
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.

10.4.2.3. Mac OS X

See the FreeTDS setup notes for Linux.

10.4.3. Connection Setup

Using an ODBC DataSource

Using Connection Parameters

10.4.4. Microsoft SQL Server Type Mapping

Table 10.2. Type mapping

Source Type	MySQL Type	Comment
INT	INT	
TINYINT	TINYINT	UNSIGNED flag set in MySQL
SMALLINT	SMALLINT	
BIGINT	BIGINT	
BIT	TINYINT(1)	
FLOAT	FLOAT	Precision value is used for storage size in both
REAL	FLOAT	
NUMERIC	DECIMAL	
DECIMAL	DECIMAL	
MONEY	DECIMAL	
SMALLMONEY	DECIMAL	
CHAR	CHAR/LONGTEXT	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
NCHAR	CHAR/LONGTEXT	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.
VARCHAR	VARCHAR/ MEDIUMTEXT/ LONGTEXT	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.
NVARCHAR	VARCHAR/ MEDIUMTEXT/ LONGTEXT	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.
DATE	DATE	
DATETIME	DATETIME	

Source Type	MySQL Type	Comment
DATETIME2	DATETIME	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
SMALLDATETIME	DATETIME	
DATETIMEOFFSET	DATETIME	
TIME	TIME	
TIMESTAMP	TIMESTAMP	
ROWVERSION	TIMESTAMP	
BINARY	BINARY/MEDIUMBLOB/ LONGBLOB	Depending on its length
VARBINARY	VARBINARY/ MEDIUMBLOB/ LONGBLOB	Depending on its length
TEXT	VARCHAR/ MEDIUMTEXT/ LONGTEXT	Depending on its length
NTEXT	VARCHAR/ MEDIUMTEXT/ LONGTEXT	Depending on its length
IMAGE	TINYBLOB/ MEDIUMBLOB/ LONGBLOB	Depending on its length
SQL_VARIANT	not migrated	There is not specific support for this datatype.
TABLE	not migrated	There is not specific support for this datatype.
HIERARCHYID	not migrated	There is not specific support for this datatype.
UNIQUEIDENTIFIER	VARCHAR(64)	A unique flag set in MySQL. There is not specific support for inserting unique identifier values.
SYSNAME	VARCHAR(160)	
XML	TEXT	

10.5. 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.

10.5.1. Preparations

What is required and needed. General information about the setup.

10.5.2. Drivers

General thoughts on the topic.

Information specific to the psqlodb driver.

If you are compiling psqlodb, first configure with the `--without-libpq` option.

10.5.3. Connection Setup

Using an ODBC DataSource

Using Connection Parameters

10.5.4. PostgreSQL Type Mapping

Table 10.3. Type mapping

Source Type	MySQL Type	Comment
INT	INT	
SMALLINT	SMALLINT	
BIGINT	BIGINT	
SERIAL	INT	Sets AUTO_INCREMENT in its table definition.
SMALLSERIAL	SMALLINT	Sets AUTO_INCREMENT in its table definition.
BIGSERIAL	BIGINT	Sets AUTO_INCREMENT in its table definition.
BIT	BIT	
BOOLEAN	TINYINT(1)	
REAL	FLOAT	
DOUBLE PRECISION	DOUBLE	
NUMERIC	DECIMAL	
DECIMAL	DECIMAL	
MONEY	DECIMAL(19,2)	
CHAR	CHAR/LONGTEXT	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
NATIONAL CHARACTER	CHAR/LONGTEXT	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.
VARCHAR	VARCHAR/ MEDIUMTEXT/ LONGTEXT	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.
NATIONAL CHARACTER VARYING	VARCHAR/ MEDIUMTEXT/ LONGTEXT	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.
DATE	DATE	
TIME	TIME	
TIMESTAMP	DATETIME	

Source Type	MySQL Type	Comment
INTERVAL	TIME	
BYTEA	LONGBLOB	
TEXT	LONGTEXT	
CIDR	VARCHAR(43)	
INET	VARCHAR(43)	
MACADDR	VARCHAR(17)	
UUID	VARCHAR(36)	
XML	LONGTEXT	
JSON	LONGTEXT	
TSVECTOR	LONGTEXT	
TSQUERY	LONGTEXT	
ARRAY	LONGTEXT	
POINT	VARCHAR	
LINE	VARCHAR	
LSEG	VARCHAR	
BOX	VARCHAR	
PATH	VARCHAR	
POLYGON	VARCHAR	
CIRCLE	VARCHAR	
TXID_SNAPSHOT	VARCHAR	

10.6. MySQL migration

Introduction

Notes about copying MySQL, and what you can do with it.

10.7. Using the MySQL Workbench Migration Wizard

Introduction, and general usage notes.

10.7.1. 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 determins 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.

10.7.2. 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.

10.7.3. 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.

10.7.4. 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.

10.7.5. 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 10.7.6, “Manual Editing” .

The steps performed include Migrating the selected objects, and generating the SQL CREATE statements.

10.7.6. 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.

10.7.7. 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.

10.7.8. 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.

10.7.9. 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.

10.7.10. Data Migration Setup

Provides additional options for data transfer, including the ability to set up a script to automate this transfer in the future.

10.7.11. Bulk Data Transfer

The transfer is executed here.

10.7.12. Migration Report

Displays the final report, that can be reviewed to ensure a proper migration was executed.

10.8. MySQL Workbench Migration Wizard FAQ

Frequently Asked Questions with answers.

Questions

- 10.8.1: [212] While using the Postgresql psqlodbc driver, I see the following error: `('08001', '[08001] Already connected. (202) (SQLDriverConnect)')`

Questions and Answers

10.8.1: While using the Postgresql psqlodbc 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 11. Extending Workbench

Table of Contents

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

11.1. 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 11.1. The main nodes in the Application Object Tree

Node	Description
wb.registry	Application data such as plugin registry, list of editors, and options.
wb.customData	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).
wb.options	Contains some default options that are used by Workbench.
wb.rdbmsMgmt	Internal registry of supported RDBMS modules, known data types.
wb.doc	The currently loaded model document.
wb.doc.physicalModels[0]	The currently loaded model object, containing the database catalog and diagrams.
wb.doc.physicalModels[0].catalog	The database catalog for the model. Contains the list of schemata.
wb.doc.physicalModels[0]catalog.schemata	List of schemata in the model. Individual schema can be accessed as a list: schemata[0], schemata[1] ...
wb.doc.physicalModels[0].catalog.schemata[0].tables (.views, .routines, ...)	Lists of tables, views, routines in the schema.
wb.doc.physicalModels[0].diagrams	List of EER diagrams in the model.
wb.doc.physicalModels[0].diagrams[0].figures (.layers, .connections, ...)	List of figures, layers, connections (relationships) in the diagram.

11.2. 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:

```
from wb import *
ModuleInfo = DefineModule(name='MyModule', author='Your Name', version='1.0')
```

4. Functions to be exported require their signature to be declared. This is achieved using the export decorator in the previously created ModuleInfo object:

```
@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:

```
from wb import *
import grt

ModuleInfo = DefineModule(name='MyModule', author="your name", version='1.0')

@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
```

11.3. 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 various object editors and wizards within MySQL Workbench. Although this latter 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:

```
@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.

11.4. 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.

11.5. 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.

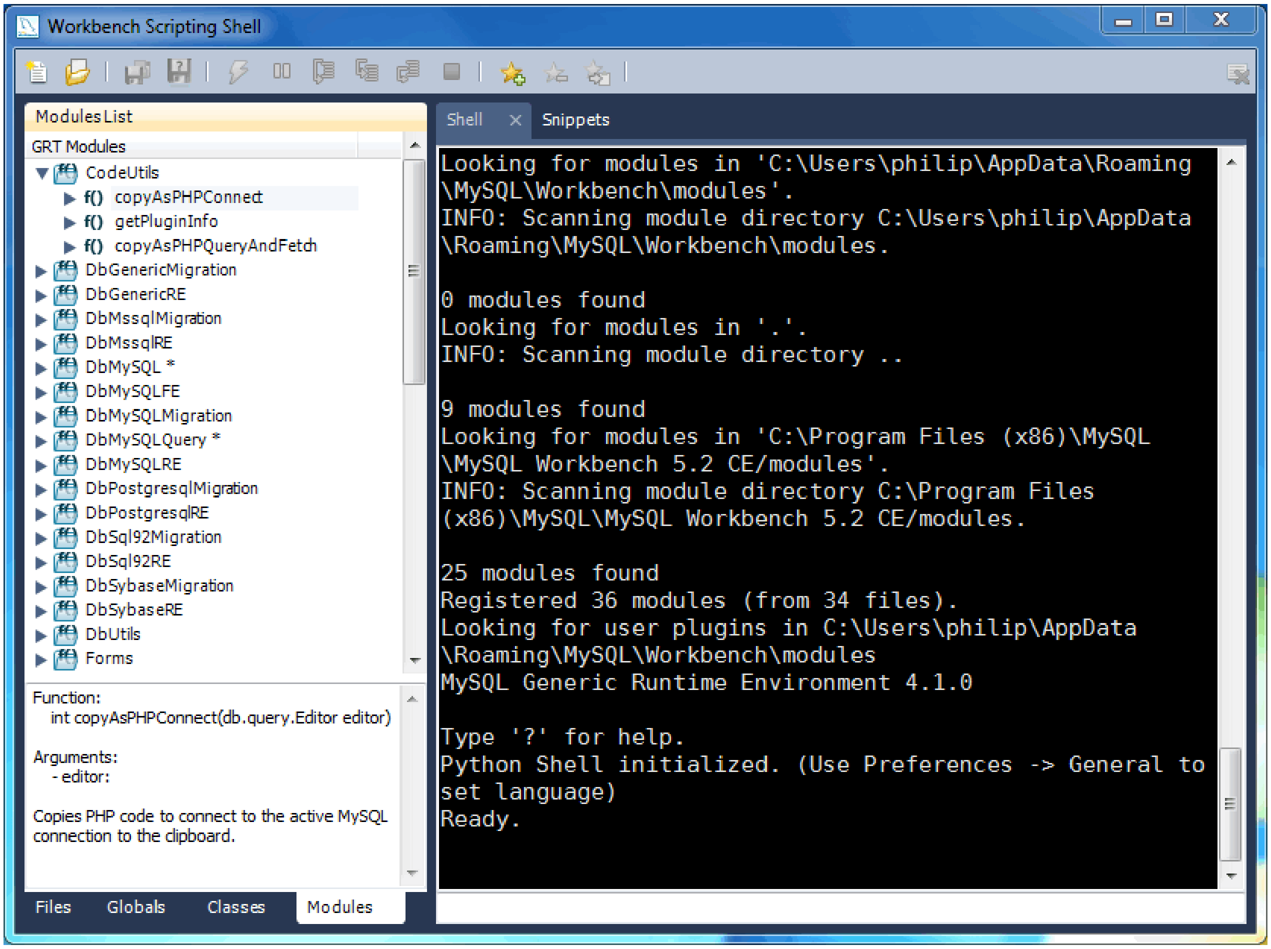
> **Note**
>
> Although they serve a different purpose, the MySQL Utililies are also bundled with MySQL Workbench. For more information, see Chapter 13, *MySQL Utilities*.

11.5.1. 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 11.1. The Workbench Scripting Shell



11.5.2. 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`.

11.5.3. 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.

11.6. 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:

```
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.

```
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:
      if table.primaryKey:
         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.

```
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 12. 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 12.1. File menu keyboard shortcuts

Function	Keyboard Shortcut	Context
New Model	Modifier+N	All
Open Model	Modifier+O	All
Open SQL Script	Modifier+Shift+O	SQL Editor
Close Tab	Modifier+W	All
Save Model	Modifier+S	Model
Save Script	Modifier+S	SQL Editor
Save Model As	Modifier+Shift+S	Model
Save Script As	Modifier+Shift+S	SQL Editor
Forward Engineer SQL CREATE Script	Modifier+Shift+G	Model
Forward Engineer SQL ALTER Script	Modifier+Alt+Y	Model
Synchronize With SQL CREATE Script	Modifier+Shift+Y	Model
Print	Modifier+P	EER Diagram mode only
Exit	Modifier+Q	All

Edit Menu

Table 12.2. Edit menu keyboard shortcuts

Function	Keyboard Shortcut	Context
Undo	Modifier+Z	Model, EER Diagram
Redo	Modifier+Y, Modifier+Shift+Z (Mac OS X)	Model, EER Diagram
Cut	Modifier+X	All
Copy	Modifier+C	All
Paste	Modifier+V	All
Delete	Modifier+Delete, Command+BackSpace (Mac OS X)	All
Edit Selected	Modifier+E	Model, EER Diagram
Edit Selected in New Window	Modifier+Shift+E	Model, EER Diagram
Select All	Modifier+A	EER Diagram

Function	Keyboard Shortcut	Context
Find	Modifier+F	All
Find Advanced	Modifier+Alt+F	All
Find Next	F3	All
Find Previous	Shift+F3	All
Search and Replace	Modifier+Shift+F	All

View Menu

Table 12.3. View menu keyboard shortcuts

Function	Keyboard Shortcut	Context
Output Window	Modifier+F2, Modifier+Option+2 (Mac OS X)	All
Set Marker n	Modifier+Shift+n (n is integer 1..9)	EER Diagram
Go to Marker n	Modifier+n (n is integer 1..9)	EER Diagram

Arrange Menu

Table 12.4. Arrange menu keyboard shortcuts

Function	Keyboard Shortcut	Context
Bring to Front	Modifier+Shift+F	EER Diagram
Send to Back	Modifier+Shift+B	EER Diagram

Model Menu

Table 12.5. Model menu keyboard shortcuts

Function	Keyboard Shortcut	Context
Add Diagram	Modifier+T	Model, EER Diagram
Validate All	Modifier+Alt+V	Model, EER Diagram
Validate All (MySQL)	Modifier+Alt+B	Model, EER Diagram
Model Options	Command+Alt+, (Shortcut available only on Mac OS X)	Model, EER Diagram

Query Menu

Table 12.6. Query menu keyboard shortcuts

Function	Keyboard Shortcut	Context
Execute statement	Modifier+Return	SQL Editor
Execute statements	Modifier+Shift+Return	SQL Editor
New Tab	Modifier+T	SQL Editor

Database Menu

Table 12.7. Database menu keyboard shortcuts

Function	Keyboard Shortcut	Context
Query Database	Modifier+U	All

Function	Keyboard Shortcut	Context
Reverse Engineer	Modifier+R	Model, EER Diagram
Forward Engineer	Modifier+G	Model, EER Diagram
Synchronize Model	Modifier+Y	Model, EER Diagram

Scripting Menu

Table 12.8. Scripting menu keyboard shortcuts

Function	Keyboard Shortcut	Context
Scripting Shell	Modifier+F3, Modifier+Option+3 (on Mac OS X)	All
Run Workbench Script File	Modifier+Shift+R	All

Help Menu

Table 12.9. Help menu keyboard shortcuts

Function	Keyboard Shortcut	Context
Help Index	F1, Command+Option+question (on Mac OS X)	All

EER Diagram Mode

In the EER Diagram view, a number of other keyboard shortcuts are available.

Table 12.10. EER diagram mode keyboard shortcuts

Function	Keyboard Shortcut
Selection tool	Escape
Hand tool	H
Delete tool	D
Layer tool	L
Note tool	N
Image tool	I
Table tool	T
View tool	V
Routine Group tool	G
Non-Identifying Relationship 1:1	1
Non-Identifying Relationship 1:n	2
Identifying Relationship 1:1	3
Identifying Relationship 1:n	4
Identifying Relationship n:m	5
Relationship Using Existing Columns	6

Chapter 13. MySQL Utilities

Table of Contents

This chapter describes the MySQL Utilities for MySQL Workbench, a set of Python tools for working with MySQL Server.

13.1. Introduction

13.1.1. Introduction to MySQL Utilities

What are the MySQL Utilities?

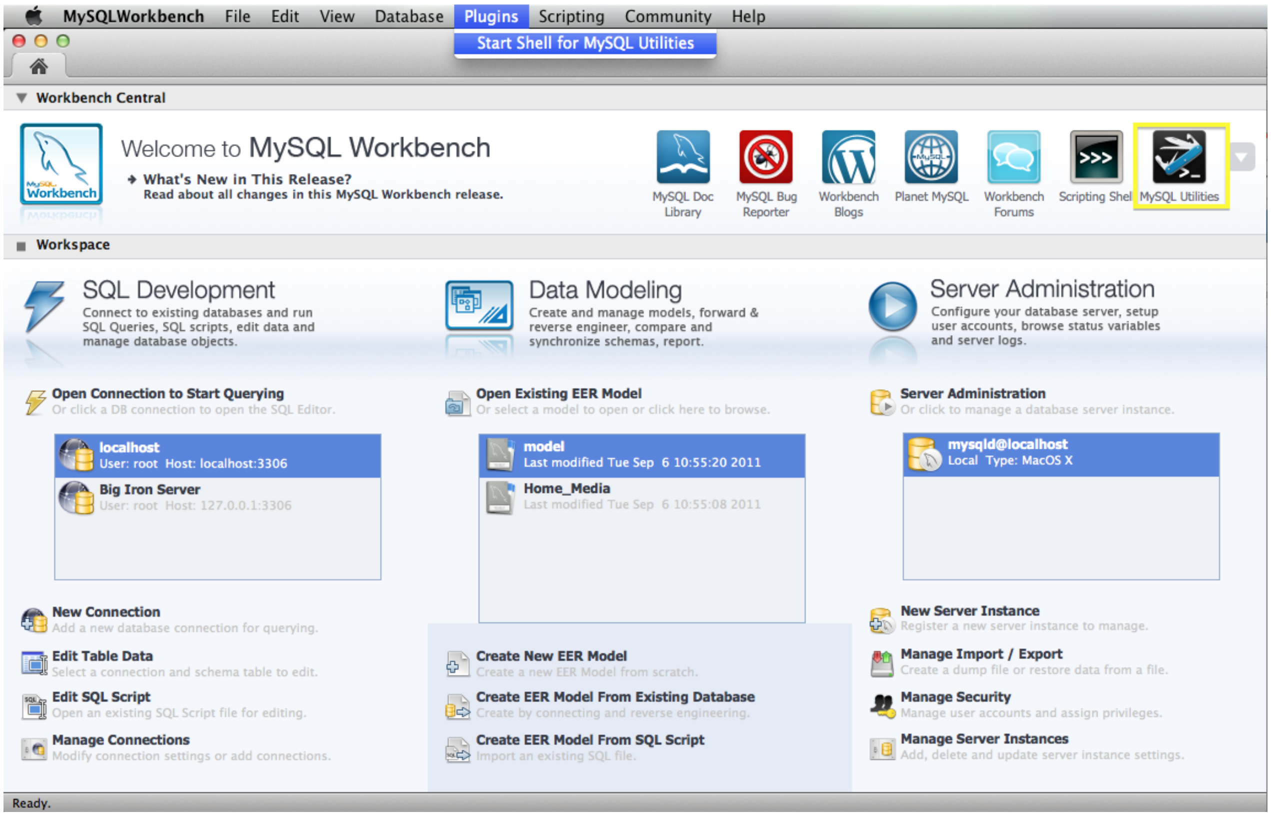
It is a package of utilities that are used for maintenance and administration of MySQL servers. These utilities encapsulate a set of primitive commands, and bundles them so they can be used to perform macro operations with a single command. They can be installed via MySQL Workbench, or as a standalone 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 2.x greater than 2.6.

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 13.1. 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.

13.1.2. 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 iIf 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.

13.1.3. 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.

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 utilties. 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:

```
Module     Class/Method              Description
---------- ------------------------- ----------------------------------------
database   Database                  Perform database-level operations
dbcompare  get_create_object         Retrieve object create statement
           diff_objects              Diff definitions of two objects
           check_consistency         Check data consistency of two tables
format     format_tabular_list       Format list in either GRID or
                                     delimited format to a file
           format_vertical_list      Format list in a vertical format to
                                     a file
           print_list                Print list based on format (CSV,
                                     GRID, TAB, or VERTICAL)
options    setup_common_options      Set up option parser and options common
                                     to all MySQL Utilities
           add_skip_options          Add common --skip options
           check_skip_options        Check skip options for validity
           check_format_option       Check format option for validity
           add_verbosity             Add verbosity and quiet options
           check_verbosity           Check whether both verbosity and quiet
                                     options are being used
           add_difftype              Add difftype option
           add_engines               Add engine, default-storage-engine
                                     options
           check_engine_options      Check whether storage engines listed
                                     in options exist
           parse_connection          Parse connection values
rpl        Replication               Establish replication connection
                                     between a master and a slave
```

```
          get_replication_tests     Return list of replication test function
                                    pointers
server    get_connection_dictionary Get connection dictionary
          find_running_servers      Check whether any servers are
                                    running on the local host
          connect_servers           Connect to source and destination server
          Server                    Connect to running MySQL server
                                    and perform server-level operations
table     Index                     Encapsulate index for a given table
                                    as defined by SHOW INDEXES
          Table                     Encapsulate table for given database
                                    to perform table-level operations
tools     get_tool_path             Search for MySQL tool and return its
                                    full path
          delete_directory          Remove directory (folder) and contents
user      parse_user_host           Parse user, passwd, host, port from
                                    user:passwd@host
          User                      Clone user and its grants to another
                                    user and perform user-level operations
```

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:

```
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:

```
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:

```
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>")
```

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:

```
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",
                  type="string", default="3307", help="the new port "
                       "for the new instance - default=%default")
parser.add_option("--new-id", action="store", dest="new_id",
                  type="string", default="2", help="the server_id for "
                       "the new instance - default=%default")

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:", e.errmsg
    exit(1)
```

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:

```
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:", e.errmsg
    exit(1)
```

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
        exit(1)
```

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 `/docs/intro/examples` folder. 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.

13.2. Commands

13.2.1. `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.grep.ROUTINE`

- mysql.utilities.command.grep.EVENT
- mysql.utilities.command.grep.TRIGGER
- mysql.utilities.command.grep.TABLE
- mysql.utilities.command.grep.DATABASE
- mysql.utilities.command.grep.VIEW
- mysql.utilities.command.grep.USER

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

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.

Returns:	SQL code for executing the operation specified by the options.
Return type:	string

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.

Parameters:	• **connections** – Sequence of connection specifiers to send the query to • **output** – File object to use for writing the result • **connector** – Connector to use for connecting to the servers

13.2.2. 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:

```
>>> 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 • **output** – File object to use for writing the result • **connector** – Connector to use for connecting to the servers

13.3. Manual Pages

13.3.1. 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:

- `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
  - Generate reports in SQL, CSV, TAB, Grid, Vertical
- `mysqlfailover`
  - Performs replication health monitoring
  - 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
- 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

13.3.2. 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` [242] 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*.

- --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:

```
$ python 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

----------------------------------------------------------------------
TEST NAME                                                STATUS   TIME
======================================================================
main.clone_user                                          [pass]     54
main.clone_user_errors                                   [pass]     27
main.clone_user_parameters                               [pass]     17
----------------------------------------------------------------------
```

```
Testing completed: Friday 03 December 2010 09:50:06

All 3 tests passed.
```

13.3.3. 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` [246] option. The user can also connect to another server by specifying the `--server2` [246] 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` [246] option to cause the utility to run all tests regardless of their end state.

Note: Using `--run-all-tests` [246] 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` [246] 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 `--skip-object-compare` [246] option. That can be useful when there are known missing objects among the databases.

3. Compare object definitions

   The definitions (the **CREATE** statements) are compared and differences are presented. To skip this test, use the `--skip-diff` [246] 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 `--skip-row-count` [246] 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 `--skip-data-check` [246] option.

You may want to use the `--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:

- **pass**

  The test succeeded.

- **FAIL**

  The test failed. Errors are displayed following the test state line.

- **SKIP**

  The test was skipped due to a missing prerequisite or a skip option.

- **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 `--difftype` [245] option:

- **unified** (default)

  Display unified format output.

- **context**

  Display context format output.

- **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` [246] 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 [245] 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 [245] 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 [246] option (host1). The rightmost database (dbx) exists on the server designated by the --server2 [246] option (host2).

- --changes-for=server1 [245]: 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 [245]: 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 [245] 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 [245]. 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**.

- --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 <*user*>[:<*passwd*>]@<*host*>[:<*port*>][:<*socket*>] format.

- --server2=<source>

  Connection information for the second server in <*user*>[:<*passwd*>]@<*host*>[:<*port*>][:<*socket*>] format.

- --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.

- --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 [245] 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 [245] specifies the differ type. An error occurs if a prefix matches more than one valid value.

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

                                                    Defn    Row     Data
Type      Object Name                               Diff    Count   Check
---------------------------------------------------------------------------
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
*************************       1. row *************************
   dept_no: d008
 dept_name: Research
1 rows.

Rows in emp2.departments not in emp1.departments
*************************       1. row *************************
   dept_no: d100
 dept_name: stupid
1 rows.

TABLE     dept_manager                              pass    pass    pass

Database consistency check failed.

# ...done
```

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 |
+---+---------------+
4 rows in set (0.00 sec)
```

```
mysql> select * from db2.t1;
+---+---------------+
| a | b             |
+---+---------------+
| 1 | Test 123      |
| 2 | Test 456      |
| 3 | Test 789      |
| 5 | New row - db2 |
+---+---------------+
4 rows in set (0.00 sec)
```

To generate the SQL statements for data transformations to make `db1.t1` the same as `db2.t1`, use the `--changes-for=server1` [245] 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

[...]

#                                                   Defn    Row     Data
# Type      Object Name                             Diff    Count
Check #
-------------------------------------------------------------------------
# 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');


# Database consistency check failed.  # # ...done
```

Similarly, when the same command is run with `--changes-for=server2` [245] and `--difftype=sql` [245], the following report is generated:

```
$ mysqldbcompare --server1=root:root@localhost \
    --server2=root:root@localhost db1:db2 --changes-for=server2 -a \
    --difftype=sql

[...]

#                                                   Defn    Row     Data
# Type      Object Name                             Diff    Count
Check #
-------------------------------------------------------------------------
# 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 `--difftype=sql` [245] SQL generation option set, `--show-reverse` [246] 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 --difftype=sql
```

```
[...]

#                                                  Defn    Row     Data
# Type      Object Name                            Diff    Count
Check #
-------------------------------------------------------------------------
# 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
```

13.3.4. 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 *db_name*:*new_db_name* syntax to specify the source and destination names explicitly. If the source and destination database names are the same, *db_name* can be used as shorthand for *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 `--exclude` [250] option with a name in *db*.*obj* format, or you can supply a search pattern. For example, `--exclude=db1.trig1` [250] excludes the single trigger and `--exclude=trig_` [250] excludes all objects from all databases having a name that begins with `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` [251] 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` [250] option.

The `--new-storage-engine` [251] option takes precedence over `--default-storage-engine` [250] if both are given.

If the `--new-storage-engine` [251] or `--default-storage-engine` [250] 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` [250] 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` [251] 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` [251] 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.

OPTIONS

`mysqldbcopy` accepts the following command-line options:

- --help

  Display a help message and exit.

- --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 *<user>*[:*<passwd>*]@*<host>*[:*<port>*][:*<socket>*] format, 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` [251] 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=<user[:password]>

  The user and password for the replication user requirement - e.g. rpl:passwd - default = rpl:rpl.

- --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 source server in <*user*>[:<*passwd*>]@<*host*>[:<*port*>][:<*socket*>] format, 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` [251] and `--default-storage-engine` [250] 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` [251] option is not valid for copying databases on the same server. An error will be generated.

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.p1
# Copying FUNCTION util_test.f1
# Copying EVENT util_test.e1
# 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` [250] 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.p1
# Copying FUNCTION util_test.f1
# Copying EVENT util_test.e1
# 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:

```
$ mysqldbcopy --source=root@localhost:3310 \
  --destination=root@localhost:3311 test123 --rpl=master \
  --rpl-user=rpl
# Source on localhost: ... connected.
# Destination on localhost: ... connected.
# Source on localhost: ... connected.
# Stopping slave
# Copying database test123
# Copying TABLE test123.t1
# Copying data for TABLE test123.t1
# Connecting to the current server as master
# Starting slave
#...done.
```

To copy a database from one slave to another attached to the same master, you can use the following command using the slave with the database to be copied as the source and the slave where the database needs to copied to as the destination:

```
$ mysqldbcopy --source=root@localhost:3311 \
  --destination=root@localhost:3312 test123 --rpl=slave \
  --rpl-user=rpl
# Source on localhost: ... connected.
# Destination on localhost: ... connected.
# Source on localhost: ... connected.
# Stopping slave
# Copying database test123
# Copying TABLE test123.t1
# Copying data for TABLE test123.t1
# Connecting to the current server's master
# Starting slave
#...done.
```

13.3.5. `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` [255] option with a name in *db*.*obj* format, or you can supply a search pattern. For example, `--exclude=db1.trig1` [255] excludes the single trigger and `--exclude=trig_` [255] 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` [257] 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` [257] option.

To specify how to display output, use one of the following values with the --format [256] 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 [255] 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 [255] 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 [255] option is ignored.

To turn off the headers for **csv** or **tab** display format, specify the --no-headers [256] option.

To turn off all feedback information, specify the --quiet [256] option.

To write the data for individual tables to separate files, use the --file-per-table [256] 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 [256] 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 [256] 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** statment 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 **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 **CHANGE MASTER** statement, use the `--rpl-user` [256] 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 **CHANGE MASTER** statement.

You can also use the `--comment-rpl` [255] option to place the replication statements inside comments for later examination.

If you specify the `--rpl-file` [256] option, the utility writes the replication statements to the file specified instead of including them in the export stream.

OPTIONS

`mysqldbexport` accepts the following command-line options:

- --help

  Display a help message and exit.

- --bulk-insert, -b

  Use bulk insert statements for data.

- --comment-rpl

  Place the replication statements in comment statements. Valid only with the `--rpl` [256] option.

- --display=<display>, -d<display>

  Control the number of columns shown. Permitted display values are **brief** (minimal columns for object creation), **full* (all columns), and **names** (only object names; not valid for `--format=sql` [256]). The default is **brief**.

- --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` [256] option, patterns use **REGEXP** matching.

This option does not apply to grants.

- --export=<export>, -e<export>

  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` [256] or `--export=both` [256] 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` [256] option.

- --rpl-user=<user[:password]>

  The user and password for the replication user requirement; for example, `rpl:passwd`. The default is `rpl:rpl`.

- --server=<server>

Connection information for the server in *<user>*[:*<passwd>*]@*<host>*[:*<port>*][:*<socket>*] format.

- --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.

- --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` [256], `--export` [256], and `--display` [255] 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` [256] specifies the grid format. An error occurs if a prefix matches more than one valid value.

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:

```
$ 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
[...]
#...done.
```

Similarly, to export the data of the database `util_test`, producing bulk insert statements, use this command:

```
$ mysqldbexport --server=root:pass@localhost \
  --export=DATA --bulk-insert util_test
# 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'),
  ('02 Test Basic database example'),
  ('03 Test Basic database example'),
  ('04 Test Basic database example'),
  ('05 Test Basic database example'),
  ('06 Test Basic database example'),
  ('07 Test Basic database example');
# Data for table util_test.t2:
INSERT INTO util_test.t2 VALUES  ('11 Test Basic database example'),
  ('12 Test Basic database example'),
  ('13 Test Basic database example');
# Data for table util_test.t3:
INSERT INTO util_test.t3 VALUES  (1, '14 test fkeys'),
  (2, '15 test fkeys'),
  (3, '16 test fkeys');
# Data for table util_test.t4:
INSERT INTO util_test.t4 VALUES  (3, 2);
#...done.
```

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` [256] option to the command:

```
$ mysqldbexport --server=root:pass@localhost \
  --export=DATA --bulk-insert util_test --locking=lock-all
# 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'),
  ('02 Test Basic database example'),
  ('03 Test Basic database example'),
  ('04 Test Basic database example'),
  ('05 Test Basic database example'),
  ('06 Test Basic database example'),
  ('07 Test Basic database example');
# Data for table util_test.t2:
INSERT INTO util_test.t2 VALUES  ('11 Test Basic database example'),
  ('12 Test Basic database example'),
  ('13 Test Basic database example');
```

```
# Data for table util_test.t3:
INSERT INTO util_test.t3 VALUES  (1, '14 test fkeys'),
  (2, '15 test fkeys'),
  (3, '16 test fkeys');
# Data for table util_test.t4:
INSERT INTO util_test.t4 VALUES  (3, 2);
#...done.
```

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:

```
$ mysqldbexport --server=root@localhost:3311 util_test \
  --export=both --rpl-user=rpl:rpl --rpl=master -v
# Source on localhost: ... connected.
#
# Stopping slave
STOP SLAVE;
#
# 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;
#...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 as master
CHANGE MASTER TO MASTER_HOST = 'localhost',
  MASTER_USER = 'rpl',
  MASTER_PASSWORD = 'rpl',
  MASTER_PORT = 3311,
  MASTER_LOG_FILE = 'clone-bin.000001' ,
  MASTER_LOG_POS = 106;
#
# Starting slave
START SLAVE;
#
```

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:

```
$ mysqldbexport --server=root@localhost:3311 util_test \
  --export=both --rpl-user=rpl:rpl --rpl=slave -v
# Source on localhost: ... connected.
#
# Stopping slave
STOP SLAVE;
#
# 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;
#...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;
#
```

13.3.6. `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` [262] 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` [262] option.

To specify the input format, use one of the following values with the `--format` [261] 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` [261] 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.

- **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` [262] option.

To turn off all feedback information, specify the `--quiet` [262] 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` [262] 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` [261] option.

The `--new-storage-engine` [262] option takes precedence over `--default-storage-engine` [261] if both are given.

If the `--new-storage-engine` [262] or `--default-storage-engine` [261] 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.

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 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**, 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` [261] 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 <*user*>[:<*passwd*>]@<*host*>[:<*port*>][:<*socket*>] format.

- --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-rpl

  Do not execute replication commands.

- --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 [262] and --default-storage-engine [261] options apply to all destination tables in the operation.

For the --format [261] and --import [262] 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 [261] specifies the grid format. An error occurs if a prefix matches more than one valid value.

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

# Source on localhost: ... connected.
# Importing definitions and data from data.sql.
#...done.
```

13.3.7. 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 [265] option. The user can also connect to another server by specifying the --server2 [265] 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 [265] option. Alternatively, you can also connect to another server by specifying the --server2 [265] option. In this case, the first object to compare is taken from server1 and the second from server2.

By default, the utilty 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 [265] 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 [265] 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 [265] 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 [265] 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 [265] option (host1). The rightmost database (dbx) exists on the server designated by the --server2 [265] option (host2).

- --changes-for=server1 [265]: 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 [265]: 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 [265] 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 [265] 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 [265]. 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 *<user>*[:*<passwd>*]@*<host>*[:*<port>*][:*<socket>*] format.

- --server2=<source>

  Connection information for the second server in *<user>*[:*<passwd>*]@*<host>*[:*<port>*][:*<socket>*] format.

- --show-reverse

  Produce a transformation report containing the SQL statements to conform the object definitions specified in reverse. For example, if --changes-for [265] 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 **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 `--changes-for` [265] option) that are not changed or do not exist in the target table, the utility generates the **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 `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 **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 `--difftype` [265] 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` [265] specifies the differ type. An error occurs if a prefix matches more than one valid value.

EXAMPLES

To compare the `employees` and `emp` databases on the local server, use this command:

```
$ mysqldiff --server1=root@localhost employees:emp1
# server1 on localhost: ... connected.
WARNING: Objects in server1:employees but not in server2:emp1:
  EVENT: e1
Compare failed. One or more differences found.

$ mysqldiff --server1=root@localhost \
           employees.t1:emp1.t1 employees.t3:emp1.t3
# server1 on localhost: ... connected.
# Comparing employees.t1 to emp1.t1                                [PASS]
# server1 on localhost: ... connected.
# Comparing employees.t3 to emp1.t3                                [PASS]
Success. All objects are the same.

$ mysqldiff --server1=root@localhost \
         employees.salaries:emp1.salaries --differ
# server1 on localhost: ... connected.
# Comparing employees.salaries to emp1.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 statments:

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 statments:

ALTER TABLE dbx.table3
  DROP COLUMN notes,
  CHANGE COLUMN misc misc char(30);

Compare failed. One or more differences found.
```

To generate a set of SQL statements that transform the definitions of `dbx.table3` and `db1.table1` in both directions, use this command:

```
$ 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 statments:

# --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);

Compare failed. One or more differences found.
```

13.3.8. `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 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` [269] 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` [269] 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 <*user*>[:<*passwd*>]@<*host*>[:<*port*>][:<*socket*>] format.

- --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` [269] 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` [269] specifies the grid format. An error occurs if a prefix matches more than one valid value.

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.

EXAMPLES

To show only the disk space usage for the `employees` and `test` databases in grid format (the default), use this command:

```
$ 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.
```

To see all disk usage for the server in CSV format, use this command:

```
$ mysqldiskusage --server=root@localhost --format=csv -a -vv
# Source on localhost: ... connected.
# Database totals:
db_name,db_dir_size,data_size,misc_files,total
test1,0,0,0,0
db3,0,0,0,0
db2,0,0,0,0
db1,0,0,0,0
backup_test,19410,1117,18293,19410
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

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.000079,168398223
/data/mysql-bin.index,76

Total size of binary logs = 168,399,105 bytes or 160.00 MB

# Server is not an active slave - no relay log information.
# InnoDB tablespace information:
InnoDB_file,size,type,specificaton
/data/ib_logfile0,5242880,log file,
/data/ib_logfile1,5242880,log file,
/data/ibdata1,220200960,shared tablespace,ibdata1:210M
/data/ibdata2,10485760,shared tablespace,ibdata2:10M:autoextend
/data/employees/departments.ibd,114688,file tablespace,
/data/employees/dept_emp.ibd,30408704,file tablespace,
/data/employees/dept_manager.ibd,131072,file tablespace,
/data/employees/employees.ibd,23068672,file tablespace,
/data/employees/salaries.ibd,146800640,file tablespace,
/data/employees/titles.ibd,41943040,file tablespace,

Total size of InnoDB files = 494,125,056 bytes or 471.00 MB

#...done.
```

13.3.9. mysqlfailover — Automatic replication health monitoring and failover

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 5.6.5 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` [273] 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` [274] 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` [273] 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.

elect This mode is the same as auto except if no candidates specified in the list of candidate slaves are viable, it does not check the remaining slaves and generates and error and exits.

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*>[:<*passwd*>]@<*host*>[:<*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` [273] and `--exec-after` [273] 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` [273] 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` [273] 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` [273] 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` [273] 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` [274] and the slave is reading the correct master log file, and slave delay is not more than the `--seconds-behind` [274] 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` [273] 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` [274] 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*>]. 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*>]. 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.

- --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 *<user>*[:*<passwd>*]@*<host>*[:*<port>*][:*<socket>*] format.

- --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.

- --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.

- --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>*]. List multiple slaves in comma-separated list.

- --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 = 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. 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` [273] option.

EXAMPLES

To launch the utility, you must specify at a minimum the `--master` [274] option and either the `--discover-slaves-login` [273] option or the `--slaves` [274] option. The option: option can be used in conjunction with the --slaves [274] 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.

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.

The default interface will display the replication health report like the following. In this example the log file is enabled. A sample startup command is shown below:

```
$ mysqlfailover --master=root@localhost:3331 --discover-slaves-login=root

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 ‘r’ 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
+------------------------------------------+
| gtid                                     |
+------------------------------------------+
| 2A67DE00-2DA1-11E2-A711-00764F2BE90F:1-7  |
| 5503D37E-2DB2-11E2-A781-8077D4C14B33:1-3  |
+------------------------------------------+
```

```
Q-quit R-refresh H-health G-GTID Lists U-UUIDs L-log entries Up|Down-scroll
```

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
+------------+-------+---------+--------------------------------------+
| host       | port  | role    | uuid                                 |
+------------+-------+---------+--------------------------------------+
| localhost  | 3331  | MASTER  | 55c65a00-71fd-11e1-9f80-ac64ef85c961  |
| localhost  | 3332  | SLAVE   | 5dd30888-71fd-11e1-9f80-dc242138b7ec  |
| localhost  | 3333  | SLAVE   | 65ccbb38-71fd-11e1-9f80-bda8146bdb0a  |
| localhost  | 3334  | SLAVE   | 6dd6abf4-71fd-11e1-9f80-d406a0117519  |
+------------+-------+---------+--------------------------------------+
Q-quit R-refresh H-health G-GTID Lists U-UUIDs L-log entries
```

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 [...]

UUIDs
+------------+-------+---------+--------+-----------+---------+
```

```
| host        | port  | role    | state  | gtid_mode  | health  |
+------------+-------+---------+--------+------------+---------+
| localhost  | 3332  | MASTER  | 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
```

If the user presses the ‘l’ key and the `--log` [273] option was specified, the interface will show the entries in the log file. Note: example truncated for space allowance.:

```
MySQL Replication Monitor and Failover Utility
Failover Mode = auto     Next Interval = Mon Mar 19 16:06:13 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 [...]

Log File
+-------------------------+---------------------------------------- ... --+
| Date                    | Entry                                   ...   |
+-------------------------+---------------------------------------- ... --+
| 2012-03-19 15:55:33 PM  | INFO Failover console started.          ...   |
| 2012-03-19 15:55:33 PM  | INFO Failover mode = auto.              ...   |
| 2012-03-19 15:55:33 PM  | INFO Getting health for master: localhos ...   |
| 2012-03-19 15:55:33 PM  | INFO Master status: binlog: mysql-bin.00 ...   |
+-------------------------+---------------------------------------- ... --+
Q-quit R-refresh H-health G-GTID Lists U-UUIDs L-log entries Up|Down-scroll\
```

13.3.10. `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 [279] option. To examine the existing indexes, use the --verbose [279] 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 [278] or --worst [279] 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 [279], --best [278], and --worst [279] options, use one of the following values with the --format [278] 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 [278] and --worst [279] 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 [279] 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 [279]. Permitted format values are **grid**, **csv**, **tab**, **sql**, and **vertical**. The default is **grid**.

- --server=<source>

  Connection information for the server in <*user*>[:<*passwd*>]@<*host*>[:<*port*>][:<*socket*>] format.

- --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` [279] 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` [278] 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` [278] specifies the grid format. An error occurs if a prefix matches more than one valid value.

EXAMPLES

To check all tables in the `employees` database on the local server to see the possible redundant and duplicate indexes, use this command:

```
$ 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)
```

13.3.11. `mysqlmetagrep` — Search Database Object Definitions

This utility searches for objects matching a given pattern on all the servers specified using instances of the `--server` [282] option. It produces output that displays the matching objects. By default, the first nonoption argument is taken to be the pattern unless the `--pattern` [282] option is given. If the `--pattern` [282] 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` [282] 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` [282] 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` [282] 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` [282] 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` [282] and `--pattern` [282] options.

- --server=<source>

  Connection information for a server to search in <*user*>[:<*passwd*>]@<*host*>[:<*port*>][:<*socket*>] format. 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` [282] 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` [282] specifies the grid format. An error occurs if a prefix matches more than one valid value.

EXAMPLES

Find all objects with a name that matches the pattern `'t_'` (the letter t followed by any single character):

```
$ mysqlmetagrep --pattern="t_" --server=mats@localhost
+------------------------+--------------+--------------+-----------+
| Connection             | Object Type  | Object Name  | Database  |
+------------------------+--------------+--------------+-----------+
| mats:*@localhost:3306  | TABLE        | t1           | test      |
| mats:*@localhost:3306  | TABLE        | t2           | test      |
| mats:*@localhost:3306  | TABLE        | t3           | test      |
+------------------------+--------------+--------------+-----------+
```

To find all object that contain `'t2'` in the name or the body (for routines, triggers, and events):

```
$ mysqlmetagrep -b --pattern="%t2%" --server=mats@localhost:3306
+------------------------+--------------+--------------+-----------+
| Connection             | Object Type  | Object Name  | Database  |
+------------------------+--------------+--------------+-----------+
| root:*@localhost:3306  | TRIGGER      | tr_foo       | test      |
| root:*@localhost:3306  | TABLE        | t2           | test      |
+------------------------+--------------+--------------+-----------+
```

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:

```
$ mysqlmetagrep -Gb --pattern="t2" --server=mats@localhost

+------------------------+--------------+--------------+-----------+
| Connection             | Object Type  | Object Name  | Database  |
+------------------------+--------------+--------------+-----------+
| root:*@localhost:3306  | TRIGGER      | tr_foo       | test      |
| root:*@localhost:3306  | TABLE        | t2           | test      |
+------------------------+--------------+--------------+-----------+
```

13.3.12. `mysqlprocgrep` — Search Server Process Lists

This utility scans the process lists for the servers specified using instances of the `--server` [285] option and selects those that match the conditions specified using the `--age` [284] 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` [284] 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 [285] 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 [284].

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 [284] 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

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` [284] or `--kill-query` [284] option is given. If a kill option is given, `--print` [285] 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 *<user>*[:*<passwd>*]@*<host>*[:*<port>*][:*<socket>*] format. 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` [284] or `--kill-query` [284] 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` [285], 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

  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` [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, `--format=g` [284] specifies the grid format. An error occurs if a prefix matches more than one valid value.

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
```

13.3.13. `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` [287] 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` [287] 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.

- Start from the beginning

  Start replication from the first event recorded in the master binary log. To do this, use the `--start-from-beginning` [288] 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` [287] 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` [287] and `--master-log-pos` [287] 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 <*user*>[:<*passwd*>]@<*host*>[:<*port*>][:<*socket*>] format.

- --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` [287] 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 *name:passwd* format. The default is `rpl:rpl`.

- --slave=<slave>

  Connection information for the slave server in *<user>*[:*<passwd>*]@*<host>*[:*<port>*][:*<socket>*] format.

- --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` [287] and `--master-log-pos` [287] 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.

EXAMPLES

To set up replication between two MySQL instances running on different ports of the same host using the default settings, use this command:

```
$ 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 uses `--pedantic` [287] 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:

```
$ mysqlreplicate --master=root@localhost:3306 \
  --slave=root@localhost:3307 --rpl-user=rpl:rpl -vv --pedantic
# master on localhost: ... connected.
# slave on localhost: ... connected.
# master id = 2
#  slave id = 99
```

```
# Checking InnoDB statistics for type and version conflicts.
# Checking storage engines...
# Checking for binary logging on master...
# Setting up replication...
# Flushing tables on master with read lock...
# Connecting slave to master...
# CHANGE MASTER TO MASTER_HOST = [...omitted...]
# Starting slave...
# status: Waiting for master to send event
# error: 0:
# Unlocking tables on master...
# ...done.
```

The following command starts replication from the current position of the master (which is the default):

```
$ 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:

```
$ 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:

```
$ 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):

```
$ 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` [287] and `-vv` options for setting up replication on production servers to avoid possible problems with differing storage engines.

13.3.14. 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 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.

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.

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.

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.

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` [292] and the slave is reading the correct master log file, and slave delay is not more than the `--seconds-behind` [293] threshold option.

reset Execute the STOP SLAVE and RESET SLAVE commands on all slaves.

start Execute the START SLAVE command on all slaves.

stop Execute the STOP SLAVE command on all slaves.

switchover Perform slave promotion to a specified candidate slave as designated by the `--new-master` [292] option. This command is available for both gtid-enabled servers and non-gtid-enabled scenarios.

Detection of a downed master is performed as follows. If the connection to the master is lost, wait `--timeout` [293] 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*>],
```

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 utility permits the user to demote a master to a slave during the switchover operation. The `--demote-master` [292] 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` [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 permits the user to log all actions taken during the commands. The `--log` [292] 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` [292] 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` [292] 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 elect, failover, start, stop, and reset commands require either the `--slaves` [293] option to list all of the slaves in the topology or the `--discover-slaves-login` [292] option to provide the user name and password to discover any slaves in the topology that are registered to the master but are not listed in the `--slaves` [293] option.

The options required for the health and gtid commands include the `--master` [292] option to specify the existing master, and either the `--slaves` [293] option to list all of the slaves in the topology or the `--discover-slaves-login` [292] option to provide the user name and password to discover any slaves in the topology that are registered to the master but are not listed in the `--slaves` [293] option.

Use the `--verbose` [293] option to see additional information in the health report and additional messages during switchover or failover.

The options required for switchover include the `--master` [292] option to specify the existing master, the `--new-master` [292] option to specify the candidate slave (the slave to become the new master.

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*>]. Valid only with failover command. List multiple slaves in comma- separated list.

- --demote-master

  Make master a slave after switchover.

- --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*>]. 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.

- --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 <*user*>[:<*passwd*>]@<*host*>[:<*port*>][:<*socket*>] format.

- --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*>]. 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.

- --quiet, -q

  Turn off all messages for quiet execution.

- --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>*]. List multiple slaves in comma-separated list.

- --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 = 3. Also used to check down status of master. Failover will wait timeout seconds to check master response. If no response, failover event occurs.

- --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.

The `--force` option cannot be used with the failover command.

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` [293] option, run the following command.:

```
$ 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.:

```
$ mysqlrpladmin --master=root@localhost:3331 \
  --slaves=root@localhost:3332,root@localhost:3333,root@localhost:3334 \
  --candidates=root@localhost:3333,root@localhost:3334 elect
# Electing candidate slave from candidate list then slaves list.
# Best slave found is located on localhost:3332.
# ...done.
```

To perform failover after a master has failed, use the following command.:

```
$ 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.:

```
$ 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` [293] option as shown below. In this example, we use vertical format to make viewing easier.:

```
$ 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
# Attempting to contact localhost ... Success
#
# Replication Topology Health:
*************************       1. row *************************
            host: localhost
            port: 3331
            role: MASTER
           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:
      SQL_Thread:
     Secs_Behind:
 Remaining_Delay:
    IO_Error_Num:
        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.:

```
$ 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.:

```
# Replication Topology Health:
+------------+-------+---------+--------+------------+---------+
| host       | port  | role    | state  | gtid_mode  | health  |
+------------+-------+---------+--------+------------+---------+
| localhost  | 3332  | MASTER  | UP     | ON         | OK      |
| localhost  | 3331  | SLAVE   | UP     | ON         | OK      |
| localhost  | 3333  | SLAVE   | UP     | ON         | OK      |
| localhost  | 3334  | SLAVE   | UP     | ON         | OK      |
+------------+-------+---------+--------+------------+---------+
```

To use the discover slaves feature, you can omit the `--slaves` [293] option 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. he option: option can be used in conjunction with the `--slaves` [293] 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.:

```
$ mysqlrpladmin --master=root@localhost:3332 --discover-slaves-login=root  health
# Discovering slaves for master at localhost:3332
# Getting health for master: localhost:3332.
```

```
#
# Replication Topology Health:
+------------+-------+---------+--------+------------+---------+
| host       | port  | role    | state  | gtid_mode  | health  |
+------------+-------+---------+--------+------------+---------+
| localhost  | 3332  | MASTER  | UP     | ON         | OK      |
| localhost  | 3331  | SLAVE   | UP     | ON         | OK      |
| localhost  | 3333  | SLAVE   | UP     | ON         | OK      |
| localhost  | 3334  | SLAVE   | UP     | ON         | OK      |
+------------+-------+---------+--------+------------+---------+
# ...done.
```

13.3.15. 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` [298] 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` [298] 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 *<user>*[:*<passwd>*]@*<host>*[:*<port>*][:*<socket>*] format.

- --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 *<user>*[:*<passwd>*]@*<host>*[:*<port>*][:*<socket>*] format.

- --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.

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:

```
$ mysqlrplcheck --master=root@host1:3310 --slave=root@host2:3311 \
  --show-slave-status -vv
# 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]

 master id = 10
  slave id = 11

Is slave connected to master?                                      [pass]
Check master information file                                      [pass]

#
# Master information file:
#
               Master_Log_File : clone-bin.000001
           Read_Master_Log_Pos : 482
                   Master_Host : host1
                   Master_User : rpl
               Master_Password : XXXX
                   Master_Port : 3310
                 Connect_Retry : 60
            Master_SSL_Allowed : 0
            Master_SSL_CA_File :
            Master_SSL_CA_Path :
               Master_SSL_Cert :
             Master_SSL_Cipher :
                Master_SSL_Key :
 Master_SSL_Verify_Server_Cert : 0

Checking InnoDB compatibility                                      [pass]
Checking storage engines compatibility                             [pass]
Checking lower_case_table_names settings                           [pass]

  Master lower_case_table_names: 2
   Slave lower_case_table_names: 2

Checking slave delay (seconds behind master)                       [pass]

#
# Slave status:
#
                Slave_IO_State : Waiting for master to send event
                   Master_Host : host1
                   Master_User : rpl
                   Master_Port : 3310
                 Connect_Retry : 60
               Master_Log_File : clone-bin.000001
           Read_Master_Log_Pos : 482
                Relay_Log_File : clone-relay-bin.000006
                 Relay_Log_Pos : 251
```

```
         Relay_Master_Log_File : clone-bin.000001
              Slave_IO_Running : Yes
             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.
```

13.3.16. 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.

To explore the slaves for each client, use the `--recurse` [302] 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` [302] 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` [302] 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` [301] 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:

```
# 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:

```
# Replication Topology Graph

localhost:3311 (MASTER)
   |
   +--- localhost:3312 - (SLAVE + MASTER)
       |
       +--- localhost:3313 - (SLAVE + MASTER)
           |
           +--- localhost:3311 <--> (SLAVE)
```

To produce a column list in addition to the graph, specify the `--show-list` [302] option. In this case, to specify how to display the list, use one of the following values with the `--format` [301] 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 of the **SHOW SLAVE HOSTS** statement to determine which slaves the master has. If you want to use the `--recurse` [302] 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.

- --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` [302] is given.

- --master=<source>

  Connection information for the master server in <*user*>[:<*passwd*>]@<*host*>[:<*port*>][:<*socket*>] format.

- --max-depth=<N>

  The maximum recursion depth. This option is valid only if `--recurse` [302] 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` [302] 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 [301] 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. User this option to map a replication topology.

- --show-list, -l

  Display a column list of the topology.

- --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 [301] 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 [301] specifies the grid format. An error occurs if a prefix matches more than one valid value.

EXAMPLES

To show the slaves for a master running on port 3311 on the local host, use the following command:

```
$ mysqlrplshow  --master=root@localhost:3311
# 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 the full replication topology of a master running on the local host, use the following command:

```
$ mysqlrplshow  --master=root@localhost:3311 --recurse
# 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:

```
$ mysqlrplshow --recurse --prompt --num-retries=1 \
  --master=root@localhost:3331

Server localhost:3331 is running on localhost.
# master on localhost: ... connected.
# Finding slaves for master: localhost:3331
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:
# master on localhost: ... connected.
# Finding slaves for master: localhost:3332
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:
# master on localhost: ... connected.
# Finding slaves for master: localhost:3333
Server localhost:3334 is running on localhost.
# master on localhost: ... FAILED.
Connection to localhost:3334 has failed.
Please enter the following information to connect to this server.
User name: root
Password:
# master on localhost: ... connected.
# Finding slaves for master: localhost:3334

# Replication Topology Graph
localhost:3331 (MASTER)
   |
   +--- localhost:3332 - (SLAVE)
   |
   +--- localhost:3333 - (SLAVE + MASTER)
       |
       +--- localhost:3334 - (SLAVE)
```

13.3.17. 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 [304]), and starts the server with a socket file. You can optionally add a password for the login user account on the new instance.

OPTIONS

mysqlserverclone accepts the following command-line options:

- --help

  Display a help message and exit.

- --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.

- --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.
```

13.3.18. `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
- 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` [306], `--datadir` [306], and `--start` [306] 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` [306] 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` [306] option.

To see the common default settings for the local server's configuration file, use the `--show-defaults` [306] option. This option reads the configuration file on the machine where the utility is run, not the machine for the host that the `--server` [306] option specifies.

To run the utility against several servers, specify the --server [306] 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 [306] 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.

- --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 [306] is given. The default range is 3306:3333.

- --server=<server>

  Connection information for a server in *<user>*[:*<passwd>*]@*<host>*[:*<port>*][:*<socket>*] format. 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 [306] and --datadir [306] options.

- --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` [306] 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` [306] specifies the grid format. An error occurs if a prefix matches more than one valid value.

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:

```
$ 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
  --innodb_data_file_path=ibdata1:778M;ibdata2:50M:autoextend
#...done.
```

13.3.19. `mysqluc` — Command line client for running MySQL Utilities

The `mysqluc` utility provides a command line environment for running MySQL Utilities, and exists as of MySQL Utilities 1.1.0.

The mysqluc utility, hence console, allows users to execute any of the currently installed MySQL Utilities command. The option is used to provide a path to the MySQL Utilities if the location is different from when the utility is executed.

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.:

```
Command                  Description
----------------------   ---------------------------------------------------
help utilities           Display list of all utilities supported.
help <utility>           Display help for a specific utility.
help | help commands     Show this list.
exit | quit              Exit the console.
```

```
set <variable>=<value>  Store a variable for recall in commands.
show options            Display list of options specified by the user on
                        launch.
show variables          Display list of variables.
<ENTER>                 Press ENTER to execute command.
<ESCAPE>                Press ESCAPE to clear the command entry.
<DOWN>                  Press DOWN to retrieve the previous command.
<UP>                    Press UP to retrieve the next command in history.
<TAB>                   Press TAB for type completion of utility, option,
                        or variable names.
<TAB><TAB>              Press TAB twice for list of matching type
                        completion (context sensitive).
```

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 neeeded.

The user can also run commands using the option. 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

  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 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"
```

```
Utility           Description
----------------  ---------------------------------------------------------
mysqlindexcheck   check for duplicate or redundant indexes
mysqlrplcheck     check replication
mysqluserclone    clone a MySQL user account to one or more new users
mysqldbcompare    compare databases for consistency
mysqldiff         compare object definitions among objects where the
                  difference is how db1.obj1 differs from db2.obj2
mysqldbcopy       copy databases from one server to another
mysqlreplicate    establish replication with a master
mysqldbexport     export metadata and data from databases
mysqldbimport     import metadata and data from files
mysqlmetagrep     search metadata
mysqlprocgrep     search process information
mysqldiskusage    show disk usage for databases
mysqlserverinfo   show server information
mysqlserverclone  start another instance of a running server
```

The following demonstrates launching the console to run several commands using the 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:
+--------------------+--------------+
| db_name            |       total  |
+--------------------+--------------+
...
| world              |           0  |
...
+--------------------+--------------+

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"

Variable  Value
--------  ----------------------------------------------------------------
SERVER    root@host123
VAR_A     57
```

13.3.20. 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 [311] 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 [311] 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

  Display a help message and exit.

- --destination=<destination>

  Connection information for the destination server in <*user*>[:<*passwd*>]@<*host*>[:<*port*>][:<*socket*>] format.

- --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 [311] 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 [311] 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 *<user>*[:*<passwd>*]@*<host>*[:*<port>*][:*<socket>*] format.

- --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` [311] option is given), and privileges to execute **GRANT** for all privileges to be granted to the new accounts.

For the `--format` [311] 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` [311] specifies the grid format. An error occurs if a prefix matches more than one valid value.

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
```

13.4. Parsers

13.4.1. 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

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:

```
>>> 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:

```
>>> slow_log = open("/var/lib/mysql/mysql-slow.log")
>>> log = SlowQueryLog(slow_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

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    with the Library, with the complete machine-readable "work that
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    uses the Library", as object code and/or source code, so that the
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---------------------------
Written by:       Philip Hazel
Email local part: ph10
Email domain:     cam.ac.uk
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/********************************************************************\
 *  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
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In May 2000, Guido and the Python core development team moved to
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                    from                                compatible? (1)

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    1.3 thru 1.5.2  1.2         1995-1999   CNRI        yes
    1.6             1.5.2       2000        CNRI        no
    2.0             1.6         2000        BeOpen.com  no
    1.6.1           1.6         2001        CNRI        yes (2)
    2.1             2.0+1.6.1   2001        PSF         no
    2.0.1           2.0+1.6.1   2001        PSF         yes
    2.1.1           2.1+2.0.1   2001        PSF         yes
    2.2             2.1.1       2001        PSF         yes
    2.1.2           2.1.1       2002        PSF         yes
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    2.3.4           2.3.3       2004        PSF         yes
    2.3.5           2.3.4       2005        PSF         yes
    2.4             2.3         2004        PSF         yes
    2.4.1           2.4         2005        PSF         yes
    2.4.2           2.4.1       2005        PSF         yes
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    2.4.3           2.4.2       2006        PSF         yes
    2.5             2.4         2006        PSF         yes
    2.5.1          2.5    2007    PSF    yes
    2.5.2          2.5.1       2008    PSF    yes
    2.5.3          2.5.2    2008    PSF    yes
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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)
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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
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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 Edited comments slightly for automatic TOC extraction.
1999-10-18 lpd Fixed typo in header comment (ansi2knr rather than md5);
      added conditionalization for C++ compilation from Martin
      Purschke <purschke@bnl.gov>.
1999-05-03 lpd Original version.

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Modified by Jack Jansen, CWI, July 1995:
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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

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:

```
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:

```
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

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

MySQL Workbench release notes are no longer published in the MySQL Workbench Manual.

Release notes for the changes in each release of MySQL Workbench are located at http://dev.mysql.com/doc/relnotes/workbench/en/.

C.2. MySQL Utilities Change History

MySQL Utilities release notes are no longer published in the MySQL Workbench Manual.

Release notes for the changes in each release of MySQL Utilities are located at http://dev.mysql.com/doc/relnotes/mysql-utilities/en/.