Abstract

This is the MySQL Installation Guide from the MySQL 5.6 Reference Manual.

For legal information, see the Legal Notices.

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

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Preface and Legal Notices

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Chapter 1 Installing and Upgrading MySQL

This chapter describes how to obtain and install MySQL. A summary of the procedure follows and later sections provide the details. If you plan to upgrade an existing version of MySQL to a newer version rather than install MySQL for the first time, see Chapter 10, Upgrading MySQL, for information about upgrade procedures and about issues that you should consider before upgrading.

If you are interested in migrating to MySQL from another database system, see MySQL 5.6 FAQ: Migration, which contains answers to some common questions concerning migration issues.

Installation of MySQL generally follows the steps outlined here:

1. **Determine whether MySQL runs and is supported on your platform.**
   
   Please note that not all platforms are equally suitable for running MySQL, and that not all platforms on which MySQL is known to run are officially supported by Oracle Corporation. For information about those platforms that are officially supported, see https://www.mysql.com/support/supportedplatforms/database.html on the MySQL website.

2. **Choose which distribution to install.**
   
   Several versions of MySQL are available, and most are available in several distribution formats. You can choose from pre-packaged distributions containing binary (precompiled) programs or source code. When in doubt, use a binary distribution. Oracle also provides access to the MySQL source code for those who want to see recent developments and test new code. To determine which version and type of distribution you should use, see Section 2.1, “Which MySQL Version and Distribution to Install”.

3. **Download the distribution that you want to install.**
   
   For instructions, see Section 2.2, “How to Get MySQL”. To verify the integrity of the distribution, use the instructions in Section 2.3, “Verifying Package Integrity Using MD5 Checksums or GnuPG”.

4. **Install the distribution.**
   
   To install MySQL from a binary distribution, use the instructions in Chapter 3, Installing MySQL on Unix/Linux Using Generic Binaries.

   To install MySQL from a source distribution or from the current development source tree, use the instructions in Chapter 4, Installing MySQL from Source.

5. **Perform any necessary postinstallation setup.**
   
   After installing MySQL, see Chapter 9, Postinstallation Setup and Testing for information about making sure the MySQL server is working properly. Also refer to the information provided in Section 9.4, “Securing the Initial MySQL Accounts”. This section describes how to secure the initial MySQL user accounts, which have no passwords until you assign passwords. The section applies whether you install MySQL using a binary or source distribution.

6. **If you want to run the MySQL benchmark scripts, Perl support for MySQL must be available. See Chapter 13, Perl Installation Notes.**

Instructions for installing MySQL on different platforms and environments is available on a platform by platform basis:

- **Unix, Linux, FreeBSD**
  
  For instructions on installing MySQL on most Linux and Unix platforms using a generic binary (for example, a .tar.gz package), see Chapter 3, Installing MySQL on Unix/Linux Using Generic Binaries.
For information on building MySQL entirely from the source code distributions or the source code repositories, see Chapter 4, *Installing MySQL from Source*.

For specific platform help on installation, configuration, and building from source see the corresponding platform section:

- Linux, including notes on distribution specific methods, see Chapter 7, *Installing MySQL on Linux*.

- Solaris, including PKG and IPS formats, see Chapter 8, *Installing MySQL on Solaris*.

- IBM AIX, see Chapter 8, *Installing MySQL on Solaris*.

- FreeBSD, see *Installing MySQL on FreeBSD*.

- **Microsoft Windows**

  For instructions on installing MySQL on Microsoft Windows, using either the MySQL Installer or Zipped binary, see Chapter 5, *Installing MySQL on Microsoft Windows*.

  For information about managing MySQL instances, see *MySQL Notifier Overview*.

  For details and instructions on building MySQL from source code using Microsoft Visual Studio, see Chapter 4, *Installing MySQL from Source*.

- **macOS**

  For installation on macOS, including using both the binary package and native PKG formats, see Chapter 6, *Installing MySQL on OS X*.

  For information on making use of an macOS Launch Daemon to automatically start and stop MySQL, see Section 6.3, “Installing a MySQL Launch Daemon”.

  For information on the MySQL Preference Pane, see Section 6.4, “Installing and Using the MySQL Preference Pane”.
Chapter 2 General Installation Guidance

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The immediately following sections contain the information necessary to choose, download, and verify your distribution. The instructions in later sections of the chapter describe how to install the distribution that you choose. For binary distributions, see the instructions at Chapter 3, Installing MySQL on Unix/Linux Using Generic Binaries or the corresponding section for your platform if available. To build MySQL from source, use the instructions in Chapter 4, Installing MySQL from Source.

2.1 Which MySQL Version and Distribution to Install

MySQL is available on a number of operating systems and platforms. For information about those platforms that are officially supported, see https://www.mysql.com/support/supportedplatforms/database.html on the MySQL website.

When preparing to install MySQL, decide which version and distribution format (binary or source) to use.

First, decide whether to install a development release or a General Availability (GA) release. Development releases have the newest features, but are not recommended for production use. GA releases, also called production or stable releases, are meant for production use. We recommend using the most recent GA release.

The naming scheme in MySQL 5.6 uses release names that consist of three numbers and an optional suffix; for example, mysql-5.6.1-m1. The numbers within the release name are interpreted as follows:

• The first number (5) is the major version number.

• The second number (6) is the minor version number. Taken together, the major and minor numbers constitute the release series number. The series number describes the stable feature set.

• The third number (1) is the version number within the release series. This is incremented for each new bugfix release. In most cases, the most recent version within a series is the best choice.

Release names can also include a suffix to indicate the stability level of the release. Releases within a series progress through a set of suffixes to indicate how the stability level improves. The possible suffixes are:

• mN (for example, m1, m2, m3, ...) indicates a milestone number. MySQL development uses a milestone model, in which each milestone introduces a small subset of thoroughly tested features. Following the releases for one milestone, development proceeds with another small number of releases that focuses on the next set of features. From one milestone to the next, feature interfaces may change or features
may even be removed, based on feedback provided by community members who try these early releases. Features within milestone releases may be considered to be of pre-production quality.

- rc indicates a Release Candidate (RC). Release candidates are believed to be stable, having passed all of MySQL's internal testing. New features may still be introduced in RC releases, but the focus shifts to fixing bugs to stabilize features introduced earlier within the series.

- Absence of a suffix indicates a General Availability (GA) or Production release. GA releases are stable, having successfully passed through the earlier release stages, and are believed to be reliable, free of serious bugs, and suitable for use in production systems.

Development within a series begins with milestone releases, followed by RC releases, and finally reaches GA status releases.

After choosing which MySQL version to install, decide which distribution format to install for your operating system. For most use cases, a binary distribution is the right choice. Binary distributions are available in native format for many platforms, such as RPM packages for Linux or DMG packages for macOS. Distributions are also available in more generic formats such as Zip archives or compressed \texttt{tar} files. On Windows, you can use the MySQL Installer to install a binary distribution.

Under some circumstances, it may be preferable to install MySQL from a source distribution:

- You want to install MySQL at some explicit location. The standard binary distributions are ready to run at any installation location, but you might require even more flexibility to place MySQL components where you want.

- You want to configure \texttt{mysqld} with features that might not be included in the standard binary distributions. Here is a list of the most common extra options used to ensure feature availability:
  
  - \texttt{-DWITH_LIBWRAP=1} for TCP wrappers support.
  - \texttt{-DWITH_ZLIB={system|bundled}} for features that depend on compression
  - \texttt{-DWITH_DEBUG=1} for debugging support

  For additional information, see Section 4.7, “MySQL Source-Configuration Options”.

- You want to configure \texttt{mysqld} without some features that are included in the standard binary distributions. For example, distributions normally are compiled with support for all character sets. If you want a smaller MySQL server, you can recompile it with support for only the character sets you need.

- You want to read or modify the C and C++ code that makes up MySQL. For this purpose, obtain a source distribution.

- Source distributions contain more tests and examples than binary distributions.

## 2.2 How to Get MySQL

Check our downloads page at \url{https://dev.mysql.com/downloads/} for information about the current version of MySQL and for downloading instructions. For a complete up-to-date list of MySQL download mirror sites, see \url{https://dev.mysql.com/downloads/mirrors.html}. You can also find information there about becoming a MySQL mirror site and how to report a bad or out-of-date mirror.

For RPM-based Linux platforms that use Yum as their package management system, MySQL can be installed using the MySQL Yum Repository. See Section 7.1, “Installing MySQL on Linux Using the MySQL Yum Repository” for details.
Verifying Package Integrity Using MD5 Checksums or GnuPG

For Debian-based Linux platforms, MySQL can be installed using the MySQL APT Repository. See Section 7.3, “Installing MySQL on Linux Using the MySQL APT Repository” for details.

For SUSE Linux Enterprise Server (SLES) platforms, MySQL can be installed using the MySQL SLES Repository. See Section 7.4, “Installing MySQL on Linux Using the MySQL SLES Repository” for details.

To obtain the latest development source, see Section 4.5, “Installing MySQL Using a Development Source Tree”.

2.3 Verifying Package Integrity Using MD5 Checksums or GnuPG

After downloading the MySQL package that suits your needs and before attempting to install it, make sure that it is intact and has not been tampered with. There are three means of integrity checking:

- MD5 checksums
- Cryptographic signatures using GnuPG, the GNU Privacy Guard
- For RPM packages, the built-in RPM integrity verification mechanism

The following sections describe how to use these methods.

If you notice that the MD5 checksum or GPG signatures do not match, first try to download the respective package one more time, perhaps from another mirror site.

2.3.1 Verifying the MD5 Checksum

After you have downloaded a MySQL package, you should make sure that its MD5 checksum matches the one provided on the MySQL download pages. Each package has an individual checksum that you can verify against the package that you downloaded. The correct MD5 checksum is listed on the downloads page for each MySQL product, and you will compare it against the MD5 checksum of the file (product) that you download.

Each operating system and setup offers its own version of tools for checking the MD5 checksum. Typically the command is named `md5sum`, or it may be named `md5`, and some operating systems do not ship it at all. On Linux, it is part of the GNU Text Utilities package, which is available for a wide range of platforms. You can also download the source code from http://www.gnu.org/software/textutils/. If you have OpenSSL installed, you can use the command `openssl md5 package_name` instead. A Windows implementation of the `md5` command line utility is available from http://www.fourmilab.ch/md5/. `winMd5Sum` is a graphical MD5 checking tool that can be obtained from http://www.nullriver.com/index/products/winmd5sum. Our Microsoft Windows examples will assume the name `md5.exe`.

Linux and Microsoft Windows examples:

```
shell> md5sum mysql-standard-5.6.49-linux-i686.tar.gz
aaab65abbec64d5e907dcd41b8699945  mysql-standard-5.6.49-linux-i686.tar.gz

shell> md5.exe mysql-installer-community-5.6.49.msi
aaab65abbec64d5e907dcd41b8699945  mysql-installer-community-5.6.49.msi
```

You should verify that the resulting checksum (the string of hexadecimal digits) matches the one displayed on the download page immediately below the respective package.

Note

Make sure to verify the checksum of the archive file (for example, the `.zip`, `.tar.gz`, or `.msi` file) and not of the files that are contained inside of the archive. In other words, verify the file before extracting its contents.
2.3.2 Signature Checking Using GnuPG

Another method of verifying the integrity and authenticity of a package is to use cryptographic signatures. This is more reliable than using MD5 checksums, but requires more work.

We sign MySQL downloadable packages with GnuPG (GNU Privacy Guard). GnuPG is an Open Source alternative to the well-known Pretty Good Privacy (PGP) by Phil Zimmermann. Most Linux distributions ship with GnuPG installed by default. Otherwise, see http://www.gnupg.org/ for more information about GnuPG and how to obtain and install it.

To verify the signature for a specific package, you first need to obtain a copy of our public GPG build key, which you can download from http://pgp.mit.edu/. The key that you want to obtain is named mysql-build@oss.oracle.com. Alternatively, you can copy and paste the key directly from the following text:

```
-----BEGIN PGP PUBLIC KEY BLOCK-----
Version: GnuPG v1

mQGiBD4+owwRBAC14GIfUCyEDSEVPwEV3SAFUbJbtqOHu/n/JKzgyQ7t9b9plUW3C
RODjQreyCITrRdwyjUGKu2FmeGVgw2u2WmdMNNLaqnpwWPbdCdk96+omSNL9brsz
fw2Ou0GcmYz2WOh0yDHuvy1Q/A/bTh0qAdqj8AW6/LO7V1W9/8VuHPqGwCvqzV3
BqGxRznNCRcXuAvuAzu1hTRcEAOoQk+I+isLunYMd1WufeXfehsc575/+yeJkewN
hxw9pRWVAmNYjDRT+rFZUe3vpqUKXU/hnEIUHRQyQIHo8gtTvxxXNQCq7fYLYV
RZhtkrPbP7F7wvEMKHyhrBeKtQGf9sirjkrj68sBgaACyp/V7b7ipxwh6d27T1n
EjtkxhAcmNpMfz8NJTkmAnEmPclAz2oOHAHdpWpK4317s3dngtobZX9q+AXwuNDI
QJXEM56fb1sL0tCniYsaAFnAWEMOGDkMqJ61y1AmFvaidB6HbPAnWcyfepf
zv0axqEmCM03o7wqwGN3P0DanaB3pjoqpxwhz6/62qJ7Q2T7X1U7WuqMhV8
2WfZ2SBFbmdpvmklcmluZya8BQm7nSxhTvnpGbrAh3N2lm9yYNXa25j2b0+jLwe
EKeECACWCGyMhCF4ACQGECGwckBWMCbMUbKQGcAwMABAUXEEB+uyWJ7te
5A1UACKCMSyC07H8R2PAJ9um0l1zCFCN+DHxVaoFLJdYVTQCFborsc7tmZs
whhgobJekZrbkoryAaNTGtqIAKQbIw1YLCqGHAWIFQIIFaIAWqMgABaHBeAахb
BQ7TADRMqkAs2VLaAoeJelejtTQcuhX4MAoKNLWacCBUj96637kvx6a/jFux5m
AJwPtmqdfUe2iuhxDrFTEP19Sb6OhomBMRRامAHHajhbsJCAcDagVqAggDBBBY
AECWcHgC4EF4AKAF3pOFCRPh7AHACqGxQHNO1by4fUmsAcedeJfqq9qWTUngmC
ACmSm4PjwuxAcOzFM8YBuMOGELL+TRf7MKrEm6ipGkXExECACkCkGyMScWIBMC
BBUCACMEFIDrQAIAQx1A8tACUQUSzR90qUJFtqhgGACRCCOGY7U7HLH9Y7tAAJ9X
IA/ymlmcpzn+Al5s8/umxMcTajCqAaMNqdlNKhHzbyC3r9X/2wxfzgArEAEAC
AAYFAIA65dGACU6qGACAlC/OxHlNrrWwW/dt/tk/XN2CMDVq+ovoM0qggIIhXZfi
NNeisvGza4msf5RGe+1bvmvDrKhxicGU48RussjxVb6KMTuy6p9vpFz9d3j
H9Op9yfa+16xySzipohmLhMty7NH20vYCYnZ5XciUAcCI2r2NH8ZNT5CNF
1uPnRn7hsHzzz7po1TjT1wFqC4q/1j62Z6CNrmdj+iSmvJY9nU6deEGtCnTpcygD
5H9K+K+7Nd/75v6yaAh4e4pOUSnXg8K97i6M0F5CSUyy?7J3kZB2OUBBWM053k
nGdALyqgSr50DAMjJMGKV142enze2RvRMNfr7t5y0OrtnMXUSQGMBLPnB1KhBAQAQI
AbBUC1i+bvQACRAohbcD0zc88dWmACACWXDX1cARUWw+j3h8d9u85ttlJn3wB
C7c1pcIKpUWvLTZ7lgzlvSB0Ah8f4kgX5A+zil6U6mpUHsKlfi713Ac9Gmpq
QGv5wSmR95l1D1hELzBFdBkUjIqLtNcGWd7F/7U709GhsS787539uuLX6aM
xGSc4LZ3DzJF5icGdbk0j+3lcrmp855gsAa3fyyU1BkcccKNawp1y7V3zD2du
pOF3B+8NPKq42P+skRkgFd4HldcI5Qct3rY4vaTEkLkgQnNA6u4r9Qogaw7tI
SxFsFlntMa2zq53tk0K+XH0kUz3R78y8bPit+1ygcycyr7m7fOp7riQcEBBBCAAG
BQJw9dAoo2Wu4Zb/gkUKKUX99M/Rnt7ccpJ3CSCrBA2USLY2Dsr+pePl2ubb
WsaEdg82sji5JGpbhIHLSg/PZqOGHtFWmmzXjK7Rt+dcgdlb3b2VwCNAWECE0JH
UKheQowelmdvnHYDKBHPJp4/I6mKOPLO/2mYyYmpMBMFz35DJ3CTJt3/Lo8N7
zF40gs/i90pePwvntPsbglbUn7X0po1/Ee8vHziAmBom52pKIuxNYV2U22m3b
Wqrd5escu6yk6jzYpxD4DH9wcTwp168eGeRruqCuis106s/mhH7Eqxh/1xrFZ
vJ11f75vossQzfgw58S03AAcgQxLwCm48PwXwJ8q/8f/eo/4Q9mFq2o2MywMqP4/fdBWuf
Lka12FQQOOQMw9h1ManEjUyjXr1P718Qa2lLqbgsFq9ejVkJrF
TzunWmOqgri6yUklixvI6QxjcvI3x2O7w2nSxycpVBpRFqGceVbZa2854DmNg
yGTAUA04z4eavMn12G1OQAy66+yTD2+CuRzdyU/HD9Y91hFjGedm0mNN57
sRjzqXPgohCThiTv4qR5/2p5SNQ/VB4ogS6Jgogsc2duu2dxCp/heureMRKfzyuK
OHQPj1/j7+gpyFhEUI7DUXt0S3c9n0PdeBc1dpBnCnxQW4M3tl4kRbGk
AQIADACIOcl2QODAvAIA1AACRCKXELlyfetFLZAB/90qxc+NCS9UQ0/dxKCTryz
v/MuaPnNqULPmLHp0t1el3I3/H/xr/dtcoCofy4cjoAvazak2Xxewq93Av/PCuB
z9xOEr2e2Lo6w6y6xOvf72Awuuxi/U68q7tKaqLRLitM02y8aARN/vq/V7uMG
mO4S5yLa1iyobygPaFDZC1fKnO3N2INv3C5mYBcXocrFGkEul2Y512MtcYXscQHP
WKFg596eFPCmd4xYMB33gLQGKSm016OFY5yeRwv+wbtgjLpD3bM/T2b3fj/J7tr
a
CSMLzearR7q8aygpL+xM7MMe2r89a6w6jmqSgNBAbzrbvDqD6JULdA4s8imCVXK2
-----END PGP PUBLIC KEY BLOCK-----
```
Signature Checking Using GnuPG
Signature Checking Using GnuPG

To import the build key into your personal public GPG keyring, use gpg --import. For example, if you have saved the key in a file named mysql_pubkey.asc, the import command looks like this:

```
shell> gpg --import mysql_pubkey.asc
```

You can also download the key from the public keyserver using the public key id, 5072E1F5:

```
shell> gpg --recv-keys 5072E1F5
```

You can also download the key from the public keyserver using the public key id, 5072E1F5:

```
shell> gpg --recv-keys 5072E1F5
```

To import the build key into your personal public GPG keyring, use gpg --import. For example, if you have saved the key in a file named mysql_pubkey.asc, the import command looks like this:

```
shell> gpg --import mysql_pubkey.asc
```

You can also download the key from the public keyserver using the public key id, 5072E1F5:

```
shell> gpg --recv-keys 5072E1F5
```
Signature Checking Using GnuPG

<table>
<thead>
<tr>
<th>File Type</th>
<th>File Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution file</td>
<td>mysql-standard-5.6.49-linux-i686.tar.gz</td>
</tr>
<tr>
<td>Signature file</td>
<td>mysql-standard-5.6.49-linux-i686.tar.gz.asc</td>
</tr>
</tbody>
</table>

Make sure that both files are stored in the same directory and then run the following command to verify the signature for the distribution file:

```shell>
gpg --verify package_name.asc
```

If the downloaded package is valid, you will see a "Good signature" similar to:

```shell>
gpg --verify mysql-standard-5.6.49-linux-i686.tar.gz.asc
```
```
gpg: Signature made Tue 01 Feb 2011 02:38:30 AM CST using DSA key ID 5072E1F5
```
```
gpg: Good signature from "MySQL Release Engineering <mysql-build@oss.oracle.com>"
```

The Good signature message indicates that the file signature is valid, when compared to the signature listed on our site. But you might also see warnings, like so:

```shell>
gpg --verify mysql-standard-5.6.49-linux-i686.tar.gz.asc
```
```
gpg: Signature made Wed 23 Jan 2013 02:25:45 AM PST using DSA key ID 5072E1F5
```
```
gpg: checking the trustdb
```
```
gpg: no ultimately trusted keys found
```
```
gpg: Good signature from "MySQL Release Engineering <mysql-build@oss.oracle.com>"
```
```
gpg: WARNING: This key is not certified with a trusted signature!
```
```
gpg: Primary key fingerprint: A4A9 4068 76FC BD3C 4567  70C8 8C71 8D3B 5072 E1F5
```

That is normal, as they depend on your setup and configuration. Here are explanations for these warnings:

- **gpg: no ultimately trusted keys found**: This means that the specific key is not "ultimately trusted" by you or your web of trust, which is okay for the purposes of verifying file signatures.

- **This key is not certified with a trusted signature! There is no indication that the signature belongs to the owner.**: This refers to your level of trust in your belief that you possess our real public key. This is a personal decision. Ideally, a MySQL developer would hand you the key in person, but more commonly, you downloaded it. Was the download tampered with? Probably not, but this decision is up to you. Setting up a web of trust is one method for trusting them.

See the GPG documentation for more information on how to work with public keys.
2.3.3 Signature Checking Using Gpg4win for Windows

The Section 2.3.2, “Signature Checking Using GnuPG” section describes how to verify MySQL downloads using GPG. That guide also applies to Microsoft Windows, but another option is to use a GUI tool like Gpg4win. You may use a different tool but our examples are based on Gpg4win, and utilize its bundled Kleopatra GUI.

Download and install Gpg4win, and then load Kleopatra. The dialog should look similar to:

Figure 2.1 Kleopatra: Initial Screen

Next, add the MySQL Release Engineering certificate. Do this by clicking File, Lookup Certificates on Server. Type "Mysql Release Engineering" into the search box and press Search.

Figure 2.2 Kleopatra: Lookup Certificates on Server Wizard: Finding a Certificate
Select the "MySQL Release Engineering" certificate. The Fingerprint and Key-ID must be "5072E1F5", or choose Details... to confirm the certificate is valid. Now, import it by clicking Import. An import dialog will be displayed, choose Okay, and this certificate will now be listed under the Imported Certificates tab.

Next, configure the trust level for our certificate. Select our certificate, then from the main menu select Certificates, Change Owner Trust... We suggest choosing I believe checks are very accurate for our certificate, as otherwise you might not be able to verify our signature. Select I believe checks are very accurate to enable "full trust" and then press OK.

Figure 2.3 Kleopatra: Change Trust level for MySQL Release Engineering

Next, verify the downloaded MySQL package file. This requires files for both the packaged file, and the signature. The signature file must have the same name as the packaged file but with an appended .asc extension, as shown by the example in the following table. The signature is linked to on the downloads page for each MySQL product. You must create the .asc file with this signature.

Table 2.2 MySQL Package and Signature Files for MySQL Installer for Microsoft Windows

<table>
<thead>
<tr>
<th>File Type</th>
<th>File Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution file</td>
<td>mysql-installer-community-5.6.49.msi</td>
</tr>
<tr>
<td>Signature file</td>
<td>mysql-installer-community-5.6.49.msi.asc</td>
</tr>
</tbody>
</table>

Make sure that both files are stored in the same directory and then run the following command to verify the signature for the distribution file. Either drag and drop the signature (.asc) file into Kleopatra, or load the dialog from File, Decrypt/Verify Files..., and then choose either the .msi or .asc file.
Click **Decrypt/Verify** to check the file. The two most common results will look like the following, and although the yellow warning looks problematic, the following means that the file check passed with success. You may now run this installer.

**Figure 2.5 Kleopatra: the Decrypt and Verify Results Dialog: All operations completed**

Seeing a red "The signature is bad" error means the file is invalid. Do not execute the MSI file if you see this error.
2.3.4 Signature Checking Using RPM

For RPM packages, there is no separate signature. RPM packages have a built-in GPG signature and MD5 checksum. You can verify a package by running the following command:

```
shell> rpm --checksig package_name.rpm
```

Example:

```
shell> rpm --checksig MySQL-server-5.6.49-0-linux_glibc2.5.i386.rpm
MySQL-server-5.6.49-0-linux_glibc2.5.i386.rpm: md5 gpg OK
```

**Note**

If you are using RPM 4.1 and it complains about (GPG) NOT OK (MISSING KEYS: GPG#5072e1f5), even though you have imported the MySQL public build key into your own GPG keyring, you need to import the key into the RPM keyring first. RPM 4.1 no longer uses your personal GPG keyring (or GPG itself). Rather, RPM maintains a separate keyring because it is a system-wide application and a user's GPG public keyring is a user-specific file. To import the MySQL public key into the RPM keyring, first obtain the key, then use `rpm --import` to import the key. For example:

```
shell> gpg --export -a 5072e1f5 > 5072e1f5.asc
```
Installation Layouts

shell> rpm --import 5072e1f5.asc

Alternatively, rpm also supports loading the key directly from a URL, and you can use this manual page:


If you need to obtain the MySQL public key, see Section 2.3.2, “Signature Checking Using GnuPG”.

2.4 Installation Layouts

The installation layout differs for different installation types (for example, native packages, binary tarballs, and source tarballs), which can lead to confusion when managing different systems or using different installation sources. The individual layouts are given in the corresponding installation type or platform chapter, as described following. Note that the layout of installations from vendors other than Oracle may differ from these layouts.

• Section 5.1, “MySQL Installation Layout on Microsoft Windows”
• Section 4.3, “MySQL Layout for Source Installation”
• Table 3.1, “MySQL Installation Layout for Generic Unix/Linux Binary Package”
• Table 7.4, “MySQL Installation Layout for Linux RPM Packages from the MySQL Developer Zone”
• Table 6.1, “MySQL Installation Layout on OS X”

2.5 Compiler-Specific Build Characteristics

In some cases, the compiler used to build MySQL affects the features available for use. The notes in this section apply for binary distributions provided by Oracle Corporation or that you compile yourself from source.

icc (Intel C++ Compiler) Builds

A server built with icc has these characteristics:

• SSL support is not included.
Chapter 3 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 Chapter 5, Installing MySQL on Microsoft Windows. See Section 2.2, “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, 5.6.49), and OS indicates the type of operating system for which the distribution is intended (for example, pc-linux-i686 or winx64).

Warnings

- 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.

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

Or, on APT-based systems:

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

- SLES 11: As of MySQL 5.6.37, 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 libnncurses.so.5.6 /lib64/libtinfo.so.5 on 64-bit systems or ln -s libnncurses.so.5.6 /lib/libtinfo.so.5 on 32-bit systems.

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.
Create a mysql User and Group

Table 3.1 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, scripts</td>
<td>mysql server, client and utility programs</td>
</tr>
<tr>
<td>data</td>
<td>Log files, databases</td>
</tr>
<tr>
<td>docs</td>
<td>MySQL manual in Info format</td>
</tr>
<tr>
<td>include</td>
<td>Include (header) files</td>
</tr>
<tr>
<td>lib</td>
<td>Libraries</td>
</tr>
<tr>
<td>mysql-test</td>
<td>Test suite</td>
</tr>
<tr>
<td>man</td>
<td>Unix manual pages</td>
</tr>
<tr>
<td>share</td>
<td>Error messages, dictionary, and SQL for database installation</td>
</tr>
<tr>
<td>sql-bench</td>
<td>Benchmarks</td>
</tr>
<tr>
<td>support-files</td>
<td>Miscellaneous support files, including sample configuration files</td>
</tr>
</tbody>
</table>

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 Chapter 4, 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 xzvf /path/to/mysql-VERSION-OS.tar.gz
shell> ln -s full-path-to-mysql-VERSION-OS mysql
shell> cd mysql
shell> scripts/mysql_install_db --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.

Note
The procedure does not assign passwords to MySQL accounts. To do so, use the instructions in Section 9.4, “Securing the Initial MySQL Accounts”.

mysql_install_db creates a default option file named my.cnf in the base installation directory. This file is created from a template included in the distribution package named my-default.cnf. For more information, see Using a Sample Default Server Configuration File.

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 Section 2.2, “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 xzvf /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/.

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:

```
shell> ln -s full-path-to-mysql-VERSION-OS mysql
```

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 Chapter 9, *Postinstallation Setup and Testing*. 
Chapter 4 Installing MySQL from Source

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Building MySQL from the source code enables you to customize build parameters, compiler
optimizations, and installation location. For a list of systems on which MySQL is known to run, see https://

Before you proceed with an installation from source, check whether Oracle produces a precompiled binary
distribution for your platform and whether it works for you. We put a great deal of effort into ensuring that
our binaries are built with the best possible options for optimal performance. Instructions for installing
binary distributions are available in Chapter 3, Installing MySQL on Unix/Linux Using Generic Binaries.

Warning
Building MySQL with nonstandard options may lead to reduced functionality,
performance, or security.

4.1 Source Installation Methods

There are two methods for installing MySQL from source:

• Use a standard MySQL source distribution. To obtain a standard distribution, see Section 2.2, “How to
Get MySQL”. For instructions on building from a standard distribution, see Section 4.4, “Installing MySQL
Using a Standard Source Distribution”.

Standard distributions are available as compressed tar files, Zip archives, or RPM packages.
Distribution files have names of the form mysql-VERSION.tar.gz, mysql-VERSION.zip, or
mysql-VERSION.rpm, where VERSION is a number like 5.6.49. File names for source distributions
can be distinguished from those for precompiled binary distributions in that source distribution names
are generic and include no platform name, whereas binary distribution names include a platform name
indicating the type of system for which the distribution is intended (for example, pc-linux-i686 or
winx64).

• Use a MySQL development tree. For information on building from one of the development trees, see
Section 4.5, “Installing MySQL Using a Development Source Tree”.

4.2 Source Installation Prerequisites

Installation of MySQL from source requires several development tools. Some of these tools are needed
no matter whether you use a standard source distribution or a development source tree. Other tool
requirements depend on which installation method you use.
Source Installation Prerequisites

To install MySQL from source, the following system requirements must be satisfied, regardless of installation method:

- **CMake**, which is used as the build framework on all platforms. CMake can be downloaded from http://www.cmake.org.

- A good `make` program. Although some platforms come with their own `make` implementations, it is highly recommended that you use GNU `make` 3.75 or higher. It may already be available on your system as `gmake`. GNU `make` is available from http://www.gnu.org/software/make/.

- A working ANSI C++ compiler. GCC 4.2.1 or later, Sun Studio 12 or later, Visual Studio 2010 or later, and many current vendor-supplied compilers are known to work.

- An SSL library is required for support of encrypted connections, entropy for random number generation, and other encryption-related operations. To specify the library explicitly, use the `WITH_SSL` option when you invoke CMake. For additional information, see Section 4.6, “Configuring SSL Library Support”.

- The ncurses library.

- Sufficient free memory. If you encounter problems such as “internal compiler error” when compiling large source files, it may be that you have too little memory. If compiling on a virtual machine, try increasing the memory allocation.

- Perl is needed if you intend to run test scripts. Most Unix-like systems include Perl. On Windows, you can use a version such as ActiveState Perl.

To install MySQL from a standard source distribution, one of the following tools is required to unpack the distribution file:

- For a `.tar.gz` compressed `tar` file: 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/.

- For a `.zip` Zip archive: WinZip or another tool that can read `.zip` files.

- For an `.rpm` RPM package: The `rpmbuild` program used to build the distribution unpacks it.

To install MySQL from a development source tree, the following additional tools are required:

- The Git revision control system is required to obtain the development source code. The GitHub Help provides instructions for downloading and installing Git on different platforms. MySQL officially joined GitHub in September, 2014. For more information about MySQL's move to GitHub, refer to the announcement on the MySQL Release Engineering blog: MySQL on GitHub

- `bison` 2.1 or higher, available from http://www.gnu.org/software/bison/. (Version 1 is no longer supported.) Use the latest version of `bison` where possible; if you experience problems, upgrade to a later version, rather than revert to an earlier one.

  `bison` is available from http://www.gnu.org/software/bison/. `bison` for Windows can be downloaded from http://gnuwin32.sourceforge.net/packages/bison.htm. Download the package labeled “Complete package, excluding sources”. On Windows, the default location for `bison` is the `C:\Program Files \GnuWin32` directory. Some utilities may fail to find `bison` because of the space in the directory name.
Also, Visual Studio may simply hang if there are spaces in the path. You can resolve these problems by installing into a directory that does not contain a space (for example C:\GnuWin32).

- On Solaris Express, m4 must be installed in addition to bison. m4 is available from http://www.gnu.org/software/m4/.

**Note**

If you have to install any programs, modify your PATH environment variable to include any directories in which the programs are located. See Setting Environment Variables.

If you run into problems and need to file a bug report, please use the instructions in How to Report Bugs or Problems.

### 4.3 MySQL Layout for Source Installation

By default, when you install MySQL after compiling it from source, the installation step installs files under /usr/local/mysql. The component locations under the installation directory are the same as for binary distributions. See Table 3.1, “MySQL Installation Layout for Generic Unix/Linux Binary Package”, and Section 5.1, “MySQL Installation Layout on Microsoft Windows”. To configure installation locations different from the defaults, use the options described at Section 4.7, “MySQL Source-Configuration Options”.

### 4.4 Installing MySQL Using a Standard Source Distribution

To install MySQL from a standard source distribution:

1. Verify that your system satisfies the tool requirements listed at Section 4.2, “Source Installation Prerequisites”.
2. Obtain a distribution file using the instructions in Section 2.2, “How to Get MySQL”.
3. Configure, build, and install the distribution using the instructions in this section.
4. Perform postinstallation procedures using the instructions in Chapter 9, Postinstallation Setup and Testing.

MySQL uses CMake as the build framework on all platforms. The instructions given here should enable you to produce a working installation. For additional information on using CMake to build MySQL, see How to Build MySQL Server with CMake.

If you start from a source RPM, use the following command to make a binary RPM that you can install. If you do not have rpmbuild, use rpm instead.

```shell
rpmbuild --rebuild --clean MySQL-VERSION.src.rpm
```

The result is one or more binary RPM packages that you install as indicated in Section 7.5, “Installing MySQL on Linux Using RPM Packages from Oracle”.

The sequence for installation from a compressed tar file or Zip archive source distribution is similar to the process for installing from a generic binary distribution (see Chapter 3, Installing MySQL on Unix/Linux Using Generic Binaries), except that it is used on all platforms and includes steps to configure and compile the distribution. For example, with a compressed tar file source distribution on Unix, the basic installation command sequence looks like this:

```shell
# Preconfiguration setup
shell> groupadd mysql
shell> useradd -r -g mysql -s /bin/false mysql
# Beginning of source-build specific instructions
```
Perform Preconfiguration Setup

On Unix, set up the **mysql** user and group that will be used to run and execute the MySQL server and own the database directory. For details, see Create a mysql User and Group. Then perform the following steps as the **mysql** user, except as noted.

Perform Preconfiguration Setup

Obtain and Unpack the Distribution

Pick the directory under which you want to unpack the distribution and change location into it.

Obtain a distribution file using the instructions in Section 2.2, “How to Get MySQL”.

Unpack the distribution into the current directory:

- To unpack a compressed **tar** file, **tar** can uncompress and unpack the distribution if it has z option support:

  ```shell
  shell> tar zxfv mysql-VERSION.tar.gz
  ```

  If your **tar** does not have z option support, use **gunzip** to unpack the distribution and **tar** to unpack it:

  ```shell
  shell> gunzip < mysql-VERSION.tar.gz | tar xvf -
  ```

---

### mysql_install_db

Creates a default option file named **my.cnf** in the base installation directory. This file is created from a template included in the distribution package named **my-default.cnf**. For more information, see Using a Sample Default Server Configuration File.

A more detailed version of the source-build specific instructions is shown following.

#### Note

The procedure shown here does not set up any passwords for MySQL accounts. After following the procedure, proceed to Chapter 9, Postinstallation Setup and Testing, for postinstallation setup and testing.

- Perform Preconfiguration Setup
- Obtain and Unpack the Distribution
- Configure the Distribution
- Build the Distribution
- Install the Distribution
- Perform Postinstallation Setup
Alternatively, CMake can uncompress and unpack the distribution:

    shell> cmake -E tar zxvf mysql-VERSION.tar.gz

- To unpack a Zip archive, use WinZip or another tool that can read .zip files.

Unpacking the distribution file creates a directory named `mysql-VERSION`.

## Configure the Distribution

Change location into the top-level directory of the unpacked distribution:

    shell> cd mysql-VERSION

Build outside of the source tree to keep the tree clean. If the top-level source directory is named `mysql-src` under your current working directory, you can build in a directory named `bld` at the same level. Create the directory and go there:

    shell> mkdir bld
    shell> cd bld

Configure the build directory. The minimum configuration command includes no options to override configuration defaults:

    shell> cmake ../mysql-src

The build directory needs not be outside the source tree. For example, you can build in a directory named `bld` under the top-level source tree. To do this, starting with `mysql-src` as your current working directory, create the directory `bld` and then go there:

    shell> mkdir bld
    shell> cd bld

Configure the build directory. The minimum configuration command includes no options to override configuration defaults:

    shell> cmake ..

If you have multiple source trees at the same level (for example, to build multiple versions of MySQL), the second strategy can be advantageous. The first strategy places all build directories at the same level, which requires that you choose a unique name for each. With the second strategy, you can use the same name for the build directory within each source tree. The following instructions assume this second strategy.

On Windows, specify the development environment. For example, the following commands configure MySQL for 32-bit or 64-bit builds, respectively:

    shell> cmake .. -G "Visual Studio 12 2013"
    shell> cmake .. -G "Visual Studio 12 2013 Win64"

On macOS, to use the Xcode IDE:

    shell> cmake .. -G Xcode

When you run `cmake`, you might want to add options to the command line. Here are some examples:

- `-DBUILD_CONFIG=mysql_release`: Configure the source with the same build options used by Oracle to produce binary distributions for official MySQL releases.

- `-DCMAKE_INSTALL_PREFIX=dir_name`: Configure the distribution for installation under a particular location.
Build the Distribution

- **-DCPACK_MONOLITHIC_INSTALL=1**: Cause `make package` to generate a single installation file rather than multiple files.

- **-DWITH_DEBUG=1**: Build the distribution with debugging support.

For a more extensive list of options, see Section 4.7, “MySQL Source-Configuration Options”.

To list the configuration options, use one of the following commands:

```shell
shell> cmake .. -L  # overview
shell> cmake .. -LH # overview with help text
shell> cmake .. -LAH # all params with help text
shell> ccmake ..   # interactive display
```

If CMake fails, you might need to reconfigure by running it again with different options. If you do reconfigure, take note of the following:

- If CMake is run after it has previously been run, it may use information that was gathered during its previous invocation. This information is stored in `CMakeCache.txt`. When CMake starts, it looks for that file and reads its contents if it exists, on the assumption that the information is still correct. That assumption is invalid when you reconfigure.

- Each time you run CMake, you must run `make` again to recompile. However, you may want to remove old object files from previous builds first because they were compiled using different configuration options.

To prevent old object files or configuration information from being used, run these commands in the build directory on Unix before re-running CMake:

```shell
shell> make clean
shell> rm CMakeCache.txt
```

Or, on Windows:

```shell
shell> devenv MySQL.sln /clean
shell> del CMakeCache.txt
```

Before asking on the MySQL Community Slack, check the files in the CMakeFiles directory for useful information about the failure. To file a bug report, please use the instructions in How to Report Bugs or Problems.

Build the Distribution

On Unix:

```shell
shell> make
shell> make VERBOSE=1
```

The second command sets VERBOSE to show the commands for each compiled source.

Use `gmake` instead on systems where you are using GNU `make` and it has been installed as `gmake`.

On Windows:

```shell
shell> devenv MySQL.sln /build RelWithDebInfo
```

If you have gotten to the compilation stage, but the distribution does not build, see Section 4.8, “Dealing with Problems Compiling MySQL”, for help. If that does not solve the problem, please enter it into our bugs database using the instructions given in How to Report Bugs or Problems. If you have installed the latest versions of the required tools, and they crash trying to process our configuration files, please report that also. However, if you get a command not found error or a similar problem for required tools, do
not report it. Instead, make sure that all the required tools are installed and that your `PATH` variable is set correctly so that your shell can find them.

**Install the Distribution**

On Unix:

```
shell> make install
```

This installs the files under the configured installation directory (by default, `/usr/local/mysql`). You might need to run the command as `root`.

To install in a specific directory, add a `DESTDIR` parameter to the command line:

```
shell> make install DESTDIR="/opt/mysql"
```

Alternatively, generate installation package files that you can install where you like:

```
shell> make package
```

This operation produces one or more `.tar.gz` files that can be installed like generic binary distribution packages. See Chapter 3, *Installing MySQL on Unix/Linux Using Generic Binaries*. If you run `CMake` with `-DCPACK_MONOLITHIC_INSTALL=1`, the operation produces a single file. Otherwise, it produces multiple files.

On Windows, generate the data directory, then create a `.zip` archive installation package:

```
shell> devenv MySQL.sln /build RelWithDebInfo /project initial_database
shell> devenv MySQL.sln /build RelWithDebInfo /project package
```

You can install the resulting `.zip` archive where you like. See Section 5.4, “Installing MySQL on Microsoft Windows Using a `noinstall` ZIP Archive”.

**Perform Postinstallation Setup**

The remainder of the installation process involves setting up the configuration file, creating the core databases, and starting the MySQL server. For instructions, see Chapter 9, *Postinstallation Setup and Testing*.

**Note**

The accounts that are listed in the MySQL grant tables initially have no passwords. After starting the server, you should set up passwords for them using the instructions in Chapter 9, *Postinstallation Setup and Testing*.

**4.5 Installing MySQL Using a Development Source Tree**

This section describes how to install MySQL from the latest development source code, which is hosted on GitHub. To obtain the MySQL Server source code from this repository hosting service, you can set up a local MySQL Git repository.

On GitHub, MySQL Server and other MySQL projects are found on the MySQL page. The MySQL Server project is a single repository that contains branches for several MySQL series.

MySQL officially joined GitHub in September, 2014. For more information about MySQL's move to GitHub, refer to the announcement on the MySQL Release Engineering blog: MySQL on GitHub

- Prerequisites for Installing from Development Source
- Setting Up a MySQL Git Repository
Prerequisites for Installing from Development Source

To install MySQL from a development source tree, your system must satisfy the tool requirements listed at Section 4.2, "Source Installation Prerequisites".

Setting Up a MySQL Git Repository

To set up a MySQL Git repository on your machine, use this procedure:

1. Clone the MySQL Git repository to your machine. The following command clones the MySQL Git repository to a directory named `mysql-server`. The initial download will take some time to complete, depending on the speed of your connection.

   ```bash
   ~$ git clone https://github.com/mysql/mysql-server.git
   Cloning into 'mysql-server'...
   remote: Counting objects: 1035465, done.
   remote: Total 1035465 (delta 0), reused 0 (delta 0)
   Receiving objects: 100% (1035465/1035465), 437.48 MiB | 5.10 MiB/s, done.
   Resolving deltas: 100% (855607/855607), done.
   Checking connectivity... done.
   Checking out files: 100% (21902/21902), done.
   ```

2. When the clone operation completes, the contents of your local MySQL Git repository appear similar to the following:

   ```bash
   ~$ cd mysql-server
   ~/mysql-server$ ls
   BUILD          COPYING     libmysqld  regex   tests
   BUILD-CMAKE    dbug        libservices scripts unittest
   client         Docs        man        sql      VERSION
   cmake          extra       mysql-test sql-bench vio
   CMakeLists.txt include    mysyis    sql-common win
   cmd-line-utils INSTALL-SOURCE  packaging  storage  zlib
   config.h.cmake INSTALL-WIN-SOURCE  plugin     strings
   configure.cmake libmysql    README    support-files
   ```

3. Use the `git branch -r` command to view the remote tracking branches for the MySQL repository.

   ```bash
   ~/mysql-server$ git branch -r
   origin/5.5
   origin/5.6
   origin/5.7
   origin/HEAD -> origin/5.7
   origin/cluster-7.2
   origin/cluster-7.3
   origin/cluster-7.4
   ```

4. To view the branches that are checked out in your local repository, issue the `git branch` command. When you cloned the MySQL Git repository, the MySQL 5.7 branch was checked out automatically. The asterisk identifies the 5.7 branch as the active branch.

   ```bash
   ~/mysql-server$ git branch
   * 5.7
   ```

5. To check out a different MySQL branch, run the `git checkout` command, specifying the branch name. For example, to check out the MySQL 5.6 branch:

   ```bash
   ~/mysql-server$ git checkout 5.6
   Branch 5.6 set up to track remote branch 5.6 from origin.
   Switched to a new branch '5.6'
   ```

6. Run `git branch` again to verify that the MySQL 5.6 branch is present. MySQL 5.6, which is the last branch you checked out, is marked by an asterisk indicating that it is the active branch.
4.6 Configuring SSL Library Support

An SSL library is required for support of encrypted connections, entropy for random number generation, and other encryption-related operations. Your system must support either OpenSSL or yaSSL:

- MySQL Enterprise Edition binary distributions are compiled using OpenSSL. It is not possible to use yaSSL with MySQL Enterprise Edition.
- MySQL Community Edition binary distributions are compiled using yaSSL.
- MySQL Community Edition source distributions can be compiled using either OpenSSL or yaSSL.

Note

It is possible to compile MySQL using yaSSL as an alternative to OpenSSL only prior to MySQL 5.6.46. As of MySQL 5.6.46, support for yaSSL is removed and all MySQL builds use OpenSSL.

If you compile MySQL from a source distribution, CMake configures the distribution to use the installed OpenSSL library by default.
To compile using OpenSSL, use this procedure:

1. Ensure that OpenSSL 1.0.1 or higher is installed on your system. If the installed OpenSSL version is lower than 1.0.1, CMake produces an error at MySQL configuration time. If it is necessary to obtain OpenSSL, visit http://www.openssl.org.

2. The WITH_SSL CMake option determines which SSL library to use for compiling MySQL (see Section 4.7, “MySQL Source-Configuration Options”). The default is -DWITH_SSL=system, which uses OpenSSL. To make this explicit, specify that option on the CMake command line. For example:

   ```
   cmake . -DWITH_SSL=system
   ```

   That command configures the distribution to use the installed OpenSSL library. Alternatively, to explicitly specify the path name to the OpenSSL installation, use the following syntax. This can be useful if you have multiple versions of OpenSSL installed, to prevent CMake from choosing the wrong one:

   ```
   cmake . -DWITH_SSL=path_name
   ```

3. Compile and install the distribution.

   To check whether a mysql server supports encrypted connections, examine the value of the have_ssl system variable:

   ```
   mysql> SHOW VARIABLES LIKE 'have_ssl';
   +---------------+-------+
   | Variable_name | Value |
   +---------------+-------+
   | have_ssl      | YES   |
   +---------------+-------+
   ```

   If the value is YES, the server supports encrypted connections. If the value is DISABLED, the server is capable of supporting encrypted connections but was not started with the appropriate --ssl-xxx options to enable encrypted connections to be used; see Configuring MySQL to Use Encrypted Connections.

   To determine whether a server was compiled using OpenSSL or yaSSL, check the existence of any of the system or status variables that are present only for OpenSSL. See SSL Library-Dependent Capabilities

4.7 MySQL Source-Configuration Options

The CMake program provides a great deal of control over how you configure a MySQL source distribution. Typically, you do this using options on the CMake command line. For information about options supported by CMake, run either of these commands in the top-level source directory:

```
cmake . -LH
ccmake .
```

You can also affect CMake using certain environment variables. See Chapter 12, Environment Variables.

For boolean options, the value may be specified as 1 or ON to enable the option, or as 0 or OFF to disable the option.

Many options configure compile-time defaults that can be overridden at server startup. For example, the CMAKE_INSTALL_PREFIX, MYSQL_TCP_PORT, and MYSQL_UNIX_ADDR options that configure the default installation base directory location, TCP/IP port number, and Unix socket file can be changed at server startup with the --basedir, --port, and --socket options for mysql. Where applicable, configuration option descriptions indicate the corresponding mysql startup option.

The following sections provide more information about CMake options.
CMake Option Reference

The following table shows the available CMake options. In the Default column, PREFIX stands for the value of the CMAKE_INSTALL_PREFIX option, which specifies the installation base directory. This value is used as the parent location for several of the installation subdirectories.

<table>
<thead>
<tr>
<th>Formats</th>
<th>Description</th>
<th>Default</th>
<th>Introduced</th>
<th>Removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILD_CONFIG</td>
<td>Use same build options as official releases</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMAKE_BUILD_TYPE</td>
<td>Type of build to produce</td>
<td>RelWithDebInfo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMAKE_CXX_FLAGS</td>
<td>Flags for C++ Compiler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMAKE_C_FLAGS</td>
<td>Flags for C Compiler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMAKE_INSTALL_PREFIX</td>
<td>Installation base directory</td>
<td>/usr/local/mysql</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMPILATION_COMMENT</td>
<td>Comment about compilation environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPACK_MONOLITHIC_INSTALL</td>
<td>Whether package build produces single file</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEFAULT_CHARSET</td>
<td>The default server character set</td>
<td>latin1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEFAULT_COLLATION</td>
<td>The default server collation</td>
<td>latin1_swedish_ci</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENABLED_LOCAL_INFILE</td>
<td>Whether to enable LOCAL for LOAD DATA</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENABLED_PROFILING</td>
<td>Whether to enable query profiling code</td>
<td>ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENABLE_DEBUG_SYNC</td>
<td>Whether to enable Debug Sync support</td>
<td>ON</td>
<td></td>
<td>5.6.36</td>
</tr>
<tr>
<td>ENABLE_DOWNLOADS</td>
<td>Whether to download optional files</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENABLE_DTRACE</td>
<td>Whether to include DTrace support</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENABLE_GCOV</td>
<td>Whether to include gcov support</td>
<td></td>
<td></td>
<td>5.6.3</td>
</tr>
<tr>
<td>ENABLE_GPROF</td>
<td>Enable gprof (optimized Linux builds only)</td>
<td>OFF</td>
<td></td>
<td>5.6.6</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Formats</th>
<th>Description</th>
<th>Default</th>
<th>Introduced</th>
<th>Removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGNORE_AIO_CHECK</td>
<td>With -DBUILD_CONFIG=mysql_release, ignore libaio check</td>
<td>OFF</td>
<td>5.6.1</td>
<td></td>
</tr>
<tr>
<td>INNODB_PAGE_ATOMIC_REF_COUNT</td>
<td>Enable or disable atomic page reference counting</td>
<td>ON</td>
<td>5.6.16</td>
<td></td>
</tr>
<tr>
<td>INSTALL_BINDIR</td>
<td>User executables directory</td>
<td>PREFIX/bin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_DOCDIR</td>
<td>Documentation directory</td>
<td>PREFIX/docs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_DOCREADMEDIR</td>
<td>README file directory</td>
<td>PREFIX/docs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALLINCLUDEDIR</td>
<td>Header file directory</td>
<td>PREFIX/include</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_INFODIR</td>
<td>Info file directory</td>
<td>PREFIX/docs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_LAYOUT</td>
<td>Select predefined installation layout</td>
<td>STANDALONE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_LIBDIR</td>
<td>Library file directory</td>
<td>PREFIX/lib</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_MANDIR</td>
<td>Manual page directory</td>
<td>PREFIX/man</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_MYSQLSHAREDIR</td>
<td>Shared data directory</td>
<td>PREFIX/share</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_MYSQLTESTDIR</td>
<td>mysql-test directory</td>
<td>PREFIX/mysql-test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_PLUGINDIR</td>
<td>Plugin directory</td>
<td>PREFIX/lib/plugin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_SBINDIR</td>
<td>Server executable directory</td>
<td>PREFIX/bin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_SCRIPTDIR</td>
<td>Scripts directory</td>
<td>PREFIX/scripts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_SECURE_FILE_PRIV_DIR</td>
<td>secure_file_priv default value</td>
<td>platform specific</td>
<td></td>
<td>5.6.34</td>
</tr>
<tr>
<td>INSTALL_SECURE_FILE_PRIV_EMBEDDEDDIR</td>
<td>secure_file_priv default value for libmysqld</td>
<td>platform specific</td>
<td></td>
<td>5.6.34</td>
</tr>
<tr>
<td>INSTALL_SHAREDIR</td>
<td>aclocal/mysql.m4 installation directory</td>
<td>PREFIX/share</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_SQLBENCHDIR</td>
<td>sql-bench directory</td>
<td>PREFIX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTALL_SUPPORTFILESDIR</td>
<td>Extra support files directory</td>
<td>PREFIX/support-files</td>
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<td>MEMCACHED_HOME</td>
<td>Path to memcached</td>
<td>[none]</td>
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<td></td>
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<tr>
<td>MYSQL_DATADIR</td>
<td>Data directory</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>MYSQL_MAINTAINER_MODE</td>
<td>Whether to enable MySQL maintainer-specific development environment</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MYSQL_PROJECT_NAME</td>
<td>Windows/OS X project name</td>
<td>MySQL</td>
<td>5.6.5</td>
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<tr>
<td>MYSQL_TCP_PORT</td>
<td>TCP/IP port number</td>
<td>3306</td>
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<tr>
<td>MYSQL_UNIX_ADDR</td>
<td>Unix socket file</td>
<td>/tmp/mysql.sock</td>
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<tr>
<td>ODBC_INCLUDES</td>
<td>ODBC includes directory</td>
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<tr>
<td>ODBC_LIB_DIR</td>
<td>ODBC library directory</td>
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<tr>
<td>Formats</td>
<td>Description</td>
<td>Default</td>
<td>Introduced</td>
<td>Removed</td>
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<tr>
<td>---------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------</td>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>OPTIMIZER_TRACE</td>
<td>Whether to support optimizer tracing</td>
<td></td>
<td>5.6.3</td>
<td></td>
</tr>
<tr>
<td>REPRODUCIBLE_BUILD</td>
<td>Take extra care to create a build result independent of build location and time</td>
<td></td>
<td>5.6.37</td>
<td></td>
</tr>
<tr>
<td>SUNPRO_CXX_LIBRARY</td>
<td>Client link library on Solaris 10+</td>
<td></td>
<td>5.6.20</td>
<td></td>
</tr>
<tr>
<td>SYSCONFDIR</td>
<td>Option file directory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TMPDIR</td>
<td>tmpdir default value</td>
<td></td>
<td>5.6.16</td>
<td></td>
</tr>
<tr>
<td>WITHOUT_xxx_STORAGE_ENGINE</td>
<td>Exclude storage engine xxx from build</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_ASAN</td>
<td>Enable AddressSanitizer</td>
<td>OFF</td>
<td>5.6.15</td>
<td></td>
</tr>
<tr>
<td>WITH_BUNDLED_LIBEVENT</td>
<td>Use bundled libevent when building ndbmemcache</td>
<td>ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_BUNDLED_MEMCACHED</td>
<td>Use bundled memcached when building ndbmemcache</td>
<td>ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_CLASSPATH</td>
<td>Classpath to use when building MySQL Cluster Connector for Java. Default is an empty string.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_DEBUG</td>
<td>Whether to include debugging support</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_DEFAULT_COMPILER_OPTIONS</td>
<td>Whether to use default compiler options</td>
<td>ON</td>
<td>5.6.6</td>
<td></td>
</tr>
<tr>
<td>WITH_DEFAULT_FEATURE_SET</td>
<td>Whether to use default feature set</td>
<td>ON</td>
<td>5.6.6</td>
<td></td>
</tr>
<tr>
<td>WITH_EDITLINE</td>
<td>Which libedit/editline library to use</td>
<td>bundled</td>
<td>5.6.12</td>
<td></td>
</tr>
<tr>
<td>WITH_EMBEDDED_SERVER</td>
<td>Whether to build embedded server</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_EMBEDDED_SHARED_LIB</td>
<td>Whether to build a shared embedded server library</td>
<td>OFF</td>
<td>5.6.17</td>
<td></td>
</tr>
<tr>
<td>WITH_ERROR_INSERT</td>
<td>Enable error injection in the NDB storage engine. Should not be used for building binaries intended for production.</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_EXTRA_CHARSETS</td>
<td>Which extra character sets to include</td>
<td>all</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_GMOCK</td>
<td>Path to googlemock distribution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_INNODB_MEMCACHED</td>
<td>Whether to generate memcached shared libraries.</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_LIBEDIT</td>
<td>Use bundled libedit library</td>
<td>ON</td>
<td>5.6.12</td>
<td></td>
</tr>
<tr>
<td>Formats</td>
<td>Description</td>
<td>Default</td>
<td>Introduced/Removed</td>
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</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-----------</td>
<td>--------------------</td>
<td></td>
</tr>
<tr>
<td>WITH_LIBEVENT</td>
<td>Which libevent library to use</td>
<td>bundled</td>
<td>5.6.6</td>
<td></td>
</tr>
<tr>
<td>WITH_LIBWRAP</td>
<td>Whether to include libwrap (TCP wrappers) support</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_NDBCLUSTER</td>
<td>Build the NDB storage engine; alias for WITH_NDBCLUSTER_STORAGE_ENGINE</td>
<td>ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_NDBCLUSTER_STORAGE_ENGINE</td>
<td>Build the NDB storage engine</td>
<td>ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_NDBMTD</td>
<td>Build multithreaded data node.</td>
<td>ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_NDB_BINLOG</td>
<td>Enable binary logging by default by mysqld.</td>
<td>ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_NDB_DEBUG</td>
<td>Produce a debug build for testing or troubleshooting.</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_NDB_JAVA</td>
<td>Enable building of Java and ClusterJ support. Enabled by default. Supported in MySQL Cluster only.</td>
<td>ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_NDB_PORT</td>
<td>Default port used by a management server built with this option. If this option was not used to build it, the management server's default port is 1186.</td>
<td>[none]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_NDB_TEST</td>
<td>Include NDB API test programs.</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_NUMA</td>
<td>Set NUMA memory allocation policy</td>
<td></td>
<td>5.6.27</td>
<td></td>
</tr>
<tr>
<td>WITH_READLINE</td>
<td>Use bundled readline library</td>
<td>OFF</td>
<td>5.6.5</td>
<td></td>
</tr>
<tr>
<td>WITH_SSL</td>
<td>Type of SSL support</td>
<td>system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_SYMVVER16</td>
<td>Whether libmysqlclient.so.18 contains both symver 16 and 18 symbols.</td>
<td>OFF</td>
<td>5.6.31</td>
<td></td>
</tr>
<tr>
<td>WITH_UNIT_TESTS</td>
<td>Compile MySQL with unit tests</td>
<td>ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_UNIXODBC</td>
<td>Enable unixODBC support</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_VALGRIND</td>
<td>Whether to compile in Valgrind header files</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_ZLIB</td>
<td>Type of zlib support</td>
<td>bundled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH_xxx_STORAGE_ENGINE</td>
<td>Compile storage engine xxx statically into server</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### General Options

- `-DBUILD_CONFIG=mysql_release`

This option configures a source distribution with the same build options used by Oracle to produce binary distributions for official MySQL releases.
Installation Layout Options

- **-DCMAKE_BUILD_TYPE=type**

The type of build to produce:

- **RelWithDebInfo**: Enable optimizations and generate debugging information. This is the default MySQL build type.
- **Debug**: Disable optimizations and generate debugging information. This build type is also used if the `WITH_DEBUG` option is enabled. That is, `-DWITH_DEBUG=1` has the same effect as `-DCMAKE_BUILD_TYPE=Debug`.
- **-DCPACK_MONOLITHIC_INSTALL=bool**

This option affects whether the `make package` operation produces multiple installation package files or a single file. If disabled, the operation produces multiple installation package files, which may be useful if you want to install only a subset of a full MySQL installation. If enabled, it produces a single file for installing everything.

### Installation Layout Options

The `CMAKE_INSTALL_PREFIX` option indicates the base installation directory. Other options with names of the form `INSTALL_xxx` that indicate component locations are interpreted relative to the prefix and their values are relative pathnames. Their values should not include the prefix.

- **-DCMAKE_INSTALL_PREFIX=dir_name**

  The installation base directory.

  This value can be set at server startup with the `--basedir` option.

- **-DINSTALL_BINDIR=dir_name**

  Where to install user programs.

- **-DINSTALL_DOCDIR=dir_name**

  Where to install documentation.

- **-DINSTALL_DOCREADMEDIR=dir_name**

  Where to install README files.

- **-DINSTALL_INCLUDEDIR=dir_name**

  Where to install header files.

- **-DINSTALL_INFODIR=dir_name**

  Where to install Info files.

- **-DINSTALL_LAYOUT=name**

  Select a predefined installation layout:

  - **STANDALONE**: Same layout as used for `.tar.gz` and `.zip` packages. This is the default.
  - **RPM**: Layout similar to RPM packages.
  - **SVR4**: Solaris package layout.
Installation Layout Options

• **DEB**: DEB package layout (experimental).

You can select a predefined layout but modify individual component installation locations by specifying other options. For example:

```cmake
  cmake . -DINSTALL_LAYOUT=SVR4 -DMYSQL_DATADIR=/var/mysql/data
```

• `-DINSTALL_LIBDIR=dir_name`

  Where to install library files.

• `-DINSTALL_MANDIR=dir_name`

  Where to install manual pages.

• `-DINSTALL_MYSQLSHAREDIR=dir_name`

  Where to install shared data files.

• `-DINSTALL_MYSQLTESTDIR=dir_name`

  Where to install the `mysql-test` directory. As of MySQL 5.6.12, to suppress installation of this directory, explicitly set the option to the empty value (`-DINSTALL_MYSQLTESTDIR=`).

• `-DINSTALL_PLUGINDIR=dir_name`

  The location of the plugin directory.

  This value can be set at server startup with the `--plugin_dir` option.

• `-DINSTALL_SBINDIR=dir_name`

  Where to install the `mysqld` server.

• `-DINSTALL_SCRIPTDIR=dir_name`

  Where to install `mysql_install_db`.

• `-DINSTALL_SECURE_FILE_PRIVDIR=dir_name`

  The default value for the `secure_file_priv` system variable. The default value is platform specific and depends on the value of the `INSTALL_LAYOUT` CMake option; see the description of the `secure_file_priv` system variable in Server System Variables.

  This option was added in MySQL 5.6.34. To set the value for the `libmysqld` embedded server, use `INSTALL_SECURE_FILE_PRIV_EMBEDDEDDIR`.

• `-DINSTALL_SECURE_FILE_PRIV_EMBEDDEDDIR=dir_name`

  The default value for the `secure_file_priv` system variable, for the `libmysqld` embedded server. This option was added in MySQL 5.6.34.

• `-DINSTALL_SHAREDIR=dir_name`

  Where to install `aclocal/mysql.m4`. 
Storage Engine Options

- **\-DINSTALL_SQLBENCHDIR=dir_name**
  Where to install the sql-bench directory. To suppress installation of this directory, explicitly set the option to the empty value (\-DINSTALL_SQLBENCHDIR=).

- **\-DINSTALL_SUPPORTFILESDIR=dir_name**
  Where to install extra support files.

- **\-DMYSQL_DATADIR=dir_name**
  The location of the MySQL data directory.
  This value can be set at server startup with the --datadir option.

- **\-DODBC_INCLUDES=dir_name**
  The location of the ODBC includes directory, and may be used while configuring Connector/ODBC.

- **\-DODBC_LIB_DIR=dir_name**
  The location of the ODBC library directory, and may be used while configuring Connector/ODBC.

- **\-DSYSCONFDIR=dir_name**
  The default my.cnf option file directory.
  This location cannot be set at server startup, but you can start the server with a given option file using the --defaults-file=\_file_name \option, where file_name is the full path name to the file.

- **\-DTMPDIR=dir_name**
  The default location to use for the tmpdir system variable. If unspecified, the value defaults to P_tmpdir in <stdio.h>. This option was added in MySQL 5.6.16.

### Storage Engine Options

Storage engines are built as plugins. You can build a plugin as a static module (compiled into the server) or a dynamic module (built as a dynamic library that must be installed into the server using the INSTALL PLUGIN statement or the --plugin-load option before it can be used). Some plugins might not support static or dynamic building.

The InnoDB, MyISAM, MERGE, MEMORY, and CSV engines are mandatory (always compiled into the server) and need not be installed explicitly.

To compile a storage engine statically into the server, use **\-DWITH\_engine\_STORAGE\_ENGINE=1**. Some permissible engine values are ARCHIVE, BLACKHOLE, EXAMPLE, FEDERATED, NDB or NDBCLUSTER (NDB), PARTITION (partitioning support), and PERFSCHEMA (Performance Schema). Examples:

-\-DWITH_ARCHIVE\_STORAGE\_ENGINE=1
-\-DWITH_BLACKHOLE\_STORAGE\_ENGINE=1
-\-DWITH_PERFSCHEMA\_STORAGE\_ENGINE=1

**Note**

\-DWITH_NDBCLUSTER\_STORAGE\_ENGINE is supported only when building NDB Cluster using the NDB Cluster sources. It cannot be used to enable clustering support in other MySQL source trees or distributions. In NDB Cluster source
Feature Options

distributions, it is enabled by default. See Building NDB Cluster from Source on Linux, and Compiling and Installing NDB Cluster from Source on Windows, for more information.

To exclude a storage engine from the build, use `-DWITHOUT_engine_STORAGE_ENGINE=1`. Examples:

- `DWITHOUT_EXAMPLE_STORAGE_ENGINE=1`
- `DWITHOUT_FEDERATED_STORAGE_ENGINE=1`
- `DWITHOUT_PARTITION_STORAGE_ENGINE=1`

If neither `-DWITH_engine_STORAGE_ENGINE` nor `-DWITHOUT_engine_STORAGE_ENGINE` are specified for a given storage engine, the engine is built as a shared module, or excluded if it cannot be built as a shared module.

Feature Options

- `-DCOMPILATION_COMMENT=string`

A descriptive comment about the compilation environment.

- `-DDEFAULT_CHARSET=charset_name`

The server character set. By default, MySQL uses the latin1 (cp1252 West European) character set.

`charset_name` may be one of `binary, armSCII8, ascii, big5, cp1250, cp1251, cp1256, cp1257, cp850, cp852, cp866, cp932, dec8, eucjpms, euckr, gb2312, gbk, geostd8, greek, hebrew, hp8, keybcs2, koi8r, koi8u, latin1, latin2, latin5, latin7, macce, macroman, sjis, swe7, tis620, ucs2, ujis, utf8, utf8mb4, utf16, utf16le, utf32`. The permissible character sets are listed in the `cmake/character_sets.cmake` file as the value of `CHARSETS_AVAILABLE`.

This value can be set at server startup with the `--character_set_server` option.

- `-DDEFAULT_COLLATION=collation_name`

The server collation. By default, MySQL uses `latin1_swedish_ci`. Use the `SHOW COLLATION` statement to determine which collations are available for each character set.

This value can be set at server startup with the `--collation_server` option.

- `-DENABLE_DEBUG_SYNC=bool`

**Note**

As of MySQL 5.6.36, `ENABLE_DEBUG_SYNC` is removed and enabling `WITH_DEBUG` enables Debug Sync.

Whether to compile the Debug Sync facility into the server. This facility is used for testing and debugging. This option is enabled by default, but has no effect unless MySQL is configured with debugging enabled. If debugging is enabled and you want to disable Debug Sync, use `-DENABLE_DEBUG_SYNC=0`.

When compiled in, Debug Sync is disabled by default at runtime. To enable it, start `mysqld` with the `--debug-sync-timeout=N` option, where `N` is a timeout value greater than 0. (The default value is 0, which disables Debug Sync.) `N` becomes the default timeout for individual synchronization points.

For a description of the Debug Sync facility and how to use synchronization points, see MySQL Internals: Test Synchronization.
Feature Options

- **-DENABLEDOWNLOADS=bool**
  Whether to download optional files. For example, with this option enabled, CMake downloads the Google Test distribution that is used by the test suite to run unit tests.

- **-DENABLEDTRACE=bool**
  Whether to include support for DTrace probes. For information about DTrace, see Tracing mysqld Using DTrace.

- **-DENABLEDGCOV=bool**
  Whether to include gcov support (Linux only).

- **-DENABLEDGPROF=bool**
  Whether to enable gprof (optimized Linux builds only).

- **-DENABLEDLOCALINFILE=bool**
  This option controls the compiled-in default LOCAL capability for the MySQL client library. Clients that make no explicit arrangements therefore have LOCAL capability disabled or enabled according to the ENABLEDLOCALINFILE setting specified at MySQL build time.

  By default, the client library in MySQL binary distributions is compiled with ENABLEDLOCALINFILE enabled. If you compile MySQL from source, configure it with ENABLEDLOCALINFILE disabled or enabled based on whether clients that make no explicit arrangements should have LOCAL capability disabled or enabled, respectively.

  ENABLEDLOCALINFILE controls the default for client-side LOCAL capability. For the server, the local_infile system variable controls server-side LOCAL capability. To explicitly cause the server to refuse or permit LOAD DATA LOCAL statements (regardless of how client programs and libraries are configured at build time or runtime), start mysqld with local_infile disabled or enabled, respectively. local_infile can also be set at runtime. See Security Considerations for LOAD DATA LOCAL.

- **-DENABLED_PROFILING=bool**
  Whether to enable query profiling code (for the SHOW PROFILE and SHOW PROFILES statements).

- **-DIGNORE_AIO_CHECK=bool**
  If the -DBUILD_CONFIG=mysql_release option is given on Linux, the libaio library must be linked in by default. If you do not have libaio or do not want to install it, you can suppress the check for it by specifying -DIGNORE_AIO_CHECK=1.

- **-DINNODBPAGE_ATOMICREF_COUNT=bool**
  Whether to enable or disable atomic page reference counting. Fetching and releasing pages from the buffer pool and tracking the page state are expensive and complex operations. Using a page mutex to track these operations does not scale well. With INNODB_PAGE_ATOMICREF_COUNT=ON (default), fetch and release is tracked using atomics where available. For platforms that do not support atomics, set INNODB_PAGE_ATOMICREF_COUNT=OFF to disable atomic page reference counting.

  When atomic page reference counting is enabled (default), “[Note] InnoDB: Using atomics to ref count buffer pool pages” is printed to the error log at server startup. If atomic page reference counting is disabled, “[Note] InnoDB: Using mutexes to ref count buffer pool pages” is printed instead.
Feature Options

**INNODB_PAGE_ATOMIC_REF_COUNT** was introduced with the fix for MySQL Bug #68079. The option is removed in MySQL 5.7.5. Support for atomics is required to build MySQL as of MySQL 5.7.5, which makes the option obsolete.

- **-DMYSQL_MAINTAINER_MODE=bool**

  Whether to enable a MySQL maintainer-specific development environment. If enabled, this option causes compiler warnings to become errors. It may also cause some minor changes in generated code, to initialize some variables to 0.

- **-DMYSQL_PROJECT_NAME=name**

  For Windows or macOS, the project name to incorporate into the project file name.

- **-DMYSQL_TCP_PORT=port_num**

  The port number on which the server listens for TCP/IP connections. The default is 3306.

  This value can be set at server startup with the **--port** option.

- **-DMYSQL_UNIX_ADDR=file_name**

  The Unix socket file path on which the server listens for socket connections. This must be an absolute path name. The default is `/tmp/mysql.sock`.

  This value can be set at server startup with the **--socket** option.

- **-DOPTIMIZER_TRACE=bool**

  Whether to support optimizer tracing. See *MySQL Internals: Tracing the Optimizer*.

- **-DREPRODUCIBLE_BUILD=bool**

  For builds on Linux systems, this option controls whether to take extra care to create a build result independent of build location and time.

  This option was added in MySQL 5.6.37.

- **-DWITH_ASAN=bool**

  Whether to enable AddressSanitizer, for compilers that support it. The default is off. This option was added in MySQL 5.6.15.

- **-DWITH_DEBUG=bool**

  Whether to include debugging support.

  Configuring MySQL with debugging support enables you to use the **--debug="d,parser_debug"** option when you start the server. This causes the Bison parser that is used to process SQL statements to dump a parser trace to the server's standard error output. Typically, this output is written to the error log.

  As of MySQL 5.6.36, enabling **WITH_DEBUG** also enables Debug Sync. For a description of the Debug Sync facility and how to use synchronization points, see *MySQL Internals: Test Synchronization*.

- **-DWITH_DEFAULT_FEATURE_SET=bool**

  Whether to use the flags from `cmake/build_configurations/feature_set.cmake`. 
Feature Options

- `-DWITH_EDITLINE=value`
  Which `libedit/editline` library to use. The permitted values are `bundled` (the default) and `system`. `WITH_EDITLINE` was added in MySQL 5.6.12. It replaces `WITH_LIBEDIT`, which has been removed.

- `-DWITH_EMBEDDED_SERVER=bool`
  Whether to build the `libmysqld` embedded server library.

- `-DWITH_EMBEDDED_SHARED_LIBRARY=bool`
  Whether to build a shared `libmysqld` embedded server library. This option was added in MySQL 5.6.17.

- `-DWITH_EXTRA_CHARSETS=name`
  Which extra character sets to include:
  - `all`: All character sets. This is the default.
  - `complex`: Complex character sets.
  - `none`: No extra character sets.

- `-DWITH_GMOCK=path_name`
  The path to the googlemock distribution, for use with Google Test-based unit tests. The option value is the path to the distribution Zip file. Alternatively, set the `WITH_GMOCK` environment variable to the path name. It is also possible to use `-DENABLE_DOWNLOADS=1` and `CMake` will download the distribution from GitHub.

  If you build MySQL without the Google Test-based unit tests (by configuring without `WITH_GMOCK`), `CMake` displays a message indicating how to download it.

- `-DWITH_INNODB_MEMCACHED=bool`
  Whether to generate memcached shared libraries (`libmemcached.so` and `innodb_engine.so`).

- `-DWITH_LIBEVENT=string`
  Which `libevent` library to use. Permitted values are `bundled` (default), `system`, and `yes`. If you specify `system` or `yes`, the system `libevent` library is used if present. If the system library is not found, the bundled `libevent` library is used. The `libevent` library is required by InnoDB memcached.

- `-DWITH_LIBEDIT=bool`
  Whether to use the `libedit` library bundled with the distribution.

  `WITH_LIBEDIT` was removed in MySQL 5.6.12. Use `WITH_EDITLINE` instead.

- `-DWITH_LIBWRAP=bool`
  Whether to include `libwrap` (TCP wrappers) support.
Feature Options

• `-DWITH_NUMA=bool`

Explicitly set the NUMA memory allocation policy. CMake sets the default `WITH_NUMA` value based on whether the current platform has NUMA support. For platforms without NUMA support, CMake behaves as follows:

• With no NUMA option (the normal case), CMake continues normally, producing only this warning: NUMA library missing or required version not available

• With `-DWITH_NUMA=ON`, CMake aborts with this error: NUMA library missing or required version not available

This option was added in MySQL 5.6.27.

• `-DWITH_SSL={ssl_type|path_name}`

For support of encrypted connections, entropy for random number generation, and other encryption-related operations, MySQL must be built using an SSL library. This option specifies which SSL library to use.

• `ssl_type` can be one of the following values:
  
  • `no`: No SSL support. This is the default before MySQL 5.6.6. As of 5.6.6, this is no longer a permitted value and the default is `bundled`.
  
  • `yes`: Use the system OpenSSL library if present, else the library bundled with the distribution.
  
  • `bundled`: Use the SSL library bundled with the distribution. This is the default from MySQL 5.6.6 through 5.6.45. As of 5.6.46, this is no longer a permitted value and the default is `system`.
  
  • `system`: Use the system OpenSSL library. This is the default as of MySQL 5.6.46.

• `path_name`, permitted for MySQL 5.6.7 and after, is the path name to the OpenSSL installation to use. This can be preferable to using the `ssl_type` value of `system` because it can prevent CMake from detecting and using an older or incorrect OpenSSL version installed on the system. (Another permitted way to do the same thing is to set `WITH_SSL` to `system` and set the `CMAKE_PREFIX_PATH` option to `path_name`).

For additional information about configuring the SSL library, see Section 4.6, “Configuring SSL Library Support”.

• `-DWITH_SYMVER16=bool`

If enabled, this option causes the `libmysqlclient` client library to contain extra symbols to be compatible with `libmysqlclient` on RHEL/OEL 5, 6, and 7; and Fedora releases. All symbols present in `libmysqlclient.so.16` are tagged with symver 16 in `libmsqlclient.so.18`, making those symbols have both symver 16 and 18. The default is `OFF`.

This option was added in MySQL 5.6.31.

• `-DWITH_UNIT_TESTS={ON|OFF}`

If enabled, compile MySQL with unit tests. The default is ON unless the server is not being compiled.

• `-DWITH_UNIXODBC=I`

Enables unixODBC support, for Connector/ODBC.
Compiler Flags

- **-DWITH_VALGRIND=bool**
  Whether to compile in the Valgrind header files, which exposes the Valgrind API to MySQL code. The default is OFF.

  To generate a Valgrind-aware debug build, **-DWITH_VALGRIND=1** normally is combined with **-DWDEBUG=1**. See Building Debug Configurations.

- **-DWITH_ZLIB=lib_type**
  Some features require that the server be built with compression library support, such as the COMPRESS() and UNCOMPRESS() functions, and compression of the client/server protocol. The WITH_ZLIB indicates the source of zlib support:
  - **bundled**: Use the zlib library bundled with the distribution. This is the default.
  - **system**: Use the system zlib library.

## Compiler Flags

- **-DCMAKE_C_FLAGS="flags"**
  Flags for the C Compiler.

- **-DCMAKE_CXX_FLAGS="flags"**
  Flags for the C++ Compiler.

- **-DWITH_DEFAULT_COMPILER_OPTIONS=bool**
  Whether to use the flags from cmake/build_configurations/compiler_options.cmake.

  - **Note**: All optimization flags were carefully chosen and tested by the MySQL build team. Overriding them can lead to unexpected results and is done at your own risk.

- **-DSUNPRO_CXX_LIBRARY="lib_name"**
  Enable linking against libcstd instead of stlport4 on Solaris 10 or later. This works only for client code because the server depends on C++98.

  This option was added in MySQL 5.6.20.

To specify your own C and C++ compiler flags, for flags that do not affect optimization, use the CMAKE_C_FLAGS and CMAKE_CXX_FLAGS CMake options.

When providing your own compiler flags, you might want to specify CMAKE_BUILD_TYPE as well.

For example, to create a 32-bit release build on a 64-bit Linux machine, do this:

```
mkdir bld
cd bld
cmake .. -DCMAKE_C_FLAGS=-m32 \
-DCMAKE_CXX_FLAGS=-m32 \
-DCMAKE_BUILD_TYPE=RelWithDebInfo
```

If you set flags that affect optimization (\(-O{number}\)), you must set the CMAKE_C_FLAGS_build_type and/or CMAKE_CXX_FLAGS_build_type options, where build_type corresponds
CMake Options for Compiling NDB Cluster

The following options are for use when building NDB Cluster with the NDB Cluster sources; they are not currently supported when using sources from the MySQL 5.6 Server tree.

- `DMEMCACHED_HOME=dir_name`

Perform the build using the memcached (version 1.6 or later) installed in the system directory indicated by `dir_name`. Files from this installation that are used in the build include the memcached binary, header files, and libraries, as well as the `memcached_utilities` library and the header file `engine_testapp.h`.

You must leave this option unset when building `ndbmemcache` using the bundled memcached sources (`WITH_BUNDLED_MEMCACHED` option); in other words, the bundled sources are used by default).

This option was added in MySQL NDB Cluster 7.2.2.

While additional CMake options—such as for SASL authorization and for providing dtrace support—are available for use when compiling `memcached` from external sources, these options are currently not enabled for the `memcached` sources bundled with NDB Cluster.

- `WITH_BUNDLED_LIBEVENT={ON|OFF}`

Use the `libevent` included in the NDB Cluster sources when building NDB Cluster with `ndbmemcached` support (MySQL NDB Cluster 7.2.2 and later). Enabled by default. OFF causes the system's libevent to be used instead.

- `WITH_BUNDLED_MEMCACHED={ON|OFF}`

Build the memcached sources included in the NDB Cluster source tree (MySQL NDB Cluster 7.2.3 and later), then use the resulting memcached server when building the `ndbmemcache` engine. In this case, `make install` places the `memcached` binary in the installation `bin` directory, and the `ndbmemcache` engine shared library file `ndb_engine.so` in the installation `lib` directory.

This option is ON by default.

- `WITH_CLASSPATH=path`

Sets the classpath for building NDB Cluster Connector for Java. The default is empty. In MySQL NDB Cluster 7.2.9 and later, this option is ignored if `WITH_NDB_JAVA=OFF` is used.

- `WITH_ERROR_INSERT={ON|OFF}`

Enables error injection in the NDB kernel. For testing only; not intended for use in building production binaries. The default is OFF.

- `WITH_NDBCLUSTER_STORAGE_ENGINE={ON|OFF}`

Build and link in support for the NDB (NDBCLUSTER) storage engine in `mysqld`. The default is ON.
• `--DWITH_NDBCLUSTER={ON|OFF}`

This is an alias for `WITH_NDBCLUSTER_STORAGE_ENGINE`.

• `--DWITH_NDBMTD={ON|OFF}`

Build the multithreaded data node executable `ndbmtd`. The default is ON.

• `--DWITH_NDB_BINLOG={ON|OFF}`

Enable binary logging by default in the `mysqld` built using this option. ON by default.

• `--DWITH_NDB_DEBUG={ON|OFF}`

Enable building the debug versions of the NDB Cluster binaries. OFF by default.

• `--DWITH_NDB_JAVA={ON|OFF}`

Enable building NDB Cluster with Java support, including `ClusterJ`.

This option was added in MySQL NDB Cluster 7.2.9, and is ON by default. If you do not wish to compile NDB Cluster with Java support, you must disable it explicitly by specifying `--DWITH_NDB_JAVA=OFF` when running `CMake`. Otherwise, if Java cannot be found, configuration of the build fails.

• `--DWITH_NDB_PORT=port`  

Causes the NDB Cluster management server (`ndb_mgmd`) that is built to use this `port` by default. If this option is unset, the resulting management server tries to use port 1186 by default.

• `--DWITH_NDB_TEST={ON|OFF}`

If enabled, include a set of NDB API test programs. The default is OFF.

### 4.8 Dealing with Problems Compiling MySQL

The solution to many problems involves reconfiguring. If you do reconfigure, take note of the following:

• If `CMake` is run after it has previously been run, it may use information that was gathered during its previous invocation. This information is stored in `CMakeCache.txt`. When `CMake` starts, it looks for that file and reads its contents if it exists, on the assumption that the information is still correct. That assumption is invalid when you reconfigure.

• Each time you run `CMake`, you must run `make` again to recompile. However, you may want to remove old object files from previous builds first because they were compiled using different configuration options.

To prevent old object files or configuration information from being used, run the following commands before re-running `CMake`:

**On Unix:**

```
shell> make clean
shell> rm CMakeCache.txt
```

**On Windows:**

```
shell> devenv MySQL.sln /clean
shell> del CMakeCache.txt
```

If you build outside of the source tree, remove and recreate your build directory before re-running `CMake`. For instructions on building outside of the source tree, see How to Build MySQL Server with CMake.
On some systems, warnings may occur due to differences in system include files. The following list describes other problems that have been found to occur most often when compiling MySQL:

- To define which C and C++ compilers to use, you can define the CC and CXX environment variables. For example:

```
shell> CC=gcc
shell> CXX=g++
shell> export CC CXX
```

To specify your own C and C++ compiler flags, use the CMAKE_C_FLAGS and CMAKE_CXX_FLAGS CMake options. See Compiler Flags.

To see what flags you might need to specify, invoke mysql_config with the --cflags and --cxxflags options.

- To see what commands are executed during the compile stage, after using CMake to configure MySQL, run `make VERBOSE=1` rather than just `make`.

- If compilation fails, check whether the MYSQL_MAINTAINER_MODE option is enabled. This mode causes compiler warnings to become errors, so disabling it may enable compilation to proceed.

- If your compile fails with errors such as any of the following, you must upgrade your version of make to GNU make:

```
make: Fatal error in reader: Makefile, line 18:
Badly formed macro assignment
```

Or:

```
make: file `Makefile' line 18: Must be a separator (;
```

Or:

```
pthread.h: No such file or directory
```

Solaris and FreeBSD are known to have troublesome make programs.

GNU make 3.75 is known to work.

- The sql_yacc.cc file is generated from sql_yacc.yy. Normally, the build process does not need to create sql_yacc.cc because MySQL comes with a pregenerated copy. However, if you do need to re-create it, you might encounter this error:

```
"sql_yacc.yy", line xxx fatal: default action causes potential...
```

This is a sign that your version of yacc is deficient. You probably need to install a recent version of bison (the GNU version of yacc) and use that instead.

Versions of bison older than 1.75 may report this error:

```
sql_yacc.yy:#####: fatal error: maximum table size (32767) exceeded
```

The maximum table size is not actually exceeded; the error is caused by bugs in older versions of bison.

For information about acquiring or updating tools, see the system requirements in Chapter 4, Installing MySQL from Source.
4.9 MySQL Configuration and Third-Party Tools

Third-party tools that need to determine the MySQL version from the MySQL source can read the VERSION file in the top-level source directory. The file lists the pieces of the version separately. For example, if the version is MySQL 5.7.4-m14, the file looks like this:

```
MYSQL_VERSION_MAJOR=5
MYSQL_VERSION_MINOR=7
MYSQL_VERSION_PATCH=4
MYSQL_VERSION_EXTRA=-m14
```

If the source is not for a General Availability (GA) release, the MYSQL_VERSION_EXTRA value will be nonempty. For the example, the value corresponds to Milestone 14.

To construct a five-digit number from the version components, use this formula:

```
MYSQL_VERSION_MAJOR*10000 + MYSQL_VERSION_MINOR*100 + MYSQL_VERSION_PATCH
```
Chapter 5 Installing MySQL on Microsoft Windows

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Important

MySQL Community 5.6 Server requires the Microsoft Visual C++ 2010
Redistributable Package to run on Windows platforms. Users should make sure the
package has been installed on the system before installing the server. The package
is available at the Microsoft Download Center.

MySQL is available for Microsoft Windows, for both 32-bit and 64-bit versions. For supported Windows
platform information, see https://www.mysql.com/support/supportedplatforms/database.html.

There are different methods to install MySQL on Microsoft Windows.

MySQL Installer Method

The simplest and recommended method is to download MySQL Installer (for Windows) and let it install and
configure all of the MySQL products on your system. Here is how:


   Note

   Unlike the standard MySQL Installer, the smaller "web-community" version does
   not bundle any MySQL applications but it will download the MySQL products
   you choose to install.

2. Choose the appropriate Setup Type for your system. Typically you will choose Developer Default to
   install MySQL server and other MySQL tools related to MySQL development, helpful tools like MySQL
   Workbench. Or, choose the Custom setup type to manually select your desired MySQL products.
Note

Multiple versions of MySQL server can exist on a single system. You can choose one or multiple versions.

3. Complete the installation process by following the instructions. This will install several MySQL products and start the MySQL server.

MySQL is now installed. If you configured MySQL as a service, then Windows will automatically start MySQL server every time you restart your system.

Note

You probably also installed other helpful MySQL products like MySQL Workbench and MySQL Notifier on your system. Consider loading MySQL Workbench to check your new MySQL server connection, and MySQL Notifier Overview to view the connection's status. By default, these two programs automatically start after installing MySQL.

This process also installs the MySQL Installer application on your system, and later you can use MySQL Installer to upgrade or reconfigure your MySQL products.

**Additional Installation Information**

It is possible to run MySQL as a standard application or as a Windows service. By using a service, you can monitor and control the operation of the server through the standard Windows service management tools. For more information, see Section 5.4.7, “Starting MySQL as a Windows Service”.

Generally, you should install MySQL on Windows using an account that has administrator rights. Otherwise, you may encounter problems with certain operations such as editing the PATH environment variable or accessing the Service Control Manager. When installed, MySQL does not need to be executed using a user with Administrator privileges.

For a list of limitations on the use of MySQL on the Windows platform, see Section 5.7, “Windows Platform Restrictions”.

In addition to the MySQL Server package, you may need or want additional components to use MySQL with your application or development environment. These include, but are not limited to:

- To connect to the MySQL server using ODBC, you must have a Connector/ODBC driver. For more information, including installation and configuration instructions, see MySQL Connector/ODBC Developer Guide.

  Note

  MySQL Installer will install and configure Connector/ODBC for you.

- To use MySQL server with .NET applications, you must have the Connector/.NET driver. For more information, including installation and configuration instructions, see MySQL Connector/.NET Developer Guide.

  Note

  MySQL Installer will install and configure MySQL Connector/.NET for you.

MySQL distributions for Windows can be downloaded from https://dev.mysql.com/downloads/. See Section 2.2, “How to Get MySQL”.
MySQL on Windows Considerations

MySQL for Windows is available in several distribution formats, detailed here. Generally speaking, you should use MySQL Installer. It contains more features and MySQL products than the older MSI, is simpler to use than the compressed file, and you need no additional tools to get MySQL up and running. MySQL Installer automatically installs MySQL Server and additional MySQL products, creates an options file, starts the server, and enables you to create default user accounts. For more information on choosing a package, see Section 5.2, “Choosing an Installation Package”.

- A MySQL Installer distribution includes MySQL Server and additional MySQL products including MySQL Workbench, MySQL Notifier, and MySQL for Excel. MySQL Installer can also be used to upgrade these products in the future.

For instructions on installing MySQL using MySQL Installer, see Section 5.3, “MySQL Installer for Windows”.

- The standard binary distribution (packaged as a compressed file) contains all of the necessary files that you unpack into your chosen location. This package contains all of the files in the full Windows MSI Installer package, but does not include an installation program.

For instructions on installing MySQL using the compressed file, see Section 5.4, “Installing MySQL on Microsoft Windows Using a noinstall ZIP Archive”.

- The source distribution format contains all the code and support files for building the executables using the Visual Studio compiler system.

For instructions on building MySQL from source on Windows, see Chapter 4, Installing MySQL from Source.

MySQL on Windows Considerations

- Large Table Support

If you need tables with a size larger than 4 GB, install MySQL on an NTFS or newer file system. Do not forget to use \texttt{MAX\_ROWS} and \texttt{AVG\_ROW\_LENGTH} when you create tables. See CREATE TABLE Statement.

\begin{quote}
\textbf{Note}

InnoDB tablespace files cannot exceed 4 GB on Windows 32-bit systems.
\end{quote}

- MySQL and Virus Checking Software

Virus-scanning software such as Norton/Symantec Anti-Virus on directories containing MySQL data and temporary tables can cause issues, both in terms of the performance of MySQL and the virus-scanning software misidentifying the contents of the files as containing spam. This is due to the fingerprinting mechanism used by the virus-scanning software, and the way in which MySQL rapidly updates different files, which may be identified as a potential security risk.

After installing MySQL Server, it is recommended that you disable virus scanning on the main directory (\texttt{datadir}) used to store your MySQL table data. There is usually a system built into the virus-scanning software to enable specific directories to be ignored.

In addition, by default, MySQL creates temporary files in the standard Windows temporary directory. To prevent the temporary files also being scanned, configure a separate temporary directory for MySQL temporary files and add this directory to the virus scanning exclusion list. To do this, add a configuration option for the \texttt{tmpdir} parameter to your \texttt{my.ini} configuration file. For more information, see Section 5.4.2, “Creating an Option File”.

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MySQL Installation Layout on Microsoft Windows

- Running MySQL on a 4K Sector Hard Drive

  Running the MySQL server on a 4K sector hard drive on Windows is not supported with `innodb_flush_method=async_unbuffered`, which is the default setting. The workaround is to use `innodb_flush_method=normal`.

5.1 MySQL Installation Layout on Microsoft Windows

For MySQL 5.6 on Windows, the default installation directory is `C:\Program Files\MySQL\MySQL Server 5.6` for installations performed with MySQL Installer. If you use the ZIP archive method to install MySQL, you may prefer to install in `C:\mysql`. However, the layout of the subdirectories remains similar (exceptions are indicated).

All of the files are located within this parent directory, using the structure shown in the following table.

### Table 5.1 Default MySQL Installation Layout for Microsoft Windows

<table>
<thead>
<tr>
<th>Directory</th>
<th>Contents of Directory</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>bin, scripts</td>
<td><code>mysqld</code> server, client and utility programs</td>
<td></td>
</tr>
<tr>
<td>%PROGRAMDATA%\MySQL \MySQL Server 5.6\</td>
<td>Log files, databases</td>
<td>The Windows system variable %PROGRAMDATA% defaults to C:\ProgramData.</td>
</tr>
<tr>
<td>data</td>
<td>Pristine templates</td>
<td></td>
</tr>
<tr>
<td>docs</td>
<td>Release documentation</td>
<td>With MySQL Installer, use the Modify operation to select this optional folder.</td>
</tr>
<tr>
<td>include</td>
<td>Include (header) files</td>
<td></td>
</tr>
<tr>
<td>lib</td>
<td>Libraries</td>
<td></td>
</tr>
<tr>
<td>share</td>
<td>Miscellaneous support files, including error messages, character set files, sample configuration files, SQL for database installation</td>
<td></td>
</tr>
<tr>
<td>mysql-test, scripts, and sql-bench</td>
<td>Debug binaries and test suite</td>
<td>ZIP archive only.</td>
</tr>
</tbody>
</table>

The packages create and set up the data directory that the installed server will use and also creates a pristine “template” data directory named `data` under the installation directory. After an installation has been performed using this package, the template data directory can be copied to set up additional MySQL instances. See Running Multiple MySQL Instances on One Machine.

5.2 Choosing an Installation Package

For MySQL 5.6, there are multiple installation package formats to choose from when installing MySQL on Windows. The package formats described in this section are:

- MySQL Installer
- MySQL noinstall ZIP Archives
- MySQL Docker Images
Program Database (PDB) files (with file name extension .pdb) provide information for debugging your MySQL installation in the event of a problem. These files are included in ZIP Archive distributions (but not MSI distributions) of MySQL.

**MySQL Installer**

This package has a file name similar to `mysql-installer-community-5.6.49.0.msi` or `mysql-installer-commercial-5.6.49.0.msi`, and utilizes MSIs to automatically install MySQL server and other products. MySQL Installer will download and apply updates to itself, and for each of the installed products. It also configures the installed MySQL server (including a sandbox InnoDB cluster test setup) and MySQL Router. MySQL Installer is recommended for most users.

MySQL Installer can install and manage (add, modify, upgrade, and remove) many other MySQL products, including:

- **Applications** – MySQL Workbench, MySQL for Visual Studio, MySQL Notifier, MySQL for Excel, MySQL Utilities, MySQL Shell, MySQL Router
- **Connectors** – MySQL Connector/C++, MySQL Connector/NET, Connector/ODBC, MySQL Connector/Python, MySQL Connector/J, MySQL Connector/Node.js
- **Documentation** – MySQL Manual (PDF format), samples and examples

MySQL Installer operates on all MySQL supported versions of Windows (see [https://www.mysql.com/support/supportedplatforms/database.html](https://www.mysql.com/support/supportedplatforms/database.html)).

---

**Note**

Because MySQL Installer is not a native component of Microsoft Windows and depends on .NET, it will not work on minimal installation options like the Server Core version of Windows Server.

For instructions on how to install MySQL using MySQL Installer, see Section 5.3, “MySQL Installer for Windows”.

**MySQL noinstall ZIP Archives**

These packages contain the files found in the complete MySQL Server installation package, with the exception of the GUI. This format does not include an automated installer, and must be manually installed and configured.

The noinstall ZIP archives are split into two separate compressed files. The main package is named `mysql-VERSION-winx64.zip` for 64-bit and `mysql-VERSION-win32.zip` for 32-bit. This contains the components needed to use MySQL on your system. The optional MySQL test suite, MySQL benchmark suite, and debugging binaries/information components (including PDB files) are in a separate compressed file named `mysql-VERSION-winx64-debug-test.zip` for 64-bit and `mysql-VERSION-win32-debug-test.zip` for 32-bit.

If you choose to install a noinstall ZIP archive, see Section 5.4, “Installing MySQL on Microsoft Windows Using a noinstall ZIP Archive”.

**MySQL Docker Images**

For information on using the MySQL Docker images provided by Oracle on Windows platform, see Section 7.8.3, “Deploying MySQL on Windows and Other Non-Linux Platforms with Docker”.

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MySQL Installer for Windows

Warning
The MySQL Docker images provided by Oracle are built specifically for Linux platforms. Other platforms are not supported, and users running the MySQL Docker images from Oracle on them are doing so at their own risk.

5.3 MySQL Installer for Windows

MySQL Installer is a standalone application designed to ease the complexity of installing and configuring MySQL products that run on Microsoft Windows. It supports the following MySQL products:

• MySQL Servers

MySQL Installer can install and manage multiple, separate MySQL server instances on the same host at the same time. For example, MySQL Installer can install, configure, and upgrade a separate instance of MySQL 5.6, MySQL 5.7, and MySQL 8.0 on the same host. MySQL Installer does not permit server upgrades between major and minor version numbers, but does permit upgrades within a release series (such as 5.7.18 to 5.7.19).

Note
MySQL Installer cannot install both Community and Commercial releases of MySQL server on the same host. If you require both releases on the same host, consider using the ZIP archive distribution to install one of the releases.

• MySQL Applications

MySQL Workbench, MySQL Shell, MySQL Router, MySQL for Visual Studio, MySQL for Excel, and MySQL Notifier.

• MySQL Connectors

MySQL Connector/.NET, MySQL Connector/Python, MySQL Connector/ODBC, MySQL Connector/J, and MySQL Connector/C++.

Note
To install MySQL Connector/Node.js, see https://dev.mysql.com/downloads/connector/nodejs/. Connector/Node.js does not provide an .msi file for use with MySQL Installer.

• Documentation and Samples

MySQL Reference Manuals (by version) in PDF format and MySQL database samples (by version).

Installation Requirements

MySQL Installer requires Microsoft .NET Framework 4.5.2 or later. If this version is not installed on the host computer, you can download it by visiting the Microsoft website.

MySQL Installer Community Release

Download software from https://dev.mysql.com/downloads/installer/ to install the Community release of all MySQL products for Windows. Select one of the following MySQL Installer package options:

• Web: Contains MySQL Installer and configuration files only. The web package downloads only the MySQL products you select to install, but it requires an internet connection for each download.
MySQL Installer Commercial Release

The size of this file is approximately 2 MB; the name of the file has the form mysql-installer-community-web-VERSION.N.msi where VERSION is the MySQL server version number such as 8.0 and N is the package number, which begins at 0.

- **Full or Current Bundle**: Bundles all of the MySQL products for Windows (including the MySQL server). The file size is over 300 MB, and the name has the form mysql-installer-community-VERSION.N.msi where VERSION is the MySQL Server version number such as 8.0 and N is the package number, which begins at 0.

MySQL Installer Commercial Release

Download software from https://edelivery.oracle.com/ to install the Commercial release (Standard or Enterprise Edition) of MySQL products for Windows. If you are logged in to your My Oracle Support (MOS) account, the Commercial release includes all of the current and previous GA versions available in the Community release, but it excludes development-milestone versions. When you are not logged in, you see only the list of bundled products that you downloaded already.

The Commercial release also includes the following products:

- Workbench SE/EE
- MySQL Enterprise Backup
- MySQL Enterprise Firewall

The Commercial release integrates with your MOS account. For knowledge-base content and patches, see My Oracle Support.

5.3.1 MySQL Installer Initial Setup

- Choosing a Setup Type
- Path Conflicts
- Check Requirements
- MySQL Installer Configuration Files

When you download MySQL Installer for the first time, a setup wizard guides you through the initial installation of MySQL products. As the following figure shows, the initial setup is a one-time activity in the overall process. MySQL Installer detects existing MySQL products installed on the host during its initial setup and adds them to the list of products to be managed.

**Figure 5.1 MySQL Installer Process Overview**

MySQL Installer extracts configuration files (described later) to the hard drive of the host during the initial setup. Although MySQL Installer is a 32-bit application, it can install both 32-bit and 64-bit binaries.
The initial setup adds a link to the Start menu under the MySQL group. Click Start, All Programs, MySQL, MySQL Installer to open MySQL Installer.

Choosing a Setup Type

During the initial setup, you are prompted to select the MySQL products to be installed on the host. One alternative is to use a predetermined setup type that matches your setup requirements. By default, both GA and pre-release products are included in the download and installation with the Developer Default, Client only, and Full setup types. Select the Only install GA products option to restrict the product set to include GA products only when using these setup types.

Choosing one of the following setup types determines the initial installation only and does not limit your ability to install or update MySQL products for Windows later:

- **Developer Default**: Install the following products that compliment application development with MySQL:
  - MySQL Server (Installs the version that you selected when you downloaded MySQL Installer.)
  - MySQL Shell
  - MySQL Router
  - MySQL Workbench
  - MySQL for Visual Studio
  - MySQL for Excel
  - MySQL Notifier
  - MySQL Connectors (for .NET / Python / ODBC / Java / C++)
  - MySQL Documentation
  - MySQL Samples and Examples
- **Server only**: Only install the MySQL server. This setup type installs the general availability (GA) or development release server that you selected when you downloaded MySQL Installer. It uses the default installation and data paths.
- **Client only**: Only install the most recent MySQL applications and MySQL connectors. This setup type is similar to the Developer Default type, except that it does not include MySQL server or the client programs typically bundled with the server, such as `mysql` or `mysqladmin`.
- **Full**: Install all available MySQL products.
- **Custom**: The custom setup type enables you to filter and select individual MySQL products from the MySQL Installer catalog.

Use the Custom setup type to install:

- A product or product version that is not available from the usual download locations. The catalog contains all product releases, including the other releases between pre-release (or development) and GA.
- An instance of MySQL server using an alternative installation path, data path, or both. For instructions on how to adjust the paths, see Section 5.3.2, “Setting Alternative Server Paths with MySQL Installer”.

MySQL Installer Initial Setup

- Two or more MySQL server versions on the same host at the same time (for example, 5.6, 5.7, and 8.0).

- A specific combination of products and features not offered as a predetermine setup type. For example, you can install a single product, such as MySQL Workbench, instead of installing all client applications for Windows.

Path Conflicts

When the default installation or data folder (required by MySQL server) for a product to be installed already exists on the host, the wizard displays the Path Conflict step to identify each conflict and enable you to take action to avoid having files in the existing folder overwritten by the new installation. You see this step in the initial setup only when MySQL Installer detects a conflict.

To resolve the path conflict, do one of the following:

- Select a product from the list to display the conflict options. A warning symbol indicates which path is in conflict. Use the browse button to choose a new path and then click Next.

- Click Back to choose a different setup type or product version, if applicable. The Custom setup type enables you to select individual product versions.

- Click Next to ignore the conflict and overwrite files in the existing folder.

- Delete the existing product. Click Cancel to stop the initial setup and close MySQL Installer. Open MySQL Installer again from the Start menu and delete the installed product from the host using the Delete operation from the dashboard.

Check Requirements

MySQL Installer uses entries in the package-rules.xml file to determine whether the prerequisite software for each product is installed on the host. When the requirements check fails, MySQL Installer displays the Check Requirements step to help you update the host. Requirements are evaluated each time you download a new product (or version) for installation. The following figure identifies and describes the key areas of this step.
Figure 5.2 Check Requirements

Description of Check Requirements Elements

1. Shows the current step in the initial setup. Steps in this list may change slightly depending on the products already installed on the host, the availability of prerequisite software, and the products to be installed on the host.

2. Lists all pending installation requirements by product and indicates the status as follows:
   - A blank space in the **Status** column means that MySQL Installer can attempt to download and install the required software for you.
   - The word **Manual** in the **Status** column means that you must satisfy the requirement manually. Select each product in the list to see its requirement details.

3. Describes the requirement in detail to assist you with each manual resolution. When possible, a download URL is provided. After you download and install the required software, click **Check** to verify that the requirement has been met.

4. Provides the following set operations to proceed:
   - **Back** – Return to the previous step. This action enables you to select a different the setup type.
   - **Execute** – Have MySQL Installer attempt to download and install the required software for all items without a manual status. Manual requirements are resolved by you and verified by clicking **Check**.
   - **Next** – Do not execute the request to apply the requirements automatically and proceed to the installation without including the products that fail the check requirements step.
Setting Alternative Server Paths with MySQL Installer

- **Cancel** – Stop the installation of MySQL products. Because MySQL Installer is already installed, the initial setup begins again when you open MySQL Installer from the Start menu and click **Add** from the dashboard. For a description of the available management operations, see **Product Catalog**.

MySQL Installer Configuration Files

All MySQL Installer files are located within the `C:\Program Files (x86)` and `C:\ProgramData` folders. The following table describes the files and folders that define MySQL Installer as a standalone application.

**Note**

Installed MySQL products are neither altered nor removed when you update or uninstall MySQL Installer.

<table>
<thead>
<tr>
<th>File or Folder</th>
<th>Description</th>
<th>Folder Hierarchy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MySQL Installer for Windows</strong></td>
<td>This folder contains all of the files needed to run MySQL Installer and <strong>MySQLInstallerConsole.exe</strong>, a command-line program with similar functionality.</td>
<td><code>C:\Program Files (x86)</code></td>
</tr>
<tr>
<td><strong>Templates</strong></td>
<td>The <strong>Templates</strong> folder has one file for each version of MySQL server. Template files contain keys and formulas to calculate some values dynamically.</td>
<td><code>C:\ProgramData\MySQL\MySQL Installer for Windows\Manifest</code></td>
</tr>
<tr>
<td><strong>package-rules.xml</strong></td>
<td>This file contains the prerequisites for every product to be installed.</td>
<td><code>C:\ProgramData\MySQL\MySQL Installer for Windows\Manifest</code></td>
</tr>
<tr>
<td><strong>products.xml</strong></td>
<td>The <strong>products</strong> file (or product catalog) contains a list of all products available for download.</td>
<td><code>C:\ProgramData\MySQL\MySQL Installer for Windows\Manifest</code></td>
</tr>
<tr>
<td><strong>Product Cache</strong></td>
<td>The <strong>Product Cache</strong> folder contains all standalone <code>.msi</code> files bundled with the full package or downloaded afterward.</td>
<td><code>C:\ProgramData\MySQL\MySQL Installer for Windows</code></td>
</tr>
</tbody>
</table>

5.3.2 Setting Alternative Server Paths with MySQL Installer

You can change the default installation path, the data path, or both when you install MySQL server. After you have installed the server, the paths cannot be altered without removing and reinstalling the server instance.

**To change paths for MySQL server**

1. Identify the MySQL server to change and display the **Advanced Options** link.

   a. Navigate to the **Select Products and Features** step by doing one of the following:
      
      i. If this is an **initial setup** of MySQL Installer, select the **Custom** setup type and click **Next**.
      
      ii. If MySQL Installer is installed already, launch it from the Start menu and then click **Add** from the dashboard.
b. Click **Edit** to apply a filter on the product list shown in **Available Products** (see **Locating Products to Install**).

c. With the server instance selected, use the arrow to move the selected server to the **Products/Features To Be Installed** list.

d. Click the server to select it. When you select the server, the **Advanced Options** link appears. For details, see the figure that follows.

2. Click **Advanced Options** to open a dialog box where you can enter alternative path names. After the path names are validated, click **Next** to continue with the configuration steps.

**Figure 5.3 Change MySQL Server Path**

![Figure 5.3 Change MySQL Server Path](image)

**5.3.3 Installation Workflow with MySQL Installer**

MySQL Installer provides a wizard-like tool to install and configure new MySQL products for Windows. Unlike the initial setup, which runs only once, MySQL Installer invokes the wizard each time you download or install a new product. For first-time installations, the steps of the initial setup proceed directly into the steps of the installation. For assistance with product selection, see **Locating Products to Install**.

**Note**

Full permissions are granted to the user executing MySQL Installer to all generated files, such as *my.ini*. This does not apply to files and directories for specific products, such as the MySQL server data directory in `%ProgramData%` that is owned by **SYSTEM**.
Products installed and configured on a host follow a general pattern that might require your input during the various steps. If you attempt to install a product that is incompatible with the existing MySQL server version (or a version selected for upgrade), you are alerted about the possible mismatch.

MySQL Installer loads all selected products together using the following workflow:

- **Product download.** If you installed the full (not web) MySQL Installer package, all .msi files were loaded to the **Product Cache** folder during the initial setup and are not downloaded again. Otherwise, click **Execute** to begin the download. The status of each product changes from **Downloading** to **Downloaded**.

- **Product installation.** The status of each product in the list changes from **Ready to Install**, to **Installing**, and lastly to **Complete**. During the process, click **Show Details** to view the installation actions.

  If you cancel the installation at this point, the products are installed, but the server (if installed) is not yet configured. To restart the server configuration, open MySQL Installer from the Start menu and click the **Reconfigure** link next to the appropriate server in the dashboard.

- **Product configuration.** This step applies to MySQL Server, MySQL Router, and samples only. The status for each item in the list should indicate **Ready to Configure**.

  Click **Next** to start the configuration wizard for all items in the list. The configuration options presented during this step are specific to the version of database or router that you selected to install.

  Click **Execute** to begin applying the configuration options or click **Back** (repeatedly) to return to each configuration page. Click **Finish** to open the **MySQL Installer dashboard**.

- **Installation complete.** This step finalizes the installation for products that do not require configuration. It enables you to copy the log to a clipboard and to start certain applications, such as MySQL Workbench and MySQL Shell. Click **Finish** to open the **MySQL Installer dashboard**.

**5.3.3.1 MySQL Server Configuration with MySQL Installer**

MySQL Installer performs the initial configuration of the MySQL server. For example:

- For the MySQL 8.0 release series, a server can be configured to run as a standalone database, as a sandbox InnoDB cluster on a single host, or to create a production InnoDB cluster inside a local network (see **High Availability**).

- It creates the configuration file (**my.ini**) that is used to configure the MySQL server. The values written to this file are influenced by choices you make during the installation process. Some definitions are host dependent. For example, query_cache is enabled if the host has fewer than three cores.

  **Note**

  Query cache was deprecated in MySQL 5.7 and removed in MySQL 8.0 (and later).

- By default, a Windows service for the MySQL server is added.

- Provides default installation and data paths for MySQL server. For instructions on how to change the default paths, see **Section 5.3.2, “Setting Alternative Server Paths with MySQL Installer”**.

- It can optionally create MySQL server user accounts with configurable permissions based on general roles, such as DB Administrator, DB Designer, and Backup Admin. It optionally creates a Windows user named **MysqlSys** with limited privileges, which would then run the MySQL Server.
User accounts may also be added and configured in MySQL Workbench.

- Checking **Show Advanced Options** enables additional **Logging Options** to be set. This includes defining custom file paths for the error log, general log, slow query log (including the configuration of seconds it requires to execute a query), and the binary log.

During the configuration process, click **Next** to proceed to the next step or **Back** to return to the previous step. Click **Execute** at the final step to apply the server configuration.

The sections that follow describe the server configuration options that apply to MySQL server on Windows. The server version you installed will determine which steps and options you can configure. Configuring MySQL server may include some or all of the steps.

**High Availability**

MySQL Installer enables you to install, configure, and deploy MySQL Server as a standalone instance or as a member of a highly available cluster using MySQL Group Replication. In either case, MySQL Installer restricts the installation and configuration of the server (or servers) to the local Windows host computer.

- **Standalone MySQL Server / Classic MySQL Replication (default)**
  
  Select this option to configure one MySQL instance to run as a standalone database server. This option is ideal if you intend to set up classic replication later and then to include this server in your custom solution. The remaining configuration steps are described in the sections that follow, starting with **Type and Networking**.

- **InnoDB cluster**
  
  Select this option to create or extend an InnoDB cluster solution that is based on MySQL Group Replication (see **Introducing InnoDB Cluster**). You can configure (or reconfigure) a minimum of three server instances to perform a basic setup as a test-only sandbox cluster on a single computer or to create a production cluster inside a local network.

  **InnoDB Cluster Log Verbosity Level.** This configuration step includes an adjustable log that captures information during the configuration of each server instance in the production or sandbox cluster. The values are: **MINIMAL**, **MEDIUM** (default), and **DEBUG**. If the cluster configuration fails, use the **Reconfigure** action from the **MySQL Installer dashboard** to restart the configuration and then set the verbosity level to **DEBUG** to gather additional information during your next attempt.

MySQL Installer provides the following configuration variations to deploy an InnoDB cluster:

- **Set Up a Local Server Cluster for Testing Only**
  
  Select **Create a Sandbox InnoDB cluster for Testing** to enable this option. When prompted, define the number of server sandbox instances in the cluster, set a password for the **root** user, and adjust the InnoDB cluster log verbosity level as needed. For a more detailed description of the configuration, see **Deploying a Sandbox InnoDB Cluster with MySQL Installer**. This setup requires MySQL 5.7.17 or higher.

- **Create or Join an InnoDB cluster**
  
  To set up a highly available InnoDB cluster using MySQL Installer, you must have a minimum of three computers on a local network. If you require a more advanced setup, use MySQL Shell to configure some or all of the server instances in the cluster. For details about how to perform a local-network cluster setup, see **Setting up an InnoDB cluster with MySQL Installer**. This setup requires MySQL 8.0.0 or higher.
InnoDB cluster was designed to operate with MySQL Shell, which enables you to perform advanced cluster administration, and MySQL Router to automate the connections made between client applications and server instances. Neither MySQL Shell nor MySQL Router are required to deploy a cluster on Windows using MySQL Installer.

**Deploying a Sandbox InnoDB Cluster with MySQL Installer**

A sandbox deployment includes multiple server sandbox instances that run together on the same computer. Because all server instances reside on the same computer, a sandbox cluster does not meet the requirements of a highly available solution. Instead, this deployment option simulates an environment from which you can explore the techniques associated with InnoDB cluster administration.

When you select **Create a Sandbox InnoDB cluster for Testing**, a follow-on step prompts you to select a cluster consisting of three, five, seven, or nine MySQL server instances. Unlike the other server setups provided by MySQL Installer, the sandbox deployment skips the usual server configuration steps (except Authentication Method). The resulting cluster, named `sandboxCluster`, is available on selected ports that are configured for you.

**Note**

MySQL Installer deletes ports 3310 to 3390 during the configuration, if those ports were set for the sandbox InnoDB cluster manually using MySQL Shell.

Each sandbox instance is configured to run as a process (not a Windows service). You must start each instance in the sandbox cluster manually after restarting the computer.

After you create the test cluster, click the **Summary** tab to view the specific ports that apply to your cluster. To modify the number of server instances within the existing cluster or to adjust the logging level, use the **Reconfigure** quick action from the MySQL Installer dashboard.

**Warning**

MySQL Installer deletes all existing sandbox cluster data when the cluster is reconfigured or when the server instances within the sandbox cluster are upgraded.

MySQL Installer stores all sandbox InnoDB cluster configuration entries in the `installer_config.xml` file. By default, MySQL Installer creates the sandbox instances in `%userprofile%\MySQL\mysql-sandboxes` on the local host.

**Setting up InnoDB Cluster with MySQL Installer**

To create a single InnoDB cluster, select **InnoDB Cluster** as the High Availability option and then select **Create a New InnoDB Cluster**. Adjust the log verbosity level (as needed), and click **Next** to configure the first server instance. This setup process involves installing and running MySQL Installer on multiple computers.

Define the first server instance (or seed) by providing the following configuration information:

- **InnoDB Cluster Name:**
  
  The default cluster name is `myCluster`. If you intend to configure multiple clusters, replace the default name with one that is meaningful within your solution. Alphanumeric characters, spaces, and underscore (_) characters are valid for this field. The limit is 40 characters.

- **Cluster Admin User Name:**
The default cluster administrator name is ic. You can reuse the same MySQL administrative account across multiple clusters. You will be prompted for this account name (and password) later when you configure other server instances to join the cluster. The limit is 32 characters.

- **Cluster Admin Password:**
  Enter a password for the cluster administrator account (minimum length is four characters). MySQL Installer will evaluate the strength of the MySQL password as you type. Use the Repeat Password field to confirm the password.

- **Host Address:**
  Select the host name or IP address of the local host from the list. When joining additional server instances to the cluster, you will be prompted to identify the seed instance by the host name or IP address.

- **Server ID:**
  The default value is 1. This identifier is required to record the events of a server instance in the binary log. The ID of each server instance within a cluster must be unique; however, you can reuse the same number in a different cluster. The server ID you specify in this field also appears later in Advanced Options step. If you change the value in Advanced Option, the number is changed for the InnoDB cluster Setup too.

Click Next and then complete the remaining configuration steps, which are described in the sections that follow, starting with Type and Networking. After the seed instance is added and the cluster is created, it requires more instances for full tolerance. At this point, the status is OK_NO_TOLERANCE.

To add the second and third server instances to the cluster, you must use a separate computer inside the local network for each. Some of the configuration details of the seed instance are required to complete the join operation.

After you start MySQL Installer and install the server instance on the next computer, begin the configuration by selecting InnoDB Cluster as the High Availability option and then select Add Local MySQL Server Instance to an InnoDB Cluster. Adjust the InnoDB Cluster Log Verbosity Level (as needed) and then click Next.

Define the joining server instance by providing the following configuration information:

- **Seed Instance Address:**
  Enter the host name or IP address of the computer that hosts the seed instance.

- **Seed Instance Port:**
  The default value is 3306, which is the port for classic MySQL. Use the same TCP port that you configured for the seed instance.

- **Cluster Admin User Name:**
  The default cluster administrator name is ic. If you assigned a different name when you configured the seed instance, enter the alternative cluster administrator name.

- **Cluster Admin Password:**
  Enter the password assigned to the cluster administrator account.

- **Host Address:**
Select the host name or IP address of the local host from the list.

- **Server ID:**
  The default value is 1. This identifier is required to record the events of a server instance in the binary log. The ID of each server instance within a cluster must be unique; however, you can reuse the same number in a different cluster. The server ID you specify in this field also appears later in Advanced Options step. If you change the value in Advanced Option, the number is changed for the InnoDB cluster Setup too.

- **Test Connection**
  Use this button to verify the connection between the local server instance and the seed instance defined for the cluster. A valid connection is required to proceed.

Click Next and then complete the remaining configuration steps, which are described in the sections that follow, starting with Type and Networking.

With one seed instance and a second server instance in the cluster, the status is **OK_NO_TOLERANCE**. After you add the third server instance, the status is **OK**, which indicates that the cluster now is tolerant to the failure of one instance.

**Type and Networking**

- **Server Configuration Type**
  Choose the MySQL server configuration type that describes your setup. This setting defines the amount of system resources (memory) to assign to your MySQL server instance.

  - **Development**: A computer that hosts many other applications, and typically this is your personal workstation. This setting configures MySQL to use the least amount of memory.

  - **Server**: Several other applications are expected to run on this computer, such as a web server. The Server setting configures MySQL to use a medium amount of memory.

  - **Dedicated**: A computer that is dedicated to running the MySQL server. Because no other major applications run on this server, this setting configures MySQL to use the majority of available memory.

- **Connectivity**
  Connectivity options control how the connection to MySQL is made. Options include:

  - **TCP/IP**: This option is selected by default. You may disable TCP/IP Networking to permit local host connections only. With the TCP/IP connection option selected, you can modify the following items:

    - **Port** for the classic MySQL protocol connections. The default value is 3306.
    - **X Protocol Port** shown when configuring MySQL 8.0 server only.
    - **Open Windows Firewall port for network access**, which is selected by default for TCP/IP.

    If a port number is in use already, you will see the information icon (⚠️) next to the default value and Next is disabled until you provide a new port number.

  - **Named Pipe**: Enable and define the pipe name, similar to setting the named_pipe system variable. The default name is MySQL.
Installation Workflow with MySQL Installer

- **Shared Memory**: Enable and define the memory name, similar to setting the `shared_memory` system variable. The default name is `MySQL`.

- **Advanced Configuration**

  Check **Show Advanced and Logging Options** to set custom logging and advanced options in later steps. The Logging Options step enables you to define custom file paths for the error log, general log, slow query log (including the configuration of seconds it requires to execute a query), and the binary log. The Advanced Options step enables you to set the unique server ID required when binary logging is enabled in a replication topology.

- **MySQL Enterprise Firewall (Enterprise Edition only)**

  The **Enable MySQL Enterprise Firewall** check box is deselected by default. Select this option to enable a security whitelist that offers protection against certain types of attacks. Additional post-installation configuration is required (see **MySQL Enterprise Firewall**).

  **Important**

  There is an issue for MySQL 8.0.19 that prevents the server from starting if MySQL Enterprise Firewall is selected during the server configuration steps. If the server startup operation fails, click **Cancel** to end the configuration process and return to the dashboard. You must uninstall the server.

  The workaround is to run MySQL Installer without MySQL Enterprise Firewall selected. (That is, do not select the **Enable MySQL Enterprise Firewall** check box.) Then install MySQL Enterprise Firewall afterward using the instructions for manual installation (see **Installing or Uninstalling MySQL Enterprise Firewall**).

**Authentication Method**

The **Authentication Method** step is visible only during the installation or upgrade of MySQL 8.0.4 or higher. It introduces a choice between two server-side authentication options. The MySQL user accounts that you create in the next step will use the authentication method that you select in this step.

MySQL 8.0 connectors and community drivers that use `libmysqlclient` 8.0 now support the `mysql_native_password` default authentication plugin. However, if you are unable to update your clients and applications to support this new authentication method, you can configure the MySQL server to use `mysql_native_password` for legacy authentication. For more information about the implications of this change, see **caching_sha2_password as the Preferred Authentication Plugin**.

If you are installing or upgrading to MySQL 8.0.4 or higher, select one of the following authentication methods:

- **Use Strong Password Encryption for Authentication (RECOMMENDED)**

  MySQL 8.0 supports a new authentication based on improved, stronger SHA256-based password methods. It is recommended that all new MySQL server installations use this method going forward.

  **Important**

  The `caching_sha2_password` authentication plugin on the server requires new versions of connectors and clients, which add support for the new MySQL 8.0 default authentication.

- **Use Legacy Authentication Method (Retain MySQL 5.x Compatibility)**
Using the old MySQL 5.x legacy authentication method should be considered only in the following cases:

- Applications cannot be updated to use MySQL 8.0 connectors and drivers.
- Reccompilation of an existing application is not feasible.
- An updated, language-specific connector or driver is not available yet.

**Accounts and Roles**

- **Root Account Password**

  Assigning a root password is required and you will be asked for it when performing other MySQL Installer operations. Password strength is evaluated when you repeat the password in the box provided. For descriptive information regarding password requirements or status, move your mouse pointer over the information icon (⚠️) when it appears.

- **MySQL User Accounts (Optional)**

  Click **Add User** or **Edit User** to create or modify MySQL user accounts with predefined roles. Next, enter the required account credentials:

  - **User Name**: MySQL user names can be up to 32 characters long.
  - **Host**: Select `localhost` for local connections only or `<All Hosts (%)>` when remote connections to the server are required.
  - **Role**: Each predefined role, such as `DB Admin`, is configured with its own set of privileges. For example, the `DB Admin` role has more privileges than the `DB Designer` role. The **Role** drop-down list contains a description of each role.
  - **Password**: Password strength assessment is performed while you type the password. Passwords must be confirmed. MySQL permits a blank or empty password (considered to be insecure).

**MySQL Installer Commercial Release Only**: MySQL Enterprise Edition for Windows, a commercial product, also supports an authentication method that performs external authentication on Windows. Accounts authenticated by the Windows operating system can access the MySQL server without providing an additional password.

To create a new MySQL account that uses Windows authentication, enter the user name and then select a value for **Host** and **Role**. Click Windows authentication to enable the `authentication_windows` plugin. In the Windows Security Tokens area, enter a token for each Windows user (or group) who can authenticate with the MySQL user name. MySQL accounts can include security tokens for both local Windows users and Windows users that belong to a domain. Multiple security tokens are separated by the semicolon character (;) and use the following format for local and domain accounts:

- **Local account**
  
  Enter the simple Windows user name as the security token for each local user or group; for example, `finley;jeffrey;admin`.

- **Domain account**
  
  Use standard Windows syntax (`domain\domainuser`) or MySQL syntax (`domain\username`) to enter Windows domain users and groups.
For domain accounts, you may need to use the credentials of an administrator within the domain if the account running MySQL Installer lacks the permissions to query the Active Directory. If this is the case, select **Validate Active Directory users with** to activate the domain administrator credentials.

Windows authentication permits you to test all of the security tokens each time you add or modify a token. Click **Test Security Tokens** to validate (or revalidate) each token. Invalid tokens generate a descriptive error message along with a red x icon and red token text. When all tokens resolve as valid (green text without an x icon), you can click **OK** to save the changes.

### Windows Service

On the Windows platform, MySQL server can run as a named service managed by the operating system and be configured to start up automatically when Windows starts. Alternatively, you can configure MySQL server to run as an executable program that requires manual configuration.

- **Configure MySQL server as a Windows service** (Selected by default.)
  
  When the default configuration option is selected, you can also select the following:
  
  - **Start the MySQL Server at System Startup**
    
    When selected (default), the service startup type is set to Automatic; otherwise, the startup type is set to Manual.
  
  - **Run Windows Service as**
    
    When **Standard System Account** is selected (default), the service logs on as Network Service.
    
    The **Custom User** option must have privileges to log on to Microsoft Windows as a service. The **Next** button will be disabled until this user is configured with the required privileges.
    
    A custom user account is configured in Windows by searching for "local security policy" in the Start menu. In the Local Security Policy window, select **Local Policies**, **User Rights Assignment**, and then **Log On As A Service** to open the property dialog. Click **Add User or Group** to add the custom user and then click **OK** in each dialog to save the changes.
    
    - **Deselect the Windows Service option**

### Logging Options

This step is available if the **Show Advanced Configuration** check box was selected during the **Type and Networking** step. To enable this step now, click **Back** to return to the **Type and Networking** step and select the check box.

Advanced configuration options are related to the following MySQL log files:

- **Error Log**
- **General Log**
- **Slow Query Log**
- **Bin Log**

**Note**

The binary log is enabled by default for MySQL 5.7 and higher.
Advanced Options

This step is available if the **Show Advanced Configuration** check box was selected during the **Type and Networking** step. To enable this step now, click **Back** to return to the **Type and Networking** step and select the check box.

The advanced-configuration options include:

- **Server ID**

  Set the unique identifier used in a replication topology. If binary logging is enabled, you must specify a server ID. The default ID value depends on the server version. For more information, see the description of the `server_id` system variable.

  **Tip**

  If you specified an ID for a server instance of an InnoDB cluster, then MySQL Installer adjusts the ID (shown on this page) to match the previous identifier.

- **Table Names Case**

  You can set the following options during the initial and subsequent configuration the server. For the MySQL 8.0 release series, these options apply only to the initial configuration of the server.

  - **Lower Case**

    Sets the `lower_case_table_names` option value to 1 (default), in which table names are stored in lowercase on disk and comparisons are not case-sensitive.

  - **Preserve Given Case**

    Sets the `lower_case_table_names` option value to 2, in which table names are stored as given but compared in lowercase.

Apply Server Configuration

All configuration settings are applied to the MySQL server when you click **Execute**. Use the **Configuration Steps** tab to follow the progress of each action; the icon for each toggles from white to green (with a check mark) on success. Otherwise, the process stops and displays an error message if an individual action times out. Click the **Log** tab to view the log.

When the installation completes successfully and you click **Finish**, MySQL Installer and the installed MySQL products are added to the Microsoft Windows Start menu under the **MySQL** group. Opening MySQL Installer loads the **dashboard** where installed MySQL products are listed and other MySQL Installer operations are available.

5.3.3.2 MySQL Router Configuration with MySQL Installer

MySQL Installer downloads and installs a suite of tools for developing and managing business-critical applications on Windows. The suite consist of applications, connectors, documentation, and samples.

During the **initial setup**, choose any predetermined setup type, except **Server only**, to install the latest GA version of the tools. Use the **Custom** setup type to install an individual tool or specific version. If MySQL Installer is installed on the host already, use the **Add** operation to select and install tools from the MySQL Installer dashboard.
MySQL Router Configuration

MySQL Installer provides a configuration wizard that can bootstrap an installed instance of MySQL Router 8.0 or later to route traffic between MySQL applications and an InnoDB cluster. When configured, MySQL Router runs as a local Windows service. For detailed information about using MySQL Router with an InnoDB cluster, see Routing for MySQL InnoDB cluster.

Note
You are prompted to configure MySQL Router after the initial installation and when you reconfigure an installed router explicitly. In contrast, the upgrade operation does not require or prompt you to configure the upgraded product.

To configure MySQL Router, do the following:

1. Set up InnoDB cluster. For instructions on how to configure a sandbox InnoDB cluster on the local host using MySQL Installer, see High Availability.
   
   For general InnoDB cluster information, see InnoDB Cluster.

2. Using MySQL Installer, download and install the MySQL Router application. After the installation finishes, the configuration wizard prompts you for information. Select the Configure MySQL Router for InnoDB cluster check box to begin the configuration and provide the following configuration values:

   • **Hostname:** Host name of the primary (seed) server in the InnoDB cluster (localhost by default).
   
   • **Port:** The port number of the primary (seed) server in the InnoDB cluster (3310 by default).
   
   • **Management User:** An administrative user with root-level privileges.
   
   • **Password:** The password for the management user.

   **Classic MySQL protocol connections to InnoDB cluster**

   **Read/Write:** Set the first base port number to one that is unused (between 80 and 65532) and the wizard will select the remaining ports for you.

   The figure that follows shows an example of the MySQL Router configuration page, with the first base port number specified as 6446 and the remaining ports set by the wizard as 6447, 6448, and 6449.
3. Click **Next** and then **Execute** to apply the configuration. Click **Finish** to close MySQL Installer or return to the MySQL Installer dashboard.

After installing a production cluster with MySQL Router, the root account only exists in the user table as `root@localhost` (local), instead of `root@%` (remote). Regardless of where the router or client are located, even if both are located on the same host as the seed server, any connection that passes through the router is viewed by server as being remote, not local. As a result, a connection made to the server using the local host (see the example that follows), does not authenticate.

```
shell> \c root@localhost:6446
```

### 5.3.4 MySQL Installer Product Catalog and Dashboard

- **Product Catalog**
- **MySQL Installer Dashboard**
- **Locating Products to Install**
- **Upgrading MySQL Installer**

This section describes the MySQL Installer product catalog and the dashboard.

#### Product Catalog

The product catalog stores the complete list of released MySQL products for Microsoft Windows that are available to download from MySQL Downloads. By default, and when an Internet connection is present, MySQL Installer updates the catalog daily. You can also update the catalog manually from the dashboard (described later).

An up-to-date catalog performs the following actions:
• Populates the **Available Products** pane of the Select Products and Features step. This step appears when you select:
  
  • The **Custom** setup type during the **initial setup**.
  
  • The **Add** operation from the dashboard.

• Identifies when product updates are available for the installed products listed in the dashboard.

The catalog includes all development releases (Pre-Release), general releases (Current GA), and minor releases (Other Releases). Products in the catalog will vary somewhat, depending on the MySQL Installer release that you download.

**MySQL Installer Dashboard**

The MySQL Installer dashboard is the default view that you see when you start MySQL Installer after the **initial setup** finishes. If you closed MySQL Installer before the setup was finished, MySQL Installer resumes the initial setup before it displays the dashboard.

**Figure 5.5 MySQL Installer Dashboard Elements**

![](image)

**Description of MySQL Installer Dashboard Elements**

1. MySQL Installer dashboard operations provide a variety of actions that apply to installed products or products listed in the catalog. To initiate the following operations, first click the operation link and then select the product or products to manage:

  • **Add**: This operation opens the Select Products and Features page. From there, you can filter the product in the product catalog, select one or more products to download (as needed), and begin the installation. For hints about using the filter, see **Locating Products to Install**.
• **Modify**: Use this operation to add or remove the features associated with installed products. Features that you can modify vary in complexity by product. When the Program Shortcut check box is selected, the product appears in the Start menu under the MySQL group.

• **Upgrade**: This operation loads the Select Products to Upgrade page and populates it with all the upgrade candidates. An installed product can have more than one upgrade version and requires a current product catalog.

**Important server upgrade conditions:**

- MySQL Installer does not permit server upgrades between major release versions or minor release versions, but does permit upgrades within a release series, such as an upgrade from 5.7.18 to 5.7.19.

- Upgrades between milestone releases (or from a milestone release to a GA release) are not supported. Significant development changes take place in milestone releases and you may encounter compatibility issues or problems starting the server.

- For upgrades to MySQL 8.0.16 server and higher, a check box enables you to skip the upgrade check and process for system tables, while checking and processing data dictionary tables normally. MySQL Installer does not prompt you with the check box when the previous server upgrade was skipped or when the server was configured as a sandbox InnoDB cluster. This behavior represents a change in how MySQL Server performs an upgrade (see What the MySQL Upgrade Process Upgrades) and it alters the sequence of steps that MySQL Installer applies to the configuration process.

If you select **Skip system tables upgrade check and process. (Not recommended)**, MySQL Installer starts the upgraded server with the `--upgrade=MINIMAL` server option, which upgrades the data dictionary only. If you stop and then restart the server without the `--upgrade=MINIMAL` option, the server upgrades the system tables automatically, if needed.

The following information appears in the Log tab and log file after the upgrade configuration (with system tables skipped) is complete:

```
WARNING: The system tables upgrade was skipped after upgrading MySQL Server. The server will be started now with the --upgrade=MINIMAL option, but then each time the server is started it will attempt to upgrade the system tables, unless you modify the Windows service (command line) to add --upgrade=MINIMAL to bypass the upgrade.

FOR THE BEST RESULTS: Run mysqld.exe --upgrade=FORCE on the command line to upgrade the system tables manually.
```

To choose a new product version:

a. Click **Upgrade**. Confirm that the check box next to product name in the **Upgradeable Products** pane has a check mark. Deselect the products that you do not intend to upgrade at this time.

**Note**

For server milestone releases in the same release series, MySQL Installer deselects the server upgrade and displays a warning to indicate that the upgrade is not supported, identifies the risks of continuing, and provides a summary of the steps to perform a logical upgrade manually. You can reselect server upgrade at your own risk. For instructions on how to perform a logical upgrade with a milestone release, see Logical Upgrade.
b. Click a product in the list to highlight it. This action populates the Upgradeable Versions pane with the details of each available version for the selected product: version number, published date, and a Changes link to open the release notes for that version.

MySQL Installer upgrades all of the selected products in one action. Click Show Details to view the actions performed by MySQL Installer.

- **Remove**: This operation opens the Remove Products page and populates it with the MySQL products installed on the host. Select the MySQL products you want to remove (uninstall) and then click Execute to begin the removal process. During the operation, an indicator shows the number of steps that are executed as a percentage of all steps.

To select products to remove, do one of the following:
- Select the check box for one or more products.
- Select the Product check box to select all products.

To remove a local MySQL server:

a. Determine whether the local data directory should be removed. If you retain the data directory, another server installation can reuse the data. This option is enabled by default (removes the data directory).

b. If the local server is a member of an InnoDB cluster, reconfigure the cluster as follows:

   i. Type the administrator password for the cluster affected when the local server is removed and then click Test Connection to verify the credentials. MySQL Installer can perform the following actions, depending on the configuration of the existing cluster:

      • If the local server is a seed instance and the number of instances in the cluster is one, dissolve the cluster when you remove the local server.

      • If the local server is a seed instance and the number of instances in the cluster is greater than one, remove the instance from the cluster or dissolve the cluster when you remove the local server.

      • If the local server is a slave instance within the cluster and the number of instances in the cluster is greater than two, remove the local instance from the cluster. (A single slave instance within a cluster reverts to a seed instance automatically.)

      • If the local server is configured as a sandbox InnoDB cluster, remove all instances created for the sandbox server installation.

   ii. When prompted, do one of the following:

      • Select an action to apply to the cluster and click Next.

      • Click Next without selecting an action. In most cases, MySQL Group Replication can manage the cluster when the local server becomes unavailable. A warning message
reminds you that skipping the step may result in an inconsistent InnoDB cluster configuration.

c. Click **Execute** to begin uninstalling the local server. Note that all products that you selected to remove are also uninstalled at this time.

d. (Optional) Click the **Log** tab to display the current actions performed by MySQL Installer.

2. The **Reconfigure** link in the Quick Action column next to each installed server loads the current configuration values for the server and then cycles through all configuration steps enabling you to change the options and values. You must provide credentials with root privileges to reconfigure these items. Click the **Log** tab to show the output of each configuration step performed by MySQL Installer.

On completion, MySQL Installer stops the server, applies the configuration changes, and restarts the server for you. For a description of each configuration option, see Section 5.3.3.1, “MySQL Server Configuration with MySQL Installer”. Installed Samples and Examples associated with a specific MySQL server version can be also be reconfigured to apply new feature settings, if any.

3. The **Catalog** link enables you to download the latest catalog of MySQL products manually and then to integrate those product changes with MySQL Installer. The catalog-download action does not perform an upgrade of the products already installed on the host. Instead, it returns to the dashboard and displays an arrow icon in the Version column for each installed product that has a newer version. Use the **Upgrade** operation to install the newer product version.

You can also use the **Catalog** link to display the current change history of each product without downloading the new catalog. Select the **Do not update at this time** check box to view the change history only.

4. The MySQL Installer About icon (?) shows the current version of MySQL Installer and general information about MySQL. The version number is located above the **Back** button.

   **Tip**

   Always include this version number when reporting a problem with MySQL Installer.

In addition to the About MySQL information (?), you can also select the following icons from the side panel:

- License icon ( ) for MySQL Installer.

   This product may include third-party software, used under license. If you are using a Commercial release of MySQL Installer, the icon opens the MySQL Installer Commercial License Information User Manual for licensing information, including licensing information relating to third-party software that may be included in this Commercial release. If you are using a Community release of MySQL Installer, the icon opens the MySQL Installer Community License Information User Manual for licensing information, including licensing information relating to third-party software that may be included in this Community release.

- Resource links icon ( ) to the latest MySQL product documentation, blogs, webinars, and more.

5. The MySQL Installer Options icon ( ) includes the following tabs:
• **Product Catalog**: Manages the daily automatic catalog updates. By default, catalog updates are scheduled at a fixed hour. When new products or product versions are available, MySQL Installer adds them to the catalog and then displays an arrow icon (↑) next to the version number of installed products listed in the dashboard.

Use this option to enable or disable automatic catalog updates and to reset the time of day when the MySQL Installer updates the catalog automatically. For specific settings, see the task named `ManifestUpdate` in the Windows Task Scheduler.

• **Connectivity Settings**: Several operations performed by MySQL Installer require internet access. This option enables you to use a default value to validate the connection or to use a different URL, one selected from a list or added by you manually. With the **Manual** option selected, new URLs can be added and all URLs in the list can be moved or deleted. When the **Automatic** option is selected, MySQL Installer attempts to connect to each default URL in the list (in order) until a connection is made. If no connection can be made, it raises an error.

### Locating Products to Install

MySQL products in the catalog are listed by category: MySQL Servers, Applications, MySQL Connectors, and Documentation. Only the latest GA versions appear in the **Available Products** pane by default. If you are looking for a pre-release or older version of a product, it may not be visible in the default list.

To change the default product list, click **Add** on the dashboard to open the Select Products and Features page, and then click **Edit** to open the filter dialog box (see the figure that follows). Modify the product values and then click **Filter**.

**Figure 5.6 Filter Available Products**

![Filter Available Products](image)

Reset one or more of the following values to filter the list of available products:

- **Text**: Filter by text.
- **Category**: All Software (default), MySQL Servers, Applications, MySQL Connectors, or Documentation (for samples and documentation).
- **Maturity**: Current Bundle (appears initially with the full package only), Pre-Release, Current GA, or Other Releases.
Note
The Commercial release of MySQL Installer does not display any MySQL products when you select the Pre-Release age filter. Products in development are available from the Community release of MySQL Installer only.

- Already Downloaded (the check box is deselected by default).
- Architecture: Any (default), 32-bit, or 64-bit.

Upgrading MySQL Installer

MySQL Installer remains installed on your computer, and like other software, MySQL Installer can be upgraded from the previous version. In some cases, other MySQL software may require that you upgrade MySQL Installer for compatibility. This section describes how to identify the current version of MySQL Installer and how to upgrade MySQL Installer manually.

To locate the installed version of MySQL Installer:
1. Start MySQL Installer from the search menu. The MySQL Installer dashboard opens.
2. Click the MySQL Installer About icon (?). The version number is located above the Back button.

To initiate an on-demand upgrade of MySQL Installer:
1. Connect the computer with MySQL Installer installed to the internet.
2. Start MySQL Installer from the search menu. The MySQL Installer dashboard opens.
3. Click Catalog on the bottom of the dashboard to open the Update Catalog window.
4. Click Execute to begin the process. If the installed version of MySQL Installer can be upgraded, you will be prompted to start the upgrade.
5. Click Next to review all changes to the catalog and then click Finish to return to the dashboard.
6. Verify the (new) installed version of MySQL Installer (see the previous procedure).

5.3.5 MySQLInstallerConsole Reference

MySQLInstallerConsole.exe provides command-line functionality that is similar to MySQL Installer. It is installed when MySQL Installer is initially executed and then available within the MySQL Installer directory. Typically, that is in C:\Program Files (x86)\MySQL\MySQL Installer\, and the console must be executed with administrative privileges.

To use, invoke the command prompt with administrative privileges by choosing Start, Accessories, then right-click on Command Prompt and choose Run as administrator. And from the command line, optionally change the directory to where MySQLInstallerConsole.exe is located:

C:\> cd Program Files (x86)\MySQL\MySQL Installer for Windows
C:\Program Files (x86)\MySQL\MySQL Installer for Windows> MySQLInstallerConsole.exe help
------------------------------------------- Start Initialization -------------------------------------------
MySQL Installer is running in Community mode

Attempting to update manifest.
Initializing product requirements
Loading product catalog
Checking for product catalog snippets
Checking for product packages in the bundle
Categorizing product catalog
Finding all installed packages.
Your product catalog was last updated at 11/1/2016 4:10:38 PM
-------------------- End Initialization --------------------

The following commands are available:

- **Configure** - Configures one or more of your installed programs.
- **Help** - Provides list of available commands.
- **Install** - Install and configure one or more available MySQL programs.
- **List** - Provides an interactive way to list all products available.
- **Modify** - Modifies the features of installed products.
- **Remove** - Removes one or more products from your system.
- **Status** - Shows the status of all installed products.
- **Update** - Update the current product catalog.
- **Upgrade** - Upgrades one or more of your installed programs.

MySQLInstallerConsole.exe supports the following commands:

**Note**

Configuration block values that contain a colon (":") must be wrapped in double quotes. For example, installdir="C:\MySQL\MySQL Server 8.0".

- **configure** [product1]:[setting]=value; [product2]:[setting]=value; [...]  

Configure one or more MySQL products on your system. Multiple setting=value pairs can be configured for each product.

Switches include:

- **-showsettings** : Displays the available options for the selected product, by passing in the product name after **-showsettings**.

- **-silent** : Disable confirmation prompts.

```
C:\> MySQLInstallerConsole configure -showsettings server
C:\> MySQLInstallerConsole configure server:port=3307
```

- **help** [command]

Displays a help message with usage examples, and then exits. Pass in an additional command to receive help specific to that command.

```
C:\> MySQLInstallerConsole help
C:\> MySQLInstallerConsole help install
```

- **install** [product]:[features]:[config block]:[config block]:[config block]; [...]  

Install one or more MySQL products on your system. If pre-release products are available, both GA and pre-release products are installed when the value of the **-type** switch is **Developer**, **Client**, or **Full**. Use the **-only_ga_products** switch to restrict the product set to GA products only when using these setup types.

Switches and syntax options include:

- **-only_ga_products** : Restricts the product set to include GA products only.

- **-type=[SetupType]** : Installs a predefined set of software. The "SetupType" can be one of the following:
Non-custom setup types can only be chosen if no other MySQL products are installed.

- **Developer**: Installs a complete development environment.
- **Server**: Installs a single MySQL server
- **Client**: Installs client programs and libraries
- **Full**: Installs everything
- **Custom**: Installs user selected products. This is the default option.

- **-showsettings**: Displays the available options for the selected product, by passing in the product name after `-showsettings`.
- **-silent**: Disable confirmation prompts.

- **[config block]**: One or more configuration blocks can be specified. Each configuration block is a semicolon separated list of key value pairs. A block can include either a "config" or "user" type key, where "config" is the default type if one is not defined.

Configuration block values that contain a colon character (:) must be wrapped in double quotes. For example, `installdir="C:\MySQL\MySQL Server 8.0"`.

Only one "config" type block can be defined per product. A "user" block should be defined for each user that should be created during the product’s installation.

Note

Adding users is not supported when a product is being reconfigured.

- **[feature]**: The feature block is a semicolon separated list of features, or an asterisk character (*) to select all features.

```
C:\> MySQLInstallerConsole install server;5.6.25:*:port=3307;serverid=2:type=user;username=foo;password=bar;role=DBManager
C:\> MySQLInstallerConsole install server;5.6.25;x64 -silent

An example that passes in additional configuration blocks, separated by ^ to fit:

C:\> MySQLInstallerConsole install server;5.6.25;x64:*:type=config;openfirewall=true;\^generallog=true;binlog=true;serverid=3306;enable_tcpip=true;port=3306;rootpasswd=pass;\^installdir="C:\MySQL\MySQL Server 5.6":type=user;datadir="C:\MySQL\data";username=foo;password=pass

```

- **list**

Lists an interactive console where all of the available MySQL products can be searched. Execute `MySQLInstallerConsole list` to launch the console, and enter in a substring to search.

```
C:\> MySQLInstallerConsole list
```
• `modify [product1:-removelist|+addlist] [product2:-removelist|+addlist] [...]`

Modifies or displays features of a previously installed MySQL product.

• `-silent`: Disable confirmation prompts.

```
C:\> MySQLInstallerConsole modify server
C:\> MySQLInstallerConsole modify server:+documentation
C:\> MySQLInstallerConsole modify server:-debug
```

• `remove [product1] [product2] [...]`

Removes one or more products from your system.

• `*`: Pass in `*` to remove all of the MySQL products.
• `-continue`: Continue the operation even if an error occurs.
• `-silent`: Disable confirmation prompts.

```
C:\> MySQLInstallerConsole remove *
C:\> MySQLInstallerConsole remove server
```

• `status`

Provides a quick overview of the MySQL products that are installed on the system. Information includes product name and version, architecture, date installed, and install location.

```
C:\> MySQLInstallerConsole status
```

• `update`

Downloads the latest MySQL product catalog to your system. On success, the download catalog will be applied the next time either MySQLInstaller or MySQLInstallerConsole is executed.

```
C:\> MySQLInstallerConsole update
```

**Note**

The **Automatic Catalog Update** GUI option executes this command from the Windows Task Scheduler.

• `upgrade [product1:version] [product2:version] [...]`

Upgrades one or more products on your system. Syntax options include:

• `*`: Pass in `*` to upgrade all products to the latest version, or pass in specific products.
• `!`: Pass in `!` as a version number to upgrade the MySQL product to its latest version.
• `-silent`: Disable confirmation prompts.

```
C:\> MySQLInstallerConsole upgrade *
C:\> MySQLInstallerConsole upgrade workbench:6.3.5
C:\> MySQLInstallerConsole upgrade workbench:!
C:\> MySQLInstallerConsole upgrade workbench:6.3.5 excel:1.3.2
```
5.4 Installing MySQL on Microsoft Windows Using a noinstall ZIP Archive

Users who are installing from the noinstall package can use the instructions in this section to manually install MySQL. The process for installing MySQL from a ZIP Archive package is as follows:

1. Extract the archive to the desired install directory
2. Create an option file
3. Choose a MySQL server type
4. Start the MySQL server
5. Secure the default user accounts

This process is described in the sections that follow.

5.4.1 Extracting the Install Archive

To install MySQL manually, do the following:

1. If you are upgrading from a previous version please refer to Section 10.8, “Upgrading MySQL on Windows”, before beginning the upgrade process.
2. Make sure that you are logged in as a user with administrator privileges.
3. Choose an installation location. Traditionally, the MySQL server is installed in C:\mysql. If you do not install MySQL at C:\mysql, you must specify the path to the install directory during startup or in an option file. See Section 5.4.2, “Creating an Option File”.

   Note
   The MySQL Installer installs MySQL under C:\Program Files\MySQL.

4. Extract the install archive to the chosen installation location using your preferred file-compression tool. Some tools may extract the archive to a folder within your chosen installation location. If this occurs, you can move the contents of the subfolder into the chosen installation location.

5.4.2 Creating an Option File

If you need to specify startup options when you run the server, you can indicate them on the command line or place them in an option file. For options that are used every time the server starts, you may find it most convenient to use an option file to specify your MySQL configuration. This is particularly true under the following circumstances:

- The installation or data directory locations are different from the default locations (C:\Program Files\MySQL\MySQL Server 5.6 and C:\Program Files\MySQL\MySQL Server 5.6\data).
- You need to tune the server settings, such as memory, cache, or InnoDB configuration information.

When the MySQL server starts on Windows, it looks for option files in several locations, such as the Windows directory, C:\, and the MySQL installation directory (for the full list of locations, see Using Option Files). The Windows directory typically is named something like C:\WINDOWS. You can determine its exact location from the value of the WINDIR environment variable using the following command:
MySQL looks for options in each location first in the `my.ini` file, and then in the `my.cnf` file. However, to avoid confusion, it is best if you use only one file. If your PC uses a boot loader where `C:` is not the boot drive, your only option is to use the `my.ini` file. Whichever option file you use, it must be a plain text file.

**Note**

When using the MySQL Installer to install MySQL Server, it will create the `my.ini` at the default location. And as of MySQL Server 5.5.27, the user running MySQL Installer is granted full permissions to this new `my.ini`.

In other words, be sure that the MySQL Server user has permission to read the `my.ini` file.

You can also make use of the example option files included with your MySQL distribution; see Server Configuration Defaults.

An option file can be created and modified with any text editor, such as Notepad. For example, if MySQL is installed in `E:\mysql` and the data directory is in `E:\mydata\data`, you can create an option file containing a `[mysqld]` section to specify values for the `basedir` and `datadir` options:

```
[mysqld]
# set basedir to your installation path
basedir=E:/mysql
# set datadir to the location of your data directory
datadir=E:/mydata/data
```

Microsoft Windows path names are specified in option files using (forward) slashes rather than backslashes. If you do use backslashes, double them:

```
[mysqld]
# set basedir to your installation path
basedir=E:\mysql
# set datadir to the location of your data directory
datadir=E:\mydata\data
```

The rules for use of backslash in option file values are given in Using Option Files.

The data directory is located within the AppData directory for the user running MySQL.

If you would like to use a data directory in a different location, you should copy the entire contents of the `data` directory to the new location. For example, if you want to use `E:\mydata` as the data directory instead, you must do two things:

1. Move the entire `data` directory and all of its contents from the default location (for example `C:\Program Files\MySQL\MySQL Server 5.6\data`) to `E:\mydata`.
2. Use a `--datadir` option to specify the new data directory location each time you start the server.

### 5.4.3 Selecting a MySQL Server Type

The following table shows the available servers for Windows in MySQL 5.6.

<table>
<thead>
<tr>
<th>Binary</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>mysqld</td>
<td>Optimized binary with named-pipe support</td>
</tr>
<tr>
<td>mysqld-debug</td>
<td>Like <code>mysqld</code>, but compiled with full debugging and automatic memory allocation checking</td>
</tr>
</tbody>
</table>
All of the preceding binaries are optimized for modern Intel processors, but should work on any Intel i386-class or higher processor.

Each of the servers in a distribution support the same set of storage engines. The `SHOW ENGINES` statement displays which engines a given server supports.

All Windows MySQL 5.6 servers have support for symbolic linking of database directories.

MySQL supports TCP/IP on all Windows platforms. MySQL servers on Windows also support named pipes, if you start the server with the `named_pipe` system variable enabled. It is necessary to enable this variable explicitly because some users have experienced problems with shutting down the MySQL server when named pipes were used. The default is to use TCP/IP regardless of platform because named pipes are slower than TCP/IP in many Windows configurations.

### 5.4.4 Starting the Server for the First Time

This section gives a general overview of starting the MySQL server. The following sections provide more specific information for starting the MySQL server from the command line or as a Windows service.

The information here applies primarily if you installed MySQL using the `noinstall` version, or if you wish to configure and test MySQL manually rather than with the GUI tools.

**Note**

MySQL server will automatically start after using MySQL Installer, and MySQL Notifier can be used to start/stop/restart at any time.

The examples in these sections assume that MySQL is installed under the default location of `C:\Program Files\MySQL\MySQL Server 5.6`. Adjust the path names shown in the examples if you have MySQL installed in a different location.

Clients have two options. They can use TCP/IP, or they can use a named pipe if the server supports named-pipe connections.

MySQL for Windows also supports shared-memory connections if the server is started with the `shared_memory` system variable enabled. Clients can connect through shared memory by using the `--protocol=MEMORY` option.

For information about which server binary to run, see Section 5.4.3, “Selecting a MySQL Server Type”.

Testing is best done from a command prompt in a console window (or “DOS window”). In this way you can have the server display status messages in the window where they are easy to see. If something is wrong with your configuration, these messages make it easier for you to identify and fix any problems.

To start the server, enter this command:

```
C:\> "C:\Program Files\MySQL\MySQL Server 5.6\bin\mysqld" --console
```

For a server that includes InnoDB support, you should see the messages similar to those following as it starts (the path names and sizes may differ):

```
InnoDB: The first specified datafile c:\ibdata\ibdata1 did not exist:
InnoDB: a new database to be created!
InnoDB: Setting file c:\ibdata\ibdata1 size to 209715200
InnoDB: Database physically writes the file full: wait...
InnoDB: Log file c:\iblogs\ib_logfile0 did not exist: new to be created
InnoDB: Setting log file c:\iblogs\ib_logfile0 size to 31457280
InnoDB: Log file c:\iblogs\ib_logfile1 did not exist: new to be created
InnoDB: Setting log file c:\iblogs\ib_logfile1 size to 31457280
```
InnoDB: Log file c:\iblogs\ib_logfile2 did not exist: new to be created
InnoDB: Setting log file c:\iblogs\ib_logfile2 size to 31457280
InnoDB: Doublewrite buffer not found: creating new
InnoDB: Doublewrite buffer created
InnoDB: creating foreign key constraint system tables
InnoDB: foreign key constraint system tables created
011024 10:58:25 InnoDB: Started

When the server finishes its startup sequence, you should see something like this, which indicates that the server is ready to service client connections:

mysqld: ready for connections
Version: '5.6.49' socket: '' port: 3306

The server continues to write to the console any further diagnostic output it produces. You can open a new console window in which to run client programs.

If you omit the --console option, the server writes diagnostic output to the error log in the data directory (C:\Program Files\MySQL\MySQL Server 5.6\data by default). The error log is the file with the .err extension, and may be set using the --log-error option.

**Note**
The accounts that are listed in the MySQL grant tables initially have no passwords. After starting the server, you should set up passwords for them using the instructions in Section 9.4, “Securing the Initial MySQL Accounts”.

### 5.4.5 Starting MySQL from the Windows Command Line

The MySQL server can be started manually from the command line. This can be done on any version of Windows.

**Note**
MySQL Notifier can also be used to start/stop/restart the MySQL server.

To start the mysqld server from the command line, you should start a console window (or “DOS window”) and enter this command:

C:\> "C:\Program Files\MySQL\MySQL Server 5.6\bin\mysqld"

The path to mysqld may vary depending on the install location of MySQL on your system.

You can stop the MySQL server by executing this command:

C:\> "C:\Program Files\MySQL\MySQL Server 5.6\bin\mysqladmin" -u root shutdown

**Note**
If the MySQL root user account has a password, you need to invoke mysqladmin with the -p option and supply the password when prompted.

This command invokes the MySQL administrative utility mysqladmin to connect to the server and tell it to shut down. The command connects as the MySQL root user, which is the default administrative account in the MySQL grant system.

**Note**
Users in the MySQL grant system are wholly independent from any operating system users under Microsoft Windows.
If `mysqld` doesn't start, check the error log to see whether the server wrote any messages there to indicate the cause of the problem. By default, the error log is located in the `C:\Program Files\MySQL\MySQL Server 5.6\data` directory. It is the file with a suffix of `.err`, or may be specified by passing in the `--log-error` option. Alternatively, you can try to start the server with the `--console` option; in this case, the server may display some useful information on the screen that will help solve the problem.

The last option is to start `mysqld` with the `--standalone` and `--debug` options. In this case, `mysqld` writes a log file `C:\mysqld.trace` that should contain the reason why `mysqld` doesn't start. See The DBUG Package.

Use `mysqld --verbose --help` to display all the options that `mysqld` supports.

### 5.4.6 Customizing the PATH for MySQL Tools

#### Warning

You must exercise great care when editing your system PATH by hand; accidental deletion or modification of any portion of the existing PATH value can leave you with a malfunctioning or even unusable system.

To make it easier to invoke MySQL programs, you can add the path name of the MySQL bin directory to your Windows system PATH environment variable:

- On the Windows desktop, right-click the My Computer icon, and select Properties.
- Next select the Advanced tab from the System Properties menu that appears, and click the Environment Variables button.
- Under System Variables, select Path, and then click the Edit button. The Edit System Variable dialogue should appear.
- Place your cursor at the end of the text appearing in the space marked Variable Value. (Use the End key to ensure that your cursor is positioned at the very end of the text in this space.) Then enter the complete path name of your MySQL bin directory (for example, `C:\Program Files\MySQL\MySQL Server 5.6\bin`).

#### Note

There must be a semicolon separating this path from any values present in this field.

Dismiss this dialogue, and each dialogue in turn, by clicking OK until all of the dialogues that were opened have been dismissed. The new PATH value should now be available to any new command shell you open, allowing you to invoke any MySQL executable program by typing its name at the DOS prompt from any directory on the system, without having to supply the path. This includes the servers, the mysql client, and all MySQL command-line utilities such as mysqldadmin and mysqldump.

You should not add the MySQL bin directory to your Windows PATH if you are running multiple MySQL servers on the same machine.

### 5.4.7 Starting MySQL as a Windows Service

On Windows, the recommended way to run MySQL is to install it as a Windows service, so that MySQL starts and stops automatically when Windows starts and stops. A MySQL server installed as a service can also be controlled from the command line using NET commands, or with the graphical Services utility.
Generally, to install MySQL as a Windows service you should be logged in using an account that has administrator rights.

Note

MySQL Notifier can also be used to monitor the status of the MySQL service.

The Services utility (the Windows Service Control Manager) can be found in the Windows Control Panel. To avoid conflicts, it is advisable to close the Services utility while performing server installation or removal operations from the command line.

Installing the service

Before installing MySQL as a Windows service, you should first stop the current server if it is running by using the following command:

C:\> "C:\Program Files\MySQL\MySQL Server 5.6\bin\mysqladmin" -u root shutdown

Note

If the MySQL root user account has a password, you need to invoke mysqladmin with the -p option and supply the password when prompted.

This command invokes the MySQL administrative utility mysqladmin to connect to the server and tell it to shut down. The command connects as the MySQL root user, which is the default administrative account in the MySQL grant system.

Note

Users in the MySQL grant system are wholly independent from any operating system users under Windows.

Install the server as a service using this command:

C:\> "C:\Program Files\MySQL\MySQL Server 5.6\bin\mysqld" --install

The service-installation command does not start the server. Instructions for that are given later in this section.

To make it easier to invoke MySQL programs, you can add the path name of the MySQL bin directory to your Windows system PATH environment variable:

- On the Windows desktop, right-click the My Computer icon, and select Properties.

- Next select the Advanced tab from the System Properties menu that appears, and click the Environment Variables button.

- Under System Variables, select Path, and then click the Edit button. The Edit System Variable dialogue should appear.

- Place your cursor at the end of the text appearing in the space marked Variable Value. (Use the End key to ensure that your cursor is positioned at the very end of the text in this space.) Then enter the complete path name of your MySQL bin directory (for example, C:\Program Files\MySQL\MySQL Server 5.6\bin), and there should be a semicolon separating this path from any values present in this field. Dismiss this dialogue, and each dialogue in turn, by clicking OK until all of the dialogues that were opened have been dismissed. You should now be able to invoke any MySQL executable.
program by typing its name at the DOS prompt from any directory on the system, without having to supply the path. This includes the servers, the `mysql` client, and all MySQL command-line utilities such as `mysqladmin` and `mysqldump`.

You should not add the MySQL `bin` directory to your Windows `PATH` if you are running multiple MySQL servers on the same machine.

**Warning**

You must exercise great care when editing your system `PATH` by hand; accidental deletion or modification of any portion of the existing `PATH` value can leave you with a malfunctioning or even unusable system.

The following additional arguments can be used when installing the service:

- You can specify a service name immediately following the `--install` option. The default service name is `MySQL`.

- If a service name is given, it can be followed by a single option. By convention, this should be `--defaults-file=file_name` to specify the name of an option file from which the server should read options when it starts.

  The use of a single option other than `--defaults-file` is possible but discouraged. `--defaults-file` is more flexible because it enables you to specify multiple startup options for the server by placing them in the named option file.

- You can also specify a `--local-service` option following the service name. This causes the server to run using the `LocalService` Windows account that has limited system privileges. If both `--defaults-file` and `--local-service` are given following the service name, they can be in any order.

For a MySQL server that is installed as a Windows service, the following rules determine the service name and option files that the server uses:

- If the service-installation command specifies no service name or the default service name (`MySQL`) following the `--install` option, the server uses the service name of `MySQL` and reads options from the `[mysqld]` group in the standard option files.

- If the service-installation command specifies a service name other than `MySQL` following the `--install` option, the server uses that service name. It reads options from the `[mysqld]` group and the group that has the same name as the service in the standard option files. This enables you to use the `[mysqld]` group for options that should be used by all MySQL services, and an option group with the service name for use by the server installed with that service name.

- If the service-installation command specifies a `--defaults-file` option after the service name, the server reads options the same way as described in the previous item, except that it reads options only from the named file and ignores the standard option files.

As a more complex example, consider the following command:

```bash
C:\> "C:\Program Files\MySQL\MySQL Server 5.6\bin\mysqld"
     --install MySQL --defaults-file=C:\my-opts.cnf
```

Here, the default service name (`MySQL`) is given after the `--install` option. If no `--defaults-file` option had been given, this command would have the effect of causing the server to read the `[mysqld]` group from the standard option files. However, because the `--defaults-file` option is present, the server reads options from the `[mysqld]` option group, and only from the named file.
Starting MySQL as a Windows Service

Note

On Windows, if the server is started with the --defaults-file and --install options, --install must be first. Otherwise, mysqld.exe will attempt to start the MySQL server.

You can also specify options as Start parameters in the Windows Services utility before you start the MySQL service.

Finally, before trying to start the MySQL service, make sure the user variables %TEMP% and %TMP% (and also %TMPDIR%, if it has ever been set) for the operating system user who is to run the service are pointing to a folder to which the user has write access. The default user for running the MySQL service is LocalSystem, and the default value for its %TEMP% and %TMP% is C:\Windows\Temp, a directory LocalSystem has write access to by default. However, if there are any changes to that default setup (for example, changes to the user who runs the service or to the mentioned user variables, or the --tmpdir option has been used to put the temporary directory somewhere else), the MySQL service might fail to run because write access to the temporary directory has not been granted to the proper user.

Starting the service

After a MySQL server instance has been installed as a service, Windows starts the service automatically whenever Windows starts. The service also can be started immediately from the Services utility, or by using an sc start mysql_service_name or NET START mysql_service_name command. SC and NET commands are not case-sensitive.

When run as a service, mysqld has no access to a console window, so no messages can be seen there. If mysqld does not start, check the error log to see whether the server wrote any messages there to indicate the cause of the problem. The error log is located in the MySQL data directory (for example, C:\Program Files\MySQL\MySQL Server 5.6\data). It is the file with a suffix of .err.

When a MySQL server has been installed as a service, and the service is running, Windows stops the service automatically when Windows shuts down. The server also can be stopped manually using the Services utility, the sc stop mysql_service_name command, the NET START mysql_service_name command, or the mysqladmin shutdown command.

You also have the choice of installing the server as a manual service if you do not wish for the service to be started automatically during the boot process. To do this, use the --install-manual option rather than the --install option:

C:\> "C:\Program Files\MySQL\MySQL Server 5.6\bin\mysqld" --install-manual

Removing the service

To remove a server that is installed as a service, first stop it if it is running by executing SC STOP mysql_service_name or NET STOP mysql_service_name. Then use SC DELETE mysql_service_name to remove it:

C:\> SC DELETE mysql

Alternatively, use the mysqld --remove option to remove the service.

C:\> "C:\Program Files\MySQL\MySQL Server 5.6\bin\mysqld" --remove

If mysqld is not running as a service, you can start it from the command line. For instructions, see Section 5.4.5, "Starting MySQL from the Windows Command Line".
If you encounter difficulties during installation, see Section 5.5, “Troubleshooting a Microsoft Windows MySQL Server Installation”.

For more information about stopping or removing a Windows service, see Starting Multiple MySQL Instances as Windows Services.

5.4.8 Testing The MySQL Installation

You can test whether the MySQL server is working by executing any of the following commands:

C:\> "C:\Program Files\MySQL\MySQL Server 5.6\bin\mysqlshow"
C:\> "C:\Program Files\MySQL\MySQL Server 5.6\bin\mysqlshow" -u root mysql
C:\> "C:\Program Files\MySQL\MySQL Server 5.6\bin\mysqladmin" version status proc
C:\> "C:\Program Files\MySQL\MySQL Server 5.6\bin\mysql" test

If mysqld is slow to respond to TCP/IP connections from client programs, there is probably a problem with your DNS. In this case, start mysqld with the skip_name_resolve system variable enabled and use only localhost and IP addresses in the Host column of the MySQL grant tables. (Be sure that an account exists that specifies an IP address or you may not be able to connect.)

You can force a MySQL client to use a named-pipe connection rather than TCP/IP by specifying the --pipe or --protocol=PIPE option, or by specifying . (period) as the host name. Use the --socket option to specify the name of the pipe if you do not want to use the default pipe name.

If you have set a password for the root account, deleted the anonymous account, or created a new user account, then to connect to the MySQL server you must use the appropriate -u and -p options with the commands shown previously. See Connecting to the MySQL Server Using Command Options.

For more information about mysqlshow, see mysqlshow — Display Database, Table, and Column Information.

5.5 Troubleshooting a Microsoft Windows MySQL Server Installation

When installing and running MySQL for the first time, you may encounter certain errors that prevent the MySQL server from starting. This section helps you diagnose and correct some of these errors.

Your first resource when troubleshooting server issues is the error log. The MySQL server uses the error log to record information relevant to the error that prevents the server from starting. The error log is located in the data directory specified in your my.ini file. The default data directory location is C:\Program Files\MySQL\MySQL Server 5.6\data, or C:\ProgramData\Mysql on Windows 7 and Windows Server 2008. The C:\ProgramData directory is hidden by default. You need to change your folder options to see the directory and contents. For more information on the error log and understanding the content, see The Error Log.

For information regarding possible errors, also consult the console messages displayed when the MySQL service is starting. Use the SC_START mysqld_service_name or NET_START mysqld_service_name command from the command line after installing mysqld as a service to see any error messages regarding the starting of the MySQL server as a service. See Section 5.4.7, “Starting MySQL as a Windows Service”.

The following examples show other common error messages you might encounter when installing MySQL and starting the server for the first time:

• If the MySQL server cannot find the mysql privileges database or other critical files, it displays these messages:
Troubleshooting a Microsoft Windows MySQL Server Installation

System error 1067 has occurred.
Fatal error: Can't open and lock privilege tables:
Table 'mysql.user' doesn't exist

These messages often occur when the MySQL base or data directories are installed in different locations than the default locations (C:\Program Files\MySQL\MySQL Server 5.6 and C:\Program Files\MySQL\MySQL Server 5.6\data, respectively).

This situation can occur when MySQL is upgraded and installed to a new location, but the configuration file is not updated to reflect the new location. In addition, old and new configuration files might conflict. Be sure to delete or rename any old configuration files when upgrading MySQL.

If you have installed MySQL to a directory other than C:\Program Files\MySQL\MySQL Server 5.6, ensure that the MySQL server is aware of this through the use of a configuration (my.ini) file. Put the my.ini file in your Windows directory, typically C:\WINDOWS. To determine its exact location from the value of the WINDIR environment variable, issue the following command from the command prompt:

C:\> echo %WINDIR%

You can create or modify an option file with any text editor, such as Notepad. For example, if MySQL is installed in E:\mysql and the data directory is D:\MySQLdata, you can create the option file and set up a [mysqld] section to specify values for the basedir and datadir options:

```
[mysqld]
# set basedir to your installation path
basedir=E:/mysql
# set datadir to the location of your data directory
datadir=D:/MySQLdata
```

Microsoft Windows path names are specified in option files using (forward) slashes rather than backslashes. If you do use backslashes, double them:

```
[mysqld]
# set basedir to your installation path
basedir=C:\\Program Files\\MySQL\\MySQL Server 5.6
# set datadir to the location of your data directory
datadir=D:\\MySQLdata
```

The rules for use of backslash in option file values are given in Using Option Files.

If you change the datadir value in your MySQL configuration file, you must move the contents of the existing MySQL data directory before restarting the MySQL server.

See Section 5.4.2, “Creating an Option File”.

• If you reinstall or upgrade MySQL without first stopping and removing the existing MySQL service and install MySQL using the MySQL Installer, you might see this error:

```
Error: Cannot create Windows service for MySql. Error: 0
```

This occurs when the Configuration Wizard tries to install the service and finds an existing service with the same name.

One solution to this problem is to choose a service name other than mysql when using the configuration wizard. This enables the new service to be installed correctly, but leaves the outdated service in place. Although this is harmless, it is best to remove old services that are no longer in use.

To permanently remove the old mysql service, execute the following command as a user with administrative privileges, on the command line:
If the `SC` utility is not available for your version of Windows, download the `delsrv` utility from [http://www.microsoft.com/windows2000/techinfo/reskit/tools/existing/delsrv-o.asp](http://www.microsoft.com/windows2000/techinfo/reskit/tools/existing/delsrv-o.asp) and use the `delsrv mysql` syntax.

### 5.6 Windows Postinstallation Procedures

GUI tools exist that perform most of the tasks described in this section, including:

- **MySQL Installer**: Used to install and upgrade MySQL products.
- **MySQL Workbench**: Manages the MySQL server and edits SQL statements.
- **MySQL Notifier**: Starts, stops, or restarts the MySQL server, and monitors its status.
- **MySQL for Excel**: Edits MySQL data with Microsoft Excel.

On Windows, you need not create the data directory and the grant tables. MySQL distributions for Windows include the grant tables with a set of preinitialized accounts in the `mysql` database under the data directory.

Regarding passwords, if you installed MySQL using the MySQL Installer, you may have already assigned passwords to the accounts. (See Section 5.3, “MySQL Installer for Windows”.) Otherwise, use the password-assignment procedure given in Section 9.4, “Securing the Initial MySQL Accounts”.

Before assigning passwords, you might want to try running some client programs to make sure that you can connect to the server and that it is operating properly. Make sure that the server is running (see Section 5.4.4, “Starting the Server for the First Time”). You can also set up a MySQL service that runs automatically when Windows starts (see Section 5.4.7, “Starting MySQL as a Windows Service”).

These instructions assume that your current location is the MySQL installation directory and that it has a `bin` subdirectory containing the MySQL programs used here. If that is not true, adjust the command path names accordingly.

If you installed MySQL using MySQL Installer (see Section 5.3, “MySQL Installer for Windows”), the default installation directory is `C:\Program Files\MySQL\MySQL Server 5.6`:

```
C:\> cd "C:\Program Files\MySQL\MySQL Server 5.6"
```

A common installation location for installation from a ZIP archive is `C:\mysql`:

```
C:\> cd C:\mysql
```

Alternatively, add the `bin` directory to your `PATH` environment variable setting. That enables your command interpreter to find MySQL programs properly, so that you can run a program by typing only its name, not its path name. See Section 5.4.6, “Customizing the PATH for MySQL Tools”.

With the server running, issue the following commands to verify that you can retrieve information from the server. The output should be similar to that shown here.

Use `mysqlshow` to see what databases exist:

```
C:\> bin\mysqlshow
+--------------------+
```
The list of installed databases may vary, but will always include the minimum of `mysql` and `information_schema`.

The preceding command (and commands for other MySQL programs such as `mysql`) may not work if the correct MySQL account does not exist. For example, the program may fail with an error, or you may not be able to view all databases. If you installed MySQL using MySQL Installer, the `root` user will have been created automatically with the password you supplied. In this case, you should use the `-u root` and `-p` options. (You must use those options if you have already secured the initial MySQL accounts.) With `-p`, the client program prompts for the `root` password. For example:

```sql
C:\> bin\mysqlshow -u root -p
Enter password: (enter root password here)
```

If you specify a database name, `mysqlshow` displays a list of the tables within the database:

```sql
C:\> bin\mysqlshow mysql
Database: mysql
```

```
<table>
<thead>
<tr>
<th>Tables</th>
</tr>
</thead>
<tbody>
<tr>
<td>columns_priv</td>
</tr>
<tr>
<td>db</td>
</tr>
<tr>
<td>event</td>
</tr>
<tr>
<td>func</td>
</tr>
<tr>
<td>general_log</td>
</tr>
<tr>
<td>help_category</td>
</tr>
<tr>
<td>help_keyword</td>
</tr>
<tr>
<td>help_relation</td>
</tr>
<tr>
<td>help_topic</td>
</tr>
<tr>
<td>innodb_index_stats</td>
</tr>
<tr>
<td>innodb_table_stats</td>
</tr>
<tr>
<td>ndb_binlog_index</td>
</tr>
<tr>
<td>plugin</td>
</tr>
<tr>
<td>proc</td>
</tr>
<tr>
<td>procs_priv</td>
</tr>
<tr>
<td>proxies_priv</td>
</tr>
<tr>
<td>servers</td>
</tr>
<tr>
<td>slave_master_info</td>
</tr>
<tr>
<td>slave_relay_log_info</td>
</tr>
<tr>
<td>slave_worker_info</td>
</tr>
<tr>
<td>slow_log</td>
</tr>
<tr>
<td>tables_priv</td>
</tr>
<tr>
<td>time_zone</td>
</tr>
<tr>
<td>time_zone_leap_second</td>
</tr>
<tr>
<td>time_zone_name</td>
</tr>
<tr>
<td>time_zone_transition</td>
</tr>
<tr>
<td>time_zone_transition_type</td>
</tr>
<tr>
<td>user</td>
</tr>
</tbody>
</table>
```
Use the `mysql` program to select information from a table in the `mysql` database:

```
C:\> bin\mysql -e "SELECT User, Host, plugin FROM mysql.user" mysql
+------+-----------+-----------------------+------------------|
| User | Host      | plugin                |
| root | localhost | mysql_native_password |
```

For more information about `mysql` and `mysqlshow`, see `mysql — The MySQL Command-Line Client`, and `mysqlshow — Display Database, Table, and Column Information`.

### 5.7 Windows Platform Restrictions

The following restrictions apply to use of MySQL on the Windows platform:

- **Process memory**

  On Windows 32-bit platforms, it is not possible by default to use more than 2GB of RAM within a single process, including MySQL. This is because the physical address limit on Windows 32-bit is 4GB and the default setting within Windows is to split the virtual address space between kernel (2GB) and user/applications (2GB).

  Some versions of Windows have a boot time setting to enable larger applications by reducing the kernel application. Alternatively, to use more than 2GB, use a 64-bit version of Windows.

- **File system aliases**

  When using MyISAM tables, you cannot use aliases within Windows link to the data files on another volume and then link back to the main MySQL `datadir` location.

  This facility is often used to move the data and index files to a RAID or other fast solution, while retaining the main `.frm` files in the default data directory configured with the `datadir` option.

- **Limited number of ports**

  Windows systems have about 4,000 ports available for client connections, and after a connection on a port closes, it takes two to four minutes before the port can be reused. In situations where clients connect to and disconnect from the server at a high rate, it is possible for all available ports to be used up before closed ports become available again. If this happens, the MySQL server appears to be unresponsive even though it is running. Ports may be used by other applications running on the machine as well, in which case the number of ports available to MySQL is lower.

  For more information about this problem, see [http://support.microsoft.com/default.aspx?scid=kb;en-us;196271](http://support.microsoft.com/default.aspx?scid=kb;en-us;196271).

- **DATA DIRECTORY and INDEX DIRECTORY**

  The `DATA DIRECTORY` clause of the `CREATE TABLE` statement is supported on Windows for InnoDB tables only, as described in Creating Tables Externally. For MyISAM and other storage engines, the `DATA DIRECTORY` and `INDEX DIRECTORY` clauses for `CREATE TABLE` are ignored on Windows and any other platforms with a nonfunctional `realpath()` call.

- **DROP DATABASE**

  You cannot drop a database that is in use by another session.

- **Case-insensitive names**
Windows Platform Restrictions

File names are not case-sensitive on Windows, so MySQL database and table names are also not case-sensitive on Windows. The only restriction is that database and table names must be specified using the same case throughout a given statement. See Identifier Case Sensitivity.

• Directory and file names

On Windows, MySQL Server supports only directory and file names that are compatible with the current ANSI code pages. For example, the following Japanese directory name will not work in the Western locale (code page 1252):

```
datadir="C:/私たちのプロジェクトのデータ"
```

The same limitation applies to directory and file names referred to in SQL statements, such as the data file path name in `LOAD DATA`.

• The `\` path name separator character

Path name components in Windows are separated by the `\` character, which is also the escape character in MySQL. If you are using `LOAD DATA` or `SELECT ... INTO OUTFILE`, use Unix-style file names with `/` characters:

```
mysql> LOAD DATA INFILE 'C:/tmp/skr.txt' INTO TABLE skr;
mysql> SELECT * INTO OUTFILE 'C:/tmp/skr.txt' FROM skr;
```

Alternatively, you must double the `\` character:

```
mysql> LOAD DATA INFILE 'C:\tmp\skr.txt' INTO TABLE skr;
mysql> SELECT * INTO OUTFILE 'C:\tmp\skr.txt' FROM skr;
```

• Problems with pipes

Pipes do not work reliably from the Windows command-line prompt. If the pipe includes the character `^Z / CHAR(24)`, Windows thinks that it has encountered end-of-file and aborts the program.

This is mainly a problem when you try to apply a binary log as follows:

```
C:\> mysqlbinlog binary_log_file | mysql --user=root
```

If you have a problem applying the log and suspect that it is because of a `^Z / CHAR(24)` character, you can use the following workaround:

```
C:\> mysqlbinlog binary_log_file --result-file=/tmp/bin.sql
C:\> mysql --user=root --execute "source /tmp/bin.sql"
```

The latter command also can be used to reliably read any SQL file that may contain binary data.
# Chapter 6 Installing MySQL on OS X

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For a list of OS X versions that the MySQL server supports, see [https://www.mysql.com/support/supportedplatforms/database.html](https://www.mysql.com/support/supportedplatforms/database.html).

MySQL for OS X is available in a number of different forms:

- **Native Package Installer**, which uses the native OS X installer (DMG) to walk you through the installation of MySQL. For more information, see Section 6.2, "Installing MySQL on OS X Using Native Packages". You can use the package installer with OS X. The user you use to perform the installation must have administrator privileges.

- **Compressed TAR archive**, which uses a file packaged using the Unix `tar` and `gzip` commands. To use this method, you will need to open a Terminal window. You do not need administrator privileges using this method, as you can install the MySQL server anywhere using this method. For more information on using this method, you can use the generic instructions for using a tarball, Chapter 3, *Installing MySQL on Unix/Linux Using Generic Binaries*.

In addition to the core installation, the Package Installer also includes Section 6.3, “Installing a MySQL Launch Daemon” and Section 6.4, “Installing and Using the MySQL Preference Pane”, both of which simplify the management of your installation.

For additional information on using MySQL on OS X, see Section 6.1, “General Notes on Installing MySQL on OS X”.

## 6.1 General Notes on Installing MySQL on OS X

You should keep the following issues and notes in mind:

- As of MySQL server 5.6.26, the DMG bundles a launchd daemon instead of the deprecated startup item. Startup items do not function as of OS X 10.10 (Yosemite), so using launchd is preferred. The available MySQL preference pane under OS X **System Preferences** was also updated to use launchd.

- You may need (or want) to create a specific `mysql` user to own the MySQL directory and data. You can do this through the Directory Utility, and the `mysql` user should already exist. For use in single user mode, an entry for `_mysql` (note the underscore prefix) should already exist within the system `/etc/passwd` file.

- Because the MySQL package installer installs the MySQL contents into a version and platform specific directory, you can use this to upgrade and migrate your database between versions. You will need to either copy the `data` directory from the old version to the new version, or alternatively specify an alternative `datadir` value to set location of the data directory. By default, the MySQL directories are installed under `/usr/local/`.

- You might want to add aliases to your shell’s resource file to make it easier to access commonly used programs such as `mysql` and `mysqladmin` from the command line. The syntax for **bash** is:

  ```bash
  alias mysql="/usr/local/mysql/bin/mysql"
  ```
Installing MySQL on OS X Using Native Packages

```bash
alias mysqladmin=/usr/local/mysql/bin/mysqladmin
```

For `tcsh`, use:

```bash
alias mysql /usr/local/mysql/bin/mysql
alias mysqladmin /usr/local/mysql/bin/mysqladmin
```

Even better, add `/usr/local/mysql/bin` to your `PATH` environment variable. You can do this by modifying the appropriate startup file for your shell. For more information, see Invoking MySQL Programs.

- After you have copied over the MySQL database files from the previous installation and have successfully started the new server, you should consider removing the old installation files to save disk space. Additionally, you should also remove older versions of the Package Receipt directories located in `/Library/Receipts/mysql-VERSION.pkg`.
- Prior to OS X 10.7, MySQL server was bundled with OS X Server.

6.2 Installing MySQL on OS X Using Native Packages

**Note**

Before proceeding with the installation, be sure to stop all running MySQL server instances by using either the MySQL Manager Application (on OS X Server), the preference pane, or `mysqladmin shutdown` on the command line.

To install MySQL using the package installer:

1. Download the disk image (.dmg) file (the community version is available here) that contains the MySQL package installer. Double-click the file to mount the disk image and see its contents.

   ![MySQL Package Installer: DMG Contents](image)

2. Double-click the MySQL installer package. It will be named according to the MySQL version and the OS X version you have chosen. For example, if you have downloaded the package for MySQL 5.6.49 and OS X 10.8, double-click `mysql-5.6.49-osx-10.8-x86_64.pkg`.

3. You will be presented with the opening installer dialog. Click Continue to begin installation.
4. If you have downloaded the community version of MySQL, you will be shown a copy of the relevant GNU General Public License. Click Continue and then Agree to continue.
5. From the **Installation Type** page you can either click **Install** to execute the installation wizard using all defaults, click **Customize** to alter which components to install (MySQL server, Preference Pane, Launchd Support -- all enabled by default).

**Note**

Although the **Change Install Location** option is visible, the installation location cannot be changed.

**Figure 6.3 MySQL Package Installer: Installation Type**
6. Click **Install** to begin the installation process.
7. Once the installation has been completed successfully, you will be shown an **Install Succeeded** message with a short summary. Now, **Close** the wizard and begin using the MySQL server.

**Figure 6.5 MySQL Package Installer: Summary**

MySQL server is now installed, but it is not loaded (or started) by default. Use either launchctl from the command line, or start MySQL by clicking "Start" using the MySQL preference pane. For additional information, see Section 6.3, “Installing a MySQL Launch Daemon”, and Section 6.4, “Installing and Using the MySQL Preference Pane”. Use the MySQL Preference Pane or launchd to configure MySQL to automatically start at bootup.

When installing using the package installer, the files are installed into a directory within `/usr/local` matching the name of the installation version and platform. For example, the installer file `mysql-5.6.49-osx10.8-x86_64.dmg` installs MySQL into `/usr/local/mysql-5.6.49-osx10.8-x86_64/`. The following table shows the layout of the installation directory.

**Table 6.1 MySQL Installation Layout on OS X**

<table>
<thead>
<tr>
<th>Directory</th>
<th>Contents of Directory</th>
</tr>
</thead>
<tbody>
<tr>
<td>bin, scripts</td>
<td>MySQL server, client and utility programs</td>
</tr>
<tr>
<td>data</td>
<td>Log files, databases</td>
</tr>
<tr>
<td>docs</td>
<td>Helper documents, like the Release Notes and build information</td>
</tr>
<tr>
<td>include</td>
<td>Include (header) files</td>
</tr>
<tr>
<td>lib</td>
<td>Libraries</td>
</tr>
</tbody>
</table>
Installing a MySQL Launch Daemon

### Directory Contents

<table>
<thead>
<tr>
<th>Directory</th>
<th>Contents of Directory</th>
</tr>
</thead>
<tbody>
<tr>
<td>man</td>
<td>Unix manual pages</td>
</tr>
<tr>
<td>mysql-test</td>
<td>MySQL test suite</td>
</tr>
<tr>
<td>share</td>
<td>Miscellaneous support files, including error messages, sample configuration files, SQL for database installation</td>
</tr>
<tr>
<td>sql-bench</td>
<td>Benchmarks</td>
</tr>
<tr>
<td>support-files</td>
<td>Scripts and sample configuration files</td>
</tr>
<tr>
<td>/tmp/mysql.sock</td>
<td>Location of the MySQL Unix socket</td>
</tr>
</tbody>
</table>

During the package installer process, a symbolic link from `/usr/local/mysql` to the version/platform specific directory created during installation will be created automatically.

### 6.3 Installing a MySQL Launch Daemon

OS X uses launch daemons to automatically start, stop, and manage processes and applications such as MySQL.

**Note**

Before MySQL 5.6.26, the OS X builds installed startup items instead of launchd daemons. However, startup items do not function as of OS X 10.10 (Yosemite). The OS X builds now install launchd daemons.

By default, the installation package (DMG) on OS X installs a launchd file named `/Library/LaunchDaemons/com.oracle.oss.mysql.mysqld.plist` that contains a plist definition similar to:

```xml
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE plist PUBLIC "-//Apple Computer//DTD PLIST 1.0//EN" "http://www.apple.com/DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
  <dict>
    <key>Label</key>             <string>com.oracle.oss.mysql.mysqld</string>
    <key>ProcessType</key>       <string>Interactive</string>
    <key>Disabled</key>          <false/>
    <key>RunAtLoad</key>         <true/>
    <key>KeepAlive</key>         <true/>
    <key>SessionCreate</key>     <true/>
    <key>LaunchOnlyOnce</key>    <false/>
    <key>UserName</key>          <string>_mysql</string>
    <key>GroupName</key>         <string>_mysql</string>
    <key>ExitTimeOut</key>       <integer>600</integer>
    <key>Program</key>           <string>/usr/local/mysql/bin/mysqld</string>
    <key>ProgramArguments</key>  <array>
      <string>/usr/local/mysql/bin/mysqld</string>
      <string>--user=_mysql</string>
      <string>--basedir=/usr/local/mysql</string>
      <string>--datadir=/usr/local/mysql/data</string>
      <string>--plugin-dir=/usr/local/mysql/lib/plugin</string>
      <string>--log-error=/usr/local/mysql/data/mysqld.local.err</string>
      <string>--pid-file=/usr/local/mysql/data/mysqld.local.pid</string>
    </array>
    <key>WorkingDirectory</key>  <string>/usr/local/mysql</string>
  </dict>
</plist>
```
Note

Some users report that adding a plist DOCTYPE declaration causes the launchd operation to fail, despite it passing the lint check. We suspect it's a copy-n-paste error. The md5 checksum of a file containing the above snippet is 60d7963a0bb2994b69b8b9c123db09df.

To enable the launchd service, you can either:

- Click **Start MySQL Server** from the MySQL preference pane.

**Figure 6.6 MySQL Preference Pane: Location**
6.4 Installing and Using the MySQL Preference Pane

The MySQL Installation Package includes a MySQL preference pane that enables you to start, stop, and control automated startup during boot of your MySQL installation.

This preference pane is installed by default, and is listed under your system’s System Preferences window.
Installing and Using the MySQL Preference Pane

Figure 6.8 MySQL Preference Pane: Location

To install the MySQL Preference Pane:

1. Download the disk image (.dmg) file (the community version is available here) that contains the MySQL package installer. Double-click the file to mount the disk image and see its contents.
Note

Before MySQL 5.6.26, OS X packages included the deprecated startup items instead of launchd daemons, and the preference pane managed that instead of launchd.

2. Go through the process of installing the MySQL server, as described in the documentation at Section 6.2, “Installing MySQL on OS X Using Native Packages”. 
3. Click **Customize** at the **Installation Type** step. The “Preference Pane” option is listed there and enabled by default; make sure it is not deselected.

**Figure 6.10 MySQL Installer on OS X: Customize**

![MySQL Installer on OS X: Customize](image)

4. Complete the MySQL server installation process.

**Note**

The MySQL preference pane only starts and stops MySQL installation installed from the MySQL package installation that have been installed in the default location.

Once the MySQL preference pane has been installed, you can control your MySQL server instance using the preference pane. To use the preference pane, open the **System Preferences...** from the Apple menu. Select the MySQL preference pane by clicking the MySQL icon within the preference panes list.
Figure 6.11 MySQL Preference Pane: Location
The MySQL Preference Pane shows the current status of the MySQL server, showing **stopped** (in red) if the server is not running and **running** (in green) if the server has already been started. The preference pane also shows the current setting for whether the MySQL server has been set to start automatically.

- **To start the MySQL server using the preference pane:**
  
  Click **Start MySQL Server**. You may be prompted for the username and password of a user with administrator privileges to start the MySQL server.

- **To stop the MySQL server using the preference pane:**
  
  Click **Stop MySQL Server**. You may be prompted for the username and password of a user with administrator privileges to stop the MySQL server.

- **To automatically start the MySQL server when the system boots:**
  
  Check the check box next to **Automatically Start MySQL Server on Startup**.

- **To disable automatic MySQL server startup when the system boots:**
  
  Uncheck the check box next to **Automatically Start MySQL Server on Startup**.

You can close the **System Preferences...** window once you have completed your settings.
Chapter 7 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 7.1 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 7.7, “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
7.1 Installing MySQL on Linux Using the MySQL Yum Repository

The MySQL Yum repository for Oracle Linux, Red Hat Enterprise Linux, and CentOS 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 Section 10.5, “Upgrading MySQL with the MySQL Yum Repository” or Section 7.2, “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 release of MySQL (from the MySQL 5.7 series currently) 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:


b. Select and download the release package for your platform.

c. 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

The installation command adds the MySQL Yum repository to your system's repository list and downloads the GnuPG key to check the integrity of the software packages. See Section 2.3.2, “Signature Checking Using GnuPG” for details on GnuPG key checking.

You can check that the MySQL Yum repository has been successfully added by the following command:

shell> yum repolist enabled | grep "mysql.*-community.*"
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:

```
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
```

Besides using yum-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:

```
[mysql57-community]
name=MySQL 5.7 Community Server
baseurl=http://repo.mysql.com/yum/mysql-5.7-community/el/6/$basearch/
enabled=1
gpgcheck=1
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-mysql
```

Find the entry for the subrepository you want to configure, and edit the enabled option. Specify enabled=0 to disable a subrepository, or enabled=1 to enable a subrepository. For example, to install MySQL 5.6, make sure you have enabled=0 for the above subrepository entry for MySQL 5.7, and have enabled=1 for the entry for the 5.6 series:

```
# Enable to use MySQL 5.6
[mysql56-community]
name=MySQL 5.6 Community Server
baseurl=http://repo.mysql.com/yum/mysql-5.6-community/el/6/$basearch/
enabled=1
gpgcheck=1
```
Disabling the Default MySQL Module

You should only enable subrepository for one release series at any time. When subrepositories for more than one release series are enabled, the latest series will be used by Yum.

Verify that the correct subrepositories have been enabled and disabled by running the following command and checking its output:

shell> yum repolist enabled | grep mysql

Disabling the Default MySQL Module

(EL8 systems only) EL8-based systems such as RHEL8 and Oracle Linux 8 include a MySQL module that is enabled by default. Unless this module is disabled, it masks packages provided by MySQL repositories. To disable the included module and make the MySQL repository packages visible, use the following command (for dnf-enabled systems, replace `yum` in the command with `dnf`):

shell> sudo yum module disable mysql

Installing MySQL

Install MySQL by the following command:

shell> sudo yum install mysql-community-server

This installs the package for MySQL server (`mysql-community-server`) and also packages for the components required to run the server, including packages for the client (`mysql-community-client`), the common error messages and character sets for client and server (`mysql-community-common`), and the shared client libraries (`mysql-community-libs`).

Starting the MySQL Server

Start the MySQL server with the following command:

shell> sudo service mysqld start

This is a sample output of the above command:

Starting mysqld:[ OK ]

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

shell> sudo service mysqld status

This is a sample output of the above command:

mysqld (pid 3066) is running.

Securing the MySQL Installation

The program `mysql_secure_installation` allows you to perform important operations like setting the root password, removing anonymous users, and so on. Always run it to secure your MySQL installation:

shell> mysql_secure_installation

It is important to remember the root password you set. See `mysql_secure_installation — Improve MySQL Installation Security` for details.
Installing Additional MySQL Products and Components with Yum

For more information on the postinstallation procedures, see Chapter 9, *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:

```
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:

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

For example, to install MySQL Workbench:

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

To install the shared client libraries:

```
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 Section 10.5, “Upgrading MySQL with the MySQL Yum Repository” for details.

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

For supported Yum-based platforms (see Section 7.1, “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:

**Back 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

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 on the system, or a `yum update mysql-server`.

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:

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

This is a sample output for the command:

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

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

This is a sample output for the command:

<table>
<thead>
<tr>
<th>Package Type</th>
<th>Version</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percona-Server-client-55</td>
<td>5.5.39-rel136-0.e16</td>
<td>@percona-release-1386</td>
</tr>
<tr>
<td>Percona-Server-server-55</td>
<td>5.5.39-rel136-0.e16</td>
<td>@percona-release-1386</td>
</tr>
<tr>
<td>Percona-Server-shared-55</td>
<td>5.5.39-rel136-0.e16</td>
<td>@percona-release-1386</td>
</tr>
<tr>
<td>percona-release.noarch</td>
<td>0.1-3</td>
<td>@percona-release-0.1-3.noarch</td>
</tr>
</tbody>
</table>
Uninstalling the Nonnative Third-Party MySQL Distribution of MySQL

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

\texttt{shell> yum --disablerepo=* provides mysql*}

The next step is to stop Yum from receiving packages from the nonnative repository. If the \texttt{yum-config-manager} utility is supported on your platform, you can, for example, use this command for stopping delivery from MariaDB:

\texttt{shell> sudo yum-config-manager --disable mariadb}

And use this command for stopping delivery from Percona:

\texttt{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 \texttt{/etc/yum.repos.d/} directory. This is how the entry typically looks like for MariaDB:

\begin{verbatim}
[mariadb] name = MariaDB baseurl = [base URL for repository] gpgkey = [URL for GPG key] gpgcheck =1
\end{verbatim}

The entry is usually found in the file \texttt{/etc/yum.repos.d/MariaDB.repo} for MariaDB—delete the file, or remove entry from it (or from the file in which you find the entry).

\begin{itemize}
\item \textbf{Note} \\
This step is not necessary for an installation that was configured with a Yum repository release package (like Percona) if you are going to remove the release package (\texttt{percona-release.noarch} for Percona), as shown in the uninstall command for Percona in Step 3 below.
\end{itemize}

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:

\texttt{shell> sudo yum remove MariaDB-common MariaDB-compat MariaDB-server}

For the Percona packages we found in Step 2 above:

\texttt{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 7.1, “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 [115].

7.3 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.

7.4 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.

7.5 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 7.1, “Installing MySQL on Linux Using the MySQL Yum Repository” for details).
  - The MySQL SLES repository (see Section 7.4, “Installing MySQL on Linux Using the MySQL SLES Repository” for details).
- From the MySQL Downloads 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.

There are two kinds of RPM packages for installing MySQL 5.6:

- The older kind: Their package names started with `MYSQL-`. They are available from the MySQL Downloads page in the MySQL Developer Zone. The instructions given in this section are for using these packages.

- The newer kind: Their package names started with `mysql-community-` or `mysql-commercial-`. They are available from the MySQL Yum repository and MySQL SLES repository. If, instead of configuring your system to install these RPM directly from the MySQL repositories (which is recommended), you are downloading the packages from the repositories and then installing them manually in separate steps, use the installation commands given for the MySQL 5.7 RPMs in Installing MySQL on Linux Using RPM Packages from Oracle, but consult this section for information like installation layout, server initialization, root password, and so on.

RPM packages for MySQL are listed in the following tables:

### Table 7.2 RPM Packages for MySQL Community Edition

<table>
<thead>
<tr>
<th>Package Name</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>MySQL-server</td>
<td>Database server and related tools</td>
</tr>
<tr>
<td>MySQL-client</td>
<td>MySQL client applications and tools</td>
</tr>
<tr>
<td>MySQL-devel</td>
<td>Development header files and libraries for MySQL database client applications</td>
</tr>
<tr>
<td>MySQL-shared</td>
<td>Shared libraries for MySQL database client applications</td>
</tr>
<tr>
<td>MySQL-shared-compat</td>
<td>Shared compatibility libraries for previous MySQL installations</td>
</tr>
<tr>
<td>MySQL-embedded</td>
<td>MySQL embedded library</td>
</tr>
<tr>
<td>MySQL-test</td>
<td>Test suite for the MySQL server</td>
</tr>
</tbody>
</table>

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.
Installing MySQL on Linux Using RPM Packages from Oracle

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 7.3 MySQL Linux RPM Package Distribution Identifiers**

<table>
<thead>
<tr>
<th><code>distribution</code> Value</th>
<th>Intended Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>el6, el7</td>
<td>Red Hat Enterprise Linux/Oracle Linux/CentOS 5, 6, or 7</td>
</tr>
<tr>
<td>sles11, sles12</td>
<td>SUSE Linux Enterprise Server 11 or 12</td>
</tr>
<tr>
<td>linux_glibc2.5</td>
<td>Distribution independent; run on any RPM-based Linux distribution</td>
</tr>
</tbody>
</table>

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

```
shell> rpm -qpl MySQL-server-version-distribution-arch.rpm
```

In most cases, you need to install the `MySQL-server` and `MySQL-client` to get a functional, standard MySQL installation. To perform such a standard, minimal installation, go to the folder that contains all those packages (and, preferably, no other RPM packages with similar names), and issue the following command (replace `yum` with `zypper` for SLES systems):

```
shell> yum install MySQL-{server,client}-*
```

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 installing the `MySQL-server` package; issue the following command (replace `yum` with `zypper` for SLES systems):

```
shell> yum install MySQL-client-*
```

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 7.4 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><code>/usr/bin</code></td>
</tr>
<tr>
<td><code>mysqld</code> server</td>
<td><code>/usr/sbin</code></td>
</tr>
<tr>
<td>Data directory</td>
<td><code>/var/lib/mysql</code></td>
</tr>
<tr>
<td>Error log file</td>
<td>For RHEL, Oracle Linux, or CentOS: <code>/var/lib/mysql/host_name.err</code></td>
</tr>
<tr>
<td></td>
<td>For SLES: <code>/var/log/mysql/mysqld.log</code></td>
</tr>
<tr>
<td>System V init script</td>
<td><code>/etc/init.d/mysql</code></td>
</tr>
<tr>
<td>Systemd service</td>
<td><code>mysql</code></td>
</tr>
<tr>
<td>Pid file</td>
<td><code>/var/lib/mysql/host_name.pid</code></td>
</tr>
<tr>
<td>Unix manual pages</td>
<td><code>/usr/share/man</code></td>
</tr>
<tr>
<td>Include (header) files</td>
<td><code>/usr/include/mysql</code></td>
</tr>
</tbody>
</table>
Installing MySQL on Linux Using RPM Packages from Oracle

<table>
<thead>
<tr>
<th>Files or Resources</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Libraries</td>
<td>/usr/lib/mysql</td>
</tr>
<tr>
<td>Socket</td>
<td>/var/lib/mysql/mysql.sock</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.

MySQL is not automatically started at the end of the installation process. Use the following command to start MySQL:

```
shell> service mysql start
```

At the initial start up of the server, the server is initialized if the data directory of the server is empty. `mysql_install_db` is invoked with the `--random-passwords` option, which assigns a random password to the MySQL `root` accounts and sets the "password expired" flag for those accounts. It will be necessary after installation to start the server, connect as `root` using the initial random password, and assign a new `root` password. Until this is done, `root` cannot do anything else. This must be done for each `root` account you intend to use. To change the password, you can use the `SET PASSWORD` statement (for example, with the `mysql` client). You can also use `mysqladmin` or `mysql_secure_installation`. For additional details (including where to find the assigned random `root` password), see `mysql_install_db — Initialize MySQL Data Directory`. (Install operations using RPMs for Unbreakable Linux Network are unaffected because they do not run `mysql_install_db`.)

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.

If something goes wrong during installation, you might find debug information in the error log file `/var/lib/mysql/host_name.err`.

**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` 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-shared` package is replaced with the `MySQL-shared-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-shared-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.

**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 DEBUG Package for the debug options you can use.
Installing MySQL on Linux Using Debian Packages from Oracle

Note

The default plugin directory for debug builds changed from `/usr/lib64/mysql/plugin` to `/usr/lib64/mysql/plugin/debug` in 5.6.39. Previously, it was necessary to change `plugin_dir` to `/usr/lib64/mysql/plugin/debug` for debug builds.

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.

Important

RPMs for NDB Cluster. Standard MySQL server RPMs built by MySQL do not provide support for the `NDBCLUSTER` storage engine. For more information about installing NDB Cluster from RPMs, see NDB Cluster Installation.

7.6 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, supporting Debian and Ubuntu platforms. For details, see Section 7.3, “Installing MySQL on Linux Using the MySQL APT Repository”.

- The MySQL Developer Zone’s Download Area. For details, see Section 2.2, “How to Get MySQL”. The following are some information on the Debian packages available there and the instructions for installing them:

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

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

  • For Debian 7 and 8, and Ubuntu 12, 14, and 15:

    • Various Debian packages are provided in the MySQL Developer Zone for installing different components of MySQL. 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
    ```

    • In general, install the `deb` packages unpacked from the tarball with the command (see explanations below for the extra steps required for installing the server package):

    ```
    shell> sudo dpkg -i package-name.deb
    ```
There are four packages to install:

- The database common files (install this package before the other ones):
  ```
  shell> sudo dpkg -i mysql-common_MVER-DVER_CPU.deb
  ```

- The MySQL server:
  Install first the package for the database common files (see the last bullet), and then pre-configure your server installation by the following command:
  ```
  shell> sudo dpkg-preconfigure mysql-community-server_MVER-DVER_CPU.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. However, it is very important that you set the password soon using the program `mysql_secure_installation`, as people can gain anonymous access to your MySQL server until you have secured the database’s root account with a password.

  Next, install the server package with the following command:
  ```
  shell> sudo dpkg -i mysql-community-server_MVER-DVER_CPU.deb
  ```

- The MySQL client:
  ```
  shell> sudo dpkg -i mysql-community-client_MVER-DVER_CPU.deb
  ```

- The MySQL shared client library:
  ```
  shell> sudo dpkg -i libmysqlclient18_MVER-DVER_CPU.deb
  ```

Here are where the files are installed on the system:

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

- **For Debian 6:**

  - Debian package files directly downloaded from the MySQL Developer Zone have names in the `mysql-MVER-DVER-CPU.deb` format. `MVER` is the MySQL version and `DVER` is the Debian version. The `CPU` value indicates the processor type or family for which the package is built, as shown in the following table:

  **Table 7.6 MySQL Debian 6 Installation Package CPU Identifiers**

<table>
<thead>
<tr>
<th>CPU Value</th>
<th>Intended Processor Type or Family</th>
</tr>
</thead>
<tbody>
<tr>
<td>i686</td>
<td>Pentium processor or better, 32 bit</td>
</tr>
<tr>
<td>x86_64</td>
<td>64-bit x86 processor</td>
</tr>
</tbody>
</table>
7.7 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 7, 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 7.1, “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:

code

```
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
---> Processing Dependency: perl-DBD-MySQL for package: mysql-server-5.1.48-2.fc13.x86_64
--- Running transaction check
--- Package perl-DBD-MySQL.x86_64 0:4.017-1.fc13 set to be updated
```
Installing MySQL on Linux from the Native Software Repositories

---

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`:

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

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

```
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.
Installing MySQL on Linux from the Native Software Repositories

- Debian, Ubuntu, Kubuntu

Note

For Debian, Ubuntu, and Kubuntu, MySQL can be installed using the MySQL APT Repository instead of the platform's native software repository. See Section 7.3, “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):

```
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:
  libmysqlclient15off libmysqlclient16
  mysql-common postfix
Suggested packages:
  libmysqlclient15off libmysqlclient16 libnet-daemon-perl libplrpc-perl mailx
  mysql-common postfix
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.
Setting up mysql-common (5.1.30really5.0.75-0ubuntu10.5) [...
```
* Stopping MySQL database server mysqld
...done.
100825 11:46:15 InnoDB: Started; log sequence number 0 46409
100825 11:46:15 InnoDB: Starting shutdown...
100825 11:46:17 InnoDB: Shutdown completed; log sequence number 0 46409
100825 11:46:17 [Warning] Forcing shutdown of 1 plugins
* Starting MySQL database server mysqld
...done.
* Checking for corrupt, not cleanly closed and upgrade needing tables.
...
Processing triggers for libc6 ...
ldconfig deferred processing now taking place

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.

• **Gentoo Linux**

As a source-based distribution, installing MySQL on Gentoo involves downloading the source, patching the Gentoo specifics, and then compiling the MySQL server and installing it. This process is handled automatically by the **emerge** command.

The MySQL server and client tools are provided within a single package, **dev-db/mysql**. You can obtain a list of the versions available to install by looking at the portage directory for the package:

```
root-shell> ls /usr/portage/dev-db/mysql/mysql-5.6*
mysql-5.6.27.ebuild
mysql-5.6.27-r1.ebuild
```
To install a specific MySQL version, you must specify the entire atom. For example:

```
root-shell> emerge -dev-db/mysql-5.6.27-r1
```

After installation, you should initialize the data directory and set the password for the MySQL root user (see Section 9.1, “Initializing the Data Directory”). Alternatively, use the configuration interface to perform those tasks:

```
root-shell> emerge --config -dev-db/mysql-5.6.27-r1
```

During installation, a sample configuration file is created for you in `/etc/mysql/my.cnf`, and an init script is created in `/etc/init.d/mysql`.

To enable MySQL to start automatically at the normal (default) run levels, use this command:

```
root-shell> rc-update add mysql default
```

---

## 7.8 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.

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

#### Warning

The MySQL Docker images maintained by the MySQL team are built specifically for Linux platforms. Other platforms are not supported, and users using these MySQL Docker images on them are doing so at their own risk. See the discussion [here](#) for some known limitations for running these containers on non-Linux operating systems.

- [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](#)
Basic Steps for MySQL Server Deployment with Docker

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 Server image, run this command:

```bash
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.

You can list downloaded Docker images with this command:

```bash
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>

Starting a MySQL Server Instance

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

```bash
docker run --name=mysql1 -d mysql/mysql-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:

```bash
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: starting)</td>
</tr>
</tbody>
</table>

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:

```bash
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:

```bash
docker logs mysql1 2>&1 | grep GENERATED
```

| GENERATED ROOT PASSWORD: Axegh3kAygDLaRuemecis&ESh0s |

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:

```bash
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:

```sql
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:

```bash
docker exec -it mysql1 bash
```

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
ls /var/lib/mysql
```

**Stopping and Deleting a MySQL Container**

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

```bash
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 (mysql in the case of a MySQL Server container) is stopped, the Docker container stops automatically.

To start the MySQL Server container again:

```bash
docker start mysql1
```

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

```bash
docker restart mysql1
```

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

```bash
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 7.8.2, "More Topics on Deploying MySQL Server with Docker".

**7.8.2 More Topics on Deploying MySQL Server with Docker**

- The Optimized MySQL Installation for Docker
More Topics on Deploying MySQL Server with 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
  - /usr/bin/mysqldump
  - /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 Server:

```
docker run --name mysql1 -d mysql/mysql-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
More Topics on Deploying MySQL Server with Docker

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 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 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 Server container:

```
docker run --name=mysql1 \
```

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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:

```bash
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. For example:

```bash
docker run --name=mysql1 --network=my-custom-net -d mysql/mysql-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:

```bash
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 5.6 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.

• `MYSQL_RANDOM_ROOT_PASSWORD`: When this variable is true (which is its default state, unless `MYSQL_ROOT_PASSWORD` 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 5.6 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=true` and `MYSQL_ONETIME_PASSWORD=true` being both 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=true` and `MYSQL_ONETIME_PASSWORD=true` being both true.

7.8.3 Deploying MySQL on Windows and Other Non-Linux Platforms with Docker

Warning

The MySQL Docker images provided by Oracle are built specifically for Linux platforms. Other platforms are not supported, and users running the MySQL Docker images from Oracle on them are doing so at their own risk. This section discusses some known issues for the images when used on non-Linux platforms.

Known Issues for using the MySQL Server Docker images from Oracle on Windows include:

- If you are bind-mounting on the container’s MySQL data directory (see Persisting Data and Configuration Changes for details), you have to set the location of the server socket file with the `--socket` option to somewhere outside of the MySQL data directory; otherwise, the server will fail to start. This is because the way Docker for Windows handles file mounting does not allow a host file from being bind-mounted on the socket file.

7.9 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/).
Chapter 8 Installing MySQL on Solaris

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Note
MySQL 5.6 supports Solaris 10 (Update 11 and later), and 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 8.1, “Installing MySQL on Solaris Using a Solaris PKG”.

- To use a standard \texttt{tar} binary installation, use the notes provided in Chapter 3, \textit{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.

To obtain a binary MySQL distribution for Solaris in tarball or PKG format, \url{https://dev.mysql.com/downloads/mysql/5.6.html}.

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

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

  \begin{verbatim}
  groupadd mysql
  useradd -g mysql -s /bin/false mysql
  \end{verbatim}

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

  \begin{verbatim}
  pkg install archiver/gnu-tar
  \end{verbatim}

- You should mount any file systems on which you intend to store InnoDB files with the \texttt{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 \texttt{support-files/mysql.server} to \texttt{/etc/init.d} and create a symbolic link to it named \texttt{/etc/rc3.d/S99mysql.server}.

- If too many processes try to connect very rapidly to \texttt{mysqld}, you should see this error in the MySQL log:

  \begin{verbatim}
  Error in accept: Protocol error
  \end{verbatim}

  You might try starting the server with the \texttt{--back_log=50} option as a workaround for this.

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

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

To use this package, download the corresponding `mysql-VERSION-solaris10-PLATFORM.pkg.gz` file, then uncompress it. For example:

```shell
$ gunzip mysql-5.6.49-solaris10-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-5.6.49-solaris10-x86_64.pkg
```

The following packages are available:

<table>
<thead>
<tr>
<th>Package</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>mysql</td>
<td>MySQL Community Server (GPL)</td>
<td>5.6.49</td>
</tr>
</tbody>
</table>

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
$ 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
$ pkgrm mysql
$ pkgadd -d mysql-5.6.49-solaris10-x86_64.pkg
$ mysqld_safe &
$ mysql_upgrade
```

You should check the notes in Chapter 10, *Upgrading MySQL* before performing any upgrade.
Chapter 9 Postinstallation Setup and Testing

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This section discusses tasks that you should perform after installing MySQL:

- If necessary, initialize the data directory and create the MySQL grant tables. For some MySQL installation methods, data directory initialization may be done for you automatically:
  - Installation on Windows
  - Installation on Linux using a server RPM or Debian distribution from Oracle.
  - Installation using the native packaging system on many platforms, including Debian Linux, Ubuntu Linux, Gentoo Linux, and others.
  - Installation on macOS using a DMG distribution.

For other platforms and installation types, you must initialize the data directory manually. These include installation from generic binary and source distributions on Unix and Unix-like system, and installation from a ZIP Archive package on Windows. For instructions, see Section 9.1, “Initializing the Data Directory”.


- Assign passwords to any initial accounts in the grant tables, if that was not already done during data directory initialization. Passwords prevent unauthorized access to the MySQL server. You may also wish to restrict access to test databases. For instructions, see Section 9.4, “Securing the Initial MySQL Accounts”.

- Optionally, arrange for the server to start and stop automatically when your system starts and stops. For instructions, see Section 9.5, “Starting and Stopping MySQL Automatically”.

- Optionally, populate time zone tables to enable recognition of named time zones. For instructions, see MySQL Server Time Zone Support.

When you are ready to create additional user accounts, you can find information on the MySQL access control system and account management in Access Control and Account Management.

9.1 Initializing the Data Directory

After MySQL is installed, the data directory must be initialized, including the tables in the \texttt{mysql} system database:
Initializing the Data Directory

- For some MySQL installation methods, data directory initialization is automatic, as described in Chapter 9, Postinstallation Setup and Testing.

- For other installation methods, you must initialize the data directory manually. These include installation from generic binary and source distributions on Unix and Unix-like systems, and installation from a ZIP Archive package on Windows.

This section describes how to initialize the data directory manually for MySQL installation methods for which data directory initialization is not automatic. For some suggested commands that enable testing whether the server is accessible and working properly, see Section 9.3, “Testing the Server”.

In the examples shown here, the server is intended 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 (see Create a mysql User and Group), or substitute the name of a different existing login account that you plan to use for running the server.

1. Change location to the top-level directory of your MySQL installation, which is typically /usr/local/mysql (adjust the path name for your system as necessary):

   ```bash
cd /usr/local/mysql
   ```

   You will find several files and subdirectories inside the directory, including the bin and scripts subdirectories, which contain the server as well as client and utility programs.

2. 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. For example:

   ```bash
   scripts/mysql_install_db --user=mysql
   ```

   Typically, data directory initialization need be done only after you first install MySQL. (For upgrades to an existing installation, perform the upgrade procedure instead; see Chapter 10, Upgrading MySQL.) However, the command that initializes the data directory does not overwrite any existing privilege tables, so it is safe to run in any circumstances.

   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 if you run `mysql_install_db` as root, include the `--user` option as shown.

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

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

   ```bash
   scripts/mysql_install_db --user=mysql
   --basedir=/opt/mysql/mysql
   --datadir=/opt/mysql/mysql/data
   ```

   For a more secure installation, invoke `mysql_install_db` with the `--random-passwords` option. This causes it to assign a random password to the MySQL root accounts, set the "password expired" flag for those accounts, and remove the anonymous-user MySQL accounts. For additional details, see `mysql_install_db — Initialize MySQL Data Directory` (Install operations using RPMs for Unbreakable Linux Network are unaffected because they do not use `mysql_install_db`.)
If you do not want to have the `test` database, you can remove it after starting the server, using the instructions in Section 9.4, “Securing the Initial MySQL Accounts”.

If you have trouble with `mysql_install_db` at this point, see Section 9.1.1, “Problems Running `mysql_install_db`”.

3. In the absence of any option files, the server starts with its default settings. (See Server Configuration Defaults.) To specify options that the MySQL server should use at startup, put them in an option file such as `/etc/my.cnf` or `/etc/mysql/my.cnf`. (See Using Option Files.) For example, you can use an option file to set the `secure_file_priv` system variable.

4. To arrange for MySQL to start without manual intervention at system boot time, see Section 9.5, “Starting and Stopping MySQL Automatically”.

5. 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.

### 9.1.1 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.

```bash
mv data/mysql data/mysql.old
scripts/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 `XXXXXX` 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.

- **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
Problems Running mysql_install_db

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:

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

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

```
scripts/mysql_install_db --user=mysql
bin/mysqld_safe --user=mysql &
```

If mysql_install_db is located in the scripts directory, modify the first command to scripts/mysql_install_db.

See How to Protect or Change the MySQL Unix Socket File, and Chapter 12, 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 differ 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:

```
scripts/mysql_install_db --user=mysql
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.
9.2 Starting the Server

This section describes how to start the server on Unix and Unix-like systems. (For Windows, see Section 5.4.4, “Starting the Server for the First Time”.) For some suggested commands that you can use to test whether the server is accessible and working properly, see Section 9.3, “Testing the Server”.

Start the MySQL server like this:

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

It is important that the MySQL server be run using an unprivileged (non-root) login account. To ensure this if you run `mysqld_safe` as root, 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.

For further instructions for running MySQL as an unprivileged user, see How to Run MySQL as a Normal User.

If the command fails immediately and prints `mysqld ended`, look for information in the error log (which by default is the `host_name.err` file in the data directory).

If the server is unable to access the data directory it starts or read the grant tables in the `mysql` database, it writes a message to its error log. Such problems can occur if you neglected to create the grant tables by initializing the data directory before proceeding to this step, or if you ran the command that initializes the data directory without the `--user` option. Remove the data directory and run the command with the `--user` option.

If you have other problems starting the server, see Section 9.2.1, “Troubleshooting Problems Starting the MySQL Server”. For more information about `mysqld_safe`, see `mysqld_safe — MySQL Server Startup Script`.

9.2.1 Troubleshooting Problems Starting the MySQL Server

This section provides troubleshooting suggestions for problems starting the server. For additional suggestions for Windows systems, see Section 5.5, “Troubleshooting a Microsoft Windows MySQL Server Installation”.

If you have problems starting the server, here are some things to try:

- Check the error log to see why the server does not start. Log files are located in the data directory (typically `C:\Program Files\MySQL\MySQL Server 5.6\data` on Windows, `/usr/local/mysql/data` for a Unix/Linux binary distribution, and `/usr/local/var` for a Unix/Linux source distribution). Look in the data directory for files with names of the form `host_name.err` and `host_name.log`, where `host_name` is the name of your server host. Then examine the last few lines of these files. Use `tail` to display them:

  ```
  shell> tail host_name.err
  shell> tail host_name.log
  ```

- Specify any special options needed by the storage engines you are using. You can create a `my.cnf` file and specify startup options for the engines that you plan to use. If you are going to use storage engines that support transactional tables (InnoDB, NDB), be sure that you have them configured the way you want before starting the server. If you are using InnoDB tables, see InnoDB Configuration for guidelines and InnoDB Startup Options and System Variables for option syntax.

  Although storage engines use default values for options that you omit, Oracle recommends that you review the available options and specify explicit values for any options whose defaults are not appropriate for your installation.
Troubleshooting Problems Starting the MySQL Server

• Make sure that the server knows where to find the **data directory**. The `mysqld` server uses this directory as its current directory. This is where it expects to find databases and where it expects to write log files. The server also writes the pid (process ID) file in the data directory.

The default data directory location is hardcoded when the server is compiled. To determine what the default path settings are, invoke `mysqld` with the `--verbose` and `--help` options. If the data directory is located somewhere else on your system, specify that location with the `--datadir` option to `mysqld` or `mysqld_safe`, on the command line or in an option file. Otherwise, the server will not work properly. As an alternative to the `--datadir` option, you can specify `mysqld` the location of the base directory under which MySQL is installed with the `--basedir`, and `mysqld` looks for the data directory there.

To check the effect of specifying path options, invoke `mysqld` with those options followed by the `--verbose` and `--help` options. For example, if you change location to the directory where `mysqld` is installed and then run the following command, it shows the effect of starting the server with a base directory of `/usr/local`:

```
shell> ./mysqld --basedir=/usr/local --verbose --help
```

You can specify other options such as `--datadir` as well, but `--verbose` and `--help` must be the last options.

Once you determine the path settings you want, start the server without `--verbose` and `--help`.

If `mysqld` is currently running, you can find out what path settings it is using by executing this command:

```
shell> mysqladmin variables
```

Or:

```
shell> mysqladmin -h host_name variables
```

`host_name` is the name of the MySQL server host.

• Make sure that the server can access the **data directory**. The ownership and permissions of the data directory and its contents must allow the server to read and modify them.

If you get **Errcode 13** (which means **Permission denied**) when starting `mysqld`, this means that the privileges of the data directory or its contents do not permit server access. In this case, you change the permissions for the involved files and directories so that the server has the right to use them. You can also start the server as `root`, but this raises security issues and should be avoided.

Change location to the data directory and check the ownership of the data directory and its contents to make sure the server has access. For example, if the data directory is `/usr/local/mysql/var`, use this command:

```
shell> ls -la /usr/local/mysql/var
```

If the data directory or its files or subdirectories are not owned by the login account that you use for running the server, change their ownership to that account. If the account is named `mysql`, use these commands:

```
shell> chown -R mysql /usr/local/mysql/var
shell> chgrp -R mysql /usr/local/mysql/var
```

Even with correct ownership, MySQL might fail to start up if there is other security software running on your system that manages application access to various parts of the file system. In this case, reconfigure that software to enable `mysqld` to access the directories it uses during normal operation.
Testing the Server

- Verify that the network interfaces the server wants to use are available.

  If either of the following errors occur, it means that some other program (perhaps another `mysqld` server) is using the TCP/IP port or Unix socket file that `mysqld` is trying to use:

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

  Use `ps` to determine whether you have another `mysqld` server running. If so, shut down the server before starting `mysqld` again. (If another server is running, and you really want to run multiple servers, you can find information about how to do so in Running Multiple MySQL Instances on One Machine.)

  If no other server is running, execute the command `telnet your_host_name tcp_ip_port_number`. (The default MySQL port number is 3306.) Then press Enter a couple of times. If you do not get an error message like `telnet: Unable to connect to remote host: Connection refused`, some other program is using the TCP/IP port that `mysqld` is trying to use. Track down what program this is and disable it, or tell `mysqld` to listen to a different port with the `--port` option. In this case, specify the same non-default port number for client programs when connecting to the server using TCP/IP.

  Another reason the port might be inaccessible is that you have a firewall running that blocks connections to it. If so, modify the firewall settings to permit access to the port.

  If the server starts but you cannot connect to it, make sure that you have an entry in `/etc/hosts` that looks like this:

  ```
  127.0.0.1       localhost
  ```

- If you cannot get `mysqld` to start, try to make a trace file to find the problem by using the `--debug` option. See The DBUG Package.

9.3 Testing the Server

After the data directory is initialized and you have started the server, perform some simple tests to make sure that it works satisfactorily. This section assumes that your current location is the MySQL installation directory and that it has a `bin` subdirectory containing the MySQL programs used here. If that is not true, adjust the command path names accordingly.

Alternatively, add the `bin` directory to your `PATH` environment variable setting. That enables your shell (command interpreter) to find MySQL programs properly, so that you can run a program by typing only its name, not its path name. See Setting Environment Variables.

Use `mysqladmin` to verify that the server is running. The following commands provide simple tests to check whether the server is up and responding to connections:

```
shell> bin/mysqladmin version
shell> bin/mysqladmin variables
```

If you cannot connect to the server, specify a `--u root` option to connect as `root`. If you have assigned a password for the `root` account already, you'll also need to specify `--p` on the command line and enter the password when prompted. For example:

```
shell> bin/mysqladmin --u root --p version
Enter password: (enter root password here)
```

The output from `mysqladmin version` varies slightly depending on your platform and version of MySQL, but should be similar to that shown here:

```
shell> bin/mysqladmin version
```
Testing the Server

```
mysqladmin  Ver 14.12 Distrib 5.6.49, for pc-linux-gnu on i686
..  
Server version          5.6.49
Protocol version        10
Connection              Localhost via UNIX socket
UNIX socket             /var/lib/mysql/mysql.sock
Uptime:                 14 days 5 hours 5 min 21 sec
Threads: 1  Questions: 366  Slow queries: 0
Opens: 0  Flush tables: 1  Open tables: 19
Queries per second avg: 0.000
```

To see what else you can do with `mysqladmin`, invoke it with the `--help` option.

Verify that you can shut down the server (include a `-p` option if the `root` account has a password already):

```
shell> bin/mysqladmin -u root shutdown
```

Verify that you can start the server again. Do this by using `mysqld_safe` or by invoking `mysqld` directly. For example:

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

If `mysqld_safe` fails, see Section 9.2.1, "Troubleshooting Problems Starting the MySQL Server".

Run some simple tests to verify that you can retrieve information from the server. The output should be similar to that shown here.

Use `mysqlshow` to see what databases exist:

```
shell> bin/mysqlshow
```

```
+--------------------+
|     Databases      |
+--------------------+
| information_schema |
| mysql              |
| performance_schema |
| test               |
+--------------------+
```

The list of installed databases may vary, but always includes at least `mysql` and `information_schema`.

If you specify a database name, `mysqlshow` displays a list of the tables within the database:

```
shell> bin/mysqlshow mysql
Database: mysql
+---------------------------+
|   Tables                  |
+---------------------------+
| columns_priv              |
| db                        |
| event                     |
| func                      |
| general_log               |
| help_category             |
| help_keyword              |
| help_relation             |
| help_topic                |
| innodb_index_stats        |
| innodb_table_stats        |
| ndb_binlog_index          |
| plugin                    |
| proc                      |
| procs_priv                |
| proxies_priv              |
| servers                   |
| slave_master_info         |
```

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Securing the Initial MySQL Accounts

Use the `mysql` program to select information from a table in the `mysql` database:

```
shell> bin/mysql -e "SELECT User, Host, plugin FROM mysql.user" mysql
```

<table>
<thead>
<tr>
<th>User</th>
<th>Host</th>
<th>plugin</th>
</tr>
</thead>
<tbody>
<tr>
<td>root</td>
<td>localhost</td>
<td>mysql_native_password</td>
</tr>
</tbody>
</table>

At this point, your server is running and you can access it. To tighten security if you have not yet assigned passwords to the initial account or accounts, follow the instructions in Section 9.4, "Securing the Initial MySQL Accounts".

For more information about `mysql`, `mysqladmin`, and `mysqlshow`, see `mysql — The MySQL Command-Line Client`, `mysqladmin — Client for Administering a MySQL Server`, and `mysqlshow — Display Database, Table, and Column Information`.

### 9.4 Securing the Initial MySQL Accounts

The MySQL installation process involves initializing the data directory, including the grant tables in the `mysql` system database that define MySQL accounts. For details, see Section 9.1, “Initializing the Data Directory”.

This section describes how to assign passwords to the initial accounts created during the MySQL installation procedure, if you have not already done so.

The `mysql.user` grant table defines the initial MySQL user accounts and their access privileges:

- Some accounts have the user name `root`. These are superuser accounts that have all privileges and can do anything. If these `root` accounts have empty passwords, anyone can connect to the MySQL server as `root` without a password and be granted all privileges.

- On Windows, `root` accounts are created that permit connections from the local host only. Connections can be made by specifying the host name `localhost`, the IP address `127.0.0.1`, or the IPv6 address `::1`. If the user selects the Enable root access from remote machines option during installation, the Windows installer creates another `root` account that permits connections from any host.

- On Unix, each `root` account permits connections from the local host. Connections can be made by specifying the host name `localhost`, the IP address `127.0.0.1`, the IPv6 address `::1`, or the actual host name or IP address.

An attempt to connect to the host `127.0.0.1` normally resolves to the `localhost` account. However, this fails if the server is run with `skip_name_resolve` enabled, so the `127.0.0.1` account is useful in that case. The `::1` account is used for IPv6 connections.

- If accounts for anonymous users were created, these have an empty user name. The anonymous accounts have no password, so anyone can use them to connect to the MySQL server.
Securing the Initial MySQL Accounts

• On Windows, there is one anonymous account that permits connections from the local host. Connections can be made by specifying a host name of localhost.

• On Unix, each anonymous account permits connections from the local host. Connections can be made by specifying a host name of localhost for one of the accounts, or the actual host name or IP address for the other.

• The 'root'@'localhost' account also has a row in the mysql.proxies_priv table that enables granting the PROXY privilege for ''@'', that is, for all users and all hosts. This enables root to set up proxy users, as well as to delegate to other accounts the authority to set up proxy users. See Proxy Users.

To display which accounts exist in the mysql.user system table and check whether their passwords are empty, use the following statement:

```
mysql> SELECT User, Host, Password FROM mysql.user;
+------+--------------------+----------+
| User | Host               | Password |
+------+--------------------+----------+
| root | localhost          |          |
| root | myhost.example.com |          |
| root | 127.0.0.1          |          |
| root | ::1                |          |
|      | localhost          |          |
|      | myhost.example.com |          |
+------+--------------------+----------+
```

This output indicates that there are several root and anonymous-user accounts, none of which have passwords. The output might differ on your system, but the presence of accounts with empty passwords means that your MySQL installation is unprotected until you do something about it:

• Assign a password to each MySQL root account that does not have one.

• To prevent clients from connecting as anonymous users without a password, either assign a password to each anonymous account or remove the accounts.

In addition, the mysql.db table contains rows that permit all accounts to access the test database and other databases with names that start with test_. This is true even for accounts that otherwise have no special privileges such as the default anonymous accounts. This is convenient for testing but inadvisable on production servers. Administrators who want database access restricted only to accounts that have permissions granted explicitly for that purpose should remove these mysql.db table rows.

The following instructions describe how to set up passwords for the initial MySQL accounts, first for the root accounts, then for the anonymous accounts. The instructions also cover how to remove anonymous accounts, should you prefer not to permit anonymous access at all, and describe how to remove permissive access to test databases. Replace new_password in the examples with the password that you want to use. Replace host_name with the name of the server host. You can determine this name from the output of the preceding SELECT statement. For the output shown, host_name is myhost.example.com.

You need not remove anonymous entries in the mysql.proxies_priv table, which are used to support proxy users. See Proxy Users.

Note

For additional information about setting passwords, see Assigning Account Passwords. If you forget your root password after setting it, see How to Reset the Root Password.
Assigning root Account Passwords

To set up additional accounts, see Adding Accounts, Assigning Privileges, and Dropping Accounts.

You might want to defer setting the passwords until later, to avoid the need to specify them while you perform additional setup or testing. However, be sure to set them before using your installation for production purposes.

**Note**

Alternative means for performing the process described in this section:

- On Windows, you can perform the process during installation with MySQL Installer (see Section 5.3, “MySQL Installer for Windows”).
- On all platforms, the MySQL distribution includes `mysql_secure_installation`, a command-line utility that automates much of the process of securing a MySQL installation.
- On all platforms, MySQL Workbench is available and offers the ability to manage user accounts (see MySQL Workbench).

• Assigning root Account Passwords
• Assigning Anonymous Account Passwords
• Removing Anonymous Accounts
• Securing Test Databases

**Assigning root Account Passwords**

A root account password can be set several ways. The following discussion demonstrates three methods:

- Use the `SET PASSWORD` statement
- Use the `UPDATE` statement
- Use the `mysqladmin` command-line client program

To assign passwords using `SET PASSWORD`, connect to the server as root and issue a `SET PASSWORD` statement for each root account listed in the `mysql.user` system table.

For Windows, do this:

```shell
mysql> SET PASSWORD FOR 'root'@'localhost' = PASSWORD('new_password');
mysql> SET PASSWORD FOR 'root'@'127.0.0.1' = PASSWORD('new_password');
mysql> SET PASSWORD FOR 'root'@'::1' = PASSWORD('new_password');
mysql> SET PASSWORD FOR 'root'@'%' = PASSWORD('new_password');
```

The last statement is unnecessary if the `mysql.user` table has no root account with a host value of %.

For Unix, do this:

```shell
mysql> SET PASSWORD FOR 'root'@'localhost' = PASSWORD('new_password');
mysql> SET PASSWORD FOR 'root'@'127.0.0.1' = PASSWORD('new_password');
mysql> SET PASSWORD FOR 'root'@'::1' = PASSWORD('new_password');
```
Assigning Anonymous Account Passwords

You can also use a single statement that assigns a password to all root accounts by using `UPDATE` to modify the `mysql.user` table directly. This method works on any platform:

```
shell> mysql -u root
mysql> UPDATE mysql.user SET Password = PASSWORD('new_password')
    -> WHERE User = 'root';
```

The `FLUSH` statement causes the server to reread the grant tables. Without it, the password change remains unnoticed by the server until you restart it.

To assign passwords to the root accounts using `mysqladmin`, execute the following commands:

```
shell> mysqladmin -u root password "new_password"
shell> mysqladmin -u root -h host_name password "new_password"
```

Those commands apply both to Windows and to Unix. The double quotation marks around the password are not always necessary, but you should use them if the password contains spaces or other characters that are special to your command interpreter.

The `mysqladmin` method of setting the root account passwords does not work for the 'root'@'127.0.0.1' or 'root'@':1' account. Use the `SET PASSWORD` method shown earlier.

After the root passwords have been set, you must supply the appropriate password whenever you connect as root to the server. For example, to shut down the server with `mysqladmin`, use this command:

```
shell> mysqladmin -u root -p shutdown
Enter password: (enter root password here)
```

The `mysql` commands in the following instructions include a `-p` option based on the assumption that you have assigned the root account passwords using the preceding instructions and must specify that password when connecting to the server.

Assigning Anonymous Account Passwords

To assign passwords to the anonymous accounts, connect to the server as root, then use either `SET PASSWORD` or `UPDATE`.

To use `SET PASSWORD` on Windows, do this:

```
shell> mysql -u root -p
Enter password: (enter root password here)
mysql> SET PASSWORD FOR ''@'localhost' = PASSWORD('new_password');
```

To use `SET PASSWORD` on Unix, do this:

```
shell> mysql -u root -p
Enter password: (enter root password here)
mysql> SET PASSWORD FOR ''@'localhost' = PASSWORD('new_password');
```

To set the anonymous-user account passwords with a single `UPDATE` statement, do this (on any platform):

```
shell> mysql -u root -p
Enter password: (enter root password here)
mysql> UPDATE mysql.user SET Password = PASSWORD('new_password')
    -> WHERE User = '';
```
Removing Anonymous Accounts

If you prefer to remove any anonymous accounts rather than assigning them passwords, do so as follows on Windows:

```
shell> mysql -u root -p
Enter password: (enter root password here)
mysql> DROP USER ''@'localhost';
```

On Unix, remove the anonymous accounts like this:

```
shell> mysql -u root -p
Enter password: (enter root password here)
mysql> DROP USER ''@'localhost';
mysql> DROP USER ''@'host_name';
```

Securing Test Databases

By default, the `mysql.db` table contains rows that permit access by any user to the `test` database and other databases with names that start with `test_`. (These rows have an empty `User` column value, which for access-checking purposes matches any user name.) This means that such databases can be used even by accounts that otherwise possess no privileges. If you want to remove any-user access to test databases, do so as follows:

```
shell> mysql -u root -p
Enter password: (enter root password here)
mysql> DELETE FROM mysql.db WHERE Db LIKE 'test%';
mysql> FLUSH PRIVILEGES;
```

The `FLUSH` statement causes the server to reread the grant tables. Without it, the privilege change remains unnoticed by the server until you restart it.

With the preceding change, only users who have global database privileges or privileges granted explicitly for the `test` database can use it. However, if you prefer that the database not exist at all, drop it:

```
mysql> DROP DATABASE test;
```

9.5 Starting and Stopping MySQL Automatically

This section discusses methods for starting and stopping the MySQL server.

Generally, you start the `mysqld` server in one of these ways:

- Invoke `mysqld` directly. This works on any platform.
- On Windows, you can set up a MySQL service that runs automatically when Windows starts. See Section 5.4.7, “Starting MySQL as a Windows Service”.
- On Unix and Unix-like systems, you can invoke `mysqld_safe`, which tries to determine the proper options for `mysqld` and then runs it with those options. See `mysqld_safe — MySQL Server Startup Script`.
- On systems that use System V-style run directories (that is, `/etc/init.d` and run-level specific directories), invoke `mysql.server`. This script is used primarily at system startup and shutdown. It
usually is installed under the name `mysql`. The `mysql.server` script starts the server by invoking `mysqld_safe`. See `mysql.server — MySQL Server Startup Script`.

- On macOS, install a launchd daemon to enable automatic MySQL startup at system startup. The daemon starts the server by invoking `mysqld_safe`. For details, see Section 6.3, “Installing a MySQL Launch Daemon”. A MySQL Preference Pane also provides control for starting and stopping MySQL through the System Preferences. See Section 6.4, “Installing and Using the MySQL Preference Pane”.

- On Solaris, use the service management framework (SMF) system to initiate and control MySQL startup. The `mysqld_safe` and `mysql.server` scripts, Solaris SMF, and the macOS Startup Item (or MySQL Preference Pane) can be used to start the server manually, or automatically at system startup time. `mysql.server` and the Startup Item also can be used to stop the server.

The following table shows which option groups the server and startup scripts read from option files.

<table>
<thead>
<tr>
<th>Script</th>
<th>Option Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>mysqld</code></td>
<td><code>[mysqld], [server], [mysqld-major_version]</code></td>
</tr>
<tr>
<td><code>mysqld_safe</code></td>
<td><code>[mysqld], [server], [mysqld_safe]</code></td>
</tr>
<tr>
<td><code>mysql.server</code></td>
<td><code>[mysqld], [mysql.server], [server]</code></td>
</tr>
</tbody>
</table>

`[mysqld-major_version]` means that groups with names like `[mysqld-5.5]` and `[mysqld-5.6]` are read by servers having versions 5.5.x, 5.6.x, and so forth. This feature can be used to specify options that can be read only by servers within a given release series.

For backward compatibility, `mysql.server` also reads the `[mysql_server]` group and `mysqld_safe` also reads the `[safe_mysqld]` group. However, you should update your option files to use the `[mysql.server]` and `[mysqld_safe]` groups instead.

For more information on MySQL configuration files and their structure and contents, see Using Option Files.
Chapter 10 Upgrading MySQL

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This section describes the steps to upgrade a MySQL installation.

Upgrading is a common procedure, as you pick up bug fixes within the same MySQL release series or significant features between major MySQL releases. You perform this procedure first on some test systems to make sure everything works smoothly, and then on the production systems.

Note

In the following discussion, MySQL commands that must be run using a MySQL account with administrative privileges include -u root on the command line to specify the MySQL root user. Commands that require a password for root also include a -p option. Because -p is followed by no option value, such commands prompt for the password. Type the password when prompted and press Enter.

SQL statements can be executed using the mysql command-line client (connect as root to ensure that you have the necessary privileges).

10.1 Before You Begin

Review the information in this section before upgrading. Perform any recommended actions.

• Protect your data by creating a backup. The backup should include the mysql system database, which contains the MySQL system tables. See Database Backup Methods.

• Review Section 10.2, “Upgrade Paths” to ensure that your intended upgrade path is supported.

• Review Section 10.3, “Changes in MySQL 5.6” for changes that you should be aware of before upgrading. Some changes may require action.

• Review What Is New in MySQL 5.6 for deprecated and removed features. An upgrade may require changes with respect to those features if you use any of them.

• Review Server and Status Variables and Options Added, Deprecated, or Removed in MySQL 5.6. If you use deprecated or removed variables, an upgrade may require configuration changes.

• Review the Release Notes for information about fixes, changes, and new features.
• If you use replication, review Upgrading a Replication Setup.

• Upgrade procedures vary by platform and how the initial installation was performed. Use the procedure that applies to your current MySQL installation:
  
  • For binary and package-based installations on non-Windows platforms, refer to Section 10.4, “Upgrading MySQL Binary or Package-based Installations on Unix/Linux”.
  
  • For installations on an Enterprise Linux platform or Fedora using the MySQL Yum Repository, refer to Section 10.5, “Upgrading MySQL with the MySQL Yum Repository”.
  
  • For installations on Ubuntu using the MySQL APT repository, refer to Section 10.6, “Upgrading MySQL with the MySQL APT Repository”.
  
  • For installations on SLES using the MySQL SLES repository, refer to Section 10.7, “Upgrading MySQL with the MySQL SLES Repository”.
  
  • For installations on Windows, refer to Section 10.8, “Upgrading MySQL on Windows”.
  
  • If your MySQL installation contains a large amount of data that might take a long time to convert after an in-place upgrade, it may be useful to create a test instance for assessing the conversions that are required and the work involved to perform them. To create a test instance, make a copy of your MySQL instance that contains the mysql database and other databases without the data. Run the upgrade procedure on the test instance to assess the work involved to perform the actual data conversion.
  
  • Rebuilding and reinstalling MySQL language interfaces is recommended when you install or upgrade to a new release of MySQL. This applies to MySQL interfaces such as PHP mysql extensions and the Perl DBD::mysql module.

10.2 Upgrade Paths

• Upgrade is only supported between General Availability (GA) releases.

• Upgrade from MySQL 5.5 to 5.6 is supported. Upgrading to the latest release is recommended before upgrading to the next version. For example, upgrade to the latest MySQL 5.5 release before upgrading to MySQL 5.6.

• Upgrade that skips versions is not supported. For example, upgrading directly from MySQL 5.1 to 5.6 is not supported.

• Upgrade within a release series is supported. For example, upgrading from MySQL 5.6.x to 5.6.y is supported. Skipping a release is also supported. For example, upgrading from MySQL 5.6.x to 5.6.z is supported.

10.3 Changes in MySQL 5.6

Before upgrading to MySQL 5.6, review the changes described in this section to identify those that apply to your current MySQL installation and applications. Perform any recommended actions.

Changes marked as Incompatible change are incompatibilities with earlier versions of MySQL, and may require your attention before upgrading. Our aim is to avoid these changes, but occasionally they are necessary to correct problems that would be worse than an incompatibility between releases. If an upgrade issue applicable to your installation involves an incompatibility, follow the instructions given in the description. Sometimes this involves dumping and reloading tables, or use of a statement such as CHECK TABLE or REPAIR TABLE.
For dump and reload instructions, see Section 10.10, “Rebuilding or Repairing Tables or Indexes”. Any procedure that involves `REPAIR TABLE` with the `USE_FRM` option must be done before upgrading. Use of this statement with a version of MySQL different from the one used to create the table (that is, using it after upgrading) may damage the table. See `REPAIR TABLE Statement`.

**Note**

Beginning with MySQL 5.6.6, several MySQL Server parameters have defaults that differ from previous releases. See the notes regarding these changes under [Configuration Changes](#), particularly regarding overriding them to preserve backward compatibility if that is a concern.

- **Configuration Changes**
- **Server Changes**
- **InnoDB Changes**
- **SQL Changes**

### Configuration Changes

- Beginning with MySQL 5.6.6, several MySQL Server parameters have defaults that differ from previous releases. The motivation for these changes is to provide better out-of-box performance and to reduce the need for the database administrator to change settings manually. These changes are subject to possible revision in future releases as we gain feedback.

In some cases, a parameter has a different static default value. In other cases, the server autosizes a parameter at startup using a formula based on other related parameters or server host configuration, rather than using a static value. For example, the setting for `back_log` now is its previous default of 50, adjusted up by an amount proportional to the value of `max_connections`. The idea behind autosizing is that when the server has information available to make a decision about a parameter setting likely to be better than a fixed default, it will.

The following table summarizes changes to defaults. Any of these can be overridden by specifying an explicit value at server startup.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Old Default</th>
<th>New Default</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>back_log</code></td>
<td>50</td>
<td>Autosized using <code>max_connections</code></td>
</tr>
<tr>
<td><code>binlog_checksum</code></td>
<td>NONE</td>
<td>CRC32</td>
</tr>
<tr>
<td><code>--binlog-row-event-max-size</code></td>
<td>1024</td>
<td>8192</td>
</tr>
<tr>
<td><code>flush_time</code></td>
<td>1800 (on Windows)</td>
<td>0</td>
</tr>
<tr>
<td><code>innodb_autoextend_increment</code></td>
<td>8</td>
<td>64</td>
</tr>
<tr>
<td><code>innodb_buffer_pool_instances</code></td>
<td>1</td>
<td>8 (platform dependent)</td>
</tr>
<tr>
<td><code>innodb_checksum_algorithm</code></td>
<td>INNODB</td>
<td>CRC32 (changed back to INNODB in MySQL 5.6.7)</td>
</tr>
<tr>
<td><code>innodb_concurrency_tickets</code></td>
<td>500</td>
<td>5000</td>
</tr>
<tr>
<td><code>innodb_file_per_table</code></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><code>innodb_old_blocks_time</code></td>
<td>0</td>
<td>1000</td>
</tr>
<tr>
<td><code>innodb_open_files</code></td>
<td>300</td>
<td>Autosized using <code>innodb_file_per_table</code>, <code>table_open_cache</code></td>
</tr>
</tbody>
</table>
Configuration Changes

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Old Default</th>
<th>New Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>innodb_stats_on_metadata</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>join_buffer_size</td>
<td>128KB</td>
<td>256KB</td>
</tr>
<tr>
<td>max_allowed_packet</td>
<td>1MB</td>
<td>4MB</td>
</tr>
<tr>
<td>max_connect_errors</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>sync_master_info</td>
<td>0</td>
<td>10000</td>
</tr>
<tr>
<td>sync_relay_log</td>
<td>0</td>
<td>10000</td>
</tr>
<tr>
<td>sync_relay_log_info</td>
<td>0</td>
<td>10000</td>
</tr>
</tbody>
</table>

With regard to compatibility with previous releases, the most important changes are:

- `innodb_file_per_table` is enabled (previously disabled).
- `innodb_checksum_algorithm` is CRC32 (previously INNODB and changed back to INNODB in MySQL 5.6.7).
- `binlog_checksum` is CRC32 (previously NONE).

Therefore, if you are upgrading an existing MySQL installation, have not already changed the values of these parameters from their previous defaults, and backward compatibility is a concern, you may want to explicitly set these parameters to their previous defaults. For example, put these lines in the server option file:

```sql
[mysqld]
innodb_file_per_table=0
innodb_checksum_algorithm=INNODB
binlog_checksum=NONE
```

Those settings preserve compatibility as follows:

- With the new default of `innodb_file_per_table` enabled, ALTER TABLE operations following an upgrade will move InnoDB tables that are in the system tablespace to individual .ibd files. Using `innodb_file_per_table=0` will prevent this from happening.

- Setting `innodb_checksum_algorithm=INNODB` permits binary downgrades after upgrading to this release. With a setting of CRC32, InnoDB would use checksumming that older MySQL versions cannot use.

- With `binlog_checksum=NONE`, the server can be used as a replication master without causing failure of older slaves that do not understand binary log checksums.

- As of MySQL 5.6.5, pre-4.1 passwords and the `mysql_old_password` authentication plugin are deprecated. Passwords stored in the older hash format used before MySQL 4.1 are less secure than passwords that use the native password hashing method and should be avoided. To prevent connections using accounts that have pre-4.1 password hashes, the `secure_auth` system variable is now enabled by default. (To permit connections for accounts that have such password hashes, start the server with `--secure_auth=0`.)

DBAs are advised to convert accounts that use the `mysql_old_password` authentication plugin to use `mysql_native_password` instead. For account upgrade instructions, see Migrating Away from Pre-4.1 Password Hashing and the mysql_old_password Plugin.

In some early development versions of MySQL 5.6 (5.6.6 to 5.6.10), the server could create accounts with a mismatched password hash and authentication plugin. For example, if the default authentication...
Server Changes

plugin is `mysql_native_password`, this sequence of statements results in an account with a plugin of `mysql_native_password` but a pre-4.1 password hash (the format used by `mysql_old_password`):

```sql
SET old_passwords = 1;
CREATE USER 'jeffrey'@'localhost' IDENTIFIED BY 'password';
```

The mismatch produces symptoms such as being unable to connect to the MySQL server and being unable to use `SET PASSWORD` with `OLD_PASSWORD()` or with `old_passwords=1`.

As of MySQL 5.6.11, this mismatch no longer occurs. Instead, the server produces an error:

```sql
mysql> SET old_passwords = 1;
Error 1827 (HY000): The password hash doesn't have the expected format. Check if the correct password algorithm is being used with the PASSWORD() function.
```

To deal with an account affected by a mismatch, the DBA can modify either the plugin or Password column in the account’s `mysql.user` system table row to be consistent with the other column:

- Set `old_passwords` to 0, then assign a new password to the account using `SET PASSWORD` and `PASSWORD()`. This sets the Password column to have a 4.1 password hash, consistent with the `mysql_native_password` plugin. This is the preferred method of fixing the account.

- Alternatively, the DBA can change the plugin to `mysql_old_password` to make the plugin match the password hash format, then flush the privileges. This is not recommended because the `mysql_old_password` plugin and pre-4.1 password hashing are deprecated and support for them will be removed in a future version of MySQL.

Server Changes

- **Incompatible change**: It is possible for a column `DEFAULT` value to be valid for the `sql_mode` value at table-creation time but invalid for the `sql_mode` value when rows are inserted or updated. Example:

  ```sql
  SET sql_mode = '';
  CREATE TABLE t (d DATE DEFAULT 0);
  SET sql_mode = 'NO_ZERO_DATE,STRICT_ALL_TABLES';
  INSERT INTO t (d) VALUES(DEFAULT);
  ```

  In this case, 0 should be accepted for the `CREATE TABLE` but rejected for the `INSERT`. However, the server did not evaluate `DEFAULT` values used for inserts or updates against the current `sql_mode`. In the example, the `INSERT` succeeds and inserts `'0000-00-00'` into the `DATE` column.

  As of MySQL 5.6.13, the server applies the proper `sql_mode` checks to generate a warning or error at insert or update time.

  A resulting incompatibility for replication if you use statement-based logging (`binlog_format=STATEMENT`) is that if a slave is upgraded, a nonupgraded master will execute the preceding example without error, whereas the `INSERT` will fail on the slave and replication will stop.

  To deal with this, stop all new statements on the master and wait until the slaves catch up. Then upgrade the slaves followed by the master. Alternatively, if you cannot stop new statements, temporarily change to row-based logging on the master (`binlog_format=ROW`) and wait until all slaves have processed all binary logs produced up to the point of this change. Then upgrade the slaves followed by the master and change the master back to statement-based logging.

- **Incompatible change**: MySQL 5.6.11 and later supports `CREATE TABLE ... [SUB]PARTITION BY ALGORITHM=n [LINEAR] KEY (...), which can be used to create a table whose `KEY` partitioning is
compatible with a MySQL 5.1 server \( (n=1) \). (Bug #14521864, Bug #66462) This syntax is not accepted by MySQL 5.6.10 and earlier, although it is supported in MySQL 5.5 beginning with MySQL 5.5.31. `mysqldump` in MySQL 5.5.31 and later MySQL 5.5 releases includes the `ALGORITHM` option when dumping tables using this option, but surrounds it with conditional comments, like this:

```sql
CREATE TABLE t1 (a INT)
/*!50100 PARTITION BY KEY */
/*!50531 ALGORITHM = 1 */
/*!50100 ()
PARTITIONS 3 */
```

When importing a dump containing such `CREATE TABLE` statements into a MySQL 5.6.10 or earlier MySQL 5.6 server, the versioned comment is not ignored, which causes a syntax error. Therefore, prior to importing such a dump file, you must either change the comments so that the MySQL 5.6 server ignores them (by removing the string `!50531` or replacing it with `!50611`, wherever it occurs), or remove them.

This is not an issue with dump files made using MySQL 5.6.11 or later, where the `ALGORITHM` option is written using `/*!50611 ... */`.

- **Incompatible change**: For `TIME`, `DATETIME`, and `TIMESTAMP` columns, the storage required for tables created before MySQL 5.6.4 differs from storage required for tables created in 5.6.4 and later. This is due to a change in 5.6.4 that permits these temporal types to have a fractional part. This change can affect the output of statements that depend on the row format, such as `CHECKSUM TABLE`. After upgrading from MySQL 5.5 to MySQL 5.6.4 or later, it is recommended that you also upgrade from MySQL 5.5 to MySQL 5.6 `TIME`, `DATETIME`, and `TIMESTAMP` types. `ALTER TABLE` currently allows the creation of tables containing temporal columns in both MySQL 5.5 and MySQL 5.6.4 (or later) binary format but this makes it more difficult to recreate tables in cases where `.frm` files are not available. Additionally, as of MySQL 5.6.4, the aforementioned temporal types are more space efficient. For more information about changes to temporal types in MySQL 5.6.4, see Date and Time Type Storage Requirements.

As of MySQL 5.6.16, `ALTER TABLE` upgrades old temporal columns to 5.6 format for `ADD COLUMN`, `CHANGE COLUMN`, `MODIFY COLUMN`, `ADD INDEX`, and `FORCE` operations. Hence, the following statement upgrades a table containing columns in the old format:

```
ALTER TABLE tbl_name FORCE;
```

This conversion cannot be done using the `INPLACE` algorithm because the table must be rebuilt, so specifying `ALGORITHM=INPLACE` in these cases results in an error. Specify `ALGORITHM=COPY` if necessary.

When `ALTER TABLE` does produce a temporal-format conversion, it generates a message that can be displayed with `SHOW WARNINGS: TIME/TIMESTAMP/DATETIME columns of old format have been upgraded to the new format.`

When upgrading to MySQL 5.6.4 or later, be aware that `CHECK TABLE ... FOR UPGRADE` does not report temporal columns that use the pre-MySQL 5.6.4 format (Bug #73008, Bug #18985579). In MySQL 5.6.24, two new system variables, `avoid_temporal_upgrade` and `show_old_temporals`, were added to provide control over temporal column upgrades (Bug #72997, Bug #19895760).

- Due to the temporal type changes described in the previous incompatible change item above, importing pre-MySQL 5.6.4 tables (using `ALTER TABLE ... IMPORT TABLESPACE`) that contain `DATETIME` and `TIMESTAMP` types into MySQL 5.6.4 (or later) fails. Importing a MySQL 5.5 table with these temporal types into MySQL 5.6.4 (or later) is the mostly likely scenario for this problem to occur.

The following procedures describe workarounds that use the original pre-MySQL 5.6.4 `.frm` file to recreate a table with a row structure that is compatible with 5.6.4 (or later). The procedures involve
changing the original pre-MySQL 5.6.4 .frm file to use the Memory storage engine instead of InnoDB, copying the .frm file to the data directory of the destination instance, and using ALTER TABLE to change the table's storage engine type back to InnoDB. Use the first procedure if your tables do not have foreign keys. Use the second procedure, which has additional steps, if your table includes foreign keys.

If the table does not have foreign keys:

1. Copy the table's original .frm file to the data directory on the server where you want to import the tablespace.

2. Modify the table's .frm file to use the Memory storage engine instead of the InnoDB storage engine. This modification requires changing 7 bytes in the .frm file that define the table's storage engine type. Using a hexadecimal editing tool:
   - Change the byte at offset position 0003, which is the legacy_db_type, from 0c (for InnoDB) to 06 (for Memory), as shown below:
     
     00000000  fe 01 09 06 03 00 00 10 01 00 00 30 00 00 10 00
   - The remaining 6 bytes do not have a fixed offset. Search the .frm file for "InnoDB" to locate the line with the other 6 bytes. The line appears as shown below:
     
     00001010  ff 00 00 00 00 00 06 00 49 6e 6e 6f 44 42 00 |.........InnoDB.|
   - Modify the bytes so that the line appears as follows:
     
     00001010  ff 00 00 00 00 00 06 00 4d 45 4d 4f 52 59 00

3. Run ALTER TABLE ... ENGINE=INNODB to add the table definition to the InnoDB data dictionary. This creates the InnoDB table with the temporal data types in the new format. For the ALTER TABLE operation to complete successfully, the .frm file must correspond to the tablespace.

4. Import the table using ALTER TABLE ... IMPORT TABLESPACE.

If table has foreign keys:

1. Recreate the tables with foreign keys using table definitions from SHOW CREATE TABLE output. The incorrect temporal column formats do not matter at this point.

2. Dump all foreign key definitions to a text file by selecting the foreign key information from INFORMATION_SCHEMA.TABLE_CONSTRAINTS and INFORMATION_SCHEMA.KEY_COLUMN_USAGE.

3. Drop all tables and complete the table import process described in steps 1 to 4 in the procedure described above for tables without foreign keys.

4. After the import operation is complete, add the foreign keys from foreign key definitions that you saved to a text file.

   • **Incompatible change**: As of MySQL 5.6, the full-text stopword file is loaded and searched using latin1 if character_set_server is ucs2, utf16, utf16le, or utf32. If any table was created with FULLTEXT indexes while the server character set was ucs2, utf16, utf16le, or utf32, repair it using this statement:

     ```
     REPAIR TABLE tbl_name QUICK;
     ```
**InnoDB Changes**

- **Incompatible change:** In MySQL 5.6.20, the patch for Bug #69477 limits the size of redo log BLOB writes to 10% of the redo log file size. As a result of this new limit, `innodb_log_file_size` should be set to a value greater than 10 times the largest BLOB data size found in the rows of your tables. No action is required if your `innodb_log_file_size` setting is already 10 times the largest BLOB data size or your tables contain no BLOB data.

  In MySQL 5.6.22, the redo log BLOB write limit is relaxed to 10% of the total redo log size (`innodb_log_file_size * innodb_log_files_in_group`). (Bug #19498877)

**InnoDB Changes**

As of MySQL 5.6.42, the zlib library version bundled with MySQL was raised from version 1.2.3 to version 1.2.11.

The zlib `compressBound()` function in zlib 1.2.11 returns a slightly higher estimate of the buffer size required to compress a given length of bytes than it did in zlib version 1.2.3. The `compressBound()` function is called by InnoDB functions that determine the maximum row size permitted when creating compressed InnoDB tables or inserting rows into compressed InnoDB tables. As a result, CREATE TABLE ... ROW_FORMAT=COMPRESSED or INSERT operations with row sizes very close to the maximum row size that were successful in earlier releases could now fail.

If you have compressed InnoDB tables with large rows, it is recommended that you test compressed table CREATE TABLE statements on a MySQL 5.6 test instance prior to upgrading.

**SQL Changes**

- Some keywords may be reserved in MySQL 5.6 that were not reserved in MySQL 5.5. See Keywords and Reserved Words. This can cause words previously used as identifiers to become illegal. To fix affected statements, use identifier quoting. See Schema Object Names.

- The `YEAR(2)` data type has certain issues that you should consider before choosing to use it. As of MySQL 5.6.6, `YEAR(2)` columns in existing tables are treated as before, but `YEAR(2)` in new or altered tables is converted to `YEAR(4)`. For more information, see 2-Digit YEAR(2) Limitations and Migrating to 4-Digit YEAR.

- As of MySQL 5.6.6, it is explicitly disallowed to assign the value `DEFAULT` to stored procedure or function parameters or stored program local variables (for example with a `SET var_name = DEFAULT` statement). This was not previously supported, or documented as permitted, but is flagged as an incompatible change in case existing code inadvertently used this construct. It remains permissible to assign `DEFAULT` to system variables, as before, but assigning `DEFAULT` to parameters or local variables now results in a syntax error.

After an upgrade to MySQL 5.6.6 or later, existing stored programs that use this construct produce a syntax error when invoked. If a `mysqldump` file from 5.6.5 or earlier is loaded into 5.6.6 or later, the load operation fails and affected stored program definitions must be changed.

- In MySQL, the `TIMESTAMP` data type differs in nonstandard ways from other data types:
  
  - `TIMESTAMP` columns not explicitly declared with the `NULL` attribute are assigned the `NOT NULL` attribute. (Columns of other data types, if not explicitly declared as `NOT NULL`, permit `NULL` values.) Setting such a column to `NULL` sets it to the current timestamp.
  
  - The first `TIMESTAMP` column in a table, if not declared with the `NULL` attribute or an explicit `DEFAULT` or `ON UPDATE` clause, is automatically assigned the `DEFAULT CURRENT_TIMESTAMP` and `ON UPDATE CURRENT_TIMESTAMP` attributes.
- **TIMESTAMP** columns following the first one, if not declared with the **NULL** attribute or an explicit **DEFAULT** clause, are automatically assigned **DEFAULT '0000-00-00 00:00:00'** (the “zero” timestamp). For inserted rows that specify no explicit value for such a column, the column is assigned '0000-00-00 00:00:00' and no warning occurs.

Those nonstandard behaviors remain the default for **TIMESTAMP** but as of MySQL 5.6.6 are deprecated and this warning appears at startup:

```
[Warning] TIMESTAMP with implicit DEFAULT value is deprecated.
Please use --explicit_defaults_for_timestamp server option (see
documentation for more details).
```

As indicated by the warning, to turn off the nonstandard behaviors, enable the new **explicit_defaults_for_timestamp** system variable at server startup. With this variable enabled, the server handles **TIMESTAMP** as follows instead:

- **TIMESTAMP** columns not explicitly declared as **NOT NULL** permit **NULL** values. Setting such a column to **NULL** sets it to **NULL**, not the current timestamp.

- No **TIMESTAMP** column is assigned the **DEFAULT CURRENT_TIMESTAMP** or **ON UPDATE CURRENT_TIMESTAMP** attributes automatically. Those attributes must be explicitly specified.

- **TIMESTAMP** columns declared as **NOT NULL** and without an explicit **DEFAULT** clause are treated as having no default value. For inserted rows that specify no explicit value for such a column, the result depends on the SQL mode. If strict SQL mode is enabled, an error occurs. If strict SQL mode is not enabled, the column is assigned the implicit default of '0000-00-00 00:00:00' and a warning occurs. This is similar to how MySQL treats other temporal types such as **DATETIME**.

To upgrade servers used for replication, upgrade the slaves first, then the master. Replication between the master and its slaves should work provided that all use the same value of **explicit_defaults_for_timestamp**:

1. Bring down the slaves, upgrade them, configure them with the desired value of **explicit_defaults_for_timestamp**, and bring them back up.

   The slaves will recognize from the format of the binary logs received from the master that the master is older (predates the introduction of **explicit_defaults_for_timestamp**) and that operations on **TIMESTAMP** columns coming from the master use the old **TIMESTAMP** behavior.

2. Bring down the master, upgrade it, and configure it with the same **explicit_defaults_for_timestamp** value used on the slaves, and bring it back up.

### 10.4 Upgrading MySQL Binary or Package-based Installations on Unix/Linux

This section describes how to upgrade MySQL binary and package-based installations on Unix/Linux. In-place and logical upgrade methods are described.

**Note**

A logical upgrade is recommended when upgrading from a previous version. For example, use this method when upgrading from 5.5 to 5.6.

- **In-Place Upgrade**
- **Logical Upgrade**
In-Place Upgrade

An in-place upgrade involves shutting down the old MySQL server, replacing the old MySQL binaries or packages with the new ones, restarting MySQL on the existing data directory, and upgrading any remaining parts of the existing installation that require upgrading.

**Note**

If you upgrade an installation originally produced by installing multiple RPM packages, upgrade all the packages, not just some. For example, if you previously installed the server and client RPMs, do not upgrade just the server RPM.

To perform an in-place upgrade:

1. If you use XA transactions with InnoDB, run `XA RECOVER` before upgrading to check for uncommitted XA transactions. If results are returned, either commit or rollback the XA transactions by issuing an `XA COMMIT` or `XA ROLLBACK` statement.

2. If you use InnoDB, configure MySQL to perform a slow shutdown by setting `innodb_fast_shutdown` to 0. For example:

   ```
   mysql -u root -p --execute="SET GLOBAL innodb_fast_shutdown=0"
   ```

   With a slow shutdown, InnoDB performs a full purge and change buffer merge before shutting down, which ensures that data files are fully prepared in case of file format differences between releases.

3. Shut down the old MySQL server. For example:

   ```
   mysqladmin -u root -p shutdown
   ```

4. Upgrade the MySQL binary installation or packages. If upgrading a binary installation, unpack the new MySQL binary distribution package. See Obtain and Unpack the Distribution. For package-based installations, install the new packages.

5. Start the MySQL 5.6 server, using the existing data directory. For example:

   ```
   mysqld_safe --user=mysql --datadir=/path/to/existing-datadir &
   ```

6. Run `mysql_upgrade`. For example:

   ```
   mysql_upgrade -u root -p
   ```

   `mysql_upgrade` examines all tables in all databases for incompatibilities with the current version of MySQL. `mysql_upgrade` also upgrades the `mysql` system database so that you can take advantage of new privileges or capabilities.

   **Note**

   `mysql_upgrade` does not upgrade the contents of the time zone tables or help tables. For upgrade instructions, see MySQL Server Time Zone Support, and Server-Side Help Support.

7. Shut down and restart the MySQL server to ensure that any changes made to the system tables take effect. For example:

   ```
   mysqladmin -u root -p shutdown
   mysqld_safe --user=mysql --datadir=/path/to/existing-datadir &
   ```
Logical Upgrade

A logical upgrade involves exporting SQL from the old MySQL instance using a backup or export utility such as `mysqldump`, installing the new MySQL server, and applying the SQL to your new MySQL instance.

To perform a logical upgrade:

1. Review the information in Section 10.1, “Before You Begin”.
2. Export your existing data from the previous MySQL installation:

   ```
   mysqldump -u root -p
   --add-drop-table --routines --events
   --all-databases --force > data-for-upgrade.sql
   ```

   **Note**
   Use the `--routines` and `--events` options with `mysqldump` (as shown above) if your databases include stored programs. The `--all-databases` option includes all databases in the dump, including the `mysql` database that holds the system tables.

3. Shut down the old MySQL server. For example:

   ```
   mysqladmin -u root -p shutdown
   ```

4. Install MySQL 5.6. For installation instructions, see Chapter 1, *Installing and Upgrading MySQL*.

5. Initialize a new data directory, as described at Section 9.1, “Initializing the Data Directory”. For example:

   ```
   scripts/mysql_install_db --user=mysql --datadir=/path/to/5.6-datadir
   ```

6. Start the MySQL 5.6 server, using the new data directory. For example:

   ```
   mysqld_safe --user=mysql --datadir=/path/to/5.6-datadir
   ```

7. Load the previously created dump file into the new MySQL server. For example:

   ```
   mysql -u root -p --force < data-for-upgrade.sql
   ```

   **Note**
   It is not recommended to load a dump file when GTIDs are enabled on the server (`gtid_mode=ON`), if your dump file includes system tables. `mysqldump` issues DML instructions for the system tables which use the non-transactional MyISAM storage engine, and this combination is not permitted when GTIDs are enabled. Also be aware that loading a dump file from a server with GTIDs enabled, into another server with GTIDs enabled, causes different transaction identifiers to be generated.

8. Run `mysql_upgrade`. For example:

   ```
   mysql_upgrade -u root -p
   ```

   `mysql_upgrade` examines all tables in all databases for incompatibilities with the current version of MySQL. `mysql_upgrade` also upgrades the `mysql` system database so that you can take advantage of new privileges or capabilities.
10.5 Upgrading MySQL with the MySQL Yum Repository

For supported Yum-based platforms (see Section 7.1, “Installing MySQL on Linux Using the MySQL Yum Repository”, for a list), you can perform an in-place upgrade for MySQL (that is, replacing the old version and then running the new version using the old data files) with the MySQL Yum repository.

Notes

- Before performing any update to MySQL, follow carefully the instructions in Chapter 10, Upgrading MySQL. Among other instructions discussed there, it is especially important to back up your database before the update.

- The following instructions assume you have installed MySQL with the MySQL Yum repository or with an RPM package directly downloaded from MySQL Developer Zone’s MySQL Download page; if that is not the case, following the instructions in Section 7.2, “Replacing a Third-Party Distribution of MySQL Using the MySQL Yum Repository”.

Selecting a Target Series

By default, the MySQL Yum repository updates MySQL to the latest version in the release series you have chosen during installation (see Selecting a Release Series for details), which means, for example, a 5.6.x installation will not be updated to a 5.7.x release automatically. To update to another release series, you need to first disable the subrepository for the series that has been selected (by default, or by yourself) and enable the subrepository for your target series. To do that, see the general instructions given in Selecting a Release Series. For upgrading from MySQL 5.6 to 5.7, perform the reverse of the steps illustrated in Selecting a Release Series, disabling the subrepository for the MySQL 5.6 series and enabling that for the MySQL 5.7 series.

As a general rule, to upgrade from one release series to another, go to the next series rather than skipping a series. For example, if you are currently running MySQL 5.5 and wish to upgrade to 5.7, upgrade to MySQL 5.6 first before upgrading to 5.7.

Important

For important information about upgrading from MySQL 5.6 to 5.7, see Upgrading from MySQL 5.6 to 5.7.

Upgrading MySQL

Upgrade MySQL and its components by the following command, for platforms that are not dnf-enabled:

```
sudo yum update mysql-server
```
Restarting MySQL

For platforms that are dnf-enabled:

```
sudo dnf upgrade mysql-server
```

Alternatively, you can update MySQL by telling Yum to update everything on your system, which might take considerably more time. For platforms that are not dnf-enabled:

```
sudo yum update
```

For platforms that are dnf-enabled:

```
sudo dnf upgrade
```

### Restarting MySQL

The MySQL server always restarts after an update by Yum. Once the server restarts, run `mysql_upgrade` 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.

You can also update only a specific component. Use the following command to list all the installed packages for the MySQL components (for dnf-enabled systems, replace `yum` in the command with `dnf`):

```
sudo yum list installed | grep "^mysql"
```

After identifying the package name of the component of your choice, update the package with the following command, replacing `package-name` with the name of the package. For platforms that are not dnf-enabled:

```
sudo yum update package-name
```

For dnf-enabled platforms:

```
sudo dnf upgrade package-name
```

### Upgrading the Shared Client Libraries

After updating MySQL using the Yum repository, applications compiled with older versions of the shared client libraries should continue to work.

If you recompile applications and dynamically link them with the updated libraries: As typical with new versions of shared libraries where there are differences or additions in symbol versioning between the newer and older libraries (for example, between the newer, standard 5.6 shared client libraries and some older—prior or variant—versions of the shared libraries shipped natively by the Linux distributions’ software repositories, or from some other sources), any applications compiled using the updated, newer shared libraries will require those updated libraries on systems where the applications are deployed. And, as expected, if those libraries are not in place, the applications requiring the shared libraries will fail. So, be sure to deploy the packages for the shared libraries from MySQL on those systems. To do this, add the MySQL Yum repository to the systems (see Adding the MySQL Yum Repository) and install the latest shared libraries using the instructions given in Installing Additional MySQL Products and Components with Yum.

### 10.6 Upgrading MySQL with the MySQL APT Repository

On Debian and Ubuntu platforms, to perform an in-place upgrade of MySQL and its components, use the MySQL APT repository. See Upgrading MySQL with the MySQL APT Repository in A Quick Guide to Using the MySQL APT Repository.
10.7 Upgrading MySQL with the MySQL SLES Repository

On the SUSE Linux Enterprise Server (SLES) platform, to perform an in-place upgrade of MySQL and its components, use the MySQL SLES repository. See Upgrading MySQL with the MySQL SLES Repository in A Quick Guide to Using the MySQL SLES Repository.

10.8 Upgrading MySQL on Windows

There are two approaches for upgrading MySQL on Windows:

- Using MySQL Installer
- Using the Windows ZIP archive distribution

The approach you select depends on how the existing installation was performed. Before proceeding, review Chapter 10, Upgrading MySQL for additional information on upgrading MySQL that is not specific to Windows.

Note

Whichever approach you choose, always back up your current MySQL installation before performing an upgrade. See Database Backup Methods.

Upgrades between milestone releases (or from a milestone release to a GA release) are not supported. Significant development changes take place in milestone releases and you may encounter compatibility issues or problems starting the server. For instructions on how to perform a logical upgrade with a milestone release, see Logical Upgrade.

Note

MySQL Installer does not support upgrades between Community releases and Commercial releases. If you require this type of upgrade, perform it using the ZIP archive approach.

Upgrading MySQL with MySQL Installer

Performing an upgrade with MySQL Installer is the best approach when the current server installation was performed with it and the upgrade is within the current release series. MySQL Installer does not support upgrades between release series, such as from 5.5 to 5.6, and it does not provide an upgrade indicator to prompt you to upgrade. For instructions on upgrading between release series, see Upgrading MySQL Using the Windows ZIP Distribution.

To perform an upgrade using MySQL Installer:

1. Start MySQL Installer.

2. From the dashboard, click Catalog to download the latest changes to the catalog. The installed server can be upgraded only if the dashboard displays an arrow next to the version number of the server.

3. Click Upgrade. All products that have a newer version now appear in a list.

Note

MySQL Installer deselects the server upgrade option for milestone releases (Pre-Release) in the same release series. In addition, it displays a warning to indicate that the upgrade is not supported, identifies the risks of continuing, and
provides a summary of the steps to perform a logical upgrade manually. You can reselect server upgrade and proceed at your own risk.

4. Deselect all but the MySQL server product, unless you intend to upgrade other products at this time, and click **Next**.

5. Click **Execute** to start the download. When the download finishes, click **Next** to begin the upgrade operation.

6. Configure the server.

---

**Upgrading MySQL Using the Windows ZIP Distribution**

To perform an upgrade using the Windows ZIP archive distribution:

1. Download the latest Windows ZIP Archive distribution of MySQL from [https://dev.mysql.com/downloads/](https://dev.mysql.com/downloads/).

2. If the server is running, stop it. If the server is installed as a service, stop the service with the following command from the command prompt:

   ```
   C:\> SC STOP mysql_service_name
   ```

   Alternatively, use **NET STOP** `mysql_service_name`.

   If you are not running the MySQL server as a service, use `mysqladmin` to stop it. For example, before upgrading from MySQL 5.5 to 5.6, use `mysqladmin` from MySQL 5.5 as follows:

   ```
   C:\> "C:\Program Files\MySQL\MySQL Server 5.5\bin\mysqladmin" -u root shutdown
   ```

   **Note**

   If the MySQL root user account has a password, invoke `mysqladmin` with the `-p` option and enter the password when prompted.

3. Extract the ZIP archive. You may either overwrite your existing MySQL installation (usually located at `C:\mysql`), or install it into a different directory, such as `C:\mysql5`. Overwriting the existing installation is recommended. However, for upgrades (as opposed to installing for the first time), you must remove the data directory from your existing MySQL installation to avoid replacing your current data files. To do so, follow these steps:

   a. Unzip the ZIP archive in some location other than your current MySQL installation.

   b. Remove the data directory.

   c. Move the data directory from the current MySQL installation to the location of the just-removed data directory

   d. Remove the current MySQL installation

   e. Move the unzipped installation to the location of the just-removed installation

4. Restart the server. For example, use the **SC START** `mysql_service_name` or **NET START mysql_service_name` command if you run MySQL as a service, or invoke `mysqld` directly otherwise.

5. As Administrator, run `mysql_upgrade` to check your tables, attempt to repair them if necessary, and update your grant tables if they have changed so that you can take advantage of any new capabilities. See `mysql_upgrade — Check and Upgrade MySQL Tables`. 

---
6. If you encounter errors, see Section 5.5, “Troubleshooting a Microsoft Windows MySQL Server Installation”.

10.9 Upgrade Troubleshooting

- If problems occur, such as that the new `mysqld` server does not start or that you cannot connect without a password, verify that you do not have an old `my.cnf` file from your previous installation. You can check this with the `--print-defaults` option (for example, `mysqld --print-defaults`). If this command displays anything other than the program name, you have an active `my.cnf` file that affects server or client operation.

- If, after an upgrade, you experience problems with compiled client programs, such as `Commands out of sync` or unexpected core dumps, you probably have used old header or library files when compiling your programs. In this case, check the date for your `mysql.h` file and `libmysqlclient.a` library to verify that they are from the new MySQL distribution. If not, recompile your programs with the new headers and libraries. Recompilation might also be necessary for programs compiled against the shared client library if the library major version number has changed (for example, from `libmysqlclient.so.15` to `libmysqlclient.so.16`).

- If you have created a user-defined function (UDF) with a given name and upgrade MySQL to a version that implements a new built-in function with the same name, the UDF becomes inaccessible. To correct this, use `DROP FUNCTION` to drop the UDF, and then use `CREATE FUNCTION` to re-create the UDF with a different nonconflicting name. The same is true if the new version of MySQL implements a built-in function with the same name as an existing stored function. See Function Name Parsing and Resolution, for the rules describing how the server interprets references to different kinds of functions.

10.10 Rebuilding or Repairing Tables or Indexes

This section describes how to rebuild or repair tables or indexes, which may be necessitated by:

- Changes to how MySQL handles data types or character sets. For example, an error in a collation might have been corrected, necessitating a table rebuild to update the indexes for character columns that use the collation.

- Required table repairs or upgrades reported by `CHECK TABLE`, `mysqlcheck`, or `mysql_upgrade`.

Methods for rebuilding a table include:

- Dump and Reload Method
- ALTER TABLE Method
- REPAIR TABLE Method

Dump and Reload Method

If you are rebuilding tables because a different version of MySQL will not handle them after a binary (in-place) upgrade or downgrade, you must use the dump-and-reload method. Dump the tables before upgrading or downgrading using your original version of MySQL. Then reload the tables after upgrading or downgrading.

If you use the dump-and-reload method of rebuilding tables only for the purpose of rebuilding indexes, you can perform the dump either before or after upgrading or downgrading. Reloading still must be done afterward.

If you need to rebuild an InnoDB table because a `CHECK TABLE` operation indicates that a table upgrade is required, use `mysqldump` to create a dump file and `mysql` to reload the file. If the `CHECK TABLE`
operation indicates that there is a corruption or causes InnoDB to fail, refer to Forcing InnoDB Recovery for information about using the `innodb_force_recovery` option to restart InnoDB. To understand the type of problem that `CHECK TABLE` may be encountering, refer to the InnoDB notes in `CHECK TABLE Statement`.

To rebuild a table by dumping and reloading it, use `mysqldump` to create a dump file and `mysql` to reload the file:

```bash
mysqldump db_name t1 > dump.sql
mysql db_name < dump.sql
```

To rebuild all the tables in a single database, specify the database name without any following table name:

```bash
mysqldump db_name > dump.sql
mysql db_name < dump.sql
```

To rebuild all tables in all databases, use the `--all-databases` option:

```bash
mysqldump --all-databases > dump.sql
mysql < dump.sql
```

### ALTER TABLE Method

To rebuild a table with `ALTER TABLE`, use a “null” alteration; that is, an `ALTER TABLE` statement that “changes” the table to use the storage engine that it already has. For example, if `t1` is an InnoDB table, use this statement:

```sql
ALTER TABLE t1 ENGINE = InnoDB;
```

If you are not sure which storage engine to specify in the `ALTER TABLE` statement, use `SHOW CREATE TABLE` to display the table definition.

### REPAIR TABLE Method

The `REPAIR TABLE` method is only applicable to MyISAM, ARCHIVE, and CSV tables.

You can use `REPAIR TABLE` if the table checking operation indicates that there is a corruption or that an upgrade is required. For example, to repair a MyISAM table, use this statement:

```sql
REPAIR TABLE t1;
```

`mysqlcheck --repair` provides command-line access to the `REPAIR TABLE` statement. This can be a more convenient means of repairing tables because you can use the `--databases` or `--all-databases` option to repair all tables in specific databases or all databases, respectively:

```bash
mysqlcheck --repair --databases db_name ...
mysqlcheck --repair --all-databases
```

### 10.11 Copying MySQL Databases to Another Machine

In cases where you need to transfer databases between different architectures, you can use `mysqldump` to create a file containing SQL statements. You can then transfer the file to the other machine and feed it as input to the `mysql` client.

### Note

You can copy the `.frm`, `.MYI`, and `.MYD` files for MyISAM tables between different architectures that support the same floating-point format. (MySQL takes care of any byte-swapping issues.) See The MyISAM Storage Engine.
Use `mysqldump --help` to see what options are available.

The easiest (although not the fastest) way to move a database between two machines is to run the following commands on the machine on which the database is located:

```bash
mysqladmin -h 'other_hostname' create db_name
mysqldump db_name | mysql -h 'other_hostname' db_name
```

If you want to copy a database from a remote machine over a slow network, you can use these commands:

```bash
mysqladmin create db_name
mysqldump -h 'other_hostname' --compress db_name | mysql db_name
```

You can also store the dump in a file, transfer the file to the target machine, and then load the file into the database there. For example, you can dump a database to a compressed file on the source machine like this:

```bash
mysqldump --quick db_name | gzip > db_name.gz
```

Transfer the file containing the database contents to the target machine and run these commands there:

```bash
mysqladmin create db_name
gunzip < db_name.gz | mysql db_name
```

You can also use `mysqldump` and `mysqlimport` to transfer the database. For large tables, this is much faster than simply using `mysqldump`. In the following commands, `DUMPDIR` represents the full path name of the directory you use to store the output from `mysqldump`.

First, create the directory for the output files and dump the database:

```bash
mkdir DUMPDIR
mysqldump --tab=DUMPDIR db_name
```

Then transfer the files in the `DUMPDIR` directory to some corresponding directory on the target machine and load the files into MySQL there:

```bash
mysqladmin create db_name       # create database
cat DUMPDIR/*.sql | mysql db_name  # create tables in database
mysqlimport db_name DUMPDIR/*.txt # load data into tables
```

Do not forget to copy the `mysql` database because that is where the grant tables are stored. You might have to run commands as the MySQL root user on the new machine until you have the `mysql` database in place.

After you import the `mysql` database on the new machine, execute `mysqladmin flush-privileges` so that the server reloads the grant table information.
Chapter 11 Downgrading MySQL

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This section describes the steps to downgrade a MySQL installation.

Downgrading is a less common operation than upgrade. Downgrading is typically performed because of a compatibility or performance issue that occurs on a production system, and was not uncovered during initial upgrade verification on the test systems. As with the upgrade procedure Chapter 10, Upgrading MySQL), perform and verify the downgrade procedure on some test systems first, before using it on a production system.

Note

In the following discussion, MySQL commands that must be run using a MySQL account with administrative privileges include -u root on the command line to specify the MySQL root user. Commands that require a password for root also include a -p option. Because -p is followed by no option value, such commands prompt for the password. Type the password when prompted and press Enter.

SQL statements can be executed using the mysql command-line client (connect as root to ensure that you have the necessary privileges).

11.1 Before You Begin

Review the information in this section before downgrading. Perform any recommended actions.

• Protect your data by taking a backup. The backup should include the mysql database, which contains the MySQL system tables. See Database Backup Methods.

• Review Section 11.2, “Downgrade Paths” to ensure that your intended downgrade path is supported.

• Review Section 11.3, “Downgrade Notes” for items that may require action before downgrading.

Note

The downgrade procedures described in the following sections assume you are downgrading with data files created or modified by the newer MySQL version. However, if you did not modify your data after upgrading, downgrading using backups taken before upgrading to the new MySQL version is recommended. Many of the changes described in Section 11.3, “Downgrade Notes” that require action are not applicable when downgrading using backups taken before upgrading to the new MySQL version.

• Use of new features, new configuration options, or new configuration option values that are not supported by a previous release may cause downgrade errors or failures. Before downgrading, reverse
changes resulting from the use of new features and remove configuration settings that are not supported by the release you are downgrading to.

11.2 Downgrade Paths

- Downgrade is only supported between General Availability (GA) releases.
- Downgrade from MySQL 5.6 to 5.5 is supported using the logical downgrade method.
- Downgrade that skips versions is not supported. For example, downgrading directly from MySQL 5.6 to 5.1 is not supported.
- Downgrade within a release series is supported. For example, downgrading from MySQL 5.6.z to 5.6.y is supported. Skipping a release is also supported. For example, downgrading from MySQL 5.6.z to 5.6.x is supported.

11.3 Downgrade Notes

Before downgrading from MySQL 5.6, review the information in this section. Some items may require action before downgrading.

System Tables

- The `mysql.user` system table in MySQL 5.6 has a `password_expired` column. The `mysql.user` table in MySQL 5.5 does not. This means that an account with an expired password in MySQL 5.6 will work normally in MySQL 5.5.
- The `mysql.host` table was removed in MySQL 5.6.7. When downgrading to a previous release, startup on the downgraded server fails with an error if the `mysql.host` table is not present. You can recreate the table manually or restore it from a backup taken prior to upgrading to MySQL 5.6.7 or higher. To recreate the table manually, retrieve the table definition from a pre-MySQL 5.6.7 instance using `SHOW CREATE TABLE`, or see Bug #73634.

Data Types

- For `TIME`, `DATETIME`, and `TIMESTAMP` columns, the storage required for tables created before MySQL 5.6.4 differs from storage required for tables created in 5.6.4 and later. This is due to a change in 5.6.4 that permits these temporal types to have a fractional part. To downgrade to a version older than 5.6.4, dump affected tables with `mysqldump` before downgrading, and reload the tables after downgrading.

```sql
SELECT TABLE_SCHEMA, TABLE_NAME, COLUMN_NAME, DATA_TYPE
FROM INFORMATION_SCHEMA.COLUMNS
WHERE DATA_TYPE IN ('TIME','DATETIME','TIMESTAMP')
ORDER BY TABLE_SCHEMA, TABLE_NAME, COLUMN_NAME;
```

InnoDB

- InnoDB search indexes (with a type of `FULLTEXT`), introduced in MySQL 5.6.4, are not compatible with earlier versions of MySQL, including earlier releases in the 5.6 series. Drop such indexes before performing a downgrade.
InnoDB tables with **FULLTEXT** indexes can be identified using an **INFORMATION_SCHEMA** query. For example:

```sql
SELECT a.NAME AS Table_name, b.NAME AS Index_name
FROM INFORMATION_SCHEMA.INNODB_SYS_TABLES a,
     INFORMATION_SCHEMA.INNODB_SYS_INDEXES b
WHERE a.TABLE_ID = b.TABLE_ID
     AND b.TYPE = 32;
```

- **InnoDB** small page sizes specified by the **innodb_page_size** configuration option, introduced in MySQL 5.6.4, are not compatible with earlier versions of MySQL, including earlier releases in the 5.6 series. Dump all **InnoDB** tables in instances that use a smaller **InnoDB** page size, drop the tables, and re-create and reload them after the downgrade.

- Tables created using persistent statistics table options (**STATS_PERSISTENT**, **STATS_AUTO_RECALC**, and **STATS_SAMPLE_PAGES**) introduced in MySQL 5.6.6, are not compatible with earlier releases (Bug #70778). Remove the options from table definitions prior to downgrading. For information about these options, see Configuring Persistent Optimizer Statistics Parameters.

- The **innodb_log_file_size** default and maximum values were increased in MySQL 5.6. Before downgrading, ensure that the configured log file size is compatible with the previous release.

- In MySQL 5.6.3, the length limit for index prefix keys is increased from 767 bytes to 3072 bytes, for **InnoDB** tables using **ROW_FORMAT=DYNAMIC** or **ROW_FORMAT=COMPRESSED**. See InnoDB Limits for details. This change is also backported to MySQL 5.5.14. If you downgrade from one of these releases or higher, to an earlier release with a lower length limit, the index prefix keys could be truncated at 767 bytes or the downgrade could fail. This issue could only occur if the configuration option **innodb_large_prefix** was enabled on the server being downgraded.

### Replication

- As of MySQL 5.6, the **relay-log.info** file contains a line count and a replication delay value, so the file format differs from that in older versions. See Slave Status Logs. If you downgrade a slave server to a version older than MySQL 5.6, the older server will not read the file correctly. To address this, modify the file in a text editor to delete the initial line containing the number of lines.

- Beginning with MySQL 5.6.6, the MySQL Server employs Version 2 binary log events when writing the binary log. Binary logs written using Version 2 log events cannot be read by earlier versions of MySQL Server. To generate a binary log that is written using Version 1 log events readable by older servers, start the MySQL 5.6.6 or later server using `--log-bin-use-v1-row-events=1`, which forces the server to employ Version 1 events when writing the binary log.

- The MySQL 5.6.5 release introduced **global transaction identifiers** (**GTIDs**) for MySQL Replication. If you enabled GTIDs in MySQL 5.6 and want to downgrade to a MySQL release that does not support GTIDs, you must disable GTIDs before downgrading (see Disabling GTID Transactions).

### 11.4 Downgrading Binary and Package-based Installations on Unix/Linux

This section describes how to downgrade MySQL binary and package-based installations on Unix/Linux. In-place and logical downgrade methods are described.

- **In-Place Downgrade**
- **Logical Downgrade**
In-Place Downgrade

In-place downgrade involves shutting down the new MySQL version, replacing the new MySQL binaries or packages with the old ones, and restarting the old MySQL version on the existing data directory.

In-place downgrade is supported for downgrades between GA releases within the same release series.

In-place downgrade is not supported for MySQL APT, SLES, and Yum repository installations.

To perform an in-place downgrade:

1. Review the information in Section 11.1, “Before You Begin”.

2. If you use XA transactions with InnoDB, run XA RECOVER before downgrading to check for uncommitted XA transactions. If results are returned, either commit or rollback the XA transactions by issuing an XA COMMIT or XA ROLLBACK statement.

3. If you use InnoDB, configure MySQL to perform a slow shutdown by setting innodb_fast_shutdown to 0. For example:

   ```
   mysql -u root -p --execute="SET GLOBAL innodb_fast_shutdown=0"
   ```

   With a slow shutdown, InnoDB performs a full purge and change buffer merge before shutting down, which ensures that data files are fully prepared in case of file format differences between releases.

4. Shut down the newer MySQL server. For example:

   ```
   mysqladmin -u root -p shutdown
   ```

5. After the slow shutdown, remove the InnoDB redo log files (the ib_logfile* files) from the data directory to avoid downgrade issues related to redo log file format changes that may have occurred between releases.

   ```
   rm ib_logfile*
   ```

6. Downgrade the MySQL binaries or packages in-place by replacing the newer binaries or packages with the older ones.

7. Start the older (downgraded) MySQL server, using the existing data directory. For example:

   ```
   mysqld_safe --user=mysql --datadir=/path/to/existing-datadir
   ```

8. Run mysql_upgrade. For example:

   ```
   mysql_upgrade -u root -p
   ```

9. Shut down and restart the MySQL server to ensure that any changes made to the system tables take effect. For example:

   ```
   mysqladmin -u root -p shutdown
   mysqld_safe --user=mysql --datadir=/path/to/existing-datadir
   ```

Logical Downgrade

Logical downgrade involves using mysqldump to dump all tables from the new MySQL version, and then loading the dump file into the old MySQL version.

Logical downgrades are supported for downgrades between releases within the same release series and for downgrades to the previous release level. Only downgrades between General Availability (GA) releases are supported. Before proceeding, review Section 11.1, “Before You Begin”.

To perform a logical downgrade:

1. Review the information in Section 11.1, “Before You Begin”.

2. Dump all databases. For example:

   ```
   mysqldump -u root -p
   --add-drop-table --routines --events
   --all-databases --force > data-for-downgrade.sql
   ```

3. Shut down the newer MySQL server. For example:

   ```
   mysqladmin -u root -p shutdown
   ```

4. Initialize an older MySQL instance, with a new data directory. For example:

   ```
   scripts/mysql_install_db --user=mysql
   ```

5. Start the older MySQL server, using the new data directory. For example:

   ```
   mysqld_safe --user=mysql --datadir=/path/to/new-datadir
   ```

6. Load the dump file into the older MySQL server. For example:

   ```
   mysql -u root -p --force < data-for-upgrade.sql
   ```

7. Run `mysql_upgrade`. For example:

   ```
   mysql_upgrade -u root -p
   ```

8. Shut down and restart the MySQL server to ensure that any changes made to the system tables take effect. For example:

   ```
   mysqladmin -u root -p shutdown
   mysqld_safe --user=mysql --datadir=/path/to/new-datadir
   ```

### 11.5 Downgrade Troubleshooting

If you downgrade from one release series to another, there may be incompatibilities in table storage formats. In this case, use `mysqldump` to dump your tables before downgrading. After downgrading, reload the dump file using `mysql` or `mysqlimport` to re-create your tables. For examples, see Section 10.11, “Copying MySQL Databases to Another Machine”.

A typical symptom of a downward-incompatible table format change when you downgrade is that you cannot open tables. In that case, use the following procedure:

1. Stop the older MySQL server that you are downgrading to.

2. Restart the newer MySQL server you are downgrading from.

3. Dump any tables that were inaccessible to the older server by using `mysqldump` to create a dump file.

4. Stop the newer MySQL server and restart the older one.
5. Reload the dump file into the older server. Your tables should be accessible.
Chapter 12 Environment Variables

This section lists environment variables that are used directly or indirectly by MySQL. Most of these can also be found in other places in this manual.

Options on the command line take precedence over values specified in option files and environment variables, and values in option files take precedence over values in environment variables. In many cases, it is preferable to use an option file instead of environment variables to modify the behavior of MySQL. See Using Option Files.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTHENTICATION_PAM_LOG</td>
<td>PAM authentication plugin debug logging settings.</td>
</tr>
<tr>
<td>CC</td>
<td>The name of your C compiler (for running CMake).</td>
</tr>
<tr>
<td>CXX</td>
<td>The name of your C++ compiler (for running CMake).</td>
</tr>
<tr>
<td>CC</td>
<td>The name of your C compiler (for running CMake).</td>
</tr>
<tr>
<td>DBI_USER</td>
<td>The default user name for Perl DBI.</td>
</tr>
<tr>
<td>DBI_TRACE</td>
<td>Trace options for Perl DBI.</td>
</tr>
<tr>
<td>HOME</td>
<td>The default path for the mysql history file is $HOME/.mysql_history.</td>
</tr>
<tr>
<td>LD_RUN_PATH</td>
<td>Used to specify the location of libmysqlclient.so.</td>
</tr>
<tr>
<td>LIBMYSQL_ENABLE_CLEARTEXT_PLUGIN</td>
<td>Enable mysql_clear_password authentication plugin; see Client-Side Cleartext Pluggable Authentication.</td>
</tr>
<tr>
<td>LIBMYSQL_PLUGIN_DIR</td>
<td>Directory in which to look for client plugins.</td>
</tr>
<tr>
<td>LIBMYSQL_PLUGINS</td>
<td>Client plugins to preload.</td>
</tr>
<tr>
<td>MYSQL_DEBUG</td>
<td>Debug trace options when debugging.</td>
</tr>
<tr>
<td>MYSQL_GROUP_SUFFIX</td>
<td>Option group suffix value (like specifying --defaults-group-suffix).</td>
</tr>
<tr>
<td>MYSQL_HISTFILE</td>
<td>The path to the mysql history file. If this variable is set, its value overrides the default for $HOME/.mysql_history.</td>
</tr>
<tr>
<td>MYSQL_HISTIGNORE</td>
<td>Patterns specifying statements not to log to $HOME/.mysql_history.</td>
</tr>
<tr>
<td>MYSQL_HOME</td>
<td>The path to the directory in which the server-specific my.cnf file resides.</td>
</tr>
<tr>
<td>MYSQL_HOST</td>
<td>The default host name used by the mysql command-line client.</td>
</tr>
<tr>
<td>MYSQL_OPENSSL_UDF_DH_BITS_THRESHOLD</td>
<td>Maximum key length for CREATE_DH_PARAMETERS(). See MySQL Enterprise Encryption Usage and Examples.</td>
</tr>
<tr>
<td>MYSQL_OPENSSL_UDF_DSA_BITS_THRESHOLD</td>
<td>Maximum DSA key length for CREATE_ASYMMETRIC_PRIV_KEY(). See MySQL Enterprise Encryption Usage and Examples.</td>
</tr>
<tr>
<td>MYSQL_OPENSSL_UDF_RSA_BITS_THRESHOLD</td>
<td>Maximum RSA key length for CREATE_ASYMMETRIC_PRIV_KEY(). See MySQL Enterprise Encryption Usage and Examples.</td>
</tr>
<tr>
<td>MYSQL_PS1</td>
<td>The command prompt to use in the mysql command-line client.</td>
</tr>
</tbody>
</table>
### Variable Description

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MYSQL_PWD</td>
<td>The default password when connecting to <code>mysqld</code>. Using this is insecure. See End-User Guidelines for Password Security.</td>
</tr>
<tr>
<td>MYSQL_TCP_PORT</td>
<td>The default TCP/IP port number.</td>
</tr>
<tr>
<td>MYSQL_TEST_LOGIN_FILE</td>
<td>The name of the <code>.mylogin.cnf</code> login path file.</td>
</tr>
<tr>
<td>MYSQL_UNIX_PORT</td>
<td>The default Unix socket file name; used for connections to <code>localhost</code>.</td>
</tr>
<tr>
<td>PATH</td>
<td>Used by the shell to find MySQL programs.</td>
</tr>
<tr>
<td>TMPDIR</td>
<td>The directory in which temporary files are created.</td>
</tr>
<tr>
<td>TZ</td>
<td>This should be set to your local time zone. See Time Zone Problems.</td>
</tr>
<tr>
<td>UMASK</td>
<td>The user-file creation mode when creating files. See note following table.</td>
</tr>
<tr>
<td>UMASK_DIR</td>
<td>The user-directory creation mode when creating directories. See note following table.</td>
</tr>
<tr>
<td>USER</td>
<td>The default user name on Windows when connecting to <code>mysqld</code>.</td>
</tr>
</tbody>
</table>

For information about the `mysql` history file, see mysql Client Logging.

`MYSQL_TEST_LOGIN_FILE` is the path name of the login path file (the file created by `mysql_config_editor`). If not set, the default value is `%APPDATA%\MySQL\.mylogin.cnf` directory on Windows and `$HOME/.mylogin.cnf` on non-Windows systems. See `mysql_config_editor — MySQL Configuration Utility`.

The default `UMASK` and `UMASK_DIR` values are `0660` and `0700`, respectively. MySQL assumes that the value for `UMASK` or `UMASK_DIR` is in octal if it starts with a zero. For example, setting `UMASK=0600` is equivalent to `UMASK=384` because 0600 octal is 384 decimal.

The `UMASK` and `UMASK_DIR` variables, despite their names, are used as modes, not masks:

- If `UMASK` is set, `mysql` uses `($UMASK | 0600)` as the mode for file creation, so that newly created files have a mode in the range from 0600 to 0666 (all values octal).

- If `UMASK_DIR` is set, `mysql` uses `($UMASK_DIR | 0700)` as the base mode for directory creation, which then is AND-ed with `(~$UMASK & 0666)`, so that newly created directories have a mode in the range from 0700 to 0777 (all values octal). The AND operation may remove read and write permissions from the directory mode, but not execute permissions.

See also Problems with File Permissions.
Chapter 13 Perl Installation Notes

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13.3 Problems Using the Perl DBI/DBD Interface ......................................... 181

The Perl DBI module provides a generic interface for database access. You can write a DBI script that works with many different database engines without change. To use DBI, you must install the DBI module, as well as a DataBase Driver (DBD) module for each type of database server you want to access. For MySQL, this driver is the DBD::mysql module.

Perl, and the DBD::MySQL module for DBI must be installed if you want to run the MySQL benchmark scripts; see The MySQL Benchmark Suite.

Note
Perl support is not included with MySQL distributions. You can obtain the necessary modules from http://search.cpan.org for Unix, or by using the ActiveState ppm program on Windows. The following sections describe how to do this.

The DBI/DBD interface requires Perl 5.6.0, and 5.6.1 or later is preferred. DBI does not work if you have an older version of Perl. You should use DBD::mysql 4.009 or higher. Although earlier versions are available, they do not support the full functionality of MySQL 5.6.

13.1 Installing Perl on Unix

MySQL Perl support requires that you have installed MySQL client programming support (libraries and header files). Most installation methods install the necessary files. If you install MySQL from RPM files on Linux, be sure to install the developer RPM as well. The client programs are in the client RPM, but client programming support is in the developer RPM.

The files you need for Perl support can be obtained from the CPAN (Comprehensive Perl Archive Network) at http://search.cpan.org.

The easiest way to install Perl modules on Unix is to use the CPAN module. For example:

    shell> perl -MCPAN -e shell
    cpan> install DBI
    cpan> install DBD::mysql

The DBD::mysql installation runs a number of tests. These tests attempt to connect to the local MySQL server using the default user name and password. (The default user name is your login name on Unix, and ODBC on Windows. The default password is "no password.") If you cannot connect to the server with those values (for example, if your account has a password), the tests fail. You can use force install DBD::mysql to ignore the failed tests.

DBI requires the Data::Dumper module. It may be installed; if not, you should install it before installing DBI.

It is also possible to download the module distributions in the form of compressed tar archives and build the modules manually. For example, to unpack and build a DBI distribution, use a procedure such as this:
1. Unpack the distribution into the current directory:

shell> gunzip < DBI-VERSION.tar.gz | tar xvf -

This command creates a directory named DBI-VERSION.

2. Change location into the top-level directory of the unpacked distribution:

shell> cd DBI-VERSION

3. Build the distribution and compile everything:

shell> perl Makefile.PL
shell> make
shell> make test
shell> make install

The make test command is important because it verifies that the module is working. Note that when you run that command during the DBD::mysql installation to exercise the interface code, the MySQL server must be running or the test fails.

It is a good idea to rebuild and reinstall the DBD::mysql distribution whenever you install a new release of MySQL. This ensures that the latest versions of the MySQL client libraries are installed correctly.

If you do not have access rights to install Perl modules in the system directory or if you want to install local Perl modules, the following reference may be useful: http://learn.perl.org/faq/perlfaq8.html#How-do-I-keep-my-own-module-library-directory-

13.2 Installing ActiveState Perl on Windows

On Windows, you should do the following to install the MySQL DBD module with ActiveState Perl:

1. Get ActiveState Perl from http://www.activestate.com/Products/ActivePerl/ and install it.

2. Open a console window.

3. If necessary, set the HTTP_proxy variable. For example, you might try a setting like this:

C:\> set HTTP_proxy=my.proxy.com:3128

4. Start the PPM program:

C:\> C:\perl\bin\ppm.pl

5. If you have not previously done so, install DBI:

ppm> install DBI

6. If this succeeds, run the following command:

ppm> install DBD-mysql

This procedure should work with ActiveState Perl 5.6 or higher.

If you cannot get the procedure to work, you should install the ODBC driver instead and connect to the MySQL server through ODBC:

use DBI;
$dbh= DBI->connect("DBI:ODBC:$dsn",User,Password) ||
die "Got error $DBI::errstr when connecting to $dsn\n";
13.3 Problems Using the Perl DBI/DBD Interface

If Perl reports that it cannot find the ../mysql/mysql.so module, the problem is probably that Perl cannot locate the libmysqlclient.so shared library. You should be able to fix this problem by one of the following methods:

- Copy libmysqlclient.so to the directory where your other shared libraries are located (probably /usr/lib or /lib).
- Modify the –L options used to compile DBD::mysql to reflect the actual location of libmysqlclient.so.
- On Linux, you can add the path name of the directory where libmysqlclient.so is located to the /etc/ld.so.conf file.
- Add the path name of the directory where libmysqlclient.so is located to the LD_RUN_PATH environment variable. Some systems use LD_LIBRARY_PATH instead.

You may also need to modify the –L options if there are other libraries that the linker fails to find. For example, if the linker cannot find libc because it is in /lib and the link command specifies –L/usr/lib, change the –L option to –L/lib or add –L/lib to the existing link command.

If you get the following errors from DBD::mysql, you are probably using gcc (or using an old binary compiled with gcc):

```
/usr/bin/perl: can't resolve symbol '__moddi3'
/usr/bin/perl: can't resolve symbol '__divdi3'
```

Add –L/usr/lib/gcc-lib/... -lgcc to the link command when the mysql.so library gets built (check the output from make for mysql.so when you compile the Perl client). The –L option should specify the path name of the directory where libgcc.a is located on your system.

Another cause of this problem may be that Perl and MySQL are not both compiled with gcc. In this case, you can solve the mismatch by compiling both with gcc.