

MySQL Connector/J Documentation

by Mark Matthews

MySQL Connector/J Documentation

by Mark Matthews

Copyright © 2004 MySQL AB

This manual is NOT distributed under a GPL style license. Use of the manual is subject to the following terms:

- Conversion to other formats is allowed, but the actual content may not be altered or edited in any way.
- You may create a printed copy for your own personal use.
- For all other uses, such as selling printed copies or using (parts of) the manual in another publication, prior written agreement from MySQL AB is required.

Please email docs@mysql.com for more information or if you are interested in doing a translation.

Table of Contents

1. Introduction	1
1.. What is MySQL Connector/J?	1
1.. Release Notes	1
1... Upgrading	1
1... Known Issues	2
2. Installation	6
2.. System Requirements	6
2... Java Versions Supported	6
2... MySQL Server Versions Supported	6
2.. Installing MySQL Connector/J	6
2... Setting the CLASSPATH (For Standalone Use)	6
2... Driver Class Name and JDBC URL Format	7
2... Installing MySQL Connector/J for Use With Servlets/JSP/EJB	17
2.. What's Next?	17
3. Developing Applications with MySQL Connector/J	18
3.. Basic Functionality	18
3... Registering MySQL Connector/J With the JDBC DriverManager	18
3... Opening a Connection to MySQL	18
3... Creating a Statement Instance	19
3... Executing a SELECT Query	19
3.. Advanced Functionality	20
3... Character Sets and Unicode	20
3... Stored Procedures	22
3... Connecting over SSL	25
4. How to Report Bugs or Problems	
5. Troubleshooting	
A. Reference	
A.. Type Conversions Supported by MySQL Connector/J	34
B. How Connector/J Maps MySQL Errors to SQLStates	
C. ChangeLog	

List of Tables

2.1. Connection Properties	8
3.1. MySQL to Java Encoding Name Translations	20
A.1. Conversion Table	34
A.2. Unsigned Types Mapping	34
B.1. Mapping of MySQL Error Numbers to SQLStates	36

List of Examples

2.1. Setting the CLASSPATH Under UNIX	6
2.2. Setting the CLASSPATH Under Microsoft Windows 9X	7
3.1. Registering the Driver With the DriverManager	18
3.2. Obtaining a Connection From the DriverManager	18
3.3. Using java.sql.Statement to Execute a SELECT Query	19
3.4. Stored Procedure Example	22
3.5. Using Connection.prepareStatement()	22
3.6. Registering Output Parameters	23
3.7. Setting CallableStatement Input Parameters	24
3.8. Retrieving Results and Output Parameter Values	24
5.1. Example of transaction with retry logic	31

Chapter 1. Introduction

What is MySQL Connector/J?

MySQL Connector/J is an implementation of Sun's JDBC 3.0 API for the MySQL relational database server. It strives to conform as much as possible to the JDBC API as specified by JavaSoft. It is known to work with many third-party products, including:

Application Servers

- Apache Tomcat [<http://jakarta.apache.org/>]
- JBoss [<http://www.jboss.org/>]
- Weblogic [<http://www.beasys.com/>]
- IBM WebSphere [<http://www-3.ibm.com/software/info1/websphere/>]

Object Relational Mapping Tools

- Hibernate [<http://hibernate.sourceforge.net/>]
- Apache ObjectRelationalBridge [<http://db.apache.org/obj/>]
- CocoBase [<http://www.thoughtinc.com/>]
- Kodo [<http://www.solarmetric.com/>]

Development Environments

- Eclipse [<http://www.eclipse.org/>]
- Borland JBuilder [<http://www.borland.com/jbuilder/>]
- IBM WebSphere Studio [<http://www-3.ibm.com/software/awdtools/studioappdev/>]

Release Notes

Upgrading

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.

Upgrading from MySQL Connector/J 3.0 to 3.1

Connector/J 3.1 is designed to be backwards-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** - The driver tries to maintain transparency between the two implementations (emulated and server-side). The only large divergence is with the re-execution of PreparedStatement with LOB parameters, when a parameter that was previously bound as a LOB has been re-bound as a non-LOB type. For server-side prepared statements, this requires all parameters to be re-bound before execution of the statement. See the next section for further details.
- **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
```

JDBC-Specific Issues When Upgrading to MySQL Server Version 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
```

Known Issues

Implementation Notes (By java.sql and javax.sql Interface/Class)

MySQL Connector/J passes all of the tests in Sun's JDBC compliance test suite except for tests requiring stored procedures (which MySQL does not have at this time). 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()`, etc) 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

PreparedStatements 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 `setBinaryS-`

stream(), 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, ResultSets 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 ResultSets 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. Also, any tables referenced by the query that created the streaming result will be locked until all of the results have been read or the connection closed.

- **ResultSetMetaData**

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

- **Statement**

Un-implemented Functionality

The following methods in the JDBC API have not been implemented yet. They rely on functionality that at this time is not present in the MySQL server:

- `Blob.truncate()`

- `Connection.setSavePoint()` is not supported in versions earlier than 3.1.1
- `Connection.prepareCall(String)` is not supported in versions earlier than 3.1.1
- `Connection.releaseSavepoint(Savepoint)` is not supported in versions earlier than 3.1.1
- `Connection.rollback(Savepoint)` is not supported in versions earlier than 3.1.1

- `PreparedStatement.setArray(int, Array)`
- `PreparedStatement.setRef()`
- `PreparedStatement.getParameterMetaData()`

- `ResultSet.getArray(int)`
- `ResultSet.getArray(colName)`
- `ResultSet.getRef(int)`
- `ResultSet.getRef(String)`
- `ResultSet.rowDeleted()`
- `ResultSet.rowInserted()`
- `ResultSet.rowUpdated()`
- `ResultSet.updateArray(int, Array)`
- `ResultSet.updateArray(String, Array)`
- `ResultSet.updateRef(int, Ref)`
- `ResultSet.updateRef(String, Ref)`

Chapter 2. Installation

This chapter contains instructions for installing the MySQL Connector/J drivers on Microsoft Windows and UNIX platforms. If you are on another platform that supports Java and the JDBC API then substitute commands appropriate for your system.

System Requirements

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.

MySQL Server Versions Supported

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

Version Guidelines

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.

Installing MySQL Connector/J

MySQL Connector/J is distributed as a `.zip` or `.tar.gz` archive containing the sources, the class files and a class-file only "binary" `.jar` archive named `mysql-connector-java-[version]-bin.jar`. You will need to use the appropriate gui or command-line utility to un-archive the distribution (for example, WinZip for the `.zip` archive, and `"tar"` for the `.tar.gz` archive).

Setting the CLASSPATH (For Standalone Use)

Once you have un-archived the distribution archive, you can install the driver in one of two ways: Either copy the `"com"` and `"org"` subdirectories and all of their contents to anywhere you like, and put the directory holding the `"com"` and `"org"` subdirectories in your classpath, or put `mysql-connector-java-[version]-bin.jar` in your classpath, either by adding the FULL path to it to your CLASSPATH environment variable, or by copying the `.jar` file to `$JAVA_HOME/jre/lib/ext`. 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 2.1. 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.

Example 2.2. Setting the CLASSPATH Under Microsoft Windows 9X

The following is an example of setting the CLASSPATH under Microsoft Windows 95, 98, ME:

```
C:\> set CLASSPATH=\path\to\mysql-connector-java-[version]-bin.jar;%CLASSPATH%
```

This command can be added as the last line in AUTOEXEC.BAT. If this is done the MySQL Connector/J driver will be made available to all Java applications that run on the Windows 9x system. This setting will require the computer to be rebooted before the changes will take effect.

Driver Class Name and JDBC URL Format

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 backwards-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][&propertyName2]=[propertyValue2]
```

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.

Starting with version 3.0.12 and 3.1.2, Connector/J supports multiple hosts with ports, separated by commas:

```
jdbc:mysql://[host:port],[host:port].../[database][?propertyName1]=[propertyValue1][&propertyName2]=[propertyValue2]
```

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, issue a 'USE dbname' query 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 good 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).

You may specify additional properties to the JDBC driver, either by placing them in a `java.util.Properties` instance and passing that instance to the `DriverManager` when you connect, or by adding them to the end of your JDBC URL as name-value pairs. The first property needs to be preceded with a '?' character, and additional name-value pair properties are separated by an '&' character. The properties, their definitions and their default values are covered in the following table:

Table 2.1. 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 'Configurations' of the documentation.	No		3.1.5
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

Property Name	Definition	Required?	Default Value	Since Version
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	3.1.0
<i>High Availability and Clustering</i>				
autoReconnect	Should the driver try to re-establish bad connections?	No	false	1.1
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
maxReconnects	Maximum number of reconnects to attempt if autoReconnect is true, default is '3'.	No	3	1.1
initialTimeout	If autoReconnect is enabled, the initial time to wait between re-connect attempts (in seconds, defaults to '2').	No	2	1.1
queriesBeforeRetry-Master	Number of queries to issue before falling back to master when failed over (when using multi-host fail-over). Whichever condition is met first, 'queriesBeforeRetry-Master' or 'secondsBeforeRetryMaster' will cause an attempt to be made to reconnect to the master. Defaults to 50.	No	50	3.0.2
secondsBeforeRetry-Master	How long should the driver wait, when failed over, before at-	No	30	3.0.2

Property Name	Definition	Required?	Default Value	Since Version
	tempting to reconnect to the master server? Whichever condition is met first, 'queries-BeforeRetryMaster' or 'secondsBeforeRetryMaster' will cause an attempt to be made to reconnect to the master. Time in seconds, defaults to 30			
<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 sensitive information in error messages and clear data structures holding sensitive data when possible? (defaults to 'false')	No	false	3.0.1
<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
prepStmtCacheSqlLimit	If prepared statement caching is enabled, what's the largest SQL the driver will	No	256	3.0.10

Property Name	Definition	Required?	Default Value	Since Version
	cache the parsing for?			
cacheCallableStmts	Should the driver cache the parsing stage of CallableStatements	No	false	3.1.2
cachePrepStmts	Should the driver cache the parsing stage of Prepared-Statements?	No	false	3.0.10
cacheResultSet-Metadata	Should the driver cache ResultSet-MetaData for Statements and Prepared-Statements? (Req. JDK-1.4+, true/false, default 'false')	No	false	3.1.1
cacheServerConfigur-ation	Should the driver cache the results of 'SHOW VARIABLES' and 'SHOW COLLATION' on a per-URL basis?	No	false	3.1.5
dontUnpackBinaryResults	Should the driver delay unpacking results from server-side prepared statements until the values are asked for?	No	false	3.1.5
dynamicCalendars	Should the driver retrieve the default calendar when required, or cache it per connection/session?	No	false	3.1.5
elideSetAutoCommits	If using MySQL-4.1 or newer, should the driver only issue 'set autocommit=n' queries when the server's state doesn't match the requested state by Connection.setAutoCommit(boolean)?	No	false	3.1.3
useFastIntParsing	Use internal String->Integer conversion routines to avoid excessive object creation?	No	true	3.1.4
useNewIO	Should the driver use the java.nio.* interfaces for network communication (true/false), defaults	No	false	3.1.0

Property Name	Definition	Required?	Default Value	Since Version
	to 'false'			
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 to 'false'	No	false	3.1.0
profileSql	Deprecated, use 'profileSQL' instead. Trace queries and their execution/fetch times on STDERR (true/false) defaults to 'false'	No		2.0.14
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
slowQueryThreshold-Millis	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
dumpQueriesOnEx-	Should the driver	No	false	3.1.3

Property Name	Definition	Required?	Default Value	Since Version
ception	dump the contents of the query sent to the server in the message for SQLExceptions?			
enablePacketDebug	When enabled, a ring-buffer of 'packetDebugBufferSize' packets will be kept, and dumped when exceptions are thrown in key areas in the driver's code	No	false	3.1.3
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 'slowQueryThreshold-Millis' 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	false	1.1g
characterEncoding	If 'useUnicode' is set to true, what character encoding should the driver use when dealing with strings? (defaults is to 'autodetect')	No		1.1g
characterSetResults	Character set to tell the server to return results as.	No		3.0.13

Property Name	Definition	Required?	Default Value	Since Version
connectionCollation	If set, tells the server to use this collation via 'set connection_collation'	No		3.0.13
allowNanAndInf	Should the driver allow NaN or +/- INF values in PreparedStatement.setDouble()?	No	false	3.1.5
autoDeserialize	Should the driver automatically detect and de-serialize 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
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 read from the server.	No	false	3.0.9
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
emulateLocators	N/A	No	false	3.1.0
ignoreNonTxTables	Ignore non-transactional table warning for rollback? (defaults to 'false').	No	false	3.0.9
jdbcCompliantTruncation	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	No	true	3.1.2

Property Name	Definition	Required?	Default Value	Since Version
	and newer)?			
maxRows	The maximum number of rows to return (0, the default means return all rows).	No	-1	all versions
pedantic	Follow the JDBC spec to the letter.	No	false	3.0.0
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
rollbackOnPooled-Close	Should the driver issue a rollback() when the logical connection in a pool is closed?	No	true	3.0.15
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
tinyIntIsBit	Should the driver treat the datatype TINYINT(1) as the BIT type (because the server silently converts BIT -> TINYINT(1) when creating tables)?	No	true	3.0.16
ultraDevHack	Create PreparedStatements for prepareCall() when required, because UltraDev is broken and issues a prepareCall() for <u>all</u> statements? (true/false, defaults to 'false')	No	false	2.0.3
useHostsInPrivileges	Add '@hostname' to users in Database-	No	true	3.0.2

Property Name	Definition	Required?	Default Value	Since Version
	MetaData.getColumn/TablePrivileges() (true/false), defaults to 'true'.			
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
useUnbufferedInput	Don't use BufferedInputStream for reading data from the server	No	true	3.0.11
zeroDateTimeBehavior	What should happen when the driver encounters DATETIME 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`.

Installing MySQL Connector/J for Use With Servlets/JSP/EJB

If you want to use MySQL Connector/J with a servlet engine or 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.

If you are developing servlets and/or JSPs, and your application server is J2EE-compliant, you should put the driver's .jar file in the WEB-INF/lib subdirectory of your webapp, as this is the 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. 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

What's Next?

Once the driver has been installed into your CLASSPATH or application server, the driver is ready for use! Taking a look at the next chapter containing programming information might be a good idea, however.

Chapter 3. Developing Applications with MySQL Connector/J

...

Basic Functionality

Registering MySQL Connector/J With the JDBC DriverManager

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.

Example 3.1. Registering the Driver With the DriverManager

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
        }
    }
}
```

Opening a Connection to MySQL

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 3.2. 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/test?user=monty&pa

        // 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.

Creating a Statement Instance

Statements allow you to execute basic SQL queries and retrieve the results through the ResultSet class which is described later. To get a Statement object, you call the createStatement() method on the Connection object you have retrieved via the DriverManager.getConnection() method. Once you have a Statement object, you can execute a SELECT query by calling the executeQuery(String SQL) 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.

Executing a SELECT Query

Example 3.3. 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;
}
}

```

Advanced Functionality

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 `ResultSets`.

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 3.1. MySQL to Java Encoding Name Translations

MySQL Character Set Name	Java-Style Character Encoding Name
usa7	US-ASCII
big5	Big5
gbk	GBK

MySQL Character Set Name	Java-Style Character Encoding Name
sjis	SJIS
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
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.

Stored Procedures

Starting with MySQL 5.0 and Connector/J 3.1.1, 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]" 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 3.4. 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 3.5. 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 per-

forms to support output parameters. For performance reasons, you should try to minimize unnecessary calls to `Connection.prepareStatement()` 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 created the stored procedure), JDBC requires that they be specified before statement execution using the various `registerOutputParameter()` methods in the `CallableStatement` interface:

Example 3.6. 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
//

cStmt.registerOutputParameter(2);

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

cStmt.registerOutputParameter(2, Types.INTEGER);

//
// Registers the named parameter 'inOutParam'
//

cStmt.registerOutputParameter("inOutParam");

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

cStmt.registerOutputParameter("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 3.7. 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 3.8. 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(1); // index-based
outputValue = cStmt.getInt("inOutParam"); // name-based
...

```

Connecting over 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
- 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 truststore
```

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 cli-

ent:

```
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, 168, 55, 103, 215,
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, 185, 178, 100, 215,
Session ID: {163, 227, 84, 53, 81, 127, 252, 254, 178, 179, 68, 63, 182, 158, 30, 11, 150, 79, 170
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.

Chapter 4. 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] 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/ \[??\]](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/>.

Chapter 5. Troubleshooting

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.

5.1.

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.

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] 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.

5.2.

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

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").

5.3.

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
```

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).

5.4.

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

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 5.1. 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 41000 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) || "41000".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));
}

```

5.5.

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

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.

Appendix A. Reference

Type Conversions Supported by MySQL Connector/J

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.

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

Table A.1. 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> Note 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>

Columns with an unsigned numeric type in MySQL are treated as the next 'larger' Java type that the signed variant of the MySQL type maps to:

Table A.2. Unsigned Types Mapping

MySQL Type	Corresponding Java Type
TINYINT UNSIGNED	<code>java.lang.Integer</code>
SMALLINT UNSIGNED	<code>java.lang.Integer</code>
MEDIUMINT UNSIGNED	<code>java.lang.Long</code>
INT UNSIGNED	<code>java.lang.Long</code>
BIGINT UNSIGNED	<code>java.math.BigInteger</code> Note Before MySQL Connector/J 3.1.3, BIGINT

Reference

MySQL Type	Corresponding Java Type
	UNSIGNED was mapped to java.math.BigDecimal.

Appendix B. How Connector/J Maps MySQL Errors to SQLStates

The JDBC API uses SQLStates as a standard way of identifying error conditions in SQLExceptions. Prior to MySQL server version 4.1, Connector/J performed this mapping itself, as the server did not use SQLStates. MySQL server versions 4.1.0 send SQLState codes with error messages which Connector/J uses in SQLExceptions.

Prior to Connector/J version 3.1.3, a combination of SQL Standard and X/Open SQLStates were used for MySQL server versions older than 4.1.0.

Connector/J version 3.1.3 and newer use the SQL Standard SQLStates returned from the server (if available), or a mapping to SQL Standard SQLStates, unless the configuration property `useSqlStateCodes` is set to `false`, which will cause the driver to use the older, `legacy` SQLState mappings that Connector/J 3.0 used.

The following table shows the mapping of MySQL error numbers to SQLStates that Connector/J uses:

Table B.1. Mapping of MySQL Error Numbers to SQLStates

MySQL Error Number	MySQL Error Name	Legacy (X/Open) SQL- State	SQL Standard SQLState
1022	ER_DUP_KEY	S1000	23000
1037	ER_OUTOFMEMORY	S1001	HY001
1038	ER_OUT_OF_SORTMEM ORY	S1001	HY001
1040	ER_CON_COUNT_ERRO R	08004	08004
1042	ER_BAD_HOST_ERROR	08004	08S01
1043	ER_HANDSHAKE_ERRO R	08004	08S01
1044	ER_DBACCESS_DENIED _ERROR	S1000	42000
1045	ER_ACCESS_DENIED_E RROR	28000	28000
1047	ER_UNKNOWN_COM_E RROR	08S01	HY000
1050	ER_TABLE_EXISTS_ER ROR	S1000	42S01
1051	ER_BAD_TABLE_ERRO R	42S02	42S02
1052	ER_NON_UNIQ_ERROR	S1000	23000
1053	ER_SERVER_SHUTDOW N	S1000	08S01
1054	ER_BAD_FIELD_ERROR	S0022	42S22
1055	ER_WRONG_FIELD_WI TH_GROUP	S1009	42000
1056	ER_WRONG_GROUP_FI ELD	S1009	42000

MySQL Error Number	MySQL Error Name	Legacy (X/Open) SQL- State	SQL Standard SQLState
1057	ER_WRONG_SUM_SELECT	S1009	42000
1058	ER_WRONG_VALUE_COUNT	21S01	21S01
1059	ER_TOO_LONG_IDENT	S1009	42000
1060	ER_DUP_FIELDNAME	S1009	42S21
1061	ER_DUP_KEYNAME	S1009	42000
1062	ER_DUP_ENTRY	S1009	23000
1063	ER_WRONG_FIELD_SPEC	S1009	42000
1064	ER_PARSE_ERROR	42000	42000
1065	ER_EMPTY_QUERY	42000	42000
1066	ER_NONUNIQ_TABLE	S1009	42000
1067	ER_INVALID_DEFAULT	S1009	42000
1068	ER_MULTIPLE_PRI_KEY	S1009	42000
1069	ER_TOO_MANY_KEYS	S1009	42000
1070	ER_TOO_MANY_KEY_PARTS	S1009	42000
1071	ER_TOO_LONG_KEY	S1009	42000
1072	ER_KEY_COLUMN_DOES_NOT_EXIT	S1009	42000
1073	ER_BLOB_USED_AS_KEY	S1009	42000
1074	ER_TOO_BIG_FIELDLENGTH	S1009	42000
1075	ER_WRONG_AUTO_KEY	S1009	42000
1080	ER_FORCING_CLOSE	S1000	08S01
1081	ER_IPSOCK_ERROR	08S01	08S01
1082	ER_NO_SUCH_INDEX	S1009	42S12
1083	ER_WRONG_FIELD_TERMINATORS	S1009	42000
1084	ER_BLOBS_AND_TERMINATED	S1009	42000
1090	ER_CANT_REMOVE_ALL_FIELDS	S1000	42000
1091	ER_CANT_DROP_FIELD_OR_KEY	S1000	42000
1101	ER_BLOB_CANT_HAVE_DEFAULT	S1000	42000
1102	ER_WRONG_DB_NAME	S1000	42000
1103	ER_WRONG_TABLE_NAME	S1000	42000
1104	ER_TOO_BIG_SELECT	S1000	42000

MySQL Error Number	MySQL Error Name	Legacy (X/Open) SQL- State	SQL Standard SQLState
1106	ER_UNKNOWN_PROCEDURE	S1000	42000
1107	ER_WRONG_PARAMCOUNT_TO_PROCEDURE	S1000	42000
1109	ER_UNKNOWN_TABLE	S1000	42S02
1110	ER_FIELD_SPECIFIED_TWICE	S1000	42000
1112	ER_UNSUPPORTED_EXTENSION	S1000	42000
1113	ER_TABLE_MUST_HAVE_COLUMNS	S1000	42000
1115	ER_UNKNOWN_CHARACTER_SET	S1000	42000
1118	ER_TOO_BIG_ROWSIZE	S1000	42000
1120	ER_WRONG_OUTER_JOIN	S1000	42000
1121	ER_NULL_COLUMN_IN_INDEX	S1000	42000
1129	ER_HOST_IS_BLOCKED	08004	HY000
1130	ER_HOST_NOT_PRIVILEGED	08004	HY000
1131	ER_PASSWORD_ANONYMOUS_USER	S1000	42000
1132	ER_PASSWORD_NOT_ALLOWED	S1000	42000
1133	ER_PASSWORD_NO_MATCH	S1000	42000
1136	ER_WRONG_VALUE_COUNT_ON_ROW	S1000	21S01
1138	ER_INVALID_USE_OF_NULL	S1000	42000
1139	ER_REGEXP_ERROR	S1000	42000
1140	ER_MIX_OF_GROUP_FUNC_AND_FIELDS	S1000	42000
1141	ER_NONEXISTING_GRANT	S1000	42000
1142	ER_TABLEACCESS_DENIED_ERROR	S1000	42000
1143	ER_COLUMNACCESS_DENIED_ERROR	S1000	42000
1144	ER_ILLEGAL_GRANT_FOR_TABLE	S1000	42000
1145	ER_GRANT_WRONG_HOST_OR_USER	S1000	42000
1146	ER_NO_SUCH_TABLE	S1000	42S02
1147	ER_NONEXISTING_TABLE	S1000	42000

MySQL Error Number	MySQL Error Name	Legacy (X/Open) SQL- State	SQL Standard SQLState
	LE_GRANT		
1148	ER_NOT_ALLOWED_CO MMAND	S1000	42000
1149	ER_SYNTAX_ERROR	S1000	42000
1152	ER_ABORTING_CONNE CTION	S1000	08S01
1153	ER_NET_PACKET_TOO LARGE	S1000	08S01
1154	ER_NET_READ_ERROR _FROM_PIPE	S1000	08S01
1155	ER_NET_FCNTL_ERROR	S1000	08S01
1156	ER_NET_PACKETS_OUT _OF_ORDER	S1000	08S01
1157	ER_NET_UNCOMPRESS _ERROR	S1000	08S01
1158	ER_NET_READ_ERROR	S1000	08S01
1159	ER_NET_READ_INTERR UPTED	S1000	08S01
1160	ER_NET_ERROR_ON_W RITE	S1000	08S01
1161	ER_NET_WRITE_INTER RUPTED	S1000	08S01
1162	ER_TOO_LONG_STRING	S1000	42000
1163	ER_TABLE_CANT_HAN DLE_BLOB	S1000	42000
1164	ER_TABLE_CANT_HAN DLE_AUTO_INCREMEN T	S1000	42000
1166	ER_WRONG_COLUMN_ NAME	S1000	42000
1167	ER_WRONG_KEY_COL UMN	S1000	42000
1169	ER_DUP_UNIQUE	S1000	23000
1170	ER_BLOB_KEY_WITHO UT_LENGTH	S1000	42000
1171	ER_PRIMARY_CANT_H AVE_NULL	S1000	42000
1172	ER_TOO_MANY_ROWS	S1000	42000
1173	ER_REQUIRES_PRIMAR Y_KEY	S1000	42000
1177	ER_CHECK_NO_SUCH_ TABLE	S1000	42000
1178	ER_CHECK_NOT_IMPL EMENTED	S1000	42000
1179	ER_CANT_DO_THIS_DU RING_AN_TRANSACTION	S1000	25000

MySQL Error Number	MySQL Error Name	Legacy (X/Open) SQL- State	SQL Standard SQLState
	N		
1184	ER_NEW_ABORTING_CONNECTION	S1000	08S01
1189	ER_MASTER_NET_READ	S1000	08S01
1190	ER_MASTER_NET_WRITE	S1000	08S01
1203	ER_TOO_MANY_USER_CONNECTIONS	S1000	42000
1205	ER_LOCK_WAIT_TIMEOUT	41000	HY000
1207	ER_READ_ONLY_TRANSACTION	S1000	25000
1211	ER_NO_PERMISSION_TO_CREATE_USER	S1000	42000
1213	ER_LOCK_DEADLOCK	41000	40001
1216	ER_NO_REFERENCED_ROW	S1000	23000
1217	ER_ROW_IS_REFERENCED	S1000	23000
1218	ER_CONNECT_TO_MASTER	S1000	08S01
1222	ER_WRONG_NUMBER_OF_COLUMNS_IN_SELECT	S1000	21000
1226	ER_USER_LIMIT_REACHED	S1000	42000
1230	ER_NO_DEFAULT	S1000	42000
1231	ER_WRONG_VALUE_FOR_VAR	S1000	42000
1232	ER_WRONG_TYPE_FOR_VAR	S1000	42000
1234	ER_CANT_USE_OPTION_HERE	S1000	42000
1235	ER_NOT_SUPPORTED_YET	S1000	42000
1239	ER_WRONG_FK_DEF	S1000	42000
1241	ER_OPERAND_COLUMNS	S1000	21000
1242	ER_SUBQUERY_NO_1_ROW	S1000	21000
1247	ER_ILLEGAL_REFERENCE	S1000	42S22
1248	ER_DERIVED_MUST_HAVE_ALIAS	S1000	42000
1249	ER_SELECT_REDUCE	S1000	01000

MySQL Error Number	MySQL Error Name	Legacy (X/Open) SQL- State	SQL Standard SQLState
1250	ER_TABLENAME_NOT_ALLOWED_HERE	S1000	42000
1251	ER_NOT_SUPPORTED_AUTH_MODE	S1000	08004
1252	ER_SPATIAL_CANT_HAVE_NULL	S1000	42000
1253	ER_COLLATION_CHARSET_MISMATCH	S1000	42000
1261	ER_WARN_TOO_FEW_RECORDS	S1000	01000
1262	ER_WARN_TOO_MANY_RECORDS	S1000	01000
1263	ER_WARN_NULL_TO_NOTNULL	S1000	01000
1264	ER_WARN_DATA_OUT_OF_RANGE	S1000	01000
1265	ER_WARN_DATA_TRUNCATED	S1000	01000
1280	ER_WRONG_NAME_FOR_INDEX	S1000	42000
1281	ER_WRONG_NAME_FOR_CATALOG	S1000	42000
1286	ER_UNKNOWN_STORAGE_ENGINE	S1000	42000

Appendix C. ChangeLog

```
# Changelog
# $Id: CHANGES,v 1.38.4.146 2004/12/21 21:49:27 mmatthew Exp $

12-23-04 - Version 3.1.6-stable

- Fixed hang on SocketInputStream.read() with Statement.setMaxRows() and
  multiple result sets when driver has to truncate result set directly,
  rather than tacking a 'LIMIT n' on the end of it.

- Fixed BUG#7026 - DBMD.getProcedures() doesn't respect catalog parameter.

12-02-04 - Version 3.1.5-gamma

- Fix comparisons made between string constants and dynamic strings that
  are either toUpperCase()d or toLowerCase()d to use Locale.ENGLISH, as
  some locales 'override' case rules for English. Also use
  StringUtils.indexOfIgnoreCase() instead of .toUpperCase().indexOf(),
  avoids creating a very short-lived transient String instance.

- Fixed BUG#5235 - Server-side prepared statements did not honor
  'zeroDateTimeBehavior' property, and would cause class-cast
  exceptions when using ResultSet.getObject(), as the all-zero string
  was always returned.

- Fixed batched updates with server prepared statements weren't looking if
  the types had changed for a given batched set of parameters compared
  to the previous set, causing the server to return the error
  'Wrong arguments to mysql_stmt_execute()'.

- Handle case when string representation of timestamp contains trailing '.'
  with no numbers following it.

- Fixed BUG#5706 - Inefficient detection of pre-existing string instances
  in ResultSet.getNativeString().

- Don't throw exceptions for Connection.releaseSavepoint().

- Use a per-session Calendar instance by default when decoding dates
  from ServerPreparedStatements (set to old, less performant behavior by
  setting property 'dynamicCalendars=true').

- Added experimental configuration property 'dontUnpackBinaryResults',
  which delays unpacking binary result set values until they're asked for,
  and only creates object instances for non-numerical values (it is set
  to 'false' by default). For some usecase/jvm combinations, this is
  friendlier on the garbage collector.

- Fixed BUG#5729 - UNSIGNED BIGINT unpacked incorrectly from
  server-side prepared statement result sets.

- Fixed BUG#6225 - ServerSidePreparedStatement allocating short-lived
  objects un-necessarily.

- Removed un-wanted new Throwable() in ResultSet constructor due to bad
  merge (caused a new object instance that was never used for every result
  set created) - Found while profiling for BUG#6359.

- Fixed too-early creation of StringBuffer in EscapeProcessor.escapeSQL(),
  also return String when escaping not needed (to avoid unnecessary object
  allocations). Found while profiling for BUG#6359.

- Use null-safe-equals for key comparisons in updatable result sets.

- Fixed BUG#6537, SUM() on Decimal with server-side prepared statement ignores
  scale if zero-padding is needed (this ends up being due to conversion to DOUBLE
  by server, which when converted to a string to parse into BigDecimal, loses all
  '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`, `ResultSetMetaData.getColumnDisplaySize()` returns incorrect values for multibyte 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.BufferedInputStream`. Disable this with `'useReadAheadInput=false'`.
- Fixed `BUG#6348`, failing to connect to the server when one of the addresses for 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` - connector/j 3.1.3 beta does not handle integers 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` -- `ServerPreparedStatement.execute*()` sometimes 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` - `ResultSet.isNull()` does not work for primitives if a previous null was returned.
- Track packet sequence numbers if `enablePacketDebug=true`, and throw an exception if packets received out-of-order.
- Fixed `BUG#4482`, `ResultSet.getObject()` returns wrong type for strings when using prepared statements.
- Calling `MysqlPooledConnection.close()` twice (even though an application error), caused NPE. Fixed.
- Fixed `BUG#5012` -- `ServerPreparedStatements` dealing with return of `DECIMAL` type don't work.
- Fixed `BUG#5032` -- `ResultSet.getObject()` doesn't return type `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 a `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 a `SQLException` with a `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 `ArrayIndexOutOfBoundsException`.
- 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`, null bitmask sent for server-side prepared 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` - Error in retrieval of mediumint column with 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 `'cacheCallableStmnts'` 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.
- 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 `getProcedures()` does not return any procedures in result set
- Fix for BUG#3540 `getProcedureColumns()` doesn't work with wildcards for procedure name
- Fixed BUG#3520 -- `DBMD.getSQLStateType()` returns incorrect value.
- 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 -- `getWarnings()` returns `SQLWarning` instead of `DataTruncation`
- 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 multibyte 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 IllegalAccessException to Calendar.getTimeInMillis() in DateTimeValue (for JDK < 1.4).
- Fix for BUG#1673, where DatabaseMetaData.getColumns() is not 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, NULL values for numeric types in binary 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 -- charset conversion issue in getTables().
- Implemented multiple result sets returned from a statement or stored procedure.
- Fixed BUG#2606 -- Server side prepared statements not returning datatype 'YEAR' correctly.
- Enabled streaming of result sets from server-side prepared statements.
- Fixed BUG#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, NULL fields not being encoded correctly 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).

xx-xx-04 - Version 3.0.17-ga

- Fixed BUG#5874, Timestamp/Time conversion goes in the wrong 'direction' when useTimeZone='true' and server timezone differs from client timezone.
- Fixed BUG#7081, DatabaseMetaData.getIndexInfo() ignoring 'unique' 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 - Statements created from a pooled connection were returning physical connection instead of logical connection when getConnection() was called.
- Fixed BUG#7033 - PreparedStatements don't encode Big5 (and other multibyte) character sets correctly in static SQL strings.
- Fixed BUG#6966, connections starting up failed-over (due to down master) never retry master.
- 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).

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, ResultSet.updateByte() when on insert row throws ArrayOutOfBoundsException.
- Fixed DatabaseMetaData.getTypes() returning incorrect (i.e. non-negative) scale for the 'NUMERIC' type.
- Fixed BUG#6198, off-by-one bug in Buffer.readString(string).
- 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, ResultSet.getTimestamp() on a column with TIME in it fails.

09-04-04 - Version 3.0.15-production

- Fixed BUG#4010 - StringUtils.escapeEasternUnicodeByteStream is still broken for GBK

- Fixed BUG#4334 - Failover for autoReconnect not using port #'s for any 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, 'DOUBLE' mapped twice in DBMD.getTypeInfo().
- Added FLOSS license exemption.
- Fixed BUG#4808, calling .close() twice on a PooledConnection causes NPE.
- Fixed BUG#4138 and BUG#4860, DBMD.getColumns() returns incorrect JDBC 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, RSMD.getPrecision() returning 0 for non-numeric types (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 - ResultSet should release Field[] instance in .close().
- Fixed BUG#5069 -- ResultSet.getMetaData() should not return incorrectly-initialized metadata if the result set has been closed, but should instead throw a 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 - Using a MySQLDatasource without server name fails
- Fixed BUG#3920 - "No Database Selected" when using MySqlConnectionPoolDataSource.
- Fixed BUG#3873 - PreparedStatement.getGeneratedKeys() method returns only 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)
- Allow java.util.Date to be sent in as parameter to PreparedStatement.setObject(), converting it to a Timestamp to maintain full precision (BUG#3103).
- Don't truncate BLOBs/CLOBs when using setBytes() and/or setBinary/CharacterStream() (BUG#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, StringUtils.escapeSJISByteStream() not covering all eastern double-byte charsets correctly.
- Renamed StringUtils.escapeSJISByteStream() to more appropriate escapeEasternUnicodeByteStream().
- Fixed BUG#3554 - Not specifying database in URL caused MalformedURLException 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 - UpdatableResultSet not picking up default values for moveToInsertRow().
- Fixed BUG#3570 - inconsistent reporting of column type. The server still doesn't return all types for *BLOBs *TEXT correctly, so the

driver won't return those correctly.

- Fixed BUG#3520 -- DBMD.getSQLStateType() returns incorrect value.
- 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).
- Fixed failover always going to last host in list (BUG#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).
- Return 'java.lang.Double' for FLOAT type from ResultSetMetaData.getColumnClassName() (fix for BUG#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).
- 'Friendlier' exception message for PacketTooLargeException (BUG#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).
- Fixed BUG#1576, dealing with large blobs and split packets not being read correctly.
- Fixed regression of Statement.getGeneratedKeys() and REPLACE statements.
- Fixed BUG#1630, subsequent call to ResultSet.updateFoo() causes NPE if result set is not updatable.
- Fix for 4.1.1-style auth with no password.
- Fix for BUG#1731, Foreign Keys column sequence is not consistent in DatabaseMetaData.getImported/Exported/CrossReference().
- Fix for BUG#1775 - DatabaseMetaData.getSystemFunction() returning bad function 'VResultsSion'.
- Fix for BUG#1592 -- cross-database updatable result sets 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)
 - 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 -- Connection property "maxRows" not honored.
 - Fix for BUG#1925 -- Statements being created too many times in DBMD.extractForeignKeyFromCreateTable().
 - Fix for BUG#1914 -- Support escape sequence {fn convert ... }
 - Fix for BUG#1958 -- ArrayIndexOutOfBounds when parameter number == number of parameters + 1.
 - Fix for BUG#2006 -- ResultSet.findColumn() should use first matching 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)
- Fixed `Statement` and `PreparedStatement` issuing bogus queries when `setMaxRows()` had been used and a `LIMIT` clause was present in the query.
- Fixed BUG#661 - `refreshRow` didn't work when primary key values 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 and BUG#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, etc).
- Fix `UpdatableResultSet` to return values for `getXXX()` when on insert row (BUG#675).
- The `insertRow` in an `UpdatableResultSet` is now loaded with the default column values when `moveToInsertRow()` is called (BUG#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)
- Fixed regression in large split-packet handling (BUG#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).
- 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, double-escaping of `'\'` when charset is SJIS or GBK and `'\'` 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, `DatabaseMetaData.getColumns()` getting confused about the keyword 'set' in character columns.
- Fixed deadlock issue with `Statement.setMaxRows()`.

- Fixed CLOB.truncate(), BUG#1130
- Optimized CLOB.setCharacterStream(), BUG#1131
- Made databaseName, portNumber and serverName optional parameters for MySQLDataSourceFactory (BUG#1246)
- Fix for BUG#1247 -- ResultSet.get/setString mashing char 127
- 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 'lobber' streaming results, by setting the 'lobberStreamingResults' 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 test suite 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)
- 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 `ArrayIndexOutOfBoundsException` exceptions 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 `SELECT`s 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 (i.e. hostnames, ports, usernames, etc.), 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)
- 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 slower)
- `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 >= 3.21.23.

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 ArrayIndexOutOfBounds 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 updateable 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 automatically 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 `'%'`.
- `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 getByte() 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 be 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 LPGL

8-14-98 -

- Fixed `Buffer.readLenString()` to correctly read data for BLOBS.
- Fixed `PreparedStatement.stringToStream` 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=...` etc).

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, etc.
- `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()