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# 1. MySQL Connector/J

MySQL provides connectivity for client applications developed in the Java programming language via a JDBC driver, which is called MySQL Connector/J.

MySQL Connector/J is a JDBC-3.0 "Type 4" driver, which means that it is pure Java, implements version 3.0 of the JDBC specification, and communicates directly with the MySQL server using the MySQL protocol.

This document is arranged for a beginning JDBC developer. If you are already experienced with using JDBC, you might consider starting with the section "Installing Connector/J".

While JDBC is useful by itself, we would hope that if you are not familiar with JDBC that after reading the first few sections of this manual, that you would avoid using "naked" JDBC for all but the most trivial problems and consider using one of the popular persistence frameworks such as Hibernate [<http://www.hibernate.org/>], Spring's JDBC templates [<http://www.springframework.org/>] or Ibatis SQL Maps [<http://www.ibatis.com/common/sqlmaps.html>] to do the majority of repetitive work and heavier lifting that is sometimes required with JDBC.

This section is not designed to be a complete JDBC tutorial. If you need more information about using JDBC you might be interested in the following online tutorials that are more in-depth than the information presented here:

- JDBC Basics [<http://java.sun.com/docs/books/tutorial/jdbc/basics/index.html>]- A tutorial from Sun covering beginner topics in JDBC
- JDBC Short Course [<http://java.sun.com/developer/onlineTraining/Database/JDBCShortCourse/index.html>] - A more in-depth tutorial from Sun and JGuru

## 1.1. Basic JDBC concepts

This section provides some general JDBC background.

### 1.1.1. Connecting to MySQL using the DriverManager Interface

When you are using JDBC outside of an application server, the DriverManager class manages the establishment of Connections.

The DriverManager needs to be told which JDBC drivers it should try to make Connections with. The easiest way to do this is to use Class.forName() on the class that implements the java.sql.Driver interface. With MySQL Connector/J, the name of this class is com.mysql.jdbc.Driver. With this method, you could use an external configuration file to supply the driver class name and driver parameters to use when connecting to a database.

The following section of Java code shows how you might register MySQL Connector/J from the main() method of your application:

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

// Notice, do not import com.mysql.jdbc.*
// or you will have problems!
```

```
public class LoadDriver {
    public static void main(String[] args) {
        try {
            // The newInstance() call is a work around for some
            // broken Java implementations

            Class.forName("com.mysql.jdbc.Driver").newInstance();
        } catch (Exception ex) {
            // handle the error
        }
    }
}
```

After the driver has been registered with the DriverManager, you can obtain a Connection instance that is connected to a particular database by calling DriverManager.getConnection():

### Example 1. Obtaining a Connection From the DriverManager

This example shows how you can obtain a Connection instance from the DriverManager. There are a few different signatures for the getConnection() method. You should see the API documentation that comes with your JDK for more specific information on how to use them.

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

... try {
    Connection conn = DriverManager.getConnection("jdbc:mysql://localhost/

    // Do something with the Connection

} catch (SQLException ex) {
    // handle any errors
    System.out.println("SQLException: " + ex.getMessage());
    System.out.println("SQLState: " + ex.getSQLState());
    System.out.println("VendorError: " + ex.getErrorCode());
}
```

Once a Connection is established, it can be used to create Statements and PreparedStatements, as well as retrieve metadata about the database. This is explained in the following sections.

## 1.1.2. Using Statements to Execute SQL

Statements allow you to execute basic SQL queries and retrieve the results through the ResultSet class which is described later.

To create a Statement instance, you call the createStatement() method on the Connection object you have retrieved via one of the DriverManager.getConnection() or DataSource.getConnection() methods described earlier.

Once you have a Statement instance, you can execute a SELECT query by calling the executeQuery(String) method with the SQL you want to use.

To update data in the database use the executeUpdate(String SQL) method. This method returns the number of rows affected by the update statement.

If you don't know ahead of time whether the SQL statement will be a `SELECT` or an `UPDATE/INSERT`, then you can use the `execute(String SQL)` method. This method will return `true` if the SQL query was a `SELECT`, or `false` if an `UPDATE/INSERT/DELETE` query. If the query was a `SELECT` query, you can retrieve the results by calling the `getResultSet()` method. If the query was an `UPDATE/INSERT/DELETE` query, you can retrieve the affected rows count by calling `getUpdateCount()` on the `Statement` instance.

### Example 2. Using `java.sql.Statement` to Execute a `SELECT` Query

```
// assume conn is an already created JDBC connection
Statement stmt = null;
ResultSet rs = null;

try {
    stmt = conn.createStatement();
    rs = stmt.executeQuery("SELECT foo FROM bar");

    // or alternatively, if you don't know ahead of time that
    // the query will be a SELECT...

    if (stmt.execute("SELECT foo FROM bar")) {
        rs = stmt.getResultSet();
    }

    // Now do something with the ResultSet ....
} finally {
    // it is a good idea to release
    // resources in a finally{} block
    // in reverse-order of their creation
    // if they are no-longer needed

    if (rs != null) {
        try {
            rs.close();
        } catch (SQLException sqlEx) { // ignore }

        rs = null;
    }

    if (stmt != null) {
        try {
            stmt.close();
        } catch (SQLException sqlEx) { // ignore }

        stmt = null;
    }
}
```

## 1.1.3. Using `CallableStatements` to Execute Stored Procedures

Starting with MySQL server version 5.0 when used with Connector/J 3.1.1 or newer, the `java.sql.CallableStatement` interface is fully implemented with the exception of the `getParameterMetaData()` method.

MySQL's stored procedure syntax is documented in the "Stored Procedures and Functions [[http://www.mysql.com/doc/en/Stored\\_Procedures.html](http://www.mysql.com/doc/en/Stored_Procedures.html)]" section of the MySQL Reference Manual.

Connector/J exposes stored procedure functionality through JDBC's `CallableStatement` interface.

The following example shows a stored procedure that returns the value of `inOutParam` incremented by 1, and the string passed in via `inputParam` as a `ResultSet` :

### Example 3. Stored Procedure Example

```
CREATE PROCEDURE demoSp(IN inputParam VARCHAR(255), INOUT inOutParam INT)
BEGIN
    DECLARE z INT;
    SET z = inOutParam + 1;
    SET inOutParam = z;

    SELECT inputParam;

    SELECT CONCAT('zyxw', inputParam);
END
```

To use the `demoSp` procedure with Connector/J, follow these steps:

1. Prepare the callable statement by using `Connection.prepareCall()`.

Notice that you have to use JDBC escape syntax, and that the parentheses surrounding the parameter placeholders are not optional:

### Example 4. Using `Connection.prepareCall()`

```
import java.sql.CallableStatement;

...

//
// Prepare a call to the stored procedure 'demoSp'
// with two parameters
//
// Notice the use of JDBC-escape syntax ({call ...})
//

CallableStatement cStmt = conn.prepareCall("{call demoSp(?, ?)}");

cStmt.setString(1, "abcdefg");
```

### Note

`Connection.prepareCall()` is an expensive method, due to the metadata retrieval that the driver performs to support output parameters. For performance reasons, you should try to minimize unnecessary calls to `Connection.prepareCall()` by reusing `CallableStatement` instances in your code.

2. Register the output parameters (if any exist)

To retrieve the values of output parameters (parameters specified as `OUT` or `INOUT` when you cre-

ated the stored procedure), JDBC requires that they be specified before statement execution using the various `registerOutputParameter()` methods in the `CallableStatement` interface:

### Example 5. Registering Output Parameters

```
import java.sql.Types;
...
//
// Connector/J supports both named and indexed
// output parameters. You can register output
// parameters using either method, as well
// as retrieve output parameters using either
// method, regardless of what method was
// used to register them.
//
// The following examples show how to use
// the various methods of registering
// output parameters (you should of course
// use only one registration per parameter).
//

//
// Registers the second parameter as output, and
// uses the type 'INTEGER' for values returned from
// getObject()
//

cStmt.registerOutParameter(2, Types.INTEGER);

//
// Registers the named parameter 'inOutParam', and
// uses the type 'INTEGER' for values returned from
// getObject()
//

cStmt.registerOutParameter("inOutParam", Types.INTEGER);
...
```

#### 3. Set the input parameters (if any exist)

Input and in/out parameters are set as for `PreparedStatement` objects. However, `CallableStatement` also supports setting parameters by name:

### Example 6. Setting CallableStatement Input Parameters

```
...

//
// Set a parameter by index
//

cStmt.setString(1, "abcdefg");

//
// Alternatively, set a parameter using
// the parameter name
```

```
//  
cStmt.setString("inputParameter", "abcdefg");  
  
//  
// Set the 'in/out' parameter using an index  
//  
cStmt.setInt(2, 1);  
  
//  
// Alternatively, set the 'in/out' parameter  
// by name  
//  
cStmt.setInt("inOutParam", 1);  
  
...
```

4. Execute the `CallableStatement`, and retrieve any result sets or output parameters.

While `CallableStatement` supports calling any of the `Statement` execute methods ( `executeUpdate()`, `executeQuery()` or `execute()` ), the most flexible method to call is `execute()`, as you do not need to know ahead of time if the stored procedure returns result sets:

### **Example 7. Retrieving Results and Output Parameter Values**

```
...  
  
boolean hadResults = cStmt.execute();  
  
//  
// Process all returned result sets  
//  
while (hadResults) {  
    ResultSet rs = cStmt.getResultSet();  
  
    // process result set  
    ...  
  
    hadResults = cStmt.getMoreResults();  
}  
  
//  
// Retrieve output parameters  
//  
// Connector/J supports both index-based and  
// name-based retrieval  
//  
  
int outputValue = cStmt.getInt(2); // index-based  
outputValue = cStmt.getInt("inOutParam"); // name-based  
  
...
```

### 1.1.4. Retrieving AUTO\_INCREMENT Column Values

Before version 3.0 of the JDBC API, there was no standard way of retrieving key values from databases that supported 'auto increment' or identity columns. With older JDBC drivers for MySQL, you could always use a MySQL-specific method on the Statement interface, or issue the query 'SELECT LAST\_INSERT\_ID()' after issuing an 'INSERT' to a table that had an AUTO\_INCREMENT key. Using the MySQL-specific method call isn't portable, and issuing a 'SELECT' to get the AUTO\_INCREMENT key's value requires another round-trip to the database, which isn't as efficient as possible. The following code snippets demonstrate the three different ways to retrieve AUTO\_INCREMENT values. First, we demonstrate the use of the new JDBC-3.0 method 'getGeneratedKeys()' which is now the preferred method to use if you need to retrieve AUTO\_INCREMENT keys and have access to JDBC-3.0. The second example shows how you can retrieve the same value using a standard 'SELECT LAST\_INSERT\_ID()' query. The final example shows how updatable result sets can retrieve the AUTO\_INCREMENT value when using the method 'insertRow()'.

#### **Example 8. Retrieving AUTO\_INCREMENT Column Values using Statement.getGeneratedKeys()**

```
Statement stmt = null;
ResultSet rs = null;

try {
    //
    // Create a Statement instance that we can use for
    // 'normal' result sets assuming you have a
    // Connection 'conn' to a MySQL database already
    // available

    stmt = conn.createStatement(java.sql.ResultSet.TYPE_FORWARD_ONLY,
                                java.sql.ResultSet.CONCUR_UPDATABLE);

    //
    // Issue the DDL queries for the table for this example
    //

    stmt.executeUpdate("DROP TABLE IF EXISTS autoIncTutorial");
    stmt.executeUpdate(
        "CREATE TABLE autoIncTutorial ("
        + "priKey INT NOT NULL AUTO_INCREMENT, "
        + "dataField VARCHAR(64), PRIMARY KEY (priKey))");

    //
    // Insert one row that will generate an AUTO INCREMENT
    // key in the 'priKey' field
    //

    stmt.executeUpdate(
        "INSERT INTO autoIncTutorial (dataField) "
        + "values ('Can I Get the Auto Increment Field?')",
        Statement.RETURN_GENERATED_KEYS);

    //
    // Example of using Statement.getGeneratedKeys()
    // to retrieve the value of an auto-increment
    // value
    //

    int autoIncKeyFromApi = -1;
```

```
rs = stmt.getGeneratedKeys();

if (rs.next()) {
    autoIncKeyFromApi = rs.getInt(1);
} else {

    // throw an exception from here
}

rs.close();

rs = null;

System.out.println("Key returned from getGeneratedKeys():"
    + autoIncKeyFromApi);
} finally {

    if (rs != null) {
        try {
            rs.close();
        } catch (SQLException ex) {
            // ignore
        }
    }

    if (stmt != null) {
        try {
            stmt.close();
        } catch (SQLException ex) {
            // ignore
        }
    }
}
```

### **Example 9. Retrieving AUTO\_INCREMENT Column Values using 'SELECT LAST\_INSERT\_ID()'**

```
Statement stmt = null;
ResultSet rs = null;

try {

    //
    // Create a Statement instance that we can use for
    // 'normal' result sets.

    stmt = conn.createStatement();

    //
    // Issue the DDL queries for the table for this example
    //

    stmt.executeUpdate("DROP TABLE IF EXISTS autoIncTutorial");
    stmt.executeUpdate(
        "CREATE TABLE autoIncTutorial ("
        + "priKey INT NOT NULL AUTO_INCREMENT, "
        + "dataField VARCHAR(64), PRIMARY KEY (priKey))");
```



```
//
// Insert one row that will generate an AUTO INCREMENT
// key in the 'priKey' field
//

stmt.executeUpdate(
    "INSERT INTO autoIncTutorial (dataField) "
    + "values ('Can I Get the Auto Increment Field?')");

//
// Use the MySQL LAST_INSERT_ID()
// function to do the same thing as getGeneratedKeys()
//

int autoIncKeyFromFunc = -1;
rs = stmt.executeQuery("SELECT LAST_INSERT_ID()");

if (rs.next()) {
    autoIncKeyFromFunc = rs.getInt(1);
} else {
    // throw an exception from here
}

rs.close();

System.out.println("Key returned from " + "'SELECT LAST_INSERT_ID()': "
    + autoIncKeyFromFunc);
} finally {

    if (rs != null) {
        try {
            rs.close();
        } catch (SQLException ex) {
            // ignore
        }
    }

    if (stmt != null) {
        try {
            stmt.close();
        } catch (SQLException ex) {
            // ignore
        }
    }
}
}
```

### **Example 10. Retrieving AUTO\_INCREMENT Column Values in Updatable ResultSets**

```
Statement stmt = null;
ResultSet rs = null;

try {

    //
    // Create a Statement instance that we can use for
    // 'normal' result sets as well as an 'updatable'
```

```
// one, assuming you have a Connection 'conn' to
// a MySQL database already available
//

stmt = conn.createStatement(java.sql.ResultSet.TYPE_FORWARD_ONLY,
                             java.sql.ResultSet.CONCUR_UPDATABLE);

//
// Issue the DDL queries for the table for this example
//

stmt.executeUpdate("DROP TABLE IF EXISTS autoIncTutorial");
stmt.executeUpdate(
    "CREATE TABLE autoIncTutorial ("
    + "priKey INT NOT NULL AUTO_INCREMENT, "
    + "dataField VARCHAR(64), PRIMARY KEY (priKey))");

//
// Example of retrieving an AUTO INCREMENT key
// from an updatable result set
//

rs = stmt.executeQuery("SELECT priKey, dataField "
    + "FROM autoIncTutorial");

rs.moveToInsertRow();

rs.updateString("dataField", "AUTO INCREMENT here?");
rs.insertRow();

//
// the driver adds rows at the end
//

rs.last();

//
// We should now be on the row we just inserted
//

int autoIncKeyFromRS = rs.getInt("priKey");

rs.close();

rs = null;

System.out.println("Key returned for inserted row: "
    + autoIncKeyFromRS);
} finally {

    if (rs != null) {
        try {
            rs.close();
        } catch (SQLException ex) {
            // ignore
        }
    }

    if (stmt != null) {
        try {
            stmt.close();
        } catch (SQLException ex) {
            // ignore
        }
    }
}
```

---

```
}  
    }  
}
```

When you run the example code above, you should get the following output: Key returned from `getGeneratedKeys()`: 1 Key returned from `'SELECT LAST_INSERT_ID()'`: 1 Key returned for inserted row: 2 You should be aware, that at times, it can be tricky to use the `'SELECT LAST_INSERT_ID()'` query, as that function's value is scoped to a connection. So, if some other query happens on the same connection, the value will be overwritten. On the other hand, the `'getGeneratedKeys()'` method is scoped by the Statement instance, so it can be used even if other queries happen on the same connection, but not on the same Statement instance.

## 1.2. Installing Connector/J

Use the following instructions to install Connector/J

### 1.2.1. Required Software Versions

#### 1.2.1.1. Java Versions Supported

MySQL Connector/J supports Java-2 JVMs, including JDK-1.2.x, JDK-1.3.x, JDK-1.4.x and JDK-1.5.x, and requires JDK-1.4.x or newer to compile (but not run). MySQL Connector/J does not support JDK-1.1.x or JDK-1.0.x

Because of the implementation of `java.sql.Savepoint`, Connector/J 3.1.0 and newer will not run on JDKs older than 1.4 unless the class verifier is turned off (`-Xverify:none`), as the class verifier will try to load the class definition for `java.sql.Savepoint` even though it is not accessed by the driver unless you actually use `savepoint` functionality.

Caching functionality provided by Connector/J 3.1.0 or newer is also not available on JVMs older than 1.4.x, as it relies on `java.util.LinkedHashMap` which was first available in JDK-1.4.0.

#### 1.2.1.2. MySQL Server Version Guidelines

MySQL Connector/J supports all known MySQL server versions. Some features (foreign keys, updatable result sets) require more recent versions of MySQL to operate.

When connecting to MySQL server version 4.1 or newer, it is best to use MySQL Connector/J version 3.1, as it has full support for features in the newer versions of the server, including Unicode characters, views, stored procedures and server-side prepared statements.

While Connector/J version 3.0 will connect to MySQL server, version 4.1 or newer, and implements Unicode characters and the new authorization mechanism, Connector/J 3.0 will not be updated to support new features in current and future server versions.

#### 1.2.1.3. Installing the Driver and Configuring the CLASSPATH

MySQL Connector/J is distributed as a .zip or .tar.gz archive containing the sources, the class files a class-file only "binary" .jar archive named `"mysql-connector-java-[version]-bin.jar"`, and starting with Connector/J 3.1.8 a "debug" build of the driver in a file named `"mysql-connector-java-[version]-bin-g.jar"`.

Starting with Connector/J 3.1.9, we don't ship the .class files "unbundled", they are only available in the

JAR archives that ship with the driver.

You should not use the "debug" build of the driver unless instructed to do so when reporting a problem or bug to MySQL AB, as it is not designed to be run in production environments, and will have adverse performance impact when used. The debug binary also depends on the Aspect/J runtime library, which is located in the `src/lib/aspectjrt.jar` file that comes with the Connector/J distribution.

You will need to use the appropriate graphical or command-line utility to un-archive the distribution (for example, WinZip for the .zip archive, and "tar" for the .tar.gz archive). Because there are potentially long filenames in the distribution, we use the GNU tar archive format. You will need to use GNU tar (or an application that understands the GNU tar archive format) to unpack the .tar.gz variant of the distribution.

Once you have extracted the distribution archive, you can install the driver by placing `mysql-connector-java-[version]-bin.jar` in your classpath, either by adding the FULL path to it to your CLASSPATH environment variable, or by directly specifying it with the command line switch `-cp` when starting your JVM

If you are going to use the driver with the JDBC DriverManager, you would use `"com.mysql.jdbc.Driver"` as the class that implements `java.sql.Driver`.

### **Example 11. Setting the CLASSPATH Under UNIX**

The following command works for 'csh' under UNIX:

```
$ setenv CLASSPATH /path/to/mysql-connector-java-[version]-bin.jar:$CLASSPATH
```

The above command can be added to the appropriate startup file for the login shell to make MySQL Connector/J available to all Java applications.

If you want to use MySQL Connector/J with an application server such as Tomcat or JBoss, you will have to read your vendor's documentation for more information on how to configure third-party class libraries, as most application servers ignore the CLASSPATH environment variable. This document does contain configuration examples for some J2EE application servers in the section named "Using Connector/J with J2EE and Other Java Frameworks", however the authoritative source for JDBC connection pool configuration information for your particular application server is the documentation for that application server.

If you are developing servlets and/or JSPs, and your application server is J2EE-compliant, you can put the driver's .jar file in the WEB-INF/lib subdirectory of your webapp, as this is a standard location for third party class libraries in J2EE web applications.

You can also use the `MysqlDataSource` or `MysqlConnectionPoolDataSource` classes in the `com.mysql.jdbc.jdbc2.optional` package, if your J2EE application server supports or requires them. Starting with Connector/J 5.0.0, the `javax.sql.XADataSource` interface is implemented via the `com.mysql.jdbc.jdbc2.optional.MysqlXADataSource` class, which supports XA distributed transactions when used in combination with MySQL server version 5.0.

The various `MysqlDataSource` classes support the following parameters (through standard "set" mutators):

- user
- password

- `serverName` (see the previous section about fail-over hosts)
- `databaseName`
- `port`

## 1.2.2. Upgrading from an Older Version

MySQL AB tries to keep the upgrade process as easy as possible, however as is the case with any software, sometimes changes need to be made in new versions to support new features, improve existing functionality, or comply with new standards.

This section has information about what users who are upgrading from one version of Connector/J to another (or to a new version of the MySQL server, with respect to JDBC functionality) should be aware of.

### 1.2.2.1. Upgrading from MySQL Connector/J 3.0 to 3.1

Connector/J 3.1 is designed to be backward-compatible with Connector/J 3.0 as much as possible. Major changes are isolated to new functionality exposed in MySQL-4.1 and newer, which includes Unicode character sets, server-side prepared statements, `SQLState` codes returned in error messages by the server and various performance enhancements that can be enabled or disabled via configuration properties.

- **Unicode Character Sets** - See the next section, as well as the "Character Sets" section in the server manual for information on this new feature of MySQL. If you have something misconfigured, it will usually show up as an error with a message similar to 'Illegal mix of collations'.
- **Server-side Prepared Statements** - Connector/J 3.1 will automatically detect and use server-side prepared statements when they are available (MySQL server version 4.1.0 and newer).

Starting with version 3.1.7, the driver scans SQL you are preparing via all variants of `Connection.prepareStatement()` to determine if it is a supported type of statement to prepare on the server side, and if it is not supported by the server, it instead prepares it as a client-side emulated prepared statement. You can disable this feature by passing `'emulateUnsupportedPstmts=false'` in your JDBC URL.

If your application encounters issues with server-side prepared statements, you can revert to the older client-side emulated prepared statement code that is still presently used for MySQL servers older than 4.1.0 with the following connection property:

```
useServerPrepStmts=false
```

- **Datetimes with all-zero components ('0000-00-00 ...')** - These values can not be represented reliably in Java. Connector/J 3.0.x always converted them to NULL when being read from a `ResultSet`.

Connector/J 3.1 throws an exception by default when these values are encountered as this is the most correct behavior according to the JDBC and SQL standards. This behavior can be modified using the `'zeroDateTimeBehavior'` configuration property. The allowable values are: `'exception'` (the default), which throws an `SQLException` with an `SQLState` of `'S1009'`, `'convertToNull'`, which returns NULL instead of the date, and `'round'`, which rounds the date to the nearest closest value which is `'0001-01-01'`.

Starting with Connector/J 3.1.7, `ResultSet.getString()` can be decoupled from this behavior via `'noDatetimeStringSync=true'` (the default value is `'false'`) so that you can get retrieve the unaltered all-zero value as a String. It should be noted that this also precludes using any timezone conversions, therefore the driver will not allow you to enable `noDatetimeStringSync` and `useTimezone` at the same time.

- New SQLState Codes - Connector/J 3.1 uses SQL:1999 SQLState codes returned by the MySQL server (if supported), which are different than the "legacy" X/Open state codes that Connector/J 3.0 uses. If connected to a MySQL server older than MySQL-4.1.0 (the oldest version to return SQLStates as part of the error code), the driver will use a built-in mapping. You can revert to the old mapping by using the following configuration property:

```
useSqlStateCodes=false
```

- Calling `ResultSet.getString()` on a BLOB column will now return the address of the `byte[]` array that represents it, instead of a `String` representation of the BLOB. BLOBs have no character set, so they can't be converted to `java.lang.Strings` without data loss or corruption.

To store strings in MySQL with LOB behavior, use one of the TEXT types, which the driver will treat as a `java.sql.Clob`.

- Starting with Connector/J 3.1.8 a "debug" build of the driver in a file named `"mysql-connector-java-[version]-bin-g.jar"` is shipped alongside the normal "binary" jar file that is named `"mysql-connector-java-[version]-bin.jar"`.

Starting with Connector/J 3.1.9, we don't ship the .class files "unbundled", they are only available in the JAR archives that ship with the driver.

You should not use the "debug" build of the driver unless instructed to do so when reporting a problem or bug to MySQL AB, as it is not designed to be run in production environments, and will have adverse performance impact when used. The debug binary also depends on the Aspect/J runtime library, which is located in the `src/lib/aspectjrt.jar` file that comes with the Connector/J distribution.

### 1.2.2.2. JDBC-Specific Issues When Upgrading to MySQL Server 4.1 or Newer

- *Using the UTF-8 Character Encoding* - Prior to MySQL server version 4.1, the UTF-8 character encoding was not supported by the server, however the JDBC driver could use it, allowing storage of multiple character sets in latin1 tables on the server.

Starting with MySQL-4.1, this functionality is deprecated. If you have applications that rely on this functionality, and can not upgrade them to use the official Unicode character support in MySQL server version 4.1 or newer, you should add the following property to your connection URL:

```
useOldUTF8Behavior=true
```

- *Server-side Prepared Statements* - Connector/J 3.1 will automatically detect and use server-side prepared statements when they are available (MySQL server version 4.1.0 and newer). If your application encounters issues with server-side prepared statements, you can revert to the older client-side emulated prepared statement code that is still presently used for MySQL servers older than 4.1.0 with the following connection property:

```
useServerPrepStmts=false
```

## 1.3. JDBC Reference

### 1.3.1. Driver/Datasource Class Names, URL Syntax and Configuration Properties for Connector/J

The name of the class that implements `java.sql.Driver` in MySQL Connector/J is `'com.mysql.jdbc.Driver'`. The `'org.gjt.mm.mysql.Driver'` class name is also usable to remain backward-compatible with MM.MySQL. You should use this class name when registering the driver, or when otherwise configuring software to use MySQL Connector/J.

The JDBC URL format for MySQL Connector/J is as follows, with items in square brackets ([, ]) being optional:

```
jdbc:mysql://[host][,failoverhost...][:port]/[database][?propertyName1][=propertyValue1]
```

If the hostname is not specified, it defaults to '127.0.0.1'. If the port is not specified, it defaults to '3306', the default port number for MySQL servers.

```
jdbc:mysql://[host:port],[host:port].../[database][?propertyName1][=propertyValue1]
```

If the database is not specified, the connection will be made with no 'current' database. In this case, you will need to either call the `'setCatalog()'` method on the Connection instance or fully-specify table names using the database name (i.e. `'SELECT dbname.tablename.colname FROM dbname.tablename...'`) in your SQL. Not specifying the database to use upon connection is generally only useful when building tools that work with multiple databases, such as GUI database managers.

MySQL Connector/J has fail-over support. This allows the driver to fail-over to any number of "slave" hosts and still perform read-only queries. Fail-over only happens when the connection is in an `autoCommit(true)` state, because fail-over can not happen reliably when a transaction is in progress. Most application servers and connection pools set `autoCommit` to 'true' at the end of every transaction/connection use.

The fail-over functionality has the following behavior:

If the URL property `"autoReconnect"` is false: Failover only happens at connection initialization, and fallback occurs when the driver determines that the first host has become available again.

If the URL property `"autoReconnect"` is true: Failover happens when the driver determines that the connection has failed (before *every* query), and falls back to the first host when it determines that the host has become available again (after queriesBeforeRetryMaster queries have been issued).

In either case, whenever you are connected to a "failed-over" server, the connection will be set to read-only state, so queries that would modify data will have exceptions thrown (the query will *never* be processed by the MySQL server).

Configuration properties define how Connector/J will make a connection to a MySQL server. Unless otherwise noted, properties can be set for a `DataSource` object or for a `Connection` object.

Configuration Properties can be set in one of the following ways:

- Using the `set*()` methods on MySQL implementations of `java.sql.DataSource` (which is the preferred method when using implementations of `java.sql.DataSource`):
  - `com.mysql.jdbc.jdbc2.optional.MysqlDataSource`
  - `com.mysql.jdbc.jdbc2.optional.MysqlConnectionPoolDataSource`
- As a key/value pair in the `java.util.Properties` instance passed to `DriverManager.getConnection()` or `Driver.connect()`
- As a JDBC URL parameter in the URL given to `java.sql.DriverManager.getConnection()`,

java.sql.Driver.connect() or the MySQL implementations of javax.sql.DataSource's setURL() method.

## Note

If the mechanism you use to configure a JDBC URL is XML-based, you will need to use the XML character literal `&` to separate configuration parameters, as the ampersand is a reserved character for XML.

The properties are listed in the following table:

**Table 1. Connection Properties**

Property Name	Definition	Required?	Default Value	Since Version
<i>Connection/Authentication</i>				
user	The user to connect as	No		all
password	The password to use when connecting	No		all
socketFactory	The name of the class that the driver should use for creating socket connections to the server. This class must implement the interface 'com.mysql.jdbc.SocketFactory' and have public no-args constructor.	No	com.mysql.jdbc.StandardSocketFactory	3.0.3
connectTimeout	Timeout for socket connect (in milliseconds), with 0 being no timeout. Only works on JDK-1.4 or newer. Defaults to '0'.	No	0	3.0.1
socketTimeout	Timeout on network socket operations (0, the default means no timeout).	No	0	3.0.1
useConfigs	Load the comma-delimited list of configuration properties before parsing the URL or applying user-specified properties. These configurations are explained in the 'Con-	No		3.1.5



Property Name	Definition	Required?	Default Value	Since Version
	figurations' of the documentation.			
interactiveClient	Set the CLIENT_INTERACTIVE flag, which tells MySQL to timeout connections based on INTERACTIVE_TIMEOUT instead of WAIT_TIMEOUT	No	false	3.1.0
propertiesTransform	An implementation of com.mysql.jdbc.ConnectionPropertiesTransform that the driver will use to modify URL properties passed to the driver before attempting a connection	No		3.1.4
useCompression	Use zlib compression when communicating with the server (true/false)? Defaults to 'false'.	No	false	3.0.17
<i>High Availability and Clustering</i>				
autoReconnect	Should the driver try to re-establish stale and/or dead connections? If enabled the driver will throw an exception for a queries issued on a stale or dead connection, which belong to the current transaction, but will attempt reconnect before the next query issued on the connection in a new transaction. The use of this feature is not recommended, because it has side effects related to session state and data consistency when applications don't handle SQLExceptions	No	false	1.1

Property Name	Definition	Required?	Default Value	Since Version
	properly, and is only designed to be used when you are unable to configure your application to handle SQLExceptions resulting from dead and stale connections properly. Alternatively, investigate setting the MySQL server variable "wait_timeout" to some high value rather than the default of 8 hours.			
autoReconnectForPools	Use a reconnection strategy appropriate for connection pools (defaults to 'false')	No	false	3.1.3
failOverReadOnly	When failing over in autoReconnect mode, should the connection be set to 'read-only'?	No	true	3.0.12
reconnectAtTxEnd	If autoReconnect is set to true, should the driver attempt reconnections at the end of every transaction?	No	false	3.0.10
roundRobinLoadBalance	When autoReconnect is enabled, and failoverReadOnly is false, should we pick hosts to connect to on a round-robin basis?	No	false	3.1.2
queriesBeforeRetryMaster	Number of queries to issue before falling back to master when failed over (when using multi-host failover). Whichever condition is met first, 'queriesBeforeRetryMaster' or 'secondsBeforeRetryMaster' will cause an attempt to be made to reconnect to the	No	50	3.0.2

Property Name	Definition	Required?	Default Value	Since Version
	master. Defaults to 50.			
secondsBeforeRetryMaster	How long should the driver wait, when failed over, before attempting to reconnect to the master server? Whichever condition is met first, 'queriesBeforeRetryMaster' or 'secondsBeforeRetryMaster' will cause an attempt to be made to reconnect to the master. Time in seconds, defaults to 30	No	30	3.0.2
enableDeprecatedAutoreconnect	Auto-reconnect functionality is deprecated starting with version 3.2, and will be removed in version 3.3. Set this property to 'true' to disable the check for the feature being configured.	No	false	3.2.1
<i>Security</i>				
allowMultiQueries	Allow the use of ';' to delimit multiple queries during one statement (true/false, defaults to 'false')	No	false	3.1.1
useSSL	Use SSL when communicating with the server (true/false), defaults to 'false'	No	false	3.0.2
requireSSL	Require SSL connection if useSSL=true? (defaults to 'false').	No	false	3.1.0
allowUrlInLocalInfile	Should the driver allow URLs in 'LOAD DATA LOCAL INFILE' statements?	No	false	3.1.4
paranoid	Take measures to prevent exposure	No	false	3.0.1

Property Name	Definition	Required?	Default Value	Since Version
	sensitive information in error messages and clear data structures holding sensitive data when possible? (defaults to 'false')			
<i>Performance Extensions</i>				
metadataCacheSize	The number of queries to cacheResultSetMetadata for if cacheResultSetMetaData is set to 'true' (default 50)	No	50	3.1.1
prepStmtCacheSize	If prepared statement caching is enabled, how many prepared statements should be cached?	No	25	3.0.10
prepStmtCacheSql-Limit	If prepared statement caching is enabled, what's the largest SQL the driver will cache the parsing for?	No	256	3.0.10
useCursorFetch	If connected to MySQL > 5.0.2, and setFetchSize() > 0 on a statement, should that statement use cursor-based fetching to retrieve rows?	No	false	5.0.0
blobSendChunkSize	Chunk to use when sending BLOB/CLOBs via Server-PreparedStatements	No	1048576	3.1.9
cacheCallableStmts	Should the driver cache the parsing stage of CallableStatements	No	false	3.1.2
cachePrepStmts	Should the driver cache the parsing stage of PreparedStatements of client-side prepared statements, the "check" for suitability of server-side prepared and server-side prepared statements themselves?	No	false	3.0.10

Property Name	Definition	Required?	Default Value	Since Version
cacheResultSet-Metadata	Should the driver cache ResultSet-MetaData for Statements and PreparedStatements? (Req. JDK-1.4+, true/false, default 'false')	No	false	3.1.1
cacheServerCon-figuration	Should the driver cache the results of 'SHOW VARIABLES' and 'SHOW COLLATION' on a per-URL basis?	No	false	3.1.5
defaultFetchSize	The driver will call setFetchSize(n) with this value on all newly-created Statements	No	0	3.1.9
dontTrackOpenRe-sources	The JDBC specification requires the driver to automatically track and close resources, however if your application doesn't do a good job of explicitly calling close() on statements or result sets, this can cause memory leakage. Setting this property to true relaxes this constraint, and can be more memory efficient for some applications.	No	false	3.1.7
dynamicCalendars	Should the driver retrieve the default calendar when required, or cache it per connection/session?	No	false	3.1.5
elideSetAutoCom-mits	If using MySQL-4.1 or newer, should the driver only issue 'set auto-commit=n' queries when the server's state doesn't match the requested state by Connection.setAutoComm	No	false	3.1.3

Property Name	Definition	Required?	Default Value	Since Version
	t(boolean)?			
holdResultsOpen-OverStatementClose	Should the driver close result sets on Statement.close() as required by the JDBC specification?	No	false	3.1.7
locatorFetchBufferSize	If 'emulateLocators' is configured to 'true', what size buffer should be used when fetching BLOB data for getBinaryInputStream?	No	1048576	3.2.1
useFastIntParsing	Use internal String->Integer conversion routines to avoid excessive object creation?	No	true	3.1.4
useLocalSession-State	Should the driver refer to the internal values of autocommit and transaction isolation that are set by Connection.setAutoCommit() and Connection.setTransactionIsolation(), rather than querying the database?	No	false	3.1.7
useReadAheadInput	Use newer, optimized non-blocking, buffered input stream when reading from the server?	No	true	3.1.5
<i>Debugging/Profiling</i>				
logger	The name of a class that implements 'com.mysql.jdbc.log.Log' that will be used to log messages to.(default is 'com.mysql.jdbc.log.StandardLogger', which logs to STDERR)	No	com.mysql.jdbc.log.StandardLogger	3.1.1
profileSQL	Trace queries and their execution/fetch times to the configured logger (true/false) defaults	No	false	3.1.0

Property Name	Definition	Required?	Default Value	Since Version
	to 'false'			
reportMetricsIntervalMillis	If 'gatherPerfMetrics' is enabled, how often should they be logged (in ms)?	No	30000	3.1.2
maxQuerySizeToLog	Controls the maximum length/size of a query that will get logged when profiling or tracing	No	2048	3.1.3
packetDebugBufferSize	The maximum number of packets to retain when 'enablePacketDebug' is true	No	20	3.1.3
slowQueryThresholdMillis	If 'logSlowQueries' is enabled, how long should a query (in ms) before it is logged as 'slow'?	No	2000	3.1.2
useUsageAdvisor	Should the driver issue 'usage' warnings advising proper and efficient usage of JDBC and MySQL Connector/J to the log (true/false, defaults to 'false')?	No	false	3.1.1
autoGenerateTestcaseScript	Should the driver dump the SQL it is executing, including server-side prepared statements to STDERR?	No	false	3.1.9
dumpMetadataOnColumnNotFound	Should the driver dump the field-level metadata of a result set into the exception message when ResultSet.findColumn() fails?	No	false	3.1.13
dumpQueriesOnException	Should the driver dump the contents of the query sent to the server in the message for SQLExceptions?	No	false	3.1.3
enablePacketDebug	When enabled, a ring-buffer of 'packetDebugBufferSize'	No	false	3.1.3

Property Name	Definition	Required?	Default Value	Since Version
	packets will be kept, and dumped when exceptions are thrown in key areas in the driver's code			
explainSlowQueries	If 'logSlowQueries' is enabled, should the driver automatically issue an 'EXPLAIN' on the server and send the results to the configured log at a WARN level?	No	false	3.1.2
logSlowQueries	Should queries that take longer than 'slowQueryThresholdMillis' be logged?	No	false	3.1.2
traceProtocol	Should trace-level network protocol be logged?	No	false	3.1.2
<i>Miscellaneous</i>				
useUnicode	Should the driver use Unicode character encodings when handling strings? Should only be used when the driver can't determine the character set mapping, or you are trying to 'force' the driver to use a character set that MySQL either doesn't natively support (such as UTF-8), true/false, defaults to 'true'	No	true	1.1g
characterEncoding	If 'useUnicode' is set to true, what character encoding should the driver use when dealing with strings? (defaults is to 'auto-detect')	No		1.1g
characterSetResults	Character set to tell the server to return results as.	No		3.0.13
connectionCollation	If set, tells the server to use this colla-	No		3.0.13



Property Name	Definition	Required?	Default Value	Since Version
	tion via 'set collation_connection'			
sessionVariables	A comma-separated list of name/value pairs to be sent as SET SESSION ... to the server when the driver connects.	No		3.1.8
allowNanAndInf	Should the driver allow NaN or +/-INF values in PreparedStatement.setDouble()?	No	false	3.1.5
autoClosePstmtStreams	Should the driver automatically call .close() on streams/readers passed as arguments via set*() methods?	No	false	3.1.12
autoDeserialize	Should the driver automatically detect and deserialize objects stored in BLOB fields?	No	false	3.1.5
capitalizeTypeNames	Capitalize type names in DatabaseMetaData? (usually only useful when using WebObjects, true/false, defaults to 'false')	No	false	2.0.7
clobCharacterEncoding	The character encoding to use for sending and retrieving TEXT, MEDIUMTEXT and LONGTEXT values instead of the configured connection character-encoding	No		5.0.0
clobberStreamingResults	This will cause a 'streaming' ResultSet to be automatically closed, and any outstanding data still streaming from the server to be discarded if another query is executed before all the data has been	No	false	3.0.9

Property Name	Definition	Required?	Default Value	Since Version
	read from the server.			
continueBatchOnError	Should the driver continue processing batch commands if one statement fails. The JDBC spec allows either way (defaults to 'true').	No	true	3.0.3
createDatabaseIfNotExist	Creates the database given in the URL if it doesn't yet exist. Assumes the configured user has permissions to create databases.	No	false	3.1.9
emptyStringsConvertToZero	Should the driver allow conversions from empty string fields to numeric values of '0'?	No	true	3.1.8
emulateLocators	N/A	No	false	3.1.0
emulateUnsupportedPstmts	Should the driver detect prepared statements that are not supported by the server, and replace them with client-side emulated versions?	No	true	3.1.7
ignoreNonTxTables	Ignore non-transactional table warning for roll-back? (defaults to 'false').	No	false	3.0.9
jdbcCompliant-Truncation	Should the driver throw java.sql.DataTruncation exceptions when data is truncated as is required by the JDBC specification when connected to a server that supports warnings(MySQL 4.1.0 and newer)?	No	true	3.1.2
maxRows	The maximum number of rows to return (0, the default means return all rows).	No	-1	all versions
noDatetimeString-	Don't ensure that	No	false	3.1.7

Property Name	Definition	Required?	Default Value	Since Version
Sync	Result-Set.getDatetimeType().toString().equals(ResultSet.getString())			
noTimezoneConversionForTime-Type	Don't convert TIME values using the server timezone if 'use-Timezone'='true'	No	false	5.0.0
nullCatalog-MeansCurrent	When Database-MetadataMethods ask for a 'catalog' parameter, does the value null mean use the current catalog? (this is not JDBC-compliant, but follows legacy behavior from earlier versions of the driver)	No	true	3.1.8
nullNamePattern-MatchesAll	Should Database-MetaData methods that accept *pattern parameters treat null the same as '%' (this is not JDBC-compliant, however older versions of the driver accepted this departure from the specification)	No	true	3.1.8
overrideSupportsIntegrityEnhancementFacility	Should the driver return "true" for Database-MetaData.supportsIntegrityEnhancementFacility() even if the database doesn't support it to workaround applications that require this method to return "true" to signal support of foreign keys, even though the SQL specification states that this facility contains much more than just foreign key support (one such application being OpenOffice)?	No	false	3.1.12

Property Name	Definition	Required?	Default Value	Since Version
pedantic	Follow the JDBC spec to the letter.	No	false	3.0.0
processEscapeCodesForPrepStmts	Should the driver process escape codes in queries that are prepared?	No	true	3.1.12
relaxAutoCommit	If the version of MySQL the driver connects to does not support transactions, still allow calls to commit(), rollback() and setAutoCommit() (true/false, defaults to 'false')?	No	false	2.0.13
retainStatementAfterResultSetClose	Should the driver retain the Statement reference in a ResultSet after ResultSet.close() has been called. This is not JDBC-compliant after JDBC-4.0.	No	false	3.1.11
rollbackOnPooledClose	Should the driver issue a rollback() when the logical connection in a pool is closed?	No	true	3.0.15
runningCTS13	Enables workarounds for bugs in Sun's JDBC compliance testsuite version 1.3	No	false	3.1.7
serverTimezone	Override detection/mapping of timezone. Used when timezone from server doesn't map to Java timezone	No		3.0.2
strictFloatingPoint	Used only in older versions of compliance test	No	false	3.0.0
strictUpdates	Should the driver do strict checking (all primary keys selected) of updatable result sets (true, false, defaults to 'true')?	No	true	3.0.4
tinyInt1isBit	Should the driver	No	true	3.0.16

Property Name	Definition	Required?	Default Value	Since Version
	treat the datatype TINYINT(1) as the BIT type (because the server silently converts BIT -> TINYINT(1) when creating tables)?			
transformedBitIs-Boolean	If the driver converts TINYINT(1) to a different type, should it use BOOLEAN instead of BIT for future compatibility with MySQL-5.0, as MySQL-5.0 has a BIT type?	No	false	3.1.9
ultraDevHack	Create Prepared-Statements for prepareCall() when required, because UltraDev is broken and issues a prepareCall() for _all_ statements? (true/false, defaults to 'false')	No	false	2.0.3
useGmtMillisForDatetimes	Convert between session timezone and GMT before creating Date and Timestamp instances (value of "false" is legacy behavior, "true" leads to more JDBC-compliant behavior.	No	false	3.1.12
useHostsInPrivileges	Add '@hostname' to users in DatabaseMetaData.getColumn/TablePrivileges() (true/false), defaults to 'true'.	No	true	3.0.2
useInformationSchema	When connected to MySQL-5.0.7 or newer, should the driver use the INFORMATION_SCHEMA to derive information used by DatabaseMetaData?	No	false	5.0.0

Property Name	Definition	Required?	Default Value	Since Version
useJDBCCompliantTimezoneShift	Should the driver use JDBC-compliant rules when converting TIME/TIMESTAMP/DATETIME values' timezone information for those JDBC arguments which take a java.util.Calendar argument? (Notice that this option is exclusive of the "use-Timezone=true" configuration option.)	No	false	5.0.0
useOldUTF8Behavior	Use the UTF-8 behavior the driver did when communicating with 4.0 and older servers	No	false	3.1.6
useOnlyServerErrorMessages	Don't prepend 'standard' SQLState error messages to error messages returned by the server.	No	true	3.0.15
useServerPrepStmts	Use server-side prepared statements if the server supports them? (defaults to 'true').	No	true	3.1.0
useSqlStateCodes	Use SQL Standard state codes instead of 'legacy' X/Open/SQL state codes (true/false), default is 'true'	No	true	3.1.3
useStreamLengthsInPrepStmts	Honor stream length parameter in PreparedStatement/ResultSet.setXXXStream() method calls (true/false, defaults to 'true')?	No	true	3.0.2
useTimezone	Convert time/date types between client and server timezones (true/false, defaults to 'false')?	No	false	3.0.2
useUnbufferedIn-	Don't use Buffered-	No	true	3.0.11

Property Name	Definition	Required?	Default Value	Since Version
put	InputStream for reading data from the server			
yearIsDateType	Should the JDBC driver treat the MySQL type "YEAR" as a java.sql.Date, or as a SHORT?	No	true	3.1.9
zeroDateTime-Behavior	What should happen when the driver encounters DATE-TIME values that are composed entirely of zeroes (used by MySQL to represent invalid dates)? Valid values are 'exception', 'round' and 'convertToNull'.	No	exception	3.1.4

Connector/J also supports access to MySQL via named pipes on Windows NT/2000/XP using the 'NamedPipeSocketFactory' as a plugin-socket factory via the 'socketFactory' property. If you don't use a 'namedPipePath' property, the default of '\\.\pipe\MySQL' will be used. If you use the NamedPipeSocketFactory, the hostname and port number values in the JDBC url will be ignored.

Adding the following property to your URL will enable the NamedPipeSocketFactory:

```
socketFactory=com.mysql.jdbc.NamedPipeSocketFactory
```

Named pipes only work when connecting to a MySQL server on the same physical machine as the one the JDBC driver is being used on. In simple performance tests, it appears that named pipe access is between 30%-50% faster than the standard TCP/IP access.

You can create your own socket factories by following the example code in `com.mysql.jdbc.NamedPipeSocketFactory`, or `com.mysql.jdbc.StandardSocketFactory`.

### 1.3.2. JDBC API Implementation Notes

MySQL Connector/J passes all of the tests in the publicly-available version of Sun's JDBC compliance test suite. However, in many places the JDBC specification is vague about how certain functionality should be implemented, or the specification allows leeway in implementation.

This section gives details on a interface-by-interface level about how certain implementation decisions may affect how you use MySQL Connector/J.

- **Blob**

The Blob implementation does not allow in-place modification (they are 'copies', as reported by the `DatabaseMetaData.locatorsUpdateCopies()` method). Because of this, you should use the corresponding `PreparedStatement.setBlob()` or `ResultSet.updateBlob()` (in the case of updatable result sets) methods to save changes back to the database.

Starting with Connector/J version 3.1.0, you can emulate Blobs with locators by adding the property 'emulateLocators=true' to your JDBC URL. You must then use a column alias with the value of the column set to the actual name of the Blob column in the SELECT that you write to retrieve the Blob. The SELECT must also reference only one table, the table must have a primary key, and the SELECT must cover all columns that make up the primary key. The driver will then delay loading the actual Blob data until you retrieve the Blob and call retrieval methods (getInputStream(), getBytes(), and so forth) on it.

- CallableStatement

Starting with Connector/J 3.1.1, stored procedures are supported when connecting to MySQL version 5.0 or newer via the CallableStatement interface. Currently, the getParameterMetaData() method of CallableStatement is not supported.

- Clob

The Clob implementation does not allow in-place modification (they are 'copies', as reported by the DatabaseMetaData.locatorsUpdateCopies() method). Because of this, you should use the PreparedStatement.setClob() method to save changes back to the database. The JDBC API does not have a ResultSet.updateClob() method.

- Connection

Unlike older versions of MM.MySQL the 'isClosed()' method does not "ping" the server to determine if it is alive. In accordance with the JDBC specification, it only returns true if 'closed()' has been called on the connection. If you need to determine if the connection is still valid, you should issue a simple query, such as "SELECT 1". The driver will throw an exception if the connection is no longer valid.

- DatabaseMetaData

Foreign Key information (getImported/ExportedKeys() and getCrossReference()) is only available from 'InnoDB'-type tables. However, the driver uses 'SHOW CREATE TABLE' to retrieve this information, so when other table types support foreign keys, the driver will transparently support them as well.

- Driver

- PreparedStatement

PreparedStatement are implemented by the driver, as MySQL does not have a prepared statement feature. Because of this, the driver does not implement getParameterMetaData() or getMetaData() as it would require the driver to have a complete SQL parser in the client.

Starting with version 3.1.0 MySQL Connector/J, server-side prepared statements and 'binary-encoded' result sets are used when the server supports them.

Take care when using a server-side prepared statement with "large" parameters that are set via setBinaryStream(), setAsciiStream(), setUnicodeStream(), setBlob(), or setClob(). If you want to re-execute the statement with any "large" parameter changed to a non-"large" parameter, it is necessary to call clearParameters() and set all parameters again. The reason for this is as follows:

- The driver streams the 'large' data 'out-of-band' to the prepared statement on the server side when the parameter is set (before execution of the prepared statement).
- Once that has been done, the stream used to read the data on the client side is closed (as per the JDBC spec), and can't be read from again.



- If a parameter changes from "large" to non-"large", the driver must reset the server-side state of the prepared statement to allow the parameter that is being changed to take the place of the prior "large" value. This removes all of the 'large' data that has already been sent to the server, thus requiring the data to be re-sent, via the `setBinaryStream()`, `setAsciiStream()`, `setUnicodeStream()`, `setBlob()` or `setClob()` methods.

Consequently, if you want to change the "type" of a parameter to a non-"large" one, you must call `clearParameters()` and set all parameters of the prepared statement again before it can be re-executed.

- **ResultSet**

By default, `ResultSet`s are completely retrieved and stored in memory. In most cases this is the most efficient way to operate, and due to the design of the MySQL network protocol is easier to implement. If you are working with `ResultSet`s that have a large number of rows or large values, and can not allocate heap space in your JVM for the memory required, you can tell the driver to 'stream' the results back one row at a time.

To enable this functionality, you need to create a `Statement` instance in the following manner:

```
stmt = conn.createStatement( java.sql.ResultSet.TYPE_FORWARD_ONLY,
                             java.sql.ResultSet.CONCUR_READ_ONLY );
stmt.setFetchSize( Integer.MIN_VALUE );
```

The combination of a forward-only, read-only result set, with a fetch size of `Integer.MIN_VALUE` serves as a signal to the driver to "stream" result sets row-by-row. After this any result sets created with the statement will be retrieved row-by-row.

There are some caveats with this approach. You will have to read all of the rows in the result set (or close it) before you can issue any other queries on the connection, or an exception will be thrown.

The earliest the locks these statements hold can be released (whether they be MyISAM table-level locks or row-level locks in some other storage engine such as InnoDB) is when the statement completes.

If the statement is within scope of a transaction, then locks are released when the transaction completes (which implies that the statement needs to complete first). As with most other databases, statements are not complete until all the results pending on the statement are read or the active result set for the statement is closed.

Therefore, if using "streaming" results, you should process them as quickly as possible if you want to maintain concurrent access to the tables referenced by the statement producing the result set.

- **ResultSetMetaData**

The `isAutoIncrement()` method only works when using MySQL servers 4.0 and newer.

- **Statement**

When using versions of the JDBC driver earlier than 3.2.1, and connected to server versions earlier than 5.0.3, the `setFetchSize()` method has no effect, other than to toggle result set streaming as described above.

MySQL does not support SQL cursors, and the JDBC driver doesn't emulate them, so `setCursorName()` has no effect.

### 1.3.3. Java, JDBC and MySQL Types

MySQL Connector/J is flexible in the way it handles conversions between MySQL data types and Java data types.

In general, any MySQL data type can be converted to a `java.lang.String`, and any numerical type can be converted to any of the Java numerical types, although round-off, overflow, or loss of precision may occur.

Starting with Connector/J 3.1.0, the JDBC driver will issue warnings or throw `DataTruncation` exceptions as is required by the JDBC specification unless the connection was configured not to do so by using the property `"jdbcCompliantTruncation"` and setting it to `"false"`.

The conversions that are always guaranteed to work are listed in the following table:

**Table 2. Conversion Table**

These MySQL Data Types	Can always be converted to these Java types
CHAR, VARCHAR, BLOB, TEXT, ENUM, and SET	<code>java.lang.String</code> , <code>java.io.InputStream</code> , <code>java.io.Reader</code> , <code>java.sql.Blob</code> , <code>java.sql.Clob</code>
FLOAT, REAL, DOUBLE PRECISION, NUMERIC, DECIMAL, TINYINT, SMALLINT, MEDIUMINT, INTEGER, BIGINT	<code>java.lang.String</code> , <code>java.lang.Short</code> , <code>java.lang.Integer</code> , <code>java.lang.Long</code> , <code>java.lang.Double</code> , <code>java.math.BigDecimal</code>  <b>Note</b>  round-off, overflow or loss of precision may occur if you choose a Java numeric data type that has less precision or capacity than the MySQL data type you are converting to/from.
DATE, TIME, DATETIME, TIMESTAMP	<code>java.lang.String</code> , <code>java.sql.Date</code> , <code>java.sql.Timestamp</code>

The `ResultSet.getObject()` method uses the following type conversions between MySQL and Java types, following the JDBC specification where appropriate:

**Table 3. MySQL Types to Java Types for `ResultSet.getObject()`**

MySQL Type Name	Returned as Java Class
BIT(1) (new in MySQL-5.0)	<code>java.lang.Boolean</code>
BIT(> 1) (new in MySQL-5.0)	<code>byte[]</code>
TINYINT	<code>java.lang.Boolean</code> if the configuration property <code>"tinyIntIsBit"</code> is set to <code>"true"</code> (the default) and the storage size is <code>"1"</code> , or <code>java.lang.Integer</code> if not.
BOOL, BOOLEAN	See TINYINT, above as these are aliases for TINYINT(1), currently.
SMALLINT[(M)] [UNSIGNED]	<code>java.lang.Integer</code> (regardless if UNSIGNED or not)

MySQL Type Name	Returned as Java Class
MEDIUMINT[(M)] [UNSIGNED]	java.lang.Integer, if UNSIGNED java.lang.Long
INT,INTEGER[(M)] [UNSIGNED]	java.lang.Integer, if UNSIGNED java.lang.Long
BIGINT[(M)] [UNSIGNED]	java.lang.Long, if UNSIGNED java.math.BigInteger
FLOAT[(M,D)]	java.lang.Float
DOUBLE[(M,B)]	java.lang.Double
DECIMAL[(M[,D])]	java.math.BigDecimal
DATE	java.sql.Date
DATETIME	java.sql.Timestamp
TIMESTAMP[(M)]	java.sql.Timestamp
TIME	java.sql.Time
YEAR[(2 4)]	java.sql.Date (with the date set two January 1st, at midnight)
CHAR(M)	java.lang.String (unless the character set for the column is BINARY, then byte[] is returned).
VARCHAR(M) [BINARY]	java.lang.String (unless the character set for the column is BINARY, then byte[] is returned).
BINARY(M)	byte[]
VARBINARY(M)	byte[]
TINYBLOB	byte[]
TINYTEXT	java.lang.String
BLOB	byte[]
TEXT	java.lang.String
MEDIUMBLOB	byte[]
MEDIUMTEXT	java.lang.String
LOB	byte[]
LONGTEXT	java.lang.String
ENUM('value1','value2',...)	java.lang.String
SET('value1','value2',...)	java.lang.String

### 1.3.4. Using Character Sets and Unicode

All strings sent from the JDBC driver to the server are converted automatically from native Java Unicode form to the client character encoding, including all queries sent via `Statement.execute()`, `Statement.executeUpdate()`, `Statement.executeQuery()` as well as all `PreparedStatement` and `CallableStatement` parameters with the exclusion of parameters set using `setBytes()`, `setBinaryStream()`, `setAsciiStream()`, `setUnicodeStream()` and `setBlob()`.

Prior to MySQL Server 4.1, Connector/J supported a single character encoding per connection, which could either be automatically detected from the server configuration, or could be configured by the user

through the `"useUnicode"` and `"characterEncoding"` properties.

Starting with MySQL Server 4.1, Connector/J supports a single character encoding between client and server, and any number of character encodings for data returned by the server to the client in `ResultSet`.

The character encoding between client and server is automatically detected upon connection. The encoding used by the driver is specified on the server via the configuration variable `'character_set'` for server versions older than 4.1.0 and `'character_set_server'` for server versions 4.1.0 and newer. See the "Server Character Set and Collation [<http://www.mysql.com/doc/en/Charset-server.html>]" section in the MySQL server manual for more information.

To override the automatically-detected encoding on the client side, use the `characterEncoding` property in the URL used to connect to the server.

When specifying character encodings on the client side, Java-style names should be used. The following table lists Java-style names for MySQL character sets:

**Table 4. MySQL to Java Encoding Name Translations**

MySQL Character Set Name	Java-Style Character Encoding Name
usa7	US-ASCII
big5	Big5
gbk	GBK
sjis	SJIS (or Cp932 or MS932 for MySQL Server < 4.1.11)
cp932	Cp932 or MS932 (MySQL Server > 4.1.11)
gb2312	EUC_CN
ujis	EUC_JP
euc_kr	EUC_KR
latin1	ISO8859_1
latin1_de	ISO8859_1
german1	ISO8859_1
danish	ISO8859_1
latin2	ISO8859_2
czech	ISO8859_2
hungarian	ISO8859_2
croat	ISO8859_2
greek	ISO8859_7
hebrew	ISO8859_8
latin5	ISO8859_9
latvian	ISO8859_13
latvian1	ISO8859_13
estonia	ISO8859_13
dos	Cp437
pclatin2	Cp852
cp866	Cp866

MySQL Character Set Name	Java-Style Character Encoding Name
koi8_ru	KOI8_R
tis620	TIS620
win1250	Cp1250
win1250ch	Cp1250
win1251	Cp1251
cp1251	Cp1251
win1251ukr	Cp1251
cp1257	Cp1257
macroman	MacRoman
macce	MacCentralEurope
utf8	UTF-8
ucs2	UnicodeBig

## Warning

Do not issue the query 'set names' with Connector/J, as the driver will not detect that the character set has changed, and will continue to use the character set detected during the initial connection setup.

To allow multiple character sets to be sent from the client, the "UTF-8" encoding should be used, either by configuring "utf8" as the default server character set, or by configuring the JDBC driver to use "UTF-8" through the *characterEncoding* property.

### 1.3.5. Connecting Securely Using SSL

SSL in MySQL Connector/J encrypts all data (other than the initial handshake) between the JDBC driver and the server. The performance penalty for enabling SSL is an increase in query processing time between 35% and 50%, depending on the size of the query, and the amount of data it returns.

For SSL Support to work, you must have the following:

- A JDK that includes JSSE (Java Secure Sockets Extension), like JDK-1.4.1 or newer. SSL does not currently work with a JDK that you can add JSSE to, like JDK-1.2.x or JDK-1.3.x due to the following JSSE bug: <http://developer.java.sun.com/developer/bugParade/bugs/4273544.html>
- A MySQL server that supports SSL and has been compiled and configured to do so, which is MySQL-4.0.4 or later, see: [http://www.mysql.com/doc/en/Secure\\_connections.html](http://www.mysql.com/doc/en/Secure_connections.html)
- A client certificate (covered later in this section)

You will first need to import the MySQL server CA Certificate into a Java truststore. A sample MySQL server CA Certificate is located in the 'SSL' subdirectory of the MySQL source distribution. This is what SSL will use to determine if you are communicating with a secure MySQL server.

To use Java's 'keytool' to create a truststore in the current directory, and import the server's CA certificate ('cacert.pem'), you can do the following (assuming that 'keytool' is in your path. It's located in the 'bin' subdirectory of your JDK or JRE):

```
shell> keytool -import -alias mysqlServerCACert -file cacert.pem -keystore trustst
```

Keytool will respond with the following information:

```
Enter keystore password:  *****
Owner: EMAILADDRESS=walrus@example.com, CN=Walrus, O=MySQL AB, L=Orenburg, ST=Some
-State, C=RU
Issuer: EMAILADDRESS=walrus@example.com, CN=Walrus, O=MySQL AB, L=Orenburg, ST=Som
e-State, C=RU
Serial number: 0
Valid from: Fri Aug 02 16:55:53 CDT 2002 until: Sat Aug 02 16:55:53 CDT 2003
Certificate fingerprints:
    MD5:  61:91:A0:F2:03:07:61:7A:81:38:66:DA:19:C4:8D:AB
    SHA1: 25:77:41:05:D5:AD:99:8C:14:8C:CA:68:9C:2F:B8:89:C3:34:4D:6C
Trust this certificate? [no]: yes
Certificate was added to keystore
```

You will then need to generate a client certificate, so that the MySQL server knows that it is talking to a secure client:

```
shell> keytool -genkey -keyalg rsa -alias mysqlClientCertificate -keystore keystore
```

Keytool will prompt you for the following information, and create a keystore named 'keystore' in the current directory.

You should respond with information that is appropriate for your situation:

```
Enter keystore password:  *****
What is your first and last name?
[Unknown]:  Matthews
What is the name of your organizational unit?
[Unknown]:  Software Development
What is the name of your organization?
[Unknown]:  MySQL AB
What is the name of your City or Locality?
[Unknown]:  Flossmoor
What is the name of your State or Province?
[Unknown]:  IL
What is the two-letter country code for this unit?
[Unknown]:  US
Is <CN=Matthews, OU=Software Development, O=MySQL AB,
L=Flossmoor, ST=IL, C=US> correct?
[no]:  y

Enter key password for <mysqlClientCertificate>
(RETURN if same as keystore password):
```

Finally, to get JSSE to use the keystore and truststore that you have generated, you need to set the following system properties when you start your JVM, replacing 'path\_to\_keystore\_file' with the full path to the keystore file you created, 'path\_to\_truststore\_file' with the path to the truststore file you created, and using the appropriate password values for each property.

```
-Djavax.net.ssl.keyStore=path_to_keystore_file
-Djavax.net.ssl.keyStorePassword=*****
-Djavax.net.ssl.trustStore=path_to_truststore_file
-Djavax.net.ssl.trustStorePassword=*****
```

You will also need to set 'useSSL' to 'true' in your connection parameters for MySQL Connector/J, either by adding 'useSSL=true' to your URL, or by setting the property 'useSSL' to 'true' in the java.util.Properties instance you pass to DriverManager.getConnection().

You can test that SSL is working by turning on JSSE debugging (as detailed below), and look for the following key events:

```
...
*** ClientHello, v3.1
RandomCookie: GMT: 1018531834 bytes = { 199, 148, 180, 215, 74, 12, 54, 244, 0,
Session ID: {}
Cipher Suites: { 0, 5, 0, 4, 0, 9, 0, 10, 0, 18, 0, 19, 0, 3, 0, 17 }
Compression Methods: { 0 }
***
[write] MD5 and SHA1 hashes: len = 59
0000: 01 00 00 37 03 01 3D B6 90 FA C7 94 B4 D7 4A 0C ...7..=.....J.
0010: 36 F4 00 A8 37 67 D7 40 10 8A E1 BE 84 99 02 D9 6...7g.@.....
0020: DB EF CA 13 79 4E 00 00 10 00 05 00 04 00 09 00 ....yN.....
0030: 0A 00 12 00 13 00 03 00 11 01 00 .....
main, WRITE: SSL v3.1 Handshake, length = 59
main, READ: SSL v3.1 Handshake, length = 74
*** ServerHello, v3.1
RandomCookie: GMT: 1018577560 bytes = { 116, 50, 4, 103, 25, 100, 58, 202, 79, 1
Session ID: {163, 227, 84, 53, 81, 127, 252, 254, 178, 179, 68, 63, 182, 158, 30
Cipher Suite: { 0, 5 }
Compression Method: 0
***
%% Created: [Session-1, SSL_RSA_WITH_RC4_128_SHA]
** SSL_RSA_WITH_RC4_128_SHA
[read] MD5 and SHA1 hashes: len = 74
0000: 02 00 00 46 03 01 3D B6 43 98 74 32 04 67 19 64 ...F..=.C.t2.g.d
0010: 3A CA 4F B9 B2 64 D7 42 FE 15 53 BB BE 2A AA 03 :.O..d.B..S..*..
0020: 84 6E 52 94 A0 5C 20 A3 E3 54 35 51 7F FC FE B2 .nR..\ ..T5Q....
0030: B3 44 3F B6 9E 1E 0B 96 4F AA 4C FF 5C 0F E2 18 .D?.....O.L.\...
0040: 11 B1 DB 9E B1 BB 8F 00 05 00 .....
main, READ: SSL v3.1 Handshake, length = 1712
...
```

JSSE provides debugging (to STDOUT) when you set the following system property: -Djavax.net.debug=all This will tell you what keystores and truststores are being used, as well as what is going on during the SSL handshake and certificate exchange. It will be helpful when trying to determine what is not working when trying to get an SSL connection to happen.

### 1.3.6. Using Master/Slave Replication with ReplicationConnection

Starting with Connector/J 3.1.7, we've made available a variant of the driver that will automatically send queries to a read/write master, or a failover or round-robin loadbalanced set of slaves based on the state of `Connection.getReadOnly()`.

An application signals that it wants a transaction to be read-only by calling `Connection.setReadOnly(true)`, this "replication-aware" connection will use one of the slave connections, which are load-balanced per-vm using a round-robin scheme (a given connection is "sticky" to a slave unless that slave is removed from service). If you have a write transaction, or if you have a read that is "time-sensitive" (remember, replication in MySQL is asynchronous), set the connection to be not read-only, by calling `Connection.setReadOnly(false)` and the driver will ensure that further calls are sent to the "master" MySQL server. The driver takes care of propagating the current state of autocommit, isolation level, and catalog between all of the connections that it uses to accomplish this load balancing functionality.

To enable this functionality, use the "`com.mysql.jdbc.ReplicationDriver`" class when configuring your application server's connection pool or when creating an instance of a JDBC driver for your standalone application. Because it accepts the same URL format as the standard MySQL JDBC driver, `ReplicationDriver` does not currently work with `java.sql.DriverManager`-based connection creation unless it is the only MySQL JDBC driver registered with the `DriverManager`.

Here is a short, simple example of how ReplicationDriver might be used in a standalone application.

```
import java.sql.Connection;
import java.sql.ResultSet;
import java.util.Properties;

import com.mysql.jdbc.ReplicationDriver;

public class ReplicationDriverDemo {

    public static void main(String[] args) throws Exception {
        ReplicationDriver driver = new ReplicationDriver();

        Properties props = new Properties();

        // We want this for failover on the slaves
        props.put("autoReconnect", "true");

        // We want to load balance between the slaves
        props.put("roundRobinLoadBalance", "true");

        props.put("user", "foo");
        props.put("password", "bar");

        //
        // Looks like a normal MySQL JDBC url, with a comma-separated list
        // of hosts, the first being the 'master', the rest being any number
        // of slaves that the driver will load balance against
        //

        Connection conn =
            driver.connect("jdbc:mysql://master,slave1,slave2,slave3/test",
                props);

        //
        // Perform read/write work on the master
        // by setting the read-only flag to "false"
        //

        conn.setReadOnly(false);
        conn.setAutoCommit(false);
        conn.createStatement().executeUpdate("UPDATE some_table ....");
        conn.commit();

        //
        // Now, do a query from a slave, the driver automatically picks one
        // from the list
        //

        conn.setReadOnly(true);

        ResultSet rs = conn.createStatement().executeQuery("SELECT a,b,c FROM some
            .....
    }
}
```

## 1.4. Using Connector/J with J2EE and Other Java Frameworks

This section describes how to use Connector/J in several contexts.

---



## 1.4.1. General J2EE Concepts

This section provides general background on J2EE concepts that pertain to use of Connector/J.

### 1.4.1.1. Understanding Connection Pooling

Connection pooling is a technique of creating and managing a pool of connections that are ready for use by any thread that needs them.

This technique of "pooling" connections is based on the fact that most applications only need a thread to have access to a JDBC connection when they are actively processing a transaction, which usually take only milliseconds to complete. When not processing a transaction, the connection would otherwise sit idle. Instead, connection pooling allows the idle connection to be used by some other thread to do useful work.

In practice, when a thread needs to do work against a MySQL or other database with JDBC, it requests a connection from the pool. When the thread is finished using the connection, it returns it to the pool, so that it may be used by any other threads that want to use it.

When the connection is "loaned out" from the pool, it is used exclusively by the thread that requested it. From a programming point of view, it is the same as if your thread called `DriverManager.getConnection()` every time it needed a JDBC connection, however with connection pooling, your thread may end up using either a new, or already-existing connection.

Connection pooling can greatly increase the performance of your Java application, while reducing overall resource usage. The main benefits to connection pooling are:

- Reduced connection creation time

While this is not usually an issue with the quick connection setup that MySQL offers compared to other databases, creating new JDBC connections still incurs networking and JDBC driver overhead that will be avoided if connections are "recycled."

- Simplified programming model

When using connection pooling, each individual thread can act as though it has created its own JDBC connection, allowing you to use straight-forward JDBC programming techniques.

- Controlled resource usage

If you don't use connection pooling, and instead create a new connection every time a thread needs one, your application's resource usage can be quite wasteful and lead to unpredictable behavior under load.

Remember that each connection to MySQL has overhead (memory, CPU, context switches, and so forth) on both the client and server side. Every connection limits how many resources there are available to your application as well as the MySQL server. Many of these resources will be used whether or not the connection is actually doing any useful work!

Connection pools can be tuned to maximize performance, while keeping resource utilization below the point where your application will start to fail rather than just run slower.

Luckily, Sun has standardized the concept of connection pooling in JDBC through the JDBC-2.0 "Optional" interfaces, and all major application servers have implementations of these APIs that work fine with MySQL Connector/J.

Generally, you configure a connection pool in your application server configuration files, and access it via the Java Naming and Directory Interface (JNDI). The following code shows how you might use a connection pool from an application deployed in a J2EE application server:

### **Example 12. Using a Connection Pool with a J2EE Application Server**

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

import javax.naming.InitialContext;
import javax.sql.DataSource;

public class MyServletJspOrEjb {

    public void doSomething() throws Exception {
        /*
         * Create a JNDI Initial context to be able to
         * lookup the DataSource
         *
         * In production-level code, this should be cached as
         * an instance or static variable, as it can
         * be quite expensive to create a JNDI context.
         *
         * Note: This code only works when you are using servlets
         * or EJBs in a J2EE application server. If you are
         * using connection pooling in standalone Java code, you
         * will have to create/configure datasources using whatever
         * mechanisms your particular connection pooling library
         * provides.
         */

        InitialContext ctx = new InitialContext();

        /*
         * Lookup the DataSource, which will be backed by a pool
         * that the application server provides. DataSource instances
         * are also a good candidate for caching as an instance
         * variable, as JNDI lookups can be expensive as well.
         */

        DataSource ds = (DataSource)ctx.lookup("java:comp/env/jdbc/MySQLDB");

        /*
         * The following code is what would actually be in your
         * Servlet, JSP or EJB 'service' method...where you need
         * to work with a JDBC connection.
         */

        Connection conn = null;
        Statement stmt = null;

        try {
            conn = ds.getConnection();

            /*
             * Now, use normal JDBC programming to work with
             * MySQL, making sure to close each resource when you're
             * finished with it, which allows the connection pool
             * resources to be recovered as quickly as possible
            */
        }
    }
}
```

```
        */

        stmt = conn.createStatement();
        stmt.execute("SOME SQL QUERY");

        stmt.close();
        stmt = null;

        conn.close();
        conn = null;
    } finally {
        /*
         * close any jdbc instances here that weren't
         * explicitly closed during normal code path, so
         * that we don't 'leak' resources...
         */

        if (stmt != null) {
            try {
                stmt.close();
            } catch (SQLException sqlex) {
                // ignore -- as we can't do anything about it here
            }

            stmt = null;
        }

        if (conn != null) {
            try {
                conn.close();
            } catch (SQLException sqlex) {
                // ignore -- as we can't do anything about it here
            }

            conn = null;
        }
    }
}
```

As shown in the example above, after obtaining the JNDI InitialContext, and looking up the DataSource, the rest of the code should look familiar to anyone who has done JDBC programming in the past.

The most important thing to remember when using connection pooling is to make sure that no matter what happens in your code (exceptions, flow-of-control, and so forth), connections, and anything created by them (such as statements or result sets) are closed, so that they may be re-used, otherwise they will be "stranded," which in the best case means that the MySQL server resources they represent (such as buffers, locks, or sockets) may be tied up for some time, or worst case, may be tied up forever.

#### What's the Best Size for my Connection Pool?

As with all other configuration rules-of-thumb, the answer is "It depends." While the optimal size depends on anticipated load and average database transaction time, the optimum connection pool size is smaller than you might expect. If you take Sun's Java Petstore blueprint application for example, a connection pool of 15-20 connections can serve a relatively moderate load (600 concurrent users) using MySQL and Tomcat with response times that are acceptable.

To correctly size a connection pool for your application, you should create load test scripts with tools such as Apache JMeter or The Grinder, and load test your application.

An easy way to determine a starting point is to configure your connection pool's maximum number of

connections to be "unbounded," run a load test, and measure the largest amount of concurrently used connections. You can then work backward from there to determine what values of minimum and maximum pooled connections give the best performance for your particular application.

### 1.4.2. Using Connector/J with Tomcat

The following instructions are based on the instructions for Tomcat-5.x, available at <http://jakarta.apache.org/tomcat/tomcat-5.0-doc/jndi-datasource-examples-howto.html> which is current at the time this document was written.

First, install the .jar file that comes with Connector/J in \$CATALINA\_HOME/common/lib so that it is available to all applications installed in the container.

Next, Configure the JNDI DataSource by adding a declaration resource to \$CATALINA\_HOME/conf/server.xml in the context that defines your web application:

```
<Context ....>

...

<Resource name="jdbc/MySQLDB"
          auth="Container"
          type="javax.sql.DataSource"/>

<!-- The name you used above, must match _exactly_ here!

      The connection pool will be bound into JNDI with the name
      "java:/comp/env/jdbc/MySQLDB"
-->

<ResourceParams name="jdbc/MySQLDB">
  <parameter>
    <name>factory</name>
    <value>org.apache.commons.dbcp.BasicDataSourceFactory</value>
  </parameter>

  <!-- Don't set this any higher than max_connections on your
       MySQL server, usually this should be a 10 or a few 10's
       of connections, not hundreds or thousands -->

  <parameter>
    <name>maxActive</name>
    <value>10</value>
  </parameter>

  <!-- You don't want to many idle connections hanging around
       if you can avoid it, only enough to soak up a spike in
       the load -->

  <parameter>
    <name>maxIdle</name>
    <value>5</value>
  </parameter>

  <!-- Don't use autoReconnect=true, it's going away eventually
       and it's a crutch for older connection pools that couldn't
       test connections. You need to decide if your application is
       supposed to deal with SQLExceptions (hint, it should), and
       how much of a performance penalty you're willing to pay
       to ensure 'freshness' of the connection -->

  <parameter>
```

```
<name>validationQuery</name>
<value>SELECT 1</value>
</parameter>

<!-- The most conservative approach is to test connections
before they're given to your application. For most applications
this is okay, the query used above is very small and takes
no real server resources to process, other than the time used
to traverse the network.

If you have a high-load application you'll need to rely on
something else. -->

<parameter>
  <name>testOnBorrow</name>
  <value>true</value>
</parameter>

<!-- Otherwise, or in addition to testOnBorrow, you can test
while connections are sitting idle -->

<parameter>
  <name>testWhileIdle</name>
  <value>true</value>
</parameter>

<!-- You have to set this value, otherwise even though
you've asked connections to be tested while idle,
the idle evictor thread will never run -->

<parameter>
  <name>timeBetweenEvictionRunsMillis</name>
  <value>10000</value>
</parameter>

<!-- Don't allow connections to hang out idle too long,
never longer than what wait_timeout is set to on the
server...A few minutes or even fraction of a minute
is sometimes okay here, it depends on your application
and how much spikey load it will see -->

<parameter>
  <name>minEvictableIdleTimeMillis</name>
  <value>60000</value>
</parameter>

<!-- Username and password used when connecting to MySQL -->

<parameter>
  <name>username</name>
  <value>someuser</value>
</parameter>

<parameter>
  <name>password</name>
  <value>somepass</value>
</parameter>

<!-- Class name for the Connector/J driver -->

<parameter>
  <name>driverClassName</name>
  <value>com.mysql.jdbc.Driver</value>
</parameter>
```

```
<!-- The JDBC connection url for connecting to MySQL, notice
      that if you want to pass any other MySQL-specific parameters
      you should pass them here in the URL, setting them using the
      parameter tags above will have no effect, you will also
      need to use &amp; to separate parameter values as the
      ampersand is a reserved character in XML -->

<parameter>
  <name>url</name>
  <value>jdbc:mysql://localhost:3306/test</value>
</parameter>

</ResourceParams>
</Context>
```

In general, you should follow the installation instructions that come with your version of Tomcat, as the way you configure datasources in Tomcat changes from time-to-time, and unfortunately if you use the wrong syntax in your XML file, you will most likely end up with an exception similar to the following:

```
Error: java.sql.SQLException: Cannot load JDBC driver class 'null ' SQL
state: null
```

### 1.4.3. Using Connector/J with JBoss

These instructions cover JBoss-4.x. To make the JDBC driver classes available to the application server, copy the .jar file that comes with Connector/J to the lib directory for your server configuration (which is usually called "default"). Then, in the same configuration directory, in the subdirectory named "deploy", create a datasource configuration file that ends with "-ds.xml", which tells JBoss to deploy this file as a JDBC Datasource. The file should have the following contents:

```
<datasources>
  <local-tx-datasource>
    <!-- This connection pool will be bound into JNDI with the name
          "java:/MySQLDB" -->

    <jndi-name>MySQLDB</jndi-name>
    <connection-url>jdbc:mysql://localhost:3306/dbname</connection-url>
    <driver-class>com.mysql.jdbc.Driver</driver-class>
    <user-name>user</user-name>
    <password>pass</password>

    <min-pool-size>5</min-pool-size>

    <!-- Don't set this any higher than max_connections on your
          MySQL server, usually this should be a 10 or a few 10's
          of connections, not hundreds or thousands -->

    <max-pool-size>20</max-pool-size>

    <!-- Don't allow connections to hang out idle too long,
          never longer than what wait_timeout is set to on the
          server...A few minutes is usually okay here,
          it depends on your application
          and how much spikey load it will see -->

    <idle-timeout-minutes>5</idle-timeout-minutes>

    <!-- If you're using Connector/J 3.1.8 or newer, you can use
          our implementation of these to increase the robustness
```

```
of the connection pool. -->  
  
    <exception-sorter-class-name>com.mysql.jdbc.integration.jboss.ExtendedMySQ  
    <valid-connection-checker-class-name>com.mysql.jdbc.integration.jboss.MySQ  
  
    </local-tx-datasource>  
</datasources>
```

## 1.5. Diagnosing Connector/J Problems

This section describes how to solve problems that you may encounter when using Connector/J.

### 1.5.1. Common Problems and Solutions

There are a few issues that seem to be commonly encountered often by users of MySQL Connector/J. This section deals with their symptoms, and their resolutions. If you have further issues, see the "SUPPORT" section.

#### 1.5.1.1:

Question:

When I try to connect to the database with MySQL Connector/J, I get the following exception:

```
SQLException: Server configuration denies access to data source  
SQLState: 08001  
VendorError: 0
```

What's going on? I can connect just fine with the MySQL command-line client.

Answer:

MySQL Connector/J must use TCP/IP sockets to connect to MySQL, as Java does not support Unix Domain Sockets. Therefore, when MySQL Connector/J connects to MySQL, the security manager in MySQL server will use its grant tables to determine whether or not the connection should be allowed.

You must add grants to allow this to happen. The following is an example of how to do this (but not the most secure).

From the mysql command-line client, logged in as a user that can grant privileges, issue the following command:

```
GRANT ALL PRIVILEGES ON [dbname].* to  
    '[user]'@'[hostname]' identified by  
    '[password]'
```

replacing [dbname] with the name of your database, [user] with the user name, [hostname] with the host that MySQL Connector/J will be connecting from, and [password] with the password you want to use. Be aware that RedHat Linux is broken with respect to the hostname portion for the case when you are connecting from localhost. You need to use "localhost.localdomain" for the [hostname] value in this case. Follow this by issuing the "FLUSH PRIVILEGES" command.

### Note

Testing your connectivity with the "mysql" command-line client will not work unless you add the "--host" flag, and use something other than "localhost" for the host. The "mysql" command-

line client will use Unix domain sockets if you use the special hostname "localhost". If you are testing connectivity to "localhost", use "127.0.0.1" as the hostname instead.

## Warning

If you don't understand what the 'GRANT' command does, or how it works, you should read and understand the 'General Security Issues and the MySQL Access Privilege System' [[http://www.mysql.com/doc/en/Privilege\\_system.html](http://www.mysql.com/doc/en/Privilege_system.html)] section of the MySQL manual before attempting to change privileges.

Changing privileges and permissions improperly in MySQL can potentially cause your server installation to not have optimal security properties.

### 1.5.1.2:

Question:

My application throws an SQLException 'No Suitable Driver'. Why is this happening?

Answer:

One of two things are happening. Either the driver is not in your CLASSPATH (see the "INSTALLATION" section above), or your URL format is incorrect (see "Developing Applications with MySQL Connector/J").

### 1.5.1.3:

Question:

I'm trying to use MySQL Connector/J in an applet or application and I get an exception similar to:

```
SQLException: Cannot connect to MySQL server on host:3306.  
Is there a MySQL server running on the machine/port you  
are trying to connect to?
```

```
( java.security.AccessControlException)  
SQLState: 08S01  
VendorError: 0
```

Answer:

Either you're running an Applet, your MySQL server has been installed with the "--skip-networking" option set, or your MySQL server has a firewall sitting in front of it.

Applets can only make network connections back to the machine that runs the web server that served the .class files for the applet. This means that MySQL must run on the same machine (or you must have some sort of port re-direction) for this to work. This also means that you will not be able to test applets from your local file system, you must always deploy them to a web server.

MySQL Connector/J can only communicate with MySQL using TCP/IP, as Java does not support Unix domain sockets. TCP/IP communication with MySQL might be affected if MySQL was started with the "--skip-networking" flag, or if it is firewalled.

If MySQL has been started with the "--skip-networking" option set (the Debian Linux package of MySQL server does this for example), you need to comment it out in the file /etc/mysql/my.cnf or /etc/my.cnf. Of course your my.cnf file might also exist in the "data" directory of your MySQL server, or anywhere else (depending on how MySQL was compiled for your system). Binaries created by MySQL AB always look in /etc/my.cnf and [datadir]/my.cnf. If your MySQL server has been firewalled, you



will need to have the firewall configured to allow TCP/IP connections from the host where your Java code is running to the MySQL server on the port that MySQL is listening to (by default, 3306).

#### 1.5.1.4:

Question:

I have a servlet/application that works fine for a day, and then stops working overnight

Answer:

MySQL closes connections after 8 hours of inactivity. You either need to use a connection pool that handles stale connections or use the "autoReconnect" parameter (see "Developing Applications with MySQL Connector/J").

Also, you should be catching SQLExceptions in your application and dealing with them, rather than propagating them all the way until your application exits, this is just good programming practice. MySQL Connector/J will set the SQLState (see `java.sql.SQLException.getSQLState()` in your APIDocs) to "08S01" when it encounters network-connectivity issues during the processing of a query. Your application code should then attempt to re-connect to MySQL at this point.

The following (simplistic) example shows what code that can handle these exceptions might look like:

### Example 13. Example of transaction with retry logic

```
public void doBusinessOp() throws SQLException {
    Connection conn = null;
    Statement stmt = null;
    ResultSet rs = null;

    //
    // How many times do you want to retry the transaction
    // (or at least _getting_ a connection)?
    //
    int retryCount = 5;

    boolean transactionCompleted = false;

    do {
        try {
            conn = getConnection(); // assume getting this from a
                                   // javax.sql.DataSource, or the
                                   // java.sql.DriverManager

            conn.setAutoCommit(false);

            //
            // Okay, at this point, the 'retry-ability' of the
            // transaction really depends on your application logic,
            // whether or not you're using autocommit (in this case
            // not), and whether you're using transactional storage
            // engines
            //
            // For this example, we'll assume that it's _not_ safe
            // to retry the entire transaction, so we set retry count
            // to 0 at this point
            //
            // If you were using exclusively transaction-safe tables,
            // or your application could recover from a connection going
```

```
// bad in the middle of an operation, then you would not
// touch 'retryCount' here, and just let the loop repeat
// until retryCount == 0.
//
retryCount = 0;

stmt = conn.createStatement();

String query = "SELECT foo FROM bar ORDER BY baz";

rs = stmt.executeQuery(query);

while (rs.next()) {
}

rs.close();
rs = null;

stmt.close();
stmt = null;

conn.commit();
conn.close();
conn = null;

transactionCompleted = true;
} catch (SQLException sqlEx) {

    //
    // The two SQL states that are 'retry-able' are 08S01
    // for a communications error, and 40001 for deadlock.
    //
    // Only retry if the error was due to a stale connection,
    // communications problem or deadlock
    //

    String sqlState = sqlEx.getSQLState();

    if ("08S01".equals(sqlState) || "40001".equals(sqlState)) {
        retryCount--;
    } else {
        retryCount = 0;
    }
} finally {
    if (rs != null) {
        try {
            rs.close();
        } catch (SQLException sqlEx) {
            // You'd probably want to log this . . .
        }
    }

    if (stmt != null) {
        try {
            stmt.close();
        } catch (SQLException sqlEx) {
            // You'd probably want to log this as well . . .
        }
    }

    if (conn != null) {
        try {
            //

```

```
        // If we got here, and conn is not null, the
        // transaction should be rolled back, as not
        // all work has been done

        try {
            conn.rollback();
        } finally {
            conn.close();
        }
    } catch (SQLException sqlEx) {
        //
        // If we got an exception here, something
        // pretty serious is going on, so we better
        // pass it up the stack, rather than just
        // logging it. . .

        throw sqlEx;
    }
}

} while (!transactionCompleted && (retryCount > 0));
}
```

#### 1.5.1.5:

Question:

I'm trying to use JDBC-2.0 updatable result sets, and I get an exception saying my result set is not updatable.

Answer:

Because MySQL does not have row identifiers, MySQL Connector/J can only update result sets that have come from queries on tables that have at least one primary key, the query must select all of the primary key(s) and the query can only span one table (i.e. no joins). This is outlined in the JDBC specification.

## 1.5.2. How to Report Bugs or Problems

The normal place to report bugs is <http://bugs.mysql.com/>, which is the address for our bugs database. This database is public, and can be browsed and searched by anyone. If you log in to the system, you will also be able to enter new reports.

If you have found a sensitive security bug in MySQL, you can send email to [security@mysql.com](mailto:security@mysql.com) [mailto:security@mysql.com].

Writing a good bug report takes patience, but doing it right the first time saves time both for us and for yourself. A good bug report, containing a full test case for the bug, makes it very likely that we will fix the bug in the next release.

This section will help you write your report correctly so that you don't waste your time doing things that may not help us much or at all.

If you have a repeatable bug report, please report it to the bugs database at <http://bugs.mysql.com/> [???].

Any bug that we are able to repeat has a high chance of being fixed in the next MySQL release.

To report other problems, you can use one of the MySQL mailing lists.

Remember that it is possible for us to respond to a message containing too much information, but not to one containing too little. People often omit facts because they think they know the cause of a problem and assume that some details don't matter.

A good principle is this: If you are in doubt about stating something, state it. It is faster and less troublesome to write a couple more lines in your report than to wait longer for the answer if we must ask you to provide information that was missing from the initial report.

The most common errors made in bug reports are (a) not including the version number of Connector/J or MySQL used, and (b) not fully describing the platform on which Connector/J is installed (including the JVM version, and the platform type and version number that MySQL itself is installed on).

This is highly relevant information, and in 99 cases out of 100, the bug report is useless without it. Very often we get questions like, "Why doesn't this work for me?" Then we find that the feature requested wasn't implemented in that MySQL version, or that a bug described in a report has already been fixed in newer MySQL versions.

Sometimes the error is platform-dependent; in such cases, it is next to impossible for us to fix anything without knowing the operating system and the version number of the platform.

If at all possible, you should create a repeatable, standalone testcase that doesn't involve any third-party classes.

To streamline this process, we ship a base class for testcases with Connector/J, named `'com.mysql.jdbc.util.BaseBugReport'`. To create a testcase for Connector/J using this class, create your own class that inherits from `com.mysql.jdbc.util.BaseBugReport` and override the methods `setUp()`, `tearDown()` and `runTest()`.

In the `setUp()` method, create code that creates your tables, and populates them with any data needed to demonstrate the bug.

In the `runTest()` method, create code that demonstrates the bug using the tables and data you created in the `'setUp'` method.

In the `tearDown()` method, drop any tables you created in the `setUp()` method.

In any of the above three methods, you should use one of the variants of the `getConnection()` method to create a JDBC connection to MySQL:

- `getConnection()` - Provides a connection to the JDBC URL specified in `getUrl()`. If a connection already exists, that connection is returned, otherwise a new connection is created.
- `getNewConnection()` - Use this if you need to get a new connection for your bug report (i.e. there's more than one connection involved).
- `getConnection(String url)` - Returns a connection using the given URL.
- `getConnection(String url, Properties props)` - Returns a connection using the given URL and properties.

If you need to use a JDBC URL that is different than `'jdbc:mysql:///test'`, then override the method `getUrl()` as well.

Use the `assertTrue(boolean expression)` and `assertTrue(String failureMessage, boolean expression)` methods to create conditions that must be met in your testcase demonstrating the behavior you are expecting (vs. the behavior you are observing, which is why you are most likely filing a bug report).

Finally, create a `main()` method that creates a new instance of your testcase, and calls the `run` method:

```
public static void main(String[] args) throws Exception {
    new MyBugReport().run();
}
```

Once you have finished your testcase, and have verified that it demonstrates the bug you are reporting, upload it with your bug report to <http://bugs.mysql.com/>.

## 1.6. MySQL Connector/J Change History

12-22-05 - Version 5.0.0-beta

- `XADataSource` implemented (ported from 3.2 branch which won't be released as a product). Use `"com.mysql.jdbc.jdbc2.optional.MysqlXADataSource"` as your `datasource` class name in your application server to utilize XA transactions in MySQL-5.0.10 and newer.
- `PreparedStatement.setString()` didn't work correctly when `sql_mode` on server contained `NO_BACKSLASH_ESCAPES`, and no characters that needed escaping were present in the string.
- Attempt detection of the MySQL type `"BINARY"` (it's an alias, so this isn't always reliable), and use the `java.sql.Types.BINARY` type mapping for it.
- Moved `-bin-g.jar` file into separate `"debug"` subdirectory to avoid confusion.
- Don't allow `.setAutoCommit(true)`, or `.commit()` or `.rollback()` on an XA-managed connection as-per the JDBC specification.
- If the connection `"useTimezone"` is set to `"true"`, then also respect timezone conversions in escape-processed string literals (e.g. `"{ts ...}"` and `"{t ...}"`).
- Return original column name for `RSMD.getColumnNames()` if the column was alias name for `.getColumnLabel()` (if aliased), and original table name for `.getTableName()`. Note this only works for MySQL-4.1 and newer, as older servers don't make this information available to clients.
- Setting `"useJDBCCompliantTimezoneShift=true"` (it's not the default) causes the driver to use GMT for `_all_` `TIMESTAMP/DATETIME` timezones, and the current VM timezone for any other type that refers to timezones. This feature can not be used when `"useTimezone=true"` to convert between server and client timezones.
- Add one level of indirection of internal representation of `CallableStatement` parameter metadata to avoid class not found issues on JDK-1.3 for `ParameterMetadata` interface (which doesn't exist prior to JDBC-3.0).
- Added unit tests for `XADatasource`, as well as friendlier exceptions for XA failures compared to the `"stock"` `XAException` (which has no messages).
- Fixed BUG#14279 [<http://bugs.mysql.com/14279>] - Idle timeouts cause `XAConnection` to reconnect themselves back
- Added support for Connector/MXJ integration via url subprotocol `"jdbc:mysql:mxj://...."`.
- Moved all `SQLException` constructor usage to a factory in `SQLException` (ground-work for JDBC-4.0 `SQLState`-based exception classes).

- Removed Java5-specific calls to BigDecimal constructor (when result set value is '', (int)0 was being used as an argument in-directly via method return value. This signature doesn't exist prior to Java5.)
- Moved all SQLException creation to a factory method in SQLError, groundwork for JDBC-4.0 SQLState class-based exceptions.
- Added service-provider entry to META-INF/services/java.sql.Driver for JDBC-4.0 support.
- Return "[VAR]BINARY" for RSMD.getColumnTypeName() when that is actually the type, and it can be distinguished (MySQL-4.1 and newer).
- When fix for BUG#14562 [<http://bugs.mysql.com/14562>] was merged from 3.1.12, for CallableStatement's parameter metadata to return correct information for .getParameterClassName().
- Fuller synchronization of Connection to avoid deadlocks when using multithreaded frameworks that multithread a single connection (usually not recommended, but the JDBC spec allows it anyways), part of fix to BUG#14972 [<http://bugs.mysql.com/14972>].
- Implementation of Statement.cancel() and Statement.setQueryTimeout(). Both require MySQL-5.0.0 or newer server, require a separate connection to issue the "KILL QUERY" command, and in the case of setQueryTimeout() creates an additional thread to handle the timeout functionality.

Note: Failures to cancel the statement for setQueryTimeout() may manifest themselves as RuntimeExceptions rather than failing silently, as there is currently no way to unblock the thread that is executing the query being cancelled due to timeout expiration and have it throw the exception instead.

#### xx-xx-05 - Version 3.1.13

- Fixed BUG#15464 [<http://bugs.mysql.com/15464>] - INOUT parameter does not sto
- Fixed BUG#14609 [<http://bugs.mysql.com/14609>] - Exception thrown for new dec using updatable result sets.
- Fixed BUG#15544 [<http://bugs.mysql.com/15544>], no "dos" character set in MyS
- Fixed BUG#15383 [<http://bugs.mysql.com/15383>] - PreparedStatement.setObject( BigInteger as object, rather than sending as numeric value (and is thus not complementary to .getObject() on an UNSIGNED LONG type).
- Fixed BUG#11874 [<http://bugs.mysql.com/11874>] - ResultSet.getShort() for UNS returned wrong values.
- Fixed BUG#15676 [<http://bugs.mysql.com/15676>] - lib-nodist directory missing package breaks out-of-box build
- Fixed BUG#15854 [<http://bugs.mysql.com/15854>] - DBMD.getColumns() returns wr

#### 11-30-05 - Version 3.1.12

- Fixed client-side prepared statement bug with embedded ? inside quoted identifiers (it was recognized as a placeholder, when it was not).
- Don't allow executeBatch() for CallableStatements with registered OUT/INOUT parameters (JDBC compliance).

- Fall back to platform-encoding for `URLDecoder.decode()` when parsing driver URL properties if the platform doesn't have a two-argument version of this method.
- Fixed BUG#14562 [<http://bugs.mysql.com/14562>] - Java type conversion may be mediumint.
- Added configuration property "useGmtMillisForDatetimes" which when set to true causes `ResultSet.getDate()`, `ResultSet.getTimestamp()` to return correct millis-since GMT when `ResultSet.getTime()` is called on the return value (currently default is "false" for legacy behavior).
- Fixed `DatabaseMetaData.stores*Identifiers()`:
  - \* if `lower_case_table_names=0` (on server):  
  
`storesLowerCaseIdentifiers()` returns false  
`storesLowerCaseQuotedIdentifiers()` returns false  
`storesMixedCaseIdentifiers()` returns true  
`storesMixedCaseQuotedIdentifiers()` returns true  
`storesUpperCaseIdentifiers()` returns false  
`storesUpperCaseQuotedIdentifiers()` returns true
  - \* if `lower_case_table_names=1` (on server):  
  
`storesLowerCaseIdentifiers()` returns true  
`storesLowerCaseQuotedIdentifiers()` returns true  
`storesMixedCaseIdentifiers()` returns false  
`storesMixedCaseQuotedIdentifiers()` returns false  
`storesUpperCaseIdentifiers()` returns false  
`storesUpperCaseQuotedIdentifiers()` returns true
- Fixed BUG#14815 [<http://bugs.mysql.com/14815>] - `DatabaseMetaData.getColumns()` return `TABLE_NAME` correctly.
- Fixed BUG#14909 [<http://bugs.mysql.com/14909>] - escape processor replaces quote in quoted string with string delimiter.
- Fixed BUG#12975 [<http://bugs.mysql.com/12975>] - OpenOffice expects `DBMD.supportsIntegrityEnhancementFacility()` to return "true" if foreign keys are supported by the datasource, even though this method also covers support for check constraints, which MySQL \_doesn't\_ have. Setting the configuration property "overrideSupportsIntegrityEnhancementFacility" to "true" causes the driver to return "true" for this method.
- Added "com.mysql.jdbc.testsuite.url.default" system property to set default JDBC url for testsuite (to speed up bug resolution when I'm working in Eclipse).
- Fixed BUG#14938 [<http://bugs.mysql.com/14938>] - Unable to initialize character tables (due to J2EE classloader differences).
- Fixed BUG#14972 [<http://bugs.mysql.com/14972>] - Deadlock while closing server statements from multiple threads sharing one connection.
- Fixed BUG#12230 [<http://bugs.mysql.com/12230>] - `logSlowQueries` should give better
- Fixed BUG#13775 [<http://bugs.mysql.com/13775>] - Extraneous sleep on `autoReconnect`
- Fixed BUG#15024 [<http://bugs.mysql.com/15024>] - Driver incorrectly closes statement arguments to PreparedStatements. Reverts to legacy behavior by setting the JDBC configuration property "autoClosePstmtStreams"

to "true" (also included in the 3-0-Compat configuration "bundle").

- Fixed BUG#13048 [<http://bugs.mysql.com/13048>] - maxQuerySizeToLog is not res bound values for execute() phase of server-side prepared statements when profileSQL=true as well.
- Fixed BUG#15065 [<http://bugs.mysql.com/15065>] - Usage advisor complains about columns, even though they've been referenced.
- Don't increase timeout for failover/reconnect (BUG#6577 [<http://bugs.mysql.com/6577>]).
- Process escape tokens in Connection.prepareStatement(...), fix for BUG#15141 [<http://bugs.mysql.com/15141>]. You can disable this behavior by the JDBC URL configuration property "processEscapeCodesForPrepStmts" to "false".
- Fixed BUG#13255 [<http://bugs.mysql.com/13255>] - Reconnect during middle of execute should not occur if autoReconnect is enabled.

10-07-05 - Version 3.1.11-stable

- Fixed BUG#11629 [<http://bugs.mysql.com/11629>] - Spurious "!" on console when encoding is "utf8".
- Fixed statements generated for testcases missing ";" for "plain" statements.
- Fixed BUG#11663 [<http://bugs.mysql.com/11663>] - Incorrect generation of testcases for server-side prepared statements.
- Fixed regression caused by fix for BUG#11552 [<http://bugs.mysql.com/11552>] to return incorrect values for unsigned integers when those integers were within the range of the positive signed type.
- Moved source code to svn repo.
- Fixed BUG#11797 [<http://bugs.mysql.com/11797>] - Escape tokenizer doesn't respect escapes.
- GEOMETRY type not recognized when using server-side prepared statements.
- Fixed BUG#11879 [<http://bugs.mysql.com/11879>] -- ReplicationConnection won't throw "Catalog can't be null" exception.
- Fixed BUG#12218 [<http://bugs.mysql.com/12218>], properties shared between master and replication connection.
- Fixed BUG#10630 [<http://bugs.mysql.com/10630>], Statement.getWarnings() fails if connection has been closed.
- Only get char[] from SQL in PreparedStatement.ParseInfo() when needed.
- Fixed BUG#12104 [<http://bugs.mysql.com/12104>] - Geometry types not handled with server-side prepared statements.
- Fixed BUG#11614 [<http://bugs.mysql.com/11614>] - StringUtils.getBytes() doesn't handle multibyte character encodings and a length in \_characters\_ is not specified.
- Fixed BUG#11798 [<http://bugs.mysql.com/11798>] - Pstmt.setObject(..., Types.NUMERIC) fails.
- Fixed BUG#11976 [<http://bugs.mysql.com/11976>] - maxPerformance.properties missing "elideSetAutoCommits".
- Fixed BUG#11575 [<http://bugs.mysql.com/11575>] -- DBMD.storesLower/Mixed/Upper case characters.



reports incorrect values for servers deployed on Windows.

- Fixed BUG#11190 [<http://bugs.mysql.com/11190>] - `ResultSet.moveToCurrentRow()` preceded by a call to `ResultSet.moveToInsertRow()`.
- Fixed BUG#11115 [<http://bugs.mysql.com/11115>], VARBINARY data corrupted when prepared statements and `.setBytes()`.
- Fixed BUG#12229 [<http://bugs.mysql.com/12229>] - `explainSlowQueries` hangs with prepared statements.
- Fixed BUG#11498 [<http://bugs.mysql.com/11498>] - Escape processor didn't honor with double quotes.
- Lifted restriction of changing streaming parameters with server-side prepared statements. As long as `_all_` streaming parameters were set before execution, `.clearParameters()` does not have to be called. (due to limitation of client/server protocol, prepared statements can not reset `_individual_` stream data on the server side).
- Reworked `Field` class, `*Buffer`, and `MysqlIO` to be aware of field lengths > `Integer.MAX_VALUE`.
- Updated `DBMD.supportsCorrelatedQueries()` to return true for versions > 4.1, `supportsGroupByUnrelated()` to return true and `getResultSetHoldability()` to return `HOLD_CURSORS_OVER_COMMIT`.
- Fixed BUG#12541 [<http://bugs.mysql.com/12541>] - Handling of catalog argument `DatabaseMetaData.getIndexInfo()`, which also means changes to the following methods in `DatabaseMetaData`:
  - `getBestRowIdentifier()`
  - `getColumns()`
  - `getCrossReference()`
  - `getExportedKeys()`
  - `getImportedKeys()`
  - `getIndexInfo()`
  - `getPrimaryKeys()`
  - `getProcedures()` (and thus indirectly `getProcedureColumns()`)
  - `getTables()`

The "catalog" argument in all of these methods now behaves in the following way:

- Specifying `NULL` means that catalog will not be used to filter the results (thus all databases will be searched), unless you've set `"nullCatalogMeansCurrent=true"` in your JDBC URL properties.
- Specifying `"` means "current" catalog, even though this isn't quite JDBC spec compliant, it's there for legacy users.
- Specifying a catalog works as stated in the API docs.
- Made `Connection.clientPrepare()` available from "wrapped" connections in the `jdbc2.optional` package (connections built by `ConnectionPoolDataSource` instances).
- Added `Connection.isMasterConnection()` for clients to be able to determine if a multi-host master/slave connection is connected to the first host in the list.
- Fixed BUG#12753 [<http://bugs.mysql.com/12753>] - Tokenizer for `"=` in URL property `sessionVariables=....` to be parameterized incorrectly.
- Fixed BUG#11781 [<http://bugs.mysql.com/11781>], foreign key information that

parsed incorrectly when DatabaseMetaData methods use that information.

- The "sendBlobChunkSize" property is now clamped to "max\_allowed\_packet" with consideration of stream buffer size and packet headers to avoid PacketTooBigExceptions when "max\_allowed\_packet" is similar in size to the default "sendBlobChunkSize" which is 1M.
- CallableStatement.clearParameters() now clears resources associated with INOUT/OUTPUT parameters as well as INPUT parameters.
- Fixed BUG#12417 [<http://bugs.mysql.com/12417>] - Connection.prepareCall() is case-sensitive (on Windows systems).
- Fixed BUG#12752 [<http://bugs.mysql.com/12752>] - Cp1251 incorrectly mapped to servers newer than 4.0.x.
- Fixed BUG#12970 [<http://bugs.mysql.com/12970>] - java.sql.Types.OTHER returns BINARY and VARBINARY columns when using DatabaseMetaData.getColumns().
- ServerPreparedStatement.getBinding() now checks if the statement is closed before attempting to reference the list of parameter bindings, to avoid throwing a NullPointerException.
- Fixed BUG#13277 [<http://bugs.mysql.com/13277>] - ResultSetMetaData from Statement.getGeneratedKeys() caused NullPointerExceptions to be thrown whenever a method that required a connection reference was called.
- Backport of Field class, ResultSetMetaData.getColumnClassName(), and ResultSet.getObject(int) changes from 5.0 branch to fix behavior surrounding VARCHAR BINARY/VARBINARY and related types.
- Fixed NullPointerException when converting "catalog" parameter in many DatabaseMetaDataMethods to byte[]s (for the result set) when the parameter is null. ("null" isn't technically allowed by the JDBC specification, but we've historically allowed it).
- Backport of VAR[BINARY|CHAR] [BINARY] types detection from 5.0 branch.
- Read response in MysqlIO.sendFileToServer(), even if the local file can't be opened, otherwise next query issued will fail, because it's reading the response to the empty LOAD DATA INFILE packet sent to the server.
- Workaround for BUG#13374 [<http://bugs.mysql.com/13374>] - ResultSet.getStatement() on closed result set returns NULL (as per JDBC 4.0 spec, but not backward-compatible). Set the connection property "retainStatementAfterResultSetClose" to "true" to be able to retrieve a ResultSet's statement after the ResultSet has been closed via .getStatement() (the default is "false", to be JDBC-compliant and to reduce the chance that code using JDBC leaks Statement instances).
- Fixed BUG#13453 [<http://bugs.mysql.com/13453>] - URL configuration parameters '&' or '=' in their values. The JDBC driver now parses configuration parameters as if they are encoded using the application/x-www-form-urlencoded format as specified by java.net.URLDecoder - <http://java.sun.com/j2se/1.5.0/docs/api/java/net/URLDecoder.html>

If the '%' character is present in a configuration property,

it must now be represented as %25, which is the encoded form of '%' when using application/x-www-form-urlencoded encoding.

- The configuration property "sessionVariables" now allows you to specify variables that start with the "@" sign.
- Fixed BUG#13043 [<http://bugs.mysql.com/13043>] - when 'gatherPerfMetrics' is servers older than 4.1.0, a NullPointerException is thrown from the constructor of ResultSet if the query doesn't use any tables.

#### 06-23-05 - Version 3.1.10-stable

- Fixed connecting without a database specified raised an exception in `MySQLIO.changeDatabaseTo()`.
- Initial implementation of `ParameterMetadata` for `PreparedStatement.getParameterMetadata()`. Only works fully for `CallableStatements`, as current server-side prepared statements return every parameter as a `VARCHAR` type.

#### 06-22-05 - Version 3.1.9-stable

- Overhaul of character set configuration, everything now lives in a properties file.
- Driver now correctly uses CP932 if available on the server for Windows-31J, CP932 and MS932 java encoding names, otherwise it resorts to SJIS, which is only a close approximation. Currently only MySQL-5.0.3 and newer (and MySQL-4.1.12 or .13, depending on when the character set gets backported) can reliably support any variant of CP932.
- Fixed BUG#9064 [<http://bugs.mysql.com/9064>] - `com.mysql.jdbc.PreparedStatement` does unnecessary call to `toCharArray()`.
- Fixed Bug#10144 [<http://bugs.mysql.com/10144>] - Memory leak in `ServerPrepare` `serverPrepare()` fails.
- Actually write manifest file to correct place so it ends up in the binary jar file.
- Added "createDatabaseIfNotExist" property (default is "false"), which will cause the driver to ask the server to create the database specified in the URL if it doesn't exist. You must have the appropriate privileges for database creation for this to work.
- Fixed BUG#10156 [<http://bugs.mysql.com/10156>] - Unsigned SMALLINT treated as fixed all cases for UNSIGNED integer values and server-side prepared statements as well as `ResultSet.getObject()` for UNSIGNED TINYINT.
- Fixed BUG#10155 [<http://bugs.mysql.com/10155>], double quotes not recognized client-side prepared statements.
- Made `enableStreamingResults()` visible on `com.mysql.jdbc.jdbc2.optional.StatementWrapper`.
- Made `ServerPreparedStatement.asSql()` work correctly so auto-explain functionality would work with server-side prepared statements.
- Made JDBC2-compliant wrappers public in order to allow access to vendor extensions.
- Cleaned up logging of profiler events, moved code to dump a profiler event as a string to `com.mysql.jdbc.log.LogUtils` so that third

parties can use it.

- `DatabaseMetaData.supportsMultipleOpenResults()` now returns true. The driver has supported this for some time, DBMD just missed that fact.
- Fixed BUG#10310 [<http://bugs.mysql.com/10310>] - Driver doesn't support `{?=CA` stored functions. This involved adding support for function retrieval to `DatabaseMetaData.getProcedures()` and `getProcedureColumns()` as well.
- Fixed BUG#10485 [<http://bugs.mysql.com/10485>], `SQLException` thrown when retr with `ResultSet.getString()`. The driver will now always treat YEAR types as `java.sql.Dates` and return the correct values for `getString()`. Alternatively, the "yearIsDateType" connection property can be set to "false" and the values will be treated as SHORTs.
- The datatype returned for TINYINT(1) columns when "tinyIntIsBoolean" (the default) can be switched between `Types.BOOLEAN` and `Types.BIT` using the new configuration property "transformedBitIsBoolean", which defaults to "false". If set to "false" (the default), `DatabaseMetaData.getColumns()` and `ResultSetMetaData.getColumnType()` will return `Types.BOOLEAN` for TINYINT(1) columns. If "true", `Types.BOOLEAN` will be returned instead. Irregardless of this configuration property, if "tinyIntIsBoolean" is enabled, columns with the type TINYINT(1) will be returned as `java.lang.Boolean` instances from `ResultSet.getObject(...)`, and `ResultSetMetaData.getColumnClassName()` will return "java.lang.Boolean".
- Fixed BUG#10496 [<http://bugs.mysql.com/10496>] - `SQLException` is thrown when "characterSetResults" with cp932 or eucjps.
- Reorganized directory layout, sources now in "src" folder, don't pollute parent directory when building, now output goes to "./build", distribution goes to "./dist".
- Added support/bug hunting feature that generates .sql test scripts to STDERR when "autoGenerateTestcaseScript" is set to "true".
- Fixed BUG#10850 [<http://bugs.mysql.com/10850>] - 0-length streams not sent to using server-side prepared statements.
- Setting "cachePrepStmts=true" now causes the Connection to also cache the check the driver performs to determine if a prepared statement can be server-side or not, as well as caches server-side prepared statements for the lifetime of a connection. As before, the "prepStmtCacheSize" parameter controls the size of these caches.
- Try to handle `OutOfMemoryErrors` more gracefully. Although not much can be done, they will in most cases close the connection they happened on so that further operations don't run into a connection in some unknown state. When an OOM has happened, any further operations on the connection will fail with a "Connection closed" exception that will also list the OOM exception as the reason for the implicit connection close event.
- Don't send `COM_RESET_STMT` for each execution of a server-side prepared statement if it isn't required.
- Driver detects if you're running MySQL-5.0.7 or later, and does not scan for "LIMIT ?[,?]" in statements being prepared, as the server supports those types of queries now.
- Fixed BUG#11115 [<http://bugs.mysql.com/11115>], Varbinary data corrupted when prepared statements and `ResultSet.getBytes()`.

- `Connection.setCatalog()` is now aware of the "useLocalSessionState" configuration property, which when set to true will prevent the driver from sending "USE ..." to the server if the requested catalog is the same as the current catalog.
- Added the following configuration bundles, use one or many via the "useConfigs" configuration property:
  - \* `maxPerformance` -- maximum performance without being reckless
  - \* `solarisMaxPerformance` -- maximum performance for Solaris, avoids syscalls where it can
  - \* `3-0-Compat` -- Compatibility with Connector/J 3.0.x functionality
- Added "maintainTimeStats" configuration property (defaults to "true"), which tells the driver whether or not to keep track of the last query time and the last successful packet sent to the server's time. If set to false, removes two syscalls per query.
- Fixed BUG#11259 [<http://bugs.mysql.com/11259>], `autoReconnect` ping causes exception at startup.
- Fixed BUG#11360 [<http://bugs.mysql.com/11360>] Connector/J dumping query into log.
- Fixed `PreparedStatement.setClob()` not accepting null as a parameter.
- Fixed BUG#11411 [<http://bugs.mysql.com/11411>] - Production package doesn't include test classes.
- Removed nonsensical "costly type conversion" warnings when using usage advisor.

#### 04-14-05 - Version 3.1.8-stable

- Fixed `DatabaseMetaData.getTables()` returning views when they were not asked for as one of the requested table types.
- Added support for new precision-math DECIMAL type in MySQL >= 5.0.3.
- Fixed `ResultSet.getTime()` on a NULL value for server-side prepared statements throws NPE.
- Made `Connection.ping()` a public method.
- Fixed Bug#8868 [<http://bugs.mysql.com/8868>], `DATE_FORMAT()` queries returned incorrect results.
- `ServerPreparedStatement` now correctly 'stream' BLOB/CLOB data to the server. You can configure the threshold chunk size using the JDBC URL property 'blobSendChunkSize' (the default is one megabyte).
- `BlobFromLocator` now uses correct identifier quoting when generating prepared statements.
- Server-side session variables can be preset at connection time by passing them as a comma-delimited list for the connection property 'sessionVariables'.
- Fixed regression in `ping()` for users using `autoReconnect=true`.
- Fixed BUG#9040 [<http://bugs.mysql.com/9040>] - `PreparedStatement.addBatch()` did not work for prepared statements and streaming BINARY data.
- Fixed BUG#8800 [<http://bugs.mysql.com/8800>] - `DBMD.supportsMixedCaseIdentifiers` value on servers running on case-sensitive filesystems.

- Fixed BUG#9206 [<http://bugs.mysql.com/9206>], can not use 'UTF-8' for character configuration property.
- Fixed BUG#9236 [<http://bugs.mysql.com/9236>], a continuation of BUG#8868 [<http://bugs.mysql.com/8868>] that should return non-string types when resolved by temporary tables suddenly become opaque binary strings (work-around for server limitation). Also fixed fields with type of CHAR(n) CHARACTER SET BINARY to return correct/matching classes for `ResultSet.getColumnClassName()` and `ResultSet.getObject()`.
- Fixed BUG#8792 [<http://bugs.mysql.com/8792>] - `DBMD.supportsResultSetConcurrency` true for forward-only/read-only result sets (we obviously support this).
- Fixed BUG#8803 [<http://bugs.mysql.com/8803>], 'DATA\_TYPE' column from `DBMD.getColumns()` causes `ArrayIndexOutOfBoundsException` when accessed (and in fact, didn't return any value).
- Check for empty strings ('') when converting char/varchar column data to numeric. Throw exception if 'emptyStringsConvertToZero' configuration property is set to 'false' (for backward-compatibility with 3.0, it is now set to 'true' by default, but will most likely default to 'false' in 3.2).
- Fixed BUG#9320 [<http://bugs.mysql.com/9320>] - `PreparedStatement.getMetaData()` under certain conditions when not using server-side prepared statements.
- `Connection.canHandleAsPreparedStatement()` now makes 'best effort' to distinguish LIMIT clauses with placeholders in them from ones without in order to have fewer false positives when generating work-arounds for statements the server cannot currently handle as server-side prepared statements.
- Fixed `build.xml` to not compile log4j logging if log4j not available.
- Added support for the c3p0 connection pool's (<http://c3p0.sf.net/>) validation/connection checker interface which uses the lightweight 'COM\_PING' call to the server if available. To use it, configure your c3p0 connection pool's 'connectionTesterClassName' property to use 'com.mysql.jdbc.integration.c3p0.MySqlConnectionTester'.
- Better detection of LIMIT inside/outside of quoted strings so that the driver can more correctly determine whether a prepared statement can be prepared on the server or not.
- Fixed BUG#9319 [<http://bugs.mysql.com/9319>] - Stored procedures with same name in different databases confuse the driver when it tries to determine parameter counts/types.
- Added finalizers to `ResultSet` and `Statement` implementations to be JDBC spec-compliant, which requires that if not explicitly closed, these resources should be closed upon garbage collection.
- Fixed BUG#9682 [<http://bugs.mysql.com/9682>] - Stored procedures with DECIMAL storage specifications that contained ", " in them would fail.
- `PreparedStatement.setObject(int, Object, int type, int scale)` now uses scale value for `BigDecimal` instances.
- Fixed BUG#9704 [<http://bugs.mysql.com/9704>] - `Statement.getMoreResults()` could fail if existing result set was `.close()`d.
- The performance metrics feature now gathers information about number of tables referenced in a SELECT.
- The logging system is now automatically configured. If the value has been set by the user, via the URL property "logger" or the system property "com.mysql.jdbc.logger", then use that, otherwise, autodetect

it using the following steps:

Log4j, if it's available,  
Then JDK1.4 logging,  
Then fallback to our STDERR logging.

- Fixed BUG#9778 [<http://bugs.mysql.com/9778>], DBMD.getTables() shouldn't return are asked for, even if the database version doesn't support views.
- Fixed driver not returning 'true' for '-1' when ResultSet.getBoolean() was called on result sets returned from server-side prepared statements.
- Added a Manifest.MF file with implementation information to the .jar file.
- More tests in Field.isOpaqueBinary() to distinguish opaque binary (i.e. fields with type CHAR(n) and CHARACTER SET BINARY) from output of various scalar and aggregate functions that return strings.
- Fixed BUG#9917 [<http://bugs.mysql.com/9917>] - Should accept null for catalog in DBMD methods, even though it's not JDBC-compliant for legacy's sake. Disable by setting connection property "nullCatalogMeansCurrent" to "false" (which will be the default value in C/J 3.2.x).
- Fixed BUG#9769 [<http://bugs.mysql.com/9769>] - Should accept null for name parameter even though it isn't JDBC compliant, for legacy's sake. Disable by setting connection property "nullNamePatternMatchesAll" to "false" (which will be the default value in C/J 3.2.x).

#### 02-18-05 - Version 3.1.7-stable

- Fixed BUG#7686 [<http://bugs.mysql.com/7686>], Timestamp key column data needed stripped for UpdatableResultSet.refreshRow().
- Fixed BUG#7715 [<http://bugs.mysql.com/7715>] - Timestamps converted incorrectly with Server-side prepared statements and updatable result sets.
- Detect new sql\_mode variable in string form (it used to be integer) and adjust quoting method for strings appropriately.
- Added 'holdResultsOpenOverStatementClose' property (default is false), that keeps result sets open over statement.close() or new execution on same statement (suggested by Kevin Burton).
- Fixed BUG#7952 [<http://bugs.mysql.com/7952>] -- Infinite recursion when 'failover' in failover configuration.
- Disable multi-statements (if enabled) for MySQL-4.1 versions prior to version 4.1.10 if the query cache is enabled, as the server returns wrong results in this configuration.
- Fixed duplicated code in configureClientCharset() that prevented useOldUTF8Behavior=true from working properly.
- Removed 'dontUnpackBinaryResults' functionality, the driver now always stores results from server-side prepared statements as-is from the server and unpacks them on demand.
- Fixed BUG#8096 [<http://bugs.mysql.com/8096>] where emulated locators corrupt when using server-side prepared statements.
- Fixed synchronization issue with ServerPreparedStatement.serverPrepare() that could cause deadlocks/crashes if connection was shared between threads.

- By default, the driver now scans SQL you are preparing via all variants of `Connection.prepareStatement()` to determine if it is a supported type of statement to prepare on the server side, and if it is not supported by the server, it instead prepares it as a client-side emulated prepared statement (BUG#4718 [<http://bugs.mysql.com/4718>] disable this by passing 'emulateUnsupportedPstmts=false' in your JDBC URL).
- Remove `_binary` introducer from parameters used as in/out parameters in `CallableStatement`.
- Always return `byte[]`s for output parameters registered as `*BINARY`.
- Send correct value for 'boolean' "true" to server for `PreparedStatement.setObject(n, "true", Types.BIT)`.
- Fixed bug with `Connection` not caching statements from `prepareStatement()` when the statement wasn't a server-side prepared statement.
- Choose correct 'direction' to apply time adjustments when both client and server are in GMT timezone when using `ResultSet.get(..., cal)` and `PreparedStatement.set(..., cal)`.
- Added 'dontTrackOpenResources' option (default is false, to be JDBC compliant), which helps with memory use for non-well-behaved apps (i.e applications which don't close Statements when they should).
- Fixed BUG#8428 [<http://bugs.mysql.com/8428>] - `ResultSet.getString()` doesn't stored on server, bug fix only enabled when 'noDatetimeStringSync' property is set to 'true' (the default is 'false').
- Fixed NPE in `ResultSet.realClose()` when using usage advisor and result set was already closed.
- Fixed BUG#8487 [<http://bugs.mysql.com/8487>] - PreparedStatements not creating sets.
- Don't pass NULL to `String.valueOf()` in `ResultSet.getNativeConvertToString()`, as it stringifies it (i.e. returns "null"), which is not correct for the method in question.
- Fixed BUG#8484 [<http://bugs.mysql.com/8484>] - `ResultSet.getBigDecimal()` throws exception when rounding would need to occur to set scale. The driver now chooses a rounding mode of 'half up' if non-rounding `BigDecimal.setScale()` fails.
- Added 'useLocalSessionState' configuration property, when set to 'true' the JDBC driver trusts that the application is well-behaved and only sets autocommit and transaction isolation levels using the methods provided on `java.sql.Connection`, and therefore can manipulate these values in many cases without incurring round-trips to the database server.
- Added `enableStreamingResults()` to `Statement` for connection pool implementations that check `Statement.setFetchSize()` for specification-compliant values. Call `Statement.setFetchSize(>=0)` to disable the streaming results for that statement.
- Added support for BIT type in MySQL-5.0.3. The driver will treat `BIT(1-8)` as the JDBC standard BIT type (which maps to `java.lang.Boolean`), as the server does not currently send enough information to determine the size of a bitfield when `< 9` bits are declared. `BIT(>9)` will be treated as `VARBINARY`, and will return



12-23-04 - Version 3.1.6-stable

- 12-02-04 - Version 3.1.5-gamma

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'padding' zeros).

- Use `DatabaseMetaData.getIdentifierQuoteString()` when building DBMD queries.
- Use 1MB packet for sending file for `LOAD DATA LOCAL INFILE` if that is < 'max\_allowed\_packet' on server.
- Fixed BUG#6399 [<http://bugs.mysql.com/6399>], `ResultSetMetaData.getColumnDisplaySize()` returns wrong values for multi-byte charsets.
- Make auto-deserialization of `java.lang.Objects` stored in BLOBs configurable via 'autoDeserialize' property (defaults to 'false').
- Re-work `Field.isOpaqueBinary()` to detect 'CHAR(n) CHARACTER SET BINARY' to support fixed-length binary fields for `ResultSet.getObject()`.
- Use our own implementation of buffered input streams to get around blocking behavior of `java.io.BufferedReader`. Disable this with 'useReadAheadInput=false'.
- Fixed BUG#6348 [<http://bugs.mysql.com/6348>], failing to connect to the server if the given host name is IPV6 (which the server does not yet bind on). The driver now loops through `_all_` IP addresses for a given host, and stops on the first one that `accepts()` a `socket.connect()`.

#### 09-04-04 - Version 3.1.4-beta

- Fixed BUG#4510 [<http://bugs.mysql.com/4510>] - connector/j 3.1.3 beta does not work correctly (caused by changes to support unsigned reads in `Buffer.readInt()` -> `Buffer.readShort()`).
- Added support in `DatabaseMetaData.getTables()` and `getTableTypes()` for VIEWS which are now available in MySQL server version 5.0.x.
- Fixed BUG#4642 [<http://bugs.mysql.com/4642>] -- `ServerPreparedStatement.executeUpdate()` threw `ArrayIndexOutOfBoundsException` when unpacking field metadata.
- Optimized integer number parsing, enable 'old' slower integer parsing using JDK classes via 'useFastIntParsing=false' property.
- Added 'useOnlyServerErrorMessages' property, which causes message text in exceptions generated by the server to only contain the text sent by the server (as opposed to the `SQLState`'s 'standard' description, followed by the server's error message). This property is set to 'true' by default.
- Fixed BUG#4689 [<http://bugs.mysql.com/4689>] - `ResultSet.wasNull()` does not work if previous null was returned.
- Track packet sequence numbers if `enablePacketDebug=true`, and throw an exception if packets received out-of-order.
- Fixed BUG#4482 [<http://bugs.mysql.com/4482>], `ResultSet.getObject()` returns wrong values when using prepared statements.
- Calling `MysqlPooledConnection.close()` twice (even though an application error), caused NPE. Fixed.
- Fixed BUG#5012 [<http://bugs.mysql.com/5012>] -- `ServerPreparedStatement` deal with `DECIMAL` type don't work.
- Fixed BUG#5032 [<http://bugs.mysql.com/5032>] -- `ResultSet.getObject()` doesn't return `Boolean` for pseudo-bit types from prepared statements on 4.1.x (shortcut for avoiding extra type conversion when using binary-encoded

result sets obscured test in getObject() for 'pseudo' bit type)

- You can now use URLs in 'LOAD DATA LOCAL INFILE' statements, and the driver will use Java's built-in handlers for retrieving the data and sending it to the server. This feature is not enabled by default, you must set the 'allowUrlInLocalInfile' connection property to 'true'.
- The driver is more strict about truncation of numerics on ResultSet.get\*(), and will throw an SQLException when truncation is detected. You can disable this by setting 'jdbcCompliantTruncation' to false (it is enabled by default, as this functionality is required for JDBC compliance).
- Added three ways to deal with all-zero datetimes when reading them from a ResultSet, 'exception' (the default), which throws an SQLException with an SQLState of 'S1009', 'convertToNull', which returns NULL instead of the date, and 'round', which rounds the date to the nearest closest value which is '0001-01-01'.
- Fixed ServerPreparedStatement to read prepared statement metadata off the wire, even though it's currently a placeholder instead of using MysqlIO.clearInputStream() which didn't work at various times because data wasn't available to read from the server yet. This fixes sporadic errors users were having with ServerPreparedStatements throwing ArrayIndexOutOfBoundsExceptions.
- Use com.mysql.jdbc.Message's classloader when loading resource bundle, should fix sporadic issues when the caller's classloader can't locate the resource bundle.

#### 07-07-04 - Version 3.1.3-beta

- Mangle output parameter names for CallableStatements so they will not clash with user variable names.
- Added support for INOUT parameters in CallableStatements.
- Fix for BUG#4119 [<http://bugs.mysql.com/4119>], null bitmask sent for server-statements was incorrect.
- Use SQL Standard SQL states by default, unless 'useSqlStateCodes' property is set to 'false'.
- Added packet debugging code (see the 'enablePacketDebug' property documentation).
- Added constants for MySQL error numbers (publicly-accessible, see com.mysql.jdbc.MysqlErrorNumbers), and the ability to generate the mappings of vendor error codes to SQLStates that the driver uses (for documentation purposes).
- Externalized more messages (on-going effort).
- Fix for BUG#4311 [<http://bugs.mysql.com/4311>] - Error in retrieval of medium prepared statements and binary protocol.
- Support new timezone variables in MySQL-4.1.3 when 'useTimezone=true'
- Support for unsigned numerics as return types from prepared statements. This also causes a change in ResultSet.getObject() for the 'bigint unsigned' type, which used to return BigDecimal instances, it now returns instances of java.lang.BigInteger.

#### 06-09-04 - Version 3.1.2-alpha

- Fixed stored procedure parameter parsing info when size was specified for a parameter (i.e. `char()`, `varchar()`).
- Enabled callable statement caching via `'cacheCallableStmts'` property.
- Fixed case when no output parameters specified for a stored procedure caused a bogus query to be issued to retrieve out parameters, leading to a syntax error from the server.
- Fixed case when no parameters could cause a `NullPointerException` in `CallableStatement.setOutputParameters()`.
- Removed wrapping of exceptions in `MysqlIO.changeUser()`.
- Fixed sending of split packets for large queries, enabled nio ability to send large packets as well.
- Added `.toString()` functionality to `ServerPreparedStatement`, which should help if you're trying to debug a query that is a prepared statement (it shows SQL as the server would process).
- Added `'gatherPerformanceMetrics'` property, along with properties to control when/where this info gets logged (see docs for more info).
- `ServerPreparedStatements` weren't actually de-allocating server-side resources when `.close()` was called.
- Added `'logSlowQueries'` property, along with property `'slowQueriesThresholdMillis'` to control when a query should be considered 'slow'.
- Correctly map output parameters to position given in `prepareCall()` vs. order implied during `registerOutParameter()` - fixes BUG#3146 [<http://bugs.mysql.com/3146>].
- Correctly detect initial character set for servers  $\geq 4.1.0$
- Cleaned up detection of server properties.
- Support placeholder for parameter metadata for server  $\geq 4.1.2$
- Fix for BUG#3539 [<http://bugs.mysql.com/3539>] `getProcedures()` does not return result set
- Fix for BUG#3540 [<http://bugs.mysql.com/3540>] `getProcedureColumns()` doesn't return procedure name
- Fixed BUG#3520 [<http://bugs.mysql.com/3520>] `-- DBMD.getSQLStateType()` returns
- Added `'connectionCollation'` property to cause driver to issue `'set collation_connection=...'` query on connection init if default collation for given charset is not appropriate.
- Fixed `DatabaseMetaData.getProcedures()` when run on MySQL-5.0.0 (output of `'show procedure status'` changed between 5.0.1 and 5.0.0).
- Fixed BUG#3804 [<http://bugs.mysql.com/3804>] `-- getWarnings()` returns `SQLWarn`
- Don't enable server-side prepared statements for server version 5.0.0 or 5.0.1 as they aren't compatible with the '4.1.2+' style that the driver uses (the driver expects information to come back that isn't there, so it hangs).

02-14-04 - Version 3.1.1-alpha

- Fixed bug with UpdatableResultSets not using client-side prepared statements.
- Fixed character encoding issues when converting bytes to ASCII when MySQL doesn't provide the character set, and the JVM is set to a multi-byte encoding (usually affecting retrieval of numeric values).
- Unpack 'unknown' data types from server prepared statements as Strings.
- Implemented long data (Blobs, Clobs, InputStreams, Readers) for server prepared statements.
- Implemented Statement.getWarnings() for MySQL-4.1 and newer (using 'SHOW WARNINGS').
- Default result set type changed to TYPE\_FORWARD\_ONLY (JDBC compliance).
- Centralized setting of result set type and concurrency.
- Re-factored how connection properties are set and exposed as DriverPropertyInfo as well as Connection and DataSource properties.
- Support for NIO. Use 'useNIO=true' on platforms that support NIO.
- Support for SAVEPOINTS (MySQL >= 4.0.14 or 4.1.1).
- Support for mysql\_change\_user()...See the changeUser() method in com.mysql.jdbc.Connection.
- Reduced number of methods called in average query to be more efficient.
- Prepared Statements will be re-prepared on auto-reconnect. Any errors encountered are postponed until first attempt to re-execute the re-prepared statement.
- Ensure that warnings are cleared before executing queries on prepared statements, as-per JDBC spec (now that we support warnings).
- Support 'old' profileSql capitalization in ConnectionProperties. This property is deprecated, you should use 'profileSQL' if possible.
- Optimized Buffer.readLenByteArray() to return shared empty byte array when length is 0.
- Allow contents of PreparedStatement.setBlob() to be retained between calls to .execute\*().
- Deal with 0-length tokens in EscapeProcessor (caused by callable statement escape syntax).
- Check for closed connection on delete/update/insert row operations in UpdatableResultSet.
- Fix support for table aliases when checking for all primary keys in UpdatableResultSet.

- Removed `useFastDates` connection property.
- Correctly initialize datasource properties from JNDI Refs, including explicitly specified URLs.
- `DatabaseMetaData` now reports `supportsStoredProcedures()` for MySQL versions `>= 5.0.0`
- Fixed stack overflow in `Connection.prepareCall()` (bad merge).
- Fixed `IllegalAccessError` to `Calendar.getTimeInMillis()` in `DateTimeValue` (for JDK `< 1.4`).
- Fix for BUG#1673 [<http://bugs.mysql.com/1673>], where `DatabaseMetaData.getColumns()` returning correct column ordinal info for non '%' column name patterns.
- Merged fix of datatype mapping from MySQL type 'FLOAT' to `java.sql.Types.REAL` from 3.0 branch.
- Detect collation of column for `RSMD.isCaseSensitive()`.
- Fixed sending of queries `> 16M`.
- Added named and indexed input/output parameter support to `CallableStatement`. MySQL-5.0.x or newer.
- Fixed `NullPointerException` in `ServerPreparedStatement.setTimestamp()`, as well as year and month discrepancies in `ServerPreparedStatement.setTimestamp()`, `setDate()`.
- Added ability to have multiple database/JVM targets for compliance and regression/unit tests in `build.xml`.
- Fixed NPE and year/month bad conversions when accessing some datetime functionality in `ServerPreparedStatements` and their resultant result sets.
- Display where/why a connection was implicitly closed (to aid debugging).
- `CommunicationsException` implemented, that tries to determine why communications was lost with a server, and displays possible reasons when `.getMessage()` is called.
- Fixed BUG#2359 [<http://bugs.mysql.com/2359>], NULL values for numeric types in encoded result sets causing `NullPointerExceptions`.
- Implemented `Connection.prepareCall()`, and `DatabaseMetaData.getProcedures()` and `getProcedureColumns()`.
- Reset 'long binary' parameters in `ServerPreparedStatement` when `clearParameters()` is called, by sending `COM_RESET_STMT` to the server.
- Merged prepared statement caching, and `.getMetaData()` support from 3.0 branch.
- Fixed off-by-1900 error in some cases for years in `TimeUtil.fastDate/TimeCreate()` when unpacking results from server-side prepared statements.
- Fixed BUG#2502 [<http://bugs.mysql.com/2502>] -- charset conversion issue in `ResultSet`
- Implemented multiple result sets returned from a statement

or stored procedure.

- Fixed BUG#2606 [<http://bugs.mysql.com/2606>] -- Server side prepared statements datatype 'YEAR' correctly.
- Enabled streaming of result sets from server-side prepared statements.
- Fixed BUG#2623 [<http://bugs.mysql.com/2623>] -- Class-cast exception when using scrolling result sets and server-side prepared statements.
- Merged unbuffered input code from 3.0.
- Fixed ConnectionProperties that weren't properly exposed via accessors, cleaned up ConnectionProperties code.
- Fixed BUG#2671 [<http://bugs.mysql.com/2671>], NULL fields not being encoded in all cases in server side prepared statements.
- Fixed rare buffer underflow when writing numbers into buffers for sending prepared statement execution requests.
- Use DocBook version of docs for shipped versions of drivers.

02-18-03 - Version 3.1.0-alpha

- Added 'requireSSL' property.
- Added 'useServerPrepStmts' property (default 'false'). The driver will use server-side prepared statements when the server version supports them (4.1 and newer) when this property is set to 'true'. It is currently set to 'false' by default until all bind/fetch functionality has been implemented. Currently only DML prepared statements are implemented for 4.1 server-side prepared statements.
- Track open Statements, close all when Connection.close() is called (JDBC compliance).

06-23-05 - Version 3.0.17-ga

- Fixed BUG#5874 [<http://bugs.mysql.com/5874>], Timestamp/Time conversion goes wrong when useTimeZone='true' and server timezone differs from client timezone.
- Fixed BUG#7081 [<http://bugs.mysql.com/7081>], DatabaseMetaData.getIndexInfo() parameter.
- Support new protocol type 'MYSQL\_TYPE\_VARCHAR'.
- Added 'useOldUTF8Behavior' configuration property, which causes JDBC driver to act like it did with MySQL-4.0.x and earlier when the character encoding is 'utf-8' when connected to MySQL-4.1 or newer.
- Fixed BUG#7316 [<http://bugs.mysql.com/7316>] - Statements created from a pool returning physical connection instead of logical connection when getConnection() was called.
- Fixed BUG#7033 [<http://bugs.mysql.com/7033>] - PreparedStatement don't encode multi-byte character sets correctly in static SQL strings.
- Fixed BUG#6966 [<http://bugs.mysql.com/6966>], connections starting up failed-never retry master.
- Fixed BUG#7061 [<http://bugs.mysql.com/7061>], PreparedStatement.fixDecimalExp

'+', making number unparseable by MySQL server.

- Fixed BUG#7686 [<http://bugs.mysql.com/7686>], Timestamp key column data needs UdatableResultSet.refreshRow().
- Backported SQLState codes mapping from Connector/J 3.1, enable with 'useSqlStateCodes=true' as a connection property, it defaults to 'false' in this release, so that we don't break legacy applications (it defaults to 'true' starting with Connector/J 3.1).
- Fixed BUG#7601 [<http://bugs.mysql.com/7601>], PreparedStatement.fixDecimalExp '+', making number unparseable by MySQL server.
- Escape sequence {fn convert(..., type)} now supports ODBC-style types that are prepended by 'SQL\_'.
- Fixed duplicated code in configureClientCharset() that prevented useOldUTF8Behavior=true from working properly.
- Handle streaming result sets with > 2 billion rows properly by fixing wraparound of row number counter.
- Fixed BUG#7607 [<http://bugs.mysql.com/7607>] - MS932, SHIFT\_JIS and Windows\_3 aliases for sjis.
- Fixed BUG#6549 [<http://bugs.mysql.com/6549>] (while fixing #7607), adding 'CP sjis'.
- Fixed BUG#8064 [<http://bugs.mysql.com/8064>], which requires hex escaping of multi-byte charsets with prepared statements.
- Fixed BUG#8812 [<http://bugs.mysql.com/8812>], NON\_UNIQUE column from DBMD.get inverted value.
- Workaround for server BUG#9098 [<http://bugs.mysql.com/9098>] - default values DATE/TIME/TIMESTAMP/TIMESTAMP columns can't be distinguished from 'string' values, so UdatableResultSet.moveToInsertRow() generates bad SQL for inserting default values.
- Fixed BUG#8629 [<http://bugs.mysql.com/8629>] - 'EUCKR' charset is sent as 'SE MySQL-4.1 and newer doesn't understand.
- DatabaseMetaData.supportsSelectForUpdate() returns correct value based on server version.
- Use hex escapes for PreparedStatement.setBytes() for double-byte charsets including 'aliases' Windows-31J, CP934, MS932.
- Added support for the "EUC\_JP\_Solaris" character encoding, which maps to a MySQL encoding of "eucjpms" (backported from 3.1 branch). This only works on servers that support eucjpms, namely 5.0.3 or later.

11-15-04 - Version 3.0.16-ga

- Re-issue character set configuration commands when re-using pooled connections and/or Connection.changeUser() when connected to MySQL-4.1 or newer.
- Fixed ResultSetMetaData.isReadOnly() to detect non-writable columns when connected to MySQL-4.1 or newer, based on existence of 'original' table and column names.
- Fixed BUG#5664 [<http://bugs.mysql.com/5664>], ResultSet.updateByte() when on throws ArrayOutOfBoundsException.



- Fixed DatabaseMetaData.getTypes() returning incorrect (i.e. non-negative) scale for the 'NUMERIC' type.
- Fixed BUG#6198 [<http://bugs.mysql.com/6198>], off-by-one bug in Buffer.readSt
- Made TINYINT(1) -> BIT/Boolean conversion configurable via 'tinyIntIsBit' property (default 'true' to be JDBC compliant out of the box).
- Only set 'character\_set\_results' during connection establishment if server version >= 4.1.1.
- Fixed regression where useUnbufferedInput was defaulting to 'false'.
- Fixed BUG#6231 [<http://bugs.mysql.com/6231>], ResultSet.getTimestamp() on a c fails.

09-04-04 - Version 3.0.15-production

- Fixed BUG#4010 [<http://bugs.mysql.com/4010>] - StringUtils.escapeEasternUnico broken for GBK
- Fixed BUG#4334 [<http://bugs.mysql.com/4334>] - Failover for autoReconnect not hosts, and not retrying all hosts. (WARN: This required a change to the SocketFactory connect() method signature, which is now  
  
public Socket connect(String host, int portNumber, Properties props)  
  
therefore any third-party socket factories will have to be changed to support this signature.
- Logical connections created by MysqlConnectionPoolDataSource will now issue a rollback() when they are closed and sent back to the pool. If your application server/connection pool already does this for you, you can set the 'rollbackOnPooledClose' property to false to avoid the overhead of an extra rollback().
- Removed redundant calls to checkRowPos() in ResultSet.
- Fixed BUG#4742 [<http://bugs.mysql.com/4742>], 'DOUBLE' mapped twice in DBMD.g
- Added FLOSS license exemption.
- Fixed BUG#4808 [<http://bugs.mysql.com/4808>], calling .close() twice on a Poo
- Fixed BUG#4138 [<http://bugs.mysql.com/4138>] and BUG#4860 [<http://bugs.mysql.com/4860>] type for unsigned columns. This affects type mappings for all numeric types in the RSMD.getColumnType() and RSMD.getColumnTypeNames() methods as well, to ensure that 'like' types from DBMD.getColumns() match up with what RSMD.getColumnType() and getColumnTypeName() return.
- 'Production' - 'GA' in naming scheme of distributions.
- Fix for BUG#4880 [<http://bugs.mysql.com/4880>], RSMD.getPrecision() returning (should return max length in chars for non-binary types, max length in bytes for binary types). This fix also fixes mapping of RSMD.getColumnType() and RSMD.getColumnTypeName() for the BLOB types based on the length sent from the server (the server doesn't distinguish between TINYBLOB, BLOB, MEDIUMBLOB or LONGBLOB at the network protocol level).
- Fixed BUG#5022 [<http://bugs.mysql.com/5022>] - ResultSet should release Field
- Fixed BUG#5069 [<http://bugs.mysql.com/5069>] -- ResultSet.getMetaData() should incorrectly-initialized metadata if the result set has been closed, but should instead throw an SQLException. Also fixed for getRow() and getWarnings() and traversal methods by calling checkClosed() before

operating on instance-level fields that are nullified during `.close()`.

- Parse new timezone variables from 4.1.x servers.
- Use `_binary` introducer for `PreparedStatement.setBytes()` and `set*Stream()` when connected to MySQL-4.1.x or newer to avoid misinterpretation during character conversion.

05-28-04 - Version 3.0.14-production

- Fixed URL parsing error

05-27-04 - Version 3.0.13-production

- Fixed BUG#3848 [<http://bugs.mysql.com/3848>] - Using a `MySQLDataSource` without `setURL()`
- Fixed BUG#3920 [<http://bugs.mysql.com/3920>] - "No Database Selected" when using `MySQLConnectionPoolDataSource`.
- Fixed BUG#3873 [<http://bugs.mysql.com/3873>] - `PreparedStatement.getGeneratedKeys()` returning 1 result for batched insertions

05-18-04 - Version 3.0.12-production

- Add unsigned attribute to `DatabaseMetaData.getColumns()` output in the `TYPE_NAME` column.
- Added 'failOverReadOnly' property, to allow end-user to configure state of connection (read-only/writable) when failed over.
- Backported 'change user' and 'reset server state' functionality from 3.1 branch, to allow clients of `MySQLConnectionPoolDataSource` to reset server state on `getConnection()` on a pooled connection.
- Don't escape SJIS/GBK/BIG5 when using MySQL-4.1 or newer.
- Allow 'url' parameter for `MySQLDataSource` and `MySQLConnectionPoolDataSource` so that passing of other properties is possible from inside appservers.
- Map duplicate key and foreign key errors to `SQLState` of '23000'.
- Backport documentation tooling from 3.1 branch.
- Return creating statement for `ResultSets` created by `getGeneratedKeys()` (BUG#2957 [<http://bugs.mysql.com/2957>])
- Allow `java.util.Date` to be sent in as parameter to `PreparedStatement.setObject()`, converting it to a `Timestamp` to maintain full precision (BUG#3103 [<http://bugs.mysql.com/3103>]).
- Don't truncate BLOBs/CLOBs when using `setBytes()` and/or `setBinary/CharacterStream()` (BUG#2670 [<http://bugs.mysql.com/2670>]).
- Dynamically configure character set mappings for field-level character sets on MySQL-4.1.0 and newer using 'SHOW COLLATION' when connecting.
- Map 'binary' character set to 'US-ASCII' to support DATETIME charset recognition for servers >= 4.1.2
- Use 'SET character\_set\_results' during initialization to allow any charset to be returned to the driver for result sets.

- Use `charsetnr` returned during connect to encode queries before issuing 'SET NAMES' on MySQL >= 4.1.0.
- Add helper methods to `ResultSetMetaData` (`getColumnCharacterEncoding()` and `getColumnCharacterSet()`) to allow end-users to see what charset the driver thinks it should be using for the column.
- Only set `character_set_results` for MySQL >= 4.1.0.
- Fixed BUG#3511 [<http://bugs.mysql.com/3511>], `StringUtils.escapeSJISByteStream` eastern double-byte charsets correctly.
- Renamed `StringUtils.escapeSJISByteStream()` to more appropriate `escapeEasternUnicodeByteStream()`.
- Fixed BUG#3554 [<http://bugs.mysql.com/3554>] - Not specifying database in URL exception.
- Auto-convert MySQL encoding names to Java encoding names if used for `characterEncoding` property.
- Added encoding names that are recognized on some JVMs to fix case where they were reverse-mapped to MySQL encoding names incorrectly.
- Use `junit.textui.TestRunner` for all unit tests (to allow them to be run from the command line outside of Ant or Eclipse).
- Fixed BUG#3557 [<http://bugs.mysql.com/3557>] - `UpdatableResultSet` not picking for `moveToInsertRow()`.
- Fixed BUG#3570 [<http://bugs.mysql.com/3570>] - inconsistent reporting of column still doesn't return all types for \*BLOBs \*TEXT correctly, so the driver won't return those correctly.
- Fixed BUG#3520 [<http://bugs.mysql.com/3520>] -- `DBMD.getSQLStateType()` return
- Fixed regression in `PreparedStatement.setString()` and eastern character encodings.
- Made `StringRegressionTest` 4.1-unicode aware.

02-19-04 - Version 3.0.11-stable

- Trigger a 'SET NAMES utf8' when encoding is forced to 'utf8' \_or\_ 'utf-8' via the 'characterEncoding' property. Previously, only the Java-style encoding name of 'utf-8' would trigger this.
- `AutoReconnect` time was growing faster than exponentially (BUG#2447 [<http://bugs.mysql.com/2447>])
- Fixed failover always going to last host in list (BUG#2578 [<http://bugs.mysql.com/2578>])
- Added 'useUnbufferedInput' parameter, and now use it by default (due to JVM issue <http://developer.java.sun.com/developer/bugParade/bugs/4401235.html>)
- Detect 'on/off' or '1','2','3' form of `lower_case_table_names` on server.
- Return 'java.lang.Integer' for TINYINT and SMALLINT types from `ResultSetMetaData.getColumnClassName()` (fix for BUG#2852 [<http://bugs.mysql.com/2852>])
- Return 'java.lang.Double' for FLOAT type from `ResultSetMetaData.getColumnClassName()` (fix for BUG#2855 [<http://bugs.mysql.com/2855>]).
- Return '[B' instead of `java.lang.Object` for BINARY, VARBINARY and

LONGVARBINARY types from ResultSetMetaData.getColumnClassName()  
(JDBC compliance).

- Issue connection events on all instances created from a  
ConnectionPoolDataSource.

01-13-04 - Version 3.0.10-stable

- Don't count quoted id's when inside a 'string' in PreparedStatement  
parsing (fix for BUG#1511 [<http://bugs.mysql.com/1511>]).
- 'Friendlier' exception message for PacketTooLargeException  
(BUG#1534 [<http://bugs.mysql.com/1534>]).
- Backported fix for aliased tables and UpdatableResultSets in  
checkUpdatability() method from 3.1 branch.
- Fix for ArrayIndexOutOfBoundsException exception when using Statement.setMaxRows()  
(BUG#1695 [<http://bugs.mysql.com/1695>]).
- Fixed BUG#1576 [<http://bugs.mysql.com/1576>], dealing with large blobs and sp  
read correctly.
- Fixed regression of Statement.getGeneratedKeys() and REPLACE statements.
- Fixed BUG#1630 [<http://bugs.mysql.com/1630>], subsequent call to ResultSet.up  
result set is not updatable.
- Fix for 4.1.1-style auth with no password.
- Fix for BUG#1731 [<http://bugs.mysql.com/1731>], Foreign Keys column sequence  
DatabaseMetaData.getImported/Exported/CrossReference().
- Fix for BUG#1775 [<http://bugs.mysql.com/1775>] - DatabaseMetaData.getSystemFu  
bad function 'VResultsSion'.
- Fix for BUG#1592 [<http://bugs.mysql.com/1592>] -- cross-database updatable re  
are not checked for updatability correctly.
- DatabaseMetaData.getColumns() should return Types.LONGVARCHAR for  
MySQL LONGTEXT type.
- ResultSet.getObject() on TINYINT and SMALLINT columns should return  
Java type 'Integer' (BUG#1913 [<http://bugs.mysql.com/1913>])
- Added 'alwaysClearStream' connection property, which causes the driver  
to always empty any remaining data on the input stream before  
each query.
- Added more descriptive error message 'Server Configuration Denies  
Access to DataSource', as well as retrieval of message from server.
- Autoreconnect code didn't set catalog upon reconnect if it had been  
changed.
- Implement ResultSet.updateClob().
- ResultSetMetaData.isCaseSensitive() returned wrong value for CHAR/VARCHAR  
columns.
- Fix for BUG#1933 [<http://bugs.mysql.com/1933>] -- Connection property "maxRow
- Fix for BUG#1925 [<http://bugs.mysql.com/1925>] -- Statements being created to  
DBMD.extractForeignKeyFromCreateTable().

- Fix for BUG#1914 [<http://bugs.mysql.com/1914>] -- Support escape sequence {fn
- Fix for BUG#1958 [<http://bugs.mysql.com/1958>] -- ArrayIndexOutOfBounds when number of parameters + 1.
- Fix for BUG#2006 [<http://bugs.mysql.com/2006>] -- ResultSet.findColumn() should return column name when there are duplicate column names in SELECT query (JDBC-compliance).
- Removed static synchronization bottleneck from PreparedStatement.setTimestamp().
- Removed static synchronization bottleneck from instance factory method of SingleByteCharsetConverter.
- Enable caching of the parsing stage of prepared statements via the 'cachePrepStmts', 'prepStmtCacheSize' and 'prepStmtCacheSqlLimit' properties (disabled by default).
- Speed up parsing of PreparedStatements, try to use one-pass whenever possible.
- Fixed security exception when used in Applets (applets can't read the system property 'file.encoding' which is needed for LOAD DATA LOCAL INFILE).
- Use constants for SQLStates.
- Map charset 'kol8\_ru' to 'kol8r' when connected to MySQL-4.1.0 or newer.
- Ensure that Buffer.writeString() saves room for the \0.
- Fixed exception 'Unknown character set 'danish' on connect w/ JDK-1.4.0
- Fixed mappings in SQLError to report deadlocks with SQLStates of '41000'.
- 'maxRows' property would affect internal statements, so check it for all statement creation internal to the driver, and set to 0 when it is not.

#### 10-07-03 - Version 3.0.9-stable

- Faster date handling code in ResultSet and PreparedStatement (no longer uses Date methods that synchronize on static calendars).
- Fixed test for end of buffer in Buffer.readString().
- Fixed ResultSet.previous() behavior to move current position to before result set when on first row of result set (bugs.mysql.com BUG#496 [<http://bugs.mysql.com/496>])
- Fixed Statement and PreparedStatement issuing bogus queries when setMaxRows() had been used and a LIMIT clause was present in the query.
- Fixed BUG#661 [<http://bugs.mysql.com/661>] - refreshRow didn't work when primary key contained values that needed to be escaped (they ended up being doubly-escaped).
- Support InnoDB constraint names when extracting foreign key info in DatabaseMetaData BUG#517 [<http://bugs.mysql.com/517>] and BUG#664 [<http://bugs.mysql.com/664>] (impl. ideas from Parwinder Sekhon)
- Backported 4.1 protocol changes from 3.1 branch (server-side SQL states, new field info, larger client capability flags,

connect-with-database, and so forth).

- Fix UpdatableResultSet to return values for getXXX() when on insert row (BUG#675 [<http://bugs.mysql.com/675>]).
- The insertRow in an UpdatableResultSet is now loaded with the default column values when moveToInsertRow() is called (BUG#688 [<http://bugs.mysql.com/688>]).
- DatabaseMetaData.getColumns() wasn't returning NULL for default values that are specified as NULL.
- Change default statement type/concurrency to TYPE\_FORWARD\_ONLY and CONCUR\_READ\_ONLY (spec compliance).
- Don't try and reset isolation level on reconnect if MySQL doesn't support them.
- Don't wrap SQLExceptions in RowDataDynamic.
- Don't change timestamp TZ twice if useTimezone==true (BUG#774 [<http://bugs.mysql.com/774>]).
- Fixed regression in large split-packet handling (BUG#848 [<http://bugs.mysql.com/848>]).
- Better diagnostic error messages in exceptions for 'streaming' result sets.
- Issue exception on ResultSet.getXXX() on empty result set (wasn't caught in some cases).
- Don't hide messages from exceptions thrown in I/O layers.
- Don't fire connection closed events when closing pooled connections, or on PooledConnection.getConnection() with already open connections (BUG#884 [<http://bugs.mysql.com/884>]).
- Clip +/- INF (to smallest and largest representative values for the type in MySQL) and NaN (to 0) for setDouble/setFloat(), and issue a warning on the statement when the server does not support +/- INF or NaN.
- Fix for BUG#879 [<http://bugs.mysql.com/879>], double-escaping of '\\' when character appears in non-escaped input.
- When emptying input stream of unused rows for 'streaming' result sets, have the current thread yield() every 100 rows in order to not monopolize CPU time.
- Fixed BUG#1099 [<http://bugs.mysql.com/1099>], DatabaseMetaData.getColumns() got keyword 'set' in character columns.
- Fixed deadlock issue with Statement.setMaxRows().
- Fixed CLOB.truncate(), BUG#1130 [<http://bugs.mysql.com/1130>].
- Optimized CLOB.setCharacterStream(), BUG#1131 [<http://bugs.mysql.com/1131>].
- Made databaseName, portNumber and serverName optional parameters for MySQLDataSourceFactory (BUG#1246 [<http://bugs.mysql.com/1246>]).
- Fix for BUG#1247 [<http://bugs.mysql.com/1247>] -- ResultSet.get/setString mas
- Backported auth. changes for 4.1.1 and newer from 3.1 branch.
- Added com.mysql.jdbc.util.BaseBugReport to help creation of testcases for bug reports.

- Added property to 'clobber' streaming results, by setting the 'clobberStreamingResults' property to 'true' (the default is 'false'). This will cause a 'streaming' ResultSet to be automatically closed, and any outstanding data still streaming from the server to be discarded if another query is executed before all the data has been read from the server.

#### 05-23-03 - Version 3.0.8-stable

- Allow bogus URLs in Driver.getPropertyInfo().
- Return list of generated keys when using multi-value INSERTS with Statement.getGeneratedKeys().
- Use JVM charset with filenames and 'LOAD DATA [LOCAL] INFILE'
- Fix infinite loop with Connection.cleanup().
- Changed Ant target 'compile-core' to 'compile-driver', and made testsuite compilation a separate target.
- Fixed result set not getting set for Statement.executeUpdate(), which affected getGeneratedKeys() and getUpdateCount() in some cases.
- Unicode character 0xFFFF in a string would cause the driver to throw an ArrayOutOfBoundsException (Bug #378 [<http://bugs.mysql.com/378>])
- Return correct amount of generated keys when using 'REPLACE' statements.
- Fix problem detecting server character set in some cases.
- Fix row data decoding error when using `_very_` large packets.
- Optimized row data decoding.
- Issue exception when operating on an already-closed prepared statement.
- Fixed SJIS encoding bug, thanks to Naoto Sato.
- Optimized usage of EscapeProcessor.
- Allow multiple calls to Statement.close()

#### 04-08-03 - Version 3.0.7-stable

- Fixed MysqlPooledConnection.close() calling wrong event type.
- Fixed StringIndexOutOfBoundsException in PreparedStatement.setClob().
- 4.1 Column Metadata fixes
- Remove synchronization from Driver.connect() and Driver.acceptsUrl().
- IOExceptions during a transaction now cause the Connection to be closed.
- Fixed missing conversion for 'YEAR' type in ResultSetMetaData.getColumnTypeName().
- Don't pick up indexes that start with 'pri' as primary keys

for `DBMD.getPrimaryKeys()`.

- Throw `SQLExceptions` when trying to do operations on a forcefully closed `Connection` (i.e. when a communication link failure occurs).
- You can now toggle profiling on/off using `Connection.setProfileSql(boolean)`.
- Fixed charset issues with database metadata (charset was not getting set correctly).
- Updatable `ResultSets` can now be created for aliased tables/columns when connected to MySQL-4.1 or newer.
- Fixed 'LOAD DATA LOCAL INFILE' bug when file > max\_allowed\_packet.
- Fixed escaping of 0x5c ('\') character for GBK and Big5 charsets.
- Fixed `ResultSet.getTimestamp()` when underlying field is of type `DATE`.
- Ensure that packet size from `alignPacketSize()` does not exceed `MAX_ALLOWED_PACKET` (JVM bug)
- Don't reset `Connection.isReadOnly()` when `autoReconnecting`.

#### 02-18-03 - Version 3.0.6-stable

- Fixed `ResultSetMetaData` to return "" when catalog not known. Fixes `NullPointerExceptions` with Sun's `CachedRowSet`.
- Fixed `DBMD.getTypeInfo()` and `DBMD.getColumns()` returning different value for precision in `TEXT/BLOB` types.
- Allow ignoring of warning for 'non transactional tables' during rollback (compliance/usability) by setting 'ignoreNonTxTables' property to 'true'.
- Fixed `SQLExceptions` getting swallowed on initial connect.
- Fixed `Statement.setMaxRows()` to stop sending 'LIMIT' type queries when not needed (performance)
- Clean up `Statement` query/method mismatch tests (i.e. `INSERT` not allowed with `.executeQuery()`).
- More checks added in `ResultSet` traversal method to catch when in closed state.
- Fixed `ResultSetMetaData.isWritable()` to return correct value.
- Add 'window' of different `NULL` sorting behavior to `DBMD.nullsAreSortedAtStart` (4.0.2 to 4.0.10, true, otherwise, no).
- Implemented `Blob.setBytes()`. You still need to pass the resultant `Blob` back into an updatable `ResultSet` or `PreparedStatement` to persist the changes, as MySQL does not support 'locators'.
- Backported 4.1 charset field info changes from Connector/J 3.1

#### 01-22-03 - Version 3.0.5-gamma

- Fixed `Buffer.fastSkipLenString()` causing `ArrayIndexOutOfBoundsExceptions` with some queries when unpacking fields.



- Implemented an empty `TypeMap` for `Connection.getTypeMap()` so that some third-party apps work with MySQL (IBM WebSphere 5.0 Connection pool).
- Added missing `LONGTEXT` type to `DBMD.getColumns()`.
- Retrieve `TX_ISOLATION` from database for `Connection.getTransactionIsolation()` when the MySQL version supports it, instead of an instance variable.
- Quote table names in `DatabaseMetaData.getColumns()`, `getPrimaryKeys()`, `getIndexInfo()`, `getBestRowIdentifier()`
- Greatly reduce memory required for `setBinaryStream()` in `PreparedStatement`.
- Fixed `ResultSet.isBeforeFirst()` for empty result sets.
- Added update options for foreign key metadata.

01-06-03 - Version 3.0.4-gamma

- Added quoted identifiers to database names for `Connection.setCatalog`.
- Added support for quoted identifiers in `PreparedStatement` parser.
- Streamlined character conversion and `byte[]` handling in `PreparedStatement` for `setByte()`.
- Reduce memory footprint of `PreparedStatement` by sharing outbound packet with `MysqlIO`.
- Added 'strictUpdates' property to allow control of amount of checking for 'correctness' of updatable result sets. Set this to 'false' if you want faster updatable result sets and you know that you create them from `SELECTs` on tables with primary keys and that you have selected all primary keys in your query.
- Added support for 4.0.8-style large packets.
- Fixed `PreparedStatement.executeBatch()` parameter overwriting.

12-17-02 - Version 3.0.3-dev

- Changed `charsToByte` in `SingleByteCharConverter` to be non-static
- Changed `SingleByteCharConverter` to use lazy initialization of each converter.
- Fixed charset handling in `Fields.java`
- Implemented `Connection.nativeSQL()`
- More robust escape tokenizer -- recognize '--' comments, and allow nested escape sequences (see `testsuite.EscapeProcessingTest`)
- `DBMD.getImported/ExportedKeys()` now handles multiple foreign keys per table.
- Fixed `ResultSetMetaData.getPrecision()` returning incorrect values for some floating point types.

- Fixed `ResultSetMetaData.getColumnTypeName()` returning BLOB for TEXT and TEXT for BLOB types.
- Fixed `Buffer.isLastDataPacket()` for 4.1 and newer servers.
- Added `CLIENT_LONG_FLAG` to be able to get more column flags (`isAutoIncrement()` being the most important)
- Because of above, implemented `ResultSetMetaData.isAutoIncrement()` to use `Field.isAutoIncrement()`.
- Honor '`lower_case_table_names`' when enabled in the server when doing table name comparisons in `DatabaseMetaData` methods.
- Some MySQL-4.1 protocol support (extended field info from selects)
- Use non-aliased table/column names and database names to fully qualify tables and columns in `UpdatableResultSet` (requires MySQL-4.1 or newer)
- Allow user to alter behavior of `Statement/PreparedStatement.executeBatch()` via '`continueBatchOnError`' property (defaults to '`true`').
- Check for connection closed in more `Connection` methods (`createStatement`, `prepareStatement`, `setTransactionIsolation`, `setAutoCommit`).
- More robust implementation of updatable result sets. Checks that `_all_` primary keys of the table have been selected.
- '`LOAD DATA LOCAL INFILE ...`' now works, if your server is configured to allow it. Can be turned off with the '`allowLoadLocalInfile`' property (see the README).
- Substitute '?' for unknown character conversions in single-byte character sets instead of '\0'.
- `NamedPipeSocketFactory` now works (only intended for Windows), see README for instructions.

11-08-02 - Version 3.0.2-dev

- Fixed issue with updatable result sets and `PreparedStatements` not working
- Fixed `ResultSet.setFetchDirection(FETCH_UNKNOWN)`
- Fixed issue when calling `Statement.setFetchSize()` when using arbitrary values
- Fixed incorrect conversion in `ResultSet.getLong()`
- Implemented `ResultSet.updateBlob()`.
- Removed duplicate code from `UpdatableResultSet` (it can be inherited from `ResultSet`, the extra code for each method to handle updatability I thought might someday be necessary has not been needed).
- Fixed "`UnsupportedEncodingException`" thrown when "forcing" a character encoding via properties.
- Fixed various non-ASCII character encoding issues.

- Added driver property 'useHostsInPrivileges'. Defaults to true. Affects whether or not '@hostname' will be used in DBMD.getColumn/TablePrivileges.
- All DBMD result set columns describing schemas now return NULL to be more compliant with the behavior of other JDBC drivers for other databases (MySQL does not support schemas).
- Added SSL support. See README for information on how to use it.
- Properly restore connection properties when autoReconnecting or failing-over, including autoCommit state, and isolation level.
- Use 'SHOW CREATE TABLE' when possible for determining foreign key information for DatabaseMetaData...also allows cascade options for DELETE information to be returned
- Escape 0x5c character in strings for the SJIS charset.
- Fixed start position off-by-1 error in Clob.getSubString()
- Implemented Clob.truncate()
- Implemented Clob.setString()
- Implemented Clob.setAsciiStream()
- Implemented Clob.setCharacterStream()
- Added com.mysql.jdbc.MiniAdmin class, which allows you to send 'shutdown' command to MySQL server...Intended to be used when 'embedding' Java and MySQL server together in an end-user application.
- Added 'connectTimeout' parameter that allows users of JDK-1.4 and newer to specify a maximum time to wait to establish a connection.
- Failover and autoReconnect only work when the connection is in a autoCommit(false) state, in order to stay transaction safe
- Added 'queriesBeforeRetryMaster' property that specifies how many queries to issue when failed over before attempting to reconnect to the master (defaults to 50)
- Fixed DBMD.supportsResultSetConcurrency() so that it returns true for ResultSet.TYPE\_SCROLL\_INSENSITIVE and ResultSet.CONCUR\_READ\_ONLY or ResultSet.CONCUR\_UPDATABLE
- Fixed ResultSet.isLast() for empty result sets (should return false).
- PreparedStatement now honors stream lengths in setBinary/Ascii/Character Stream() unless you set the connection property 'useStreamLengthsInPrepStmts' to 'false'.
- Removed some not-needed temporary object creation by using Strings smarter in EscapeProcessor, Connection and DatabaseMetaData classes.

09-21-02 - Version 3.0.1-dev

- Fixed ResultSet.getRow() off-by-one bug.
- Fixed RowDataStatic.getAt() off-by-one bug.
- Added limited Clob functionality (ResultSet.getClob(), PreparedStatement.setClob(), PreparedStatement.setObject(Clob)).

- Added `socketTimeout` parameter to URL.
- `Connection.isClosed()` no longer "pings" the server.
- `Connection.close()` issues `rollback()` when `getAutoCommit() == false`
- Added "paranoid" parameter...sanitizes error messages removing "sensitive" information from them (such as hostnames, ports, or usernames), as well as clearing "sensitive" data structures when possible.
- Fixed `ResultSetMetaData.isSigned()` for TINYINT and BIGINT.
- Charsets now automatically detected. Optimized code for single-byte character set conversion.
- Implemented `ResultSet.getCharacterStream()`
- Added "LOCAL TEMPORARY" to table types in `DatabaseMetaData.getTableTypes()`
- Massive code clean-up to follow Java coding conventions (the time had come)

07-31-02 - Version 3.0.0-dev

- !!! LICENSE CHANGE !!! The driver is now GPL. If you need non-GPL licenses, please contact me <mark@mysql.com>
- JDBC-3.0 functionality including `Statement/PreparedStatement.getGeneratedKeys()` and `ResultSet.getURL()`
- Performance enhancements - driver is now 50-100% faster in most situations, and creates fewer temporary objects
- Repackaging...new driver name is "com.mysql.jdbc.Driver", old name still works, though (the driver is now provided by MySQL-AB)
- Better checking for closed connections in `Statement` and `PreparedStatement`.
- Support for streaming (row-by-row) result sets (see README) Thanks to Doron.
- Support for large packets (new addition to MySQL-4.0 protocol), see README for more information.
- JDBC Compliance -- Passes all tests besides stored procedure tests
- Fix and sort primary key names in `DBMetaData` (SF bugs 582086 and 582086)
- Float types now reported as `java.sql.Types.FLOAT` (SF bug 579573)
- `ResultSet.getTimestamp()` now works for DATE types (SF bug 559134)
- `ResultSet.getDate/Time/Timestamp` now recognizes all forms of invalid values that have been set to all zeroes by MySQL (SF bug 586058)
- Testsuite now uses Junit (which you can get from [www.junit.org](http://www.junit.org))
- The driver now only works with JDK-1.2 or newer.

- Added multi-host failover support (see README)
- General source-code cleanup.
- Overall speed improvements via controlling transient object creation in MysqlIO class when reading packets
- Performance improvements in string handling and field metadata creation (lazily instantiated) contributed by Alex Twisleton-Wykeham-Fiennes

05-16-02 - Version 2.0.14

- More code cleanup
- PreparedStatement now releases resources on .close() (SF bug 553268)
- Quoted identifiers not used if server version does not support them. Also, if server started with --ansi or --sql-mode=ANSI\_QUOTES then ''' will be used as an identifier quote, otherwise ``' will be used.
- ResultSet.getDouble() now uses code built into JDK to be more precise (but s
- LogicalHandle.isClosed() calls through to physical connection
- Added SQL profiling (to STDERR). Set "profileSql=true" in your JDBC url. See README for more information.
- Fixed typo for relaxAutoCommit parameter.

04-24-02 - Version 2.0.13

- More code cleanup.
- Fixed unicode chars being read incorrectly (SF bug 541088)
- Faster blob escaping for PrepStmt
- Added set/getPortNumber() to DataSource(s) (SF bug 548167)
- Added setURL() to MySQLXADataSource (SF bug 546019)
- PreparedStatement.toString() fixed (SF bug 534026)
- ResultSetMetaData.getColumnClassName() now implemented
- Rudimentary version of Statement.getGeneratedKeys() from JDBC-3.0 now implemented (you need to be using JDK-1.4 for this to work, I believe)
- DBMetaData.getIndexInfo() - bad PAGES fixed (SF BUG 542201)

04-07-02 - Version 2.0.12

- General code cleanup.
- Added getIdleFor() method to Connection and MysqlLogicalHandle.
- Relaxed synchronization in all classes, should fix 520615 and 520393.
- Added getTable/ColumnPrivileges() to DBMD (fixes 484502).
- Added new types to getTypeInfo(), fixed existing types thanks to Al Davis and Kid Kalanon.

- Added support for BIT types (51870) to PreparedStatement.
- Fixed `getRow()` bug (527165) in ResultSet
- Fixes for ResultSet updatability in PreparedStatement.
- Fixed timezone off by 1-hour bug in PreparedStatement (538286, 528785).
- ResultSet: Fixed updatability (values being set to null if not updated).
- DataSources - fixed `setUrl` bug (511614, 525565), wrong datasource class name (532816, 528767)
- Added identifier quoting to all DatabaseMetaData methods that need them (should fix 518108)
- Added support for YEAR type (533556)
- `ResultSet.insertRow()` should now detect `auto_increment` fields in most cases and use that value in the new row. This detection will not work in multi-valued keys, however, due to the fact that the MySQL protocol does not return this information.
- `ResultSet.refreshRow()` implemented.
- Fixed `testsuite.Traversal` afterLast() bug, thanks to Igor Lastric.

#### 01-27-02 - Version 2.0.11

- Fixed missing `DELETE_RULE` value in `DBMD.getImported/ExportedKeys()` and `getCrossReference()`.
- Full synchronization of `Statement.java`.
- More changes to fix "Unexpected end of input stream" errors when reading BLOBs. This should be the last fix.

#### 01-24-02 - Version 2.0.10

- Fixed spurious "Unexpected end of input stream" errors in `MysqlIO` (bug 507456).
- Fixed null-pointer-exceptions when using `MysqlConnectionPoolDataSource` with Websphere 4 (bug 505839).

#### 01-13-02 - Version 2.0.9

- Ant build was corrupting included jar files, fixed (bug 487669).
- Fixed extra memory allocation in `MysqlIO.readPacket()` (bug 488663).
- Implementation of `DatabaseMetaData.getExported/ImportedKeys()` and `getCrossReference()`.
- Full synchronization on methods modifying instance and class-shared references, driver should be entirely thread-safe now (please let me know if you have problems)
- DataSource implementations moved to `org.gjt.mm.mysql.jdbc2.optional` package, and (initial) implementations of `PooledConnectionDataSource` and `XADataSource` are in place (thanks to Todd Wolff for the implementation and testing of `PooledConnectionDataSource` with

IBM WebSphere 4).

- Added detection of network connection being closed when reading packets (thanks to Todd Lizambri).
- Fixed quoting error with escape processor (bug 486265).
- Report batch update support through DatabaseMetaData (bug 495101).
- Fixed off-by-one-hour error in PreparedStatement.setTimestamp() (bug 491577).
- Removed concatenation support from driver (the '||' operator), as older versions of VisualAge seem to be the only thing that use it, and it conflicts with the logical '||' operator. You will need to start mysqld with the "--ansi" flag to use the '||' operator as concatenation (bug 491680)
- Fixed casting bug in PreparedStatement (bug 488663).

11-25-01 - Version 2.0.8

- Batch updates now supported (thanks to some inspiration from Daniel Rall).
- XADataSource/ConnectionPoolDataSource code (experimental)
- PreparedStatement.setAnyNumericType() now handles positive exponents correctly (adds "+" so MySQL can understand it).
- DatabaseMetaData.getPrimaryKeys() and getBestRowIdentifier() are now more robust in identifying primary keys (matches regardless of case or abbreviation/full spelling of Primary Key in Key\_type column).

10-24-01 - Version 2.0.7

- PreparedStatement.setCharacterStream() now implemented
- Fixed dangling socket problem when in high availability (autoReconnect=true) mode, and finalizer for Connection will close any dangling sockets on GC.
- Fixed ResultSetMetaData.getPrecision() returning one less than actual on newer versions of MySQL.
- ResultSet.getBlob() now returns null if column value was null.
- Character sets read from database if useUnicode=true and characterEncoding is not set. (thanks to Dmitry Vereshchagin)
- Initial transaction isolation level read from database (if available) (thanks to Dmitry Vereshchagin)
- Fixed DatabaseMetaData.supportsTransactions(), and supportsTransactionIsolationLevel() and getTypeInfo() SQL\_DATETIME\_SUB and SQL\_DATA\_TYPE fields not being readable.
- Fixed PreparedStatement generating SQL that would end up with syntax errors for some queries.
- Fixed ResultSet.isAfterLast() always returning false.

- Fixed timezone issue in `PreparedStatement.setTimestamp()` (thanks to Erik Olofsson)
- Capitalize type names when `"capitalizeTypeNames=true"` is passed in URL or properties (for `WebObjects`, thanks to Anjo Krank)
- Updatable result sets now correctly handle NULL values in fields.
- `PreparedStatement.setDouble()` now uses full-precision doubles (reverting a fix made earlier to truncate them).
- `PreparedStatement.setBoolean()` will use 1/0 for values if your MySQL version is 3.21.23 or higher.

06-16-01 - Version 2.0.6

- Fixed `PreparedStatement` parameter checking
- Fixed case-sensitive column names in `ResultSet.java`

06-13-01 - Version 2.0.5

- Fixed `ResultSet.getBlob()` `ArrayIndex` out-of-bounds
- Fixed `ResultSetMetaData.getColumnTypeName` for TEXT/BLOB
- Fixed `ArrayIndexOutOfBoundsException` when sending large BLOB queries (Max size packet was not being set)
- Added ISOLATION level support to `Connection.setIsolationLevel()`
- Fixed NPE on `PreparedStatement.executeUpdate()` when all columns have not been set.
- Fixed data parsing of TIMESTAMPS with 2-digit years
- Added `Byte` to `PreparedStatement.setObject()`
- `ResultSet.getBoolean()` now recognizes '-1' as 'true'
- `ResultSet` has +/-Inf/inf support
- `ResultSet.insertRow()` works now, even if not all columns are set (they will be set to "NULL")
- `DataBaseMetaData.getCrossReference()` no longer `ArrayIndexOOB`
- `getObject()` on `ResultSet` correctly does TINYINT->Byte and SMALLINT->Short

12-03-00 - Version 2.0.3

- Implemented `getBigDecimal()` without scale component for JDBC2.
- Fixed composite key problem with updatable result sets.
- Added detection of -/+INF for doubles.
- Faster ASCII string operations.
- Fixed incorrect detection of MAX\_ALLOWED\_PACKET, so sending



large blobs should work now.

- Fixed off-by-one error in java.sql.Blob implementation code.
- Added "ultraDevHack" URL parameter, set to "true" to allow (broken) Macromedia UltraDev to use the driver.

04-06-00 - Version 2.0.1

- Fixed RSMD.isWritable() returning wrong value. Thanks to Moritz Maass.
- Cleaned up exception handling when driver connects
- Columns that are of type TEXT now return as Strings when you use getObject()
- DatabaseMetaData.getPrimaryKeys() now works correctly wrt to key\_seq. Thanks to Brian Slesinsky.
- No escape processing is done on PreparedStatements anymore per JDBC spec.
- Fixed many JDBC-2.0 traversal, positioning bugs, especially wrt to empty result sets. Thanks to Ron Smits, Nick Brook, Cessar Garcia and Carlos Martinez.
- Fixed some issues with updatability support in ResultSet when using multiple primary keys.

02-21-00 - Version 2.0pre5

- Fixed Bad Handshake problem.

01-10-00 - Version 2.0pre4

- Fixes to ResultSet for insertRow() - Thanks to Cesar Garcia
- Fix to Driver to recognize JDBC-2.0 by loading a JDBC-2.0 class, instead of relying on JDK version numbers. Thanks to John Baker.
- Fixed ResultSet to return correct row numbers
- Statement.getUpdateCount() now returns rows matched, instead of rows actually updated, which is more SQL-92 like.

10-29-99

- Statement/PreparedStatement.getMoreResults() bug fixed. Thanks to Noel J. Bergman.
- Added Short as a type to PreparedStatement.setObject(). Thanks to Jeff Crowder
- Driver now automagically configures maximum/preferred packet sizes by querying server.
- Autoreconnect code uses fast ping command if server supports it.
- Fixed various bugs wrt. to packet sizing when reading from the server and when alloc'ing to write to the server.

08-17-99 - Version 2.0pre

- Now compiles under JDK-1.2. The driver supports both JDK-1.1 and JDK-1.2 at the same time through a core set of classes. The driver will load the appropriate interface classes at runtime by figuring out which JVM version you are using.
- Fixes for result sets with all nulls in the first row. (Pointed out by Tim Endres)
- Fixes to column numbers in SQLExceptions in ResultSet (Thanks to Blas Rodriguez Somoza)
- The database no longer needs to be specified to connect. (Thanks to Christian Motschke)

07-04-99 - Version 1.2b

- Better Documentation (in progress), in doc/mm.doc/book1.html
- DBMD now allows null for a column name pattern (not in spec), which it changes to '%'. (thanks to Alik for some ideas on how to fix it)
- DBMD now has correct types/lengths for getXXX().
- ResultSet.getDate(), getTime(), and getTimestamp() fixes. (contributed by Alan Wilken)
- EscapeProcessor now handles \{ \} and { or } inside quotes correctly. (thanks to Alik for some ideas on how to fix it)
- Fixes to properties handling in Connection. (contributed by Juho Tikkala)
- ResultSet.getObject() now returns null for NULL columns in the table, rather than bombing out. (thanks to Ben Grosman)
- ResultSet.getObject() now returns Strings for types from MySQL that it doesn't know about. (Suggested by Chris Perdue)
- Removed DataInput/Output streams, not needed, 1/2 number of method calls per IO operation.
- Use default character encoding if one is not specified. This is a work-around for broken JVMs, because according to spec, EVERY JVM must support "ISO8859\_1", but they don't.
- Fixed Connection to use the platform character encoding instead of "ISO8859\_1" if one isn't explicitly set. This fixes problems people were having loading the character-converter classes that didn't always exist (JVM bug). (thanks to Fritz Elfert for pointing out this problem)
- Changed MysqlIO to re-use packets where possible to reduce memory usage.
- Fixed escape-processor bugs pertaining to {} inside quotes.

04-14-99 - Version 1.2a

- Fixed character-set support for non-Javasoft JVMs

(thanks to many people for pointing it out)

- Fixed `ResultSet.getBoolean()` to recognize 'y' & 'n' as well as '1' & '0' as boolean flags.  
(thanks to Tim Pizey)
- Fixed `ResultSet.getTimestamp()` to give better performance.  
(thanks to Richard Swift)
- Fixed `getBytes()` for numeric types.  
(thanks to Ray Bellis)
- Fixed `DatabaseMetaData.getTypeInfo()` for DATE type.  
(thanks to Paul Johnston)
- Fixed `EscapeProcessor` for "fn" calls.  
(thanks to Piyush Shah at locomotive.org)
- Fixed `EscapeProcessor` to not do extraneous work if there are no escape codes.  
(thanks to Ryan Gustafson)
- Fixed `Driver` to parse URLs of the form "jdbc:mysql://host:port"  
(thanks to Richard Lobb)

03-24-99 - Version 1.1i

- Fixed Timestamps for PreparedStatements
- Fixed null pointer exceptions in RSMD and RS
- Re-compiled with jikes for valid class files (thanks ms!)

03-08-99 - Version 1.1h

- Fixed escape processor to deal with un-matched { and }  
(thanks to Craig Coles)
- Fixed escape processor to create more portable (between DATETIME and TIMESTAMP types) representations so that it will work with BETWEEN clauses.  
(thanks to Craig Longman)
- `MysqlIO.quit()` now closes the socket connection. Before, after many failed connections some OS's would run out of file descriptors. (thanks to Michael Brinkman)
- Fixed `NullPointerException` in `Driver.getPropertyInfo`.  
(thanks to Dave Potts)
- Fixes to `MysqlDefs` to allow all \*text fields to be retrieved as Strings.  
(thanks to Chris at Leverage)
- Fixed `setDouble` in `PreparedStatement` for large numbers to avoid sending scientific notation to the database.  
(thanks to J.S. Ferguson)
- Fixed `getScale()` and `getPrecision()` in RSMD.  
(contrib'd by James Klicman)
- Fixed `getObject()` when field was DECIMAL or NUMERIC  
(thanks to Bert Hobbs)
- `DBMD.getTables()` bombed when passed a null table-name

pattern. Fixed. (thanks to Richard Lobb)

- Added check for "client not authorized" errors during connect. (thanks to Hannes Wallnoefer)

02-19-99 - Version 1.1g

- Result set rows are now byte arrays. Blobs and Unicode work bidirectionally now. The useUnicode and encoding options are implemented now.
- Fixes to PreparedStatement to send binary set by setXXXStream to be sent un-touched to the MySQL server.
- Fixes to getDriverPropertyInfo().

12-31-98 - Version 1.1f

- Changed all ResultSet fields to Strings, this should allow Unicode to work, but your JVM must be able to convert between the character sets. This should also make reading data from the server a bit quicker, because there is now no conversion from StringBuffer to String.
- Changed PreparedStatement.streamToString() to be more efficient (code from Uwe Schaefer).
- URL parsing is more robust (throws SQL exceptions on errors rather than NullPointerExceptions)
- PreparedStatement now can convert Strings to Time/Date values via setObject() (code from Robert Currey).
- IO no longer hangs in Buffer.readInt(), that bug was introduced in 1.1d when changing to all byte-arrays for result sets. (Pointed out by Samo Login)

11-03-98 - Version 1.1b

- Fixes to DatabaseMetaData to allow both IBM VA and J-Builder to work. Let me know how it goes. (thanks to Jac Kersing)
- Fix to ResultSet.getBoolean() for NULL strings (thanks to Barry Lagerweij)
- Beginning of code cleanup, and formatting. Getting ready to branch this off to a parallel JDBC-2.0 source tree.
- Added "final" modifier to critical sections in MysqlIO and Buffer to allow compiler to inline methods for speed.

9-29-98

- If object references passed to setXXX() in PreparedStatement are null, setNull() is automatically called for you. (Thanks for the suggestion goes to Erik Ostrom)
- setObject() in PreparedStatement will now attempt to write a serialized representation of the object to the database for objects of Types.OTHER and objects of unknown type.
- Util now has a static method readObject() which given a ResultSet and a column index will re-instantiate an object serialized in the above manner.

9-02-98 - Version 1.1

- Got rid of "ugly hack" in `MysqlIO.nextRow()`. Rather than catch an exception, `Buffer.isLastDataPacket()` was fixed.
- `Connection.getCatalog()` and `Connection.setCatalog()` should work now.
- `Statement.setMaxRows()` works, as well as setting by property `maxRows`. `Statement.setMaxRows()` overrides `maxRows` set via properties or url parameters.
- Automatic re-connection is available. Because it has to "ping" the database before each query, it is turned off by default. To use it, pass in `"autoReconnect=true"` in the connection URL. You may also change the number of reconnect tries, and the initial timeout value via `"maxReconnects=n"` (default 3) and `"initialTimeout=n"` (seconds, default 2) parameters. The timeout is an exponential backoff type of timeout, e.g. if you have initial timeout of 2 seconds, and `maxReconnects` of 3, then the driver will timeout 2 seconds, 4 seconds, then 16 seconds between each re-connection attempt.

8-24-98 - Version 1.0

- Fixed handling of blob data in `Buffer.java`
- Fixed bug with authentication packet being sized too small.
- The JDBC Driver is now under the LGPL

8-14-98 -

- Fixed `Buffer.readLenString()` to correctly read data for BLOBS.
- Fixed `PreparedStatement.toStringStream` to correctly read data for BLOBS.
- Fixed `PreparedStatement.setDate()` to not add a day.  
(above fixes thanks to Vincent Partington)
- Added URL parameter parsing (`?user=...` and so forth).

8-04-98 - Version 0.9d

- Big news! New package name. Tim Endres from ICE Engineering is starting a new source tree for GNU GPL'd Java software. He's graciously given me the `org.gjt.mm` package directory to use, so now the driver is in the `org.gjt.mm.mysql` package scheme. I'm "legal" now. Look for more information on Tim's project soon.
- Now using dynamically sized packets to reduce memory usage when sending commands to the DB.
- Small fixes to `getTypeInfo()` for parameters, and so forth.
- `DatabaseMetaData` is now fully implemented. Let me know if these drivers work with the various IDEs

out there. I've heard that they're working with JBuilder right now.

- Added JavaDoc documentation to the package.
- Package now available in .zip or .tar.gz.

#### 7-28-98 - Version 0.9

- Implemented `getTypeInfo()`.  
`Connection.rollback()` now throws an `SQLException` per the JDBC spec.
- Added `PreparedStatement` that supports all JDBC API methods for `PreparedStatement` including `InputStreams`. Please check this out and let me know if anything is broken.
- Fixed a bug in `ResultSet` that would break some queries that only returned 1 row.
- Fixed bugs in `DatabaseMetaData.getTables()`, `DatabaseMetaData.getColumns()` and `DatabaseMetaData.getCatalogs()`.

- Added functionality to `Statement` that allows `executeUpdate()` to store values for IDs that are automatically generated for `AUTO_INCREMENT` fields. Basically, after an `executeUpdate()`, look at the `SQLWarnings` for warnings like `"LAST_INSERTED_ID = 'some number', COMMAND = 'your SQL query'"`.

If you are using `AUTO_INCREMENT` fields in your tables and are executing a lot of `executeUpdate()`s on one `Statement`, be sure to `clearWarnings()` every so often to save memory.

#### 7-06-98 - Version 0.8

- Split `MysqlIO` and `Buffer` to separate classes. Some `ClassLoaders` gave an `IllegalAccessException` error for some fields in those two classes. Now `mm.mysql` works in applets and all classloaders.

Thanks to Joe Ennis <jce@mail.boone.com> for pointing out the problem and working on a fix with me.

#### 7-01-98 - Version 0.7

- Fixed `DatabaseMetadata` problems in `getColumns()` and bug in switch statement in the `Field` constructor.

Thanks to Costin Manolache <costin@tdiinc.com> for pointing these out.

#### 5-21-98 - Version 0.6

- Incorporated efficiency changes from Richard Swift <Richard.Swift@kanatek.ca> in `MysqlIO.java` and `ResultSet.java`
- We're now 15% faster than gwe's driver.
- Started working on `DatabaseMetaData`.

The following methods are implemented:

- \* `getTables()`
- \* `getTableTypes()`
- \* `getColumns`
- \* `getCatalogs()`