MySQL and Linux/Unix
Abstract

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Preface and Legal Notices

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Chapter 1 Installing MySQL on Unix/Linux Using Generic Binaries

Oracle provides a set of binary distributions of MySQL. These include generic binary distributions in the form of compressed tar files (files with a .tar.gz extension) for a number of platforms, and binaries in platform-specific package formats for selected platforms.

This section covers the installation of MySQL from a compressed tar file binary distribution on Unix/Linux platforms. For other platform-specific binary package formats, see the other platform-specific sections in this manual. For example, for Windows distributions, see Installing MySQL on Microsoft Windows. See How to Get MySQL on how to obtain MySQL in different distribution formats.

MySQL compressed tar file binary distributions have names of the form mysql-VERSION-OS.tar.gz, where VERSION is a number (for example, 5.7.23), and OS indicates the type of operating system for which the distribution is intended (for example, pc-linux-i686 or winx64).

Warning

If you have previously installed MySQL using your operating system native package management system, such as Yum or APT, you may experience problems installing using a native binary. Make sure your previous MySQL installation has been removed entirely (using your package management system), and that any additional files, such as old versions of your data files, have also been removed. You should also check for configuration files such as /etc/my.cnf or the /etc/mysql directory and delete them.

For information about replacing third-party packages with official MySQL packages, see the related APT guide or Yum guide.

Important

- MySQL has a dependency on the libaio library. Data directory initialization and subsequent server startup steps will fail if this library is not installed locally. If necessary, install it using the appropriate package manager. For example, on Yum-based systems:

  ```shell
  shell> yum search libaio  # search for info
  shell> yum install libaio  # install library
  ```

  Or, on APT-based systems:

  ```shell
  shell> apt-cache search libaio  # search for info
  shell> apt-get install libaio1  # install library
  ```

- For MySQL 5.7.19 and later: Support for Non-Uniform Memory Access (NUMA) has been added to the generic Linux build, which has a dependency now on the libnuma library; if the library has not been installed on your system, use you system’s package manager to search for and install it (see the last bullet for some sample commands).

To install a compressed tar file binary distribution, unpack it at the installation location you choose (typically /usr/local/mysql). This creates the directories shown in the following table.
Table 1.1 MySQL Installation Layout for Generic Unix/Linux Binary Package

<table>
<thead>
<tr>
<th>Directory</th>
<th>Contents of Directory</th>
</tr>
</thead>
<tbody>
<tr>
<td>bin</td>
<td>mysqld server, client and utility programs</td>
</tr>
<tr>
<td>docs</td>
<td>MySQL manual in Info format</td>
</tr>
<tr>
<td>man</td>
<td>Unix manual pages</td>
</tr>
<tr>
<td>include</td>
<td>Include (header) files</td>
</tr>
<tr>
<td>lib</td>
<td>Libraries</td>
</tr>
<tr>
<td>share</td>
<td>Error messages, dictionary, and SQL for database installation</td>
</tr>
<tr>
<td>support-files</td>
<td>Miscellaneous support files</td>
</tr>
</tbody>
</table>

Note

SLES 11: as of MySQL 5.7.19, the Linux Generic tarball package format is EL6 instead of EL5. As a side effect, the MySQL client bin/mysql needs libtinfo.so.5.

A workaround is to create a symlink, such as `ln -s libncurses.so.5.6 /lib64/libtinfo.so.5` on 64-bit systems or `ln -s libncurses.so.5.6 /lib/libtinfo.so.5` on 32-bit systems.

Debug versions of the mysqld binary are available as mysqld-debug. To compile your own debug version of MySQL from a source distribution, use the appropriate configuration options to enable debugging support. See Installing MySQL from Source.

To install and use a MySQL binary distribution, the command sequence looks like this:

```
shell> groupadd mysql
shell> useradd -r -g mysql -s /bin/false mysql
shell> cd /usr/local
shell> tar zxvf /path/to/mysql-VERSION-OS.tar.gz
shell> ln -s full-path-to-mysql-VERSION-OS mysql
shell> cd mysql
shell> mkdir mysql-files
shell> chown mysql:mysql mysql-files
shell> chmod 750 mysql-files
shell> bin/mysqld --initialize --user=mysql
shell> bin/mysqld_safe --user=mysql &
# Next command is optional
shell> cp support-files/mysql.server /etc/init.d/mysql.server
```

Note

This procedure assumes that you have root (administrator) access to your system. Alternatively, you can prefix each command using the sudo (Linux) or pfexec (Solaris) command.

The mysql-files directory provides a convenient location to use as the value for the secure_file_priv system variable, which limits import and export operations to a specific directory. See Server System Variables.

A more detailed version of the preceding description for installing a binary distribution follows.
Create a mysql User and Group

If your system does not already have a user and group to use for running `mysqld`, you may need to create them. The following commands add the `mysql` group and the `mysql` user. You might want to call the user and group something else instead of `mysql`. If so, substitute the appropriate name in the following instructions. The syntax for `useradd` and `groupadd` may differ slightly on different versions of Unix/Linux, or they may have different names such as `adduser` and `addgroup`.

```
shell> groupadd mysql
shell> useradd -r -g mysql -s /bin/false mysql
```

**Note**

Because the user is required only for ownership purposes, not login purposes, the `useradd` command uses the `-r` and `-s /bin/false` options to create a user that does not have login permissions to your server host. Omit these options if your `useradd` does not support them.

Obtain and Unpack the Distribution

Pick the directory under which you want to unpack the distribution and change location into it. The example here unpacks the distribution under `/usr/local`. The instructions, therefore, assume that you have permission to create files and directories in `/usr/local`. If that directory is protected, you must perform the installation as root.

```
shell> cd /usr/local
```

Obtain a distribution file using the instructions in How to Get MySQL. For a given release, binary distributions for all platforms are built from the same MySQL source distribution.

Unpack the distribution, which creates the installation directory. `tar` can uncompress and unpack the distribution if it has `z` option support:

```
shell> tar zxvf /path/to/mysql-VERSION-OS.tar.gz
```

The `tar` command creates a directory named `mysql-VERSION-OS`.

To install MySQL from a compressed `tar` file binary distribution, your system must have GNU `gunzip` to uncompress the distribution and a reasonable `tar` to unpack it. If your `tar` program supports the `z` option, it can both uncompress and unpack the file.

GNU `tar` is known to work. The standard `tar` provided with some operating systems is not able to unpack the long file names in the MySQL distribution. You should download and install GNU `tar`, or if available, use a preinstalled version of GNU `tar`. Usually this is available as `gnutar`, `gtar`, or as `tar` within a GNU or Free Software directory, such as `/usr/sfw/bin` or `/usr/local/bin`. GNU `tar` is available from [http://www.gnu.org/software/tar/](http://www.gnu.org/software/tar/).

If your `tar` does not have `z` option support, use `gunzip` to unpack the distribution and `tar` to unpack it. Replace the preceding `tar` command with the following alternative command to uncompress and extract the distribution:

```
shell> gunzip < /path/to/mysql-VERSION-OS.tar.gz | tar xvf -
```

Next, create a symbolic link to the installation directory created by `tar`:
Perform Postinstallation Setup

The `ln` command makes a symbolic link to the installation directory. This enables you to refer more easily to it as `/usr/local/mysql`. To avoid having to type the path name of client programs always when you are working with MySQL, you can add the `/usr/local/mysql/bin` directory to your `PATH` variable:

```
shell> export PATH=$PATH:/usr/local/mysql/bin
```

Perform Postinstallation Setup

The remainder of the installation process involves setting distribution ownership and access permissions, initializing the data directory, starting the MySQL server, and setting up the configuration file. For instructions, see *Postinstallation Setup and Testing*. 
Chapter 2 Installing MySQL on Linux

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Linux supports a number of different solutions for installing MySQL. We recommend that you use one of the distributions from Oracle, for which several methods for installation are available:

Table 2.1 Linux Installation Methods and Information

<table>
<thead>
<tr>
<th>Type</th>
<th>Setup Method</th>
<th>Additional Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apt</td>
<td>Enable the MySQL Apt repository</td>
<td>Documentation</td>
</tr>
<tr>
<td>Yum</td>
<td>Enable the MySQL Yum repository</td>
<td>Documentation</td>
</tr>
<tr>
<td>Zypper</td>
<td>Enable the MySQL SLES repository</td>
<td>Documentation</td>
</tr>
<tr>
<td>RPM</td>
<td>Download a specific package</td>
<td>Documentation</td>
</tr>
<tr>
<td>DEB</td>
<td>Download a specific package</td>
<td>Documentation</td>
</tr>
<tr>
<td>Generic</td>
<td>Download a generic package</td>
<td>Documentation</td>
</tr>
<tr>
<td>Source</td>
<td>Compile from source</td>
<td>Documentation</td>
</tr>
<tr>
<td>Docker</td>
<td>Use Docker Hub</td>
<td>Documentation</td>
</tr>
<tr>
<td>Oracle Unbreakable Linux Network</td>
<td>Use ULN channels</td>
<td>Documentation</td>
</tr>
</tbody>
</table>

As an alternative, you can use the package manager on your system to automatically download and install MySQL with packages from the native software repositories of your Linux distribution. These native packages are often several versions behind the currently available release. You will also normally be unable to install development milestone releases (DMRs), as these are not usually made available in the native repositories. For more information on using the native package installers, see Section 2.8, “Installing MySQL on Linux from the Native Software Repositories”.

Note

For many Linux installations, you will want to set up MySQL to be started automatically when your machine starts. Many of the native package installations perform this operation for you, but for source, binary and RPM solutions you may need to set this up separately. The required script, `mysql.server`, can be found
in the `support-files` directory under the MySQL installation directory or in a MySQL source tree. You can install it as `/etc/init.d/mysql` for automatic MySQL startup and shutdown. See `mysql.server — MySQL Server Startup Script`.

## 2.1 Installing MySQL on Linux Using the MySQL Yum Repository

The MySQL Yum repository for Oracle Linux, Red Hat Enterprise Linux, CentOS, and Fedora provides RPM packages for installing the MySQL server, client, MySQL Workbench, MySQL Utilities, MySQL Router, MySQL Shell, Connector/ODBC, Connector/Python and so on (not all packages are available for all the distributions; see `Installing Additional MySQL Products and Components with Yum` for details).

### Before You Start

As a popular, open-source software, MySQL, in its original or re-packaged form, is widely installed on many systems from various sources, including different software download sites, software repositories, and so on. The following instructions assume that MySQL is not already installed on your system using a third-party-distributed RPM package; if that is not the case, follow the instructions given in `Upgrading MySQL with the MySQL Yum Repository` or Section 2.2, “Replacing a Third-Party Distribution of MySQL Using the MySQL Yum Repository”.

### Steps for a Fresh Installation of MySQL

Follow the steps below to install the latest GA version of MySQL with the MySQL Yum repository:

#### Adding the MySQL Yum Repository

First, add the MySQL Yum repository to your system’s repository list. This is a one-time operation, which can be performed by installing an RPM provided by MySQL. Follow these steps:

2. Select and download the release package for your platform.
3. Install the downloaded release package with the following command, replacing `platform-and-version-specific-package-name` with the name of the downloaded RPM package:

   ```shell
   sudo yum localinstall platform-and-version-specific-package-name.rpm
   ```

   For an EL6-based system, the command is in the form of:

   ```shell
   sudo yum localinstall mysql57-community-release-el6-{version-number}.noarch.rpm
   ```

   For an EL7-based system:

   ```shell
   sudo yum localinstall mysql57-community-release-el7-{version-number}.noarch.rpm
   ```

   For Fedora 26:

   ```shell
   sudo dnf install mysql57-community-release-fc26-{version-number}.noarch.rpm
   ```

   For Fedora 27:
Selecting a Release Series

When using the MySQL Yum repository, the latest GA series (currently MySQL 5.7) is selected for installation by default. If this is what you want, you can skip to the next step, Installing MySQL.

Within the MySQL Yum repository, different release series of the MySQL Community Server are hosted in different subrepositories. The subrepository for the latest GA series (currently MySQL 5.7) is enabled by default, and the subrepositories for all other series (for example, the MySQL 5.6 series) are disabled by default. Use this command to see all the subrepositories in the MySQL Yum repository, and see which of them are enabled or disabled (for Fedora, replace `yum` in the command with `dnf`):

```
shell> yum repolist all | grep mysql
```

To install the latest release from the latest GA series, no configuration is needed. To install the latest release from a specific series other than the latest GA series, disable the subrepository for the latest GA series and enable the subrepository for the specific series before running the installation command. If your platform supports `yum-config-manager`, you can do that by issuing these commands, which disable the subrepository for the 5.7 series and enable the one for the 5.6 series:

```
shell> sudo yum-config-manager --disable mysql57-community
shell> sudo yum-config-manager --enable mysql56-community
```

For Fedora platforms:

```
shell> sudo dnf config-manager --disable mysql57-community
shell> sudo dnf config-manager --enable mysql56-community
```

Besides using `yum-config-manager` or the `dnf config-manager` command, you can also select a release series by editing manually the `/etc/yum.repos.d/mysql-community.repo` file. This is a typical entry for a release series' subrepository in the file:
Installing MySQL

The command to install MySQL is:

```
shell> sudo yum install mysql-community-server
```

This command installs the MySQL server (`mysql-community-server`) and also installs packages for the components required to run the server, including:

- `mysql-community-client` for the client components,
- `mysql-community-common` for the common error messages and character sets,
- `mysql-community-libs` for the shared client libraries.

Starting the MySQL Server

Start the MySQL server with the following command:

```
shell> sudo service mysqld start
Starting mysqld: [ OK ]
```

You can check the status of the MySQL server with the following command:

```
shell> sudo service mysqld status
mysqld (pid 3066) is running.
```

At the initial start up of the server, the following happens, given that the data directory of the server is empty:

- The server is initialized.
Installing Additional MySQL Products and Components with Yum

- SSL certificate and key files are generated in the data directory.
- `validate_password` is installed and enabled.
- A superuser account `'root'@'localhost` is created. A password for the superuser is set and stored in the error log file. To reveal it, use the following command:

  ```shell
  sudo grep 'temporary password' /var/log/mysqld.log
  ```

  Change the root password as soon as possible by logging in with the generated, temporary password and set a custom password for the superuser account:

  ```shell
  mysql> ALTER USER 'root'@'localhost' IDENTIFIED BY 'MyNewPass4!';
  ```

  **Note**
  `validate_password` is installed by default. The default password policy implemented by `validate_password` requires that passwords contain at least one upper case letter, one lower case letter, one digit, and one special character, and that the total password length is at least 8 characters.

  For more information on the postinstallation procedures, see Postinstallation Setup and Testing.

  **Note**
  Compatibility Information for EL7-based platforms: The following RPM packages from the native software repositories of the platforms are incompatible with the package from the MySQL Yum repository that installs the MySQL server. Once you have installed MySQL using the MySQL Yum repository, you will not be able to install these packages (and vice versa).

  - akonadi-mysql

**Installing Additional MySQL Products and Components with Yum**

You can use Yum to install and manage individual components of MySQL. Some of these components are hosted in sub-repositories of the MySQL Yum repository: for example, the MySQL Connectors are to be found in the MySQL Connectors Community sub-repository, and the MySQL Workbench in MySQL Tools Community. You can use the following command to list the packages for all the MySQL components available for your platform from the MySQL Yum repository (for Fedora, replace `yum` in the command with `dnf`):

```shell
sudo yum --disablerepo=* --enablerepo=mysql*-community* list available
```

Install any packages of your choice with the following command, replacing `package-name` with name of the package (for Fedora, replace `yum` in the command with `dnf`):

```shell
sudo yum install package-name
```

For example, to install MySQL Workbench on Fedora:

```shell
sudo dnf install mysql-workbench-community
```
To install the shared client libraries (for Fedora, replace `yum` in the command with `dnf`):

```
shell> sudo yum install mysql-community-libs
```

### Updating MySQL with Yum

Besides installation, you can also perform updates for MySQL products and components using the MySQL Yum repository. See Upgrading MySQL with the MySQL Yum Repository for details.

#### 2.2 Replacing a Third-Party Distribution of MySQL Using the MySQL Yum Repository

For supported Yum-based platforms (see Section 2.1, “Installing MySQL on Linux Using the MySQL Yum Repository”, for a list), you can replace a third-party distribution of MySQL with the latest GA release (from the MySQL 5.7 series currently) from the MySQL Yum repository. According to how your third-party distribution of MySQL was installed, there are different steps to follow:

### Replacing a Native Third-Party Distribution of MySQL

If you have installed a third-party distribution of MySQL from a native software repository (that is, a software repository provided by your own Linux distribution), follow these steps:

**Backing Up Your Database**

To avoid loss of data, always back up your database before trying to replace your MySQL installation using the MySQL Yum repository. See Backup and Recovery, on how to back up your database.

**Adding the MySQL Yum Repository**

Add the MySQL Yum repository to your system’s repository list by following the instructions given in Adding the MySQL Yum Repository.

**Replacing the Native Third-Party Distribution by a Yum Update or a DNF Upgrade**

By design, the MySQL Yum repository will replace your native, third-party MySQL with the latest GA release (from the MySQL 5.7 series currently) from the MySQL Yum repository when you perform a `yum update` command (or `dnf upgrade` for Fedora) on the system, or a `yum update mysql-server` (or `dnf upgrade mysql-server` for Fedora).

After updating MySQL using the Yum repository, applications compiled with older versions of the shared client libraries should continue to work. However, if you want to recompile applications and dynamically link them with the updated libraries, see Upgrading the Shared Client Libraries, for some special considerations.

### Replacing a Nonnative Third-Party Distribution of MySQL

If you have installed a third-party distribution of MySQL from a nonnative software repository (that is, a software repository not provided by your own Linux distribution), follow these steps:

**Backing Up Your Database**

To avoid loss of data, always back up your database before trying to replace your MySQL installation using the MySQL Yum repository. See Backup and Recovery, on how to back up your database.
Stopping Yum from Receiving MySQL Packages from Third-Party, Nonnative Repositories

Before you can use the MySQL Yum repository for installing MySQL, you must stop your system from receiving MySQL packages from any third-party, nonnative Yum repositories.

For example, if you have installed MariaDB using their own software repository, get a list of the installed MariaDB packages using the following command (for Fedora, replace `yum` in the command with `dnf`):

```shell
>yum list installed mariadb*  
```

<table>
<thead>
<tr>
<th>Package</th>
<th>Version</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>MariaDB-common.i686</td>
<td>10.0.4-1</td>
<td>@mariadb</td>
</tr>
<tr>
<td>MariaDB-compat.i686</td>
<td>10.0.4-1</td>
<td>@mariadb</td>
</tr>
<tr>
<td>MariaDB-server.i686</td>
<td>10.0.4-1</td>
<td>@mariadb</td>
</tr>
</tbody>
</table>

From the command output, we can identify the installed packages (MariaDB-common, MariaDB-compat, and MariaDB-server) and the source of them (a nonnative software repository named mariadb).

As another example, if you have installed Percona using their own software repository, get a list of the installed Percona packages using the following command (for Fedora, replace `yum` in the command with `dnf`):

```shell
>yum list installed Percona*  
```

<table>
<thead>
<tr>
<th>Package</th>
<th>Version</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percona-Server-client-55.i686</td>
<td>5.5.39-rel36.0.el6</td>
<td>@percona-release-i386</td>
</tr>
<tr>
<td>Percona-Server-server-55.i686</td>
<td>5.5.39-rel36.0.el6</td>
<td>@percona-release-i386</td>
</tr>
<tr>
<td>Percona-Server-shared-55.i686</td>
<td>5.5.39-rel36.0.el6</td>
<td>@percona-release-i386</td>
</tr>
<tr>
<td>percona-release.noarch</td>
<td>0.1-3</td>
<td>@/percona-release-0.1-3.noarch</td>
</tr>
</tbody>
</table>

From the command output, we can identify the installed packages (Percona-Server-client, Percona-Server-server, Percona-Server-shared, and percona-release.noarch) and the source of them (a nonnative software repository named percona-release).

If you are not sure which third-party MySQL fork you have installed, this command should reveal it and list the RPM packages installed for it, as well as the third-party repository that supplies the packages (for Fedora, replace `yum` in the command with `dnf`):

```shell
>yum --disablerepo=* provides mysql*  
```

The next step is to stop Yum from receiving packages from the nonnative repository. If the `yum-config-manager` utility is supported on your platform, you can, for example, use this command for stopping delivery from MariaDB (on Fedora, use the `dnf config-manager` command instead of `yum-config-manager`):

```shell
>sudo yum-config-manager --disable mariadb  
```

Use this command for stopping delivery from Percona (on Fedora, use the `dnf config-manager` command instead of `yum-config-manager`):

```shell
>sudo yum-config-manager --disable percona-release  
```

You can perform the same task by removing the entry for the software repository existing in one of the repository files under the `/etc/yum.repos.d/` directory. This is how the entry typically looks for MariaDB:
Uninstalling the Nonnative Third-Party MySQL Distribution of MySQL

The nonnative third-party MySQL distribution must first be uninstalled before you can use the MySQL Yum repository to install MySQL. For the MariaDB packages found in Step 2 above, uninstall them with the following command (for Fedora, replace `yum` in the command with `dnf`):

```
shell> sudo yum remove MariaDB-common MariaDB-compat MariaDB-server
```

For the Percona packages we found in Step 2 above (for Fedora, replace `yum` in the command with `dnf`):

```
shell> sudo yum remove Percona-Server-client-55 Percona-Server-server-55
     Percona-Server-shared-55.i686 percona-release
```

Installing MySQL with the MySQL Yum Repository

Then, install MySQL with the MySQL Yum repository by following the instructions given in Section 2.1, "Installing MySQL on Linux Using the MySQL Yum Repository".

Important

If you have chosen to replace your third-party MySQL distribution with a newer version of MySQL from the MySQL Yum repository, remember to run `mysql_upgrade` after the server starts, to check and possibly resolve any incompatibilities between the old data and the upgraded software. `mysql_upgrade` also performs other functions; see `mysql_upgrade --Check and Upgrade MySQL Tables` for details.

For EL7-based platforms: See Compatibility Information for EL7-based platforms [9].

2.3 Installing MySQL on Linux Using the MySQL APT Repository

The MySQL APT repository provides `deb` packages for installing and managing the MySQL server, client, and other components on Debian and Ubuntu platforms.

Instructions for using the MySQL APT Repository are available in A Quick Guide to Using the MySQL APT Repository.
2.4 Installing MySQL on Linux Using the MySQL SLES Repository

The MySQL SLES repository provides RPM packages for installing and managing the MySQL server, client, and other components on SUSE Enterprise Linux Server.

Instructions for using the MySQL SLES repository are available in A Quick Guide to Using the MySQL SLES Repository.

Note
The MySQL SLES repository is now in development release. We encourage you to try it and provide us with feedback. Please report any bugs or inconsistencies you observe to our Bugs Database.

2.5 Installing MySQL on Linux Using RPM Packages from Oracle

The recommended way to install MySQL on RPM-based Linux distributions is by using the RPM packages provided by Oracle. There are two sources for obtaining them, for the Community Edition of MySQL:

• From the MySQL software repositories:
  • The MySQL Yum repository (see Section 2.1, “Installing MySQL on Linux Using the MySQL Yum Repository” for details).
  • The MySQL SLES repository (see Section 2.4, “Installing MySQL on Linux Using the MySQL SLES Repository” for details).

• From the Download MySQL Community Server page in the MySQL Developer Zone.

Note
RPM distributions of MySQL are also provided by other vendors. Be aware that they may differ from those built by Oracle in features, capabilities, and conventions (including communication setup), and that the installation instructions in this manual do not necessarily apply to them. The vendor’s instructions should be consulted instead.

If you have such a third-party distribution of MySQL running on your system and now want to migrate to Oracle's distribution using the RPM packages downloaded from the MySQL Developer Zone, see Compatibility with RPM Packages from Other Vendors below. The preferred method of migration, however, is to use the MySQL Yum repository or MySQL SLES repository.

RPM packages for MySQL are listed in the following tables:

Table 2.2 RPM Packages for MySQL Community Edition

<table>
<thead>
<tr>
<th>Package Name</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>mysql-community-server</td>
<td>Database server and related tools</td>
</tr>
<tr>
<td>mysql-community-client</td>
<td>MySQL client applications and tools</td>
</tr>
<tr>
<td>mysql-community-common</td>
<td>Common files for server and client libraries</td>
</tr>
</tbody>
</table>
### Table 2.3 RPM Packages for the MySQL Enterprise Edition

<table>
<thead>
<tr>
<th>Package Name</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>mysql-commercial-server</td>
<td>Database server and related tools</td>
</tr>
<tr>
<td>mysql-commercial-client</td>
<td>MySQL client applications and tools</td>
</tr>
<tr>
<td>mysql-commercial-common</td>
<td>Common files for server and client libraries</td>
</tr>
<tr>
<td>mysql-commercial-server-minimal</td>
<td>Minimal installation of the database server and related tools</td>
</tr>
<tr>
<td>mysql-commercial-devel</td>
<td>Development header files and libraries for MySQL database client applications</td>
</tr>
<tr>
<td>mysql-commercial-libs</td>
<td>Shared libraries for MySQL database client applications</td>
</tr>
<tr>
<td>mysql-commercial-libs-compat</td>
<td>Shared compatibility libraries for previous MySQL installations</td>
</tr>
<tr>
<td>mysql-commercial-embedded</td>
<td>MySQL embedded library</td>
</tr>
<tr>
<td>mysql-commercial-embedded-devel</td>
<td>Development header files and libraries for MySQL as an embeddable library</td>
</tr>
</tbody>
</table>
### Package Name | Summary
--- | ---
mysql-commercial-test | Test suite for the MySQL server

The full names for the RPMs have the following syntax:

`packagename-version-distribution-arch.rpm`

The `distribution` and `arch` values indicate the Linux distribution and the processor type for which the package was built. See the table below for lists of the distribution identifiers:

#### Table 2.4 MySQL Linux RPM Package Distribution Identifiers

<table>
<thead>
<tr>
<th>distribution Value</th>
<th>Intended Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>el6, el7</td>
<td>Red Hat Enterprise Linux/Oracle Linux/CentOS 6, or 7</td>
</tr>
<tr>
<td>fc26, fc27</td>
<td>Fedora 26 and 27</td>
</tr>
<tr>
<td>sles12</td>
<td>SUSE Linux Enterprise Server 12</td>
</tr>
</tbody>
</table>

To see all files in an RPM package (for example, `mysql-community-server`), use the following command:

```
shell> rpm -qpl mysql-community-server-version-distribution-arch.rpm
```

*The discussion in the rest of this section applies only to an installation process using the RPM packages directly downloaded from Oracle, instead of through a MySQL repository.*

Dependency relationships exist among some of the packages. If you plan to install many of the packages, you may wish to download the RPM bundle `tar` file instead, which contains all the RPM packages listed above, so that you need not download them separately.

In most cases, you need to install the `mysql-community-server`, `mysql-community-client`, `mysql-community-libs`, `mysql-community-common`, and `mysql-community-libs-compat` packages to get a functional, standard MySQL installation. To perform such a standard, basic installation, go to the folder that contains all those packages (and, preferably, no other RPM packages with similar names), and issue the following command for platforms other than Red Hat Enterprise Linux/Oracle Linux/CentOS 5:

```
shell> sudo yum install mysql-community-{server,client,common,libs}-%
```

Replace `yum` with `zypper` for SLES, and with `dnf` for Fedora.

While it is much preferable to use a high-level package management tool like `yum` to install the packages, users who prefer direct `rpm` commands can replace the `yum install` command with the `rpm -Uvh` command; however, using `rpm -Uvh` instead makes the installation process more prone to failure, due to potential dependency issues the installation process might run into.

To install only the client programs, you can skip `mysql-community-server` in your list of packages to install; issue the following command for platforms other than Red Hat Enterprise Linux/Oracle Linux/CentOS 5:
Installing MySQL on Linux Using RPM Packages from Oracle

```
shell> sudo yum install mysql-community-{client,common,libs}-*
```

Replace `yum` with `zypper` for SLES, and with `dnf` for Fedora.

For Red Hat Enterprise Linux/Oracle Linux/CentOS 5 systems:

```
shell> sudo yum install mysql-community-{client,common,libs}-* mysql-5.*
```

A standard installation of MySQL using the RPM packages result in files and resources created under the system directories, shown in the following table.

**Table 2.5 MySQL Installation Layout for Linux RPM Packages from the MySQL Developer Zone**

<table>
<thead>
<tr>
<th>Files or Resources</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client programs and scripts</td>
<td>/usr/bin</td>
</tr>
<tr>
<td><code>mysqld</code> server</td>
<td>/usr/sbin</td>
</tr>
<tr>
<td>Configuration file</td>
<td>/etc/my.cnf</td>
</tr>
<tr>
<td>Data directory</td>
<td>/var/lib/mysql</td>
</tr>
<tr>
<td>Error log file</td>
<td>For RHEL, Oracle Linux, CentOS or Fedora platforms: /var/log/mysqld.log For SLES: /var/log/mysql/mysqld.log</td>
</tr>
<tr>
<td>Value of <code>secure_file_priv</code></td>
<td>/var/lib/mysql-files</td>
</tr>
<tr>
<td>System V init script</td>
<td>For RHEL, Oracle Linux, CentOS or Fedora platforms: /etc/init.d/mysqld For SLES: /etc/init.d/mysql</td>
</tr>
<tr>
<td>Systemd service</td>
<td>For RHEL, Oracle Linux, CentOS or Fedora platforms: mysqld For SLES: mysql</td>
</tr>
<tr>
<td>Pid file</td>
<td>/var/run/mysqld/mysqld.pid</td>
</tr>
<tr>
<td>Socket</td>
<td>/var/lib/mysql/mysqld.sock</td>
</tr>
<tr>
<td>Keyring directory</td>
<td>/var/lib/mysql-keyring</td>
</tr>
<tr>
<td>Unix manual pages</td>
<td>/usr/share/man</td>
</tr>
<tr>
<td>Include (header) files</td>
<td>/usr/include/mysql</td>
</tr>
<tr>
<td>Libraries</td>
<td>/usr/lib/mysql</td>
</tr>
<tr>
<td>Miscellaneous support files (for example, error messages, and character set files)</td>
<td>/usr/share/mysql</td>
</tr>
</tbody>
</table>

The installation also creates a user named `mysql` and a group named `mysql` on the system.

**Note**

Installation of previous versions of MySQL using older packages might have created a configuration file named `/usr/my.cnf`. It is highly recommended that you examine the contents of the file and migrate the desired settings inside to the file `/etc/my.cnf` file, then remove `/usr/my.cnf`. 
MySQL is not automatically started at the end of the installation process. For Red Hat Enterprise Linux, Oracle Linux, CentOS, and Fedora systems, use the following command to start MySQL:

```sh
shell> sudo service mysqld start
```

For SLES systems, the command is the same, but the service name is different:

```sh
shell> sudo service mysql start
```

If the operating system is systemd enabled, standard `service` commands such as `stop`, `start`, `status` and `restart` should be used to manage the MySQL server service. The `mysqld` service is enabled by default, and it starts at system reboot. Notice that certain things might work differently on systemd platforms: for example, changing the location of the data directory might cause issues. See Section 2.10, “Managing MySQL Server with systemd” for additional information.

During an upgrade installation using RPM packages, if the MySQL server is running when the upgrade occurs then the MySQL server is stopped, the upgrade occurs, and the MySQL server is restarted. One exception: if the edition also changes during an upgrade (such as community to commercial, or vice-versa), then MySQL server is not restarted.

At the initial start up of the server, the following happens, given that the data directory of the server is empty:

- The server is initialized.
- An SSL certificate and key files are generated in the data directory.
- `validate_password` is installed and enabled.
- A superuser account ‘root’@’localhost’ is created. A password for the superuser is set and stored in the error log file. To reveal it, use the following command for RHEL, Oracle Linux, CentOS, and Fedora systems:

```sh
shell> sudo grep 'temporary password' /var/log/mysqld.log
```

Use the following command for SLES systems:

```sh
shell> sudo grep 'temporary password' /var/log/mysql/mysqld.log
```

The next step is to log in with the generated, temporary password and set a custom password for the superuser account:

```sh
shell> mysql -uroot -p
mysql> ALTER USER 'root'@'localhost' IDENTIFIED BY 'MyNewPass4!';
```

Note

`validate_password` is installed by default. The default password policy implemented by `validate_password` requires that passwords contain at least one upper case letter, one lower case letter, one digit, and one special character, and that the total password length is at least 8 characters.
Installing MySQL on Linux Using RPM Packages from Oracle

If something goes wrong during installation, you might find debug information in the error log file /var/log/mysqld.log.

For some Linux distributions, it might be necessary to increase the limit on number of file descriptors available to mysqld. See File Not Found and Similar Errors

Compatibility with RPM Packages from Other Vendors. If you have installed packages for MySQL from your Linux distribution's local software repository, it is much preferable to install the new, directly-downloaded packages from Oracle using the package management system of your platform (yum, dnf, or zypper), as described above. The command replaces old packages with new ones to ensure compatibility of old applications with the new installation; for example, the old mysql-libs package is replaced with the mysql-community-libs-compat package, which provides a replacement-compatible client library for applications that were using your older MySQL installation. If there was an older version of mysql-community-libs-compat on the system, it also gets replaced.

If you have installed third-party packages for MySQL that are NOT from your Linux distribution's local software repository (for example, packages directly downloaded from a vendor other than Oracle), you should uninstall all those packages before installing the new, directly-downloaded packages from Oracle. This is because conflicts may arise between those vendor's RPM packages and Oracle's: for example, a vendor's convention about which files belong with the server and which belong with the client library may differ from that used for Oracle packages. Attempts to install an Oracle RPM may then result in messages saying that files in the RPM to be installed conflict with files from an installed package.

Installing Client Libraries from Multiple MySQL Versions. It is possible to install multiple client library versions, such as for the case that you want to maintain compatibility with older applications linked against previous libraries. To install an older client library, use the --oldpackage option with rpm. For example, to install mysql-community-libs-5.5 on an EL6 system that has libmysqlclient.20 from MySQL 5.7, use a command like this:

```
shell> rpm --oldpackage -ivh mysql-community-libs-5.5.50-2.el6.x86_64.rpm
```

Debug Package. A special variant of MySQL Server compiled with the debug package has been included in the server RPM packages. It performs debugging and memory allocation checks and produces a trace file when the server is running. To use that debug version, start MySQL with /usr/sbin/mysqld-debug, instead of starting it as a service or with /usr/sbin/mysqld. See The DBUG Package for the debug options you can use.

Note

The default plugin directory for debug builds changed from /usr/lib64/mysql/plugin to /usr/lib64/mysql/plugin/debug in 5.7.21. Previously, manually changing plugin_dir was required.

Rebuilding RPMs from source SRPMs. Source code SRPM packages for MySQL are available for download. They can be used as-is to rebuild the MySQL RPMs with the standard rpmbuild tool chain.

root passwords for pre-GA releases. For MySQL 5.7.4 and 5.7.5, the initial random root password is written to the .mysql_secret file in the directory named by the HOME environment variable. When trying to access the file, bear in mind that depending on operating system, using a command such as sudo may cause the value of HOME to refer to the home directory of the root system user. .mysql_secret is created with mode 600 to be accessible only to the system user for whom it is created. Before MySQL 5.7.4, the accounts (including root) created in the MySQL grant tables for an RPM installation initially have no passwords; after starting the server, you should assign passwords to them using the instructions in Postinstallation Setup and Testing."
2.6 Installing MySQL on Linux Using Debian Packages from Oracle

Oracle provides Debian packages for installing MySQL on Debian or Debian-like Linux systems. The packages are available through two different channels:

- The **MySQL APT Repository**. This is the preferred method for installing MySQL on Debian-like systems, as it provides a simple and convenient way to install and update MySQL products. For details, see Section 2.3, “Installing MySQL on Linux Using the MySQL APT Repository”.

- The **MySQL Developer Zone’s Download Area**. For details, see How to Get MySQL. The following are some information on the Debian packages available there and the instructions for installing them:

  - Various Debian packages are provided in the MySQL Developer Zone for installing different components of MySQL on different Debian or Ubuntu platforms. The preferred method is to use the tarball bundle, which contains the packages needed for a basic setup of MySQL. The tarball bundles have names in the format of `mysql-server_MVER-DVER_CPU.deb-bundle.tar`. `MVER` is the MySQL version and `DVER` is the Linux distribution version. The `CPU` value indicates the processor type or family for which the package is built, as shown in the following table:

    | CPU Value | Intended Processor Type or Family |
    |-----------|----------------------------------|
    | i386      | Pentium processor or better, 32 bit |
    | amd64     | 64-bit x86 processor |

  - After downloading the tarball, unpack it with the following command:

    ```shell
    tar -xvf mysql-server_MVER-DVER_CPU.deb-bundle.tar
    ```

  - You may need to install the `libaio` library if it is not already present on your system:

    ```shell
    sudo apt-get install libaio1
    ```

  - Preconfigure the MySQL server package with the following command:

    ```shell
    sudo dpkg-preconfigure mysql-community-server_*.deb
    ```

    You will be asked to provide a password for the root user for your MySQL installation. You might also be asked other questions regarding the installation.

    **Important**

    Make sure you remember the root password you set. Users who want to set a password later can leave the `password` field blank in the dialogue box and just press **OK**; in that case, root access to the server is authenticated using the MySQL Socket Peer-Credential Authentication Plugin for connections using a Unix socket file. You can set the root password later using `mysql_secure_installation`.

  - For a basic installation of the MySQL server, install the database common files package, the client package, the client metapackage, the server package, and the server metapackage (in that order); you can do that with a single command:
Deploying MySQL on Linux with Docker

shell> sudo dpkg -i mysql-{common,community-client,client,community-server,server}_*.deb

If you are being warned of unmet dependencies by `dpkg`, you can fix them using `apt-get`:

```
sudo apt-get -f install
```

Here are where the files are installed on the system:

- All configuration files (like `my.cnf`) are under `/etc/mysql`
- All binaries, libraries, headers, etc., are under `/usr/bin` and `/usr/sbin`
- The data directory is `/var/lib/mysql`

**Note**

Debian distributions of MySQL are also provided by other vendors. Be aware that they may differ from those built by Oracle in features, capabilities, and conventions (including communication setup), and that the instructions in this manual do not necessarily apply to installing them. The vendor’s instructions should be consulted instead.

### 2.7 Deploying MySQL on Linux with Docker

The Docker deployment framework supports easy installation and configuration of MySQL Server. This section explains how to use a MySQL Server Docker image.

You need to have Docker installed on your system before you can use a MySQL Server Docker image. See [Install Docker](#) for instructions.

**Important**

You need to either run `docker` commands with `sudo`, or create a `docker` usergroup, and then add to it any users who want to run `docker` commands. See details [here](#). Because Docker containers are always run with root privileges, you should understand the [Docker daemon attack surface](#) and properly mitigate the related risks.

The instructions for using the MySQL Docker container are divided into two sections.

#### 2.7.1 Basic Steps for MySQL Server Deployment with Docker

- Downloading a MySQL Server Docker Image
- Starting a MySQL Server Instance
- Connecting to MySQL Server from within the Container
- Container Shell Access
- Stopping and Deleting a MySQL Container
- More Topics on Deploying MySQL Server with Docker

**Note**

*Using the MySQL Enterprise Server container:* A subscription is required to use the Docker images for MySQL Enterprise Server. Subscriptions work by a Bring Your
Basic Steps for MySQL Server Deployment with Docker

OWN LICENSE MODEL; SEE HOW TO BUY MYSQL PRODUCTS AND SERVICES FOR DETAILS. TO OBTAIN AUTHORIZED ACCESS TO THE MYSQL ENTERPRISE SERVER IMAGE, GO TO THE MYSQL ENTERPRISE SERVER ENTERPRISE EDITION PAGE IN THE DOCKER STORE, CLICK ON PROCEED TO CHECKOUT, AND PROVIDE THE REQUIRED INFORMATION. AUTHORIZED ACCESS TO THE CONTAINER IS THEN ASSOCIATED WITH YOUR DOCKER ID.

DOWNLOADING A MYSQL SERVER DOCKER IMAGE

Downloading the server image in a separate step is not strictly necessary; however, performing this step before you create your Docker container ensures your local image is up to date. To download the MySQL Community Edition image, run this command:

docker pull mysql/mysql-server:tag

The tag is the label for the image version you want to pull (for example, 5.5, 5.6, 5.7, 8.0, or latest). If :tag is omitted, the latest label is used, and the image for the latest GA version of MySQL Community Server is downloaded. Refer to the list of tags for available versions on the mysql/mysql-server page in the Docker Hub.

To download the MySQL Enterprise Edition image, run this command:

docker pull store/oracle/mysql-enterprise-server:5.7

5.7 is the label for the image version you want to pull. The MySQL Enterprise Edition container only provides the latest GA version (5.7) of the MySQL Enterprise Server.

You can list downloaded Docker images with this command:

shell> docker images

<table>
<thead>
<tr>
<th>REPOSITORY</th>
<th>TAG</th>
<th>IMAGE ID</th>
<th>CREATED</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>mysql/mysql-server</td>
<td>latest</td>
<td>3157d7f55f8d</td>
<td>4 weeks ago</td>
<td>241MB</td>
</tr>
</tbody>
</table>

(The REPOSITORY column of the output reads mysql/mysql-server for the MySQL Community Server and store/oracle/mysql-enterprise-server for the MySQL Enterprise Server.)

STARTING A MYSQL SERVER INSTANCE

Start a new Docker container for the MySQL Community Server with this command:

docker run --name=mysql1 -d mysql/mysql-server:tag

Start a new Docker container for the MySQL Enterprise Server with this command:

docker run --name=mysql1 -d store/oracle/mysql-enterprise-server:tag

The --name option, for supplying a custom name for your server container (mysql1 in the example), is optional; if no container name is supplied, a random one is generated. If the Docker image of the specified name and tag has not been downloaded by an earlier docker pull or docker run command, the image is now downloaded. After download completes, initialization for the container begins, and the container appears in the list of running containers when you run the docker ps command; for example:

shell> docker ps

<table>
<thead>
<tr>
<th>CONTAINER ID</th>
<th>IMAGE</th>
<th>COMMAND</th>
<th>CREATED</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>a24888f0d6f4</td>
<td>mysql/mysql-server</td>
<td>&quot;/entrypoint.sh my...&quot;</td>
<td>14 seconds ago</td>
<td>Up 13 seconds (health: sta</td>
</tr>
</tbody>
</table>

(The IMAGE column of the output reads mysql/mysql-server for the MySQL Community Server and store/oracle/mysql-enterprise-server for the MySQL Enterprise Server.)
Basic Steps for MySQL Server Deployment with Docker

The container initialization might take some time. When the server is ready for use, the STATUS of the container in the output of the `docker ps` command changes from (health: starting) to (healthy).

The `-d` option used in the `docker run` command above makes the container run in the background. Use this command to monitor the output from the container:

```
docker logs mysql1
```

Once initialization is finished, the command’s output is going to contain the random password generated for the root user; check the password with, for example, this command:

```
shell> docker logs mysql1 2>&1 | grep GENERATED
GENERATED ROOT PASSWORD: Axegh3kAjyDLaRuBemecis&EShOs
```

Connecting to MySQL Server from within the Container

Once the server is ready, you can run the `mysql` client within the MySQL Server container you just started, and connect it to the MySQL Server. Use the `docker exec -it` command to start a `mysql` client inside the Docker container you have started, like the following:

```
docker exec -it mysql1 mysql -uroot -p
```

When asked, enter the generated root password (see the last step in Starting a MySQL Server Instance above on how to find the password). Because the `MYSQL_ONETIME_PASSWORD` option is true by default, after you have connected a `mysql` client to the server, you must reset the server root password by issuing this statement:

```
mysql> ALTER USER 'root'@'localhost' IDENTIFIED BY 'newpassword';
```

Substitute `newpassword` with the password of your choice. Once the password is reset, the server is ready for use.

Container Shell Access

To have shell access to your MySQL Server container, use the `docker exec -it` command to start a bash shell inside the container:

```
shell> docker exec -it mysql1 bash
bash-4.2#
```

You can then run Linux commands inside the container. For example, to view contents in the server’s data directory inside the container, use this command:

```
bash-4.2# ls /var/lib/mysql
auto.cnf  ca.pem  client-key.pem  ib_logfile0  ibdata1  mysql  mysql.sock.lock  private_key.pem  ca-key.pem  client-cert.pem  ib_buffer_pool  ib_logfile1  ibtmp1  mysql.sock  performance_schema  public_key.pem
```

Stopping and Deleting a MySQL Container

To stop the MySQL Server container we have created, use this command:

```
docker stop mysql1
```

`docker stop` sends a SIGTERM signal to the `mysqld` process, so that the server is shut down gracefully.

Also notice that when the main process of a container (`mysqld` in the case of a MySQL Server container) is stopped, the Docker container stops automatically.

To start the MySQL Server container again:
To stop and start again the MySQL Server container with a single command:

```
docker restart mysql1
```

To delete the MySQL container, stop it first, and then use the `docker rm` command:

```
docker stop mysql1
docker rm mysql1
```

If you want the Docker volume for the server’s data directory to be deleted at the same time, add the `-v` option to the `docker rm` command.

### More Topics on Deploying MySQL Server with Docker

For more topics on deploying MySQL Server with Docker like server configuration, persisting data and configuration, server error log, and container environment variables, see Section 2.7.2, “More Topics on Deploying MySQL Server with Docker”.

#### 2.7.2 More Topics on Deploying MySQL Server with Docker

- The Optimized MySQL Installation for Docker
- Configuring the MySQL Server
- Persisting Data and Configuration Changes
- Running Additional Initialization Scripts
- Connect to MySQL from an Application in Another Docker Container
- Server Error Log
- Docker Environment Variables

### The Optimized MySQL Installation for Docker

Docker images for MySQL are optimized for code size, which means they only include crucial components that are expected to be relevant for the majority of users who run MySQL instances in Docker containers. A MySQL Docker installation is different from a common, non-Docker installation in the following aspects:

- Included binaries are limited to:
  - `/usr/bin/my_print_defaults`
  - `/usr/bin/mysql`
  - `/usr/bin/mysql_config`
  - `/usr/bin/mysql_install_db`
  - `/usr/bin/mysql_tzinfo_to_sql`
  - `/usr/bin/mysql_upgrade`
  - `/usr/bin/mysqladmin`
  - `/usr/bin/mysqlcheck`
More Topics on Deploying MySQL Server with Docker

- /usr/bin/mysqldump
- /usr/bin/mysqlpump
- /usr/sbin/mysqld
- All binaries are stripped; they contain no debug information.

Configuring the MySQL Server

When you start the MySQL Docker container, you can pass configuration options to the server through the `docker run` command; for example, for the MySQL Community Server:

```
docker run --name mysql1 -d mysql/mysql-server --character-set-server=utf8mb4 --collation-server=utf8mb4_coll
```

For the MySQL Enterprise Server:

```
docker run --name mysql1 -d store/oracle/mysql-enterprise-server --character-set-server=utf8mb4 --collation-server=utf8mb4_coll
```

The command starts your MySQL Server with `utf8mb4` as the default character set and `utf8mb4_coll` as the default collation for your databases.

Another way to configure the MySQL Server is to prepare a configuration file and mount it at the location of the server configuration file inside the container. See Persisting Data and Configuration Changes for details.

Persisting Data and Configuration Changes

Docker containers are in principle ephemeral, and any data or configuration are expected to be lost if the container is deleted or corrupted (see discussions here). Docker volumes, however, provides a mechanism to persist data created inside a Docker container. At its initialization, the MySQL Server container creates a Docker volume for the server data directory. The JSON output for running the `docker inspect` command on the container has a `Mount` key, whose value provides information on the data directory volume:

```
shell> docker inspect mysql1
...
"Mounts": [{
  "Type": "volume",
  "Name": "4f2d463cfc4bddd4baebcb098c97d7da3337195ed2c6572bc0b89f7e845d27652",
  "Source": "/var/lib/docker/volumes/4f2d463cfc4bddd4baebcb098c97d7da3337195ed2c6572bc0b89f7e845d27652/_data",
  "Destination": "/var/lib/mysql",
  "Driver": "local",
  "Mode": "",
  "RW": true,
  "Propagation": ""
},
...]
```

The output shows that the source folder `/var/lib/docker/volumes/4f2d463cfc4bddd4baebcb098c97d7da3337195ed2c6572bc0b89f7e845d27652/_data`, in which data is persisted on the host, has been mounted at `/var/lib/mysql`, the server data directory inside the container.

Another way to preserve data is to bind-mount a host directory using the `--mount` option when creating the container. The same technique can be used to persist the configuration of the server. The following
command creates a MySQL Community Server container and bind-mounts both the data directory and the server configuration file:

```
docker run --name=mysql1 \
--mount type=bind,src=/path-on-host-machine/my.cnf,dst=/etc/my.cnf \
--mount type=bind,src=/path-on-host-machine/datadir,dst=/var/lib/mysql \
-d mysql/mysql-server:tag
```

The following command creates a MySQL Enterprise Server container and bind-mounts both the data directory and the server configuration file:

```
docker run --name=mysql1 \
--mount type=bind,src=/path-on-host-machine/my.cnf,dst=/etc/my.cnf \
--mount type=bind,src=/path-on-host-machine/datadir,dst=/var/lib/mysql \
-d store/oracle/mysql-enterprise-server:tag
```

The command mounts `path-on-host-machine/my.cnf` at `/etc/my.cnf` (the server configuration file inside the container), and `path-on-host-machine/datadir` at `/var/lib/mysql` (the data directory inside the container). The following conditions must be met for the bind-mounting to work:

- The configuration file `path-on-host-machine/my.cnf` must already exist, and it must contain the specification for starting the server using the user `mysql`:

  ```
  [mysqld]
  user=mysql
  ```

  You can also include other server configuration options in the file.

- The data directory `path-on-host-machine/datadir` must already exist. For server initialization to happen, the directory must be empty. You can also mount a directory prepopulated with data and start the server with it; however, you must make sure you start the Docker container with the same configuration as the server that created the data, and any host files or directories required are mounted when starting the container.

### Running Additional Initialization Scripts

If there are any `.sh` or `.sql` scripts you want to run on the database immediately after it has been created, you can put them into a host directory and then mount the directory at `/docker-entrypoint-initdb.d/` inside the container. For example, for a MySQL Community Server container:

```
docker run --name=mysql1 \
--mount type=bind,src=/path-on-host-machine/scripts/,dst=/docker-entrypoint-initdb.d/ \
-d mysql/mysql-server:tag
```

For a MySQL Enterprise Server container:

```
docker run --name=mysql1 \
--mount type=bind,src=/path-on-host-machine/scripts/,dst=/docker-entrypoint-initdb.d/ \
-d store/oracle/mysql-enterprise-server:tag
```

### Connect to MySQL from an Application in Another Docker Container

By setting up a Docker network, you can allow multiple Docker containers to communicate with each other, so that a client application in another Docker container can access the MySQL Server in the server container. First, create a Docker network:

```
docker network create my-custom-net
```

Then, when you are creating and starting the server and the client containers, use the `--network` option to put them on network you created. When using a MySQL Community Server container:
When using a MySQL Enterprise Server container:

```
docker run --name=mysql1 --network=my-custom-net -d store/oracle/mysql-enterprise-server

docker run --name=myapp1 --network=my-custom-net -d myapp
```

The `myapp1` container can then connect to the `mysql1` container with the `mysql1` hostname and vice versa, as Docker automatically sets up a DNS for the given container names. In the following example, we run the `mysql` client from inside the `myapp1` container to connect to host `mysql1` in its own container:

```
docker exec -it myapp1 mysql --host=mysql1 --user=myuser --password
```

For other networking techniques for containers, see the Docker container networking section in the Docker Documentation.

**Server Error Log**

When the MySQL Server is first started with your server container, a server error log is NOT generated if either of the following conditions is true:

- A server configuration file from the host has been mounted, but the file does not contain the system variable `log_error` (see Persisting Data and Configuration Changes on bind-mounting a server configuration file).

- A server configuration file from the host has not been mounted, but the Docker environment variable `MYSQL_LOG_CONSOLE` is true (the variable's default state for MySQL 5.7 server containers is false). The MySQL Server's error log is then redirected to stderr, so that the error log goes into the Docker container's log and is viewable using the `docker logs mysqld-container` command.

To make MySQL Server generate an error log when either of the two conditions is true, use the `--log-error` option to configure the server to generate the error log at a specific location inside the container. To persist the error log, mount a host file at the location of the error log inside the container as explained in Persisting Data and Configuration Changes. However, you must make sure your MySQL Server inside its container has write access to the mounted host file.

**Docker Environment Variables**

When you create a MySQL Server container, you can configure the MySQL instance by using the `--env` option (-e in short) and specifying one or more of the following environment variables.

**Notes**

- None of the variables below has any effect if the data directory you mount is not empty, as no server initialization is going to be attempted then (see Persisting Data and Configuration Changes for more details). Any pre-existing contents in the folder, including any old server settings, are not modified during the container startup.

- The boolean variables including `MYSQL_RANDOM_ROOT_PASSWORD`, `MYSQL_ONETIME_PASSWORD`, `MYSQL_ALLOW_EMPTY_PASSWORD`, and `MYSQL_LOG_CONSOLE` are made true by setting them with any strings of nonzero lengths. Therefore, setting them to, for example, “0”, “false”, or “no” does not make them false, but actually makes them true. This is a known issue of the MySQL Server containers.
More Topics on Deploying MySQL Server with Docker

- **MYSQL_RANDOM_ROOT_PASSWORD**: When this variable is true (which is its default state, unless **MYSQL_ROOT_PASSWORD** is set or **MYSQL_ALLOW_EMPTY_PASSWORD** is set to true), a random password for the server's root user is generated when the Docker container is started. The password is printed to stdout of the container and can be found by looking at the container's log (see Starting a MySQL Server Instance).

- **MYSQL_ONETIME_PASSWORD**: When the variable is true (which is its default state, unless **MYSQL_ROOT_PASSWORD** is set or **MYSQL_ALLOW_EMPTY_PASSWORD** is set to true), the root user's password is set as expired and must be changed before MySQL can be used normally.

- **MYSQL_DATABASE**: This variable allows you to specify the name of a database to be created on image startup. If a user name and a password are supplied with **MYSQL_USER** and **MYSQL_PASSWORD**, the user is created and granted superuser access to this database (corresponding to GRANT ALL). The specified database is created by a CREATE DATABASE IF NOT EXIST statement, so that the variable has no effect if the database already exists.

- **MYSQL_USER, MYSQL_PASSWORD**: These variables are used in conjunction to create a user and set that user's password, and the user is granted superuser permissions for the database specified by the **MYSQL_DATABASE** variable. Both **MYSQL_USER** and **MYSQL_PASSWORD** are required for a user to be created—if any of the two variables is not set, the other is ignored. If both variables are set but **MYSQL_DATABASE** is not, the user is created without any privileges.

**Note**

There is no need to use this mechanism to create the root superuser, which is created by default with the password set by either one of the mechanisms discussed in the descriptions for **MYSQL_ROOT_PASSWORD** and **MYSQL_RANDOM_ROOT_PASSWORD**, unless **MYSQL_ALLOW_EMPTY_PASSWORD** is true.

- **MYSQL_ROOT_HOST**: By default, MySQL creates the 'root'@'localhost' account. This account can only be connected to from inside the container as described in Connecting to MySQL Server from within the Container. To allow root connections from other hosts, set this environment variable. For example, the value 172.17.0.1, which is the default Docker gateway IP, allows connections from the host machine that runs the container. The option accepts only one entry, but wildcards are allowed (for example, **MYSQL_ROOT_HOST=172.*.*.*/** or **MYSQL_ROOT_HOST=%**).

- **MYSQL_LOG_CONSOLE**: When the variable is true (the variable's default state for MySQL 5.7 server containers is false), the MySQL Server's error log is redirected to stderr, so that the error log goes into the Docker container's log and is viewable using the `docker logs mysqld-container` command.

**Note**

The variable has no effect if a server configuration file from the host has been mounted (see Persisting Data and Configuration Changes on bind-mounting a configuration file).

- **MYSQL_ROOT_PASSWORD**: This variable specifies a password that is set for the MySQL root account.

**Warning**

Setting the MySQL root user password on the command line is insecure. As an alternative to specifying the password explicitly, you can set the variable with a container file path for a password file, and then mount a file from your host that contains the password at the container file path. This is still not very secure, as
the location of the password file is still exposed. It is preferable to use the default settings of `MYSQL_RANDOM_ROOT_PASSWORD` and `MYSQL_ONETIME_PASSWORD` both being true.

- `MYSQL_ALLOW_EMPTY_PASSWORD`. Set it to true to allow the container to be started with a blank password for the root user.

**Warning**

Setting this variable to true is insecure, because it is going to leave your MySQL instance completely unprotected, allowing anyone to gain complete superuser access. It is preferable to use the default settings of `MYSQL_RANDOM_ROOT_PASSWORD` and `MYSQL_ONETIME_PASSWORD` both being true.

### 2.8 Installing MySQL on Linux from the Native Software Repositories

Many Linux distributions include a version of the MySQL server, client tools, and development components in their native software repositories and can be installed with the platforms' standard package management systems. This section provides basic instructions for installing MySQL using those package management systems.

**Important**

Native packages are often several versions behind the currently available release. You will also normally be unable to install development milestone releases (DMRs), as these are not usually made available in the native repositories. Before proceeding, we recommend that you check out the other installation options described in Chapter 2, *Installing MySQL on Linux*.

Distribution specific instructions are shown below:

- **Red Hat Linux, Fedora, CentOS**

**Note**

For a number of Linux distributions, you can install MySQL using the MySQL Yum repository instead of the platform's native software repository. See Section 2.1, “Installing MySQL on Linux Using the MySQL Yum Repository” for details.

For Red Hat and similar distributions, the MySQL distribution is divided into a number of separate packages, `mysql` for the client tools, `mysql-server` for the server and associated tools, and `mysql-libs` for the libraries. The libraries are required if you want to provide connectivity from different languages and environments such as Perl, Python and others.

To install, use the `yum` command to specify the packages that you want to install. For example:

```
root-shell> yum install mysql mysql-server mysql-libs mysql-server
Loaded plugins: presto, refresh-packagekit
Setting up Install Process
Resolving Dependencies
---> Running transaction check
---> Package mysql.x86_64 0:5.1.48-2.fc13 set to be updated
---> Package mysql-libs.x86_64 0:5.1.48-2.fc13 set to be updated
---> Package mysql-server.x86_64 0:5.1.48-2.fc13 set to be updated
```
Installing MySQL on Linux from the Native Software Repositories

--> Processing Dependency: perl-DBD-MySQL for package: mysql-server-5.1.48-2.fc13.x86_64
--> Running transaction check
```bash
--> Package perl-DBD-MySQL.x86_64 0:4.017-1.fc13 set to be updated
--> Finished Dependency Resolution
```

Dependencies Resolved

<table>
<thead>
<tr>
<th>Package</th>
<th>Arch</th>
<th>Version</th>
<th>Repository</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>mysql</td>
<td>x86_64</td>
<td>5.1.48-2.fc13</td>
<td>updates</td>
<td>889 k</td>
</tr>
<tr>
<td>mysql-libs</td>
<td>x86_64</td>
<td>5.1.48-2.fc13</td>
<td>updates</td>
<td>1.2 M</td>
</tr>
<tr>
<td>mysql-server</td>
<td>x86_64</td>
<td>5.1.48-2.fc13</td>
<td>updates</td>
<td>8.1 M</td>
</tr>
<tr>
<td>perl-DBD-MySQL</td>
<td>x86_64</td>
<td>4.017-1.fc13</td>
<td>updates</td>
<td>136 k</td>
</tr>
</tbody>
</table>

Transaction Summary

Install 4 Package(s)
Upgrade 0 Package(s)
Total download size: 10 M
Installed size: 30 M
Is this ok [y/N]: y

MySQL and the MySQL server should now be installed. A sample configuration file is installed into /etc/my.cnf. An init script, to start and stop the server, will have been installed into /etc/init.d/mysqld. To start the MySQL server use service:

```bash
root-shell> service mysqld start
```

To enable the server to be started and stopped automatically during boot, use chkconfig:

```bash
root-shell> chkconfig --levels 235 mysqld on
```

Which enables the MySQL server to be started (and stopped) automatically at the specified the run levels.

The database tables will have been automatically created for you, if they do not already exist. You should, however, run `mysql_secure_installation` to set the root passwords on your server.

- Debian, Ubuntu, Kubuntu
Installing MySQL on Linux from the Native Software Repositories

Note
On Debian, Ubuntu, and Kubuntu, MySQL can be installed using the MySQL APT Repository instead of the platform's native software repository. See Section 2.3, “Installing MySQL on Linux Using the MySQL APT Repository” for details.

On Debian and related distributions, there are two packages for MySQL in their software repositories, `mysql-client` and `mysql-server`, for the client and server components respectively. You should specify an explicit version, for example `mysql-client-5.1`, to ensure that you install the version of MySQL that you want.

To download and install, including any dependencies, use the `apt-get` command, specifying the packages that you want to install.

Note
Before installing, make sure that you update your `apt-get` index files to ensure you are downloading the latest available version.

A sample installation of the MySQL packages might look like this (some sections trimmed for clarity):

```bash
root-shell> apt-get install mysql-client-5.1 mysql-server-5.1
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  linux-headers-2.6.28-11 linux-headers-2.6.28-11-generic
Use 'apt-get autoremove' to remove them.
The following extra packages will be installed:
  bsd-mailx libdbd-mysql-perl libdbi-perl libhtml-template-perl
  libmysqlclient15off libmysqlclient16 libnet-daemon-perl libplrpc-perl mailx
  mysql-common postfix
Suggested packages:
  dbishell libipc-sharedcache-perl tinyca procmail postfix-mysql postfix-pgsql
  postfix-ldap postfix-pcre asl12-bin resolvconf postfix-cdb
The following NEW packages will be installed:
  bsd-mailx libdbd-mysql-perl libdbi-perl libhtml-template-perl
  libmysqlclient15off libmysqlclient16 libnet-daemon-perl libplrpc-perl mailx
  mysql-client-5.1 mysql-common mysql-server-5.1 postfix
0 upgraded, 13 newly installed, 0 to remove and 182 not upgraded.
Need to get 1907kB/25.3MB of archives.
After this operation, 59.5MB of additional disk space will be used.
Do you want to continue [Y/n]? Y
Get: 1 http://gb.archive.ubuntu.com jaunty-updates/main mysql-common 5.1.30really5.0.75-0ubuntu10.5 [63.6kB]
Get: 2 http://gb.archive.ubuntu.com jaunty-updates/main libmysqlclient15off 5.1.30really5.0.75-0ubuntu10.5 [1843kB]
Fetched 1907kB in 9s (205kB/s)
Preconfiguring packages ...
Selecting previously deselected package mysql-common.
(Reading database ... 121260 files and directories currently installed.) ...
Processing 1 added doc-base file(s)...
Registering documents with scrollkeeper...
Setting up libnet-daemon-perl (0.43-1) ...
Setting up libplrpc-perl (0.2020-1) ...
Setting up libdbi-perl (1.607-1) ...
Setting up libmysqlclient15off (5.1.30really5.0.75-0ubuntu10.5) ...
Setting up libmysqlclient16 (5.1.31-1ubuntu2) ...
Setting up mysql-client-5.1 (5.1.31-1ubuntu2) ...
Setting up mysql-server-5.1 (5.1.31-1ubuntu2) ...
* Stopping MySQL database server mysqld
```
Note

The `apt-get` command will install a number of packages, including the MySQL server, in order to provide the typical tools and application environment. This can mean that you install a large number of packages in addition to the main MySQL package.

During installation, the initial database will be created, and you will be prompted for the MySQL root password (and confirmation). A configuration file will have been created in `/etc/mysql/my.cnf`. An init script will have been created in `/etc/init.d/mysql`.

The server will already be started. You can manually start and stop the server using:

```
root-shell> service mysql [start|stop]
```

The service will automatically be added to the 2, 3 and 4 run levels, with stop scripts in the single, shutdown and restart levels.

### 2.9 Installing MySQL on Linux with Juju

The Juju deployment framework supports easy installation and configuration of MySQL servers. For instructions, see [https://jujucharms.com/mysql/](https://jujucharms.com/mysql/).

### 2.10 Managing MySQL Server with systemd

If you install MySQL using an RPM or Debian package on the following Linux platforms, server startup and shutdown is managed by systemd:

- **RPM package platforms:**
  - Red Hat Enterprise Linux 7; Oracle Linux 7; CentOS 7
  - SUSE Linux Enterprise Server 12
  - Fedora 26 and 27
- **Debian package platforms:**
  - Debian 8 or higher
  - Ubuntu 16 or higher

If you install MySQL from a source distribution on a platform that uses systemd, obtain systemd support for MySQL by configuring the distribution using the `-DWITH_SYSTEMD=1` CMake option. See [MySQL Source-Configuration Options](https://dev.mysql.com/doc/refman/8.0/en/enable-systemd.html).

The following discussion covers these topics:
Overview of systemd

- Overview of systemd
- Configuring systemd for MySQL
- Configuring Multiple MySQL Instances Using systemd
- Migrating from mysqld_safe to systemd

Note
On platforms for which systemd support for MySQL is installed, scripts such as `mysqld_safe` and the System V initialization script are unnecessary and are not installed. For example, `mysqld_safe` can handle server restarts, but systemd provides the same capability, and does so in a manner consistent with management of other services rather than by using an application-specific program.

Because systemd has the capability of managing multiple MySQL instances on platforms for which systemd support for MySQL is installed, `mysqld_multi` and `mysqld_multi.server` are unnecessary and are not installed.

Overview of systemd

systemd provides automatic MySQL server startup and shutdown. It also enables manual server management using the `systemctl` command. For example:

```
systemctl {start|stop|restart|status} mysqld
```

Alternatively, use the `service` command (with the arguments reversed), which is compatible with System V systems:

```
service mysqld {start|stop|restart|status}
```

Note
For the `systemctl` or `service` commands, if the MySQL service name is not `mysqld`, use the appropriate name. For example, use `mysql` rather than `mysqld` on Debian-based and SLES systems.

Support for systemd includes these files:

- `mysqld.service` (RPM platforms), `mysql.service` (Debian platforms): systemd service unit configuration file, with details about the MySQL service.
- `mysqld@.service` (RPM platforms), `mysql@.service` (Debian platforms): Like `mysqld.service` or `mysql.service`, but used for managing multiple MySQL instances.
- `mysqld.tmpfiles.d`: File containing information to support the `tmpfiles` feature. This file is installed under the name `mysql.conf`.
- `mysqld_pre_systemd` (RPM platforms), `mysql-system-start` (Debian platforms): Support script for the unit file. This script assists in creating the error log file only if the log location matches a pattern (/var/log/mysql*.log for RPM platforms, /var/log/mysql/*.log for Debian platforms). In other cases, the error log directory must be writable or the error log must be present and writable for the user running the `mysqld` process.

Configuring systemd for MySQL

To add or change systemd options for MySQL, these methods are available:
Configuring systemd for MySQL

- Use a localized systemd configuration file.
- Arrange for systemd to set environment variables for the MySQL server process.
- Set the `MYSQLD_OPTS` systemd variable.

To use a localized systemd configuration file, create the `/etc/systemd/system/mysqld.service.d` directory if it does not exist. In that directory, create a file that contains a `[Service]` section listing the desired settings. For example:

```
[Service]
LimitNOFILE=max_open_files
PIDFile=/path/to/pid/file
Nice=nice_level
LimitCore=core_file_limit
Environment="LD_PRELOAD=/path/to/malloc/library"
Environment="TZ=time_zone_setting"
```

The discussion here uses `override.conf` as the name of this file. Newer versions of systemd support the following command, which opens an editor and permits you to edit the file:

```
systemctl edit mysqld  # RPM platforms
systemctl edit mysql   # Debian platforms
```

Whenever you create or change `override.conf`, reload the systemd configuration, then tell systemd to restart the MySQL service:

```
systemctl daemon-reload
systemctl restart mysqld  # RPM platforms
systemctl restart mysql   # Debian platforms
```

With systemd, the `override.conf` configuration method must be used for certain parameters, rather than settings in a `[mysqld]` or `[mysqld_safe]` group in a MySQL option file:

- For some parameters, `override.conf` must be used because systemd itself must know their values and it cannot read MySQL option files to get them.
- Parameters that specify values otherwise settable only using options known to `mysqld_safe` must be specified using systemd because there is no corresponding `mysqld` parameter.

For additional information about using systemd rather than `mysqld_safe`, see Migrating from `mysqld_safe` to `systemd`.

You can set the following parameters in `override.conf`:

- To specify the process ID file:
  
  - As of MySQL 5.7.10: Use `override.conf` and change both `PIDFile` and `ExecStart` to name the PID file path name. Any setting of the process ID file in MySQL option files is ignored. To modify `ExecStart`, it must first be cleared. For example:

  ```
  [Service]
  PIDFile=/var/run/mysqld/mysqld-custom.pid
  ExecStart=
  ExecStart=/usr/sbin/mysqld --daemonize --pid-file=/var/run/mysqld/mysqld-custom.pid $MYSQLD_OPTS
  ```

  - Before MySQL 5.7.10: Use `PIDFile` in `override.conf` rather than the `--pid-file` option for `mysqld` or `mysqld_safe`. systemd must know the PID file location so that it can restart or stop the
server. If the PID file value is specified in a MySQL option file, the value must match the `PIDFile` value or MySQL startup may fail.

- To set the number of file descriptors available to the MySQL server, use `LimitNOFILE` in `override.conf` rather than the `--open-files-limit` option for `mysqld` or `mysqld_safe`.

- To set the maximum core file size, use `LimitCore` in `override.conf` rather than the `--core-file-size` option for `mysqld_safe`.

- To set the scheduling priority for the MySQL server, use `Nice` in `override.conf` rather than the `--nice` option for `mysqld_safe`.

Some MySQL parameters are configured using environment variables:

- `LD_PRELOAD`: Set this variable if the MySQL server should use a specific memory-allocation library.

- `TZ`: Set this variable to specify the default time zone for the server.

There are multiple ways to specify environment variable values for use by the MySQL server process managed by systemd:

- Use `Environment` lines in the `override.conf` file. For the syntax, see the example in the preceding discussion that describes how to use this file.

- Specify the values in the `/etc/sysconfig/mysql` file (create the file if it does not exist). Assign values using the following syntax:

  ```
  LD_PRELOAD=/path/to/malloc/library
  TZ=time_zone_setting
  ```

  After modifying `/etc/sysconfig/mysql`, restart the server to make the changes effective:

  ```
  systemctl restart mysqld  # RPM platforms
  systemctl restart mysql   # Debian platforms
  ```

  To specify options for `mysqld` without modifying systemd configuration files directly, set or unset the `MYSQLD_OPTS` systemd variable. For example:

  ```
  systemctl set-environment MYSQLD_OPTS="--general_log=1"
  systemctl unset-environment MYSQLD_OPTS
  ```

  `MYSQLD_OPTS` can also be set in the `/etc/sysconfig/mysql` file.

  After modifying the systemd environment, restart the server to make the changes effective:

  ```
  systemctl restart mysqld  # RPM platforms
  systemctl restart mysql   # Debian platforms
  ```

For platforms that use systemd, the data directory is initialized if empty at server startup. This might be a problem if the data directory is a remote mount that has temporarily disappeared: The mount point would appear to be an empty data directory, which then would be initialized as a new data directory. As of MySQL 5.7.20, to suppress this automatic initialization behavior, specify the following line in the `/etc/sysconfig/mysql` file (create the file if it does not exist):

  ```
  NO_INIT=true
  ```
Configuring Multiple MySQL Instances Using systemd

This section describes how to configure systemd for multiple instances of MySQL.

Note
Because systemd has the capability of managing multiple MySQL instances on platforms for which systemd support is installed, `mysqld_multi` and `mysqld_multi.server` are unnecessary and are not installed. This is true as of MySQL 5.7.13 for RPM platforms, 5.7.19 for Debian platforms.

To use multiple-instance capability, modify the `my.cnf` option file to include configuration of key options for each instance. These file locations are typical:

- `/etc/my.cnf` or `/etc/mysql/my.cnf` (RPM platforms)
- `/etc/mysql/mysql.conf.d/mysqld.cnf` (Debian platforms)

For example, to manage two instances named `replica01` and `replica02`, add something like this to the option file:

RPM platforms:

```conf
[mysqld@replica01]
datadir=/var/lib/mysql-replica01
socket=/var/lib/mysql-replica01/mysql.sock
port=3307
log-error=/var/log/mysqld-replica01.log
[mysqld@replica02]
datadir=/var/lib/mysql-replica02
socket=/var/lib/mysql-replica02/mysql.sock
port=3308
log-error=/var/log/mysqld-replica02.log
```

Debian platforms:

```conf
[mysqld@replica01]
datadir=/var/lib/mysql-replica01
socket=/var/lib/mysql-replica01/mysql.sock
port=3307
log-error=/var/log/mysql/replica01.log
[mysqld@replica02]
datadir=/var/lib/mysql-replica02
socket=/var/lib/mysql-replica02/mysql.sock
port=3308
log-error=/var/log/mysql/replica02.log
```

The replica names shown here use `@` as the delimiter because that is the only delimiter supported by systemd.

Instances then are managed by normal systemd commands, such as:

```
systemctl start mysqld@replica01
systemctl start mysqld@replica02
```

To enable instances to run at boot time, do this:

```
systemctl enable mysqld@replica01
```
Migrating from mysqld_safe to systemd

Use of wildcards is also supported. For example, this command displays the status of all replica instances:

```bash
systemctl status 'mysqld@replica*'
```

For management of multiple MySQL instances on the same machine, systemd automatically uses a different unit file:

- `mysqld@.service` rather than `mysqld.service` (RPM platforms)
- `mysql@.service` rather than `mysql.service` (Debian platforms)

In the unit file, `%I` and `%i` reference the parameter passed in after the `@` marker and are used to manage the specific instance. For a command such as this:

```bash
systemctl start mysqld@replica01
```

systemd starts the server using a command such as this:

```bash
mysqld --defaults-group-suffix=@%I ...
```

The result is that the `[server]`, `[mysqld]`, and `[mysqld@replica01]` option groups are read and used for that instance of the service.

---

**Note**

On Debian platforms, AppArmor prevents the server from reading or writing `/var/lib/mysql-replica*`, or anything other than the default locations. To address this, you must customize or disable the profile in `/etc/apparmor.d/usr.sbin.mysqld`.

**Note**

On Debian platforms, the packaging scripts for MySQL uninstallation cannot currently handle `mysqld@` instances. Before removing or upgrading the package, you must stop any extra instances manually first.

---

**Migrating from mysqld_safe to systemd**

Because `mysqld_safe` is not installed on platforms that use systemd to manage MySQL, options previously specified for that program (for example, in an `[mysqld_safe]` option group) must be specified another way:

- Some `mysqld_safe` options are also understood by `mysqld` and can be moved from the `[mysqld_safe]` option group to the `[mysqld]` group. This does not include `--pid-file`, `--open-files-limit`, or `--nice`. To specify those options, use the `override.conf` systemd file, described previously.

- For some `mysqld_safe` options, there are similar `mysqld` options. For example, the `mysqld_safe` option for enabling syslog logging is `--syslog`, which is deprecated. For `mysqld`, enable the `log_syslog` system variable instead. For details, see The Error Log.

- `mysqld_safe` options not understood by `mysqld` can be specified in `override.conf` or environment variables. For example, with `mysqld_safe`, if the server should use a specific memory allocation library,
this is specified using the `--malloc-lib` option. For installations that manage the server with systemd, arrange to set the `LD_PRELOAD` environment variable instead, as described previously.
Chapter 3 Installing MySQL on Solaris

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Note
MySQL 5.7 supports Solaris 11 (Update 3 and later).

MySQL on Solaris is available in a number of different formats.

- For information on installing using the native Solaris PKG format, see Section 3.1, “Installing MySQL on Solaris Using a Solaris PKG”.

- To use a standard tar binary installation, use the notes provided in Chapter 1, Installing MySQL on Unix/Linux Using Generic Binaries. Check the notes and hints at the end of this section for Solaris specific notes that you may need before or after installation.

Important
The installation packages have a dependency on the Oracle Developer Studio 12.5 Runtime Libraries, which must be installed before you run the MySQL installation package. See the download options for Oracle Developer Studio here. The installation package enables you to install the runtime libraries only instead of the full Oracle Developer Studio; see instructions in Installing Only the Runtime Libraries on Oracle Solaris 11.

To obtain a binary MySQL distribution for Solaris in tarball or PKG format, http://dev.mysql.com/downloads/mysql/5.7.html.

Additional notes to be aware of when installing and using MySQL on Solaris:

- If you want to use MySQL with the mysql user and group, use the groupadd and useradd commands:

  ```
  groupadd mysql
  useradd -g mysql -s /bin/false mysql
  ```

- If you install MySQL using a binary tarball distribution on Solaris, because the Solaris tar cannot handle long file names, use GNU tar (gtar) to unpack the distribution. If you do not have GNU tar on your system, install it with the following command:

  ```
  pkg install archiver/gnu-tar
  ```

- You should mount any file systems on which you intend to store InnoDB files with the forcedirectio option. (By default mounting is done without this option.) Failing to do so will cause a significant drop in performance when using the InnoDB storage engine on this platform.

- If you would like MySQL to start automatically, you can copy support-files/mysql.server to /etc/init.d and create a symbolic link to it named /etc/rc3.d/S99mysql.server.

- If too many processes try to connect very rapidly to mysqld, you should see this error in the MySQL log:
Error in accept: Protocol error

You might try starting the server with the `--back_log=50` option as a workaround for this.

- To configure the generation of core files on Solaris you should use the `coreadm` command. Because of the security implications of generating a core on a `setuid()` application, by default, Solaris does not support core files on `setuid()` programs. However, you can modify this behavior using `coreadm`. If you enable `setuid()` core files for the current user, they will be generated using the mode 600 and owned by the superuser.

3.1 Installing MySQL on Solaris Using a Solaris PKG

You can install MySQL on Solaris using a binary package of the native Solaris PKG format instead of the binary tarball distribution.

**Important**

The installation package has a dependency on the Oracle Developer Studio 12.5 Runtime Libraries, which must be installed before you run the MySQL installation package. See the download options for Oracle Developer Studio [here](#). The installation package enables you to install the runtime libraries only instead of the full Oracle Developer Studio; see instructions in Installing Only the Runtime Libraries on Oracle Solaris 11.

To use this package, download the corresponding `mysql-VERSION-solaris11-PLATFORM.pkg.gz` file, then uncompress it. For example:

```
shell> gunzip mysql-5.7.23-solaris11-x86_64.pkg.gz
```

To install a new package, use `pkgadd` and follow the onscreen prompts. You must have root privileges to perform this operation:

```
shell> pkgadd -d mysql-5.7.23-solaris11-x86_64.pkg
```

The following packages are available:

```
  1  mysql  MySQL Community Server (GPL)
       (i86pc) 5.7.23
```

Select package(s) you wish to process (or 'all' to process all packages). (default: all) [?,??,q]:

The PKG installer installs all of the files and tools needed, and then initializes your database if one does not exist. To complete the installation, you should set the root password for MySQL as provided in the instructions at the end of the installation. Alternatively, you can run the `mysql_secure_installation` script that comes with the installation.

By default, the PKG package installs MySQL under the root path `/opt/mysql`. You can change only the installation root path when using `pkgadd`, which can be used to install MySQL in a different Solaris zone. If you need to install in a specific directory, use a binary `tar` file distribution.

The `pkg` installer copies a suitable startup script for MySQL into `/etc/init.d/mysql`. To enable MySQL to startup and shutdown automatically, you should create a link between this file and the init script directories. For example, to ensure safe startup and shutdown of MySQL you could use the following commands to add the right links:

```
shell> ln /etc/init.d/mysql /etc/rc3.d/S91mysql
```
**Installing MySQL on Solaris Using a Solaris PKG**

To remove MySQL, the installed package name is `mysql`. You can use this in combination with the `pkgrm` command to remove the installation.

To upgrade when using the Solaris package file format, you must remove the existing installation before installing the updated package. Removal of the package does not delete the existing database information, only the server, binaries and support files. The typical upgrade sequence is therefore:

```
shell> ln /etc/init.d/mysql /etc/rc0.d/K02mysql

To remove MySQL, the installed package name is `mysql`. You can use this in combination with the `pkgrm` command to remove the installation.

To upgrade when using the Solaris package file format, you must remove the existing installation before installing the updated package. Removal of the package does not delete the existing database information, only the server, binaries and support files. The typical upgrade sequence is therefore:

```
shell> mysqladmin shutdown
shell> pkgrm mysql
shell> pkgadd -d mysql-5.7.23-solaris11-x86_64.pkg
shell> mysql_upgrade
```

You should check the notes in [Upgrading or Downgrading MySQL](#) before performing any upgrade.
Chapter 4 Installing MySQL on FreeBSD

This section provides information about installing MySQL on variants of FreeBSD Unix.

You can install MySQL on FreeBSD by using the binary distribution provided by Oracle. For more information, see Chapter 1, Installing MySQL on Unix/Linux Using Generic Binaries.

The easiest (and preferred) way to install MySQL is to use the mysql-server and mysql-client ports available at http://www.freebsd.org/. Using these ports gives you the following benefits:

• A working MySQL with all optimizations enabled that are known to work on your version of FreeBSD.
• Automatic configuration and build.
• Startup scripts installed in /usr/local/etc/rc.d.
• The ability to use pkg_info -L to see which files are installed.
• The ability to use pkg_delete to remove MySQL if you no longer want it on your machine.

The MySQL build process requires GNU make (gmake) to work. If GNU make is not available, you must install it first before compiling MySQL.

To install using the ports system:

```bash
# cd /usr/ports/databases/mysql57-server
# make
...
# cd /usr/ports/databases/mysql57-client
# make
...
```

The standard port installation places the server into /usr/local/libexec/mysqld, with the startup script for the MySQL server placed in /usr/local/etc/rc.d/mysql-server.

Some additional notes on the BSD implementation:

• To remove MySQL after installation using the ports system:

```bash
# cd /usr/ports/databases/mysql57-server
# make deinstall
...
# cd /usr/ports/databases/mysql57-client
# make deinstall
...
```

• If you get problems with the current date in MySQL, setting the TZ variable should help. See MySQL Program Environment Variables.
Chapter 5 Initializing the Data Directory

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After installing MySQL, the data directory, including the tables in the mysql system database, must be initialized. For some MySQL installation methods, data directory initialization can be done automatically, as described in Postinstallation Setup and Testing. For other installation methods, including installation from generic binary and source distributions, you must initialize the data directory yourself.

This section describes how to initialize the data directory on Unix and Unix-like systems. (For Windows, see Windows Postinstallation Procedures.) For some suggested commands that you can use to test whether the server is accessible and working properly, see Testing the Server.

In the examples shown here, the server is going to run under the user ID of the mysql login account. This assumes that such an account exists. Either create the account if it does not exist, or substitute the name of a different existing login account that you plan to use for running the server. For information about creating the account, see Creating a mysql System User and Group, in Chapter 1, Installing MySQL on Unix/Linux Using Generic Binaries.

1. Change location into the top-level directory of your MySQL installation directory, which is typically /
   usr/local/mysql:

   
   shell> cd /usr/local/mysql

   You will find several files and subdirectories inside the folder, including the bin subdirectory, which
   contains the server as well as the client and utility programs.

2. Create a directory whose location can be provided to the secure_file_priv system variable, which
   limits import/export operations to that specific directory:

   
   shell> mkdir mysql-files

   Grant ownership of the directory to the mysql user and group ownership to the mysql group, and set
   the right permissions for the directory:

   
   shell> chown mysql:mysql mysql-files
   shell> chmod 750 mysql-files

3. Initialize the data directory, including the mysql database containing the initial MySQL grant tables that
   determine how users are permitted to connect to the server.

   Typically, data directory initialization need be done only after you first installed MySQL. If you are
   upgrading an existing installation, you should run mysql_upgrade instead (see mysql_upgrade—
   Check and Upgrade MySQL Tables). However, the command that initializes the data directory does not
   overwrite any existing privilege tables, so it should be safe to run in any circumstances. Use the server
   to initialize the data directory; for example:

   
   shell>
Initializing the Data Directory Manually Using mysqld

This section describes how to initialize the data directory using mysqld, the MySQL server.

The following instructions assume that your current location is the MySQL installation directory, represented here by BASEDIR:

```
shell> cd BASEDIR
```

To initialize the data directory, invoke mysqld with the **--initialize** or **--initialize-insecure** option, depending on whether you want the server to generate a random initial password for the 'root'@'localhost' account.

On Windows, use one of these commands:

```shell
bin/mysqld --initialize --user=mysql
```

See Section 5.1, "Initializing the Data Directory Manually Using mysqld" for some important information on the command, especially on the command options you might use.

**Note**

Initialization of the data directory might fail because some required software libraries are missing from your system. For example:

```
shell> bin/mysqld --initialize --user=mysql
```

```
bin/mysqld: error while loading shared libraries: libnuma.so.1: cannot open shared object file: No such file or directory
```

When this happens, you have to install the missing libraries manually or with your system's package manager before retrying the data directory initialization.

4. If you want the server to be able to deploy with automatic support for secure connections, use the ***mysql_ssl_rsa_setup*** utility to create default SSL and RSA files:

```
shell> bin/mysql_ssl_rsa_setup
```

For more information, see **mysql_ssl_rsa_setup** — Create SSL/RSA Files.

5. If the plugin directory (the directory named by the **plugin_dir** system variable) is writable by the server, it may be possible for a user to write executable code to a file in the directory using **SELECT ... INTO DUMPFILE**. This can be prevented by making the plugin directory read only to the server or by setting the **secure_file_priv** system variable at server startup to a directory where **SELECT** writes can be performed safely. (For example, set it to the **mysql_files** directory created earlier.)

6. To specify options that the MySQL server should use at startup, put them in a **/etc/my.cnf** or **/etc/mysql/my.cnf** file. You can use such a file to set, for example, the **secure_file_priv** system variable. See **Server Configuration Defaults**. If you do not do this, the server starts with its default settings.

7. If you want MySQL to start automatically when you boot your machine, see **Starting and Stopping MySQL Automatically**.

Data directory initialization creates time zone tables in the **mysql** database but does not populate them. To do so, use the instructions in **MySQL Server Time Zone Support**.

### 5.1 Initializing the Data Directory Manually Using mysqld

This section describes how to initialize the data directory using mysqld, the MySQL server.

The following instructions assume that your current location is the MySQL installation directory, represented here by `BASEDIR`:

```
shell> cd BASEDIR
```

To initialize the data directory, invoke `mysqld` with the **--initialize** or **--initialize-insecure** option, depending on whether you want the server to generate a random initial password for the 'root'@'localhost' account.

On Windows, use one of these commands:
On Unix and Unix-like systems, it is important to make sure that the database directories and files are owned by the `mysql` login account so that the server has read and write access to them when you run it later. To ensure this, start `mysqld` from the system `root` account and include the `--user` option as shown here:

```
shell> bin/mysqld --initialize --user=mysql
shell> bin/mysqld --initialize-insecure --user=mysql
```

Otherwise, execute the program while logged in as `mysql`, in which case you can omit the `--user` option from the command.

Regardless of platform, use `--initialize` for “secure by default” installation (that is, including generation of a random initial `root` password). In this case, the password is marked as expired and you will need to choose a new one. With the `--initialize-insecure` option, no `root` password is generated; it is assumed that you will assign a password to the account in timely fashion before putting the server into production use.

It might be necessary to specify other options such as `--basedir` or `--datadir` if `mysqld` cannot identify the correct locations for the installation directory or data directory. For example (enter the command on one line):

```
shell> bin/mysqld --initialize --user=mysql
    --basedir=/opt/mysql/mysql
    --datadir=/opt/mysql/mysql/data
```

Alternatively, put the relevant option settings in an option file and pass the name of that file to `mysqld`. For Unix and Unix-like systems, suppose that the option file name is `/opt/mysql/mysql/etc/my.cnf`. Put these lines in the file:

```
[mysqld]
basedir=/opt/mysql/mysql
datadir=/opt/mysql/mysql/data
```

Then invoke `mysqld` as follows (enter the command on a single line with the `--defaults-file` option first):

```
shell> bin/mysqld --defaults-file=/opt/mysql/mysql/etc/my.cnf
    --initialize --user=mysql
```

On Windows, suppose that `C:\my.ini` contains these lines:

```
[mysqld]
basedir=C:\Program Files\MySQL\MySQL Server 5.7
datadir=D:\MySQLdata
```

Then invoke `mysqld` as follows (the `--defaults-file` option must be first):

```
C:\> bin/mysqld --defaults-file=C:\my.ini --initialize
```

When invoked with the `--initialize` or `--initialize-insecure` option, `mysqld` performs the following initialization sequence.
1. The server checks for the existence of the data directory as follows:
   • If no data directory exists, the server creates it.
   • If a data directory exists but is not empty (that is, it contains files or subdirectories), the server exits after producing an error message:

   ```
   [ERROR] --initialize specified but the data directory exists. Aborting.
   ```

   In this case, remove or rename the data directory and try again.

   As of MySQL 5.7.11, an existing data directory is permitted to be nonempty if every entry either has a name that begins with a period (.) or is named using an `--ignore-db-dir` option.

   Note
   Avoid the use of the `--ignore-db-dir` option, which has been deprecated since MySQL 5.7.16.

2. Within the data directory, the server creates the `mysql` system database and its tables, including the grant tables, server-side help tables, and time zone tables. For a complete listing and description of the grant tables, see The MySQL Access Privilege System.

3. The server initializes the `system tablespace` and related data structures needed to manage InnoDB tables.

   Note
   After `mysqld` sets up the InnoDB system tablespace, changes to some tablespace characteristics require setting up a whole new instance. This includes the file name of the first file in the system tablespace and the number of undo logs. If you do not want to use the default values, make sure that the settings for the `innodb_data_file_path` and `innodb_log_file_size` configuration parameters are in place in the MySQL configuration file before running `mysqld`. Also make sure to specify as necessary other parameters that affect the creation and location of InnoDB files, such as `innodb_data_home_dir` and `innodb_log_group_home_dir`.

   If those options are in your configuration file but that file is not in a location that MySQL reads by default, specify the file location using the `--defaults-extra-file` option when you run `mysqld`.

4. The server creates a `root'@'localhost` superuser account and other reserved accounts (see Reserved User Accounts). Some reserved accounts are locked and cannot be used by clients, but `root'@'localhost` is intended for administrative use and you should assign it a password.

   The server's action with respect to a password for the `root'@'localhost` account depends on how you invoke it:
• With --initialize but not --initialize-insecure, the server generates a random password, marks it as expired, and writes a message displaying the password:

```
[Warning] A temporary password is generated for root@localhost: iTag*AfrH5ej
```

• With --initialize-insecure, (either with or without --initialize because --initialize-insecure implies --initialize) the server does not generate a password or mark it expired, and writes a warning message:

```
Warning] root@localhost is created with an empty password! Please consider switching off the --initialize-insecure option.
```

See later in this section for instructions on assigning a new 'root'@'localhost' password.

5. The server populates the server-side help tables if content is available (in the fill_help_tables.sql file). The server does not populate the time zone tables; to do so, see MySQL Server Time Zone Support.

6. If the --init-file option was given to name a file of SQL statements, the server executes the statements in the file. This option enables you to perform custom bootstrapping sequences.

When the server operates in bootstrap mode, some functionality is unavailable that limits the statements permitted in the file. These include statements that relate to account management (such as CREATE USER or GRANT), replication, and global transaction identifiers.

7. The server exits.

After you initialize the data directory by starting the server with --initialize or --initialize-insecure, start the server normally (that is, without either of those options) and assign the 'root'@'localhost' account a new password:

1. Start the server. For instructions, see Starting the Server.

2. Connect to the server:

   • If you used --initialize but not --initialize-insecure to initialize the data directory, connect to the server as root using the random password that the server generated during the initialization sequence:

     ```
     shell> mysql -u root -p
     Enter password: (enter the random root password here)
     ```

     Look in the server error log if you do not know this password.

   • If you used --initialize-insecure to initialize the data directory, connect to the server as root without a password:

     ```
     shell> mysql -u root --skip-password
     ```

3. After connecting, assign a new root password:

   ```
   mysql> ALTER USER 'root'@'localhost' IDENTIFIED BY 'new_password';
   ```
5.2 Initializing the Data Directory Manually Using mysql_install_db

This section describes how to initialize the data directory using `mysql_install_db`.

Note

The procedure described here is used on Unix and Unix-like systems prior to MySQL 5.7.6. (For Windows, MySQL distributions include a data directory with prebuilt tables in the `mysql` database.) As of MySQL 5.7.6, `mysql_install_db` is deprecated. To initialize the data directory, use the procedure described at Section 5.1, “Initializing the Data Directory Manually Using mysqld”.

The following instructions assume that your current location is the MySQL installation directory, represented here by `BASEDIR`:

```
shell> cd BASEDIR
```

To initialize the data directory, invoke `mysql_install_db`. This program is located under the base directory in either `bin` or `scripts`, depending on your version of MySQL. If it is in `scripts`, adjust the following commands appropriately.

```
shell> bin/mysql_install_db --user=mysql
```

It is important to make sure that the database directories and files are owned by the `mysql` login account so that the server has read and write access to them when you run it later. To ensure this, run `mysql_install_db` as `root` and include the `--user` option as shown. Otherwise, execute the program while logged in as `mysql`, in which case you can omit the `--user` option from the command.

The `mysql_install_db` command creates the server's data directory. Under the data directory, it creates directories for the `mysql` database that holds the grant tables and (prior to MySQL 5.7.4) a `test` database that you can use to test MySQL. The program also creates privilege table entries for the initial account or accounts. For a complete listing and description of the grant tables, see The MySQL Access Privilege System.

It might be necessary to specify other options such as `--basedir` or `--datadir` if `mysql_install_db` does not identify the correct locations for the installation directory or data directory. For example:

```
shell> bin/mysql_install_db --user=mysql \
  --basedir=/opt/mysql/mysql \
  --datadir=/opt/mysql/mysql/data
```

If `mysql_install_db` generates a random password for the `root` account, start the server and assign a new password:

1. Start the server (use the first command if your installation includes `mysqld_safe`, the second it if includes systemd support):
Problems Running mysql_install_db

The purpose of the mysql_install_db program is to initialize the data directory, including the tables in the mysql system database. It does not overwrite existing MySQL privilege tables, and it does not affect any other data.

To re-create your privilege tables, first stop the mysqld server if it is running. Then rename the mysql directory under the data directory to save it, and run mysql_install_db. Suppose that your current directory is the MySQL installation directory and that mysql_install_db is located in the bin directory and the data directory is named data. To rename the mysql database and re-run mysql_install_db, use these commands.

```
shell> mv data/mysql data/mysql.old
shell> bin/mysql_install_db --user=mysql
```

When you run mysql_install_db, you might encounter the following problems:

- **mysql_install_db fails to install the grant tables**

  You may find that mysql_install_db fails to install the grant tables and terminates after displaying the following messages:

  ```
  Starting mysqld daemon with databases from XXXXXX
  mysqld ended
  ```

  In this case, you should examine the error log file very carefully. The log should be located in the directory XXXXXXX named by the error message and should indicate why mysqld did not start. If you do not understand what happened, include the log when you post a bug report. See How to Report Bugs or Problems.
Problems Running mysql_install_db

- There is a mysqld process running

This indicates that the server is running, in which case the grant tables have probably been created already. If so, there is no need to run mysql_install_db at all because it needs to be run only once, when you first install MySQL.

- Installing a second mysqld server does not work when one server is running

This can happen when you have an existing MySQL installation, but want to put a new installation in a different location. For example, you might have a production installation, but you want to create a second installation for testing purposes. Generally the problem that occurs when you try to run a second server is that it tries to use a network interface that is in use by the first server. In this case, you should see one of the following error messages:

Can't start server: Bind on TCP/IP port:  
Address already in use  
Can't start server: Bind on unix socket...

For instructions on setting up multiple servers, see Running Multiple MySQL Instances on One Machine.

- You do not have write access to the /tmp directory

If you do not have write access to create temporary files or a Unix socket file in the default location (the /tmp directory) or the TMPDIR environment variable, if it has been set, an error occurs when you run mysql_install_db or the mysqld server.

You can specify different locations for the temporary directory and Unix socket file by executing these commands prior to starting mysql_install_db or mysqld, where some_tmp_dir is the full path name to some directory for which you have write permission:

```shell
shell> TMPDIR=/some_tmp_dir/
shell> MYSQL_UNIX_PORT=/some_tmp_dir/mysql.sock
shell> export TMPDIR MYSQL_UNIX_PORT
```

Then you should be able to run mysql_install_db and start the server with these commands:

```shell
shell> bin/mysql_install_db --user=mysql
shell> bin/mysqld_safe --user=mysql &
```

See How to Protect or Change the MySQL Unix Socket File, and MySQL Program Environment Variables.

There are some alternatives to running the mysql_install_db program provided in the MySQL distribution:

- If you want the initial privileges to be different from the standard defaults, use account-management statements such as CREATE USER, GRANT, and REVOKE to change the privileges after the grant tables have been set up. In other words, run mysql_install_db, and then use mysql -u root mysql to connect to the server as the MySQL root user so that you can issue the necessary statements. (See Account Management Statements.)

To install MySQL on several machines with the same privileges, put the CREATE USER, GRANT, and REVOKE statements in a file and execute the file as a script using mysql after running mysql_install_db. For example:
Problems Running mysql_install_db

```
shell> bin/mysql_install_db --user=mysql
shell> bin/mysql -u root < your_script_file
```

This enables you to avoid issuing the statements manually on each machine.

- It is possible to re-create the grant tables completely after they have previously been created. You might want to do this if you are just learning how to use `CREATE USER`, `GRANT`, and `REVOKE` and have made so many modifications after running `mysql_install_db` that you want to wipe out the tables and start over.

To re-create the grant tables, stop the server if it is running and remove the `mysql` database directory. Then run `mysql_install_db` again.